Appendix C

Traffic Analysis

Webb County-City of Laredo Regional Mobility Authority
March 2020

Prepared by:
HNTB Corporation

-- page intentionally left blank --

Table of Contents

Introduction 1

Purpose........ 1

Existing Files 1

Methodology 1

Network Scenarios 4

Overview 4

2018 Existing, 2040 Existing and 2018 Scenario 1 4

2040 Scenario 1 5

2018 Scenario 2 and 2040 Scenario 2........ 5

2018 Scenarios 3-5 5

2040 Scenarios 3-5 6

Results 7

Network Comparison 7

Key Roadway Comparison........ 7

Summary of Results 8

Model Recommendations........ 10

Attachment C-1 TAZ and Roadway Network Exhibits 12

Attachment C-2 Roadway Comparison Tables........ 15

Introduction

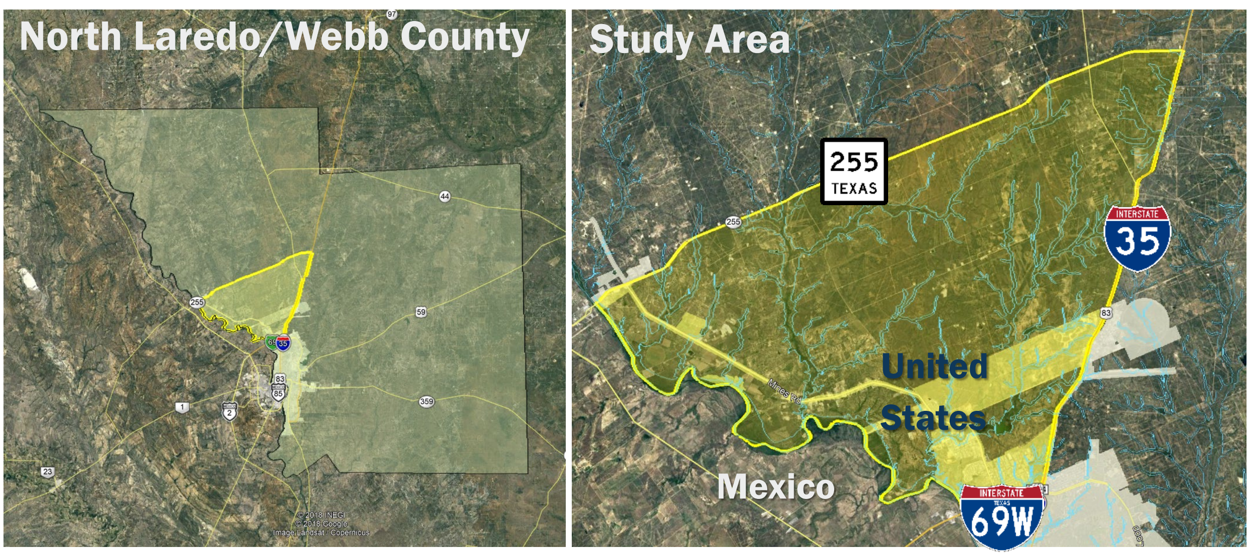
This appendix summarizes the methodology and factors behind the travel demand modeling of the North Laredo study area done to support this study. The Laredo travel demand model (TDM) was used to evaluate several different future year scenarios with varying proposed improvements to the transportation network in order to support the planning and decision-making process while identifying potential deficiencies in the system. The North Laredo-Webb County study area can be seen in **Figure 1**. The Base Year and Design Year for this project are 2018 and 2040, respectively.

Purpose

The methodology for updating the regional travel demand model involved several steps:

- Verify original year (2008) demographic information and roadway network database are accurate
- Develop base year (2018) demographic information
- Verify and update design year (2040) demographic information
- Develop base year (2018) roadway network database
- Verify and update design year (2040) roadway network database
- Develop base year (2018) and design year (2040) roadway network databases for scenarios to be modeled (existing roadway configuration plus 5 alternatives)
- Develop trip generation, distribution, and assignment for each roadway network database
- Verify travel demand models

Figure 1 – Project Study Area

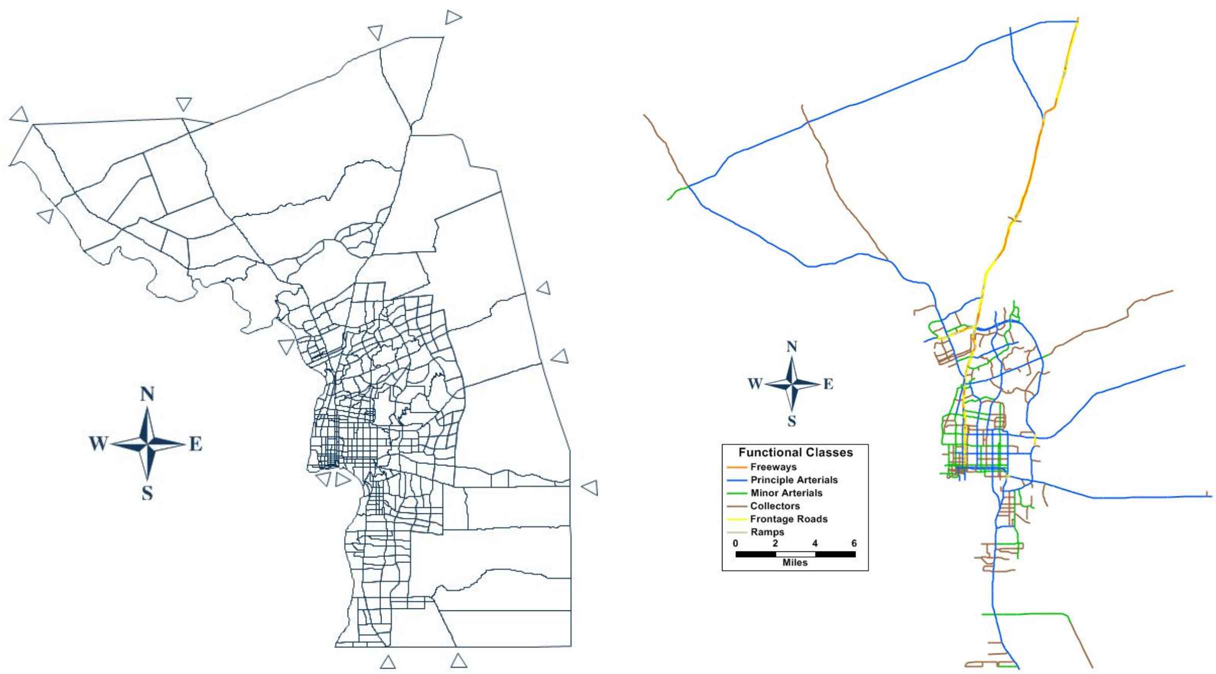


The goal of this summary is to provide an overview of the process used to accomplish these steps, including methodology and any relevant analytical procedures.

Existing Files

The study area is broken down into traffic analysis zones (TAZs): geographical units that include demographic information such as population, households, household income, and employment estimates. TAZ databases for the original year (2008) and future year (2040) were provided for this analysis. Roadway network databases for the original year (2008) and future year (2040) were also provided. The network databases contain relevant physical and operational characteristics relating to the roadways, including (but not limited to) length, number of lanes, daily speed, daily capacity, and average weekday traffic counts. **Figure 2** shows the Laredo TAZ structure (left) as well as the Laredo roadway network (right).

