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16. Abstract

This report documents the estimated impacts of the proposed Railroad Relocation Demonstration Project (north of Brownsville, Texas) on U.S. 77/83 frontage road traffic circulation. The proposed design associated with this project includes the closure of frontage roads at the railroad crossings. This analysis specifically focused on potential adverse impacts to land use activities located adjacent to the frontage roads in the area surrounding the proposed railroad crossing.

The results of the analysis indicate that there will actually be a benefit to traffic circulation (relative to existing conditions), should the proposed design be implemented. Issues related to safety of the railroad crossing are also discussed.

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Impact of North Brownsville Railroad Relocation Demonstration Project on U.S. 77/83 Frontage Road Traffic Circulation

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Research Report 2903-3
Research Study Number 7-2903
Research Study Title: Planning, Design and Operation of Transportation Facilities in Pharr District

Sponsored by the
Texas Department of Transportation

September 1995

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IMPLEMENTATION STATEMENT

The results of this analysis can be used in conjunction with currently proposed design plans for the proposed railroad facility between Merryman Road and Old Alice Road on U.S. 77/83 to obtain Federal Highway Administration (FHWA) approval for this project.

DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the opinions, findings, and conclusions presented herein. The contents do not necessarily reflect the official views of policies of the Texas Department of Transportation. This report does not constitute a standard, specification, or regulation, nor is it intended for constructions, bidding, or permit purposes. This report was prepared by Russell H. Henk, P.E. #74460.

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SUMMARY

A Federal-Aid Highway Act Railroad Relocation Demonstration Project is being implemented just north of Brownsville, Texas. The proposed design in association with this project calls for discontinuous frontage roads between Merryman Road and Old Alice Road, so as to prevent interaction between rail traffic and frontage road vehicular traffic. This study addresses the potential impacts of this design on traffic circulation for land use activities immediately adjacent to the U.S. 77/83 frontage roads in this area.

The results of the analysis indicate that there will ve a net benefit (i.e., reduction in travel time and distance) for traffic circulation between Merryman Road and Old Alice Road. In addition, data regarding the railroad operations in this area indicate that the frontage roads will be blocked for a major portion of the day, regardless of the selection of design treatments. This analysis, therefore, supports the implementation of the current proposed design. Due to the need to maintain U.S. 77/83 as a hurricane evacuation route, however, the proposed operation of this rail facility should forego priority treatment during emergency conditions.

I. INTRODUCTION

BACKGROUND

A new segment of rail line is currently being proposed which will connect the Union Pacific Railroad north of Brownsville, Texas (and just west of U.S. 77/83) with the rail yards at Brownsville Harbor (Figure 1). This improvement is a Federal-Aid Highway Act Railroad Relocation Demonstration Project aimed at investigating the economic, environmental, and social benefits of relocating rail facilities away from urban areas. This new rail facility will require the construction of a new bridge (i.e., grade separation) for U.S. 77/83 between Old Alice Road and Merryman Road, just north of Brownsville, Texas (Figure 2).

In addition to this required grade separation between the freeway and the rail line, the Union Pacific Railroad has requested that there be no potential interaction between motor vehicle traffic and rail car traffic -- thus, necessitating the removal of the frontage roads within the immediate vicinity of the proposed new crossing. This request is primarily based upon safety concerns and the fact that projections of rail traffic indicate the presence of rail cars at this location up to 12 hours per day.

The Texas Department of Transportation, however, maintains U.S. 77/83 as an emergency evacuation route. The use of the frontage roads along this route becomes critically necessary during threats of hurricanes and icing conditions. Removal of the frontage roads in the immediate vicinity of the proposed railroad crossing is, therefore, not feasible. The currently proposed design, consists of barriers being implemented that would prohibit the interaction of motor vehicle and rail traffic during non-emergency conditions.

