

# **Executive Summary**

## **Thoroughfare Assessment Program Phase 2.0**

Prepared for:

North Central Texas Council of Governments

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## **TAP PHASE 2.0 EXECUTIVE SUMMARY**

### **Introduction**

In the Fall of 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. A team of consultants led by Kimley-Horn and Associates, Inc. was selected to complete the project. TAP Phase 2.0 has retimed 482 traffic signals operated by eight different cities and two Districts of the Texas Department of Transportation (TxDOT). This project achieved seamless progression along more than 140 miles of arterial streets without regard to jurisdictional boundaries. **Figure 1** illustrates the locations of the traffic signals retimed as part of Phase 2.0.

### **Project Scope**

The scope of Phase 2.0 included the following preliminary tasks:

- A quantitative, multi-step screening process was performed to prioritize the candidate corridors. Factors considered included traffic volumes, signal spacing, and existing peak-hour travel time and delay. Corridors that collectively include approximately 2,000 intersections were ranked for improvement.
- Two pilot projects (one in the Eastern Sub-region and one in the Western Sub-Region) were performed. Their primary purpose was to test alternative methodologies for quantifying the project's air quality and mobility benefits. The East Pilot project included 29 intersections – 24 operated by the City of Dallas and five operated by the City of Carrollton – all within TxDOT Dallas District. The West Pilot project included 22 intersections operated by TxDOT Fort Worth District in three adjacent cities.

Following these preliminary tasks, the “production phase” has retimed 18 corridors that have collectively included 431 intersections. These corridors have ranged in size from as few as four intersections to as many as 123.

Although the major focus of the program has been traffic signal retiming, a limited pool of funds was available for associated capital improvements. These included such items as signal control equipment upgrades, communications apparatus, and restriping to achieve more efficient lane configurations. Hardware upgrades were made at approximately 127 intersections. The improvements included the following:

- A closed-loop signal system was designed and deployed for 37 intersections operated by the TxDOT Fort Worth District.
- GPS clocks were installed at 86 intersections; 58 in Richardson and 28 in Fort Worth.
- Left-turn signals were modified at four intersections to allow the use of lead-lag signal sequences.

## **Data Collection**

The project included extensive data collection:

- For all 482 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 131 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 38 seven-day counts, 56 24-hour counts, and 37 vehicle classification counts.
- As one means of measuring the benefits of the project, over 15,000 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 for the weekday AM, midday, and PM peaks. In many cases, separate versions of the AM and midday plans were required for time 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, a comparison of the before and after travel time runs determined that the following reductions had been attained in travel time, stops, and delay:

- Average travel time savings:
  - 8.7 percent overall reduction in travel time.
  - Over 280 vehicle-minutes or 4.7 vehicle-hours reduction per weekday.
- Reduction in stops:
  - 22.7 percent overall reduction in number of stops.
  - Over 300 vehicle-stops reduced per weekday.

### ***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 20.7 percent
- Fuel consumption was reduced by 19.1 percent
  - Reduction of 64,000 gallons per weekday
- Emissions were reduced by 12.9 percent
  - CO reduction of over 3,500 kilograms per weekday
  - NOx reduction of over 680 kilograms per weekday
  - VOC reduction of over 800 kilograms per weekday

***Estimated Economic Benefits***

The following rationale was used to estimate the daily user savings from the new timing plans:

- 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 over \$389,000 per weekday. Assuming 248 weekdays per year, this equates to an annual savings of almost \$97 million.