Figure 2 – 2008 Laredo TAZ Structure (left) and Roadway Network (right)



Methodology

Because the original year (2008) model was over 10 years old, a new base year travel demand model needed to be developed. The base year selected for the updated model was 2018. In order to develop the new travel demand model, base year (2018) TAZ and roadway network databases needed to be created.

The design year (2040) travel demand model needed to be checked for accuracy and updated (if needed). It was determined that more accurate model results would be achieved if a new design year (2040) TAZ database was developed; the new TAZ database would split up several of the much larger (in terms of area) TAZ's where there were extremely low (if not zero) populations, households, and employment in 2008, but where significant development was expected prior to 2040. Proposed 2040 roadways were used to determine the new split TAZ boundaries in order to provide trips with comparable access opportunities. The external trip tables were then updated to reflect the new TAZ's; trips were interpolated based on the area of the new TAZ's (with the restriction that trips had to be a multiple of 0.5). The new trip tables were compared to the original tables to ensure that all the row, column, and entire table totals matched (i.e. no trips were added or removed from the system or from specific TAZ's).

Once the base year (2018) and design year (2040) models were developed, individual scenario models could be created by making adjustments and additions to the 2018 and 2040 models based on the proposed improvements included in each scenario.

The methodology for establishing the base year (2018) TAZ database involved the following steps:

- Calculate Compound Annual Growth Rates (CAGR) for each demographic input (population, household, employment, etc.) in each TAZ using the original year (2008) and design year (2040) as static reference points
- Interpolate base year (2018) demographic information using the CAGR values calculated in the previous step
- Identify TAZ's where any of the demographic information was expected to see significant growth (CAGR > 0.5%) between 2008 and 2040 datasets (this would indicate significant development was forecasted to occur in that TAZ between 2008 and 2040)
- Conduct visual check in Google Earth and Google Maps comparing aerials from 2008 and 2018 to determine what level of development had actually occurred in the TAZ's identified in the above step
- In the previously identified TAZ's, approximate what percentage of the projected development from 2008 to 2040 had occurred by 2018. Use this approximated figure to determine the corresponding CAGR value for the TAZ
- Compare the approximated TAZ demographic data to other TAZ's with similar employment and population information to check feasibility.
- Identify which (if any) TAZ's may have seen unexpected development (i.e. 2018 demographic inputs are larger than 2040 values), and which TAZ's have seen little to no development despite high projected growth between 2008 and 2040. Determine if any manual adjustments to the inputs are needed
- Conduct QA/QC on newly developed 2018 TAZ database and on any recommended adjustments to 2040 TAZ database
- A map of the final 2018 TAZ and socioeconomic data can be found in **Attachment C-1**

The methodology for establishing the new design year (2040) TAZ database involved the following steps:

- Identify which (if any) TAZ's may have seen unexpected development (i.e. 2018 demographic inputs are larger than 2040 values), and which TAZ's have seen little to no development despite high projected growth between 2008 and 2040. Determine if any TAZ inputs need to be adjusted in the 2040 model to line up with calculated 2018 demographic inputs
- Identify which TAZ's within the study area should be split (of the 511 internal TAZ's and 14 external TAZ's, 24 internal and 0 external TAZ's were identified)
- Determine new TAZ boundaries based on roadway system. Calculate what percentage area of the original TAZ's the new TAZ's include (the 24 internal TAZ's were split into 33 new internal TAZ's)
- Calculate demographic inputs for the new TAZ's based on area. Verify that the sum of the demographic inputs for the smaller TAZ's adds up to the total demographic inputs of the larger TAZ that was split up
- Manually update auto and truck trip tables (after completing design year 2040 model run). Adjust trip tables by splitting old TAZ's in both the origins and destinations of the matrices into new TAZ's. Verify that the sum of the old trip table rows and columns matches the sum of the new trip table rows and columns
- Conduct QA/QC on newly developed 2040 TAZ database
- A map of the final 2040 TAZ and socioeconomic data can be found in **Attachment C-1**

The methodology for establishing the base year (2018) roadway network database involved the following steps:

- Create base year (2018) roadway network file by copying the original year (2008) roadway network database
- Conduct visual check in Google Earth and Google Maps comparing aerials from 2018 to the roadways that are present in the original year (2008) roadway network database to determine what roadways have been constructed between 2008 and 2018
- Identify which of the recently constructed roadways noted in the previous step appear in the design year (2040) model and copy those into the base year (2018) model
- For any recently constructed roadways not appearing in the design year (2040) model, create new links in the roadway network
- Populate attribute fields for any new links with known physical and operational information. If any of the field inputs are unknown, find comparable roadways in the model and determine appropriate values for those attribute fields from similar roadways
- Create new attribute field for existing count data. Pull count data from TxDOT website for relevant locations (130 total) and populate existing count attribute field. Existing count data will eventually be used to verify model outputs
- Calculate CAGR values for each roadway link using the original year (2008) and design year (2040) as static reference points
- Interpolate base year (2018) traffic volume using the CAGR values calculated in the previous step
- Run base year model using base year (2018) TAZ database, roadway network database, and external trip tables
- Verify model results to ensure there are no errors or missing links/connections that would affect the outputs

- Compare model results to existing traffic count data. In areas where model output volumes are significantly higher/lower than existing counts, review trip generation inputs for nearby TAZ's, network attributes, external trip tables, and trip distribution factors, then rerun the model. Repeat this process until model results are deemed to be representative of existing conditions when compared to existing counts
- Conduct QA/QC on newly developed 2018 roadway network database
- A map of the final 2018 roadway network and functional classes can be found in **Attachment C-1**

The methodology for establishing the design year (2040) roadway network database involved the following steps:

- Create a new design year (2040) roadway network file by copying the base year (2018) roadway network database
- Create new centroid connector links corresponding to the design year (2040) TAZ database with the newly split TAZ's
- Identify which roadways not included in the new base year (2018) model appear in the original design year (2040) model and copy those into the new design year (2040) model
- Run design year model using design year (2040) TAZ database, roadway network database, and external trip tables
- Verify model results to ensure there are no errors or missing links/connections that would affect the outputs
- Compare model results to original 2040 model output. In areas where model output volumes are significantly higher/lower than existing counts, review trip generation inputs for nearby TAZ's, network attributes, external trip tables, and trip distribution factors, then rerun the model. Repeat this process until model results are deemed to be representative of future conditions when compared to original 2040 model output
- Conduct QA/QC on newly developed 2040 roadway network database
- A map of the final 2040 roadway network and functional classes can be found in **Attachment C-1**

The methodology for establishing the roadway network database for each individual scenario involved the following steps:

- Create new base year (2018) and design year (2040) roadway network files for each scenario by copying base year (2018) and design year (2040) roadway network databases
- Make all relevant proposed changes to roadways already in the base year (2018) and design year (2040) models (i.e. number of lanes, capacity, etc.)
- Identify which of the proposed roadways included in the scenario appear in the original design year (2040) model and copy those into the base year (2018) and future year (2040) scenario models where they appear
- For any proposed roadways not appearing in the original design year (2040) model, create new links in the roadway network based on shape files provided by the project team
- Populate attribute fields for any new links with known physical and operational information. If any of the field inputs are unknown, find comparable roadways in the model and determine appropriate values for those attribute fields from similar roadways
- Run scenario models using the appropriate base year (2018) or design year (2040) TAZ database, roadway network database, and external trip tables

- Verify model results to ensure there are no errors or missing links/connections that would affect the outputs
- Compare scenario model results to the appropriate base year (2018) or design year (2040) model runs. Determine if scenario model results are reasonable given the proposed changes to the roadway network and re-run scenario models (if needed)
- Conduct QA/QC on newly developed scenario roadway network databases

Network Scenarios

Overview

The Existing models are representative of the functionally classified roadways currently in existence plus select local roadways that provide key access routes, run with both the 2018 and 2040 trip generation and distribution data. Scenario 1 (both 2018 and 2040) is similar to the respective year's base case; two additional proposed roadways are included in 2040 Scenario 1. Scenario 2 includes several more basic roadway improvement projects meant to address delay and capacity issues on key corridors.

