Laredo Synchronization Traffic Report

Laredo | Citywide

STATE OF TEXAS
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11/26/2019

Prepared for: CITY OF Laredo

11/26/2019

LAREDO TRAFFIC DEPARTMENT

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1 Executive Summary

The City of Laredo selected the Lockwood, Andrews & Newnam, Inc. (LAN) team to synchronize traffic signals city-wide as part of its efforts to relieve congestion and improve the flow of vehicles along key corridors.

The project team:

- Collected traffic data for seven major corridors, including 80 signals.
- Analyzed the signal systems and developed signal synchronization plans for each corridor.
- Implemented signal timings in coordination with the City and the Texas Department of Transportation.
- Observed traffic progression, adjusted synchronization as needed, and obtained new corridor travel times.

The 80 study intersections included:

1. FM 1472 (Mines Road) – 13 Signals
2. US 83 – 19 Signals
3. Loop 20 – 6 Signals
4. McPherson Road – 17 Signals
5. SH 359 – 6 Signals

6 & 7. BUS 35 / IH 35 Frontage Roads – 19 Signals

The signal synchronization was performed using *Synchro 10* software. Clearance timing intervals (yellow, red, and pedestrian) were developed following the NCHRP 731 and TMUTCD guidelines. The traffic data and *Synchro 10* analysis results are detailed and summarized in this traffic report.

Traffic synchronization is one of the most economical and effective means to reduce congestion and consequently, emissions. Although the signal re-timing included timing plans to cover the typical weekday and weekend time periods, the AM and PM peak hour project results indicate:

- Estimated 144,000 vehicle-hours of travel time yearly reduction in the AM & PM peak hour traffic.
- Estimated 532,000 grams of CO yearly reduction in the AM & PM peak hour traffic.
- Estimated 102,500 grams of NOx yearly reduction in the AM & PM peak hour traffic.
- Estimated 124,500 grams of VOC yearly reduction in the AM & PM peak hour traffic.

2 Introduction

The City of Laredo selected the Lockwood, Andrews & Newnam, Inc. (LAN) team to synchronize traffic signals city-wide as part of its efforts to relieve congestion and improve the flow of vehicles along key corridors.

Laredo is one of the fastest growing cities in the United States. According to a 2017 study prepared for the United States Conference of Mayors, Laredo's population is expected to boom in the next 30 years outpacing most other cities in the country. Its strategic location on the Mexican border gives the City additional importance to the nation's trade strategies. Also, the City is home to the largest inland port in the country.

Keeping this in mind, the Laredo City Council has prioritized this project to improve travel efficiency for its growing population and trade. Specifically, the City has identified and prioritized seven corridors, beginning with Mines Road (FM 1472), which is the most congested transportation corridor.

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Figure 1 on the next page shows the corridor locations and 80 study intersections:

6. FM 1472 (Mines Road) – 13 Signals
7. US 83 – 19 Signals
8. Loop 20 – 6 Signals
9. McPherson Road – 17 Signals
10. SH 359 – 6 Signals
11. & 7. BUS 35 / IH 35 Frontage Roads – 19 Signals

This summary covers the corridors highlighted in yellow that were re-timed by LAN and others shown in blue that were by LEE Engineering, as shown in **Figure 1** below.

