Luling

TRANSPORTATION STUDY

Summary Report – July 2019

CAMPO

CAPITAL AREA METROPOLITAN PLANNING ORGANIZATION

CENTRAL TEXAS

ACKNOWLEGEMENTS

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APPENDICES

ACRONYMS

AADT	Average annual daily traffic
ADT	Average daily traffic
CAMPO	Capital Area Metropolitan Planning Organization
CARTS	Capital Area Rural Transportation System
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
LOS	Level of service
OD	Origin-destination
ROW	Right of way
RTP	Regional transportation plan
TCDS	Traffic count database system
TMC	Turning movement count
TxDOT	Texas Department of Transportation
UPRR	Union Pacific Railroad

1 INTRODUCTION

The City of Luling, Texas, sits at the crossroads of several major highways – US 183, US 90, and SH 80 – and is bisected by a key east-west line of Union Pacific Railroad (UPRR). The highways connect with IH 10 at the City's southern extents, linking with key domestic and international freight routes.

Historically, oil production has been the chief industry in Luling and the surrounding rural lands in Caldwell, Guadalupe, and Gonzales Counties. While Luling's oil production peaked in the 1920s and declined through the 1990s, a resurgence occurred in the early 2010s in response to rising global oil prices. Amid this recent resurgence, pass-through truck traffic volumes intensified on Magnolia Avenue (US 183) and Austin Street (SH 80), particularly around the UPRR crossing near the Magnolia Avenue / Pierce Street intersection (US 183 / SH 80 / US 90) intersection. Since 2014, the stabilization of global oil prices and decreases in regional production have caused traffic growth to recess to pre-boom levels, but traffic levels are beginning to rise again. Notably, Luling is a common pass-through point for recreational trips between Central Texas cities and the Texas Gulf Coast, so traffic levels tend to spike on weekends from the late spring to the early fall. Under these conditions, Caldwell County and Luling officials established the need for a Transportation Study to explore potential solutions for existing transportation issues as well as issues that may arise during the next oil boom.

1.1 Study Background

In 2011, Caldwell County and Luling officials began discussing the potential for transportation improvements to ease congestion within central Luling, prevent conflicts between vehicle and rail movement, and improve safety / comfort for downtown visitors. Caldwell County committed to study the feasibility of various transportation improvements on the major routes entering and exiting Luling, as well as the potential for new roadway corridors. In 2018, Caldwell County entrusted CAMPO to lead the Luling Transportation Study.

1.2 Steering Committee

A Steering Committee made up representatives from Caldwell County, the City of Luling, the Luling Economic Development Corporation, and the Texas Department of Transportation (TxDOT) was assembled to guide the development of the Luling Transportation Study. Steering Committee members provided input from their respective State, County, and local perspectives. Steering Committee feedback was used to shape and affirm study goals / objectives, identify area transportation issues, and assess the viability of improvement options. The Steering Committee also actively assisted in reaching stakeholders and other targeted outreach opportunities throughout the public engagement process.

1.3 Study Goals and Objectives

The purpose of the Luling Transportation Study ("Study") is to evaluate transportation conditions and needs in Luling, to identify potential improvements, and to set an implementation plan for one or more recommended improvements. Four project goals and associated objectives, displayed on the following page, were established through coordination with the project Steering Committee and used to guide the Study.

Goals	Objectives – Evaluate and Consider…
1 Identify needed safety improvements	• Traffic crash data • Pedestrian movement and safety • Union Pacific Railroad corridor and crossings • Local emergency response services and evacuation routes
2 Enhance mobility in downtown for local and through traffic	• Local travel, freight travel, and recreational through travel • Near- and long-term improvements • Ease of travelling public and emergency response to cross railroad tracks
3 Evaluate feasibility of an alternate route for through traffic	• Future impacts with and without an alternate route • Various future growth scenarios for Luling
4 Incorporate tools to promote the unique character of downtown and economic development opportunities	• Effects on businesses • Types and ranges of visitors to downtown Luling

1.4 Study Area

The study area for the Study is comprised of the primary roadways approaching / departing Luling, including US 183, US 90 and SH 80, and five key intersections within the City:

1. Magnolia Avenue (US 183) / FM 86 / Lincoln Street
2. Magnolia Avenue / Austin Street (US 183 / SH 80)
3. Magnolia Avenue / Pierce Street (US 183 / SH 80 / US 90)
4. Hackberry Avenue / Austin Street (SH 80)
5. Hackberry Avenue / Pierce Street (US 90)

Drivers entering Luling will typically pass through at least one of these intersections in route to their destination. Nearly all trips that pass through Luling cross the Magnolia Avenue / Pierce Street intersection. A map of the study area is shown in **Figure 1**.

1.5 Project Timeline

The Luling Transportation Study began in fall 2018 with stakeholder discussions, data collection, and identification of local transportation issues. Through the first half of 2019, the project team evaluated various potential improvement options using community input and technical analysis. This report represents the culmination of the Study and provides a summary of the upfront data collection and evaluation processes as well as recommendations and materials to guide the next steps of implementation.

Figure 1 – Study Area

2 DATA AND DISCOVERY

The first step in understanding current transportation conditions and needs in Luling was the comprehensive review of existing planning work, community opinions, and available data. Combined with newly collected data, this body of information helped identify a list of transportation issues and frame the evaluation of potential improvement options.

2.1 Review of Previous Plans and Studies

This section contains a literature review of previously adopted plans and studies with relevance to the Luling Transportation Study. Several planned and funded transportation improvements in and around Luling were identified in the Caldwell County Transportation Plan and the 2040 Regional Transportation Plan (RTP). Additionally, the City of Luling Master Plan identified several transportation issues related to mobility through Luling and within downtown. Several other sources, including the TxDOT Unified Transportation Program, Statewide Transportation Improvement Program, CAMPO four-year Transportation Improvement Program, TxDOT Letting Schedule, the 2009 Austin Area Freight Transportation Study, and the 2016 Texas Rail Plan, were reviewed, but these plans did not contain information pertinent to the Luling Transportation Study. **Appendix A** provides a detailed review of each plan and maps of both funded and unfunded roadway capacity projects in the Luling area.

2.1.1 Caldwell County Transportation Plan

The Caldwell County Transportation Plan was adopted in March 2013 and was a collaboration between Caldwell County and CAMPO. Portions of the analysis and recommendations pertained to major roadways in Luling and the surrounding area.

An analysis of the existing conditions (year 2010) indicated that most of Caldwell County's roadway system operated at a level of service (LOS) C or better. However, US 183 in downtown Luling was identified as LOS D. For forecast year 2035 with the existing roadway network and committed projects, US 183 in downtown Luling and SH 80 and US 90 to the west of Luling exceeded LOS C. The analysis also included a 2035 scenario with a relief route through Luling from US 183 north of downtown to IH 10, which resulted in better operations on US 183 through downtown but did not improve LOS on SH 80 or US 90. The Plan recommends additional studies to compare LOS and environmental impacts before a preferred alternative is chosen.

Table 1 provides a list of projects near Luling as document in the Caldwell County Transportation Plan. Each of these projects was envisioned to occur over a long-term timeframe. In addition to the relief route alternatives, the Plan includes the widening of SH 80 to the Luling city limits.

In addition to capacity / operational improvement projects, the Caldwell County Transportation Plan identifies and prioritizes County roadway maintenance projects based on the pavement condition, crash history, environmental considerations, and connectivity. N Hackberry Avenue is in the top half of the prioritized list of County roadway segments needing maintenance. No other County roadways in the Luling area appear on this list.

Table 1 – Luling Area Roadway Projects in Caldwell County Transportation Plan

Road	Limit	Improvement	Type of Improvement	Jurisdiction	Estimated Cost (Millions)
SH 80	CR 111 / Political Road to Luling City Limits	Widen to four lanes	Existing Roadway	TxDOT	$18.51
CR 309 / US 183	US 183 to FM 2984, start of West Relief Route	Upgrade to 4-lane divided	Existing Roadway	County	$0.72
US 183	Luling West Relief Route	Proposed 4-lane divided roadway	Proposed New Roadway	TBD	$66.99
US 183	Luling East Relief Route	Proposed 4-lane divided roadway	Proposed New Roadway	TBD	$71.81

2.1.2 2040 RTP

The CAMPO 2040 Regional Transportation Plan (RTP) was adopted in May 2015 and includes the long-term transportation vision for the six-county region, including Caldwell County. The RTP included several recommendations within the City of Luling under "Chapter 5 Action Plan and Projects." **Table 2** summarizes the Luling Area projects included in the RTP. Several projects in Caldwell County lacked allocated funds or sponsors. Unfunded Luling projects include construction of a new four-lane divided highway identified as the Luling East Relief Route Alternative and the widening of SH 80 to four lanes from CR 111 / Political Road to the City Limits of Luling. Additionally, the Capital Area Rural Transportation System (CARTS) has several near- and long-term projects that would expand transit service between Luling and neighboring jurisdictions.

Table 2 – Luling Area Projects in CAMPO 2040 RTP

County	Sponsor	Location	Project /Description	Let Year	Estimated Cost (Millions)
Caldwell	Caldwell	US 183 North of Luling to US 183 / SH 80 South of Luling	Alternatives analysis for relief route	2017	$0.3
Caldwell	N/A*	Luling East Relief Route Alternative	Construct new 4-lane divided highway	N/A*	N/A*
Caldwell	N/A*	SH 80 from CR 111/Political Rd to Luling City Limit	Widen to 4 lanes	N/A*	N/A*
Caldwell	CARTS	Caldwell County	Fixed Routes to connect cities in Caldwell County	2029	$5.1
Caldwell	CARTS	Luling to Lockhart	Intercity Express Bus / Luling Express	2023	$1.3
Caldwell / Hays	CARTS	Luling to San Marcos	Intercity Express Bus	2030	$3.6
Caldwell	CARTS	Lockhart / Luling	Intermodal Facility to serve Lockhart / Luling Area	2021	$0.9

* Illustrative project without identified sponsor or funding

2.1.3 Luling Master Plan

The City of Luling Master Plan was adopted in 2012 and includes chapters on the topics of land use, housing, economic development, street and drainage, water, wastewater, and recommendations for capital improvements.

The economic development section predicts an increase in traffic congestion, particularly from freight traffic, on SH 80 between Luling and San Marcos and increase in delays on segments of US 183 from Lockhart to IH 10. The Master Plans recommends conducting a transportation study to assess the long-term needs of the community, evaluate the viability of a relief route for traffic passing through the City, and establish a recommended alternative.

A Central Business District (CBD) Analysis performed by this Plan identified segmented sidewalks, lack of crossings at some intersections (Magnolia Avenue / Davis Street), parking issues during lunch time between Magnolia and Laurel Street, and rising traffic volumes within the CBD. The Plan recommends adding crosswalks, sidewalks, and a transit circulator route within the CBD.

The recommended capital improvements list contains projects funded by the City from 2012 to 2017. Roadway improvements such as seal coat, pavement rehabilitation, and resurfacing with curb and gutter were recommended for several City streets. A total pavement rehabilitation with curb and gutter construction on Hackberry Street from the north City limits to Pierce Street was scheduled for 2015. However, as of 2019, no maintenance projects have occurred on this roadway.

2.1.4 Railroad Plans

The 2016 Texas Rail Plan and Austin Area Freight Transportation Study did not contain any planned rail safety or capacity projects that would impact the number of train crossings per day or function of at-grade crossing locations in Luling. According to discussions with the Luling Chamber of Commerce and City of Luling staff, the Union Pacific Railroad maintains the right to double-track through downtown and has occasionally contacted the City to discuss closures of existing at-grade crossings in exchange for infrastructure improvements and quiet zone status. Though a scientific count of train activity in Luling has not been conducted, City of Luling staff indicate that approximately 40 to 50 trains pass through daily, with an average gate closure time of 4 to 5 minutes per train.

