section 6: needs and gap analysis

6.1 – highways and bridges

With more than 93% of the region's commuters using automobiles (US Census Bureau, 2008-2012), the highway mode is by far the current mode of choice for Wacoans to get from point A to point B. This section provides an overview on how the highway system is currently operating and identifies existing deficiencies both in terms of capacity and condition.

highway capacity, traffic congestion and relationship to level of service

Capacity refers to the maximum rate of flow that can be accommodated on a roadway segment under prevailing conditions. Congestion occurs when demand exceeds the capacity of a roadway resulting in a reduction of the rate of flow. *The Highway Capacity Manual (HCM)*, published by the Transportation Research Board, defines the relationship between congestion and service characteristics through the use of level of service (LOS) measurements. Roadways are described in terms that represent reasonable ranges in three dimensions: average travel speed, density, and flow rate. LOS measures are used to identify existing problem areas, to measure the effects of increased travel demand, to determine the number of lanes needed to achieve efficient movement, and to compare alternatives between proposed projects. Table 6.1 provides a definition of Level of Service and its relationship with congestion.

table 6.1 – level of service (los) definition

	Estimated Maximum Volume to Capacity Ratio			
Level of Service	Collectors & 2 Lane Arterials	Multi-Lane Arterials	Expressways & Interstates	Relationship to Congestion
A	0.10	0.35	0.35	Free Flow
B	0.25	0.50	0.50	Light Traffic
C	0.40	0.65	0.70	Moderate Traffic
D	0.60	0.80	0.85	Heavy Traffic
E	1.00	1.00	1.00	Congested
F	>1.00	>1.00	>1.00	Heavily Congested

6.1.1 – highway level of service: 2010

As a general rule, the functionally classified highway system is operating at an acceptable level of service. In 2010, less than 4% of the functionally classified highway system was operating at an unacceptable level of service. This is somewhat less than that observed in 2007 (4.7%) and closely approximates the national trend of decreased traffic volumes during the Great Recession. Those portions of the system at a level of service "F" tend to be concentrated within the suburban areas. Despite this, a significant portion of the system is operating at a marginal level of service, suggesting that the system will be unable to accommodate much future growth in traffic.

With regards to specific classifications, IH-35 was the worst performing with nearly the entire system operating at marginal or worse level of service. Principal arterials were next with nearly 2 out of 3 miles operating at marginal or worse LOS. Minor arterials and collectors were functioning somewhat better. Table 6.2 outlines the level of service characteristics for the functionally classified highway system. Table 6.3 identifies those highway segments that have the worst congestion levels within the Metropolitan Area.

table 6.2 – level of service (los) per classification: 2010 network

Classification	Acceptable LOS A to C	Marginal LOS D & E	Unacceptable LOS F	Average LOS
Interstate	8.1%	91.9%	0.0%	D
Other Expressways	96.0%	4.0%	0.0%	B
Principal Arterials	36.2%	59.0%	4.8%	D
Minor Arterials	49.2%	43.5%	7.3%	C
Major Collectors	66.4%	30.8%	2.8%	C
Minor Collectors	100%	0.0%	0.0%	B
Total System	60.5%	36.0%	3.5%	C

chart 6.1 – percent marginal or unacceptable level of service by functional classification: 2010

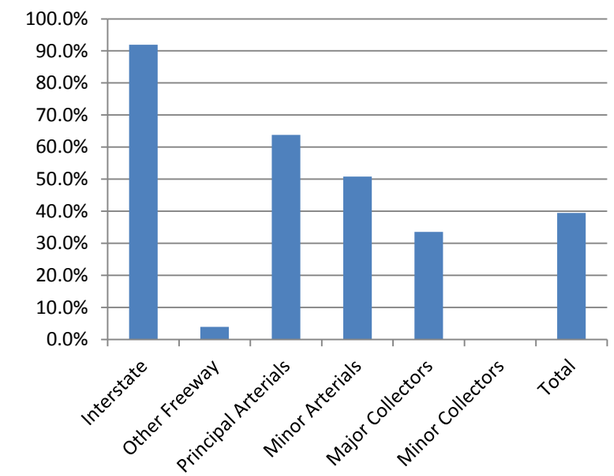
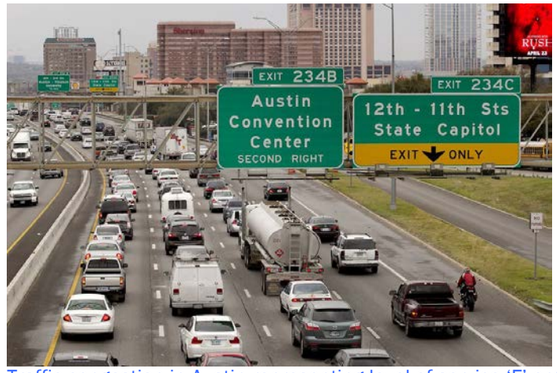


table 6.3 – top 10 most congested roads: 2010

Road	Limits	Lanes	Volume to Capacity Ratio
China Spring Rd (FM 1637)	FM 3434 to FM 3051	2	1.947
China Spring Rd (FM 1637)	FM 2490 to FM 3434	2	1.819
Texas Central Pkwy	FM 3223 to US 84	2	1.273
North 18th St	Bosque Blvd / Homan Ave to Maple Ave	2 with center turn lane	1.239
China Spring Rd (FM 1637)	FM 185 to FM 2490	2	1.224
Gholson Rd (FM 933)	FM 308 to FM 1858	2	1.212
Hewitt Dr (FM 1695)	FM 3223 to US 84	4 with center turn lane	1.194
Steinbeck Bend Rd (FM 3051)	FM 1637 to Lake Shore Dr	2	1.193
M L King Dr (Lake Brazos Dr)	Lake Shore Dr to E Herring Ave	2	1.126
Hewitt Dr (FM 1695)	Mars Dr to FM 3223	4 with center turn lane	1.111

In regards to specific facilities, Table 6.3 above shows the worst in terms of current conditions. Each of these facilities exceeds the threshold of 'unacceptable' traffic conditions. It should be noted that with the exception of Hewitt Drive (FM 1695), each of these facilities have only 2 travel lanes. Also, with the exception of N 18th Street, each of these facilities represents suburban facilities where population growth has exceeded the capacity of the transportation network. These and other facilities considered marginal or unacceptable are identified on Map 6.1.



Traffic congestion in Austin representing level of service 'F' or 'unacceptable' conditions. Fortunately traffic conditions in Waco are not often observed at this level. Without significant changes in either travel behavior, land use or highway capacities, conditions such as this may be observed more frequently in the future.

On the opposite extreme, many of the facilities within the urban core of the metropolitan area are operating well below their design capacity. Table 6.4 shows that the one-way pairs in downtown and the relic expressways of Business 77 and Marlin Highway are the facilities with the most excess capacity. Much of this can be attributed to changes in population and employment patterns (see sections 4.2.1 and 4.2.3) with the largest decreases observed in the general vicinity of these facilities.

