



JULY 27, 2021

## Lead Avenue and Coal Avenue Rest-in-Red Feasibility



ONE  
ALBUQUE  
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Lead Avenue and Coal Avenue  
Rest-in-Red Feasibility

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FINAL

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Prepared For:



City of Albuquerque  
Department of Municipal Development

Prepared By:



LEE ENGINEERING

Lee Engineering, LLC



7/28/2021

## Introduction

This report documents the impact and operations assessment of Rest-in-Red operations on Lead Ave and Coal Ave from Broadway Blvd to Washington St. The Rest-in-Red operation aims to improve the quality of life needs for the residential areas that abut these streets through enhanced speed-sensitive traffic signal operations. Traditional Rest-in-Red operations can be enhanced by adding advanced traffic detection to the system to detect the approaching vehicle's speed. If the vehicle is exceeding a given speed, the detector will not provide the signal with notice of the approaching vehicle and the traffic signal will remain red until the driver reaches the stop line detection at the intersection. By managing the speeds, this methodology has the potential to reduce the number and severity of crashes. The project tasks include:

1. Overview of Rest-in-Red Operations
2. Summary of Previous Rest-in-Red Deployments
3. Previous Studies along the Corridor
4. Background Data
5. Intersection Evaluation and Ranking
6. Operations Assessment
7. Recommendations

## Overview of Rest-in-Red Operations

Rest-in-Red operations is a method of traffic signal operations where the traffic signal is set to run free (not coordinated with adjacent signals) and programmed such that the signal returns to RED in all directions when there is no traffic detected. By resting in RED for all directions, the traffic signal is ready to serve the next vehicle detected immediately upon request. This basic Rest-in-Red operation is more responsive to vehicles regardless of the travel direction.

Building upon the operations described above, Rest-in-Red operations can be enhanced by adding advanced traffic detection to the system. The advanced detection includes speed monitoring on the main street and provides logic to forward a vehicles' detection call to the controller if speed conditions are met. Specifically, when traffic approaches the signal from the east on Lead Ave or west on Coal Ave and is recognized by the advanced detector, the signal will receive a green request for vehicles driving at or below an appropriate speed. If vehicles are exceeding that speed, the traffic signal will remain red until the driver reaches the stop line detection at the intersection approach.

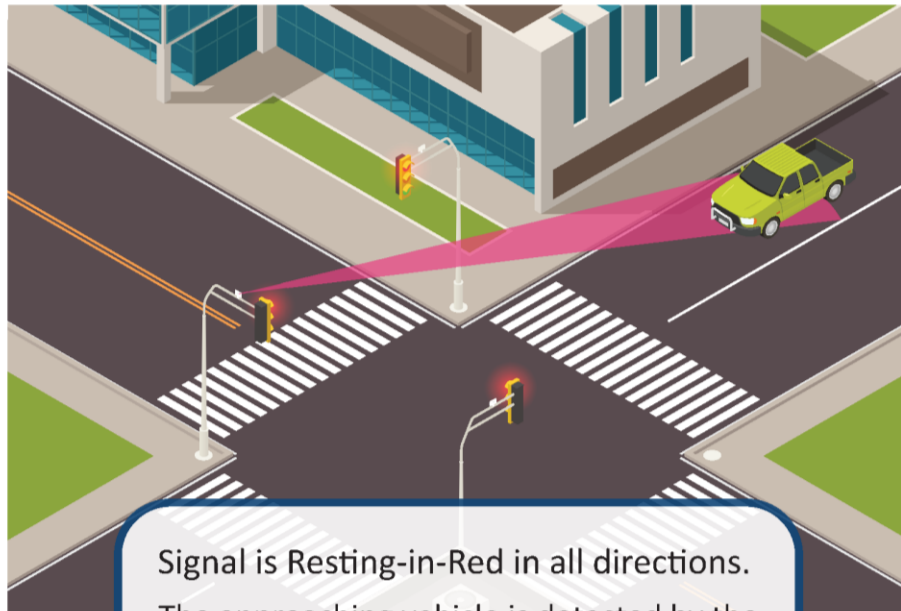
It should be noted that if the signal is currently processing another traffic operation (not Resting-in-Red), the main street service request will be made; however, it will not be serviced until the previous operation is completed. For example, if the signal is currently serving an emergency preemption call, a pedestrian call, or another vehicle movement, the traffic signal will finish the requirements of its current state before changing to the advanced request. Also, if the first arriving vehicle is compliant with the speed criteria, the green indication will be given to the main street approach, and the speed for any near or following vehicle's speed will not be assessed. In no case will the signal **turn** RED for vehicles detected going over the speed limit.

The following items and settings are required to implement and operate Rest-in-Red operations:

- Advance and stop bar detection
- Preemption equipment
- Tie pedestrian movements together
- ASC/3 Controller (w Rest-in-Red)
- Communication systems
- Tie Phases 4 and 8 together



## Lead Avenue and Coal Avenue Rest-in-Red Feasibility



Signal is Resting-in-Red in all directions.  
The approaching vehicle is detected by the  
advanced detector and its speed is measured.

If speed is less  
than desired speed



Request is made to the traffic signal  
and if there are no other operations  
ongoing, a green indication is  
immediately given.

If speed is greater  
than desired speed



No advanced call is provided  
to the signal. Vehicle is detected  
at the stop line shown above.  
A green signal indication is  
provided when appropriate.



## **Summary of Previous Rest-in-Red Deployments**

Research of Rest-in-Red operations was conducted. “Speed Management Through Rest-in-Red Traffic Signal Operation” is a published article in the Public Works Journal Corporation. The Rest-in-Red traffic signal operation was implemented in May of 1976 and had rewarding results. Out of 18 of 20 samples, the study showed that the Rest-in-Red operations reduced the speeds by 0.5 to 5.0 MPH within 600 feet of the intersection. While it is noted that this study was conducted about 45 years ago, the advancements in technology could create new opportunities for implementation.

Lee Engineering branch offices in Dallas and San Antonio, Texas, have implemented Rest-in-Red operations in the past. The strategic focus of these deployments was to mitigate intersection delay for all movements and were implemented 10-20 years ago.

Lee Engineering interviewed Arek Harmandayan, a traffic engineer for the City of Long Beach, California. The City of Long Beach implemented Rest-in-Red operations in 2012 and identified the project as successful. The City of Long Beach did not detail the findings in a formal document.

Further research was conducted but did not return detailed information for the implementation of Rest-in-Red operations for speed control.

## **Previous Studies Along the Corridor**

The City of Albuquerque has attempted to implement mitigations to reduce the speeds along the corridor. In July of 2018, the City of Albuquerque conducted a speed study (Traffic Analysis on Lead Avenue and Coal Avenue) following complaints from the neighborhood. The study showed that the corridor was experiencing some level of increased speeding. The 2018 speed study recommended reassessing the timing along the corridor. The City implemented coordinated speed signing along the corridor. Coordinated speed signing is a methodology in which the timing of the traffic lights is programmed to help drivers maintain a safe driving speed (30 mph) along the corridor. A second speed study (Speed Data Collection – Lead and Coal Avenues) conducted in November of 2019 showed that the coordinated speed signing did not reduce the speeds significantly. Following the study, the City tried reducing the maximum green times along the corridor. This current study shows that the reduced green times did not significantly reduce the speeds. The City is now looking at additional alternatives to reduce the speeds along the corridor. Operations Rest-in-Red is a strategy that the City may implement along the corridor. Attachment A provides a map comparing the 85<sup>th</sup> percentile speeds from the studies in 2018, 2019, and this current study. The 85<sup>th</sup> percentile speed is defined as 85% of vehicles traveling at or below a given speed.

## **Background Data**

The following sections describe the study procedures and present the findings for the Rest-in-Red operations feasibility, impacts, and operations assessment. The assessment included the following preliminary steps:

- Inventory of Existing Signal Infrastructure
- Data Collection
- Crash History Review

# Lead Avenue and Coal Avenue Rest-in-Red Feasibility

## Inventory of Existing Signal Infrastructure and Functionality

Lee Engineering staff visited the study area on February 2, 2021, to conduct field reviews. The field reviews included an inventory and assessment of Lead Ave and Coal Ave's existing signals infrastructure and its functionality. Signal controllers, vehicle detection sensors, preemption devices, and communication systems were observed and documented. The City of Albuquerque traffic staff tested the functionality of the preemption devices. See Attachment B for the inventory and functionality assessment results for the project area's existing signal infrastructure.

## Cost Estimate and Timeline

Stemming from the inventory of existing signal infrastructure, a cost estimate was calculated based on the needs of each intersection to meet the minimum deployment requirements.

The cost per intersection was estimated based on the required equipment to implement Rest-in-Red operations. Costs to implement Rest-in-Red operations varied by the intersection's existing equipment and implementation needs. Equipment required included a Wavetronix Smart Sensor Matrix Detection Systems, a Wavetronix Advanced Detection System, an ATC TS2 Cabinet, an ASC/3 Controller, and Optical Detectors and Cabling. Table 1: Coal Ave and Lead Ave Cost Estimates provide the estimated cost per intersection. Attachment C details the recommended equipment and costs per intersection.

Table 1: Coal Ave and Lead Ave Cost Estimates

Coal Ave Cost Estimate		Lead Ave Cost Estimate	
Intersection Name	Total Cost	Intersection Name	Total Cost
Broadway Blvd	\$ 56,550.00	Morningside Dr	\$ 46,200.00
Spruce St	\$ 30,300.00	Carlisle Blvd	\$ 30,300.00
University Blvd	\$ 39,150.00	Wellesley Dr	\$ 46,200.00
Buena Vista Dr	\$ 46,200.00	Girard Blvd	\$ 46,950.00
Yale Blvd	\$ 45,450.00	Columbia Dr	\$ 46,950.00
Stanford Dr	\$ 46,200.00	Yale Blvd	\$ 36,900.00
Girard Blvd	\$ 28,800.00	Buena Vista Dr	\$ 46,950.00
Bryn Mawr Dr	\$ 46,950.00	University Blvd	\$ 28,800.00
Carlisle Blvd	\$ 31,050.00	Cedar St	\$ 46,950.00
Montclair Dr	\$ 46,200.00	Broadway Blvd	\$ 56,550.00
Coal/ Lead Ave & Washington St	\$ 28,800.00		

The cost for the design and engineering for the implementation of Rest-in-Red operations is estimated to be about \$70,000. The estimated timeline for the project is one year, which includes six months for designing and engineering and six months to procure and install the equipment. If the project were to be completed using an On-Call, the design, engineering, and construction for the project could be reduced. Based on the recent traffic signal equipment and ancillary telemetry infrastructure improvements along the corridor, construction such as ground trenching, removals, and replacement of street infrastructure is not anticipated. As the design and survey process proceeds, the need for such work may be identified resulting in an increased project cost.

## Data Collection

Lee Engineering conducted traffic counts on January 20-22, and February 2-3, 2021, with pneumatic tube counts at 22 locations. The pneumatic tube counts provided traffic volumes and speed data. Traffic counts were analyzed for a 48-hour period. Lee Engineering also conducted side street traffic volume samples via

CCTV observations. The 15-minute intervals were observed for each study intersection. Counter locations, speed data, traffic volumes, and side street traffic volume samples are also included in Attachment A.

The speed data revealed that Girard Blvd and east of this location exhibited the most speed concerns. Specifically, Coal Ave between Carlisle Blvd and Montclair Dr recorded the most significant speed violations. With a threshold of 7 MPH, 63% of vehicles were traveling over 37 MPH. With a threshold of 5 MPH, an average of 78% of vehicles were traveling over 35 MPH.

### Crash History

A crash analysis for Coal Ave and Lead Ave was conducted to investigate which intersections experienced the most crashes. Bernalillo County provided five years of crash data for the years 2014-2018. Crash rates were calculated for each study intersection using methodologies from the Federal Highway Administration. The analysis highlights the crash rates, trends, and observations from the summarized crash data provided in Attachment D. Based on the information presented in Attachment D; the following observations are made for the studied intersections:

- Coal Ave & Yale Blvd and Coal Ave & Buena Vista Blvd experienced the highest crash rates of 2.08 and 2.00 crashes per million entering vehicles (MEV), respectively.
- Lead Ave & Cedar St, Coal Ave & Girard Blvd, and Lead Ave & Yale Blvd experienced crash rates between 1.99, 1.79, 1.73, and 1.69 crashes per MEV, respectively.
- Coal Ave & Girard Blvd and Coal Ave & Stanford Dr experienced crash rates of 1.25 and 1.02 crashes per MEV, respectively.
- Lead Ave & University Blvd, Lead Ave & Girard Blvd, and Lead Ave & Yale Blvd experienced the most significant number of crashes with 74, 64, and 62 crashes, respectively.
- Coal Ave & Yale Blvd and Coal Ave & University Blvd experienced the most significant number of crashes with 77 and 74 crashes, respectively.
- The top contributing factors were Driver Inattention, Failed to Yield Right of Way, Following too Closely, and Improper Backing.

Based on the Albuquerque Area High Fatal and Injury Network (2014-2018), crash rates for the following intersections are two to three times the mean of 0.38.

- |                          |                              |
|--------------------------|------------------------------|
| • Lead Ave & Girard Blvd | • Coal Ave & Girard Blvd     |
| • Lead Ave & Yale Blvd   | • Coal Ave and Carlisle Blvd |
| • Lead Ave & Cedar St    | • Coal Ave and Yale Blvd     |

### Intersection Evaluation and Ranking

The Lead Ave and Coal Ave's signals have been evaluated and ranked as possible candidates for Rest-in-Red operations. The signal evaluation criteria matrix included cost, travel speed data, and crash history.

### Costs

The signalized intersections were ranked based on costs to implement Rest-in-Red. The lower the costs, the better the ranking (1 being best) was for each intersection. The cost estimate per intersection is detailed further in Table 2.



# Lead Avenue and Coal Avenue Rest-in-Red Feasibility

## Speed

The signalized intersections were ranked on the collected speeds. The greater the speeds near each intersection, the higher the intersection ranking.

## Crash History

The signalized intersections were ranked based on the calculated crash rates. The greater the crash rate the higher the ranking was for each intersection .

## Final Ranking

Table 2 below summarizes the signal rankings. Also, included are the per intersection and cumulative costs used to organize the intersections into logical funding groups. The groups are color-coded, with dark green representing the highest priority and light green representing the lowest priority intersections. The gray shaded area represents intersections that were not analyzed because these intersections are coordinated north and south and implementing Rest-in-Red operations at these intersections would adversely affect their traffic operations. It should be noted that Coal Ave and Buena Vista Dr was originally in the top ten rankings but was manually ranked due to the proximity of Coal Ave/Lead Ave and Yale Blvd.

Table 2: Intersection Rankings and Total Costs

Rest-In-Red Ranking				
Intersection Name	Ranking	Comments	Cost	Cumulative Total
Coal Ave & Carlisle Blvd	1	-	\$ 31,050.00	\$ 31,050.00
Coal Ave & Girard Blvd	2	-	\$ 28,800.00	\$ 59,850.00
Lead Ave & Carlisle Blvd	3	-	\$ 30,300.00	\$ 90,150.00
Lead Ave & Cedar St	4	-	\$ 46,950.00	\$ 137,100.00
Lead Ave & Girard Blvd	5	-	\$ 46,950.00	\$ 184,050.00
Coal Ave & Montclair Dr	6	-	\$ 46,200.00	\$ 230,250.00
Coal Ave & Yale Blvd	7	-	\$ 45,450.00	\$ 275,700.00
Lead Ave & Yale Blvd	8	-	\$ 36,900.00	\$ 312,600.00
Coal Ave & Spruce St	9	-	\$ 30,300.00	\$ 342,900.00
Coal Ave & Stanford Dr	10	-	\$ 46,200.00	\$ 389,100.00
Coal Ave & Buena Vista Dr	11	-	\$ 46,200.00	\$ 435,300.00
Coal Ave & Bryn Mawr Dr	11	-	\$ 46,950.00	\$ 482,250.00
Lead Ave & Columbia Dr	15	-	\$ 46,950.00	\$ 529,200.00
Lead Ave & Wellesley Dr	10	-	\$ 46,200.00	\$ 575,400.00
Lead Ave & Morningside Dr	14	-	\$ 46,200.00	\$ 621,600.00
Lead Ave & Buena Vista Dr	16	-	\$ 46,950.00	\$ 668,550.00
Coal Ave & Broadway Blvd	-	Coordinated	\$ 56,550.00	\$ 725,100.00
Coal Ave & University Blvd	-	Coordinated	\$ 39,150.00	\$ 764,250.00
Coal/ Lead Ave & Washington St	-	Coordinated	\$ 28,800.00	\$ 793,050.00
Lead Ave & University Blvd	-	Coordinated	\$ 28,800.00	\$ 821,850.00
Lead Ave & Broadway Blvd	-	Coordinated	\$ 56,550.00	\$ 878,400.00

\*Note: Total cost includes 20% to include NMGR, mobilization, and contingency.