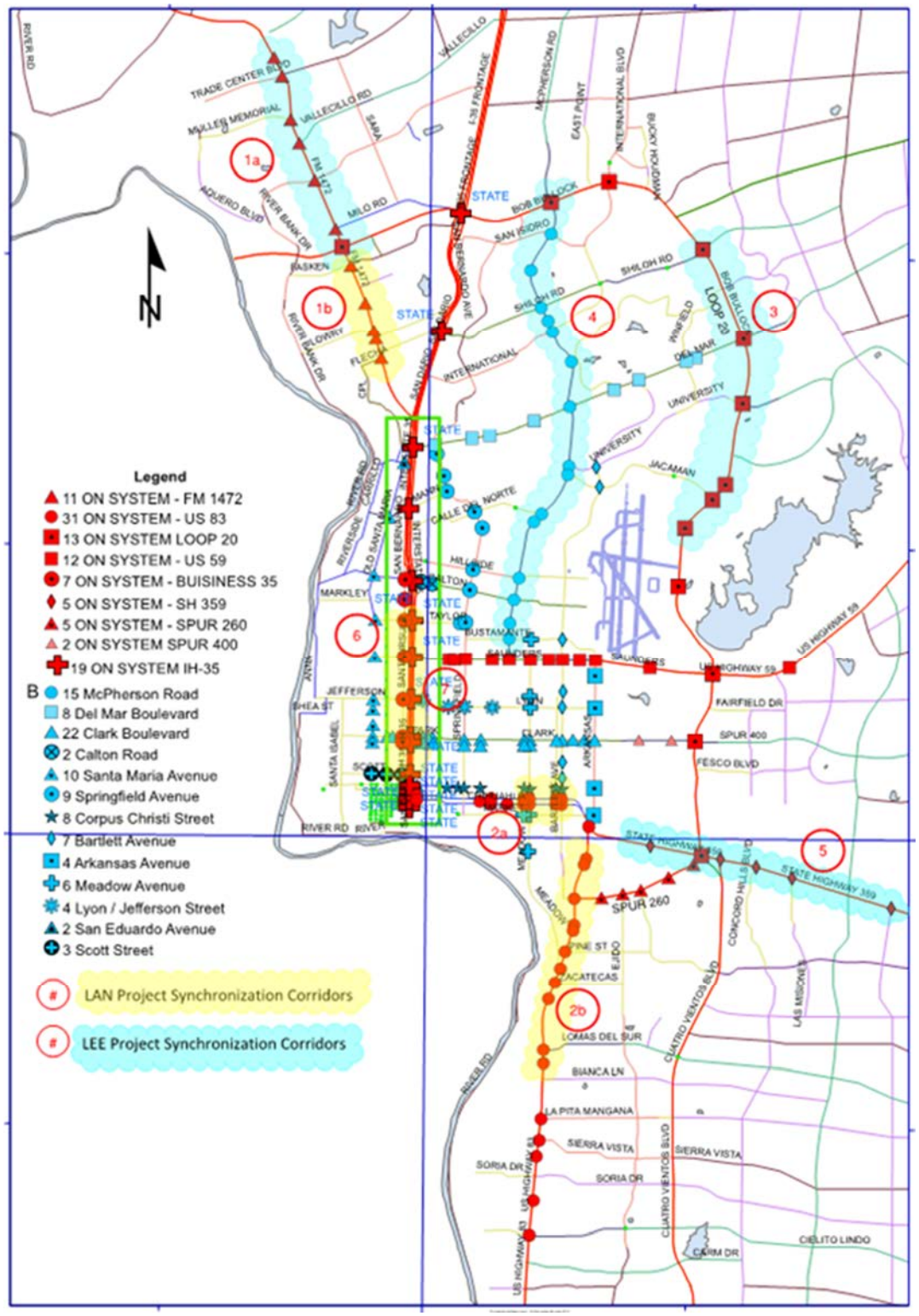


Figure 1: Project Synchronization Corridors & Location

3 Methodology

Kick off Meeting

The LAN and LEE project team met with the City and TXDOT to discuss count locations, methodology, local concerns and challenges, and possible signal remedies such as flashing yellow arrow (FYA) left turn conversion and lead/lag phasing implementation. The team discussed specific traffic concerns impacting the city-wide corridor synchronization implementation, for instance, trucks on FM 1472 and the *Streetwise* upgrade to *ATMS* central operating system.

Initial Data Collection

- Performed Tube Counts to gather a 7-day arterial traffic count to record traffic variations during the week. After studying traffic trends, performed peak hour(s) video/manual intersection turning movement counts (TMC) with pedestrian counts and truck classification.
- Collected detailed information related to control hardware (controller type and communications), as well as details related to City and TxDOT signal operations, phasing, and timing for each signalized intersection. Consideration of previous signal and coordination timing, signal hardware; signal head displays (e.g. left turn phasing type, overlaps), force-off programming, overlap features, vehicular detection, pedestrian accommodations.
- Observed and reviewed existing intersection and arterial geometric/operational conditions (e.g. businesses, school zones, speed limits, emergency signals) and pinpointed bottleneck locations.
- Measured distances to pedestrian push buttons and crosswalk lengths.
- Conducted “Before” travel time runs using *PC-Travel*.

