# Eastern Avenue
# Adaptive Signal Control Technology

Final Report — March 2021

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# 01 Executive Summary

On March 12, 2020, the Regional Transportation Commission (RTC) of Southern Nevada Board of Commissioners approved project 144AG-FTI2 Adaptive Signal Control Technology (ASCT), to test the ability of adaptive traffic signal control technology to improve performance of the traffic signal system on Eastern Avenue between Beckler Drive and Pebble Road. The pilot was performed in partnership with the RTC, City of Henderson (CoH), and Clark County (CC).

Rhythm Engineering's InSync system was chosen to provide the adaptive traffic solution and Ludian as the independent consultant to provide subject matter expertise and produce this overall pilot study report, including a before and after performance analysis.

This pilot study report details the implementation of the InSync technology and the effectiveness the ASCT had on the traffic on the Eastern Avenue corridor and associated side streets. The key performance indicators (KPI's) that are included in this report are as follows:

- Corridor speed
- Corridor travel time
- Number of stops on the corridor
- Stop delay on the corridor
- Individual intersection delay
- Co2 emissions
- Financial impact

Based on the above KPI's the study on Eastern Avenue witnessed improvements in all the individual KPI's and was deemed a success and a benefit to both the drivers of the corridor and the community.

In addition to the project KPI's, the pilot study included improvement to the RTC transit service timings, project payback period, crash data and recommendations on the potential future locations for additional ASCT deployments.

Table 1 highlights a summary of improvements for the Northbound and Southbound directions on the Eastern Avenue corridor. These results show how the RTC has achieved the study goals as defined prior to the deployment of the ASCT.

The pilot study results also included an overall improvement in intersection delay of 19,381 hours across the year, a 34% reduction in reported crashes and 4.61% improvement in RTC Transit journey time.

| **Eastern Avenue Northbound Summary of Improvements** | | | |
|---|---|---|---|
| Measure | Percentage | Per vehicle | Yearly |
| Speed | 31.1% | 7.5 mph | |
| Travel Time | 24% | 117 s | 370,665 Hours |
| Stops | 69.1% | 2.8 | 32.7 Million |
| Stop Delay | 57.5% | 82 s | 257,581 Hours |
| CO2 Emission | 7.89% | 93.6g | 1,168 Ton |

| **Eastern Avenue Southbound Summary of Improvements** | | | |
|---|---|---|---|
| Measure | Percentage | Per Vehicle | Yearly |
| Speed | 8.2% | 2.1 mph | |
| Travel Time | 8.6% | 40 s | 113,052 Hours |
| Stops | 37.6% | 1.4 | 14.5 Million |
| Stop Delay | 10.6% | 14 s | 36,741 Hours |
| CO2 Emission | 2.66% | 31.2 g | 350 Ton |

Table 1: Summary of Improvements

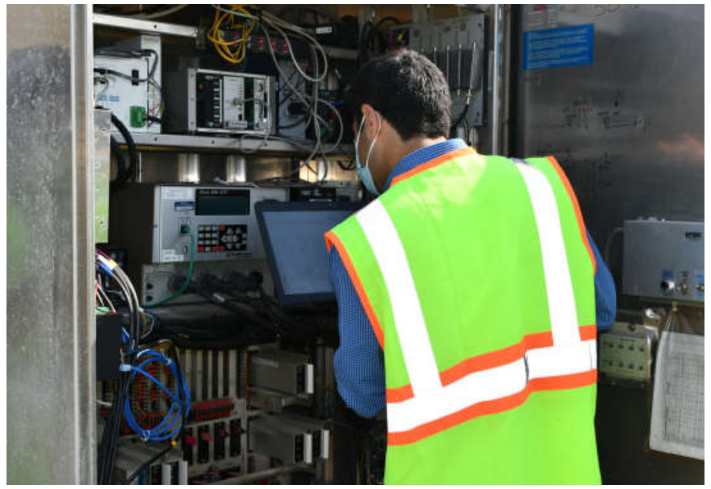

Figure 1: ASCT Switch On


## 02 Introduction

In March of 2020, the Regional Transportation Commission (RTC) of Southern Nevada (SNV) board greenlit the pilot to install Adaptive Signal Control Technology (ASCT) along Eastern Avenue. ASCT is a technology that captures current traffic demand data and adjusts traffic signal timing accordingly to optimize traffic flow. The ASCT pilot was operational from October 2020 to February 2021, following this the ASCT system was handed over to RTC FAST.

The ASCT pilot tested the ability of ASCT to improve performance of the traffic signal system as well as providing traffic improvements. The project's aim was to deviate from semi-actuated time-based systems to improve traffic operations along Eastern Avenue. Rather than using traditional coordinated signal timing plans to improve traffic flow, the project used innovative and new technology, to improve trip times, decrease delays, reduce emissions, and improve overall performance of the corridor.

Figure 2: Signal at Eastern Avenue and Beckler Drive

The pilot was performed in partnership with the City of Henderson (CoH) and Clark County (CC). In addition, the partnership of RTC, CoH, and CC brought on Rhythm Engineering as the technology provider and Ludian as the subject matter expert and experienced consultant and advisor to ASCT projects.



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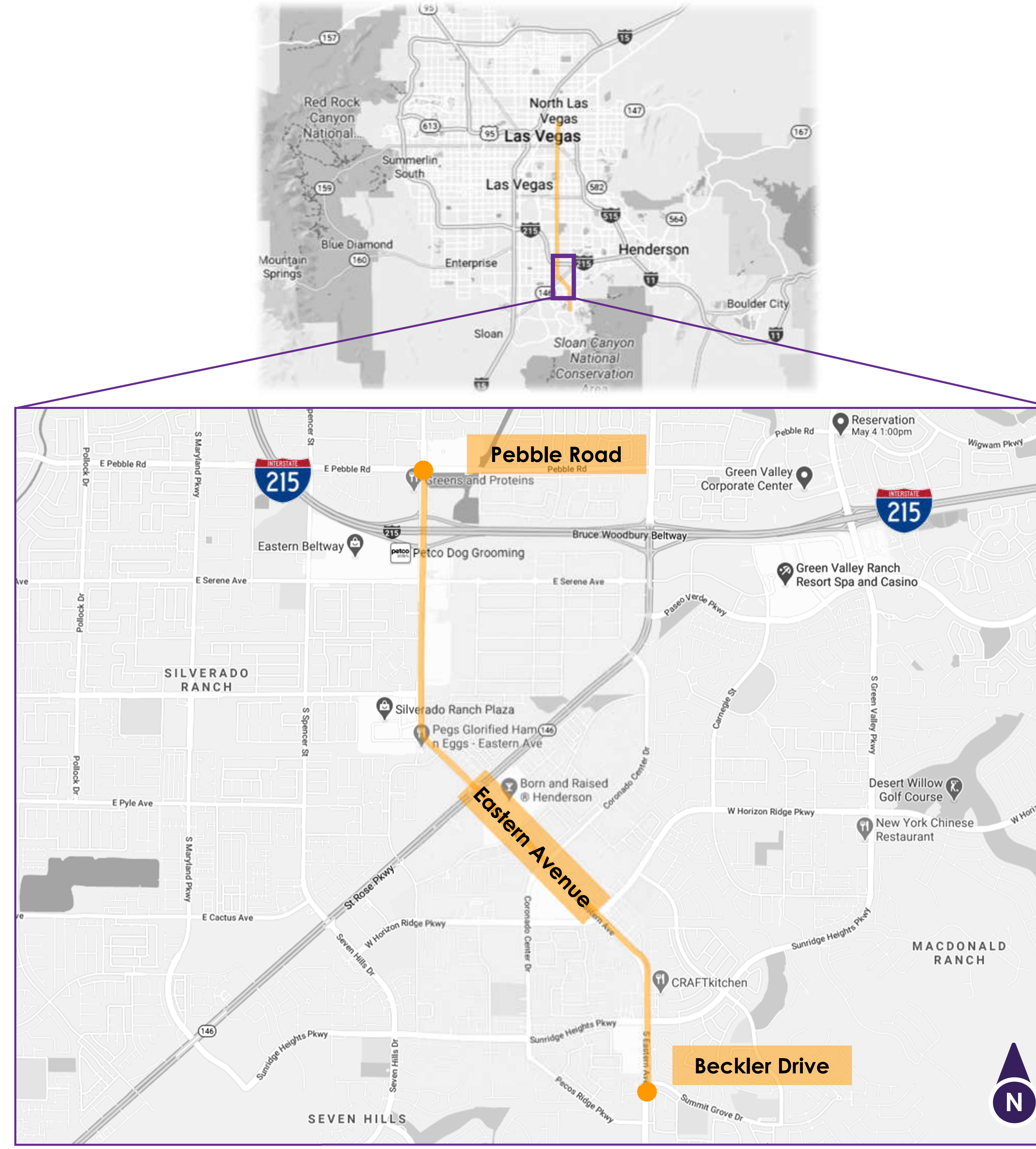


Figure 3: Project Location

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# 03 Background

The RTC, CoH, and CC partnered with Ludian and Rhythm Engineering to deploy ASCT pilot project and gain an in-depth understanding of the systems' performance along a major corridor. In a previous report conducted by an independent consultant in 2020, it was stated that the Eastern Avenue Corridor would only show a 5% improvement from ASCT; however, that study did not fully analyze the ASCT technology and its implementation. Part of the purpose for this pilot was to determine how the traffic on the corridor can be improved and if the technology can make a more influential impact in a more cost effective manner compared to installation of new infrastructure such as capacity improvements.

This final report analyzes and describes the results using multiple data sources to better understand and demonstrate the ASCT technology's impact on not only the main corridor, but also the side streets and the individual intersection delay changes.

### 3.1. Adaptive Signal Control Technology

FHWA defines ASCT as "*technologies that capture current traffic demand data to adjust traffic signal timing to optimize traffic flow in coordinated traffic signal systems*" (*https://www.fhwa.dot.gov/innovation/everydaycounts/edc-1/asct.cfm)*

ASCT has been used since the 1980's and has improved the travel time and reliability and reduced congestion across the globe. There are many different forms of the technology, some created locally by the operating agencies and some as a joint effort between development labs and the technology industry. The list below is a selection of the different systems available:

- Split Cycle Offset Optimization Technique (SCOOT)
- Synchro Green
- Sydney Coordinated Adaptive Traffic System (SCATS)
- Real Time Hierarchical Optimized Distributed Effective System (RHODES)
- InSync
- Optimized Policies for Adaptive Control (OPAC)
- Virtual Fixed Cycle
- ACS Lite
- SURTRAC
- Kadence

The project team decided to use the Rhythm InSync technology for this pilot project. InSync had been previously deployed in other states such as: Southern California, Virginia and Kansas to credible success, showcasing that proper application of ASCT can reduce congestion, smooth flows, improve travel times, reduce emissions and delay, while eliminating the need for more costly improvements, such as adding additional infrastructure.