## Operations Assessment

Using PTV Vistro, Lee Engineering staff created a model of the Coal Ave corridor. The analysis was completed using volumes scenarios, including a low count, medium count, and high count. Turning movements were calculated based on 15-minute intervals counts via Closed-Circuit Television (CCTV) cameras and prorated to project volumes for the other scenarios. From the results shown in Attachment E, the intersections along Coal Ave that improved Level of Service and Vehicle Delay included:

- Coal Ave and Spruce
- Coal Ave and Yale Blvd
- Coal Ave and Girard
- Coal Ave and Carlisle Blvd
- Coal Ave and Buena Vista
- Coal Ave and Stanford Dr
- Coal Ave and Bryn Mawr Dr
- Coal Ave and Montclair Dr

Based on the results and volumes on Coal Ave and Lead Ave, the corridors are within the capacity to implement Rest-in-Red operations that will be fully functional during any time of the day.

## Recommendations

Based on the study, rankings, and operational assessment, Lee Engineering recommends that Rest-in-Red operations be implemented with a systems engineering approach, building up to the peak hours of the corridors. This system can be phased and tested, starting with off-peak hours and ultimately testing peak hours. The deployment should be monitored through each phase to ensure the corridor is still operating at an optimal accepted level.


### Attachments:

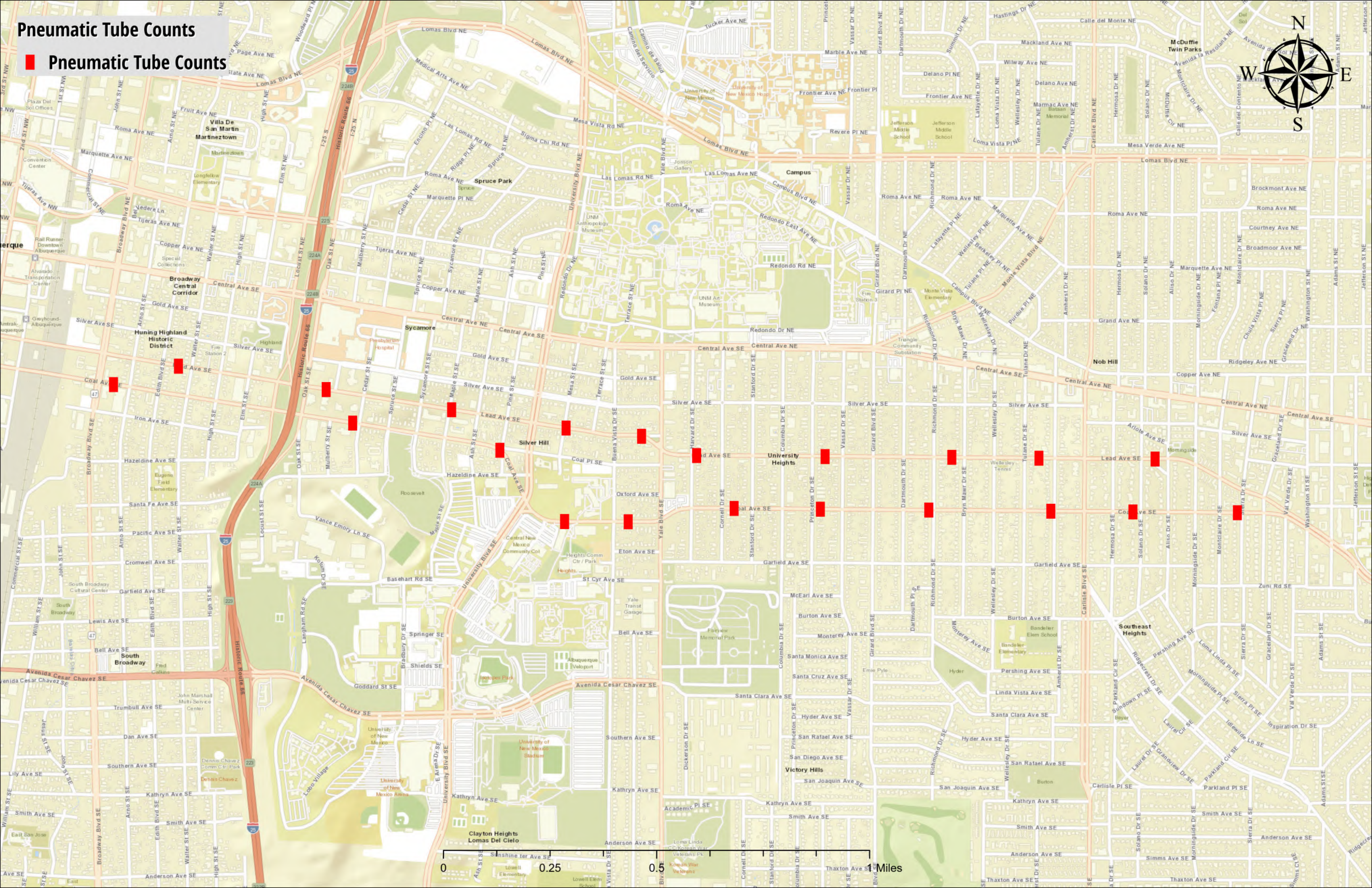
- A. Pneumatic Tube Counts and Speed Data
- B. Inventory and Documentation of Existing Signal Infrastructure
- C. Recommended Equipment and Cost Estimates
- D. Rest-in-Red Crash Summary
- E. Coal Ave Rest-in-Red Summary

## A. Pneumatic Tube Counts, Side Street Counts, and Speed Data



# Pneumatic Tube Counts

 Pneumatic Tube Counts

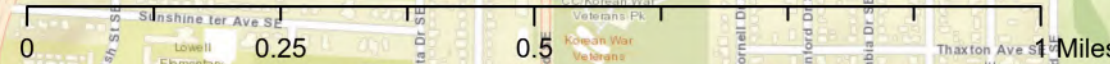
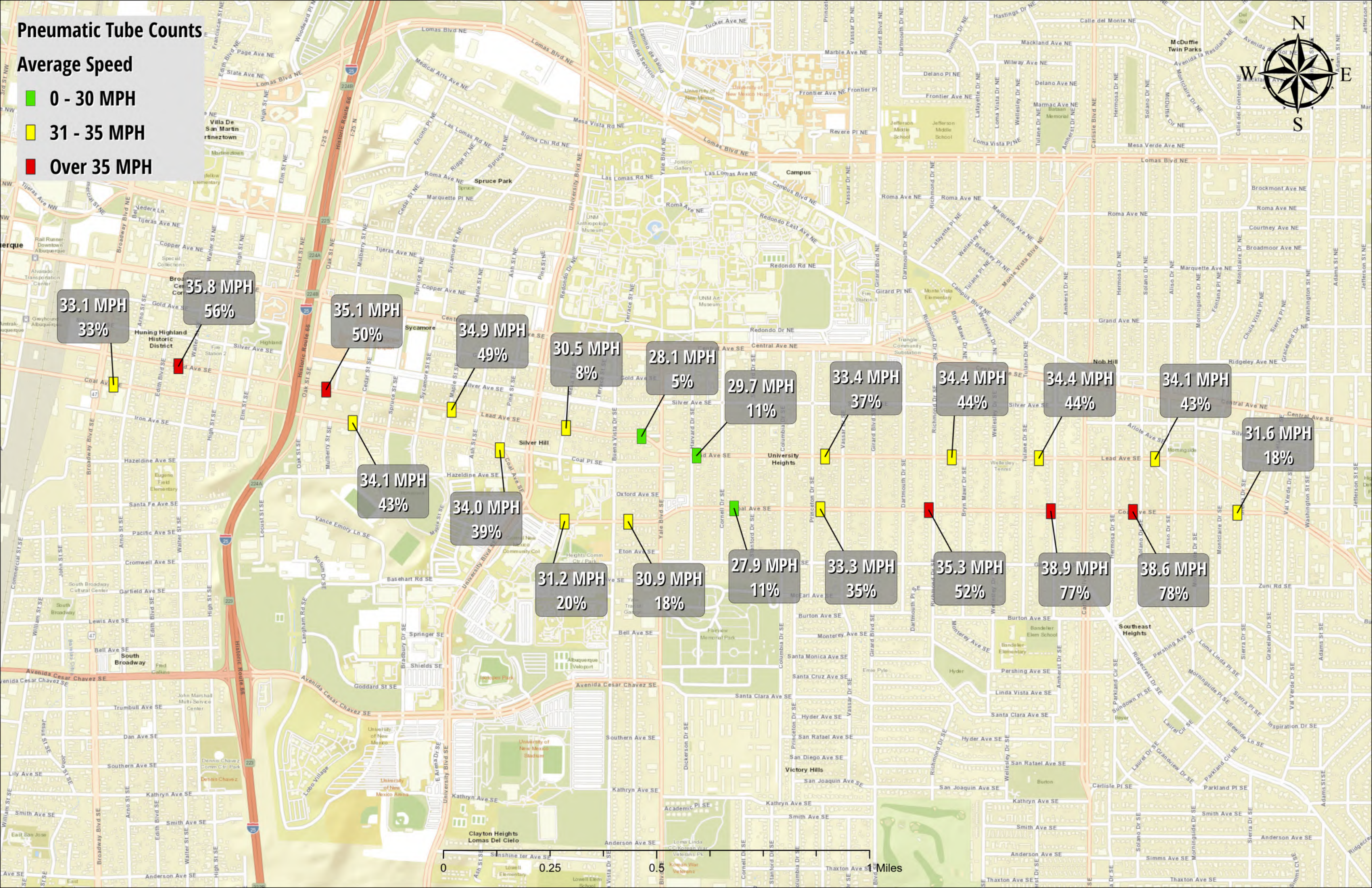




Pneumatic Tube Counts

Average Speed

- 0 - 30 MPH
- 31 - 35 MPH
- Over 35 MPH

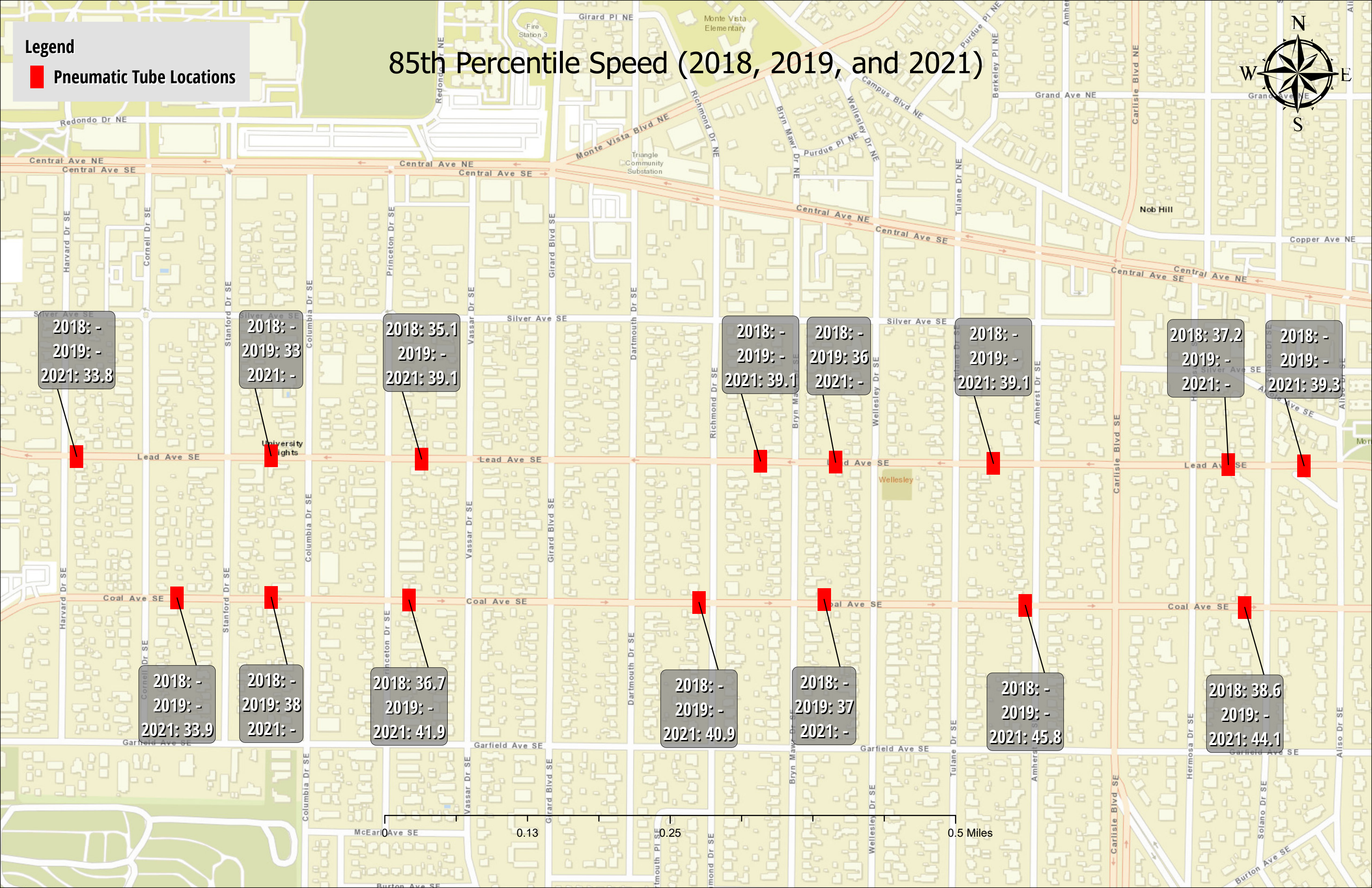




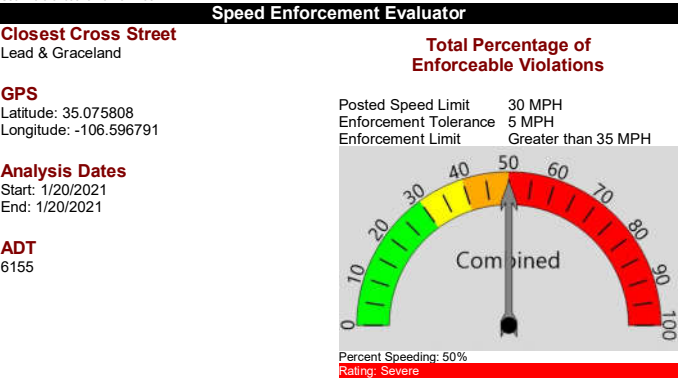
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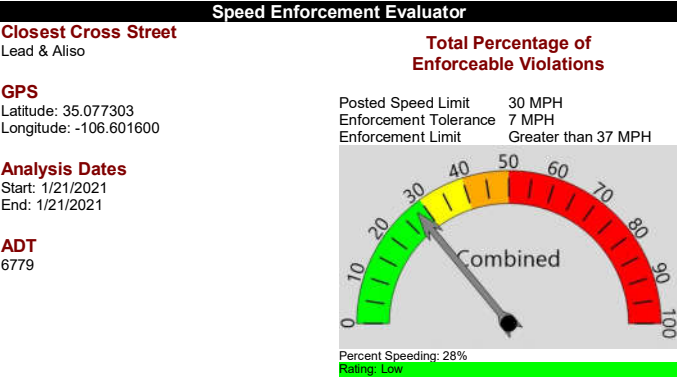
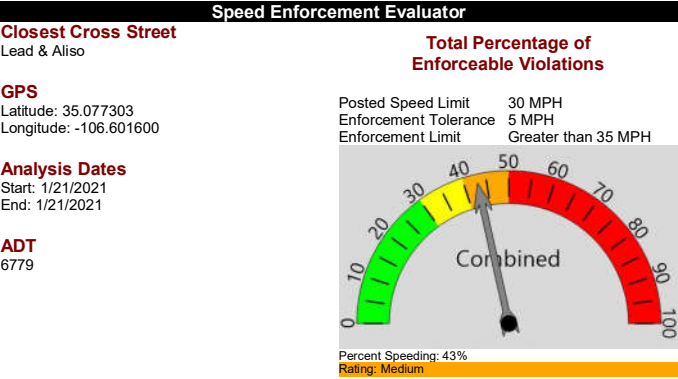
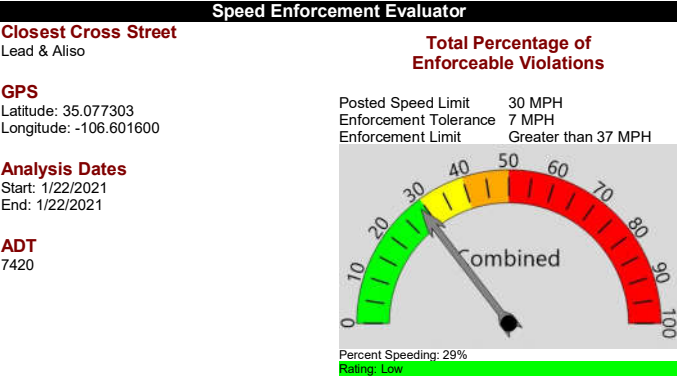
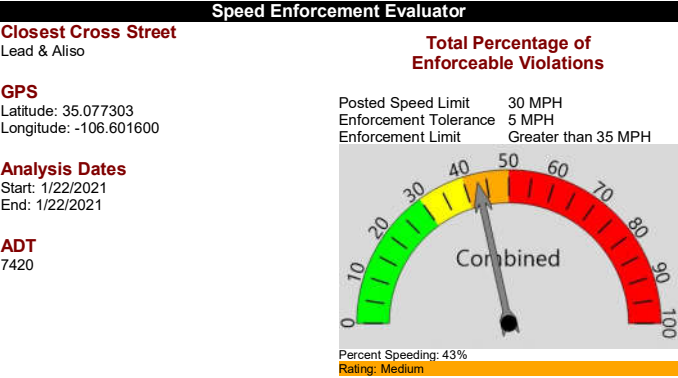
 **Pneumatic Tube Locations**