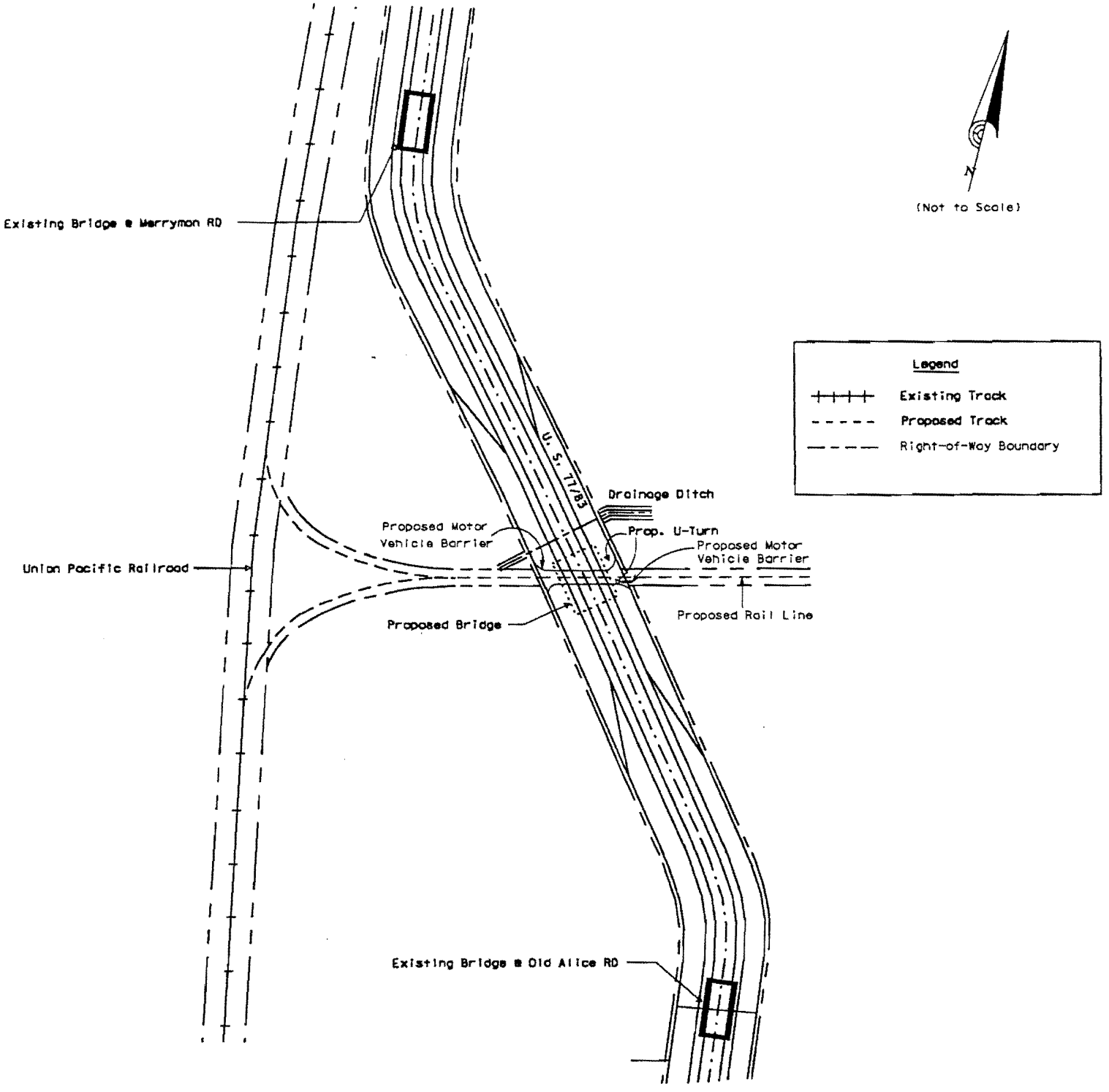

Figure 1. Vicinity Map for Proposed Rail Line North of Brownsville

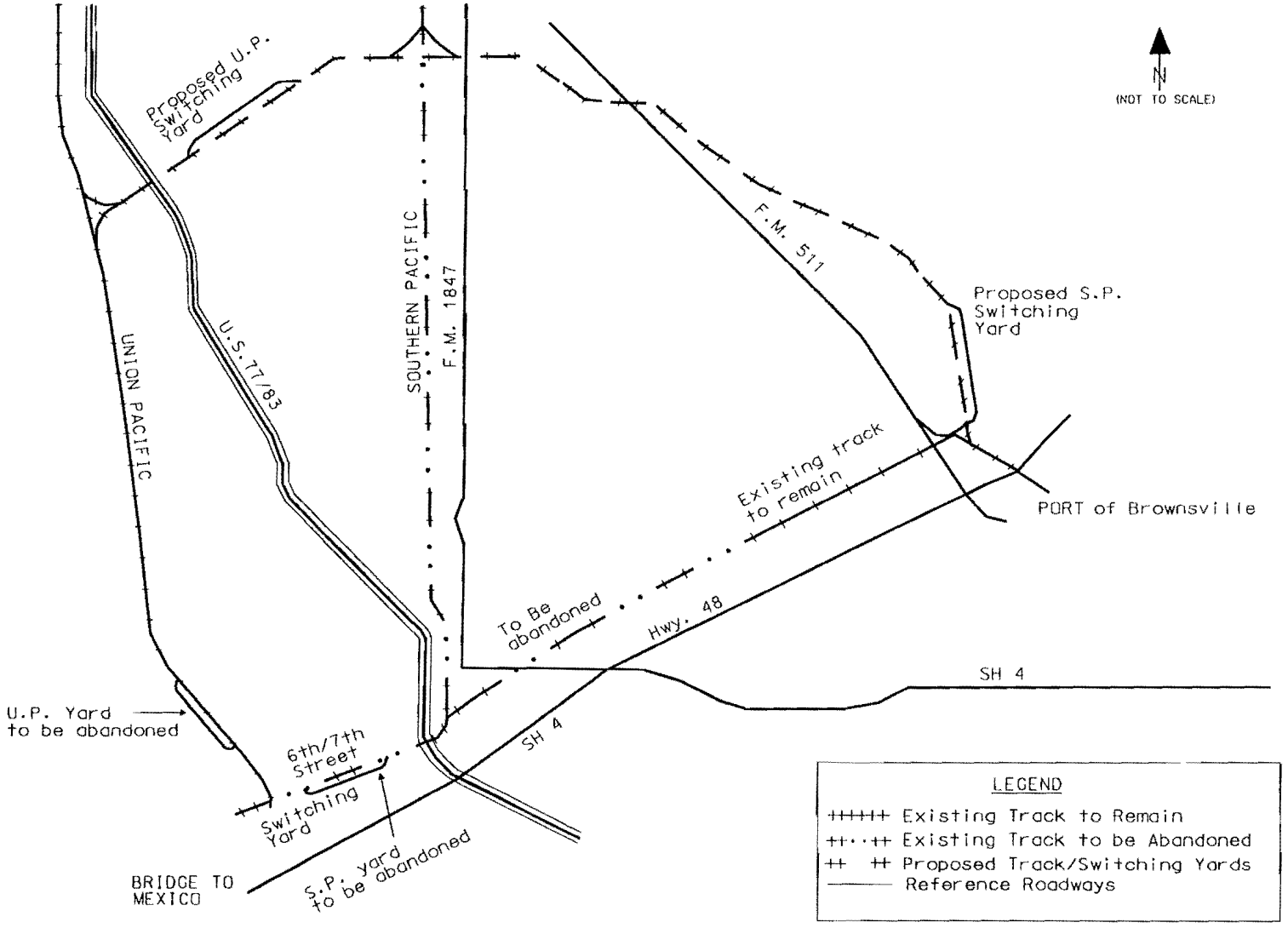

Figure 2. Vicinity Map of Rail Re-Location Activities in the Brownsville Area

SCOPE OF ANALYSIS

The primary objective of this analysis is to examine the impacts of the proposed geometric configuration (see Figure 3) on traffic patterns between Merryman Road and Old Alice Road. In meeting this objective, this analysis focuses on the impact of discontinuous frontage roads (between Old Alice Road and Merryman Road) on traffic during non-emergency conditions. Issues such as local traffic circulation, land use, safe at-grade railroad crossing treatments and plans for additional capacity (for U.S. 77/83) are addressed.