### 3.2. Project Area

As shown in Figure 4, the pilot project is located on Eastern Avenue between Beckler Drive and Pebble Road, the entire pilot project location totals 16,520 feet. In total, the technology was deployed on 14 intersections on Eastern Avenue as listed in Table 2.

| Intersection Number | Intersection Name | Jurisdiction |
|---|---|---|
| 1 | Beckler Drive | CoH |
| 2 | Summit Grove Drive | CoH |
| 3 | Sunridge Heights Parkway | CoH |
| 4 | Horizon Ridge Parkway | CoH |
| 5 | Coronado Center Drive | CoH |
| 6 | Siena Heights Drive | CoH |
| 7 | Saint Rose Parkway | CoH |
| 8 | Ione Road | CoH |
| 9 | Silverado Ranch Boulevard/ Presque Isle Street | CC |
| 10 | Richmar Avenue | CC |
| 11 | Serene Avenue | CC |
| 12 | South I-215 Ramps | CC |
| 13 | North I-215 Ramps | CC |
| 14 | Pebble Road | CC |

Table 2: List of Intersections

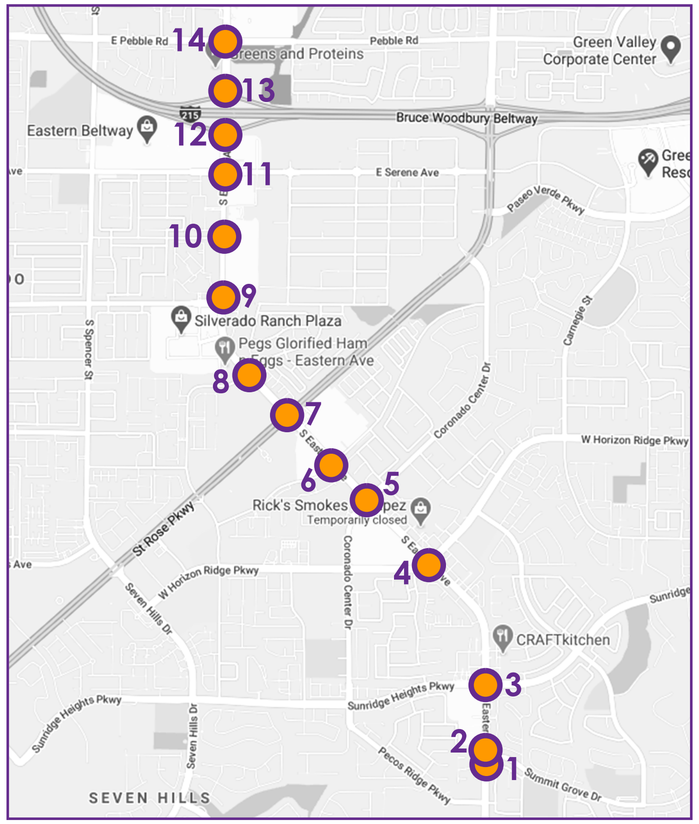


Figure 4: Project Area


# 04 Pre-Existing Conditions

Eastern Avenue was selected for its reputation of being a highly congested area with mixed land use, ranging from commercial to residential, and a major connector to I-215 and St. Rose Parkway. The corridor has historically received a high volume of complaints regarding long wait times at signalized intersections and pedestrian demand.

In particular, the corridor on the North end, as shown in Figure 5, is subject to high traffic businesses such as Walmart, Goodwill, as well as popular eateries. These locations are significant as they generate a high volume of traffic for both vehicles and pedestrians. In addition, the North end of the corridor hosts on and off ramps to the I-215, one of the major freeways in the Henderson / Clark County area. The I-215 on and off ramps from both North and South direction are known to have long wait times and traffic demand, particularly in peak AM and PM timeframes.

Another major challenge of this corridor is the intersection at St. Rose Parkway. This is a large 4 lane arterial that witnesses heavy traffic flow during all times of the day but is especially busy during peak hours. St. Rose Parkway connects directly to both I-15 from the West and I-215 from the East. In addition, this particular corridor has high traffic locations such as a hospital, Costco, In and Out, Sam's Club and large shopping attractions such as Lowes and Walmart.


Figure 5: Project Area, North End

## 4.1. Project Goals

The pilot project was intended to provide results on the Rhythm Engineering InSync ASCT and the suitability for Southern Nevada. It was

to determine if the ASCT is suitable for improving traffic efficiency on corridors and side streets. This was measured using the agreed KPI's and goals, including:

- Reducing Traffic Delays
- Reducing Congestion
- Improving Travel Time
- Improving Travel Time Reliability
- Improving Corridor Speed
- Improving Intersection Delay
- Reducing CO2 Emissions
- Cost saving for residents

The results of these KPI's and goals are captured in the sections below and the final results are included within the conclusion section.

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## 05 Findings

## 5.1. Adaptive Signal Control Switch On

The ASCT pilot was officially deployed on October the 19th 2020. Select intersections were switched to adaptive mode on site and with attendance from all the stakeholders to ensure smooth operations without any adverse effects on these intersections and the overall corridor.

Following the switch on, the Rhythm Engineering staff conducted a two (2) week fine tuning exercise. This exercise is typical best practice during the implementation of an ASCT. The initial configuration and timing plans are derived from the traffic volume counts, travel time between intersections, and local knowledge of the specific operational challenges on the corridor. The initial timings plans were used by the system and then based on factors such as driving the corridor at different times of the day, different days of the week, monitoring of the system at individual intersection and data analysis, the system was updated and finetuned.

After completing the two (2) week fine tuning, the ASCT was ready to be analyzed.

## 5.2. Study Data Sources

When undertaking an independent study of the effect of a change, the more data points that can be harnessed, the more accurate the comparison will be. For this study, there has been four main sources of data, plus on-site data collection and monitoring. The details of the data sources and how they have been used is included in the following sub-sections.

### 5.2.1. RTC FAST AVL

The project team utilized the RTC FAST AVL application to undertake a known probe data pre and post implementation for comparison. The RTC FAST AVL application uses both FAST support vehicles and a mobile phone-based application to capture journey times.

The FAST AVL system enabled the project team to collect the results from the probe data for the corridor and included the following measures:

- Speed
- Travel Time
- Number of Stops
- Stop Delay

For extracting the data, the project team selected the start and end intersections on the Eastern Avenue and the date range. Figure 6 shows the selected route in Red.



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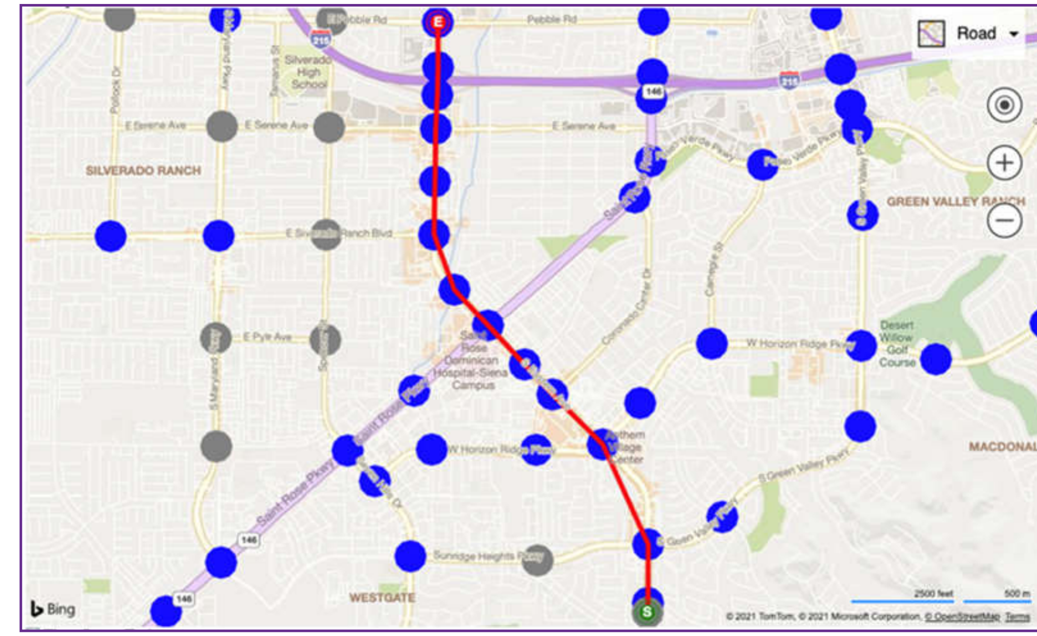


Figure 6: FAST AVL Application Showing Route

The FAST AVL system displayed the journey information of each vehicle, as shown in Figure 7. This is one of the data extracts performed for AM peak Northbound. A red line denotes the before data and blue the after.

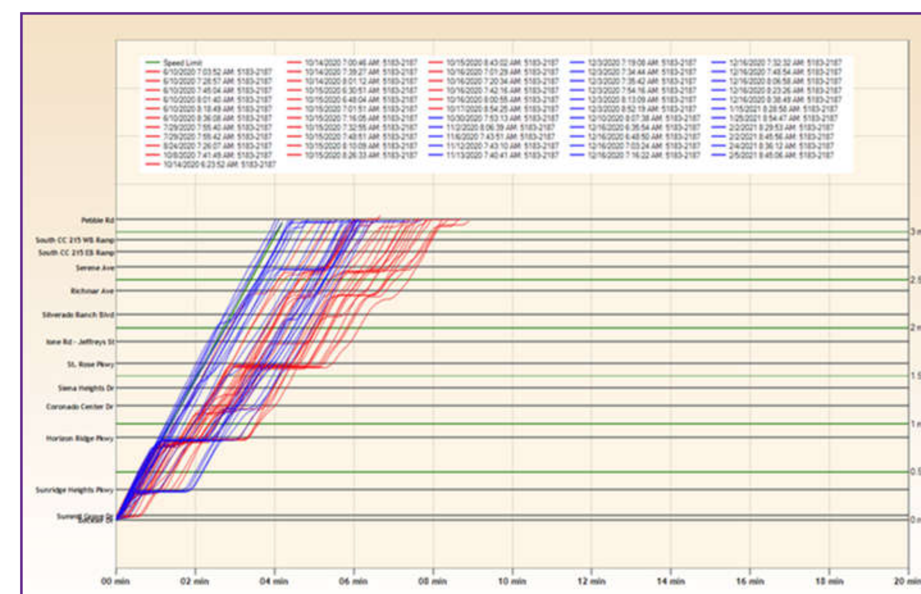

Figure 7: FAST AVL Application Showing Journey Details

Figure 8 shows how the individual trip data has been used to create an average set of results for the before and after ASCT deployment.


Summary Table

| Period | Speed (mph) | Travel Time (s) | Distance (ft) | Speed Ratio | # of Stops | Stop% | Stop Time (s) | Speed Variance (Standard Deviation) | Travel Time Index (TTI) | Planning Time Index (PI) | Buffer Index (BI) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Speed Limit | 45.0 | 250 | 16520 | 1 | 0 | 0% | 0 | | | | |
| All | 28.7 | 427 | 16520 | 0.64 | 2.7 | 19.4% | 105 | 7.7 | 1.71 | 2.38 | 0.39 |
| Before | 24.6 | 493 | 16520 | 0.55 | 4.1 | 29.1% | 146 | 5.6 | 1.97 | 2.91 | 0.48 |
| After | 32.8 | 361 | 16520 | 0.73 | 1.4 | 9.6% | 64 | 7.3 | 1.44 | 2.05 | 0.42 |
| Difference | 8.2 | -132 | 0 | 0.18 | -2.7 | -19.4% | -82 | 1.7 | -0.53 | -0.85 | -0.05 |
| Difference% | 33.5% | -26.8% | 0% | 33.5% | -66.8% | -66.8% | -56.4% | 31.2% | -26.8% | -29.4% | -10.8% |

Figure 8: FAST AVL Data Results

### 5.2.2. StreetLight Data

The StreetLight data platform provided the information used to create the results for intersection delay calculations.