Trains crossings can delay traffic approaching and departing the north leg of 183 / US 90 / SH 80 intersection by several minutes.

2.2 Data Sources and Findings

Several data sources were used to develop a better understanding of existing transportation conditions and issues in Luling:

- Demographic data from the 2010 Census and American Community Survey.
- Economic data related to oil production in Luling and the surrounding Eagle Ford Shale region.
- Current and historical average annual daily traffic (AADT) volumes within the study area.
- PM peak hour turning movement counts at the five key intersections identified in **Figure 1**.
- Travel pattern and travel time metrics derived from aggregated cell phone and vehicle navigation data.
- Multi-year vehicle crash data.
- Environmental constraints including municipal and natural resources, floodplains, and other hazards.

2.2.1 Demographics

The 2018 estimated population of Luling is 5,954, a 10% increase from the 2010 Census count. The annual estimates suggest a fairly consistent population growth rate of about 1% over an eight-year period, both during and after the oil boom. The population of the surrounding region has grown somewhat faster than Luling. During the same period, the populations of Caldwell County and the Austin-Round Rock Metropolitan Area increased by 14% and 26%, respectively. These data points, shown in **Table 3**. suggest that local population growth is not likely driving the recent increase in traffic congestion on Luling roadways, but population and industrial growth in the surrounding region is leading to more trips passing-through Luling.

Table 3 – Population Data from 2010 - 2018

Location	2010	2011	2012	2013	2014	2015	2016	2017	2018
Luling	5,411	5,505	5,530	5,604	5,659	5,701	5,814	5,919	5,954
Caldwell County	38,066	38,472	38,690	39,215	39,721	40,442	41,169	42,425	43,247
Austin-Round Rock MSA	1,716,309	1,780,605	1,834,926	1,883,901	1,943,409	2,002,591	2,062,211	2,115,230	2,168,316
Notes: 2010 data based on the 2010 Census. All other years are estimated as part of the Populations Estimates Program.									

Socio-demographics information in Luling was compiled as part of the Environmental Justice analysis in the 2040 Regional Transportation Plan. The land within the Luling City limits is considered an Environmental Justice area due to high concentrations of aging population (>9%), persons with disabilities (>15%), limited English proficiency populations (>10%). Detailed demographic data and the Environmental Justice sociodemographic maps are provided in **Appendix B**.

The Eagle Ford Shale Region and its Impact on Luling

The Eagle Ford Shale is a hydrocarbon-producing geological region with the capability of producing both natural gas and oil at higher yields than traditional shale oil fields. The rising cost of oil in the early 2010's resulted in a significant increase in oil production throughout the Eagle Ford Shale. However, the decline and accompanying stabilization of oil prices in recent years has reduced both the issuance of drilling permits and overall oil production within the Eagle Ford region (**Figure 2**).

Workers and freight traveling between San Marcos / Austin and the Eagle Ford Shale region will typically pass through Luling on SH 80 or US 183. As is discussed in the next section (Average Annual Daily Traffic Counts), traffic on these corridors tends to fluctuate with production activity in the Eagle Ford region.

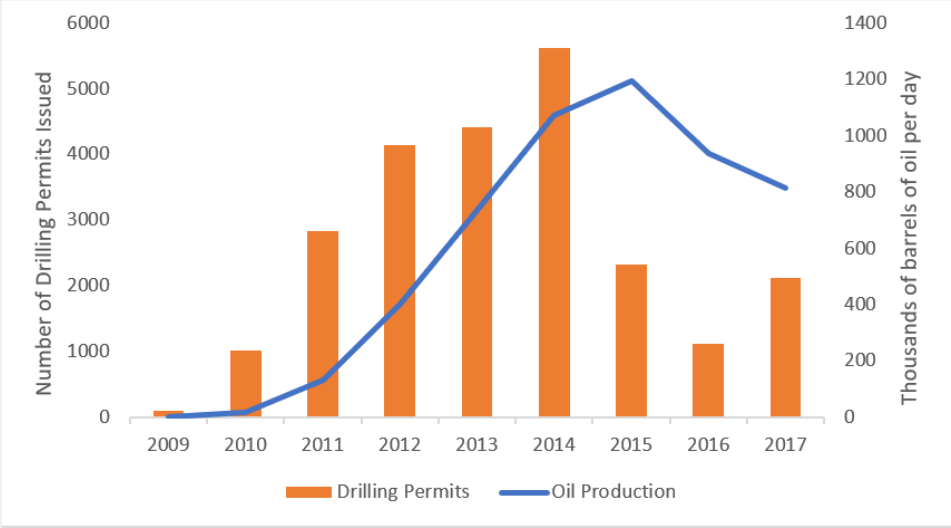


Figure 2 – Drilling Permits Issued vs. Oil Production in the Eagle Ford Shale Region

Source: Texas Railroad Commission Production Data and Drilling Permit Query, accessed March 2018.

2.2.2 Average Annual Daily Traffic Counts

Historical and existing traffic counts were collected for the study area to better understand the changing traffic characteristics of the region. Average annual daily traffic (AADT) counts from the TxDOT Traffic Count Database System (TCDS) were compiled and summarized for the study area roadways entering and exiting the City of Luling, shown in **Figure 3**. **Figure 4** illustrates citywide AADT trends from 1999 to 2017 as well as major events that may have influenced the rise and fall of traffic volumes. A detailed table of AADT and truck counts from the TCDS is provided in **Appendix C**.

Over the 18-year period, AADT volumes grew by an average of 1% across all locations. However, growth spiked from 2011 to 2013 at two locations – SH 80 west of Wall Street and US 183 east of Blanco Avenue. This rapid traffic growth coincided with the peak of oil production in Luling and the Eagle Ford Shale, as traffic traveling between San Marcos and must traverse Luling from SH 80 to US 183 to access the Eagle Ford Shale and the Texas Gulf Coast. Volumes at these two locations then decreased after the opening of the SH 130 extension between Lockhart and Seguin and after Eagle Ford shale drilling permits began to decline. Overall, the historical trends indicate that, while traffic growth has been fairly low on most entering / exiting roadway during the past two decades, volumes on SH 80 west and US 183 east may spike under “oil boom” conditions.

Figure 3 – Roadways Entering/Existing Luling (use with Figure 4)

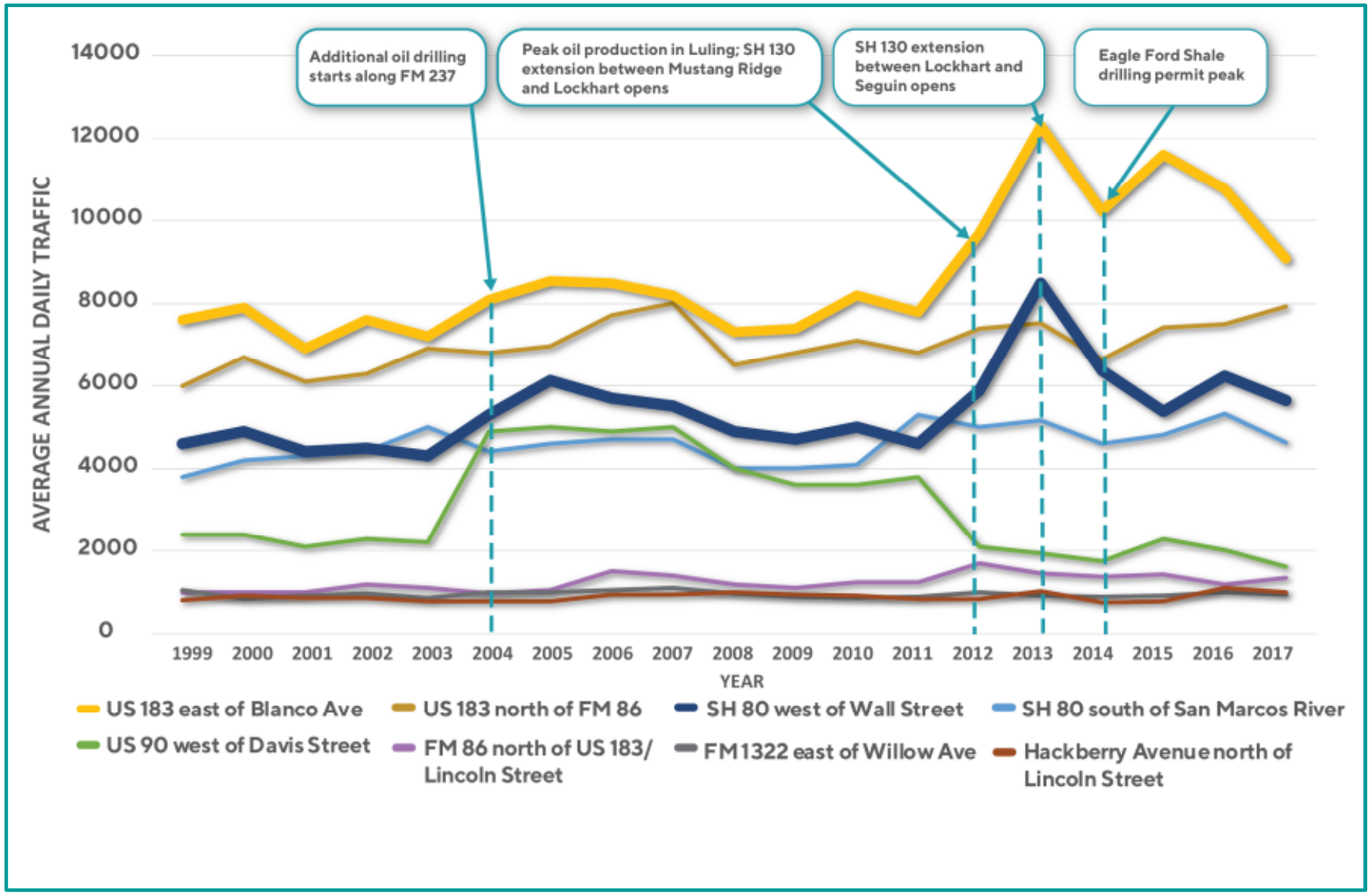


Figure 4 - Historical Counts Entering/Exiting Luling (use with Figure 3)

2.2.3 Peak Period Intersection Traffic Counts

Peak period traffic turning movement counts (TMCs) were collected for the five study area intersections identified in **Figure 1**. Based on input from the Steering Committee and other community stakeholders, counts were conducted during the PM peak period of both a typical weekday (Thursday) and a Friday. Stakeholders suggested that Friday traffic volumes were higher, particularly during the late spring through early summer, due to recreational travel between Central Texas cities and the Gulf Coast.

The Thursday and Friday TMCs were compared for the PM peak period between 4 and 6 PM, with the total entering count for each intersection and the sum of all five intersections calculated for each 15-minute period. Results are summarized in **Figure 5** and show that PM peak traffic volumes in Luling are approximately 20% higher on Friday than during the same period on a typical weekday. Due to the higher traffic volumes and more congested conditions observed on Friday, all operational and level of service (LOS) analysis (discussed in the Performance Measures section) was conducted for Friday PM peak hour conditions.

Appendix C provides the detailed peak hour TMCs at each intersection.

