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TEXAS TRANSPORTATION INSTITUTE

BENEFITS OF THE TEXAS TRAFFIC LIGHT SYNCHRONIZATION (TLS) GRANT PROGRAM II: VOLUME II. APPENDICES D - F

REPORT 3010-1F

COOPERATIVE PROGRAM

TEXAS TRANSPORTATION INSTITUTE
THE TEXAS A&M UNIVERSITY SYSTEM
COLLEGE STATION, TEXAS

TEXAS DEPARTMENT OF TRANSPORTATION

in cooperation with the
Texas Governor's Energy Office and
the U.S. Department of Energy

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16. Abstract

The Texas Department of Transportation (TxDOT) was the administering agency for the Traffic Light Synchronization (TLS) Program II which was funded with Oil Overcharge funds made available by the Governor's Energy Office. The TLS Program was approved by the United States Department of Energy as part of a package of transportation-related programs with the objective of reducing energy consumption. TLS II resulted in a total of $7.7 million of program funds and local matches being spent for the optimization of traffic signal timing plans and the replacement of outdated signal controller equipment across the state. As stated previously, the program's objective was to reduce traffic congestion and facilitate the flow of traffic, with the goal of achieving more efficient use of energy resources.

With 73 completed projects, the TLS II Program has resulted in benefits that will pay for the cost of the program many times over. These benefits were estimated from the required before and after studies that were submitted by the cities. These studies document the major goals of the TLS II Program -- reductions in fuel consumption and unnecessary delay and stops. All projects were evaluated using the same unit costs. The TLS II Program resulted in 1,348 intersections in 43 cities being improved; the expenditure of $7.7 million of program funds and local matches; and annual reductions in fuel consumption, delay, and stops of 13.5 percent (20.8 million gallons), 29.6 percent (22 million hours), and 11.5 percent (729 million stops), respectively. The total savings to the public in the form of reduced fuel, delay, and stops will be approximately $252 million in the next year alone. In regard to fuel savings, Texas motorists are realizing $2.68 in savings for every dollar spent, and if stops and delay are included, Texas motorists are realizing $32.30 in savings for every dollar spent. These savings will continue for the next few years without additional expenditures; therefore, the benefits to the public will be even greater.

This report is the second of two volumes. The other volume is: Benefits of Texas Traffic Light Synchronization (TLS) Grant Program II: Volume I. Executive Summary and Appendices A - C

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BENEFITS OF THE TEXAS TRAFFIC LIGHT SYNCHRONIZATION (TLS) GRANT PROGRAM II

VOLUME II. APPENDICES D - F

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Program Title: Traffic Light Synchronization (TLS) Grant Program II

Sponsored by
The Texas Department of Transportation
and
The Texas Governor's Energy Office

February 1995

TEXAS TRANSPORTATION INSTITUTE
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College Station, Texas 77843-3135

IMPLEMENTATION STATEMENT

This report documents results of a special grant program, "Traffic Light Synchronization Grant Program II" rather than the results of a research study. Thus, there are no findings, recommended procedures for implementation, or additional work needed to achieve implementation.

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DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the opinions, findings, and conclusions presented herein. The contents do not necessarily reflect the official views or policies of the Texas Department of Transportation, Governor's Energy Office, or U.S. Department of Energy. This report does not constitute a standard, specification, or regulation and is NOT INTENDED FOR CONSTRUCTION, BIDDING, OR PERMIT PURPOSES. The engineer in charge of preparing this report was Daniel B. Fambro, P.E. No. 47535 (Texas).

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The Texas Department of Transportation secured the funding, prepared the grant manual, and was responsible for all contractual and administrative matters. TxDOT staff members making significant contributions to the TLS II Program include:

Byron C. Blaschke	Anna M. Isbell	Henry A. Thomason
Connie Bohuslav	Ernest W. Kanak	Gary K. Trietsch
Phil Fredricks	Michael J. McAndrew	Roger G. Welsch
Bob G. Hodge	Wilbur Mehaffey	Brenda Nilsson
Victor J. Holubec	Cindy Nelson	

The training manuals, related materials, and documentation of benefits were prepared by the Texas Transportation Institute and Texas Engineering Extension Service at Texas A&M University, and the McTrans Center at the University of Florida. Staff members from these organizations that made significant contributions to the TLS II Program include:

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SUMMARY

The Texas Department of Transportation (TxDOT) was the administering agency for the Traffic Light Synchronization II (TLS II) Program, which was funded with Oil Overcharge funds made available through the Governor's Energy Office. The TLS II Program was approved by the United States Department of Energy as part of a package of transportation-related programs with the objective of reducing energy consumption. TLS II resulted in a total of $7.7 million of program funds and local matches being spent for the optimization of traffic signal timing plans and the replacement of outdated signal controller equipment across the state. As stated previously, the program's objective was to reduce traffic congestion and facilitate the flow of traffic, with the goal of achieving more efficient use of energy resources.

With 73 completed projects, the TLS II Program has resulted in benefits that will pay for the cost of the program many times over. These benefits were estimated from the required before and after studies that were submitted by the cities. These studies document the major goals of the TLS II Program -- reductions in fuel consumption and unnecessary delay and stops. All projects were evaluated using the same unit costs. The TLS II Program resulted in 1,348 intersections in 43 cities being improved; the expenditure of $7.7 million of program funds and local matches; and annual reductions in fuel consumption, delay, and stops of 13.5 percent (20.8 million gallons), 29.6 percent (22 million hours), and 11.5 percent (729 million stops), respectively. The total savings to the public in the form of reduced fuel, delay, and stops will be approximately $252 million in the next year alone. In regard to fuel savings, Texas motorists are realizing $2.68 in savings for every dollar spent, and if stops and delay are included, Texas motorists are realizing $32.30 in savings for every dollar spent. These savings will continue for the next few years without additional expenditures; therefore, the benefits to the public will be even greater.

Besides the intuitive benefits of reducing unnecessary vehicle stops, delays, fuel consumption and emissions, the TLS II Program brought together the diverse transportation community of city staffs, consultants, TxDOT personnel and researchers to improve traffic operations at the state's signalized intersections. The program also has increased the expertise of transportation professionals in Texas and created a traffic data base that can be used for additional transportation projects. Most importantly, perhaps, the TLS II Program has enhanced the image of the transportation profession by improving the quality of traffic flow on arterial streets in Texas, and helping to change the driver's perspective of always stopping at a "red" light to not stopping at a "green" light.

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APPENDIX D

INDIVIDUAL PROJECT SUMMARIES

LARGE CITIES

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Table D-1. Individual Project Summaries - Large Cities.

City	System	Reduction in Daily Totals: Stops	Delay (veh-hrs)	Fuel (gals)	Total Annual Savings ($)	Total Cost ($)	B/C Ratio	Page
Arlington	Diamond Interchange	11,940	681.00	600.00	2,273,148	56,864.00	39.98	D-5
Austin	Airport Blvd.	135,662	653.70	3,404.65	3,552,275	78,652.72	45.16	D-10
	Burnet/Anderson	-22285	271.15	121.29	756,238	16,817.24	44.97	D-13
	Burnet/Braker/Kramer	60,879	3,296.20	2,798.83	10,983,939	14,389.45	763.33	D-16
	Central/Lamar/UT Area	133,274	610.35	3,911.44	3,564,233	35,398.29	100.69	D-19
	East First St.	1,157	262.05	196.44	849,941	9,718.25	87.46	D-22
	E. 6th/7th St.	6,518	59.65	146.85	250,381	25,803.68	9.7	D-25
	E. Riverside Dr.	6,064	66.54	118.75	260,712	27,187.40	9.59	D-28
	Enfield/15th	96,219	2,046.15	2,044.35	7,155,875	37,214.12	192.29	D-31
	Far South Austin Area	225,361	23,050.65	12,645.90	73,892,234	104,915.61	704.3	D-34
	Far West Blvd.	10,167	(2.75)	60.70	52,658	5,676.13	9.28	D-37
	I.H. 35/U.S. 290	17,780	218.25	637.40	920,644	7,918.40	116.27	D-40
	Jollyville Road	12,697	535.40	368.30	1,770,017	15,581.50	113.6	D-43
	Northland Drive	87,464	2,283.15	2,202.37	7,877,508	18,010.29	437.39	D-46
	N. Lamar/Koenig Ln.	18,312	108.10	230.85	470,465	20,497.56	22.95	D-49
	N. Lamar/Rundberg/Rutland	28,598	1,905.10	1,302.88	6,226,274	4,667.46	1333.97	D-52
Corpus Christi	Shoreline Blvd./Ocean Dr.	31,293	1,194.35	871.00	3,975,771	199,619.00	19.92	D-55
Dallas	City of Dallas	(6,132)	369.66	158.80	1,130,866	583,355.93	1.94	D-58
El Paso	City of El Paso	34,778	1,568.84	2,415.98	5,577,363	235,747.38	23.66	D-64
Fort Worth	Jacksboro Highway	10,063	479.98	423.30	1,609,194	95,414.55	16.87	D-69
Houston	Various Arterials	84,448	2,067.58	2,128.48	7,195,966	1,119,556.00	6.43	D-74
San Antonio	Various Intersections	640,760	2,025.00	7,673.00	11,068,092	375,924.00	29.44	D-84

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Diamond Interchanges

The City of Arlington Department of Public Works and Transportation worked on the following project. There are six Diamond Interchanges and Brown Boulevard included in the Various Diamond project. Four of these diamonds are in conjunction with SH 360, one with IH 30, and one with IH 20. Brown Boulevard also intersects with SH 360. These diamonds are in the residential regions of the city and generate significant home-to-work and work-to-home traffic patterns. The Diamond Intersections and Brown Boulevard were running in a free mode at the before study time. The attached figure shows the project network and cross streets.

All the intersections were actuated controlled with a constant number of phases (8). All of them had pedestrian control, and the controllers used were EPAC 300, EAGLE DP 9800, ECONOLITE 740, EAGLE 2209, and EAGLE 1409.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times and travel delays, saturation flow rates using the assistant function in PASSER II, and an operating cost study. Timing plans were developed using TRANSYT-7F. Travel time runs were obtained using the test car method. Six runs were made on each link in each time period (AM, OFF, and PM), and the mean travel times were determined.

Based on the TRANSYT-7F simulation, the project resulted in an estimated $2,273,148 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 3,582,000 stops (a 6.5 percent reduction), a total annual fuel savings of 180,000 gallons (a 11.7 percent reduction), and an annual delay savings of 204,300 veh-hrs (a 17.3 percent reduction). The total cost of the project was $56,864.06, and the resultant benefit to cost ratio was 40 to 1.

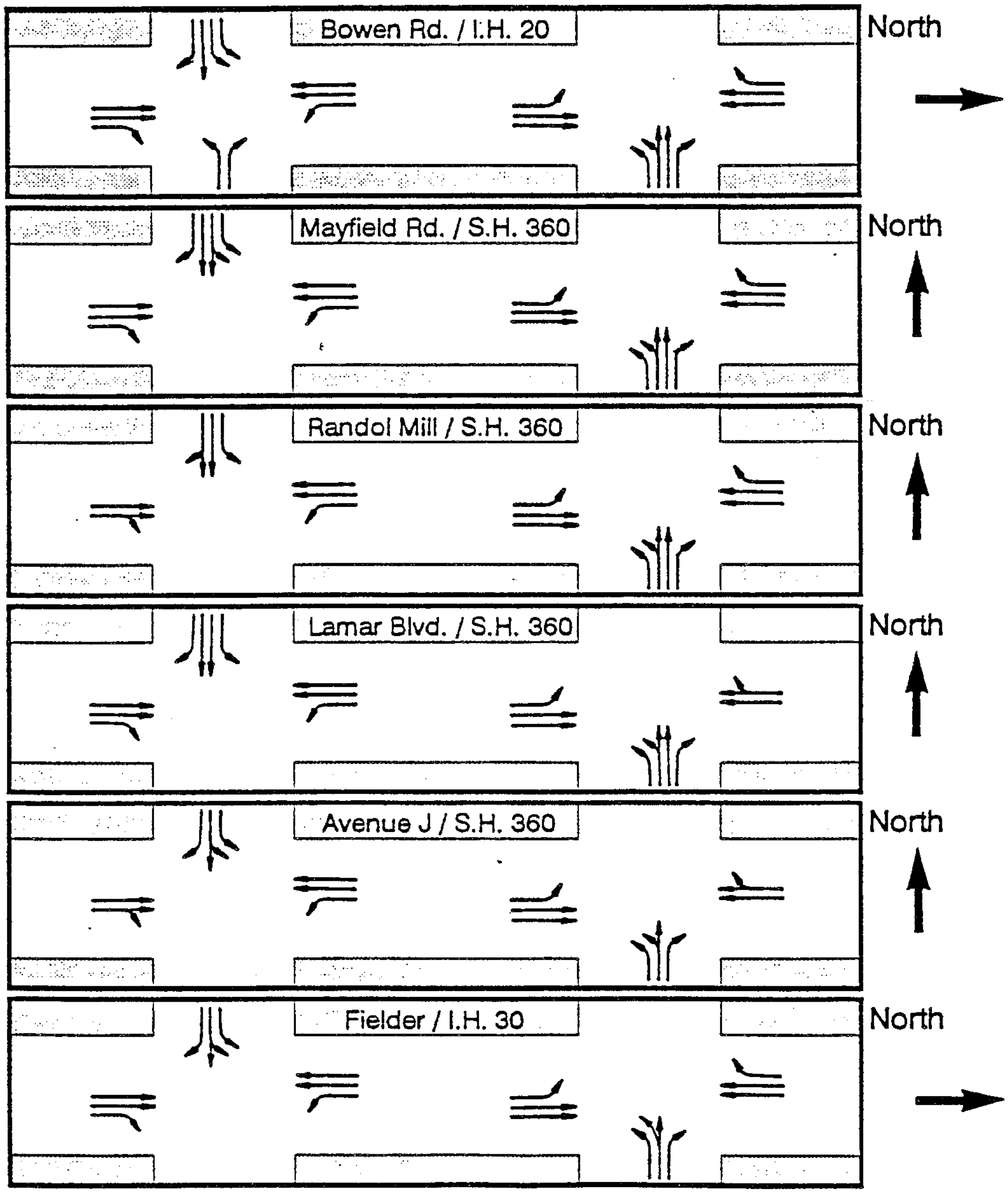
		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	5844	5231	71	77	165	151
	OFF	2889	2822	13	15	68	71
	NOON	3836	3843	19	20	91	92
	PM	6305	5860	74	88	173	172
DIFFERENCES	AM		613		-6		14
	OFF		67		-2		-3
	NOON		-7		-1		-1
	PM		445		-14		1
HRS/DAY	AM		2		2		2
	OFF		8		8		8
	NOON		2		2		2
	PM		3		3		3
DAILY TOTALS	AM		1226		-12		28
	OFF		536		-16		-24
	NOON		-14		-2		-2
	PM		1335		-42		3
	TOTAL		3083		-72		5
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$12,949		($216,000)		$1,500
PROJECT COST:		(refer to summary)		TOTAL ANNUAL SAVINGS:			($201,551)
BENEFIT/COST RATIO:		(refer to summary)					

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	18778	16855	383	281	443	354
	NOON	14168	12420	194	134	258	210
	PM	18657	18152	756	613	716	609
DIFFERENCES	AM	1923		102		89	
	NOON	1748		60		48	
	PM	505		143		107	
HRS/DAY	AM	2		2		2	
	NOON	2		2		2	
	PM	3		3		3	
DAILY TOTALS	AM	3846		204		178	
	NOON	3496		120		96	
	PM	1515		429		321	
	TOTAL	8857		753		595	
UNIT VALUES		$0.014		$10.00		$1.00	
ANNUAL SAVINGS		$37,199		$2,259,000		$178,500	

PROJECT COST: (refer to summary) TOTAL ANNUAL SAVINGS: $2,474,699

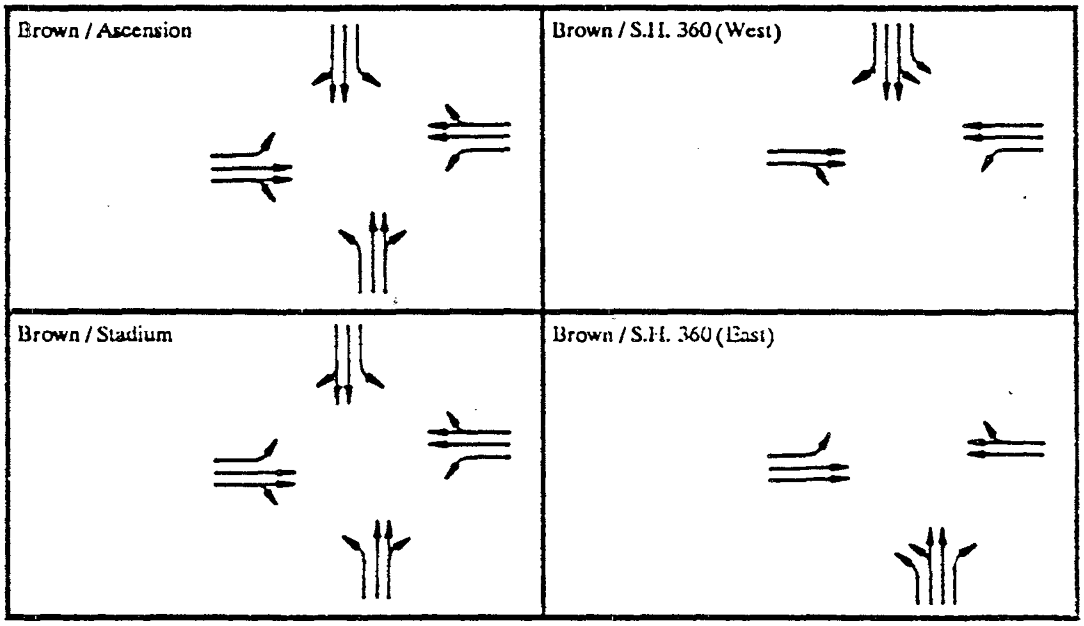
BENIFIT/COST RATIO: (refer to summary)

Summary Of Intersection Details
Intersection Geometry => **Diamond Intersections**



North

Summary Of Intersection Details
Intersection Geometry => **Brown Boulevard**



Airport Boulevard

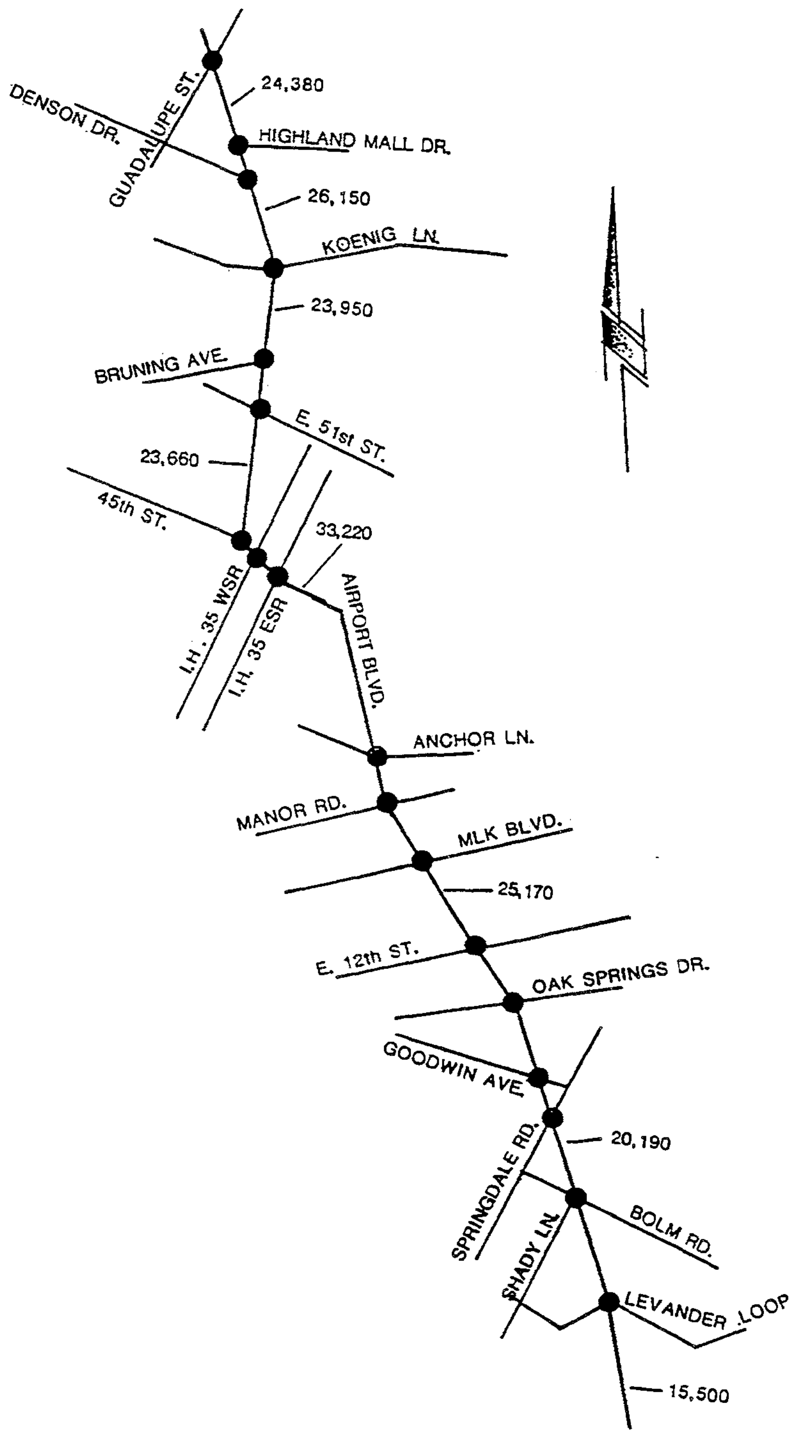
The City of Austin Department of Public Works and Transportation worked on the following project. The Airport Boulevard system is an arterial street that is a major north-south route between Lamar Boulevard, State Highway 71, and the former Bergstorm Air Force Base. Airport Boulevard also intersects Koenig Lane, a major east-west arterial. Airport Boulevard is a 60 foot roadway with two travel lanes in each direction and a two-way left turn lane. Major congestion points exist at Bolm Road/ Shady Lane, IH 35 Service Roads, and at Manor Road. The attached figure shows the project network, cross streets, and average daily traffic volumes.

