

# Executive Summary

## Thoroughfare Assessment Program Phase 3.1

Prepared for:

North Central Texas Council of Governments

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# **TAP PHASE 3.1 EXECUTIVE SUMMARY**

## **Introduction**

In 2002 the North Central Texas Council of Governments (NCTCOG) launched the Thoroughfare Assessment Program (TAP), the goal of which has been to reduce vehicular emissions and improve mobility through traffic signal retiming. The program's second phase – TAP Phase 3.1 – began in 2005 and a team of consultants led by Kimley-Horn and Associates, Inc. was selected to complete the project. This Executive Summary covers a total of 559 traffic signals operated by 10 cities – Addison, Arlington, Carrollton, Dallas, Euless, Fort Worth, Garland, Haltom City, Richardson, and Rowlett – and the Dallas and Fort Worth Districts of the Texas Department of Transportation (TxDOT). **Figure 1** illustrates the locations of these traffic signals. This project has achieved seamless progression along over 200 centerline miles of arterial streets without regard to jurisdictional boundaries.

## **Project Scope**

The assigned intersections were grouped into designated corridors that ranged in size from four to 111 intersections. For each corridor, the scope included the following tasks:

- A baseline assessment to document the conditions as of the beginning of the project.
- Development, implementation, and fine-tuning of the new signal timing plans.
- An after assessment to quantify and document the project results.

The major focus of the program has been traffic signal retiming. However, a limited pool of funds was available for signal equipment upgrades at the intersections that were originally part of TAP Phase 3.2. This work, which included signal phasing changes, vehicular detection enhancements, installation of pedestrian signals and push buttons, and wheelchair ramp installations, was performed at ten intersections operated by TxDOT Fort Worth District.

## **Data Collection**

The project included extensive data collection:

- For all 559 intersections, peak-hour turning movement counts were made by human observers who used electronic count boards to record the number of vehicles by approach direction and by movement (i.e., left turn, straight through, or right turn).
- Approximately 157 bi-directional machine counts were made with pneumatic tube-type counters that digitally record the number of vehicles in 15-minute increments, totaled on an hourly basis. These included 54 seven-day counts, 57 24-hour counts, and 46 vehicle classification counts.
- As one means of measuring the benefits of the project, approximately 7,200 miles of travel time runs were made with an instrumented vehicle. The software electronically recorded the vehicle's speed, the distance traveled, and the number and elapsed time of each stop.

## Signal Timing Plans

For all corridors, new timing plans were developed the weekday AM, Midday and PM peaks. In many cases, separate versions of the AM and midday plans were required for times when school speed zones are in operation. Some corridors required timing plans for other periods such as the Saturday afternoon peak or the late evening off-peak. After the new timing plans were operational, extensive “fine-tuning” was performed to improve actual on-street performance.

## Project Results

### *Travel Time Runs*

The project results were measured quantitatively through the travel time runs made with an instrumented vehicle traveling at the pace set by other traffic. The “before” runs were made at the start of the project, prior to any changes in the previous signal timing. Later, after the new signal timing plans had been installed and fine-tuned, the “after” runs were made. Averaging all corridors (total of 180 miles of test routes), a comparison of the before and after travel time runs determined that the test vehicles had collectively attained the following reductions in travel time, stops, and delay:

- Average travel time savings:
  - 9.0 percent overall reduction in travel time.
  - 293 vehicle-minutes or 4.9 vehicle-hours reduction per weekday.
- Reduction in stops:
  - 27.2 percent overall reduction in number of stops.
  - Over 367 vehicle-stops reduced per weekday

Forty-six of the 54 travel time run routes experienced reductions in travel time. Five of the six that did not were in corridors that have the signal arrayed in a grid configuration. Even though one of the travel time run routes within the grid experienced a travel time increase, the overall results for each of those corridors were positive.