Two of the goals of this plan are to encourage new development to occur where supporting infrastructure already exists and to make use of existing capacity to the extent practicable before investing in system expansions. Many prior plans focused on the 'greater downtown' region with goals of 10,000 to 20,000 new residents. With the significant excess capacity of many roadways within this region, the initial analysis suggests that the existing system is more than adequate to accommodate any increase in trips should these goals be realized.

The other question that arises with excess capacity is that these lane-miles must be maintained at substantial cost over time despite their lack of use. The MPO will be studying the Business 77 corridor in FY 15 and 16 to determine whether significant savings in maintenance can be achieved without compromising mobility needs by redesigning the facility as a boulevard instead of the current expressway design. In addition, the City of Waco will be considering several conversions of one-way streets within downtown Waco as part of recommendations from the Downtown Transit Study and at the request of the several merchants and the Greater Waco Chamber of Commerce. The question the City will be investigating is whether conversion to two-way operations can accommodate future mobility needs with the lower capacities. The advantage of conversion is that two-way access to each property is restored and some of the existing lanes can be repurposed to better support bicycle and pedestrian modes.

table 6.4 – the bottom 10 – arterials or expressways with the greatest excess capacity: 2010

Road	Limits	Lanes	Traffic as a Percent of Capacity
LaSalle Ave (US Bus 77)	S Univ Parks Dr to Marlin Hwy	6	6.4%
Washington Ave	N 11th St to N 18th St	4	7.0%
Kendall Ln	Orchard Ln to E Loop 340	2	8.8%
Washington Ave	N 18th St to N 26th St	4	11.6%
N Loop Dr (US Bus 77)	IH-35 to US 84	8*	12.3%
N Univ Parks Dr	Washington Ave to Franklin Ave	4	13.6%
S Loop Dr (US Bus 77)	Marlin Hwy to Orchard Ln	8*	14.4%
Washington Ave	N 4th St to N 11th St	4	14.5%
Marlin Hwy (Spur 484)	US Bus 77 to E Loop 340	8*	14.7%
S Loop 340 / SH 6	S 12th St to US 77	8*	15.6%

*4 main lanes with 2 lane frontage roads in each direction.

Business 77 at IH-35 interchange in East Waco under construction in 1970. While traffic was significant shortly after construction, travel patterns and changes in adjacent land use have resulted in Business 77 being underutilized. IH-35 reconstruction plans call for this interchange to be reconstructed as a simple diamond design with the elimination of the direct connects ramps.

6.1.2 – projected 2040 highway level of service

The Waco MPO utilizes a travel demand forecast model to estimate future level of service for the functionally classified highway system. The results of this analysis represent a "no build" scenario in which only those roads completed or under construction as of 2010 are added to the highway network.

IMPORTANT NOTE: Much of the development of the Waco MPO travel demand forecast model is performed by the Texas Department of Transportation, Transportation Planning and Programming Division (TP&P). TP&P delivered the validated 2040 model to the MPO just prior to the publication of the draft MTP. Therefore, the MPO staff was unable to consider the results of the 2040 model prior to development of recommendations for this plan. As a result, the MPO staff utilized the results of the 2035 model for initial analysis of highway project recommendations. The MPO staff intends to reevaluate each highway project recommendation after adoption of this plan using the 2040 model to determine if any significant changes in those recommendations are warranted. If so, then the MPO staff will present an amendment to this plan for consideration by the MPO Policy Board. The following information provides the general process for development of both the 2035 and 2040 models with the primary difference being more up to date demographic and highway network information for the 2040 model.

travel demand forecast model development

Travel Demand Modeling is the process used to determine highway facility needs in the future. The Travel Demand Model is developed by the Texas Department of Transportation with assistance from the MPO staff using TRANSCAD modeling software. This Plan Update is based on an updated model. The Waco MPO staff provided TxDOT with 2010 base year data and highway network and 2 scenarios of forecasted 2040 population, income, employment and dwelling units by Traffic Analysis Zone to be used by TxDOT in the development of the model (see Section 4.2.2 for a discussion of the 2040 forecast scenarios).

Travel demand modeling utilizes the following four step process:

1. Trip Generation
2. Trip Distribution
3. Mode Choice
4. Traffic Assignment

The Waco Urban Area, due to its size and relatively low utilization of modes other than automobiles, does not utilize Mode Choice in the modeling process.

Modeling utilizes socioeconomic data (population, income, dwelling units and employment by Standard Industrial Code) to forecast the number of trips from one given destination to another. This data is collected in small study areas called Traffic Analysis Zones (TAZs). The Waco MPO Study Area was originally delineated into 206 analysis zones for the 1964 Plan. Since that time the analysis zones have been revised several times as the arterial network and study area have changed. In 2003 the MPO expanded the Study Area to include all of McLennan County. For this Plan Update, the model uses 431 TAZs delineated in 2005 after the latest Study Area expansion.

trip generation

Trip generation is the process by which socioeconomic variables (population, income, number of dwelling units, employment, land use and special generators) are translated into numbers of trips. Based on the relationships mentioned above, this process determines the number of trips each traffic zone will produce and the number of trips each traffic zone will attract.

Detailed analyses of household trip making characteristics, stratified by income, provides the basis for the development of zonal trip production rates. Trip attraction rates are based primarily on employment data in each zone, but also look at special generators and land use acreage found within each zone.

trip distribution

Trip distribution is the process by which the model determines where the trips produced in each traffic zone will go. In other words it determines how the trips produced in each zone will be allotted among all the other zones in the area. In general, this model takes into account the relative attractiveness (based on employment, land use and special generators) and accessibility (based on trip lengths in minutes and socioeconomic and topographical barriers) of all zones in the area.

Once trip distribution is completed, the model is calibrated. Calibration is necessary to ensure the transportation network will have a balanced number of productions and attractions.

traffic assignment

After determining the number of trips between each TAZ (trip distribution), the next step in the modeling process is traffic assignment. Traffic assignment determines how the trips will get from the production TAZ to the attraction TAZ. Assignment is the process of assigning trips to the street network based upon the most likely route of travel between the trip's origin and destination. Trips are assigned to the available routes using a mathematical algorithm which determines the amount of traffic to allocate to each route. The traffic allocation is generally based on the relative time it takes to travel along each available path, and the design capacity of each street link.

One important step in the traffic assignment process is validation. Model validation establishes the credibility of the model by demonstrating its ability to replicate actual travel patterns. Validation is accomplished by comparing traffic volumes estimated by the model to actual base year ground counts. Traffic estimated by the model is typically compared to actual traffic counts at points where streets cross barriers called cordon lines, screenlines and cutlines. Various model parameters are adjusted until the model satisfactorily replicates the ground counts. The Waco MPO model was validated using 2010 ground counts.

Once validation is completed, the model is used to assess the performance of the existing transportation system. The final traffic assignment is run on the existing network to produce a base year benchmark. The validated model is then provided to the MPO Staff to forecast future traffic conditions and to evaluate the effectiveness of proposed improvements.

year 2035 no-build traffic projections

Please refer to the important note at the beginning of this section regarding the use of 2035 model results versus 2040.

