

Executive Summary

RTSRP

Prepared for:
North Central Texas Council of Governments

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Prepared in cooperation with the Regional Transportation Council, NCTCOG, and the Texas Department of Transportation.

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1.0 Introduction

The North Central Texas Council of Governments (NCTCOG) contracted HDR, Inc. to provide assistance to local agencies to coordinate traffic signal timing for 235 traffic signals along various corridors within the Metroplex. This summary covers traffic signals operated by Carrollton, Irving, Plano, Fort Worth, Dallas, Lake Worth, the Fort Worth, and Dallas Districts of the Texas Department of Transportation (TxDOT). Figure 1 illustrates the locations of these traffic signals. This project has improved progression along these arterial streets without regard to jurisdictional boundaries.

2.0 Project Scope

The assigned intersections were grouped into designated corridors that ranged in size from 6 to 44 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.

3.0 Data Collection

The project included extensive data collection:

- For all 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).
- 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 seven-day counts, 24-hour counts, and vehicle classification counts.
- As one means of measuring the benefits of the project, 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.

4.0 Signal Timing Plans

For all corridors, new timing plans were developed for the AM and PM peaks plus the weekday midday peak in many cases. In some 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.



5.0 Project Results

5.1 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. A comparison of the “before” and “after” travel time runs determined that the following reductions had been attained in travel time, stops, and delay:

- Travel Time
 - Weekday
 - 10 percent overall reduction
 - 9,453 seconds (158 minutes) reduction per day
 - 4,961 vehicle-hours reduction per day
 - Saturday
 - 5 percent overall reduction
 - 1,144 seconds (19 minutes) reduction per day
 - 320 vehicle-hours reduction per day
- Stops
 - Weekday
 - 25% percent overall reduction
 - 200 stops reduction per day
 - 365,310 vehicle-stops reduction per day
 - Saturday
 - 7% percent overall reduction in number of stops
 - 24 stops reduction per day
 - 20,719 reduction per day

Some corridors experienced an increase in travel time, stops, and delay during the “after” travel time runs including Wheatland, SH 183, and FM 1220.

5.1.1 SH 183

On US 183 during the AM peak period travel times, stops, and delays increased. This was due to the fact that the vehicle recording the “after” travel time data did not begin the westbound direction run at the start of green. This caused variability in the results which explains the significant increase in stops. Separate unofficial “after” travel time runs were recorded by HDR during the AM peak period fine tuning. These runs yielded an average travel time run of 24 seconds better (6% decrease) than the before travel time runs. During the weekend peak, average travel times and delays increased. The Saturday peak period was set to run free due to complaints of large waiting times on side streets. While setting the corridor to run free would increase travel times and main street delay, the side streets would be served much faster, thereby reducing waiting time.

5.1.2 FM 1220

During the Saturday peak, the intersection of Boat Club Road and Azle Avenue required a larger cycle length than the remainder of the FM 1220 corridor. As a result, the 820 interchange served as a boundary intersection between the two control groups operating at different cycle lengths. Based on a review of the travel time videos, it was determined that on Saturday southbound FM 1220 travel times runs, the driver



stopped at the IH 820 interchange. On three of the four runs, the driver sat for 95 seconds or longer. The time of arrival at the 820 interchange is completely random since the driver is crossing between control areas. Vehicles could just as easily not stop at all, as happened on the other run.

5.1.3 Wheatland Road

Operations on Wheatland Road were sacrificed to benefit the I-20 frontage roads and nearby Hampton Road which accommodate higher traffic volumes than Wheatland Road. This is reflected in the PM and Weekend period “after” travel time results.

5.1.4 Plano Parkway

Performance along Plano Parkway showed both improvements and declines based on direction of travel and peak period. The mixed results shown along Plano Parkway were due to prioritization of signal timing coordination along Preston Road, the higher volume corridor. Modifications made to improve Plano Parkway further would negatively impact Preston Road and were therefore not implemented.