A total of 19 signals were included in this project. All traffic signal controllers in this system are Type-170. These controllers were installed as part of the central traffic computer control system project. All controllers are controlled by time-base which is refreshed by the central computer system. These controllers are capable of actuated-coordinated control, special functions, and changes can easily be made from the central office. All controllers were pretimed. Pedestrian signal indications and push buttons as well as vehicle actuation hardware were installed as part of this project.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Timing plans were developed using PASSER II-90. Upon selection of optimum timing plans, proposed green time for each intersection and a timing plan was evaluated with respect to the required minimum pedestrian time. Pedestrian actuation equipment and vehicle loop detectors were installed as a part of this project to further enhance the improvements made by improved signal timing plans. Travel time information was obtained by the floating car technique. Six runs were made on each link in each time period (AM, OFF, and PM), and the mean travel times were determined. The optimum cycle length used for the after conditions for the AM, OFF, and PM peak periods was 100 seconds.

Based on the PASSER II-90 simulation, the project resulted in an estimated $3,552,275 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 40,698,600 stops (a 16.7 percent reduction), a total annual fuel savings of 1,021,395 gallons (a 16.8 percent reduction), and an annual delay savings of 196,110 veh-hrs (a 10.4 percent reduction). The total cost of the project was $78,652, and the resultant benefit to cost ratio was 45 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	38045	34156	272.6	283.7	904.7	868.8
	OFF	41120	33965	301.2	277.1	1025.1	846.3
	PM	57324	47861	616.5	468.1	1516.3	1226.6
DIFFERENCES	AM		3889		-11.1		35.9
	OFF		7155		24.1		178.8
	AM		9463		148.4		289.7
HRS/DAY	AM		1.5		1.5		1.5
	OFF		15.5		15.5		15.5
	PM		2		2		2
DAILY TOTALS	AM		5834		-16.65		53.85
	OFF		110903		373.55		2771.4
	PM		18926		296.8		579.4
	TOTAL		135662		653.7		3404.65
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$569,780		$1,961,100		$1,021,395
PROJECT COST:			$78,652.72	TOTAL ANNUAL SAVINGS:			$3,552,275
BENEFIT/COST RATIO:			45				


24,380
DENSON DR.
GUADALUPE ST.
HIGHLAND MALL DR.
26,150
KOENIG LN.
23,950
BRUNING AVE.
E. 51st ST.
23,660
45th ST.
33,220
I.H. 35 WSR
I.H. 35 ESR
AIRPORT BLVD.
ANCHOR LN.
MANOR RD.
MLK BLVD.
25,170
E. 12th ST.
OAK SPRINGS DR.
GOODWIN AVE.
SPRINGDALE RD.
20,190
BOLM RD.
SHADY LN.
LEVANDER LOOP
15,500

Burnet/Anderson

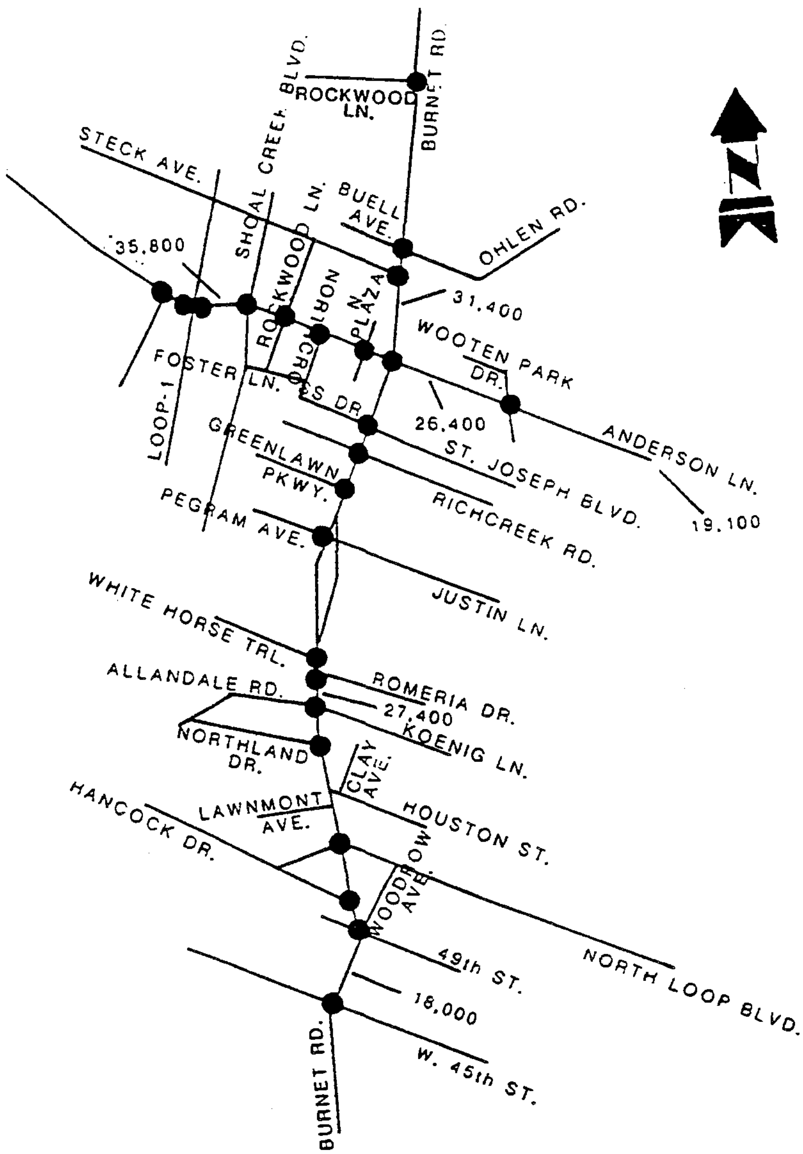
The City of Austin Department of Public Works and Transportation worked on the following project. The Burnet Road and Anderson Lane system consists of two intersecting arterial streets. Traffic along Anderson Lane is not only generated by the shopping centers along Anderson Lane, but also carries through east-west traffic. Burnet Road is a four-lane from W. 45th Street to Koenig Lane. A two-way left turn lane is in place from Koenig Lane to Ohlen Road. Anderson Lane is a four-lane divided roadway with left turn lanes at signalized intersections. Major congestion points exist along Anderson Lane at Loop 1 (ESR), Shoal Creek Boulevard, and at Burnet Road. The intersection of Burnet Road and Koenig Lane is also a major congestion point. The attached figure shows the project network, cross streets, and average daily traffic volumes.

A total of 25 signals were included in this project. All traffic signal controllers in this system are Type-170. These controllers were installed as part of the central traffic computer control system project. All controllers are controlled by time-base which is refreshed by the central computer system. These controllers are capable of actuated-coordinated control, special functions, and changes can easily be made from the central office. The signals along Anderson Lane at Shoal Creek Boulevard, Northcross Drive, Anderson Plaza, and at Burnet Road are actuated-coordinated. The signals at Burnet Road and Koenig Lane are also actuated-coordinated.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Timing plans were developed using PASSER II-90. Upon selection of optimum timing plans, proposed green time for each intersection and a timing plan was evaluated with respect to the required minimum pedestrian time. Pedestrian actuation equipment and vehicle loop detectors were installed as a part of this project to further enhance the improvements made by improved signal timing plans. Travel time information was obtained by the floating car technique. Six runs were made on each link in each time period (AM, OFF, and PM), and the mean travel times were determined. The optimum cycle length used for the after conditions for the AM, OFF, and PM peak periods was 90 seconds.

Based on the PASSER II-90 simulation, the project resulted in an estimated $756,238 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included an increase of 6,685,500 stops (a 2.8 percent increase), a total annual fuel savings of 36,386 gallons (a 0.7 percent reduction), and an annual delay savings of 81,345 veh-hrs (a 4.2 percent reduction). The total cost of the project was $16,817, and the resultant benefit to cost ratio was 45 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	48403	49449	387	360	1056.7	1042.75
	OFF	57605	58521	436.4	423.9	1261.7	1258.9
	PM	62929	68478	656.4	606.7	1506.8	1471.32
DIFFERENCES	AM		-1046		27		13.95
	OFF		-916		12.5		2.8
	PM		-5549		49.7		35.48
HRS/DAY	AM		1.5		1.5		1.5
	OFF		10.5		10.5		10.5
	PM		2		2		2
DAILY TOTALS	AM		-1569		40.5		20.925
	OFF		-9618		131.25		29.4
	PM		-11098		99.4		70.96
	TOTAL		-22285		271.15		121.285
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			($93,597)		$813,450		$36,385
PROJECT COST:			$16,817.24	TOTAL ANNUAL SAVINGS:			$756,238
BENEFIT/COST RATIO:			45				


ROCKWOOD LN.
BURNET RD.
SHOAL CREEK BLVD.
STECK AVE.
BUELL AVE.
OHLEN RD.
35,800
31,400
ROCKWOOD LN.
NORTHCROSS DR.
N. PLAZA
WOOTEN PARK DR.
FOSTER LN.
LOOP-1
26,400
ANDERSON LN.
GREENLAWN PKWY.
ST. JOSEPH BLVD.
19,100
RICHCREEK RD.
PEGRAM AVE.
JUSTIN LN.
WHITE HORSE TRL.
ALLANDALE RD.
ROMERIA DR.
27,400
KOENIG LN.
NORTHLAND DR.
CLAY AVE.
LAWNMONT AVE.
HOUSTON ST.
HANCOCK DR.
WOODROW AVE.
NORTH LOOP BLVD.
49th ST.
18,000
W. 45th ST.
BURNET RD.
N

Burnet/Braker/Kramer

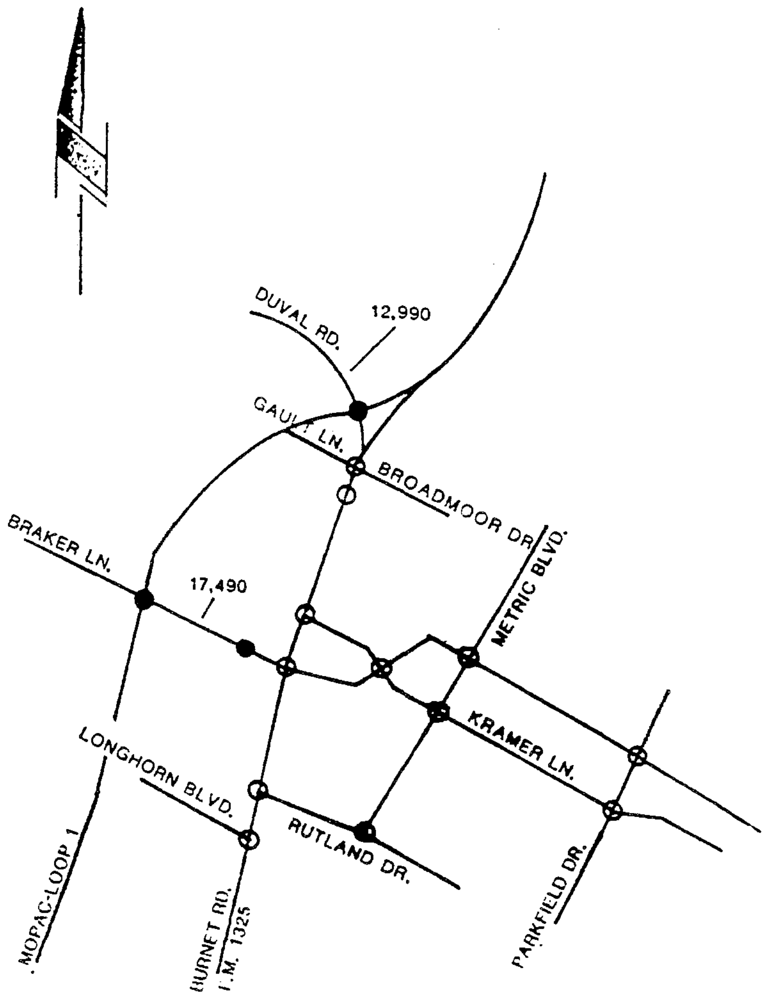
The City of Austin Department of Public Works and Transportation worked on the following project. The Burnet Road/Braker Lane/Kramer Lane system consists of 15 intersections along three intersecting arterial streets. Since the opening of Loop 1/U.S. 183 interchange, traffic along Burnet Road has shifted to the new facility. Burnet Road is still expected to carry traffic to local businesses as well as to IBM. Braker Lane has recently been completed through Lamar Boulevard to IH 35. All roadways have posted speed limits of 40 mph or greater. Major congestion points exist on Burnet Road at Braker Lane and at Kramer Lane. The attached figure shows the project network, cross streets, and average daily traffic volumes.

All traffic signal controllers in this system are Type-170. The controllers along Burnet Road were installed as part of the central traffic computer control system project. All controllers are controlled by time-base which is refreshed by the central computer system. These controllers are capable of actuated-coordinated control, special functions, and changes can easily be made from the central office. All signals in this project are actuated-coordinated.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Timing plans were developed using PASSER II-90. Upon selection of optimum timing plans, proposed green time for each intersection and a timing plan was evaluated with respect to the required minimum pedestrian time. Pedestrian actuation equipment and vehicle loop detectors were installed as a part of this project to further enhance the improvements made by improved signal timing plans. Travel time information was obtained by the floating car technique. Six runs were made on each link in each time period (AM, OFF, and PM), and the mean travel times were determined. The optimum cycle length used for the after conditions for the AM, OFF, and PM peak periods was 90 seconds.

Based on the PASSER II-90 simulation, the project resulted in an estimated $10,983,939 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 18,263,700 stops (a 10.5 percent reduction), a total annual fuel savings of 839,648 gallons (a 17.8 percent reduction), and an annual delay savings of 988,860 veh-hrs (a 38.6 percent reduction). The total cost of the project was $14,389, and the resultant benefit to cost ratio was 763 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	73820	64619	1445.5	822.3	2107.3	1648.7
	OFF	46276	43658	417.8	374.7	1141.5	1069.6
	PM	80735	65246	1827.1	733	2498.7	1635.3
DIFFERENCES	AM		9201		623.2		458.6
	OFF		2618		43.1		71.9
	PM		15489		1094.1		863.4
HRS/DAY	AM		1.75		1.75		1.75
	OFF		6.75		6.75		6.75
	PM		1.75		1.75		1.75
DAILY TOTALS	AM		16102		1090.6		802.55
	OFF		17672		290.925		485.325
	PM		27106		1914.675		1510.95
	TOTAL		60879		3296.2		2798.825
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$255,692		$9,888,600		$839,648
PROJECT COST:			$14,389.45	TOTAL ANNUAL SAVINGS:			$10,983,939
BENEFIT/COST RATIO:			763				


DUVAL RD.
12,990
GAULT LN.
BROADMOOR DR.
BRAKER LN.
17,490
METRIC BLVD.
KRAMER LN.
LONGHORN BLVD.
RUTLAND DR.
MOPAC-LOOP 1
BURNET RD.
F.M. 1325
PARKFIELD DR.

Central Lamar/UT Area

The City of Austin Department of Public Works and Transportation worked on the following project. The Central Lamar/University of Texas Area consists of 58 intersections along eight intersecting arterial streets. Roadway geometrics vary from two-lane on sections of 38th Street to five-lane on sections of Red River Street and Martin Luther King (MLK) Boulevard. Pedestrian traffic is especially heavy on Guadalupe Street in the "drag" area (MLK to 27th Street) adjacent to the University of Texas. Parking and "drop-off" traffic are also congestion factors in this area. The attached figure shows the project network, cross streets, and average daily traffic volumes.

All traffic signal controllers in this system are Type-170. These controllers were installed as part of the central traffic computer control system project. All controllers are controlled by time-base which is refreshed by the central computer system. These controllers are capable of actuated-coordinated control, special functions, and changes can easily be made from the central office. The signals at Loop 1 (ESR) and Jackson Avenue are actuated-coordinated. Except at C. Lamar/MLK Blvd., all other intersections have pedestrian controls. All controllers are pretimed.

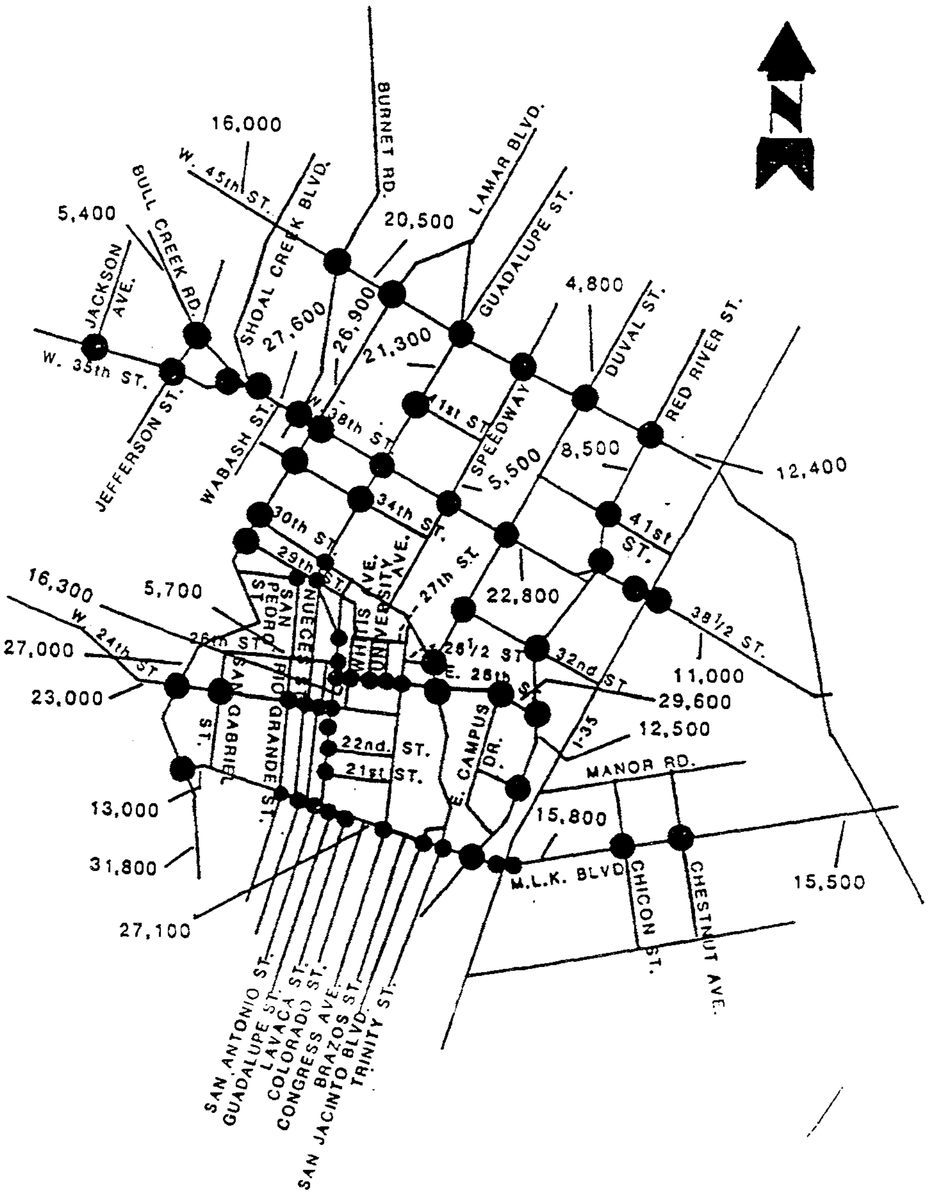
In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Timing plans were developed using PASSER II-90. Upon selection of optimum timing plans, proposed green time for each intersection and a timing plan was evaluated with respect to the required minimum pedestrian time. Nine (9) intersections were identified that needed pedestrian actuation equipment at the intersection. These were installed during the project. Travel time information was obtained by the floating car technique. Six runs were made on each link in each time period (AM, OFF, and PM), and the mean travel times were determined. The optimum cycle lengths used for the after conditions for the AM, OFF, and PM peak periods were 75, 75, and 105 seconds, respectively.

