Traffic Engineering Consultants, Inc.

CAPACITY ANALYSIS

Downtown Main Street Streetscape
Broken Arrow, Oklahoma

Prepared for:

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1.0 INTRODUCTION

Traffic Engineering Consultants, Inc. (TEC) was retained to conduct a capacity analysis of Main Street from Ft. Worth to College in Downtown Broken Arrow. There are traffic signals currently in place at College, Broadway, Commercial, and Dallas. There are eastbound and westbound stop signs at El Paso, and a westbound stop sign at Ft. Worth (T-type intersection).

Main Street currently is a four lane street. The purpose of this study was to evaluate the operational impacts of reducing the traffic lanes on Main Street from four lanes to three lanes (with center left turn lane) or to two lanes. This analysis is required in order to assist the City in making critical decisions regarding the proposed streetscape project in Downtown Broken Arrow.

2.0 TRAFFIC VOLUMES

96-hour traffic count data was collected on Main north of College and on Main north of Ft. Worth in February 2012 when Broken Arrow Public Schools were in session. These counts covered a Thursday through Sunday time period. The weekday volume was approximately 9,400 vehicles per day (vpd). The Saturday volume was 7,100 vpd. The Sunday volume was 3,800 vpd.

The Main Street counts indicate that there is a definite peak demand between 7:30 and 8:30 a.m. and again between 3:00 and 4:00 p.m. There is no significant peak demand over the lunch hour. On average the heavier direction is northbound in the a.m. peak hour and southbound in the p.m. peak hour, although the differences are rather small in the p.m. peak hour.

Weekday morning and afternoon peak hour turning movement counts were made in March 2012 when Broken Arrow Public Schools were in session at all six intersections in the study area. These counts are summarized graphically in **Figure 1**. It is apparent at a glance that the Main Street volumes are very much higher than any of the side street volumes at every one of the intersections. Typically, the Main Street traffic accounts for approximately 85% of the total traffic at all intersections except El Paso where it accounts for 95% of the total traffic.

The reason that the Main Street traffic volumes are so much higher than the cross-street traffic volumes can be explained by two primary factors. First, the shopping activities are focused almost exclusively on Main Street. Second, and more importantly, Main Street serves as the only continuous north/south