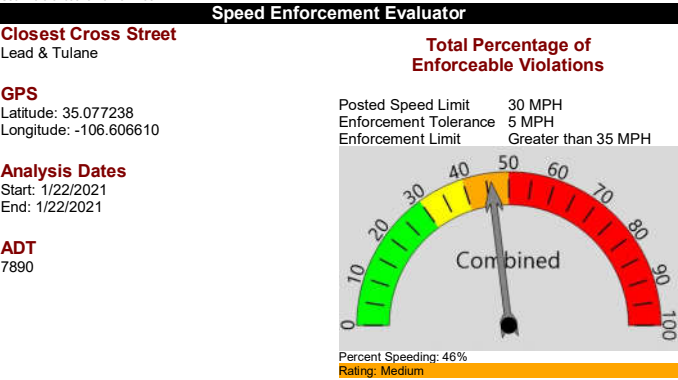
# 85th Percentile Speed (2018, 2019, and 2021)



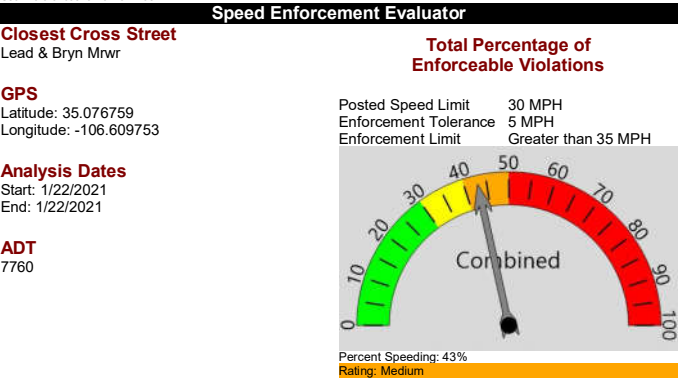


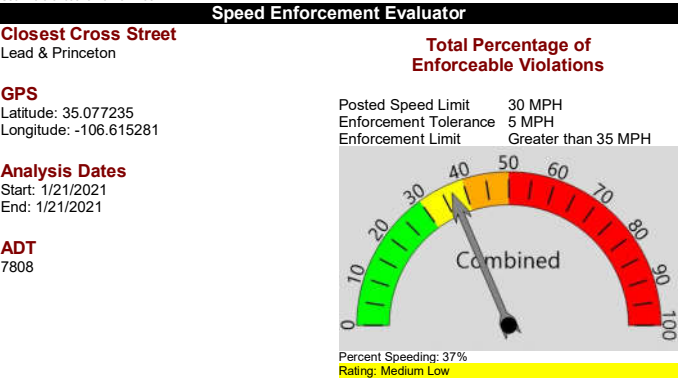


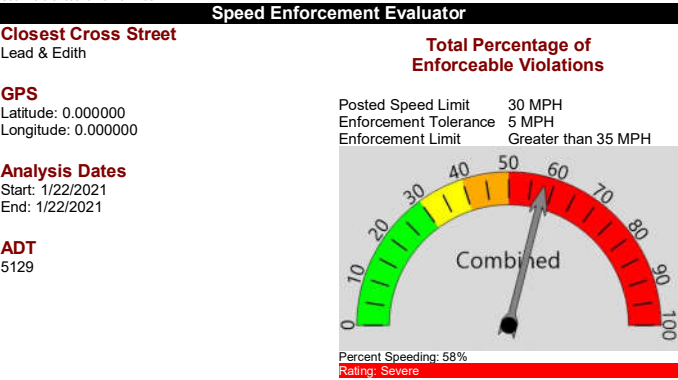


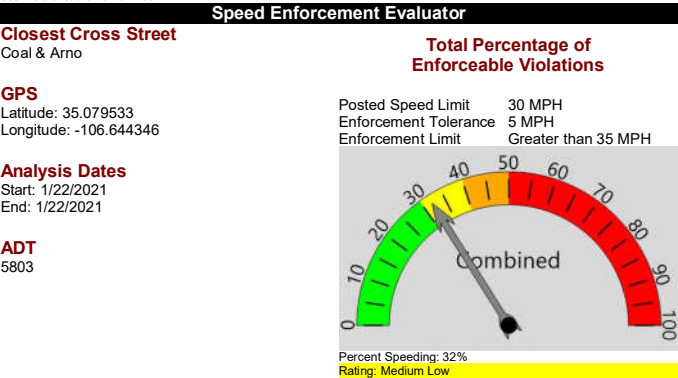


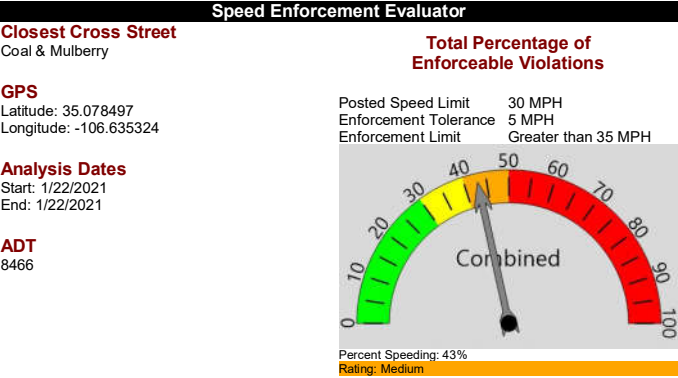




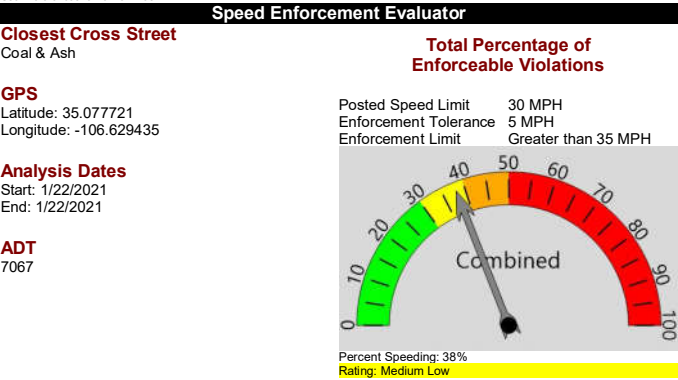


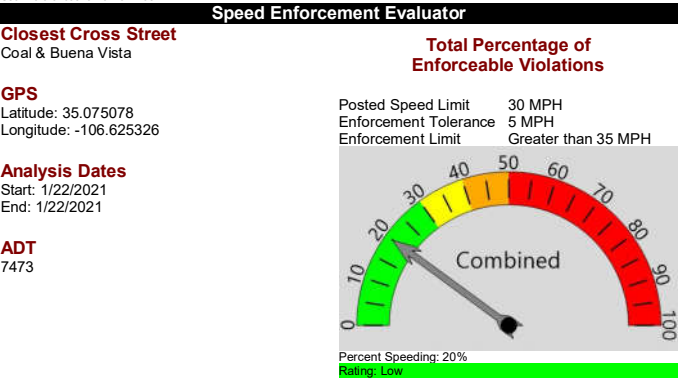


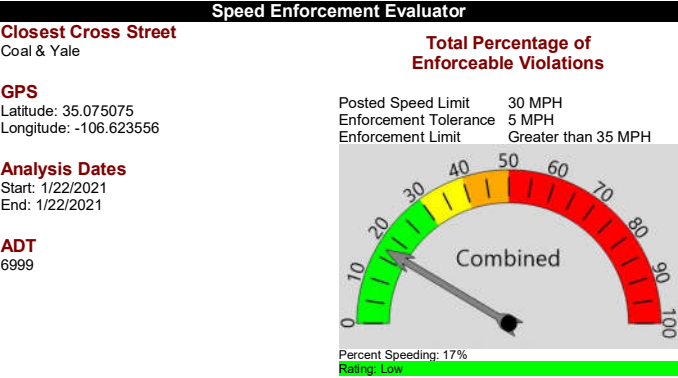


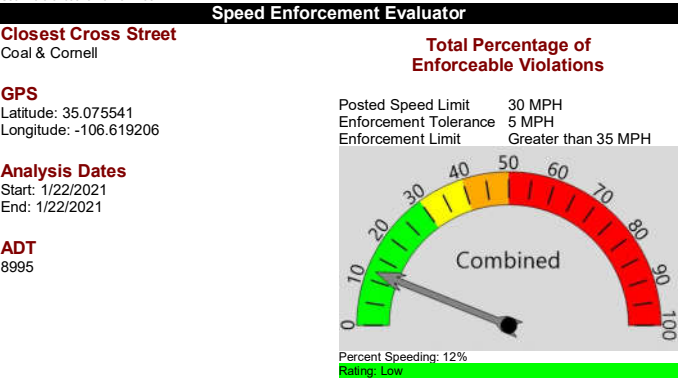


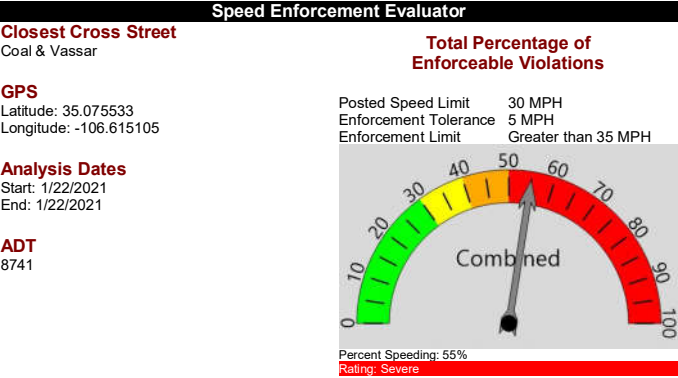




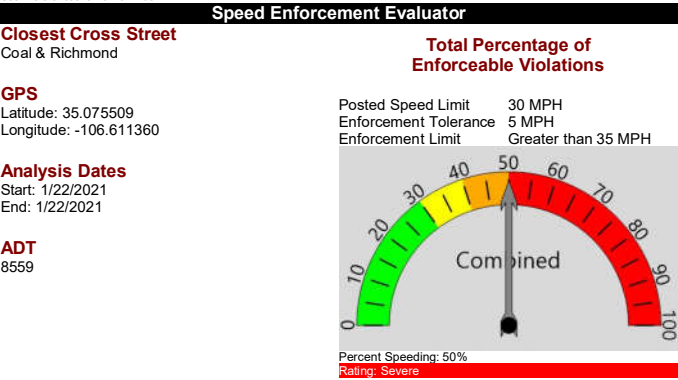


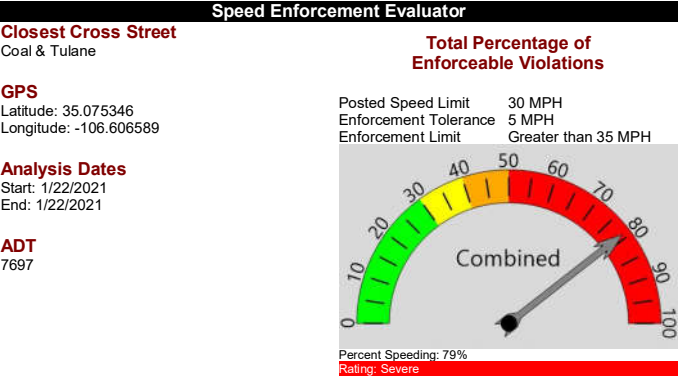


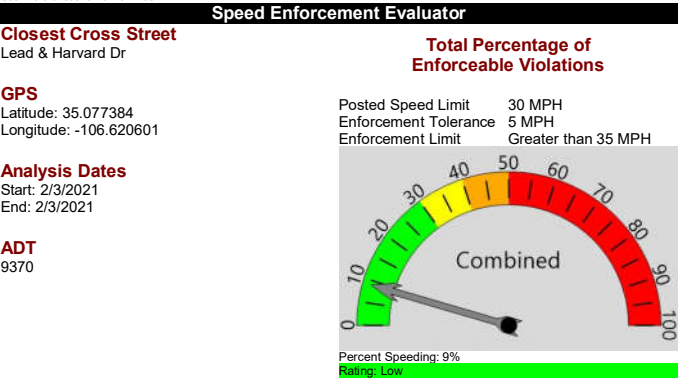


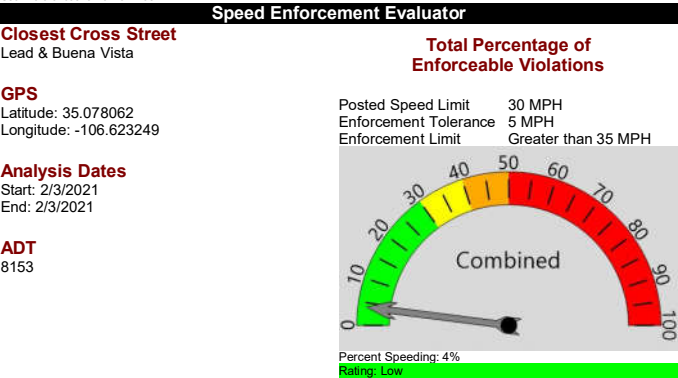












Speed Enforcement Evaluator

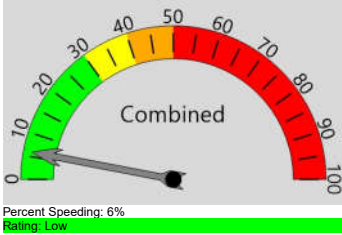
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Lead & Mesa

**GPS**  
Latitude: 35.078282  
Longitude: -106.625972

**Analysis Dates**  
Start: 2/25/2021  
End: 2/25/2021

**ADT**  
6642

**Total Percentage of Enforceable Violations**  
Posted Speed Limit 30 MPH  
Enforcement Tolerance 5 MPH  
Enforcement Limit Greater than 35 MPH



Speed Enforcement Evaluator

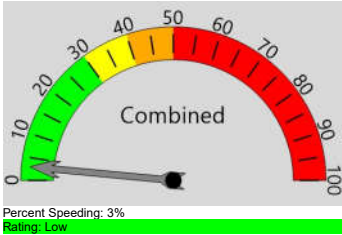
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Lead & Mesa

**GPS**  
Latitude: 35.078282  
Longitude: -106.625972

**Analysis Dates**  
Start: 2/25/2021  
End: 2/25/2021

**ADT**  
6642

**Total Percentage of Enforceable Violations**  
Posted Speed Limit 30 MPH  
Enforcement Tolerance 7 MPH  
Enforcement Limit Greater than 37 MPH