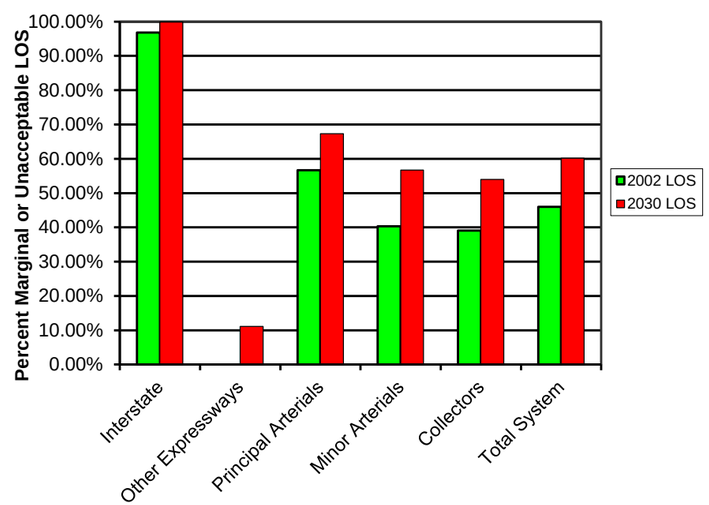
Without substantial capacity increases, the functionally classified highway network is projected to be operating at a marginal level of service during the year 2035. Over 60% of the system is projected to be operating at a marginal or unacceptable level of service, an increase of over 20% compared to 2010. Despite this, less than two in five miles of the system is projected to have an unacceptable level of service.

table 6.5 – projected 2040 level of service (los) per classification – existing network

Classification	Acceptable LOS A to C	Marginal LOS D & E	Unacceptable LOS F	Percent Change in Marginal or Unacceptable LOS*	Average LOS
Interstate	0.0%	44.3%	55.6%	+9.0%	E
Other Expressways	88.9%	11.1%	0.0%	+7.1%	B
Principal Arterials	32.7%	48.7%	18.6%	+3.5%	D
Minor Arterials	43.3%	38.3%	18.4%	+5.9%	C
Collectors	46.0%	48.8%	5.2%	+20.4%	D
Total System	39.8%	42.3%	17.9%	+20.7%	D

*Compared to 2010.

Chart 6.2 – projected 2040 percent marginal or unacceptable level of service by functional classification



Similar to 2010 conditions, Interstate 35 is projected to have the worst performance with the entire system operating worse than level of service "C" and better than half of the system operating at unacceptable levels. All other facility types show a significant increase in mileage at a marginal or unacceptable level of service with Minor Arterials showing the largest increase. In terms of location, nearly all of the facilities with significantly worse levels of service were found in the suburban areas such as Hewitt, Woodway, West Waco or China Spring. These are also the regions expected to experience the greatest growth in population and employment during the planning period.

Table 6.6 – projected top 10 most congested roads: 2035

Road	From	To	Volume to Capacity Ratio	Percent Change in Traffic from 2010
China Spring Rd (FM 1637)	FM 3434	Steinbeck Bend Rd (FM 3051)	3.03	+55.1%
China Spring Rd (FM 1637)	Wortham Bend Rd (FM 2490)	FM 3434	2.43	+33.8%
Texas Central Pkwy	Imperial Dr (FM 3223)	US 84	1.83	+44.0%
Speegleville Rd	Speegle Rd	SH 6	1.80	+143.9%
Steinbeck Bend Dr (FM 3051)	China Spring Rd (FM 1637)	Lake Shore Dr	1.58	+32.6%
Aviation Pkwy	US 84	Maehr Rd	1.58	+810.7%
Robinson Dr (US 77)	SH 6 / Loop 340	Newland Dr	1.56	+100.5%
Spring Valley Rd (FM 2113)	FM 2837	Hewitt Dr (FM 1695)	1.56	+84.0%
Speegleville Rd	US 84	FM 3047	1.50	+142.0%
Spring Valley Rd (FM 2113)	FM 2416	FM 2837	1.49	+89.5%

6.1.3 – highway surface conditions

Proper maintenance will keep a road or bridge in good operating condition for many years beyond a normal useful life of 40 years. Even with proper maintenance, at some point the road or structure will deteriorate to the level of requiring reconstruction. This section reviews the condition of the highway system to help determine which facilities are in need of reconstruction.

The MPO staff conducted a visual survey of the surface condition of approximately 87% of the functionally classified system between 2011 and 2013. The MPO staff also evaluated a small number of local streets with significant traffic volumes during this time (approximately 150 lane-miles). The survey consisted of observing the presence or absence of the following conditions: travel path cracking, patching, weathering, potholes and edge cracking. Each condition was scored based on 2 points for no visible problems, 1 point for visible problems that did not significantly impact ride quality and 0 points for visible problems that significantly impacted ride quality.

The results showed that as a general rule, the functionally classified network has an acceptable pavement surface condition. Of those facilities evaluated, the average condition score was nearly 8, which represents a score of 'good'. Of the evaluated facilities, less than 2% were observed to have a surface condition rating below 5, which represents a score of 'poor'. None of the state highway system received a score of less than 5 (see Table 6.7). It is important to note that at the time of publication, a significant portion of IH-35 was under construction and thus was not evaluated. Map 6.3 shows pavement condition scores for the metropolitan area.

table 6.7 – road surface condition by system responsibility*

System	Average Condition Rating	Percent with Rating Below 5
State	8.38	0.0%
County or Municipal	7.24	5.4%
Total	7.88	1.5%

*Roads under construction were not evaluated.

Example of poor road conditions that significantly impact ride quality. A road in this condition represents a score of approximately 3.

table 6.8 – road surface condition by functional classification*

Classification	Average Condition Rating	Percent with Rating Below 5
Interstate	9.11	0.0%
Other Expressways	8.32	0.0%
Principal Arterials	8.45	0.0%
Minor Arterials	7.89	1.1%
Collectors	7.51	1.8%
Frontage Roads	8.36	0.0%
Local Streets	6.79	10.0%
Total	7.88	1.5%

*Roads under construction were not evaluated.

6.1.4 – bridge conditions

Every 2 years the Texas Department of Transportation evaluates the structural condition of every public use bridge within Texas to help determine priorities for bridge rehabilitation and reconstruction. Each bridge receives a score based on a maximum of 100 points with scores of 50 or below an indication of structural deficiency. Bridges scoring below 50 points are eligible for replacement using federal funds whereas those scoring below 75 points are eligible for rehabilitation.

The results show that most bridges significantly exceed minimum standards for structural integrity. Of the 676 public use bridges in McLennan County, only 15 or 2.2% were considered structurally deficient. This is a significant improvement from 2007 when 28 bridges were deemed structurally deficient. Of the structurally deficient bridges, 14 or 93.3% were maintained either by McLennan County or a local municipality. The one structurally deficient bridge on the State highway system was FM 3149 over IH-35 in the town of Ross. As of publication time, this bridge was in the process of being replaced as a part of the IH-35 widening and reconstruction project currently underway.