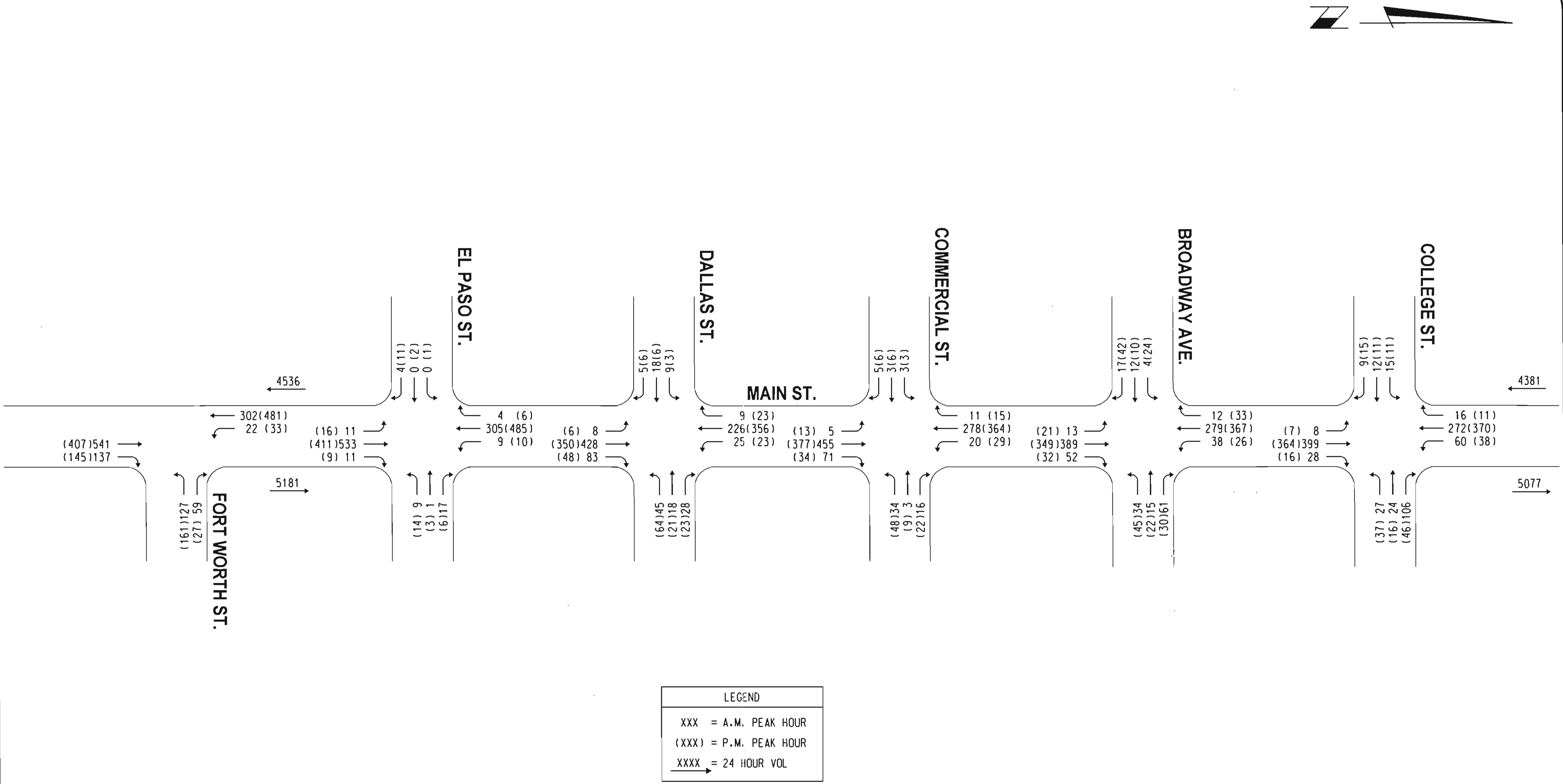

FIGURE 1 . 2012 EXISTING TRAFFIC

TRAFFIC ENGINEERING CONSULTANTS

collector street between Elm Place and 9th Street from Kenosha to Washington. Every other north/south street is interrupted by the railroad tracks or other physical features. Consequently, Main Street carries a significant amount of through traffic with destinations outside the Downtown District.

An additional traffic count was taken on Main Street north of Ft. Worth on Friday afternoon and evening, April 20, 2012 in order to measure traffic on an evening when there was a large event at the Broken Arrow Performing Arts Center. There was a concert in the "Encore Series" scheduled for April 20th at 7:30 p.m. The traffic volumes before and after the event were far less than the typical weekday a.m. and p.m. peak hour volumes on Main Street. Consequently, no special traffic consideration is necessary for evening and weekend events at the Performing Arts Center.

Detailed printouts of all traffic counts are included in the appendix.

3.0 CAPACITY ANALYSIS

Capacity analysis calculations for signalized and unsignalized intersections basically compute the average delay per vehicle (in seconds) that will be experienced by vehicles passing through the intersection and then assigning a letter grade (level-of-service) "A" through "F" based on the amount of calculated delay. Level-of-service "A", "B" and "C" are typically considered good. Level-of-service "D" is typically considered acceptable in peak hours. Level-of-service "E" is typically considered undesirable. Level-of-service "F" is typically considered unacceptable.

3.1 4-Lane Main Street

Table 1 summarizes the capacity analysis results for the current conditions with four lane Main Street, current intersection control, and current signal timing.

TABLE 1
Capacity Analysis Summary
for 4-Lane Main Street

Intersection	Type of Traffic Control	AM Peak Hour					PM Peak Hour				
		Critical Movement			Intersection		Critical Movement			Intersection	
		Movement	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Movement	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Current Intersection Control and Signal Timuing											
Current Traffic											
College	**Signal**	**WB**	**13.2**	**B**	**6.6**	**A**	**WB**	**16.2**	**B**	**6.5**	**A**
Broadway	**Signal**	**WB**	**13.1**	**B**	**6.9**	**A**	**WB**	**15.5**	**B**	**7.1**	**A**
Commercial	**Signal**	**WB**	**15.3**	**B**	**5.7**	**A**	**WB**	**17.2**	**B**	**6.9**	**A**
Dallas	**Signal**	**WB**	**15.5**	**B**	**6.6**	**A**	**WB**	**21.0**	**C**	**8.8**	**A**
El Paso	**Stop**	**WB**	**14.3**	**B**			**WB**	**18.0**	**C**		
Ft. Worth	**Stop**	**WB**	**35.5**	**E**			**WB**	**43.2**	**E**		
Current Intersection Control and Signal Timing											
2.2 Times Current Traffic											
College	**Signal**	**WB**	**54.4**	**D**	**46.4**	**D**	**WB**	**27.3**	**C**	**18.1**	**B**
Broadway	**Signal**	**WB**	**46.5**	**D**	**29.3**	**C**	**WB**	**31.2**	**C**	**17.7**	**B**
Commercial	**Signal**	**WB**	**21.2**	**C**	**14.2**	**B**	**WB**	**27.7**	**C**	**17.0**	**B**
Dallas	**Signal**	**WB**	**23.2**	**C**	**17.1**	**B**	**WB**	**51.9**	**D**	**21.7**	**C**
El Paso	**Stop**	**WB**	**115.3**	**F**			**WB**	**293.4**	**F**		
Ft. Worth	**Stop**	**WB**	***	**F**			**WB**	***	**F**		

*** **Beyond the range of normal calculations**

The upper half of **Table1** shows results using current traffic for both the a.m. and p.m. peak hours. The "intersection" delay and level-of-service (LOS) describes the overall operation of the intersection with the average delay for all vehicles passing through the intersection. The "critical movement" delay and level-of-service describes the individual movement at the intersection with the highest delay and, consequently, lowest level-of-service of all the movements at the intersection (worst case movement).

The signalized intersections are all shown to operate at an overall level-of-service "A" during both peak hours. No individual movements operate lower than level-of-service "C".

The stop sign controlled intersection at El Paso operates at level-of-service "C" or better during both peaks. However, the stop controlled intersection at Ft. Worth presently operates at an undesirable level-of-service "E" during both a.m. and p.m. peak hours. Ft. Worth, in the first block east of Main Street, carries high traffic volumes because it serves a de facto Houston Street connection since Houston Street is interrupted by the railroad.