Speed Enforcement Evaluator

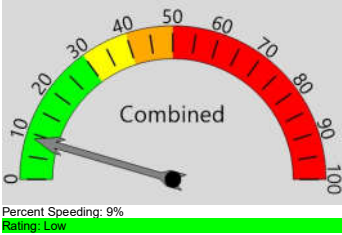
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Lead & Mesa

**GPS**  
Latitude: 35.078282  
Longitude: -106.625972

**Analysis Dates**  
Start: 2/24/2021  
End: 2/24/2021

**ADT**  
9021

**Total Percentage of Enforceable Violations**  
Posted Speed Limit 30 MPH  
Enforcement Tolerance 5 MPH  
Enforcement Limit Greater than 35 MPH



Speed Enforcement Evaluator

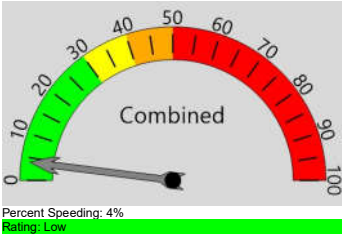
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Lead & Mesa

**GPS**  
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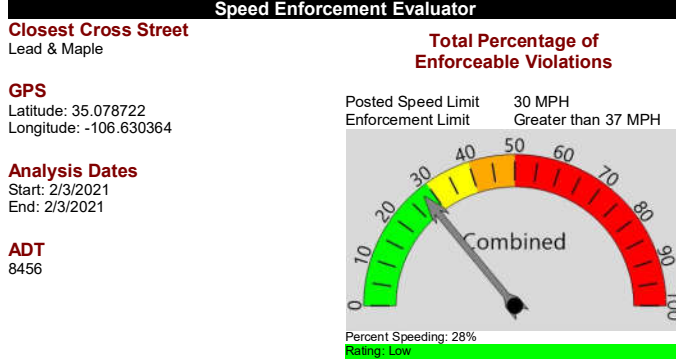
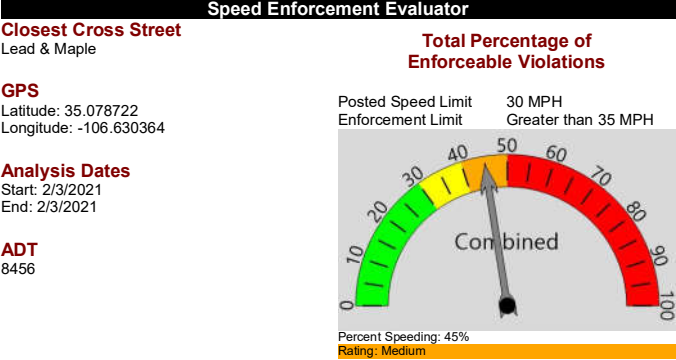
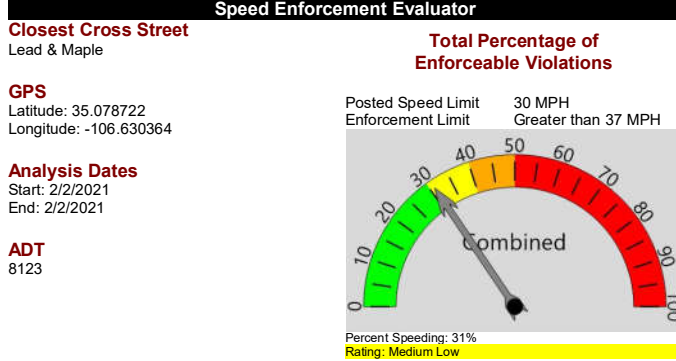
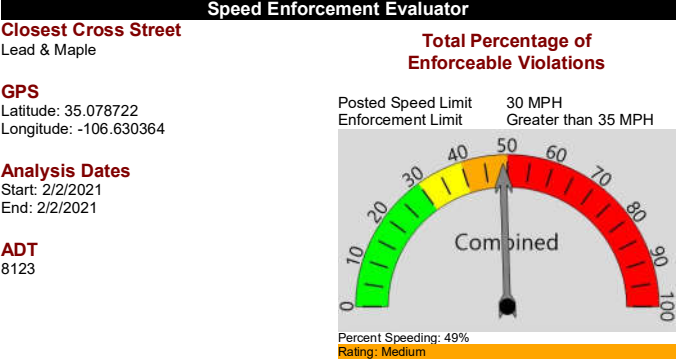
**Analysis Dates**  
Start: 2/24/2021  
End: 2/24/2021

**ADT**  
9021

**Total Percentage of Enforceable Violations**  
Posted Speed Limit 30 MPH  
Enforcement Tolerance 7 MPH  
Enforcement Limit Greater than 37 MPH







### Speed Enforcement Evaluator

**Location**  
Lead & Mulberry St SE

**GPS**  
Latitude: 35.079474  
Longitude: -106.635239

**Analysis Dates**  
Start: 2/25/2021  
End: 2/25/2021

**ADT**  
10228

#### Total Percentage of Enforceable Violations

Posted Speed Limit 30 MPH  
Enforcement Tolerance 5 MPH  
Enforcement Limit Greater than 35 MPH



Percent Speeding: 51%  
Rating: Severe



### Speed Enforcement Evaluator

**Location**  
Lead & Mulberry St SE

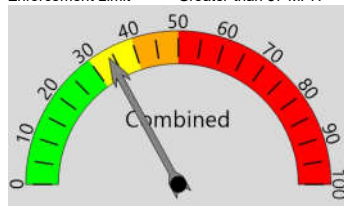
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**Analysis Dates**  
Start: 2/25/2021  
End: 2/25/2021

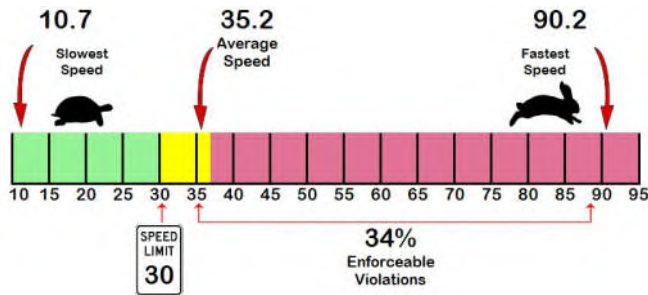
**ADT**  
10228

#### Total Percentage of Enforceable Violations

Posted Speed Limit 30 MPH  
Enforcement Tolerance 7 MPH  
Enforcement Limit Greater than 37 MPH



Percent Speeding: 34%  
Rating: Medium Low



### Speed Enforcement Evaluator

**Location**  
Lead & Mulberry St SE

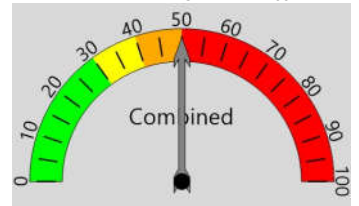
**GPS**  
Latitude: 35.079474  
Longitude: -106.635239

**Analysis Dates**  
Start: 2/24/2021  
End: 2/26/2021

**ADT**  
9941

#### Total Percentage of Enforceable Violations

Posted Speed Limit 30 MPH  
Enforcement Tolerance 5 MPH  
Enforcement Limit Greater than 35 MPH



Percent Speeding: 50%  
Rating: Severe



### Speed Enforcement Evaluator

**Location**  
Lead & Mulberry St SE

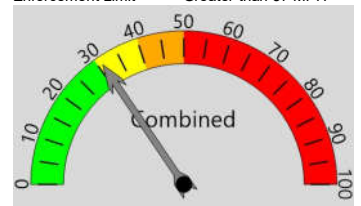
**GPS**  
Latitude: 35.079474  
Longitude: -106.635239

**Analysis Dates**  
Start: 2/24/2021  
End: 2/24/2021

**ADT**  
10580

#### Total Percentage of Enforceable Violations

Posted Speed Limit 30 MPH  
Enforcement Tolerance 7 MPH  
Enforcement Limit Greater than 37 MPH



Percent Speeding: 31%  
Rating: Medium Low



**Closest Cross Street**  
Coal & Hermosa

**GPS**  
Latitude: 35.075410  
Longitude: -106.603696

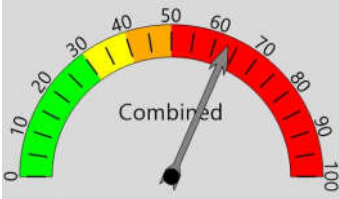
**Analysis Dates**  
Start: 2/3/2021  
End: 2/3/2021

**ADT**  
6871

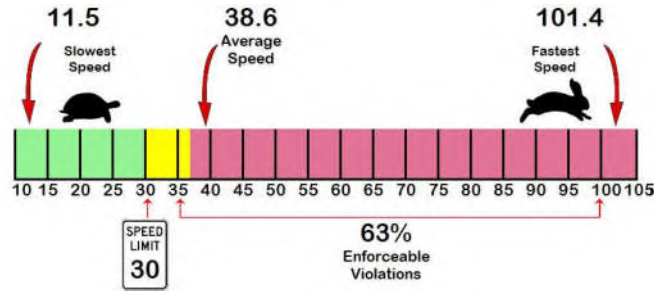
Speed Enforcement Evaluator

Total Percentage of  
Enforceable Violations

Posted Speed Limit 30 MPH  
Enforcement Limit Greater than 37 MPH



Percent Speeding: 63%  
Rating: Severe



**Closest Cross Street**  
Coal & Hermosa

**GPS**  
Latitude: 35.075410  
Longitude: -106.603696

**Analysis Dates**  
Start: 2/3/2021  
End: 2/3/2021

**ADT**  
6871

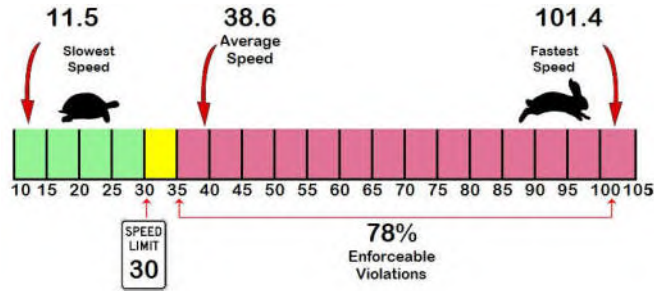
Speed Enforcement Evaluator

Total Percentage of  
Enforceable Violations

Posted Speed Limit 30 MPH  
Enforcement Limit Greater than 35 MPH



Percent Speeding: 78%  
Rating: Severe



**Closest Cross Street**  
Coal & Hermosa

**GPS**  
Latitude: 35.075410  
Longitude: -106.603696

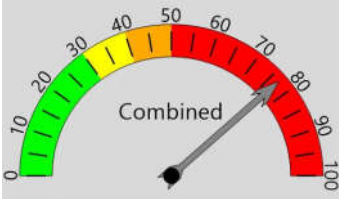
**Analysis Dates**  
Start: 2/2/2021  
End: 2/2/2021

**ADT**  
6871

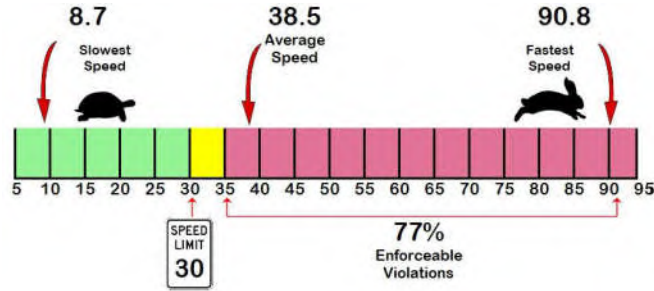
Speed Enforcement Evaluator

Total Percentage of  
Enforceable Violations

Posted Speed Limit 30 MPH  
Enforcement Limit Greater than 35 MPH



Percent Speeding: 77%  
Rating: Severe



**Closest Cross Street**  
Coal & Hermosa

**GPS**  
Latitude: 35.075410  
Longitude: -106.603696

**Analysis Dates**  
Start: 2/2/2021  
End: 2/2/2021

**ADT**  
6871

Speed Enforcement Evaluator

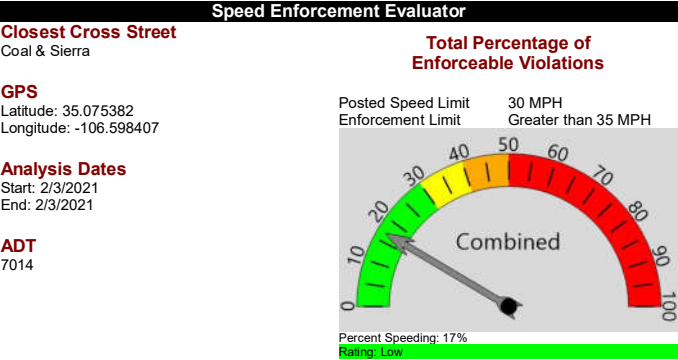
Total Percentage of  
Enforceable Violations

Posted Speed Limit 30 MPH  
Enforcement Limit Greater than 37 MPH



Percent Speeding: 63%  
Rating: Severe





Location	15-Minute Counts 7:30-7:45 AM				15-Minute Counts 5:00-5:15 PM			
Lead Ave & Broadway Blvd	SBT	SBR	NBL	NBT	SBT	SBR	NBL	NBT
	53	17	13	84	110	16	10	71
Lead Ave & Locust St	SBT	SBR	NBL	NBT	SBT	SBR	NBL	NBT
	110	71	-	-	88	70	-	-
Lead Ave & Oak St	SBT	SBR	NBL	NBT	SBT	SBR	NBL	NBT
	-	-	25	71	-	-	15	84
Lead Ave & Cedar St	SBT	SBR	NBL	NBT	SBT	SBR	NBL	NBT
	1	32	1	34	5	68	4	2
Lead Ave & University Blvd	SBT	SBR	NBL	NBT	SBT	SBR	NBL	NBT
	28	15	9	32	83	22	10	45
Lead Ave & Buena Vista Dr	SBT	SBR	NBL	NBT	SBT	SBR	NBL	NBT
	1	1	8	0	0	0	4	1
Lead Ave & Yale Blvd	SBT	SBR	NBL	NBT	SBT	SBR	NBL	NBT
	18	-	14	30	46	-	25	49
Lead Ave & Columbia Dr	SBT	SBR	NBL	NBT	SBT	SBR	NBL	NBT
	1	3	8	0	4	1	2	5
Lead Ave & Girard Blvd	SBT	SBR	NBL	NBT	SBT	SBR	NBL	NBT
	20	6	13	28	35	19	3	40
Lead Ave & Wellesly Dr	SBT	SBR	NBL	NBT	SBT	SBR	NBL	NBT
	2	-	-	2	1	5	4	3
Lead Ave & Carlisle Blvd	SBT	SBR	NBL	NBT	SBT	SBR	NBL	NBT
	26	4	15	14	30	16	11	45
Lead Ave & Morningside Dr	SBT	SBR	NBL	NBT	SBT	SBR	NBL	NBT
	1	7	4	9	5	12	1	6



Location	15-Minute Counts 7:30-7:45 AM				15-Minute Counts 5:00-5:15 PM			
Coal Ave & Broadway Blvd	NBT	NBR	SBT	SBL	NBT	NBR	SBT	SBL
	99	3	55	5	63	13	105	22
Coal Ave & Locust St	NBT	NBR	SBT	SBL	NBT	NBR	SBT	SBL
	-	-	8	125	-	-	37	79
Coal Ave & Oak St	NBT	NBR	SBT	SBL	NBT	NBR	SBT	SBL
	40	39	-	-	52	16	-	-
Coal Ave & Spruce St	NBT	NBR	SBT	SBL	NBT	NBR	SBT	SBL
	2	1	0	3	2	2	2	4
Coal Ave & University Blvd	NBT	NBR	SBT	SBL	NBT	NBR	SBT	SBL
	46	No View	38	9	60	No View	73	37
Coal Ave & Buena Vista Dr	NBT	NBR	SBT	SBL	NBT	NBR	SBT	SBL
	0	0	2	1	9	1	3	2
Coal Ave & Yale Blvd	NBT	NBR	SBT	SBL	NBT	NBR	SBT	SBL
	29	28	26	4	62	52	75	4
Coal Ave & Stanford Dr	NBT	NBR	SBT	SBL	NBT	NBR	SBT	SBL
	0	4	1	0	2	0	0	3
Coal Ave & Girard Blvd	NBT	NBR	SBT	SBL	NBT	NBR	SBT	SBL
	27	2	15	8	25	5	45	16
Coal Ave & Bryn Mawr Dr	NBT	NBR	SBT	SBL	NBT	NBR	SBT	SBL
	1	1	0	2	1	0	3	2
Coal Ave & Carlisle Blvd	NBT	NBR	SBT	SBL	NBT	NBR	SBT	SBL
	27	6	30	0	50	16	34	3
Coal Ave & Montclair Dr	NBT	NBR	SBT	SBL	NBT	NBR	SBT	SBL
	1	0	1	3	3	0	0	1