Based on the PASSER II-90 simulation, the project resulted in an estimated $3,564,233 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 39,982,200 stops (a 6.2 percent reduction), a total annual fuel savings of 1,173,432 gallons (a 8.4 percent reduction), and an annual delay savings of 183,105 veh-hrs (a 2.3 percent reduction). The total cost of the project was $35,398, and the resultant benefit to cost ratio was 101 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	133404	133245	907.8	897.4	2426.97	2409.69
	OFF	139741	134787	1073.1	986.1	2731.79	2665.23
	PM	222564	206147	3145.8	3089.7	4983.35	4483.03
DIFFERENCES	AM		159		10.4		17.28
	OFF		4954		87		66.56
	PM		16417		56.1		500.32
HRS/DAY	AM		1.5		1.5		1.5
	OFF		2		2		2
	PM		7.5		7.5		7.5
DAILY TOTALS	AM		239		15.6		25.92
	OFF		9908		174		133.12
	PM		123128		420.75		3752.4
	TOTAL		133274		610.35		3911.44
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$559,751		$1,831,050		$1,173,432

PROJECT COST: $35,398.29 TOTAL ANNUAL SAVINGS: $3,564,233

BENEFIT/COST RATIO: 101



16,000
W. 45th ST.
BURNET RD.
LAMAR BLVD.
SHOAL CREEK BLVD.
20,500
BULL CREEK RD.
5,400
GUADALUPE ST.
JACKSON AVE.
27,600
26,900
21,300
4,800
DUVAL ST.
RED RIVER ST.
W. 35th ST.
JEFFERSON ST.
WABASH ST.
W. 38th ST.
41st ST.
SPEEDWAY
5,500
8,500
12,400
34th ST.
30th ST.
29th ST.
41st ST.
22,800
16,300
5,700
W. 24th ST.
26th ST.
SAN PEDRO ST.
NUECES ST.
WHITIS AVE.
UNIVERSITY AVE.
27th ST.
28 1/2 ST.
32nd ST.
38 1/2 ST.
27,000
11,000
23,000
E. 26th
29,600
12,500
RIO GRANDE ST.
SAN GABRIEL ST.
22nd. ST.
21st ST.
E. CAMPUS DR.
I-35
MANOR RD.
13,000
15,800
31,800
M.L.K. BLVD.
CHICON ST.
CHESTNUT AVE.
15,500
27,100
SAN ANTONIO ST.
GUADALUPE ST.
LAVACA ST.
COLORADO ST.
CONGRESS AVE.
BRAZOS ST.
SAN JACINTO BLVD.
TRINITY ST.
N

East First Street

The City of Austin Department of Public Works and Transportation worked on the following project. The East First Street system is a 40 foot arterial street providing access to the Central Business District and IH 35 for residents and traffic originating east of Austin. East First Street was recently converted from one-way to two-way operation with left turn bays at the signalized intersections. Pleasant Valley Road between Town Lake and East Seventh Street was also widened to further improve traffic flow. There are seven signalized intersections included in this project. The attached figure shows the project network, cross streets, and average daily traffic volumes.

All traffic signal controllers in this system are Type 170. These controllers were installed as part of the central traffic computer control system project. All controllers are coordinated by time-base which is refreshed by the central computer system. These controllers are capable of actuated-coordinated control, special functions, and the central office can easily make changes. All controllers are pretimed. Pedestrian push buttons were installed as a part of this project.

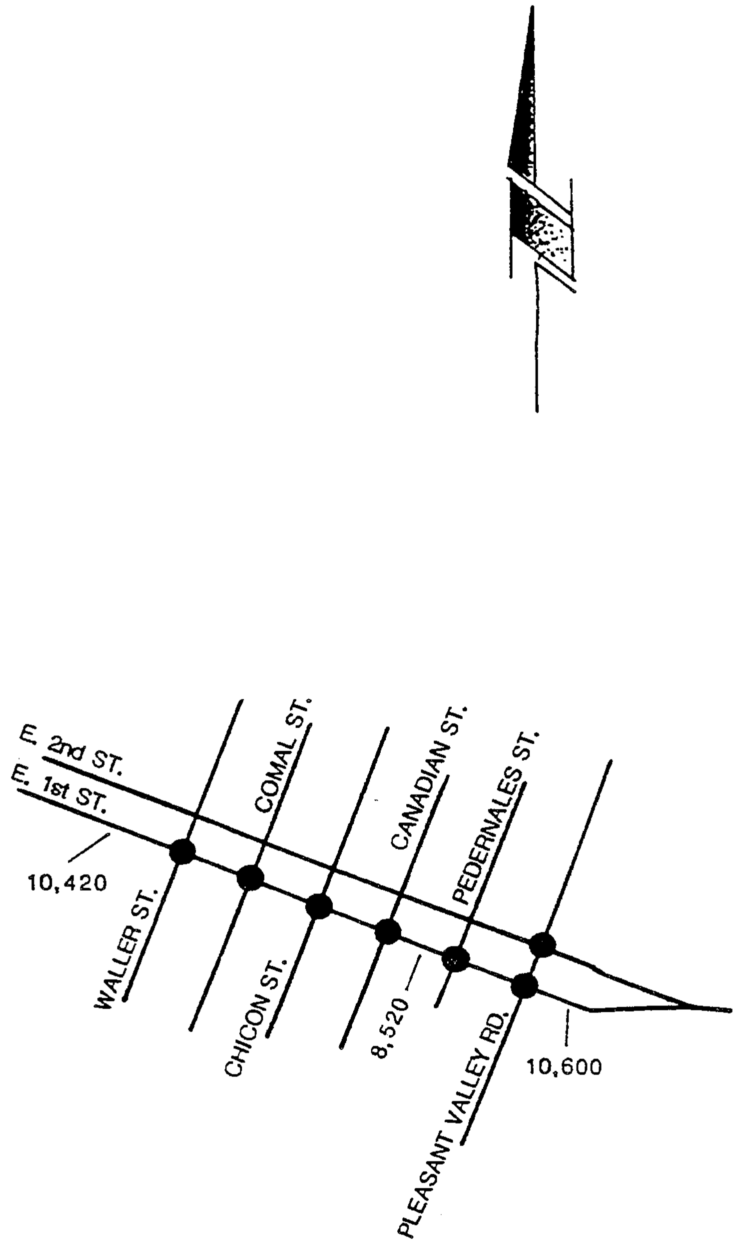
In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Timing plans were developed using PASSER II-90. Upon selection of optimum timing plans, proposed green time for each intersection and a timing plan was evaluated with respect to the required minimum pedestrian time. Pedestrian signal actuation equipment (push buttons) were installed at each intersection. Travel time information was obtained by the floating car technique. Six runs were made on each link in each time period (AM, OFF, and PM), and the mean travel times were determined. The optimum cycle lengths used for the after conditions for the AM, OFF, and PM peak periods were 60, 50, and 65 seconds, respectively.

Based on the PASSER II-90 simulation, the project resulted in an estimated $849,941 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 347,100 stops (a 1.2 percent reduction), a total annual fuel savings of 58,932 gallons (a 10.7 percent reduction), and an annual delay savings of 78,615 veh-hrs (a 41.7 percent reduction). The total cost of the project was $9,718, and the resultant benefit to cost ratio was 88 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	10108	9058	72	31.5	199.27	163.37
	OFF	7366	7530	38.3	21.3	138.65	127.07
	PM	12130	11724	116.1	79.2	248.9	221.03
DIFFERENCES	AM		1050		40.5		35.9
	OFF		-164		17		11.58
	PM		406		36.9		27.87
HRS/DAY	AM		1.5		1.5		1.5
	OFF		7.5		7.5		7.5
	PM		2		2		2
DAILY TOTALS	AM		1575		60.75		53.85
	OFF		-1230		127.5		86.85
	PM		812		73.8		55.74
	TOTAL		1157		262.05		196.44
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$4,859		$786,150		$58,932

PROJECT COST: $9,718.25 TOTAL ANNUAL SAVINGS: $849,941

BENEFIT/COST RATIO: 87


E. 2nd ST.
E. 1st ST.
10,420
WALLER ST.
COMAL ST.
CHICON ST.
CANADIAN ST.
8,520
PEDERNALES ST.
PLEASANT VALLEY RD.
10,600

East 6th/7th Street

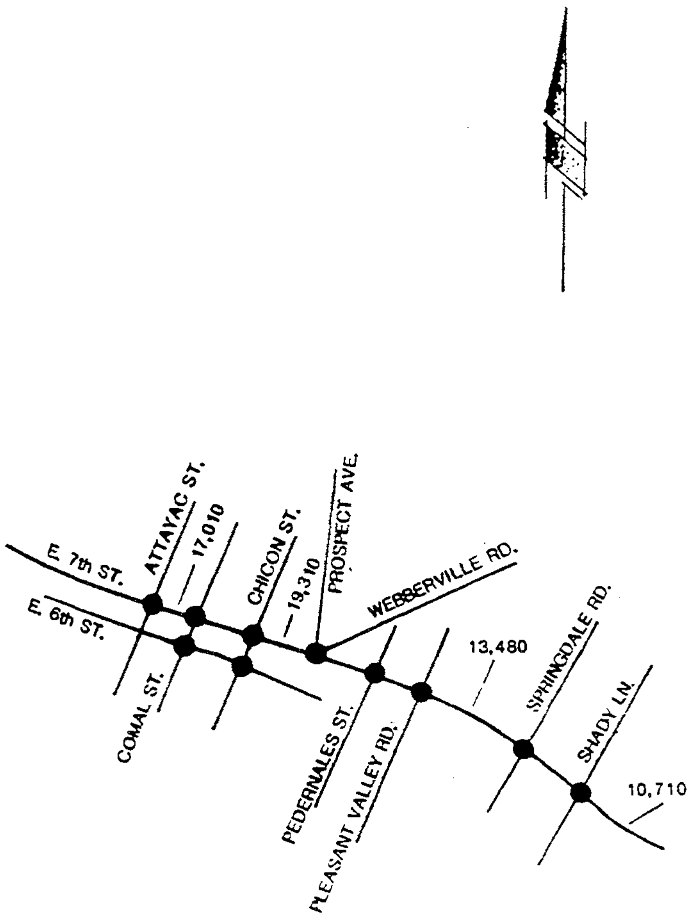
The City of Austin Department of Public Works and Transportation worked on the following project. East 6th/7th Street system is a 66 foot arterial street. It is an important east-west route for residential and commercial traffic to and from the Central Business District. East 7th Street is a four-lane roadway with left turn bays at the signalized intersections. There are ten (10) signalized intersections included in this project. The attached figure shows the project network, cross streets, and average daily traffic volumes.

All traffic signal controllers in this system are Type 170. These controllers were installed as part of the central traffic computer control system project. All controllers are coordinated by time-base which is refreshed by the central computer system. These controllers are capable of actuated-coordinated control, special functions, and changes can easily be made from the central office. All controllers were pretimed. Seven of ten intersections were upgraded to actuated-coordinated control as part of this project.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Timing plans were developed using PASSER II-90. Upon selection of optimum timing plans, proposed green time for each intersection and a timing plan was evaluated with respect to the required minimum pedestrian time. Pedestrian signal actuation equipment (push buttons) was installed as part of this project. Travel time information was obtained by the floating car technique. Six runs were made on each link in each time period (AM, OFF, and PM), and the mean travel times were determined. The optimum cycle lengths used for the after conditions for the AM, OFF, and PM peak periods were 60, 75, and 65 seconds, respectively.

Based on the PASSER II-90 simulation, the project resulted in an estimated $250,381 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 1,955,400 stops (a 5.8 percent reduction), a total annual fuel savings of 44,055 gallons (a 6 percent reduction), and an annual delay savings of 17,895 veh-hrs (a 13.8 percent reduction). The total cost of the project was $25,804, and the resultant benefit to cost ratio was 10 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	10330	8663	40	29.2	237.4	211.9
	OFF	9188	9075	36.4	31.7	202.1	193.3
	PM	13306	11721	50.3	46.2	285.2	263.9
DIFFERENCES	AM		1667		10.8		25.5
	OFF		113		4.7		8.8
	PM		1585		4.1		21.3
HRS/DAY	AM		1.5		1.5		1.5
	OFF		7.5		7.5		7.5
	PM		2		2		2
DAILY TOTALS	AM		2501		16.2		38.25
	OFF		848		35.25		66
	PM		3170		8.2		42.6
	TOTAL		6518		59.65		146.85
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$27,376		$178,950		$44,055
PROJECT COST:			$25,803.68	TOTAL ANNUAL SAVINGS:			$250,381
BENEFIT/COST RATIO:			10				



E. 7th ST.
E. 6th ST.
ATTAYAC ST.
17,010
CHICON ST.
19,310
PROSPECT AVE.
WEBBERVILLE RD.
13,480
SPRINGDALE RD.
SHADY LN.
10,710
COMAL ST.
PEDERNALES ST.
PLEASANT VALLEY RD.

East Riverside Drive

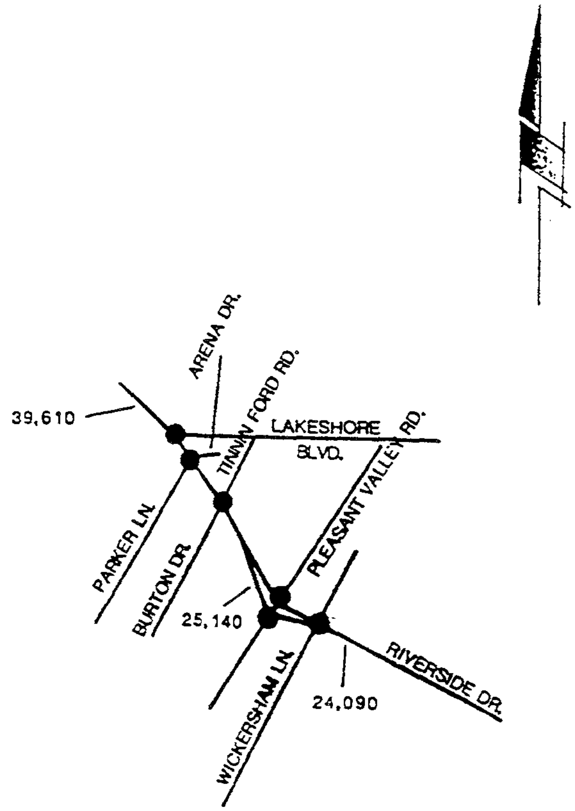
The City of Austin Department of Public Works and Transportation worked on the following project. East Riverside Drive is a 60 foot arterial street and is a major route to and from IH 35 for residents and traffic originating east of Austin, such as the former Bergstrom Air Force Base. It is a six-lane roadway with left turn bays at the signalized intersections. The intersection at Pleasant Valley Road is a diamond interchange. The University of Texas and industries like IBM Corp., Texas Instruments, Lockheed, and Motorola/Tracor are major traffic generators. The attached figure shows the project network, cross streets, and average daily traffic volumes.

A total of six signals were included in this project. All traffic signal controllers in this system are Type-170. These controllers were installed as part of the central traffic computer control system project. All controllers are controlled by time-base which is refreshed by the central computer system. These controllers are capable of actuated-coordinated control, special functions, and changes can easily be made from the central office. All controllers were pretimed. Four of the six intersections were upgraded to actuated-coordinated control as a part of this project.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Timing plans were developed using PASSER II-90. Field data was compared to the timing plans simulated by PASSER-II-90, and input data was appropriately adjusted until it was in close agreement. Travel time information was obtained by the floating car technique. A minimum of six runs were made on each link in each time period (AM, OFF, and PM), and the mean travel times and delays were determined. The optimum cycle lengths used for after conditions for the AM, OFF, and PM peak periods were 60, 60, and 80 seconds, respectively.

Based on the PASSER II-90 simulation, the project resulted in an estimated $260,712 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 1,819,050 stops (a 6.8 percent reduction), a total annual fuel savings of 35,625 gallons (a 5.6 percent reduction), and an annual delay savings of 19,962 veh-hrs (a 15 percent reduction). The total cost of the project was $27,187, and the resultant benefit to cost ratio was 10 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	7541	8089	37.02	32.7	177.02	178.26
	OFF	7833	7037	38.3	30.3	184.92	170.22
	PM	10264	9471	55.7	57.1	243.83	236.51
DIFFERENCES	AM		-548		4.32		-1.24
	OFF		796		8		14.7
	PM		793		-1.4		7.32
HRS/DAY	AM		2		2		2
	OFF		7.5		7.5		7.5
	PM		1.5		1.5		1.5
DAILY TOTALS	AM		-1096		8.64		-2.48
	OFF		5970		60		110.25
	PM		1190		-2.1		10.98
	TOTAL		6064		66.54		118.75
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$25,467		$199,620		$35,625
PROJECT COST:			$27,187.40	TOTAL ANNUAL SAVINGS:			$260,712
BENEFIT/COST RATIO:			10				


ARENA DR.
TINNIN FORD RD.
LAKESHORE
BLVD.
PLEASANT VALLEY RD.
39,610
PARKER LN.
BURTON DR.
25,140
WICKERSHAM LN.
24,090
RIVERSIDE DR.

Enfield/15th

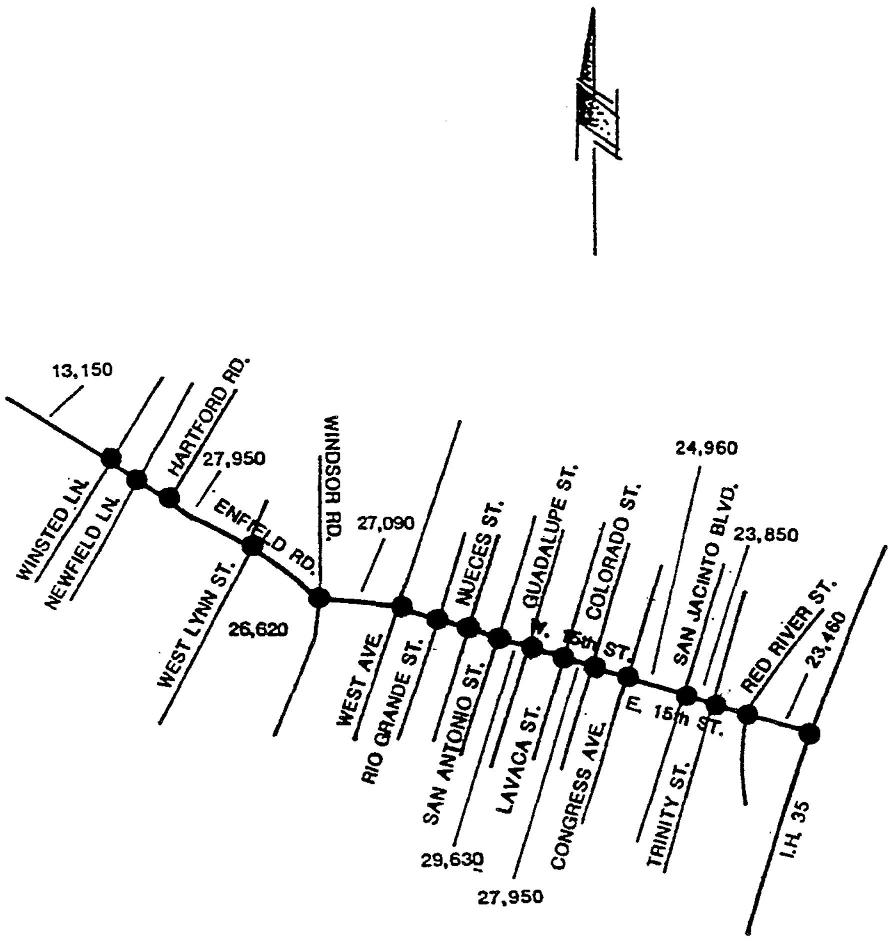
The City of Austin Department of Public Works and Transportation worked on the following project. The Enfield/15th Street system is an arterial street that is a major east-west route between IH35 and Loop 1 in the downtown area. Enfield Road is a 40 foot roadway with two travel lanes in each direction. Fifteenth Street has three travel lanes in each direction with a raised median. Left turn bays are available at each signalized intersection. Major congestion points exist at the approaches to Loop 1 and to IH 35. Other congestion points include Lavaca Street, Guadalupe Street, and San Jacinto Blvd. The attached figure shows the project network, cross streets, and average daily traffic volumes.