5.2 Synchro™ Version 8.0 Measures of Effectiveness

The project results were also estimated from the Synchro™ Version 8.0 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). The following improvements were estimated by the Synchro™ Version 8.0 comparison:

- Signal Delay
 - Weekday
 - 6,975 overall vehicle-hour reduction per day
 - Saturday
 - 1,989 overall vehicle-hour reduction per day
- Fuel Consumption
 - Weekday
 - 3,594 overall gallon reduction per day
 - Saturday
 - 842 overall gallon reduction per day
- Emissions
 - Weekday
 - VOC reduction of approximately 25,500 grams per day
 - CO reduction of approximately 1,473,500 grams per day
 - NOx reduction of approximately 75,100 grams per day
 - Saturday
 - VOC reduction of approximately 8,500 grams per day
 - CO reduction of approximately 285,100 grams per day
 - NOx reduction of approximately 19,300 grams per day



5.3 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 period timing plan
 - Two hours of benefit from the PM peak period timing plan
 - Five hours of benefit from the midday period 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.
- On Saturday, there will be four hours of benefit from the timing plan.

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 2035 - 2013 Amendment.

For each corridor, the "before" and "after" Synchro™ Version 8.0 models were compared for each of the timing plans. Considering the composite total signal delay for all corridors and using the above-described rationale, the estimated user benefit is \$87,191 per weekday. Assuming 248 weekdays per year, this equates to an annual savings of approximately \$21.6 million.

The attached Table 1 provides a summary of the project benefits. The data provided include the following statistics per travel time route: 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™ Version 8.0 models (reductions in total signal delay, stops, travel time, fuel consumed, and emissions). Daily user savings are calculated using \$12.50 per vehicle-hour of delay and total signal delay (veh-hours) from the Synchro™ Version 8.0.

The greatest per-intersection improvements were attained in Corridor 5 (Old Denton Road), Corridor 6 (Belt Line Road), Corridor 18 (Preston Road), Corridor 20 (US 380), and Corridor 22 (US 377). These corridors all saw daily delay savings of more than \$500 per intersection. These benefits were realized through improved phasing, adjusted cycle lengths, and improved coordination between intersections.

