U.S. 287 at Lamar EA – Traffic Safety Assessment

PREPARED FOR: US 287 at Lamar

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DATE: 5/24/2012

PROJECT NUMBER: 172922

Purpose

The purpose of this memorandum is to utilize the most recent (years 2007 through 2011) highway traffic and accident data to update the safety assessment for the U.S. 287 at Lamar EA.

Introduction

The original safety analysis conducted for the EA was completed using a methodology whereby average crash (also termed "accident") rates for the study area are compared to statewide average crash rates for similar facilities. Based on this approach, the analysis effort concluded that average crash rates for the four years between 2001 and 2004 on both U.S. 287 and U.S. 50 were well above the respective statewide averages. However, research in the area of safety assessment has advanced since the time of the original analysis and modified the way traffic safety is evaluated. CDOT now uses a methodology called safety performance functions (SPFs) to assess how a particular facility is performing with regard to safety as compared to similar facilities statewide.

An SPF represents the complex relationship between traffic exposure measured in average annual daily traffic (AADT) and the number of crashes on a given roadway segment measured in crashes per mile per year. The SPF models provide an estimate of the normal or expected crash frequency for a range of AADT on similar facilities.

Safety Assessment

The CDOT Safety and Data Analysis Group provided the following crash listings for the years 2007 through 2011:

- U.S 287 south of Lamar: Mileposts 72.00 to 77.64
- U.S. 287 north of Lamar: Mileposts 85.19 to 88.00
- U.S. 50 east of Lamar: Mileposts 427.7 to 442.00

These listings cover the highway segments adjacent to and through the city limits. From this comprehensive listing of crashes, the safety analysis focused on those that occurred on the highway segments in the areas being studied for the bypass facility (U.S. 287 north and south of the City, and U.S. 50 east of the City). The analysis also included the U.S. 287 intersection with U.S. 50 and an assumed area of influence equal to 200 feet along the intersection approaches. The following lists the mileposts focused on for the safety analysis:

- U.S 287 south of Lamar: Mileposts 72.00 to 75.00
- U.S. 287 north of Lamar: Mileposts 85.80 to 87.90
- U.S. 50 east of Lamar: Mileposts 436.70 to 439.71

Average annual daily traffic volumes were obtained from the CDOT website.

Crash Statistics

A total of 58 crashes were reported on the select study area highways and the U.S. 287 intersection with U.S. 50 during the study period. The following briefly summarizes the crash statistics for the highway segments and intersection.

Highway Segments. Twenty-two crashes occurred on these three highway segments during the five-year study period. Three of these crashes (14 percent) were severe and resulted in one fatality and four injuries. The fatal crash occurred during an early March morning on U.S. 287 near the location at which the highway transitions from a 2-lane facility to a 4-lane facility on the southern edge of Lamar. The fatally injured driver of a passenger vehicle reportedly lost control in snowy conditions and the vehicle was sideswiped by a truck traveling in the opposite direction. The two injury crashes occurred on U.S. 50. One of these crashes occurred when the driver of a passenger car reportedly attempted to make an illegal u-turn and was sideswiped by another passenger vehicle (both drivers were injured). The other injury crash occurred at an intersection on U.S. 50 that is controlled by a flashing signal. The driver of a passenger car reportedly turned left in the path of an oncoming vehicle and was injured. The majority of the other highway segment crashes were single-vehicle collisions that occurred in dry, daylight conditions.

Six of these 22 highway segment crashes (27 percent) are assumed to have involved a truck since the crash records are coded with a vehicle type of "vehicle combination greater than 10,001 pounds." Five of these crashes resulted in property damage and one resulted in a fatality. In half of these crashes, passenger vehicles were reported as the first vehicle, or the driver that initiated the crash. The following summarizes these crashes:

- Truck reported as first vehicle:
    - Truck driver sideswiped another truck while changing lanes.
    - Truck driver hit a deer.
    - Debris fell from truck and hit the passenger vehicle following the truck.
- Passenger vehicle reported as first vehicle:
    - Passenger car driver lost control and vehicle was sideswiped by a truck (fatal crash).
    - Passenger car driver hit a deer and then sideswiped a truck.
    - Passenger car driver rear-ended a truck.