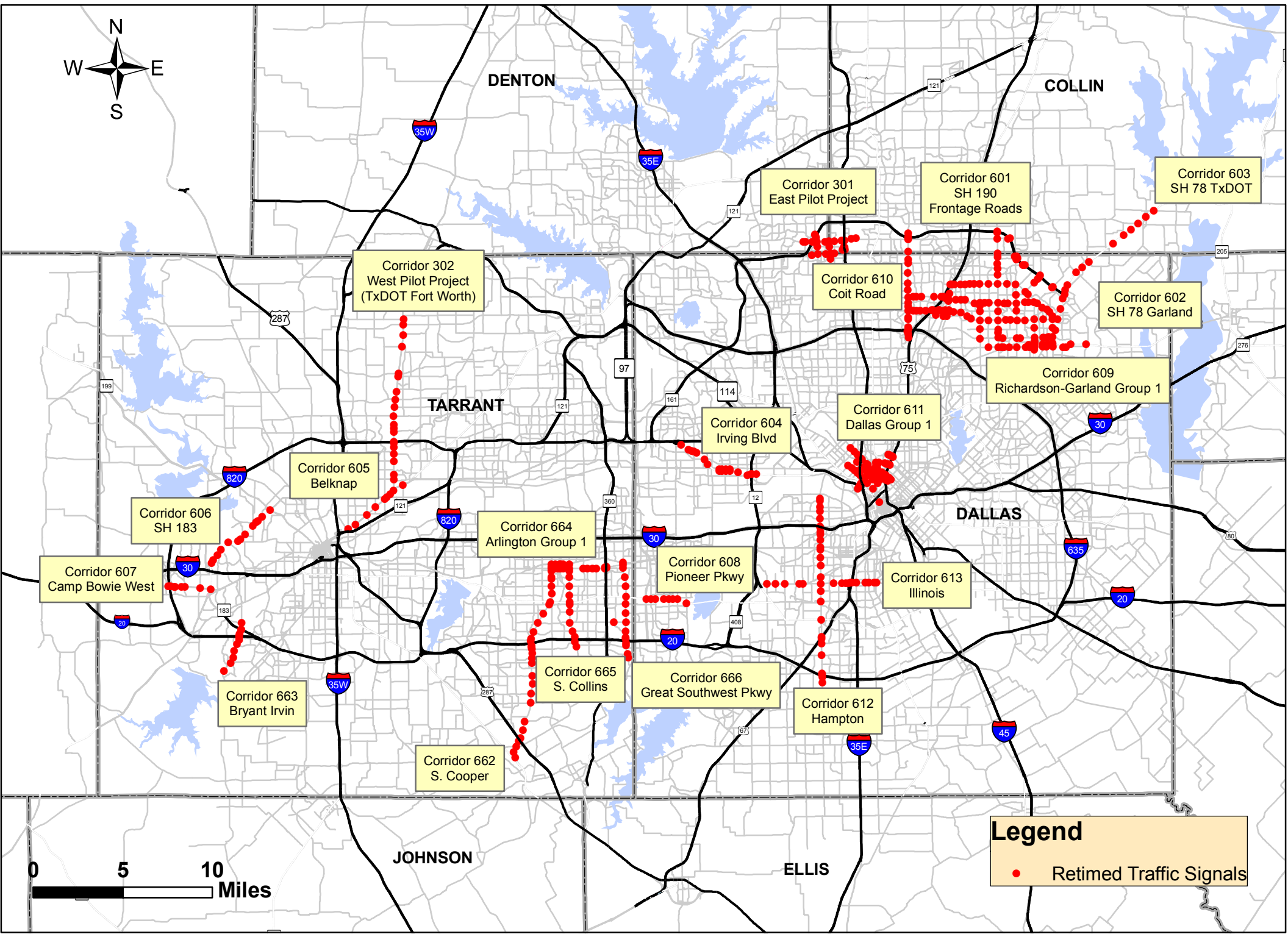
The attached **Table 1** provides a summary of the project benefits. The data provided include the following statistics per travel time route: route limits, number of signals, average daily traffic volume, and project benefits (reductions in travel time, stops, and delay). Also provided were the following 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™, the greatest per-intersection improvements were attained in Corridors 302, 602, 603, 609 and 610. Corridor 302 (the West Pilot Project) is a high-volume corridor (US 377) that had not previously had coordinated signal timing. The next two (Corridors 602 and 603) involve a high-growth corridor (SH 78) where the previous timing plans were no longer adequate for the traffic volumes. The other two corridors, Corridor 610 (Coit Road) and Corridor 609 (Richardson-Garland Group 1) involve signals operated by different cities and a significant portion of the benefit came from the provision of seamless coordination across the city boundaries.