Period Start	Thursday, September 27th						Friday, September 28th					
	SH 80 at Hackberry Avenue	US 183 & SH 80 & US 90	US 183 & SH 80	US 183 & SH 86	US 90 at Hackberry Avenue	Total (15-minutes)	SH 80 at Hackberry Avenue	US 183 & SH 80 & US 90	US 183 & SH 80	US 183 & SH 86	US 90 at Hackberry Avenue	Total (15-minutes)
16:00	241	381	346	236	179	1383	277	472	425	291	197	1662
16:15	217	351	347	254	108	1277	247	462	424	299	111	1543
16:30	189	383	348	259	98	1277	261	456	444	314	104	1579
16:45	205	368	348	253	102	1276	199	442	385	289	117	1432
17:00	178	382	333	243	108	1244	253	446	415	310	111	1535
17:15	190	378	349	266	111	1294	249	420	426	301	98	1494
17:30	191	379	345	241	104	1260	245	459	422	266	79	1471
17:45	201	344	310	200	108	1163	240	421	428	309	120	1518

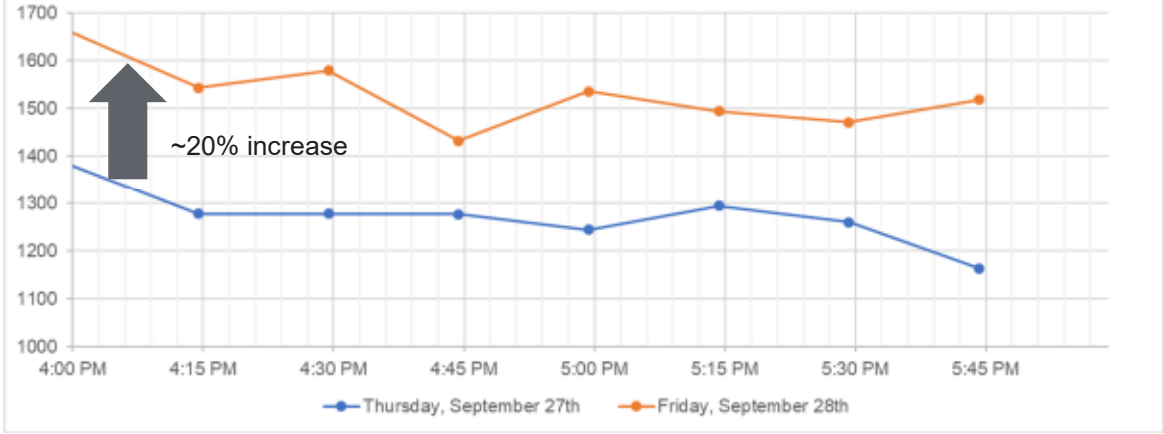


Figure 5 - Traffic Count Comparison at Study Intersections

2.2.4 Travel Patterns

Historic travel pattern and activity data was obtained and analyzed to better understand peak Friday travel conditions and the most common routes of travel through Luling for automobiles and heavy trucks. StreetLight Data provided anonymized travel pattern data derived from GPS enabled smart devices and in-vehicle navigation systems.[1]

Activity data was extracted for an average weekday and an average Friday between November 2016 and October 2017, which was the most recent full year of data available at the point of extraction. Activity data was also characterized by vehicle classification (personal automobile, medium duty commercial vehicle, and heavy commercial vehicles), day parts (including 3-hour PM peak period, 1-hour PM peak, and all day), and average duration.

Figure 6 shows the estimated number of daily vehicles and heavy trucks on each of the roadways leading into/out of Luling on a typical Friday. The three locations with the highest traffic demand are US 183 east of Blanco Avenue, US 183 north of FM 86, and SH 80 west of Wall Street. Heavy trucks comprise a large proportion of total daily traffic at these locations – with SH 80 west of Wall Street consisting of almost 20% heavy trucks.

Nearly half of all daily trips traveling on SH 80 west of Wall Street traverse central Luling in route to / from US 183 east of Blanco Avenue. About a third of daily trips at US 183 north of FM 86 make this same traversal. As shown in **Figure 7**, these traffic streams combine for a three block stretch in downtown Luling between SH 80 and US 90, directly north of the Union Pacific Railroad crossing. While the total number of daily trips making this traversal from SH 80 and US 183 north is about equal, about 70% more trucks go to / come from SH 80. Detailed outputs from the travel pattern analysis are provided in **Appendix D**.

[1] The device sample size used by StreetLight captures an average of 23% the travelling population.

Figure 6 - Average Daily Traffic - 2017 (Friday Average) Total & Heavy Vehicles

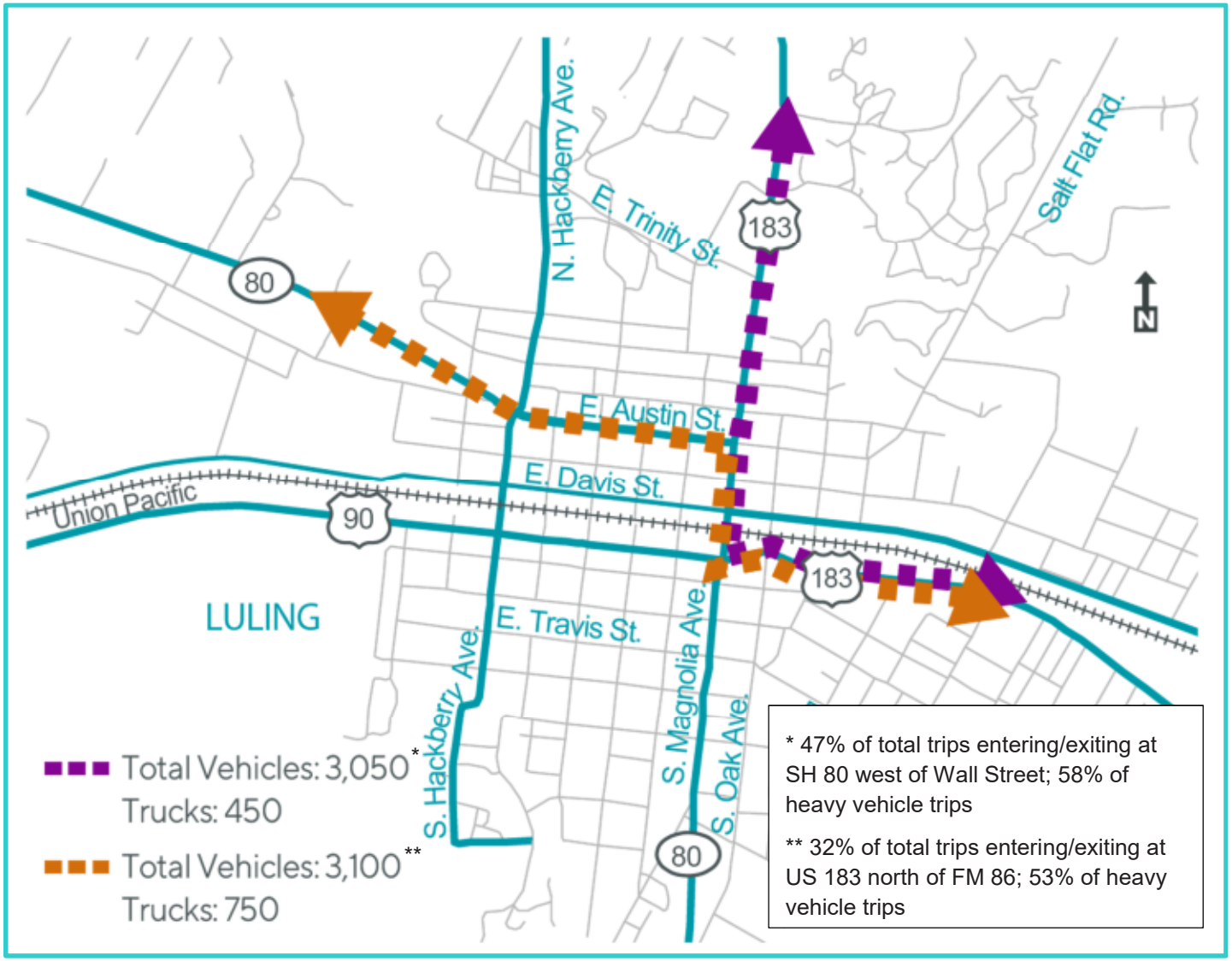


Figure 7 - Average Daily Traffic - 2017 (Friday Average) Total & Heavy Vehicles Traversing Luling to/from SH 80 and US 183

2.2.5 Crash Data

Six years of crash records from the TxDOT Crash Records Information System (CRIS) were compiled for sections of US 183, US 90, and SH 80 within the Luling jurisdictional boundaries. The data, shown in **Figure 8**, indicate that the total number of crashes along these corridors in 2017 was about equal to 2013 oil boom peak levels (despite the lower average daily traffic loads in 2017) and that crashes have increased every year since 2015. Also, serious and fatal injuries now make up a greater share of crashes compared to several years ago.

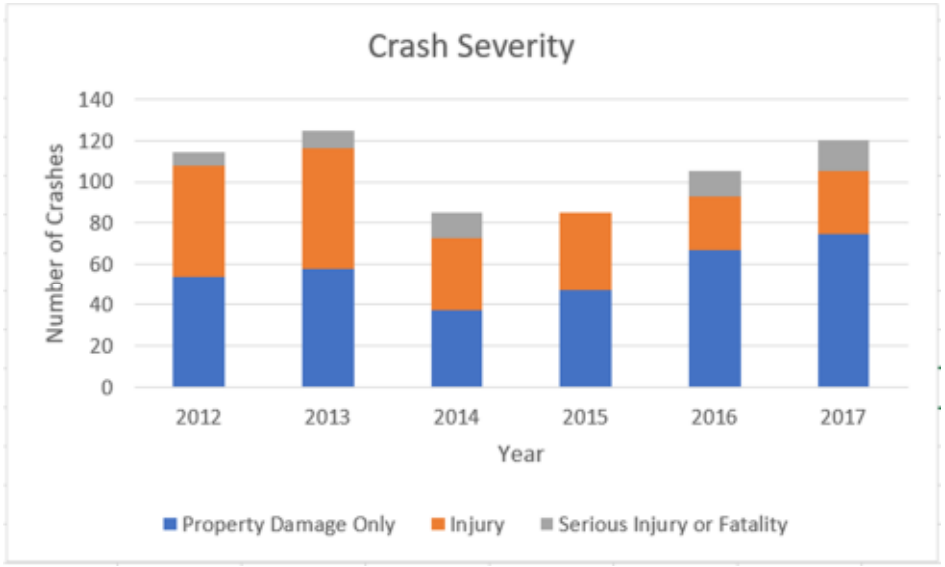


Figure 8 – Crashes on US 183, US 90, and SH 80 within Luling

Crashes on US 183, US 90, and SH 80 within central Luling were mapped in **Figure 9**, showing the manner of the crash and totals at major intersections. Over twice as many crashes occurred at the Magnolia Avenue / Pierce Street Intersection (US 183 / SH 80 / US 90) than at any other intersection in the mapped area. Over 70% of these crashes were rear-end or left-turn related, possibly due to congestion and insufficient passage time from the traffic signal. Additionally, three crashes involving railroad trains happened at the at-grade crossing adjacent to this intersection.

Crashes involving a pedestrian occurred at two intersections – Magnolia Avenue (US 183) / Davis Street and Pierce Street (US 90) / Walnut Avenue. The Magnolia Avenue / Davis Street intersection is a major dividing point / barrier in the otherwise walkable and active Davis Street corridor. Despite major attractors to the east and west of Magnolia Avenue, there are no marked crosswalks or protected crossing points across Magnolia Avenue at Davis Street or Pierce Street. The Pierce Street / Walnut Avenue intersection is a four-way controlled stop but had four crashes involving pedestrians over the six-year data period. As the primary crossing point for residents walking from the northern half of Luling to the schools, hospital, and grocery store, a protected, signalized crossing may be needed to improve pedestrian visibility and safety.

Appendix E includes a map of citywide crashes and a summary table of the crash types.