## B. Inventory and Documentation of Existing Signal Infrastructure

Coal Avenue Inventory

Intersection	Coal Avenue Inventory					
	Controller Cabinet	Controller	Detection: (Type/Lanes)	CCTV	Preemption	Communication
Coal Ave and Broadway Blvd	P TS1	ASC/2S-2100	Loop SB Left	P	N Not Operational	P
Coal Ave and Locust St	ATC TS2	ASC/3	Video SB Left/Thru	P	EB/SB	P
Coal Ave and Oak St	ATC TS2	ASC/3	Video NB Thru NB Right Construction	P	NB/EB	P
Coal Ave and Spruce St	ATC TS2	ASC/3	Video NB/SB	P	EB	P
Coal Ave and University Blvd	ATC TS2	ASC/3	Video SB Left	P	NB/EB/SB Not Operational	P
Coal Ave and Buena Vista Dr	ATC TS2	`	Video NB Not Working Set to M	P	EB	P
Coal Ave and Yale Blvd	ATC TS2	ASC/3	None	P	NB/EB/SB EB Not Operational	P
Coal Ave and Stanford Dr	ATC TS2	ASC/3	None	P	EB	P
Coal Ave and Girard Blvd	ATC TS2	ASC/3	Video NB/SB	P	NB/EB/SB	P
Coal Ave and Bryn Mawr Dr	ATC TS2	ASC/3	None	P	EB Not Operational	P
Coal Ave and Carlisle Blvd	ATC TS2	ASC/3	Video NB/SB	P	EB Not Operational	P
Coal Ave and Montclair Dr	ATC TS2	ASC/3	None	P	EB	P
Coal/Lead Ave and Washington St	ATC	Cobalt	Vantage EB/ EBL/ SBT/ NBT/ WB/ WBL	P	NB/EB/SB/WB	P

Lead Avenue Inventory

Intersection	Lead Avenue Inventory					
	Controller Cabinet	Controller	Detection: (Type/Lanes)	CCTV	Preemption	Communication
Lead Ave and Morningside Dr	ATC TS2	ASC/3	None	P	WB	P
Lead Ave and Carlisle Blvd	ATC TS2	ASC/3	Video NB/SB	P	WB	P
Lead Ave and Wellesley Dr	ATC TS2	ASC/3	None	P	WB	P
Lead Ave and Girard Blvd	ATC TS2	ASC/3	None	P	NB/SB/WB WB Not Operational	P
Lead Ave and Columbia Dr	ATC TS2	ASC/3	None	P	WB Not Operational	P
Lead Ave and Yale Blvd	ATC TS2	ASC/3	Video SB NB Missing	P	NB/SB/WB 1 Red/ 1 Green Card	P
Lead Ave and Buena Vista Dr	ATC TS2	ASC/3	None	P	WB WB Not Operational	P
Lead Ave and University Blvd	ATC TS2	ASC/3	Video NB/SB	P	NB/SB/WB	P
Lead Ave and Cedar St	ATC TS2	ASC/3	Video SB NB Missing Constant Detection on Green	P	WB WB Not Operational	P
Lead Ave and Oak St	ATC TS2	ASC/3	Video NB WB Call Constant	P	NB/WB	P
Lead Ave and Locust St	ATC TS2	ASC/3	Video SB Thru/Right	P	SB/WB	P
Lead Ave and Broadway Blvd	M TS1	ASC/2S-2100	Loop NB	P	WB Not Operational	P

## C. Recommended Equipment and Cost Estimates



Intersection Name	Coal Ave																				
	Additional Detection Required					Controller Cabinet		Controller		Preemption						CCTV				Total Cost	Total Cost (Mobilization + Contingency)
	Wavetronix Matrix Channels	Quantity	Unit Cost	Wavetronix Advanced	Unit Cost	ATC TS2	Unit Cost	ASC/3	Unit Cost	1D/1C	Unit Cost	2D/1C	Unit Cost	Detector Cable (FT)	Unit Cost	CCTV	Unit Cost	CCTV Cable	Unit Cost		
Broadway Blvd	3	1	\$ 24,500.00	1	\$ 10,000.00	-	-	1	\$ 8,000.00	1	\$ 1,250.00	1	\$ 1,500.00	750	\$ 2.50		\$ 3,900.00		\$ 1.75	\$ 47,125.00	\$ 56,550.00
Spruce St	1	1	\$ 11,250.00	1	\$ 10,000.00	-	-	0	\$ -	0	\$ 1,250.00	1	\$ 1,500.00	500	\$ 2.50		\$ 3,900.00		\$ 1.75	\$ 25,250.00	\$ 30,300.00
University Blvd	2	1	\$ 18,000.00	1	\$ 10,000.00	-	-	0	\$ -	1	\$ 1,250.00	1	\$ 1,500.00	750	\$ 2.50		\$ 3,900.00		\$ 1.75	\$ 32,625.00	\$ 39,150.00
Buena Vista Dr	3	1	\$ 24,500.00	1	\$ 10,000.00	-	-	0	\$ -	0	\$ 1,250.00	1	\$ 1,500.00	500	\$ 2.50		\$ 3,900.00		\$ 1.75	\$ 38,500.00	\$ 46,200.00
Yale Blvd	3	1	\$ 24,500.00	1	\$ 10,000.00	-	-	0	\$ -	1	\$ 1,250.00	0	\$ 1,500.00	250	\$ 2.50		\$ 3,900.00		\$ 1.75	\$ 37,875.00	\$ 45,450.00
Stanford Dr	3	1	\$ 24,500.00	1	\$ 10,000.00	-	-	0	\$ -	0	\$ 1,250.00	1	\$ 1,500.00	500	\$ 2.50		\$ 3,900.00		\$ 1.75	\$ 38,500.00	\$ 46,200.00
Girard Blvd	1	1	\$ 11,250.00	1	\$ 10,000.00	-	-	0	\$ -	0	\$ 1,250.00	0	\$ 1,500.00	0	\$ 2.50		\$ 3,900.00		\$ 1.75	\$ 24,000.00	\$ 28,800.00
Bryn Mawr Dr	3	1	\$ 24,500.00	1	\$ 10,000.00	-	-	0	\$ -	1	\$ 1,250.00	1	\$ 1,500.00	750	\$ 2.50		\$ 3,900.00		\$ 1.75	\$ 39,125.00	\$ 46,950.00
Carlisle Blvd	1	1	\$ 11,250.00	1	\$ 10,000.00	-	-	0	\$ -	1	\$ 1,250.00	1	\$ 1,500.00	750	\$ 2.50		\$ 3,900.00		\$ 1.75	\$ 25,875.00	\$ 31,050.00
Montclair Dr	3	1	\$ 24,500.00	1	\$ 10,000.00	-	-	0	\$ -	0	\$ 1,250.00	1	\$ 1,500.00	500	\$ 2.50		\$ 3,900.00		\$ 1.75	\$ 38,500.00	\$ 46,200.00
Coal/ Lead Ave & Washing	1	1	\$ 11,250.00	1	\$ 10,000.00	-	-	0	\$ -	0	\$ 1,250.00	0	\$ 1,500.00	0	\$ 2.50		\$ 3,900.00		\$ 1.75	\$ 24,000.00	\$ 28,800.00

Intersection Name	Lead Ave																				
	Additional Detection Required					Controller Cabinet		Controller		Preemption						CCTV				Sub-Total	Total Cost (Mobilization + Contingency)
	Wavetronix Matrix Channels	Quantity	Unit Cost	Wavetronix Advanced	Unit Cost	ATC TS2	Unit Cost	ASC/3	Unit Cost	1D/1C	Unit Cost	2D/1C	Unit Cost	Detector Cable (FT)	Unit Cost	CCTV	Unit Cost	CCTV Cable	Unit Cost		
Morningside Dr	3	1	\$ 24,500.00	1	\$ 10,000.00	-	-	0	\$ -	0	\$ 1,250.00	1	\$ 1,500.00	500	\$ 2.50		\$ 3,900.00		\$ 1.75	\$ 38,500.00	\$ 46,200.00
Carlisle Blvd	1	1	\$ 11,250.00	1	\$ 10,000.00	-	-	0	\$ -	0	\$ 1,250.00	1	\$ 1,500.00	500	\$ 2.50		\$ 3,900.00		\$ 1.75	\$ 25,250.00	\$ 30,300.00
Wellesley Dr	3	1	\$ 24,500.00	1	\$ 10,000.00	-	-	0	\$ -	0	\$ 1,250.00	1	\$ 1,500.00	500	\$ 2.50		\$ 3,900.00		\$ 1.75	\$ 38,500.00	\$ 46,200.00
Girard Blvd	3	1	\$ 24,500.00	1	\$ 10,000.00	-	-	0	\$ -	1	\$ 1,250.00	1	\$ 1,500.00	750	\$ 2.50		\$ 3,900.00		\$ 1.75	\$ 39,125.00	\$ 46,950.00
Columbia Dr	3	1	\$ 24,500.00	1	\$ 10,000.00	-	-	0	\$ -	1	\$ 1,250.00	1	\$ 1,500.00	750	\$ 2.50		\$ 3,900.00		\$ 1.75	\$ 39,125.00	\$ 46,950.00
Yale Blvd	2	1	\$ 18,000.00	1	\$ 10,000.00	-	-	0	\$ -	0	\$ 1,250.00	0	\$ 1,500.00	0	\$ 2.50		\$ 3,900.00		\$ 1.75	\$ 30,750.00	\$ 36,900.00
Buena Vista Dr	3	1	\$ 24,500.00	1	\$ 10,000.00	-	-	0	\$ -	1	\$ 1,250.00	1	\$ 1,500.00	750	\$ 2.50		\$ 3,900.00		\$ 1.75	\$ 39,125.00	\$ 46,950.00
University Blvd	1	1	\$ 11,250.00	1	\$ 10,000.00	-	-	0	\$ -	0	\$ 1,250.00	0	\$ 1,500.00	0	\$ 2.50		\$ 3,900.00		\$ 1.75	\$ 24,000.00	\$ 28,800.00
Cedar St	3	1	\$ 24,500.00	1	\$ 10,000.00	-	-	0	\$ -	1	\$ 1,250.00	1	\$ 1,500.00	750	\$ 2.50		\$ 3,900.00		\$ 1.75	\$ 39,125.00	\$ 46,950.00
Broadway Blvd	3	1	\$ 24,500.00	1	\$ 10,000.00	1	\$ 30,000.00	1	\$ 8,000.00	1	\$ 1,250.00	1	\$ 1,500.00	750	\$ 2.50		\$ 3,900.00		\$ 1.75	\$ 47,125.00	\$ 56,550.00

#### D. Rest in Red Crash Summary

Crash Based Ranking			
Frequency		Crash Rate (Crashes/MEV)	
Coal/Yale	77	Coal/Yale	2.08
Lead/Girard	64	Coal/Buena Vista	2.00
Lead/Yale	62	Lead/Cedar	1.99
Lead/Cedar	50	Coal/Carlisle	1.79
Coal/Girard	45	Lead/Girard	1.73
Coal/Carlisle	45	Lead/Yale	1.69
Coal/Buena Vista	37	Coal/Girard	1.25
Lead/Carlisle	26	Coal/Stanford	1.02
Coal/Stanford	24	Lead/Carlisle	0.87
Lead/Columbia	19	Lead/Columbia	0.75
Coal/Bryn Mawr	16	Coal/Montclair	0.74
Lead/Wellesly	15	Lead/Wellesly	0.72
Coal/Spruce	15	Coal/Bryn Mawr	0.69
Coal/Montclair	11	Coal/Spruce	0.69
Lead/Buena Vista	10	Lead/Buena Vista	0.50
Lead/Morningside	5	Lead/Morningside	0.28

Crash Summary		LEAD/COAL AVE	LEAD AVE				
		WASHINGTON ST	BETWEEN WASHINGTON ST & MORNINGSIDE DR	MORNINGSIDE DR	BETWEEN MORNINGSIDE DR & CARLISLE BLVD	CARLISLE BLVD	BETWEEN CARLISLE BLVD & WELLESLEY DR
Total Crashes		17	20	5	27	26	19
By Year	2014	3	1	1	4	5	2
	2015	7	6	2	4	3	7
	2016	4	6	1	6	2	1
	2017	2	3	0	4	10	4
	2018	1	4	1	9	6	5
By Type	Fixed Object	3	3	0	3	1	2
	Unknown/Non-Collision	0	1	0	1	0	0
	Other Vehicle - All Others/Entering At Angle	3	3	1	7	8	4
	Other Vehicle - Both Going Straight/Entering At Angle	2	0	0	0	2	1
	Other Vehicle - From Opposite Direction	4	3	0	1	0	1
	Other Vehicle - From Opposite Direction/All Others	2	1	1	7	6	2
	Other Vehicle - From Opposite Direction/Both Going Straight	0	1	0	2	3	1
	Other Vehicle - From Same Direction/All Others	0	1	0	0	0	0
	Other Vehicle - From Same Direction/Both Going Straight	1	1	0	2	0	1
	Other Vehicle - From Same Direction/Rear End Collision	1	2	2	0	4	1
	Other Vehicle - From Same Direction/Sideswipe Collision	0	0	0	1	0	2
	Other Vehicle - Not Stated and All Other	0	0	1	0	0	0
	Other Vehicle - One Left Turn/Entering At Angle	1	1	0	1	1	1
	Other Vehicle - One Right Turn/Entering At Angle	0	1	0	1	0	1
	Parked Vehicle	0	1	0	1	0	2
	Pedestrian	0	1	0	0	0	0
	Vehicle on Other Road	0	0	0	0	1	0
By Lighting Conditions	% Other Vehicle - From Opposite Direction/All Others	18%	15%	20%	26%	31%	21%
	% Other Vehicle - From Same Direction/Rear End Collision	12%	5%	20%	26%	23%	11%
	% Other Vehicle - From Same Direction/All Others	24%	15%	0%	4%	0%	5%
	Day	11	15	1	19	16	14
	Dawn/Dusk	0	1	1	1	1	0
By Severity	Dark	4	4	3	6	7	5
	Invalid Code/Not Specified	2	0	0	1	2	0
	% Day	65%	75%	20%	70%	62%	74%
	PDO	13	11	3	17	14	14
	Injury	4	9	2	9	12	5
By Cause	Fatality	0	0	0	1	0	0
	% Property Damage Only	76%	55%	60%	63%	54%	74%
	% Injury	24%	45%	40%	33%	46%	26%
	Alcohol/Drug Involved	0	1	1	0	3	0
	Avoid No Contact - Vehicle	0	1	0	1	0	1
	Disregarded Traffic Signal	1	1	1	3	8	2
	Driver Inattention	4	8	2	7	5	2
	Drove Left Of Center	0	0	0	1	0	1
	Excessive Speed	1	0	0	1	0	3
	Failed to Yield Right of Way	2	2	0	4	2	4
	Following Too Closely	0	0	1	1	2	0
	Improper Backing/ Lane Change/ Overtaking/ Turn/ Driving	1	0	0	2	0	0
	Inadequate Brakes	1	0	0	0	0	0
	Made Improper Turn	0	1	0	1	1	1
	Missing Data	3	1	0	2	3	1
	None	0	2	0	2	1	2
	Other Improper Driving	1	1	0	0	0	2
	Passed Stop Sign	0	2	0	2	1	0
	Pedestrian Error	1	0	0	0	0	0
	Speed Too Fast for Conditions	2	0	0	0	0	0
	% Driver Inattention	24%	40%	40%	26%	19%	11%
	% Failed to Yield Right of Way	6%	5%	20%	11%	31%	11%
	% Following Too Closely	12%	10%	0%	15%	8%	21%
	% Improper Backing	18%	5%	0%	7%	12%	5%

