Executive Summary
Regional Traffic Signal Retiming Program

Prepared for:

North Central Texas Council of Governments

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REGIONAL TRAFFIC SIGNAL RETIMING PROGRAM
EXECUTIVE SUMMARY

Introduction

In 2010, the North Central Texas Council of Governments (NCTCOG) launched the Regional Traffic Signal Retiming Program (RTSRP), 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 approximately half of the program's intersections. This summary covers 200 traffic signals operated by three cities – Arlington, Dallas, and Grand Prairie. **Figure 1** illustrates the locations of these traffic signals. This project has achieved seamless progression along 25 miles of arterial streets without regard to jurisdictional boundaries.

Project Scope

The assigned intersections were grouped into designated corridors that ranged in size from 10 to 50 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.

Data Collection

The project included extensive data collection:

- For 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 39 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 17 seven-day counts, 8 24-hour counts, and 14 vehicle classification counts.

- As one means of measuring the benefits of the project, approximately 2,300 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 four time periods – the weekday AM, Midday and PM peaks plus the Saturday peak. In many cases, separate versions of the AM and midday plans were required for times when school speed zones are in operation. Additionally:

- An off-peak/late night timing plan was developed for all of the Arlington and Dallas corridors; and

- A mid-afternoon plan, which had a cycle length longer than the midday plan but shorter than the PM peak plan, was developed for Coit corridor.

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 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 both directions for all corridors (total of 55 miles of test routes), a comparison of the before and after travel time runs determined that the following reductions had been attained in travel time and stops:

- Average travel time savings:
  - 7.3 percent overall reduction in travel time.
  - 1.65 vehicle-hours reduction per weekday.
- Reduction in stops:
  - 31.1 percent overall reduction in number of stops.
  - 165 vehicle-stops reduced per weekday

Synchro™ Measures of Effectiveness

The project results were also estimated from the Synchro™ models that were used in the development of 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 5.4 percent
- Fuel consumption was reduced by 14.3 percent
  - Reduction of 10,899 gallons per weekday
- Emissions were reduced by 4.9 percent
  - CO reduction of 761 kilograms per weekday
  - NOx reduction of 148 kilograms per weekday
  - VOC reduction of 176 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, the cost of delay was assumed to be $12.50 per vehicle-hour (as reflected in NCTCOG's Mobility 2035 – 2013 Update).

For each corridor, the before and after Synchro™ models were compared for each of the three weekday timing plans. Considering the composite total signal delay for all corridors and using the above-described rationale, the estimated user benefit is $103,513 per weekday. Assuming 248 weekdays per year, this equates to an annual savings of $25.6 million.

The attached **Table 1** shows 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 7, the greatest per-intersection improvements were attained in the Coit Corridor in Dallas, which had delay reductions of over 100 vehicle-hours per day per intersection. The four Arlington corridors saw delay reductions of 47 vehicle-hours per day per intersection. These benefits were realized through adjusted cycle lengths and phase sequences and improved coordination between intersections.
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Figure 1: Regional Traffic Signal Retiming Program (RTSRP) - Phase 1