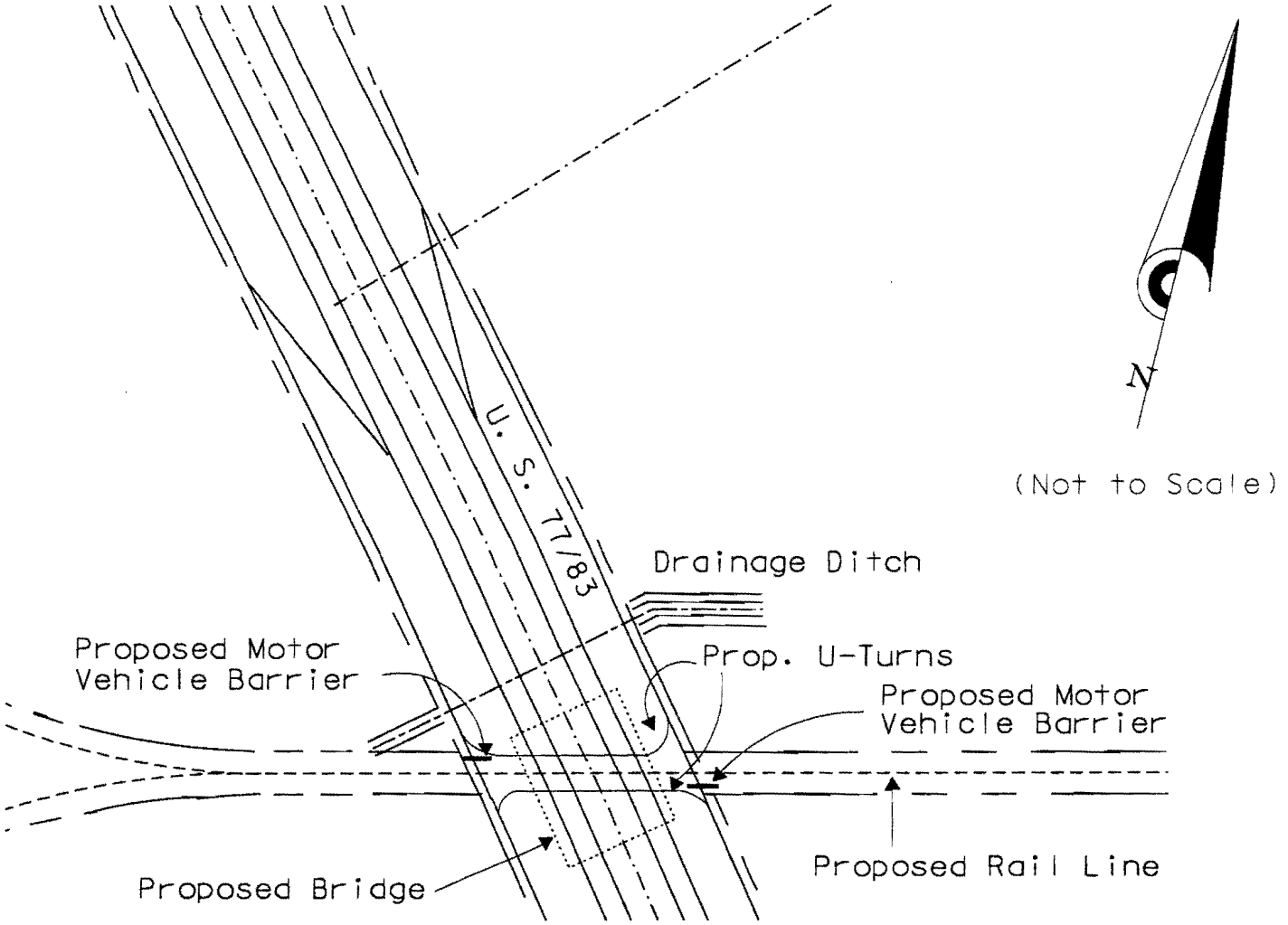

Figure 3. General Characteristics Associated with Proposed Design

II. TRAFFIC VOLUMES

Traffic data were collected in the vicinity of the proposed railroad facility during the weeks of March 20-24, 1995 and May 8-12, 1995. Data were collected during March to assess the potential increase in traffic brought about by Spring Break activities in the area. Analysis of these data indicated that there was no significant difference between the traffic volumes collected in March as compared to May.

The volumes illustrated in Figure 4 represent the weekly average conditions observed in May 1995. Examination of these volumes reveals that, while the freeway volumes are fairly significant (31,450 average daily traffic (ADT)), the frontage road volumes are extremely low (560 to 720 ADT).

Indicated in Figure 5 are the estimated volumes for the year 2015. These estimates are based on an assumed compounded annual growth rate of 4.0 percent. Analysis of two automatic traffic recorder (ATR) stations in the vicinity of the proposed railroad facility indicated a growth rate of 4.0 to 4.5 percent per year over the last 15 years (1979-1994). These estimated future volumes compare favorably with future volumes recently published by the Brownsville Metropolitan Planning Organization.