Scenarios 3 through 5 include the same set of more extensive roadway additions and improvements of Scenario 2 with a couple notable differences:

- Scenario 3 upgrades FM 1472 (Mines Road) between IH-69 and TX-255 to a full access-controlled freeway with a corresponding frontage road system
- Scenario 4 increases capacity on Sara Road, as well as restricts vehicles entering the system from the World Trade bridge from using FM 1472 (Mines Road) to access Milo Road/Sara Road. Those vehicles instead need to take IH-69 east to a Texas turnaround near IH-35 in order to get to Milo Road/Sara Road
- Scenario 5 is identical to Scenario 4 except that instead of restricting vehicles to the Texas turnaround, a proposed roadway directly connecting the World Trade Bridge to Milo Road is included for vehicles entering the system from the World Trade bridge going to Milo Road/Sara Road

All scenario improvements and specific model details are discussed in the following sections.

2018 Existing, 2040 Existing and 2018 Scenario 1

The 2018 Existing, 2040 Existing, and 2018 Scenario 1 roadway networks are identical. These networks include all roadways currently in existence in 2018, plus the proposed roadways:

- Mueller Memorial Boulevard (2 lane collector)
- Trade Center Boulevard (4 lane industrial collector)
- United Avenue (4 lane minor arterial)
- Carriers Drive (4 lane collector)
- Port Drive (4 lane collector)

No other roadway projects or capacity improvements were included in these roadway networks.

The 2018 Existing and 2018 Scenario 1 roadway networks were paired with the base year (2018) TAZ database to run the travel demand models for these two scenarios. The 2040 Existing roadway network was paired with the design year (2040) TAZ database to run the travel demand model for that scenario.

2040 Scenario 1

The 2040 Scenario 1 roadway network is the same as the 2040 Existing network, plus the proposed roadways:

- Hachar Parkway (4 lane divided rural highway)
- Vallecillo Road (4 lane principal arterial)

No other roadway projects or capacity improvements were included in this roadway network.
The 2040 Scenario 1 roadway network was paired with the design year (2040) TAZ database to run the travel demand model for that scenario.

2018 Scenario 2 and 2040 Scenario 2

The 2018 Scenario 2 and 2040 Scenario 2 roadway networks are the same as the 2040 Scenario 1 network, plus the proposed roadway:

- Riverbank Road (4 lane minor arterial)

Additionally, the following roadways have proposed capacity expansions:

- Milo Road (increases from 2 lanes to 4 lanes)
- Las Tiendas Road (increases from 2 lanes to 4 lanes)

The 2018 Scenario 2 roadway network was paired with the base year (2018) TAZ database to run the travel demand model for that scenario. The 2040 Scenario 2 roadway network was paired with the design year (2040) TAZ database to run the travel demand model for that scenario.

2018 Scenarios 3-5

The 2018 Scenario 3 through 5 roadway networks are the same as the 2018 Scenario 2 network, plus the proposed roadways:

- Beltway-Uniroyal Extension (4 lane principal arterial)
- McPherson Road Extension (4 lane principal arterial)
- International Boulevard Extension (4 lane minor arterial)
- North-South Boulevard Extension (4 lane principal arterial)
- Verde Boulevard Extension (4 lane collector)

Additionally, the following distinct improvements are unique to each scenario:

- Scenario 3 upgrades FM 1472 (Mines Road) to a 6-lane expressway, along with 2-lane northbound and 2-lane southbound frontage roads, between IH-69 and TX-255
- Scenario 4 increases Sara Road from 4 lanes to 6 lanes, and restricts vehicles entering the system from the World Trade bridge from using FM 1472 (Mines Road) to access Milo Road/Sara Road. Those vehicles instead need to take IH-69W east to a Texas turnaround near IH-35 in order to get to Milo Road/Sara Road
- Scenario 5 is identical to Scenario 4 except that instead of restricting vehicles to the Texas turnaround, a proposed 4 lane roadway directly connecting the World Trade Bridge to Milo Road is included for vehicles entering the system from the World Trade Bridge traveling to Milo Road/Sara Road

The 2018 Scenario 3 through 5 roadway networks were paired with the base year (2018) TAZ database to run the travel demand model for those scenarios.

2040 Scenarios 3-5

The 2040 Scenario 3 through 5 roadway networks are the same as the 2040 Scenario 2 network, plus the proposed roadways:

- Hachar Parkway Extension (4 lane divided rural highway)
- Vallecillo Road Extension (4 lane principal arterial)
- Beltway-Uniroyal Extension (4 lane principal arterial)
- McPherson Road Extension (4 lane principal arterial)
- International Boulevard Extension (4 lane minor arterial)
- North-South Boulevard Extension (4 lane principal arterial)
- Verde Boulevard Extension (4 lane collector)
- Sara Road Extension (4 lane multiway boulevard)
- North-South Boulevard (4 lane principal arterial)
- Verde Boulevard (4 lane collector)
- East-West Boulevard (4 lane multiway boulevard)

The following roadway also has proposed capacity expansion:

- TX-255 (increases from 2 lanes to 4 lanes)

Additionally, the following distinct improvements are unique to each scenario:

- Scenario 3 upgrades FM 1472 (Mines Road) to a 6-lane expressway, along with 2-lane northbound and 2-lane southbound frontage roads, between IH-69 and TX-255
- Scenario 4 increases Sara Road from 4 lanes to 6 lanes, and restricts vehicles entering the system from the World Trade bridge from using FM 1472 (Mines Road) to access Milo Road/Sara Road. Those vehicles instead need to take IH-69 east to a Texas turnaround near IH-35 in order to get to Milo Road/Sara Road
- Scenario 5 is identical to Scenario 4 except that instead of restricting vehicles to the Texas turnaround, a proposed 4 lane roadway directly connecting the World Trade Bridge to Milo Road is included for vehicles entering the system from the World Trade bridge going to Milo Road/Sara Road

The 2040 Scenario 3 through 5 roadway networks were paired with the design year (2040) TAZ database to run the travel demand model for those scenarios.

Results

Data collected from the model runs for each of the base year (2018) and design year (2040) scenarios was summarized in order to determine how the network performed in each case. The resulting data and comparisons between scenarios can provide insight into which potential projects may offer the most benefit in terms of delay reduction and network efficiency.

Network Comparison

Performance and efficiency of each scenario were measured in terms of network-wide data, including Vehicle Miles Traveled (VMT), Vehicle Hours Traveled (VHT), percentage of links that are over capacity, and percentage of travel time that is delayed. These results are shown in **Table 1**.