The calculations were then successively rerun using increasing growth factors to determine at what point any individual movements would drop into an undesirable level-of-service "E" or lower. It was found that the four signalized intersections could operate acceptably with up to 2.2 times the current traffic (current traffic + 120% increase). Long before reaching that level of increased traffic the stop controlled intersections at El Paso and Ft. Worth would both have reached level-of-service "F" and traffic signals would need to have been installed. These results are all shown in the lower half of **Table1**.

3.2 3-Lane Main Street

Table 2 summarizes the capacity analysis results for a 3-lane Main Street scenario, current intersection control, and current signal timing.

TABLE 2
Capacity Analysis Summary
for 3-Lane Main Street

Intersection	Type of Traffic Control	AM Peak Hour					PM Peak Hour				
		Critical Movement			Intersection		Critical Movement			Intersection	
		Movement	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Movement	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Current Intersection Control and Signal Timing											
Current Traffic											
College	**Signal**	**WB**	**13.2**	**B**	**8.2**	**A**	**WB**	**16.2**	**B**	**7.9**	**A**
Broadway	**Signal**	**WB**	**13.1**	**B**	**10.4**	**B**	**WB**	**15.5**	**B**	**9.2**	**A**
Commercial	**Signal**	**WB**	**15.3**	**B**	**10.1**	**B**	**WB**	**17.2**	**B**	**9.3**	**A**
Dallas	**Signal**	**WB**	**15.5**	**B**	**10.8**	**B**	**WB**	**21.0**	**C**	**11.1**	**B**
El Paso	**Stop**	**WB**	**16.9**	**C**			**WB**	**22.9**	**C**		
Ft. Worth	**Stop**	**WB**	**39.4**	**E**			**WB**	**59.3**	**F**		
Current Intersection Control and Signal Timing											
1.5 Times Current Traffic											
College	**Signal**	**NB**	**24.2**	**C**	**18.2**	**B**	**WB**	**18.2**	**B**	**15.2**	**B**
Broadway	**Signal**	**NB**	**51.3**	**D**	**32.5**	**C**	**WB**	**20.2**	**C**	**17.1**	**B**
Commercial	**Signal**	**NB**	**39.8**	**D**	**27.9**	**C**	**WB**	**19.9**	**B**	**16.6**	**B**
Dallas	**Signal**	**NB**	**37.1**	**D**	**26.0**	**C**	**WB**	**26.7**	**C**	**22.2**	**C**
El Paso	**Stop**	**WB**	**36.8**	**E**			**WB**	**136.6**	**F**		
Ft. Worth	**Stop**	**WB**	**527.2**	**F**			**WB**	**933.9**	**F**		
Current Intersection Control with Coordinated Signal Timing (fixed time)											
Current Traffic											
College	**Signal**	**NB**	**17.9**	**B**	**13.9**	**B**	**SB**	**16.3**	**B**	**13.2**	**B**
Broadway	**Signal**	**NB**	**25.6**	**C**	**17.1**	**B**	**SB**	**15.6**	**B**	**13.4**	**B**
Commercial	**Signal**	**NB**	**52.5**	**D**	**35.4**	**D**	**NB**	**17.6**	**B**	**15.8**	**B**
Dallas	**Signal**	**NB**	**50.0**	**D**	**32.4**	**C**	**NB**	**19.9**	**B**	**15.0**	**B**
El Paso	**Stop**	**WB**	**16.9**	**C**			**WB**	**23.3**	**C**		
Ft. Worth	**Stop**	**WB**	**39.4**	**E**			**WB**	**59.3**	**F**		
Current Intersection Control with Coordinated Signal Timing (semi-actuated)											
Current Traffic											
College	**Signal**	**EB**	**23.9**	**C**	**8.9**	**A**	**WB**	**21.6**	**C**	**8.8**	**A**
Broadway	**Signal**	**WB**	**27.9**	**C**	**7.2**	**A**	**WB**	**25.0**	**C**	**7.0**	**A**
Commercial	**Signal**	**WB**	**27.9**	**C**	**6.6**	**A**	**WB**	**25.7**	**C**	**7.3**	**A**
Dallas	**Signal**	**WB**	**29.5**	**C**	**8.9**	**A**	**WB**	**30.1**	**C**	**11.7**	**B**
El Paso	**Stop**	**WB**	**16.9**	**C**			**WB**	**23.0**	**C**		
Ft. Worth	**Stop**	**WB**	**39.4**	**E**			**WB**	**59.3**	**F**		

The top segment of **Table 2** shows results using current traffic for both the a.m. and p.m. peak hours. The signalized intersections are all shown to operate at an overall level-of-service "A" or "B" during both peak hours. No individual movements operate lower than level-of-service "C". The overall average delay consistently show small increases when compared to the 4-lane scenario, as would be expected with a reduced number of lanes, but the levels-of-service are still very good.

The stop sign controlled intersection at El Paso operates at level-of-service "C" during both peak hours. However, the stop sign controlled intersection at Ft. Worth would drop to level-of-service "F" during the p.m. peak hour as a result of the single lane for each direction of through traffic on Main Street. This would most likely trigger the need for a traffic signal at this intersection.

Once again, the calculations were successively rerun using increasing growth factors to determine at what point any individual movements would drop into an undesirable level-of-service "E" or lower. It was found that the four signalized intersections could operate acceptably with up to 1.5 times the current traffic (current traffic +50% increase). These results are all shown in the second segment of **Table 2**.