Synchronization Evaluation

- Perform initial *Synchro* models – Review capacity & Level of Service (LOS) results under base (“Before”) conditions.
- Check clearance timing intervals (yellow, red, and pedestrian). Developed/update clearances following the NCHRP 731 and TMUTCD guidelines.
- Consideration of cycle length and progression bandwidth – review cycle length of nearby corridors, spacing of signalized intersections, select cycle length that provides optimum progression without substantial side street delay and excessive main street turn lane queuing.
- Determination of control boundaries – determined whether entire corridor can operate on one cycle length and master location (as applicable).

Summary of Recommendation – New Timing Plans and Time-Space (T-S) Diagrams

- Documented methodology, data collection, initial analysis, cycle length and control boundary, time-of-day (TOD) plans, day-of-week (DOW) plans, and any intersection specific recommendations.
- Submitted to City for comments and approval.

New Timing Implementation

- Once the City approved the new Synchro T-S diagrams and timing plans, the City programmed the signal controllers for field implementation. LAN and LEE made fine-tuning adjustments, performed qualitative observation of the signal system, and reviewed City/TxDOT feedback. LAN utilized the new *TranSync* mobile virtual controller software during implementation.
- After completion of fine-tuning, conducted “After” travel time runs using *PC-Travel*.

4 Corridor Characteristics

4.1 FM 1472 (Mines Road)

FM 1472 is the City's most congested corridor connecting the industrial area in Laredo to the Colombia – Solidarity International Bridge over the Rio Grande. The urban project corridor is 6-lane divided, known as Mines Road, has 13 signals grouped in 2 subsystems (north and south) as shown in **Figures 2 and 3**. Mines Road north is where the predominant freight truck traffic comes across the border. Mines Road south also has heavy truck traffic, but it is more localized in concentration as compared to the north section.

