CENTRAL TEXAS RAIL RELOCATION STUDY

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Texas Department of Transportation

Transportation Planning & Programming Division
Multimodal Section

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Executive Summary

The Central Texas Rail Network is an extensive system of freight rail corridors connecting multimodal hubs in Houston, Dallas/Fort Worth, and San Antonio to national and international markets. Within the Central Texas region, Union Pacific Railroad (UP) owns and operates over a system that contains nearly 600 miles of mainline trackage, connecting to international trade centers at Brownsville, El Paso, Corpus Christi, Galveston, Houston, and Laredo. Although chemical products and coal top the list of commodities shipped, the magnitude of NAFTA related products shipped has steadily increased over recent years.

As a result, the volume of train traffic throughout the network has increased to the point where the bottlenecks and pinch-points along the system have begun to affect the timeliness of freight shipments and impact other public and private transportation sectors.

A series of train accidents in the San Antonio area in 2004 resulted in 4 fatalities. One accident was a derailment near a high school which spilled diesel fuel into the San Antonio River. A second accident resulted in the death of three people following a two-train collision that emitted chlorine gas. An additional 49 people were treated for breathing problems. Another derailment in the fall of that year caused a boxcar to crash into a building, killing an office worker that was trapped inside.

These incidents, coupled with increasing congestion, air quality issues, and other concerns, have caused the municipalities of Austin, San Antonio, and other communities in the region to display an increased desire to relocate the through-freight rail operations onto alternative routes. This would address safety and quality of life issues while potentially allowing the use of the existing rail lines for commuter rail traffic.

The Texas Department of Transportation (TxDOT) requested that UP assist TxDOT in determining the feasibility of relocating UP's through-freight rail services away from their Austin Subdivision (Sub) route, which runs from Taylor through Austin to San Marcos and San Antonio. The purpose of this request was to identify alternative alignments for UP's through-freight service which could provide substantial benefits to the public sector and UP from the relocation of these services. The public benefits could include:

- Reductions in public exposure at roadway-rail crossings (vehicular delay, accidents, horn noise) by moving the route outside of the Austin and San Antonio metro areas and other communities including Taylor, Elgin, Bastrop, Lockhart, and San Marcos,
- Reductions in hazardous materials movements within urban areas,
- Improvements to air quality from reductions in vehicular idling and reduced locomotive operations,

- Reductions in fuel usage for vehicular traffic,
- Improvements in economic development opportunities, and
- Possible implementation of commuter rail services in the existing corridor.

Potential benefits to UP could include:

- Reductions in train accident exposure at highway-rail grade crossings,
- Possible increases in freight rail capacity,
- Improvements in train operating efficiency along the new route,
- Possibility of the railroad to "grow business" due to possible increases in capacity,
- Short term reductions in maintenance expenses on the newly constructed alignments, and
- Reductions in Total Central Curve Angle which may correlate to reductions in wear and tear on locomotives, rolling stock, roadbed, track and structures.

In response to this request, UP provided information on how their existing Lockhart and Waco Subdivisions could possibly be upgraded to allow the diversion of freight from the Austin Subdivision to those alternatives, relocating those services from San Marcos to Taylor to the east. TxDOT utilized the services of an engineering consultant to perform an analysis of the information UP provided. The Study Team performed a "windshield survey" of the existing routes in the region and identified areas of potential conflict which could inhibit the relocation of through freight services from the Austin Sub (between Taylor and San Marcos) to the Waco and Lockhart Subs. Alternative alignments through and around Taylor, Elgin, and Bastrop were proposed which could mitigate the potentially adverse impacts of rerouting freight rail services to the existing Waco and Lockhart Sub routes. The Study Team also proposed a new conceptual alternative alignment which traversed from Taylor to Lockhart via the most direct route, then from Lockhart to San Marcos on the existing route and continuing on to San Antonio on the existing Austin Sub which could minimize restrictions encountered near Taylor, Elgin and Bastrop. Information regarding this part of the study is included in Section 1.

These alternatives provided potential benefits to both the UP and the public sector from the relocation of freight rail traffic between Taylor and San Marcos. However, these alternatives did not address the movement of through freight near significant public facilities in San Antonio (Alamodome, SBC Center) as well as through the San Antonio Central Business District (CBD). The Study Team was therefore directed to investigate the possibility of relocating UP's through freight services between San Marcos and San Antonio on the Austin Sub to an alternative alignment. It was determined that traffic could be rerouted from the southern portion of the Austin Sub to a new conceptual alignment that traversed from Lockhart to Seguin. At Seguin, the new alignment would connect to the existing Glidden Sub, providing connectivity to San Antonio's existing

infrastructure while avoiding the CBD and the Alamodome. The Study Team concluded that significant upgrades would be required to reroute traffic from the Austin Sub to the Glidden Sub in San Antonio. Information regarding this part of the study is included in Section 2.

The issues described in Section 2 regarding San Antonio access from the east on the Glidden Sub, and the conflict with urban development along the FM 78 corridor complicate upgrading the Glidden/Del Rio Sub to the standards recommended in this report. The Study Team, therefore, analyzed a conceptual San Antonio bypass from the Seguin area to the southwest portion of San Antonio. This bypass would connect UP's Glidden Sub (east of San Antonio) with their Rockport, Corpus Christi, Laredo, and Del Rio Subs (southwest of San Antonio) via a bypass around the southern portion of the metropolitan area. This would provide east-west connectivity with north-south connectivity through a loop around San Antonio that relocates and links all of UP's mainlines outside the metropolitan area. This east/west and north/south connectivity currently occurs within the city of San Antonio itself and must be provided for in order to relocate through-freight services to an alternative alignment. The study team also identified the need to construct a new yard(s) where the classification, servicing, and intermodal movements that are currently performed at SoSan, East, and Kirby Yards (within the San Antonio metropolitan area) could be relocated. Order of magnitude costs for the conceptual alternatives were developed for consideration when evaluating public and private benefits along with environmental issues.

The bypass and new yard location would therefore relocate all through freight services from the east, west, and south (as well as train classification movements) from the San Antonio urban area. Trains to and from the north could be relocated from the Austin Sub to the Waco Sub or the new direct route alignment, connecting with the San Antonio bypass near Seguin. This could reduce train movements within San Antonio by as much as 60 – 70%, with the majority of the remaining train movements associated with servicing freight rail customers located within the urban area. However, the conceptual bypass alignments all resulted in a significant increase in mileage for trains routed onto the bypass from the existing system which could have negative impacts to UP's operations and costs in comparison to the existing operations.

Further studies were conducted as part of TxDOT's "San Antonio Region Freight Study" to quantify the public and private benefits of the bypass alternatives and provide comparisons to the existing system and operations. These studies also analyzed operational impacts and costs to UP from the diversion of trains from the existing routes to the bypass alternatives presented. No preferred alignment can be determined without considering this information, further coordination with UP, and required environmental studies.

Table 1 contains order of magnitude estimates for the conceptual alternatives considered in this report (see Figure 1 for study area). The table shows the individual costs of the possible San Antonio bypass, southern alignment (i.e., direct route between Lockhart and Seguin), and four alternatives for the northern alignment (i.e., between Lockhart and Taylor). Table 2 shows the estimated costs and associated benefits of the planning cases studied as part of the San Antonio Region Freight Study as summarized below and described in further detail in Section 4 of this report.

In general, the planning cases consisted of:

- Planning Case A (PC A) – San Antonio rail bypass between Seguin and Macdona with new rail yards at Marion and Macdona
- Planning Case B1 (PC B1) – Austin rail bypass between Taylor and Seguin with a new intermodal yard at Macdona, trains routed on the Del Rio Subdivision between East Yard and Tower 112
- Planning Case B2 (PC B2) – Austin rail bypass between Taylor and Seguin with a new intermodal yard at Macdona, trains routed on the Austin Mainline 2 Subdivision between East Yard and Tower 112
- Planning Case C (PC C) – Combined San Antonio and Austin rail bypass between Taylor and Macdona with new rail yards at Marion and Macdona

The costs and conceptual alignments in this report were developed by the Study Team between 2004 and 2005, with additional information gathered from the San Antonio Region Freight Study in 2006 – 2007. These costs have been adjusted for inflation to 2007 dollars, and consideration must be given to such increases annually in the future. Final review and editing of the report were not completed until the release date of this report.

Central Texas Rail Relocation Order of Magnitude Cost Summary Table						
	San Antonio Bypass	Southern Alignment	Northern Alignment			
	Bypass (Seguin to San Antonio/ Macdona)	Lockhart to Seguin Direct Route	UP Existing Route	Blue Alternative	Red Alternative	Taylor to Lockhart Direct Route
Segment Cost	$1,369,610,000	$350,970,000	$545,650,000	$598,000,000	$602,460,000	$702,930,000
Total (Northern + Southern + San Antonio Bypass)			$2,266,230,000	$2,318,580,000	$2,323,040,000	$2,423,510,000

Table 1: Central Texas Rail Relocation Cost Estimates (2007 dollars)

Planning Case	Estimated Cost	Estimated Public Benefit	Ratio: Public Benefit/Cost	Estimated Private Benefit	Ratio: Private Benefit/ Cost	Estimated Total Benefit	Ratio: Total Benefit/Cost
A	$ 1,369,610,000	$ 504,790,000	0.37	$ (162,860,000)	-0.12	$ 341,930,000	0.25
B1	$ 1,595,900,000	$ 587,100,000	0.37	$ 161,990,000	0.10	$ 749,090,000	0.47
B2	$ 1,741,260,000	$ 843,460,000	0.48	$ 157,890,000	0.09	$ 1,001,350,000	0.58
C	$ 2,423,510,000	$1,424,950,000	0.59	$ 95,490,000	0.04	$ 1,520,440,000	0.63
Estimated public and private benefits are based on a 20-year study period.							

Table 2: Central Texas Rail Relocation Cost and Benefit Analysis Summary (2007 dollars)

NOTE: The maps included with this report depict some alternative alignments and/or facilities <u>for illustrative purposes only</u> to assist in general comprehension of the conceptual alternatives and issues discussed. These conceptual alternatives <u>do not</u> represent any proposed location or planned alignment for the relocation of freight rail services. These conceptual alternatives were necessary in order to obtain a "ballpark" estimate of mileage, necessary bridge structures, highway-rail grade separations, earthwork, etc. so that order of magnitude costs could be developed for comparison purposes. Precise planned or proposed alternative alignments can only be identified during the NEPA environmental process, which is not a part of this study or report.

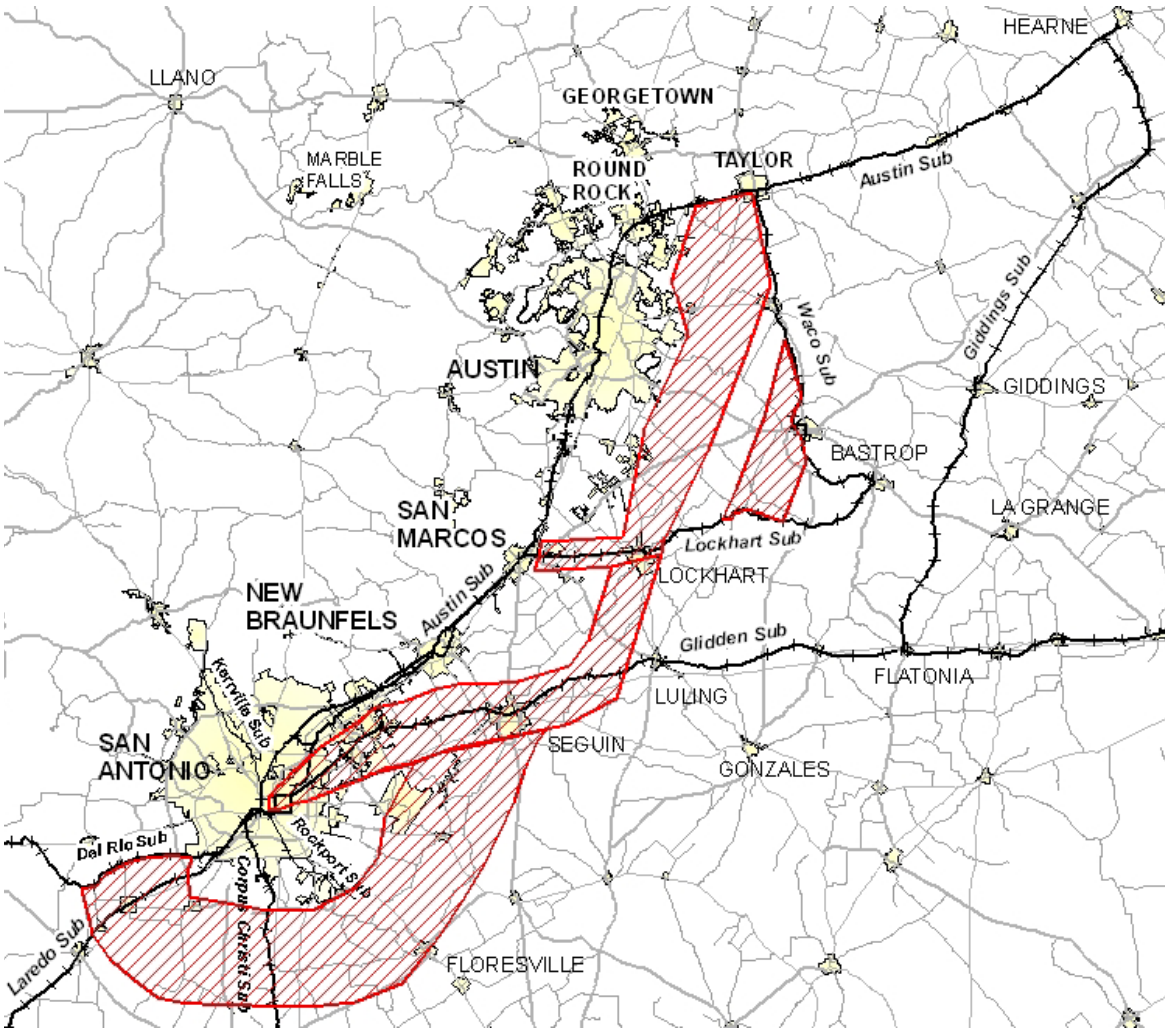

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Figure 1: Potential Bypass Corridors

Introduction

The Texas Department of Transportation (TxDOT) requested that Union Pacific Railroad (UP) assist TxDOT in determining the feasibility of relocating UP's through-freight rail service away from their Austin Subdivision (Sub) route which runs from Taylor through Austin to San Marcos and San Antonio. The purpose of this request was to identify alternative alignments for UP's through-freight services in the central Texas region which could provide substantial benefits to the public sector and UP from the relocation of these services.

TxDOT utilized the services of an engineering consultant to perform an analysis of the existing freight rail system and operations. Under a confidentiality agreement, UP provided necessary data to the consultant for use in the analysis as well as information regarding upgrades that would be necessary to their existing lines, located east of the Austin Sub, if freight rail services were relocated to that route. Significant public and private benefits may be attainable from the relocation of through-freight rail services to an alternative route. The public benefits could include:

- Reductions in public exposure at roadway-rail crossings (vehicular delay, accidents, horn noise) by moving the route outside of the Austin and San Antonio metro areas and other communities including Taylor, Elgin, Bastrop, Lockhart, and San Marcos,
- Reductions in hazardous materials movements within urban areas,
- Improvements to air quality from reductions in vehicular idling and reduced locomotive operations,
- Reductions in fuel usage for vehicular traffic,
- Improvements in economic development opportunities, and
- Possible implementation of commuter rail services in the existing corridor.

Potential benefits to UP could include:

- Reductions in train accident exposure at highway-rail grade crossings,
- Possible increases in freight rail capacity,
- Improvements in train operating efficiency along the new route,
- Possibility of the railroad to "grow business" due to possible increases in capacity,
- Short term reductions in maintenance expenses on the newly constructed alignments, and
- Reductions in Total Central Curve Angle which may correlate to reductions in wear and tear on locomotives, rolling stock, roadbed, track and structures.

The report will be broken down into six separate parts. "Part 1 – Northern Alignment" deals with the feasibility of relocating UP's through freight services between Taylor and San Marcos. This includes an analysis of the technical aspects of UP's report and the identification of conceptual alternative routes. "Part 2 – Southern Alignment" deals with the re-route requirements consistent with eliminating through-freight traffic on UP's Austin Subdivision between San Marcos and San Antonio. "Part 3 – San Antonio Bypass" deals with the feasibility and reroute requirements consistent with eliminating through-freight traffic from within the San Antonio metropolitan area. "Part 4 – Alternatives Analysis" deals with the public and private sector impacts of constructing a rail bypass of the central Texas rail network and provides a cost benefit analysis of those impacts. "Part 5 – Methodology" gives a description of the methodologies used to quantify the public and private benefits. "Part 6 – Conclusion" gives a brief summary of the study's findings.

1.0 – Northern Alignment

1.1 – Description

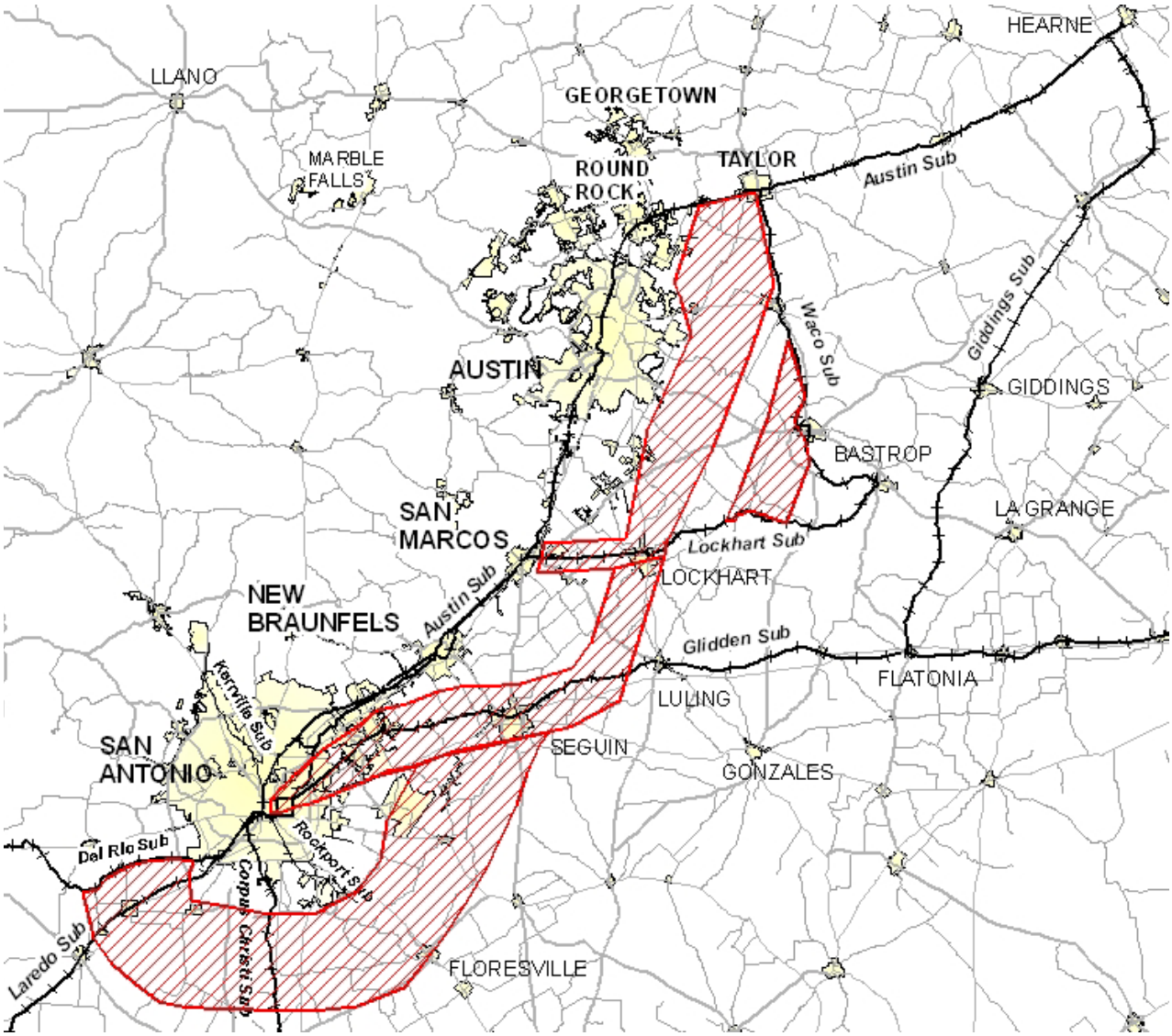
The Northern Alignment under consideration is an area bounded by Taylor to the northeast, Round Rock to the northwest, Lockhart to the southeast, and San Marcos to the southwest. The consultant performed an analysis of the information presented by UP, which provided technical information describing the improvements necessary to reroute UP's through freight rail services on the Austin Sub from Taylor to San Marcos onto an alternative route that utilized all or portions of UP's Waco and Lockhart Subs.

The methodology of the Part 1 technical analysis is summarized below:

- Review the material presented by the UP for the Waco and Lockhart Subs which includes preliminary design assumptions, condensed profiles of the Waco and Lockhart Subs, Top of Rail profile for the Bastrop Cutoff and Material and Force Account Estimates.
- Perform a "windshield survey" of the UP corridors and identify issues or potential conflicts which would inhibit the relocation of freight rail services to the areas identified.
- Locate proposed UP curve reductions and line changes on USGS topographic mapping.
- Based on information gathered during the "windshield survey", develop alternative alignments for the proposed line relocation that may mitigate the issues and conflicts previously determined.
- Utilize USGS Digital Elevation Models (DEM) to develop rough grading quantities for line relocations.
- Review proposed curve reductions by calculating approximate change in curve lengths and maximum track shifts. This information will be used to identify curves which may overlap each other and identify areas where significant Right of Way (ROW) acquisition may be required.
- Development of quantities and costs for the determination of order of magnitude cost comparisons.

Figure 1-0 is a general location map of the proposed Austin – San Antonio rail relocation corridor. Further detail is shown in Figures 1-1 through 1-14 located at the end of this section. Exact alignments would only be determined during the environmental process if the relocation is funded.

The maps included with this report depict some alternative alignments and/or facilities <u>for illustrative purposes only</u> to assist in general comprehension of the alternatives and issues discussed. These alternatives <u>do not</u> represent any proposed location or planned alignment for the relocation of freight rail services. Precise planned or proposed alternative alignments can only be identified during the NEPA environmental process, which is not a part of this study or report.



This map depicts some alternative alignments and/or facilities <u>for illustrative purposes only</u> to assist in general comprehension of the conceptual alternatives and issues discussed. Precise planned or proposed alternative alignments can only be identified during the NEPA environmental process, which is not a part of this study or report.

Figure 1-0: Rail Relocation Study Corridors

1.2 - Northern Alignment Design Assumptions

The preliminary design assumptions included engineering and operating comparisons between the existing Austin Sub route and the proposed diversion to the existing Waco Sub/Bastrop Cutoff/Lockhart Sub route.

The following assumptions are reasonable in nature for proposed high speed heavy-haul freight operations:

- The existing UP route is approximately 77 route miles from Taylor to San Marcos
- The existing route was designed per FRA Class 5 geometry, with a maximum 70 mph operating speed.
- Service to customers must still be provided on the Austin Sub.
- Rail and tie rehabilitation on existing Lockhart and Waco Subdivisions is required for higher operating speeds (quantity estimates are proposing approximately 100% rail relay and 50% tie renewal).
- The improved Lockhart and Waco Subs would include 44.5 miles of second main line with a service road next to the existing Waco and Lockhart Subdivisions.
- The improved Lockhart and Waco Subs would include 14.9 miles of new double main with a service road for the Bastrop Cutoff.
- The improved Lockhart and Waco Subs will require 29 curve reductions on the existing Waco and Lockhart Sub.
- The improved Lockhart and Waco Subs will require 18 miles of line change on the Waco Sub to reduce grades for 50 mph minimum operating speed.
- The study team identified 6 potential grade separations on the Waco Sub, 9 on the Lockhart Sub, and 3 for the Bastrop Cutoff. Each grade separation is estimated at $8 million for the Lockhart and Waco Subs aas well as the Bastrop Cutoff.
- The improved Lockhart and Waco Subs contained 9 universal crossovers spaced approximately 10 miles apart and 1 single crossover.
- The improved Lockhart and Waco Subs included bad order setout tracks spaced at 16 miles between dragging equipment detectors (DEDs).
- The improved Lockhart and Waco Subs included a CTC signal system to allow bidirectional traffic.

In determining alternative route analyses, the study team incorporated UP guidelines with regard to profile, alignment, universal crossover size and spacing, access road requirements, and setout track locations. Additional preliminary design criteria are consistent with the information contained in Table 1-1.

Railroad Design Criteria	
General	
Design train speed	70 mph (max) freight
Track spacing	25'-0", access road one side
Trackbed	
Rail	141# RE Continuously Welded Rail (CWR)
Wood cross ties @ 19.5" c/c	Subballast and Ballast depth 12" minimum (ea.)
Trackbed width for double track w/ access rd	64'-0" at top of subgrade elevation
Minimum Cross slope	1%
Track stabilization	6% lime treatment to a 12" below subgrade depth
Maximum ditch foreslope/backslope	2:1
Horizontal Geometry	
Maximum curvature - desired	1^0-29'
Minimum tangent distance	500'
Mainline turnouts	#24
Siding turnouts	#15
Setout track turnouts	#15
Vertical Geometry	
Minimum grade	0.00%
Maximum grade	1.00%
Maximum rate of change	
Sag curve	0.06
Summit curve	0.1

Table 1-1: Railroad Design Criteria

1.3 - Northern Alignment Geometrics and Location

Upgrades to Waco Subdivision – Taylor to Bastrop

The Waco Sub segment of the alternative route begins with a proposed connection from the Austin Sub at Taylor and continues south to a proposed Bastrop/Bastrop Cutoff just north of Bastrop (See Figures 1-1 and 1-2). This segment contains the following elements:

- 10 curve reductions
- 12.9 miles of second main line
- 17.7 miles of double track line change
- 4 universal crossovers
- 6 bad order setout tracks (1200 ft. and 2 - No.15 turnouts each)
- 8 dragging equipment detectors (DED)
- 11 bridges over drainage ways
- 6 grade separations

Taylor

As shown in Figure 1-3 the Austin/Waco Sub rail/rail crossing in Taylor is located in the middle of town. There is limited room available for a South-East wye connection track. A very tight curve, approximately 7 degrees, will be required which will limit the operating speed to 35 mph. There is also an existing spur track to an agribusiness which will be impacted. Construction of a flatter wye would impact residences, churches, businesses, a city park and an electrical

substation. If a high speed connection between the Austin and Waco Subs is required then a bypass around Taylor should be considered. One possible bypass corridor is shown in blue on Figure 1-3.

Coupland

An overpass for FM 1466 is proposed in Coupland. Coupland is a small community and the main business district is located along FM 1466 and only a few hundred feet away from the railroad (Figure 1-1). Elevating FM 1466 through this area will have a significant impact to access to the businesses. Further study is needed to determine if a grade separation is feasible at this location.

Elgin

The approximate location of the proposed 12.3 mile line change around the west side of Elgin is shown in orange on Figures 1-1 and 1-2, and was identified by the review team on USGS mapping prior to the field visit. Issues/conflicts with the alignment which were identified during the field visit include:

- The proposed SH-95 overpass is at an extreme skew angle. It is likely SH-95 will require horizontal alignment changes to reduce the skew angle.
- There are new homes constructed along FM 1100 in the area of the proposed overpass. Also in the near vicinity of the proposed rail corridor are new housing subdivisions and a new High School.
- Due to the development in the area of the proposed line change corridor, a conceptual alternate location for crossing FM 1100 and US 290 was identified. Figure 1-2 shows in blue the conceptual alternate line change corridor which is located west of the development issues noted above.

If the Elgin line change is not constructed the following issues would need to be considered:

- UP will require 12.3 additional miles of second main track and 19 additional curve reductions.
- Existing ROW along the Waco Sub is very limited for double tracking and curve reductions through Elgin.
- The railroad bridge over US 290 will be impacted by the curve reductions
- Either the rail/rail at-grade crossing of the Austin Area Terminal Railroad will need to be grade separated in downtown Elgin or UP would have to reduce speed over the crossing.
- There are 8 at-grade roadway crossings in Elgin

Elgin to Bastrop

A second line change is included between Elgin and Bastrop from MP 945.2 to MP 950.4 (Figure 1-2). The existing route is approximately 5.2 miles in length and the line change will reduce the route length by approximately 0.5 miles. The line change reduces the total central angle and also reduces the maximum track elevation through this area by approximately 26 feet.

There are several issues to consider regarding conceptual Waco Sub curve reductions. The maximum horizontal shift required for the curve reductions is dependent on the existing degree of curvature and the amount of central angle the curve passes through. Table 1-2 provides a comparison summary of the existing curves versus the reduced curves on the Waco Sub. This information is based on simple curves and does not take spirals into consideration. It does, however, provide an approximate look at the magnitude of the track changes required for the curve reductions. As the size of the maximum track shift increases, so do the impacts to adjacent properties and the need for additional right of way.

PROPOSED CURVE REDUCTIONS WACO SUBDIVISION								
	Existing Curve			Proposed Curve				
Milepost	Degree of Curve	Central Angle	Length (FT)	Degree of Curve	Central Angle	Length (FT)	Change in Length (FT)	Maximum Centerline Shift (FT)
919.60	3	14.55	485	1.4833	14.55	981	496	16
920.30	3	49.68	1656	1.4833	49.68	3349	1693	199
921.00	4	25.42	636	1.4833	25.42	1714	1078	61
921.75	2	15.18	759	1.4833	15.18	1023	264	9
927.50	3	38.17	1272	1.4833	38.17	2573	1301	114
928.10	3	20.90	697	1.4833	20.90	1409	712	33
941.60	3	16.00	533	1.4833	16.00	1079	545	19
942.20	4	58.78	1470	1.4833	58.78	3963	2493	359
943.00	4	49.52	1238	1.4833	49.52	3339	2101	246
943.45	3	50.33	1678	1.4833	50.33	3393	1715	205

Shaded cells indicate proposed curve reductions which results in either overlap of adjacent curves or inadequate tangent distance between adjacent curves

Table 1-2: Waco Subdivision Curves

In some locations where existing curves are in close proximity to each other, the curve reductions cannot be made because the proposed curves overlap, or there is inadequate tangent distance between curves. One example of this situation occurs between MP 942 and MP 943 and is shown in Figure 1-4.

When this situation occurs, the only way to reduce the curvature and achieve the desired operating speed is to construct a line change through the area, as represented by the dashed line in Figure 1-4.

<u>Bastrop Cutoff – Bastrop to Red Rock</u>

The Bastrop Cutoff segment of the conceptual alternative route is designed to shorten UP's existing route by making a direct connection from Red Rock toward the northeast near Bastrop, instead of routing trains (on the existing route) east

from Red Rock to Smithville then back northwest to Bastrop. This conceptual alternative route begins with a proposed connection from the Waco Subdivision just north of Bastrop near MP 950.5 and continues southwesterly to a proposed connection to the Lockhart Subdivision at Red Rock near MP 21.8 (See Figure 1-5). This segment contains the following elements:

- 17.5 miles of new double track.
- 1 universal crossover
- 2 bad order setout tracks (1200 ft. and 2 - No.15 turnouts each)
- 4 dragging equipment detectors (DED)
- 1 major bridge over the Colorado River
- 5 bridges over minor drainage ways (estimated)
- 3 roadway grade separations (estimated)

The approximate route for the Bastrop Cutoff was laid out for informational purposes by the review team on USGS mapping prior to the field visit. Issues/conflicts with the alignment which were identified during the field visit include:

- Development along SH-71 just west of Bastrop.
- The route passes through an oil field just north of Rockne.
- The route appears to closely skirt the east edge of Rockne.
- An additional crossing of SH-21 will be required for the east leg of the wye at Red Rock.

SH-71 (4 lane section with median) between Bastrop and FM-20 is lined with several businesses. The area between County Roads (CR) 969 and 1304 has recently become congested along the south side of SH-71 with a new shopping center and a 500 unit subdivision under development. It will be a challenge to find the path of least resistance for a grade separation over/under SH-71 and construct a double track railroad in this area. This was the most significant issue noted during the field visit between Bastrop and Red Rock. Figure 1-6 shows two possible alternate route corridors that avoid the new shopping center and subdivision. One alternative, shown in blue, crosses SH-71 closer to Bastrop and avoids the issues noted. However this SH-71 overpass will impact the intersection with CR 1304.

The second conceptual alternative, shown in red (Figure 1-5), crosses SH-71 about ½ mile west of the FM-20 interchange, and would require a large cut section for the railroad to pass beneath SH-71. Once the route is south of SH-71 it closely parallels FM-20 to the west en-route to Red Rock.

The probable location of this alternative with respect to SH-71 is currently undeveloped. Figure 1-6, however, depicts areas of development near Bastrop that have been approved by county planners and may inhibit placement of the railroad right-of-way through this area. In addition, the horizontal realignment of

FM-20 may be required to accomplish the overpass where the railroad crosses FM-20.

Upgrades to Lockhart Sub – Red Rock to San Marcos

The Lockhart Sub segment of the route begins with a conceptual connection from the Bastrop/Red Rock Cutoff at Red Rock and continues west to San Marcos on the existing route where the line merges with the Austin Sub (See Figures 1-7 and 1-8). This segment contains the following potential upgrade elements:

- 19 curve reductions
- 31.5 miles of second main line
- 4 universal crossovers and 1 single crossover
- 4 bad order setout tracks (a total of 1200 track feet and 2 - No.15 turnouts each)
- 5 dragging equipment detectors (DED)
- 22 bridges over drainage ways
- 9 grade separations

Table 1-3 provides a comparison summary of the existing curves versus the reduced curves on the Lockhart Sub. There are several problem areas with the proposed curve reductions on the Lockhart Subdivision. In general, the curve reduction from the Taylor to Bastrop section is still applicable. In particular there are six curves that overlap. The overlap is severe especially with the curves through the town of Lockhart. Reducing the curves for 70 mph operation in Lockhart could have major impacts to the community. See Figure 1-9 for a map of Lockhart which illustrates the magnitude of the curve reduction issues. Due to the constraints of major drainage ways, parks, cemeteries, businesses and homes, there is little opportunity to reduce curvature in order to increase train speeds in a manner consistent for a mainline railroad.

PROPOSED CURVE REDUCTIONS LOCKHART SUBDIVISION								
	Existing Curve			Proposed Curve				
Milepost	Degree	Central Angle	Length	Degree	Central Angle	Length	Change in Length (ft)	Maximum Shift (ft)
22.67	2	35.63	1782	1.4833	35.63	2402	621	50
23.50	4	52.98	1325	1.4833	52.98	3572	2247	285
23.95	2.07	15.45	746	1.4833	15.45	1042	295	10
24.80	2.45	20.67	844	1.4833	20.67	1394	550	25
25.75	2	12.55	628	1.4833	12.55	846	219	6
26.35	4	55.00	1375	1.4833	55.00	3708	2333	310
27.10	4	42.03	1051	1.4833	42.03	2834	1783	173
27.55	3	24.05	802	1.4833	24.05	1621	820	44
30.65	1.6722	40.67	2432	1.4833	40.67	2742	310	29
33.30	2.5	24.53	981	1.4833	24.53	1654	673	37
35.03	2.49	27.12	1089	1.4833	27.12	1828	739	45
35.30	4	63.65	1591	1.4833	63.65	4291	2700	430
35.95	4	30.00	750	1.4833	30.00	2023	1273	86
36.40	2	27.45	1373	1.4833	27.45	1851	478	29
36.85	2.99	23.05	771	1.4833	23.05	1554	783	40
44.65	2	30.03	1502	1.4833	30.03	2025	523	35
45.45	2	22.02	1101	1.4833	22.02	1485	384	19
50.70	3	25.07	836	1.4833	25.07	1690	854	48
51.15	2	17.01	851	1.4833	17.01	1147	296	11

Shaded cells indicate proposed curve reductions which results in either overlap of adjacent curves or inadequate tangent distance between adjacent curves

Table 1-3: Lockhart Subdivision Curves

Double tracking the Lockhart Sub included 3 grade separations in Lockhart. Figure 1-9 identifies possible locations of the proposed overpasses at US-183, Blanco St. and at Pecos St.

- The overpass for US-183 would require additional spans to cross Branch Creek. An intersection for Park Road within the limits of the proposed overpass would be affected by the construction of the overpass.
- Blanco Street is in a residential area. The intersection of Blanco and Willow Streets would be impacted. Either some homes would need to be removed to make way for a frontage road or the east end of Willow Street would need to be closed. There is a day care business located just north of the existing crossing.
- The south approach to the Pecos Street crossing is very closely bordered by several silos on the east side of the street and a few houses and a small commercial building on the west side of the street. The north approach is bordered by a City park on the west.

Lockhart Bypass

One possible alternative for avoiding the public impacts, curve reduction, and grade separation issues within Lockhart (shown in Figures 1-7 and 1-9) is to construct a new 70 mph alignment that would bypass Lockhart to the north (green alignment). A connection could be made to the UP Lockhart Sub east of Lockhart near MP 33, then traverse in a northwesterly direction, to a point where

the proposed SH-130 and existing US-183 separate, approximately 2 miles north of the existing US-183/UP crossing.

The Lockhart north bypass would then reconnect to the UP Lockhart Sub approximately 2 ½ miles west of the existing US-183/UP crossing. This bypass would be 6.2 miles in length and avoid the overlapping curve reduction issue upgrading the existing UP alignment through Lockhart would present.

Maxwell

The proposed FM-1966 overpass at Maxwell (Figure 1-8) would be challenging due to a sharp curve in the road immediately north of the existing crossing at the intersection with CR 241. There is also a commercial property in this same area which would likely effect the ultimate location of the overpass. The intersection of FM-1966 with Church Street is immediately south of the existing crossing. The overpass would likely need to be moved west of the existing crossing location and would require right-of-way through an area currently occupied by residences.

Reedville

The north and south approaches to the proposed FM-1984 (Figure 1-8) overpass in Reedville are closely lined with residences and driveways. There is minimal room available to construct an MSE wall type overpass and there are streets intersecting FM-1984 close to the existing crossing.

San Marcos

The biggest challenges facing the conceptual double tracking through San Marcos are the proposed FM-12 overpass and the proposed wye connection between the Lockhart and Austin Subs near MP 51.4. (See Figure 1-10 for a map of San Marcos which illustrates these impacts.) FM-12 is lined with multiple businesses and shopping areas in the vicinity of the proposed overpass. Within the limits of an overpass, several driveways would be impacted as well as intersections with Cheatham Street, Long Street, Bobcat Drive, and Thorpe Lane. The existing FM-12 crossing of the Austin Subdivision is also within the limits of the proposed overpass. To further complicate the overpass, FM-12 is on a curved alignment north of the existing crossing. The proposed wye connection appears to diverge from the Lockhart Sub near the IH-35 southbound frontage road crossing. Constructing a new track through this area is unlikely because the area has been developed with several stores and restaurants. The original wye connection was located near the FM-12 crossing and appeared to be at least a 12° curve. The old wye track roadbed is still visible. Reconstructing on the old alignment would result in a low speed connection and would require turnouts to be constructed in a curve on both the Lockhart and Austin Subs.

The UP route did not indicate any curve reductions south/west of IH-35 in San Marcos. If 70 mph is desired through town there will be a major curve reduction

required near MP 51.5 which is also the location for the proposed FM-12 overpass. This curve reduction would have significant impact to businesses and homes.

San Marcos Bypass

As with Lockhart, a bypass of San Marcos could mitigate the complexities that would be encountered from upgrading the rail facility in and through San Marcos. Shown in Figure 1-12, a possible bypass route would depart the Lockhart Subdivision just west of Maxwell, traverse in a south and southwesterly direction, then reconnect to the UP Austin Sub north of FM-1102.

This conceptual alternative route contains six at-grade crossings that would require signaled and gated protection, four locations (FM-621, FM-1978, and a local road at or near Sta. 512, and Centerpoint Road) where the roadways cross over the railroad, and four locations (FM-245, SH-123, FM-266, and IH-35 with frontage roads) where the railroad would span roadways.

The majority of this alignment is very rural. There may be a minor impact to residential areas along Posey Road as the alignment nears the Austin Sub. The alignment must also avoid a substation and at least two cemeteries. The major impact, however, will be grade separating the San Marcos bypass and IH-35 and its frontage roads. The cost estimates for this alignment included associated bridge costs for the railroad crossing over both IH-35 and the frontage roads.

By adjusting the alignment, the Study Team identified a possible location where the existing grade permitted the railroad to span over IH-35, effectively reducing the overall cost of bridge construction, and lessening the impact on the traveling public. Initial estimates for a facility where IH-35 and frontage roads crossed over the railroad totaled $26.6 million. By spanning IH-35 with the railroad, however, the estimated costs have been reduced to approximately $8.2 million.

Lockhart – San Marcos South Bypass

Yet another conceptual alternative for avoiding the curve reduction and grade separation issues between and including Lockhart and San Marcos would be to construct a 70 mph bypass around Lockhart to the south toward Seguin (Figures 1-7 & 1-9, red alternative). Through-freight traffic would re-route to San Antonio via a new conceptual direct corridor from Lockhart, connecting to the existing UP Glidden Subdivision at Seguin.

Regarding the Lockhart south bypass, a connection would be made to the UP Lockhart Sub east of Lockhart near MP 33 (Figures 1-7 & 1-9), then traverse in a southwesterly direction, crossing US-183 somewhere south of the Lockhart Municipal Airport. The alignment would then move primarily in a westerly direction (Figure 1-7), crossing FM-20 approximately south of the FM-20/CR-109 interchange, and connect to a new conceptual alignment near the CR-211

interchange (Figure 1-8). Although this route is approximately 9 ½ miles in length, the issues regarding through-freight traffic between Lockhart and San Marcos along the alignment proposed by UP would be eliminated.

Cost estimates for the Lockhart south bypass routes are included in Section 1.5 of this report.

Direct Route Alternative - Taylor to San Marcos

As previously mentioned, there are many challenges for upgrading the existing Waco and Lockhart Subs between Taylor and San Marcos. Consequently, the Study Team investigated a possible new location conceptual alternative which traversed between Taylor and Lockhart in the most direct route (Figure 1-11), and incorporates bypass alternatives mentioned earlier in the report regarding Taylor and Lockhart. The proposed connection to the Austin Sub at San Marcos would be via the San Marcos bypass.

As shown in Figure 1-11A, the "Taylor to Lockhart Direct Route" would connect to the previously proposed "blue route" Taylor bypass, however instead of connecting near MP 924 of the Waco Sub (as with the alternative routes previously discussed) this alignment would go under SH-95 and the existing Waco Sub, then traverse cross country in a south-southwesterly direction to Lockhart. The Taylor bypass contains one at-grade crossing (FM-619) and one additional grade separated structure, where CR-112 would cross over the railroad.

Between Taylor and US-290, the route would be grade separated for the major arterial roadways. Lower density roads would be signaled and gated, while private crossings would simply receive 'cross-buck' protection. Along the route conceived by the Study Team, there were seven locations deemed as private crossings and 22 public at-grade crossings. The Study Team also determined that eleven 2-lane roads could be grade separated by spanning over the railroad. The two major highways in the study area, US-290 and SH-71, would also span over the railroad, since in both locations the railroad facility is at an elevation substantially lower than the highway.

A few residential areas could be impacted, in particular those near the FM-1660/CR-406 intersection and at the end of Eyerly Road. At the Williamson/Travis Counties line, the existing FM-973 bridge that crosses Brushy Creek is approximately 550' long. The Study Team included a railroad bridge of equal length in the estimated costs.

At US-290 (Figure 1-11B,), the conceptual alignment is in a substantial cut, therefore it is anticipated that US-290 would pass over the Direct Route alignment. South of US-290, the alignment profile should be elevated to cross over both the Austin Area Terminal Railroad (AUAR) and Littig Road.

Between the Colorado River crossing and SH-71, the conceptual alignment passes through a rather large gravel pit/cement plant to the east of Norwood Lane. In an effort to avoid this established business, the Study Team investigated an alternative route that would pass to the west of Norwood Lane en-route to SH-71. The profile through this area is on fill, however at SH-71, the railroad would pass under the highway.