Before reaching that level of increased traffic the stop controlled intersection at El Paso would have reached level-of-service "F" during the p.m. peak hour. This would most likely trigger the need for a traffic signal at this intersection as well.

The third segment of **Table 2** summarizes the results for a 3-lane scenario using current traffic but with a "fixed-time" coordinated signal system. The advantage of a fixed-time coordinated signal system is that pedestrians do not have to push the push button in order to get the WALK light to come on (the lights cycle continuously) and no vehicle detection systems have to be operated or maintained. Traffic speeds can also be limited to a certain extent by the progression speed of the changing lights along the street. This is like the fixed-time signal system in Downtown Tulsa.

The results for this system, however, are not good for Downtown Broken Arrow because of the high traffic volumes on Main Street and the low traffic volumes on the cross-streets. This type of coordination system fails to give enough green time to Main Street and devotes unnecessary green time to the cross-streets when there are no pedestrians or few vehicles to be served. The use of this type of system is not recommended for Downtown Broken Arrow.

The bottom segment of **Table 2** summarizes the results for a 3-lane scenario using current traffic but with a "semi-actuated" coordinated signal system. This system would maintain the current system features of side-street vehicle detection and pedestrian push buttons but would provide better progression for the Main Street traffic by forcing all four, five, or six signals to operate with a common background cycle and established reference points in that cycle.

A coordinated system often creates some added delay for side-street traffic, but it reduces stops and delay for the high volume coordinated street. In this test scenario a 75 second optimized background cycle was used in the a.m. peak hour and a 65 second optimized background cycle was used in the p.m. peak hour. The measures of effectiveness for the entire system shows that the total delay would be reduced by 17% in the a.m. peak and 8% in the p.m. peak when compared to the current uncoordinated system. The total stops would be reduced by 34% in the a.m. peak hour and 32% in the p.m. peak hour when compared to the current uncoordinated system.

3.3 2-lane Main Street

Table 3 summarizes the capacity analysis results for a 2-lane Main Street scenario, current intersection control, and current signal timing.

TABLE 3

Capacity Analysis Summary
for 2-Lane Main Street

Intersection	Type of Traffic Control	AM Peak Hour					PM Peak Hour				
		Critical Movement			Intersection		Critical Movement			Intersection	
		Movement	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Movement	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Current Intersection Control and Signal Timuing											
Current Traffic											
College	**Signal**	**WB**	**13.2**	**B**	**8.9**	**A**	**WB**	**17.0**	**B**	**8.2**	**A**
Broadway	**Signal**	**WB**	**13.1**	**B**	**11.1**	**B**	**WB**	**15.6**	**B**	**9.9**	**A**
Commercial	**Signal**	**WB**	**15.3**	**B**	**10.4**	**B**	**WB**	**17.4**	**B**	**10.1**	**B**
Dallas	**Signal**	**WB**	**15.5**	**B**	**11.2**	**B**	**WB**	**21.0**	**C**	**11.4**	**B**
El Paso	**Stop**	**WB**	**16.9**	**C**			**WB**	**23.0**	**C**		
Ft. Worth	**Stop**	**WB**	**39.4**	**E**			**WB**	**59.3**	**F**		
Current Intersection Control and Signal Timing											
1.4 Times Current Traffic											
College	**Signal**	**NB**	**19.5**	**B**	**17.7**	**B**	**WB**	**17.5**	**B**	**15.6**	**B**
Broadway	**Signal**	**NB**	**39.2**	**D**	**27.1**	**C**	**WB**	**18.7**	**B**	**16.6**	**B**
Commercial	**Signal**	**NB**	**28.8**	**C**	**21.8**	**C**	**WB**	**19.2**	**B**	**17.5**	**B**
Dallas	**Signal**	**NB**	**28.4**	**C**	**21.4**	**C**	**WB**	**25.6**	**C**	**20.6**	**C**
El Paso	**Stop**	**WB**	**29.9**	**D**			**WB**	**78.4**	**F**		
Ft. Worth	**Stop**	**WB**	**359.6**	**F**			**WB**	**636.8**	**F**		

The upper segment of **Table 3** shows results using current traffic for both the a.m. and p.m. peak hours. The overall average delay in seconds per vehicle at the signalized intersections is shown to be slightly higher for the 2-lane scenario than for the 3-lane scenario as would be expected. However, it is not a lot higher primarily because the left turn volumes on Main Street are not very large. If the through volumes and/or the left turn volumes on Main Street were to increase much the delays would begin to grow rapidly because the left turn vehicles would more frequently and for longer time periods block the only lane on Main Street for moving traffic.

Once again, the calculations were successively rerun using increasing growth factors to determine at what point any individual movements would drop into an undesirable level-of-service "E" or lower. It was found that the four signalized intersections could operate acceptably with up to 1.4 times the current traffic (current traffic + 40% increase). The results are shown in the lower segment of **Table 3**.

The capacity calculation printouts for all scenarios analyzed are included in the appendix.

4.0 MEASURES OF EFFECTIVENESS

The capacity analysis software TEC uses also calculates certain cumulative measures of effectiveness (MOE) for the entire study area at the same time that it is performing detailed calculations for each movement at each intersection. **Table 4** summarizes the results for two very helpful MOE -- Total Delay (in hours) and Total Stops. The table generally indicates how reducing the number of lanes on Main Street increases the Total Delay and Total Stops if everything else remains equal and constant.