Table 1
Summary of Project Benefits

Corridor	Type	Contract Number of Signals	Average Daily Traffic	Benefits											Daily User Savings ^B	
				From Travel Time Runs ^A			From Synchro						Corridor Total	Per Intersection		
				Travel Time (seconds)	Stops	Delay (seconds)	Total Signal Delay (veh-hours)	Stops	Total Travel Time (veh-hours)	Fuel Consumed (gallons)	VOC Emissions (grams)	CO Emissions (grams)			NOx Emissions (grams)	
5	Old Denton Road	Weekday	11	24,272	-700	-7	-635	-694	-9,102	-672	-84	-459	25,585	1,892	\$8,676.25	\$788.75
		Saturday		25,176	-204	-5	-176	-438	-6,140	-615	-270	-2,688	-95,884	-8,268	\$5,475.00	\$497.73
6	Belt Line Road	Weekday	14	25,481	-513	-14	-443	-1,607	-94,297	-1,467	-2,198	-29,417	-1,128,681	-107,913	\$20,087.50	\$1,434.82
		Saturday		26,289	-56	-2	-52	-181	-12,480	-464	-341	-2,512	-109,420	-10,180	\$2,265.00	\$161.79
7	PGBT Access Road	Weekday	12	23,793	-257	-10	-239	38	543	160	114	-58	2,980	2,130	-\$480.00	-\$40.00
		Saturday		26,199	-156	-4	-152	7	-776	68	47	-828	-35,656	-1,848	-\$85.00	-\$7.08
11	Trinity Boulevard	Weekday	11	11,146	-808	-20	-725	-98	-24,165	-120	-104	-940	-87,694	-2,469	\$1,223.75	\$87.41
	Amon Carter Boulevard	Weekday	3	8,579	-222	-4	-184									
13/23	SH 26 (Grapevine Hwy)	Weekday	13	23,545	-1,234	-24	-850	-370	-31,486	-498	-135	2,332	99,522	13,301	\$4,626.25	\$355.87
14	Walnut Hill Lane	Weekday	6	28,700	-357	-13	-354	116	-8,607	489	-7	-407	-15,679	-827	-\$1,453.75	-\$242.29
15	Royal Lane	Weekday	6	13,379	-443	-11	-420	-62	-12,235	-73	-58	-761	-45,272	-2,587	\$770.00	\$128.33
16	SH 356	Weekday	21	21,504	-287	-7	-230	82	3,450	103	55	1,317	34,831	3,532	-\$1,028.75	-\$48.99
17	Northgate Drive	Weekday	6	12,694	-420	-12	-385	34	-4,400	36	1	-96	-8,933	-639	-\$421.25	-\$70.21
18	Preston Road	Weekday	44	35,923	-132	-1	-116	-2,930	19,580	-2,711	-406	3,468	101,924	15,082	\$36,627.50	\$832.44
	Legacy Drive	Weekday			-278	-5	-274									
	Spring Creek Parkway	Weekday			-228	-4	-216									
	Parker Road	Weekday			-80	-2	-54									
	Park Boulevard	Weekday			-46	0	-6									
Plano Parkway	Weekday			20	1	56										
19	SH 183	Weekday	6	14,382	-8	2	-3	-14	-188	-19	-7	112	4,147	117	\$168.75	\$28.13
		Saturday		11,488	68	2	68	6	976	8	10	-80	4,624	-160	-\$80.00	-\$13.33
20	US 380	Weekday	8	38,199	-663	-15	-627	-342	-21,143	-311	-110	2,873	34,278	9,260	\$4,271.25	\$533.91
		Saturday		35,503	-172	-6	-176	-160	-9,596	-142	-18	-2,640	-46,828	-3,516	\$2,005.00	\$250.63
21	SH 78	Weekday	11	28,434	-160	-1	-157	-203	-9,547	-196	-72	592	-16,348	2,718	\$2,532.50	\$230.23
		Saturday		42,391	-36	-1	4	-343	-2,904	-333	-72	2,636	41,600	8,112	\$4,290.00	\$390.00
22	US 377	Weekday	12	35,478	-919	-11	-828	-350	-16,100	-372	-132	-404	-51,222	-1,137	\$4,378.75	\$364.90
		Saturday		45,161	-540	-10	-492	-601	-11,896	-539	-53	216	22,940	3,208	\$7,515.00	\$626.25
24	FM 1220/SH 199	Weekday	9	28,700	-244	-11	-227	-407	-33,265	-395	-146	813	-45,905	1,736	\$5,086.25	\$231.19
			13	41,920	-584	-13	-549									
		Saturday	9	29,100	96	1	124	-112	-16,788	-118	-57	-1,184	-31,496	-3,120	\$1,400.00	\$63.64
		Saturday	13	39,400	-308	-8	-284									
25	FM 2499	Weekday	17	34,632	-726	-18	-559	-632	-54,516	-586	-305	-3,614	-334,884	-4,009	\$7,895.00	\$464.41
26	Wheatland Road	Weekday	12	27,867	-164	-1	-160	462	-10,787	405	0	-822	-42,134	-5,240	-\$5,768.75	-\$480.73
		Saturday		31,086	164	8	160	-166	-2,764	-217	-90	-1,404	-34,992	-3,520	\$2,075.00	\$172.92
Average	Weekday				-394	-8	-341	-410	-18,016	-366	-211	-1,498	-86,676	-4,415	\$5,128.90	\$270.48
	Saturday				-114	-2	-98	-221	-6,930	-261	-94	-943	-31,679	-2,144	\$2,762.22	\$238.06
Total	Weekday				-9453	-200	-8185	-6,975	-306,265	-6,228	-3,594	-25,471	-1,473,485	-75,053	\$87,191.25	\$4,598.17
	Saturday				-1144	-24	-976	-1,989	-62,368	-2,350	-842	-8,484	-285,112	-19,292	\$24,860.00	\$2,142.52

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