Table 1 – Comparison of Network Results

Scenario	Network VMT	Network VHT	Percentage of Links Over Capacity	Percentage of Delay
2018 Existing	4,857,296	462,292	11.40%	71.60%
2018 Scenario 1	4,857,296	462,292	11.40%	71.60%
2018 Scenario 2	4,982,256	194,497	9.58%	30.94%
2018 Scenario 3	5,006,678	194,259	9.17%	30.35%
2018 Scenario 4	4,982,468	194,183	9.46%	30.85%
2018 Scenario 5	4,969,066	193,727	9.30%	30.88%
2040 Existing	7,410,837	1,458,341	20.16%	86.50%
2040 Scenario 1	7,510,538	1,022,358	20.12%	80.50%
2040 Scenario 2	10,872,903	856,202	25.45%	66.96%
2040 Scenario 3	10,851246	799,359	24.23%	64.73%
2040 Scenario 4	10,849,505	807,799	25.03%	65.19%
2040 Scenario 5	10,921,752	813,199	25.18%	65.23%

Key Roadway Comparison

Ten locations along key roadways were identified to compare results between scenarios. Looking at the results from these locations can help to determine which scenario or proposed projects provide the most benefit to a specific route's operation. An example of the results from one of these locations is shown in **Table 2**. All of the key roadway comparison tables can be found in **Attachment C-2**.

Table 2 – Comparison of Milo Road (Between River Bank Road and IH-35) Results

Scenario	Volume	Link VMT	Link VHT	Volume to Capacity (V/C) Ratio	Delay (Hours)
2017 Count Data	11148	-	-	1.03	-
2018 Existing	7764	2381.5	79.0	0.72	19.5
2018 Scenario 1	7764	2381.5	79.0	0.72	19.5
2018 Scenario 2*	10755	3299.2	87.2	0.50	4.7
2018 Scenario 3*	5692	1539.4	37.0	0.26	2.8
2018 Scenario 4*	11152	3420.9	88.4	0.52	2.9
2018 Scenario 5*	11499	3527.5	91.5	0.53	3.3
2040 Existing	8585	2633.5	74.7	0.79	8.9
2040 Scenario 1	8596	2636.9	74.3	0.80	8.4
2040 Scenario 2*	15971	4899.0	127.7	0.74	5.2
2040 Scenario 3*	10395	2811.4	67.8	0.48	5.3
2040 Scenario 4*	18557	5692.5	160.4	0.86	18.1
2040 Scenario 5*	19690	6040.0	161.2	0.91	10.2

*indicates a scenario with proposed improvements to this roadway

Summary of Results

The network-wide data for Scenarios 2-5 indicates significant improvement in network efficiency and operations through the increase in VMT and simultaneous decrease in VHT and delay when compared to the existing Scenario and Scenario 1. On a network level, the differences in results are minimal between Scenarios 2, 3, 4, and 5 which indicates there is no one "right answer" for improving the system. The difference in results between Scenario 1 and Scenario 2 suggests that the proposed projects included in Scenario 2 are very important for helping improve network operations and efficiency.

Looking at the ten key locations provides a little more insight into differences between scenarios. IH-69W Eastbound and Westbound sees fairly consistent results among scenarios and doesn't seem to be affected greatly by any of the proposed projects. IH-35 Northbound and Southbound are similar, except that these two locations see a large jump in volume and delay in the 2040 Scenarios 2-5; this is mainly due to FM 1472 (Mines Road) being so over capacity in those situations that drivers are seeking alternate routes even if they are a bit out of the way. Additionally, with the improvements to existing east/west roadways and additions of several new east/west roadways occurring in each of the 2040 scenarios, it is much easier for drivers to travel between FM 1472 (Mines Road) and IH-35 where it may be more difficult to do so with the existing network as is.

In the cases of FM 1472 (Mines Road) and Sara Road, it is evident how near to or over capacity these roads are currently, as well as in nearly every scenario (even those which include improvements on these two roads). This tends to indicate that while proposed projects involving improvements to these roads can help prevent the situation from getting worse, other projects improving nearby existing roadways or creating new roadways are also critical in order to provide relief valves to help divert excess traffic off of FM 1472 (Mines Road) and Sara Road.

Milo Road shows fairly consistent results between scenarios, but that assumes the improvement project increasing the number of lanes on the roadway does take place (capacity expansion is included in Scenarios 2-5). This seems to suggest the importance of that project occurring given the growth that is forecasted in that area.

Killam Industrial Boulevard is noticeably over capacity with the existing roadway network, but once Hachar Parkway and Vallecillo Road are added to the network, volumes and delay do drop to more manageable levels, again indicating the importance of those two projects. All of the scenarios where Hachar Parkway and Vallecillo Road are included (2018 Scenarios 2-5 and 2040 Scenarios 1-5) see consistent results.

The last three locations (Vallecillo Road, Hachar Parkway, and Riverbank Road) are all roadways that do not exist in the current network. Vallecillo Road sees consistent results between scenarios (both 2018 and 2040) but does have high usage in terms of volume and volume to capacity ratio. The high usage even in the 2018 cases indicates that this project may need to be considered sooner rather than later. Both Hachar Parkway and Riverbank Road see minimal usage in the 2018 scenarios, but project for high usage in the 2040 cases. While these roadways may not currently be needed to improve network operations, they are definitely beneficial in the long-term.

Model Recommendations

As described earlier in the memo, a lot of work was done to take the last iteration of this travel demand model (2008) and update it to a new base year (2018) in order to help accurately look at base year and future year (2040) scenarios for network improvements. Through this effort, several factors were identified as objectives that could be improved upon when these models are revisited in the future. Possible recommendations to improve the process of maintaining and updating the model in future iterations include:

- Collect existing traffic counts (especially along key corridors) more frequently
    - Some locations examined had traffic count data from each of the last ten years while others only had a single year of data or none at all
    - Having existing counts at least once every 2-3 years allows for comparing volumes to model projections to determine if growth is occurring as expected throughout the network or if existing volumes are not lining up and revisions to previous projections need to be made
    - Can also help in planning and decision-making process for which proposed improvement projects should take place at what point in time
    - RMA/MPO should be able to provide input to TxDOT on priority locations, especially in areas where growth is occurring or projected to occur as well as locations of possible future improvement projects so that there is enough existing data present for alternative model results to be compared to
    - RMA/MPO coordination with TxDOT necessary. RMA/MPO could either provide additional funding so that TxDOT can collect more counts each year or RMA/MPO could be responsible for collecting counts at key locations that are not covered (or not covered as frequently) by TxDOT. Ideally, these counts would be integrated into TxDOT database and would be subject to same processing as counts collected by TxDOT for continuity

- Investigate formalizing process of collecting and projecting socioeconomic data at regular, more frequent periods
    - Similar to the above point, the more frequently data can be collected, the less approximation or interpolation needs to take place, which will ultimately result in more accurate models
    - Datasets including relatively recent conditions (within the past ~5 years) can be used for analysis such as that which is described in this memo. However, the most recent socioeconomic data, future year data projection, and TDM update were from 2008, so an intermediate year dataset needed to be interpolated from that available data
    - While detailed census data is available every ten years, intermediate year datasets (including housing and employment figures) should be available in order to refresh future year projections that were made based off of previous data and growth projections, and to update the TDM
    - Ideally this would be an MPO undertaking consistent with the long-range transportation plan update process (approximately every 5 years). RMA could provide funding to help this process
    -

- Review TAZ configuration and determine if larger TAZ's should be broken down into smaller zones to make accounting for future development more accurate in models

- Include freight commodity based sub-model element

  - Can build off of Texas Statewide Analysis Model. This includes Mexico, so data such as cross-border freight can be utilized and expanded upon
  - Statewide Analysis Model builds off of Freight Analysis Framework national dataset which includes commodity information.
  - The above can be enhanced with local OD datasets such as Streetlight