A total of 18 signals were included in this project. All traffic signal controllers in this system are Type-170. These controllers were installed as part of the central traffic computer control system project. All controllers are controlled by time-base which is refreshed by the central computer system. These controllers are capable of actuated-coordinated control, special functions, and changes can easily be made from the central office. All controllers were pretimed. Nine of the eighteen intersections were upgraded to actuated-coordinated control as a part of this project.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Timing plans were developed using PASSER II-90. Field data was compared to the timing plans simulated by PASSER II-90, and input data was appropriately adjusted until it was in close agreement. Travel time information was obtained by the test car technique. A minimum of six runs were made on each link in each time period (AM, OFF, and PM), and the mean travel times and delays were determined. The optimum cycle lengths used for after conditions for the AM, OFF, and PM peak periods were 90, 75, and 90 seconds, respectively.

Based on the PASSER II-90 simulation, the project resulted in an estimated $7,155,875 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 28,865,700 stops (a 11.4 percent reduction), a total annual fuel savings of 613,305 gallons (a 13.5 percent reduction), and an annual delay savings of 613,845 veh-hrs (a 26.6 percent reduction). The total cost of the project was $37,214, and the resultant benefit to cost ratio was 192 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	70361	59583	1349.4	639.8	1750.5	1168.8
	OFF	41190	36790	233.3	218.7	647	611.9
	PM	82934	73566	1437.4	928.9	1912.6	1482.4
DIFFERENCES	AM		10778		709.6		581.7
	OFF		4400		14.6		35.1
	PM		9368		508.5		430.2
HRS/DAY	AM		1.5		1.5		1.5
	OFF		15		15		15
	PM		1.5		1.5		1.5
DAILY TOTALS	AM		16167		1064.4		872.55
	OFF		66000		219		526.5
	PM		14052		762.75		645.3
	TOTAL		96219		2046.15		2044.35
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$404,120		$6,138,450		$613,305
PROJECT COST:			$37,214.12	TOTAL ANNUAL SAVINGS:			$7,155,875
BENEFIT/COST RATIO:			192				


13,150
WINSTED LN.
NEWFIELD LN.
HARTFORD RD.
27,950
ENFIELD RD.
WEST LYNN ST.
26,620
WINDSOR RD.
27,090
WEST AVE.
RIO GRANDE ST.
NUECES ST.
SAN ANTONIO ST.
GUADALUPE ST.
W. 15th ST.
LAVACA ST.
COLORADO ST.
CONGRESS AVE.
29,630
27,950
24,960
SAN JACINTO BLVD.
23,850
E. 15th ST.
TRINITY ST.
RED RIVER ST.
23,460
I.H. 35

Far South Austin

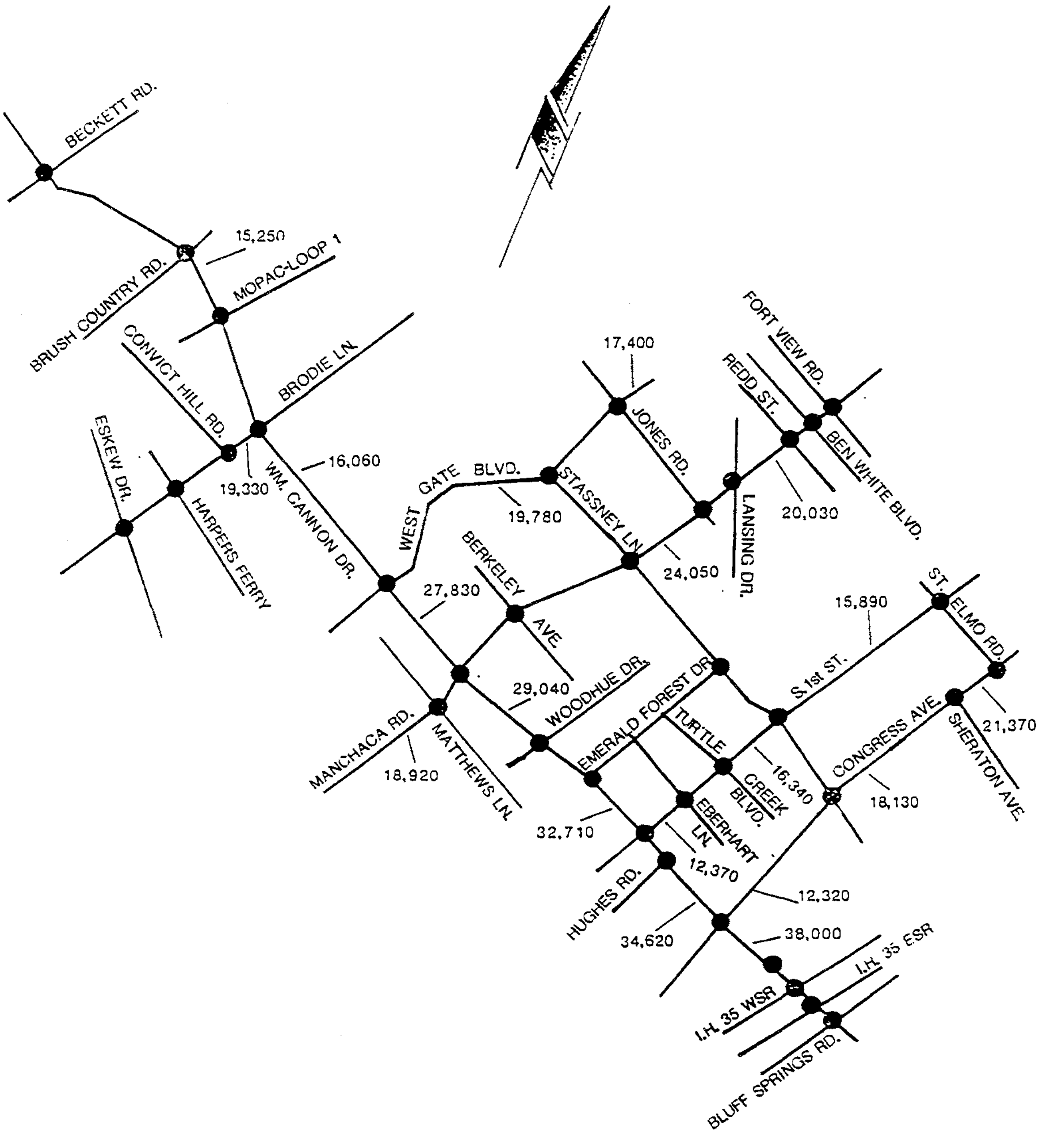
The City of Austin Department of Public Works and Transportation worked on the following project. There are several major work centers in Austin, not all of which are in the Central Business District. The State and Federal offices, The University of Austin, and industries, such as IBM Corp., Texas Instruments, Lockheed, and Motorala/Tracor generate traffic patterns that do not always direct traffic into and out of the CBD. The Far South Austin area consists of 36 intersections along intersecting arterial streets. The attached figure shows the project network, cross streets, and average daily traffic volumes.

The roadway geometrics of all 36 intersections vary from four to six lanes. All traffic signal controllers in this system are Type-170. These controllers were installed as part of the central traffic computer control system project. All controllers are controlled by time-base which is refreshed by the central computer system. These controllers are capable of actuated-coordinated control, special functions, and changes can easily be made from the central office. Pedestrian signal indications and push buttons as well as vehicle actuation hardware were installed as part of this project.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Timing plans were developed using PASSER II-90. Upon selection of optimum timing plans, proposed green time for each intersection and a timing plan was evaluated with respect to the required minimum pedestrian time. Pedestrian actuation equipment was provided at 18 intersections that were identified. Travel time information was obtained by the test car technique. A minimum of six runs were made on each link in each time period (AM, OFF, and PM), and the mean travel times were determined.

Based on the PASSER II-90 simulation, the project resulted in an estimated $73,892,234 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 67,608,150 stops (a 13.5 percent reduction), a total annual fuel savings of 3,793,770 gallons (a 23.7 percent reduction), and an annual delay savings of 6,915,195 veh-hrs (a 54.7 percent reduction). The total cost of the project was $104,916, and the resultant benefit to cost ratio was 704 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	166729	135252	3694.2	2002.7	4842.6	3880.7
	NOON	84099	77718	1988.1	672.5	2674.8	2008.2
	PM	188291	153559	5604.7	3031.8	6455	4885.7
DIFFERENCES	AM		31477		1691.5		961.9
	NOON		6381		1315.6		666.6
	PM		34732		2572.9		1569.3
HRS/DAY	AM		2.25		2.25		2.25
	NOON		9.25		9.25		9.25
	PM		2.75		2.75		2.75
DAILY TOTALS	AM		70823		3805.875		2164.275
	NOON		59024		12169.3		6166.05
	PM		95513		7075.475		4315.575
	TOTAL		225361		23050.65		12645.9
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$946,514		$69,151,950		$3,793,770
PROJECT COST:			$104,915.61	TOTAL ANNUAL SAVINGS:			$73,892,234
BENEFIT/COST RATIO:			704				


BECKETT RD.
15,250
BRUSH COUNTRY RD.
MOPAC-LOOP 1
CONVICT HILL RD.
BRODIE LN.
ESKEW DR.
HARPERS FERRY
19,330
16,060
WM. CANNON DR.
WEST GATE BLVD.
19,780
17,400
JONES RD.
STASSNEY LN.
REDD ST.
FORT VIEW RD.
BEN WHITE BLVD.
LANSING DR.
20,030
24,050
BERKELEY AVE
27,830
15,890
ST. ELMO RD.
S. 1st ST.
29,040
WOODHUE DR.
EMERALD FOREST DR.
TURTLE CREEK BLVD.
16,340
21,370
CONGRESS AVE.
SHERATON AVE
18,130
MANCHACA RD.
18,920
MATTHEWS LN.
32,710
EBERHART LN.
12,370
HUGHES RD.
12,320
34,620
38,000
I.H. 35 WSR
I.H. 35 ESR
BLUFF SPRINGS RD.

Far West Boulevard

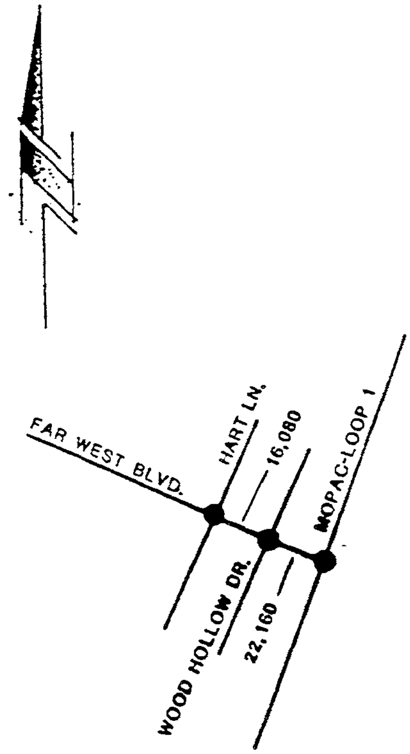
The City of Austin Department of Public Works and Transportation worked on the following project. There are several major work centers in Austin, not all of which are in the Central Business District. The State and Federal offices, The University of Austin, and industries, such as IBM Corp., Texas Instruments, Lockheed, and Motorala/Tracor generate traffic patterns that do not always direct traffic into and out of the CBD. The Far West Boulevard system is an 80 foot arterial street with a raised center median. It provides access to a large residential area in west Austin from Loop 1. The existing timing plans had not been updated in several years. The attached figure shows the project network, cross streets, and average daily traffic volumes.

The Far West Boulevard system consists of three intersections. All traffic signal controllers in this system are Type-170. These controllers were installed as part of the central traffic computer control system project. All controllers are controlled by time-base which is refreshed by the central computer system. These controllers are capable of actuated-coordinated control, special functions, and changes can easily be made from the central office. The controller at Loop 1 is pretimed at present. The remaining two intersections have semi-actuated/coordinated operation.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Timing plans were developed using PASSER II-90. Upon selection of optimum timing plans, proposed green time for each intersection and a timing plan was evaluated with respect to the required minimum pedestrian time. Pedestrian actuation equipment was provided at 18 intersections that were identified. Travel time information was obtained by the test car method. A minimum of six runs were made on each link in each time period (AM, OFF, and PM), and the mean travel times were determined.

Based on the PASSER II-90 simulation, the project resulted in an estimated $52,658 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 3,050,100 stops (a 13.2 percent reduction), a total annual fuel savings of 18,210 gallons (a 5.3 percent reduction), and an annual increase in delay of 825 veh-hrs (a 0.7 percent increase). The total cost of the project was $5,676, and the resultant benefit to cost ratio was 9 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	8488	6987	53.2	43	125.28	109.66
	OFF	6252	5518	28.9	29.6	93.15	88.88
	PM	8649	7444	39.7	46.1	128.56	125.94
DIFFERENCES	AM		1501		10.2		15.62
	OFF		734		-0.7		4.27
	PM		1205		-6.4		2.62
HRS/DAY	AM		1.5		1.5		1.5
	OFF		7.5		7.5		7.5
	PM		2		2		2
DAILY TOTALS	AM		2252		15.3		23.43
	OFF		5505		-5.25		32.025
	PM		2410		-12.8		5.24
	TOTAL		10167		-2.75		60.70
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$42,699		($8,250)		$18,209
PROJECT COST:			$5,676.13	TOTAL ANNUAL SAVINGS:			$52,658
BENEFIT/COST RATIO:			9				


FAR WEST BLVD.
HART LN.
16,080
MOPAC-LOOP 1
WOOD HOLLOW DR.
22,160

IH 35/US 290

The City of Austin Department of Public Works and Transportation worked on the following project. The IH 35/US 290 system is a split-diamond interchange which is a major access to Highland Mall and other adjacent shopping areas. IH 35/US 290 is a three-lane interchange. The inside lane is a left turn lane while the center lane is an option straight/left on all approaches. Major congestion points exist at the northbound and westbound approaches to the interchange. There are four signals included in this system. The attached figure shows the project network, cross streets, and average daily traffic volumes.

All traffic signal controllers in this system are NEMA (KMT-4000). All controllers are coordinated by time-base which is field-checked periodically. All controllers are pretimed. All signals have pedestrian controls and were operated on a two phase mode.

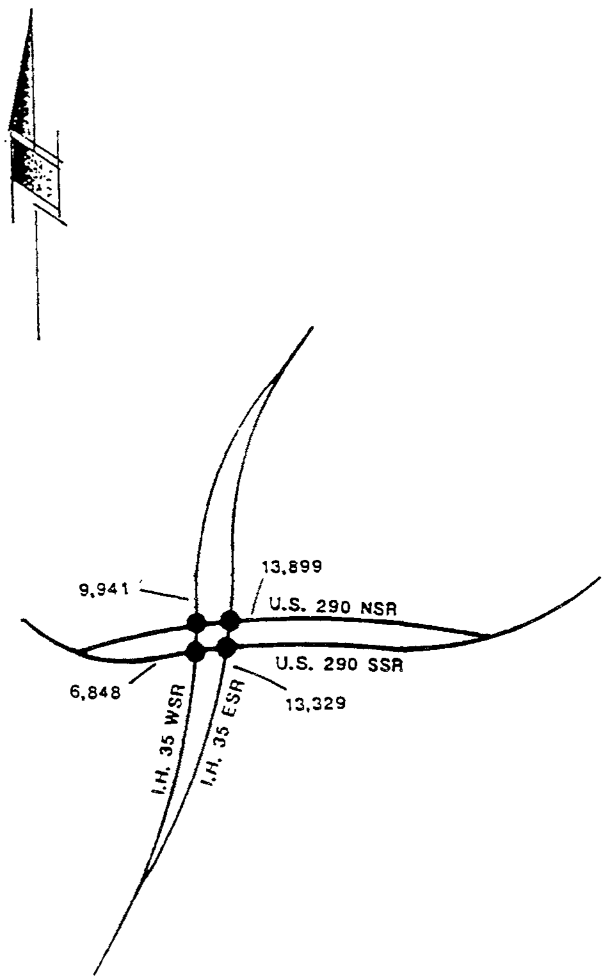
In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Timing plans were developed using TRANSYT-7F. Upon selection of optimum timing plans, proposed green time for each intersection and a timing plan was evaluated with respect to the required minimum pedestrian time. Pedestrian signal actuation equipment (push buttons) was installed at each intersection. Travel time information was obtained by the floating car technique. Six runs were made on each link in each time period (AM, OFF, and PM), and the mean travel times were determined. The optimum cycle length used for the after conditions for the AM, OFF, and PM peak periods was 55 seconds.

Based on the TRANSYT-7F simulation, the project resulted in an estimated $920,644 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 5,333,850 stops (a 20 percent reduction), a total annual fuel savings of 191,220 gallons (a 35.7 percent reduction), and an annual delay savings of 65,475 veh-hrs (a 36.6 percent reduction). The total cost of the project was $7,918, and the resultant benefit to cost ratio was 116 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	4939	3335	33.2	16	99.9	56.6
	OFF	6509	5207	41.6	27.8	129.6	84.2
	PM	7486	6786	59	38.6	157.4	108.4
DIFFERENCES	AM		1604		17.2		43.3
	OFF		1302		13.8		45.4
	PM		700		20.4		49
HRS/DAY	AM		3		3		3
	OFF		8.75		8.75		8.75
	PM		2.25		2.25		2.25
DAILY TOTALS	AM		4812		51.60		129.90
	OFF		11393		120.75		397.25
	PM		1575		45.90		110.25
	TOTAL		17780		218.25		637.40
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$74,674		$654,750		$191,220

PROJECT COST: $7,918.40 TOTAL ANNUAL SAVINGS: $920,644

BENEFIT/COST RATIO: 116


9,941
13,899
U.S. 290 NSR
U.S. 290 SSR
6,848
13,329
I.H. 35 WSR
I.H. 35 ESR

Jollyville Road

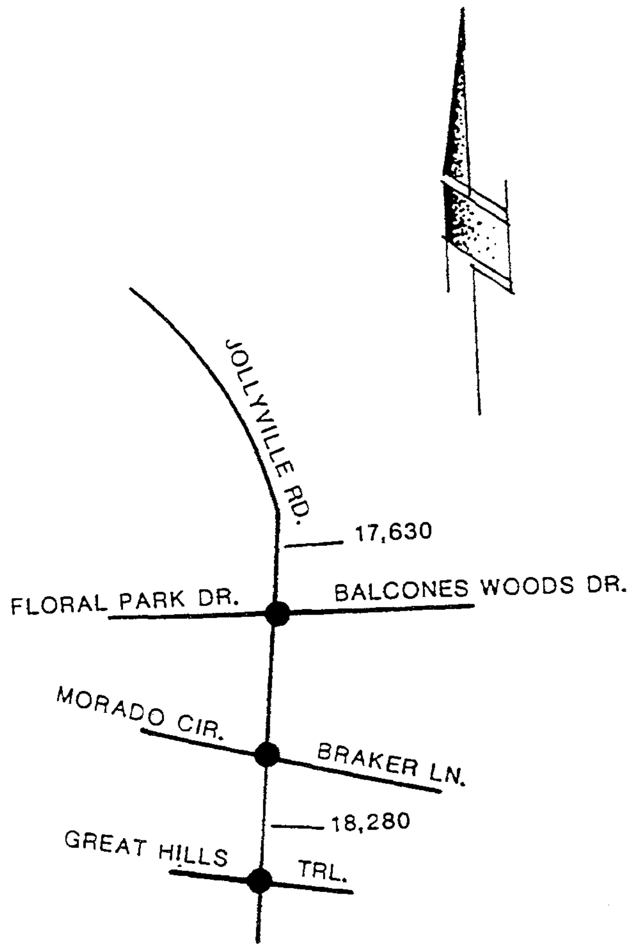
The City of Austin Department of Public Works and Transportation worked on the following project. The Jollyville Road system is a 60 foot arterial street parallel to US 183. It serves as an alternate route for traffic in the northwest area of the city. As US 183 is constructed into a freeway, Jollyville Road will become more widely used. It is a five lane roadway with a two-way left turn lane. The intersection at Great Hills Trail is a major congestion point, with one approach being the exit from the Arboretum shopping and office complex. The attached figure shows the project network, cross streets, and average daily traffic volumes.