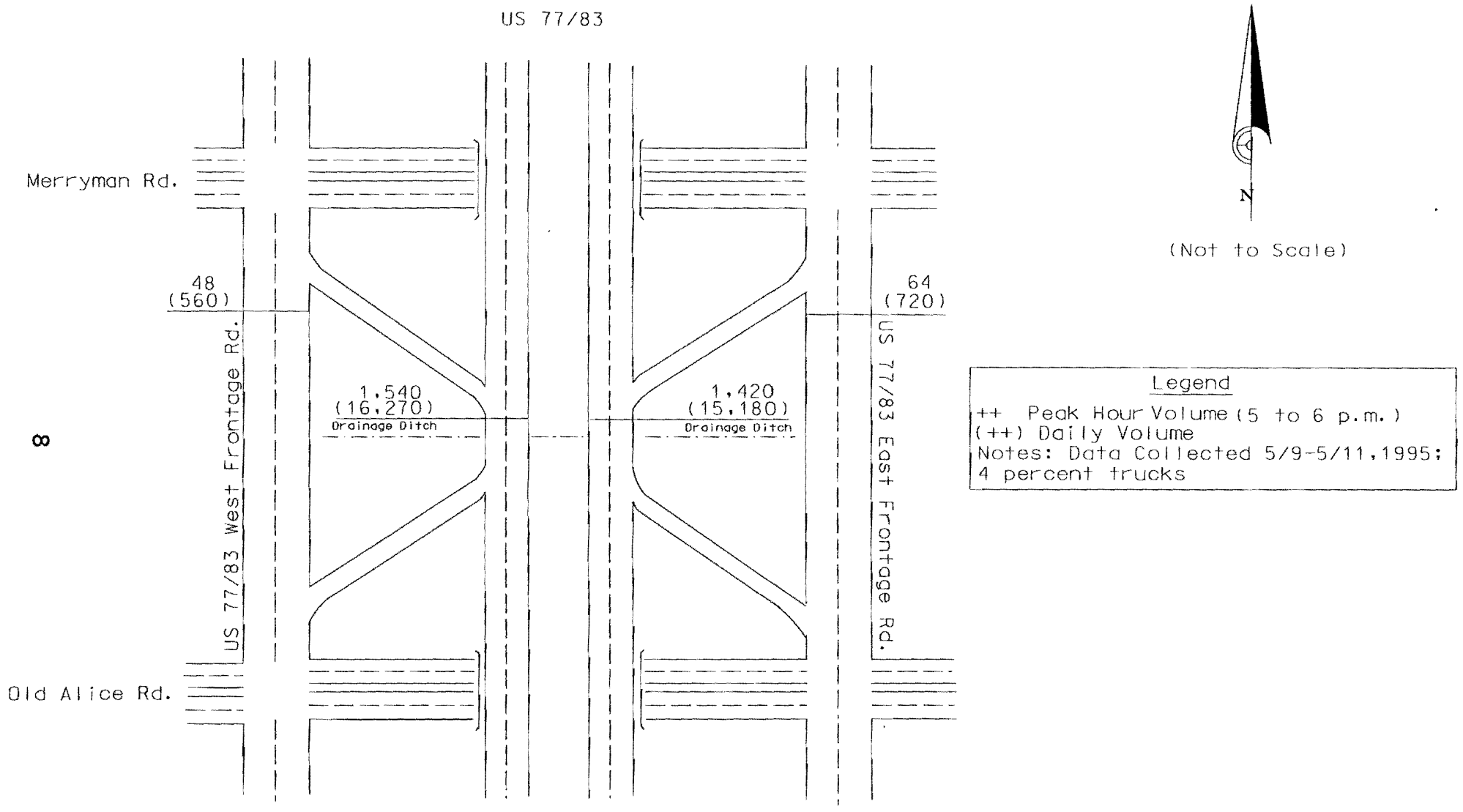

Figure 4. Existing Volumes (1995)

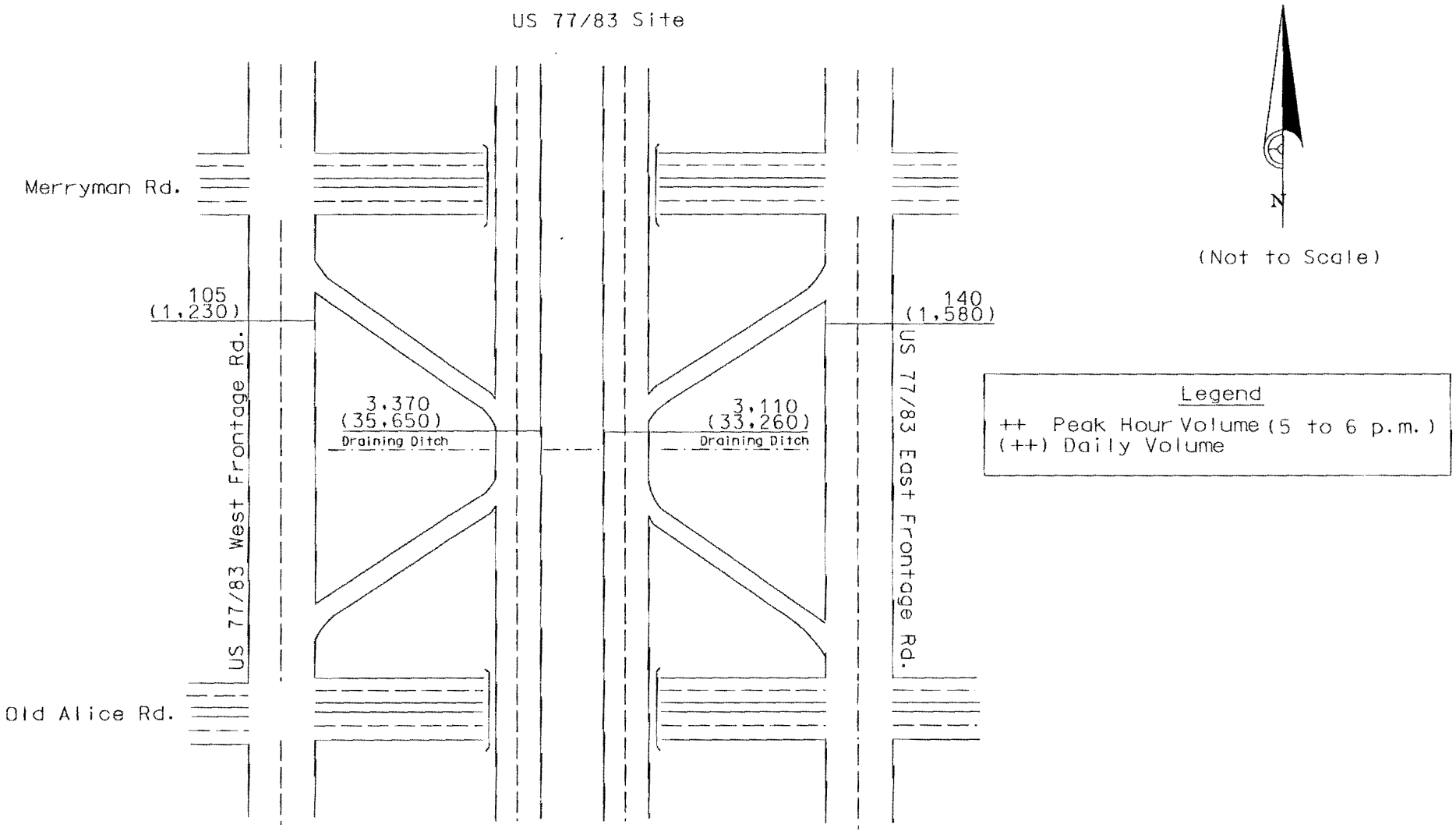

Figure 5. Estimated Future Volumes (Year 2015)

III. TRAFFIC PATTERNS

LAND USE

One of the primary issues associated with the proposed changes illustrated in Figure 3 is that of traffic patterns and their relationship to adjacent land use. The property owners and businesses which will be most directly impacted by the new rail facility are illustrated in Figure 6. With the exception of the flea markets located to the southwest of the new bridge structure, the businesses along the impacted frontage roads generate a relatively small amount of traffic (as evidenced by the low frontage road volumes). In the case of the flea markets, any traffic generated by these locations would be concentrated on the weekends, thereby, not adversely impacting peak-hour operations relative to U.S. 77/83.