Intersection. All of the 36 crashes that occurred at the U.S. 287 intersection with U.S. 50 during the five-year study period were multiple-vehicle crashes. One of the rear-end collisions and one of the broadside collisions (6 percent of the total intersection crashes) resulted in injuries. As expected at an intersection, the predominate crash type was broadside collision, which accounted for 31 percent of the crashes. Other common crash types were rear-end collision (22 percent of the crashes) and collision with parked motor vehicles (22 percent of the crashes). The moving vehicles in two of the parked motor vehicle collisions were large trucks. All of the intersection crashes occurred in daylight or dark-lighted conditions.

One-third of the intersection crashes (12 crashes) involved large trucks (crash records coded with a vehicle type of "vehicle combination greater than 10,001 pounds"). All twelve crashes resulted in property damage. In seven of these twelve crashes, the truck is reported as the first vehicle (indicating the truck driver initiated the crash). The following summarizes these crashes:

- Truck reported as first vehicle:
    - Truck driver rear-ended a passenger vehicle stopped in traffic (2 crashes).
    - Truck driver veered out of lane and sideswiped a parked motor vehicle (2 crashes).
    - Truck driver veered out of lane and sideswiped a moving passenger vehicle (2 crashes).
    - Truck driver turned left from the through lane and sideswiped a left-turning passenger vehicle.

- Passenger vehicle reported as first vehicle:
  - Passenger car driver broadsided a truck while executing a left-turn maneuver (2 crashes).
  - Passenger car driver veered out of lane and sideswiped a truck.
  - Passenger car driver improperly exited a parking space and sideswiped a truck.
  - Passenger car driver veered out of lane and sideswiped a parked truck.

Safety Performance Assessment

Highway segments and intersections operate under different volume conditions and prevailing speeds, and have different types of conflict points. For these reasons, crash types and severities tend to vary between the highway segment and intersection components of the roadway network. Therefore, safety performance assessments were performed separately for the study area highways adjacent to the city limits and for the intersection in downtown Lamar. The safety performance of the study area roadways was analyzed by comparing the recorded accident history over the five-year study period to the relative CDOT Safety Performance Function (SPF) graph.

Highway Segments. The CDOT SPF for "Rural Flat and Rolling 2-Lane Highways" was used for this comparative assessment of the study area roadways. This particular SPF best represents the character of the highway segments adjacent to the Lamar city limits. Exhibit 1 summarizes the data used in Exhibit 2 to perform the SPF comparison to similar highway segments across the state.