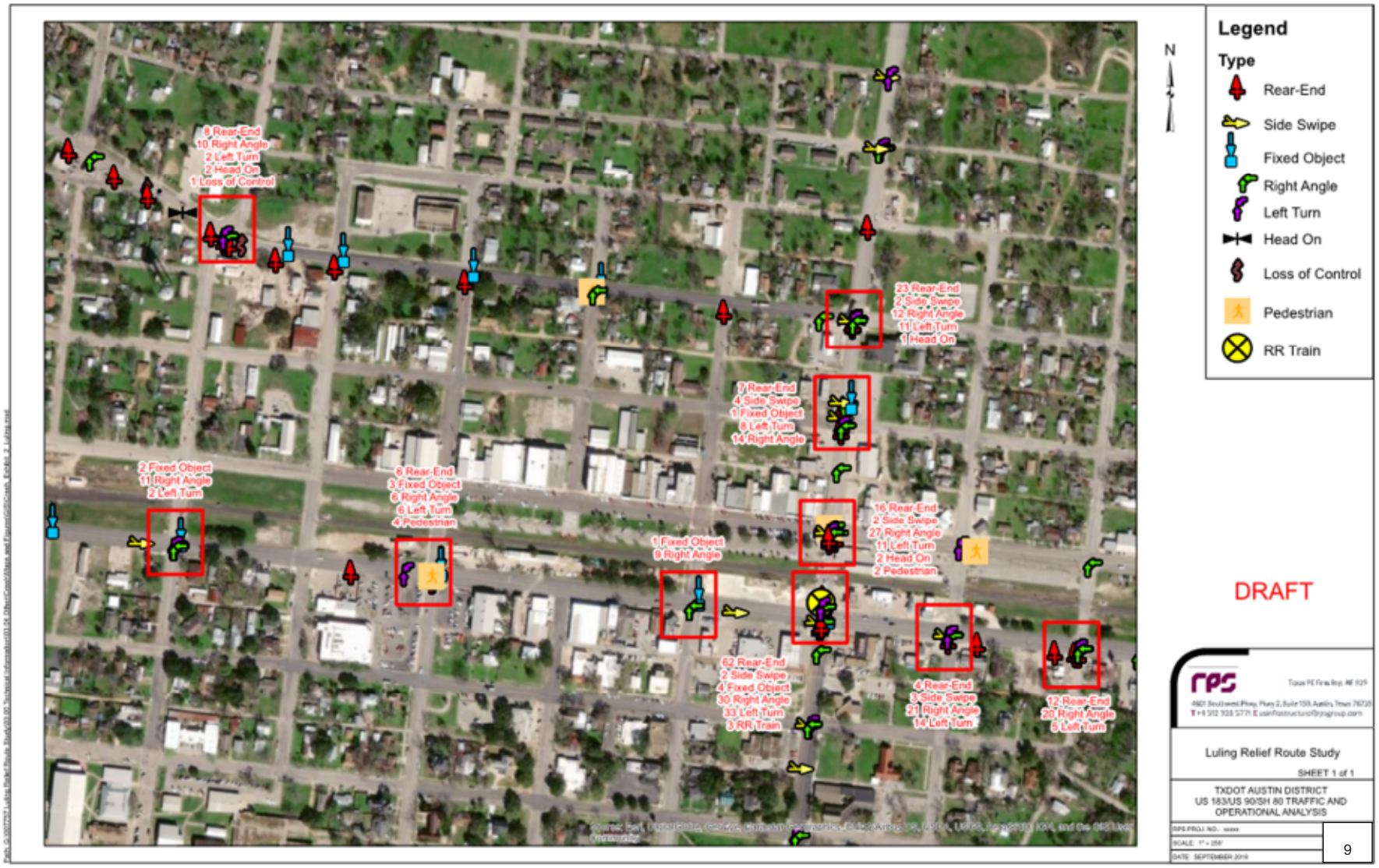


Figure 9 – 2012-2017 Crashes in Central Luling

2.2.6 Environmental Constraints Mapping

Environmental constraints mapping is the process of identifying features related to land use, ecology, and geography that need to be considered during conceptual design and feasibility of a transportation project. Watersheds and floodplains were obtained from the Federal Emergency Management Agency (FEMA), and other sites were obtained from the Environmental Protection Agency (EPA) NEPAssist Tool. Parcel data was obtained from the Caldwell County Appraisal District. The list below provides definitions for special features contained on the map:

- Historic Sites – sites contained on the National Register of Historic Places.
- National Pollutant Discharge Elimination System – sites with federal permit to discharge pollutants into waters of the United States.
- Hazardous Waste Resource Conservation and Recovery Act Information – sites registered as having generators, transporters, treaters, storers, and disposers of hazardous waste.
- Toxic Releases Inventory – sites with toxic chemical releases and waste management activities reported annually by certain industries as well as federal facilities.
- Threatened and Endangered Species Occurrence – potential habitat of specifies classified as threatened or endangered by the Environmental Protection Agency.
- 100-year floodplain[2] – land with a 1% annual chance of flood hazard.
- 500-year floodplain – land with a 0.2% annual chance of flood hazard.
- Parcels – division of property boundaries.

Figure 10 shows the environmental constraints map, with all the features described above. Floodplains and oil/gas pipelines are very prominent on the map, with the 100-year floodplain covering large portions of land directly to the south, east, and north of Luling. Oil / gas pipelines traverse much of the land to the north of the City.

[2] Floodplains defined by FEMA do not account for new rainfall data in the Atlas 14 study. Areas in Central Texas that have modelled floodplains using the Atlas 14 data typically report larger 100-year and 500-year floodplains than those defined by FEMA.

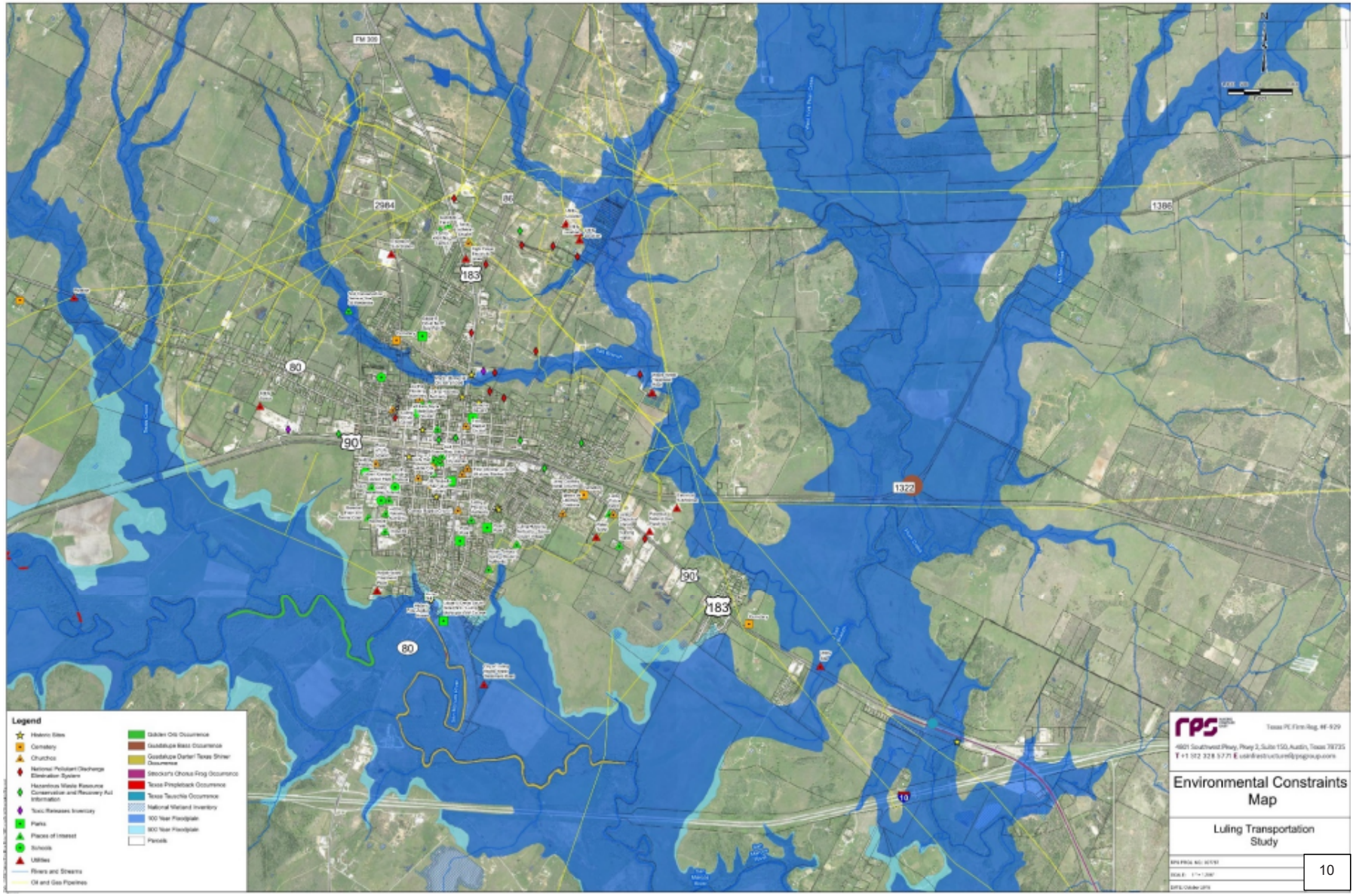


Figure 10 - Environmental Constraints Map

2.3 Public Outreach

A key component of the Luling Transportation Study was to engage the community and collect input from local stakeholders to develop a plan that reflects the values of the area and considers multiple perspectives. The goals, approach, and findings of this effort are summarized below with detailed notes and results provided in **Appendix F**.

2.3.1 Outreach Goals

- Create public awareness of the study and facilitate active and collaborative participation
- Maintain an open and transparent process throughout the engagement effort and provide timely and engaging project updates
- Engage and collect input from a wide range of stakeholders, including the local community, those visiting downtown Luling, and through travelers
- Use public input and comments in the development and refinement of the study

2.3.2 Approach

The Steering Committee made up of representatives from Caldwell County, the City of Luling, the Luling Economic Development Corporation, and TxDOT guided the study outreach process. Members provided information on existing conditions and future plans and assisted in the public engagement process.

Table 4 – Community & Stakeholder Meetings

Sept. & Nov. 2018	• Meetings held with City Market, Caldwell County, City of Luling, Luling Tire Service, Luling EDC, Big Iron Trucking • Steering Committee Meeting
Dec. 2018	• Visited 20+ businesses and groups in downtown Luling • Public Open House Meeting
Jan. 2019	• Meeting with Main Street Board of Directors • Pop-up event at Mom's Front Porch • Steering Committee Meeting • Focus group with EMS, City of Luling, and Seton • Round 1 survey
Feb. 2019	• Pop-up events at Apple Lumber • Visited 20+ businesses and groups in downtown Luling • Pop-up event at City Market
April 2019	• Mailer to 2300+ residents • 2 Public Open House Meetings • Round 2 survey

Outreach was conducted in two rounds and utilized multiple tools to notify and engage the community, including: email notices, social media campaigns, signage, and a direct mailing. Outreach was conducted through local businesses and community organizations, open house meetings were held, and two surveys were shared online and in paper format to collect input and feedback. To engage the Spanish speaking population, materials were translated and bilingual team members visited with churches and building supply stores to distribute surveys.

Round 1 – General background information and traffic data was shared with the community and outreach focused on gathering input on existing conditions and needs for transportation in Luling. A summary of results is provided in the next section.

Round 2 – Using input from round one, the study team developed potential near and long-term transportation solutions for Luling, and outreach was focused on collecting input on potential improvements. Results of this outreach round are summarized in the Alternatives Analysis chapter.