TRAFFIC CIRCULATION

In reviewing the land use in this area, it appears that the only potential adverse impact to a (relatively) significant traffic generator is that of Tip-O-Tex Recreational Vehicle (R.V.) Park. The proposed design (which includes discontinuous frontage roads) would prohibit vehicles from accessing the R.V. Park via the northbound frontage road, thus lengthening the trips for northbound vehicles wishing to access the R.V. Park. By the same token, however, the provision of U-turn lanes (specifically the U-turn lane providing southbound vehicles access to the northbound frontage road in the vicinity of the new railroad line) will actually shorten the trip for southbound vehicles by allowing drivers to access the R.V. Park without having to travel through the Old Alice Road Interchange and return along the northbound frontage road.

Similar scenarios (including this one) for business and/or property owners which will be impacted by the proposed design are summarized in Table 1. Changes (measured in

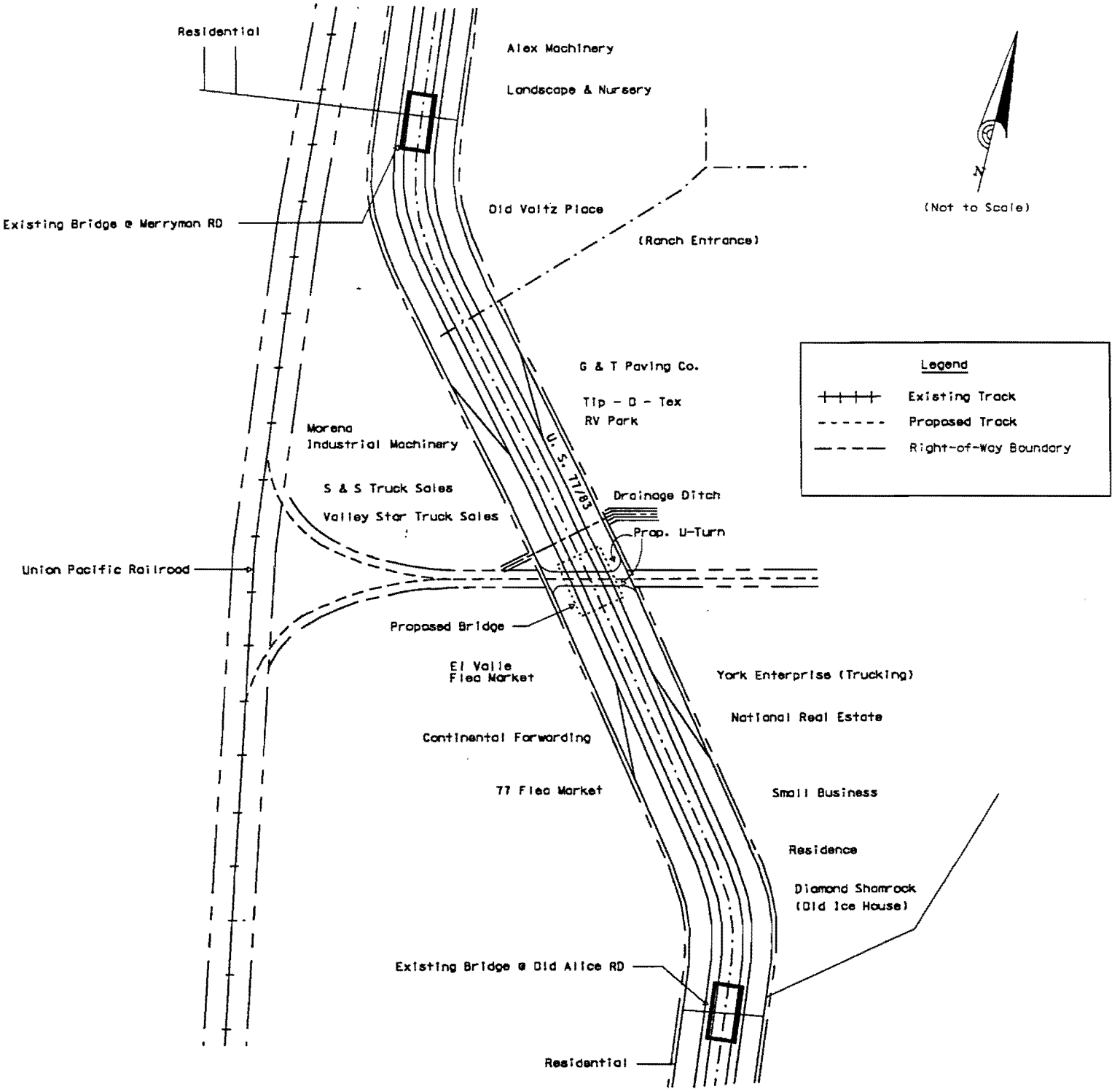

Figure 6. Existing Land Use in Vicinity of Proposed Rail Line

feet) from their probable existing route are also noted for both access and egress movements (Table 1).