- Update model to include means for roadway links to exclude trucks if desired
  - Pairing with the above freight sub-model element, these additional details and attributes relating to trucking would allow for trucking specific analysis, such as examining truck only lanes, truck tolling, and truck exclusion along routes

- Update the TAZ and roadway network files more frequently
  - Would help to avoid complete overhauls or new modeling efforts requiring extensive approximation or interpolation

Attachment C-1 TAZ and Roadway Network Exhibits

Figure C-1 – Existing Road Network, Number of Lanes and POE in Study Area

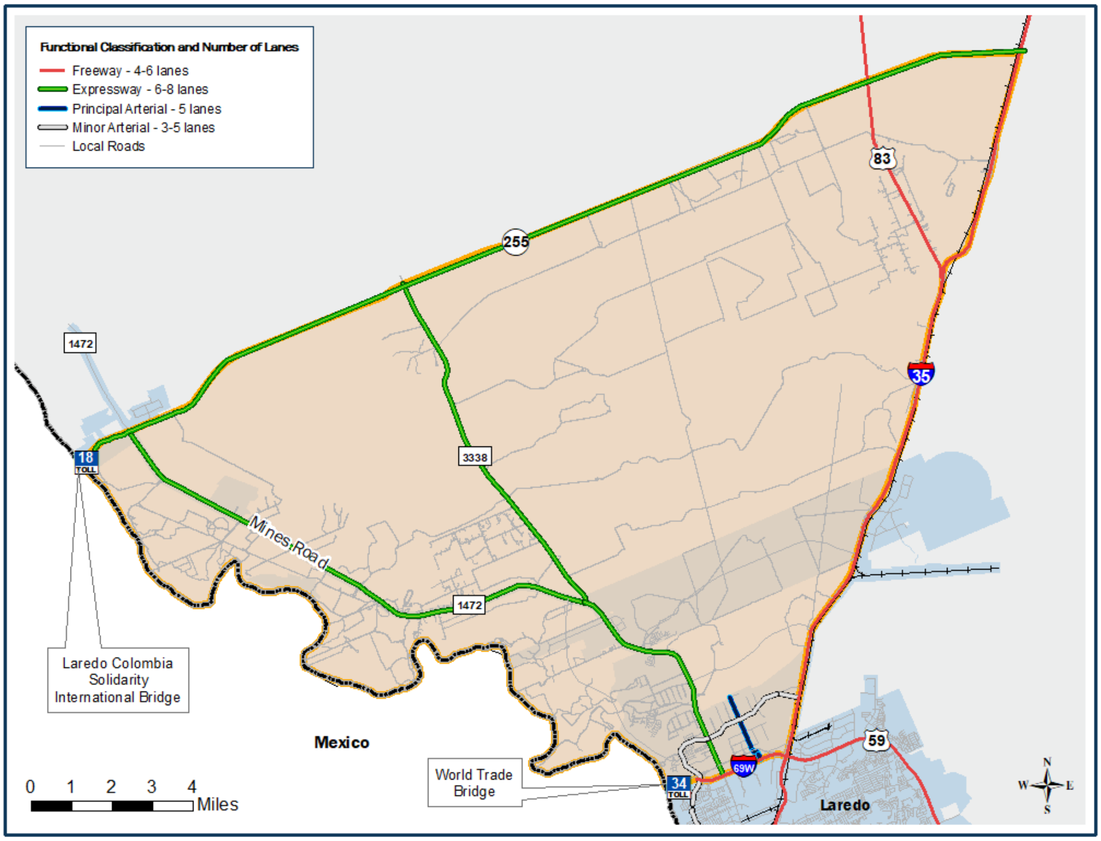


Figure C-2 – Future Roadway Network in Study Area

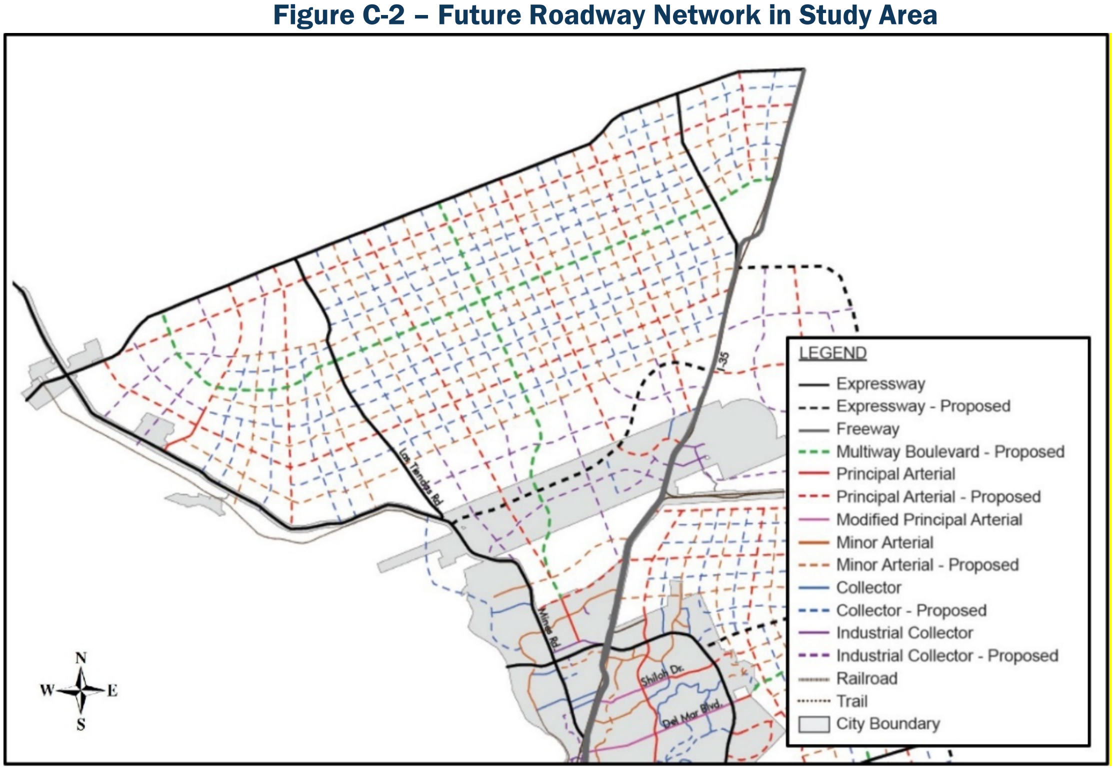


Figure C-3 – Existing Population Density in the Study Area

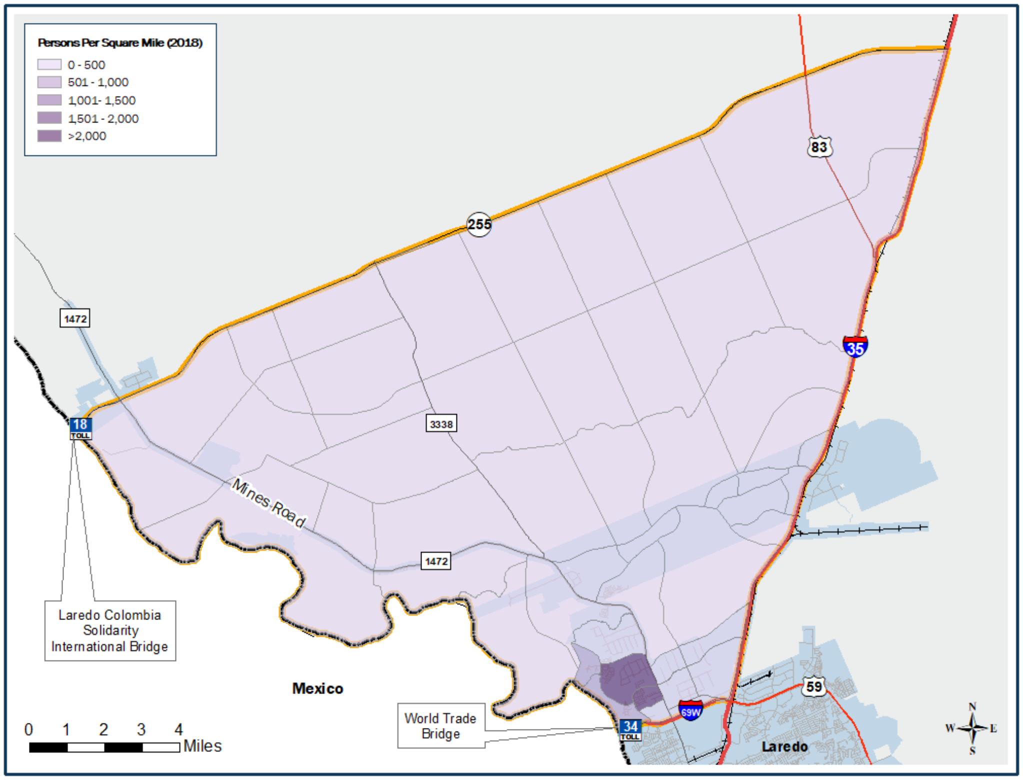


Figure C-4 – Future Population Density in the Study Area

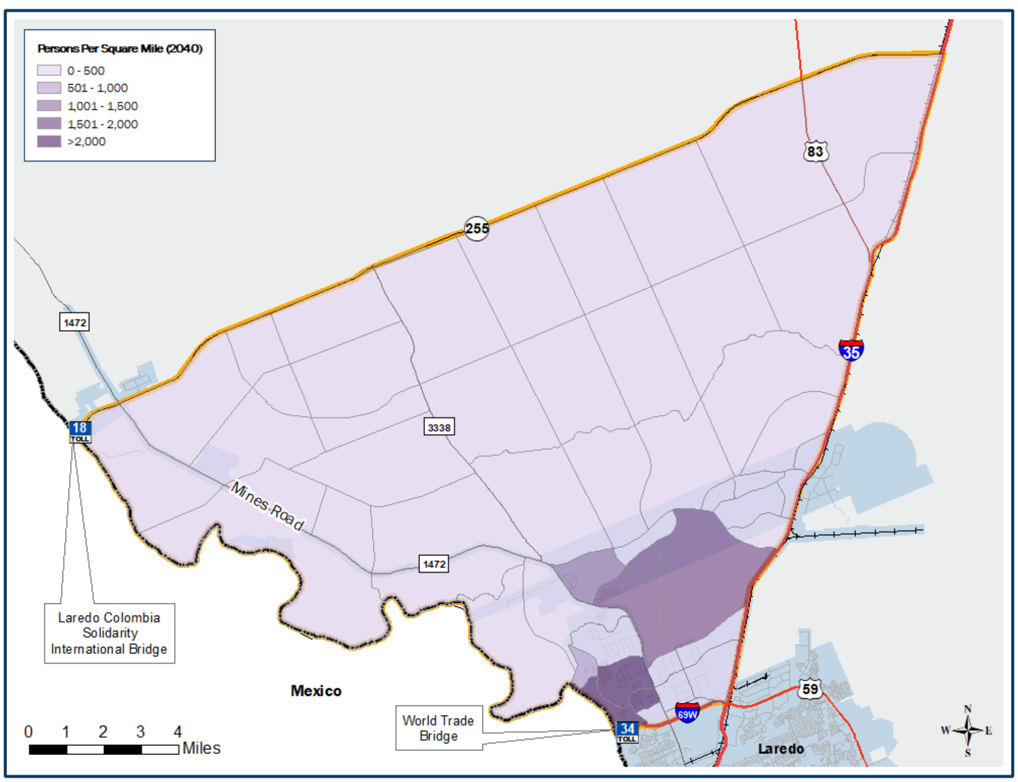


Figure C-5 – Existing Employment Density in the Study Area

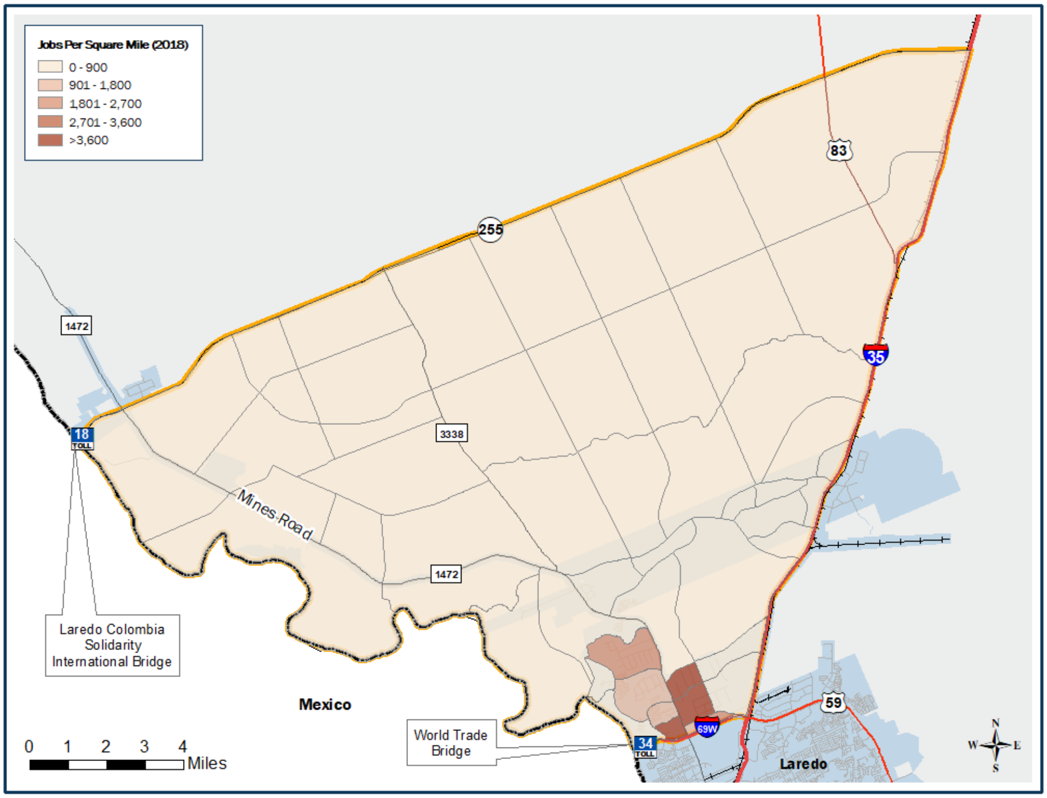
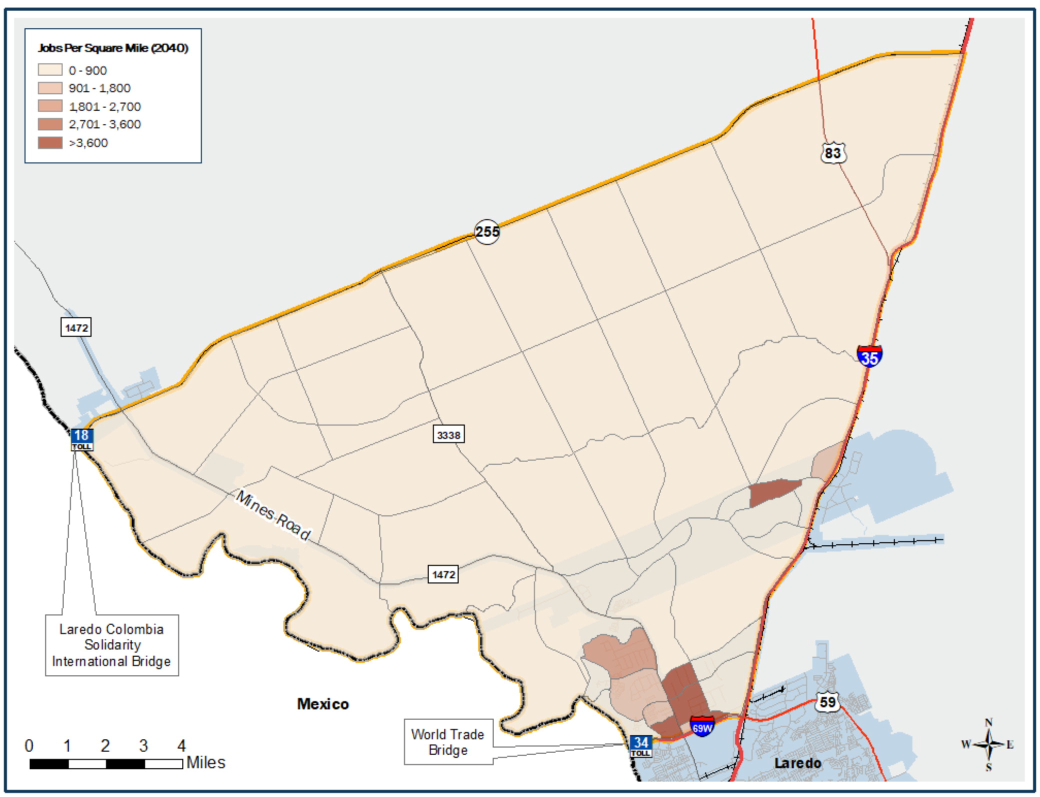