South of US-71 (Figure 1-11C), both the original and conceptual alignments would have minor impacts to residential areas, in particular near Jacobsen Road. North of FM-812, the Xtreme Energy Company's East Elroy oil fields may be impacted depending upon the proximity of the alignment to their active sites. The original alignment passes to the east of the oil fields, while the conceptual alignment passes to the west, paralleling Maha Creek then Long Hollow, crossing SH-21 near Skyline Road.

South of SH-21, prior to connecting to the northern end of the proposed SH-130 Segment 6 right-of-way (Figure 1-11D), the alignment passes to the west of the Dry Creek Reservoir and dam before crossing FM-1185.

The alignment would somewhat parallel SH-183 on the east side, crossing over the highway (and subsequently SH-130) near Plum Creek Once on the west side of SH-183/SH-130 the alignment connects to the west leg of the Lockhart North bypass, then to the Lockhart Sub west of Lockhart near FM-2720, which will need to be grade separated. Table 1-4 summarizes a mileage comparison between the existing UP infrastructure and proposed alternatives.

The maps included with this report depict some alternative alignments and/or facilities for illustrative purposes only to assist in general comprehension of the alternatives and issues discussed. These alternatives do not represent any proposed location or planned alignment for the relocation of freight rail services. Precise planned or proposed alternative alignments can only be identified during the NEPA environmental process, which is not a part of this study or report.

1.4 - Quantities and Costs

An engineer's estimate of probable construction quantities and order of magnitude costs has been developed for comparison to UP's estimate for each of the three segments. Assumptions made by the review team have been summarized in the following paragraphs.

<u>Track Construction</u>

Quantities for track construction were developed by the review team from the following information provided in the UP report:

- UP Preliminary Design Assumptions

- Condensed track profiles for the Waco and Lockhart Subdivisions
- Top of rail profile for the Bastrop to Bastrop Cutoff
- Where information was lacking, especially on the Bastrop to Bastrop Cutoff, quantities were taken from UP's Material and Force Account Estimate
- No. 15 turnouts to access industrial sidings were used
- At-grade crossings are pre-cast concrete crossing panels, 26' in length
- Embankment quantities were not modeled for the second track construction

Site Work

Rough grading quantities were calculated for the Bastrop Cutoff by creating a grading model. USGS Digital Elevation Model (DEM) data was used to create a Digital Terrain Model (DTM) for the existing ground surface. Proposed cuts and fills were developed from modeling a standard roadbed section template across the DTM. The proposed typical section criteria are included in Table 1-1. The earthwork was calculated using end area format with a 200 foot cross section interval. It has been assumed that fills would include a 30% shrinkage factor.

Signal

Based on the limited signal criteria and information an independent cost estimate was developed for the 3 major segments of the Lockhart and Waco Subs route. The UP signal estimate appears to be valid for this conceptual level analysis.

Bridge Analysis

The following assumptions were made for the bridge analysis:

- Stream Crossings with existing Timber Pile Trestle Bridges - A new, parallel Pre-cast Concrete Box Girder (PCB) bridge consisting of 4 standard double box girders in width supporting a new track and maintenance road.
- Stream Crossings with existing Steel Bridges - A new, parallel ballasted deck, Deck Plate Girder (DPG) bridge supporting one new track.
- Stream crossings where a curve change required the existing bridge to be replaced - A new PCB bridge consisting of 8 standard double box girders in width supporting two tracks at 25' centers and a maintenance road.
- Stream crossings at new alignment locations - A new PCB bridge consisting of 8 standard double box girders in width supporting two tracks at 25' centers and a maintenance road.
- Colorado River and Cedar Creek Crossings - A new ballasted deck, DPG bridge supporting two new tracks at 25' centers.

Many of the existing bridges in the study area are open deck timber pile trestle structures. This analysis assumed that the bridges not affected by track curvature reductions will be unchanged. These bridges may, however, need to be replaced in the future as either a maintenance or capital improvement item. The approximate cost of these replacements is $44 million, of which $20.5 million is on the Waco Sub and $23.5 million is on the Lockhart Sub.

Cost/Quantity Summaries

As mentioned in earlier in this report, viable alternative routes (Figure 1-11) were determined by the study team which addressed curve reduction and physical obstruction issues contained within the UP report. Consequently the route mileage increased slightly and is summarized in Table 1-4 below. Table 1-5 shows the estimated route mileage for each of the planning cases studied as part of the San Antonio Region Freight Study described in further detail in Section 4 of this report.

	Existing Route - Waco and Lockhart Subdivisions	Existing Route - Austin Subdivision	UP Waco/Lockhart Subdivision Report	Blue Alternative	Blue (Elgin) and Red (Bastrop Cutoff) Alternative	
Taylor to San Marcos via Austin		69.8				
Taylor to Bastrop	33.7		33	34.3	34.3	Waco Sub MP 919 to MP 950.5
Bastrop to Red Rock via Smithville	40.7					Waco Sub MP 950.5 to MP 969.4 and Lockhart Sub MP 0.0 to MP 21.9
Bastrop to Red Rock via new Cutoff			14.9	15	15.5	Waco Sub MP 950.5 to Lockhart Sub MP 21.9
Red Rock to San Marcos	31		31	31	31	Lockhart Sub MP 21.9 to MP 51.9 and Austin Sub MP 209.1 to MP 209.7
Totlal Route Mileage	**105.4**	**69.8**	**78.9**	**80.3**	**80.8**	

Table 1-4: Estimated Route Mileage

Mileage Comparison	Limits	Miles
Existing Route	Macdona to Seguin via Del Rio Sub	54
PC A - San Antonio Bypass (including North Seguin Bypass)	Macdona to Seguin	68
Existing Route	Taylor to Macdona via ASML 1 and Del Rio Sub	127
PC B1 - Austin Bypass	Taylor to Seguin via Bypass, Seguin to Macdona via Del Rio Sub	131
PC B2 - Austin Bypass	Taylor to Seguin via Bypass, Seguin to Wye Connection at ASML 2, Wye to Tower 112 via ASML 2, Tower 112 to Macdona via Del Rio Sub	131
Existing Route	Taylor to Macdona via ASML 1 and Del Rio Sub	127
PC C - Combined San Antonio and Austin Bypass	Macdona to Taylor via Bypass	145

Table 1-5: Estimated Planning Case Route Mileages

As noted, the existing Waco/Lockhart Subs route with the Blue Alternative (Figure 1-11) increases the route mileage by 1.4 miles. Between Taylor and Bastrop, this number includes the conceptual re-route around Taylor in order to allow for a high-speed connection to the existing Austin Sub. Also included is the additional mileage required to bypass a residential community and high school in Elgin. In order to maintain consistency, the mileage was increased to include that length of the Austin Sub where the Blue Alternative route would connect. Between Bastrop and Red Rock, the Blue Alternative route is only 1/10th of a mile longer than that contained within the UP report, however it too is not a desirable alternative.

The existing Waco/Lockhart Subs route with the Red Alternative includes that portion of the Blue Alternative through Taylor and Elgin in addition to the Study Team's conceptual alignment around Bastrop, then nearly paralleling FM-20 to Red Rock. Although this route is approximately 2 miles longer than indicated in the UP report, it presents an alignment from Taylor to Red Rock where many constructability issues could be rectified.

Since bypasses around either Lockhart or San Marcos were not included in the UP report, the mileage between Red Rock and San Marcos was assumed to be consistent with all alternatives.

Mileage comparisons for the Study Team alternatives that incorporated the Taylor to Lockhart Direct Route alignment, including bypasses at Lockhart and San Marcos, are summarized in Table 1-6.

	Independent bypass segment mileage	Existing Route - Austin Subdivision	Direct Route with bypass options
Taylor bypass	4	69.8	4
Direct Route Alternative	47.5		47.5
Lockhart North bypass	6.2		
Lockhart North - West leg	2.9		2.9
Lockhart Sub (existing section used)	5.4		5.4
San Marcos bypass	15		15
Add'l mileage to SM bypass conn		4.2	
Totlal Route Mileage	**81**	**74**	**74.8**

Table 1-6: Northern Bypass Alternative Approximate Mileage

The existing mileage along the Austin Sub is determined from the point where the Study Team's Taylor bypass connects to the Austin Sub east of Taylor at or near MP 142.12 to where the Study Team's conceptual San Marcos bypass

connects to the Austin Sub south of San Marcos at or near MP 216.19. As can be readily noticed, the Direct Route alignment nearly matches the current Austin Sub route mileage from just south of San Marcos to Taylor, the predominant route of northbound traffic, while decreasing the distance predominately southbound trains currently travel between Taylor and San Marcos by approximately 31 miles.

An overall cost comparison between all alternatives analyzed is included in Tables 1-7, while Table 1-8 provides a cost summary and comparison of alternative routes (including bypass routes) investigated.

A cost comparison between the UP report route and that duplicated as best as possible by the Study Team did not produce any major discrepancies for the overall cost.

Within the Bastrop cut-off segment, however, the Study Team's bridge cost estimate was considerably higher than that contained within the UP report. Since the UP report was not detailed regarding the quantity of bridges that would be built, it is understandable how the Study Team's Bastrop cut-off segment bridge costs could be higher. The cumulative bridge cost for the three segments, however, is comparable to the Study Team's estimate.

Segment costs for the Blue and Red Study Team alternatives did not go into the same amount of detail as the route cost comparison. Rather, the Study Team took a 'per mile' cost for each segment and applied that factor to the additional re-route mileage.

The estimated costs of the Blue and Red alternatives, therefore, are represented in a lump sum figure, without detail.

Cost Summary Table				
	Union Pacific	Study Team	Blue Alternative	Red Alternative
Waco Subdivision				
Engineering	$7,960,000	$7,960,000		
Right-of-way	$3,390,000	$3,390,000		
Earthwork	$31,720,000	$40,740,000		
Track Construction	$56,650,000	$53,260,000		
Drainage	$1,340,000	$1,060,000		
Structures	$73,630,000	$69,060,000		
Signalization	$11,350,000	$10,180,000		
Homeline Freight	$3,390,000	$3,390,000		
Equipment Charges	$3,390,000	$3,390,000		
Contingency	$19,310,000	$19,310,000		
Subtotal	**$212,130,000**	**$211,740,000**	**$248,140,000**	**$248,140,000**
Bastrop Cutoff				
Engineering	$4,560,000	$4,560,000		
Right-of-way	$2,230,000	$2,230,000		
Earthwork	$18,040,000	$27,160,000		
Track Construction	$28,330,000	$28,330,000		
Drainage	$1,120,000	$1,120,000		
Structures	$40,840,000	$63,440,000		
Signalization	$5,620,000	$6,790,000		
Homeline Freight	$2,230,000	$2,230,000		
Equipment Charges	$2,230,000	$2,230,000		
Contingency	$10,180,000	$13,580,000		
Subtotal	**$115,380,000**	**$151,670,000**	**$152,980,000**	**$157,440,000**
Lockhart Subdivision				
Engineering	$7,960,000	$7,320,000		
Right-of-way	$1,120,000	$1,120,000		
Earthwork	$15,910,000	$16,970,000		
Track Construction	$48,700,000	$45,300,000		
Drainage	$1,120,000	$340,000		
Structures	$107,150,000	$94,100,000		
Signalization	$12,410,000	$13,580,000		
Homeline Freight	$2,230,000	$2,020,000		
Equipment Charges	$2,230,000	$2,120,000		
Contingency	$19,310,000	$18,040,000		
Subtotal	**$218,140,000**	**$200,910,000**	**$196,880,000**	**$196,880,000**
Total	**$545,650,000**	**$564,320,000**	**$598,000,000**	**$602,460,000**

Table 1-7: Cost Summary Table – 2007 dollars

Table 1-8 gives a segment breakdown of costs for the Taylor, Lockhart, and San Marcos bypass alternatives, the Taylor to Lockhart Direct Route alternative, as well as a cumulative summary for what may be deemed the most direct route between Taylor and San Marcos.

The Taylor bypass, shown in Blue in Figure 1-1, provides for a high-speed double track connection between the Austin and Waco Subs, while minimizing the impact to residential and commercial areas at the proximity of current interchange. Since this area is developed with churches, residences, and

agribusiness, the estimated cost per acre for right-of-way procurement was substantially higher than for other sectors within the study area.

Cost Summary Table				
	Taylor Bypass	Lockhart North Bypass	San Marcos Bypass	Taylor to Lockhart Direct Route
	3.8 Double Track Route Miles	6.2 Double Track Route Miles	14.9 Double Track Route Miles	52 Double Track Route Miles
Earthwork & Right-of-Way	$7,160,000	$8,840,000	$33,050,000	$165,010,000
Railroad Construction	$21,690,000	$21,450,000	$81,620,000	$273,980,000
Roadways	$31,730,000	$24,190,000	$29,960,000	$58,980,000
Miscellaneous (Utilities, Drainiage, Stormwater Pollution Prevention)	$3,120,000	$2,980,000	$7,680,000	$7,420,000
Engineering, Permitting, Contractor Mobilization & Construction Management	Not Included	Not Included	Not Included	$105,660,000
Contingencies	$11,280,000	$10,880,000	$27,870,000	$91,880,000
Total	**$74,980,000**	**$68,340,000**	**$180,180,000**	**$702,930,000**

Table 1-8: Bypass Cost Summary – 2007 dollars

As with Taylor, the Lockhart North bypass could minimize the impact to the residential and commercial areas surrounding Lockhart. An existing cemetery and city park could also be avoided, and with the west leg of the bypass paralleling the proposed SH-130 Segment 6 right-of-way, an already optimum route avoiding a Texas State Park is utilized. This bypass also simplifies the Railroad/US-183 crossing. A higher than average cost per acre for right-of way acquisition was also used for this segment.

The final, and perhaps most effective, bypass analyzed by the Study Team minimizes a myriad of complexities regarding through-freight traffic in and around San Marcos. Initially three conceptual alignments were reviewed, one which attempted to follow the proposed FM-110 San Marcos outer loop. In two of the three alternatives, 'fatal flaw' characteristics such as a city reservoir and three cemeteries contained within the conceptual alignment forced the bypass to start further east of San Marcos and re-connect to the UP's Austin Sub further to the south of San Marcos.

The cost summary includes a grade separation between the railroad and IH-35, with the railroad crossing over IH-35. By adjusting the alignment, the Study Team was able to determine a location where the existing grade would permit the railroad to cross over IH-35, effectively reducing the cost of bridge construction (if IH-35 were to span the railroad).

Taylor to Lockhart Direct Route

In order to analyze the most re-route options, the Study Team identified a conceptual direct route from Taylor to Lockhart (Figure 1-11). The Direct Route

alternative minimizes the impact to Bastrop's long range development plans and, for the most part, avoids currently developed areas. Encompassing the Taylor bypass on the north end and connecting to the west leg of the Lockhart North bypass at the southern end, the Direct Route alignment allows for a double track, bi-directional, grade-separated railroad facility that optimizes Class 5 operating speeds.

In utilizing this alternative, the overall distance from Taylor to San Marcos is nearly that of the current Taylor to San Marcos via Austin segment. In terms of distance, this alternative would appear to benefit southbound through-freight traffic more so than northbound through-freight traffic. The Direct Route alternative, however, may be capable of design for Class 5 operating speeds for freight rail traffic, compared to the Class 4 speeds on the existing Austin Sub, thereby benefiting through-freight traffic in both directions. However, rerouting trains onto the direct route or other alternative could have negative impacts to UP's operations and costs in comparison to the existing operations.

Further studies were conducted as part of the San Antonio Region Freight Study to quantify the public and private benefits of the bypass alternatives and provide comparisons to the existing system and operations. The study also analyzed the operational impacts and costs to UP from the diversion of trains from the existing routes to the bypass alternative. The results of that study are included in Section 4 of this report. However, the public and private benefits of relocating UP to an improved Waco Subdivision were not quantified as part of that study. The benefits of relocating to an improved existing route could be quantified as part of the environmental process should the project move forward. The study team has not identified a preferred alignment, which would require further coordination with UP and required environmental studies.

Table 1-8 summarizes order of magnitude costs of the Direct Route alignment. This estimate includes the Taylor bypass estimate, with revisions for the grade separated Waco Sub/SH-95 crossing where it is intended for both to span the Direct Route alignment, and also the west leg of the Lockhart North bypass.

Table 1-9 summarizes the estimated cost of the UP report alignment and the alternatives investigated by the Study Team. Although the Taylor to San Marcos via the Direct Route alternative with Taylor, Lockhart, and San Marcos bypasses is considerably costlier than the UP Report Route, this alignment will provide for an unrestricted railroad facility which is optimized for Class 5 operating speeds, bi-directional, and nearly entirely grade-separated.

Alternative Cost Comparison	
Route/Segment	**Route Cost**
UP - Waco & Lockhart Subs	**$545,650,000**
Waco Sub	$212,130,000
Bastrop Cutoff	$115,380,000
Lockhart Sub	$218,140,000
Study Team Due Dilligence	**$564,320,000**
Waco Sub	$211,740,000
Bastrop Cutoff	$151,670,000
Lockhart Sub	$200,910,000
Study Team Waco & Lockhart Blue Alternative	**$598,000,000**
Waco Sub	$248,140,000
Bastrop Cutoff	$152,980,000
Lockhart Sub (Maxwell to SM)	$196,880,000
Study Team Waco & Lockhart Red Alternative	**$602,460,000**
Waco Sub	$248,140,000
Bastrop Cutoff	$157,440,000
Lockhart Sub	$196,880,000
Taylor to Lockhart Direct Route	**$702,930,000**
San Marcos Bypass*	**$180,180,000**

***NOTE: The San Marcos Bypass is recommended for the above alternatives if returning to the Austin Sub from the Lockhart Sub.**

Table 1-9: Overall Alternative Cost Comparison – 2007 dollars

1.5 - Northern Alignment Technical Aspects

In Summary, the Study Team reviewed the material provide by UP, including preliminary design assumptions such as condensed profiles of the Waco and Lockhart Subs, and top of rail profiles for the conceptual Bastrop cutoff. Prior to performing a "windshield survey" of the UP route, the Study Team located the proposed route on USGS topographical maps, then identified through field analysis potential conflicts which could inhibit the placement of a rail corridor within areas provided by UP.

The Study Team then developed alternative alignments for the proposed line relocation which may mitigate the issues and conflicts determined from the "windshield survey." As mentioned in the body of the report, alternative alignments were investigated through and around Taylor, Elgin, and Bastrop.

Using industry standard costing, the Study Team developed an independent cost comparison to UP's estimates. Although a large discrepancy existed between

costs of the Bastrop Cutoff (in particular with respect to railroad bridges), the overall cost as determined by UP was well within reason, and was approximately $19 million lower than that determined by the Study Team.

The existing alignment with the red alternatives discussed within the report was deemed by the Study Team as being the most viable alternative of the options that maintained consistency with the alignment contained within the information provided by UP. This alignment, however, would cost approximately $602 million and did not fully satisfy the potential conflicts in the Bastrop area.

UP information did not specifically address conceptual re-route options through and around Lockhart and San Marcos. Due to the physical restrictions noticed during the windshield survey in both Lockhart and San Marcos, curve reduction to increase operating speeds would not be attainable without considerable line changes. As a result, the Study Team investigated alternative routes around these municipalities and determined that bypassing Lockhart and San Marcos is feasible; and thus the desired operating speeds are attainable and would also provide benefits to the public sector in those communities.

To provide a conceptual analysis determining the “most desirable” route, the Study Team also analyzed an alignment that traversed cross-country, completely independent of existing freight routes. Incorporating bypass segments at Taylor, Lockhart, and San Marcos, the effective route (in terms of mileage) from Taylor to just south of San Marcos on the Austin Sub is nearly identical to the existing route predominately used by northbound freight trains, and approximately 31 miles shorter than the current route traveled by predominately southbound trains.

Although the cost of this alternative is higher than the information provided by UP, it provides for a predominantly grade separated, bi-directional, double track rail facility which optimizes Class 5 operating speeds. Maintaining higher operating speeds decreases trip times and train delays per 100 train miles, and effectively may produce a cost benefit in terms of fuel consumption and crew utilization to UP. This facility could provide public benefits in the form of reduced congestion, reduced grade crossing delays, reduced vehicular emissions, improved safety, vehicular fuel savings, implementation of commuter rail services in the corridor, and could foster economic development opportunities.

2.0 - Southern Alignment

2.1 - Description

The basic premise of the Southern Alignment freight rail relocation analysis is to determine the feasibility of re-routing through-freight trains from UP's Austin Sub between San Marcos and San Antonio. The Austin Sub passes near significant public facilities and it was determined that an alternative route should be considered for through freight traffic on the entire Austin Subdivision.

Figure 2-1 of this section shows the region and the subdivisions discussed in this section.

The Austin Sub between San Marcos and San Antonio is a double track, Centralized Traffic Control (CTC) dispatched railroad. Austin Sub Mainline 1 (ML1) is the former Missouri Pacific Railroad (MP) route approaching San Marcos from the north, via Austin. Austin Sub ML2 is the former Missouri-Kansas-Texas Railroad (MKT) line and approaches San Marcos from the east, via Lockhart.

Typically, northbound traffic leaving San Antonio will travel through San Marcos to Taylor via Austin on ML1. This is also the predominant track used by Amtrak. ML2 typically handles southbound movements from San Marcos, and is also the predominant track used by the BNSF, which has trackage rights along the UP into San Antonio and to Laredo.

The two mainlines distance themselves north of San Antonio, coming into the vicinity on two distinctly different routes. ML1 comes into the San Antonio central business district (CBD) to the west of IH-10/IH-35 en-route to SoSan yard, while ML2 closely parallels IH-35 to the east of the CBD, then turns south passing by the SBC Center, and then follows IH-10 west to a connection with the former Southern Pacific Railroad (SP) alignment.

The former SP alignment is known as the Del Rio Sub between SoSan and Kirby Yards, and then the Glidden Sub from the east end of Kirby Yard to Houston. En-route to Houston, this alignment passes to the south of the CBD, then bears north at the interchange with Austin Sub ML2 and travels past the east side of Alamodome before turning back in an easterly direction, momentarily paralleling IH-35, then paralleling FM-78 past Kirby, Randolph AFB and eventually paralleling IH-10 to Houston. Figure 2-2 provides a schematic of the San Antonio rail network, including yard facilities.

Figure 2-1 San Antonio Region

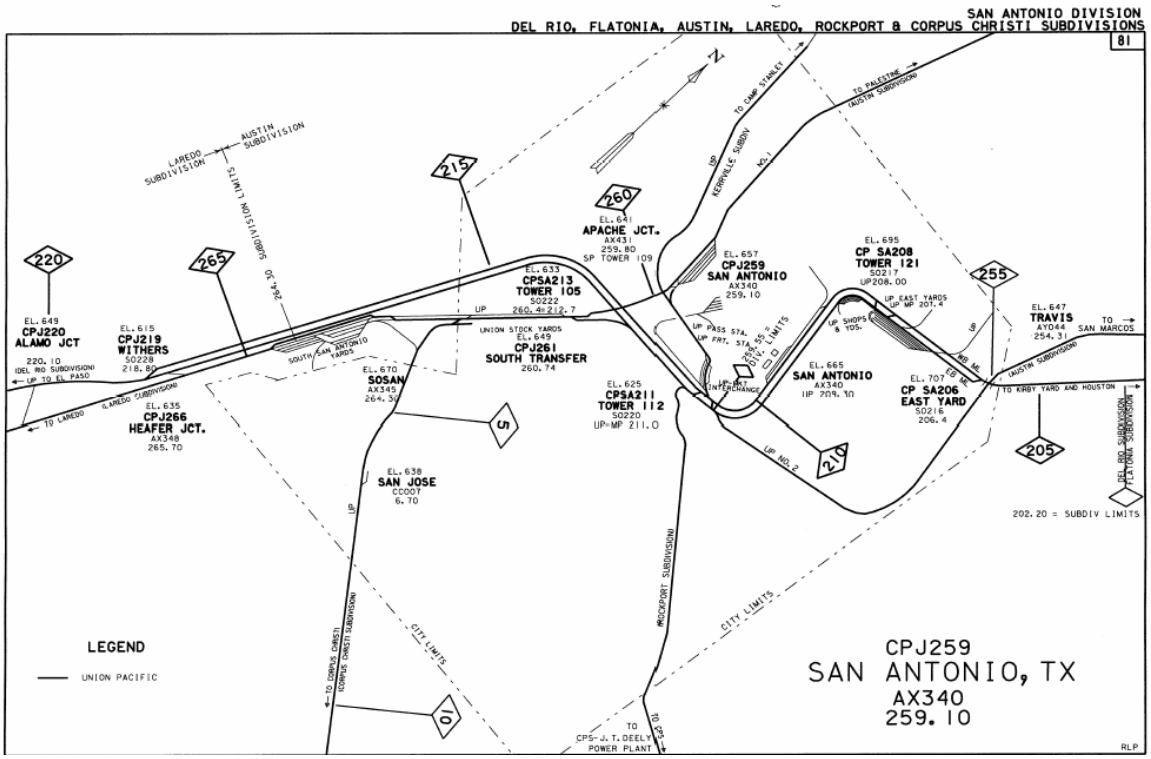


Figure 2-2: San Antonio Rail Network

Along the Del Rio Sub there are 3 functioning yard facilities. Kirby Yard, at the eastern most part of the Del Rio Sub serves as an in-line fueling facility, a crew change point, and also has an auto facility along the north side of the yard. Figure 2-3 shows a schematic of Kirby Yard. East Yard, which is located along the portion of the Del Rio Sub that parallels IH-35, serves the local industries in and around San Antonio. Figure 2-4 shows a schematic of East Yard. There is also a trailer-on-flat-car (TOFC) facility where tractor-trailer loads are taken off and/or loaded onto railway flat cars. Finally, the largest of the three San Antonio yards, SoSan Yard (see Figure 2-5) serves as the working point for UP's International freight traffic. SoSan Yard is also anticipated to handle freight traffic from the Toyota facility that is beginning operations in the southwestern sector of San Antonio. A fourth yard, just north of Apache Junction on the Austin Sub ML1, exists as well. At the time of the "windshield survey", however, it appeared that this yard's main function is to temporarily store working trains, such as rock trains coming off the Kerrville Sub, until they are routed across the system.

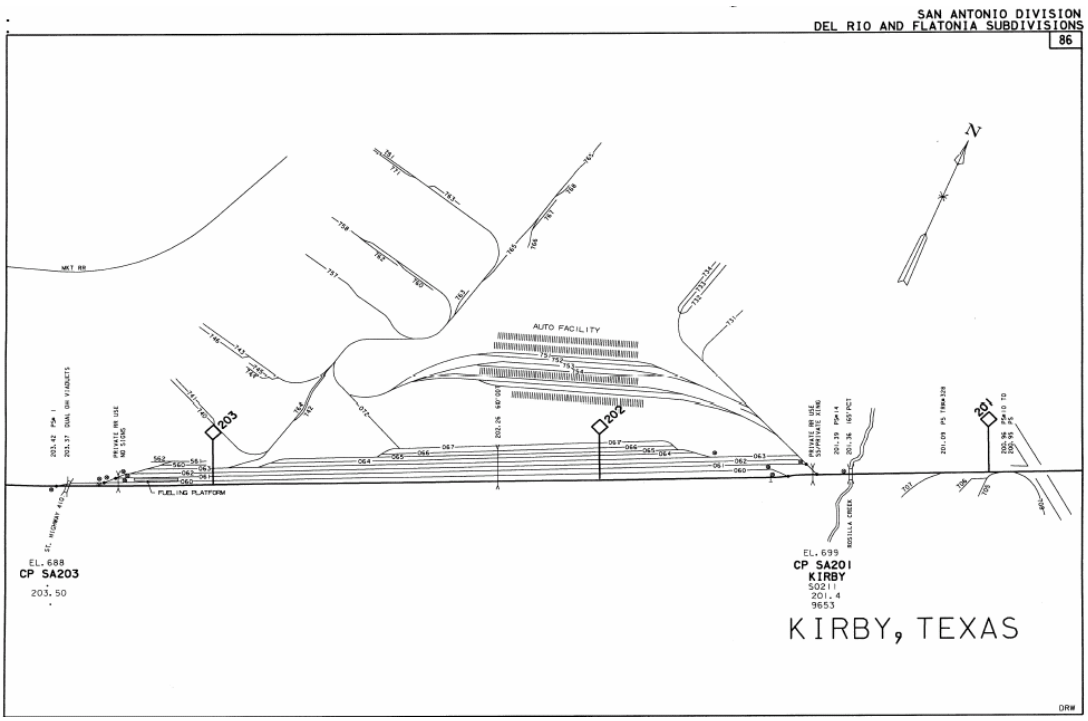


Figure 2-3: Kirby Yard

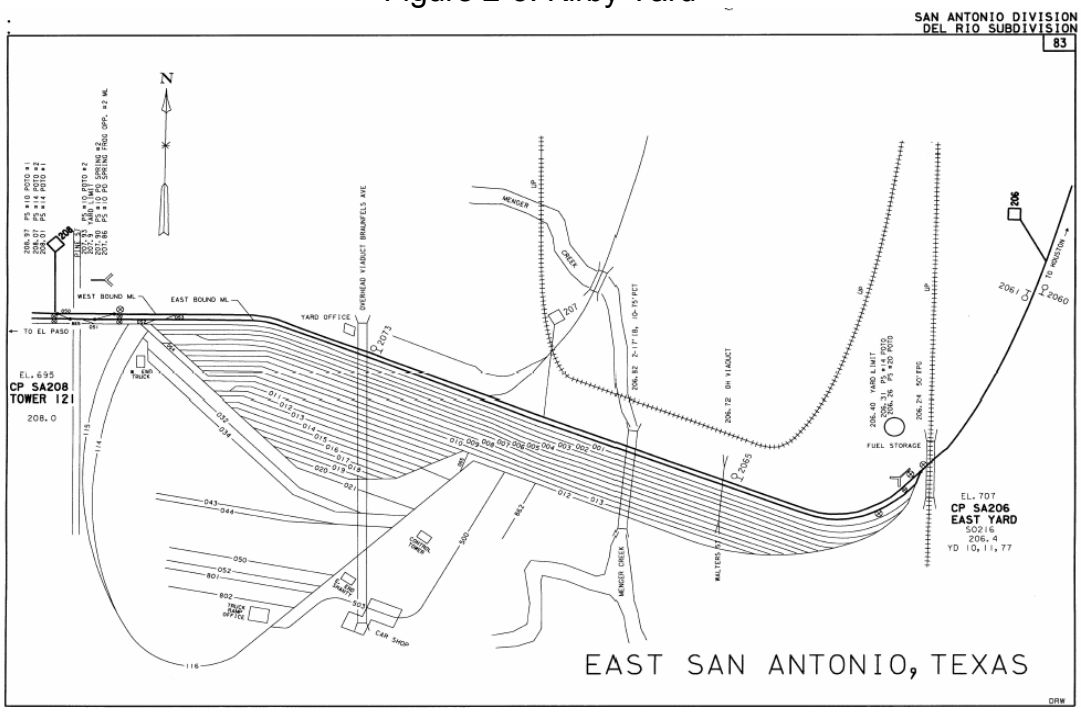


Figure 2-4: East Yard

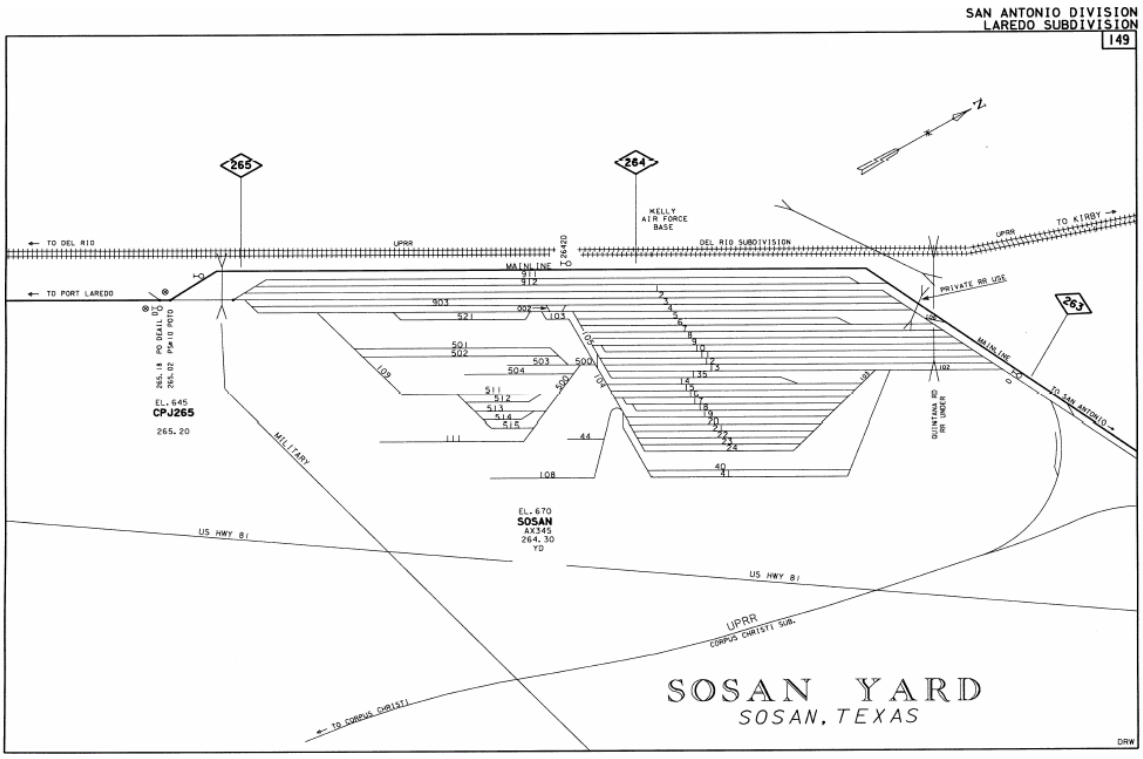


Figure 2-5: SoSan Yard

The Glidden/Del Rio Sub is also the preferred route for the majority of southbound through-freight traffic coming into Texas from Texarkana. At Hearne, freight trains are routed along the Giddings Sub to Flatonia, and then travel westerly to San Antonio. At Flatonia, through-freight trains from both Houston and Texarkana jointly enter San Antonio along the Glidden/Del Rio Subs.

To effectively re-route Austin Sub through-freight traffic onto another route on the existing system, a viable alternative route must be developed that will replace the two mainlines (Austin Sub ML1 and ML2) entering San Antonio.

The Glidden/Del Rio Sub was determined to be the logical route, since traffic on the Austin Sub would involve movement from/to Taylor, and a connection from the northern alignment to the Glidden/Del Rio Sub would be most feasible. It is also apparent that an upgrade of this line would accommodate through-freight traffic re-routed from the Austin Sub.

The study team evaluated three conceptual alternative routes via the Glidden Sub for northbound through-freight movement from/to San Antonio and Taylor and/or Hearne. They are (see Figure 2-10):

- Upgrading the existing Del Rio/Glidden Sub from San Antonio to Flatonia then upgrading the existing Giddings Sub from Flatonia to Hearne

- Upgrading the Del Rio/Glidden Sub to Luling, then utilizing an abandoned rail corridor from Luling to Lockhart, connecting to Taylor via the Direct Route Alternative previously discussed

- Upgrading the Del Rio/Glidden Sub to Seguin, connecting to a new Direct Route Alternative from Seguin to Lockhart, then the Direct Route Alternative to Taylor.

Selecting the route via the Giddings Sub would redirect all northbound through-freight traffic from San Antonio to Hearne. Traffic bound for Dallas/Fort Worth would bypass Taylor all together, essentially increasing the San Antonio to Waco travel distance from 228 miles (San Antonio to San Marcos to Smithville to Taylor to Waco) to 252 miles (San Antonio to Flatonia to Hearne to Waco). It also leaves UP with only one available route for north and southbound through-freight movement. In the event of an emergency or derailment along this route, train movement through the area could come to a halt.

Selecting this alternative involves upgrading and/or rehabilitating 196 miles of railroad from Hearne to Flatonia (Giddings and Cuero Subs) and from Flatonia to San Antonio (Glidden Sub) at a cost of approximately $1 billion. Consequently, the Study Team did not deem this alternative alignment an option that merits consideration.

The second option involved upgrading the Glidden Sub from San Antonio to Luling, then re-activating the abandoned San Antonio and Aransas Pass Railway (SAAP) from Luling to Lockhart. This segment of the SAAP was built in 1889 connecting Shiner to Lockhart via Luling, and was acquired by the SP in 1892. The Shiner to Luling portion was abandoned in 1933, with the Luling to Lockhart portion abandoned in 1942.

As is often the case with abandoned rail lines, property ownership may have reverted back to the original deed holder or his/her successor in areas where the track has been removed. A “windshield survey” of the Lockhart to Luling segment found no remnants of the existing right-of-way, and many areas where the line segment was thought to have existed have since been built up commercially (particularly in the Lockhart area). Since no trackage was found during the windshield survey, the cost of re-acquiring right-of-way for this segment could be substantial. Because the area north of Luling is rich in oil fields, it may be cumbersome to obtain environmental clearances in order to reconstruct the railroad facility.

The third option is to upgrade the Glidden Sub to Seguin, then route through-freight train traffic to Lockhart via a new conceptual direct route alignment between Seguin and Lockhart. Northbound trains would then operate over the preferred alignment discussed in Section I of this report to Taylor and/or Hearne. Conversely, the southbound traffic which normally travels from Lockhart to San Antonio via San

Marcos, would then be able to operate from Lockhart to San Antonio via Seguin. This alternative would eliminate through-freight traffic on the Austin Sub from San Antonio to Taylor via San Marcos and Austin.

An assumption was made by the Study Team that the Glidden Sub would, at a minimum, be upgraded from single to double track. Between Kirby Yard and the east end of East Yard, the Del Rio Sub will also be analyzed as a double track facility. As will be discussed in Section 2.2, the Study Team did not think it feasible to triple track (there are currently 2 mainlines) the Del Rio Sub between East Yard and Tower 112. Consequently, the Study Team opted to analyze re-routing traffic off the Del Rio Sub onto the Austin Sub ML2 alignment just east of East Yard via a new double track wye connection. The Austin Sub ML2 would then effectively, by adding two additional mainlines, become a triple track railroad from East Yard to Tower 112. From Tower 112 to SoSan Yard, one additional mainline track would be added.

Finally, the Study Team reviewed prior studies regarding the feasibility of including a freight rail facility within or near the proposed SH-130 Segment 6 corridor. The inclusion of freight rail within or near that corridor was found to be feasible. The Study Team did not perform any additional analysis of that feasibility, but included a freight rail conceptual alignment between Lockhart and Seguin as a possible component of the Central Texas rail relocation.

2.2 - Southern Alignment Geometrics and Location

The design assumptions for the Southern Alignment were identical to those used in Section I of this report. In alternative route analyses, the Study Team incorporated UP guidelines with respect to profile, alignment, universal crossover size and spacing, and setout track locations. Table 1-1 in the Northern Alignment section of this report summarizes the design criteria used by the Study Team.

The Study Team performed a "windshield survey" of the Southern Alignment route from Seguin to SoSan Yard via the Glidden and Del Rio Subs, and to SoSan Yard via the Austin Sub ML1 and ML2 alignments. A "windshield survey" of the conceptual Lockhart to Seguin direct route connector to the Glidden Sub was also performed.

Prior study reports, in particular the SH-130 Segment 6 Freight Rail Feasibility Study, have shown that a Seguin to Lockhart bi-directional, Class 5 double track railroad is possible.

Seguin to Kirby Yard

Currently, the Glidden Sub between Seguin and Kirby Yard is a single track facility. The alignment is generally adequate for Class 5 operations except for 3 curves that restrict speeds to 60 mph. These curves would need to be reduced in order to optimize Class 5 design speeds.

The Glidden Sub parallels US-90 near Seguin, then FM 78 as it approaches Randolph AFB and Kirby Yard. Between Seguin and just east of Loop 1604 (at Randolph AFB) the surrounding area is generally rural. Photo 1 shows the approximate location of the conceptual Lockhart to Seguin direct route connection to the Glidden Sub.

Between Seguin and Randolph AFB, there are approximately 25 highway-rail crossings and two major river crossings. Four (4) of the crossings are with FM roads, five (5) are at private crossings, while the rest are city/town type roadways. The first major bridge spans the Guadalupe River, and is also in the vicinity of a 2˚-7' curve that would need to be reduced to 1˚-30'. The second major crossing spans Cibolo Creek just east of Randolph AFB (See Photo 2).

Near the main entrance to Randolph AFB, the Glidden Sub crosses SH-218, which intersects with FM 78 just south of the mainline. As shown in Photo 4, the proximity of the intersection between SH-218 and FM 78 with the Glidden Sub can create a traffic back-up at the grade crossing. Constructing a second mainline to the north may pose a challenge due to the commercialization in this area. Figure 2-6 depicts the Study Team's typical cross-section of adding a second mainline track (Figures 2-6 thru 2-10 are at the end of this section).

Photo 1: Glidden Subdivision – View West near SH-130 Segment 6 wye connection to Glidden Sub

Photo 2: Glidden Subdivision – View West Cibolo Creek Crossing

Photo 3: View South – SH 218/Glidden Sub Crossing

Photo 4: View West – Glidden Sub/SH 218 Crossing

Between Randolph AFB and the east end of Kirby Yard, the alignment allows for Class 5 operations, however there is an approximate mile long segment through

Converse where speeds are restricted to 60 mph. There are two major highway-rail crossings at Walzem Road and Rittiman Road. Both roadway crossing are currently signaled and gated, but would require being upgraded with a four quad gate system. Grade separating the crossings could be difficult since both roadways and the railroad are near the same elevation throughout the area. Grade separating Walzem Road for example (Photo 5), could possibly require lowering the railroad facility as well as constructing an overpass.

Photo 5: View south - Walzem Road grade crossing

Kirby Yard to east of East Yard

At the east end of Kirby Yard, the Glidden Sub becomes the Del Rio Sub, maintaining this name to and through SoSan Yard. The alignment is acceptable for Class 5 operations, however maximum speeds are restricted through Kirby Yard to 30 mph, and 50 mph from Kirby Yard to just east of the Del Rio Sub – Austin Sub ML2 overpass. There are a number of industrial tracks in the area, particularly at Salado Junction, just east of MP 205. One area of potential conflict for double tracking this line segment is the IH-10 overpass just west of the west end of Kirby Yard. Photo 6 shows a view of the east end of Kirby Yard. The upright stanchions and pipes on both sides of the UP locomotive in the photo show one of the in-line fueling facilities common to Kirby Yard.

Photo 6: View west - east end Kirby Yard

East of East Yard to Tower 112 via Del Rio Subdivision

This segment of the Del Rio Sub is currently a double track railroad facility; however, there are three large curves that could not be reduced due to physical restrictions within the area. The first curve, a 4° 30' curve at the east end of East Yard (shown in Photo 7) is restricted by a residential community, industrial complex, and a water tank north of the mainline.

The second curve, a 9° 45' curve, is at the west end of East Yard (shown in Photo 8) near the Southwest Research Institute's Locomotive Technology Center.

The final major curve, a 4° 30' curve, is west of Tower 121 (Photos 9 and 10) and is restricted by industrial development in the area and the abandoned Hays Road overpass just west of this curve. There are considerable grade crossings in this area as well.

Speeds through this segment are restricted to 40 mph at East Yard, 25 mph near the Locomotive Technology Center and Tower 121, then 45 mph to Tower 112. The addition of a third mainline through this area would not provide a substantial benefit to through-freight traffic, since allowable track speeds would remain at current levels.

Photo 7: View east – East end East Yard

Photo 8: View west – Near Locomotive Technology Center

Photo 9: View east – Tower 121 vicinity

Photo 10: View east – Tower 121 vicinity

From the west end of East Yard to Tower 112, there are 14 highway-rail crossings, and the Del Rio Sub passes directly by the Alamodome on the east. Just north of the Alamodome is Amtrak's Sunset Station. As can be seen in Photos 11 and 12, adding an additional mainline track near the Alamodome may be a very complex undertaking.

Photo 11: View Railroad West – Del Rio Sub. Alamodome on right.