The Jollyville Road system consists of three signals. Two of the traffic signal controllers are Type-170. The controller at Balcones Woods Drive and Jollyville Road was upgraded as a part of this project. All controllers are coordinated by time-base which is refreshed by the central computer system. These controllers are capable of actuated-coordinated control, special functions, and changes can easily be made from the central office. Two of the intersections are actuated and operate in an isolated mode during evening hours. The intersection at Balcones Woods is pre-timed and isolated during this same period. The phases of these signals range from a minimum of 3 to a maximum of 5. All the intersections contain pedestrian controls.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Timing plans were developed using PASSER II-90. Field data was compared to the timing plans simulated by PASSER-II-90, and input data was appropriately adjusted until it was in close agreement. Travel time information was obtained by the test car technique. A minimum of six runs were made on each link in each time period (AM, OFF, and PM), and the mean travel times and delays were determined. The optimum cycle lengths used for after conditions for the AM, OFF, and PM peak periods were 110, 75, and 90 seconds, respectively.

Based on the PASSER II-90 simulation, the project resulted in an estimated $1,770,017 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 3,809,100 stops (a 23.7 percent reduction), a total annual fuel savings of 110,490 gallons (a 27.2 percent reduction), and an annual delay savings of 160,620 veh-hrs (a 60.1 percent reduction). The total cost of the project was $15,581, and the resultant benefit to cost ratio was 114 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	16256	9406	368.4	91.6	472.84	239.58
	OFF	7752	7428	66.6	59.8	157.02	148.92
	PM	8792	7824	119.3	64.3	204.51	201.38
DIFFERENCES	AM		6850		276.8		233.26
	OFF		324		6.8		8.1
	PM		968		55		3.13
HRS/DAY	AM		1.5		1.5		1.5
	OFF		1.5		1.5		1.5
	PM		2		2		2
DAILY TOTALS	AM		10275		415.2		349.89
	OFF		486		10.2		12.15
	PM		1936		110		6.26
	TOTAL		12697		535.4		368.3
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$53,327		$1,606,200		$110,490
PROJECT COST:			$15,581.50	TOTAL ANNUAL SAVINGS:			$1,770,017
BENEFIT/COST RATIO:			114				


JOLLYVILLE RD.
17,630
FLORAL PARK DR.
BALCONES WOODS DR.
MORADO CIR.
BRAKER LN.
18,280
GREAT HILLS
TRL.

Northland Drive

The City of Austin Department of Public Works and Transportation worked on the following project. The Northland Drive system is a 60 foot arterial street and is a major route to and from Loop 1 for residents and traffic generating west of Austin. Northland Drive is also the western end of an east/west arterial along Koenig Lane between Loop 1 and IH 35. Northland Drive is a four-lane roadway with left turn bays at the signalized intersections. The attached figure shows the project network, cross streets, and average daily traffic volumes.

This project includes six signalized intersections along Northland Drive. All traffic signal controllers in this system are Type-170. These controllers were installed as part of the central traffic computer control system project. All controllers are controlled by time-base which is refreshed by the central computer system. These controllers are capable of actuated-coordinated control, special functions, and changes can easily be made from the central office. All controllers are pretimed at present with actuation of minor movements at four intersections.

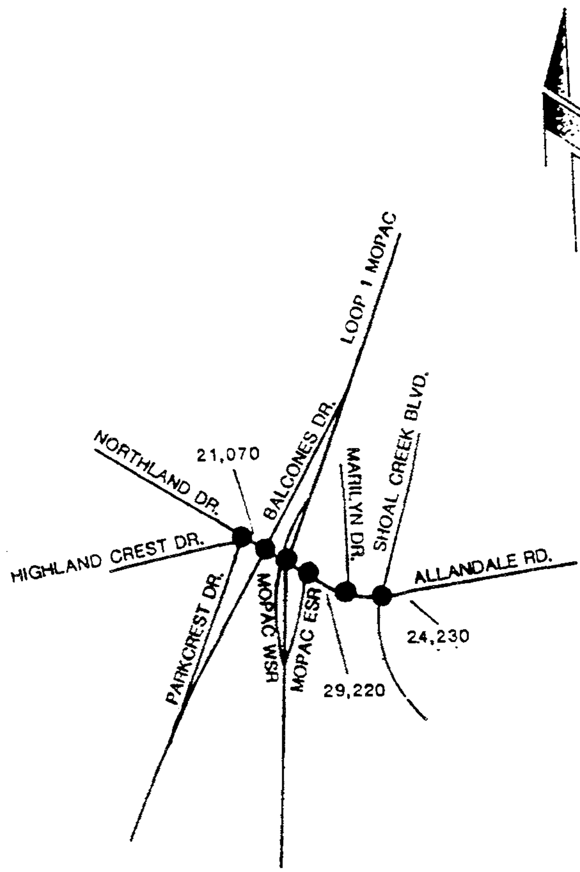
In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Timing plans were developed using PASSER II-90. Upon selection of optimum timing plans, proposed green time for each intersection and timing plan was evaluated with respect to the required minimum pedestrian time. Pedestrian actuation equipment and vehicle loop detectors were installed as a part of this project to further enhance the improvements made by improved signal timing plans. Travel time information was obtained by the floating car technique. Six runs were made on each link in each time period (AM, OFF, and PM), and the mean travel times were determined. The optimum cycle lengths used for the after conditions for the AM, OFF, and PM peak periods were 90, 80, and 90 seconds, respectively.

Based on the PASSER II-90 simulation, the project resulted in an estimated $7,877,508 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 26,239,200 stops (a 36.2 percent reduction), a total annual fuel savings of 660,711 gallons (a 45.7 percent reduction), and an annual delay savings of 684,945 veh-hrs (a 68.3 percent reduction). The total cost of the project was $18,010, and the resultant benefit to cost ratio was 437 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	24677	15438	431.2	129.1	556.16	277.88
	OFF	18385	12386	194.4	66.8	325.84	197.46
	PM	26816	15371	495.8	146.6	617.3	288.46
DIFFERENCES	AM		9239		302.1		278.28
	OFF		5999		127.6		128.38
	PM		11445		349.2		328.84
HRS/DAY	AM		1.5		1.5		1.5
	OFF		7.5		7.5		7.5
	PM		2.5		2.5		2.5
DAILY TOTALS	AM		13859		453.15		417.42
	OFF		44993		957		962.85
	PM		28613		873		822.1
	TOTAL		87464		2283.15		2202.37
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$367,347		$6,849,450		$660,711

PROJECT COST: $18,010.29 TOTAL ANNUAL SAVINGS: $7,877,508

BENEFIT/COST RATIO: 437


LOOP 1 MOPAC
NORTHLAND DR.
21,070
BALCONES DR.
MARILYN DR.
SHOAL CREEK BLVD.
HIGHLAND CREST DR.
ALLANDALE RD.
PARKCREST DR.
MOPAC WSR
MOPAC ESR
24,230
29,220

North Lamar/Koenig Lane

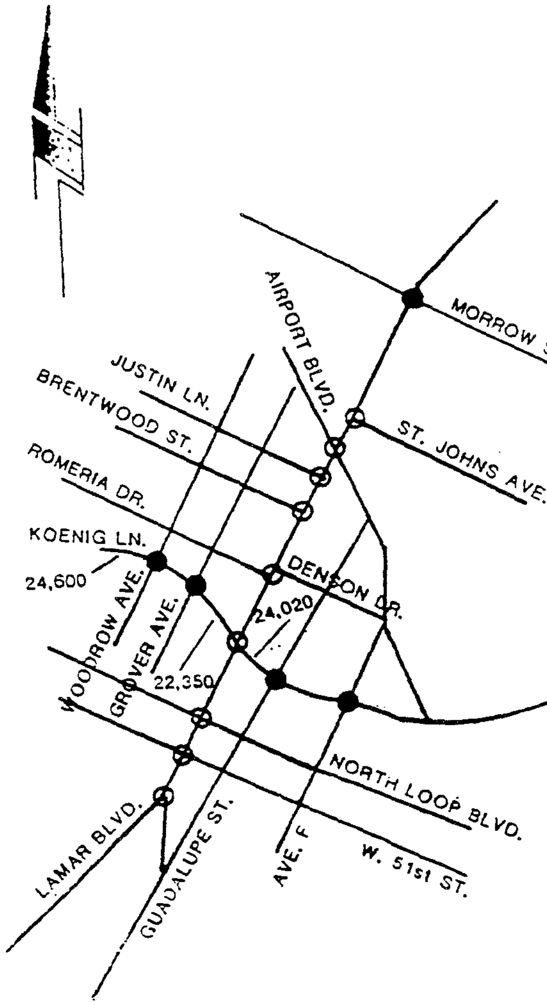
The City of Austin Department of Public Works and Transportation worked on the following project. North Lamar is a five-lane roadway. The center lane is a two-way left turn lane. Major congestion points exist along North Lamar at North Loop, Koenig Lane, Airport Boulevard and St. John's Avenue. Koenig Lane is a four-lane roadway that serves as part of an east-west route between Loop 1 and IH 35. Congestion is increased at each intersection because there are no left turn bays to accommodate traffic. The attached figure shows the project network, cross streets, and average daily traffic volumes.

A total of 14 signals were included in this project. All traffic signal controllers in this system are Type-170. These controllers were installed as part of the central traffic computer control system project. All controllers are controlled by time-base which is refreshed by the central computer system. These controllers are capable of actuated-coordinated control, special functions, and changes can easily be made from the central office. Pedestrian signal indications and push buttons as well as vehicle actuation hardware were installed at several intersections as part of this project.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Timing plans were developed using PASSER II-90. Upon selection of optimum timing plans, proposed green time for each intersection and a timing plan was evaluated with respect to the required minimum pedestrian time. Travel time information was obtained by the floating car technique. Six runs were made on each link in each time period (AM, OFF, and PM), and the mean travel times were determined. The optimum cycle lengths used for the after conditions for the AM, OFF, and PM peak periods were 100, 110, and 95 seconds, respectively.

Based on the PASSER II-90 simulation, the project resulted in an estimated $470,465 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 5,493,600 stops (a 4.1 percent reduction), a total annual fuel savings of 69,255 gallons (a 2.3 percent reduction), and an annual delay savings of 32,430 veh-hrs (a 2.6 percent reduction). The total cost of the project was $20,498, and the resultant benefit to cost ratio was 23 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	37440	34396	317.8	278.3	830.2	774.1
	OFF	38755	37791	362.7	355.6	884.8	874.2
	PM	50004	46746	469.8	472	1107.9	1074.3
DIFFERENCES	AM		3044		39.5		56.1
	OFF		964		7.1		10.6
	PM		3258		-2.2		33.6
HRS/DAY	AM		1.5		1.5		1.5
	OFF		7.5		7.5		7.5
	PM		2		2		2
DAILY TOTALS	AM		4566		59.25		84.15
	OFF		7230		53.25		79.5
	PM		6516		-4.4		67.2
	TOTAL		18312		108.1		230.85
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$76,910		$324,300		$69,255
PROJECT COST:			$20,497.56	TOTAL ANNUAL SAVINGS:			$470,465
BENEFIT/COST RATIO:			23				


MORROW ST.
AIRPORT BLVD.
ST. JOHNS AVE.
JUSTIN LN.
BRENTWOOD ST.
ROMERIA DR.
KOENIG LN.
24,600
DENSON DR.
WOODROW AVE.
GROVER AVE.
24,020
22,350
NORTH LOOP BLVD.
W. 51st ST.
AVE. F
GUADALUPE ST.
LAMAR BLVD.

N. Lamar/Rundberg/Rutland

The City of Austin Department of Public Works and Transportation worked on the following project. In recent years, Far North Lamar has experienced development of businesses and, therefore, an increase in the number of traffic signals. In addition, Rundberg Lane has become an east-west route to IH 35. Far North Lamar is five lanes from Thurmond to North Bend. Rutland is a four-lane divided roadway with left turn lanes at North Lamar. A major congestion point exists along Far North Lamar at Rundberg Lane. Since the TLS-I project was completed, geometric improvements have been completed on Rundberg Lane at IH 35. Eastbound and westbound right turn lanes have been constructed. In addition, Braker Lane was extended from Lamar Boulevard to IH 35. This provides two westbound through lanes and a left turn bay at Lamar Boulevard. Braker Lane is now a major east-west arterial from IH 35 to US 183. The attached figure shows the project network, cross streets, and average daily traffic volumes.

The Far North Lamar/Rundberg Lane/Rutland Drive system consists of 16 signals. All traffic signal controllers along North Lamar are Type-170. These controllers were installed as part of the central traffic computer control system project. All controllers are controlled by time-base which is refreshed by the central computer system. These controllers are capable of actuated-coordinated control, special functions, and changes can easily be made from the central office. The phases of these signals range from a minimum of two to a maximum of eight. All the intersections contain pedestrian controls. The signals on North Lamar at Peyton Gin, Rundberg Lane, Masterson Pass, North Meadows, and North Bend are actuated-coordinated.

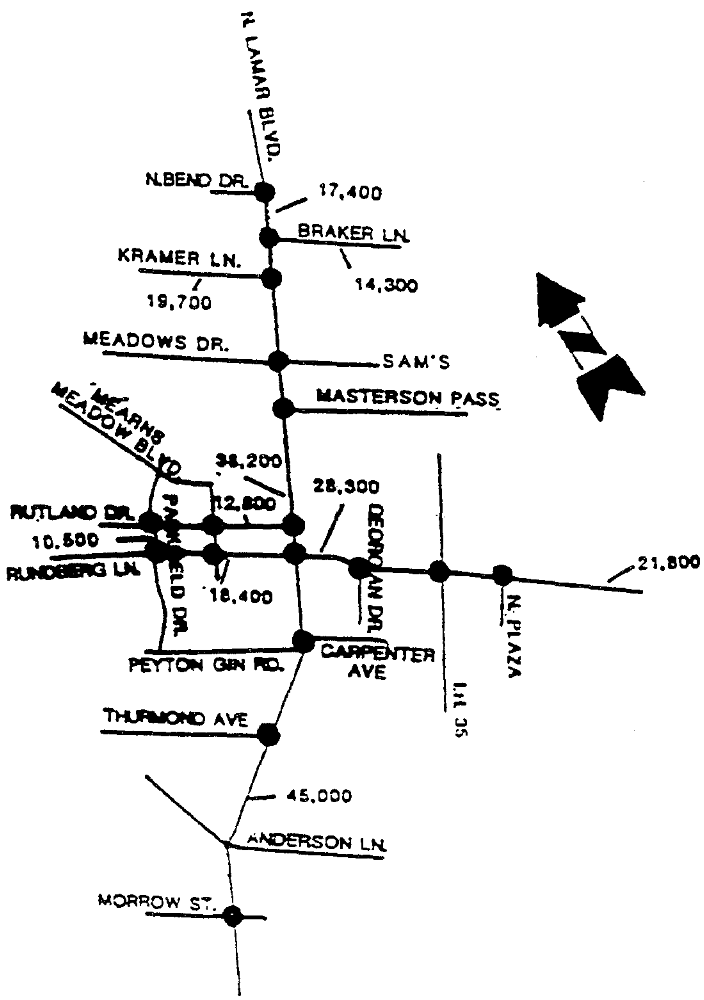
In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Timing plans were developed using PASSER II-90. Field data was compared to the timing plans simulated by PASSER II-90, and input data was appropriately adjusted until it was in close agreement. Travel time information was obtained by the test car technique. A minimum of six runs were made on each link in each time period (AM, OFF, and PM), and the mean travel times and delays were determined. The optimum cycle lengths used for after conditions for the AM, OFF, and PM peak periods were 110, 100, and 110 seconds, respectively.

Based on the PASSER II-90 simulation, the project resulted in an estimated $6,226,274 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 8,579,400 stops (a 4.4 percent reduction), a total annual fuel savings of 390,863 gallons (a 8.3 percent reduction), and an annual delay savings of 571,530 veh-hrs (a 25.5 percent reduction). The total cost of the project was $4,667, and the resultant benefit to cost ratio was 1334 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	56773	55778	764.3	381.2	1415.69	1347.8
	OFF	44077	41808	380.4	315.5	1007.1	936.03
	PM	65325	62688	1091.8	814.5	1749.23	1538.62
DIFFERENCES	AM		995		383.1		67.89
	OFF		2269		64.9		71.07
	PM		2637		277.3		210.61
HRS/DAY	AM		1.5		1.5		1.5
	OFF		8.75		8.75		8.75
	PM		2.75		2.75		2.75
DAILY TOTALS	AM		1493		574.65		101.835
	OFF		19854		567.875		621.8625
	PM		7252		762.575		579.1775
	TOTAL		28598		1905.1		1302.875
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$120,112		$5,715,300		$390,863

PROJECT COST: $4,667.46 TOTAL ANNUAL SAVINGS: $6,226,274

BENEFIT/COST RATIO: 1334


N. LAMAR BLVD.
N.BEND DR.
17,400
BRAKER LN.
KRAMER LN.
14,300
19,700
MEADOWS DR.
SAM'S
MASTERSON PASS
MEADOW BLVD.
38,200
28,300
RUTLAND DR.
12,800
10,500
RUNDBERG LN.
18,400
21,800
N. PLAZA
PEYTON GIN RD.
CARPENTER AVE
THURMOND AVE
45,000
ANDERSON LN.
MORROW ST.

Shoreline Blvd/Ocean Drive

The City of Corpus Christi Department of Public Works and Transportation worked on the following project. Corpus Christi's main attraction is the bayfront along which Shoreline Boulevard and Ocean Drive closely traverse. This arterial system is also used as a primary through travel route by commuters to and from the city's central business district. Shoreline Boulevard and Ocean Drive are also the location along which a majority of the city's special public events are held (such as Bayfest, Buccaneer Days), resulting in large volumes of unpredictable traffic demand for all hours of the day during the special events. The attached figure shows the project network, cross streets, and average daily traffic volumes.

A total of nine signalized intersections were included in this project. A tenth signalized intersection at Lawrence/Shoreline will be added to the system at the time of implemented project improvements. This arterial system consists of three (through) travel lanes per direction of travel. The intersecting signalized cross-streets are very contrasting, ranging from four-lane undivided two-way streets to two-lane undivided one-way streets. Congestion along Shoreline/Ocean is most pronounced during the early morning peak period (7:30-8:00 a.m.) and the early evening peak period (4:50-5:20 p.m.) in the inbound and outbound directions, respectively.

The previous system control was divided into two separate synchronized systems, one for the Shoreline Boulevard intersections between Peoples Street and Park Avenue, and the second for the Shoreline Boulevard and Ocean Drive intersections between Buford Street and Louisiana Parkway. The former consisted of pre-timed, solid-state controllers with three different time-of-day programs. The latter consisted of traffic-responsive, solid-state controllers utilizing the Dynamic Arterial Responsive Traffic System (DARTS) mode of coordination. All the nine intersections were included in the closed-loop system.