StreetLight uses location data from smart phones and navigation devices in connected vehicles. This equated to around 40 billion individual sets of data across North America. The data is anonymized so it cannot be traced to an individual person or vehicle. The data used in the final report is from the StreetLight data (StreetLight) platform.

The StreetLight data capture-rate per approach is approximately 50% of the actual vehicle count for each approach. As an example, for Horizon Ridge, StreetLight registered on average 13,950 vehicles and the actual count was on average 25,166 vehicles per day. For Silverado, Southbound, StreetLight registered on average 17,149 vehicles and the actual count was on average 28,560 vehicles per day. The data in Appendix B includes the analysis data used from the StreetLight data platform.

A total of 46 zones were used to extract the data and these were created within the 28 intersection files listed in Table 3.

Each zone was created uniquely at each intersection to capture the required data for individual movements through the intersection, e. g. north to east, west to south.

Figure 9 shows the virtual zone on St. Rose Parkway at the intersection with Eastern Avenue. The arrow dictates the direction of vehicles movement for data extraction, also known as an “in” zone for the origin-destination trip data.



| | |
|---|---|
| 1 | Eastern ASCT Beckler Inbound |
| 2 | Eastern ASCT Beckler Outbound |
| 3 | Eastern ASCT Summit Inbound |
| 4 | Eastern ASCT Summit Outbound |
| 5 | Eastern ASCT Sunridge Inbound |
| 6 | Eastern ASCT Sunridge Outbound |
| 7 | Eastern ASCT Horizon Inbound |
| 8 | Eastern ASCT Horizon Outbound |
| 9 | Eastern ASCT Coronado Inbound |
| 10 | Eastern ASCT Coronado Outbound |
| 11 | Eastern ASCT Siena Inbound |
| 12 | Eastern ASCT Siena Outbound |
| 13 | Eastern ASCT St. Rose Inbound |
| 14 | Eastern ASCT St. Rose Outbound |
| 15 | Eastern ASCT Ione Inbound |
| 16 | Eastern ASCT Ione Outbound |
| 17 | Eastern ASCT Silverado Inbound |
| 18 | Eastern ASCT Silverado Outbound |
| 19 | Eastern ASCT Richmar Inbound |
| 20 | Eastern ASCT Richmar Outbound |
| 21 | Eastern ASCT Serene Inbound |
| 22 | Eastern ASCT Serene Outbound |
| 23 | Eastern ASCT 215 Inbound |
| 24 | Eastern ASCT 215 Outbound |
| 25 | Eastern ASCT 215 extra Northbound |
| 26 | Eastern ASCT 215 extra Southbound |
| 27 | Eastern ASCT Pebble - Inbound |
| 28 | Eastern ASCT Pebble - Outbound |

Table 3: StreetLight Data Files

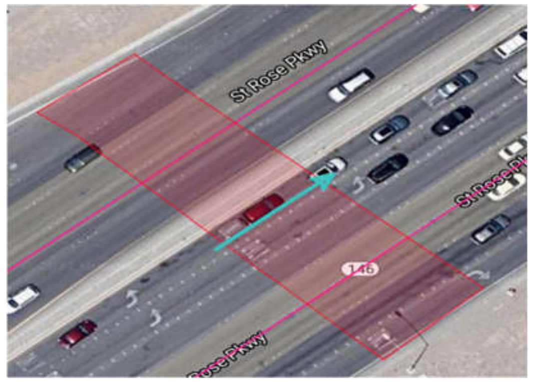


Figure 9: St. Rose 'In Bound' Zone

Figure 10 shows the same virtual zone at on St. Rose Parkway at the intersection with Eastern Avenue. The arrow dictates the direction of movement for data extraction, also known as an “out” zone for the origin-destination trip data.

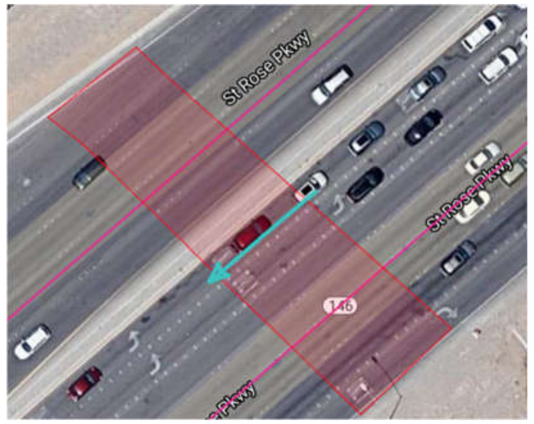


Figure 10: St. Rose 'Out Bound' Zone

Figure 11 is a full view of the four virtual zones on the intersection of Eastern Avenue and St Rose Parkway. The data analysis in Section 5.3 is derived using the virtual gates at each intersection. The project team used the streetLight data to measure the time taken for each movement at each intersection as below:

- Northbound to Northbound
- Northbound to Westbound
- Southbound to Southbound
- Southbound to Eastbound
- Eastbound to Eastbound
- Eastbound to Northbound
- Westbound to Westbound
- Westbound to Southbound

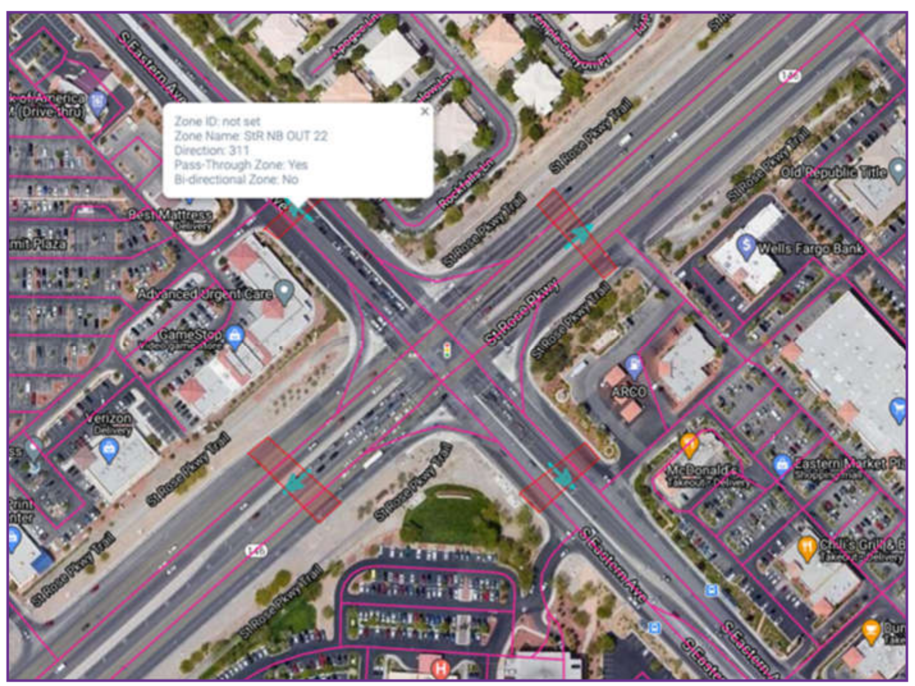

Figure 11: StreetLight Data St Rose All Zones

This was repeated on every intersection and the data collated. The time taken to make each movement was multiplied by the total vehicles making the movement per day to produce a daily total vehicle duration. This was calculated using the data before and after the adaptive signal control technology was deployed.

### 5.2.3. Iteris Velocity Bluetooth

For the ASCT project, Bluetooth detectors were installed along the Eastern Avenue. 12 new detectors were installed at the following intersections:

- Summit Grove Drive
- Sunridge Heights Parkway
- Horizon Ridge Parkway
- Coronado Centre Drive
- Siena Heights Drive
- Ione Road
- Silverado Ranch Boulevard
- Richmar Avenue
- Serene Avenue
- 215 EB
- 215 WB
- Pebble Road

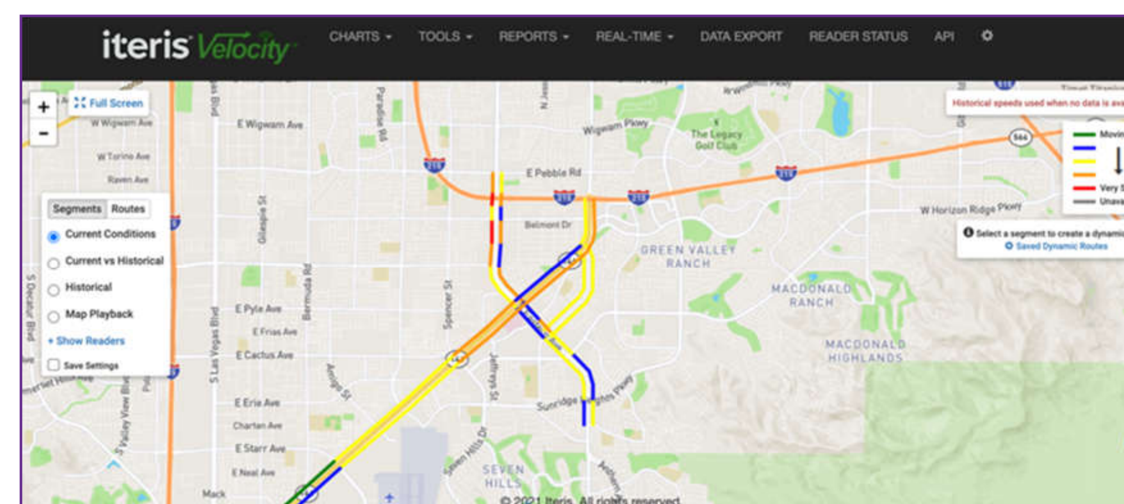

Figure 12: Iteris Bluetooth Journey Time Data Platform

Prior to the project, the same type of Bluetooth readers had been installed along St. Rose Parkway, which included the intersection at Eastern Avenue and St. Rose Parkway.

The system captures each Bluetooth-enabled device as it passes one of the installed intersections and the data is stored for analysis. This enables the user to capture travel time and speed data between two points or the complete route. This Bluetooth data can be used as an additional resource for data analysis.

Figure 12 shows a screen shot of the Iteris application.

### 5.2.4. Rhythm InSync

The Rhythm InSync technology was deployed at all 14 intersections on the Eastern Avenue. The system's main function is to adapt in real time to the traffic demands and move the traffic as efficiently as possible while maintaining safety.

The system records the statistics of operation including vehicle counts, pedestrian calls, allocated green time per phase, and tunnel period in operation. This data is stored for 30 days on the local server and can be archived to allow for historical reporting.

For the study data the InSync system was used to capture vehicle count for all turning movements at all the 14 intersections. The system has a 'Daily Summary' report that can be used for each day to summarize the data. The image below shows how this information is displayed.

For the overall changes, the above counts were used, for Monday, February 9 thru Sunday, February 14. These dates represented a typical week on the corridor with no adverse weather and no local or national holidays.

For the peak hour's breakdown, the following download feature in InSync was used.