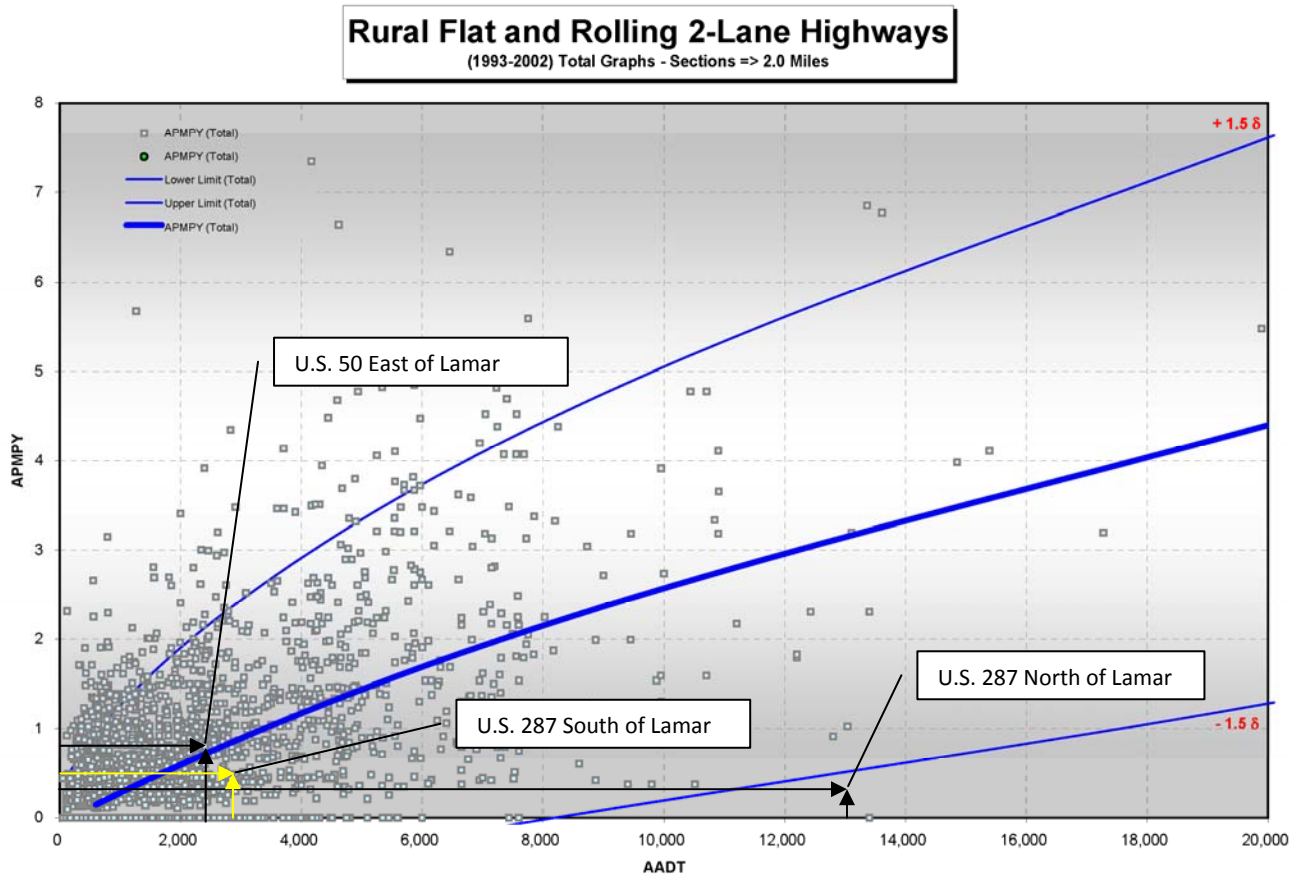
Exhibit 2 shows the SPF graph developed by CDOT for the highway type representative of the study area highways. The AADT is plotted along the X-axis of the SPF graph and the crashes (termed "accidents" in the graph) per mile per year are plotted along the Y-axis. The large blue line on Exhibit 2 represents the expected safety performance (expected number of annual crashes per mile) for a given AADT on two-lane rural, rolling highways. As shown on Exhibit 2, all three data points for the study area segments (representing the combination of crashes per mile per year and AADT) plot at or below the line representing the expected number of annual crashes per mile. Hence, the expected number of annual crashes for an AADT of 2,600 vehicles occurred on the three-mile segment of U.S. 50 east of Lamar during the study period. The two segments of U.S. 287 north and south of Lamar experienced fewer annual crashes than expected (fewer crashes occurred on these segments as compared to similar facilities across the state) during the study period.

Exhibit 1 – Highway Segment Traffic and Accident Data

Highway Segments	2007 – 2011 Data			
	Crashes	Length	APMPY	AADT
U.S. 287 North of Lamar (MP 85.80 – 87.90)	3	2.1	0.29	13,000
U.S. 50 East of Lamar (MP 436.71 – 439.71)	12	3.0	0.80	2,600
U.S. 287 South of Lamar (MP 72.00 – 75.00)	7	3.0	0.47	2,900
Notes: APMPY = Crashes Per Mile Per Year (5 year study period); AADT = Annual Average Daily Traffic				

Routing large trucks from these highway segments to a bypass could improve the safety performance of the segments by reducing the annual average daily traffic (the SPF methodology assumes more crashes can be expected with increasing traffic volumes).