Of the three prior train stations in San Antonio, this is the only one left in service. Sunset Station is also registered as a Historical Landmark. Both the MP and the MKT had stations as well, however, the MKT station has been demolished, and the MP station is now a bank building.

Amtrak service to San Antonio must be maintained, whether at Sunset Station or an alternative location. If through-freight traffic on the Del Rio Sub from Tower 112 through East Yard is re-routed, and only local service remains, it may be possible to relocate Amtrak service to another part of the proposed re-route alignment.

Photo 12: View Railroad East - Amtrak's Sunset Station on left

East of East Yard to Tower 112 via Austin Subdivision ML2

The existing Austin Sub ML2 from just north of the Del Rio Sub overpass to just east of Tower 112 is grade separated except for 3 highway-rail crossings. This line segment is characterized by 6 overhead bridges (one of which is IH-37), one overhead pipeline, and 6 below grade street bridges. Two of the three highway-rail crossings are located just prior to the Del Rio Sub connection on either side of the IH-37 overhead. The third is at East Houston Avenue.

Although currently a single track railroad, the Study Team determined adding two additional tracks along this route could be more readily attainable than adding a third track along the Del Rio Sub discussed in the last segment.

Figure 2-9 depicts a conceptual double track wye connection between the Del Rio Sub and the Austin Sub ML2 just east of East Yard. Currently, the area where the wye connection would be placed is undeveloped, although a water tower and transmission towers may need to be relocated. Rail access from East Yard into an industrial area east of the proposed wye would also need to be maintained. Photo 13 shows the area of the conceptual wye, along with the Del Rio Sub overhead bridge in the background.

Photo 13: View North – Austin Sub ML2
Possible 'wye' connection area on right, Del Rio Sub bridge in background

Much of the approximate 6 mile segment is either elevated or in a 'cut section' as shown in Photo14.

Photo 14: Austin Sub ML2 – rock cut area

Figure 2-8 depicts the Study Team's conceptual cross-section through these cut and fill locations.

The existing overhead street bridges may need to be lengthened to accommodate a triple track railroad. A typical overhead structure is shown in Photo 15.

Photo 15: View west - Austin Sub ML2. N. Braunfels OH in background

Tower 112 to Tower 105

Austin Sub ML2 reconnects to the Del Rio Sub at Tower 112, which is just west of the IH-37 overhead. The area to the east of Tower 112 (Photo 16), prior to the lines connecting, would require changing the signal system from a mast type which is currently in place to an overhead signal bridge spanning all tracks.

Although generally in an industrial area, the grade crossings at both South Presa (Photo 17) and Carolina Streets would need to have the crossing protection systems upgraded as well.

The Tower 112 area would also require the installation of universal crossovers allowing for the movement of trains between tracks as needed. Photo 18 shows the current Austin Sub ML2 switch onto the Del Rio Sub at Tower 112.

Between Towers 112 and 105, a third mainline track will be required to handle train capacity between these points. Figure 2-7 shows a conceptual cross section of this addition. A third bridge crossing the San Antonio River will be required as well.

Photo 16: View West – Austin Sub ML2 on left, Del Rio Sub on right

Photo 17: View north. Austin Sub ML2 in foreground, Del Rio sub in background

Photo 18: View east – Del Rio Sub and Austin Sub ML2 point of switch on right

Tower 105 to SoSan Yard

At Tower 105, the Del Rio Sub crosses the Austin Sub ML1 (Photo 19).

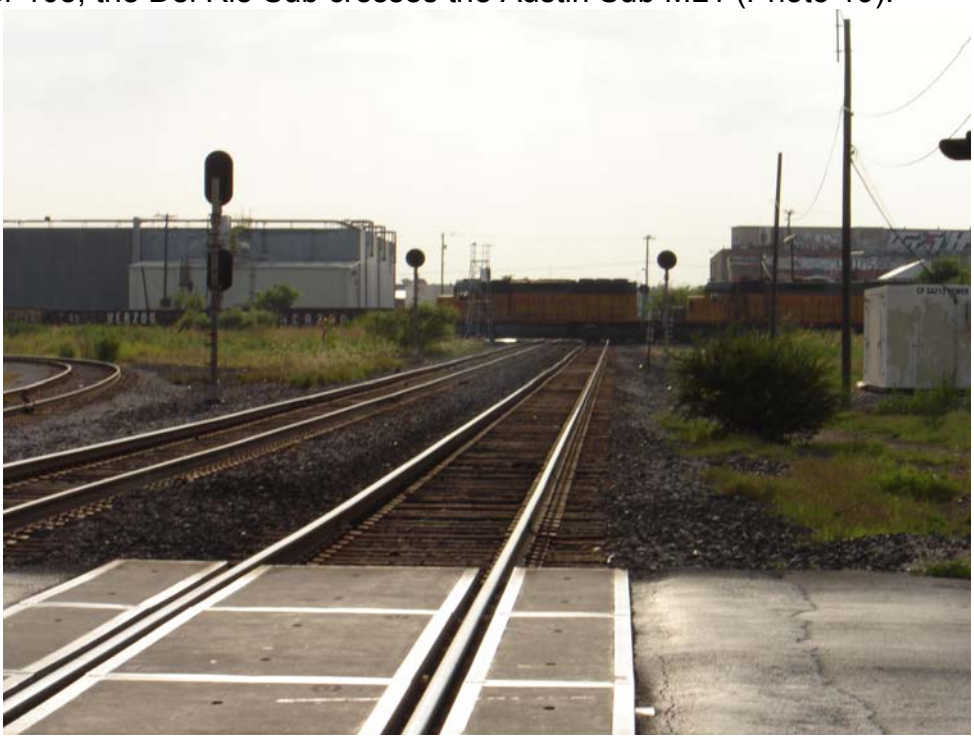


Photo 19: View west – Del Rio Sub/Austin Sub ML1 diamond. Laredo Sub wye on left

The Austin Sub becomes the Laredo Sub at this location, and the line shown in Photo 19 heads (in the direction the locomotive is pointed in the photo) to SoSan Yard. There are in effect two tracks that access SoSan Yard from Tower 105 along the Laredo Sub. There is also a switch from the Laredo Sub onto the Corpus Christi Sub before reaching SoSan Yard.

Past the Laredo Sub wye, accessing SoSan Yard along the Del Rio Sub is not possible for train traffic coming from the east (Photo 20).

Photo 20: SoSan Yard. Note Del Rio Sub ML on far right, Laredo Sub ML in foreground

At a minimum, either an additional mainline track will need to be included on the Laredo Sub or the Del Rio Sub from Tower 105 into SoSan Yard. Access from the east into SoSan Yard from the Del Rio Sub may also need to be provided. The cross-section in Figure 2-7 shows the Study Team's concept of adding a third mainline to a double track facility.

In summary, the Study Team concluded the following upgrades would be required to reroute traffic from the Austin Sub to the Glidden Sub in the San Antonio rail network:

- Double tracking the Glidden Sub from Seguin to Kirby Yard
- Adding an additional through-track in Kirby Yard
- Double tracking the Del Rio Sub from Kirby Yard to just east of East Yard
- Constructing a double track wye onto the Austin Sub ML2 from the Del Rio Sub east of East Yard

- Triple tracking the Austin Sub ML2 to Tower 112
- Adding an additional mainline from Tower 112 to Tower 105
- Either adding an additional mainline to the Laredo Sub from Tower 105 to SoSan Yard or adding an additional mainline to the Del Rio Sub from Tower 105 to SoSan Yard. This would also require installing a switch from the Del Rio Sub west of the Quintana Street bridge (Photo 21) providing westbound trains access into SoSan Yard.

Photo 21: View West – Del Rio Sub just west of Quintana Street bridge
Possible location of switch into SoSan Yard if horizontal clearance at overhead is possible

Figure 2-10 depicts the upgrades and areas where they would be necessary to accomplish the rerouting of Austin Sub traffic onto the Glidden and Del Rio Subs.

Lockhart to Seguin Direct Route

The Study Team reviewed prior studies regarding the feasibility of including a freight rail facility within or near to the proposed SH-130 Segment 6 corridor. These studies identified a conceptual alignment that was generally parallel to the east side of the SH-130 Segment 6 corridor between Lockhart and Seguin. The conceptual alignment fully satisfied the design assumptions listed in Table 1-1 of this report. The Study Team included a freight rail conceptual alignment between Lockhart and Seguin as a possible component of the Central Texas rail relocation.

2.3 - Southern Alignment Quantities and Costs

Table 2-1 gives a cost summary for the Lockhart to Seguin Direct Route. This conceptual direct connection from the conceptual northern alignment bypass to the Glidden Sub would need to be constructed in order to reroute Austin Sub traffic from San Marcos to the San Antonio CBD to an alternative route.

Lockhart to Seguin Direct Route Alignment Summary Table	
(24.0 Double Track Route Miles)	
Earthwork & Right-of-Way	$79,920,000
Railroad Construction	$140,540,000
Roadways	$27,870,000
Miscellaneous (Utilities, Drainiage, Stormwater Pollution Prevention)	$3,720,000
Engineering, Permitting, Contractor Mobilization & Construction Management	$52,910,000
Contingencies	$46,010,000
Total	**$350,970,000**

Table 2-1: Lockhart to Seguin Direct Route Costs – 2007 dollars

Table 2-2 gives a breakdown of costs for the improvements necessary on the Glidden/Del Rio Subs from Seguin to SoSan Yard. Highway overpass modifications to IH-37, IH-35, Loop 410, Loop 1604, East Houston Street, Nogalitos Street, Probandt Street, Cupples Street, and South Zarzamora Street were included in the estimate. Modifications to the US-281 and US-90 highway overpasses were also included in the estimate, with an additional 50' of right-of-way assumed for the entire line segment.

As information, the respective mileage for each line segment is as follows:

Seguin to the proposed wye connection	:	42.0 miles
The Wye connection to Tower 112	:	9.5 miles
Tower 112 to Tower 105	:	1.7 miles
Tower 105 to SoSan Yard	:	3.8 miles
Total	:	57.0 miles

Preliminary Cost Estimate Seguin to South San Yard					
	Seguin to Wye	Wye to Tower 112	Tower 112 to Tower 105	Tower 105 to SoSan	Total Cost
Earthwork & Right-of-way					
Right-of-way	$ 6,950,000	$ 780,000	$ 280,000	$ 630,000	$ 8,640,000
Embankment	$ 4,960,000	$ 1,310,000	$ 440,000	$ 660,000	$ 7,370,000
Excavation	$ 4,960,000	$ 1,310,000	$ 440,000	$ 660,000	$ 7,370,000
Subtotal	**$ 16,870,000**	**$ 3,400,000**	**$ 1,160,000**	**$ 1,950,000**	**$ 23,380,000**
Railroad Construction					
Wye Track	$ -	$ 5,000,000	$ -	$ -	$ 5,000,000
Railroad Trackbed (Add One Track)	$ 17,440,000	$ -	$ 710,000	$ 1,570,000	$ 19,720,000
Railroad Track (Add One Track)	$ 44,060,000	$ -	$ 1,780,000	$ 3,990,000	$ 49,830,000
Railroad Trackbed (Add Two Tracks)	$ -	$ 4,860,000	$ -	$ -	$ 4,860,000
Railroad Track (Add Two Tracks)	$ -	$ 17,570,000	$ -	$ -	$ 17,570,000
Railroad Signals (convert single to double)	$ 45,890,000	$ -	$ -	$ -	$ 45,890,000
Railroad Signals (convert single to triple)	$ -	$ 31,010,000	$ 5,570,000	$ 12,460,000	$ 49,040,000
Railroad Bridges (Double Track bridge w/road)	$ 58,240,000	$ 5,370,000	$ 5,970,000	$ 5,280,000	$ 74,860,000
Subtotal	**$ 165,630,000**	**$ 63,810,000**	**$ 14,030,000**	**$ 23,300,000**	**$ 266,770,000**
Roadways					
Grade Crossings	$ 7,650,000	$ -	$ 1,090,000	$ 2,190,000	$ 10,930,000
Grade Separations	$ 9,180,000	$ 9,180,000	$ 18,360,000	$ 18,360,000	$ 55,080,000
Highway overpass modifications	$ 65,560,000	$ 16,390,000	$ -	$ 16,390,000	$ 98,340,000
Roadway overpass modifications	$ 21,850,000	$ -	$ -	$ 5,460,000	$ 27,310,000
Subtotal	**$ 104,240,000**	**$ 25,570,000**	**$ 19,450,000**	**$ 42,400,000**	**$ 191,660,000**
Miscellaneous					
Utilities	$ 5,740,000	$ 1,760,000	$ 690,000	$ 1,350,000	$ 9,540,000
Drainage	$ 6,880,000	$ 1,550,000	$ 280,000	$ 620,000	$ 9,330,000
Stormwater Pollution Prevention	$ 5,740,000	$ 1,760,000	$ 690,000	$ 1,350,000	$ 9,540,000
Miscellaneous	$ 28,830,000	$ 8,950,000	$ 3,520,000	$ 6,910,000	$ 48,210,000
Subtotal	**$ 47,190,000**	**$ 14,020,000**	**$ 5,180,000**	**$ 10,230,000**	**$ 76,620,000**
Contingencies	$ 66,790,000	$ 20,360,000	$ 7,960,000	$ 15,570,000	$ 110,680,000
Total	**$ 400,720,000**	**$ 127,160,000**	**$ 47,780,000**	**$ 93,450,000**	**$ 669,110,000**

Table 2-2: Seguin to SoSan Yard Costs – 2007 dollars

2.4 - Southern Alignment Summary and Conclusions

As described in Section 1 of this report, the Study Team analyzed alternative alignments to relocate through freight services from the Taylor to San Marcos corridor and determined that a new "Taylor to Lockhart Direct Route" alignment would allow for optimum operating speeds consistent with FRA Class 5 operations, and minimize the impact to the public in general. This alignment would also remove through-freight traffic through towns such as Taylor, Elgin, Bastrop and Lockhart, improving grade crossing safety in the process.

At a cost of approximately $703 million, the Taylor to Lockhart Direct Route alternative alignment alone would not eliminate through-freight traffic into San Marcos, but rather would create more of a bottleneck in this area than currently exists. The Study Team, therefore, determined yet another conceptual alternative alignment that would bypass San Marcos to the south, reconnecting to the UP Austin Sub around Hunter. This alternative, along with the upgrades between San Marcos and Lockhart, increased the overall estimated price of the direct route to approximately $883 million.

Between San Marcos and San Antonio, the existing railroad facility is a double track mainline system. One track, ML1, is the former MP track that continues toward San

Antonio from Austin. The other, ML2, is the former MKT alignment, which continues toward San Antonio from Smithville via Lockhart. Both routes enter San Antonio at or near the CBD and pass sporting venues such as the Alamodome and the SBC Center. Consequently, issues with regard to public transportation (cars, trucks, busses, taxi's, etc.) and its relationship to through-freight trains, has fostered interest in relocating through-freight rail operations from San Marcos into San Antonio via the Austin Sub.

The Study Team therefore analyzed re-routing through-freight traffic off the Austin Sub from San Antonio to San Marcos via additional alternative alignments. The Study Team reviewed prior studies regarding the feasibility of including a freight rail facility within or near the proposed SH-130 Segment 6 corridor. These studies identified a conceptual alignment that was generally parallel to the east side of the SH-130 Segment 6 corridor between Lockhart and Seguin. At Seguin, a connection would be made onto the existing Glidden Sub, and through-freight traffic would travel along an upgraded (from single to double track) route to Kirby Yard. The conceptual alignment fully satisfied the design assumptions listed in Table 1-1 of this report. The Study Team included a freight rail conceptual alignment between Lockhart and Seguin as a possible component of the Central Texas rail relocation. This conceptual route would therefore connect the Lockhart to Seguin Direct Route with the Taylor – Lockhart Direct Route.

The rerouted traffic would travel on the Glidden Sub between Seguin and Kirby Yard. At Kirby Yard, the Glidden Sub becomes the Del Rio Sub. Here, an additional through track could be constructed to a location just east of the current bridge where the Austin Sub ML2 goes under the Del Rio Sub. A double track high-speed wye connection would be made from the Del Rio Sub onto Austin Sub ML2, and two additional mainlines of track would be constructed to the Tower 112 location. At Tower 112, one additional mainline would be constructed past Tower 105 and on to SoSan Yard. This alternative eliminates the through-freight traffic within the confines of the San Antonio CBD, the Alamodome, and the SBC Center. It also allows commuter rail traffic to operate along the southern alignment portion of the Austin Sub.

The cost of the Glidden/Del Rio Sub upgrades is estimated at approximately $669 million, while the estimated cost of the conceptual Lockhart to Seguin connector is $351 million. Adding in the estimated cost of the Direct Route alternative ($703 million), the overall estimated cost of what the Study Team deemed the most desirable alternative(s) between Taylor and San Antonio to facilitate through-freight rail relocation, therefore, is over $1.7 billion as shown in Table 2-3.

Preliminary Cost Estimate Direct Route			
Upgrades to Existing Track	Seguin (Glidden MP 170) to Wye (Del Rio MP 206)	36	$400,700,000
Upgrades to Existing Track	Wye to Tower 112 via ASML 2	5	$127,200,000
Upgrades to Existing Track	Tower 112 (Del Rio MP 211) to Tower 105 (Del Rio MP 213)	2	$47,800,000
Upgrades to Existing Track	Tower 105 (Laredo MP 260) to SoSan Yard (Laredo MP 264)	4	$93,500,000
Taylor to Lockhart Bypass	Taylor (ASML MP 144) to Lockhart	52	$702,930,000
Lockhart to Seguin Bypass via SH 130 Seg. 6	Lockhart to Seguin (North end of North Seguin Bypass at Glidden MP 170)	25	$350,970,000
Total	Taylor (ASML MP 144) to Seguin (Glidden MP 170) via Austin Bypass, Seguin to Macdona via Glidden, Del Rio, and ASML 2 Sub		**$1,723,100,000**

Table 2-3: Direct Route Cost Summary – 2007 dollars

The task of relocating through-freight operations along the Austin Sub would be a significant undertaking from an engineering, environmental, and cost standpoint; however it could be done incrementally, upgrading certain sections while constructing new alignments. The added benefits that may be provided to the traveling public in terms of increased safety and providing avenues of transportation alternatives (such as the implementation of commuter rail between Austin and San Antonio), may warrant the expense.

Accessing San Antonio from the east on the Glidden Sub presents significant engineering challenges, such as:

- 3 curves that would require reduction to increase operations from Class 4 to Class 5 speeds
- Double tracking between Seguin and Kirby yard that would require major bridge projects at the Guadalupe River
- Development issues near Randolph Air Base and along FM-78
- Grade separations at Walzem and Rittiman Roads where elevations are not conducive to easy separations
- IH-10 overpass would need to be modified
- Residential communities and industrial complexes near the east end of East yard inhibit curve reductions in the area
- Additional grade crossings that would require additional gates and lights
- Alamodome located directly adjacent to the alignment on the Del Rio Sub in route to SoSan Yard.

These issues regarding San Antonio access from the east on the Glidden Sub complicate upgrading the existing Glidden/Del Rio Subs to the standards recommended in this report. The Study Team, therefore, analyzed a conceptual San Antonio bypass from the Seguin area to the southwest portion of San Antonio, referred to as the San Antonio Bypass. The conceptual San Antonio Bypass study findings are presented in Section 3 of this report.

3.0 - San Antonio Bypass

3.1 - Description

The Study Team completed the development of conceptual improvements and alternative alignments for relocating through-freight rail services from UP's existing Austin Sub. The concepts developed included upgrades to the existing Waco and Lockhart Subs to provide for the relocation of freight rail services from Taylor to San Marcos; and the development of a new direct route from Taylor to Lockhart. Conceptual improvements were also developed for through freight services from San Antonio to San Marcos which would relocate through freight services away from the Alamodome and CBD (on the Austin Sub) to the existing Glidden and Del Rio Subs.

Issues discussed in Section 2 regarding San Antonio access from the east and the conflict with urban development along the FM 78-corridor, complicate upgrading the Glidden/Del Rio Subs to the standards presented in this report. The Study Team, therefore, analyzed a conceptual San Antonio bypass from the Seguin area to the southwest portion of San Antonio. This bypass would connect UP's Glidden Sub (east of San Antonio) with their Rockport, Corpus Christi, Laredo, and Del Rio Subs (southwest of San Antonio) via a bypass around the southern portion of the metropolitan area. This would provide east-west connectivity with north-south connectivity through a loop around San Antonio that relocates and links all of UP's main lines outside the metropolitan area. This east/west and north/south connectivity currently occurs within the city of San Antonio itself and must be provided for in order to relocate through-freight services to an alternative alignment. Order of magnitude costs were developed for consideration when evaluating public and private benefits along with environmental issues.

The study team also identified the need to construct a new yard(s) (if a bypass were constructed) to provide for the diversion of freight car classification operations, fueling, servicing, repairs, re-crews, intermodal transfers, etc. that are currently performed at SoSan, East, and Kirby Yards which are within the San Antonio metropolitan area. The bypass and new yard location(s) would therefore relocate all through freight services from the east, west, and south (as well as train classification movements) from the San Antonio urban area. Trains to and from the north could be relocated from the Austin Sub to the Waco Sub or the new direct route alignment (including the Lockhart to Seguin segment), connecting with the San Antonio bypass near Seguin. This could reduce train movements within San Antonio by as much as 60 – 70%, with the remaining train movements associated with servicing freight rail customers located within the urban area. The San Antonio bypass study area conceptual alignment is shown in Figure 3-1 at the end of this section.

The basic premise of the San Antonio Bypass is to determine the feasibility of relocating through-freight trains from the San Antonio metropolitan area. A

significant volume of the rail freight moving into and/or out of San Antonio does not originate or terminate there; but is only in San Antonio to be switched or classified into another train destined elsewhere, or for movement onto another mainline that traverses the San Antonio area. However, the conceptual bypass alignment resulted in a significant increase in mileage for trains routed onto the bypass from the existing system. Rerouting trains onto the bypass could have negative impacts to UP's operations and costs in comparison to the existing operations.

Further studies were conducted as part of TxDOT's "San Antonio Region Freight Study" to quantify the public and private benefits of the bypass alternatives and provide comparisons to the existing system and operations. These studies also analyzed operational impacts and costs to UP from the diversion of trains from the existing routes to the bypass alternatives presented. The study team has not identified a preferred alignment, which would require further coordination with UP and required environmental studies.

3.2 - San Antonio Bypass Design Assumptions

The design assumptions for the San Antonio Bypass Alignment were identical to those used in Sections 1 and 2 of this report. In determining alternative route analyses, the Study Team incorporated UP guidelines with respect to profile, alignment, universal crossover size and spacing, and setout track locations. Table 1-1 of this report (Section 1) summarizes the design criteria used by the Study Team.

The relocation of San Antonio's yard operations to a new location(s) presents significant challenges from an engineering and operational perspective, as well as from possible environmental impacts. It is estimated that approximately 70 to 75% of the trains moving into/out of San Antonio are "worked" at SoSan Yard, located near Kelly USA. East Yard is primarily used as an industrial service yard for local and regional customers. North/south trains terminating in San Antonio therefore typically do so at East Yard, located north of the Alamo Dome and Amtrak Station. Kirby Yard, located east of San Antonio near Kirby, is a crew change point as well as in-line fueling facility. Kirby also is equipped for unloading auto racks and provides some local service.

In order to optimize the efficiencies of new yard facilities, the Study Team determined that it would be best to construct one such facility toward the western end of the conceptual San Antonio Bypass; perhaps at or near UP's new intermodal facility located between the Del Rio and Laredo Subs, just off I-35. Another yard facility may be necessary on the eastern end of the alignment, possibly near Marion.

The Study Team performed a "windshield survey" of the conceptual San Antonio Bypass corridor and utilized USGS topographic maps to further develop conceptual corridors for analysis and feasibility evaluation.

Connectivity to the Austin Subdivision

The Study Team investigated the feasibility of connecting a San Antonio Bypass to the existing Austin Sub, in the event that the Taylor to San Antonio reroute was not implemented. Potential alignments were identified that would connect the Austin Sub to the Glidden Sub. One conceptual alignment would connect with the Glidden Sub just west of Marion and traverse in a generally northward direction to connect with the Austin Sub ML2, south of New Braunfels. The second conceptual alignment would connect with the Glidden Sub on the Seguin north conceptual bypass, and traverse in a northward direction to a connection with the Austin Sub north of New Braunfels.

Although determined to be feasible, the study team has no information that the UP has indicated any interest in a San Antonio (only) bypass for operational reasons. This would significantly increase UP's mileage in the San Antonio region (from all other subdivisions to the Austin Sub) without providing any benefits in the form of reduced transit time, fuel usage, crew costs, or improved operating efficiencies. In fact, a bypass of San Antonio without the new direct northern route could increase UP's costs significantly, although it could provide some public benefit to the San Antonio metropolitan area.

3.3 - San Antonio Bypass Quantities and Costs

An order of magnitude estimate of the costs of the general bypass route is shown in Table 3-1.

San Antonio Bypass (Seguin to Macdona) Alignment Summary Table	
(68 Double Track Route Miles)	
Earthwork & Right-of-Way	$216,470,000
Railroad Construction	$336,910,000
Roadways	$177,530,000
Miscellaneous (Utilities, Drainiage, Stormwater Pollution Prevention)	$9,230,000
Engineering, Permitting, Contractor Mobilization & Construction Management	$132,750,000
Contingencies	$115,430,000
Subtotal	**$988,320,000**
New Yard Facilities	
Macdona Yard w/ Fueling Facility	$200,000,000
Marion Yard	$15,000,000
Subtotal	**$215,000,000**
Upgrades to Exisitng Track (Marion @ Glidden MP 187 to Seguin @ Glidden MP 170)	
Earthwork & Right-of-Way	$54,300,000
Railroad Construction	$60,200,000
Roadways	$0
Miscellaneous (Utilities, Drainiage, Stormwater Pollution Prevention)	$1,780,000
Engineering, Permitting, Contractor Mobilization & Construction Management	$26,750,000
Contingencies	$23,260,000
Subtotal	**$166,290,000**
Total	**$1,369,610,000**

Table 3-1: San Antonio Bypass Cost Estimate Summary – 2007 dollars

4.0 - Alternatives Analysis[1]

4.1 - Introduction

This report is intended to provide the Central Texas region with an examination of a new direct route railroad corridor (bypass) and quantify the public and private benefits of the relocation of through freight rail services from the existing alignment to the bypass. The alignments identified for analysis were based on the results of freight rail operations modeling (RTC) intended to improve freight rail movement efficiency through rail relocation.

The analysis included identifying the existing conditions, estimating the implementation costs and timeframe, and estimating the public and private benefits associated with the bypasses. The estimated implementation costs for each bypass are order of magnitude costs based on preliminary planning. The costs included in this study represent an estimate of probable costs prepared in good faith and with reasonable care. The study team has no control over the costs of construction labor, materials, or equipment, nor over competitive bidding or negotiating methods and does not make any commitment or assume any duty to assure that bids or negotiated prices will not vary from these estimates. The costs are subject to inflation, and in some cases will be calculated using current county appraisal district values for right-of-way acquisition, which may vary significantly from the eventual cost of acquiring property.

Anticipated public benefits include reductions in vehicular delay times at existing at-grade crossings, reductions in vehicle and locomotive fuel consumption, improvements in air quality, improvements in public safety, improvements in mobility for vehicular and freight traffic due to changes in train operations from improvements, reductions in noise and vibration from rerouting of trains, and improved freight mobility from more efficient routes.

The estimated public benefits at grade crossing locations were determined by using a grade crossing "impedance" or delay model which takes into account the volume and frequency of vehicular and train traffic at roadway-rail grade crossings, estimating the amount of time motorists are delayed by rail traffic. The model measures the anticipated public costs (burden) associated with traffic delays and calculates the extra emissions and fuel usage experienced while delayed by a train at each of the rail crossings analyzed. The cost of collisions is added to time costs, emissions, and fuel used to provide an annualized estimate of total public burden per grade crossing. Forecasts for growth in both rail and vehicular traffic will be

[1] "Section 4.0 Alternatives Analysis" was completed during TxDOT's *San Antonio Region Freight Study* and is contained in Section 7 of that report. The information from Section 7 of that study was edited for content and context and included herein as "Section 4 Alternatives Analysis". The editing did not affect the accuracy of the information provided.

used to provide an annualized estimate of public costs projected for a 20-year study period.

Potential benefits that may be realized by the railroads as a result of the identified improvements may include improved train operating efficiency (including reductions in train delays) and improved train run-times, as well as reductions in public exposure to train operations.

4.2 - Central Texas Rail Bypass Description

The basic premise of the bypass is to determine the feasibility of relocating through-freight trains from the metropolitan areas. A significant volume of the rail freight moving into and/or out of San Antonio does not originate or terminate there; but is only in San Antonio to be switched or classified into another train destined elsewhere, or for movement onto another mainline that traverses the San Antonio area. In addition, New Braunfels, San Marcos, Austin, Round Rock, and Taylor all experience a high volume of this “through” rail freight that is merely traveling through those areas.

The concept provides for the relocation of through-freight rail services to a new route from Taylor to Seguin, where it would connect to a San Antonio bypass from Seguin to the southwest portion of San Antonio as shown in Figure 4-1. The alignment of a Central Texas rail bypass would fall within the general footprint of the proposed Trans Texas Corridor (TTC) alignment. Figure 4-1 shows the new rail connection in the Taylor area, where the proposed TTC alignment is more to the west (Hutto). The connection of the bypass with the Corpus Christi Subdivision is also represented within the TTC alignment. This potential routing south of San Antonio is intended to complete a connection with the UP’s intermodal facility south and west of the city and the Laredo and Del Rio Subdivisions. However, the decision as to whether or not the bypass would be a component of the TTC is beyond the scope of this study.

This bypass would provide east-west and north-south connectivity through a loop around San Antonio that relocates and links all of UP’s mainlines outside the metropolitan area. The east-west and north-south connectivity currently occurs within the city of San Antonio and must be alternately provided in order to relocate through-freight services to an alternate alignment.

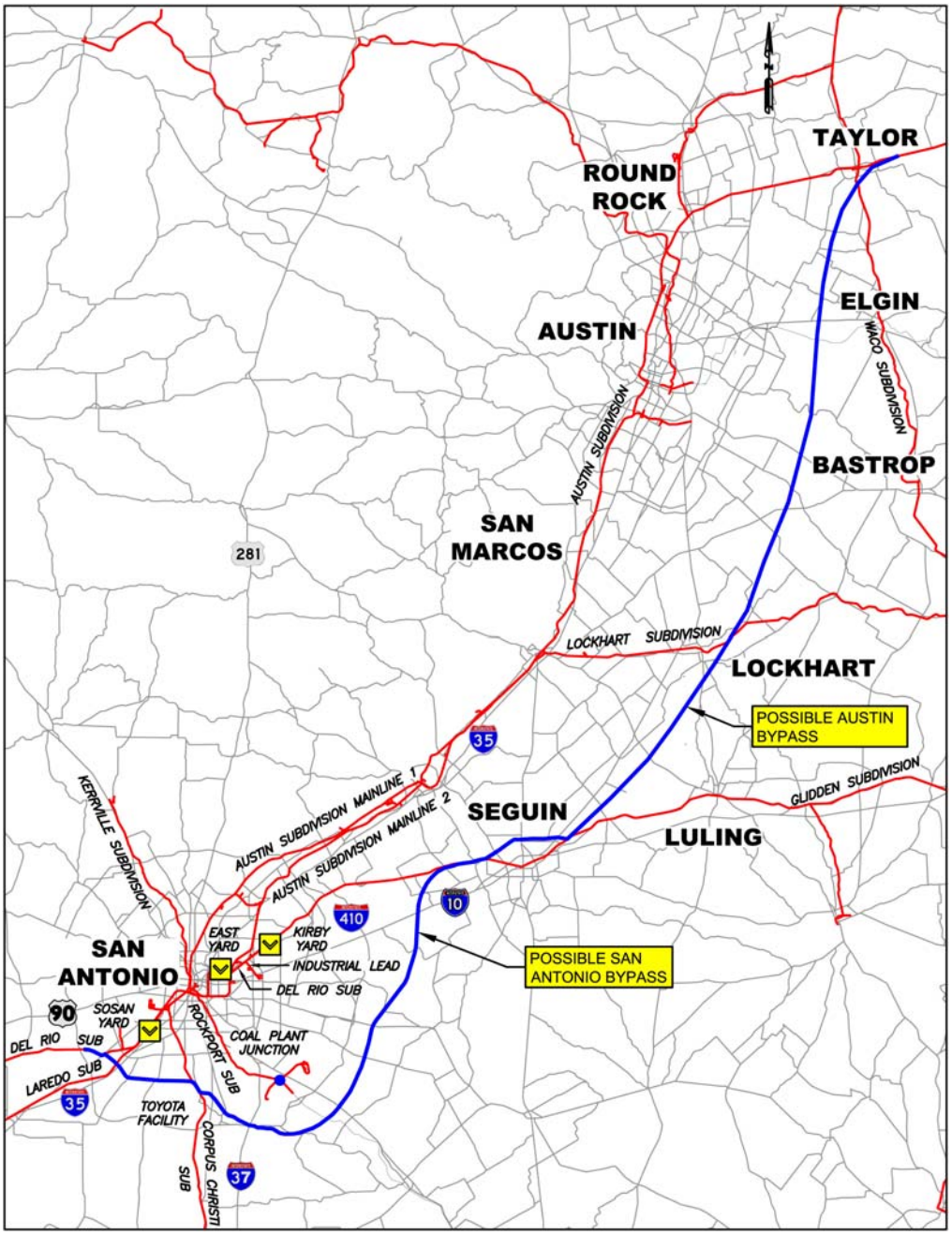


Figure 4-1: San Antonio Region Railroad Subdivisions and Possible Bypass Locations

The maps included with this report depict possible alignments and/or facilities for illustrative purposes only to assist in general comprehension of the possible alternatives and issues discussed. These alternatives do not represent any proposed location or planned alignment for the relocation of freight rail services. These possible alternatives were necessary in order to obtain "ballpark" estimates of mileage, necessary bridge structures, highway-rail grade separations, earthwork, etc. so that order of magnitude costs could be developed for comparison purposes. Precise planned or proposed alternative alignments can only be identified during the NEPA environmental process, which is not a part of this study or report.

4.3 - San Antonio Bypass Description

The San Antonio (only) bypass would connect UP's Glidden Subdivision (east of San Antonio) with their Rockport, Corpus Christi, Laredo, and Del Rio Subdivisions

(southwest of San Antonio) via a possible bypass around the southern portion of the metropolitan area. The connection with the Rockport Subdivision would require an extension of the existing line from Elmendorf towards Kenedy on the abandoned Southern Pacific right-of-way. Trains to and from the north could be relocated from the Austin Subdivision to a new Taylor/Seguin direct route alignment, connecting with the San Antonio bypass near Seguin or an upgraded Austin Subdivision ML 2.

The study team also identified the need for new facilities near San Antonio if a bypass were constructed to provide for the diversion of freight car classification operations, fueling, servicing, repairs, re-crews, intermodal transfers, etc. These operations are currently performed at SoSan, East, and Kirby Yards, which are within the San Antonio metropolitan area. Implementing replacement facilities along the possible bypass route would potentially relocate all through-freight services from the east, west, and south (as well as train classification movements) from within the San Antonio urban area.

The relocation of San Antonio's yard operations to a new location(s) presents significant challenges from an engineering and operational perspective, as well as possible environmental impacts. It is estimated that approximately 70 to 75 percent of the trains moving into/out of San Antonio are "worked" at SoSan Yard, located near Kelly USA. East Yard is primarily used as an industrial service yard for local and regional customers. North-south trains terminating in San Antonio therefore typically do so at East Yard, located north of the Alamo Dome and the Amtrak Station. Kirby Yard, located east of San Antonio near Kirby, is a crew change point as well as in-line fueling facility. Kirby Yard is also equipped for unloading auto racks and provides some local service.

In order to optimize the efficiencies of new yard facilities, the study team determined that it would be preferable to construct one such facility toward the western end of the possible San Antonio bypass; potentially at or near UP's new intermodal facility located between the Del Rio and Laredo Subdivisions near I-35.[2] This location could serve as a main line fueling facility and crew exchange point for through-freight operations and handle typical mechanical department operations for that area.

Another yard facility may be necessary on the eastern end of the alignment potentially near Marion and could be used for train make-up for the San Antonio area, thereby potentially reducing traffic entering East Yard for that same purpose. A facility at Marion could provide the operational logistics as a staging area for local trains, a crew exchange point, and a locomotive fueling facility. Located northeast of San Antonio, mixed freight trains could be routed to this location, reducing traffic through the city, with freight cars separated for local delivery.

[2] San Antonio, Texas, November 29, 2006 – UP today announced a preliminary layout design of its new $90 million state-of-the-art intermodal terminal in Southwest Bexar County. The design will provide truck and auto access and egress points at Interstate 35.

4.4 - Austin Subdivision

The study team also investigated the feasibility of connecting a San Antonio bypass to the existing Austin Subdivision, in the event that the Taylor to Seguin direct route is not implemented. Two possible alignments were identified that would connect the Austin Subdivision to the Glidden Subdivision. One possible alignment would connect with the Glidden Subdivision just west of Marion and traverse northward to connect with the Austin Subdivision ML2 south of New Braunfels. The second possible alignment would connect with the Glidden Subdivision on the Seguin north possible bypass and traverse northward to a connection with the Austin Subdivision north of New Braunfels.

Although determined to be feasible, the study team has no information that the UP has indicated any interest in a San Antonio (only) bypass for operational reasons. Such a bypass would significantly increase UP's mileage in the San Antonio region (from all other subdivisions to the Austin Subdivision) without providing any major private benefits in the form of reduced transit time, fuel usage, crew costs, or improved operating efficiencies. In fact, a bypass of San Antonio without the new direct northern (Taylor-Seguin) route could increase UP's costs significantly, although it could provide public benefit to the San Antonio metropolitan area.

The task of relocating through-freight operations along the Austin Subdivision would be a significant undertaking; however, it could be completed incrementally by upgrading certain sections while constructing new alignments, although it should be noted that such phasing may not be supported by UP. The added benefits that may be provided to the traveling public in terms of increased safety and providing avenues of transportation alternatives may warrant the expense.

The potential public benefits associated with the relocation of through-freight rail services in the corridor could include:

- Reductions in public exposure at roadway-rail crossings (vehicular delay, accidents, horn noise) by moving the route outside of the Austin and San Antonio metro areas and other communities including Taylor, Elgin, Bastrop, Lockhart, and San Marcos,
- Reductions in hazardous materials movements within urban areas,
- Improvements to air quality from reductions in vehicular idling and reduced locomotive operations,
- Reductions in fuel usage for vehicular traffic,
- Improvements in economic development opportunities, and
- Possible implementation of commuter rail services in the existing corridor.

Potential benefits to UP could include:

- Reductions in train accident exposure at highway-rail grade crossings,
- Possible increases in freight rail capacity,

- Improvements in train operating efficiency along the new route,
- Possibility of the railroad to “grow business” due to possible increases in capacity,
- Short term reductions in maintenance expenses on the newly constructed alignments, and
- Reductions in ”total central curve angle”, which may correlate to reductions in wear and tear on locomotives, rolling stock, roadbed, track and structures.

Benefits to the private sector are based on the degree to which operational performance measures such as train mileage, run time, and delay time for each planning case change relative to those of the base case. Each performance measure has been translated to an economic value using the following unit costs:

- Train mileage = $51.23/mile
- Run time or delay time = $407.19/hour
- Fuel = $3.33/gallon[3]

The train mileage cost of $51.23/mile is a representative industry cost that reflects rail operating expense per train mile. The run and delay time cost of $407.19/hour assumes a 60:40 ratio of yard-to-line haul operating times within San Antonio, where expected yard operating expenses are $285.82 per hour and line haul operating expenses are $589.24 per hour.

4.5 - RTC Planning Cases

The identified potential bypasses were used to develop planning cases, as discussed in the following section, and modeled in RTC. Planning cases were investigated with the ultimate goal of improving train mobility and efficiency as well as addressing the areas of greatest congestion within the network. As the tables following each RTC planning case will show, a comparison of the performance measures listed below is made between the base case and the potential improvements included in the planning cases.

Operating performance of trains is measured by the following:

- Total Run Time
- Stop/Delay Time
- Delay Percentage
- Delay per 100 Train Miles
- Average Train Speed

The total run time is the average daily hours of train operation in each part of the network. This time includes dwell time for train make-up, en route switching, crew changes, fueling, or other activities. Stop or delay time also is shown as average

[3] Houston Spot Diesel Prices, Argus Rail Business, Vol. 14,16, April 21, 2008.

daily hours. A delay percentage is calculated as the stop time as a share of total run time. For the respective segments, the stop time represents the total time that trains are stopped awaiting meets with other trains, or because of track congestion ahead. It does not include acceleration and deceleration times associated with train stop time, because that time may be split between segments. However, stop time for the total network does include acceleration and deceleration times as part of the overall measure of delay, so the resulting delay percentage calculations for the individual segments are not directly comparable with the delay percent for the total network. The tabulated RTC results for each planning case include the minutes of delay per 100 train miles, the average speed of all trains operated in each segment as well as on the full network, fuel in gallons, and gallons consumed per mile.

4.6 - Base Case

Existing railroad infrastructure and operations were analyzed to develop an RTC base case model for comparison to potential alternatives and improvements. The RTC model was run for each case (base case and planning cases) for a four week simulation period, which accounts for day to day variances in operations. The cases were run for the full network, including the lines to Hearne via Austin, Smithville, and Giddings. The base case for measurement of the impact or benefit of proposed capacity improvements is the performance of the current network.

Eight additional daily trains were added to the simulation to represent anticipated traffic growth with the opening of the Toyota Assembly Plant, so that this set of simulations reflects expected train operations during the coming year. Similarly, several track improvement projects recently completed or now underway to support the Toyota operation were incorporated into the network to reflect anticipated operations when the plant opens. These improvements make up the base case simulation. Simulation results for this case are shown in Table 4-1.

RTC Performance Measure	Base Case Results
Trains Operated (28 days)	2,891
Train Miles (28 Days)	359,028
Total Run Time Hours (Avg. Daily Hours)	496.2
Delay Time Hours (Avg. Daily Hours)	86.6
Delay Percentage	17.50%
Delay Minutes/100 Train Miles	40.52
Average Speed	25.8
Fuel (gallons)	2,956,784
Gallons/Train Mile	8.2

Table 4-1: RTC Base Case Summary

4.7 Planning Case A – San Antonio Bypass

Planning Case A analyzed the base case plus a possible San Antonio bypass with new yards at Marion and Macdona. The San Antonio bypass alternative consists of a potential new double track rail corridor for an approximate length of 68 miles that would bypass San Antonio between Seguin (where the bypass would connect to the existing Glidden Subdivision line) and Macdona (where the bypass would connect to the existing Del Rio Subdivision). Planning Case A also includes upgrades to existing track between Marion and the connection with the possible Austin bypass in Seguin. The new yard at Marion would replace most of the activities currently completed at East Yard. The new yard at Macdona would serve as a fueling facility for through-trains. The conceptual location of the possible San Antonio bypass is shown in Figure 4-2. The estimated cost of Planning Case A is approximately **$1.37 billion**, including the cost of identified grade separated roadway and rail crossings.

Trains that could be rerouted to a San Antonio bypass consist of through-trains primarily from the Glidden and Del Rio Subdivisions, coal trains that serve regional power plants, and intermodal trains that are currently serviced at either SoSan or East Yards. However, local service trains, rock trains to and from Hunter (north of San Antonio), passenger trains (Amtrak Texas Eagle and Sunset Limited routes), and international freight from Laredo that is destined for SoSan Yard would remain on existing rail lines.