The data extract from InSync breaks down the count for each phase into a 15 minute count total, this information is used to calculate the peak period vehicle counts.

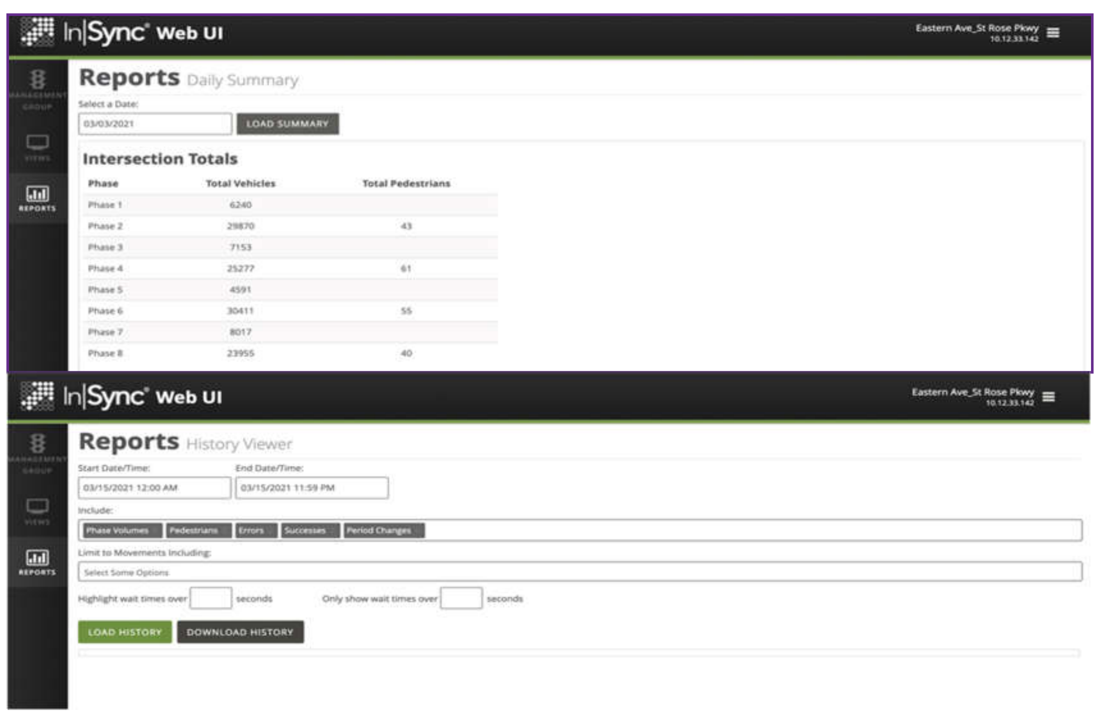


Figure 13: Rhythm Engineering Insync Application

### 5.3. Data Analysis

### 5.3.1. FAST AVL

To create an effective pre and post project comparison, the project team selected data close to the deployment of the InSync ATSC. The study has looked at data of a number of days and time spans, the project team used the following:

Standard Weekday (Tuesday/Wednesday/Thursday)

- Morning peak: 6:00 a.m. to 9:00 a.m.
- Midday peak: 11:00 a.m. to 1:30 p.m.
- Evening peak: 3:00 p.m. to 6:00 p.m.

All Week (Monday/Tuesday/Wednesday/Thursday/Friday/Saturday/Sunday)

- 24 Hours

Using the RTC FAST AVL data the results were correlated, and a comparison was made on the before and after data. All the data captured was in similar weather conditions and not during any special events. Table 4 captures the Northbound data and compares speed, corridor travel time, number of stops and the stop delay. All these values are shown in a percentage difference.

The results for the Northbound data show significant improvements on all KPI's measured. Each measure undertaken showed an improvement, the data captured for this report looks at June 1st to February 28th.

The current construction works on Eastern Avenue under the I-215 overpass has the left lane closed in either direction, this construction works was in place during the full study program, so any before and after data is a direct comparison with no effecting influences.

| Northbound Eastern Avenue Percentage Change | | | | |
|---|---|---|---|---|
| Period | Speed | Travel Time | Number of Stops | Stop Delay |
| Morning Peak | 29.70% | -22.40% | -69.10% | -55.00% |
| Midday Peak | 32.40% | -23.80% | -66.50% | -46.80% |
| Evening Peak | 26.30% | -20.20% | -70.00% | -58.00% |

Table 4: Northbound Speed, Travel Time, Number of Stops, Stop Delay Percentage Change

Table 5 captures the Southbound data for comparing road speed, corridor travel time, number of stops and the stop delay. All these values are shown in a percentage difference. The improvement on Southbound is not as high as Northbound but overall, shows an improvement compared to the semi actuated coordinated plan that was implemented previously. The Morning and Evening peaks show an improvement with the Midday peak highlighting a reduction in performance only for stop delay, this is not seen as a negative factor as the ASCT is balancing the improvements across the whole corridor. There are a number of reasons for this result, but the main change to the previous fixed time coordinated plan is the linking between Pebble Road and the I-215 WB intersection.

The number of vehicles turning West onto 215 from Eastern is a higher priority than the vehicles travelling Southbound from Pebble Road, therefore, the InSync adaptive system holds this Southbound traffic at I-215 WB intersection. In addition, the midday peak is typically higher than AM peak and the number of vehicles from the side streets onto the Eastern Avenue increases for lunchtime access to the high number of food outlets.

| Southbound Eastern Avenue Percentage Change | | | | |
|---|---|---|---|---|
| Period | Speed | Travel Time | Number of Stops | Stop Delay |
| Morning Peak | 13.90% | -11.40% | -53.30% | -8.20% |
| Midday Peak | -0.90% | -0.20% | -13.80% | 12.90% |
| Evening Peak | -0.90% | -1.20% | -25.40% | -0.80% |

Table 5: Southbound Speed, Travel Time, Number of Stops, Stop Delay Percentage Change

With the new configuration of Southbound traffic stopping vehicles at the I-215 WB intersection, an alternative before and after study was performed from the I-215 WB intersection to Beckler Drive. This was undertaken to better understand the changes along the main Southbound movement of Eastern Avenue without considering the impact the new configuration made to the movement between Pebble Road and I-215 WB intersection. This additional data extraction has not been used for the overall comparison results. Table 6 demonstrates the percentage changes measured.



| Southbound Eastern Avenue Percentage Change (215 WB to Beckler Drive) | | | | |
|---|---|---|---|---|
| Period | Speed | Travel Time | Number of Stops | Stop Delay |
| Morning Peak | 19.40% | -16.20% | -65.90% | -52.20% |
| Midday Peak | 11.70% | -8.80% | -30.90% | -21.80% |
| Evening Peak | 13.00% | -11.90% | -39.80% | -38.60% |

Table 6: Southbound (215WB to Beckler Drive) Speed, Travel Time, Number of Stops, Stop Delay Percentage Change

Table 7 and Table 8 detail the before, after, and difference in values for the road speed, corridor travel time, number of stops on the corridor, and the amount of delay time caused by the number of stops.

| Northbound Eastern Avenue Comparison | | | | | |
|---|---|---|---|---|---|
| Period | | Speed (MPH) | Travel Time (s) | Number of Stops | Stop Delay (s) |
| Morning Peak | Before | 26.80 | 429.00 | 3.40 | 107.00 |
| | After | 34.80 | 333.00 | 1.00 | 48.00 |
| | Difference | 8.00 | -96.00 | -2.30 | -59.00 |
| Midday Peak | Before | 22.30 | 523.00 | 4.70 | 156.00 |
| | After | 29.50 | 398.00 | 1.60 | 83.00 |
| | Difference | 7.20 | -125.00 | -3.10 | -73.00 |
| Evening Peak | Before | 23.90 | 484.00 | 4.20 | 137.00 |
| | After | 30.20 | 386.00 | 1.30 | 58.00 |
| | Difference | 6.30 | -98.00 | -2.90 | -79.00 |

Table 7: Northbound Peak: Speed, Travel Time, Number of Stops, Stop Delay Summary

Using the time space diagrams from the FAST AVL system in Appendix A, the impact of the new configuration changes to the I-215 WB intersection can be seen. This additional stop at the I-215 WB intersection has limited the improvement results for the Southbound movement.

| Southbound Eastern Avenue Comparison | | | | | |
|---|---|---|---|---|---|
| Period | | Speed (MPH) | Travel Time (s) | Number of Stops | Stop Delay (s) |
| Morning Peak | Before | 28.10 | 406.00 | 3.40 | 72.00 |
| | After | 32.00 | 359.00 | 1.60 | 66.00 |
| | Difference | 3.90 | -46.00 | -1.80 | -6.00 |
| Midday Peak | Before | 25.50 | 460.00 | 3.50 | 120.00 |
| | After | 25.30 | 460.00 | 3.00 | 136.00 |
| | Difference | -0.20 | -1.00 | -0.50 | 16.00 |
| Evening Peak | Before | 24.50 | 484.00 | 3.70 | 140.00 |
| | After | 24.30 | 478.00 | 2.80 | 139.00 |
| | Difference | -0.20 | -6.00 | -0.90 | -1.00 |

Table 8: Southbound Peak: Speed, Travel Time, Number of Stops, Stop Delay Summary

Table 9 shows the difference in values for the road speed, corridor travel time, number of stops on the corridor and the amount of delay time caused by the number of stops from I-215 WB to Beckler Drive. Even with this additional data comparison the results are not as significant as the Northbound movement, but it is an improvement over the results including the movement from Pebble Road to 215WB.



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| Southbound Eastern Avenue Comparison (215 WB to Beckler) | | | | | |
|---|---|---|---|---|---|
| Period | | Speed (MPH) | Travel Time (s) | Number of Stops | Stop Delay (s) |
| Morning Peak | Before | 31.60 | 342.00 | 2.40 | 46.00 |
| | After | 37.80 | 286.00 | 0.80 | 22.00 |
| | Difference | 6.10 | -56.00 | -1.60 | -24.00 |
| Midday Peak | Before | 27.60 | 394.00 | 2.70 | 85.00 |
| | After | 30.80 | 359.00 | 1.90 | 67.00 |
| | Difference | 3.20 | -35.00 | -0.80 | -18.00 |
| Evening Peak | Before | 26.90 | 409.00 | 2.70 | 90.00 |
| | After | 30.40 | 361.00 | 1.60 | 55.00 |
| | Difference | 3.50 | -48.00 | -1.10 | -35.00 |

Table 9: Southbound Peak (215WB to Beckler Drive): Speed, Travel Time, Number of Stops, Stop Delay Summary

Table 10 captures the results for Northbound and Southbound for all days. This table takes into account 7 days a week and 24 hours a day to fully capture the average change on the corridor.

| Eastern Avenue Percentage Change All Days | | | | |
|---|---|---|---|---|
| Direction | Speed | Travel Time | Number of Stops | Stop Delay |
| Northbound | 31.10% | -24.00% | -69.10% | -57.50% |
| Southbound | 8.20% | -8.60% | -37.60% | -10.60% |

Table 10: All Days: Speed, Travel Time, Number of Stops, Stop Delay Summary  Percentage

Table 11 captures the results for 7 days a week and 24 hours a day. The results show an overall improvement for all directions and all measures.

| Eastern Avenue Comparison All Days | | | | | |
|---|---|---|---|---|---|
| Direction | | Speed (MPH) | Travel Time (s) | Number of Stops | Stop Delay (s) |
| Northbound | Before | 24.10 | 490 | 4.10 | 143.00 |
| | After | 31.60 | 373 | 1.30 | 61.00 |
| | Difference | 7.50 | -118 | 2.80 | -82.00 |
| Southbound | Before | 25.40 | 467 | 3.80 | 124.00 |
| | After | 27.50 | 427 | 2.30 | 110.00 |
| | Difference | 2.10 | -40 | -1.40 | -13.00 |

Table 11: All Days: Speed, Travel Time, Number of Stops, Stop Delay Summary

### 5.3.2. StreetLight Data

To create an effective pre and post deployment comparison, the project team selected data close to the deployment of the InSync ASCT. The project team used 6 weeks pre-deployment data (August 16th to September 30th), and 6 weeks post-deployment data (November 1st to December 15th). The post-deployment data was captured after the 2 weeks of fine tuning exercise was conducted. This was limited to the available data on the StreetLight data platform when this report was created. The study has looked at 24 hours per day for the following scenarios:

- Mid-Week Days (Tuesday to Thursday)
- All Days (Monday to Sunday)
- Weekends (Saturday & Sunday)

This study has used a percentage comparison to determine the changes in delay for each movement at each intersection. This method is an effective way to determine the intersection delay change following the deployment of the ASCT.