As is indicated in Table 1, most locations will experience no net change in travel associated with the proposed design. One specific movement will be lengthened, while another will be shortened by the same distance. This condition is due to the fact that the proposed U-turn lanes (and also the proposed rail line) are approximately half-way between Merryman Road and Old Alice Road. The change in distance (whether it be a greater or shorter distance) amounts to a loop of approximately 1,525 meters (5,000 feet) which either must now be traveled or is now saved because the movement was not previously possible.

In some cases, there will be a net benefit once the proposed design is implemented. This condition applies to locations downstream from an exit ramp (e.g., Old Voltz Place and the 77 Flea Market) or upstream from an entrance ramp (e.g., Diamond Shamrock and the small business just south of N. Real Estate). Excluding the 77 Flea Market (since trips associated with this location would not apply to normal weekday operations), the benefits of the proposed U-turn lanes to traffic circulation would amount to approximately $0.5 million. The assumptions used to develop this estimate are included in Exhibit 1.

Exhibit 1. Based upon these assumptions the calculations indicated below can be made:

- Benefits apply to 20% of trips (conservative, since 30% of the locations will actually benefit)
- 250 working days per year
- 1.25 persons per vehicle
- 20-year project life
- $11.06 per person-hour (value of time)
- Discount rate (I) of 4%
  64 kph average speed (including accel./decel.)

Delay
Savings = 0.2 x $\frac{1{,}280 \text{ veh.-trips}}{\text{day}}$ x $\frac{250 \text{ days}}{\text{yr}}$ x $\frac{1.25 \text{ persons}}{\text{veh}}$ x $\frac{\$11.06}{\text{person-hr}}$ x $\frac{1{,}525 \text{ m.}}{\text{trip}}$ x $\frac{1 \text{ km.}}{1{,}000 \text{ m}}$ x $\frac{1 \text{ hour}}{64 \text{ km.}}$ x 13.6 (P/A) = $286,731

Fuel Consumption and
Vehicle Maint. Savings = 0.2 x $\frac{1{,}280 \text{ trips}}{\text{day}}$ x $\frac{250 \text{ days}}{\text{yr}}$ x $\frac{1{,}525 \text{ m.}}{\text{trip}}$ x $\frac{1 \text{ km.}}{1{,}000 \text{ m.}}$ x $\frac{\$.18}{1 \text{ km.}}$ x 13.6 (P/A) = $238,925

TOTAL SAVINGS = **$525,909**

These estimates are based on existing volumes and should, therefore, be considered conservative.

Table 1. Summary of Proposed Design Impacts on Travel Patterns

Business/ Property Owner	Change in Travel Pattern by Direction and Movement Type								Totals[3]
	Southbound				Northbound				
	Access		Egress		Access		Egress		
	Distance Added meters (6ft)[1]	Distance Saved meters (ft)[2]	Distance Added meters (ft)[1]	Distance Saved meters (ft)[2]	Distance Added meters (ft)[1]	Distance Saved meters (ft)[2]	Distance Added meters (ft)[1]	Distance Saved meters (ft)[2]	
Tip-O-Tex R.V. Park	---	1,525 (5,000)	---	---	1,525 (5,000)	---	---	---	---
G&T Paving Co.	---	1,525 (5,000)	---	---	1,525 (5,000)	---	---	---	---
Old Voltz Place	---	1,525 (5,000)	---	---	---	---	---	---	-1,525 (5,000)
Morena Machinery	---	---	1,525 (5,000)	---	---	---	---	1,525 (5,000)	---
S&S Truck Sales	---	---	1,525 (5,000)	---	---	---	---	1,525 (5,000)	---
Valley Star Truck Sales	---	---	1,525 (5,000)	---	---	---	---	1,525 (5,000)	---
El Valle Flea Market	1,525 (5,000)	---	---	---	---	1,525 (5,000)	---	---	---
Continental Forwarding	1,525 (5,000)	---	---	---	---	1,525 (5,000)	---	---	---
77 Flea Market	---	---	---	---	---	1,525 (5,000)	---	---	-1,525 (5,000)
Diamond Shamrock	---	---	---	1,525 (5,000)	---	---	---	---	-1,525 (5,000)
Residences	---	---	---	1,525 (5,000)	---	---	---	---	-1,525 (5,000)
Small Business	---	---	---	1,525 (5,000)	---	---	---	---	-1,525 (5,000)
National Real Estate	---	---	---	1,525 (5,000)	---	---	1,525 (5,000)	---	---
York Enterprise	---	---	---	1,525 (5,000)	---	---	1,525 (5,000)	---	---
TOTALS[3]	+3,050 (10,000)	-4,575 (15,000)	+4,575 (15,000)	-2,625 (25,000)	+3,050 (10,000)	-4,575 (15,000)	+3,050 (10,000)	-4,575 (15,000)	-7,625 (25,000[4])

NOTES: Approximate distances associated with changes in travel--rounded to the nearest 200 feet.