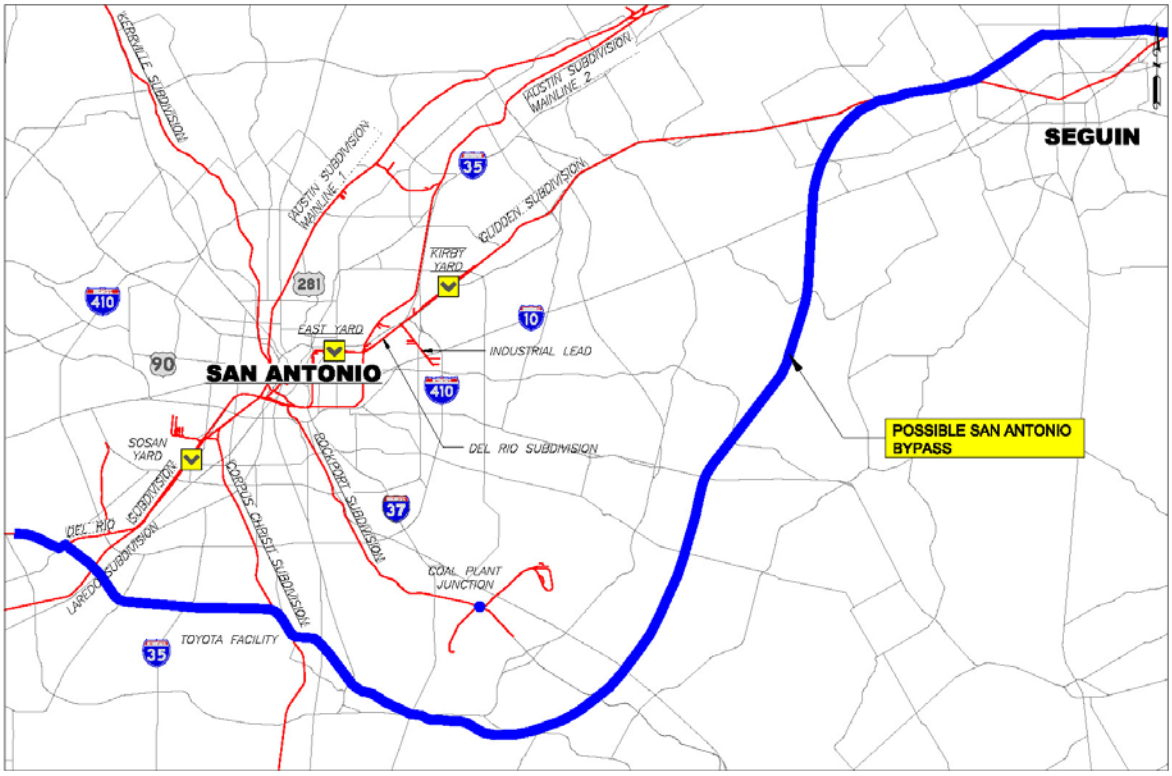


Figure 4-2: Possible San Antonio Bypass
(note: conceptual bypass route shown is for illustrative purposes only)

Table 4-2 and Figures 4-3 and 4-4 show daily train counts on existing subdivisions for the base case (no-build) scenario and the bypass scenario, as well as the projected percent reduction in daily trains on existing lines resulting from the possible bypass route. As shown in Table 4-4, the possible San Antonio bypass route is projected to provide reductions in daily train volumes ranging from 3 to 20 daily trains (25 to 70 percent) on existing lines running through San Antonio, depending on location. Although the daily train volume would be increased by 13 trains on the Glidden Subdivision between Flatonia and Seguin.

Railroad Subdivision	Daily Trains		Percent Change
	Base Case	Bypass Case	
Possible San Antonio Bypass, Seguin to Macdona	N/A	31	100%
Austin Subdivision ML 1, East of Taylor	22	13	-41%
Austin Subdivision ML 1, Taylor to Round Rock	30	21	-30%
Austin Subdivision ML 1, Round Rock to San Marcos	25	16	-36%
Austin Subdivision ML 1 and 2, San Marcos to Garden Ridge	36	23	-36%
Austin Subdivision ML 1, Garden Ridge to San Antonio (Twr 105)	22	16	-27%
Austin Subdivision ML 2, Garden Ridge to Del Rio Sub	10	3	-70%
Austin Subdivision ML 2, Del Rio Sub to Downtown San Antonio (Twr 112)	10	3	-70%
Corpus Christi Subdivision, SoSan Yard to Toyota Plant	13	5	-62%
Del Rio Subdivision, Kirby to Downtown San Antonio (Twr 105)	35	15	-57%
Del Rio Subdivision, Downtown San Antonio (Twr 105) to Macdona	24	5	-79%
Del Rio Subdivision, Macdona to Hondo	27	27	0%
Glidden Subdivision, Flatonia to Seguin	27	40	48%
Glidden Subdivision, Seguin to Kirby	27	13	-52%
Laredo Subdivision, San Antonio to Gessner	18	11	-39%
Laredo Subdivision, Gessner to Melon	18	18	0%
Lockhart Subdivision, San Marcos to West Point	12	9	-25%

Table 4-2: Daily Train Counts and Percent Change Resulting from Possible San Antonio Bypass

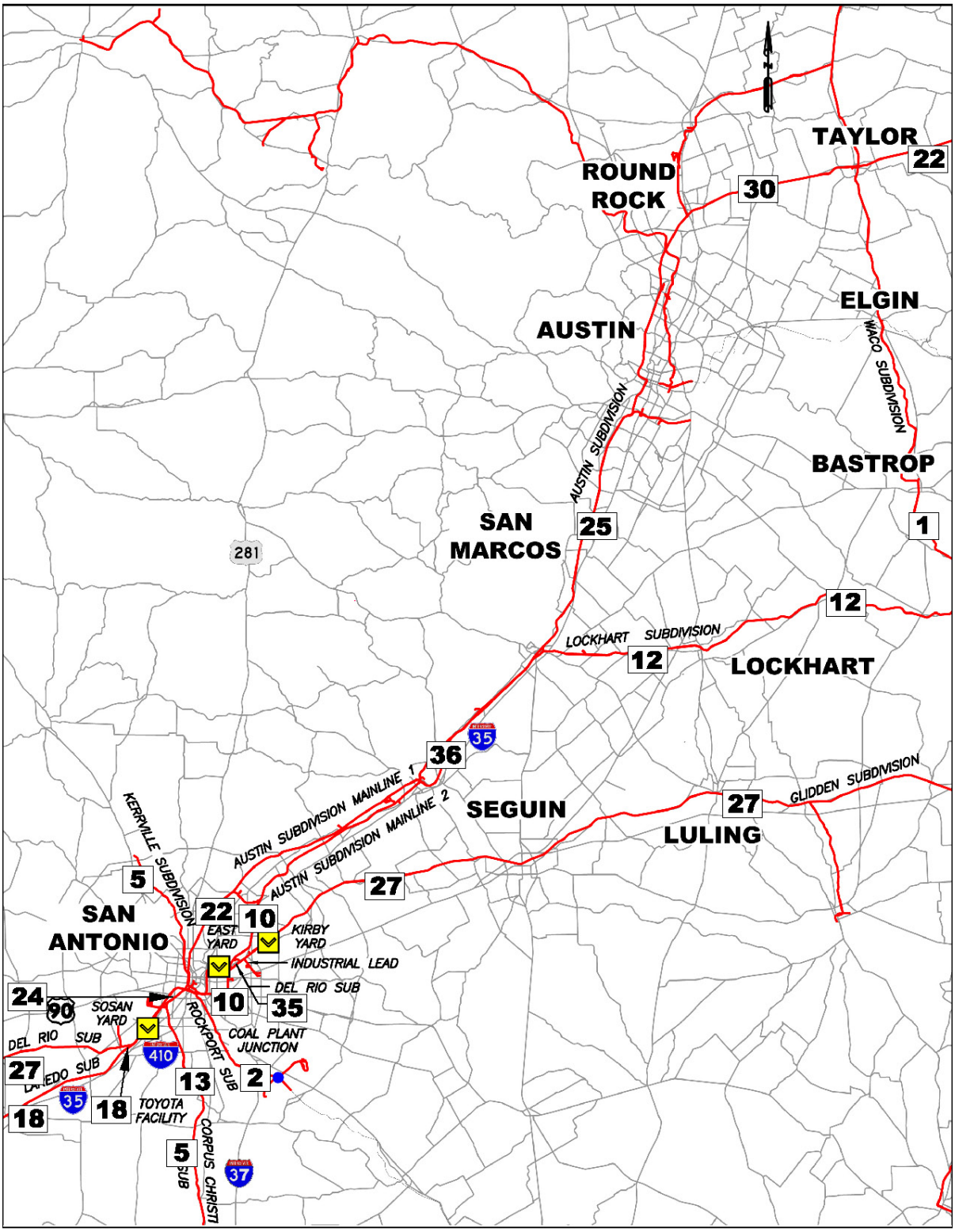


Figure 4-3: Avg. Daily Trains for Base Case Scenario (No-Build)

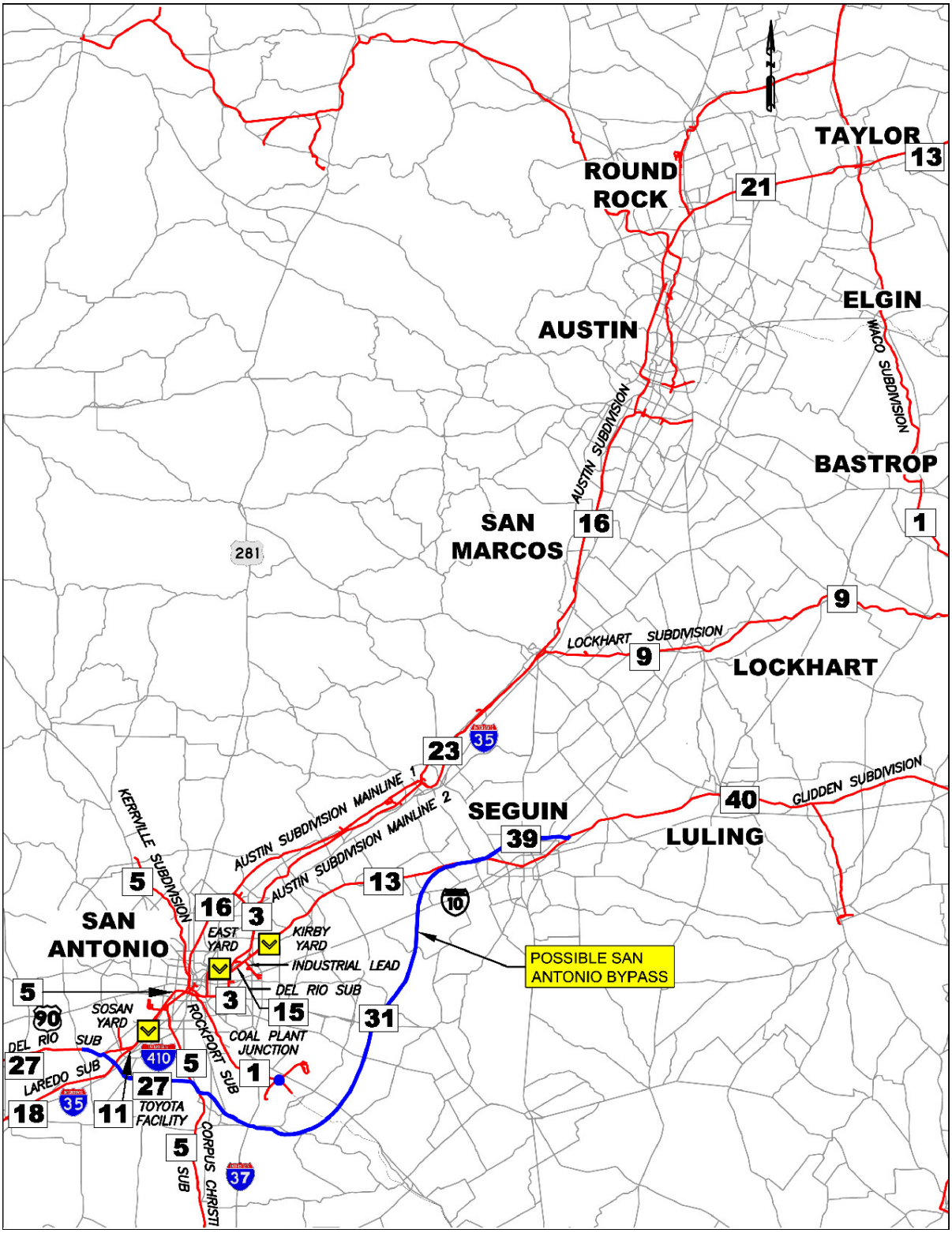


Figure 4-4: Avg. Daily Trains for Planning Case A (Possible San Antonio Bypass)
(note: conceptual bypass route shown is for illustrative purposes only)

Public Benefit Analysis

Currently, railroad operations pass directly through San Antonio central business districts. With many of the top employers of the region centrally located, the exposure of truck and rail freight movement to the traveling public brings with it a potential increase in exposure to hazardous materials transportation and increased safety hazards and delays in general.

The potential public benefits associated with the relocation of through-freight rail services from existing rail lines in the region to a San Antonio bypass (from Seguin to Macdona) could include:

- Reductions in vehicular delays and improved safety at highway-rail grade crossings,
- Improvements to air quality resulting from reductions in vehicular idling and reduced locomotive operations,
- Reductions in fuel usage for vehicular traffic, improvements in economic development opportunities, and
- Reductions in hazardous materials movement within urban areas.

The San Antonio bypass was shown to benefit the public by reducing train traffic through the urban and residential areas of San Antonio. Additionally, the possible bypass provides public benefit by reducing train traffic through cities located along the rail lines throughout the entire modeled network between San Antonio and Taylor, such as New Braunfels, San Marcos, and Austin. The reduction in train traffic, in turn reduces the safety hazards and delays motorists experience at roadway-railroad crossings in the region. The possible bypass imposes a public cost burden due to the introduction of train traffic between Seguin and Macdona; however, this burden is offset by a reduction in the public burden associated with roadway-railroad crossings along the existing subdivisions.

Grade Crossing Impedance Reduction

The estimated public benefit of the possible San Antonio bypass (from Seguin to Macdona) resulting from the reduction in public burden associated with the at-grade roadway-railroad crossings was calculated to be nearly **$348 million**, as shown in Table 4-3. The public benefits shown in Table 4-3 extend beyond the San Antonio study area to include benefits in Hays, Travis, and Williamson Counties, since the impact of the bypass extends throughout the entire region.

Railroad Subdivision	No-Build Scenario	Bypass Scenario (A)	Bypass Benefit (difference)
Austin Subdivision (San Marcos to Williamson County Line)	$297,030,000	$185,580,000	$111,450,000
Austin No 1 (San Marcos to Downotwn San Antonio)	$454,610,000	$271,850,000	$182,760,000
Austin No 2 (San Marcos to Downotwn San Antonio)	$91,390,000	$32,640,000	$58,750,000
Corpus Christi (Downtown San Antonio to Toyota Plant)	$78,170,000	$114,510,000	-$36,340,000
Del Rio (Kirby to Macdona)	$324,240,000	$175,570,000	$148,670,000
Giddings (Flatonia to Mumford)	$18,990,000	$25,520,000	-$6,530,000
Glidden (Flatonia to Kirby)	$92,530,000	$51,800,000	$40,730,000
Kerrville	$143,190,000	$108,320,000	$34,870,000
Laredo (Downtown San Antonio to Gessner)	$123,390,000	$175,600,000	-$52,210,000
Lockhart (San Marcos to Smithville)	$44,130,000	$24,540,000	$19,590,000
Rockport	$34,290,000	$4,720,000	$29,570,000
Waco (Smithville to Taylor)	$8,720,000	$9,550,000	-$830,000
Subtotal:	**$1,710,680,000**	**$1,180,200,000**	**$530,480,000**
Possible Bypass without Grade Separations	$0	$182,360,000	-$182,360,000
Total (without grade separations on bypass)			**$348,120,000**
Possible Bypass with Grade Separations	$0	$29,060,000	-$29,060,000
Total (with grade separations on bypass)			**$501,420,000**

Table 4-3: Public Costs at Roadway-Railroad Crossings (for a 20-year period)

The public cost burden due to the introduction of train traffic on a Seguin-Macdona route, shown in Table 4-3 as approximately **$182 million**, would be significantly reduced by grade separating or closing some of the roadway-railroad crossings along the corridor. Interstate crossings along the route such as I-35, I-37, and I-10 would be required to be grade separated in order to comply with Federal Highway Administration (FHWA) regulations, and, therefore are included as part of the base cost.

Additional crossings along the bypass route were analyzed and determined to be candidates for potential grade separation based on traffic flow volumes for both vehicular and train traffic. The potential grade separations are listed in Table 4-4 with their associated average daily traffic volumes for vehicles (AADT) and trains, as well as their estimated costs, and estimated public benefits. In all, the grade separations identified would reduce the public cost burden of the bypass by approximately **$153 million**, thereby increasing the public benefit of the bypass to approximately **$501.4 million** as shown in Table 4-3.

Street Name	City Name	AADT	Estimated Cost	20-Year Benefit (2007 dollars)	Benfit/ Cost Ratio
IH 35 (Mainlanes and frontage roads)	San Antonio	44,500	$16,000,000	$37,390,000	2.34
FM 2790 (Somerset Road)	San Antonio	5,200	$8,000,000	$2,890,000	0.36
SH 16	San Antonio	19,400	$8,000,000	$10,980,000	1.37
US HWY 281	Cassin	14,000	$12,000,000	$6,790,000	0.57
IH 37 (Mainlanes and frontage roads)	Buena Vista	49,000	$16,000,000	$38,440,000	2.40
Loop 1604	Buena Vista	5,000	$8,000,000	$2,860,000	0.36
US HWY 181	Saspamco	18,400	$12,000,000	$8,720,000	0.73
FM 3432 (Sulphur Springs Road)	La Vernia	3,300	$8,000,000	$1,650,000	0.21
US HWY 87	Adkins	10,500	$12,000,000	$4,600,000	0.38
FM 1346	St. Hedwig	1,900	$5,000,000	$990,000	0.20
IH 10 (Mainlanes and frontage roads)	Santa Clara	36,500	$16,000,000	$22,730,000	1.42
FM 78	McQueeney	5,500	$8,000,000	$2,650,000	0.33
SH 46	McQueeney	13,900	$10,000,000	$6,270,000	0.63
SH 123	Geronimo	14,000	$8,000,000	$6,340,000	0.79
Total:			**$147,000,000**	**$153,300,000**	**1.04**

Table 4-4: Potential Grade Separations on the Possible Bypass Route (Seguin to Macdona)

Reduced Locomotive Emissions

Additionally, the San Antonio bypass provides public benefit in the form of reduced locomotive emissions (pollutants) in the region. The locomotive emissions reduction for the bypass is a function of the reduced run time hours and delay time hours from the base case, as listed in Table 4-6. Planning Case A provides a public benefit from reduced locomotive emissions over the 20-year study period of **$3.4 million** as shown in Table 4-5.

The total public benefits over a 20-year duration, assuming the crossings listed in Table 4-4 would be grade separated, are shown in Table 4-5 for Planning Case A.

Public Sector Benefits ($ million)	
Grade Crossing Impedance (Freight)	501.40
Locomotive Emssions Reduction	3.39
Total ($ million)	504.79

Table 4-5: Public Benefits for Planning Case A

The public benefit of the San Antonio bypass is the result of the relocation of freight trains out of urban and residential areas onto a bypass that runs predominately through rural areas. However, the San Antonio bypass scenario (without the Austin bypass) may not carry the potential for commuter rail implementation that would significantly increase the value of public benefit for the bypass. Commuter rail may not be feasible on existing rail lines in conjunction with a possible San Antonio bypass because the rail lines north of San Antonio (which would not be impacted significantly by the San Antonio bypass) may not sustain commuter rail operations due to the lack of available capacity from freight operations. The Austin bypass

would reduce freight train volumes on existing lines north of San Antonio, thereby providing capacity that could potentially support commuter rail operations.

Private Benefit Analysis

Planning Case A provides significant performance benefits compared with the base case. Run time and stop time are reduced, and the delay ratio improves. Minutes of delay per 100 train miles drops, and average train speeds over the entire network increase. The addition of the bypass to the network removes more trains from the existing trackage, with a consequent reduction in conflicts and delays to the trains that remain on existing trackage.

Table 4-6 compares the simulation results of the base case to Planning Case A, and lists the net change in each RTC simulation parameter that is expected to occur upon implementation of this planning case. For example, construction of the San Antonio bypass from Macdona to Seguin would likely increase operating distances by 15,477 train miles over a 28-day period, resulting in the consumption of approximately 173,296 additional gallons of diesel fuel over the same time period. On the other hand, this planning case should reduce total run time by 11 hours per day.

RTC Performance Measure	Base Case Results	Planning Case A Results	Net Change
Trains Operated (28 days)	2,891	2,663	-228
Train Miles (28 Days)	359,028	374,505	15,477
Total Run Time Hours (Avg. Daily Hours)	496.2	485.3	-10.9
Delay Time Hours (Avg. Daily Hours)	86.6	86.4	-0.2
Delay Percentage	17.50%	17.8%	0.3%
Delay Minutes/100 Train Miles	40.52	38.76	-1.8
Average Speed	25.8	27.6	1.8
Fuel (gallons)	2,956,784	3,130,080	173,296
Gallons/Train Mile	8.2	8.3	0.1

Table 4-6: RTC Planning Case A Summary

Table 4-7 shows the economic benefit to the private sector over a 20-year study period, based on changes in performance measures attributable to Planning Case A as shown in Table 4-6. The methodology used in the analysis of private benefits is discussed in greater detail in Section 5.

Relocation of train traffic to an outer San Antonio bypass increases 20-year train mileage costs by $111.97 million and increases fuel costs by $81.49 million over this same period when discounted at a nominal cost of capital of 6.68 percent (see Appendix G for cost of capital calculations). This planning case also reduces 20-year run time and delay time costs by $17.60 million and $0.27 million respectively, resulting in a burden (i.e., costs minus savings) of approximately $176 million over the project life. However, the San Antonio bypass also provides a benefit in the form of reduced track maintenance and grade crossing accident costs of $8.92 million

and $3.80 million, respectively. Total private sector costs and savings associated with Planning Case A amount to a net private sector cost of **$163 million**.

Private Sector Benefits ($ million)	
Freight Rail Operations:	
Train Miles	-111.97
Run Time	17.60
Delay Time	0.27
Fuel	-81.49
Track Maintenance Savings	8.92
Grade Crossing Accident Avoidance	3.80
Total ($ million)	-162.86

Table 4-7: Private Benefits for Planning Case A

4.8 - Planning Case B – Austin Bypass

Planning Cases B1 and B2 each analyzed the base case plus an Austin bypass with a new intermodal yard at Macdona. The Austin bypass is a potential new rail corridor for an approximate length of 77 miles between Taylor (where the bypass would connect to the existing Austin Subdivision line) and Seguin (where the bypass would connect to the existing Glidden Subdivision) that would bypass Austin, San Marcos, and other towns. The conceptual location of an Austin bypass is shown in Figure 4-5.

In Planning Case B1, trains were routed via the existing Del Rio Subdivision between the possible Austin bypass connection in Seguin and railroad Tower 112, which is how trains are currently routed under existing conditions. Planning Case B1 also includes upgrades to existing track between Seguin and East Yard as well as between Tower 112 and SoSan Yard. The estimated cost of Planning Case B1 is **$1.6 billion**, including the cost of identified grade separated roadway-railroad crossings.

In Planning Case B2, trains were routed via the existing Austin Subdivision ML2 between the possible Austin bypass connection in Seguin and railroad Tower 112. Planning Case B2 would require the construction of a new wye connection between the Del Rio Subdivision and Austin Subdivision ML2. Planning Case B2 also includes upgrades to existing track between Seguin and the possible new wye connection along the Del Rio Subdivision, between the wye and Tower 112 on the Austin Subdivision ML2, and between Tower 112 and SoSan Yard on the Del Rio Subdivision. The estimated cost of Planning Case B2 is **$1.74 billion**, including the cost of identified grade separated roadway-railroad crossings.

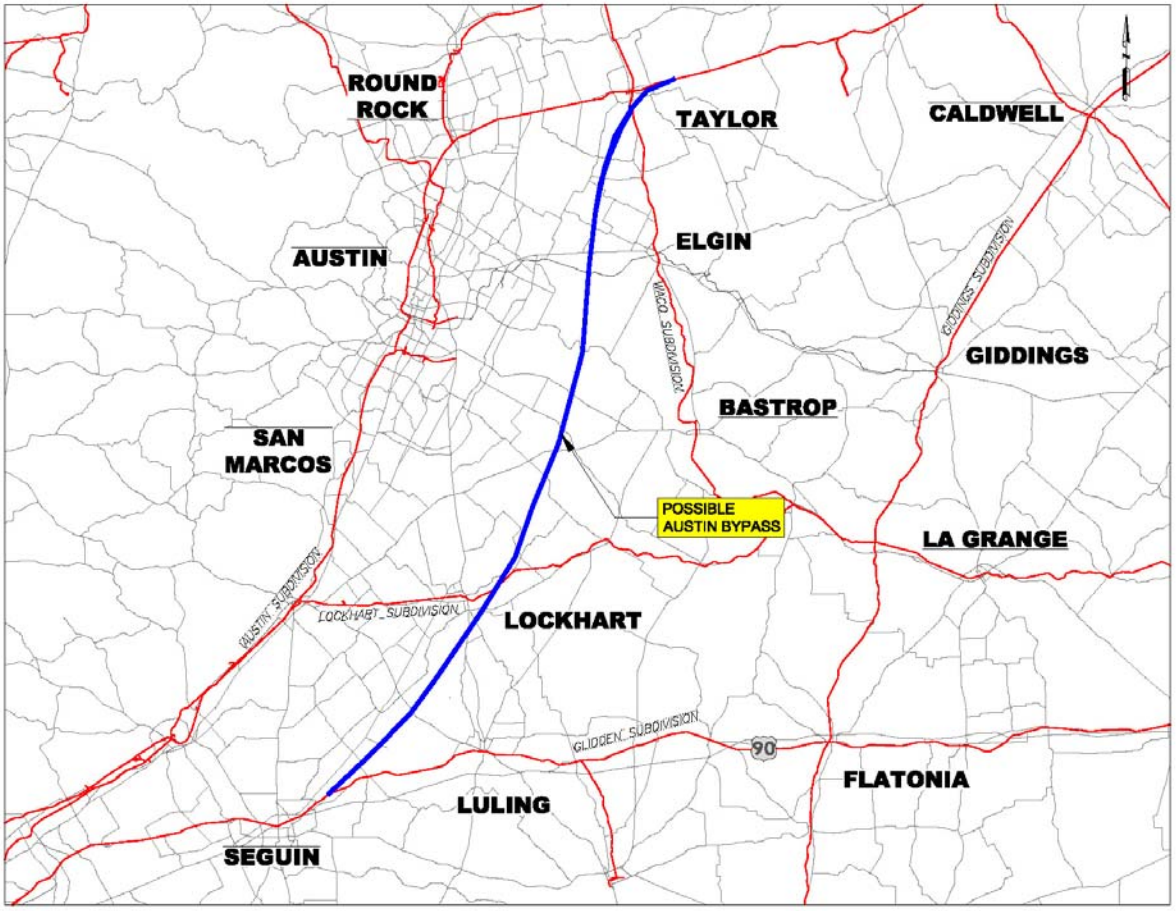


Figure 4-5: Possible Austin Bypass
(note: conceptual bypass route shown is for illustrative purposes only)

Trains that may be rerouted to the Austin bypass include through-trains and manifest (mixed-freight) trains running north-south and destined for Hearne, Dallas-Fort Worth, and other destinations north of Austin. Trains that would remain on the existing rail lines consist of passenger trains (Amtrak Texas Eagle route), rock trains to Hunter and Georgetown, local trains providing service between Taylor and San Marcos, and coal trains (minimal). Additionally, connectivity would be maintained to Capital Metro owned freight lines in the region.

Table 4-8 and Figures 4-6 through 4-8 show the daily train counts on existing subdivisions for the base case (no-build) scenario and the Austin bypass scenario, as well as the projected percent reduction in daily trains on existing lines resulting from the possible bypass route. As shown in Table 4-8, an Austin bypass route would provide reductions in daily train volumes of up to 23 daily trains on existing lines running through San Marcos, Austin, and various other cities, depending on location. Although, the daily train volumes would be increased on segments of the Austin Subdivision ML1, Del Rio Subdivision, and the Glidden Subdivision.

Railroad Subdivision	Daily Trains			Percent Change (B1)	Percent Change (B2)
	Base Case	Bypass Case (B1)	Bypass Case (B2)		
Possible Austin Bypass, Seguin to Lockhart	N/A	28	28	100%	100%
Possible Austin Bypass, Lockhart to Taylor	N/A	29	29	100%	100%
Austin Subdivision ML 1, East of Taylor	22	33	33	50%	50%
Austin Subdivision ML 1, Taylor to Round Rock	30	13	13	-57%	-57%
Austin Subdivision ML 1, Round Rock to San Marcos	25	8	8	-68%	-68%
Austin Subdivision ML 1 and 2, San Marcos to Garden Ridge	36	12	12	-67%	-67%
Austin Subdivision ML 1, Garden Ridge to San Antonio (Twr 105)	22	8	8	-64%	-64%
Austin Subdivision ML 2, Garden Ridge to Del Rio Sub	10	1	1	-90%	-90%
Austin Subdivision ML 2, Del Rio Sub to Downtown San Antonio (Twr 112)	10	1	48	-90%	380%
Corpus Christi Subdivision, SoSan Yard to Toyota Plant	13	13	13	0%	0%
Del Rio Subdivision, Kirby to Downtown San Antonio (Twr 105)	35	56	10	60%	-71%
Del Rio Subdivision, Downtown San Antonio (Twr 105) to	24	36	36	50%	50%
Glidden Subdivision, Flatonia to Seguin	27	24	24	-11%	-11%
Glidden Subdivision, Seguin to Kirby	27	52	52	93%	93%
Laredo Subdivision, San Antonio to Gessner	18	18	18	0%	0%
Lockhart Subdivision, San Marcos to West Point	12	6	6	-50%	-50%

Table 4-8: Daily Train Counts and Percent Change Resulting from Possible Austin Bypass

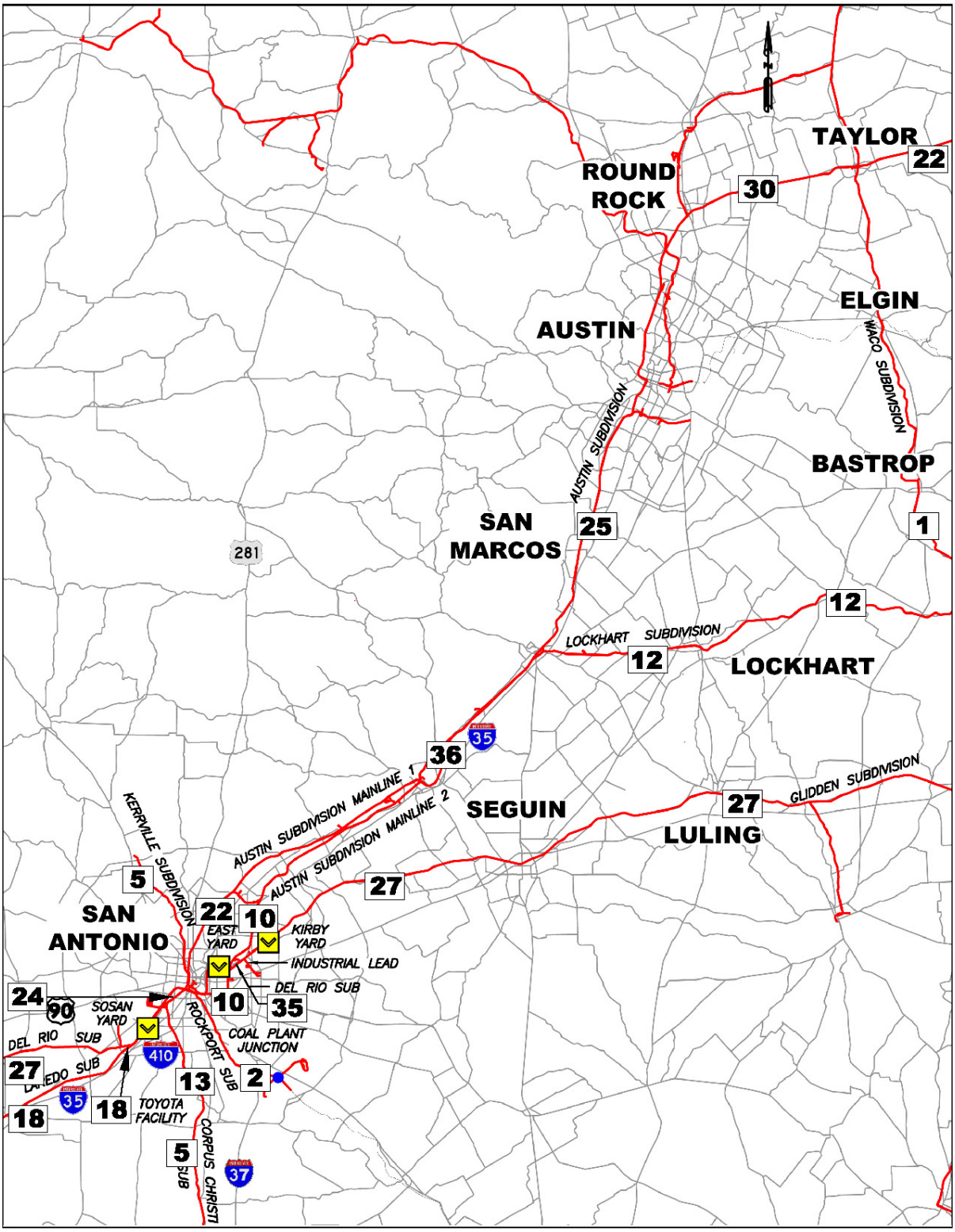


Figure 4-6: Avg. Daily Trains for Base Case Scenario (No-Build)

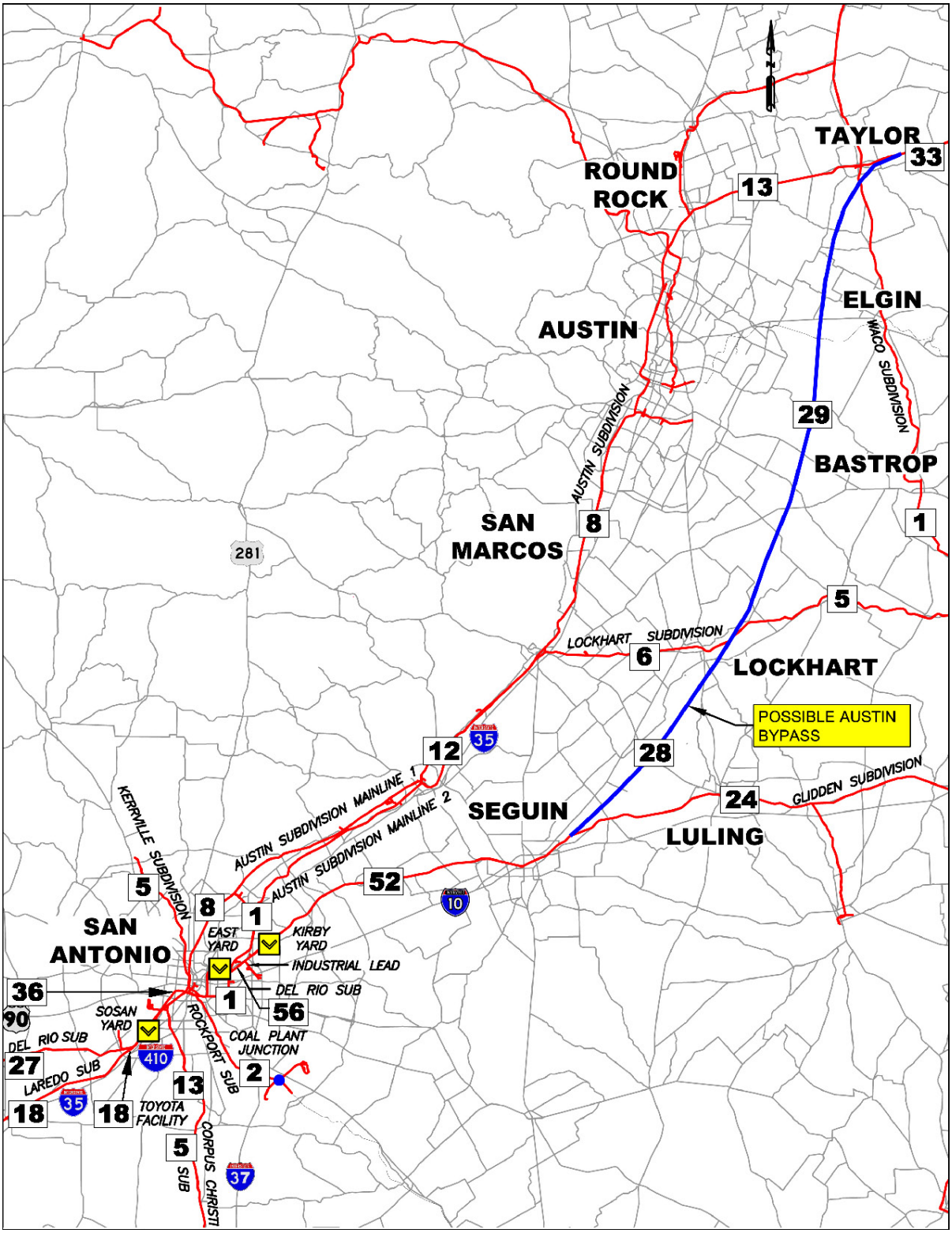


Figure 4-7: Avg. Daily Trains for Planning Case B1 (Possible Austin Bypass)
(note: conceptual bypass route shown is for illustrative purposes only)

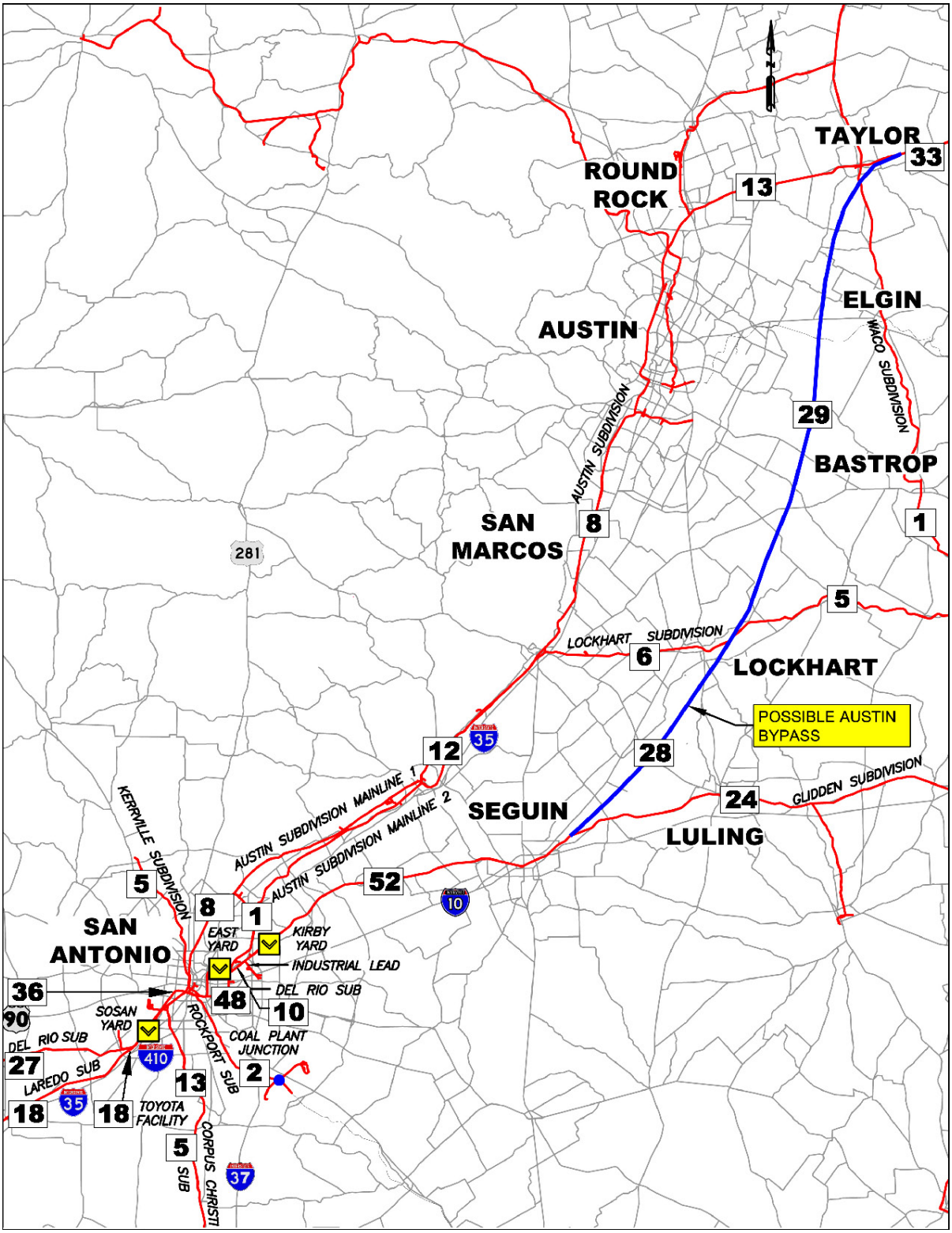


Figure 4-8: Avg. Daily Trains for Planning Case B2 (Possible Austin Bypass)
(note: conceptual bypass route shown is for illustrative purposes only)

Public Benefit Analysis

The potential public benefits associated with the relocation of through-freight rail services from existing rail lines in the region to an Austin bypass (Taylor-Seguin) would be similar to those of the San Antonio bypass such as reductions in vehicular delays, safety hazards (including roadway-railroad crossings as well as reduced hazardous material exposure), vehicle and locomotive emissions, and fuel usage, in addition to the possible implementation of commuter rail services in the existing corridor.

Commuter rail service between Austin and San Antonio has been desired for some time, and relocation of through-trains to a bypass or Austin Subdivision ML 2 alternative may allow for these plans to materialize. The relocation of freight rail operations would lessen grade crossing impedance, provide an alternative to vehicular travel, and capture the benefits of transit-oriented development.

Grade Crossing Impedance Reduction

The Austin bypass was shown to benefit the public by reducing train traffic and therefore delay and safety hazards through urban and residential areas including San Marcos and Austin. Like the San Antonio bypass, an Austin bypass would impose a public cost burden due to the introduction of train traffic between Taylor and Seguin; however, this burden is offset by a reduction in the public burden associated with roadway-railroad crossings along the existing Austin Subdivision mainlines.

The estimated public benefit of an Austin bypass resulting from the reduction in public burden associated with the at-grade roadway-railroad crossings in the region was calculated to be approximately **$6.5 million** for Planning Case B1 and **$263 million** for Planning Case B2, as shown in Tables 4-9 and 4-10, respectively. The public benefits shown in Tables 4-9 and 4-10 extend beyond the San Antonio study area to include benefits in Hays, Travis, and Williamson Counties, since the impact of the bypass is not restricted to the San Antonio area.