Using the StreetLight data the results were correlated, and a comparison made on the pre and post deployment data. All the data captured was in similar weather conditions and not during any special events. Table 12 demonstrates the individual intersection movements for mid-week data, Tuesday to Thursday.





Table 12 also includes side street and the main Eastern Avenue data for all the intersections. Overall, on the 14 intersections on Eastern Avenue, ***the delay time was improved by 12.92 hours per day, which equates to 4,716 hours per year saved for the users of Eastern Avenue.*** The calculated data for each intersection movement can be seen in Section 5.3.1 and the raw StreetLight Data extract in Appendix A.

| Intersection Number | Intersection | Study Days | Hours of Delay (negative shows improvement) | Delay Change on Main Corridor (s) | % Main Corridor Vehicles | Delay Change on Side Streets (s) | % Side Street Vehicles |
|---|---|---|---|---|---|---|---|
| 1 & 2 | Beckler and Summit | Week Days (Tue - Thur) | 3.56 | -28,866 | 95% | 41,687 | 5% |
| 3 | Sunridge Heights Pkwy | Week Days (Tue - Thur) | -17.88 | -133,108 | 66% | 68,755 | 34% |
| 4 | Horizon Ridge Pkwy | Week Days (Tue - Thur) | -12.66 | -158,334 | 70% | 112,768 | 30% |
| 5 | Coronado Center Drive | Week Days (Tue - Thur) | 0.80 | -11,065 | 80% | 13,949 | 20% |
| 6 | Siena Heights Drive | Week Days (Tue - Thur) | -0.93 | -19,283 | 86% | 15,947 | 14% |
| 7 | St Rose Pkwy | Week Days (Tue - Thur) | 44.88 | -194,821 | 55% | 356,387 | 45% |
| 8 | Ione Road | Week Days (Tue - Thur) | -6.13 | -45,042 | 82% | 22,980 | 18% |
| 9 | Silverado Ranch Blvd | Week Days (Tue - Thur) | -9.82 | -12,990 | 82% | -22,356 | 18% |
| 10 | Richmar Avenue | Week Days (Tue - Thur) | -30.76 | -17,172 | 89% | -93,560 | 11% |
| 11 | Serene Avenue | Week Days (Tue - Thur) | -23.18 | -214,651 | 79% | 131,191 | 21% |
| 12 | 215 EB | Week Days (Tue - Thur) | -15.04 | -86,209 | 80% | 32,065 | 20% |
| 13 | 215 WB | Week Days (Tue - Thur) | 30.14 | 44,846 | 81% | 63,651 | 19% |
| 14 | Pebble Road | Week Days (Tue - Thur) | 24.09 | 53,546 | 78% | 33,180 | 22% |
| **Week Days Total Change Per Day (H)** | | | **-12.92** | | | | |

Table 12: Change in Trip Time per Intersection – Weekdays (Tuesday to Thursday)

Table 13 demonstrates the individual intersection movements for all days, Monday thru Sunday. This table also includes Side Street and the main Eastern Avenue data for all the intersections. Overall, on the 14 intersections on Eastern Avenue, ***the delay time was improved by 53.10 hours per day, which equates to 19,381 hours per year saved for the users of Eastern Avenue.***

| Intersection Number | Intersection | Study Days | Hours of Delay (negative shows improvement) | Delay Change of Main Corridor (s) | % Main Corridor Vehicles | Delay Change of Side Streets (s) | % Side Street Vehicles |
|---|---|---|---|---|---|---|---|
| 1 & 2 | Beckler and Summit | All Days (Mon - Sun) | 4.26 | -6,894 | 95% | 22,235 | 5% |
| 3 | Sunridge Heights Pkwy | All Days (Mon - Sun) | -43.92 | -129,959 | 66% | -28,160 | 34% |
| 4 | Horizon Ridge Pkwy | All Days (Mon - Sun) | -33.51 | -151,433 | 70% | 30,809 | 30% |
| 5 | Coronado Center Drive | All Days (Mon - Sun) | 6.79 | -8,861 | 80% | 33,318 | 20% |
| 6 | Siena Heights Drive | All Days (Mon - Sun) | 0.96 | -1,475 | 86% | 4,947 | 14% |
| 7 | St Rose Pkwy | All Days (Mon - Sun) | 38.72 | -174,291 | 55% | 313,673 | 45% |
| 8 | Ione Road | All Days (Mon - Sun) | -4.58 | -45,842 | 82% | 29,353 | 18% |
| 9 | Silverado Ranch Blvd | All Days (Mon - Sun) | 2.40 | -13,827 | 81% | 22,453 | 19% |
| 10 | Richmar Avenue | All Days (Mon - Sun) | -7.37 | 25,894 | 89% | -52,437 | 11% |
| 11 | Serene Avenue | All Days (Mon - Sun) | -14.52 | -204,062 | 79% | 151,795 | 21% |
| 12 | 215 EB | All Days (Mon - Sun) | -23.57 | -137,805 | 80% | 52,959 | 20% |
| 13 | 215 WB | All Days (Mon - Sun) | 17.72 | 17,826 | 80% | 45,955 | 20% |
| 14 | Pebble Road | All Days (Mon - Sun) | 3.52 | -16,680 | 78% | 29,352 | 22% |
| **All Days Total Change Per Day (H)** | | | **-53.10** | | | | |

Table 13: Change in Trip Time per Intersection – All Days (Monday to Sunday)



The data highlights that the overall delay on some intersections has been reduced, while it has increased on some other intersections. The work zones on Eastern Avenue under I-215 overpass had the left lane closed in both directions, this had an impact on the results for the I-215 WB and EB. The ongoing construction works at Pebble Road did not allow for an effective comparison of the impact of the adaptive traffic signal technology. It should be noted that the data used in this study for the before and after comparison was undertaken with the construction works in place. It is suggested that following the completion of the construction works a final comparison on the before and after data should be undertaken.

St. Rose Parkway had the highest volume of side street traffic equating to 45% of the overall intersection traffic. Therefore, an increase in delay was expected at this intersection. This led to an increased overall intersection delay of 38.72 hours per day.

Table 14 captures an overview of the delay changes over the weekend. Traffic patterns vary for Saturday and Sunday from a typical weekday, the typical commute demand reduces on a Saturday. Sunday traffic is typically local trips to shopping and restaurants. As can be seen in table 14, the delay values at a number of the intersections changed considerably to the weekday values.

The two big changes were Sunridge Heights and St. Rose Parkway. For the weekend ***the delay time was improved by 53.89 hours per day, which equates to 19,671 hours per year saved for the users of Eastern Avenue.***


Figure 14: On Site Deployment

Figure 15: Camera Detection Set-Up

| Intersection Number | Intersection Name | Daily Hours of Delay (negative shows improvement) | Yearly Hours of Delay (negative shows improvement) |
|---|---|---|---|
| 1 & 2 | Beckler and Summit | -6.70 | -2,445 |
| 3 | Sunridge Heights Pkwy | 1.15 | 420 |
| 4 | Horizon Ridge Pkwy | -29.35 | -10,714 |
| 5 | Coronado Center Drive | -13.30 | -4,855 |
| 6 | Siena Heights Drive | -2.96 | -1,081 |
| 7 | St Rose Pkwy | -1.59 | -580 |
| 8 | Ione Road | 7.67 | 2,801 |
| 9 | Silverado Ranch Blvd | 17.16 | 6,262 |
| 10 | Richmar Avenue | -7.41 | -2,705 |
| 11 | Serene Avenue | 3.58 | 1,307 |
| 12 | 215 EB | -17.12 | -6,247 |
| 13 | 215 WB | 1.75 | 640 |
| 14 | Pebble Road | -6.78 | -2,475 |
| **Change in Delay (H)** | | **-53.89** | **-19,671** |

Table 14: Change in Trip Time per Intersection – Weekend (Saturday & Sunday)

## 5.4. Changes Following Deployment

After the 2 weeks of system fine tuning, the ASCT was analyzed and data collected, during this time no changes were made to the timings or configurations.

In December of 2020 the system was configured to run an adaptive tunnel overnight and a minor timing change to Serene, Beckler Drive and Summit Grove. The project team also decided to make changes on two intersections on St. Rose Parkway as part of a number of experiments the RTC FAST team requested to test the potential linking of other intersections without the ASCT installed.



### 5.4.1. St. Rose Parkway Linking

St. Rose Parkway is a major arterial route for East and West bound traffic across Henderson, and connects to both the I-215 and I-15. From the count data collected, the split in North and South to East West was 55% of the traffic travels North and Southbound, with 45% of the traffic East and West bound.

Prior to the deployment of the ASCT, St. Rose Parkway was operating a fixed time coordinated plan in alignment with the semi actuated fixed time plan on Eastern Avenue. When ASCT was deployed, the linked plan on St. Rose was no longer effective.

The effect on this was measured using the StreetLight Data platform as part of the intersection delay calculations, for all weekly traffic (Monday to Sunday) the daily delay increase was 38.72 hours. In comparison for a weekend, the daily delay reduction was 1.59 hours, these results concluded that the weekly business traffic on St Rose has been impacted.

To mitigate this impact on St. Rose Parkway, an alternative fixed time coordinated plan was introduced by the RTC FAST team at the intersections of Seven Hills Drive and Jeffreys Street, both West of Eastern Avenue. As shown on Figure 16, the new timing plans allowed for an alignment with the period length running on Eastern Avenue.


Figure 16: St Rose Parkway Linked Intersections

Using the Bluetooth technology deployed along St. Rose Parkway, the project team conducted a before and after study on travel time. The parameters for the data collection matched the 160 second and 180 second tunnel periods on the InSync ASCT and are as follows:

Before Data

- January 18th thru February 7th
- 06:00 to 14:00

After Data

- February 15th thru February 28th
- 06:00 to 14:00

The above parameters allowed a 2 week before and after comparison.