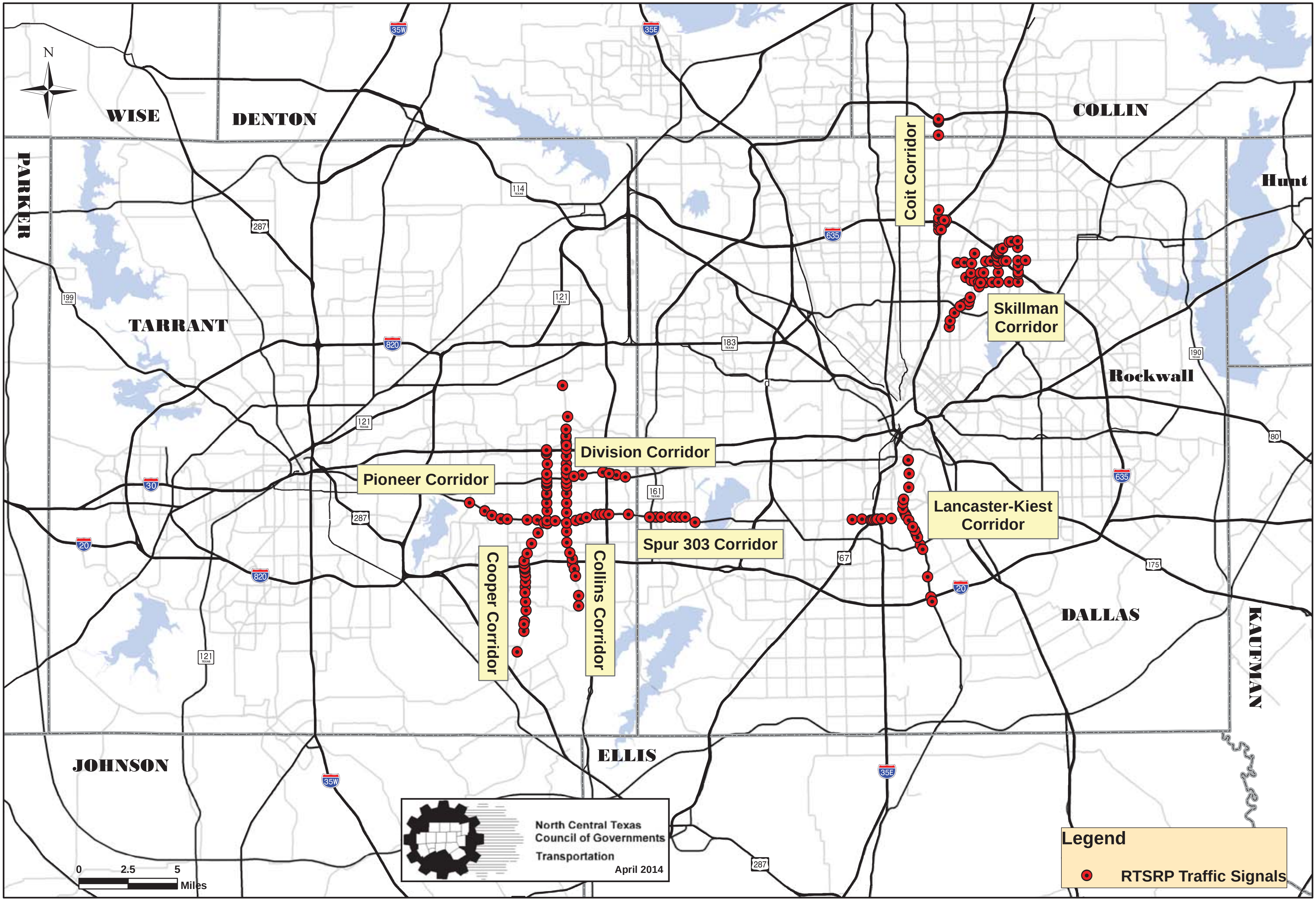

Table 1
Summary of Project Benefits

	Corridor	Travel Time Route(s)	From	To	Number of Signals: Along Travel Time Route	Number of Signals: Corridor Total	Average Daily Traffic	Benefits: From Travel Time Runns [A]: Travel Time (seconds)	From Travel Time Runs [A]: Stops	From Travel Time Runs [A]: Delay (veh-sec)	From Synchro™ [A]: Total Signal Delay (veh-hours)	From Synchro™ [A]: Stops	From Synchro™ [A]: Total Travel Time (veh-hours)	From Synchro™ [A]: Fuel Consumed (gallons)	From Synchro™ [A]: CO Emissions (kilograms)	From Synchro™ [A]: NOx Emissions (kilograms)	From Synchro™ [A]: VOC Emissions (kilograms)	Daily User Savings [E] ($): Corridor Total	Daily User Savings [E] ($): Per Intersection
Arlington	Collins St	Collins St [B]	North Green Oaks Blvd	Caplin Dr	27		28000 to 38,000	-520	-16.4	-501	-4,311	-228,867	-3,675	-6,130	-428.25	-83.14	-99.29	$53,888	$592
	Cooper St	Cooper St	Lamar Blvd	Turner Warnell Rd	34		34,000 to 51,000	-1,711	-32.8	-1,711									
	Division St	Division St	Collins St	Great Southwest Pkwy	8		16,000 to 22,000	-114	-4.0	-154									
	Pioneer Pkwy	Pioneer Pkwy	Oak Ridge Sch	Susan Dr	20		19,500 to 40,000	-1,364	-32.2	-1,363									
			Total Signals in Arlington Corridors			91													
Spur 303 (Gr. Priairie)		Spur 303	Great Southwest Pkwy	SE 14th St	10	10	22000 to 31,000	-576	-10.7	-179	-215	-7,197	-166	-501	-35.00	-6.77	-8.14	$2,688	$269
Dallas	Coit Road	Coit Rd [C]	SH 190 WBFR	Churchill Way	20	25	34000 to 52,000	-706	-20.6	-690	-2,729	-35,918	-2,672	-2,651	-185.28	-36.00	-42.96	$34,113	$1,365
	Skillman	Skillman St/Forest Ln	University Blvd	Plano Rd	19		17,000 to 49,000	-159	-2.0	-84	-921	-28,411	-1,080	-1,204	-83.72	-16.30	-19.43	$11,513	$230
		Abrams Road	Whitehurst Dr	Larmanda St	7		16,000 to 20,000	-245	-9.4	-184									
		Plano Road	Forest Ln	Walnut Hill Ln	7		22,000 to 33,000	-57	-6.0	-55									
		Royal Lane/Miller Rd	Greenville Ave	Sanden Dr	10		21,000 to 26,000	-259	-4.0	-188									