Figure C-6 – Future Employment Density in the Study Area



Attachment C-2 Roadway Comparison Tables

Table C-1 – Comparison of IH-69W Eastbound (Between POE and IH-35) Results

Scenario	Volume	Link VMT	Link VHT	Volume to Capacity (V/C) Ratio	Delay (Hours)
2017 Count Data	17925	-	-	0.46	-
2018 Existing	22043	794.2	14.7	0.57	0.3
2018 Scenario 1	22043	794.2	14.7	0.57	0.3
2018 Scenario 2	21203	764.0	14.1	0.54	0.2
2018 Scenario 3	9851	354.9	6.5	0.25	0.0
2018 Scenario 4	21027	757.6	13.9	0.54	0.1
2018 Scenario 5	20366	733.8	13.5	0.52	0.2
2040 Existing	21172	762.9	14.1	0.54	0.2
2040 Scenario 1	21582	777.6	14.3	0.55	0.2
2040 Scenario 2	29464	1061.6	20.2	0.76	0.9
2040 Scenario 3	21878	788.3	14.5	0.56	0.2
2040 Scenario 4	28103	1012.6	19.2	0.72	0.8
2040 Scenario 5	26836	966.9	18.2	0.69	0.6

Table C-2 – Comparison of IH-69W Westbound (Between POE and IH-35) Results

Scenario	Volume	Link VMT	Link VHT	Volume to Capacity (V/C) Ratio	Delay (Hours)
2017 Count Data	13660	-	-	0.35	-
2018 Existing	12586	3615.7	67.5	0.32	1.8
2018 Scenario 1	12586	3615.7	67.5	0.32	1.8
2018 Scenario 2	7365	2115.8	38.6	0.19	0.1
2018 Scenario 3	6853	1968.8	35.9	0.18	0.1
2018 Scenario 4	6820	1959.0	35.7	0.17	0.1
2018 Scenario 5	7190	2065.4	37.7	0.18	0.1
2040 Existing	14136	4060.7	76.9	0.36	3.1
2040 Scenario 1	13394	3847.7	72.3	0.34	2.3
2040 Scenario 2	15172	4358.4	83.6	0.39	4.4
2040 Scenario 3	16760	4814.7	94.7	0.43	7.2
2040 Scenario 4	9460	2717.4	49.8	0.24	0.4
2040 Scenario 5	14251	4093.7	77.6	0.37	3.2

Table C-3 – Comparison of IH-35 Northbound (Between IH-69W and US 83) Results

Scenario	Volume	Link VMT	Link VHT	Volume to Capacity (V/C) Ratio	Delay (Hours)
2017 Count Data	19483	-	-	0.38	-
2018 Existing	24172	20924.6	479.0	0.47	157.1
2018 Scenario 1	24172	20924.6	479.0	0.47	157.1
2018 Scenario 2	20313	17583.5	401.1	0.39	130.6
2018 Scenario 3	20753	17964.5	409.9	0.40	133.5
2018 Scenario 4	20780	17988.3	410.4	0.40	133.7
2018 Scenario 5	20613	17843.7	407.1	0.40	132.6
2040 Existing	32874	28457.8	662.8	0.64	225.0
2040 Scenario 1	33879	29327.0	685.1	0.66	233.9
2040 Scenario 2	52905	45797.6	1213.4	1.03	508.8
2040 Scenario 3	51939	44961.3	1179.2	1.01	487.5
2040 Scenario 4	51026	44170.8	1147.9	0.99	468.4
2040 Scenario 5	51726	44776.5	1171.8	1.00	482.9

Table C-4 – Comparison of IH-35 Southbound (Between IH-69W and US 83) Results

Scenario	Volume	Link VMT	Link VHT	Volume to Capacity (V/C) Ratio	Delay (Hours)
2017 Count Data	26613	-	-	0.52	-
2018 Existing	28285	10927.0	251.7	0.55	83.6
2018 Scenario 1	28285	10927.0	251.7	0.55	83.6
2018 Scenario 2	25225	9744.9	223.4	0.49	73.5
2018 Scenario 3	27173	10497.3	241.3	0.53	79.8
2018 Scenario 4	25019	9665.1	221.5	0.48	72.8
2018 Scenario 5	24781	9573.5	219.3	0.48	72.0
2040 Existing	34625	13376.3	313.3	0.67	107.5
2040 Scenario 1	35898	13867.9	326.3	0.70	112.9
2040 Scenario 2	56971	22009.0	611.7	1.10	273.1
2040 Scenario 3	54176	20929.0	562.4	1.05	240.4
2040 Scenario 4	53815	20789.6	556.3	1.04	236.5
2040 Scenario 5	54679	21123.3	570.9	1.06	245.9

Table C-5 – Comparison of FM 1472 (Mines Road) (Between IH-35 and TX-255) Results