In Table 15 for the EB, the speed has decreased by 0.1 mph and travel time has increased by 6.24 seconds. This could be for a number of reasons. For this movement, vehicles can join at Seven Hills Street from either straight ahead on St. Rose Parkway, the free right turn from Seven Hills Street or the signalized left turn from Spencer Street. For vehicles joining from other directions and not from St. Rose Parkway, the coordination will be disrupted and can lead to the journey time measure over this distance to be inconclusive. A larger data collection is recommended to fully clarify if the changes made to the intersections at Seven Hills Drive and Jeffreys Street were effective.

| St. Rose Parkway Eastbound - Seven Hills to Eastern Avenue | | |
|---|---|---|
| Period | Speed (MPH) | Travel Time (s) |
| Before | 34.89 | 100.91 |
| After | 34.79 | 107.15 |
| **Change** | **0.10** | **6.24** |

Table 15: St Rose Parkway East Bound Linked Results

In Table 16 for the WB, the speed has increased by 1.28 mph and travel time has decreased by 3.66 seconds. Although we have seen an improvement in the data following the re-timing of Seven Hills Street and Jeffreys Street, a higher level of improvement would have been predicted.

The majority of vehicles are travelling Westbound along St Rose Parkway, but as was mentioned for the EB data, there are vehicles turning left and right onto St. Rose Parkway at Eastern Avenue intersection. A wider data capture is required to fully analyze the changes in signal timing. It was noted that the WB offset to Jeffreys Street and Seven Hills Street was allowing green too early and cut off the end of the platoon release from Eastern Avenue and the left turn onto Seven Hills Street ended before any vehicles reached the intersection when released from Eastern Avenue WB.



| St. Rose Parkway Westbound - Seven Hills to Eastern Avenue | | |
|---|---|---|
| Period | Speed (MPH) | Travel Time (s) |
| Before | 29.09 | 122.11 |
| After | 30.37 | 118.46 |
| **Change** | **-1.28** | **-3.66** |

Table 16: St Rose Parkway West Bound Linked Results

### 5.4.2 Overnight Tunnel

When the ASCT was deployed in October 2020, the configuration for the overnight operation mid-week 10:00pm to 04:30am and weekend 10:00pm to 05:30am, was running a tunnel-less adaptive configuration. This configuration was using the ASCT algorithms on a local basis at each intersection but with no coordination between intersections on Eastern Avenue. It was agreed with the project team that there would be a benefit to running an adaptive tunnel along Eastern Avenue overnight.

On the week commencing the 14th of December 2020, the changes were made to the overnight tunnel. These changes introduced a 105 second tunnel with a truncation parameter of 60% of tunnel time served and a 4 second gap trigger from 10pm to midnight, then a 103 second tunnel with a truncation parameter of 40% of tunnel time served and a 3 second gap trigger from midnight. This would service the side streets more efficiently during this time period.

### 5.4.3. Intersection Configuration Changes

#### 5.4.3.1. Serene

During the on-site works carried out in December on the ASCT configuration, some minor amendments were made to the side street priority at Serene Avenue. These changes were following continued observations on-street and the additional demand witnessed over the weekends. The changes allowed the intersection to be more efficient for all week and weekday operations.

#### 5.4.3.2. Beckler Drive and Summit Grove Drive

The two intersections at Beckler Drive and Summit Grove Drive are approximately 236 feet apart, with the two intersections being so close it is important to unify the operations of the traffic signals. Additional changes at these two intersections were made to share the detection inputs on the ASCT to enable the North to South and South to North movements to function as one. The project team did not want the possibility of a scenario where the NB traffic had a green at Beckler Drive and then a red at Summit Grove Drive, which could potentially confuse drivers and possibly lead to incidents. In other scenarios, drivers held at red at Beckler Drive with Summit Grove Drive on green can lead to driver frustration.

To alleviate this as much as possible, the detection for both intersections were configured to provide input to both intersections, this enabled both intersections to operate the same sequence at the same time. The only scenario where this was not possible, was when a pedestrian call was initiated at Summit Grove Drive across Eastern Avenue. In this scenario, the two intersections would run independently.

Figure 17 illustrates all the detection inputs that were used on both intersections.

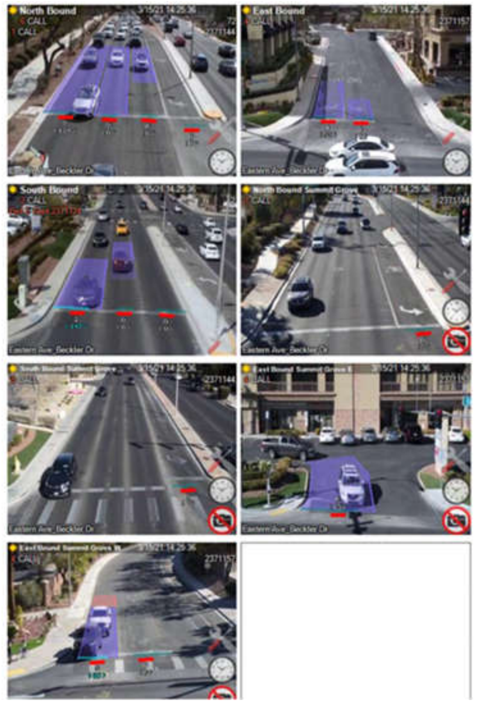

Figure 17: Rhythm InSync Detection View

Beckler Drive and Summit Grove Drive have always been a source of complaints from the public due to the close proximity of the two intersections. When intersections are this close, it is normal practice to install Louvers on the far intersection's aspects, to remove any 'read through' errors drivers might make.

The image below shows the installation of the Louvers on the 29th of December 2020 by the City of Henderson staff.

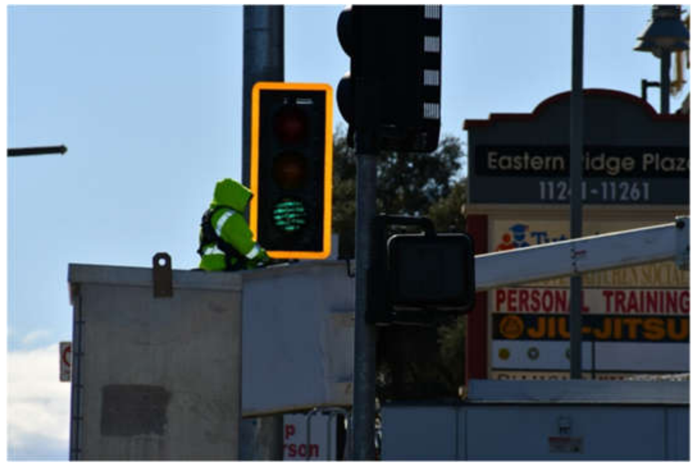


Figure 18: Installation of Louvers at Beckler Drive

Following the installation, a high number of complaints were received by the City of Henderson, and they made the decision to remove the Louvers and replace the two separate traffic signal controllers with a single controller to more effectively manage the appearance of the phase change at the two intersections. This required the two intersections to be disconnected from the ASCT and run on a semi actuated plan. The decision of re-connecting the two intersections back onto the ASCT will be made at a later date.





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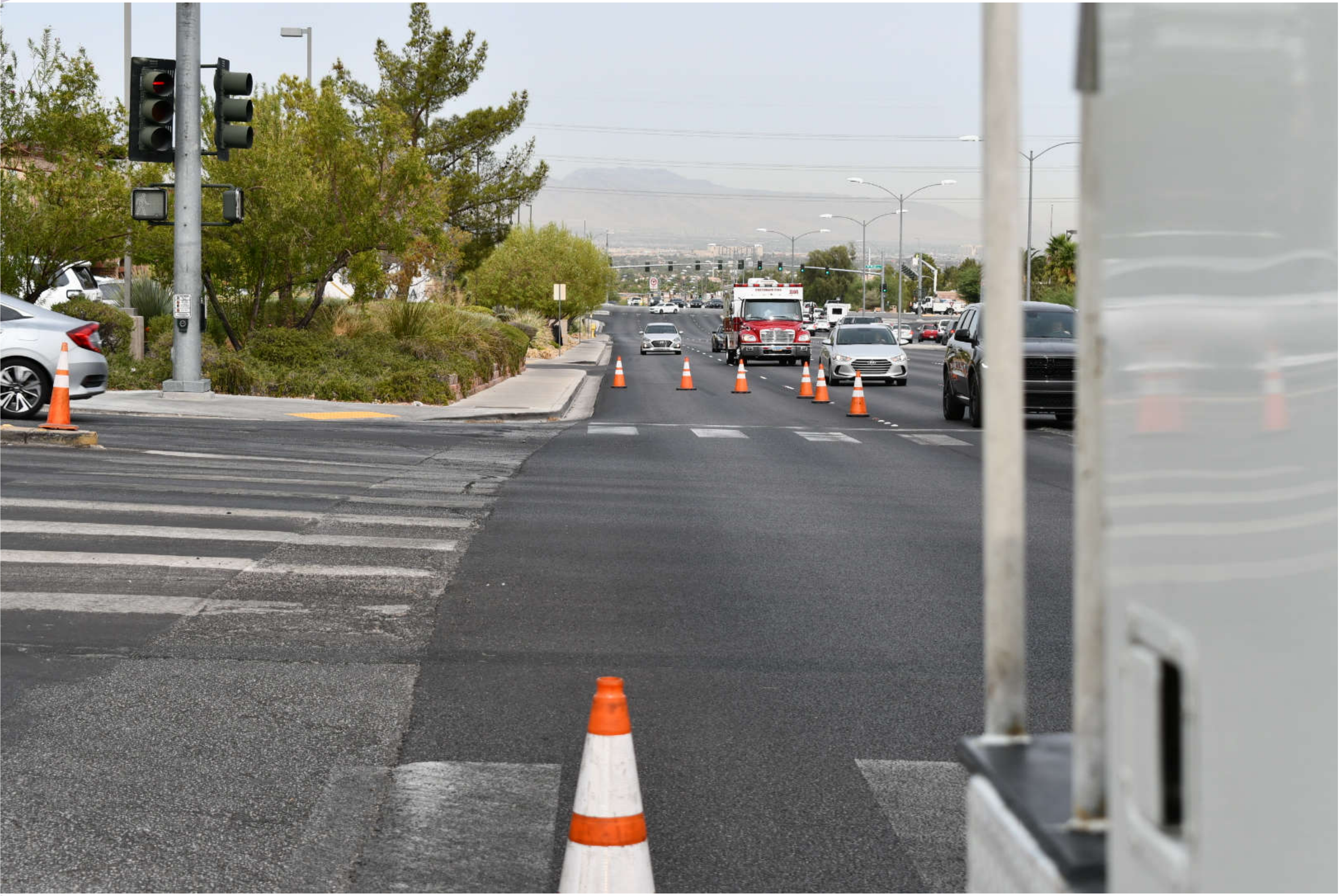

# 06 $CO_2$ Emissions

According to the US environmental protection agency, in 2018, CO2 emissions accounted for about 81.3 percent of all U.S. greenhouse gas emissions from human activities. Human activities are altering the carbon cycle–both by adding more CO2 emissions to the atmosphere, and by influencing the ability of natural sinks, like forests, oceans, and soils, to remove and store CO2 emissions from the atmosphere. While CO2 emissions come from a variety of natural sources, human-related emissions are responsible for the increase that has occurred in the atmosphere since the industrial revolution.