Railroad Subdivision	No-Build Scenario	Bypass Scenario (B1)	Bypass Benefit (difference)
Austin Subdivision (San Marcos to Williamson County Line)	$297,030,000	$126,270,000	$170,760,000
Austin No 1 (San Marcos to Downotwn San Antonio)	$454,610,000	$165,120,000	$289,490,000
Austin No 2 (San Marcos to Downotwn San Antonio)	$91,390,000	$10,910,000	$80,480,000
Corpus Christi (Downtown San Antonio to Toyota Plant)	$78,170,000	$122,930,000	-$44,760,000
Del Rio (Kirby to Macdona)	$324,240,000	$618,860,000	-$294,620,000
Giddings (Flatonia to Mumford)	$18,990,000	$11,630,000	$7,360,000
Glidden (Flatonia to Kirby)	$92,530,000	$114,220,000	-$21,690,000
Kerrville	$143,190,000	$129,060,000	$14,130,000
Laredo (Downtown San Antonio to Gessner)	$123,390,000	$262,650,000	-$139,260,000
Lockhart (San Marcos to Smithville)	$44,130,000	$18,830,000	$25,300,000
Rockport	$34,290,000	$33,310,000	$980,000
Waco (Smithville to Taylor)	$8,720,000	$7,670,000	$1,050,000
Subtotal:	**$1,710,680,000**	**$1,621,460,000**	**$89,220,000**
Possible Bypass without Grade Separations	$0	$82,750,000	-$82,750,000
Total (without grade separations on bypass)			**$6,470,000**
Possible Bypass with Grade Separations	$0	$29,900,000	-$29,900,000
Total (with grade separations on bypass)			**$59,320,000**

Table 4-9: Planning Case B1 Public Costs at Roadway-Railroad Crossings (for a 20-year period)

Railroad Subdivision	No-Build Scenario	Bypass Scenario (B2)	Bypass Benefit (difference)
Austin Subdivision (San Marcos to Williamson County Line)	$297,030,000	$126,270,000	$170,760,000
Austin No 1 (San Marcos to Downotwn San Antonio)	$454,610,000	$165,120,000	$289,490,000
Austin No 2 (San Marcos to Downotwn San Antonio)	$91,390,000	$10,410,000	$80,980,000
Corpus Christi (Downtown San Antonio to Toyota Plant)	$78,170,000	$122,930,000	-$44,760,000
Del Rio (Kirby to Macdona)	$324,240,000	$362,640,000	-$38,400,000
Giddings (Flatonia to Mumford)	$18,990,000	$11,630,000	$7,360,000
Glidden (Flatonia to Kirby)	$92,530,000	$114,220,000	-$21,690,000
Kerrville	$143,190,000	$129,060,000	$14,130,000
Laredo (Downtown San Antonio to Gessner)	$123,390,000	$262,650,000	-$139,260,000
Lockhart (San Marcos to Smithville)	$44,130,000	$18,830,000	$25,300,000
Rockport	$34,290,000	$33,310,000	$980,000
Waco (Smithville to Taylor)	$8,720,000	$7,670,000	$1,050,000
Subtotal:	**$1,710,680,000**	**$1,364,740,000**	**$345,940,000**
Possible Bypass without Grade Separations	$0	$82,750,000	-$82,750,000
Total (without grade separations on bypass)			**$263,190,000**
Possible Bypass with Grade Separations	$0	$29,900,000	-$29,900,000
Total (with grade separations on bypass)			**$316,040,000**

Table 4-10: Planning Case B2 Public Costs at Roadway-Railroad Crossings (for a 20-year period)

As modeled, the Laredo and Corpus Christi Subdivisions showed a decrease in average train speeds from the base case, which increased the public burden associated with at-grade crossing delays. These train speed decreases may be associated with the logic used in the RTC model when prioritizing train movements into and out of the SoSan Yard area. However, given the magnitude of the train speed decreases, the existing operating plan may require review and reprioritization, which may in turn increase train speeds on the Laredo and Corpus Christi Subdivisions and reduce the associated public burden shown in Tables 4-9 and 4-10.

The public cost burden due to the introduction of train traffic on a new Taylor to Seguin route, shown in Tables 4-9 and 4-10 as nearly **$83 million**, would be reduced by grade separating some of the roadway-railroad crossings along the corridor. Crossings along the route were analyzed and determined to be candidates for potential grade separation based on traffic flow volumes for both vehicular and train traffic. The potential grade separations are listed in Table 4-11 with their associated average daily traffic volumes for vehicles (AADT) and trains, as well as their estimated costs, and estimated public benefits. Certain crossings along the

route may be required to be grade separated in order to comply with FHWA regulations.

In all, the grade separations identified would reduce the public cost burden of the possible bypass route by approximately **$53 million**, thereby increasing the public benefit of the bypass to more than **$59 million** for Planning Case B1 as shown in Table 4-9 and **$316 million** for Planning Case B2 as shown in Table 4-10.

The public costs and benefits shown in Table 4-10 for Planning Case B2 assume the grade separation of two crossings (Houston Street and Presa Street) and the closure of one crossing (Hoefgen Street) on the Austin Subdivision ML 2 between the Del Rio Subdivision and Tower 112. Since Planning Case B2 would add approximately 47 average daily trains to this rail segment, leaving these three crossings at-grade would result in a net public burden of nearly $9 million on the Austin Subdivision ML 2 as opposed to the nearly $81 million benefit shown in Table 4-10.

Street Name	City Name	AADT	Estimated Cost	20-Year Benefit (2007 dollars)	Benfit/ Cost Ratio
SH 80	Prairie Lea	5,300	$8,000,000	$2,720,000	0.34
US HWY 183	Lockhart	14,900	$6,000,000	$9,530,000	1.59
FM 20	Lockhart	5,500	$6,000,000	$2,820,000	0.47
FM 812	Cedar Creek	4,600	$8,000,000	$2,190,000	0.27
SH 21	Cedar Creek	8,200	$8,000,000	$3,960,000	0.50
SH 71	Cedar Creek	28,700	$12,000,000	$15,070,000	1.26
US HWY 290	Littig	26,700	$12,000,000	$13,600,000	1.13
SH 95 (Main Street)	Taylor	6,300	$8,000,000	$2,960,000	0.37
Total:			**$68,000,000**	**$52,850,000**	**0.78**

Table 4-11: Potential Grade Separations on the Possible Austin Bypass Route (Taylor to Seguin)

Like the San Antonio bypass, the public benefit of the Austin bypass shown in Tables 4-9 and 4-10 is the result of the relocation of freight trains out of urban and residential areas onto the bypass that runs through more rural areas.

Reduced Locomotive Emissions

Also like the San Antonio bypass, the Austin bypass provides additional public benefit in the form of reduced locomotive emissions (pollutants) in the region. Planning Case B provides a public benefit from reduced locomotive emissions over the 20-year study period of **$17 million** as shown in Table 4-12.

Existing Rail Corridor Value (Commuter Rail)

Additionally, an Austin bypass provides public benefit due to the potential for the implementation of a commuter rail system that accompanies Planning Case B. The public benefits associated with the implementation of commuter rail include vehicle reduction on regional roadways, increased property values, and increased property tax revenue. The commuter rail system would also have an associated public

burden due to the introduction of additional rail traffic (passenger trains) on existing rail lines, thereby by impacting impedance at roadway-rail crossings. However, the burden would be offset by the benefits of commuter rail previously listed for a cumulative public benefit of more than **$510 million** over the 20-year study period. The methodology used in the analysis of public benefits of commuter rail systems is discussed in greater detail in the analysis of public benefits of Planning Case C, which is located later in this section. The total public benefits are shown in Table 4-12 for Planning Case B.

Public Sector Benefits ($ million)		
Commuter Rail System:	**B1**	**B2**
Vehicle Reduction	67.37	67.37
Facility Value	284.76	284.76
Property Value	106.00	106.00
Additions to Property Tax Revenue	80.74	80.74
Grade Crossing Impedance (Commuter)	-27.95	-27.95
Grade Crossing Impedance (Freight)	59.32	316.04
Locomotive Emssions Reduction	16.86	16.50
Total ($ million)	587.10	843.46

Table 4-12: Public Benefits for Planning Case B

Private Benefit Analysis

Planning Case B provides significant performance benefits compared with the base case. Run time and stop time are reduced, and the delay ratio improves. Minutes of delay per 100 train miles drops, and average train speeds over the entire network increase. The addition of the possible bypass to the network removes more trains from the existing trackage, with a consequent reduction in conflicts and delays to the trains that remain on existing trackage.

Table 4-13 compares the simulation results of the base case to Planning Cases B1 and B2, and lists the net change in each RTC simulation parameter that is expected to occur upon implementation of each planning case. For example, construction of the possible Austin bypass from Taylor to Seguin would likely reduce total run time by up to 52 daily hours and delay time by up to 28 hours per day, depending on whether trains are routed via Planning Case B1 or B2. The RTC results also show that Planning Cases B1 and B2 would reduce the net train miles traveled as well as fuel consumption despite an increase in actual route miles from the existing network. This net reduction is due primarily to a reduction in local train miles traveled in Planning Cases B1 and B2.

RTC Performance Measure	Base Case Results	Planning Case B1 Results	Planning Case B2 Results	Net Change (B1)	Net Change (B2)
Trains Operated (28 days)	2,891	2,888	2,888	-3	-3
Train Miles (28 Days)	359,028	357,047	356,965	-1,981	-2,063
Total Run Time Hours (Avg. Daily Hours)	496.2	443.9	444.9	-52.3	-51.3
Delay Time Hours (Avg. Daily Hours)	86.6	58.55	60.74	-28.1	-25.9
Delay Percentage	17.50%	13.2%	13.7%	-4.3%	-3.8%
Delay Minutes/100 Train Miles	40.52	27.6	28.6	-12.9	-11.9
Average Speed	25.8	28.7	28.7	2.9	2.9
Fuel (gallons)	2,956,784	2,956,571	2,955,889	-213	-895
Gallons/Train Mile	8.2	8.3	8.3	0.1	0.1

Table 4-13: RTC Planning Cases B1 and B2 Summary

Table 4-14 shows the economic benefit to the private sector over a 20-year study period, based on changes in performance measures attributable to Planning Case B as shown in Table 4-13. The methodology used in the analysis of private benefits is discussed in greater detail in Section 5.

Relocation of train traffic to an outer Austin bypass in Planning Case B1 decreases 20-year train mileage costs by $14.33 million and decreases fuel costs by $0.10 million over this same period when discounted at a nominal cost of capital of 6.68 percent. This planning case also reduces 20-year run time and delay time costs by $84.44 million and $44.94 million respectively, resulting in a benefit (i.e., savings minus costs) of approximately $144 million over the project life. This Austin bypass route also provides a benefit in the form of reduced track maintenance and grade crossing accident costs of $13.83 million and $4.35 million, respectively. The total of all private sector savings associated with Planning Case B1 are nearly **$162 million**.

Relocation of train traffic to an outer Austin bypass in Planning Case B2 decreases 20-year train mileage costs by $14.92 million and decreases fuel costs by $0.42 million over this same period when discounted at a nominal cost of capital of 6.68 percent. This planning case also reduces 20-year run time and delay time costs by $82.82 million and $41.54 million respectively, resulting in a benefit (i.e., savings minus costs) of approximately $140 million over the project life. This Austin bypass route also provides a benefit in the form of reduced track maintenance and grade crossing accident costs of $13.83 million and $4.35 million, respectively. The total of all private sector savings associated with Planning Case B2 are nearly **$158 million**.

Private Sector Benefits ($ million)		
Freight Rail Operations:	**B1**	**B2**
Train Miles	14.33	14.92
Run Time	84.44	82.82
Delay Time	44.94	41.54
Fuel	0.10	0.42
Track Maintenance Savings	13.83	13.83
Grade Crossing Accident Avoidance	4.35	4.35
Total ($ million)	161.99	157.89

Table 4-13: Private Benefits for Planning Case B

4.9 - Planning Case C – Central Texas Bypass

Planning Case C analyzed the base case plus possible San Antonio and Austin bypasses from Taylor to Macdona and new yards at Marion and Macdona. The Austin bypass in conjunction with the San Antonio bypass would allow through-trains that are typically routed on the UP Austin, Glidden, Del Rio, Laredo, Corpus Christi, Rockport, and Lockhart Subdivisions to be rerouted onto the bypass away from large metropolitan areas. The conceptual location of an Austin-San Antonio bypass is shown in Figure 4-9. Planning Case C also includes upgrades to existing track between Marion and the connection with the possible Austin bypass in Seguin. The estimated cost of Planning Case C is more than **$2.42 billion**, including the cost of identified grade separated roadway and rail crossings.

Although Amtrak passenger trains, rock trains, auto trains destined for Kirby Yard in San Antonio, local service trains, and a minimal number of coal trains must remain on the existing rail lines, all other trains on the network may be able to be rerouted to the Austin-San Antonio bypass.

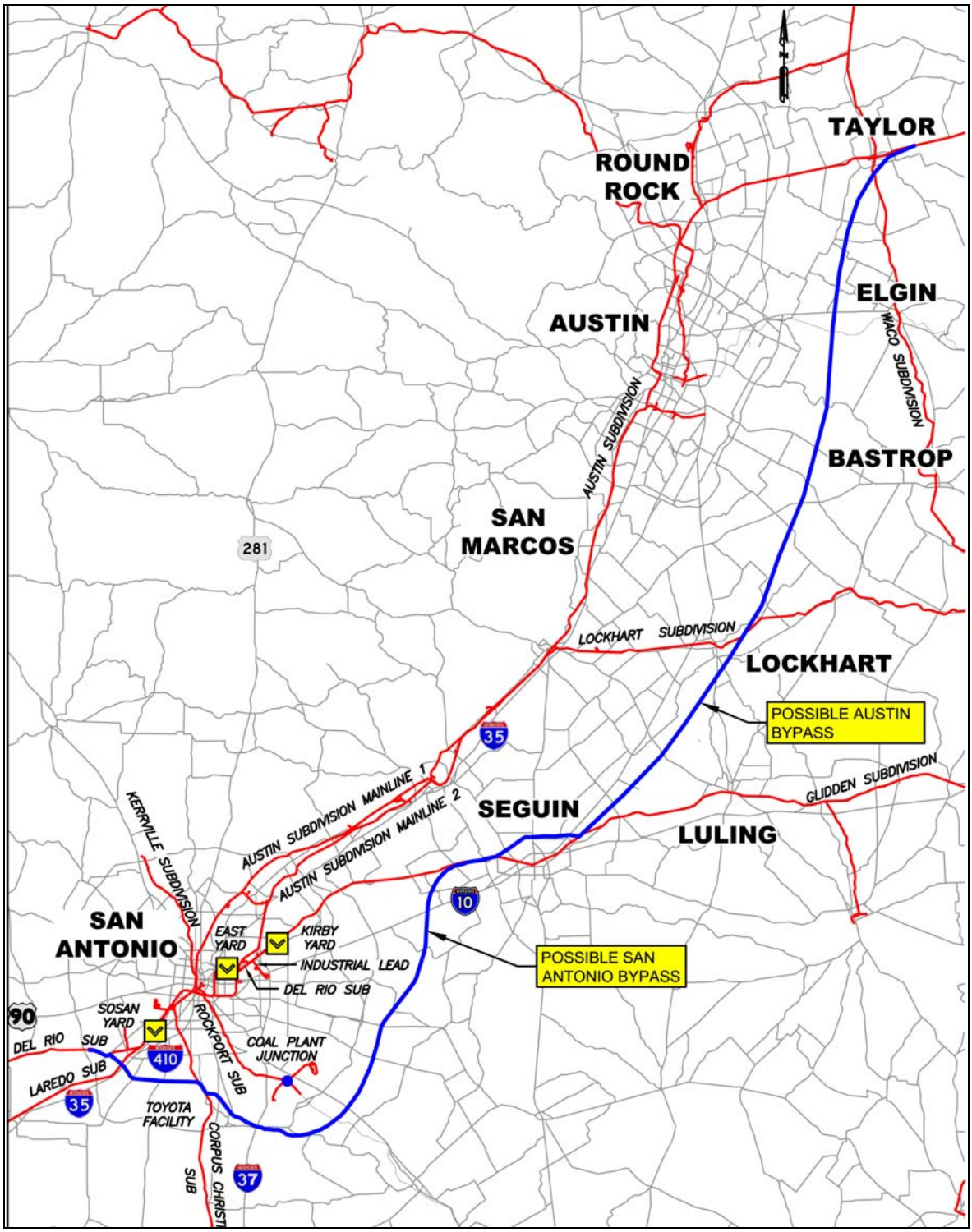


Figure 4-9: Possible Central Texas (Austin-San Antonio) Bypass
(note: conceptual bypass route shown is for illustrative purposes only)

Table 4-15 and Figures 4-10 and 4-11 show the daily train counts on existing subdivisions for the base case (no-build) scenario and the possible Austin-San Antonio bypass scenario, as well as the projected percent reduction in daily trains on

existing lines resulting from the possible bypass route. As shown in Table 4-14, the Austin-San Antonio bypass route is projected to provide reductions in daily train volumes from 3 to 24 daily trains (11 to 90 percent) on existing lines running through San Antonio, New Braunfels, San Marcos, Austin, and various other cities, depending on location.

Railroad Subdivision	Average Daily Trains		Percent Change
	Base Case	Bypass Case	
Possible Austin-San Antonio Bypass, Taylor to Seguin	N/A	29	100%
Possible Austin-San Antonio Bypass, Seguin to Macdona	N/A	42	100%
Austin Subdivision ML 1, East of Taylor	22	33	50%
Austin Subdivision ML 1, Taylor to Round Rock	30	12	-60%
Austin Subdivision ML 1, Round Rock to San Marcos	25	7	-72%
Austin Subdivision ML 1 and 2, San Marcos to Garden Ridge	36	12	-67%
Austin Subdivision ML 1, Garden Ridge to San Antonio (Twr 105)	22	7	-68%
Austin Subdivision ML 2, Garden Ridge to Del Rio Sub	10	1	-90%
Austin Subdivision ML 2, Del Rio Sub to Downtown San Antonio (Twr 112)	10	1	-90%
Corpus Christi Subdivision, SoSan Yard to Toyota Plant	13	4	-69%
Del Rio Subdivision, Kirby to Downtown San Antonio (Twr 105)	35	14	-60%
Del Rio Subdivision, Downtown San Antonio (Twr 105) to Macdona	24	4	-83%
Glidden Subdivision, Flatonia to Seguin	27	24	-11%
Glidden Subdivision, Seguin to Kirby	27	14	-48%
Laredo Subdivision, San Antonio to Gessner	18	2	-89%
Lockhart Subdivision, San Marcos to West Point	12	5	-58%

Table 4-15: Daily Train Counts and Percent Change Resulting from Possible Austin-San Antonio Bypass

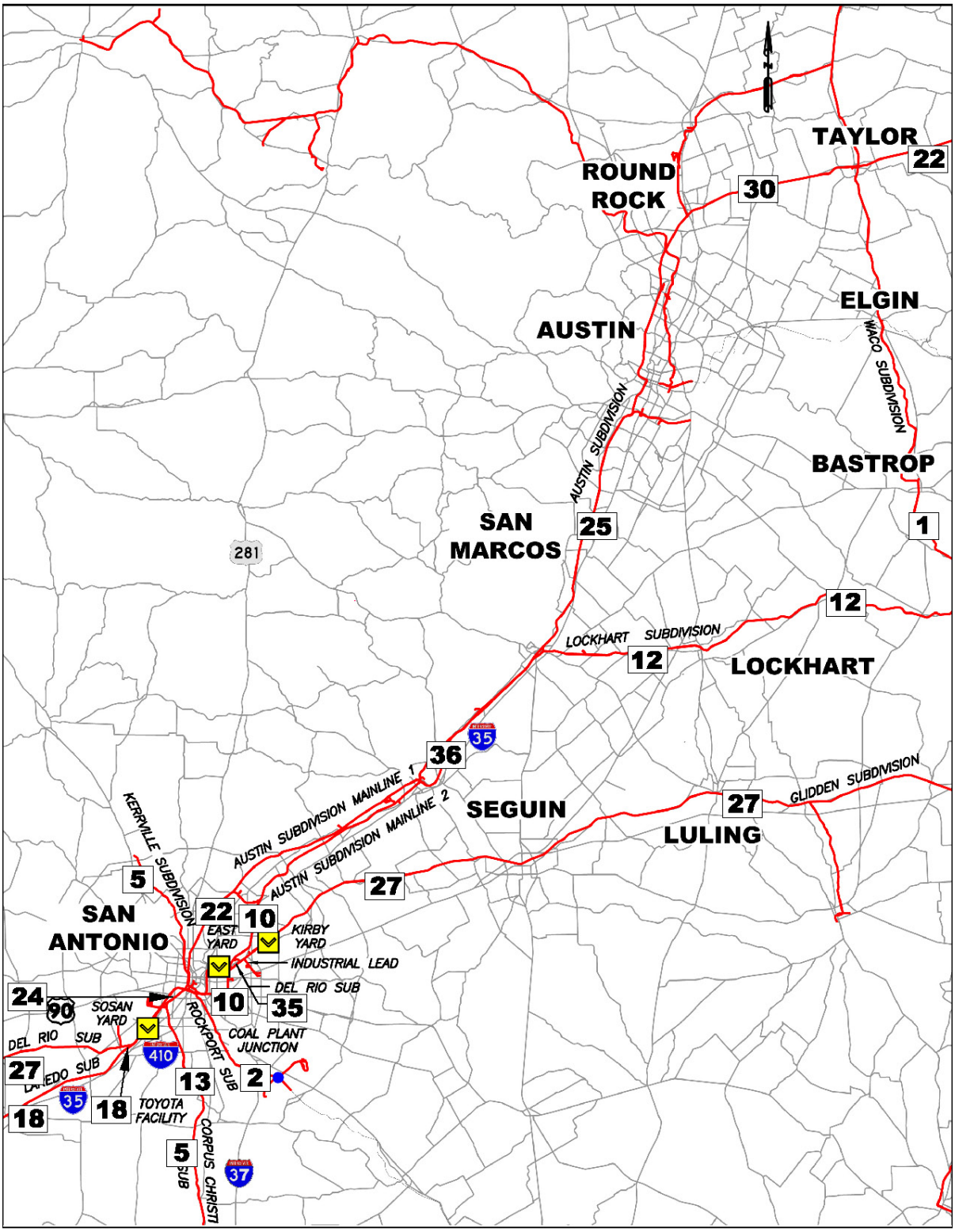


Figure 4-10: Average Daily Trains Counts for Base Case Scenario (No-Build)

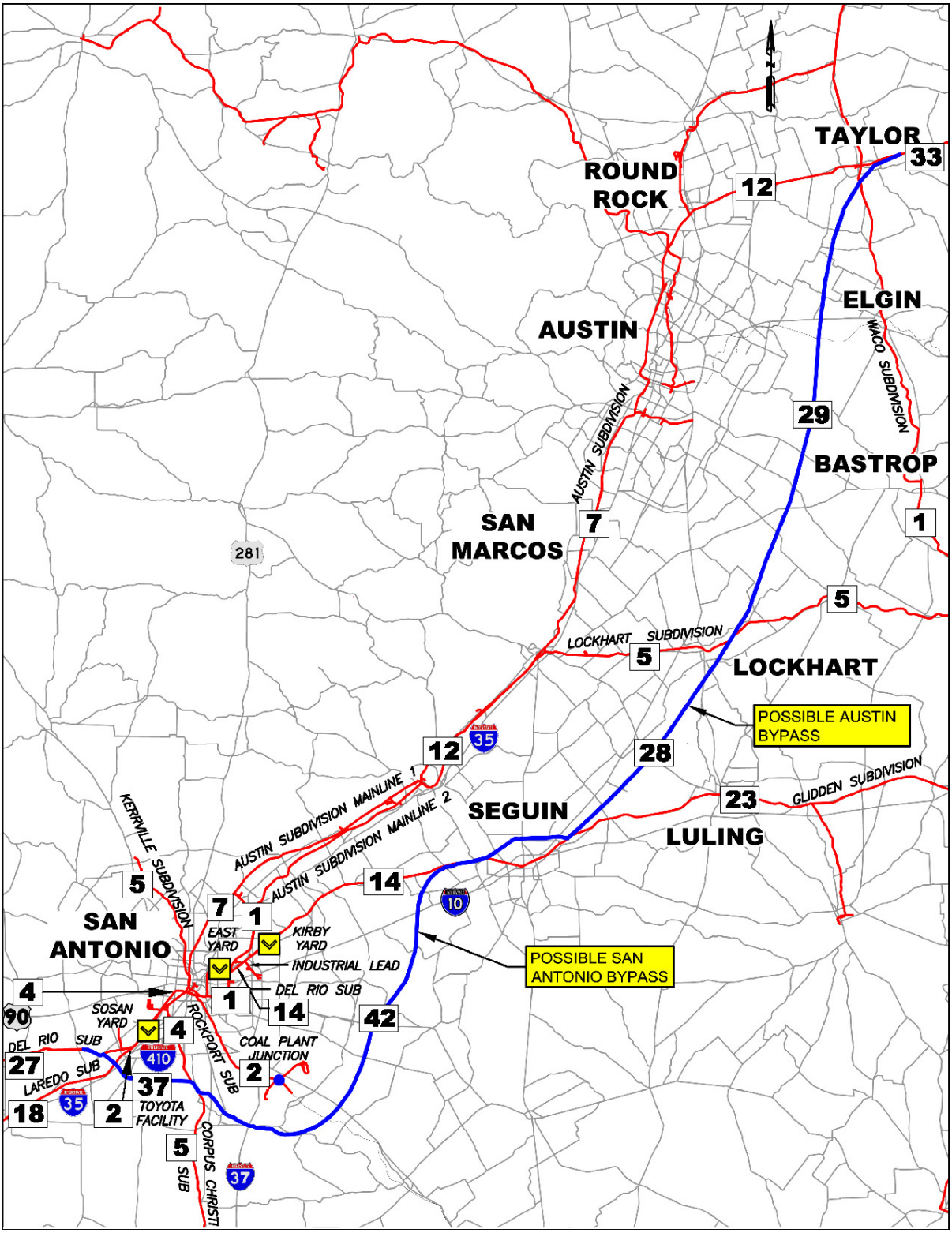


Figure 4-11: Average Daily Trains Counts for Austin-San Antonio Bypass Scenario (note: conceptual bypass route shown is for illustrative purposes only)

Public Benefit Analysis

The benefits of a rail bypass to the public are associated with the reduced interaction of vehicles with trains and the opportunity to improve urban areas that are otherwise not possible due to existing freight rail operations. The potential public benefits associated with an Austin-San Antonio bypass include those listed previously for the San Antonio bypass and the Austin bypass.

Commuter rail service between Austin and San Antonio has been desired for some time, and relocation of through-trains to a bypass would allow for these plans to materialize. The relocation of freight rail operations would lessen grade crossing impedance, provide an alternative to vehicular travel, and capture the benefits of transit-oriented development.

Grade Crossing Impedance Reduction

The Austin-San Antonio bypass was shown to benefit the public by reducing train traffic and associated safety hazards and delays through urban and residential areas including San Antonio, San Marcos, New Braunfels, and Austin. The possible bypass imposes a public cost burden due to the introduction of train traffic on the possible new Taylor to Macdona route; however, this burden is offset by a reduction in the public burden associated with roadway-railroad crossings along the existing subdivisions such as the Austin and Del Rio Subdivisions.

The estimated public benefit of an Austin-San Antonio bypass (from Taylor to Macdona) resulting from the reduction in public burden associated with the at-grade roadway-railroad crossings in the region was calculated to be approximately **$632 million**, as shown in Table 4-16.

Railroad Subdivision	No-Build Scenario	Bypass Scenario (C)	Bypass Benefit (difference)
Austin Subdivision (San Marcos to Williamson County Line)	$297,030,000	$128,490,000	$168,540,000
Austin No 1 (San Marcos to Downotwn San Antonio)	$454,610,000	$140,720,000	$313,890,000
Austin No 2 (San Marcos to Downotwn San Antonio)	$91,390,000	$6,490,000	$84,900,000
Corpus Christi (Downtown San Antonio to Toyota Plant)	$78,170,000	$86,870,000	-$8,700,000
Del Rio (Kirby to Macdona)	$324,240,000	$114,310,000	$209,930,000
Giddings (Flatonia to Mumford)	$18,990,000	$11,570,000	$7,420,000
Glidden (Flatonia to Kirby)	$92,530,000	$47,180,000	$45,350,000
Kerrville	$143,190,000	$107,920,000	$35,270,000
Laredo (Downtown San Antonio to Gessner)	$123,390,000	$39,380,000	$84,010,000
Lockhart (San Marcos to Smithville)	$44,130,000	$18,470,000	$25,660,000
Rockport	$34,290,000	$41,190,000	-$6,900,000
Waco (Smithville to Taylor)	$8,720,000	$7,660,000	$1,060,000
Subtotal:	**$1,710,680,000**	**$750,250,000**	**$960,430,000**
Possible Bypass without Grade Separations	$0	$327,920,000	-$327,920,000
Total (without grade separations on bypass)			**$632,510,000**
Possible Bypass with Grade Separations	$0	$65,500,000	-$65,500,000
Total (with grade separations on bypass)			**$894,930,000**

Table 4-16: Public Costs at Roadway-Railroad Crossings (for a 20-year period)

The construction of a rail bypass would prevent through-trains from blocking existing grade crossings and, consequently, reduce the impedance of vehicles and therefore the public costs associated with the crossings as shown in Table 4-16. The public benefits associated with reduced impedance are measured as reductions in the generation of emissions, the consumption of volatile organic compounds (fuel and oil), and the loss of time by vehicles idling at grade crossings.

The public cost burden due to the introduction of train traffic on the possible new Taylor to Macdona route, shown in Table 4-16 as nearly **$328 million**, would be significantly reduced by grade separating or closing some of the roadway-railroad crossings along the possible bypass route. Interstate crossings along the route such as I-35, I-37, and I-10 would be required to be grade separated in order to comply with FHWA regulations.

Additional crossings along the route were determined to be candidates for potential grade separation based on traffic flow volumes for both vehicular and train traffic are listed in Table 4-17. In all, the grade separations identified would reduce the public cost burden of the bypass route by approximately **$262.4 million**, thereby increasing the public benefit of the bypass over a 20-year period to more than **$894 million** as shown in Table 4-16.

Street Name	City Name	AADT	Estimated Cost	20-Year Benefit (2007 dollars)	Benfit/ Cost Ratio
IH 35 (Mainlanes and frontage roads)	San Antonio	44,500	$16,000,000	$47,210,000	2.95
FM 2790 (Somerset Road)	San Antonio	5,200	$8,000,000	$3,530,000	0.44
SH 16	San Antonio	19,400	$8,000,000	$13,700,000	1.71
US HWY 281	Cassin	14,000	$12,000,000	$10,410,000	0.87
IH 37 (Mainlanes and frontage roads)	Buena Vista	49,000	$16,000,000	$62,550,000	3.91
Loop 1604	Buena Vista	5,000	$8,000,000	$4,110,000	0.51
US HWY 181	Saspamco	18,400	$12,000,000	$13,850,000	1.15
FM 3432 (Sulphur Springs Road)	La Vernia	3,300	$8,000,000	$2,410,000	0.30
US HWY 87	Adkins	10,500	$12,000,000	$7,150,000	0.60
FM 1346	St. Hedwig	1,900	$5,000,000	$1,370,000	0.27
IH 10 (Mainlanes and frontage roads)	Santa Clara	36,500	$16,000,000	$36,490,000	2.28
FM 78	McQueeney	5,500	$8,000,000	$4,020,000	0.50
SH 46	McQueeney	13,900	$10,000,000	$970,000	0.10
SH 123 (Austin Street)	Geronimo	14,000	$8,000,000	$970,000	0.12
SH 80	Prairie Lea	5,300	$8,000,000	$2,680,000	0.34
US HWY 183	Lockhart	14,900	$6,000,000	$9,430,000	1.57
FM 20	Lockhart	5,500	$6,000,000	$2,790,000	0.47
FM 812	Cedar Creek	4,600	$8,000,000	$2,230,000	0.28
SH 21	Cedar Creek	8,200	$8,000,000	$4,050,000	0.51
SH 71	Cedar Creek	28,700	$12,000,000	$15,490,000	1.29
US HWY 290	Littig	26,700	$12,000,000	$13,980,000	1.17
SH 95 (Main Street)	Taylor	6,300	$8,000,000	$3,030,000	0.38
Total:			**$215,000,000**	**$262,420,000**	**1.22**

Table 4-17: Potential Grade Separations on the Possible Austin-San Antonio Bypass Route (Taylor to Macdona)

The public benefit of the possible Austin-San Antonio bypass shown in Table 4-16 is the result of the relocation of freight trains out of urban and residential areas onto the bypass that runs through primarily rural areas.

Reduced Locomotive Emissions

Also like the San Antonio bypass, the Austin bypass provides additional public benefit in the form of reduced locomotive emissions (pollutants) in the region. Planning Case C provides a public benefit from reduced locomotive emissions over the 20-year study period of nearly **$19 million** as shown in Table 4-18.

Existing Rail Corridor Value (Commuter Rail)

Additionally, an Austin-San Antonio bypass would provide public benefit due to the potential for the implementation of a commuter rail system that accompanies Planning Case C. The public benefits associated with the implementation of commuter rail include vehicle reduction on regional roadways, increased property values, and increased property tax revenue. The commuter rail system would also have an associated public burden due to the introduction of additional rail traffic

(passenger trains) on existing rail lines, thereby impacting impedance at roadway-rail crossings. However, the burden would be offset by the benefits of commuter rail previously listed for a cumulative public benefit of more than **$510 million** over the 20-year study period. The methodology used in the analysis of public benefits of commuter rail systems is discussed in greater detail in Section 5 of this report.

Table 4-18 lists the public benefits associated with Planning Case C including the benefits of grade crossing impedance reduction, the potential for implementation of a commuter rail system, and locomotive emissions reduction, for a total value of more than **$1.42 billion**.

Public Sector Benefits ($ million)	
Commuter Rail System:	
Vehicle Reduction	67.37
Facility Value	284.76
Property Value	106.00
Additions to Property Tax Revenue	80.74
Grade Crossing Impedance (Commuter)	-27.95
Grade Crossing Impedance (Freight)	894.93
Locomotive Emssions Reduction	19.10
Total ($ million)	1424.95

Table 4-18: Public Benefits for Planning Case C

Private Benefit Analysis

The benefits of a rail bypass to UP are generally associated with improved operating and maintenance conditions, as reflected by savings in time and cost. A sufficiently designed facility will also reduce the railroad's exposure to grade crossing incidents and eliminate the related damages to property.

Table 4-19 compares the simulation results of the base case to Planning Case C, and lists the net change in each RTC simulation parameter that is expected to occur upon implementation of this planning case. For example, construction of the possible Taylor-San Antonio bypass will likely increase operating distances by 6,500 train miles over a 28-day period, resulting in the consumption of approximately 59,613 additional gallons of diesel fuel over the same time period. On the other hand, this planning case should reduce total run time and delay time by 63 and 24 hours, respectively.

RTC Performance Measure	Base Case Results	Planning Case C Results	Net Change
Trains Operated (28 days)	2,891	2,663	-228
Train Miles (28 Days)	359,028	365,528	6,500
Total Run Time Hours (Avg. Daily Hours)	496.2	433.6	-62.6
Delay Time Hours (Avg. Daily Hours)	86.6	62.6	-24.0
Delay Percentage	17.50%	14.4%	-3.1%
Delay Minutes/100 Train Miles	40.52	28.78	-11.7
Average Speed	25.8	30.1	4.3
Fuel (gallons)	2,956,784	3,016,397	59,613
Gallons/Train Mile	8.2	8.3	0

Table 4-19: RTC Planning Case C Summary

Table 4-20 shows the economic benefit to the private sector over a 20-year study period, based on changes in performance measures attributable to Planning Case C as shown in Table 4-19. The methodology used in the analysis of private benefits is discussed in greater detail in Section 5.

Relocation of train traffic to an outer Austin-San Antonio bypass in Planning Case C increases 20-year train mileage costs by $47.02 million and increases fuel costs by $28.03 million over this same period when discounted at a nominal cost of capital of 6.68 percent. This planning case also reduces 20-year run time and delay time costs by $101.06 million and $38.57 million respectively, resulting in a benefit (i.e., savings minus costs) of approximately $65 million over the project life. This Austin-San Antonio bypass route also provides a benefit in the form of reduced track maintenance and grade crossing accident costs of $22.76 million and $8.15 million, respectively. The total of all private sector savings associated with Planning Case C are nearly **$96 million**.

Private Sector Benefits ($ million)	
Freight Rail Operations:	
Train Miles	-47.02
Run Time	101.06
Delay Time	38.57
Fuel	-28.03
Track Maintenance Savings	22.76
Grade Crossing Accident Avoidance	8.15
Total ($ million)	95.49

Table 4-20: Private Benefits for Planning Case C

4.10 Planning Case Comparisons

Table 4-21 summarizes base case and planning case simulation results for the bypass alternatives.

RTC Performance Measure	Base Case	PC A - SA Bypass	PC B1 - AUS Bypass	PC B2 - AUS Bypass	PC C - SA & AUS Bypass
Trains Operated (28 Days)	2,891	2,663	2,888	2,888	2,663
Train Miles (28 Days)	359,028	374,505	357,047	356,965	365,528
Run Time (Avg. Daily Hrs)	496.2	485.3	443.9	444.9	433.6
Stop Time (Avg. Daily Hrs)	86.6	86.4	58.55	60.74	62.6
Delay (%)	17.5%	17.8%	13.2%	13.7%	14.4%
Delay Minutes/100TM	40.51	38.76	27.6	28.6	28.78
Average Speed	25.8	27.6	28.7	28.7	30.1
Fuel (gallons)	2,956,784	3,130,080	2,956,571	2,955,889	3,016,397
Gallons/ Train Mile	8.2	8.3	8.3	8.3	8.3

Table 4-21: RTC Summary of Planning Cases A, B, and C

The largest impact to train operations occurs when Planning Cases A, B, and C are compared to the base case. The San Antonio bypass (Planning Case A) shows a 4.3 percent increase in train miles, an increase of nearly 6 percent in fuel consumption and an increase of 1.2 percent in gallons/train mile for the total network. Other categories that reflect improvements for train movements include: reduced total run time hours by 2.2 percent, reduced delay minutes/100 train miles by 4.3 percent, and increased average speed by 6.9 percent.

Construction of the possible Austin bypass from Taylor to Seguin would likely reduce total run time by approximately 10 percent and delay time by up to 32 percent, depending on whether trains are routed via Planning Case B1 or B2. The RTC results also show that Planning Cases B1 and B2 would reduce the net train miles traveled as well as fuel consumption despite an increase in actual route miles from the existing network. This net reduction is due primarily to a reduction in local train miles traveled in Planning Cases B1 and B2.

The combined San Antonio and Austin bypass (Planning Case C) shows impacts to train performance for the following measures:

- Train Miles – increased by 1.8%
- Run Time – reduced by 12.6%
- Hours of Delay – reduced by 27.7%
- Delay Minutes/ 100 Train Miles – reduced by 29%
- Average Train Speed – increased by 16.5%
- Fuel Consumption – increased by 2%
- Gallons of Fuel/ Train Mile – increased by 1.2%

Table 4-22 shows the average daily train counts by segment for the base case and planning cases A, B, and C.

Railroad Subdivision	Average Daily Trains				
	Base Case	Case A - SA Bypass	Case B1 - AUS Bypass	Case B2 - AUS Bypass	Case C - SA&AUS Bypass
Possible Austin-San Antonio Bypass, Taylor to Seguin	N/A	N/A	29	29	29
Possible Austin-San Antonio Bypass, Seguin to Macdona	N/A	31	N/A	N/A	42
Austin Subdivision ML 1, East of Taylor	22	13	33	33	33
Austin Subdivision ML 1, Taylor to Round Rock	30	21	13	13	12
Austin Subdivision ML 1, Round Rock to San Marcos	25	16	8	8	7
Austin Subdivision ML 1 and 2, San Marcos to Garden Ridge	36	23	12	12	12
Austin Subdivision ML 1, Garden Ridge to San Antonio (Twr 105)	22	16	8	8	7
Austin Subdivision ML 2, Garden Ridge to Del Rio Sub	10	3	1	1	1
Austin Subdivision ML 2, Del Rio Sub to Downtown San Antonio (Twr 112)	10	3	1	48	1
Corpus Christi Subdivision, SoSan Yard to Toyota Plant	13	5	13	13	4
Del Rio Subdivision, Kirby to Downtown San Antonio (Twr 105)	35	15	56	10	14
Del Rio Subdivision, Downtown San Antonio (Twr 105) to Macdona	24	5	36	36	4
Del Rio Subdivision, Macdona to Hondo	27	27	27	27	27
Glidden Subdivision, Flatonia to Seguin	27	40	24	24	23
Glidden Subdivision, Seguin to Kirby	27	13	52	52	14
Laredo Subdivision, San Antonio to Gessner	18	11	18	18	2
Laredo Subdivision, Gessner to Melon	18	18	18	18	18
Lockhart Subdivision, San Marcos to West Point	12	9	6	6	5

Table 4-22: Average Daily Train Volumes by Segment

4.11 Planning Case Benefit/Cost Summary

The estimated public and private benefits for each planning case are shown in Table 4-23 along with associated cost/benefit comparisons. As shown in the table, Planning Case C has the highest total public benefit to cost ratio and the largest benefit to the operating railroad, as well as the highest total benefit to cost ratio. The estimated private benefit is largely due to savings in run time and delay time over the 20-year period.

Planning Case	Estimated Cost	Estimated Public Benefit	Ratio: Public Benefit/Cost	Estimated Private Benefit	Ratio: Private Benefit/ Cost	Estimated Total Benefit	Ratio: Total Benefit/Cost
A	$ 1,369,610,000	$ 504,790,000	0.37	$ (162,860,000)	-0.12	$ 341,930,000	0.25
B1	$ 1,595,900,000	$ 587,100,000	0.37	$ 161,990,000	0.10	$ 749,090,000	0.47
B2	$ 1,741,260,000	$ 843,460,000	0.48	$ 157,890,000	0.09	$ 1,001,350,000	0.58
C	$ 2,423,510,000	$1,424,950,000	0.59	$ 95,490,000	0.04	$ 1,520,440,000	0.63
Estimated public and private benefits are based on a 20-year study period.							

Table 4-23: Planning Case Estimated Cost and Benefits Summary

The possible San Antonio bypass analyzed in Planning Case A was shown to provide a public benefit in the form of reduced impedance (delay, accidents, and emissions) at roadway-rail crossings of more than $501.4 million over the no-build scenario. Incorporating the Austin bypass with the San Antonio bypass, as analyzed in Planning Case C, would add a public benefit of more than $393.5 million. The majority of the additional benefit that may be seen from incorporating a possible Austin bypass with the San Antonio bypass option would be seen on the Laredo and Austin ML1 Subdivisions. The public benefits of reduced impedance at grade crossings along each rail subdivision for Planning Cases A, B, and C are shown in Table 4-24. The values shown represent the difference in impedance costs relative to the base case.

Railroad Subdivision	PC A - SA Bypass	PC B1 - Austin Bypass	PC B2 - Austin Bypass	PC C - SA & Austin Bypass
Austin Subdivision (San Marcos to Williamson County Line)	$111,450,000	$170,760,000	$170,760,000	$168,540,000
Austin No 1 (San Marcos to Downotwn San Antonio)	$182,760,000	$289,490,000	$289,490,000	$313,890,000
Austin No 2 (San Marcos to Downotwn San Antonio)	$58,750,000	$80,480,000	$80,980,000	$84,900,000
Corpus Christi (Downtown San Antonio to Toyota Plant)	-$36,340,000	-$44,760,000	-$44,760,000	-$8,700,000
Del Rio (Kirby to Macdona)	$148,670,000	-$294,620,000	-$38,400,000	$209,930,000
Giddings (Flatonia to Mumford)	-$6,530,000	$7,360,000	$7,360,000	$7,420,000
Glidden (Flatonia to Kirby)	$40,730,000	-$21,690,000	-$21,690,000	$45,350,000
Kerrville	$34,870,000	$14,130,000	$14,130,000	$35,270,000
Laredo (Downtown San Antonio to Gessner)	-$52,210,000	-$139,260,000	-$139,260,000	$84,010,000
Lockhart (San Marcos to Smithville)	$19,590,000	$25,300,000	$25,300,000	$25,660,000
Rockport	$29,570,000	$980,000	$980,000	-$6,900,000
Waco (Smithville to Taylor)	-$830,000	$1,050,000	$1,050,000	$1,060,000
Possible Bypass with Grade Separations	-$29,060,000	-$29,900,000	-$29,900,000	-$65,500,000
Total (with grade separations on bypass)	**$501,420,000**	**$59,320,000**	**$316,040,000**	**$894,930,000**

Table 4-24: 20-Year Grade Crossing Impedance Reduction/Public Benefit

5.0 Evaluation Methodology [4]

5.1 - Introduction

The improvements selected to be analyzed were based on the results of freight rail operations modeling (RTC) that are intended to improve freight rail movement efficiency. Additional improvements and/or recommendations were received from various discussions with stakeholder groups, such as the UP, the BNSF, the Austin-San Antonio Intermunicipal Commuter Rail District, the Port Authority of San Antonio, the San Antonio Transportation Association, the San Antonio Mobility Coalition, the San Antonio Chamber of Commerce, and discussions with San Antonio Mayor Hardberger and Bexar County Judge Wolff.