		Walnut Hill Lane [D]	Fair Oaks Blvd	Plano Rd	10		14,000 to 23,000	337	2.0	217									
			Total Signals in Skillman Corridor			50													
	Lancaster-Kiest	Corinth St/Lancaster Rd	Eighth St	Cherry Valley Blvd	23		11,000 to 33,000	-349	-20.0	-352	-105	-24,076	-883	-413	-28.74	-5.57	-6.68	$1,313	$39
		Kiest Blvd	Rugged Dr	Lancaster Rd	10		14,000 to 27,000	-223	-9.0	-224									
			Total Signals in Lancaster-Kiest Corridor			34													
GRAND TOTAL FOR RTSRP					205	210		-5,946	-165.1	-5,468	-8,281	-324,469	-8,476	-10,899	-760.99	-147.78	-176.50	$103,513	$2,494

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: The Collins corridor included two (2) other signals -- Collins & Mosier Valley (at the extreme north end) and Collins & S Green Oaks (at the extreme south end). It was decided during the project that these two intersections should remain in free operation mode. As such, the travel time results exclude the segments from Mosier Valley to N. Green Oaks and from Caplin to S. Green Oaks.

Note C: The Coit corridor officially included ten (10) City of Dallas signals on Coit Road. Four (4) are north of the City of Richardson and the other six (6) are south of the City of Richardson. Concurrently with RTSRP, the staffs of the cities of Dallas and Richardson also retimed the ten (10) Coit Road signals that are within the City of Richardson. To capture the benefits of the collective effort, the travel time runs and the Synchro modeling included all twenty (20) of these Coit Road signals (i.e. 10 RTSRP signals in Dallas plus 10 non-RTSRP signals in Richardson). Additionally, the RTSRP corridor included five (5) other signals along the US 75 frontage roads in Dallas.

Note D: The negative travel time results on Walnut Hill Lane were inconsistent with the design of the new timing plans, which should be providing improved performance. The probable cause was controller coding issues that were subsequently corrected.

Note E: Based on $12.50 per hour of Synchro total signal delay