Bridges are also evaluated every 2 years based on functional obsolescence. Bridges identified as functionally obsolete may not

meet one or more of the following standards: current design, width, vertical clearance or safety. Functionally obsolete bridges may, however, be structurally acceptable. As of 2012, approximately 1 in 6 bridges in McLennan County were deemed functionally obsolete. Map 6.4 identifies the structurally deficient and functionally obsolete bridges.

table 6.9 – 2012 bridge sufficiency ratings by functional classification

Classification	Bridges	Average Rating*	Percent Structurally Deficient	Percent Functionally Obsolete
Interstate	75	82.6	0.0%	2.7%
Other Expressways	47	81.4	0.0%	0.0%
Principal Arterials	86	87.0	0.0%	17.4%
Minor Arterials	87	84.5	2.3%	18.4%
Collectors	151	87.4	1.3%	13.9%
Frontage Rds / Ramps	33	84.1	0.0%	3.0%
Local	197	82.6	5.6%	30.5%
Total	676	84.5	2.2%	17.0%

*On a 100 point scale

The Washington Ave Bridge over the Brazos River was built in 1901 and rehabilitated in 2010. This rehabilitation work helped strengthen the bridge to once again accommodate 2-way traffic. Despite this, the bridge scored a sufficiency rating of 30.2 in 2012. As a result it is still classified as 'structurally deficient' and is thus unable to accommodate heavy trucks.

table 6.10 – change in bridge ratings by functional classification: 2007 to 2012*

Classification	Average Change in Rating**	Percent Better Score	Percent Worse Score
Interstate	-1.7	13.7%	42.5%
Other Expressways	+1.0	58.1%	23.3%
Principal Arterials	+1.4	66.7%	25.0%
Minor Arterials	-1.0	43.0%	38.4%
Collectors	+0.5	39.7%	37.1%
Frontage Rds / Ramps	+1.1	58.6%	27.6%
Local	+4.4	18.8%	56.8%
Total	+1.7	36.3%	39.8%

* Data utilizes the latest available evaluations which may have been in 2006 or 2011.
**On a 100 point scale

6.1.5 – highway crash analysis

MAP-21 identified safety improvement as a priority of emphasis for MPOs to address as part of the transportation planning process. To perform an analysis of crashes, the MPO staff collected crash data from the Texas Department of Transportation Crash Records Information System (CRIS) within McLennan County for the year 2013. The CRIS system provided 5,166 unique reports for 2013 from all but the following police departments with the region: Beverly Hills, Mart, Riesel and West. The CRIS system included 384 crashes occurring on private property which were not included in the analysis. In addition, 109 reports contained insufficient or incorrect location information and thus their location could not be verified. These reports were also not included in the analysis. The result is a total of 4,673 crash reports evaluated.

In order to compare highways with substantially different traffic volumes and distances, the MPO staff used the statistic of crashes per million vehicle miles traveled (VMT) which holds both variables constant. Comparing the different highway classifications, local streets had the highest rate of crashes per million VMT and Interstate 35 had the lowest.

Of the crashes evaluated, 29 involved a fatality and 777 involved a serious injury. This results in a fatal / serious injury rate of 17.3% or approximately 1 in 6 crashes. Of the highway classifications, collectors had the highest percentage of injury or fatal crashes and non-interstate expressways had the lowest. Map 6.5 identifies the locations of fatal and serious injury crashes in 2013.

table 6.11 – highway crash rate and severity by functional classification: 2013

Classification	Total Crashes	Crashes per Million Vehicle Miles Traveled	Percent Injury or Fatality
Interstate	1,103	1.06	14.1%
Other Expressways	225	1.07	12.4%
Principal Arterials	1,029	1.91	17.7%
Minor Arterials	1,348	2.61	19.1%
Collectors	661	2.40	21.6%
Local Streets	712	3.00	17.8%
Total*	4,673	1.66	17.3%

*Crashes occurring at the intersection of differing classification types were counted in both classifications. Thus the sum of crashes for the classification types will be greater than the actual total.

Even one crash is unacceptable. The fact that 31 persons died in McLennan County in 2013 and another 1,100 went to the hospital is even more unacceptable. When we estimate the economic impact of crashes (see Table 6.12), this totals to an estimated $721 for every man, woman and child in McLennan County every year. Unfortunately nearly all crashes are the result of driver behavior and not because of highway deficiencies. As a result it is impossible for a fiscally constrained transportation plan to eliminate even a fraction of possible crash scenarios. Instead, the MPO staff has identified the 40 worst crash locations within the Metropolitan Area and analyzed the primary crash factors at these locations.

table 6.12 – estimated crash costs by severity: 2013

Severity	Total Crashes	Estimated Cost*
Fatal	29	$96,860,000
Incapacitating Injury	138	$22,770,000
Non-Incapacitating Injury	639	$27,157,500
Possible Injury	840	$16,968,000
Non-Injury	2,854	$5,422,660
Unknown	173	$328,700
Total	4,673	$169,506,800

*Estimates based upon per crash averages from the National Safety Council.

table 6.13 – most common driving errors cited as crash factors* - mc lennan county: 2013

Crash Factor*	Total Crashes	Percent of Total	Percent Injury or Fatality
Speeding / Failed to Control Speed	1,349	28.9%	18.6%
Disregard Red Light**	458	9.8%	23.6%
Followed Too Closely	425	9.1%	11.3%
DWI / DUI	260	5.6%	31.5%
Changed Lanes when Unsafe	234	5.0%	8.5%
Fatigued or Asleep	76	1.6%	39.5%

*Cited as either a primary or secondary factor. Crashes may also cite more than one factor.
**Crashes may have been a high angle collision at a signalized intersection, but due to a lack of independent witnesses, no factors may have been cited by law enforcement.

problem areas

In identifying the worst crash locations, the MPO staff separated locations into highway segments and intersections. The worst locations for each were then identified by the absolute number of crashes and then by crashes per million vehicle miles traveled for highway segments, and crashes per million vehicles for intersections. This analysis is used in order to compare highways and intersections with differing traffic volumes and segment lengths. Further analysis provided details about the manner of collisions for each segment or intersection providing insights on possible corrective actions to reduce the number of crashes. Map 6.6 shows the highway segments and intersections identified in tables 6.14 through 6.17.

table 6.14 – worst 10 highway segments – total crashes: 2013

Street	From	To	Total Crashes	Percent Fatal or Serious Injury
IH-35*	SH 7 / FM 107	Old Lorena Rd (FM 2837)	113	22.1%
IH-35	FM 308	Tours Rd (FM 3149)	100	10.0%
IH-35*	Behrens Cir	N Loop 340	89	10.1%
IH-35*	FM 3148 / FM 1695	FM 2063 / FM 2113	86	12.8%
IH-35	S 18th St	Univ Parks Dr	76	23.7%
IH-35*	FM 2114	McLennan / Hill County Line	74	10.8%
IH-35*	Tours Rd (FM 3149)	Tokio Rd (FM 1858)	61	13.1%
N Loop 340	US 84	IH-35	56	17.9%
IH-35*	Old Lorena Rd (FM 2837)	FM 3148 / FM 1695	53	7.6%
IH-35	FM 2063 / FM 2113	SH 6 / S Loop 340	51	21.6%

*Roadway under construction in 2013.