The potential improvements determined from the sources listed above have been analyzed to determine the effects on efficiency, mobility, and safety for both rail operations in the Central Texas region. This analysis began with the identification of the existing conditions, and included estimates of the construction cost, estimated implementation timeframe, and estimated public and private benefits for the identified improvements.

The existing conditions for the locations of potential improvements incorporated a review of property land uses and estimated values, environmental constraints, traffic flow volumes for rail traffic, and accident statistics.

The estimated costs for each improvement are order of magnitude costs that were determined based on preliminary planning. The costs included in this study represent an estimate of probable costs prepared in good faith and with reasonable care. The study team has no control over the costs of construction labor, materials, or equipment, nor over competitive bidding or negotiating methods and does not make any commitment or assume any duty to assure that bids or negotiated prices will not vary from these estimates. The costs are subject to inflation and in some cases are calculated using county appraisal district values for right-of-way acquisition, which may vary from the actual cost of property acquisition.

The implementation timeframe for each improvement was estimated based on the additional analysis, design, environmental mitigation, and funding that would be required prior to implementation.

[4] "Section 5.0 Evaluation Methodology" was completed during TxDOT's *San Antonio Region Freight Study* and is contained in Section 10 of that report. The information from Section 10 of that study was edited for content and context and included herein as "Section 5.0 Evaluation Methodology". The editing did not affect the accuracy of the information provided.

5.2 - Public Benefits

Anticipated public benefits of the potential improvements include reduced impedance at roadway-rail grade crossings, benefits associated with the potential for implementation of a commuter rail system, and property tax revenue benefits.

Grade Crossing Impedance

The costs related to the interaction of vehicular and train traffic at roadway-railroad crossings was evaluated and public benefits associated with identified improvements within the 12-county San Antonio region as well as the Austin Subdivision through Hays, Travis, and Williamson Counties were estimated. This analysis included calculating changes in vehicle emission volumes, delay times, operating costs, and accident costs directly related to trains blocking roadway crossings. Public benefits of identified railroad infrastructure improvements and grade crossing improvements such as crossing closures or the construction of grade separation structures were estimated as the reduction of the public cost burden associated with the existing at-grade crossings in the region.

As Figure 5-1 illustrates, the grade crossing analysis model was developed by collecting railroad and roadway data that characterize existing conditions at the at-grade crossings in the Central Texas region. Railroad input data included daily train volumes, average train lengths and speeds, and the number of tracks at each crossing. Roadway input data included average daily traffic, vehicle classification type, number of lanes, and accident history. These parameters were used to calculate a base cost associated with train-vehicle interactions under existing conditions as prescribed by the Federal Railroad Administration (FRA).

The model measured the impact of specific infrastructure planning cases by calculating a second set of results that reflected the relocation of railroad operations. New railroad train volumes and speeds were incorporated into the model based on RTC simulation of the modified Central Texas rail network. This approach allowed for the public benefit of each planning case to be measured as a reduction in the total cost of the base case (no-build network).

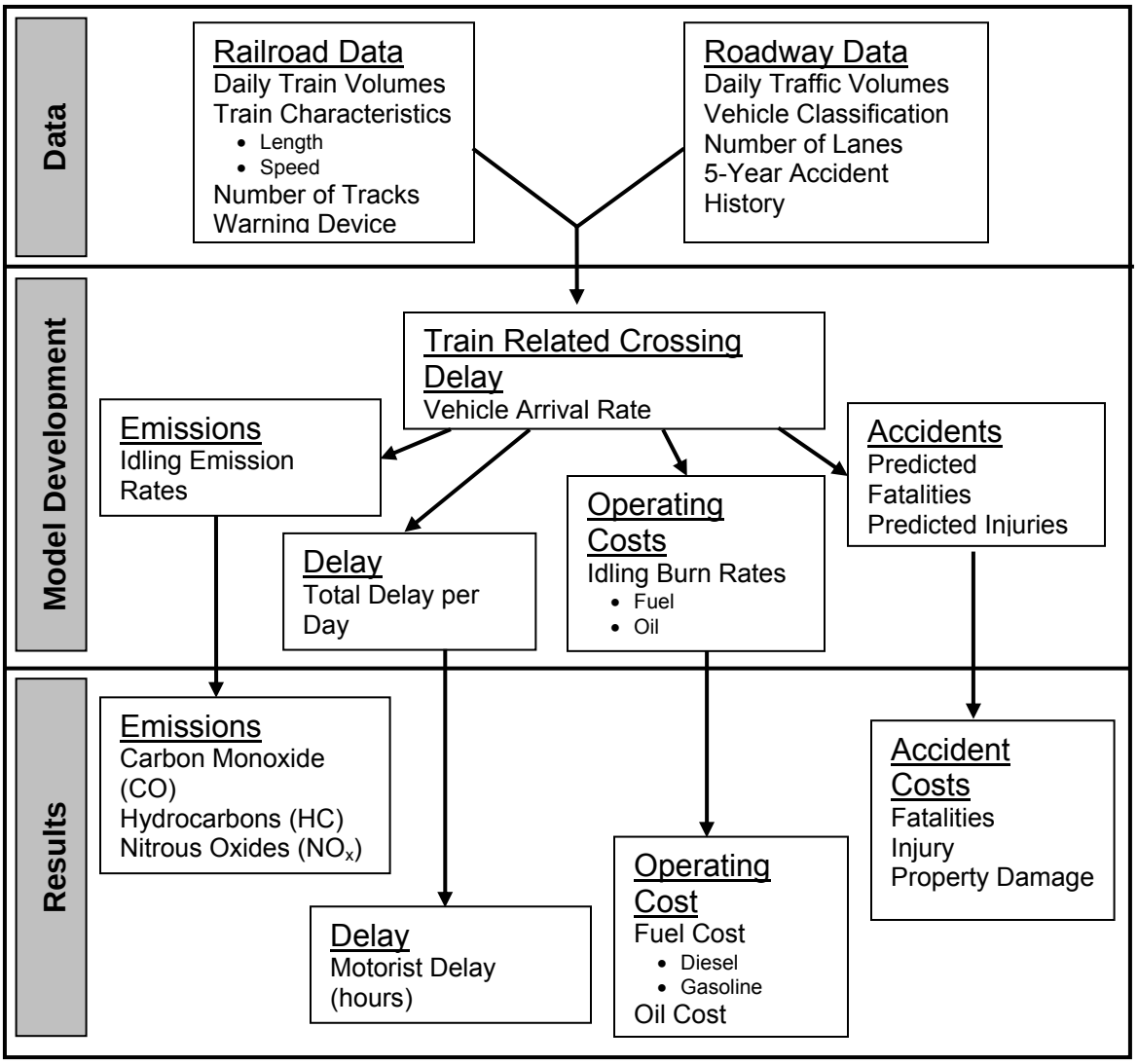


Figure 5-1: Procedure Flow Chart

The model calculated annual public costs incurred at each at-grade crossing due to train-vehicle interactions. Public costs were estimated for vehicle emission volumes, delay times, operating costs, and accidents. The model projected these current year costs over a 20-year project duration based on a 2.75 percent annual rate of growth in both vehicle traffic and train volumes.

Vehicular delay occurs when grade crossings are occupied by one of three distinct train classes: freight trains, switching trains, or passenger trains. The estimated train length of each train class was matched with a representative train speed to determine the average grade crossing block time per train. These block times were multiplied by the average number of daily trains per class, then aggregated to yield an average crossing block time per day for each crossing within a rail subdivision. Corresponding train volumes were generated by the RTC simulation, which emulated existing train operations in the Central Texas region.

Average vehicle arrival rates were calculated by aggregating data specific to three vehicle classes: passenger cars, busses, and tractor-trailer trucks. Equivalent passenger car equivalency rates were used to aggregate arrival rates of each vehicle class at grade crossings blocked by trains in order to translate the data into estimates of vehicle delay per occupied crossing.

Emission costs were measured as the volume changes in carbon monoxide (CO), hydrocarbon (HC), and nitrous oxide (NOx) produced by vehicles while idling at blocked crossings. Decreases in emissions during deceleration and increases in emissions during acceleration were not considered, resulting in a conservative total cost estimate. Emission costs per crossing closure were estimated by multiplying average idle time, the number of trains per day; and idle emission rates specific to each vehicle class to yield total CO, HC, and NOx emissions. Finally, the public cost, or environmental impact, of these emissions was calculated by multiplying the emission volumes by the respective unit cost of each pollutant.

Operating costs measure the extra fuel and oil consumed by vehicles delayed at a railroad crossing. As with delay calculations, these operating costs were based strictly on vehicle idle times and did not include the consumption of fuel and oil directly related to vehicular deceleration and acceleration. Vehicle idle times at each blocked crossing were converted to operating costs by multiplying these estimates by the burn rates and average costs of both fuel and oil.

The severity of predicted accidents at each grade crossing was estimated using Department of Transportation (DOT) formulas adopted by the FRA. The assumption of vehicle accident rates were based on warning device type, numbers of trains, number of tracks, number of roadway lanes, roadway surface condition, vehicle traffic volumes, and five-year crash histories. The predicted numbers of accidents were incorporated into DOT formulas that estimate fatality, injury-only, and property damage-only rates. These rates were then multiplied by the cost of each accident type as reported in the 2005 National Safety Council statistics.

The Net Present Value shown as the public benefit is the cumulative projected cost-burden over a 20 year period. Net present value (NPV) is a standard method for financial evaluation of long-term projects. The NPV is the value of the improvement projected 20 years into the future in terms of today's dollars.

Locomotive Emissions

The diversion of through trains to a bypass will modify the run time and delay time of existing rail operations due to changes in travel distance, network capacity, and operating speeds. The results of RTC simulation were used to translate these changes in run time and delay time to an expected change in locomotive emissions. Table 5-1 lists emission rates for hydrocarbons (HC), carbon monoxide (CO), nitrous oxides (NOx), and particulate matter (PM) according to each throttle position of a locomotive.[5]

Throttle Position	HC (g/hr)	CO (g/hr)	NO_x (g/hr)	PM_{10} (g/hr)
Brake	1400	1849	1335	622
Idle	478	492	309	228
1	226	361	1299	131
2	192	464	3000	140
3	361	1197	7267	427
4	294	2772	14014	336
5	595	3895	25584	348
6	748	5872	33600	499
7	826	3302	39766	585
8	984	3034	47027	697

Table 5-1: Locomotive Emissions per Throttle Position.

Scientific studies have valued the cost of emissions listed in Table 5-1 over a range of prices. The public benefit analysis estimates the cost of locomotive emissions using median reported values compiled from a survey of these studies, as listed in Table 5-2.

Pollutant	Cost $/ton
HC	1400
CO	520
NO_x	1060
PM_{10}	2800

Table 5-2: External Cost of Emissions.

Based on the costs of emissions in Table 5-2, the locomotive emission rates in Table 5-1 were converted to hourly emissions costs, as shown in Table 5-3. Total hourly

[5] Painter, T.D. and Barkan, C.P.L., Prospects for Dynamic Brake Energy Recovery on North American Freight Locomotives, Proceedings of the 2006 Joint Rail Conference, April 4-6, Atlanta, GA.

costs per throttle position are presented for a single locomotive and for a train consisting of two locomotives.

Throttle Position	HC ($/hr)	CO ($/hr)	NOx ($/hr)	PM_{10} ($/hr)	Total ($/engine-hr)	Total ($/train-hr)
Brake	2.16	1.06	1.56	1.92	6.69	13.39
Idle	0.74	0.28	0.36	0.70	2.08	4.17
1	0.35	0.21	1.52	0.40	2.48	4.95
2	0.30	0.27	3.50	0.43	4.50	8.99
3	0.56	0.69	8.48	1.32	11.04	22.08
4	0.45	1.59	16.36	1.04	19.44	38.87
5	0.92	2.23	29.87	1.07	34.09	68.18
6	1.15	3.36	39.22	1.54	45.28	90.56
7	1.27	1.89	46.42	1.80	51.39	102.78
8	1.52	1.74	54.90	2.15	60.30	120.61

Table 5-3: Locomotive and Train Emission Costs per Throttle Position.

The annual change in emission costs assumes that train delay time is primarily spent in the idle position, while train run time is spent at an average of throttle positions 1 through 8. Table 5-4 lists the total benefit associated with each planning case, based on changes in the delay and run times produced by RTC simulation. The results of this analysis show that the total annual benefit from reduced locomotive emissions for the San Antonio bypass and the combined Austin-San Antonio bypass is $0.27 million and $1.34 million, respectively. Operations over the Austin bypass alone results in an annual public cost beyond that of existing conditions of $1.32 million for Austin B1 and $1.11 million for Austin B2.

Locomotive Throttle Position	Avoided Emissions Costs ($/year)			
	San Antonio	Austin B1	Austin B2	SA-Austin
Idle	257	42,439	39,229	32,051
1	19,698	94,517	92,709	113,131
2	35,772	171,641	168,359	205,444
3	87,864	421,586	413,525	504,614
4	154,659	742,080	727,891	888,226
5	271,238	1,301,443	1,276,559	1,557,750
6	360,289	1,728,728	1,695,674	2,069,185
7	408,921	1,962,073	1,924,557	2,348,485
8	479,834	2,302,324	2,258,303	2,755,745
Idle	257	42,439	39,229	32,051
Run (ave)	227,285	1,090,549	1,069,697	1,305,322
Total	227,542	1,132,988	1,108,926	1,337,374

Table 5-4: Public Benefit of Locomotive Emissions Reduction

Existing Rail Corridor Value (Commuter Rail)

Commuter rail service between Austin and San Antonio has been desired for some time, and relocation of through-trains to a possible bypass would allow for these plans to materialize. The relocation of freight rail operations would lessen grade crossing impedance, provide an alternative to vehicular travel, and capture the benefits of transit-oriented development.

Assuming that the construction of a rail bypass between Taylor and Seguin would give the state ownership of the existing rail lines, the old facilities could potentially be used for commuter rail service, significantly adding to the estimated public benefit of the possible bypass. The value of this asset has been determined using previously estimated costs of developing this commuter system.[6] Table 5-5 lists the itemized costs for the case where a new track dedicated to commuter service is constructed, and the case where commuter service is shared with freight rail operations on the existing line. The asset value to the state is the difference in these costs, reflecting the benefit of acquiring a facility with track devoted to commuter rail operations. Table 5-5 shows the current value (2007 dollars) of this facility is approximately $285 million.

Ownership of the corridor would also allow the state to sell or lease portions of the 100-foot railroad right-of-way for the location of utilities or other non-intrusive facilities. A market price that reflects the unique potential of rail corridor property values has been based on relevant estimations in the recent past. Estimates for a discontinued rail corridor in East Memphis have ranged from $63.8 to $69.1 million per square mile,[7] while that for property in Milwaukee has been sold at $52.0 million per square mile.[8] The property value of the existing Austin-San Antonio corridor assumes a market price of $50.0 million per square mile, or approximately $106 million in total value.[9]

[6] Austin-San Antonio Commuter Rail Feasibility Study, Texas Department of Transportation, 1999.

[7] The Most Expensive Real Estate in Memphis?, Memphis Business Quarterly, Spring, 2007.

[8] Mequon Developer Buys Railroad Corridor for Business Park, The Business Journal of Milwaukee, April 20, 2007.

[9] The estimate of $50 million per square mile could be a very conservative estimate for the land value of a rail corridor between Austin and San Antonio in comparison to rail corridors that have been sold elsewhere. Additional value, in part, would depend on the extent of revenue generation that could be supported coincident with passenger rail operations, such as leases for utilities or other infrastructure. The potential additional value gained by the public sector acquiring this asset should be considered accordingly.

Item	1998 Costs ($ million)		
	New Track	Shared Track	Existing Asset Value
Track	116	47	69
Bridges	46	0	46
Passenger Stations	20	20	0
Signaling	48	21	27
Maintenance Shop & Yard	7	7	0
Grade Crossings	37	37	0
Right-of-Way	27	2	25
Trains	66	66	0
Testing & Start-up	2	1	1
Design & Management	49	22	27
Agency Costs	7	3	4
Contingency	50	24	26
Total	475	250	225
2007 Value ($ million)			284.76

Table 5-5: Commuter Rail Facility Value

Vehicle Reduction Benefits

The FHWA has estimated the costs of highway travel for different vehicle classifications.[10] Each of the categories shown in Table 5-6 was identified as a cost incurred by the public sector when vehicles use the highway system. The dollar amounts listed for 2000 in Table 5-6 are FHWA-reported costs associated with pavement wear, congestion, etc. The 2007 costs are adjustments of the FHWA finding to reflect current values, based on differences in 2000 and 2007 Consumer Price Index (CPI) values provided by the Federal Reserve Bank.

In the case of commuter rail service, the costs per car-mile shown in Table 5-6 represent the benefit of displacing vehicles from the roadway network with the implementation of commuter rail service on the existing rail corridor. Table 5-7 incorporates ridership projections from the state's commuter rail study into the determination of a corresponding number of displaced vehicles, assuming an average of 1.2 occupants per vehicle. Analysis of these benefits over a 20-year period uses the 1.54 percent growth in ridership assumed in the commuter rail study to forecast increases in the $3.96 million avoided public cost shown in Table 5-7.

[10] Addendum to the 1997 Federal Highway Cost Allocation Study, Final Report, U.S. Department of Transportation, Federal Highway Administration, May 2000.

Public Cost	($/car-mi)	
	2000	2007
Pavement	0.001	0.0012
Congestion	0.077	0.0922
Crash	0.0119	0.0143
Air pollution	0.0133	0.0159
Noise	0.0009	0.0011
Total	0.1041	0.1247

Table 5-6: FHWA Marginal Costs of Passenger Vehicles

Commuter Station Segment	1st Year Passengers	Segment Distance (miles)	Trip Length (passenger-miles)	Displaced Vehicles (car-miles)	1st Year Avoided Public Cost ($)
Georgetown & Round Rock	157,700	8.5	1,333,800	1,111,500	138,600
Round Rock & McNeil Jct	394,200	6.8	2,680,200	2,233,500	278,500
McNeil & US 183	370,700	4.5	1,675,700	1,396,400	174,100
US 183 & RM 2222	387,800	3.1	1,194,300	995,200	124,100
RM 2222 & Austin CBD	490,000	5.4	2,646,100	2,205,100	275,000
Austin CBD & Ben White	458,100	3.0	1,374,200	1,145,200	142,800
Ben White & San Marcos	502,800	27.0	13,575,900	11,313,200	1,410,900
San Marcos & New Braunfels	289,800	17.5	5,070,700	4,225,600	527,000
New Braunfels & Selma	232,200	16.0	3,715,700	3,096,400	386,200
Selma & San Antonio Airport	277,000	9.0	2,492,700	2,077,300	259,100
San Antonio Airport & CBD	262,100	7.0	1,842,200	1,535,200	191,500
San Antonio CBD & Kelly	123,600	4.0	490,600	408,800	51,000
Total	3,945,800	111.8	38,092,100	31,743,400	3,958,800

Table 5-7: Avoided Public Costs of Commuter Rail Travel

Property Tax Revenue Benefits

Economic studies have shown that property values near commuter stations along the Dallas Area Rapid Transit (DART) light rail system are at least 25 percent higher than properties unrelated to rail service.[11] The economic impact of commuter rail on the existing Austin-San Antonio rail corridor was evaluated for the Austin-San Antonio Intermunicipal Commuter Rail District assuming 50 percent "net new" property tax revenues associated with station-area development.[12] For the purpose of comparison, forecasts of added property tax revenue in the current analysis are based on:

1. Station-area property values prepared by Capitol Market Research for the 2006 year.[13]

[11] Weinstein, B.L. and Clower, T.L., *DART Light Rail's Effect on Taxable Property Valuations and Transit-Oriented Development*, January 2003.

[12] Final Financial & Economic Benefits Report, Austin-San Antonio Commuter Rail Project, Austin-San Antonio Intermunicipal Commuter Rail District, March 2007.

[13] Economic Impact Analysis Executive Summary, Austin-San Antonio Commuter rail Project, Austin-San Antonio Intermunicipal Commuter Rail District, April 2006.

2. Taxable property values collected from the Tax Assessor-Collector's office for each county along the existing rail corridor for the 2006 year.

Table 5-8 lists the 2006 value of property surrounding commuter rail stations proposed for an Austin-San Antonio commuter rail system. The increase in tax revenue at these locations was estimated assuming an average tax rate of 2.20 percent and an increase in property value of 25 percent, resulting in a net base year increase in tax revenue of $2.45 million.

Area Tax Base	
Station Location	Taxable Property Value in 2006 ($)
Georgetown	$2,432,882
Round Rock	$37,248,059
McNeil Road	$1,107,190
Braker Lane	$67,166,533
35th Street	$43,358,457
Seaholm	$142,736,610
Slaughter Lane	$41,796,175
Kyle-Buda	$610,449
San Marcos	$36,296,335
New Braunfels	$18,479,540
Schertz	$6,624,636
Loop 1604	$5,182,294
Loop 410	$17,324,833
San Antonio CBD	$23,360,365
Kelly USA	$1,468,300
Total	$445,192,658
Commuter Rail Impact (2006 $)	
Property Tax Rate	2.20%
Property Value Increase	25.00%
Added Tax Revenue	$2,448,560

Table 5-8: Additions to Property Tax Revenue using Austin-San Antonio Commuter Rail District Data

Table 5-9 lists the taxable property values for the five counties along the existing rail corridor, as reported by the Tax Assessor-Collector's office of each county. The increase in tax revenue in these counties was estimated assuming that 0.25 percent of county properties would be affected by development along the commuter line. The estimate also assumes an average tax rate of 2.20 percent and an increase in property value of 25 percent, resulting in a net base year increase in tax revenue of $2.56 million.

The net present value analysis shown includes a net base increase in property tax revenue using an average ($2.50 million) of the results shown in Tables 5-8 and 5-9. Station-area property values presented by Capitol Market Research projected an average annual growth of 9.63 percent over 25 years in its economic impact analysis, while the current net present value calculations assume the base year $2.50 million increase in property tax revenues grows at 7.50 percent annually.

County Tax Base		
County	Taxable Property Value in 2006 ($)	Land Size (sq. miles)
San Antonio	$66,000,000,000	1247
Comal	$12,000,000,000	562
Hays	$8,219,469,587	678
Travis	$74,193,296,448	989
Williamson	$25,655,237,959	1124
Total	$186,068,003,994	4,600
Average Value ($/sq. mile)	$40,449,566	
Commuter Rail Impact (2006 $)		
Affected Property	0.25%	
Affected Tax Base ($)	$465,170,010	
Property Tax Rate	2.20%	
Property Value Increase	25.00%	
Added Tax Revenue	$2,558,435	

Table 5-9: Additions to Property Tax Revenue using County Tax Assessor-Collector Data

5.3 - Private Benefits

The private benefits of rail improvements are generally associated with improved operating and maintenance conditions, as reflected by savings in time and cost. A sufficiently designed facility will also reduce the railroad's exposure to grade crossing incidents and eliminate the related damages to property.

Establishing an associated dollar value to what may be considered the private benefit resulting from railroad infrastructure improvements, upgrades, or operating changes is difficult in its own right, and is additionally complex without the availability of detailed economic analyses and benefit/cost studies.

The private benefit values were estimated based on calculated delay hours per day operated over the Central Texas region rail network for each planning case. Additional benefits that may be realized by the railroads as a result of the modeled improvements, but not explicitly quantified, may include:

- Reduced exposure to roadway-rail crossings
- Improved train operating efficiency
- Reduced train delays
- Improved train run-times
- Reduced public exposure in general

<u>Operating Cost Savings</u>

Benefits to the private sector are based on the degree to which operational performance measures such as train mileage, run time, and delay time for each

planning case change relative to those of the base case. Each performance measure has been translated to an economic value using the following unit costs:

- Train mileage = $51.23/mile
- Run time or delay time = $407.19/hour
- Fuel = $3.33/gallon[14]

The train mileage cost of $51.23/mile is a representative industry cost that reflects rail operating expense per train mile. The run and delay time cost of $407.19/hour assumes a 60:40 ratio of yard-to-line haul operating times within San Antonio, where expected yard operating expenses are $285.82 per hour and line haul operating expenses are $589.24 per hour.

Projecting this annualized cost 20 years into the future with an annual 3 percent rate of inflation, the NPV of this private burden was then calculated, and used as an indicator of the private benefit that may be associated with the results of the planning cases discussed in Section 4.

Track Maintenance Cost Savings

Class 1 railroads spend approximately $46,000 per mile each year maintaining track at current conditions.[15] This cost is based on the maintenance needs of rail infrastructure that, in general, has been in place for considerable time. For new track, such as the potential Austin-San Antonio rail bypass, significant savings are realized in early years due to the absence of accumulated wear that comes with freight operations over time. This feasibility analysis assumes the maintenance cost savings schedule shown in Table 5-10.

Track Maintenance		
Year	Savings (%)	Annual Cost/Mile
1	97	$1,380
2	93	$3,220
3	88	$5,520
4	81	$8,740
5	72	$12,880
6	61	$17,940
7	43	$26,220
8	35	$29,900
9	19	$37,260
10	2	$45,080
11	0	$46,000

Table 5-10: Savings Schedule for New Track
Source: Testimony of Dr. Allan M. Zarembski, before the United States Senate

[14] Houston Spot Diesel Prices, Argus Rail Business, Vol. 14,16, April 28, 2008.

[15] Testimony of Dr. Allan M. Zarembski, President of ZETA-TECH, before the United States Senate Committee on Commerce, Science and Transportation, Surface Transportation and Merchant Marine Subcommittee.

Construction of a rail bypass that results in the elimination of through-freight operations along the Austin-San Antonio corridor will likely be accompanied by the state's assumption of rights and obligations associated with ownership of the old facility. In this case, UP will avoid further maintenance costs on the old facility and assume maintenance costs on the possible bypass. Since the total length of each facility is different, the change in UP's maintenance cost can be determined as follows:

$$\Delta_{\cos t} = \left[d_{bypass}\left(1 - \%_{savings}\right) - d_{exist}\right]\left(\cos t / mile\right)$$

Where,
Δ_{cost} = change in private railroad maintenance costs
d_{bypass} = bypass length
d_{exsit} = length of the existing line
$\%_{savings}$ = percent of maintenance cost saved in any year

Assuming an Austin-San Antonio bypass length of 145 miles and a 129-mile length for the existing line, the equation above indicates that the savings rate threshold for any maintenance cost savings is:

$$\%savings = 1 - \frac{d_{exist}}{d_{bypass}} = 1 - \frac{129}{145} = 11\%$$

A savings rate threshold of 11 percent indicates that the railroad will realize maintenance cost savings through year 9 according to the schedule shown in Table 5-10. This finding is reflected in the 20-year analysis of the possible Austin-San Antonio bypass in Appendix G. Similar results are obtained for a possible Austin-only bypass using a *d*exist of 72 miles and a *d*bypass of 77 miles (6.5 percent threshold) and a possible San Antonio-only bypass using a *d*exist of 57 miles and a *d*bypass of 68 miles (16 percent threshold). The equations above reflect the fact that UP can realize positive savings in maintenance over a greater number of years as the difference in length between the existing line and the possible bypass decreases.

Grade Crossing Accident Savings

Property damages due to grade crossing accidents have been found to average $100,000 per incident.[16] Approximately eight grade crossing accidents occur each year in the counties encompassing the possible Austin-San Antonio bypass study area, suggesting that a new rail facility can play a role in the elimination of accidents and related property damage.[17] Assuming that the construction of a rail bypass will reduce the number of grade crossings by 85 percent, and that this reduction will eliminate one half of the annual grade crossing incidents, damages to property can be reduced by approximately $400,000 per year.

[16] Rail Safety Cost Factors, Washington State Department of Transportation, 2004.
[17] Safety Data, Office of Safety, Federal Railroad Administration, October, 2004.

6.0 Conclusion

The relocation of through freight rail services in the central Texas area was found to be feasible through the construction of an entirely new freight rail facility for relocating freight onto an alternative alignment, or through upgrades to UP's existing Waco, Lockhart, and Giddings Subdivisions. The benefits of relocating through freight services to a new facility were quantified during the San Antonio Region Freight Study.

The conceptual new location alignment would traverse from Taylor to Lockhart via the most direct route; then bypass Lockhart and traverse to Seguin via the most direct route; then bypass Seguin and traverse around the northeast to southwest sides of San Antonio, connecting the new alignment to UP's Glidden, Rockport, Corpus Christi, Laredo, and Del Rio Subdivisions. With the construction of a new yard(s) to relocate the classification, servicing, and intermodal movements that are currently performed within the San Antonio metropolitan area; the new location alignment would reroute all through freight traffic from the Del Rio, Laredo, Corpus Christi, Rockport, Glidden, and Austin Subdivisions to an alternative route. Freight rail service to local customers within the metropolitan areas would still be provided on the existing infrastructure.

The relocation of through freight services onto an alternative alignment would reroute most freight rail traffic from with the urban areas within the corridor and could reduce train movements within San Antonio by as much as 60 – 70%. The remaining train movements would be associated with servicing local freight rail customers located within the urban areas, thereby continuing lower-cost transportation services to those customers and preventing the diversion of freight originating or terminating in those areas to truck.

The Study Team determined that the northern alignment could be built and could operate independently of the southern alignment. The independent construction of the northern alignment could remove through freight services from the Austin Sub between Taylor and San Marcos, providing public benefits to that portion of the corridor in the form of reduced congestion, improved air quality, and improved safety. Private sector benefits have been determined and are part of the information which can be used to evaluate the proposed bypass and provide a basis for cost-sharing discussions with the operating railroad.

There does not appear to be an operational benefit for the railroad from a proposed bypass of San Antonio (only) without an improved northern route. Additionally, the Study Team determined that if the northern alignment were not constructed, the San Antonio bypass would either have to continue from Seguin to the northwest to connect all other subdivisions with the Austin Subdivision; or would have to continue on a new alignment from Seguin to Lockhart, then traverse from Lockhart to San Marcos on the existing infrastructure in order to remove Austin Sub traffic from the San Antonio metropolitan area. Either of these options would significantly increase UP's mileage in the San Antonio region.

Significant public and private benefits may be attainable from the relocation of through-freight rail services to an alternative route. The public benefits could include:

- Reductions in public exposure at roadway-rail crossings (vehicular delay, accidents, horn noise) by moving the route outside of the Austin and San Antonio metro areas and other communities including Taylor, Elgin, Bastrop, Lockhart, and San Marcos,
- Reductions in hazardous materials movements within urban areas,
- Improvements to air quality from reductions in vehicular idling and reduced locomotive operations,
- Reductions in fuel usage for vehicular traffic,
- Improvements in economic development opportunities, and
- Possible implementation of commuter rail services in the existing corridor.

Potential benefits to UP could include:

- Reductions in train accident exposure at highway-rail grade crossings,
- Possible increases in freight rail capacity,
- Improvements in train operating efficiency along the new route,
- Possibility of the railroad to “grow business” due to possible increases in capacity,
- Short term reductions in maintenance expenses on the newly constructed alignments, and
- Reductions in Total Central Curve Angle which may correlate to reductions in wear and tear on locomotives, rolling stock, roadbed, track and structures.

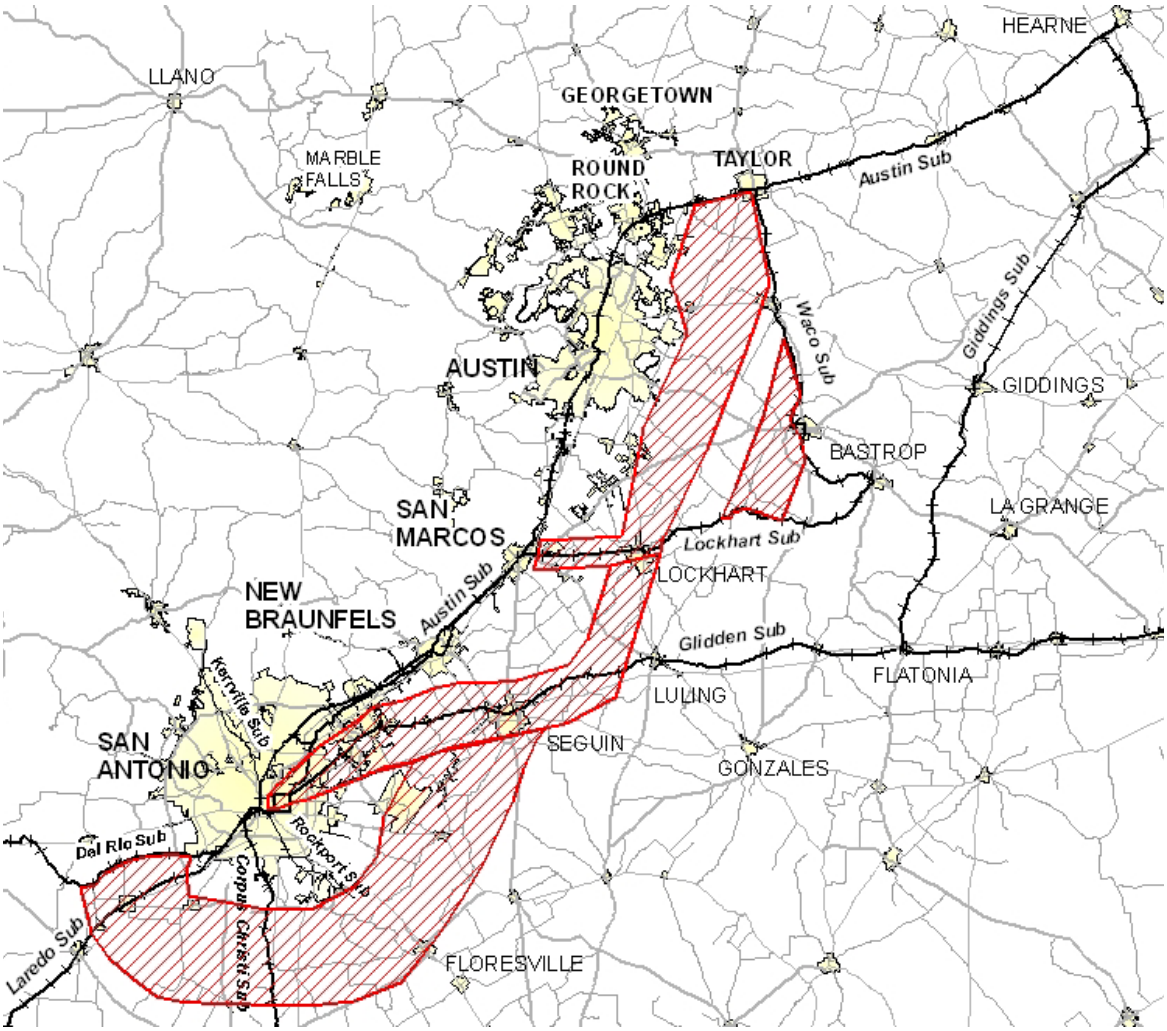
Table 6-1 contains order of magnitude estimates for the conceptual alternatives considered in this report (see Figure 6-1 for study area). The table shows the individual costs of the possible San Antonio bypass, southern alignment (i.e., direct route between Lockhart and Seguin), and four alternatives for the northern alignment (i.e., between Lockhart and Taylor). Table 6-2 shows the estimated costs and associated benefits of the planning cases studied as part of the San Antonio Region Freight Study as described in further detail in Section 4 of this report.

Central Texas Rail Relocation Order of Magnitude Cost Summary Table						
	San Antonio Bypass	Southern Alignment	Northern Alignment			
	Bypass (Seguin to San Antonio/ Macdona)	Lockhart to Seguin Direct Route	UP Existing Route	Blue Alternative	Red Alternative	Taylor to Lockhart Direct Route
Segment Cost	$1,369,610,000	$350,970,000	$545,650,000	$598,000,000	$602,460,000	$702,930,000
Total (Northern + Southern + San Antonio Bypass)			$2,266,230,000	$2,318,580,000	$2,323,040,000	$2,423,510,000

Table 6-1: Central Texas Rail Relocation Cost Estimates (2007 dollars)

Planning Case	Estimated Cost	Estimated Public Benefit	Ratio: Public Benefit/Cost	Estimated Private Benefit	Ratio: Private Benefit/ Cost	Estimated Total Benefit	Ratio: Total Benefit/Cost
A	$ 1,369,610,000	$ 504,790,000	0.37	$ (162,860,000)	-0.12	$ 341,930,000	0.25
B1	$ 1,595,900,000	$ 587,100,000	0.37	$ 161,990,000	0.10	$ 749,090,000	0.47
B2	$ 1,741,260,000	$ 843,460,000	0.48	$ 157,890,000	0.09	$ 1,001,350,000	0.58
C	$ 2,423,510,000	$1,424,950,000	0.59	$ 95,490,000	0.04	$ 1,520,440,000	0.63
Estimated public and private benefits are based on a 20-year study period.							

Table 6-2: Central Texas Rail Relocation Cost and Benefit Analysis Summary (2007 dollars)



This map depicts some alternative alignments and/or facilities <u>for illustrative purposes only</u> to assist in general comprehension of the conceptual alternatives and issues discussed. Precise planned or proposed alternative alignments can only be identified during the NEPA environmental process, which is not a part of this study or report.

Figure 6-1: Potential Bypass Corridors

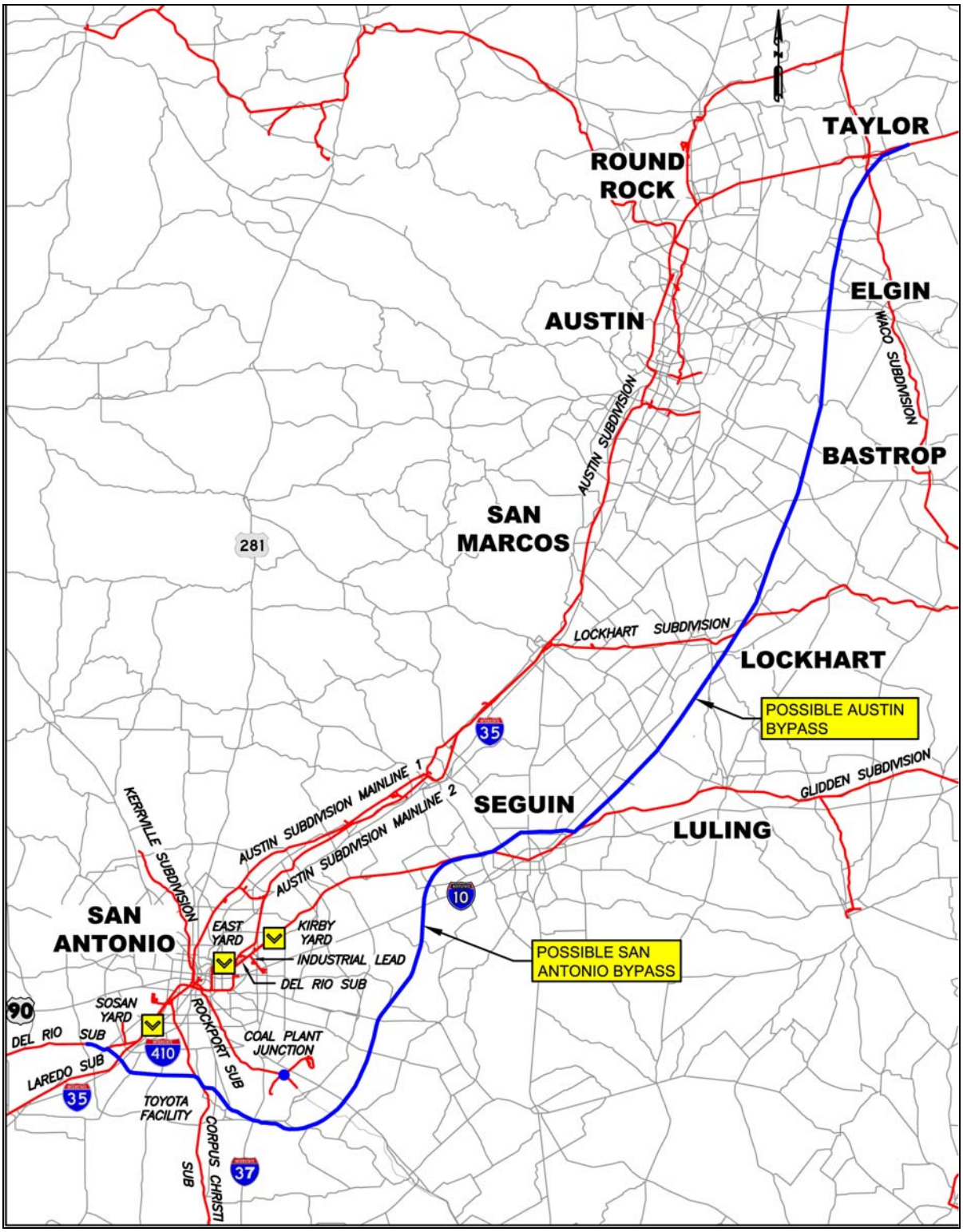


Figure 6-2: Possible Bypass Locations

This map depicts some alternative alignments and/or facilities <u>for illustrative purposes only</u> to assist in general comprehension of the conceptual alternatives and issues discussed. Precise planned or proposed alternative alignments can only be identified during the NEPA environmental process, which is not a part of this study or report.

Tables 6-3 and 6-4 show the estimated route mileage for each of the routes and planning cases studied.

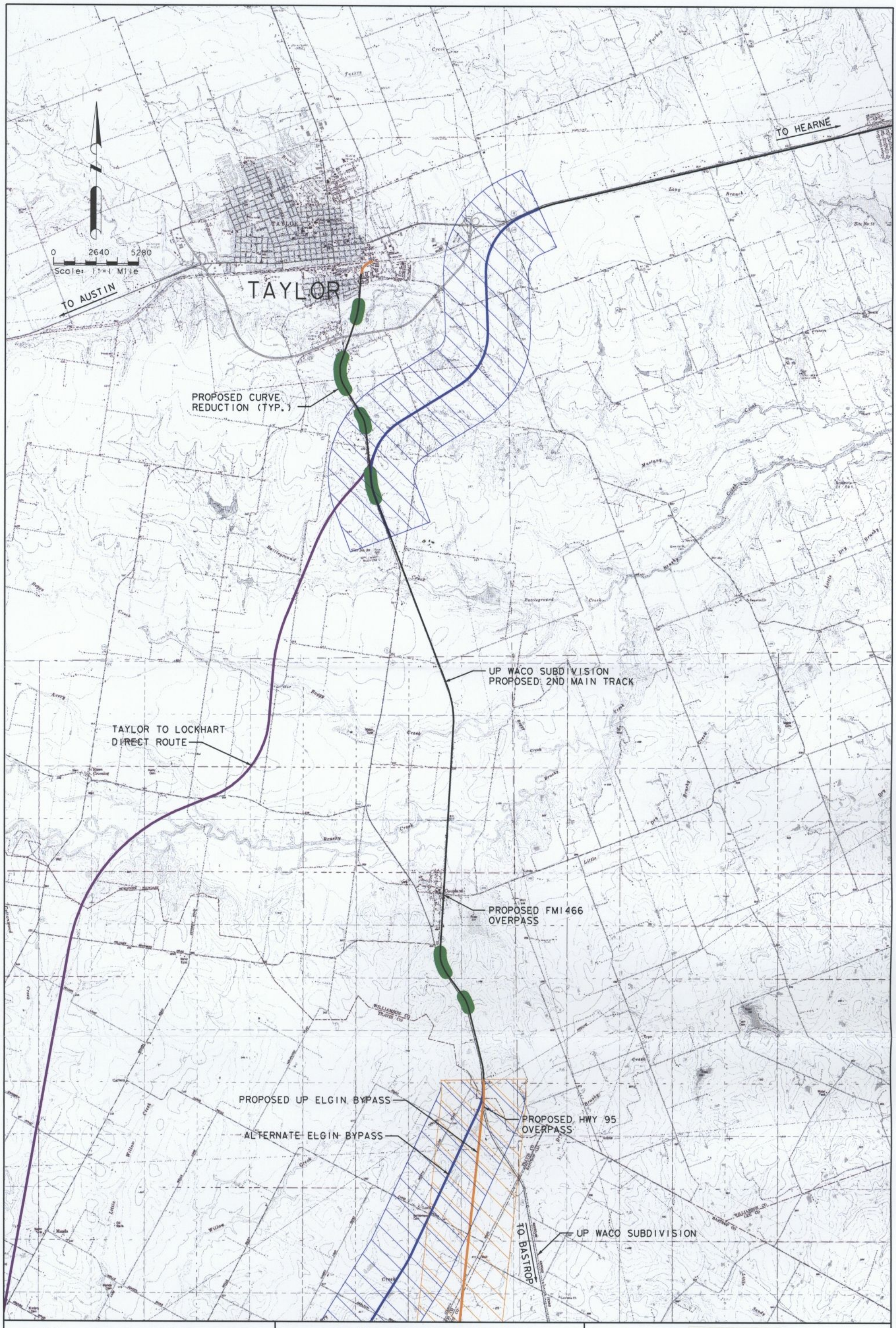
	Existing Route - Waco and Lockhart Subdivisions	Existing Route - Austin Subdivision	UP Waco/Lockhart Subdivision Report	Blue Alternative	Blue (Elgin) and Red (Bastrop Cutoff) Alternative	
Taylor to San Marcos via Austin		69.8				
Taylor to Bastrop	33.7		33	34.3	34.3	Waco Sub MP 919 to MP 950.5
Bastrop to Red Rock via Smithville	40.7					Waco Sub MP 950.5 to MP 969.4 and Lockhart Sub MP 0.0 to MP 21.9
Bastrop to Red Rock via new Cutoff			14.9	15	15.5	Waco Sub MP 950.5 to Lockhart Sub MP 21.9
Red Rock to San Marcos	31		31	31	31	Lockhart Sub MP 21.9 to MP 51.9 and Austin Sub MP 209.1 to MP 209.7
Totlal Route Mileage	**105.4**	**69.8**	**78.9**	**80.3**	**80.8**	

Table 6-3: Estimated Route Mileage

Mileage Comparison	Limits	Miles
Existing Route	Macdona to Seguin via Del Rio Sub	54
PC A - San Antonio Bypass (including North Seguin Bypass)	Macdona to Seguin	68
Existing Route	Taylor to Macdona via ASML 1 and Del Rio Sub	127
PC B1 - Austin Bypass	Taylor to Seguin via Bypass, Seguin to Macdona via Del Rio Sub	131
PC B2 - Austin Bypass	Taylor to Seguin via Bypass, Seguin to Wye Connection at ASML 2, Wye to Tower 112 via ASML 2, Tower 112 to Macdona via Del Rio Sub	131
Existing Route	Taylor to Macdona via ASML 1 and Del Rio Sub	127
PC C - Combined San Antonio and Austin Bypass	Macdona to Taylor via Bypass	145

Table 6-4: Estimated Planning Case Route Mileages

The Governor's Office and UP have negotiated a Memorandum of Understanding for cooperation in such planning efforts which will assist in the study, planning, and development of rail relocation and improvement projects within the state. However, it should be noted that UP is licensed and regulated by the federal government and cannot be compelled by the state to remove or relocate its operations or infrastructure to another location. It should also be noted that UP, as a private industry, owns and operates on its existing facility and may be resistant to relocating to another corridor without adequate compensation.