### *Synchro™ Measures of Effectiveness*

The project results were also estimated from the Synchro™ models that were used to develop the new traffic signal timing plans. For each corridor, the calibrated model of the before timing was compared with the calibrated model of the final timing. The measures of effectiveness (MOEs) that were compared included total signal delay and fuel consumption along with three categories of emissions (CO, NOx, and VOC). Averaging all corridors, the following improvement percentages were estimated by the Synchro™ comparison:

- Total signal delay was reduced by 14.7 percent
- Fuel consumption was reduced by 5.4 percent
  - Reduction of 10,951 gallons per weekday
- Emissions were reduced by 5.4 percent
  - CO reduction of over 772 kilograms per weekday
  - NOx reduction of over 150 kilograms per weekday
  - VOC reduction of over 179 kilograms per weekday

### *Estimated Economic Benefits*

The following rationale was used to estimate the per-weekday reductions from the travel time runs and the daily user savings based on the Synchro MOEs:

- On each weekday there will be:
  - Two hours of benefit from the AM peak timing plan
  - Two hours of benefit from the PM peak timing plan
  - Five hours of benefit from the midday timing plan
  - To be conservative, no benefit is assumed from other hours of the day even though most of the corridors operate the new timing plans for at least 12 hours per day.
- For the purpose of economic analysis of transportation improvements, NCTCOG's current value is \$12.50 per vehicle-hour of delay as reflected in Mobility 2030 – 2009 Amendment.

For each corridor, the before and after Synchro™ models were compared for each of the three timing plans. Considering the composite total signal delay for all corridors and using the above-described rationale, the estimated user benefit is \$175,750 per weekday. Assuming 248 weekdays per year, this equates to an annual savings of just over \$43.5 million.

The attached **Table 1** provides a summary of the project benefits. The data provided include the following statistics per travel time route: route limits, number of signals, average daily traffic volume, and project benefits (reductions in travel time, stops, and delay). Also provided were the following statistics per corridor: number of signals, project benefits as derived from the Synchro™ models (reductions in total signal delay, stops, travel time, fuel consumed, and emissions), and daily user savings.

Based on total signal delay as modeled in Synchro™ Version 6, the greatest per-intersection improvements were attained in Corridor 672 (Crowley Road), Corridor 691 (SH 174), and Corridor 651 (Renner Road). These corridors all saw delay reductions of more than 75 vehicle-hours per day per intersection. These benefits were realized through improved phasing, adjusted cycle lengths, and improved coordination between intersections.

Only two of the 24 corridors show negative results based on the Synchro MOEs. In Corridor 670 (North Collins), the Synchro results were negative because the IH 30 "Three Bridges" reconstruction project had begun before the new timing plans were implemented. As a result, the eastbound approach at the Copeland intersection was closed and several hundred vehicles per hour had been diverted to the already over-capacity Road to Six Flags intersection. The negative Synchro results in Corridor 622 (Hebron West) stemmed from the fact that the signal phasing at the SH 121 diamond had been changed for safety reasons. It should be noted that both of these corridors had positive travel time run results.