The main human activity that emits CO2 is the combustion of fossil fuels (coal, natural gas, and oil) for energy and transportation, although certain industrial processes and land-use changes also emit CO2. The main sources of CO2 emissions in the United States are described below.

The combustion of fossil fuels such as gasoline and diesel to transport people and goods was the largest source of CO2 emissions in 2018, accounting for about 33.6 percent of total U.S. CO2 emissions and 27.3 percent of total U.S. greenhouse gas emissions. This category includes transportation sources such as highway and passenger vehicles, air travel, marine transportation, and rail.

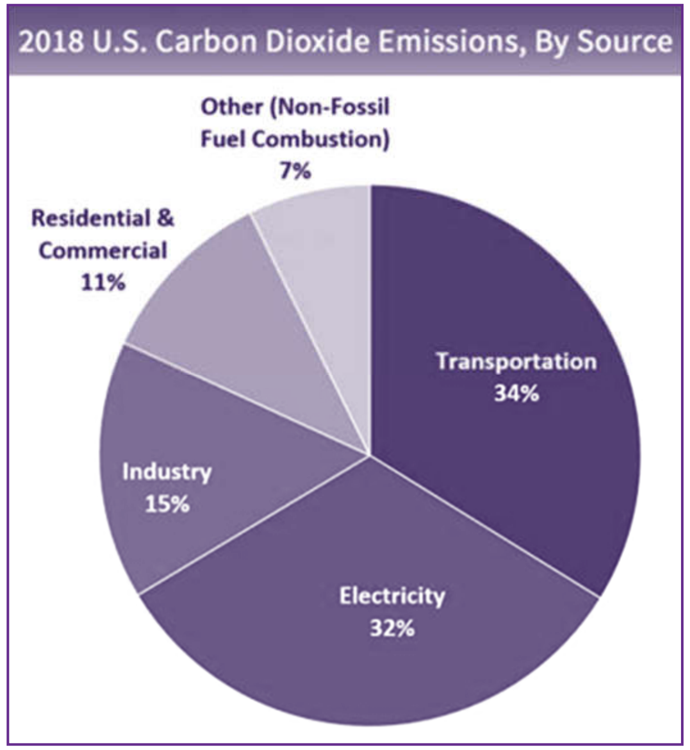


Figure 19: 2018 US Carbon Dioxide Emissions by Source
*Source: US Environmental Protection Agency*

One of the aims of the transportation industry is to reduce the CO2 emissions per mile travelled in the United States. With congested city streets contributing to the increased levels of CO2, we can measure the changes and reduce emissions by deploying ASCT.

Figure 20 is taken from a study conducted by the University of California, Riverside. This figure shows how the change in vehicle speed effects the amount of CO2 emissions from a vehicle over a one-mile distance. Using this measurement, a change in CO2 emissions has been extracted for the NB Traffic.

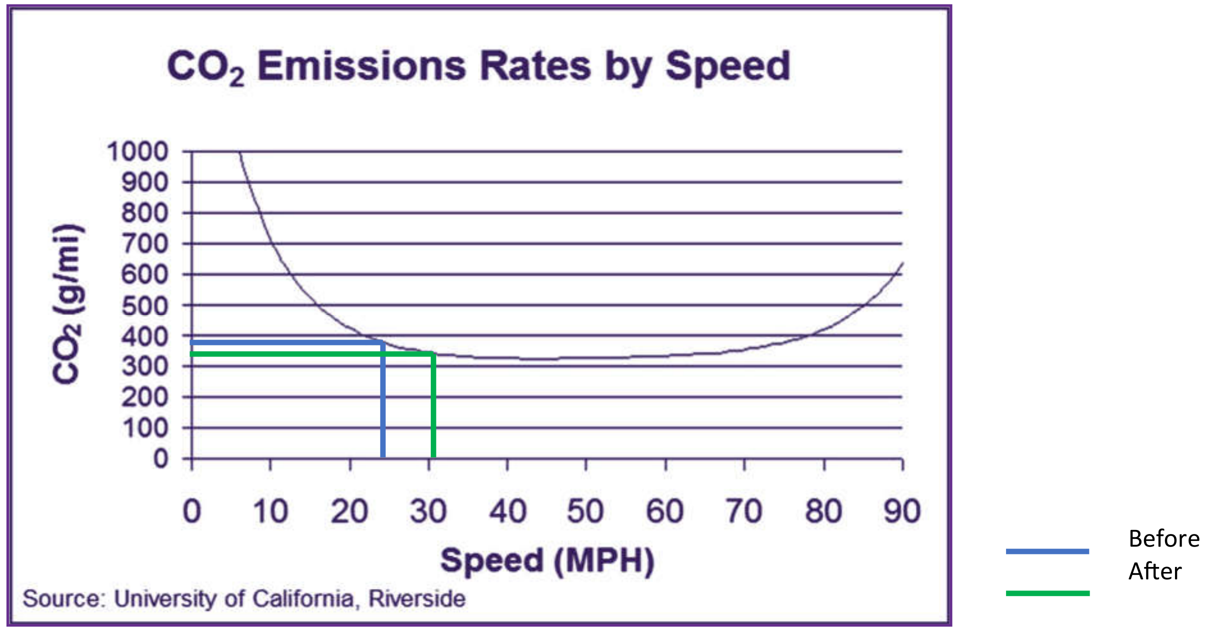


Figure 20: CO2 Emission Rates by Speed for Northbound

Table 17 captures the reduction in CO2 emissions from the data analysis. The average speed for NB on Eastern Avenue increased by 7.5 MPH, from 24.1 to 31.6 MPH. Using the data from Figure 20 this equates to a reduction of 30 grams per mile. Using the count and distance data this shows a total northbound reduction of 3.2 Ton of CO2 emissions per day, which equates to 1169 Tons of reduced CO2 emissions per year.

| | |
|---|---|
| Reduction in CO2 Emissions | 30 g/mi CO2 |
| Reduction per Vehicle per Trip | 93.6g CO2 |
| Average Daily Vehiles | 31,067 |
| **Total North Bound Reduction** | **3.2 Ton CO2** |

Table 17: Northbound CO2 Emissions

Figure 21 shows the change in CO2 emissions for the Southbound Traffic.

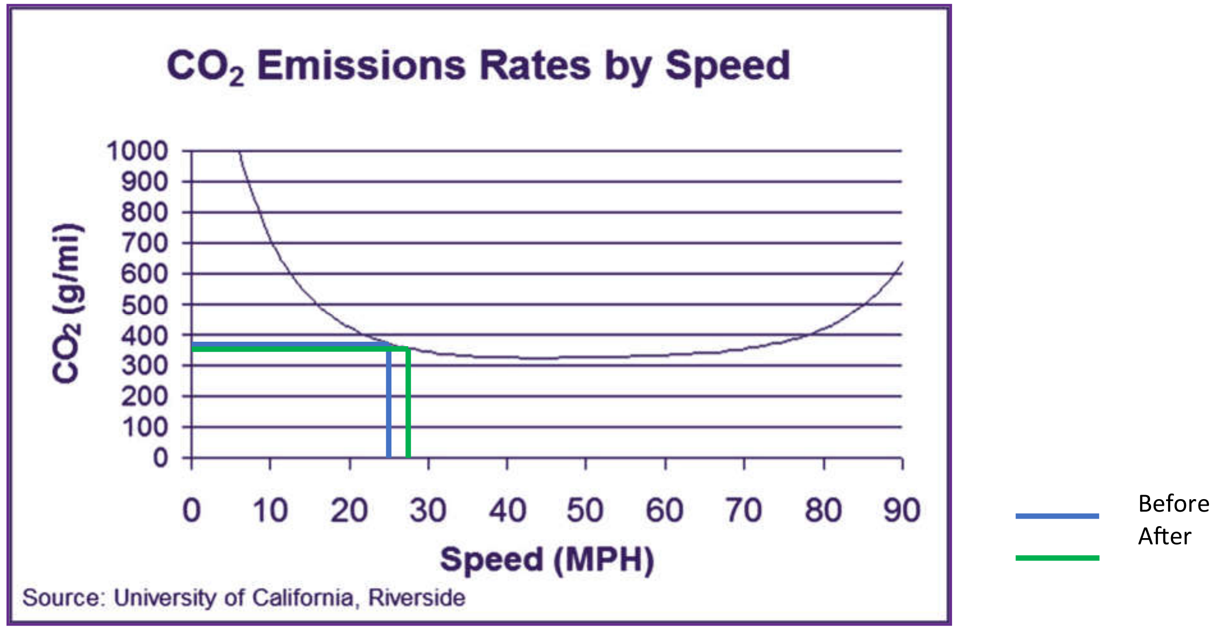


Figure 21: CO2 Emission Rates by Speed for Southbound

As with the previous calculations, Table 18 captures the reduction in CO2 emissions from the data analysis. The average speed for SB traffic on Eastern Avenue increased by 2.1 MPH, from 25.4 to 27.5 MPH. Using the data from Figure 21 this equates to a reduction of 10 grams per mile. Using the count and distance data this shows a total northbound reduction of 0.96 Ton of CO2 emissions per day, which equates to 351 Tons of reduced CO2 emissions per year.

In total, the improvements for both NB and SB on Eastern Avenue have reduced the CO2 emissions by 4.16 Tons per day and 1,520 Tons per year, which is equivalent to removing 330 cars off the roads.

| | |
|---|---|
| Reduction in CO2 Emissions | 10 g/mi CO2 |
| Reduction per Vehicle per Trip | 31.2 g CO2 |
| Average Daily Vehiles | 27,952 |
| **Total South Bound Reduction** | **0.96 Ton CO2** |

Table 18: Southbound CO2 Emissions





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## 07 Residents' Fuel and Cost Savings

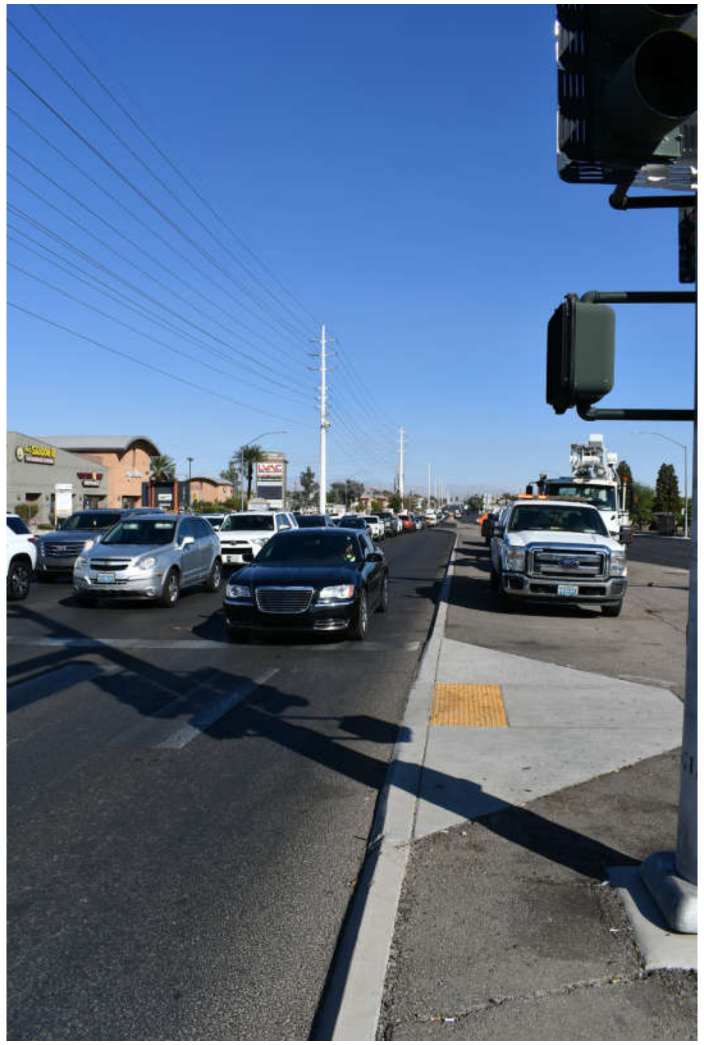

Figure 22: On-Site Installation Works

Based on Texas A&M Transportation Institute (TTI) methodology, National Transportation Research TRIP estimated in 2016, the value of lost time and wasted fuel in Nevada as a result of traffic congestion is approximately $1.6 billion per year.