Reducing from 4-lanes to 3-lanes would increase overall delay approximately 30%-33% and increase stops approximately 17%-19%. Reducing from 4-lanes to 2-lanes would increase overall delay approximately 40%-44% and increase stops approximately 21%-24%. This makes the 2-lane scenario look like it would not introduce much more delay or many more stops than the 3-lane scenario. However, it is important to remember that even modest increases in Downtown Broken Arrow traffic would cause a significant escalation in stops and delays for the 2-lane scenario because of the single lane for vehicular travel in each direction.

TABLE 4
Measures of Effectiveness
(Entire Study Area)

Scenario	Total Delay (hrs.)	Total Stops
4-lane, AM Peak Hour	9	1759
Current Conditions		
4-lane, PM Peak Hour	10	1962
Current Conditions		
3-lane, AM Peak Hour	12	2060
Current Conditions		
3-lane, PM Peak Hour	13	2329
Current Conditions		
2-lane, AM Peak Hour	13	2135
Current Conditions		
2-lane, PM Peak Hour	14	2433
Current Conditions		
3-lane, AM Peak Hour	10	1354
Semi-Actuated Coordination		
3-lane, PM Peak Hour	12	1590
Semi-Actuated Coordination		

The bottom segment of **Table 4** shows that reducing the lanes on Main Street from four to three and adding coordination to the existing semi-actuated uncoordinated system would result in delay only being increased by 11%-20%. However, stops would be reduced by 19%-23%. This shows that signal coordination could play a valuable role in mitigating the increased delay that would result from reducing 4-lanes to 3-lanes and could significantly reduce the number of stops currently being experienced on the 4-lane street.

5.0 LANE REDUCTION TRANSITIONS

Reducing a 4-lane Main Street to a 2-lane Main Street between College and Ft. Worth is a simple matter of installing signs and pavement marking arrows for a northbound "Right Lane Must Turn Right" at Ft. Worth and a southbound "Right Lane Must Turn Right" at College. Reducing a 4-lane Main Street to a 3-lane Main Street is not quite as simple.

Figures 2, 3 and 4 illustrate conceptually how a 3-lane Main Street could be created between College and Ft. Worth. There would be a northbound "Right Lane Must Turn Right" at Ft. Worth and a southbound "Right Lane Must Turn Right" at Detroit, but there would also be some carefully detailed pavement markings between College and Detroit and between El Paso and Ft. Worth. These three figures were prepared to illustrate what we believe is the best solution for appropriate and safe lane transitions.

6.0 OTHER CONSIDERATIONS

6.1 Vehicle Speed and Density

Reducing the travel lanes on Main Street from two each direction to one each direction will generally reduce the speed of traffic. This is a self-regulating phenomenon that occurs because the "density" of vehicles is greater when all the traffic in one direction is channelized into a single lane rather than two lanes. A greater "density" means that the space between successive vehicles has been reduced. Drivers automatically reduce their speed when they sense that they are following the car ahead of them more closely than they were previously.

Drivers will also tend to reduce their speed when they are aware that angle-parked vehicles could at any time start backing into their lane of travel.

6.2 Delay Caused by Parking Maneuvers

The capacity analysis software used by TEC for this study does account for the impact of "parking adjacent to the travel lane". It does not, however, differentiate between parallel and angle parking. The reason it does not is because, while parallel parking causes more delay when drivers are entering a parking space, angle parking causes more delay when drivers are exiting a parking space. The amount of delay created generally balances out. Consequently, the presence of adjacent parking is a factor in capacity, but the type of parking is not.