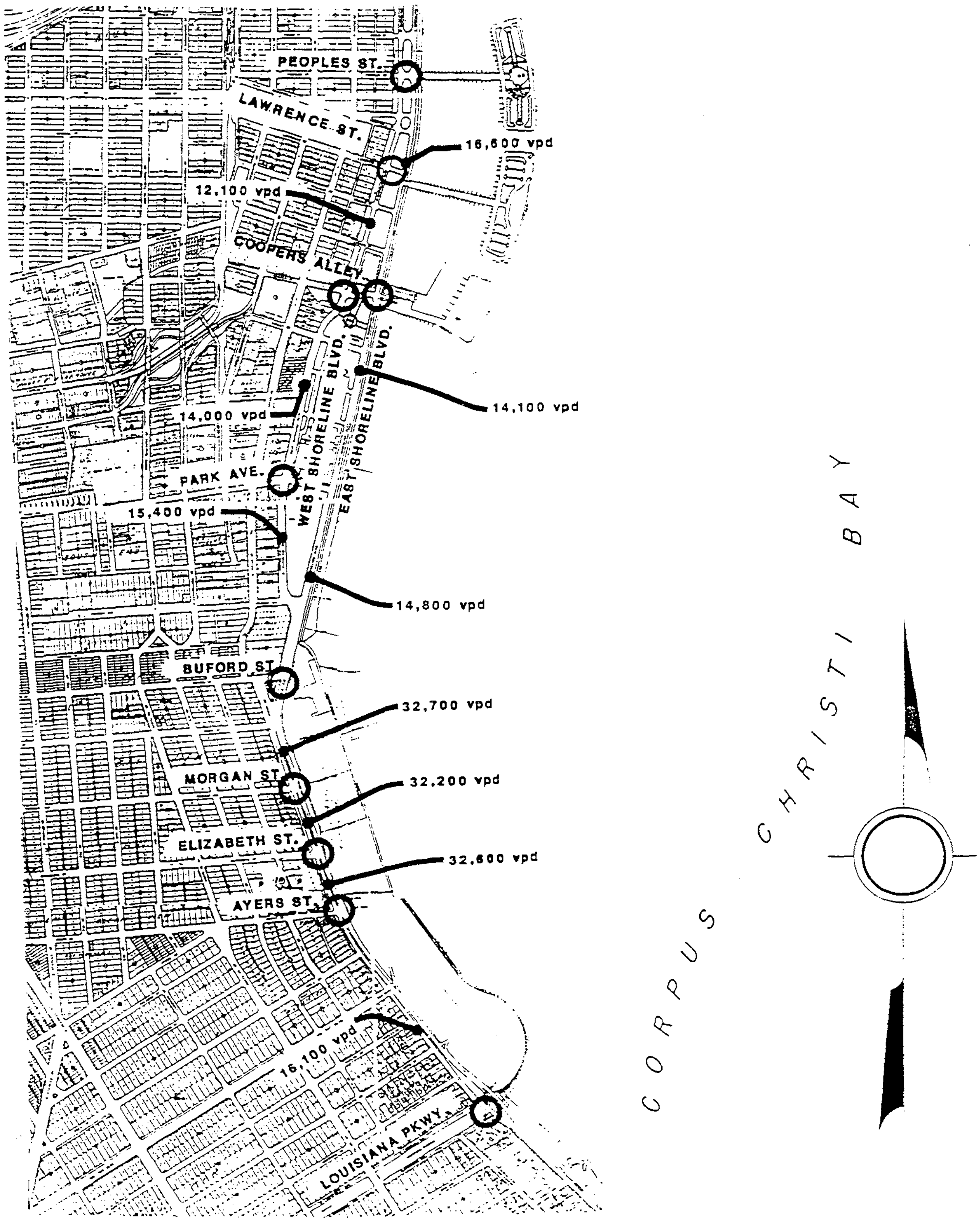
In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, travel delays, and an operating cost study. Timing plans were developed using PASSER II-90. Travel time information was obtained by the test car technique.

Based on the PASSER II-90 simulation, the project resulted in an estimated $3,975,771 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 9,387,750 stops (a 10.9 percent reduction), a total annual fuel savings of 261,300 gallons (a 15.6 percent reduction), and an annual delay savings of 358,304 veh-hrs (a 55.9 percent reduction). The total cost of the project was $199,619, and the resultant benefit to cost ratio was 20 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	18319	18312	192.8	67.2	383	336
	OFF	19380	17304	66.49	59.9	347	312
	PM	23510	19936	290.4	80.5	502	383
DIFFERENCES	AM		7		125.6		47
	OFF		2076		6.59		35
	PM		3574		209.9		119
HRS/DAY	AM		2		2		2
	OFF		7.75		7.75		7.75
	PM		4.25		4.25		4.25
DAILY TOTALS	AM		14		251.2		94
	OFF		16089		51.07		271.25
	PM		15190		892.08		505.75
	TOTAL		31293		1194.35		871
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$131,429		$3,583,042		$261,300

PROJECT COST: $199,619 TOTAL ANNUAL SAVINGS: $3,975,771

BENEFIT/COST RATIO: 20



PEOPLES ST.
LAWRENCE ST.
16,600 vpd
12,100 vpd
COOPERS ALLEY
WEST SHORELINE BLVD.
EAST SHORELINE BLVD.
14,000 vpd
14,100 vpd
PARK AVE.
15,400 vpd
14,800 vpd
BUFORD ST.
32,700 vpd
MORGAN ST.
32,200 vpd
ELIZABETH ST.
32,600 vpd
AYERS ST.
16,100 vpd
LOUISIANA PKWY.
CORPUS CHRISTI BAY

Central Business District

The City of Dallas Department of Public Works and Transportation worked on the following project. The system consists of 168 intersections including signalized, mid-block pedestrian crossings located throughout the Central Business District. The traffic control system is operated exclusively in a time-of-day mode, wherein traffic signal timing plans are selected and implemented based upon the current date and time. The attached figure shows the project network.

A total of 168 signals were included in this project. All traffic signals in this system are controlled by two traffic control systems. First, a centralized traffic control system that utilizes a modified version of the federal UTCS software package controls the existing Crouse Hinds SP40 solid state pre-timed units. In this system, the majority of the system intelligence is resident in a relatively large central processor which polls the remote controllers or controller interfaces to receive status data and to transmit command data in order to implement the system control strategies. This computer is a Perkin Elmer 3220, and the back-up computer is a Perkin Elmer 1610. The second system controls the new type 170 controllers. The City recently installed a "Quicnet" computer control system using existing computer communication cable to interconnect the upgraded Type 170 controllers. The control center for the system is located at City Hall and consists of the central computers.

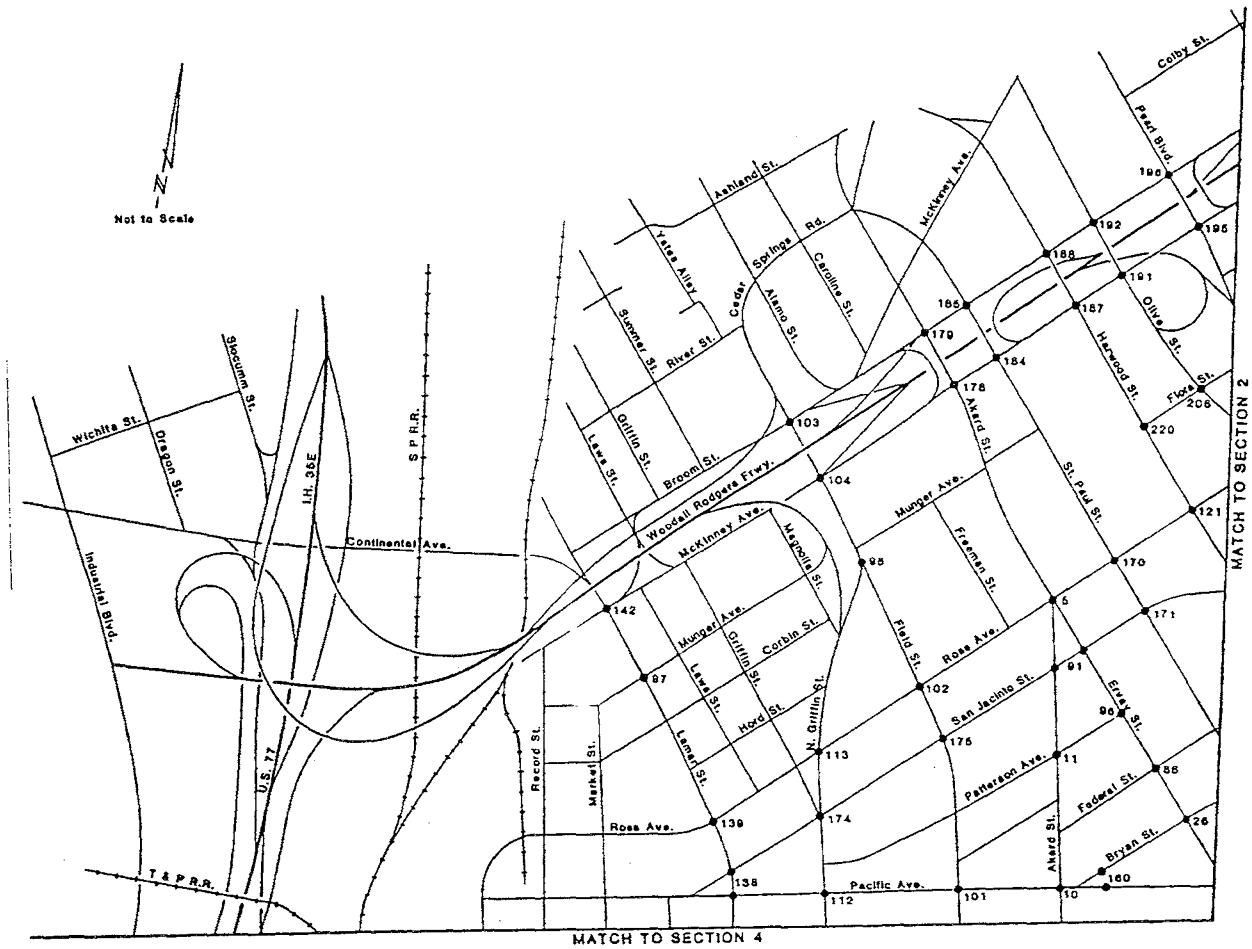
In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. TRANSYT-7F was used to develop optimum phasing, splits, and cycle lengths for each peak period. Travel time information was obtained by the floating car technique.

Based on the TRANSYT-7F simulation, the project resulted in an estimated $1,130,866 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual increase of 1,839,571 stops (a 0.5 percent increase), a total annual fuel savings of 47,640 gallons (a 0.8 percent reduction), and an annual delay savings of 110,898 veh-hrs (a 5.2 percent reduction). The total cost of the project was $583,356, and the resultant benefit to cost ratio was 2 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	138498	136750	921.79	867.46	2243.5	2215.8
	NOON	67970	69061	389.75	384.86	1169.9	1177
	PM	138851	139301	1031.34	920.4	2475.7	2395.6
DIFFERENCES	AM		1748		54.33		27.7
	NOON		-1091		4.89		-7.1
	PM		-450		110.94		80.1
HRS/DAY	AM		2		2		2
	NOON		8		8		8
	PM		2		2		2
DAILY TOTALS	AM		3496		108.66		55.4
	NOON		-8728		39.12		-56.8
	PM		-900		221.88		160.2
	TOTAL		-6132		369.66		158.8
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			($25,754)		$1,108,980		$47,640

PROJECT COST: $583,355.93 TOTAL ANNUAL SAVINGS: $1,130,866

BENEFIT/COST RATIO: 2


N
Not to Scale
Wichita St.
Oregon St.
Slocumm St.
I.H. 35E
S P R.R.
Continental Ave.
Industrial Blvd.
U.S. 77
T & P R.R.
Record St.
Market St.
Ross Ave.
Lamar St.
Lewis St.
Griffin St.
Summer St.
River St.
Yates Alley
Ashland St.
Cedar Springs Rd.
Alamo St.
Caroline St.
McKinney Ave.
Broom St.
Woodall Rodgers Frwy.
Magnolia St.
Munger Ave.
Corbin St.
Hord St.
N. Griffin St.
Field St.
San Jacinto St.
Patterson Ave.
Pacific Ave.
Akard St.
Freeman St.
St. Paul St.
Harwood St.
Olive St.
Flora St.
Pearl Blvd.
Colby St.
Ervay St.
Federal St.
Bryan St.
MATCH TO SECTION 2
MATCH TO SECTION 4
103
104
95
142
97
113
139
138
174
112
102
175
101
11
10
160
26
86
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171
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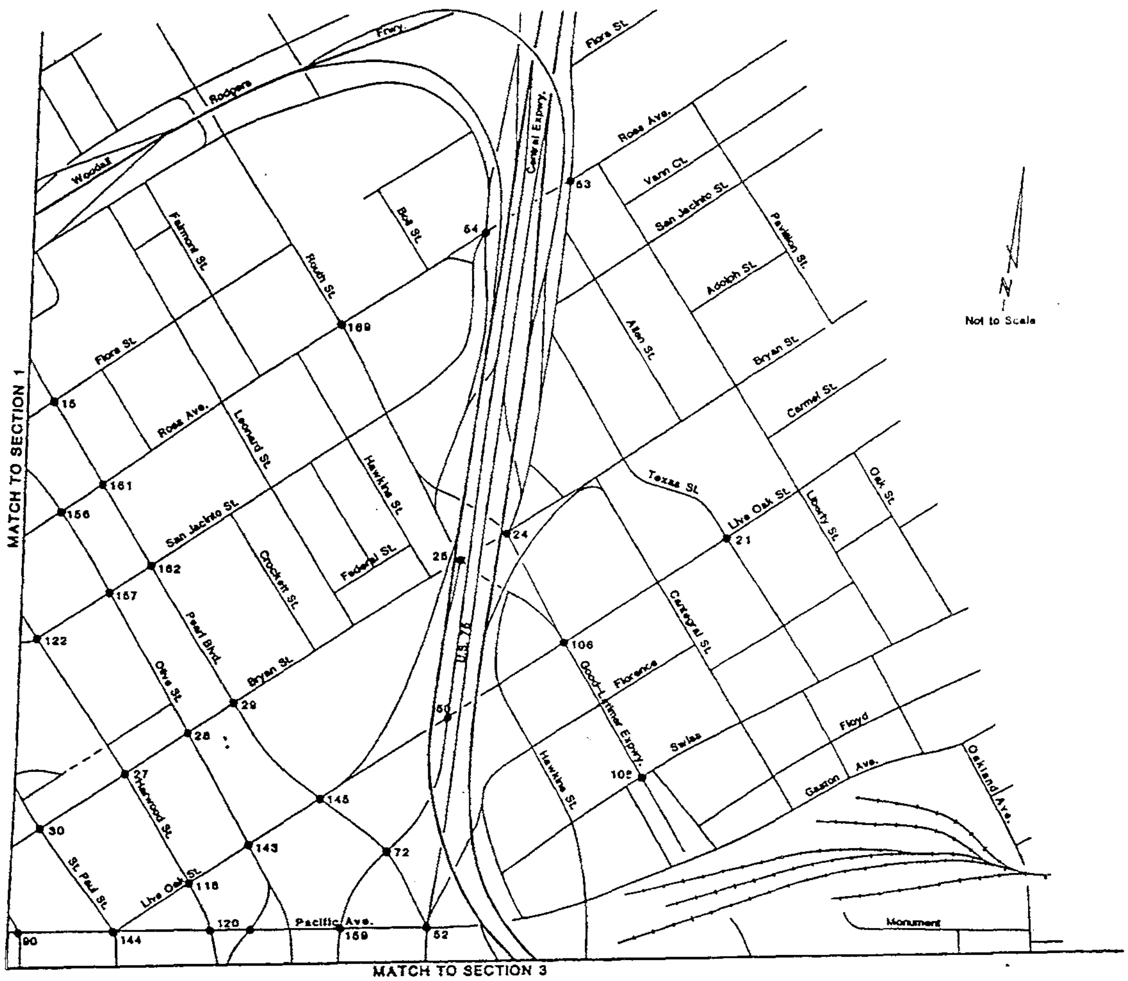
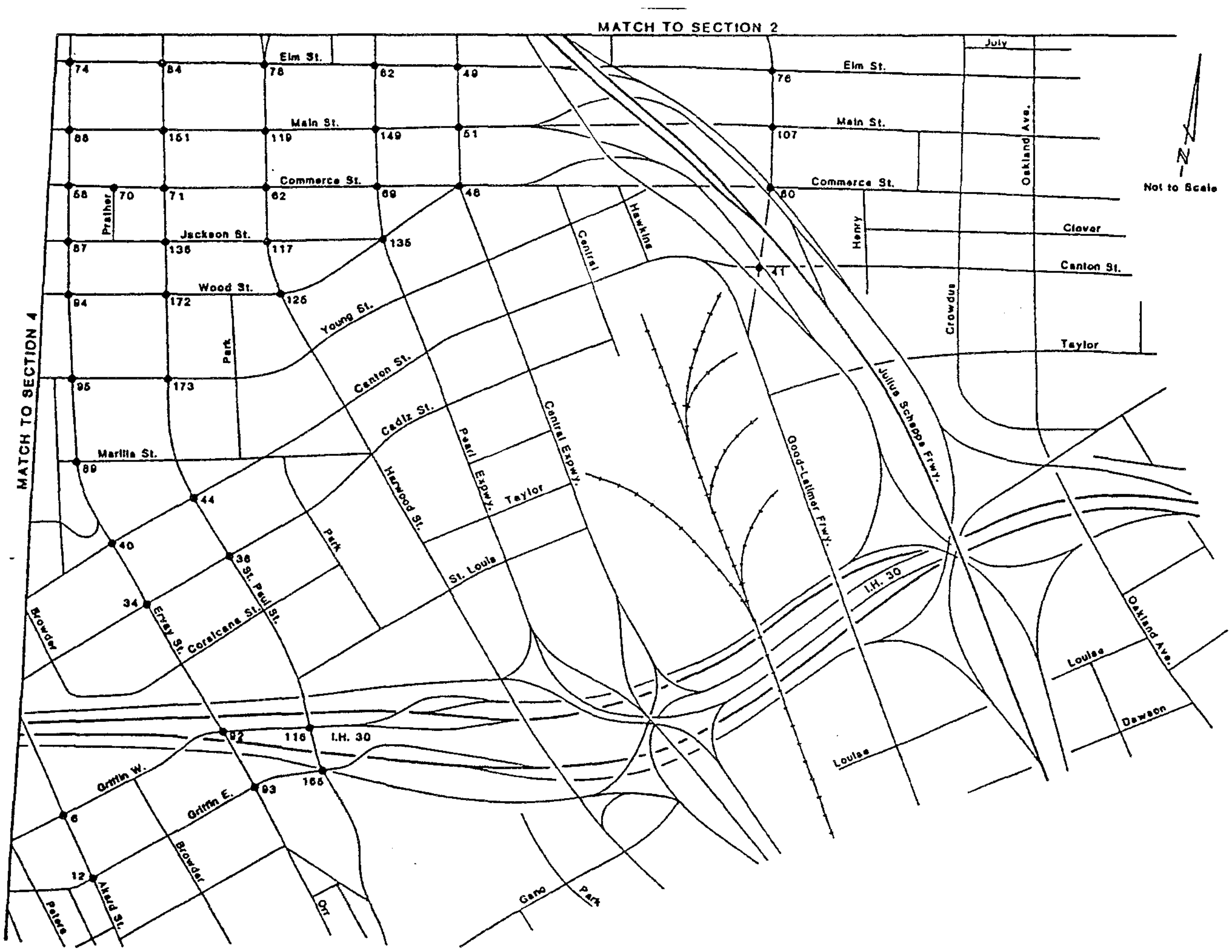
192
196
195
191
187


MATCH TO SECTION 1
MATCH TO SECTION 3
Not to Scale
N
Frwy.
Rodgers
Woodall
Fairmont St.
Routh St.
Boll St.
Central Expwy.
Flora St.
Ross Ave.
Vann Ct.
San Jacinto St.
Pavillion St.
Adolph St.
Allen St.
Bryan St.
Carmel St.
Texas St.
Live Oak St.
Liberty St.
Oak St.
Leonard St.
Hawkins St.
Crockett St.
Federal St.
Pearl Blvd.
Olive St.
Harwood St.
St. Paul St.
Pacific Ave.
U.S. 75
Cantegral St.
Florence
Good-Latimer Expwy.
Swiss
Floyd
Gaston Ave.
Oakland Ave.
Monument
15
161
156
162
157
122
29
28
27
30
145
143
118
72
120
159
52
90
144
169
54
53
24
25
21
106
50
105


MATCH TO SECTION 2
MATCH TO SECTION 4
Not to Scale
Elm St.
Main St.
Commerce St.
Jackson St.
Wood St.
Young St.
Canton St.
Cadiz St.
Marilla St.
Corsicana St.
St. Louis
Taylor
Clover
Canton St.
Julius Schepps Frwy.
Good-Latimer Frwy.
Central Expwy.
Pearl Expwy.
Harwood St.
St. Paul St.
Ervay St.
Griffin W.
Griffin E.
Akard St.
Browder
Peters
I.H. 30
Louise
Dawson
Oakland Ave.
Crowdus
Henry
Hawkins
Central
Prather
Park
Gano
Orr
July
74
84
78
82
49
76
88
151
119
149
51
107
68
70
71
62
69
46
60
87
136
117
135
41
94
172
126
95
173
89
44
40
38
34
92
116
166
93
6
12

MATCH TO SECTION 1
MATCH TO SECTION 3
Elm St.
Main St.
Commerce St.
Jackson St.
Wood St.
Young St.
Record St.
Rock Island St.
Reunion Blvd.
Industrial Blvd.
Stemmons Frwy.
Reunion West
Reunion East
Hotel St.
Houston St.
Market St.
Austin St.
Lamar St.
Griffin St.
Field St.
Akard St.
Browder
Lane
Marilla St.
Ceremonial
Sports St.
Sports Pl.
Memorial Dr.
I.H. 30
I.H. 35E
Houston St. Viaduct
Jefferson Blvd. Viaduct
Canton St.
Cadiz St.
Griffin St. W.
Griffin St. E.
Not to Scale