In terms of absolute number of crashes, Interstate 35 consistently has the most. This is not a surprise as IH-35 also has the most traffic and is the longest single facility designation within the region. In addition, many of the segments with the worst totals were under construction in 2013, a condition that research shows significantly increases the number of crashes compared to non-construction zones. The general issues with IH-35 crashes are two-fold: 1.) Speeding or driving too fast for conditions, and 2.) Unsafe lane changes. The reconstruction of IH-35, which adds travel lanes, improves sight distances, reduces the number of on and off ramps and lengthens those ramps, should reduce the number of crashes in the future.

The one exception to IH-35 in Table 6.14 is a segment of Loop 340 through Bellmead where there are a significant number of crashes between the northbound frontage road of IH-35 and LaVega High School. Additionally this segment is bracketed by two intersections with a high number of rear-end crashes.

table 6.15 – worst 10 highway segments* – crashes per million vehicle miles traveled: 2013

Street	From	To	Total Crashes	Crashes per Million VMT	Percent Fatal or Serious Injury
Austin Ave	N 17th St	N 26th St	21	27.1	33.3%
Sanger Ave	Valley Mills Dr	New Rd	13	26.3	15.3%
Dutton Ave	S 11th St	S 18th St	12	22.6	8.3%
Meyers Ln	IH-35	Airbase Rd	12	19.4	8.3%
Colcord Ave	N 18th St	N 26th St	18	19.2	27.8%
Austin Ave	N 4th St	N 17th St	28	19.1	7.1%
Franklin Ave	S 5th St	S Univ Parks Dr	15	17.6	20.0%
N Loop 340	US Bus 77	IH-35	32	13.6	6.3%
New Rd	Waco Dr (US 84)	Valley Mills Dr	16	13.5	12.5%
Dutton Ave	IH-35	S Univ Parks Dr	12	13.1	8.3%

*Minimum 10 crashes

Once traffic volumes and segment length are taken into account, a very different picture of crash locations takes place. In each instance identified in Table 6.15 the main issue are red-light running or stop sign running crashes at primary intersections. Compared to IH-35, the total number of crashes is relatively low, but considering that traffic may be 1/20th of the IH-35 volume, the number of crashes is higher than one would expect.

table 6.16 – worst 10 intersections – total crashes: 2013

Primary Street	Secondary Street	Total Crashes	Percent Fatal or Serious Injury
IH-35*	N Loop 340	49	4.1%
SH 6 / W Loop 340*	Waco Dr (US 84)*	33	12.1%
IH-35*	S 17th & S 18th Sts	27	25.9%
LaSalle Ave	Waco Traffic Circle	26	19.2%
SH 6 / W Loop 340*	Bagby Ave (FM 3476)	26	7.7%
Waco Dr (US 84)	Valley Mills Dr	26	26.9%
Valley Mills Dr*	Franklin Ave	26	27.0%
Franklin Ave	New Rd	24	26.9%
US 84	N Loop 340*	20	0.0%
US 84*	Hewitt Dr (FM 1695)	16	0.0%

*Frontage Roads only

For crashes at intersections, many of the same locations were identified as the worst for both absolute number of crashes and taking into account total number of vehicles. The primary issue once again is either red-light running or failure to yield right of way.

One location of interest is where LaSalle Ave intersects the Waco Traffic Circle. There are two primary problems with this intersection: 1.) The diameter of the traffic circle is too large which permits traffic to travel at speeds of 30 to 40 mph, faster than is recommended for traffic circles, and 2.) The close proximity of the Circle Drive intersection does not permit LaSalle Ave traffic to safely merge into the traffic circle.

table 6.17 – worst 10 intersections* – crashes per million vehicles: 2013

Primary Street	Secondary Street	Total Crashes	Crashes per Million Vehicles	Percent Fatal or Serious Injury
IH-35**	N Loop 340	49	3.66	4.1%
Valley Mills Dr**	Franklin Ave	26	3.16	27.0%
IH-35**	Crest Dr (FM 2417)	11	2.62	0.0%
LaSalle Ave	Waco Traffic Circle	26	2.60	19.2%
SH 6	FM 185	14	2.50	14.3%
N 17th St	Austin Ave	14	2.47	7.1%
SH 6 / W Loop 340**	Waco Dr (US 84)**	33	2.47	12.1%
US 84	N Loop 340**	20	2.38	0.0%
SH 6 / W Loop 340**	Bagby Ave (FM 3476)	26	2.06	7.7%
IH-35**	S 17th & S 18th Sts	27	1.86	25.9%

*Minimum 10 crashes
**Frontage Roads

Other locations of interest include the intersection of IH-35 at North Loop 340 in Bellmead and US 84 at SH 6 / Loop 340 in front of Richland Mall. Whereas red-light running is an issue in both locations, there is a greater problem with traffic turning or going straight from the wrong lane and rear-end collisions. These are indications that directional signage may be inadequate at the intersection and that speed limits may need to be more aggressively enforced.

6.2 – public transportation

In this section, the demand for public transportation is estimated to compare to current services and identify existing gaps in coverage. Important destination points are also identified and mapped to analyze the efficiency and completeness of existing services. The results from this section will be used in Section 5.2 to identify future projects to eliminate gaps in service and to ensure adequate service to those areas with the greatest estimated demand.

6.2.1 – transit need index

All areas have some degree of need for public transportation. In order to estimate this demand, an index was used to quantify and locate areas of greatest need for the six county region. Transit need indices have been widely used within urbanized areas, but generally have a significant emphasis on population density for the provision of urban fixed route services. For this plan, the transit need index has been modified to estimate overall need regardless of population density. The MTP uses the same transit need index used to estimate need for the 6 county Heart of Texas region in the Regional Public Transportation Coordination Plan.

methodology

To estimate need, several characteristics were identified for persons for whom use of a motor vehicle is either a financial burden or a physical impossibility. Each population characteristic was identified at the US Census Block Group level, the smallest level of geography for which this data were available. The primary characteristics included the following:

- Median Household Income
- Persons in Poverty
- Persons Age 65 and Above
- Persons with a Self-Care or Stay at Home Disability

Although not a population characteristic, occupied housing units with no automobiles was also used to estimate those households that have no access to a motor vehicle. Even though high transit usage by minorities is generally related to overall lower household incomes or higher poverty rates for minorities, minority population was also utilized within the index primarily because there was not a direct relationship between minority population and low income or high poverty. Some block groups within the region had relatively high minority populations but relatively high household incomes or relatively low poverty rates and vice-versa. Minority population was not emphasized within the index, however, and was weighted accordingly.