Figure 1: Thoroughfare Assessment Program (TAP) - Phase 3.1

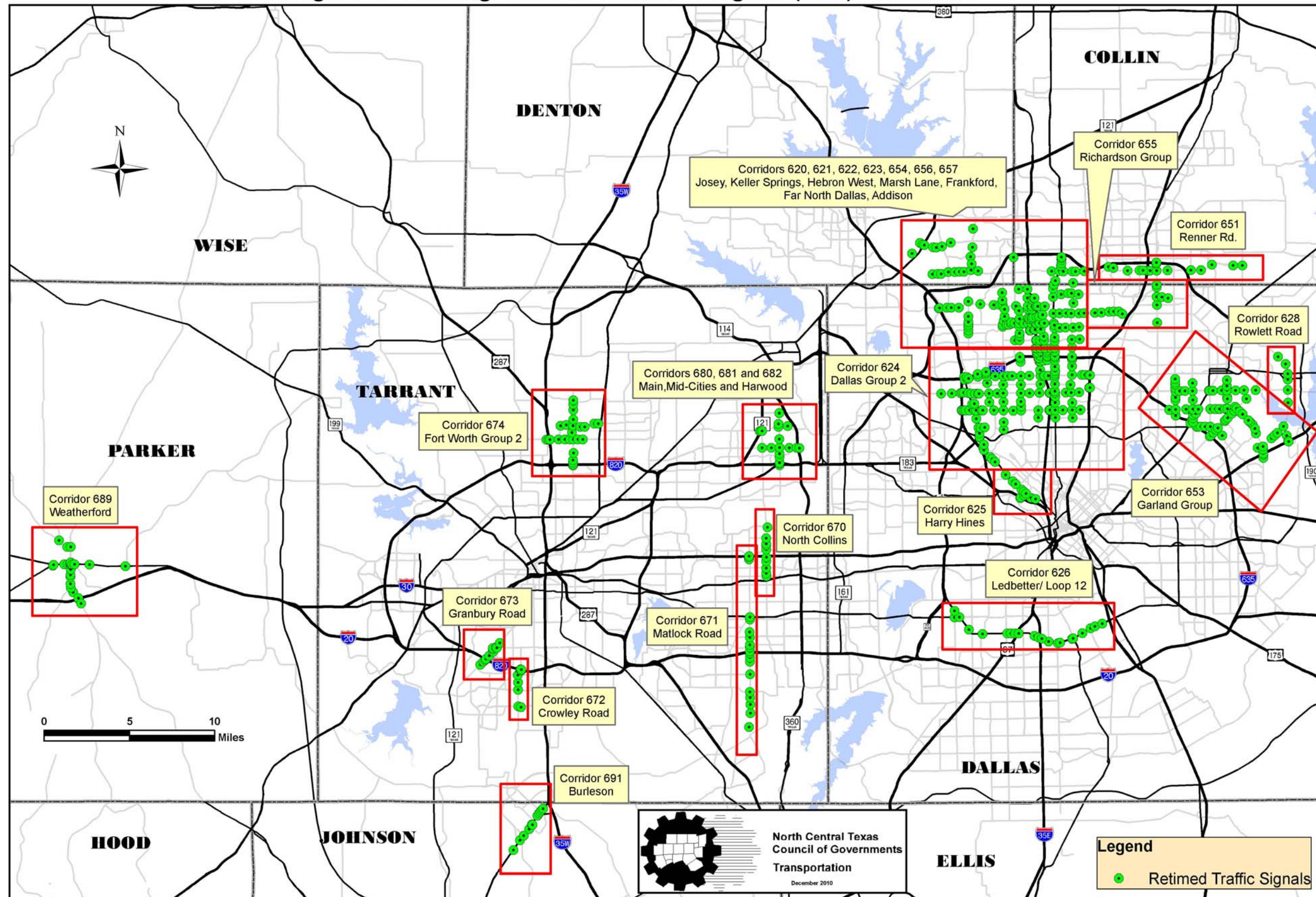


Table 1, Page 1 of 2

Corridor	Travel Time Route(s)	From	To	Number of Signals		Average Daily Traffic	Benefits												
				Along Travel Time Route	Corridor Total		From Travel Time Runs <sup>A</sup>			From Synchro <sup>TM A</sup>						Daily User Savings <sup>B</sup> (\$)			
							Travel Time (seconds)	Stops	Delay (veh-sec)	Total Signal Delay (veh-hours)	Stops	Total Travel Time (veh-hours)	Fuel Consumed (gallons)	CO Emissions (kilograms)	NOx Emissions (kilograms)	VOC Emissions (kilograms)	Corridor Total	Per Intersection	
620	Josey Lane	Josey Lane	Country Club Dr	Fyke Rd	6	6	28,000	-147	-4	-118	-61	-9,170	-47	-156	-10.81	-2.10	-2.49	\$763	\$127
621	Keller Springs	Sandy Lane/Whitlock/Keller Springs	IH 35E SBFR	Midway Rd	10	10	20,000	-396	-10	-363	-58	5,706	215	471	32.77	6.34	7.61	\$725	\$73
622	Hebron West	Hebron Pkwy	Crawford Dr/Marchant Blvd	Rolling Oaks Dr	8	8	32,000	-357	-7	-339	120	-8,741	77	-16	-1.12	-0.20	-0.31	-\$1,500	-\$188
623	Marsh Lane	Marsh Lane	Country Square Dr	Trinity Mills Rd	6	6	34,000	130	2	118	-127	-7,819	-140	-170	-12.01	-2.33	-2.73	\$1,588	\$265
624	Dallas Group 2	Forest Lane	Josey Lane	US 75 NBFR	17	111	37,000	603	1	526	-6,248	22,868	-6,225	-3,907	-273.15	-53.14	-63.31	\$78,100	\$704
		Harry Hines Blvd	Raceway Dr	Royal Ln	10		33,500	-882	-13	-862									
		Hillcrest Road	Park Ln	Churchill Way	7		25,000	-169	-2	-147									
		Inwood Road	Park Ln	Willow Ln	6		19,000	-464	-8	-409									
		Marsh Lane	Almazon Dr	Forest Ln	7		29,000	-131	0	-149									
		Midway Road	Walnut Hill Ln	IH 635 WBFR	9		23,000	-276	-1	-178									
		Preston Road	Park Ln	Churchill Way	12		30,000	-344	-3	-322									
		Royal Lane	Luna Rd	US 75 NBFR	24		25,000	-417	-12	-290									
		Walnut Hill Lane	IH 35E SBFR	Boedecker Dr	20		25,000	-1,425	-20	-1,163									
Total Signals in Corridor 624						111													
625	Harry Hines	Harry Hines Blvd	Shorecrest Dr	Wycliff Ave	12	15	30,000	-727	-17	-686	-358	-9,607	-253	-493	-34.23	-6.63	-7.94	\$4,475	\$298