Exhibit 2 – CDOT: Highway Segment Safety Performance Function



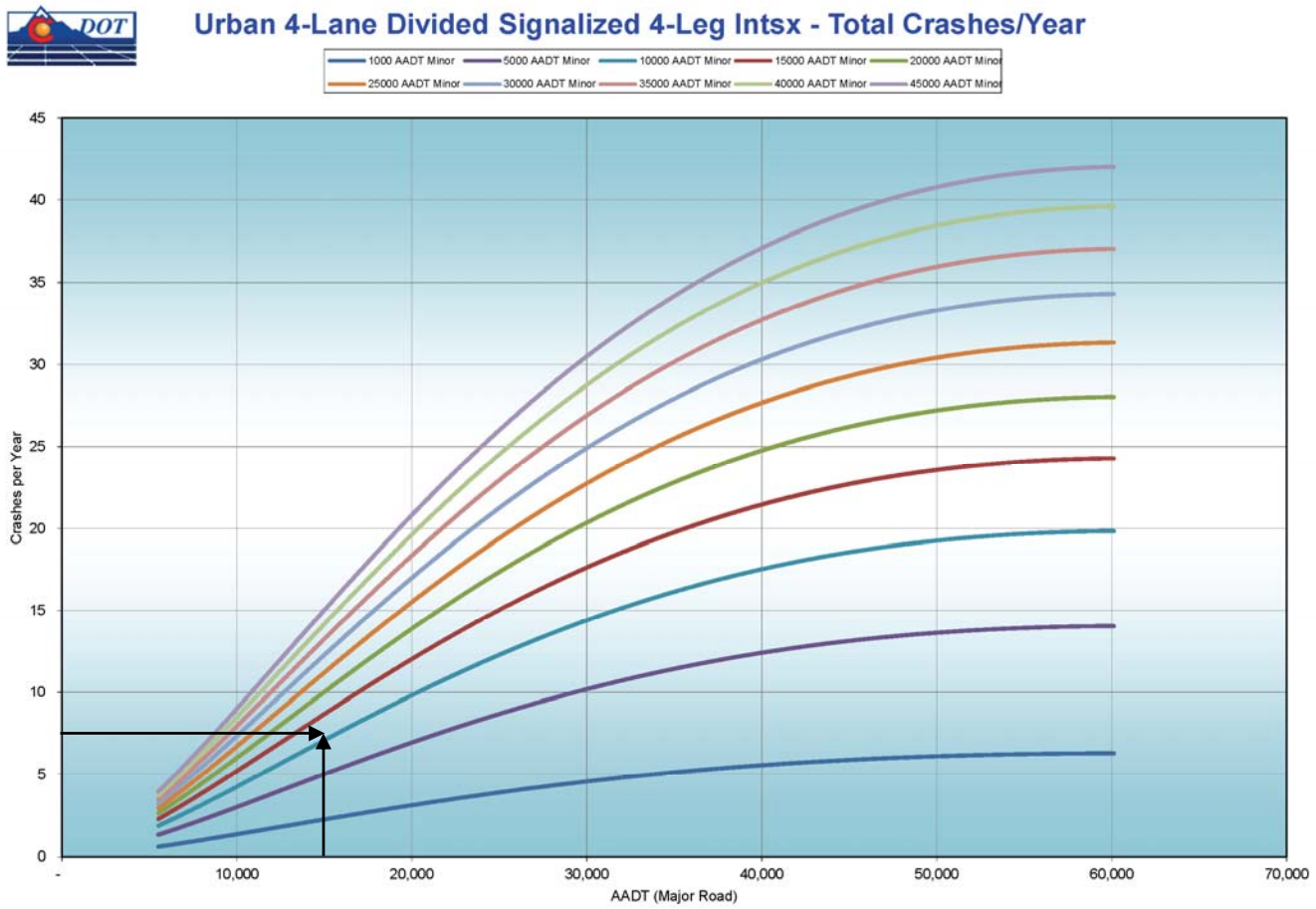
Intersection. The "urban 4-lane divided signalized 4-leg intersection" SPF best matches the intersection of U.S.287 and U.S. 50 in downtown Lamar. Exhibit 3 summarizes the data used in Exhibit 4 to perform the SPF comparison to similar intersections across the state. As the through movement, U.S. 287 is defined as the major street with an AADT of 16,000 vehicles near its intersection with U.S. 50. U.S. 50 is defined as the minor street. The eastbound intersection approach (Olive Street) opposite the U.S. 50 approach has a lower AADT, so the analysis uses the larger value of 5,600 vehicles (counted on U.S. 50 near the intersection) for the minor street volume.

Exhibit 3 – Intersection Traffic and Accident Data

Intersection	Street	Crashes Per Year	Classification	AADT
U.S. 287 / U.S. 50	U.S. 287 near MP 77.64	2.4	Major Street	16,000
	U.S. 50 / Olive Street near MP 435.39	4.8	Minor Street	5,600
Total Intersection Crashes Per Year =		7.2		

Exhibit 4 shows the SPF graph developed by CDOT for the signalized intersection type representative of this study area intersection. (This SPF graph uses the term "crashes", which means the same thing as the term "accidents" used in the highway SPF graph.) The purple line (second from the bottom) represents a minor street AADT of 5,000 vehicles, which most closely represents the U.S. 50 AADT. The data point representing 16,000 AADT for U.S. 287 and 7.2 crashes per year plots above the purple line, indicating that this intersection experienced more annual crashes than expected during the study period as compared to similar intersections across the state.