Each population characteristic was weighted within the index to reflect its relative importance or unimportance. Table 6.18 identifies the relative weights for each characteristic.

table 6.18 – population characteristics and weights

Population Characteristic	Weight
Median Household Income	1.0
Persons in Poverty	2.0
Persons Age 65 or Over	2.0
Persons with a Self-Care or Stay at Home Disability	1.5
Occupied Housing Units with No Automobiles	1.5
Minority Population	1.0
Population Density	0.5

While the goal of the transit need index is to identify places where the population may have a greater need for transit, regardless of the size of the population, the quantity of service would be greater for areas with a high need index and high population densities. For this reason, population size classes were used within the index to provide a slightly higher score for those areas with greater population. Table 6.19 identifies the population size classes used within the index.

table 6.19 – population size classes

Population Density (Persons per Square Mile)	Size Class
0 to 500	1
500.1 to 1000	2
1000.1 to 3000	3
3000.1 to 6000	4
Over 6000	5

In constructing the transit need index, each population characteristic for each block group was compared to the averages for the entire region. The average for the Heart of Texas region was indexed at 1.0. Scores for individual block groups were based on a percentage of the regional average. For instance, the regional average for percent of persons in poverty is 16.37%. A block group with a percentage of 32.74% (double the regional average) would achieve a score of 2.0 for this population characteristic. For population density, the size class would be the score for the block group. Once a score is determined, the score is multiplied by the weight for that population characteristic to determine the final, weighted score. The weighted scores are then added together to calculate the transit need index. Table 6.20 identifies the regional averages for the Heart of Texas Region.

table 6.20 – regional averages and weighted scores

Population Characteristic	Regional Average	Initial Score	Weighted Score
Median Household Income	$32,606	1.0	1.0
Percent of Persons in Poverty	16.37%	1.0	2.0
Percent of Persons Age 65 or Over	14.47%	1.0	2.0
Percent of Persons with a Self-Care or Stay at Home Disability	10.16%	1.0	1.5
Percent of Occupied Housing Units with No Automobiles	7.87%	1.0	2.0
Percent Minority Population	16.2%	1.0	1.0
Population Density	0.5	1	0.5
		Regional Score:	10.0

After the index scores had been determined for each block group, the relative demand for transit was then determined based upon their score. Table 6.21 identifies the score classifications. Map 6.7 shows the final transit need classifications for McLennan County.

table 6.21 – transit need classifications

Classification	Very High	High	Above Average	Average	Below Average	Low
Index Score	Over 22.50	17.50 to 22.49	12.50 to 17.49	10.00 to 12.49	7.50 to 9.99	Below 7.50

analysis

In order to achieve an index classification of "High" or "Very High", a block group must have high scores for each of the population characteristics used within the transit need index. Conversely, to achieve a classification of "Low", a block group must have low scores for each population characteristic. A mix of high and low scores generally results in a classification of "Average".

According to the transit need index, the most significant concentration of transit demand exists near Downtown Waco, East Waco and portions of South Waco (See Map 6.7). These areas are characterized by low incomes and high poverty rates, high percentages of persons with disabilities and relatively low automobile accessibility. Other areas within the region with high demand can be found in the vicinity of McLennan Community College, TSTC and along the Sanger Ave corridor between Lake Air Dr and Valley Mills Dr. Most other areas were generally classified as having "Average" or less transit need. The lowest scores were found in Woodway, which had the highest incomes and the lowest poverty rates. Low scores were also found in Hewitt, Robinson and the China Spring Areas.

Transit need only measures half of the equation for determining the location and type of public transportation service. Locating primary destination points (large employers, retail shopping center, doctor's offices, etc.) and how to connect these to the high demand areas is the other half of the equation. Section 6.2.2 identifies the most important destinations within the region and provides this analysis.

6.2.2 – destination analysis

The MPO staff analyzed the Waco Transit Fixed Route system to determine its effectiveness in reaching primary destination points within McLennan County. The MPO identified 1,403 locations that are likely attractors of riders from the system. Of these destinations, 176 (12.5%) were located outside of the Waco Urbanized Area. Of the destinations within the urbanized area, the MPO determined that 61.7% of the destinations within the Waco Urbanized Area were within a reasonable walking distance of one of the fixed routes (defined as ¼ mile without significant barriers to cross). This is a substantial decrease compared to 2005 when the previous analysis was performed where 72.8% of destinations were within walking distance. Since the fixed route system is substantively unchanged since 2005, this statistic shows the increasing suburbanization of the region with important destinations relocating beyond existing transit service.

Almost without exception, MPO staff observed significant decreases since 2005 in the percent of each destination type being within either walking distance or ¾ mile of the fixed route system (Table 6.22). Of particular concern is the nearly 15% decrease observed for government and public assistance destinations within ¾ mile. Many of these services are provided for those who are dependent upon public transportation. With these services locating greater than ¾ mile from the fixed route system, these services in effect become inaccessible via the fixed route system. Transit dependent populations, as a result, must depend on the much more limited services provided by the Rural Transit District operated by HOTCOG. These services require minimally a 24 hour advance reservation and cannot transport urbanized area residents to destinations elsewhere within the urbanized area.

Despite the decreases observed, nearly 3 out of 4 destinations remain located within ¾ mile of the fixed route system. One of the challenges of this plan will be to maintain this relatively high level of access for the public transportation system.

table 6.22 – destination analysis for waco transit fixed routes: waco urbanized area: 2013

Destination	Total in Urban Area	Percent within ¼ Mile	Percent within ¾ Mile	Change from 2005*
Apartment Complexes	144	66.7%	84.0%	-7.8%
Banks / Financial	75	65.3%	72.0%	-18.3%
Child Day Care	86	62.7%	73.2%	-11.1%
Government / Public Assistance	103	71.8%	75.7%	-14.9%
Hotels / Motels	55	81.8%	89.1%	-9.1%
Industrial / Manufacturing	136	48.5%	66.9%	-12.2%
Medical / Dental	122	80.3%	86.1%	-3.8%
Nursing Home / Assisted Living	22	63.6%	77.3%	+15.9%
Parks / Recreation / Tourism	114	47.4%	73.7%	+3.7%
Retail / Office Centers	158	75.9%	81.0%	-10.4%
All Others	386	50.5%	61.4%	-25.0%
All Destinations	1,401	61.7%	73.3%	-14.3%

*Change for ¾ mile buffer.

Public transportation services from the surrounding rural counties make daily trips into the Waco Metropolitan Area primarily for medical or school trips. As these services are primarily demand response services, providing curb to curb service, access to other destinations within the Waco Metropolitan Area can only be accomplished through a transfer to one of the fixed routes for Waco Transit. Below is a discussion of the medical and educational services which serve as the primary destination points for these rural services and connectivity to the Waco Transit fixed route system.

hospitals / medical offices / kidney dialysis

The Waco Metropolitan Area is served by 3 hospitals, Providence Healthcare Network and Baylor Scott & White Hillcrest Medical Center both of which are located along SH 6 / Loop 340 and the Central Texas Veterans Health Care System located on New Rd near Beverly Hills. Although each rural county has some medical services available, specialized treatments within the 6 county Heart of Texas region are generally only found in Waco. Medical treatments are generally not optional and for those older than age 65 or with serious medical conditions and regular visits to medical professionals can be a matter of life or death. For this reason, medical appointments dominate the trip purposes for rural public transportation within the Heart of Texas region with between 45 and 75 percent of all current trips being medically related. A significant percentage of these trips are related to kidney dialysis, trips that must be made on a regular basis. The following are the more important medical destinations within the region, all of which are served by one or more Waco Transit fixed routes.