--- No changes from existing travel requirements.

[1]The additional distance which would need to be traveled per trip (relative to existing conditions) upon implementation of the proposed design.

[2]The distance of travel saved per trip (relative to existing conditions) upon implementation of the proposed design.

[3]The net change in distance traveled per trip for a respective location or movement.

[4]The total change in distance traveled (assuming an equal number of trips per unit of time) for all existing land use and associated movements between Merryman Road and Old Alice Road.

IV. ADDITIONAL ISSUES

RAIL FACILITY OPERATIONS

The location of the switching yard just east [0.5 kilometers (0.3 miles)] of U.S. 77/83 raises important operational issues relative to the impact of the proposed rail lines on the U.S. 77/83 frontage roads. First, the geometric characteristics associated with the rail line will result in trains traveling at very low speeds in the vicinity of U.S. 77/83. This situation will, in turn, result in long periods during which rail cars will be present on the tracks located at the frontage roads. The switching activities associated with the rail yard just east of the freeway will also contribute to very low train speeds and high dwelling times for rail cars at U.S. 77/83.

As mentioned previously, this would translate into occupation of the tracks at the frontage roads for up to 12 hours per day. If the railroad crossings at the frontage roads were equipped with typical gates and flashing lights, not only would these devices be activated when trains were present in the immediate vicinity of the railroad crossings, but (due to the close proximity of the switching yard) it is highly likely that they would also be activated by trains waiting on switching activities -- resulting in the gates and flashing lights being activated when trains were not necessarily within view of frontage road and/or freeway motor vehicle traffic. This latter condition could result in serious adverse impacts on driver expectancy for the frontage road railroad crossing.

All told, these aforementioned conditions support the prohibition of motor vehicle traffic at the frontage road/railroad intersection during non-emergency conditions. In short, the railroad operations in this area will cause the frontage road to be impassable anyway.

RAILROAD GRADE CROSSING TREATMENTS

An additional issue warranting special consideration is the selection of appropriate railroad grade crossing treatment(s). All new railroad crossing construction on a federal-aid project is required to include train-activated traffic control devices (per the Federal-Aid Program Manual). This would typically involve flashing signals and automatic gates, but could technically be limited to either flashing signals only or cantilever signals with or without gates. A "diagnostic review" would need to be performed to make an appropriate determination based on site layout, geometrics, traffic characteristics, and other factors.

In the case of this particular location, however, train-activated devices might be waived due to infrequent use (during emergency conditions only). In fact, an agreement with the Union Pacific Railroad and/or treatments to restrict/regulate the movement of trains during emergencies (i.e., hurricane and icing conditions) is probably warranted. Especially in the case of hurricane conditions, precedence should be given to evacuating the far South Texas Coastline, thus, supporting the restriction of train movements. All of this would, of course, be subject to Federal Highway Administration approval. Even if railroad restrictions were successfully implemented, the Department should at least consider the installation of crossbucks as an inexpensive means of identifying the crossing and minimizing the potential for lawsuits.

ADDITIONAL CAPACITY FOR U.S. 77/83

As indicated in Figure 5, the traffic volumes on U.S. 77/83 in the year 2015 are expected to reach a level at which freeway operations will begin to approach

slightly congested conditions. These estimates and expected conditions support the idea of expanding U.S. 77/83 to three lanes in each direction. In light of this fact, special consideration should be given to the size (width) of the bridge structure to be constructed over the rail line and the placement of the entrance and exit ramps so as to minimize the difficulty of expanding U.S. 77/83 to six lanes (three lanes in each direction) in the future.

V. CONCLUSIONS

The analyses conducted in this study indicate that the proposed design associated with the new rail facility (illustrated in Figures 3) north of Brownsville will not have any adverse impacts on existing adjacent land use and/or traffic circulation. In fact, examination of this site indicates that benefits of approximately $0.5 million are (conservatively) expected in association with the proposed design. These benefits specifically pertain to reductions in travel to and/or from several locations between Merryman Road and Old Alice Road which will be brought about by the currently proposed design.

Examination of the geometric and operational characteristics associated with the proposed rail facility further support the prohibition of thru traffic on the frontage roads between Merryman Road and Old Alice Road. Railroad operations in this area will render this portion of the frontage road impassable for significant portions of the day. It is also likely that typical railroad crossing treatments will lead to adverse impacts on driver expectancy.

In addition, it was concluded that consideration should be given to future widening needs for U.S. 77/83, and these factors incorporated into the proposed design. Restriction and/or regulation of train traffic at this site under emergency conditions (i.e., hurricane evacuation and icing conditions) appears to be warranted as well. While access by motor vehicle thru traffic on the frontage roads should be prohibited in the area of the railroad crossing, basic railroad grade crossing identification should be considered.