The project team and steering committee visited with many community members to share information and get their feedback during the study. Input was collected on maps, in surveys, in general comments, and in meetings. A summary of outreach activities conducted through the course of the project is provided in **Table 4**.

2.3.3 Round 1 Outreach Results

A community survey was developed in both English and Spanish and was administered between January 13, 2019 and February 24, 2019. The purpose of this survey was to determine people's perception of transportation conditions and issues within Luling and gauge opinions of the Luling Transportation Study Goals. In total, 252 responses were completed. Detailed results are contained within **Appendix F**. Overall, more than 70% of respondents agreed with the goals of the study. Other major findings and a sampling of written comments from the survey are provided below.

2.4 Identified Issues

A list of current transportation issues in the Luling study area was compiled using the previous plans / studies, data analysis findings, public input, and discussions with the Steering Committee. **Table 5** provides a description of each issue, the source by which the issue was identified, and initial thoughts on potential improvement methods. **Figure 11** shows the locations of identified issues.

The identified issues served as a basis for the conceptualization and development of potential improvement options. This process is described in the following section.

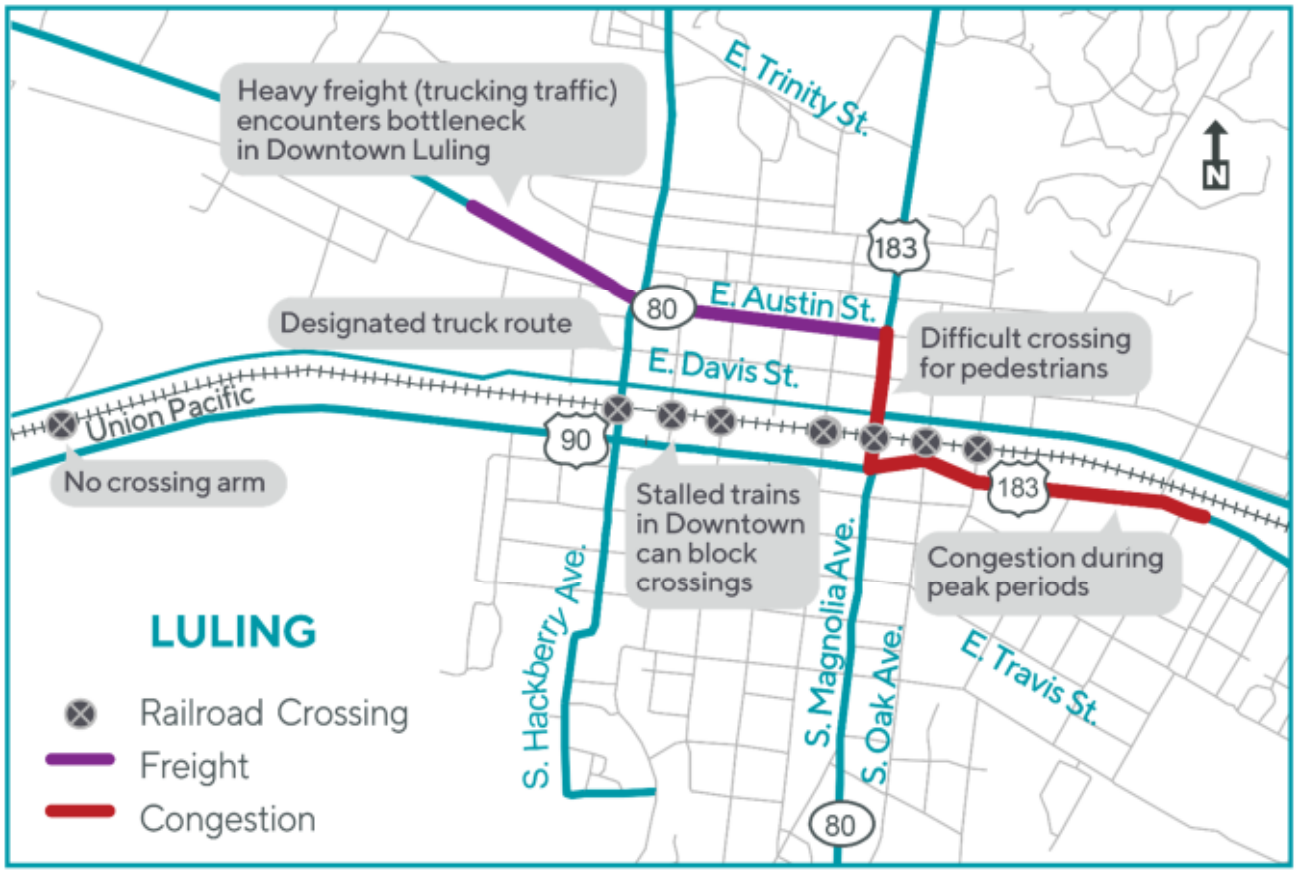


Figure 11 – Luling Transportation Issues Map

Table 5 – Luling Transportation Issues			
#	**Issue**	**Source**	**Potential Improvement Methods**
1	Queuing at southbound and westbound approaches to US 183 / US 90 / SH 80 intersection during peak periods.	• Insufficient capacity of two-lane approaches compared to traffic volume. • Signal timing scheme provides equal green time to through, right, and left turn movements (split signal phasing) though peak demand is from southbound left and westbound right movements.	• Add capacity at US 183 / US 90 / SH 80 intersection. • Improve signal timing and lane utilization scheme. • Provide relief route around northeast quadrant.
2	Diversion of traffic onto local streets during periods of peak congestion. Some local streets were not built to accommodate high volumes or heavy vehicles.	• Eastbound traffic on SH 80 diverts to parallel streets ahead of US 183 intersection if increased queuing is perceived. • Westbound traffic on US 183 / US 90 diverts to parallel streets (Cedar Avenue, Oak Avenue) ahead of US 183 / US 90 / SH 80 intersection if increased queuing is perceived. • Degradation of pavement quality due to unanticipated heavy vehicle use. • Round 1 public outreach mentioned cut-through and speeding traffic near Luling High School and the Seton Edgar B. Davis Hospital.	• Add capacity at US 183 / SH 80 / E Austin Street and US 183 / US 90 / SH 80 intersections. • Traffic calming countermeasures on local streets. • Improve wayfinding and route signage. • Provide relief route around northwest and northeast quadrants. • Improve Hackberry Avenue so that some heavy truck and vehicle traffic reroutes from US 183 between US 90 and SH 80. • Provide direct grade-separated connection between SH 80 and US 90 (west of Hackberry Avenue).
3	Train crossings delay traffic approaching and departing north leg of 183 / US 90 / SH 80 intersection by several minutes.	• Several closures of at-grade crossing near 183 / US 90 / SH 80 intersection each hour and upwards of 50 closures every day, lasting around four to five minutes each.	• Grade-separation at railroad crossing on alternate route. • Provide relief route around northwest and northeast quadrants; provide dynamic display signs to influence route choice for drivers.

Table 5 – Luling Transportation Issues			
#	**Issue**	**Source**	**Potential Improvement Methods**
4	Occasionally, trains stall within downtown, blocking multiple crossing locations and limiting vehicle and emergency service.	• Feedback from Steering Committee and stakeholder outreach. • During these events, options for crossing the railroad are often limited to the Davis Street crossing (west) and Elm Avenue (east).	• Grade-separation at railroad crossing on alternate route. • New at-grade crossing and auxiliary route outside of downtown; UPRR typically request closures of at least two at-grade crossing to approve a new at-grade crossing.
5	Unsafe conditions for pedestrians on US 183 between US 90 and SH 80. Frequent vehicle collisions on this stretch of road can exacerbate traffic congestion.	• Feedback from Steering Committee and stakeholder outreach. • No marked crosswalk currently exists at Davis Street / US 183 and no continuous sidewalks link to the nearest protected crossings. • Crash data from 2012 – 2017 shows high concentration of rear-end, left-turn, and right-angle crashes. Two crashes involving a pedestrian at US 183 / Davis occurred during this time span.	• Improve Hackberry Avenue so that some heavy truck and vehicle traffic reroutes from US 183 between US 90 and SH 80. • Provide relief route around northwest and/or northeast quadrants. • Provide direct grade-separated connection between SH 80 and US 90 (west of Hackberry Avenue). • Pedestrian crossing treatments at US 183 / Davis Street or at US 183 / SH 80 / US 90. Extend sidewalks along US 183.
6	Heavy freight traffic headed east-west via SH 80 and US 183, encounters bottleneck at US 183 / SH 80 / Austin Street and US 183 / US 90 / SH 80 intersections.	• StreetLight data indicates that this is movement with the heaviest daily and peak hour freight demand.	• Improve Hackberry Avenue so that some heavy truck and vehicle traffic reroutes from US 183 between US 90 and SH 80. • Provide direct grade-separated connection between SH 80 and US 90 (west of Hackberry Avenue). • Reconfigure lane assignment and signal timing at US 183 / US 90 / SH 80 intersection.

3 POTENTIAL IMPROVEMENT OPTIONS

Guided by the issues outlined in **Table 5**, the project team developed several conceptual infrastructure packages ("improvement options") that could improve transportation in Luling. The improvement options fell under two categories: near-term and long-term. Near-term options were judged to be achievable within the next 5 – 7 years, while the long-term options, due to probable engineering and environmental complexities, were estimated to require 10 – 20 years to implement. The near-term and long-term improvement were compared against each other and a "No Build" condition using a set of performance measures agreed upon by the Steering Committee. During Round 2 public outreach, people who live and / or work in Luling were surveyed to determine which improvement options they preferred. The project team then selected a set of recommended improvement options using results of the performance measures comparison, input from Round 2 outreach, and discussions with the Steering Committee.

Detailed profiles of the potential improvement options, results of the performance measures analysis and Round 2 outreach; and the identification of recommended improvements are contained in the following sections.

3.1 Option Profiles

A set of potential near-term improvements and three long-term improvement options are profiled in the following sections. The near-term improvements can generally be described as upgrades to the existing roadway network in Luling. Because the near-term improvements consist of projects with low-to-moderate design complexity and construction cost, they could likely be implemented within 5 – 7 years, depending on funding availability. The three long-term improvement concepts – Options A, B, and C – consist of new location roadway corridors with complex design features such as bridges and grade-separated railroad crossings (overpasses). Because each option would require considerable design, environmental documentation, right-of-way (ROW) acquisition, funding procurement, and political effort, implementation would likely take 10 – 20 years.

3.1.1 Potential Near-Term Improvements

The potential near-term improvement would address several of the identified transportation issues by upgrading existing street, sidewalks, and traffic control systems. Improvements would be concentrated in two locations – along Hackberry Avenue between Austin Street (SH 80) and Pierce Street (US 90); and at the Magnolia Avenue / Pierce Street intersection (US 183 / SH 80 / US 90).

Hackberry Avenue is the city-designated truck route for trucks approaching / departing Luling on Austin Street (SH 80). If heavy trucks to / from Austin Street were diverted onto Hackberry Avenue, traffic volumes would decrease at the congested southbound-left and westbound-right movements of the Magnolia Avenue / Pierce Street intersection. Trucks entering Luling on Austin Street and headed towards the Eagle Ford Shale, Texas Gulf Coast, and Houston would turn right onto Hackberry Avenue, turn left onto Pierce Street (US 90), and continue eastbound through the Magnolia Avenue / Pierce Avenue intersection (US 183 / SH 80 / US 90). Trucks entering Luling from the east on Pierce Street would avoid the westbound right-turn queuing at Magnolia Avenue / Pierce Street and the challenging northbound left-turn at Magnolia Avenue / Austin Street by continuing westbound through at Magnolia Avenue, turning right onto Hackberry Street, and left onto Austin Street towards San Marcos. Trucks

coming to / from Lockhart on Magnolia Avenue (which are fewer in number than those to / from San Marcos) would continue to use the southbound-left and westbound-right turning movements at Magnolia Avenue / Pierce Street, but the vehicle and heavy truck volumes at each intersection movement would be more balanced overall.