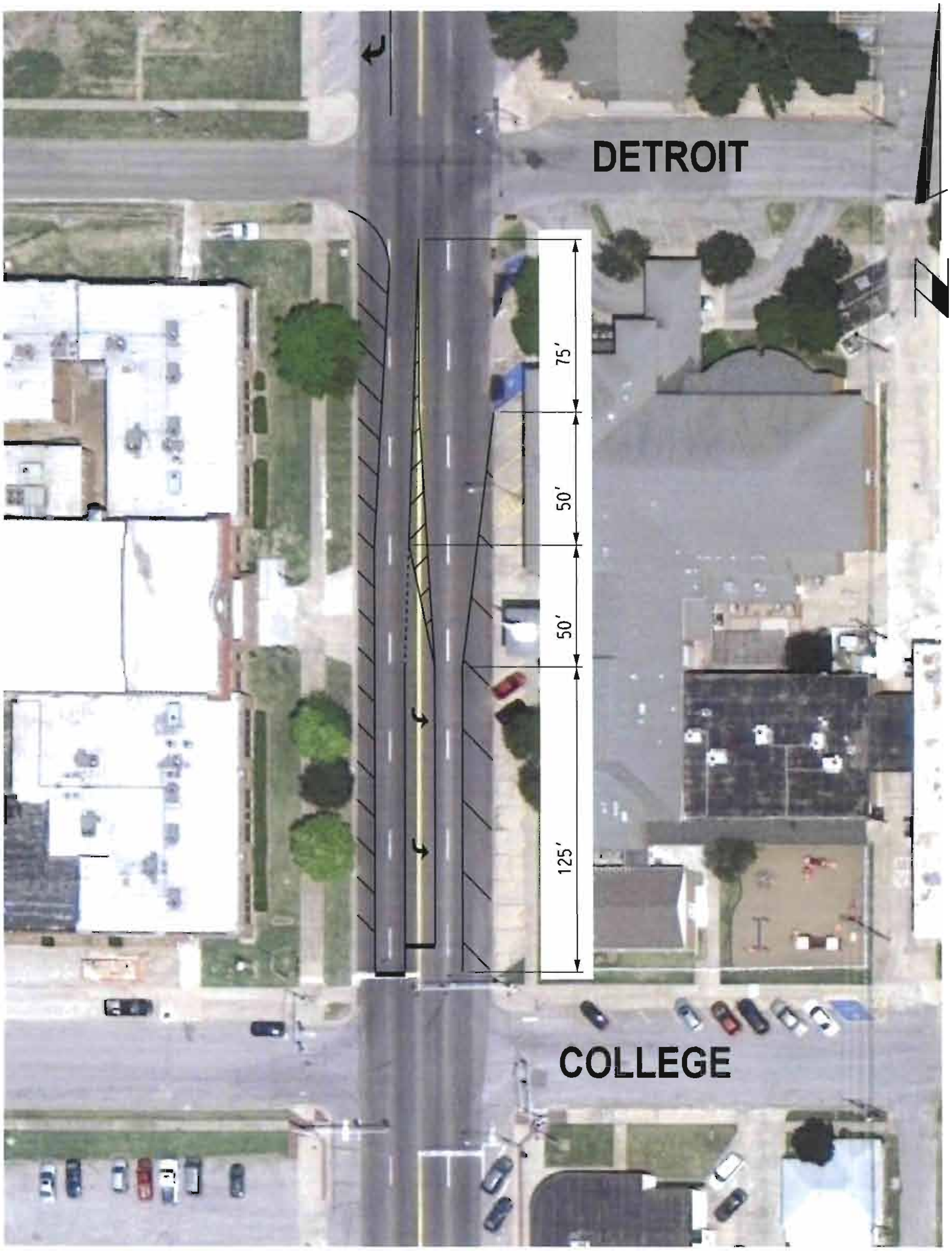

FIGURE 2 . CONCEPTUAL LANE TRANSITION (NORTH OF COLLEGE)

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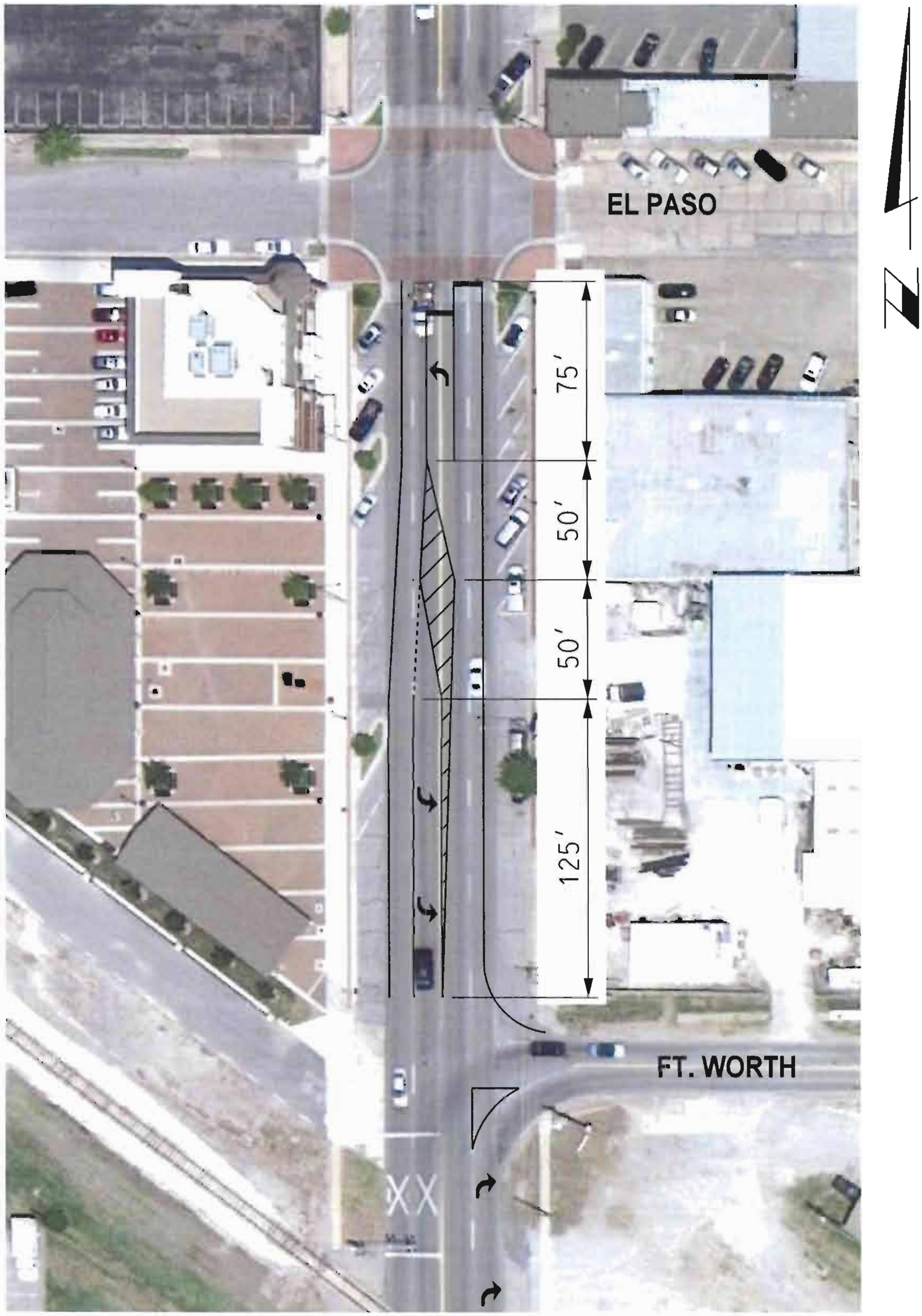