- Central Texas Veterans Health Care System, Waco
- Baylor Scott & White Hillcrest Medical Center, Waco
- Providence Healthcare Network, Waco
- Brazos Kidney Disease Center, Waco
- Bellmead Kidney Disease Center, Bellmead

education

Three institutions of higher education exist within the Waco region. Baylor University in Waco is the only four-year university within the region. Texas State Technical College (TSTC) provides two-year degrees focusing on technical trades. McLennan Community College provides two-year associate degrees in a number of disciplines as well as the City College program which permits students to earn 4-year and graduate degrees through Tarleton State University and the University of Texas at Arlington. Waco Transit serves Baylor with a shuttle service that circulates through the campus and immediate vicinity. The Waco Transit Fixed Route Service serves all three schools with one or more fixed routes.

6.2.3 – security of the system

Ever since the terrorist attacks of September 11th, ensuring adequate security of the transportation system has been a top priority of the US Government. To emphasis this, SAFETEA-LU separated security into a stand-alone planning consideration. In Waco, the public transportation system is the most obvious first line

of defense in securing the transportation system, as this is the mode with the largest concentration of travelers in one place at one time. It is not terrorism, however, but crimes such as robbery, theft or assault that pose the most realistic, although uncommon, threat to users of Waco Transit. It is important to note, however, that due to the very nature of topic, some details regarding the security of the system cannot be discussed in a public forum. Both Waco Transit and the Heart of Texas Council of Governments (rural and elderly and disabled programs) coordinate with local first responders and McLennan County Emergency Management to minimize potential threats to their respective systems. The details provided below are such that a public discussion does not jeopardize their effectiveness in minimizing threats to the users of the system.

The first line of defense for users of Waco Transit is the buses themselves. As of 2010, Waco Transit completed replacement of the existing fleet with buses equipped with an audio / video surveillance system to record all activities inside and outside of the bus as well as all sound inside the bus. This system can be monitored remotely in real time should the driver declare an emergency or a threat be made against the system. The buses also include Geographical Positioning System (GPS) technology which allows Waco Transit to track every movement the bus makes. Finally each bus is equipped with an emergency switch that can be activated by the driver that automatically sends an emergency signal to the Waco Police department and Waco Transit and activates an emergency indicator on the bus for easy identification.

The next line of defense is the facilities maintained by Waco Transit, including the Intermodal Center and the Maintenance and Administration Facility. Both facilities have video surveillance to monitor activities in and around these buildings. In addition, electronic door locks have been installed to restrict access to certain areas of each facility. Access to restricted areas can only be provided through magnetic ID cards which records the employee's name, date, time, and area of the facility the employee is accessing. This system can also be programmed to restrict the access of employees to only those areas within each facility where access is necessary for their position.

Bus shelters are another area being targeted by Waco Transit for additional security measures. During the winter months, Waco Transit fixed route operations begin and end during darkness. To provide a level of comfort for system users, future shelters are proposed to be lit with solar powered lights. In addition to these measures, emergency call boxes are proposed for installation at each shelter. Once activated by a user being threatened, video and audio surveillance of the shelter would begin and then would connect to E-911 and to local first responders.

6.2.4 – coordination of public transportation services

In July of 2011, the Heart of Texas Council of Governments (HOTCOG), in cooperation with the Waco MPO, Waco Transit, TxDOT, and Central Texas Senior Ministries, developed the Coordinated Regional Public Transportation Plan. This plan, which covers the 6 county region served by HOTCOG, identifies the long term public transportation needs for the region and strategies the region's governments intend to implement to provide more service with the same resources. The Waco MPO Policy Board adopted and supported this plan in August, 2011 and by this reference incorporates the recommendations of this plan into the MTP.

6.3 – bicycle and pedestrian

6.3.1 – bicycle needs

With one of the plan goals to encourage future development to locate in areas with existing transportation infrastructure, the bicycle and pedestrian modes become important in meeting regional mobility needs during the 25 year planning horizon. Should 85 to 90 percent of all trips continue to be made using single occupant vehicles, a significant degradation in travel times is likely regardless of which future land-use scenario becomes reality.

At shorter lengths, particularly for those less than 2 miles, bicycle trips are not significantly longer in time than automobile trips. The bicycle mode also has the significant advantages of having no emissions of ozone precursor chemicals and requiring as little as 1/20th the space to park. With the exception of expressway and Interstate main lanes, bicycles also are permitted to use the existing highway network. As a result there is not a fundamental need to construct a network of separate facilities to accommodate bicycles at considerable expense. With that said, however, because of traffic volumes traveling at high speed along certain corridors, and narrow pavement widths along others, some improvements such as signage, bike lanes or separated facilities are important especially for novice bicyclists.

As described in section 5.3.1, there are relatively few existing facilities specifically designated for bicycles. In addition, Map 5.7 shows that there are numerous highways within the metropolitan area where a novice bicyclist would be uncomfortable riding or where MPO staff does not recommend use by a novice bicyclist. Recognizing the need, in 2013 MPO staff conducted a number of public input initiatives regarding bicycle infrastructure. Staff reviewed the feedback and created a bicycle facility network based on the public input and also where staff felt it appropriate to fill in gaps. The public also revealed a preference for bicycle facilities near parks, schools, and grocery stores, so MPO staff identified additional facilities to accommodate those desires. Lastly, proposed facilities were divided by type, separated versus unseparated, and by priority 1 or 2.

Separated facilities are typically used for higher speed corridors with higher traffic volumes. They may represent several different designs ranging from a designated bike lane with no buffer, a bike lane with a painted buffer, a bike lane with a raised buffer of concrete or landscaping, or a fully separated bicycle facility. Non-separated facilities, used for lower speed streets with lower traffic volumes, generally include signage as a bike route and may also include shared lane markings for narrower streets.

An example of a buffered bike lane with a painted buffer. Facilities such as these provide greater separation from automobiles and are appropriate where traffic speeds are between 40 and 50 mph. For traffic speeds greater than 50 mph a physical raised buffer of landscaping or concrete may be more appropriate.

6.3.2 – pedestrian needs

For reasons similar to bicycling, pedestrian infrastructure will be an important component of the regional transportation system. Regardless of mode, every person becomes a pedestrian at some point during each trip even if it is only from the parking lot or driveway to the front door. For transit dependent populations or persons unable to operate a motor vehicle, pedestrian access becomes more important since public transportation is limited in the number of destinations in which it can directly access. Currently planners use ¼ mile as a practical limit when considering how far a person is willing to walk between destinations. The Federal Transit Administration uses ¾ mile, however, when calculating an effective limit to determine access to public transportation.