Crash Summary		LEAD AVE					
		WELLESLEY DR	BETWEEN WELLESLEY DR & GIRARD BLVD	GIRARD BLVD	BETWEEN GIRARD BLVD & COLUMBIA DR	COLUMBIA DR	BETWEEN COLUMBIA DR & YALE BLVD
Total Crashes		16	28	64	25	19	62
By Year	2014	3	4	9	3	6	12
	2015	2	4	8	4	2	7
	2016	5	5	20	6	2	11
	2017	1	9	13	9	3	18
	2018	5	6	14	3	6	14
By Type	Fixed Object	1	2	2	2	1	1
	Other Vehicle - All Others/Entering At Angle	3	5	15	7	4	14
	Other Vehicle - Both Going Straight/Entering At Angle	1	1	2	0	0	2
	Other Vehicle - From Opposite Direction	0	2	6	3	1	5
	Other Vehicle - From Opposite Direction/All Others	2	4	14	1	6	18
	Other Vehicle - From Opposite Direction/Both Going Straight	0	2	5	2	0	3
	Other Vehicle - From Opposite Direction/Sideswipe Collision	1	0	1	0	0	0
	Other Vehicle - From Same Direction/All Others	1	1	2	0	0	2
	Other Vehicle - From Same Direction/Both Going Straight	1	1	4	1	2	1
	Other Vehicle - From Same Direction/Both Turn Right	0	0	0	0	0	1
	Other Vehicle - From Same Direction/One Left Turn	0	1	1	0	0	1
	Other Vehicle - From Same Direction/One Stopped	0	0	0	0	1	0
	Other Vehicle - From Same Direction/Rear End Collision	1	0	3	1	1	0
	Other Vehicle - From Same Direction/Sideswipe Collision	0	1	1	2	1	1
	Other Vehicle - From Same Direction/Vehicle Backing	1	1	0	0	0	0
	Other Vehicle - One Left Turn/Entering At Angle	1	1	2	3	2	8
	Other Vehicle - One Right Turn/Entering At Angle	1	0	0	0	0	0
	Parked Vehicle	1	3	4	0	0	2
	Pedalcyclist	1	2	1	2	0	1
	Pedestrian	0	1	1	1	0	2
	% Other Vehicle - From Opposite Direction/All Others	19%	18%	23%	28%	21%	23%
	% Other Vehicle - From Same Direction/Rear End Collision	13%	14%	22%	4%	32%	29%
	% Other Vehicle - From Same Direction/All Others	0%	7%	9%	12%	5%	8%
By Lighting Conditions	Day	12	21	37	18	17	40
	Dawn/Dusk	1	1	3	3	0	2
	Dark	3	5	19	3	1	16
	Invalid Code/Not Specified	0	1	5	1	1	4
By Severity	PDO	7	21	41	20	14	45
	Injury	9	7	23	5	5	17
	% Property Damage Only	44%	75%	64%	80%	74%	73%
	% Injury	56%	25%	36%	20%	26%	27%
By Cause	Alcohol/Drug Involved	0	0	1	0	0	3
	Avoid No Contact - Other	1	0	0	1	0	0
	Avoid No Contact - Vehicle	0	1	1	0	0	2
	Disregarded Traffic Signal	3	1	21	2	2	1
	Driver Inattention	4	6	14	7	4	8
	Drove Left Of Center	0	0	1	2	1	2
	Excessive Speed	1	2	2	0	1	2
	Failed to Yield Right of Way	3	4	3	6	3	17
	Following Too Closely	1	2	1	1	2	1
	Improper Backing/ Lane Change/ Overtaking/ Turn/ Driving	0	1	1	1	0	2
	Inadequate Brakes	0	0	1	0	1	0
	Made Improper Turn	1	2	4	3	3	4
	Missing Data	1	4	4	1	2	6
	None	1	1	5	0	0	1
	Other - No Driver Error	0	0	1	0	0	0
	Other Improper Driving	0	1	1	0	0	2
	Other Mechanical Defect	0	0	1	0	0	0
	Passed Stop Sign	0	0	0	0	0	11
	Pedestrian Error	0	2	0	1	0	0
	Speed Too Fast for Conditions	0	1	2	0	0	0
	% Driver Inattention	25%	21%	22%	28%	21%	13%
	% Failed to Yield Right of Way	19%	4%	33%	8%	11%	2%
	% Following Too Closely	19%	14%	5%	24%	16%	27%
	% Improper Backing	6%	14%	6%	4%	11%	10%



Crash Summary		LEAD AVE					
		YALE BLVD	BUENA VISTA DR	BETWEEN BUENA VISTA DR AND UNIVERSITY BLVD	UNIVERSITY BLVD	BETWEEN UNIVERSITY BLVD & CEDAR ST	CEDAR ST
Total Crashes		62	10	13	74	82	50
By Year	2014	7	1	1	14	18	3
	2015	16	1	3	10	11	13
	2016	14	2	2	15	25	13
	2017	11	3	5	22	15	13
	2018	14	3	2	13	13	8
By Type	Fixed Object	8	2	0	0	2	0
	Other Vehicle - All Others/Entering At Angle	11	0	1	15	11	8
	Other Vehicle - Both Going Straight/Entering At Angle	0	0	0	3	3	1
	Other Vehicle - From Opposite Direction	6	0	1	9	10	9
	Other Vehicle - From Opposite Direction/All Others	13	2	3	20	21	9
	Other Vehicle - From Opposite Direction/Both Going Straight	1	0	1	3	0	0
	Other Vehicle - From Opposite Direction/Head-On Collision	1	0	0	0	0	0
	Other Vehicle - From Opposite Direction/One Left Turn	0	0	0	1	0	1
	Other Vehicle - From Opposite Direction/One Right Turn	0	0	0	1	0	0
	Other Vehicle - From Same Direction/All Others	0	0	0	1	4	0
	Other Vehicle - From Same Direction/Both Going Straight	3	1	0	5	6	10
	Other Vehicle - From Same Direction/One Left Turn	0	0	0	1	1	0
	Other Vehicle - From Same Direction/One Stopped	2	0	0	1	0	1
	Other Vehicle - From Same Direction/Rear End Collision	6	0	0	5	5	4
	Other Vehicle - From Same Direction/Sideswipe Collision	1	2	1	3	3	3
	Other Vehicle - One Left Turn/Entering At Angle	7	1	0	1	8	1
	Other Vehicle - One Right Turn/Entering At Angle	0	0	0	1	1	1
	Other Vehicle - One Stopped/Entering At Angle	0	0	0	1	1	0
	Overturn/Rollover	1	0	1	1	2	0
	Parked Vehicle	0	0	3	0	1	1
	Pedalcyclist	1	1	0	0	1	0
	Pedestrian	1	1	2	2	2	1
	% Other Vehicle - From Opposite Direction/All Others	18%	0%	8%	20%	13%	16%
	% Other Vehicle - From Same Direction/Rear End Collision	21%	20%	23%	27%	26%	18%
	% Other Vehicle - From Same Direction/All Others	10%	0%	8%	12%	12%	18%
By Lighting Conditions	Day	39	5	8	52	53	43
	Dawn/Dusk	2	0	1	3	7	1
	Dark	19	5	4	13	14	0
	Invalid Code/Not Specified	2	0	0	6	8	6
By Severity	PDO	42	6	7	53	59	35
	Injury	20	4	5	21	23	15
	Fatality	0	0	1	0	0	0
	% Property Damage Only	68%	60%	54%	72%	72%	70%
	% Injury	32%	40%	38%	28%	28%	30%
By Cause	Alcohol/Drug Involved	7	1	0	1	0	0
	Avoid No Contact - Other	1	0	0	0	1	0
	Avoid No Contact - Vehicle	1	0	1	0	0	0
	Disregarded Traffic Signal	9	0	0	17	2	7
	Driver Inattention	14	3	6	19	20	12
	Drove Left Of Center	1	0	0	2	0	0
	Excessive Speed	3	0	0	1	3	4
	Failed to Yield Right of Way	5	2	1	8	15	1
	Following Too Closely	4	0	0	5	8	6
	Improper Backing/ Lane Change/ Overtaking/ Turn/ Driving	2	1	1	4	7	6
	Inadequate Brakes	2	0	0	1	0	0
	Made Improper Turn	3	0	1	2	5	4
	Missing Data	4	2	0	7	7	6
	None	4	0	1	3	5	1
	Other - No Driver Error	1	0	0	0	0	1
	Other Improper Driving	0	0	2	1	1	0
	Passed Stop Sign	0	0	0	0	7	0
	Pedestrian Error	0	0	0	1	1	1
	Speed Too Fast for Conditions	1	1	0	2	0	1
	% Driver Inattention	23%	30%	46%	26%	24%	24%
	% Failed to Yield Right of Way	15%	0%	0%	23%	2%	14%
	% Following Too Closely	8%	20%	8%	11%	18%	2%
	% Improper Backing	6%	20%	0%	9%	9%	12%

Crash Summary		LEAD AVE				
		BETWEEN CEDAR ST & OAK ST	OAK ST	LOCUST ST	BETWEEN LOCUST AVE & BROADWAY BLVD	BROADWAY BLVD
Total Crashes		10	64	48	57	59
By Year	2014	3	7	8	9	9
	2015	2	12	13	8	12
	2016	1	10	6	15	14
	2017	3	19	10	13	8
	2018	1	16	11	12	16
By Type	Fixed Object	0	0	0	2	6
	Other Vehicle - All Others/Entering At Angle	0	22	11	12	14
	Other Vehicle - Both Going Straight/Entering At Angle	0	1	2	1	1
	Other Vehicle - Both Turn Left/Entering At Angle	0	0	0	1	0
	Other Vehicle - Both Turn Right/Entering At Angle	0	0	1	0	0
	Other Vehicle - From Opposite Direction	2	4	14	5	6
	Other Vehicle - From Opposite Direction/All Others	3	16	12	11	8
	Other Vehicle - From Opposite Direction/Both Going Straight	0	8	1	2	5
	Other Vehicle - From Opposite Direction/Sideswipe Collision	0	1	0	0	1
	Other Vehicle - From Same Direction/All Others	2	0	1	0	0
	Other Vehicle - From Same Direction/Both Going Straight	2	4	2	4	4
	Other Vehicle - From Same Direction/One Left Turn	0	0	0	2	0
	Other Vehicle - From Same Direction/One Stopped	0	0	0	0	2
	Other Vehicle - From Same Direction/Rear End Collision	1	0	1	2	5
	Other Vehicle - From Same Direction/Sideswipe Collision	0	2	1	3	2
	Other Vehicle - One Left Turn/Entering At Angle	0	3	2	2	2
	Other Vehicle - One Vehicle/Leave Driveway Access	0	0	0	1	0
	Other Vehicle - One Vehicle/Stopped Traffic	0	0	0	0	1
	Overturn/Rollover	0	1	0	1	0
	Parked Vehicle	0	0	0	1	0
	Pedalcyclist	0	2	0	7	1
	Pedestrian	0	0	0	0	1
	% Other Vehicle - From Opposite Direction/All Others	0%	34%	23%	21%	24%
	% Other Vehicle - From Same Direction/Rear End Collision	30%	25%	25%	19%	14%
	% Other Vehicle - From Same Direction/All Others	20%	6%	29%	9%	10%
By Lighting Conditions	Day	8	45	36	40	36
	Dawn/Dusk	0	5	2	2	3
	Dark	0	11	8	12	20
	Invalid Code/Not Specified	2	3	2	3	0
By Severity	PDO	10	41	34	37	31
	Injury	0	23	14	20	28
	% Property Damage Only	100%	64%	71%	65%	53%
	% Injury	0%	36%	29%	35%	47%
By Cause	Alcohol/Drug Involved	0	1	0	2	3
	Avoid No Contact - Other	0	0	1	2	1
	Avoid No Contact - Vehicle	0	0	1	0	3
	Disregarded Traffic Signal	0	26	16	2	19
	Driver Inattention	0	7	12	18	15
	Excessive Speed	0	5	1	1	0
	Failed to Yield Right of Way	0	5	2	9	3
	Following Too Closely	5	1	1	1	4
	Improper Backing/ Lane Change/ Overtaking/ Turn/ Driving	0	4	2	6	2
	Inadequate Brakes	0	1	0	0	1
	Made Improper Turn	1	1	1	8	1
	Missing Data	2	5	5	3	0
	None	1	5	2	1	4
	Other - No Driver Error	0	0	1	0	1
	Other Improper Driving	0	2	2	0	0
	Other Mechanical Defect	0	0	0	0	1
	Passed Stop Sign	0	0	0	2	0
	Pedestrian Error	0	1	0	0	0
	Road Defect	0	0	0	1	0
	Speed Too Fast for Conditions	1	0	1	1	1
	% Driver Inattention	0%	11%	25%	32%	25%
	% Failed to Yield Right of Way	0%	41%	33%	4%	32%
	% Following Too Closely	0%	8%	4%	16%	5%
	% Improper Backing	20%	8%	10%	5%	0%

Crash Summary		COAL AVE					
		BROADWAY BLVD	BETWEEN BROADWAY BLVD & LOCUST ST	LOCUST ST	BETWEEN LOCUST ST & OAK ST	OAK ST	BETWEEN OAK ST & SPRUCE ST
Total Crashes		47	33	40	5	65	23
By Year	2014	6	4	6	0	11	2
	2015	8	6	5	1	11	3
	2016	13	8	7	2	23	3
	2017	8	9	11	1	7	6
	2018	12	6	11	1	13	9
By Type	Fixed Object	0	1	2	0	1	2
	Unknown/Non-Collision	0	0	0	1	0	0
	Other Vehicle - All Others/Entering At Angle	16	8	4	0	22	5
	Other Vehicle - Both Going Straight/Entering At Angle	2	1	1	0	2	1
	Other Vehicle - Both Turn Left/Entering At Angle	0	0	0	0	1	0
	Other Vehicle - From Opposite Direction	5	0	2	1	5	2
	Other Vehicle - From Opposite Direction/All Others	6	3	18	1	14	4
	Other Vehicle - From Opposite Direction/Both Going Straight	5	3	0	0	8	0
	Other Vehicle - From Opposite Direction/One Left Turn	1	0	0	0	0	0
	Other Vehicle - From Opposite Direction/Sideswipe Collision	0	0	0	0	2	0
	Other Vehicle - From Same Direction/All Others	1	1	0	0	0	0
	Other Vehicle - From Same Direction/Both Going Straight	2	2	4	0	1	3
	Other Vehicle - From Same Direction/One Left Turn	1	2	2	0	0	2
	Other Vehicle - From Same Direction/One Stopped	0	1	0	0	1	0
	Other Vehicle - From Same Direction/Rear End Collision	6	2	5	0	3	0
	Other Vehicle - From Same Direction/Sideswipe Collision	0	0	1	2	1	0
	Other Vehicle - From Same Direction/Vehicle Backing	1	0	0	0	0	0
	Other Vehicle - One Left Turn/Entering At Angle	0	2	1	0	1	3
	Other Vehicle - One Right Turn/Entering At Angle	0	1	0	0	1	0
	Overturn/Rollover	0	1	0	0	0	0
	Parked Vehicle	0	4	0	0	1	0
	Pedalcyclist	1	0	0	0	1	1
	Pedestrian	0	1	0	0	0	0
	% Other Vehicle - From Opposite Direction/All Others	34%	24%	10%	0%	34%	22%
	% Other Vehicle - From Same Direction/Rear End Collision	13%	9%	45%	20%	22%	17%
	% Other Vehicle - From Same Direction/All Others	11%	0%	5%	20%	8%	9%
By Lighting Conditions	Day	27	20	32	5	50	20
	Dawn/Dusk	5	2	1	0	4	0
	Dark	13	10	4	0	9	2
	Invalid Code/Not Specified	2	1	3	0	2	1
By Severity	PDO	22	23	32	5	48	17
	Injury	25	10	8	0	17	6
	% Property Damage Only	47%	70%	80%	100%	74%	74%
	% Injury	53%	30%	20%	0%	26%	26%
By Cause	Alcohol/Drug Involved	3	1	1	0	2	1
	Avoid No Contact - Other	0	0	0	0	0	1
	Avoid No Contact - Vehicle	1	1	0	0	0	0
	Disregarded Traffic Signal	20	4	8	0	25	0
	Driver Inattention	7	7	7	2	16	5
	Drove Left Of Center	0	0	1	0	1	0
	Excessive Speed	1	2	1	0	3	1
	Failed to Yield Right of Way	4	4	1	1	5	1
	Following Too Closely	3	3	5	0	2	0
	Improper Backing/ Lane Change/ Overtaking/ Turn/ Driving	2	3	1	1	3	3
	Inadequate Brakes	1	0	0	0	0	0
	Made Improper Turn	0	3	8	1	1	9
	Missing Data	4	1	6	0	3	2
	Other Improper Driving	0	2	1	0	2	0
	Other Mechanical Defect	1	0	0	0	0	0
	Passed Stop Sign	0	2	0	0	1	0
	Speed Too Fast for Conditions	0	0	0	0	1	0
	% Driver Inattention	15%	21%	18%	40%	25%	22%
	% Failed to Yield Right of Way	43%	12%	20%	0%	38%	0%
	% Following Too Closely	9%	12%	3%	20%	8%	4%
	% Improper Backing	9%	3%	15%	0%	5%	9%