Figure 2: Corridor 1a - Mines Road North Intersections

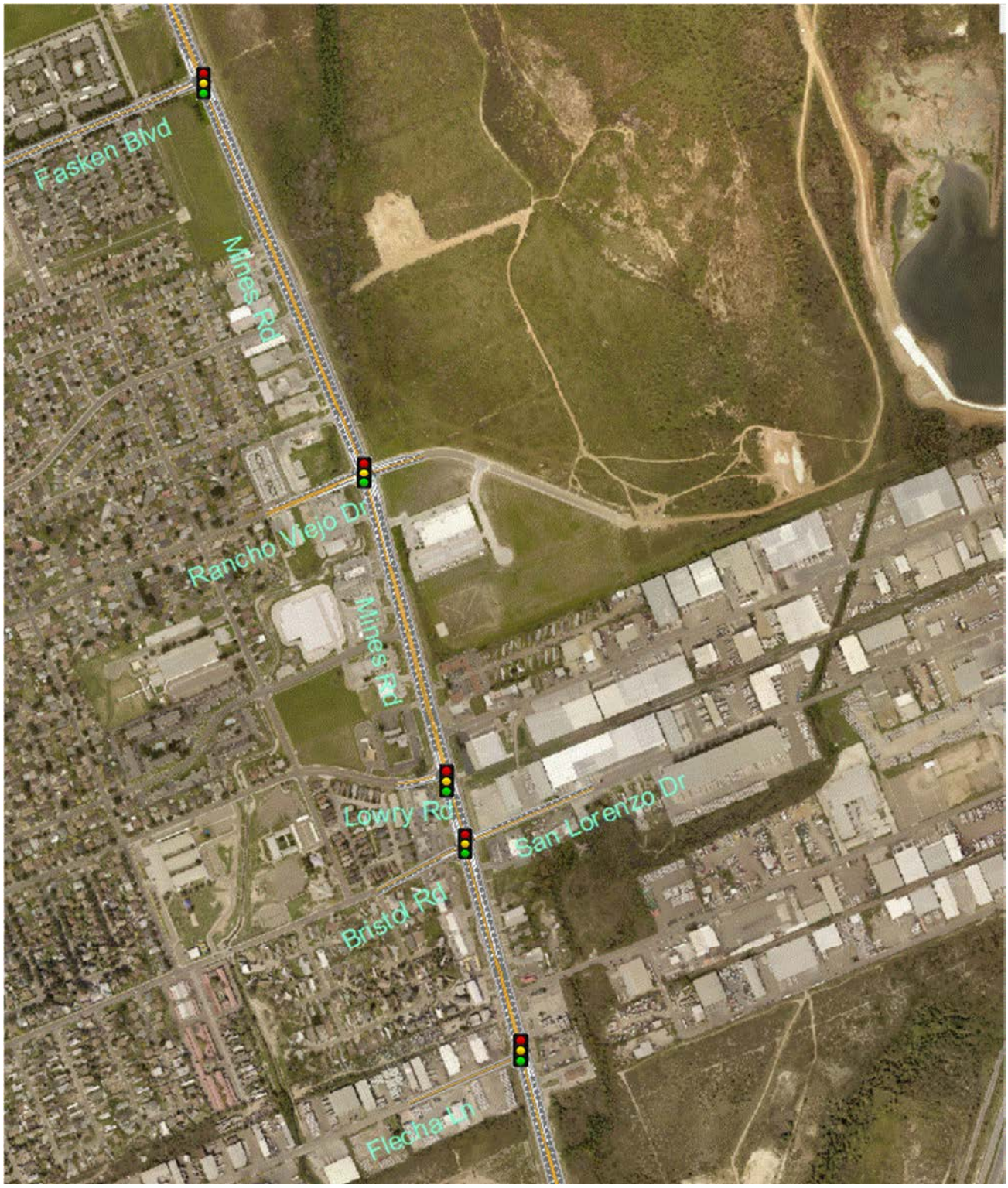


Figure 3: Corridor 1b - Mines Road South Intersections

4.2 US 83

US 83 consists of 19 signals grouped in 2 subsystems (north and south). The north corridor is an urban 2-way, 2-lane pair Guadalupe Street (US 83) westbound and Chihuahua Street eastbound consisting of 8 signals serving local traffic and to and from IH-35. The south section is Zapata Highway is primarily a 4-Lane divided roadway carrying residential commuter traffic along 11 signals.

Figure 4: Corridor 2a - US 83 North Intersections (Guadalupe Ave)

Figure 5: Corridor 2b - US 83 South Intersections (Zapata Hwy)

4.3 Loop 20

Loop 20, also known as the Bob Bullock Loop, consists of 6 signals north of the Laredo International Airport on the east side of the city. The highway is a 6-Lane divided roadway carrying a mix of traffic to and from Laredo International Airport, the Laredo Energy Arena, Texas A&M International University (TAMIU) campus, and Doctors Hospital.

Figure 6: Corridor 3 - Loop 20 Intersections (Bob Bullock Loop)

4.4 McPherson Road

McPherson Road consists of 17 signals between Loop 20 and US Highway 59 (Saunders Street). McPherson Road is primarily a north-south 4-Lane undivided roadway with a center two-way left turn lane (TWLTL) carrying light industrial traffic on the north side and residential/commercial traffic in the center of the city.