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CENTRAL TEXAS RAIL NETWORK
DUE DILIGENCE AND ALTERNATIVE ANALYSIS

Figure 1-1

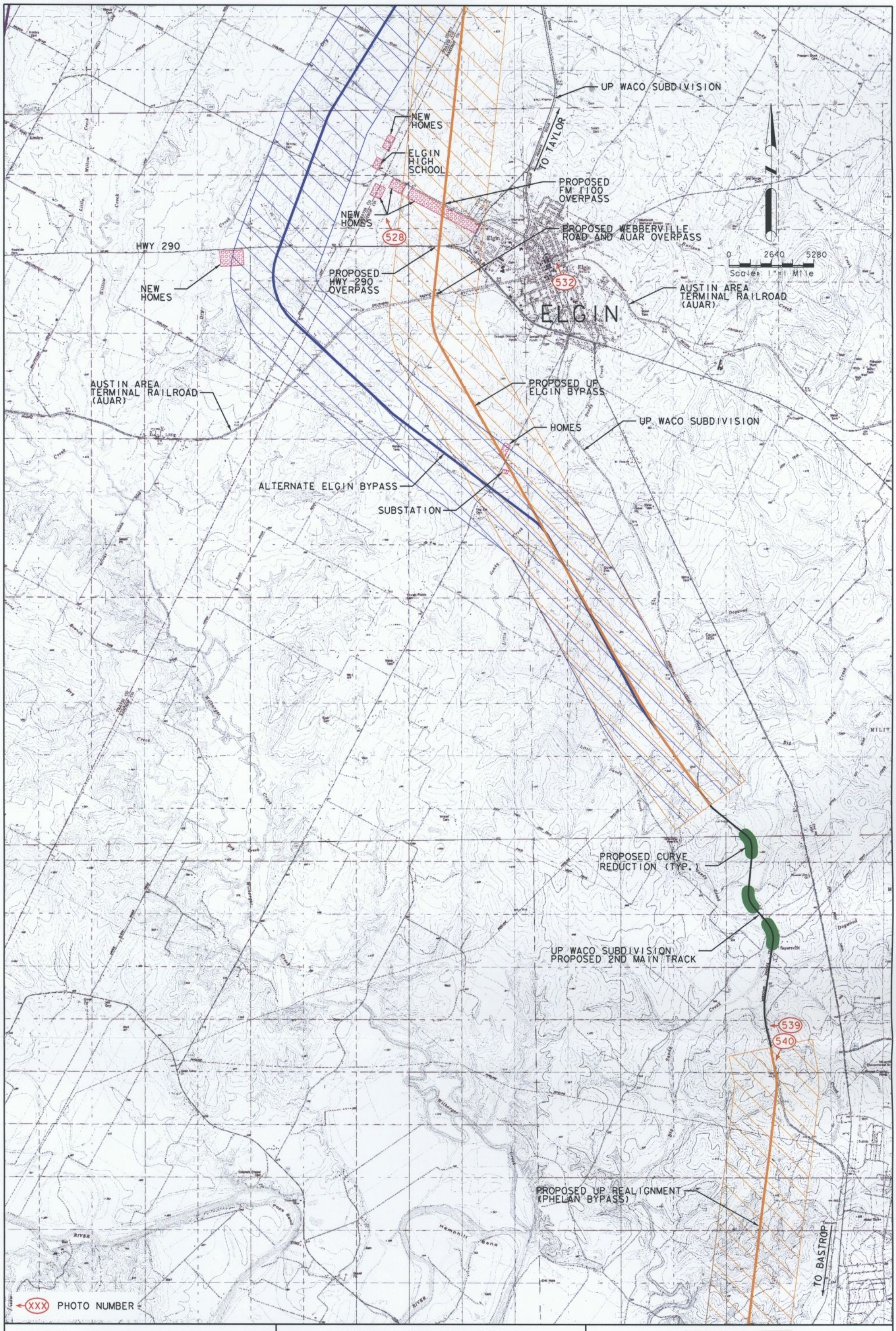

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Figure 1-2

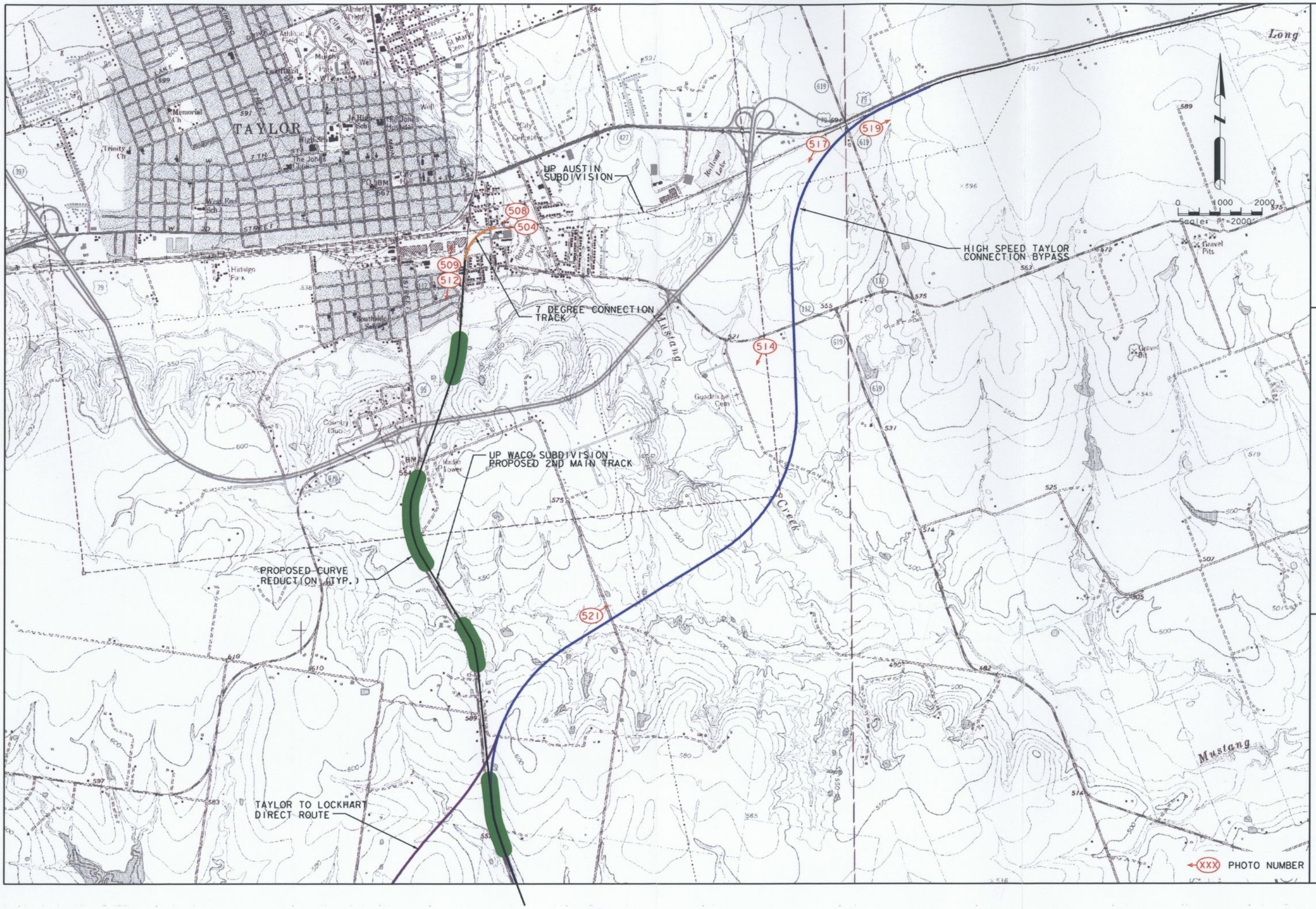

Figure 1-3

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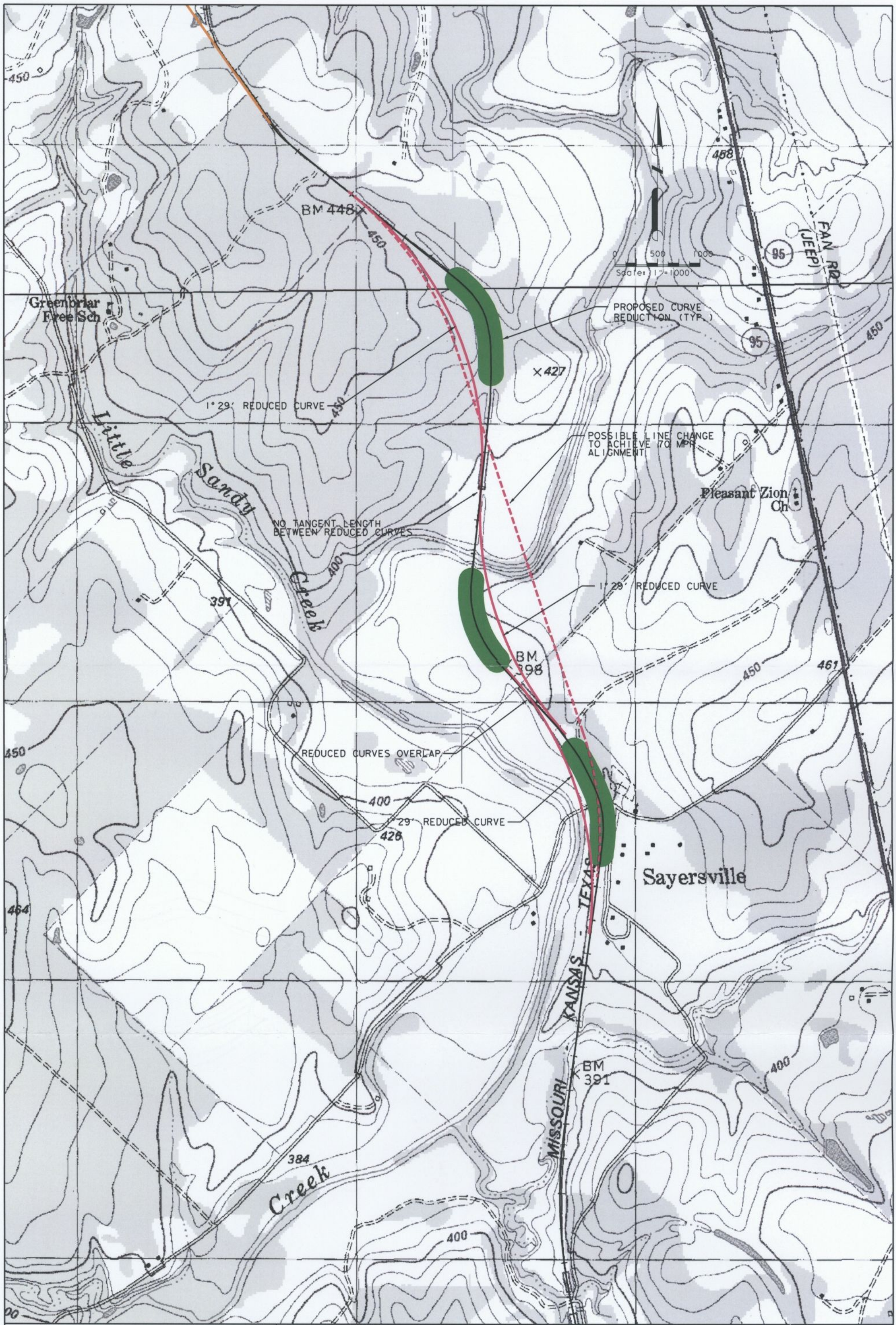

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Figure 1-4

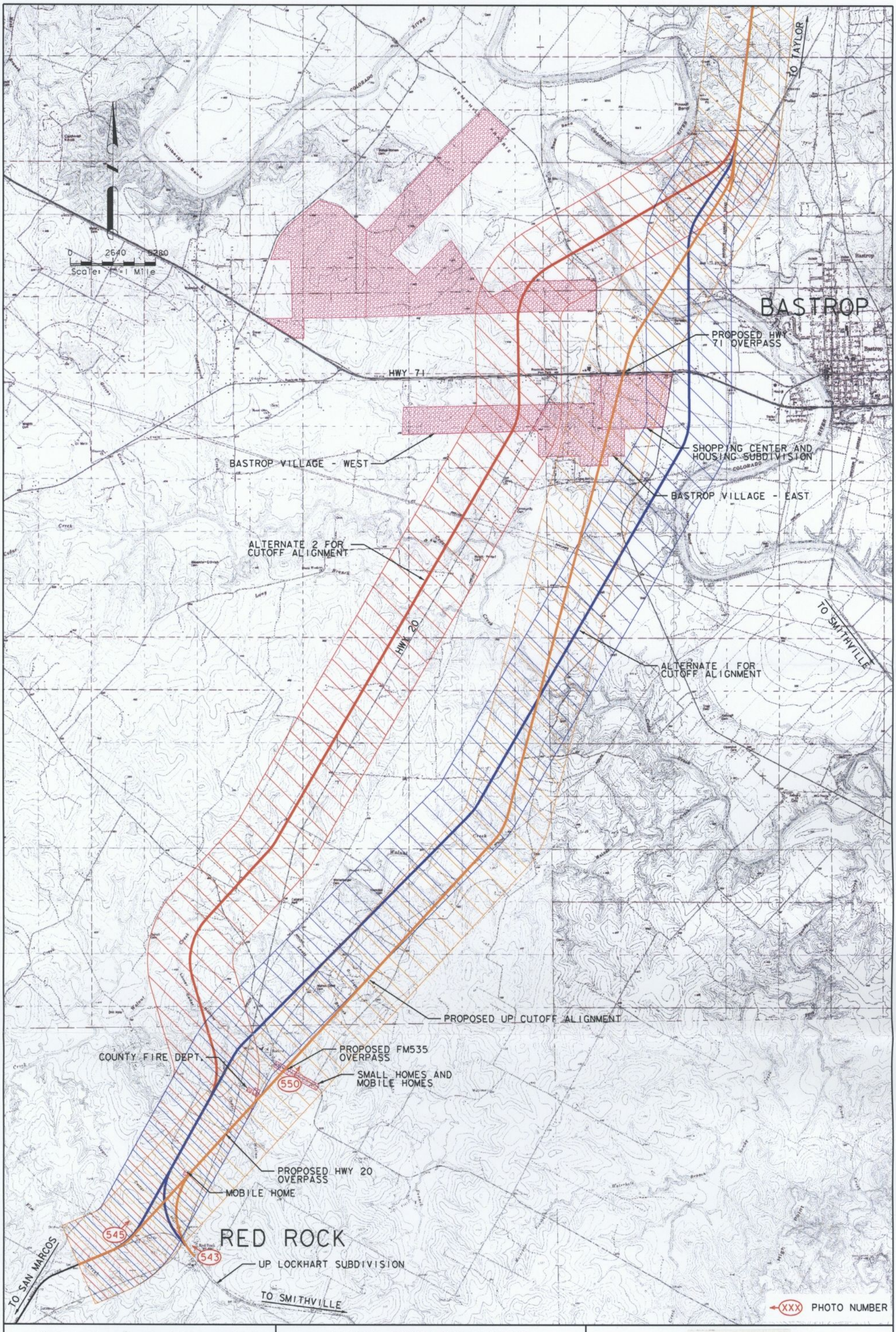

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Figure 1-5

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Figure 1-6

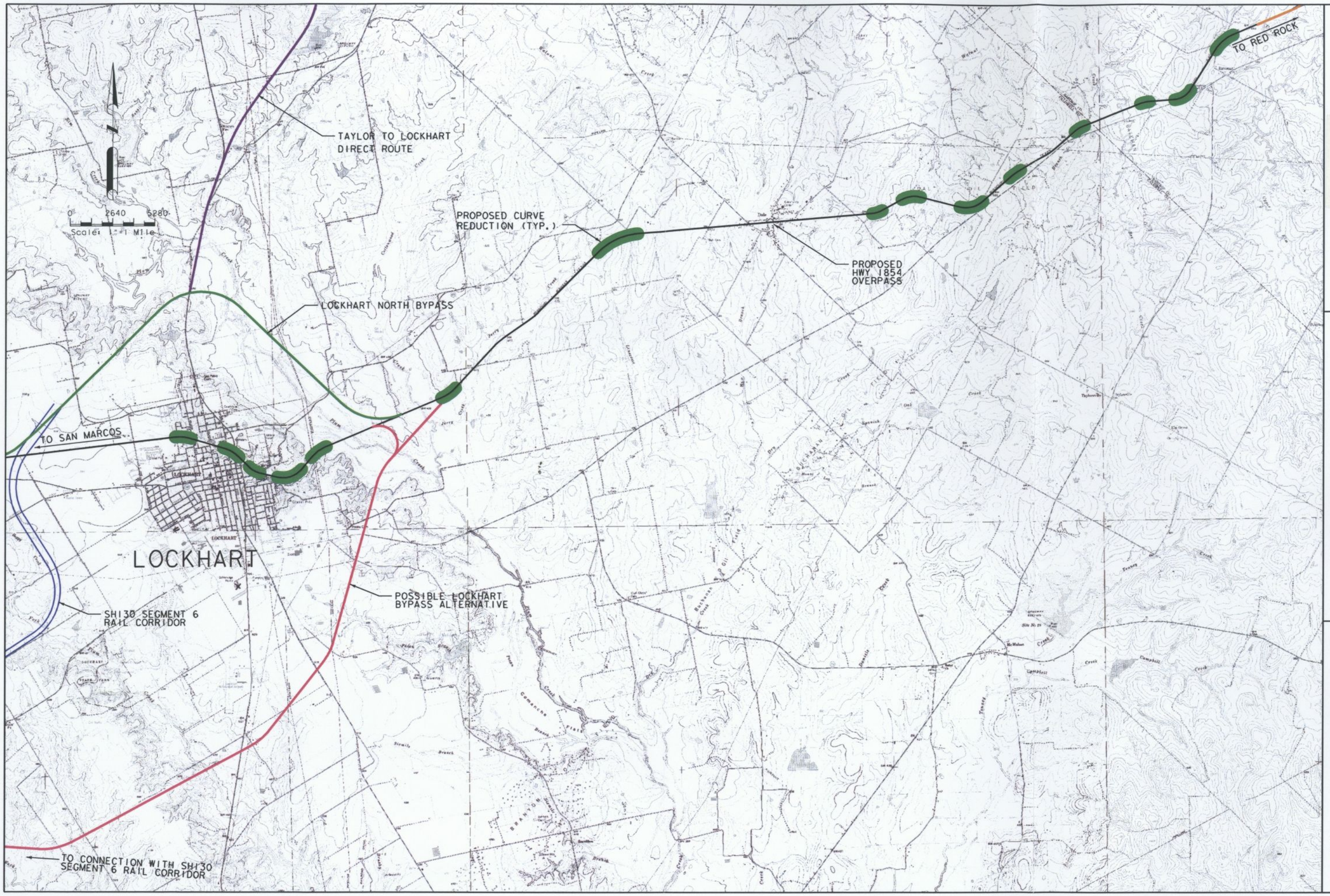

Figure 1-7

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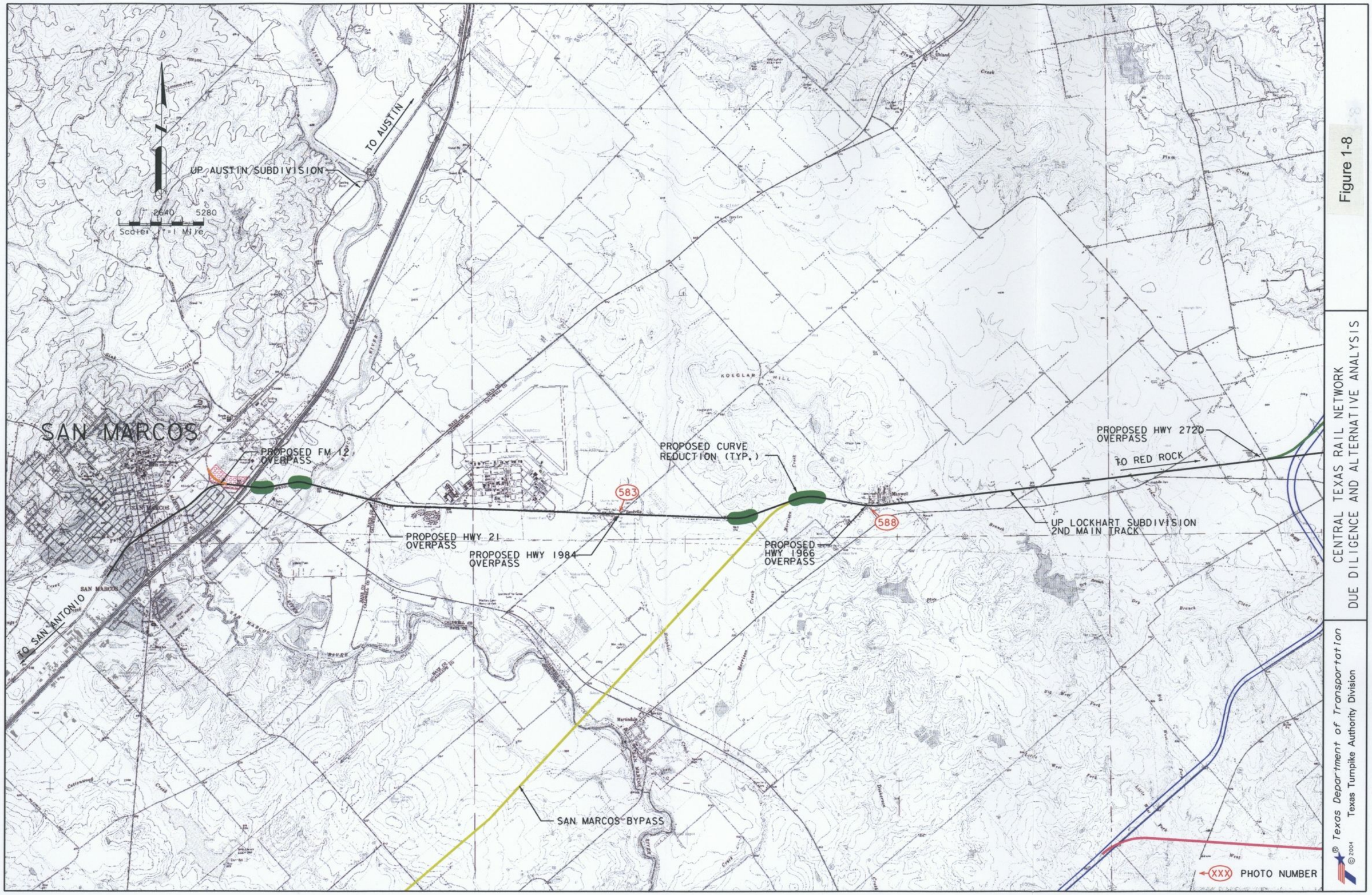

Figure 1-8

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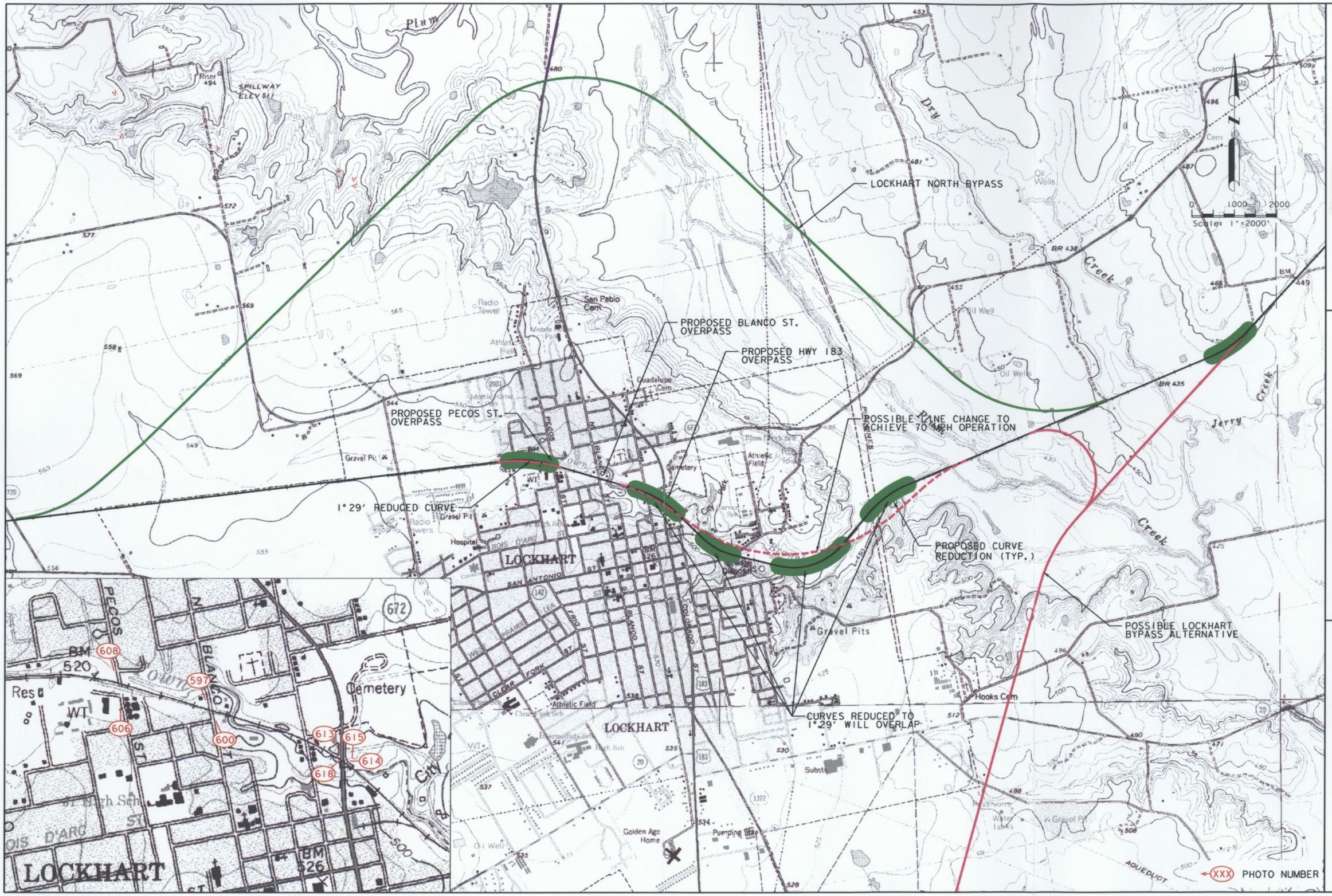

Figure 1-9

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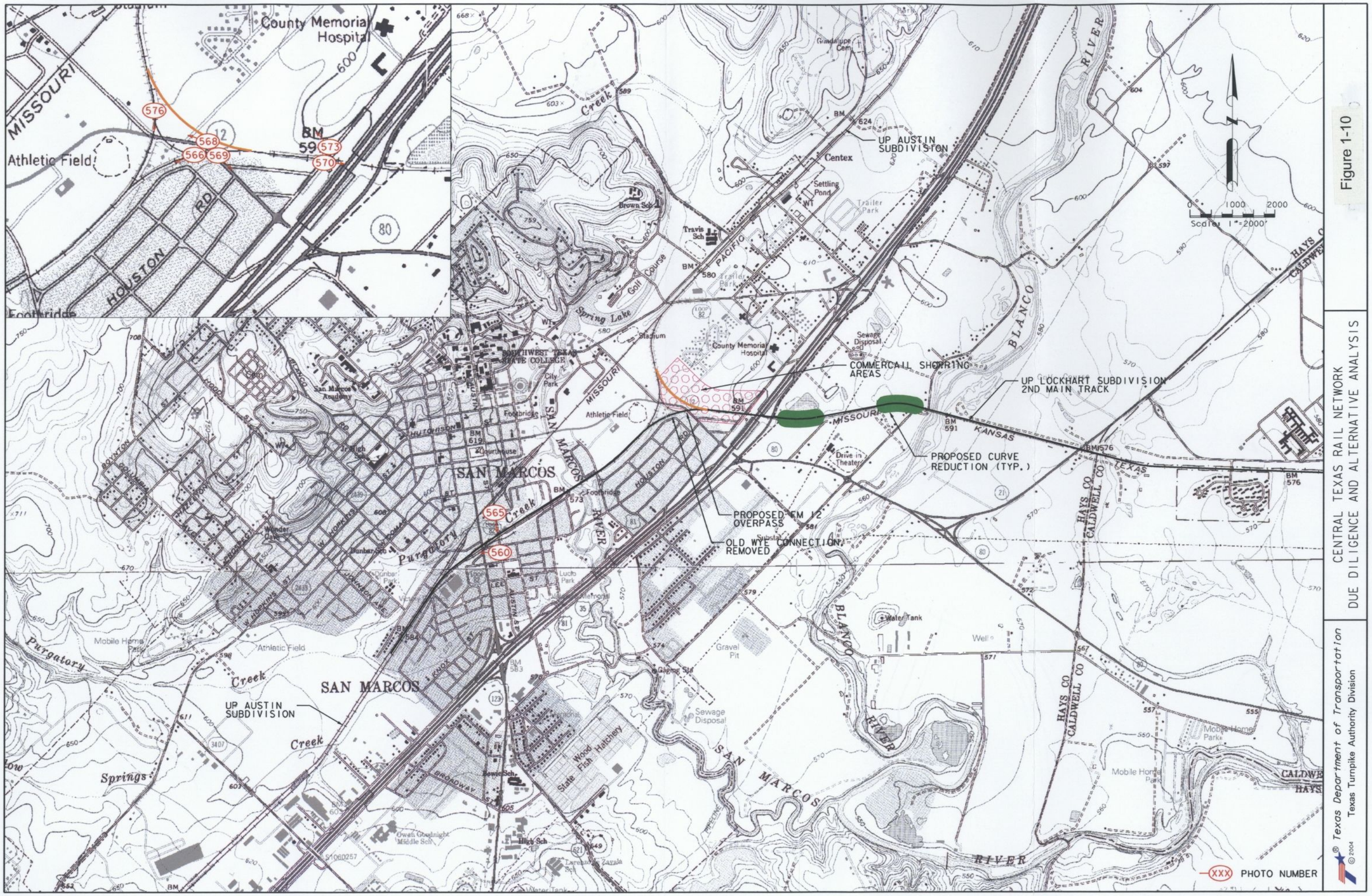

Figure 1-10

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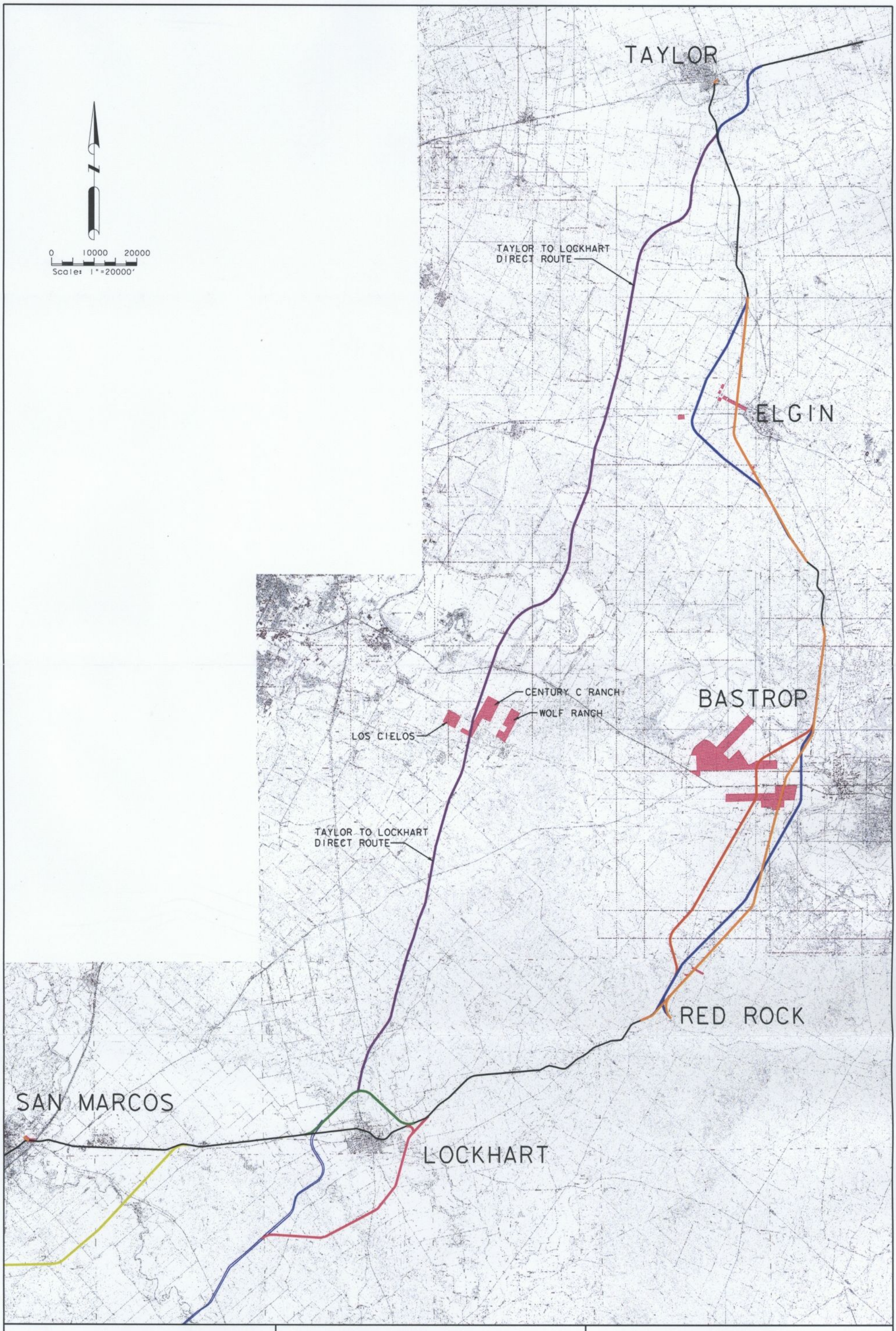

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Figure 1-11

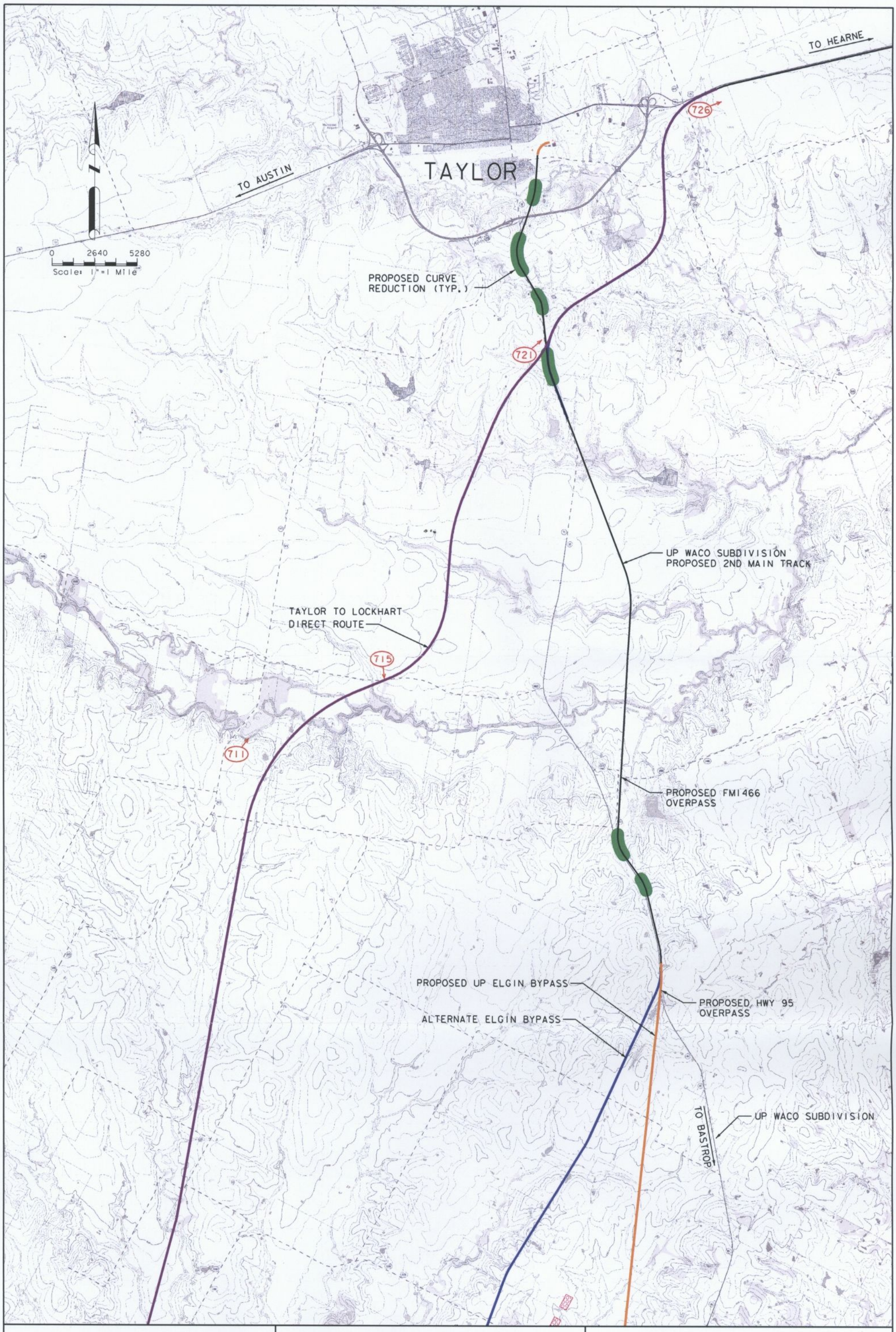

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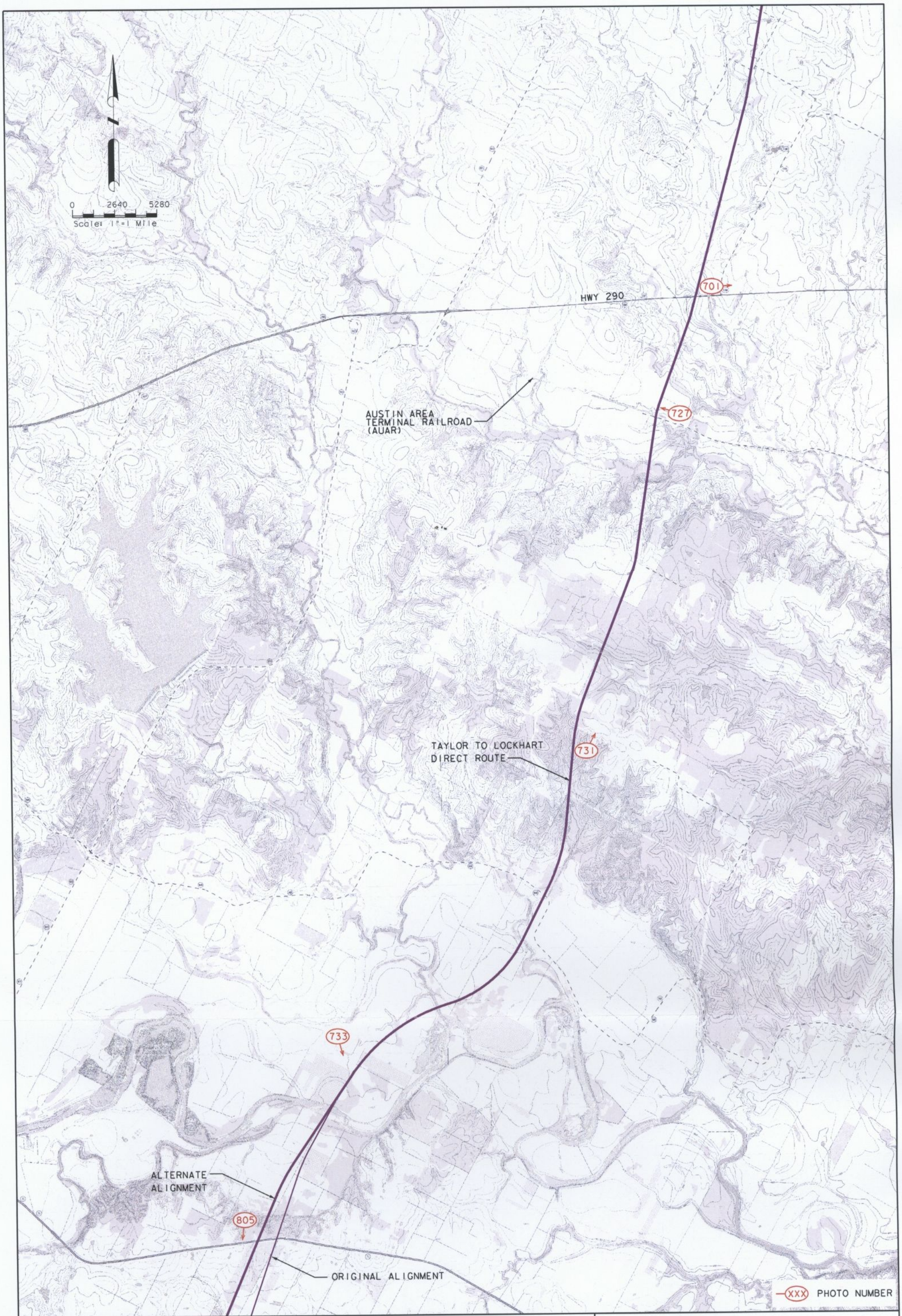
FIGURE 1 - 11A