Crash Summary		COAL AVE					
		SPRUCE ST	BETWEEN SPRUCE ST & UNIVERSITY BLVD	UNIVERSITY BLVD	BUENA VISTA DR	YALE BLVD	BETWEEN YALE BLVD & STANFORD DR
Total Crashes		15	43	74	37	77	52
By Year	2014	4	6	18	5	16	9
	2015	3	11	16	7	12	11
	2016	3	7	14	8	9	6
	2017	3	9	12	8	20	15
	2018	2	10	14	9	20	11
By Type	Fixed Object	3	8	10	1	3	5
	Other Vehicle - All Others/Entering At Angle	1	7	8	8	11	14
	Other Vehicle - Both Going Straight/Entering At Angle	0	1	1	1	3	2
	Other Vehicle - From Opposite Direction	2	3	4	3	5	0
	Other Vehicle - From Opposite Direction/All Others	2	7	14	4	27	9
	Other Vehicle - From Opposite Direction/Both Going Straight	0	0	3	0	2	0
	Other Vehicle - From Opposite Direction/Head-On Collision	0	0	1	0	0	0
	Other Vehicle - From Opposite Direction/One Left Turn	0	1	3	0	2	0
	Other Vehicle - From Opposite Direction/Sideswipe Collision	0	0	1	0	0	1
	Other Vehicle - From Same Direction/All Others	1	0	3	1	1	1
	Other Vehicle - From Same Direction/Both Going Straight	2	4	6	10	6	2
	Other Vehicle - From Same Direction/Both Turn Right	0	0	1	0	0	0
	Other Vehicle - From Same Direction/One Left Turn	1	0	0	0	0	5
	Other Vehicle - From Same Direction/One Stopped	0	2	1	0	1	0
	Other Vehicle - From Same Direction/Rear End Collision	0	2	6	1	5	1
	Other Vehicle - From Same Direction/Sideswipe Collision	1	0	3	2	3	8
	Other Vehicle - From Same Direction/Vehicle Backing	0	1	0	0	0	0
	Other Vehicle - One Left Turn/Entering At Angle	2	4	2	3	2	3
	Other Vehicle - One Right Turn/Entering At Angle	0	0	1	0	1	0
	Overturn/Rollover	0	1	0	0	1	0
	Parked Vehicle	0	2	2	0	0	0
	Pedalcyclist	0	0	2	2	2	0
	Pedestrian	0	0	2	1	2	1
	% Other Vehicle - From Opposite Direction/All Others	7%	16%	11%	22%	14%	27%
	% Other Vehicle - From Same Direction/Rear End Collision	13%	16%	19%	11%	35%	17%
	% Other Vehicle - From Same Direction/All Others	13%	7%	5%	8%	6%	0%
By Lighting Conditions	Day	11	32	50	31	51	38
	Dawn/Dusk	0	0	2	1	2	2
	Dark	3	9	19	2	15	12
	Invalid Code/Not Specified	1	2	3	3	9	0
By Severity	PDO	11	32	51	30	53	38
	Injury	4	11	23	7	24	14
	% Property Damage Only	73%	74%	69%	81%	69%	73%
	% Injury	27%	26%	31%	19%	31%	27%
By Cause	Alcohol/Drug Involved	1	2	6	0	1	0
	Avoid No Contact - Other	1	0	1	0	0	0
	Avoid No Contact - Vehicle	0	3	1	0	0	0
	Defective Steering	0	1	1	0	0	1
	Disregarded Traffic Signal	0	1	12	4	8	1
	Driver Inattention	5	10	15	6	19	7
	Drove Left Of Center	0	1	1	0	2	3
	Excessive Speed	0	2	3	2	5	1
	Failed to Yield Right of Way	3	5	5	5	13	15
	Following Too Closely	0	2	7	3	5	1
	Improper Backing/ Lane Change/ Overtaking/ Turn/ Driving	2	4	0	4	4	3
	Inadequate Brakes	0	0	0	0	1	0
	Made Improper Turn	0	5	2	6	2	9
	Missing Data	2	3	5	4	12	1
	None	0	0	5	0	3	1
	Other - No Driver Error	1	0	4	0	1	0
	Other Improper Driving	0	2	3	3	1	5
	Passed Stop Sign	0	2	1	0	0	3
	Speed Too Fast for Conditions	0	0	2	0	0	1
	% Driver Inattention	33%	23%	20%	16%	25%	13%
	% Failed to Yield Right of Way	0%	2%	16%	11%	10%	2%
	% Following Too Closely	20%	12%	7%	14%	17%	29%
	% Improper Backing	13%	7%	7%	11%	16%	2%

Crash Summary		COAL AVE					
		STANFORD DR	BETWEEN STANFORD DR & GIRARD BLVD	GIRARD BLVD	BETWEEN GIRARD BLVD & BRYN MAWR DR	BRYN MAWR DR	BETWEEN BRYN MAWR DR & CARLISLE BLVD
Total Crashes		24	45	45	20	16	27
By Year	2014	6	6	7	2	2	3
	2015	5	12	12	4	0	4
	2016	4	8	9	5	2	7
	2017	6	12	8	6	1	9
	2018	3	7	9	3	11	4
By Type	Fixed Object	1	2	2	1	1	1
	Other Vehicle - All Others/Entering At Angle	4	13	7	5	1	3
	Other Vehicle - Both Going Straight/Entering At Angle	1	1	1	0	2	0
	Other Vehicle - Both Turn Left/Entering At Angle	0	0	1	0	0	0
	Other Vehicle - From Opposite Direction	1	4	4	1	0	4
	Other Vehicle - From Opposite Direction/All Others	3	8	9	5	5	1
	Other Vehicle - From Opposite Direction/Both Going Straight	1	2	1	1	0	1
	Other Vehicle - From Opposite Direction/One Left Turn	0	1	1	0	0	0
	Other Vehicle - From Opposite Direction/Sideswipe Collision	0	0	0	1	0	1
	Other Vehicle - From Same Direction/All Others	2	1	2	0	0	1
	Other Vehicle - From Same Direction/Both Going Straight	0	3	7	1	2	3
	Other Vehicle - From Same Direction/One Left Turn	1	0	0	0	3	0
	Other Vehicle - From Same Direction/One Stopped	1	1	0	0	0	0
	Other Vehicle - From Same Direction/Rear End Collision	4	5	6	3	0	3
	Other Vehicle - From Same Direction/Sideswipe Collision	1	0	0	1	0	3
	Other Vehicle - From Same Direction/Vehicle Backing	0	0	1	0	0	0
	Other Vehicle - One Left Turn/Entering At Angle	3	1	0	1	2	3
	Other Vehicle - One Right Turn/Entering At Angle	0	2	1	0	0	1
	Parked Vehicle	1	1	1	0	0	0
	Pedalcyclist	0	0	0	0	0	2
	Pedestrian	0	0	1	0	0	0
By Lighting Conditions	Day	16	33	32	14	9	22
	Dawn/Dusk	2	1	0	3	0	1
	Dark	6	9	12	2	5	3
	Invalid Code/Not Specified	0	2	1	1	2	1
By Severity	PDO	19	29	32	17	14	15
	Injury	5	16	13	3	2	12
	% Property Damage Only	79%	64%	71%	85%	88%	56%
	% Injury	21%	36%	29%	15%	13%	44%
By Cause	Alcohol/Drug Involved	1	0	3	0	1	1
	Avoid No Contact - Other	0	1	0	0	0	0
	Avoid No Contact - Vehicle	0	1	2	0	1	1
	Defective Steering	0	1	0	0	0	0
	Disregarded Traffic Signal	1	3	9	0	1	1
	Driver Inattention	8	10	15	6	5	6
	Drove Left Of Center	1	0	0	0	0	0
	Excessive Speed	1	1	2	2	0	0
	Failed to Yield Right of Way	2	8	0	3	2	6
	Following Too Closely	3	7	4	1	0	3
	Improper Backing/ Lane Change/ Overtaking/ Turn/ Driving	2	2	1	1	0	1
	Made Improper Turn	2	0	2	4	2	2
	Missing Data	0	2	1	2	3	1
	None	0	2	1	0	1	0
	Other - No Driver Error	1	0	1	0	0	1
	Other Improper Driving	1	0	2	1	0	1
	Other Mechanical Defect	0	0	1	0	0	0
	Passed Stop Sign	0	6	0	0	0	2
	Speed Too Fast for Conditions	1	1	1	0	0	1
	% Driver Inattention	33%	22%	33%	30%	31%	22%
	% Failed to Yield Right of Way	4%	7%	20%	0%	6%	4%
	% Following Too Closely	8%	18%	0%	15%	13%	22%
	% Improper Backing	0%	4%	2%	10%	19%	4%



Crash Summary		COAL AVE			
		CARLISLE BLVD	BETWEEN CARLISLE BLVD & MONTCLAIRE DR	MONTCLAIRE DR	BETWEEN MONTCLAIRE DR & WASHINGTON ST
Total Crashes		45	20	11	4
By Year	2014	8	0	2	1
	2015	6	4	0	1
	2016	7	2	3	2
	2017	12	9	4	0
	2018	12	5	2	0
By Type	Fixed Object	1	1	0	0
	Other Vehicle - All Others/Entering At Angle	19	8	2	0
	Other Vehicle - Both Going Straight/Entering At Angle	3	0	0	1
	Other Vehicle - From Opposite Direction	5	1	1	0
	Other Vehicle - From Opposite Direction/All Others	4	2	3	2
	Other Vehicle - From Opposite Direction/Both Going Straight	1	1	0	0
	Other Vehicle - From Same Direction/All Others	1	0	1	0
	Other Vehicle - From Same Direction/Both Going Straight	2	4	1	1
	Other Vehicle - From Same Direction/One Left Turn	0	0	1	0
	Other Vehicle - From Same Direction/Rear End Collision	3	1	0	0
	Other Vehicle - One Left Turn/Entering At Angle	4	0	1	0
	Other Vehicle - One Right Turn/Entering At Angle	0	1	0	0
	Other Vehicle - One Stopped/Entering At Angle	1	0	0	0
	Parked Vehicle	0	1	0	0
	Pedalcyclist	1	0	1	0
By Lighting Conditions	Day	29	14	10	2
	Dawn/Dusk	3	0	0	0
	Dark	11	6	1	1
	Invalid Code/Not Specified	2	0	0	1
By Severity	PDO	24	11	5	3
	Injury	21	9	6	1
	% Property Damage Only	53%	55%	45%	75%
	% Injury	47%	45%	55%	25%
By Cause	Alcohol/Drug Involved	4	2	0	0
	Avoid No Contact - Other	0	0	2	0
	Avoid No Contact - Vehicle	1	0	0	0
	Disregarded Traffic Signal	17	0	0	0
	Driver Inattention	8	4	3	1
	Drove Left Of Center	0	1	0	0
	Excessive Speed	1	0	0	0
	Failed to Yield Right of Way	1	5	0	2
	Following Too Closely	1	1	0	0
	Improper Backing/ Lane Change/ Overtaking/ Turn/ Driving	2	0	1	0
	Made Improper Turn	3	3	3	0
	Missing Data	1	0	0	1
	None	5	1	1	0
	Passed Stop Sign	0	3	0	0
	Speed Too Fast for Conditions	0	0	1	0
By Cause	Traffic Control Not Functioning	1	0	0	0
	% Driver Inattention	18%	20%	27%	25%
	% Failed to Yield Right of Way	38%	0%	0%	0%
	% Following Too Closely	2%	25%	0%	50%
	% Improper Backing	2%	0%	0%	25%