Figure 7: Corridor 4 - McPherson Road North Intersections

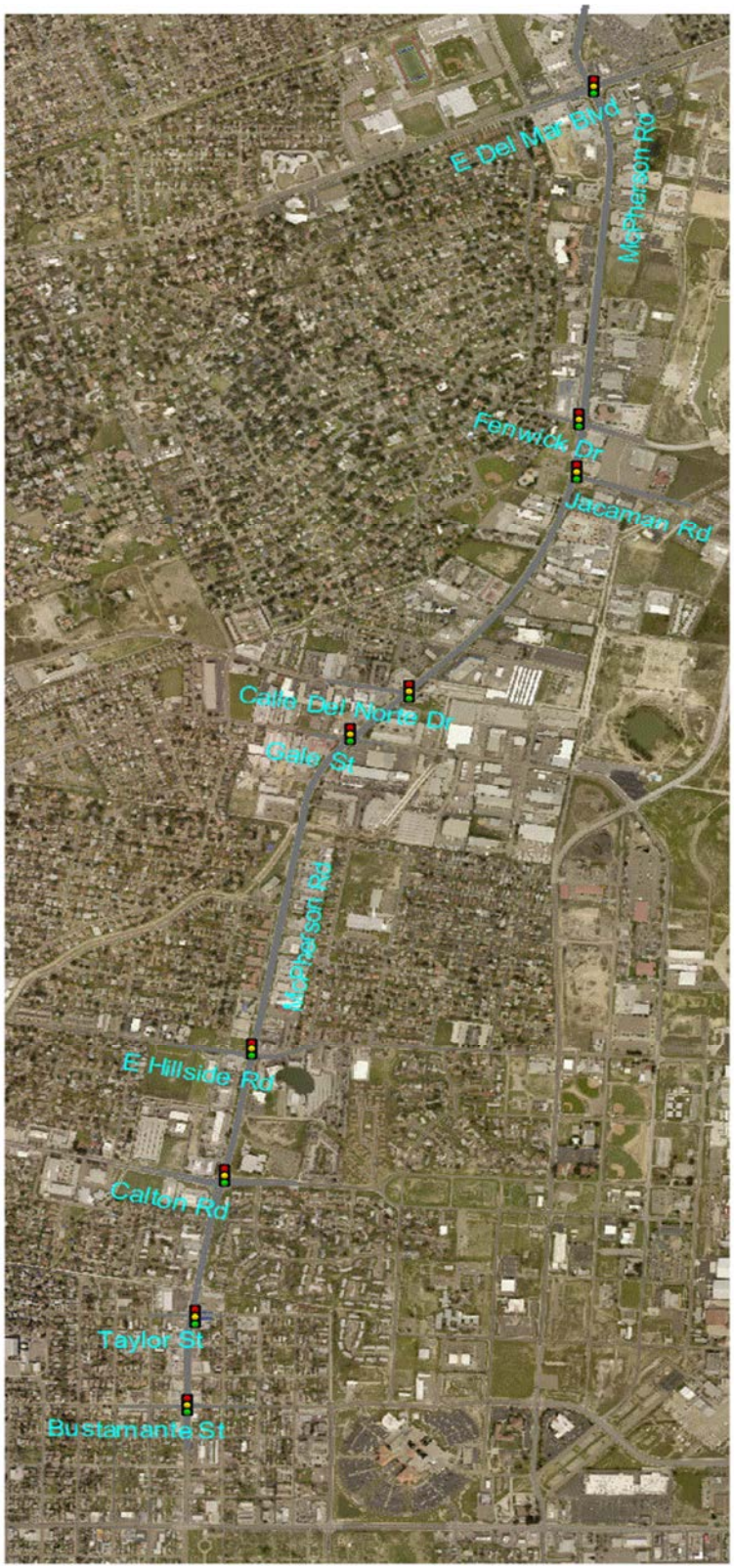


Figure 8: Corridor 4 (Continued) - McPherson Road South Intersections

4.5 SH 359

At its western terminus in Laredo, SH 359 consists of 6 signals east of US 83. SH 359 is runs east-west and is primarily a 4-Lane undivided roadway with a center two-way left turn lane (TWLTL) carrying industrial traffic and residential/commercial traffic.

Figure 9: Corridor 5 – SH 359 Intersections

4.6 BUS 35 & IH 35 Frontage Roads

BUS 35 (San Bernardo Avenue) is the commercial corridor which runs north-south parallel west of IH 35. It is a 4-Lane undivided roadway at the north end at Calton Road, transitioning to 2-Lane undivided with TWLTL and outside bike lanes south of Ugarte Street and north of Bruni Street. From Bruni Street to the south end at Scott Street, San Bernardo is primarily a 2-Lane undivided roadway. These two corridors consisted of re-timing 19 signals.

The IH 35 Frontage Roads widen to include turn lanes at the signalized intersections. The northbound frontage road is San Dario Avenue and the southbound frontage road is Santa Ursula Avenue.