City of El Paso

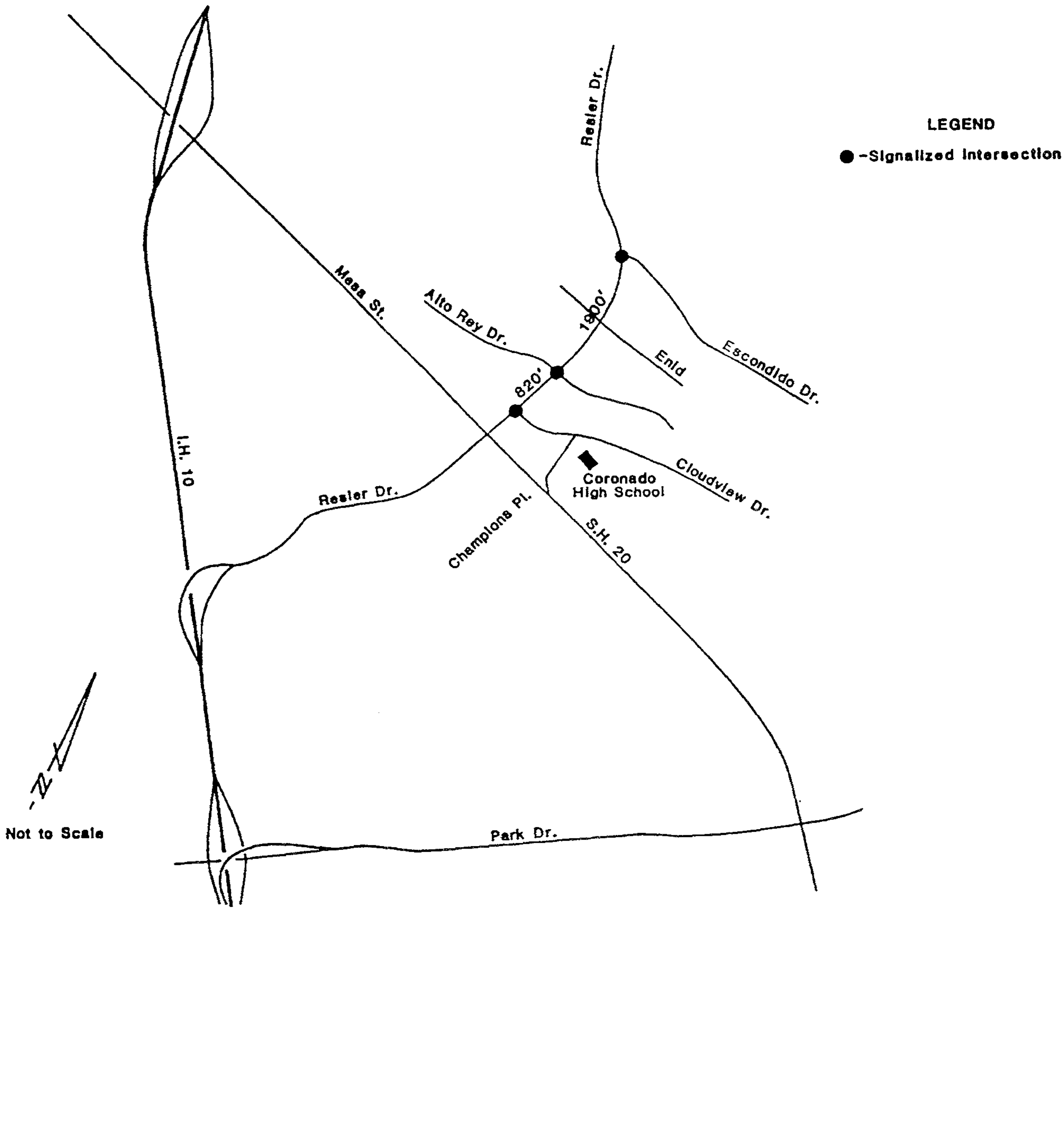
The City of El Paso Department of Public Works and Transportation worked on the following project. A total of sixteen signalized intersections in three subsystems along the arterials of Resler, Lomaland, and Zaragoza were included in the project. The Resler system is located in west El Paso and serves primarily as a residential collector-distributor. This system is approximately 0.50 miles in length and contains three signalized intersections. The Lomaland system is located in east El Paso and serves a variety of development centers. This system is approximately 2.10 miles in length and contains seven signalized intersections. The Zarazoga system is located in southeast El Paso and serves a variety of development centers. It also serves as one of the area's international border crossings with Mexico. This subsystem is approximately 1.50 miles in length and contains six signalized intersections. The attached figures display the project network, cross streets, and link distances.

In the Resler arterial, the intersections at Cloudview and at Alto Rey are TBC controlled. In the Zarazoga arterial, the intersections at Alameda and Harris are pretimed. All the other intersections in the network are actuated control type. The number of phases of the signals in the network ranged from two to eight. All the intersections have pedestrian controls. The intersections of Resler arterial at Cloudview and at Alto Rey are time-base coordinated. The intersections of the Lomaland arterial at Gateway East and at Gateway West are diamond interchanges. The intersection of the Zarazoga arterial at Roseway is railroad preempted. The Zarazoga/Smith intersection is synchronized with the North Loop intersection. All intersections, which were previously running full actuated, were coordinated within each subsystem through time-base coordination (TBC). Hardware interconnect was installed by a contractor in conduit along each arterial. City crews installed and set-up the new controllers as well as conducted inspections of the interconnect wire installations.

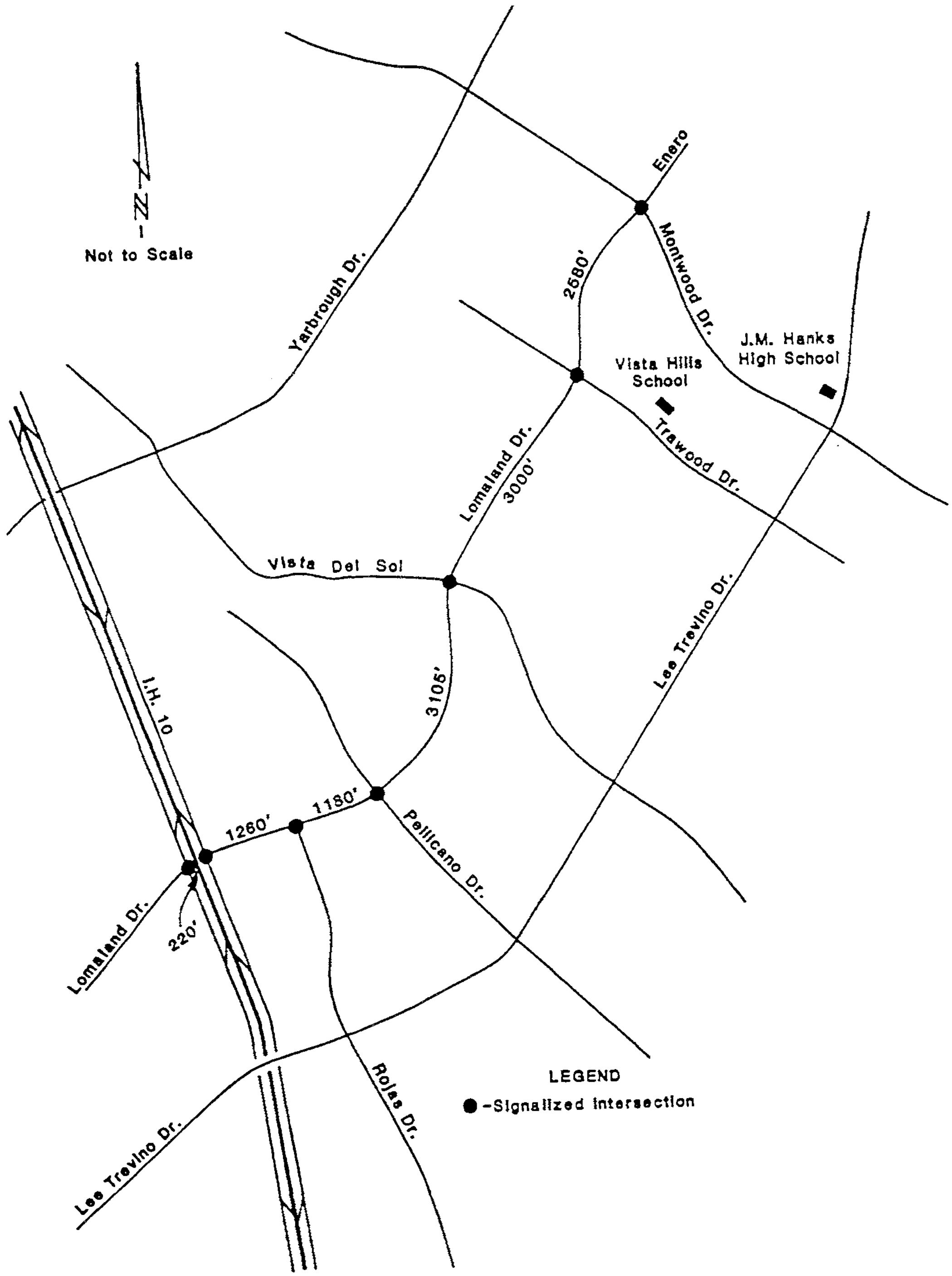
In order to evaluate the system performance, the before and after TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Travel time information was gathered using the floating car technique. Analysis of the before and after conditions, and determination of optimum cycle length was done by using the TRANSYT-7F model. A coupling analysis was done for each subsystem to estimate potential benefits of coordinating each intersection.

Based on TRANSYT-7F simulation, the project resulted in an estimated $5,577,363 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total savings of 10,433,250 stops (a 12.6 percent reduction), a total annual fuel savings of 724,792 gallons (a 19.5 percent reduction), and an annual delay savings of 470,650 veh-hrs (a 15 percent reduction). The total cost of the project was $235,747, and the resultant benefit to cost ratio was 24 to 1.

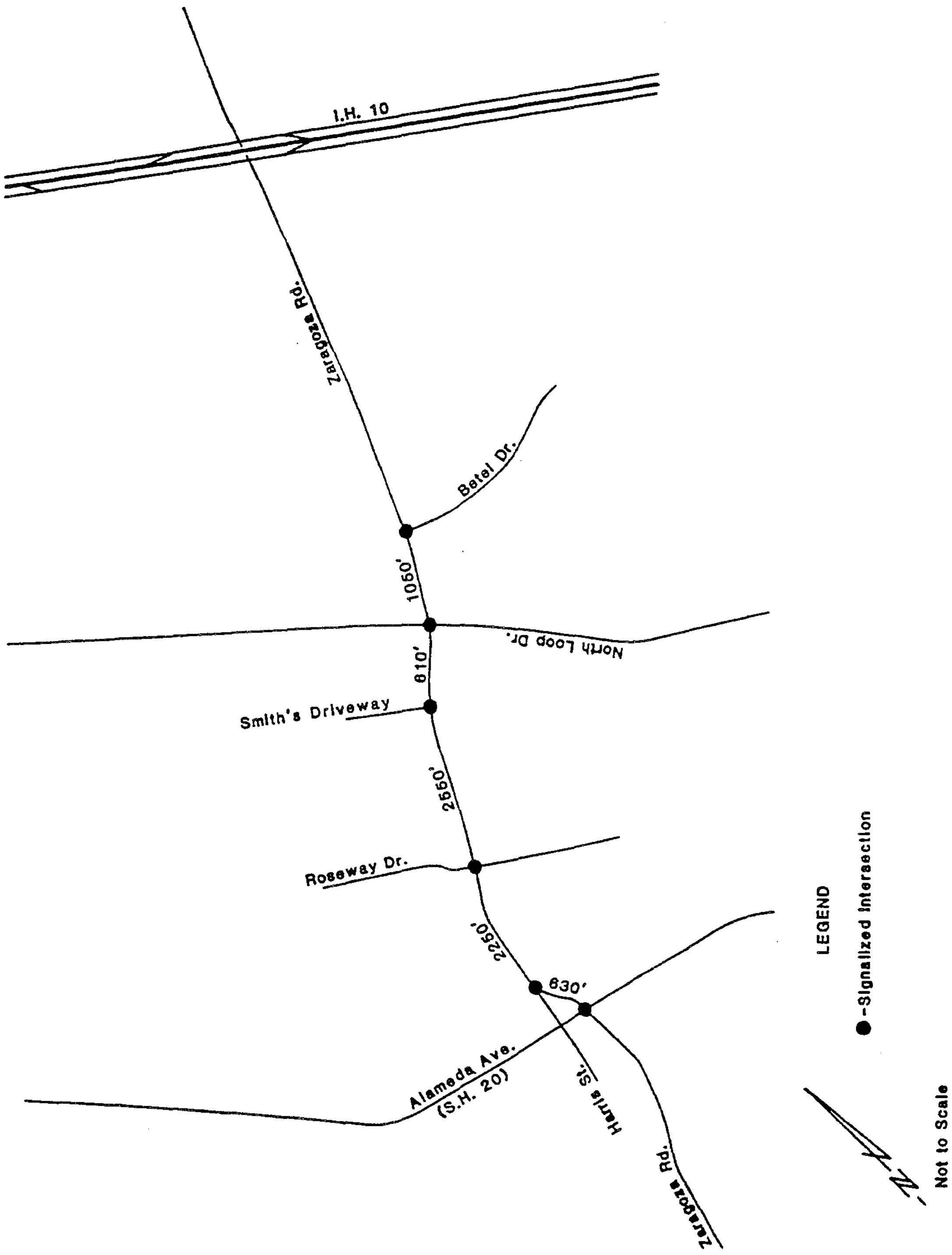
		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	30809	23568	1740.59	1597.84	1793.27	1649.5
	OFF	19928	17720	351.44	367.44	603.95	478.58
	PM	33605	30909	3112.48	2113.34	2859.83	2145.17
DIFFERENCES	AM		7241		142.75		143.77
	OFF		2208		-16		125.37
	PM		2696		999.14		714.66
HRS/DAY	AM		1.5		1.5		1.5
	OFF		9		9		9
	PM		1.5		1.5		1.5
DAILY TOTALS	AM		10862		214.125		215.655
	OFF		19872		-144		1128.33
	PM		4044		1498.71		1071.99
	TOTAL		34778		1568.835		2415.975
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$146,066		$4,706,505		$724,793
PROJECT COST:		$235,747.38		TOTAL ANNUAL SAVINGS:			$5,577,363
BENEFIT/COST RATIO:		24					



LEGEND
● -Signalized Intersection
Resler Dr.
Mesa St.
Alto Rey Dr.
1900'
Enid
Escondido Dr.
820'
Cloudview Dr.
Coronado High School
I.H. 10
Resler Dr.
Champions Pl.
S.H. 20
Not to Scale
Park Dr.



N
Not to Scale
Yarbrough Dr.
Enero
Montwood Dr.
2580'
J.M. Hanks
High School
Vista Hills
School
Trawood Dr.
Lomaland Dr.
3000'
Vista Del Sol
Lee Trevino Dr.
3105'
I.H. 10
1180'
1260'
Pellicano Dr.
Lomaland Dr.
220'
Rojas Dr.
Lee Trevino Dr.
LEGEND
● -Signalized Intersection


I.H. 10
Zaragoza Rd.
Betel Dr.
1050'
North Loop Dr.
610'
Smith's Driveway
2550'
Roseway Dr.
2250'
630'
Alameda Ave.
(S.H. 20)
Harris St.
Zaragoza Rd.
LEGEND
● -Signalized Intersection
N
Not to Scale

Jacksboro Highway

The City of Fort Worth Department of Public Works and Transportation worked on the following project. The Jacksboro Highway system was divided into MH 50 and all other intersections as a group. The MH 50 system was further broken down to two more subsystems, one along Forest Park Boulevard and the other along University Boulevard. The attached figure shows the project network, cross streets, and link distances.

A total of 15 signals were included in this project. All traffic signals in this system are controlled by a FACTS (Flexible Advanced Computer Traffic Signal) system. The FACTS system is a minicomputer based system developed for interconnected control of multi-phased signalized intersections with NEMA full-actuated and/or solid state pre-timed traffic signal controllers. It provides for flexible system operation with the capability to optimize progression, distribute traffic into cross streets and businesses along a route, and provide optimum time for all intersection movements. The system allows for traffic responsive operation, and utilizes detector inputs and predefined traffic pattern/plan sets to define appropriate cycle lengths, splits, offsets, and phase sequences.

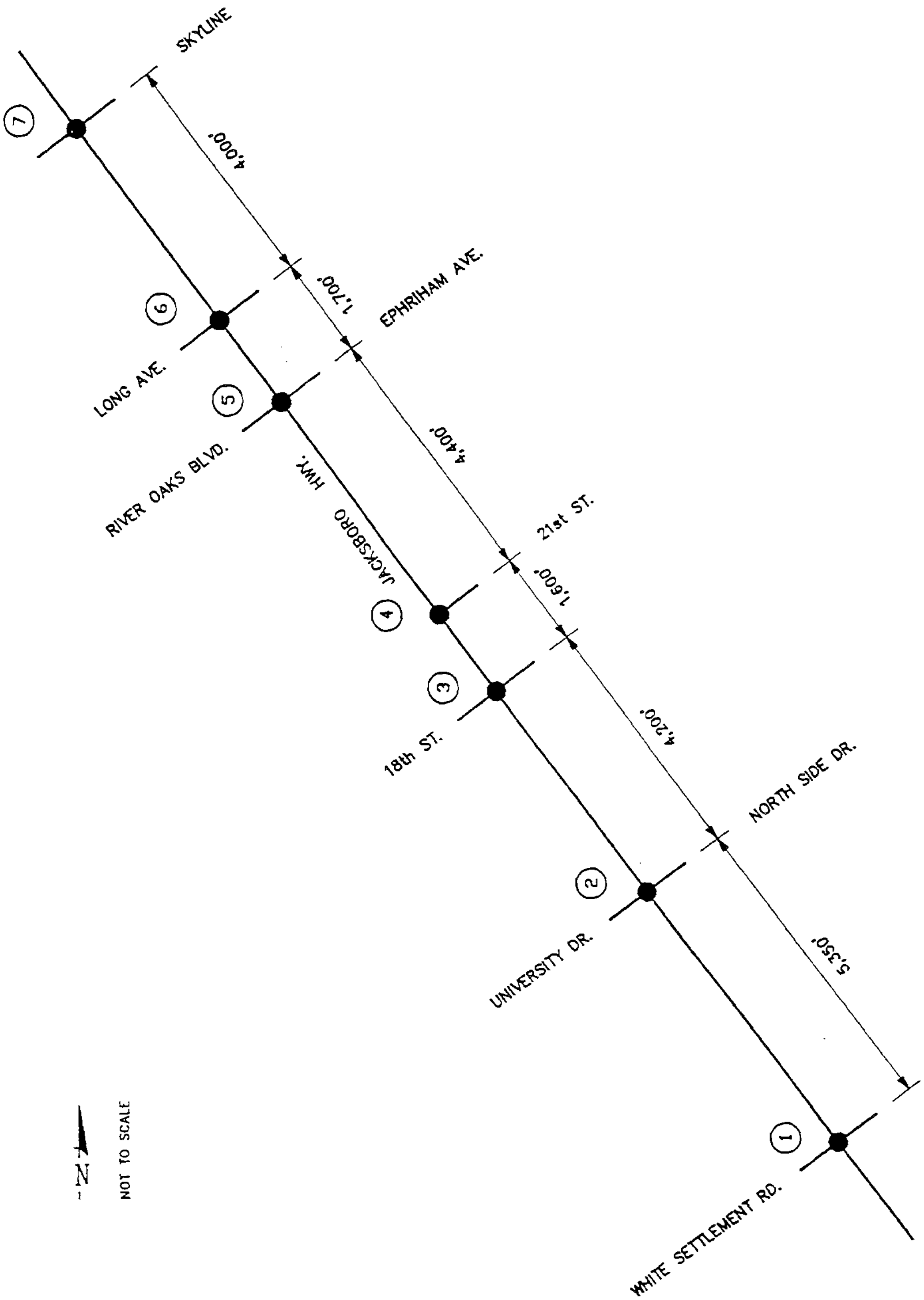
In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Timing plans were developed using PASSER-II, PASSER-III, and TRANSYT-7F. The Forest Park system includes a diamond interchange at IH 30. PASSER-III was used to develop optimum phasing, splits, and cycle lengths at the diamond interchange for each peak period. These timings were then coded into TRANSYT-7F and linked to other intersections along Forest Park. The existing phasing pattern was retained at the Rosedale intersection. The intersection of Vickery was rephased to eliminate the split phase on the cross street. TRANSYT-7F was then used to optimize the splits at Vickery and Rosedale and the offset between the intersections. Timing for the University system was developed using PASSER-II AND TRANSYT-7F. Travel time information was obtained by the floating car technique. Six runs were made on each link in each time period (AM, OFF, and PM), and the mean travel times were determined.