A package of improvements that could encourage the use of Hackberry Avenue as a viable truck route, provide additional traffic flow improvements at Magnolia Avenue / Pierce Street, and expand sidewalk connectivity and crosswalks, is described below.

Hackberry Avenue Improvements (Figure 12)

1. Install new traffic signals at Austin Street and Pierce Street and stripe crosswalks across each approach. Signals would enable protected turning movements for vehicles turning northbound-left at Hackberry Avenue / Austin Street and southbound-left at Hackberry Avenue / Pierce Street, facilitating the diversion of traffic flow. The signals and added crosswalks would also provide protected crossings for pedestrians across both Austin Street and Davis Street, where north-south crossing can be challenging and potentially dangerous during periods of heavy traffic flow.
2. Repave the roadway between Austin Street and Pierce Street. Poor pavement conditions on this stretch of roadway were noted by the Caldwell County Transportation Plan, Luling Master Plan, and public feedback. Stakeholders mentioned that uneven surface and potholes on Hackberry Avenue are the primary reasons that truck drivers avoid the designated route.
3. Stripe the roadway centerline and intersection approaches. Clear indication of north-south travel lanes and stop bars on stop-controlled side-streets (Watkins Street, Fannin Street, Davis Street).
4. Construct sidewalks and reconstruct curbs on both sides of Hackberry Avenue between Austin Street and Bowie Street. Sidewalks could be added either within the easements on either side of the roadway or by narrowing the roadway width. Combined with the new signals/crosswalks at Austin Street and Pierce Street, pedestrians would have a protected walking route between the northern half of Luling and the schools, hospital, and grocery store south of Pierce Street.

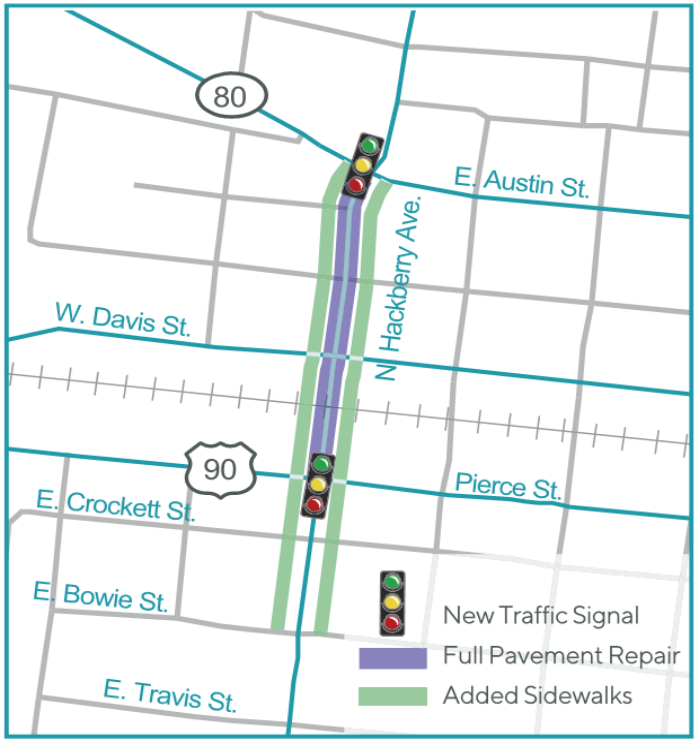
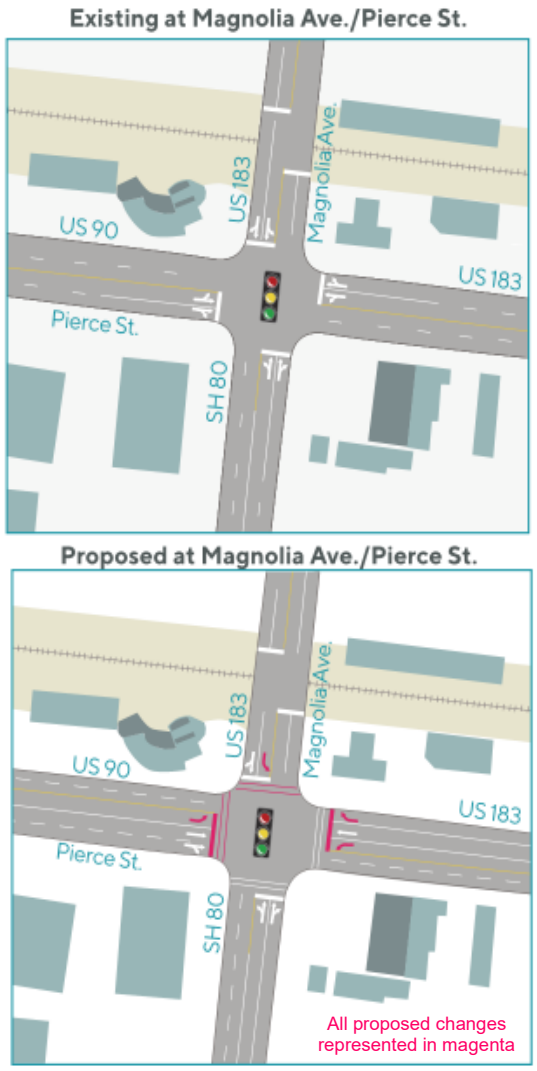


Figure 12 – Hackberry Avenue Near-Term Improvements

5. Install advance warning and truck route signage on Austin Street eastbound leading up to Hackberry Avenue and Pierce Street westbound (east of Magnolia) to inform truck drivers of the designated truck route.



Magnolia Avenue / Pierce Street (US 183 / SH 80 / US 90) Improvements (Figure 13)

1. Stripe left-turn lanes on Magnolia Avenue / Pierce Street and modify signal heads to allow for a protected left-turn phase. The existing signal runs on a pattern called *split phasing* (described on the following page). By striping dedicated left-turn lanes for the southbound, eastbound, and westbound left-turn movements at Magnolia Avenue / Pierce Street, a more efficient style of signal timing called *protected-permissive phasing* would be possible. Protected-permissive phasing would provide green time for protected left-turns and provide a new phase not possible under split phasing where through traffic (east-west or north-south) is able to proceed through the intersection simultaneously. Eastbound and westbound left-turn lanes would be able to fit on Pierce Street without widening the road or repurposing through-lanes. Because Pierce Street is 60 feet wide from curb-to-curb, five 12-foot lanes[3] could fit on each approach (two approach through lanes, one left-turn lane, and two departure lanes).

2. Stripe dedicated westbound right-turn lane on Pierce Street. Even with the reroute of trucks to Hackberry Avenue, a high volume of trucks and automobiles would need to turn right from westbound Pierce Street to northbound Magnolia Avenue. To accommodate the wide turning radius heavy truck, minor roadway curb widening and right of way (ROW) acquisition may be needed on the northeast corner of the intersection.

3. Construct sidewalks along both sides of Magnolia Avenue between Pierce Street and Davis Street. Sidewalks do not currently exist on Magnolia Avenue between Pierce Street and Davis Street, which is next to many of Luling's most popular businesses and attractions.

4. Stripe crosswalks and construct/reconstruct curb ramps at each intersection approach; add pedestrian countdown timer to north and west legs. Magnolia Avenue is a major dividing point/barrier in the otherwise walkable and active Davis Street corridor. It is currently very difficult to cross Magnolia Avenue and access Davis Street as a pedestrian, with the only protected crossing point at Austin Street (SH 80).

Figure 13 – Magnolia Avenue / Pierce Avenue Improvements

[3] TxDOT preferred standard lane width.

What is Split Phasing?

Traffic signals can be timed in a variety of ways, with numerous combinations of protected turning movements in various sequences. In *split phasing*, a street approach is given green time for all its movements concurrently (left, through, and right) while the three other street approaches are shown red / required to stopped. The signal proceeds in this sequence for each of the three other approaches. Split phasing is a good option for intersections that do not have the space for dedicated left-turn lanes but can be very inefficient when more than one approach has high traffic demand. Additionally, if a vehicle is unable to clear the intersection on the green phase provided by a split phase signal, the time it will need to wait until the next green phase is typically much longer than under most other signal timing schemes.

Additional Near-Term Studies

1. Neighborhood traffic calming study. Several Round 1 survey respondents mentioned that the streets surrounding the Luling High School, Leonard Shanklin Elementary School, and Seton Edgar B. Davis Hospital felt unsafe due to cut-through traffic and speeding. A traffic calming study would identify the extent of the cut-through and speeding issues, propose traffic calming treatments or other programs to address the cut-through / speeding issues, and provide other information that may be needed to inform the design process and to pursue grants.
2. Safe routes to school plan. Round 1 survey respondents were concerned with the connectivity and safety of the sidewalk and crosswalk network surrounding Luling High School and Leonard Shanklin Elementary School. A safe route to school plan would assess and prioritize various improvements, monitoring and education programs, and potential funding sources.
3. Four-way stop sign evaluation at Walnut Avenue / Pierce Street intersection. This evaluation would determine the appropriateness of removing and/or modifying the east-west stop-control at the Walnut Avenue / Pierce intersection. Following the installation of a new traffic signal and crosswalks at Hackberry Avenue / Pierce Street, the east-west stop signs at Walnut Avenue / Pierce Street may no longer be needed for pedestrian safety or traffic control, particularly if pedestrian crossing demand shifts to Hackberry Avenue. Removal of the east-west stop-control may encourage more cross-town drivers to divert onto Hackberry Avenue.

3.1.2 Long-Term Improvement Options

The three long-term improvement options, shown in **Figure 14**, would provide new roadway connections to divert drivers through or around Luling, alleviate traffic near downtown, and create a grade-separated crossing (roadway overpass) over the UPRR railroad tracks. Each long-term option would come with considerable design, environmental, right-of-way (ROW), funding, and political challenges and would likely take 10 – 20 years to implement.

Option A

Construct a new roadway connection to the west of central Luling from Austin Street (SH 80) to Pierce Street (US 90). An overpass would span Davis Street and the UPRR tracks, connecting with ramps at Pierce Street. The corridor would essentially function as a realignment of Austin Street to connect directly into Pierce Street (though the portion of Austin Street east to Magnolia Avenue).

Option A would take over the function of Hackberry Avenue as the primary truck route for drivers approaching / departing Luling from SH 80 west. Similar to the potential near-term improvements, vehicles would still pass through the Magnolia Avenue / Pierce Street intersection (US 183 / SH 80 / US 90), but because the approaching traffic volumes would be more balanced (less southbound, more eastbound), intersection operations would improve substantially compared to existing conditions. Option A would not direct pass-through travelers (e.g. trucks, recreational trips) away from central Luling, and businesses oriented towards Pierce Street and Davis Street would be visible to all pass-through trips on this route.

Figure 14 – Long-Term Improvement Options

Option B

Construct a new roadway connection from Austin Street (SH 80) west to Pierce Street (US 183) east, passing north of downtown and south of Salt Branch (the creek running south of Trinity Street). An overpass would span FM 1322 and the UPRR tracks east of the city limits. New intersections would be created at Hackberry Avenue and Magnolia Avenue (US 183) with a new traffic signal likely needed at Magnolia Avenue.

Option B would divert traffic from several cross-town routes that currently go through the Magnolia Avenue / Pierce Street intersection – including heavy truck traffic from San Marcos and Lockhart to IH 10, the Eagle Ford Shale, and Texas Gulf Coast (and vice-versa). The path of Option B would be slightly longer than routes on the existing roadway network, but design traffic would travel at somewhat higher speeds, encounter fewer signals, and be unimpeded by trains. Traffic volumes and peak hour congestion levels would decrease at several of the primary intersections in central Luling.