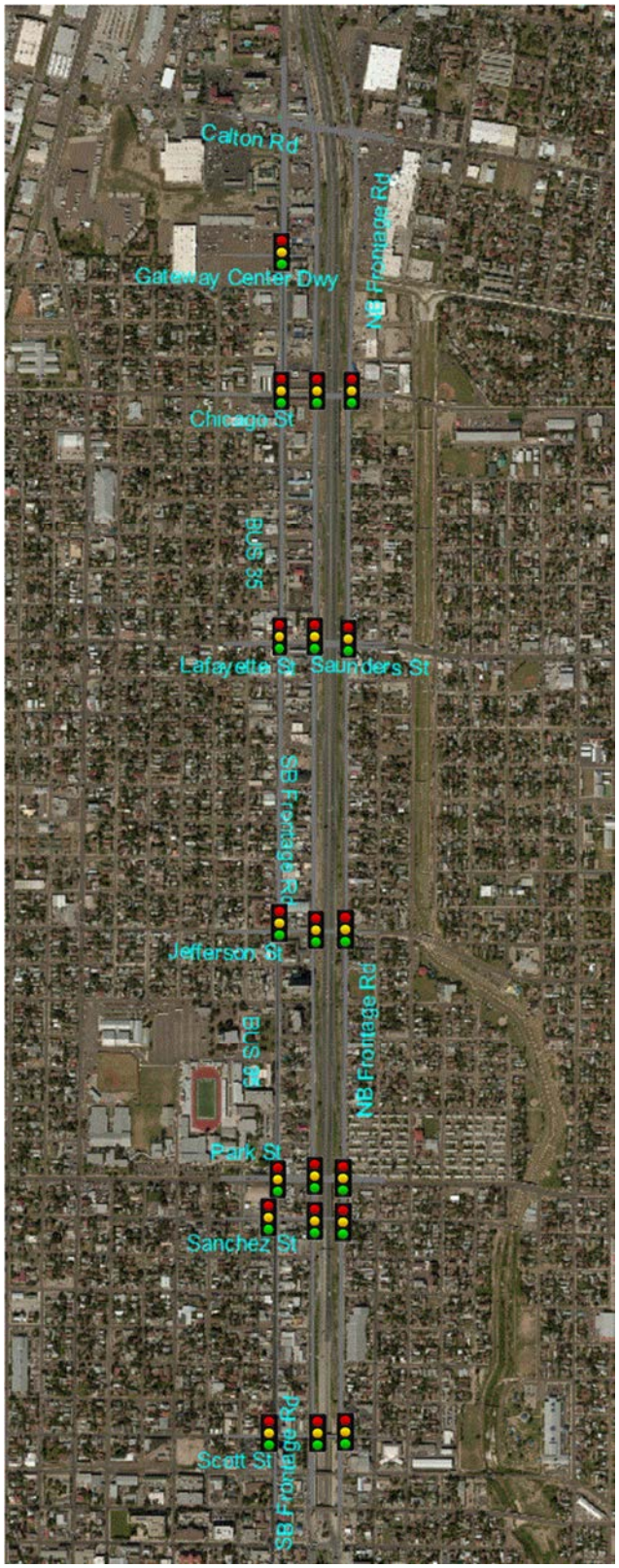


Figure 10: Corridor 6 & 7 – BUS 35 & IH 35 Frontage Rd Intersections

5 Project Results

5.1 Before & After Comparison

Although the signal re-timing included timing plans to cover the typical weekday and weekend time periods, the project results summary focused on the critical AM & PM periods. The AM & PM peak travel time change for each corridor are summarized in **Table 1** below.

Table 1: Travel Time Change Summary

CORRIDOR TRAVEL TIME CHANGE RESULTS SUMMARY					
ID NO.	CORRIDOR DESCRIPTION	TRAVEL ROUTE	No. of Signals	2018 ADT (VPD)	Avg Total AM &PM Change Results (sec)
1	FM 1472 (Mines Road)	Pan American Blvd - Flecha Ln	13	43,314	-1.0
2	US 83	Seymour Ave - Riverhill Dr	19	44,110	-9.3
3	Loop 20	Shiloh Dr - Sinatra Pkwy	6	49,974	-33.2
4	McPherson Road	Loop 20 (EB Frontage) - Bustamante St	17	36,812	-74.8
5	SH 359	Boomtown St - EG Ranch Rd	6	42,850	-127.3
6 & 7	BUS 35 & IH 35 Frontage Roads	Calton Rd - Scott St	19	11,930	-6.5

- The travel time results indicate an estimated 144,000 vehicle-hour yearly reduction in the AM & PM peak hour traffic.

Field travel time runs is one tool to measure results. But it is a snapshot, results can vary significantly based on varying traffic, weather, and actual field conditions on the day it was performed.

Improved signal timing also has indirect benefits. Better coordination along major arterials minimizes the diversion of traffic to local and residential streets, improving safety and traffic conditions. It also leads to reduced fuel consumption, reduced emissions, and improved air quality.

The AM & PM peak emissions change for each corridor are summarized in **Table 2** below.