FIGURE 3 . CONCEPTUAL LANE TRANSITION
(NORTH OF FT. WORTH)

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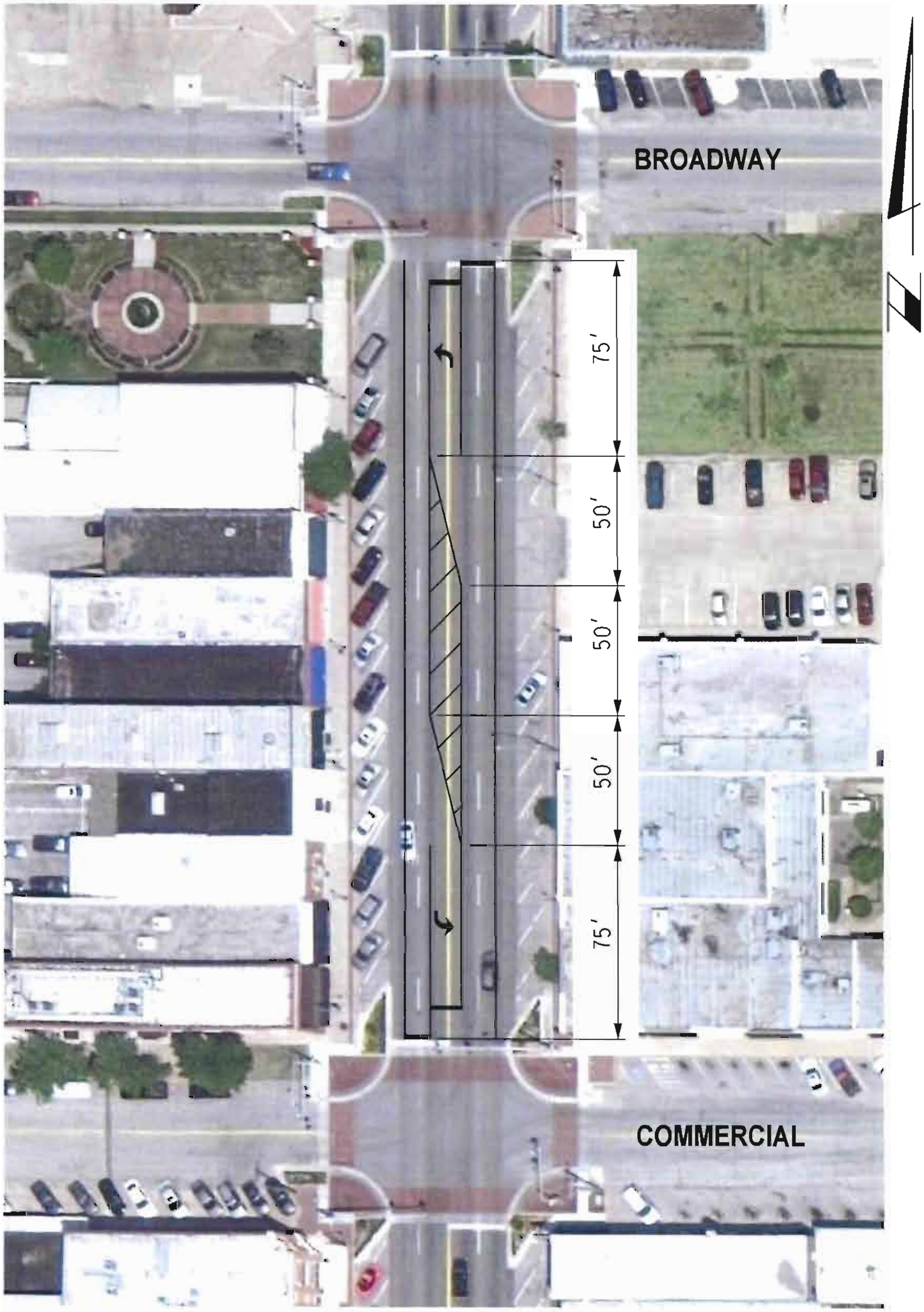

FIGURE 4 . TYPICAL 3-LANE MARKING

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6.3 Removing Signals

TEC evaluated Main and College under east/west Stop sign control, current traffic, and 3-lanes on Main Street and found that the level-of-service would be "D" during both the a.m. and p.m. peak hours. Consequently, removal of this signal is not recommended.