Even though their travel time runs showed reductions in travel times, stops, and delay, four of the corridors had small increases in total signal delay as modeled in Synchro™. This probably resulted from the use of longer cycle lengths for one or both of the following reasons:

- To provide optimum signal coordination along the crossing arterials.
- To facilitate the accommodation of pedestrian timing.

# Figure 1: Thoroughfare Assessment Program - Phase 2.0



**Table 1  
Summary of Project Benefits**

Corridor	Travel Time Route(s)	From	To	Number of Signals		Average Daily Traffic	Benefits												Daily User Savings <sup>B</sup> (\$)	
				Along Travel Time Route	Corridor Total		From Travel Time Runs <sup>A</sup>			From Synchro™ <sup>A</sup>						Corridor Total	Per Intersection			
							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)		
301 East Pilot Project	DNT NBFR	Trinity Mills	Frankford Rd	3		17,650	-219	-4.0	-223	-2,100	-225,762	-3,857	-4,992	-349.14	-67.94	-80.96	\$26,250	\$905		
	DNT SBFR	Trinity Mills	Frankford Rd	3		16,200	-189	-2.0	-193											
	Frankford Rd	Appleridge	Stone Hollow	13		34,100	-791	-23.6	-656											
	Marsh Lane	Trinity Mills	Timbergien	6		29,400	-522	-7.8	-476											
	Midway Road	Frankford Rd	Sojourn	4		40,700	-370	-3.5	-334											
	Trinity Mills	Plumdale	DNT NBFR	8		24,000	-273	-13.3	-166											
Total Signals in Corridor 301					29															
302 West Pilot Project	US 377	Keller Hicks Rd	Broadway	22	22	39,100	-1,091	-30.1	-1,051	-1,974	-51,958	-1,923	-2,322	-162.53	-31.65	-37.69	\$24,675	\$1,122		
601 SH 190 Frontage Roads	SH 190 EBFR	Jupiter Rd	Brand Rd	7		10,300	-271	-10.2	-147	-493	-49,735	-840	-1,378	-96.37	-18.75	-22.31	\$6,163	\$440		
	SH 190 WBFR	Jupiter Rd	Brand Rd	7		8,700	-52	-2.0	47											
Total Signals in Corridor 601					14															
602 SH 78 Garland	SH 78	Castle Dr	Naaman School Rd	4	4	36,800	-38	-3.4	-179	-975	-24,562	-818	186	-67.97	-13.23	-15.73	\$12,188	\$3,047		
603 SH 78 TxDOT	SH 78	Murphy Rd	Brown St	9	9	29,600	502	4.9	502	-1,266	-36,884	-2,287	-2,477	-173.12	-33.70	-40.08	\$15,825	\$1,758		
604 Irving Boulevard	Irving Boulevard	Willow Creek	Wildwood	21	21	23,700	-630	-5.2	-499	-61	-7,670	-59	-89	-6.34	-1.27	-1.45	\$763	\$36		
605 Belknap	Belknap	Sylvania Ave	Carson St	10	10	13,500	-493	-17.1	-443	-131	-11,087	-107	-175	-12.10	-2.36	-2.81	\$1,638	\$164		
606 SH 183	SH 183	Ridgmar Mall Entr	Long St	11	11	27,200	-804	-8.6	-323	-246	-14,456	-202	-273	-18.89	-3.65	-4.39	\$3,075	\$280		
607 Camp Bowie West	Camp Bowie West	Alta Mere Dr	IH 820 SBFR	8	8	22,000	-127	-3.9	-276	33	-5,296	102	67	4.48	0.90	1.02	-\$413	-\$52		
608 Pioneer Parkway	Pioneer Parkway	Great Southwest Pkwy	SE 14th St	8	8	28,300	-595	-12.5	-562	-118	-17,422	-85	-317	-22.19	-4.33	-5.17	\$1,475	\$184		
609 Richardson-Garland Group 1	Arapaho Rd-Garland Ave	US 75 SBFR	Avenue F	23		28,300	-98	-3.2	-157	-17,275	-594,669	-24,532	-42,258	-1,883.95	-366.55	-436.58	\$215,938	\$1,756		