Scenario	Volume	Link VMT	Link VHT	Volume to Capacity (V/C) Ratio	Delay (Hours)
2017 Count Data	61261	-	-	1.52	-
2018 Existing	49959	13503.6	435.8	1.24	190.3
2018 Scenario 1	49959	13503.6	435.8	1.24	190.3
2018 Scenario 2	47938	12957.4	402.6	1.19	167.0
2018 Scenario 3*	64122	17356.0	461.1	0.32	149.9
2018 Scenario 4	47864	12937.2	404.5	1.19	169.3
2018 Scenario 5	48329	13062.9	411.1	1.20	173.6
2040 Existing	54940	14849.8	531.3	1.37	261.3
2040 Scenario 1	54136	14632.6	512.9	1.35	246.9
2040 Scenario 2	70124	18954.0	1067.0	1.74	722.4
2040 Scenario 3*	103307	28148.1	721.3	0.52	244.0
2040 Scenario 4	63463	17153.6	795.2	1.58	483.3
2040 Scenario 5	65579	17725.4	868.6	1.63	546.3

*indicates a scenario with proposed improvements to this roadway

Table C-6 – Comparison of Sara Road (Between Milo Road and Vallecillo Road) Results

Scenario	Volume	Link VMT	Link VHT	Volume to Capacity (V/C) Ratio	Delay (Hours)
2017 Count Data	12765	-	-	0.84	-
2018 Existing	20579	8916.2	578.2	1.35	281.0
2018 Scenario 1	20579	8916.2	578.2	1.35	281.0
2018 Scenario 2	17021	7375.0	375.1	1.12	129.3
2018 Scenario 3	16867	7308.0	334.7	1.11	91.1
2018 Scenario 4*	19661	8518.7	349.3	0.86	65.3
2018 Scenario 5*	19364	8390.0	342.2	0.85	62.5
2040 Existing	18654	8082.2	612.9	1.23	343.5
2040 Scenario 1	17436	7554.7	490.1	1.15	238.3
2040 Scenario 2	19584	8485.4	712.9	1.29	430.1
2040 Scenario 3	18386	7966.3	469.3	1.21	203.8
2040 Scenario 4*	26071	11296.2	621.9	1.14	245.4
2040 Scenario 5*	26031	11278.8	689.6	1.14	313.6

*indicates a scenario with proposed improvements to this roadway

Table C-7 – Comparison of Milo Road (Between River Bank Road and IH-35) Results

Scenario	Volume	Link VMT	Link VHT	Volume to Capacity (V/C) Ratio	Delay (Hours)
2017 Count Data	11148	-	-	1.03	-
2018 Existing	7764	2381.5	79.0	0.72	19.5
2018 Scenario 1	7764	2381.5	79.0	0.72	19.5
2018 Scenario 2*	10755	3299.2	87.2	0.50	4.7
2018 Scenario 3*	5692	1539.4	37.0	0.26	2.8
2018 Scenario 4*	11152	3420.9	88.4	0.52	2.9
2018 Scenario 5*	11499	3527.5	91.5	0.53	3.3
2040 Existing	8585	2633.5	74.7	0.79	8.9
2040 Scenario 1	8596	2636.9	74.3	0.80	8.4
2040 Scenario 2*	15971	4899.0	127.7	0.74	5.2
2040 Scenario 3*	10395	2811.4	67.8	0.48	5.3
2040 Scenario 4*	18557	5692.5	160.4	0.86	18.1
2040 Scenario 5*	19690	6040.0	161.2	0.91	10.2

*indicates a scenario with proposed improvements to this roadway

Table C-8 – Comparison of Vallecillo Road (Between FM 1472 – Mines Road and IH-35) Results

Scenario	Volume	Link VMT	Link VHT	Volume to Capacity (V/C) Ratio	Delay (Hours)
2017 Count Data	-	-	-	-	-
2018 Existing	-	-	-	-	-
2018 Scenario 1	-	-	-	-	-
2018 Scenario 2	14201	28055.0	677.6	0.63	52.2
2018 Scenario 3	13569	26889.7	646.7	0.61	49.1
2018 Scenario 4	12824	25415.1	609.2	0.57	44.4
2018 Scenario 5	12192	24170.6	577.3	0.54	40.4
2040 Existing	-	-	-	-	-
2040 Scenario 1	12558	24808.1	622.5	0.56	69.5
2040 Scenario 2	19405	38334.8	1076.0	0.87	221.4
2040 Scenario 3	15370	30458.5	764.4	0.69	87.5
2040 Scenario 4	17202	34090.7	920.0	0.77	162.4
2040 Scenario 5	16810	33325.9	879.1	0.75	138.8

Table C-9 – Comparison of Hachar Parkway (Between FM 1472 – Mines Road and IH-35) Results

Scenario	Volume	Link VMT	Link VHT	Volume to Capacity (V/C) Ratio	Delay (Hours)
2017 Count Data	-	-	-	-	-
2018 Existing	-	-	-	-	-
2018 Scenario 1	-	-	-	-	-
2018 Scenario 2*	1094	745.4	17.4	0.04	5.0
2018 Scenario 3*	917.5	625.2	14.6	0.03	4.2
2018 Scenario 4*	1092	744.1	17.3	0.04	4.9
2018 Scenario 5*	1092	744.1	17.3	0.04	4.9
2040 Existing	-	-	-	-	-
2040 Scenario 1	5524	3764.2	87.8	0.21	25.1
2040 Scenario 2*	26881	18317.0	494.3	1.00	189.0
2040 Scenario 3*	9839	6704.1	156.8	0.37	45.1
2040 Scenario 4*	11039	7522.0	176.2	0.41	50.8
2040 Scenario 5*	11440	7795.3	182.8	0.43	52.9

Table C-10 – Comparison of Riverbank Road (Between Aquero Boulevard and FM 1472 – Mines Road) Results

Scenario	Volume	Link VMT	Link VHT	Volume to Capacity (V/C) Ratio	Delay (Hours)
2017 Count Data	-	-	-	-	-
2018 Existing	-	-	-	-	-
2018 Scenario 1	-	-	-	-	-
2018 Scenario 2	1894	999.6	23.7	0.07	1.5
2018 Scenario 3	549	289.8	6.9	0.02	0.5
2018 Scenario 4	1912	1008.8	23.9	0.07	1.5
2018 Scenario 5	2292	1209.2	28.7	0.09	1.8
2040 Existing	-	-	-	-	-
2040 Scenario 1	-	-	-	-	-
2040 Scenario 2	41394	21830.2	1061.8	1.62	576.5
2040 Scenario 3	13888	7330.6	176.1	0.54	13.3
2040 Scenario 4	28705	15144.3	455.6	1.12	119.1
2040 Scenario 5	30249	15957.9	499.2	1.18	144.6

Table C-11 – Comparison of Killam Industrial Boulevard (Between FM 1472 – Mines Road and Sara Road) Results

Scenario	Volume	Link VMT	Link VHT	Volume to Capacity (V/C) Ratio	Delay (Hours)
2017 Count Data	18219	-	-	0.68	-
2018 Existing	32858	20404.0	644.2	1.23	190.8
2018 Scenario 1	33100	20554.3	653.3	1.24	196.5
2018 Scenario 2	23209	14412.2	366.9	0.87	46.6
2018 Scenario 3	15405	8970.7	222.0	0.57	9.4
2018 Scenario 4	21764	13514.9	339.4	0.81	39.1
2018 Scenario 5	22436	13931.9	353.6	0.84	44.0
2040 Existing	33724	20941.5	769.9	1.26	304.5
2040 Scenario 1	19999	12418.9	308.9	0.75	32.9
2040 Scenario 2	18543	11514.2	280.6	0.69	24.7
2040 Scenario 3	18635	10851.1	287.4	0.70	30.2
2040 Scenario 4	24255	15061.2	389.5	0.91	54.8
2040 Scenario 5	24420	15163.9	392.8	0.91	55.8

-- page intentionally left blank --