Exhibit 4 – CDOT: Intersection Safety Performance Function



The presence of parking on all four intersection approaches could contribute to the above-average crash experience at this intersection. Since this particular SPF is for urban areas, most of the intersections included in the dataset used to create the graphs likely do not have parking adjacent to the intersection. At this study area intersection, eight crashes involved a moving vehicle hitting a parked motor vehicle. If averaged over the 5-year study period, the presence of parking adjacent to the intersection could account for 1.6 more crashes per year. Without parking, the average number of crashes per year could potentially be reduced to 5.6 crashes per year (a value that plots slightly above the line representing the expected annual number of crashes).

Routing large trucks from this intersection to a bypass could improve the safety performance of the intersection by reducing the annual average daily traffic (the SPF methodology assumes more crashes can be expected with increasing traffic volumes) that travels through the intersection. Safety could also improve if large trucks are removed from downtown Lamar streets and intersections because the resultant vehicle mix would be more homogeneous. A more uniform mix can improve safety because vehicles will travel at similar speeds and driver expectancy / understanding of the operating characteristics of the vehicles around them increases.

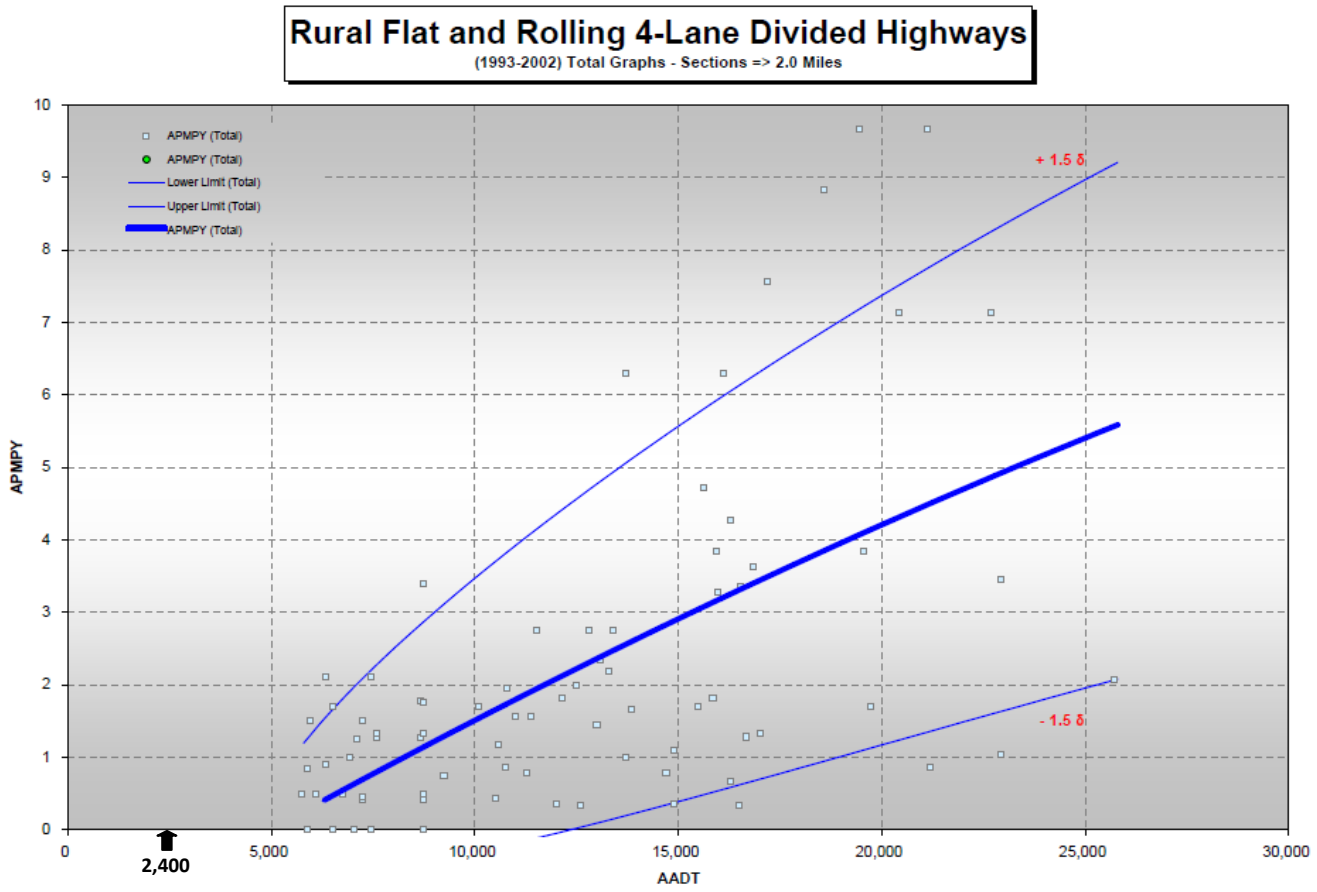
Predicted Safety Performance of Reliever Route