The average driver in the Las Vegas area loses 46 hours annually as a result of being stuck in congestion. Lost time and wasted fuel due to congestion cost the average Las Vegas driver $984 each year. This equates to an hourly lost time and wasted fuel cost of $21.39 per resident.

Using the data captured in Section 5.3.1 and the average weekly vehicle count in the NB and SB directions across all the 14 intersections on Eastern Avenue, the impact of all users in a time and financial measure can be calculated.

For a round trip from Beckler Drive to Pebble Road and back per day over the year, the savings per driver calculate to $342.67 per year.



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Figure 23: 215EB Site Switch On


Figure 24: Coronado Center Drive Switch On

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# 08 Final Remarks

### 8.1. Project Payback Period

The ASCT project on Eastern Avenue was undertaken to evaluate the technology in Southern Nevada, with a number of key criteria that had to be met. Having met these criteria and with the improvements in both the overall corridor performance and overall intersection delays, a value based on the information in section 7 can be calculated for the total corridor improvements.

Using the table above and the average daily NB vehicle counts of 31,067 and SB vehicle counts of 27,952 a total yearly savings in lost time and wasted fuel for being stuck in congestion combining the NB and SB figures equates to $10,347,360.

With the assumption on the full ASCT pilot to cost approximately $900,000, the return on investment period is 32 days.

| Eastern Avenue Adaptive Traffic Signal Control Improvements (All Vehicles) | | | | | | |
|---|---|---|---|---|---|---|
| | Daily | | Weekly | | Yearly | |
| Direction | Travel Time (H) | Stop Duration (H) | Travel Time (H) | Stop Duration (H) | Travel Time (H) | Stop Duration (H) |
| Northbound | -1,018 | -708 | -7,128 | -4,953 | | |
| Southbound | -311 | -101 | -2,174 | -707 | | |
| Total | -1,329 | -809 | -9,302 | -5,660 | -483,718 | -294,323 |

Table 19: All Days Peak: Speed, Travel Time, Number of Stops, Stop Delay Summary

### 8.2. Accident Data

Using crash analysis to determine if the ASCT system has improved safety can be very subjective. There are a number of variables that can influence the results, from incorrect reporting, missing reports, crashes not reported, and duplicate entries.

For this study, the project team used the data stored in the RTC FAST Incident Management dashboard. The dashboard does not provide all the information required to determine the severity of the crash or the impact it had on the corridor, but the project team produced a before and after number of accidents reported on the Eastern Avenue. Table 20 shows the before, after and difference in reported accidents.

The results show a reduction of 34% in reported crashes on the Eastern Avenue corridor, this excludes any reportable accidents on the I-215 or the on and off ramps. The full accident reports are included in Appendix C.

| Eastern Avenue Adaptive Traffic Signal Control Accident Data | |
|---|---|
| Period | Number of Reported Crashes |
| Before | 23 |
| After | 15 |
| Difference | -8 |

Table 20: Crash Data Comparison

## 8.3. Effect on Transit Services

The improvements on the Eastern Avenue corridor have brought a benefit to all vehicles between Beckler Drive and Pebble Road. This includes private car users, TNC, freight and delivery services and the RTC Transit vehicles.

When starting this study of ASCT on Eastern Avenue, it was not planned to measure the affect specifically on the RTC transit services. The Eastern Avenue is a heavily-used transit road, the study only looked at a small section of the transit route on Eastern Avenue as part of the data analysis works. The RTC transit team conducted a before and after comparison of the transit reporting system.

Travel times from the time point for Southbound at Pebble Road to the next time point for Northbound at Horizon Ridge Parkway showed a journey time improvement of 4.61% after the ASCT was deployed.

## 8.4. COVID-19 Pandemic Effect

The Covid-19 pandemic has had a measurable effect on transportation across the USA. Following the stay-at-home orders, closing of schools and other public establishments, the traffic across Las Vegas Valley reduced. The before and after data was collected and analyzed during this period which did provide a direct before and after comparison, but not at the levels of pre-pandemic traffic. Analysis conducted by the RTC showed the study was conducted when between 80% and 100% of pre-pandemic traffic volume was present, but the most important factor is the schools were closed during the pilot data collection and this can particularly affect the East and West bound traffic volumes along the Eastern Avenue corridor.

The InSync ASCT constantly adapts to the measured traffic volumes, but this was configured and fine tunned during the period with closed schools. It is not envisaged that the effect of schools opening will cause a dramatic effect but following full opening of the schools and the return to pre-pandemic conditions, the effect on the Eastbound and Westbound traffic will need to be monitored and any adjustments made if required.

## 8.5. Conclusion

This final report has captured the performance results for the study period of June 1st, 2020 through to February 28th, 2021 on the Eastern Avenue ASCT pilot project.

Based on the data collected against the agreed KPI's, it has been determined that the pilot project on Eastern Avenue has met and surpassed these conditions. The measured KPI's are as follows:

- Reducing Traffic Delays
- Reducing Congestion
- Improving Travel Time
- Improving Travel Time Reliability
- Improving Corridor Speed
- Improving Intersection Delay

In addition to the above, the below measures were calculated to understand how the agreed KPI's would lead to additional resident benefits:

- Reducing CO2 Emissions
- Congestion cost saving for residents
- Reduced accidents

With combining both the NB and SB data, the analysis shows a 34% reduction in reportable crashes, intersection delay improvement of 19,381 hours per year and a total resident saving in wasted time and fuel costs, based on one round trip per day of $10,347,360.

| Eastern Avenue Northbound Summary of Improvements | | | |
|---|---|---|---|
| Measure | Percentage | Per vehicle | Yearly |
| Speed | 31.1% | 7.5 mph | |
| Travel Time | 24% | 117 s | 370,665 Hours |
| Stops | 69.1% | 2.8 | 32.7 Million |
| Stop Delay | 57.5% | 82 s | 257,581 Hours |
| CO2 Emission | 7.89% | 93.6g | 1,168 Ton |

| Eastern Avenue Southbound Summary of Improvements | | | |
|---|---|---|---|
| Measure | Percentage | Per Vehicle | Yearly |
| Speed | 8.2% | 2.1 mph | |
| Travel Time | 8.6% | 40 s | 113,052 Hours |
| Stops | 37.6% | 1.4 | 14.5 Million |
| Stop Delay | 10.6% | 14 s | 36,741 Hours |
| CO2 Emission | 2.66% | 31.2 g | 350 Ton |

Table 21: Summary of Project Improvements

## 8.6. Potential Future Deployment

The use of ASCT is not suitable for every corridor or intersection in Southern Nevada, the locations have to be studied and meet specific criteria. If the intersections are too far apart or an individual intersection is remote and lightly used, then the ASCT in those instances would be a lost investment.

To fully understand all the potential locations the ASCT would be suitable would require a Valley wide study to firstly select suitable corridors and then plan the order of execution. Part of this study would also determine the order in which the ASCT locations would be deployed. If not deployed strategically, it can lead to additional congestion issues in none ASCT-deployed locations.

The basic criteria for choosing a location or corridor for deploying ASCT is listed below:

- Current congestion present
- Is coordination required
- Unpredictable traffic pattens and arrival volumes
- Seasonal traffic variation
- Customer complaints hotspots
- Freight corridors
- High profile corridors
- High transit use corridors

Based on the use of InSync ASCT on the Eastern Avenue and the criteria above, a number of potential locations for deployment can be recommended. These include:

- Green Valley Parkway at the District
- S Rampart Boulevard
- S Grand Central Parkway
- St. Rose Parkway
- Boulder Highway
- Blue Diamond Road
- Rancho Drive
- Las Vegas Boulevard North
- Las Vegas Boulevard (The Strip)
- Lake Mead Boulevard
- Lake Mead Parkway
- Charleston Avenue

| *Legend*<br>*H: High*<br>*M: Medium*<br>*L: Low*<br>*Y: Yes*<br>*N: No* | **Current congestion present** | **Is coordination required** | **Unpredictable traffic pattens and arrival vol-umes (H,M,L)** | **Seasonal traffic variation** | **Customer complaints hotspots (H,M,L)** | **Freight corridors** | **High profile corridors** | **High transit use corridors (H,M,L,N)** |
|---|---|---|---|---|---|---|---|---|
| **Green Valley Parkway, (The District)** | Y | Y | H | Y | H | N | Y | L |
| **S Rampart Boulevard** | Y | Y | H | Y | H | N | N | L |
| **S Grand Central Parkway** | Y | Y | H | Y | H | Y | Y | L |
| **St. Rose Parkway** | Y | Y | H | N | H | Y | Y | N |
| **Boulder Highway** | Y | Y | L | N | H | Y | Y | H |
| **Blue Diamond Road** | Y | Y | L | Y | H | N | N | N |
| **Rancho Drive** | Y | Y | H | N | H | Y | Y | M |
| **Las Vegas Boulevard North** | Y | Y | H | Y | H | N | Y | H |
| **Las Vegas Boulevard (The Strip)** | Y | Y | H | Y | H | N | Y | H |
| **Lake Mead Boulevard** | Y | Y | L | Y | H | N | N | H |
| **Lake Mead Parkway** | Y | Y | L | Y | H | Y | N | L |
| **Charleston Avenue** | Y | Y | H | Y | H | N | Y | H |

Table 22: Potential locations Evaluation

### 8.7. Recommendations

Based on the works undertaken in this study, the following points are recommended to be considered:

- Make additional improvements to the InSync system using the StreetLight data and/or INRIX analysis tools.
- Re-connect the InSync system to the Beckler Drive/Summit Grove Drive intersection.
- RTC FAST to set up automatic data archiving of the InSync System.
- Use the recovered InSync cabinet equipment from Summit Grove Drive as a spare.
- Discover capabilities to enhance transit performance with the built in Transit Signal Priority features in InSync.
- Investigate the use of passive pedestrian detection as part of the ASCT algorithm to optimize pedestrian demand.



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Intelligence In Mobility

**Ian Machen**
170 S Green Valley Parkway
Henderson, Nevada, 89012