	Belt Line-Main-Belt Line-First	Mimosa	Avenue D	32		26,500	-605	-16.2	-602											
	Forest-Ave B/Ave D/SH 66 EB	Jupiter Rd	Centerville Rd	16		33,000	-337	2.8	-458											
	Forest-Ave B/Ave D/SH 66 WB	Jupiter Rd	Centerville Rd	15		15,100	-417	-11.8	-496											
	Greenville Ave	Buckingham Rd	Arapaho Rd	7		15,100	-830	-16.3	-570											
	Jupiter Rd	Forest Lane	SH 190	15		17,900	-1,049	-16.1	-949											
	Plano Rd	Arapaho Rd	Walnut St	6		29,900	-1,730	-13.5	-728											
	Spring Valley-Centennial-Buckingham	Waterfall Way	First St	24		40,500	-479	-12.3	-323											
	Walnut St	Plano Rd	First St	10		19,500	-508	-6.3	-367											
Total Signals in Corridor 609					123															
610 Coit Road	Coit Road	SH 190 WBFR	Churchill Way	20	20	45,100	-975	-18.4	-953	-3,559	-201,782	-4,861	-6,733	-470.66	-91.58	-109.07	\$44,488	\$2,224		
611 Dallas Group 1	Carlisle-Cole SB	Knox	Allen at McKinney	9		7,000	20	-2.8	49	-1,564	-45,790	-1,610	-1,414	-98.87	-19.11	-22.86	\$19,550	\$288		
	Cedar Springs Rd	Kings	Bowen	7		17,100	-256	1.6	-202											
	Lemmon Ave	Inwood Rd	Peak at Haskell	17		42,000	-193	-4.0	-166											
	Maple Ave	Motor St	Turtle Creek Blvd	8		13,800	25	-0.3	83											
	McKinney Ave NB	Oak Grove	Knox	8		9,100	204	8.8	216											
	Oak Lawn Ave	Cedar Springs	Avondale	7		27,900	-256	-5.6	-329											
	Turtle Creek Blvd	Avondale	Cedar Springs	6		12,600	156	8.5	122											
Total Signals in Corridor 611					68															
612 Hampton Road	Hampton Road	Leath	Beckleymeade	27	27	26,800	-342	-1.1	-255	-473	-12,697	-305	67	4.88	0.90	1.13	\$5,913	\$219		
613 Illinois Avenue	Illinois Avenue	Corinth	Duncanville Rd	16	16	27,100	-958	-15.8	-857	602	9,780	-94	199	13.88	2.70	3.21	-\$7,525	-\$470		
662 South Cooper	S Cooper St	Division St	Debbie Lane	26	26	36,800	-527	-8.2	-332	-855	-27,671	-767	-1,114	-77.85	-15.16	-18.04	\$10,688	\$411		
663 Bryant Irvin	Bryant Irvin Rd	Bellaire	Mira Vista	12	12	34,300	-108	1.1	-59	-652	-24,576	-575	-619	-45.27	-8.41	-10.12	\$8,150	\$679		
664 Arlington Group 1	Abram St	Cooper St	SH 360 NBFR	15		19,100	-529	-13.8	-487	-53	-31,618	-141	-461	-32.29	-6.30	-7.45	\$663	\$27		
	Division St	Cooper St	Collins St	6		18,500	-181	-2.2	-175											
Total Signals in Corridor 664					25															
665 South Collins	S Collins Street	Division St	Bardin Rd	12	12	27,600	-784	-24.3	-726	113	-6,799	161	72	5.07	0.97	1.17	-\$1,413	-\$118		
666 Great Southwest Parkway	Great Southwest Pkwy	Division St	Fairmont	17	17	21,700	-311	-6.8	-303	-206	-24,938	-395	-771	-53.94	-10.50	-12.50	\$2,575	\$151		
GRAND TOTAL FOR TAP PHASE 2.0				505	482	1,013,550	-17,031	-318.5	-14,003	-31,253	-1,405,592	-43,195	-64,802	-3,543.17	-689.02	-820.68	\$390,663	\$811		

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™ total signal delay