The safety performance of the reliever route (in terms of expected number of crashes per year) is predicted using the SPF methodology. In the interim until the year 2035, the reliever route will be a two-lane undivided facility. The traffic volume projections on this facility range from 1,250 to 1,400 AADT on the southern section and from 2,100 to 2,400 AADT on the northern section. As Exhibit 2 shows, this volume range suggests less than one annual crash per mile per year can be expected on the new facility.

Beyond 2035, the ultimate condition will be a four-lane divided reliever route. Exhibit 5 shows the SPF graph developed by CDOT for this type of highway facility. The large blue line on Exhibit 5 represents the expected

safety performance (expected number of annual crashes per mile) for a given AADT on four-lane rural divided highways. The data points on the graph indicate that the traffic volumes on all of the facilities used to create this particular SPF were higher than those projected for the reliever route. Hence, this SPF cannot be used to predict an expected number of crashes on this four-lane facility beyond the year 2035. However, the documented crash history in the study area suggests it is not practical to assume no crashes will occur on the four-lane reliever route. A four-lane divided facility eliminates some of the conflict points inherent on a two-lane undivided facility (such as head-on and sideswipe opposing collisions), so it is reasonable to assume the safety performance of the divided facility will be equal to or better than the two-lane facility with the same projected traffic volumes. Thus, less than one annual crash per mile per year can be expected on the four-lane divided facility.

Exhibit 5 – CDOT: 4-Lane Divided Highway Safety Performance Function



Conclusion

Using the SPF methodology, the conclusion of this crash analysis effort is the highway segments performed as expected or better than expected in terms of average annual number of crashes, and a higher number of average annual crashes than expected occurred at the intersection during the study period. This is a slightly different conclusion than that previously reached using the crash rate comparison methodology. With the previous methodology, the statewide average crash rates for each type of roadway were calculated by combining the crashes along the roadway segments with those that occurred at the intersections. The SPF methodology incorporates one of the recent shifts in safety assessment methodology – analyzing intersections and roadway segments separately because of the varying nature of the crashes and exposure on the two elements of the roadway network. The different conclusion reached with the SPF methodology is likely attributable to the fact that the average crash rate calculation included roadway segments and intersections together along the roadway. The previously calculated crash rates seemed high because of the influence of the crashes that occurred at the U.S. 287 intersection with U.S. 50.

The 7.2 crashes that occurred each year on average at the intersection during the study period are approximately 45 percent higher than the expected number of 5 annual crashes per the SPF. The presence of parking on all four intersection approaches could contribute to the above-average crash experience at this intersection. Since this particular SPF is for urban areas, most of the intersections included in the dataset used to create the graphs likely do not have parking adjacent to the intersection.

Rerouting large trucks from the study area highway segments to a bypass could improve the safety performance of the segments by reducing the annual average daily traffic (the SPF methodology assumes more crashes can be expected with increasing traffic volumes). Furthermore, routing large trucks from this intersection to a bypass could improve the safety performance of the intersection by reducing the annual average daily traffic that travels through the intersection. Safety could also improve if large trucks are removed from downtown Lamar streets and intersections because the resultant vehicle mix would be more homogeneous. A more uniform mix can improve safety because vehicles will travel at similar speeds and driver expectancy / understanding of the operating characteristics of the vehicles around them increases. Less than one annual crash per mile per year is expected for both the two-lane (interim condition) and four-lane (ultimate condition) reliever route facility.