Option C

Construct a new roadway connection from Austin Street (SH 80) west to Pierce Street (US 183), passing north of downtown and Salt Branch. An overpass would span FM 1322 and the UPRR tracks east of the city limits. east) north of town and north of Salt Branch, the creek running north of Goliad Street and south of Trinity Street, from SH 80 to US 183 east of Blanco Avenue. New intersections would be created at Hackberry Avenue and Magnolia Avenue (US 183) with a new traffic signal likely needed at Magnolia Avenue.

Option C's impact on traffic diversion and congestion would be very similar to Option B. However, the alignment for Option C would require at least two bridges over Salt Branch – one west of Hackberry Avenue and one east of Magnolia Avenue. From the perspective of right-of-way needs, Option C would require more land, but the land would be further away from central Luling, generally less developed, and possibly less challenging to acquire.

3.1.3 Cost Estimates

Planning level costs estimates were prepared for the package of potential near-term improvements and each long-term improvement option. **Table 6** summarizes the estimated range of costs for each option. **Appendix G** contain a full schedule of the items and assumptions used to generate the cost estimates. It should be noted that costs were estimated with the project defined only at the conceptual level and in the absence of any detailed design work.

Table 6 – Planning Level Cost Estimates

Improvement Option	Cost (in thousand $)	
	Low	High
Near-Term Improvements	1,180	1,290
Option A	6,800	9,900
Option B	20,900	25,200
Option C	27,700	35,050
Notes: Near-term improvements included all items discussed in Section 3.3.1. Full schedule of items and assumptions is contained in Appendix G.		

3.2 Performance Measure Development

Multiple performance measures were developed in coordination with the Steering Committee as a means of analyzing and comparing the near-term and long-term options. Performance measures were structured to capture the relative benefit or dis-benefit of a given option relative to the goals and objectives of the project. The performance measures are listed in **Table 7** as they relate to each of the four Study goals. **Appendix H** contains additional information about the development of each performance measures, including units of measurement, general calculation method, and data sources.

Table 7 – Performance Measure by Study Goal

Goal 1 *Identify needed safety improvements*	**Goal 2** *Enhance mobility in downtown for local and through traffic*	**Goal 3** *Evaluate feasibility of an alternate route for through traffic*	**Goal 4** *Promote the unique character of downtown and economic development opportunities*
• Predicted annual crash rate • Presence of new or improved street crossings or walking paths for pedestrians • Provision of new grade-separated (overpass) railroad crossings • Improvement to travel time and reliability for evacuation and emergency responders	• Estimated daily entering traffic at Magnolia Avenue / Pierce Street intersection • Average cross-town travel time, Friday PM peak • Intersection level of service (LOS), Friday PM peak • Total railroad crossing delay during Friday PM peak	• Planning cost estimate • Environmental impacts in terms of network fuel consumption, Friday PM peak • Overall environmental suitability of improvements	• Number of vehicles passing through Luling via Magnolia Avenue / Pierce Street intersection • Improvements to pedestrian connectivity along Magnolia Avenue

3.3 Round 2 Outreach Results

A second public survey to understand community preferences about the potential near-term and long-term improvement options was administered between April 15, 2019 and May 15, 2019. The opening of this survey coincided with public open houses and tabling held in multiple locations around Luling on April 15. In total, 170 completed surveys were returned. Results show that nearly 80% of respondents think the proposed near-term improvements will help make it easier and safer to travel in Luling. Additionally, a majority of respondents (56%) believe Option A will best serve long-term transportation needs in Luling. About a third of respondents (33%) preferred options that would circumvent central Luling (Options B and C). Preferences for the long-term improvement options are summarized in **Table 8**. Detailed survey results are contained in **Appendix F**.

Table 8 – Long-Term Improvement Preferences from the Second Public Survey (Round 2 outreach)

Survey Question: *Which of the potential options, if any, do you believe would best serve long-term transportation needs in Luling?*	
Answer Choice	**Responses**
Option A	56%
Option B	12%
Option C	21%
None of these	11%

3.4 Performance Measure Results Comparison

A performance measures matrix, shown in **Table 9**, was created to visually convey how each option compares to a No Build conditions, as well as to each other, in future year 2045. The performance measures were calculated using the methods and data sources decribed in **Appendix I**. "Low" and "high" traffic growth scenarios were both analyzed to account for uncertainty and to create create a range of performance for each option. The "low" growth scenario used the average traffic growth rate experienced during the last 20 years in Luling while the "high" growth scenario accounted for greater population and employment growth, approximating a sustained oil boom condition.

Generating "High" and "Low" Traffic Forecasts

The project team recognizes that there is not a clear indication of how transportation conditions will change through Luling over the next 25 years. The oil boom ended several years ago, so some of the historical data indicates that traffic and truck growth will proceed at the moderate rates observed during much of the last 20 years. However, it could be argued that the oil market is cyclical, and new production technologies or increase in domestic/global demand could result in more booms like the one experienced between 2011 and 2014.

Several data sources and traffic models were reviewed to determine a potential range of growth rates (low and high):

- *Historical traffic counts from TxDOT Traffic Count Database System (TCDS)*– for locations with two or more years of available AADT data, a logarithmic (trendline) growth rate was calculated. All study location had data spanning 1999 – 2019.
- *CAMPO 2040 Regional Transportation Plan (RTP) Model* – CAMPO maintains a regional transportation plan model for long range traffic forecasting. CAMPO provided directional ADT and peak hour volume outputs for the City of Luling for years 2010 and 2040. Growth rates between these two years were calculated for each approaching/departing roadway.

Growth rates were averaged for the eight major roadways approaching/departing Luling. The average growth rate for the TCDS historical data is 1%, and the average growth rate for the CAMPO RTP model outputs is 2.7%. The TCDS growth rate accounts for nearly 20 years of variation in traffic volumes, including the emergence and dissipation of the oil boom between 2011 and 2014. The CAMPO RTP model may have somewhat higher growth rates than the TCDS counts due to the expectation that population and employment growth in Caldwell County will begin to pick up as the areas surrounding Austin continue to develop. To capture a range of potential traffic growth scenarios, the 1% annual growth rate from the TCDS was assumed as a "low" scenario and the 2.7% CAMPO RTP rate as a "high" scenario. A detailed description of the travel demand forecasting methodology and output is provided in **Appendix J**.

Table 9 – Performance Measure Results Matrix

Goal	Measure	Unit(s)	No Build		Near-Term		Option A		Option B/C	
			Low	High	Low	High	Low	High	Low	High
1	Predicted annual crash rate	Crashes per year	30	41	27	39	26	36	27	36
	Presence of new or improved street crossing or walking paths for pedestrians path for pedestrians	Number of protected crossings and linear feet of sidewalk added in central Luling	0		10 crossings and 3170 feet		0		0	
	Provision of new grade-separated (overpass) railroad crossings	Number of grade-separated crossings added	0		0		1		1	
	Improvement to travel time and reliability for evacuation and emergency responders	Acreage within 5 minute drive	820		2070		2170		2190	
2	Estimates daily traffic entering Magnolia Avenue / Pierce Street intersection	Total entering daily traffic	23500	32100	23500	32100	23500	32100	18550	25300
	Average cross-town travel time, Friday PM	Minutes	12	18	7	8	6	7	6	6
	Intersection level of service, Friday PM	Level of service grade	F	F	C	D	C	D	C	C
	Total railroad crossing delay during Friday PM peak	Daily vehicle hours of delay at Magnolia Street crossing	135	190	130	185	110	160	100	140
3	Planning cost estimate	Million $	n/a	n/a	1.2	1.3	7	10	21	35
	Environmental impacts in terms of network fuel consumption, Friday PM peak	Gallons of fuel consumed	240	910	160	290	150	270	160	310
	Overall environmental suitability of improvements	low = many conflicts, medium = some conflicts, high = few conflicts	-	-	High		Medium		Low	
4	Number of vehicles passing-through Luling via Magnolia Avenue / Pierce Street intersection	Pass-through AADT (non-local)	9100	15700	9100	15700	9100	15700	4100	8900
	Improvement to pedestrian connectivity on Magnolia Avenue between Davis and Pierce	Number of protected crossings and linear feet of sidewalk added	-		2 crossings and 530 feet		-		-	

The bullet list below summarizes how the improvement options compare to each other for each performance measure.

- **Predicted annual crash rate** – The number of predicted annual crashes would decrease slightly compared to the No Build for all improvement options. The difference in predicted crashes between the options would be small, though the long-term options would have fewer crashes since the new connections would spread out traffic and reduce railroad conflicts.
- **Presence of new or improved street crossing or walking paths for pedestrians** – Only the near-term improvements would add sidewalks and crosswalk network in the part of Luling where people are likely to walk.
- **Provision of new grade-separated (overpass) railroad crossings** – Due to complexity and cost, railroad overpasses were only included for the long-term options. This is one of the main areas of need that the near-term improvements do not address.
- **Improvement to travel time and reliability for evacuation and emergency responders** – The analysis measures how many acres of land can be accessed within a five-minute drive of the Luling Fire Department on Pecan Street. The analysis accounts for predicted congestion at existing and proposed intersections and reductions in delay due to new roadways and overpasses. Maps showing the coverage for each option are provided in **Appendix I**. By reducing congestion in central Luling, all the options would significantly increase the amount of land that is accessible within 5 minutes. Despite the railroad overpasses included in the long-term options, the coverage area would only be 5% greater than the near-term improvements, indicating that reducing traffic congestion would have a more significant impact on evacuation/emergency response than grade-separation of the railroad.
- **Daily entering traffic at Magnolia Avenue / Pierce Street intersection** – Daily entering traffic at Magnolia Avenue / Pierce Street would not change compared to No Build under near-term or Option A conditions, though traffic would be more distributed among the intersection approaches. Options B and C would reduce entering traffic at the intersection by about 5,000 to 7,000 daily vehicles, a decrease of approximately 20%. Additionally, heavy truck traffic at the intersection would reduce by nearly 70% under Options B and C (entering heavy truck estimates are shown in **Appendix I**).
- **Average cross-town travel time, Friday PM** – The average cross-town travel time represents the average amount of time it would take, under 2045 PM peak conditions, to travel between the west and north Luling city limits and the east and south City limits. All the studied improvement options would reduce cross-town peak travel time by at least half compared to No Build conditions. Options A, B, and C would be result in slightly faster cross-town travel times because the new roadway corridors would support slightly higher speeds and have fewer intersections than the existing cross-town roadways.
- **Intersection level of service (LOS), Friday PM peak** –TxDOT designs guidelines specify that intersections improvements should operate at LOS D or better for at least 20 years after completion. All the improvement options would operate at LOS C under the “low” growth scenario and D or better under the “high” growth scenario. Compared to a LOS C intersection, the average car approaching a LOS D intersection would take about 20 more seconds to clear the intersection.
- **Total railroad crossing delay during Friday PM peak** – The railroad crossing delay analysis assumed an average of three trains passing through Luling during the PM peak hour (compared to about 50 during an average day). The PM vehicle hours of

delay due to passing trains would decrease under all improvement options. Though the near-term improvements would not provide an overpass of the UPRR tracks, the diversion of heavy truck traffic from Magnolia Avenue to Hackberry Avenue would reduce traffic queue lengths on Magnolia Avenue during crossing events, so queues would dissipate faster after the reopening of the guard-arms. Crossing delay would further decrease under the long-term options due to the overpass, with Options B and C resulting in the highest decrease due to diversion of traffic from both SH 80 west and US 183 north.