626	Loop 12	Loop 12	Wadsworth Dr	Duncanville Rd	20	21	28,000	-1,414	-36	-1,144	-400	-42,947	-944	-1,618	-113.46	-22.05	-26.33	\$5,000	\$238
628	Rowlett Road	Rowlett Road	Hickox Rd	Chaha Rd	7	7	29,000	-194	-7	-178	-44	-14,103	-42	-172	-12.13	-2.32	-2.79	\$550	\$79
651	Renner Road	Renner Road	Waterview Pkwy	Murphy Rd	17	17	22,000	-444	-14	-179	-1,338	-26,586	-1,474	-1,295	-92.91	-17.63	-20.98	\$16,725	\$984
653	Garland Group	Broadway-First	Guthrie Rd	Casalita Dr/Washington St	18	85	33,000	-149	-12	-119	-177	-2,915	107	408	28.50	5.54	6.61	\$2,213	\$26
		Centerville Road	IH 635 EBFR	Miller Rd	13		40,000	-558	-7	-511									
		Garland Avenue	IH 635 EB Ramp	Miller Rd	5		25,000	-161	-7	-170									
		Jupiter Road	IH 635 EBFR	Miller Park Dr	9		32,000	111	5	99									
		Kingsley Road	IH 635 EBFR	Centerville Rd	11		22,000	-507	-9	-522									
		Miller Road	Jupiter Rd	Centerville Rd	12		19,000	-480	-9	-435									
		Rowlett Rd/Duck Creek Dr	Roan Rd	Greenbelt Pkwy	6		15,000	-157	6	-145									
Total Signals in Corridor 653						85													
654	Far North Dallas	Alpha Road	Inwood/DNT SBFR	Hillcrest Rd	7	90	17,000	-785	-16	-741	-2,438	-38,071	-2,224	-1,967	-137.26	-26.70	-31.82	\$30,475	\$339
		Arapaho Road	DNT SBFR	Spring Creek Rd	10		22,000	-36	1	-86									
		Belt Line Road	DNT SBFR	Meandering Way	8		40,000	-432	-7	-423									
		Frankford Road	Campbell Rd	Osage Plaza Pkwy	6		26,000	13	-2	64									
		Hillcrest Road	Hillcrest Plaza	Frankford Rd	11		35,000	-832	-15	-755									
		Montford Drive	IH 635 EBFR	Arapaho Rd	10		22,500	-452	-7	-392									
		Preston Road	Harvest Hill Rd	Mapleshade Ln	20		53,000	-330	-8	-382									
		Spring Valley Road	DNT SBFR	Meandering Way	7		28,000	-49	-1	-33									
Total Signals in Corridor 654						90													
655	Richardson Group	Arapaho Road	Coit Rd	US 75 NBFR	9	13	28,000	-220	-2	-245	-154	-5,980	-147	-186	-12.94	-2.49	-2.98	\$1,925	\$148
		Plano Road	Arapaho Rd	SH 190 WBFR	8		28,000	-396	-6	-346									
		Total Signals in Corridor 655						13											