Pedestrian needs, somewhat unlike bicycles however, have been identified within every community in McLennan County regardless of their population. Each community has at least one public school where children are likely to be walking to or from and many larger communities have a mix of retail and services similar to Waco although on a smaller scale (e.g. McGregor or West). What the rural or suburban communities generally do not have are scheduled public transportation services, thus persons unable to operate or afford an automobile are more dependent on pedestrian infrastructure than those within the Waco urbanized area.

In order to address these needs, the MPO staff identified 3 levels of priority for pedestrian corridors. The top priorities were to connect elementary and some secondary schools to nearby neighborhoods, correct a safety problem or complete a short gap in the existing system. Second priorities were to extend the system to connect to retail corridors and remaining secondary schools. Third priorities were to make final connections necessary to support an expanded public transportation network and to support the Alternative 2 land use scenario identified in section 4.1.4. It is important to note that since this plan is a fiscally constrained plan, the MPO staff could not identify a priority for all corridors where pedestrian demand may be high or which may be desirable for walking. Map 8.7 identifies the corridor priorities identified by the MPO staff.

In addition to these corridor priorities, the MPO staff preliminarily identified 22 miles of additional pedestrian infrastructure needs in order to support public transportation recommendations identified within the Downtown Transit Study conducted by Waco Transit. One of the primary recommendations identified was to transition the fixed route system away from the current flag stop system where the bus could stop at any safe location along the route to stopping only at designated locations. This would require each stop to be compliant with the requirements of the Americans with Disabilities Act. These requirements go further than simply requiring wheelchair access on and off the bus. The ADA also requires that all stops provide pedestrian and wheelchair access between the stop and some important destination, such as a shopping center or government office.

Example of a sidewalk wheelchair ramp which meets all requirements of the Americans with Disabilities Act. Note that across the street no such ramp exists providing a problem for this person as they try to cross the street. This is a common situation for Waco as many ramps are built piecemeal as new development occurs on one or two properties at a time. The corridor priorities identified in Section 8 would construction ADA compliant facilities along the entire length of the corridor thus eliminating inconsistent designs such as this example.

In addition to the MTP, the City of Waco has also produced a sidewalk plan to identify corridors where the construction or reconstruction of sidewalks is required when plans are submitted for new commercial or residential construction. This plan serves as a guide for the construction of new sidewalks as city funds become available. The MPO staff used the Waco plan as a starting point for the development of a regional sidewalk network; however, the City Plan goes further as it is not required to be fiscally constrained as is the MTP. The City of Waco will be updating their sidewalk plan as part of the development of their new Comprehensive Plan in 2015. The major focuses of this update will be to update policies regarding sidewalk maintenance and sidewalk construction as a part of development requirements as well as city funded new construction.

6.4 – passenger rail

The only passenger rail service for the Waco Metropolitan Area is through the McGregor Amtrak depot, approximately 20 miles west of Downtown Waco. Although usage of the depot has increased substantially since 2000, its location many miles west of the region's center of population severely limits the potential ridership in and out of the depot. In addition, the depot provides no services and does not meet the access requirements of the Americans with Disabilities Act. Despite these shortcomings the depot provides the City of McGregor its only non-automotive connection to the outside world. As a result, the MPO has adopted a policy that if Amtrak service is discontinued, then another service should be established providing a connection that is as good or better than the current Amtrak service.

The McGregor Amtrak Depot showing the lack of ADA access between the platform and the train.

The population of the Dallas / Houston / San Antonio triangle is anticipated to nearly double during the MTP planning period putting significant strains on the highway and aviation systems. It is anticipated that future mobility demands of the triangle could not be accommodated even if all of the following system expansions are constructed or implemented: an 8 lane IH-35, a separate toll road, and twice the airline flights using larger airplanes.

The Texas Department of Transportation, with cooperation of the Oklahoma DOT, is currently studying the feasibility of several passenger rail options between Oklahoma City and Laredo. The study is investigating enhancing current Amtrak service, establishing commuter rail service, establishing high speed rail service or some combination of these. Each service option varies significantly in terms of speed, number of stops, infrastructure and right of way needs and cost. This study is the first phase of a 2 part study which is anticipated to have initial recommendations in the spring of 2015. If any service options are deemed feasible as part of the initial study, phase 2 will go into more detail regarding possible alignments, infrastructure needs, operational details and environmental constraints.

The Trinity Railway Express in Downtown Dallas, an example of commuter passenger rail. The TRE service operates between Downtown Dallas and Downtown Fort Worth and makes 10 stops along its 30 mile route. The advertised one-way travel time is 1 hour for an average speed of 30mph. In a more suburban or rural setting, commuter rail would make fewer stops and be able to travel up to 79 mph. Commuter rail is one possible service option that could be recommended by the Texas Oklahoma Passenger Rail Study.

6.5 – aviation

US Airlines have phased out turbo-prop aircraft for their short distance and low volume routes in favor of regional jets. Regional jets are generally larger than the turboprops they are replacing with seating capacities in the range of 50 to 70. As a result they require more terminal space to accommodate the larger number of passengers and the larger aircraft require greater runway distances for takeoff and landing. ACT is capable of handling regional jets both in terms of terminal space and runway length.

Commercial aviation has transitioned to the use of regional jets similar to the one pictured above for markets such as Waco.

General aviation is also moving towards a greater usage of corporate jets as they are capable of traveling greater distances before refueling and are faster than the turboprop aircraft. These aircraft also require greater runway distances than their turboprop cousins for takeoff and landing. ACT, CNW and PWG all currently accommodate corporate jets with sufficient runway length, parking aprons, refueling and power plant services.

There are two primary future challenges for commercial aviation in smaller markets such as Waco. The first challenge is that short distance routes, such as Waco to Dallas / Fort Worth, are difficult to be profitable. In general to be profitable, a route should have an air distance of at least 500 miles. The Waco to Dallas / Fort Worth route is 89 miles by air. The second is that as air traffic increases, airspace and terminal space at hubs such as Dallas / Fort Worth eventually become saturated. Although technology such as NextGen which utilizes GPS equipment can permit more aircraft to safely operate within a smaller airspace, there are practical limits. This leads to a greater emphasis on larger aircraft from larger markets.

When these factors are added to the potential of 45 minute or faster passenger rail service to DFW or Austin, there are long-term questions regarding commercial air service for Waco Regional Airport. As part of the Texas Oklahoma Passenger Rail Study being performed by TxDOT, one of the questions being studied is whether the establishment of high speed passenger rail may open the Waco market to longer distance routes to hubs such as Atlanta, Chicago or Denver.

Short-Term, American Airlines has agreed to continue air service into Waco for the future as part of an agreement between the airline and the Texas Attorney General in return for support of their merger with USAirways. It is important to note, however, that the agreement does not state a timeframe for this continued service.