- **Planning cost estimate** – The near-term improvements would require the least complex design and lowest implementation cost of all the improvement options analyzed. The total cost for all near-term improvements defined in Section 3.1.1 would likely be only a fraction of the cost of any of the long-term improvements. The long-term options, in addition to being larger in scale, would also require more design, environmental, right-of-way (ROW), and political effort. Because Option A would have the shortest route length, fewest environmental conflicts, and least ROW requirements, the total cost would be approximately half that of Option B and one-third of Option C.
- **Environmental impacts in terms of network fuel consumption, Friday PM** – The amount of greenhouse gas emitted by automobiles is a direct function of fuel consumption. In turn, automobile fuel consumption is dependent on distance travelled and acceleration/deceleration (due to turns, stops, and interrupted traffic flow). PM peak fuel consumption would decrease under all options due to improved traffic flow. Consumption would be lowest under Option A conditions because the new alignment connecting Austin Street to Pierce Street would be a shorter distance than the existing shortest path (down Hackberry). Fuel consumption for Options B and C would be slightly higher than Option A because the cross-town route, though faster, would be longer than the existing path through central Luling.
- **Overall environmental suitability of improvements** – The near-term improvements would be contained almost entirely within the existing ROW of TxDOT and local roadways, so few environmental impacts should be anticipated. Option A could be aligned to avoid floodplains and oil / gas pipeline, though some consideration would need to be given to the proximity of pollutant and waste discharge sites (active and former industrial businesses). Options B and C would approach or cross multiple floodplains, pipelines, and several EPA-listed sites that might require remediation/mitigation. Option B could possibly avoid the floodplains, but this route may come into conflict with civic amenities, historic sites, and waste discharge sites.
- **Number of vehicles passing through Luling via Magnolia Avenue / Pierce Street intersection** – This measure is an estimate of the number of daily trips that pass-through Luling via the Magnolia Avenue / Pierce Street intersection, excluding trips that are local, i.e. start and end in Luling. This is an approximate measure of how much exposure / visibility downtown Luling businesses have to out-of-town drivers. Total pass-through traffic would remain the same compared to No Build under near-term and Option A conditions, though more drivers would view downtown Luling from Pierce Street rather than Magnolia Avenue due to changed routes. Under Options B and C, between 5,000 – 7,000 drivers (45 – 55% of No Build pass-through traffic) would be diverted from downtown Luling on the new roadway corridors. However, drivers entering / leaving Luling on Pierce Street west (US 90) and Magnolia Avenue south (SH 80 south) would still pass-by downtown.

- **Improvements to connectivity along Magnolia Avenue** – Only the near-term improvements would add sidewalks and protected crossing along the Magnolia Avenue corridor near downtown.

3.5 Recommended Improvements

Based on the results of the performance measures analysis, and Round 2 public survey, and Steering Committee input, this Study recommends the continuation of project development for the **near-term improvements** and **long-term Option A**. The near-term improvements are recommended for the following reasons:

- Significant community support
- Would relieve traffic congestion in central Luling for the next 25 years, but would not reduce the visibility of downtown Luling to pass-through traffic
- Would improve pedestrian safety and connectivity within central Luling for both residents and visitors
- Least complex design effort and lowest cost of all the improvement packages analyzed

The long-term **Option A** improvements is recommended for continued project development for the following reasons:

- Most community support among the long-term options
- Would provide an overpass of the UPRR railroad for potentially half the cost of the other long-term options
- Fewer environmental constraints between Austin Street (SH 80) and Pierce Street (US 90)
- Would relieve traffic congestion in central Luling but would not reduce the visibility of downtown Luling to pass-through traffic

The near-term improvements would complement the new traffic patterns expected under Option A conditions, and the projects could be pursued either concurrently or in sequence. The next section outlines next steps for the various stakeholders and some funding sources that could help advance various stages of implementation.

4 IMPLEMENTATION

4.1 Next Steps

Based on the results of the performance measures analysis, and Round 2 public survey, and Steering Committee input, this study has developed several recommendations for near-term and long-term transportation improvement projects in Luling. The following bullet list summarizes these recommendations and steps that will be necessary to progress implementation.

- Recommendations for **near-term** transportation improvements (5 – 7 year timeframe)
  - Incorporate near-term transportation improvements as defined in Section 3.1.1 into, at least, the 2045 Regional Transportation Plan and Regional Arterials Study.[4]
  - Determine lead agency and partnerships structure for project development.
  - Create partnerships with State and local agencies and UPRR on project development for Hackberry Avenue repaving and sidewalks improvements; Austin Street (SH 80) and Pierce Street (US 90) signal and crosswalk improvement at Hackberry Avenue; advance warning truck route signage; and Magnolia Avenue / Pierce Street (US 183 / SH 80 / US 90) striping, signal, crosswalk and sidewalk improvements.
  - Coordinate with TxDOT and CAMPO to identify potential funding sources for project design and/or construction. Work with TxDOT to pursue Categorical Exclusion for environmental documentation. As is beneficial, funding may be pursued for individual components of the near-term improvements package. For example, the sidewalk and crosswalk improvements and the traffic calming study may be eligible for Safe Routes to School grants, while roadway components would not be eligible.
  - Consider local funding sources such as bond measure or Tax Increment Reinvestment Zone to fund upfront phases of project development (i.e. preliminary engineering), local match requirements, and/or liquid capital for reimbursement-based programs.
- Recommendations for **long-term** transportation improvements (10 - 20 year timeframe)
  - Incorporate the **Option A** concept as defined in Section 3.1.2 into, at least, the 2045 Regional Transportation Plan and Regional Arterials Study.[4]
  - Determine lead agency and partnerships structure for project development.
  - Explore funding opportunities for concept refinement, preliminary engineering, and environmental documentation.
  - Coordinate with UPRR to ensure all activities align with their internal processes

[4] The Regional Arterials Study will serve as an update to the current Caldwell County Transportation Plan.

4.2 Funding Sources

Securing funding can often be the most challenging aspect of project development. Transportation funding programs and tools are available at all levels of government. The follow sections provide several options at the federal, state, and local level that could be available to Luling to fund either the near-term or long-term recommended improvements.

4.2.1 Federal

Build Grants – Better Utilizing Investments to Leverage Development (BUILD), previously TIGER Discretionary Grants, are highly competitive grants allocated annually by the US Department of Transportation (USDOT) to invest in transportation infrastructure projects. Any public entity is eligible for a BUILD Grant and may use the funding for road and bridge, rail transportation, public transportation, port infrastructure, and research projects. Projects can obtain from $5 million to $25 million with a state maximum of $90 million. Rural projects may be granted a minimum of $1 million and transportation planning projects have no minimum. Federal share of costs may not exceed 80% for urban-area projects but may be increased for rural projects. Project award will be based on the project's ability to address safety, state of good repair, economic competitiveness, environmental sustainability, and quality of life. The application and award process happen on an annual cycle, with the application period typically opening each summer.

Federal Loan – The Transportation Infrastructure Finance and Innovation Act (TIFIA) provides fixed interest rate loans granted by the USDOT Build America Bureau. The loans can be up to 49% of the project's eligible costs and are offered at below market interest rates. Eligible projects include roads, bridges, and pedestrian and bicycle infrastructure. Total project costs must be between $10 million and $75 million. TIFIA offers secured (direct) loans, loan guarantees, and standby lines of credit.

MPO Distributed – CAMPO distributes federal and state funds from the Transportation Alternative Set-Aside (TASA), Surface Transportation Block Grant (STBG), and Mobility and Congestion funding approximately every 2 years. Awarded projects are added to the regional Transportation Improvement Program (TIP). The Mobility and Congestion funding, or Metropolitan and Urban Corridor Projects, are selected in consultation with the TxDOT and, as such, criteria is regulated by TxDOT. The criteria for TASA and STBG have been established by the federal government. If seeking construction funds, projects must be ready for construction within 4 years and be eligible for at least one of the three funds. TASA has the most stringent criteria while STBG is the most flexible. TASA funds may be used for transportation projects or programs related to the construction, planning, and design of safety measures for non-drivers, such as safe routes to school programs (23 U.S.C. § 213, 2012). It should be noted that CAMPO administers TASA funds for jurisdictions within the Census-defined Large Urbanized Area[5], and TxDOT administers funds for jurisdiction outside this boundary. Because the Large Urbanized Area excludes Caldwell County, Luling would need to apply to TxDOT to receive TASA funds. Eligibility for STBG includes, but is not limited to, construction of highways, bridges, operational improvements, and safety infrastructure improvements. The project may not be located on a local road or rural minor collector, with some exceptions (23 U.S.C. § 133, 2012). This program operates on a reimbursement basis, with the funds reimbursing up to 80% of the total project cost.

[5] A map showing the Large Urbanized Area can be accessed at: http://ftp.dot.state.tx.us/pub/txdot-info/ptn/maps/austin.pdf

4.2.2 State

Safe Routes to School – The TxDOT Public Transportation Division administers Federal Highway Administration (FHWA) funds for locally sponsored infrastructure projects that facilitate walking and biking to school. The funds are distributed by TxDOT for projects located within two miles of a K-8 grade school. Eligible projects for Safe Routes to School (SRTS) include sidewalk improvements, pedestrian and bicycle crossing improvements, bike facilities, traffic diversion improvements, and bike parking. No local contribution is required. A joint call for projects (TASA and SRTS) is currently being deployed with funds awarded at the end of 2019.

Community Development Fund – The Texas Community Development Block Grant (TxCDBG) fund, also known as the Community Development Fund, is a US Department of Housing and Urban Development fund for local community development used at the discretion of state and local governments. Biennial applications to the Texas Department of Agriculture provide annual funds between $75,000 and $800,000 for affordable housing, anti-poverty programs, and infrastructure development (including the construction of, and improvements to, water, sewer, and streets). The project must benefit low- and moderate-income persons, prevent or eliminate slums, or address urgent community development needs posing a serious and immediate threat to health or welfare of community for which other funding is not available. Cities with populations less than 50,000, unless designated as a principal city of a Metropolitan Statistical Area, are eligible.

State Infrastructure Bank – The State Infrastructure Bank (SIB) offers access to federal and state funds for loans at or below market interest rates. The project must be included in the State Transportation Improvement Program (STIP) and eligible for funding under existing federal highway rules located in Title 23. There is no minimum amount and the maximum loan size varies. The funds may be used for all costs incidental to the construction or reconstruction of public highways.

4.2.3 County and Local Level

Bond Measure – Fixed rate bonds are a common way to fund transportation projects at a local level. General obligation bonds are backed by income tax, sales tax, and other levied taxes and would be placed on a ballot for residents to vote for or against the proposed tax increase. Revenue bonds are supported through any tolls or fares generated from the proposed project.

Transportation Impact Fee (TIF) – TIF are fee charged to developers for the improvement of local transportation systems, required to be paid prior to receiving construction permits. The fee is intended to recover incremental impacts of each new development while contributing to a list of local improvements defined by the community. A TIF must be adopted locally by ordinance and usually requires an upfront study to evaluate total future transportation system costs and calculate impact fee rates by development type and intensity. TIF systems are currently in place in Round Rock, Hutto, and New Braunfels and are under consideration in Georgetown.

Tax Increment Reinvestment Zone (TIRZ) – Through a TIRZ, a city or county in Texas may set-aside tax money from existing property-based taxes, relative to the annual increase in property values. This means residents will not see an increase in tax rates, but the entities that would collect the tax would give a portion, or all, of future tax revenue above the amount collected at the time of implementation. The money collected from the TIRZ can be used to fund infrastructure, landscaping, streetscaping, and other types of public enhancement. The proposed TIRZ area must be

predominantly open or undeveloped, in a federally assisted new community, or in an area in which at least 50 percent of the appraised property owners have petitioned for designation as a reinvestment zone (Texas Comptroller of Public Accounts, 2018, p. 2-3).