Table 2: Emissions Change Summary

SYNCHRO EMISSIONS CHANGE RESULTS					
ID NO.	CORRIDOR DESCRIPTION	TRAVEL ROUTE	Avg AM & PM CO Emissions (grams)	Avg AM & PM NOx Emissions (grams)	Avg AM & PM VOC Emissions (grams)
1	FM 1472 (Mines Road)	Pan American Blvd - Flecha Ln	-588	-108	-138
2	US 83	Seymour Ave - Riverhill Dr	278	58	63
3	Loop 20	Shiloh Dr - Sinatra Pkwy	-3445	-665	-805
4	McPherson Road	Loop 20 (EB Frontage) - Bustamante St	-3870	-755	-895
5	SH 359	Boomtown St - EG Ranch Rd	-2270	-440	-540
6 & 7	BUS 35 & IH 35 Frontage Roads	Calton Rd - Scott St	-3425	-665	-800
Total Average Change Results			-2128	-410	-498

- Estimated 532,000 grams of CO yearly reduction in the AM & PM peak hour traffic.
- Estimated 102,500 grams of NOx yearly reduction in the AM & PM peak hour traffic.
- Estimated 124,500 grams of VOC yearly reduction in the AM & PM peak hour traffic.

5.2 Operational Observations

The following observations were noted during the creation of the new timing plans and field implementation:

1. FM 1472 (Mines Road)

The Mines Road corridor is the most problematic of all the study corridors, requiring daily observations and signal timing adjustments at the Traffic Management Center (TMC) due to the high truck demands and complicated by the increasing local mix of industrial, residential, commuter, and school traffic. The truck traffic varies by day of the week, time of day, and is mostly dependent on the processing of shipping orders to cross the World Trade Bridge at Loop 20 (Bob Bullock Loop) at the Mexico - Laredo border to/from the major distribution centers along the corridor. The truck traffic demand causes major queuing problems at all the north section corridor signals on Mines Road.

New traffic generated from the Aquero subdivision at Wolf Creek Drive and Villas San Agustin expansion at Fasken Boulevard post traffic counts.

Critical Observations (Mines Road - North Section):

- Trade Center Boulevard – northbound (NB) inside thru lane transitions into a left turn only lane upstream of the signal which can potentially disrupt traffic flow, particularly for drivers unfamiliar with the area.

Critical Observations (Mines Road - South Section):

- Flecha Lane – this is a T-intersection and primarily used by local industrial traffic. Traffic was observed to be light in all the peak periods which allows the signal to stay green on Mines Road, creating an early release which affects the NB progression getting stop at Bristol Road/San Lorenzo Drive.
- Bristol Road/San Lorenzo Drive – this is an offset intersection that runs side street split phasing and is considered the critical intersection for the south section of Mines Road.
- Lowry Road - this is a T-intersection and primarily used by local residential traffic. Traffic was observed to be light in all the peak periods and predominately right turns. Detection issues were observed causing side street traffic to max out with no cars/demand. The proximity of the Lowry signal (500 ft) to the Bristol/San Lorenzo signal to the south creates “trapping” of vehicles when the signals are not working as programmed, i.e. detection issues.
- Rancho Viejo Drive – the westbound approach has not been built with its final connection. City is currently operating eastbound (EB) and westbound (WB) approaches to run concurrently and will revise to allow EB and WB left turn phasing in the future.
- Fasken Boulevard – NB traffic backs up throughout the day as a result of the Loop 20 Frontage Road signals which runs on a separate system coordination with the south section of Mines Road.

2. US 83

US 83 is a major commuter corridor. The volumes and level of service (LOS) did not necessitate any peak hour cycle length increases and therefore the slight peak hour increase in emissions is indicative of the increased vehicular clearance times programmed as part of the signal re-timing. Flashing Yellow Arrow (FYA) left turns were deployed in the south section for allowance of Lead/Lag operation to increase the arterial green band without creating a yellow trap for the left turning traffic.

3. Loop 20

New student traffic generated at TAMIU and new Alexander High School opened post traffic counts:

- TAMIU experienced record campus enrollment of 8000 students (up 4.6%)
- Alexander High School campus supports 1,200 students

4. McPherson Road

Two signals were running in free mode (Loop 20 & San Isidro Pkwy) and this corridor was split in 2 subsystems. The new timing established coordination for the entire corridor resulting in a major north-south arterial operating on common cycles.

5. SH 359

This corridor had no existing coordination and was mostly running in free mode, and consequently yielded the best overall travel time results. New interchange traffic was introduced upon completion of construction. Access modifications were made to the southbound Loop 20 frontage road post traffic counts. At the Loop 20 signal. driveway weaving issues along the southbound Loop 20 frontage road were noted in field observations.