## E. Coal Ave Rest-in-Red Analysis

Study Intersection	Movement	Existing Conditions									Alternative 1									
		Low			Medium			High			Low			Medium			High			
		Delay <sup>1</sup>	V/C	LOS <sup>2</sup>	Delay <sup>1</sup>	V/C	LOS <sup>2</sup>	Delay <sup>1</sup>	V/C	LOS <sup>2</sup>	Delay <sup>1</sup>	V/C	LOS <sup>2</sup>	Delay <sup>1</sup>	V/C	LOS <sup>2</sup>	Delay <sup>1</sup>	V/C	LOS <sup>2</sup>	
Coal Ave & Broadway Blvd	NBT	11.42	0.21	B	14.5	0.2	B	10.93	0.13	B	11.42	0.21	B	14.5	0.2	B	10.93	0.13	B	
	NBR	9.89	0.01	A	13.95	0.09	B	10.45	0.06	B	9.89	0.01	A	13.95	0.09	B	10.45	0.06	B	
	EBL	28.07	0.03	C	11.04	0.06	B	34.1	0.12	C	28.07	0.03	C	11.04	0.06	B	34.1	0.12	C	
	EBT	29.14	0.14	C	12.82	0.31	B	40.73	0.57	D	29.14	0.14	C	12.82	0.31	B	40.73	0.57	D	
	EBR	27.93	0.02	C	11.06	0.05	B	33.59	0.1	C	27.93	0.02	C	11.06	0.05	B	33.59	0.1	C	
	SBL	7.62	0.03	A	9.14	0.11	A	7.23	0.12	A	7.62	0.03	A	9.14	0.11	A	7.23	0.12	A	
	SBT	10.63	0.12	B	15.59	0.33	B	11.7	0.22	B	10.63	0.12	B	15.59	0.33	B	11.7	0.22	B	
	Intersection LOS	B			B			C			B			B			C			
Coal Ave & Walter St	NBT	14.91	0.24	B	14.91	0.24	B	14.91	0.24	B	8.95	0.17	A	9.6	0.29	A	9.49	0.29	A	
	NBR	12.92	0.02	B	12.92	0.02	B	12.92	0.02	B	0	0	0	0	0	0	0	0	0	
	EBT	0	0	A	0	0	A	0	0	A	4.21	0.18	A	3.76	0.39	A	3.75	0.42	A	
	SBL	9.63	0.33	A	9.63	0.33	A	9.63	0.33	A	0	0	A	6.12	0.03	A	6.51	0.05	A	
	SBT	12.86	0.01	B	12.86	0.01	B	12.86	0.01	B	0	0	0	0	0	0	0	0	0	
	Intersection LOS	B			B			B			A			A			A			
	Intersection Delay	13.02			13.02			13.02			4.13			3.85			3.84			
	Coal Ave & Locust St Coal Ave & Oak St																			
Coal Ave & Spruce St	NBT	37.61	0.31	D	35.88	0.24	D	35.4	0.24	D	13.69	0.38	0.38	9.53	0.29	A	9.52	0.29	A	
	EBL	1.36	0.17	A	1.57	0.18	A	1.79	0.22	A	3.36	0.29	0.29	3.41	0.3	A	3.34	0.34	A	
	EBT	1.41	0.18	A	1.63	0.19	A	1.86	0.23	A	3.7	0.42	0.42	3.74	0.43	A	3.65	0.45	A	
	EBR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	SBL	37.72	0.12	D	37.93	0.23	D	37.61	0.26	D	6.32	0.02	0.02	6.54	0.04	A	7.16	0.06	A	
	Intersection LOS	A			A			A			A			A			A			
	Intersection Delay	3.13			3.89			4.04			3.83			3.83			3.78			
	Coal Ave & University Blvd	NBT	14.51	0.11	B	16.05	0.13	B	16.65	0.15	B	14.51	0.11	B	16.05	0.13	B	16.65	0.15	B
NBR		14.65	0.11	B	16.21	0.12	B	16.86	0.15	B	14.65	0.11	B	16.21	0.12	B	16.86	0.15	B	
EBL		11.34	0.01	B	13.19	0.07	B	13.69	0.08	B	11.34	0.01	B	13.19	0.07	B	13.69	0.08	B	
EBT		11.53	0.04	B	15	0.32	B	16.07	0.38	B	11.53	0.04	B	15	0.32	B	16.07	0.38	B	
EBR		11.32	0.01	B	13.01	0.05	B	13.48	0.06	B	11.32	0.01	B	13.01	0.05	B	13.48	0.06	B	
SBL		10.4	0.06	B	10.61	0.18	B	10.89	0.22	B	10.4	0.06	B	10.61	0.18	B	10.89	0.22	B	
SBT		10.55	0.08	B	10.32	0.11	B	10.32	0.14	B	10.55	0.08	B	10.32	0.11	B	10.32	0.14	B	
Intersection LOS		B			B			B			B			B			B			
Coal Ave & Buena Vista Dr	NBT	0	0	A	8.19	0.04	A	8.24	0.04	A	0	0	A	7.96	0.04	A	8.01	0.04	A	
	EBL	16.52	0.03	B	17.04	0.08	B	17.21	0.1	B	16.21	0.03	B	16.72	0.08	B	16.88	0.1	B	
	EBT	16.54	0.03	B	17.1	0.09	B	17.29	0.11	B	16.23	0.03	B	16.78	0.09	B	16.96	0.1	B	
	EBR	16.3	0	B	16.4	0.01	B	16.42	0.02	B	16	0	B	16.09	0.01	B	16.11	0.02	B	
	SBL	9.16	0.01	A	8.08	0.02	A	8.1	0.02	A	8.81	0.01	A	7.85	0.02	A	7.87	0.02	A	
	Intersection LOS	B			B			B			B			B			B			
	Intersection Delay	15.76			14.14			14.28			15.45			13.85			13.98			
	Coal Ave & Yale Blvd	NBT	17.19	0.33	B	21.01	0.54	C	23.98	0.65	C	17.16	0.33	B	20.96	0.54	C	23.92	0.65	C
EBL		13.72	0.02	B	14.26	0.07	B	14.4	0.08	B	13.75	0.02	B	14.29	0.07	B	14.43	0.08	B	
EBT		14.13	0.07	B	16.28	0.31	B	16.97	0.37	B	14.16	0.07	B	16.31	0.31	B	17.01	0.37	B	
EBR		13.67	0.01	B	14.03	0.05	B	14.14	0.06	B	13.7	0.01	B	14.06	0.05	B	14.16	0.06	B	
Intersection LOS		B			B			B			B			B			B			
Intersection Delay		15.97			17.99			19.48			15.95			17.98			19.47			
Coal Ave & Stanford Dr		NBT	8.1	0.02	A	8.73	0.11	A	8.01	0.01	A	5.51	0.39	A	8.01	0.01	A	8.01	0.01	A
		EBL	17.9	0.17	B	23.18	0.52	C	26.62	0.65	C	4.52	0.16	A	23.62	0.54	C	26.62	0.65	C
	EBT	18.11	0.18	B	24.55	0.56	C	29.4	0.7	C	4.89	0.28	A	25.14	0.58	C	29.4	0.7	C	
	SBL	0	0	A	9.65	0.23	A	9.36	0.02	A	6.7	0.23	A	9.33	0.01	A	9.36	0.02	A	
	Intersection LOS	B			B			C			A			C			C			
	Intersection Delay	17.25			18.97			27.44			5.39			23.93			27.44			
	Coal Ave & Girard Blvd	NBT	8.84	0.13	A	8.73	0.11	A	8.9	0.14	A	5.51	0.39	A	6.43	0.26	A	7.03	0.28	A
		EBL	17.89	0.16	B	23.18	0.52	C	25.85	0.62	C	4.52	0.16	A	5.37	0.41	A	6.02	0.47	A
EBT		18.08	0.18	B	24.55	0.56	C	28.24	0.67	C	4.89	0.28	A	5.81	0.52	A	6.5	0.58	A	
SBL		8.68	0.11	A	9.65	0.23	A	10.09	0.28	B	6.7	0.23	A	8.05	0.45	A	8.65	0.49	A	
Intersection LOS		B			B			C			A			A			A			
Intersection Delay		13.17			18.97			21.18			5.39			6.23			6.87			
Coal Ave & Bryn Mawr Dr		NBT	8.01	0.01	A	7.97	0	A	7.98	0	A	7.79	0.01	A	7.75	0	A	7.75	0	A
		EBL	16.48	0.02	B	21.53	0.43	C	23.19	0.52	C	16.15	0.02	B	21.04	0.42	C	22.62	0.51	C
	EBT	16.5	0.02	B	22.44	0.47	C	24.56	0.56	C	16.17	0.02	B	21.89	0.46	C	23.89	0.55	C	
	Intersection LOS	B			C			C			B			C			C			
	Intersection Delay	13.42			21.43			23.23			13.12			20.92			22.63			
	Coal Ave & Carlisle Blvd	NBT	9.01	0.15	A	9.9	0.25	A	10.41	0.3	B	6.34	0.51	A	9.19	0.69	A	9.35	0.69	A
		EBL	17.73	0.15	B	21.89	0.45	C	23.74	0.54	C	4.36	0.15	A	4.79	0.36	A	5.39	0.42	A
		EBT	17.9	0.16	B	22.89	0.49	C	25.31	0.59	C	4.72	0.27	A	5.2	0.48	A	5.82	0.53	A
SBL		8.83	0.13	A	8.87	0.13	A	9.08	0.16	A	8.06	0.4	A	7.08	0.38	A	7.35	0.4	A	
Intersection LOS		B			B			B			A			A			A			
Intersection Delay		12.57			17.3			18.73			6.08			6.34			6.79			
Coal Ave & Montclair Dr		NBT	7.99	0	A	9.9	0.25	A	8.04	0.01	A	7.75	0	B	7.79	0.01	A	7.81	0.01	A
		EBL	17.72	0.15	B	21.89	0.45	C	23.14	0.52	C	17.39	0.15	B	21.04	0.42	C	22.62	0.51	C
	EBT	17.89	0.16	B	22.89	0.49	C	24.51	0.56	C	17.55	0.16	B	21.89	0.46	C	23.89	0.55	C	
	SBL	8.11	0.02	A	8.87	0.13	A	9.31	0.01	A	7.87	0.02	A	8.9	0	A	8.93	0.01	A	
	Intersection LOS	B			B			C			B			C			A			
	Intersection Delay	16.8			17.3			23.39			16.48			21.1			6.79			

Study Intersection	Movement	Alternative 2																		Alternative 3					
		Low			Medium			High			Low			Medium			High								
		Delay <sup>1</sup>	V/C	LOS <sup>2</sup>	Delay <sup>1</sup>	V/C	LOS <sup>2</sup>	Delay <sup>1</sup>	V/C	LOS <sup>2</sup>	Delay <sup>1</sup>	V/C	LOS <sup>2</sup>	Delay <sup>1</sup>	V/C	LOS <sup>2</sup>	Delay <sup>1</sup>	V/C	LOS <sup>2</sup>						
Coal Ave & Broadway Blvd	NBT	11.42	0.21	B	14.5	0.2	B	10.93	0.13	B	11.42	0.21	B	14.5	0.2	B	10.93	0.13	B						
	NBR	9.89	0.01	A	13.95	0.09	B	10.45	0.06	B	9.89	0.01	A	13.95	0.09	B	10.45	0.06	B						
	EBL	28.07	0.03	C	11.04	0.06	B	34.1	0.12	C	28.07	0.03	C	11.04	0.06	B	34.1	0.12	C						
	EBT	29.14	0.14	C	12.82	0.31	B	40.73	0.57	D	29.14	0.14	C	12.82	0.31	B	40.73	0.57	D						
	EBR	27.93	0.02	C	11.06	0.05	B	33.59	0.1	C	27.93	0.02	C	11.06	0.05	B	33.59	0.1	C						
	SBL	7.62	0.03	A	9.14	0.11	A	7.23	0.12	A	7.62	0.03	A	9.14	0.11	A	7.23	0.12	A						
	SBT	10.63	0.12	B	15.59	0.33	B	11.7	0.22	B	10.63	0.12	B	15.59	0.33	B	11.7	0.22	B						
	Intersection LOS	B			B			C			B			B			C								
Coal Ave & Walter St	NBT	8.95	0.17	A	9.6	0.29	A	9.49	0.29	A	8.95	0.17	A	9.6	0.29	A	9.49	0.29	A						
	NBR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
	EBT	4.21	0.18	A	3.76	0.39	A	3.75	0.42	A	4.21	0.18	A	3.76	0.39	A	3.75	0.42	A						
	SBL	0	0	A	6.12	0.03	A	6.51	0.05	A	0	0	A	6.12	0.03	A	6.51	0.05	A						
	SBT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
	Intersection LOS	A			A			A			A			A			A								
	Intersection Delay	4.13			3.85			3.84			4.13			3.85			3.84								
	Coal Ave & Locust St																								
Coal Ave & Spruce St	NBT	14.75	0.39	B	10.32	0.3	B	10.28	0.29	B	11.37	0.33	B	9.53	0.29	A	9.52	0.29	A						
	EBL	3.84	0.31	A	3.9	0.31	A	3.84	0.35	A	3.42	0.29	A	3.41	0.3	A	3.34	0.34	A						
	EBT	4.21	0.44	A	4.26	0.44	A	4.18	0.47	A	3.78	0.43	A	3.74	0.43	A	3.65	0.45	A						
	EBR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
	SBL	6.98	0.02	A	7.21	0.05	A	7.86	0.06	A	6.26	0.02	A	6.54	0.04	A	7.16	0.06	A						
	Intersection LOS	A			A			A			A			A			A								
	Intersection Delay	4.34			4.35			4.3			3.83			3.83			3.78								
	Coal Ave & Oak St																								
Coal Ave & University Blvd	NBT	0.11	1	14.51	16.05	0.13	B	16.65	0.15	B	14.51	0.11	B	16.05	0.13	B	16.65	0.15	B						
	NBR	0.11	1	14.65	16.21	0.12	B	16.86	0.15	B	14.65	0.11	B	16.21	0.12	B	16.86	0.15	B						
	EBL	#N/A	#N/A	#N/A	13.19	0.07	B	13.69	0.08	B	11.34	0.01	B	13.19	0.07	B	13.69	0.08	B						
	EBT	#N/A	#N/A	#N/A	15	0.32	B	16.07	0.38	B	11.53	0.04	B	15	0.32	B	16.07	0.38	B						
	EBR	#N/A	#N/A	#N/A	13.01	0.05	B	13.48	0.06	B	11.32	0.01	B	13.01	0.05	B	13.48	0.06	B						
	SBL	#N/A	#N/A	#N/A	10.61	0.18	B	10.89	0.22	B	10.4	0.06	B	10.61	0.18	B	10.89	0.22	B						
	SBT	0.08	1	10.55	10.32	0.11	B	10.32	0.14	B	10.55	0.08	B	10.32	0.11	B	10.32	0.14	B						
	Intersection LOS	12.37			B			B			B			B			B								
Coal Ave & Buena Vista Dr	NBT	0	0	A	8.19	0.04	A	8.24	0.04	A	0	0	A	6.96	0.36	A	7.35	0.41	A						
	EBL	16.52	0.03	B	17.04	0.08	B	17.21	0.1	B	3.88	0.04	A	3.84	0.09	A	3.84	0.1	A						
	EBT	16.54	0.03	B	17.1	0.09	B	17.29	0.11	B	4.31	0.11	A	4.16	0.19	A	4.16	0.21	A						
	EBR	16.3	0	B	16.4	0.01	B	16.42	0.02	B	3.89	0.02	A	3.74	0.03	A	3.71	0.04	A						
	SBL	9.16	0.01	A	8.08	0.02	A	8.1	0.02	A	4.28	0	A	4.99	0.03	A	5.14	0.04	A						
	Intersection LOS	B			B			B			A			A			A								
	Intersection Delay	15.76			14.14			14.28			4.06			4.72			4.82								
	Coal Ave & Locust St																								
Coal Ave & Yale Blvd	NBT	6.43	0.64	A	7.74	0.69	A	8.44	0.72	A	6.43	0.64	A	7.74	0.69	A	8.44	0.72	A						
	EBL	4.71	0.02	A	5.88	0.07	A	7	0.09	A	4.71	0.02	A	5.88	0.07	A	7	0.09	A						
	EBT	5.05	0.22	A	6.92	0.48	A	8.45	0.55	A	5.05	0.22	A	6.92	0.48	A	8.45	0.55	A						
	EBR	4.75	0.04	A	5.84	0.08	A	6.93	0.09	A	4.75	0.04	A	5.84	0.08	A	6.93	0.09	A						
	Intersection LOS	A			A			A			A			A			A								
	Intersection Delay	5.62			6.94			7.93			5.62			6.94			7.93								
	Coal Ave & Locust St																								
	Coal Ave & Stanford Dr	NBT	8.1	0.02	A	8.01	0.01	A	8.01	0.01	A	12.83	0.43	B	11.59	0.25	B	11.58	0.25	B					
EBL		17.9	0.17	B	23.62	0.54	C	26.62	0.65	C	3.55	0.15	A	3.19	0.34	A	3.13	0.39	A						
EBT		18.11	0.18	B	25.14	0.58	C	29.4	0.7	C	3.85	0.26	A	3.48	0.46	A	3.42	0.5	A						
SBL		0	0	A	9.33	0.01	A	9.36	0.02	A	0	0	A	7.12	0.02	A	7.84	0.03	A						
Intersection LOS		B			C			C			A			A			A								
Intersection Delay		17.25			23.93			27.44			4.38			3.47			3.42								
Coal Ave & Locust St																									
Coal Ave & Girard Blvd		NBT	5.51	0.39	A	6.43	0.26	A	7.03	0.28	A	5.51	0.39	A	6.43	0.26	A	7.03	0.28	A					
	EBL	4.52	0.16	A	5.37	0.41	A	6.02	0.47	A	4.52	0.16	A	5.37	0.41	A	6.02	0.47	A						
	EBT	4.89	0.28	A	5.81	0.52	A	6.5	0.58	A	4.89	0.28	A	5.81	0.52	A	6.5	0.58	A						
	SBL	6.7	0.23	A	8.05	0.45	A	8.65	0.49	A	6.7	0.23	A	8.05	0.45	A	8.65	0.49	A						
	Intersection LOS	A			A			A			A			A			A								
	Intersection Delay	5.39			6.23			6.87			5.39			6.23			6.87								
	Coal Ave & Locust St																								
	Coal Ave & Bryn Mawr Dr	NBT	7.79	0.01	A	7.75	0	A	7.75	0	A	6.38	0.19	A	6.8	0.07	A	7.35	0.08	A					
EBL		16.11	0.02	B	20.99	0.42	C	22.57	0.51	C	3.95	0.03	A	3.37	0.3	A	3.3	0.34	A						
EBT		16.14	0.02	B	21.84	0.46	C	23.84	0.55	C	4.54	0.11	A	3.7	0.43	A	3.6	0.45	A						
Intersection LOS		B			C			C			A			A			A								
Intersection Delay		13.12			20.87			22.58			4.61			3.64			3.58								
Coal Ave & Locust St																									
Coal Ave & Carlisle Blvd		NBT	6.34	0.51	A	9.19	0.69	A	9.35	0.69	A	6.34	0.51	A	9.19	0.69	A	9.35	0.69	A					
		EBL	4.36	0.15	A	4.79	0.36	A	5.39	0.42	A	4.36	0.15	A	4.79	0.36	A	5.39	0.42	A					
	EBT	4.72	0.27	A	5.2	0.48	A	5.82	0.53	A	4.72	0.27	A	5.2	0.48	A	5.82	0.53	A						
	SBL	8.06	0.4	A	7.08	0.38	A	7.35	0.4	A	8.06	0.4	A	7.08	0.38	A	7.35	0.4	A						
	Intersection LOS	A			A			A			A			A			A								
	Intersection Delay	6.08			6.34			6.79			6.08			6.34			6.79								
	Coal Ave & Locust St																								
	Coal Ave & Montclair Dr	NBT	5.82	0.09	A	13.67	0.35	B	13.66	0.37	B	5.82	0.09	A	13.67	0.35	B	13.66	0.37	B					
EBL											3.58	0.13	A	3.31	0.3	A	3.23	0.33	A						
EBT											3.9	0.25	A	3.64	0.43	A	3.52	0.45	A						
SBL											5.2	0.03	A	6.41	0.01	A	6.99	0.01	A						
Intersection LOS		A			A			A			A			A			A								
Intersection Delay		3.89			3.68			3.59			3.89			3.68			3.59								
Coal Ave & Locust St																									