TEC also considered removal of the signal at Main and Commercial but rejected the idea for two reasons. First, since Main Street carries 85% of the traffic at the intersection, the 15% on the side street would experience significant delay during peak hours in attempting to enter or cross Main Street. If Main Street were to be narrowed the problem would be even worse because of the closer spacing between vehicles on Main Street. Second, pedestrians need the protection of a signal controlled crossing at this key intersection in the heart of Downtown. While it is true that if Main Street is narrowed the pedestrian crossing distance and number of lanes to cross may be reduced, but the frequency of safe gaps in traffic for pedestrian crossings will also be reduced. This signal should remain in our opinion.

6.4 Commercial Delivery and Loading Activity

With a 4-lane Main Street delivery vehicles can, and most likely do, stop briefly in the outside lane to conduct their business. This means they are either blocking access to an open parking space or potentially blocking-in a parked vehicle that is ready to depart. Through traffic, however, has an open lane to use in passing the parked delivery truck.

If the street were narrowed to two lanes these delivery and loading operations would be very disruptive, troublesome, and even hazardous.

Narrowing to three lanes, however, provides a reasonable compromise because the center lane in the middle third of each block would have cross-hatched pavement markings (not a driving lane) and could potentially be used for delivery stops without interfering with traffic flow or parking. A nearby example of this same situation is in Downtown Tulsa on 6th Street between Boulder and Main where commercial deliveries and loading safely occurs on a regular basis. Abuse by customers and visitors does not seem to be a problem, and the posting of signs is not necessary.

7.0 CONCLUSIONS AND RECOMMENDATIONS

- Main Street carries approximately 9,400 vehicles per day (vpd) on weekdays. The Saturday volume is approximately 7,100 vpd. The Sunday volume is approximately 3,800 vpd.
- The morning peak occurs between 7:30 and 8:30. The afternoon peak occurs generally between 3:00 and 4:00. There is no significant lunch hour peak.
- Typically the Main Street traffic accounts for 85% of the total traffic at all intersections except El Paso. At El Paso, Main Street accounts for 95% of the total traffic.
- Main Street carries a significant amount of traffic with destinations outside the Downtown District because it is the only street that runs continuously from Kenosha to Washington between Elm Place and 9th Street.
- There are currently traffic signals on Main Street at College, Broadway, Commercial, and Dallas. They are semi-actuated signals (vehicle detection on the side street only) and are not coordinated with one another. They typically "rest" in green for Main Street.
- The side streets at El Paso and at Ft. Worth are currently controlled by stop signs.
- Ft. Worth, along with 1st Street south of Ft. Worth, serves as a connecting route to E. Houston Street because of the interruption of the railroad tracks.
- The current operation of Main Street with four lanes is a very good overall level-of-service "A" at every signalized intersection during both peak hours. No individual movement operates lower than level-of-service "C". However, the stop controlled westbound approach on Ft. Worth operates at an undesirable level-of-service "E" during both peak hours. Four lane Main Street could handle approximately 120% additional traffic before undesirable congestion and delay problems would begin to appear. Both El Paso and Ft. Worth would require traffic signals long before 120% growth is registered.
- The operation of Main Street with three lanes (center left turn lane) would be good with overall level-of-service "A" or "B" at every signalized intersection during both peak hours. Still no individual movement operates lower than level-of-service "C". However, the stop controlled westbound approach on Ft. Worth would operate at level-of-service "F" during the p.m. peak hour which would likely trigger the need for a signal at this location. Three lane Main Street could handle approximately 50% additional traffic before undesirable congestion and delay problems would appear. El Paso would also require a traffic signal long before 50% growth is registered.

- The operation of Main Street with two lanes would still be fairly good under current traffic demand with overall level-of-service "A" or "B" at every signalized intersection during both peak hours. The average delays are increased somewhat over the 3-lane scenario, but not so much that the levels-of-service are changed. Still no individual movement operates lower than level-of-service "C". The Ft. Worth intersection would require a traffic signal. Two lane Main Street could handle approximately 40% additional traffic before undesirable congestion and delay problems would appear. El Paso would also require a traffic signal long before 40% growth is registered.
- The reason that the 2-lane scenario operates as well as it does under current traffic and signal conditions is that the volume of left turns from Main Street are so low. If they were to increase significantly it would cause a rapid growth in delay which would translate into much lower levels-of-service. If the Main Street streetscape project is successful one of the likely results will be higher left turn volumes from Main to the side streets. The 2-lane option provides very little flexibility for future growth and no good solution for commercial delivery activities.
- A "fixed-time" coordination system similar to what is used in Downtown Tulsa was analyzed. The advantages would be that no vehicle detection systems have to be maintained and the Walk/Don't Walk signals cycle automatically without pedestrians having to use the pushbuttons. Progression speeds could also be controlled to a degree for traffic on Main Street. However, the large differences in traffic on Main Street (85%) versus the side streets (15%) make a "fixed-time" coordination system very inefficient. It is not a practical solution for Downtown Broken Arrow.
- A "semi-actuated" coordination system was also analyzed. It could significantly reduce the number of stops for through traffic on Main Street with only modest increases in side street delay.
- Main Street, if narrowed to three lanes, would still operate well with good levels-of-service; it would provide a portion of street width which could be devoted to wider sidewalks; it would provide reasonable accommodation for commercial delivery and loading activities without having to give up parking spaces; and it would provide flexibility for a significant amount of traffic growth in the future. If narrowing is to occur this alternate is recommended by TEC as a very acceptable option.
- Narrowing Main Street to two lanes is not recommended because future traffic growth would result in serious delay and congestion. This option provides very little flexibility and no good solution for commercial deliveries.