6. BUS 35
7. & IH 35 Frontage Roads

Several signals were running in free mode. New timings established corridor coordination for north-south on BUS 35 and east-west to the IH 35 frontage roads. Flashing Yellow Arrow (FYA) left turns were deployed on the BUS 35 for allowance of Lead/Lag operation to increase the arterial green band without creating a yellow trap for the left turning traffic. This is an industrial corridor with bike lanes. The varying traffic demands did not allow for common cycle lengths, and therefore had to be subdivided into several subsystems.

Chicago at the IH 35 frontage roads was converted to run a 3-Phase diamond operation due to the low amount of traffic. This allowed for both east-west progression. Except for the Scott interchange, the other interchanges run a 4-Phase diamond operation which typically allows for progression for one directional flow (either eastbound (EB) or westbound WB)) unless signal spacing, cycle and split lengths happen to align:

- Chicago is both EB & WB progression
- Lafayette favors EB
- Jefferson favors WB
- Park has EB & WB progression
- Sanchez favors EB
- Scott has EB & WB progression

North-south coordination is under City control, and the east-west coordination requires both City & TxDOT maintenance.

6 Recommended Improvements for Consideration

- Turn lane improvements – improves signal efficiency, decreases side street splits to reallocate back to main street, for instance split phasing can possibly be eliminated at:
  - US 83 & Spur 260
  - US 83 & Lomas Del Sur

- Upgrade detection systems (possibly Radar or Pods) – observed camera detection issues

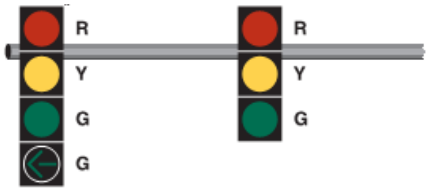
- Signal re-authorization – side street traffic at several signals were low during the peak hours and would benefit from a Warrant study for consideration to remove unwarranted signals. For instance, peak hour side street traffic was low at:
  - FM 1472 & Lowry Road
  - US 83 & Mercer Street
  - US 83 & Wooster Street
  - US 83 & Napoleon Street
  - US 83 & Santa Barbara Street

- Proximity of signals – some signals are very close affecting progression, recommend operational review of these clusters for consideration to operate with 1 controller vs. 2, for instance at the US 83 Guadalupe & Chihuahua Avenue one-way pair

- Access Management – observed operational issues with driveways impacting corridor progression that would benefit from consolidation (number, location, and spacing of connections), for instance at the US 83 Guadalupe & Chihuahua Avenue one-way pair

- Flashing Yellow Arrow (FYA) left turns - install FYA left turns to replace existing 5-section signal heads (with Dallas phasing) where protected+permitted phasing is allowed

- Operate split phasing with 4 Section Signal Head – to minimize loss time from needless driver yielding behavior, replace leftmost 3 Section (RYG) ball indication with 4 Section signal head shown below:



  See Mines Road at Bristol Road/San Lorenzo Drive signal as an example. Shared 4 Section signal faces shall only be used for a protected-only mode left turn if the circular green and green left-turn arrow indications always begin and terminate together

- Mines Road Improvements:
  - At River Bank/Killam Industrial, install right turn overlap signals for the side street right turn movements
  - At the Milo Road intersection, a northbound (NB) U-turn bay is provided but there is not a left turn signal head, therefore the U-turn is permissive. Either installing a NB left turn head (FYA or

protected-only) to match southbound (SB) left turn or restriping to close the U-turn lane would allow the SB left turn to lag (is required to lead to prevent a yellow trap for NB traffic).

- At Loop 20, install a SB right turn deceleration lane at the Loop 20 westbound frontage road (WBFR)

- Loop 20 Improvements:
  - Assess future operations and need for a signal at Winfield Parkway/Inspiration Parkway (between Shiloh Road and Del Mar Road), especially as future development occurs east of Loop 20. This could help relieve some of the school/future development traffic at the Del Mar intersection. Based on the striping, this appears to have been a median opening previously and now is restricted to only allow NB left turns for Winfield Parkway

- McPherson Boulevard Improvements:
  - At IH 20 WBFR, restripe the WB approach to provide a left turn / shared left turn+through lane configuration

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