Table 1, Page 2 of 2

Corridor	Travel Time Route(s)	From	To	Number of Signals		Average Daily Traffic	Benefits												
				Along Travel Time Route	Corridor Total		From Travel Time Runs <sup>A</sup>			From Synchro <sup>TM A</sup>						Daily User Savings <sup>B</sup> (\$)			
							Travel Time (seconds)	Stops	Delay (veh-sec)	Total Signal Delay (veh-hours)	Stops	Total Travel Time (veh-hours)	Fuel Consumed (gallons)	CO Emissions (kilograms)	NOx Emissions (kilograms)	VOC Emissions (kilograms)	Corridor Total	Per Intersection	
656	Addison	Addison Road	Landmark Pl	Sojourn Dr	8	15,000	-386	-10	-418										
		Arapaho Road	Montford Dr	Marsh Ln	9	12,000	-222	-9	-135										
		Belt Line Road	Marsh Ln	DNT NBFR	11	38,000	-184	-5	-229	-539	-15,882	-932	-77	-5.13	-1.00	-1.19	\$6,738	\$193	
		Marsh Lane	Beltway Dr	Country Square Dr	5	35,000	10	1	61										
		Midway Road	Spring Valley Rd	Keller Springs Rd	8	28,000	-703	-11	-755										
Total Signals in Corridor 656					35														
657	Carrollton Frankford-Josey	Frankford Road	Eisenhower St	Furneaux Ln	9	20,000	-35	-2	0	-86	-4,385	-152	-37	-2.73	-0.52	-0.66	\$1,075	\$77	
		Josey Lane	Frankford Rd	King Arthur/Diamond Ridge	6	26,000	69	1	0										
		Total Signals in Corridor 657					14												
670	North Collins	N Collins Street	Sanford St	N Green Oaks Blvd	10	30,000	-586	-7	-531	829	-7,184	786	578	40.36	7.86	9.38	-\$10,363	-\$1,036	
671	Matlock	Matlock Road	Central Park Dr	Turner Warnell Rd	13	28,000	-572	-17	-519	-164	-8,977	232	273	18.96	3.69	4.44	\$2,050	\$158	
672	Crowley Road	Crowley Road	IH 20 WBFR	Sycamore School Rd	6	24,500	-83	3	-84	-676	-5,877	-651	-497	-34.58	-6.75	-8.04	\$8,450	\$1,408	
673	Granbury Road	Granbury Road	Suffolk Dr	Gorman Dr	9	24,000	-80	-6	-92	-156	-11,630	-97	-353	-24.65	-4.75	-5.74	\$1,950	\$177	
674	Fort Worth Group 1	Basswood	Riverside Drive	Park Vista Blvd	6	23,000	-110	-7	-82										
		Beach	IH 820 EBFR	North Tarrant Pkwy	11	28,000	-1,029	-19	-974	-425	-18,470	-415	-507	-35.56	-6.98	-8.28	\$5,313	\$204	
		Western Center Blvd	IH 35W SBFR	Haltom Rd	8	25,000	-448	-1	-433										
		Total Signals in Corridor 674					26												
680	Main Street	Main Street	SH 10	Bear Creek Dr	9	15,000	-120	-3	-250										
681	Mid-Cities	Mid-Cities Blvd	SH 121 SBFR	Fuller-Wiser Road	5	16,000	47	3	18	-523	-15,843	-540	-450	-31.39	-6.13	-7.26	\$6,538	\$327	
682	Harwood	Harwood Rd	Industrial Blvd	SH 360 NBFR	6	16,000	-61	-1	-152										
689	Weatherford	US 180	Lamar St	Elm St	6	20,000	28	5	-215	-248	-10,618	-168	-374	-26.04	-5.07	-6.55	\$3,100	\$124	
		SH 171-FM 51	FM 1884	FM 920	8	20,000	-193	-23	-581										
		Total Signals in Corridor 689					25												
691	Burleson	SH 174	Hillery St	FM 731	9	35,000	-466	-12	-672	-789	2317	-894	-406	-32.24	-6.3	-7.49	\$9,863	\$986	
GRAND TOTAL FOR TAP PHASE 3.1					530	559	1,433,500	-17,598	-366.5	-17,066	-14,060	-233,914	-13,928	-10,951	-771.75	-149.66	-178.85	\$175,750	\$314

Note A: Based on the following hours of benefit per weekday from the three timing plans: 2 hours per weekday for AM Peak plan; 5 hours per weekday for the Midday plan; and 2 hours per weekday for PM Peak plan

Note B: Based on \$12.50 per hour of Synchro<sup>TM</sup> total signal delay