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DUE DILIGENCE AND ALTERNATIVE ANALYSIS

FIGURE 1 – 11B

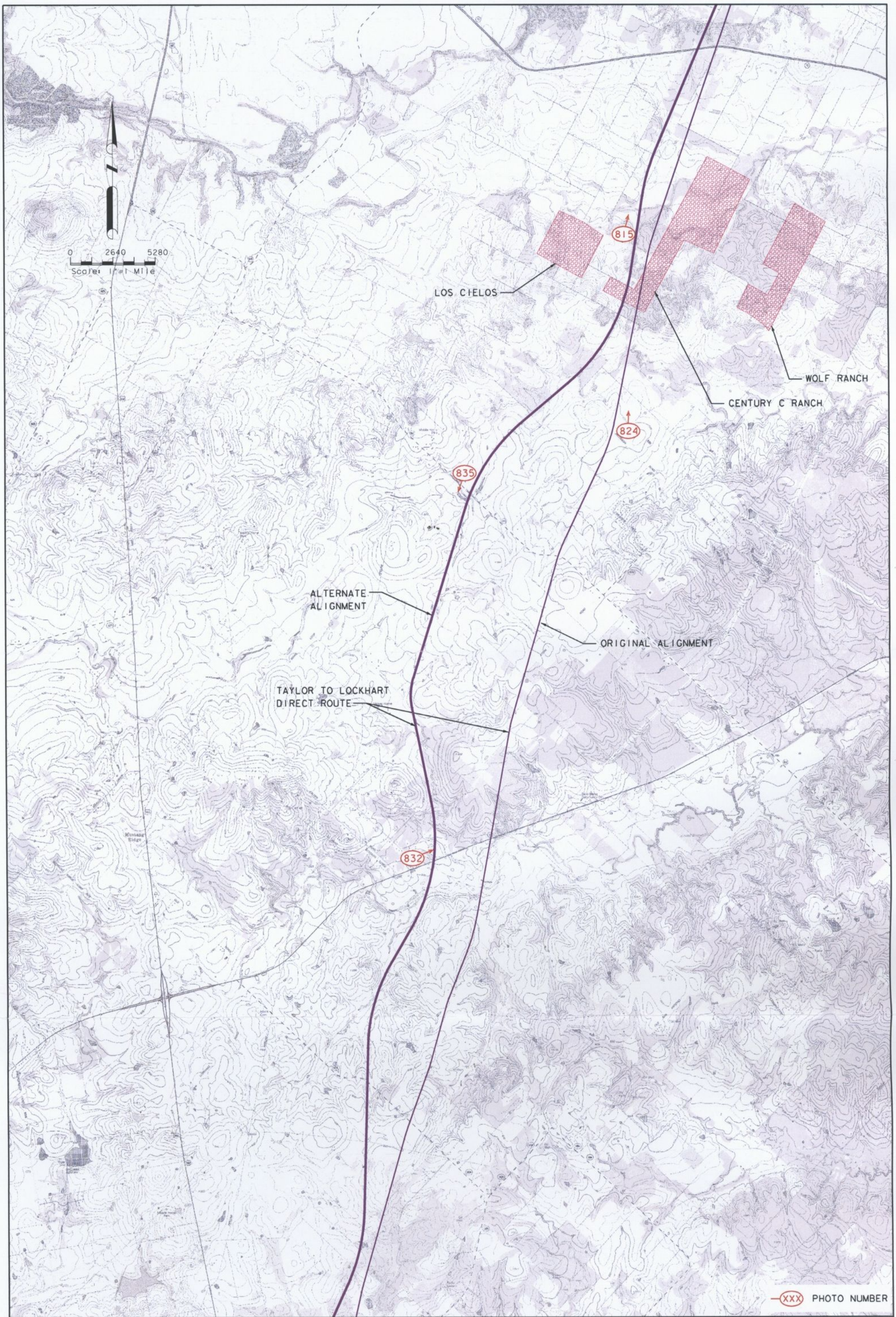

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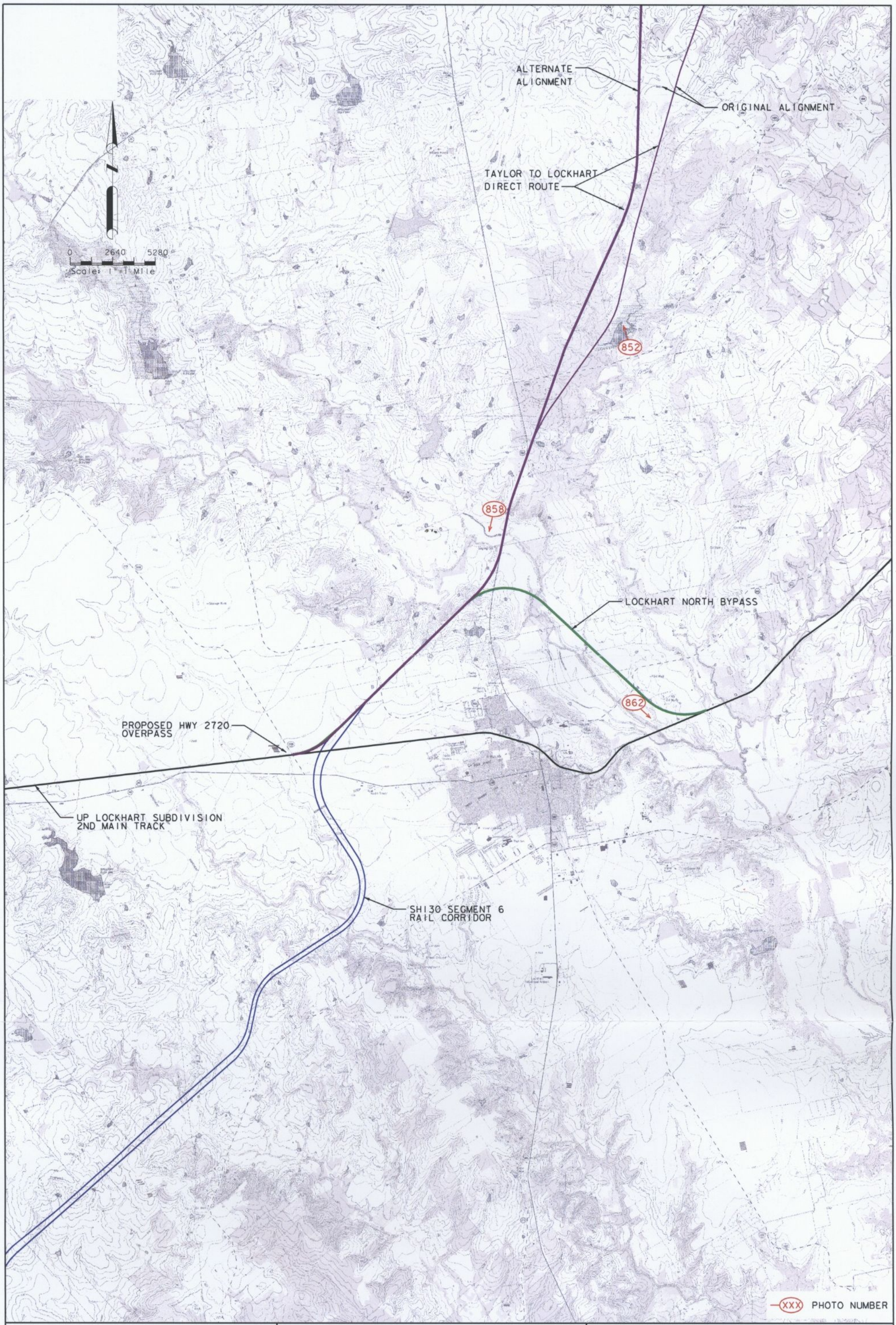
FIGURE 1 – 11C



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DUE DILIGENCE AND ALTERNATIVE ANALYSIS

FIGURE 1 - 11D

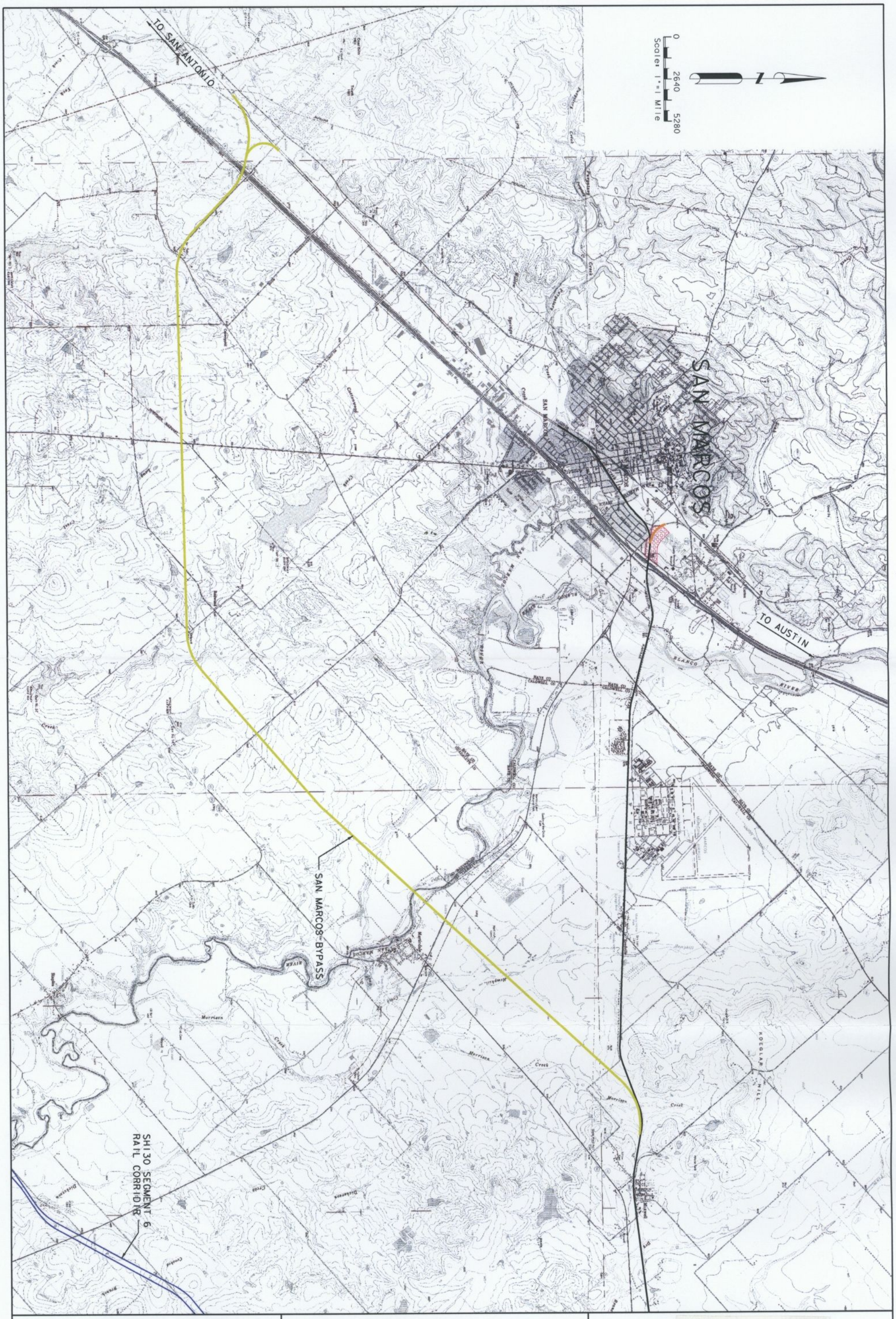

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Figure 1-12

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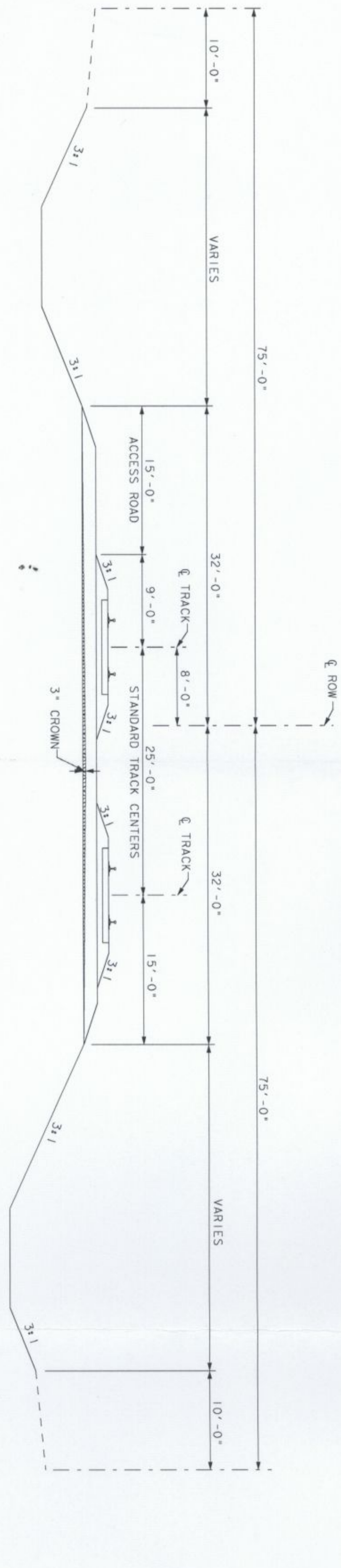
Figure 1-13



RAILROAD SECTION
DOUBLE TRACK

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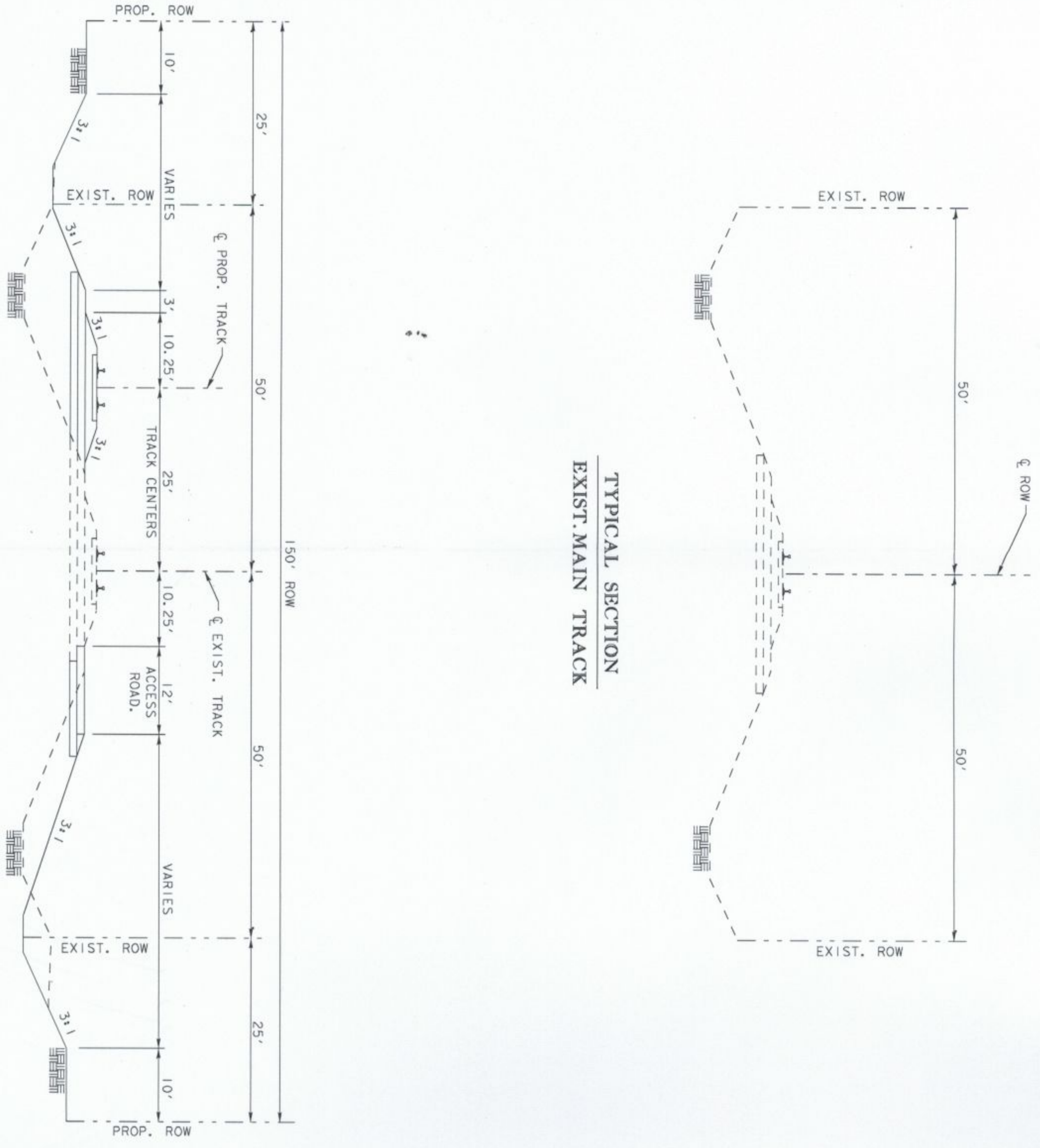
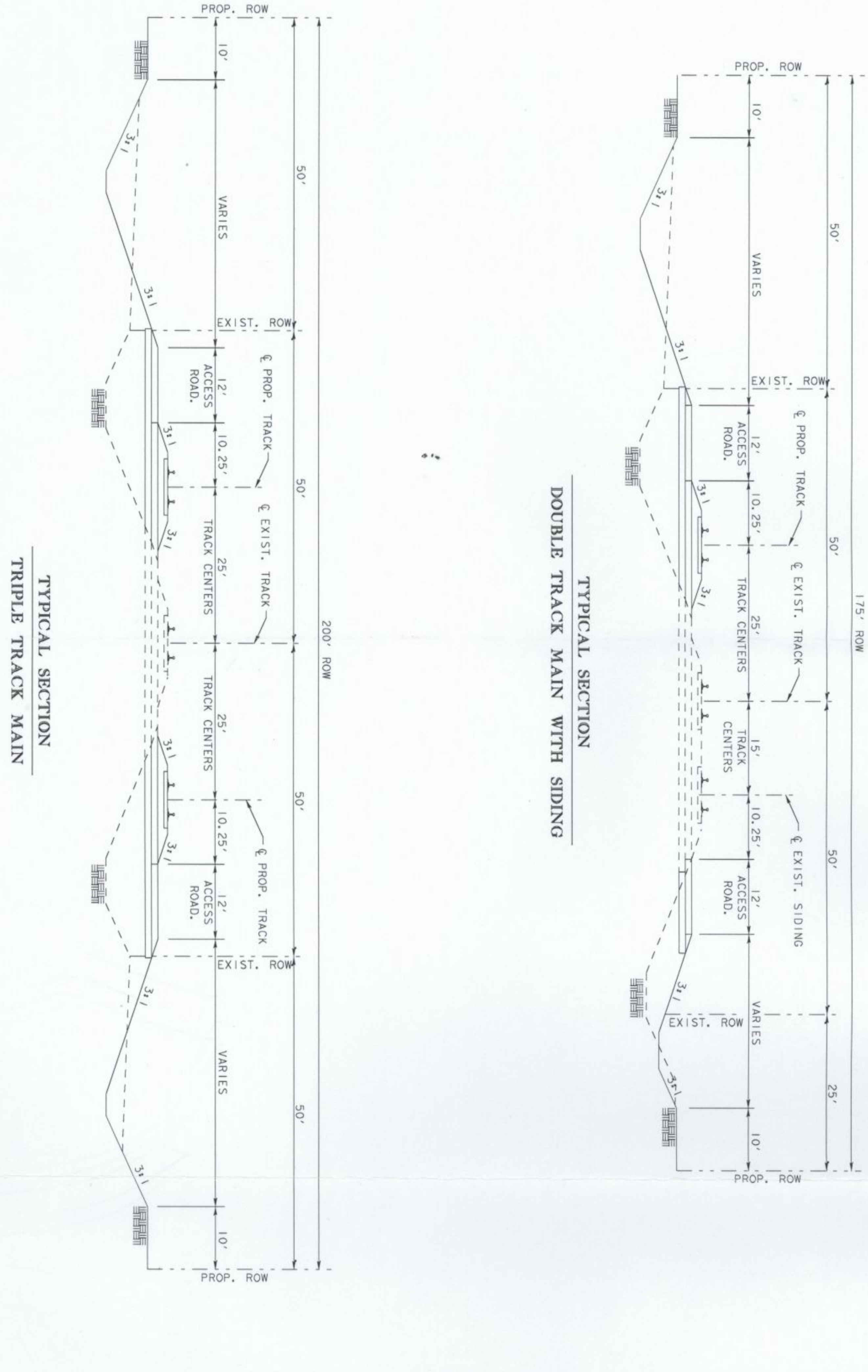


TYPICAL SECTION
DOUBLE TRACK MAIN

TYPICAL SECTION
EXIST.MAIN TRACK



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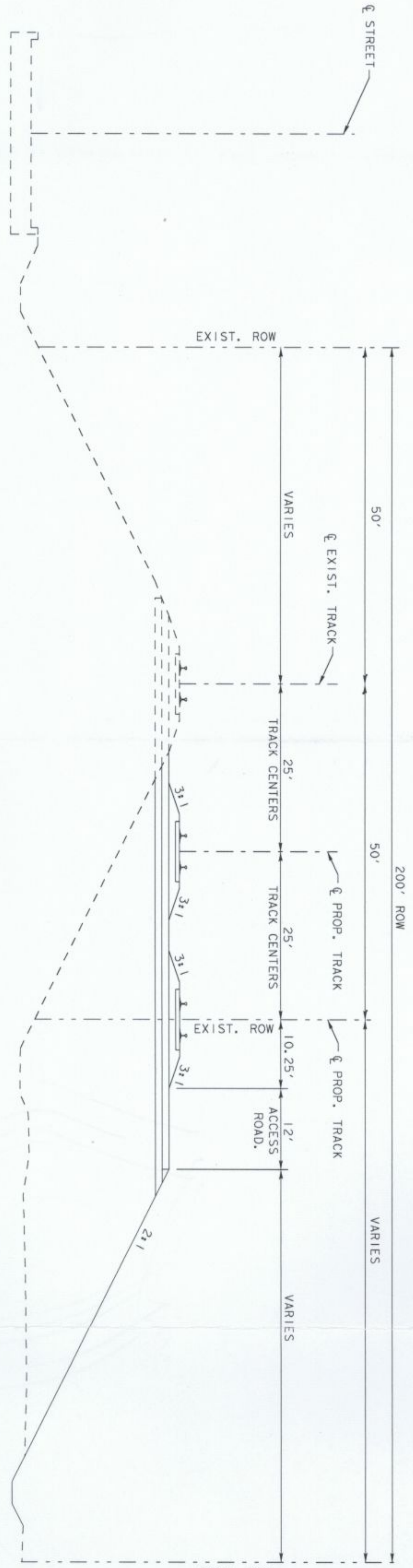
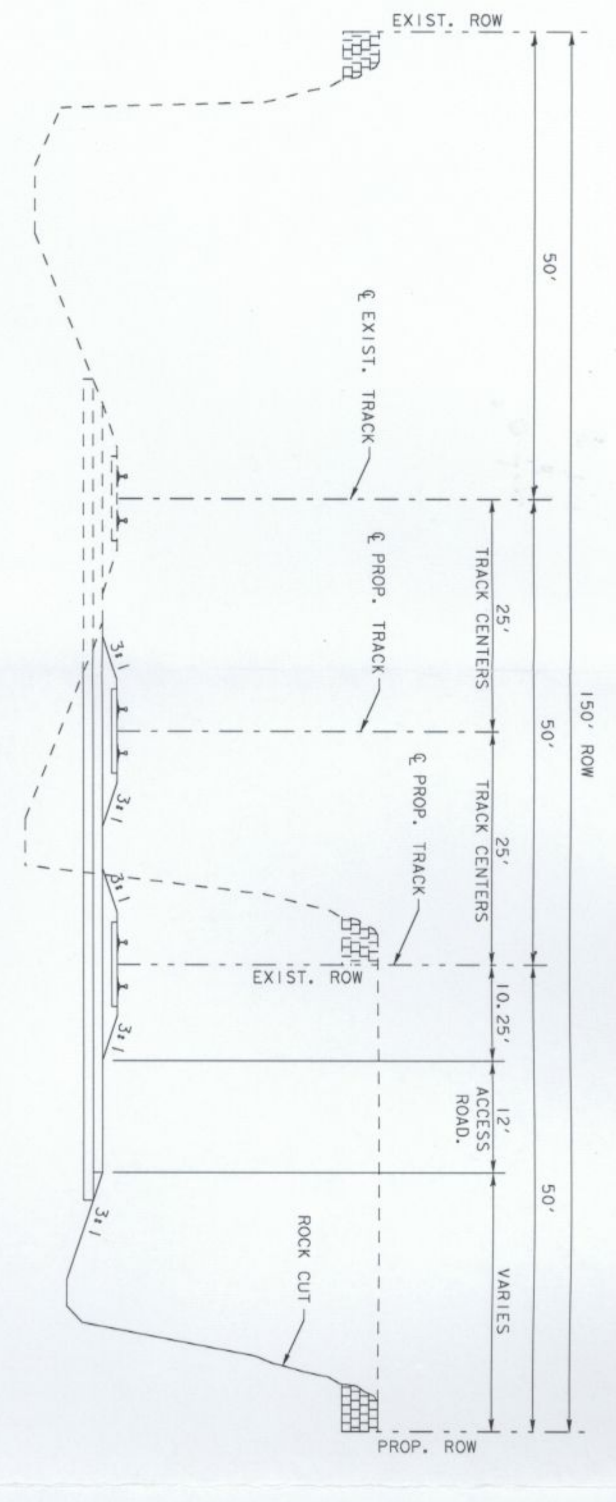
SOUTHERN ALIGNMENT
Figure 2-7



TYPICAL SECTION
TRIPLE TRACK MAIN ON FILL



TYPICAL SECTION
TRIPLE TRACK MAIN IN ROCK CUT

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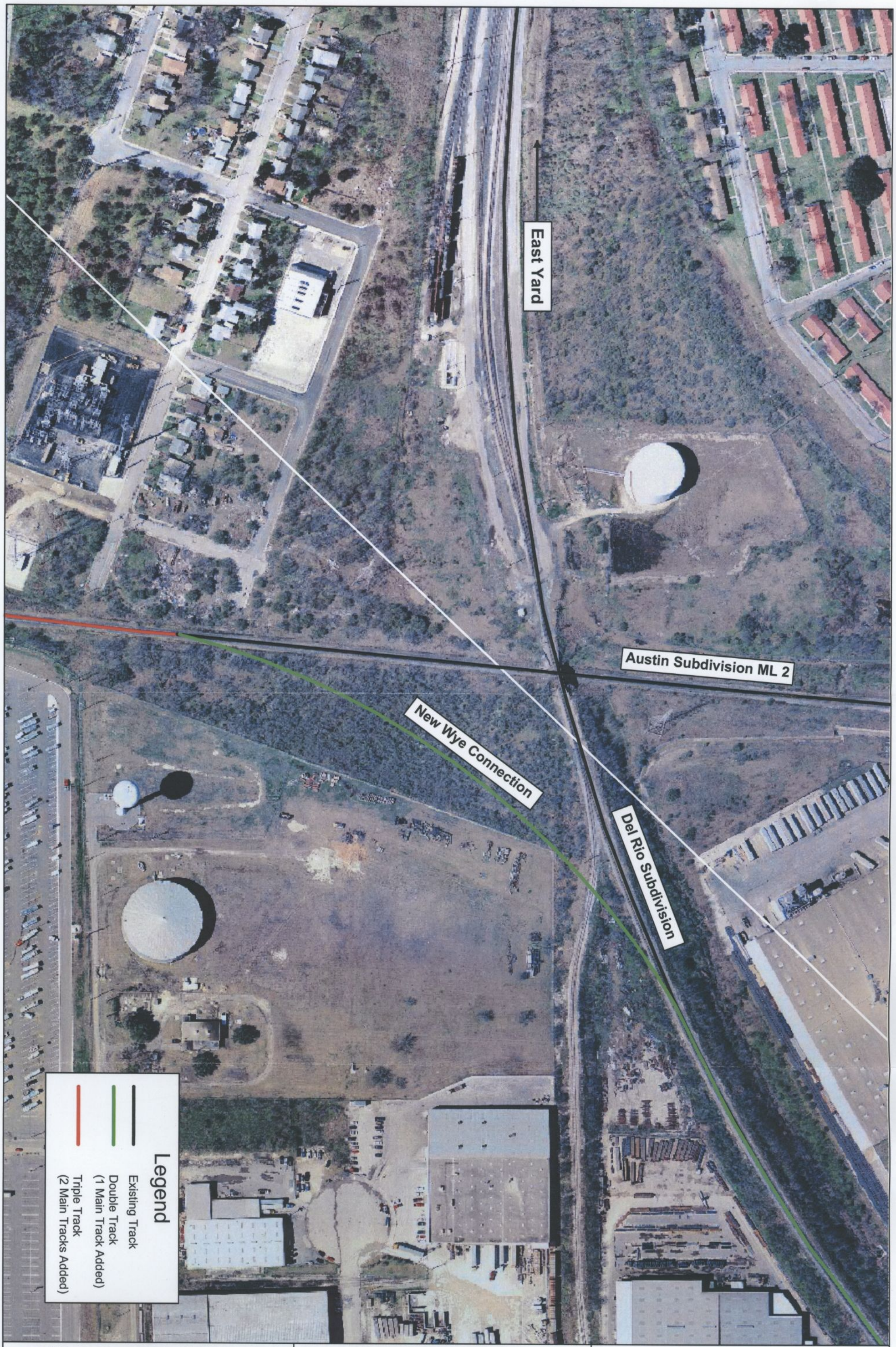

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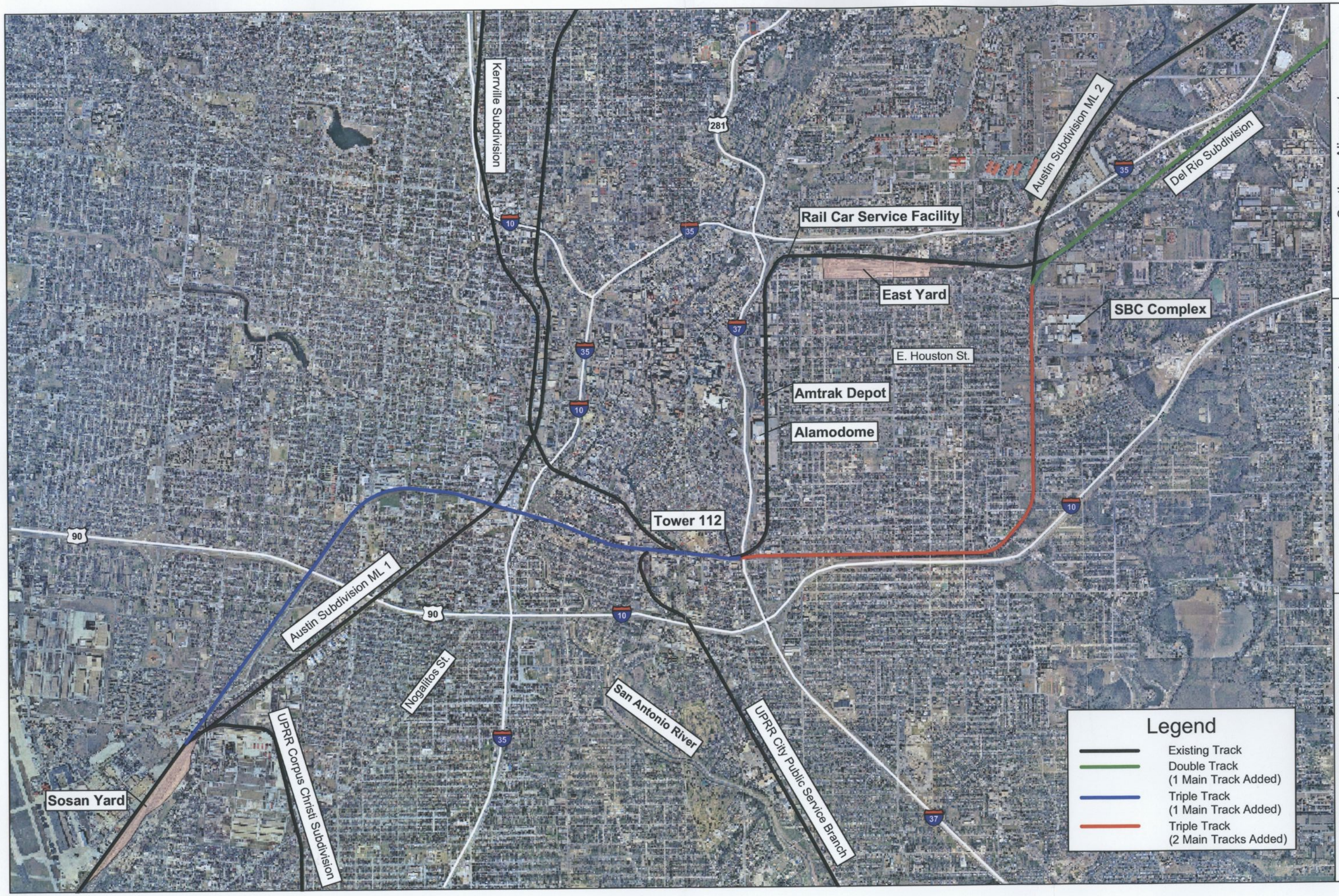
Central Texas Rail Network
Due Diligence and Alternative Analysis

New Wye Connection
Figure 2-9



Southern Alignment
San Antonio Area Aerial Figure 2-10

Central Texas Rail Network
Due Diligence and Alternative Analysis

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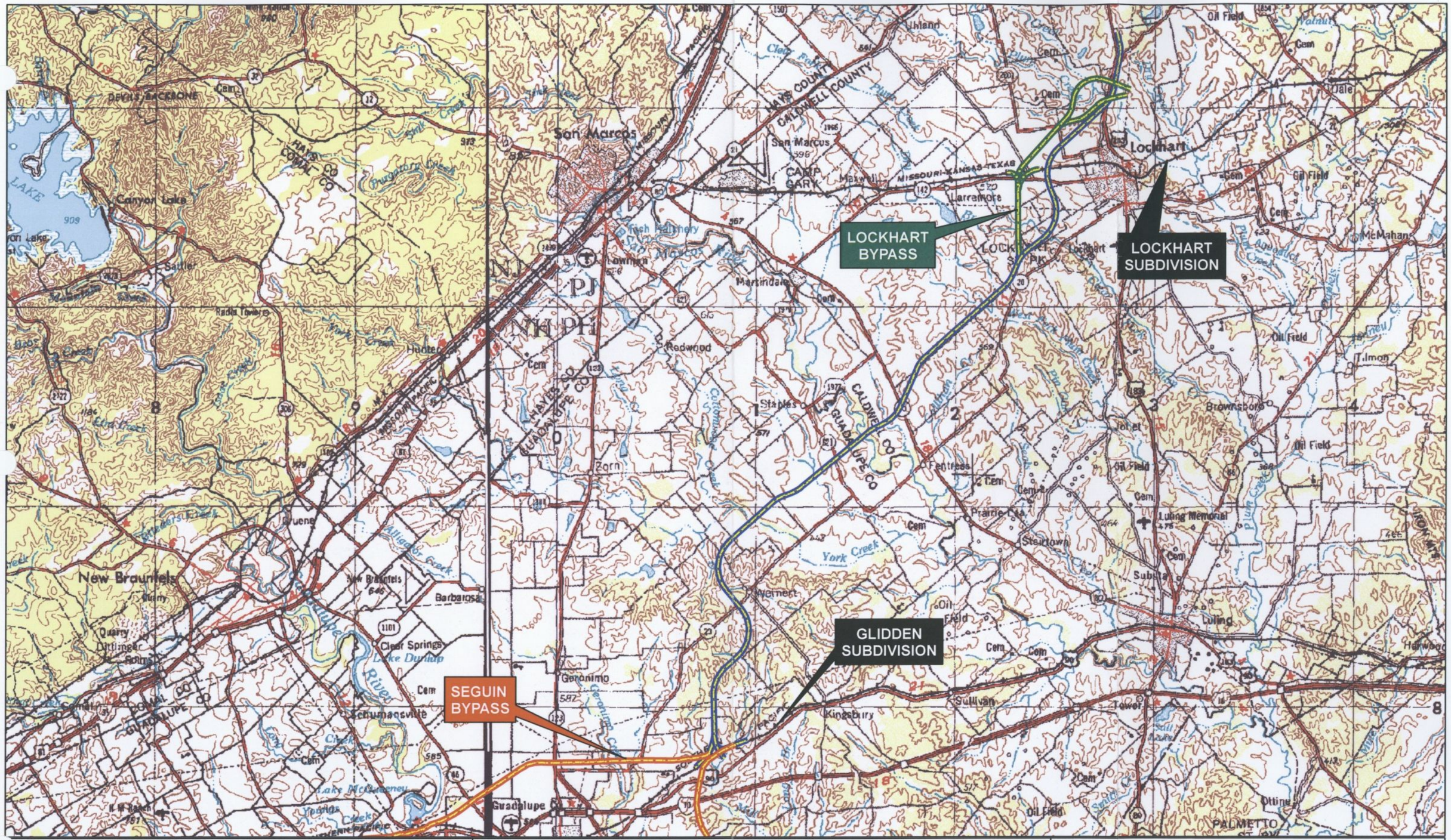

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LOCKHART-SEGUIN DIRECT ROUTE

Figure 2-11

N

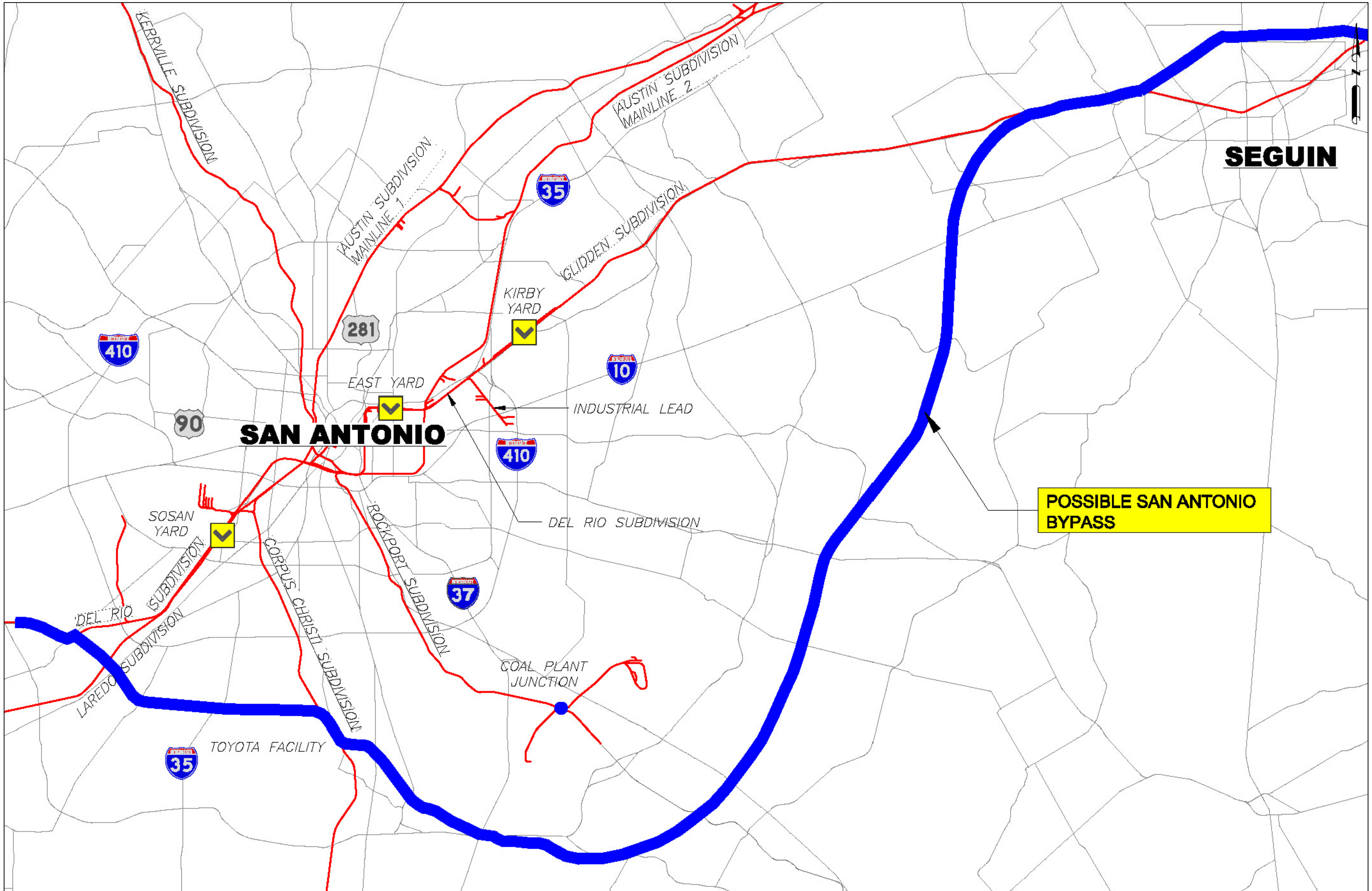

FIGURE 3-1

SAN ANTONIO THROUGH-FREIGHT RAIL CORRIDOR RELOCATION STUDY

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July 29, 2008

Ms. Jennifer Moczygemba
Section Director – Multimodal Section
Texas Department of Transportation
118 East Riverside Drive
Austin, TX 78704

Dear Jennifer,

Thank you for the opportunity to review the Central Texas Rail Network Rail Relocation Feasibility Analysis presented by TXDOT and the San Antonio Region Freight Study presented by HNTB Corporation. We appreciate all of the effort both your team and the consultants expended in order to complete both of these studies.

Consistent with the comments made in this letter, Union Pacific is prepared to move forward with further analysis of the rail infrastructure between San Antonio and Austin. This analysis will help determine what infrastructure is ultimately necessary to potentially accommodate a passenger rail service between San Antonio and Austin without negatively impacting our existing and future freight service in the region.

As we have stated before, Union Pacific could support the concept in the scenario identified in the studies as Planning Case B2. The concept begins to address our concerns which include the following:

- Affords the opportunity for passenger rail by rerouting UP's existing Austin subdivision through-freights to a new alignment which is necessary to accommodate passenger rail;
- Protects Union Pacific's ability to serve its existing customer base in the region without any degradation of service standards;
- Minimizes the impact to Union Pacific's east / west transcontinental route; and
- Eliminates a significant number of at-grade highway grade crossings

While we recognize that a new rail by-pass around the city of San Antonio, studied in Planning Case C, could potentially eliminate additional freight rail operations within the city of San Antonio, we believe this alternative is <u>not</u> a viable option for the following reasons:

- A by-pass would increase Union Pacific's east / west route mileage by approximately 15 miles, effectively reducing our competitive position with trucks plus increasing our costs and fuel usage by approximately one million gallons annually. Putting additional trucks on the road would cause congestion in an area already plagued with this problem.
- Service to local shippers and other shippers in the State of Texas may deteriorate; and
- The proposed yard structure is not operationally functional.

In addition, we are opposed to any relocation of Union Pacific's operations in the San Antonio-Austin area as a part of the Trans Texas Corridor ("TTC"). Inclusion of this corridor as part of the TTC project would limit both operational and commercial flexibility to serve existing and future customers.

Finally, in order to protect our local and through-freight rail service, this project cannot be completed in an incremental manner. The new infrastructure must be completed and turned over to Union Pacific at the time of completion.

John H. Rebensdorf
VP Network Planning & Operations

UNION PACIFIC RAILROAD
1400 Douglas St., Stop 1110, Omaha, NE 68179-1110
ph. (402) 544-4279 fx. (402) 501-0227
jrebensd@up.com

We look forward to identifying the next steps that should be taken in order to advance Planning Case B2. If we move forward on this study, it will be with the understanding that either party is free to suspend or cease participation.

Very truly yours,

cc: Joe Adams, Vice President Public Affairs, UPRR