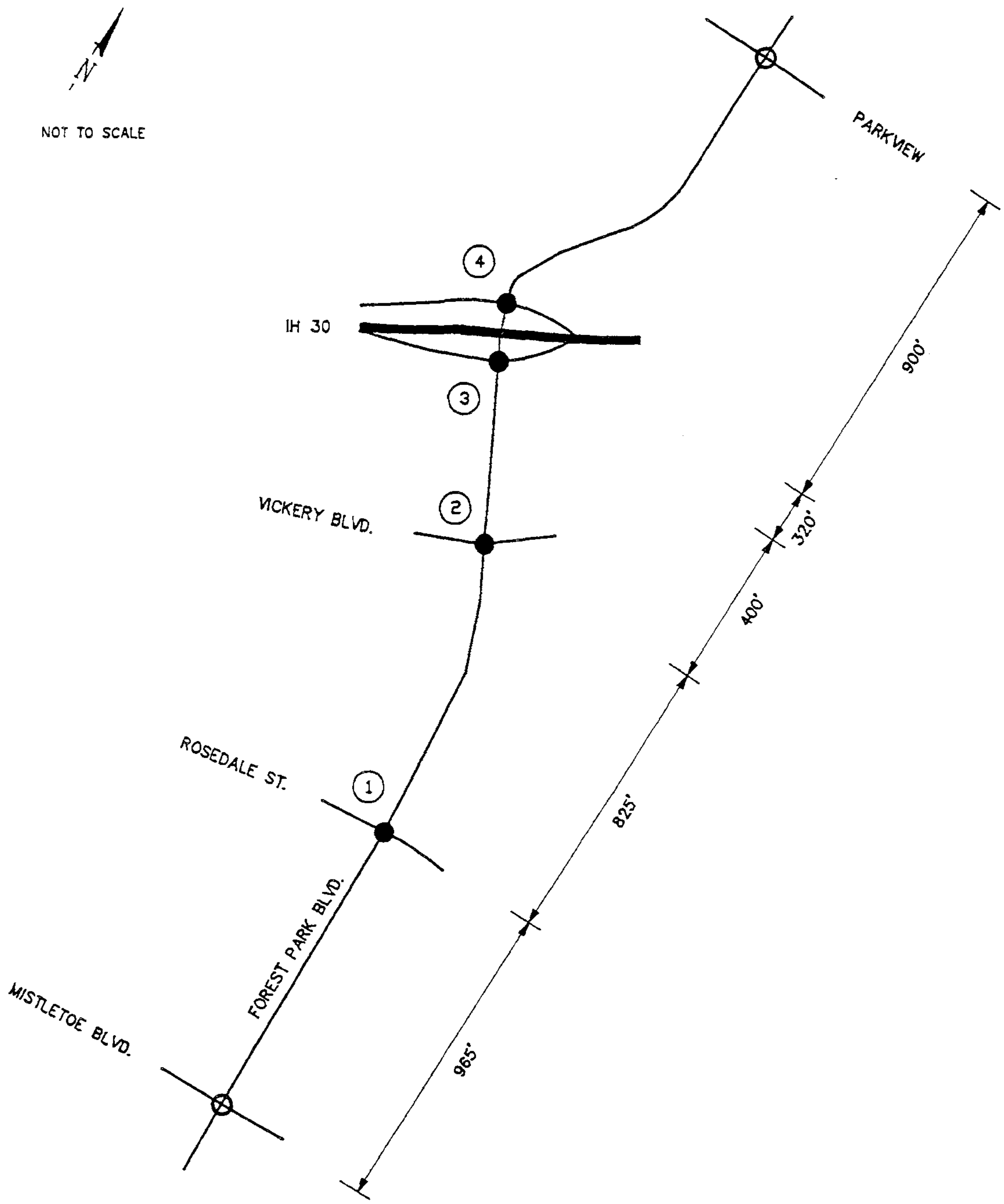
Based on the PASSER-II, PASSER-III, and TRANSYT-7F simulation, the project resulted in an estimated $1,609,194 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 3,018,870 stops (a 4.6 percent reduction), a total annual fuel savings of 126,990 gallons (a 6.2 percent reduction), and an annual delay savings of 143,994 veh-hrs (a 21.3 percent reduction). The total cost of the project was $95,415, and the resultant benefit to cost ratio was 17 to 1.

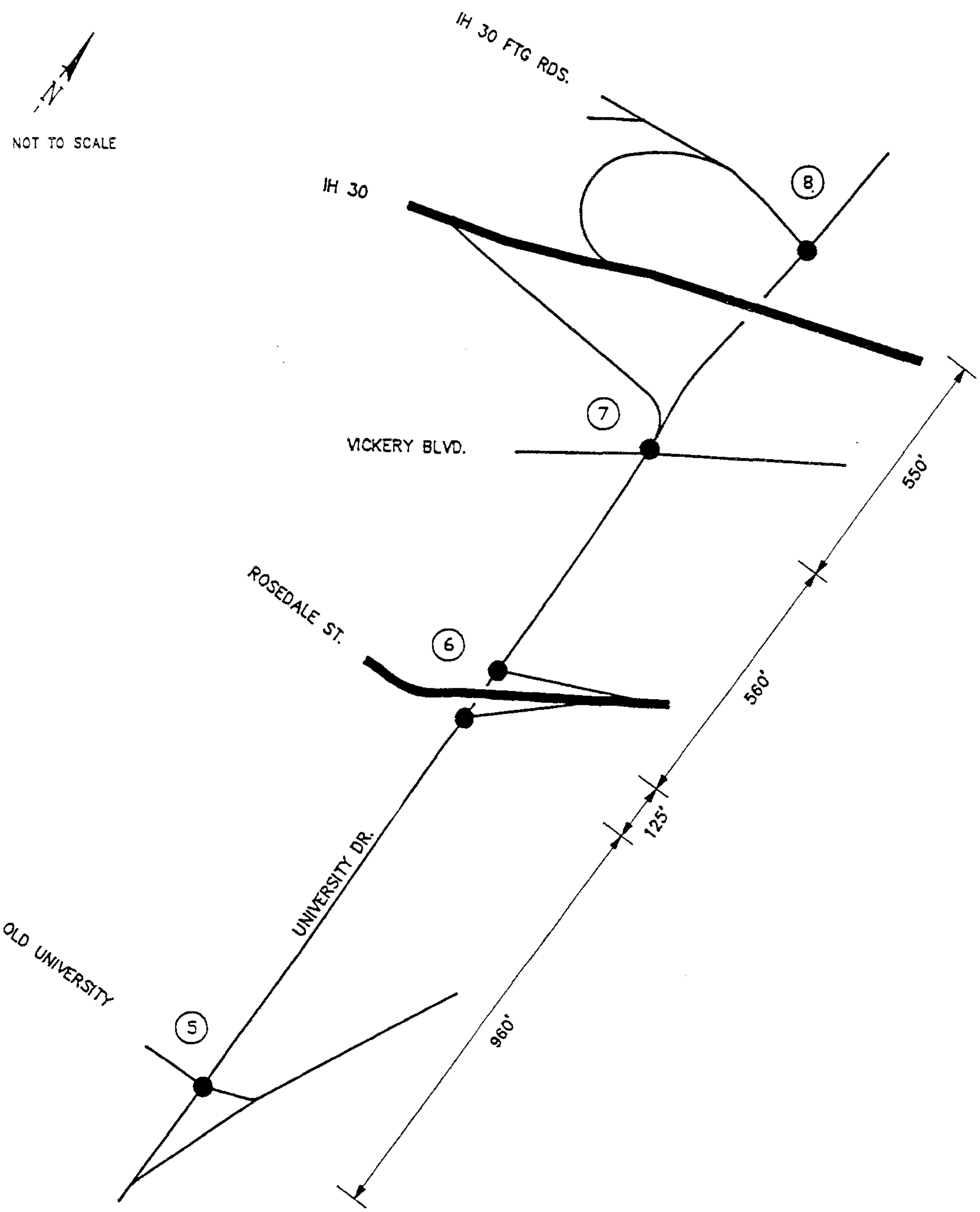
		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	25790	21959	318.5	212.68	820.8	709.1
	OFF	16678	16166	155.96	129.43	534.7	513
	NOON	20152	19837	187.31	160.71	600	579.6
	PM	28912	27406	373.26	264.54	946.1	848.9
DIFFERENCES	AM		3831		105.82		111.7
	OFF		512		26.53		21.7
	NOON		315		26.6		20.4
	PM		1506		108.72		97.2
HRS/DAY	AM		1		1		1
	OFF		8		8		8
	NOON		2		2		2
	PM		1		1		1
DAILY TOTALS	AM		3831		105.82		111.7
	OFF		4096		212.24		173.6
	NOON		630		53.2		40.8
	PM		1506		108.72		97.2
	TOTAL		10063		479.98		423.3
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$42,264		$1,439,940		$126,990

PROJECT COST: $95,414.55 TOTAL ANNUAL SAVINGS: $1,609,194

BENEFIT/COST RATIO: 17


SKYLINE
4,000'
1,700'
EPHRIHAM AVE.
LONG AVE.
RIVER OAKS BLVD.
4,400'
JACKSBORO HWY.
21st ST.
1,600'
18th ST.
4,200'
NORTH SIDE DR.
UNIVERSITY DR.
5,350'
WHITE SETTLEMENT RD.
N
NOT TO SCALE
1
2
3
4
5
6
7


N
NOT TO SCALE
PARKVIEW
4
IH 30
3
VICKERY BLVD.
2
ROSEDALE ST.
1
FOREST PARK BLVD.
MISTLETOE BLVD.
900'
320'
400'
825'
965'


N
NOT TO SCALE
IH 30 FTG RDS.
IH 30
8
7
VICKERY BLVD.
ROSEDALE ST.
6
UNIVERSITY DR.
OLD UNIVERSITY
5
550'
560'
125'
960'

City of Houston

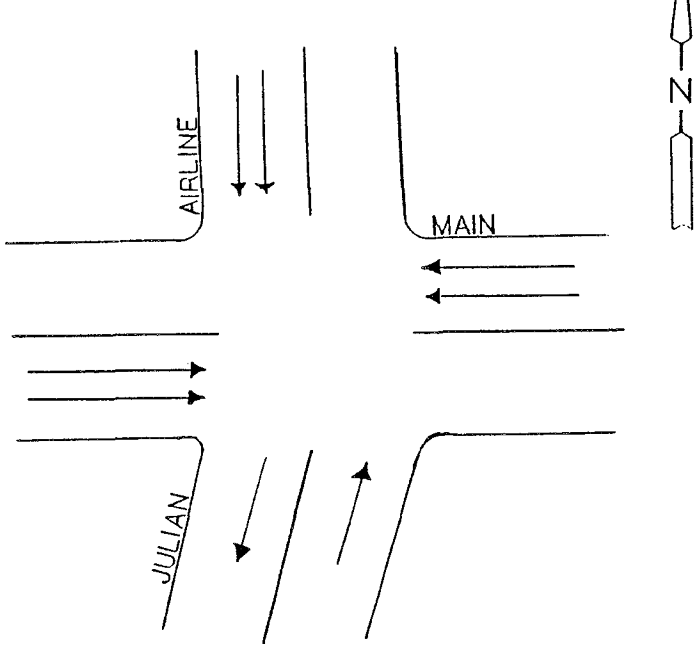
The City of Houston Department of Public Works and Transportation worked on the following project. The arterials modernized and/or re-timed under the project were Airline, Benmar, Holcombe, Bay Area Boulevard, Bellfort, Hillcroft, Jensen, T.C.Jester(w), T.C.Jester(e), Lockwood, Main Street, Montrose/Studemont, Rice Boulevard, Richmond, and Westpark. The attached figure shows the project network, cross streets, and link distances.

A total of 52 signalized intersections were included in this project. In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, travel delays, and an operating cost study. Timing plans were developed using PASSER II-90. Travel time information was obtained by the test car technique.

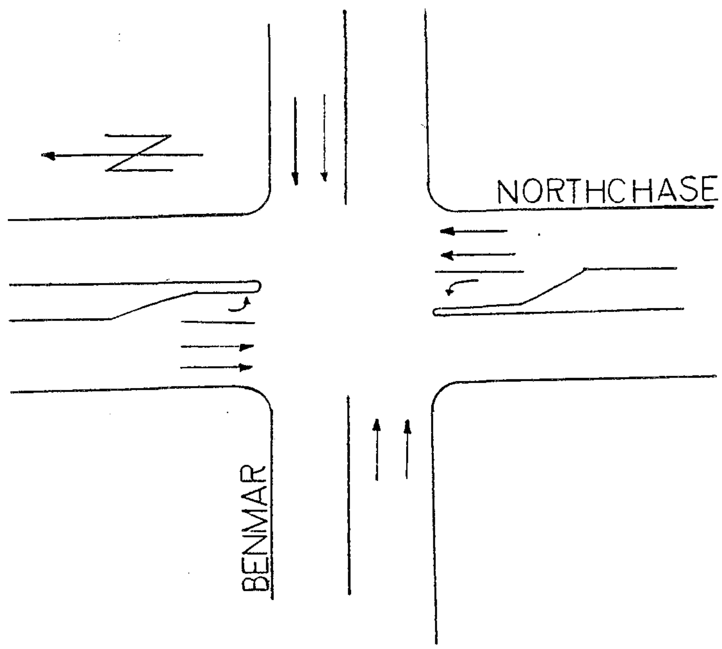
Based on the PASSER II-90 simulation, the project resulted in an estimated $7,195,966 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 25,334,400 stops (a 9.9 percent reduction), a total annual fuel savings of 638,544 gallons (a 12.7 percent reduction), and an annual delay savings of 620,274 veh-hrs (a 22.6 percent reduction). The total cost of the project was $1,119,556, and the resultant benefit to cost ratio was 6 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	86845	81802	1438.6	1248.48	2060.39	1901.97
	OFF	50950	45656	293.63	208.69	855.59	753.57
	PM	110375	97017	1813.15	1351.71	2493.76	2047.03
DIFFERENCES	AM		5043		190.12		158.42
	OFF		5294		84.94		102.02
	PM		13358		461.44		446.73
HRS/DAY	AM		2		2		2
	OFF		9		9		9
	PM		2		2		2
DAILY TOTALS	AM		10086		380.24		316.84
	OFF		47646		764.46		918.18
	PM		26716		922.88		893.46
	TOTAL		84448		2067.58		2128.48
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$354,682		$6,202,740		$638,544
PROJECT COST:			$1,119,556	TOTAL ANNUAL SAVINGS:			$7,195,966
BENEFIT/COST RATIO:			6				

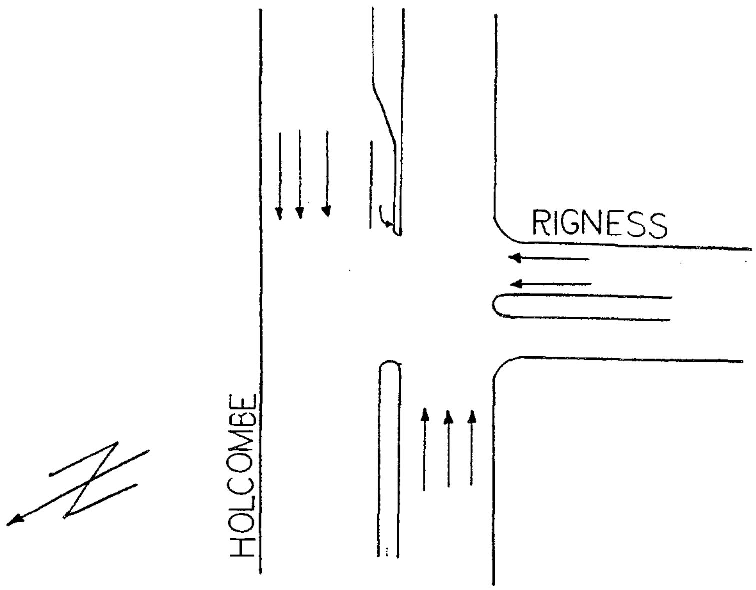
AIRLINE / JULIAN-MAIN



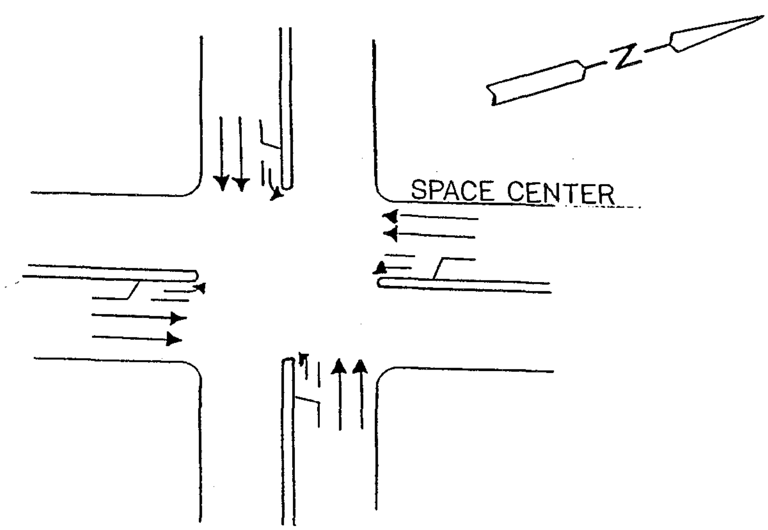
BENMAR / NORTHCHASE



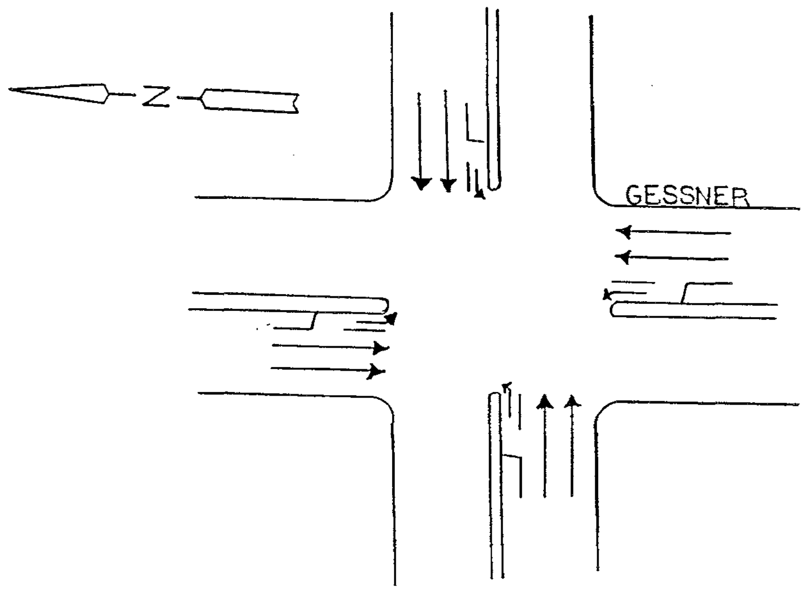
HOLCOMBE / RIGNESS



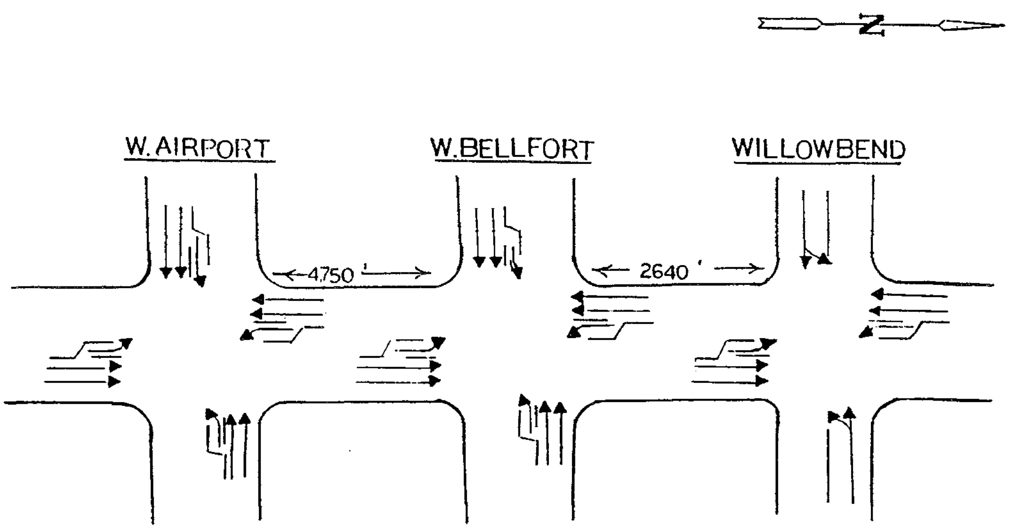
BAY AREA BLVD / SPACE CENTER



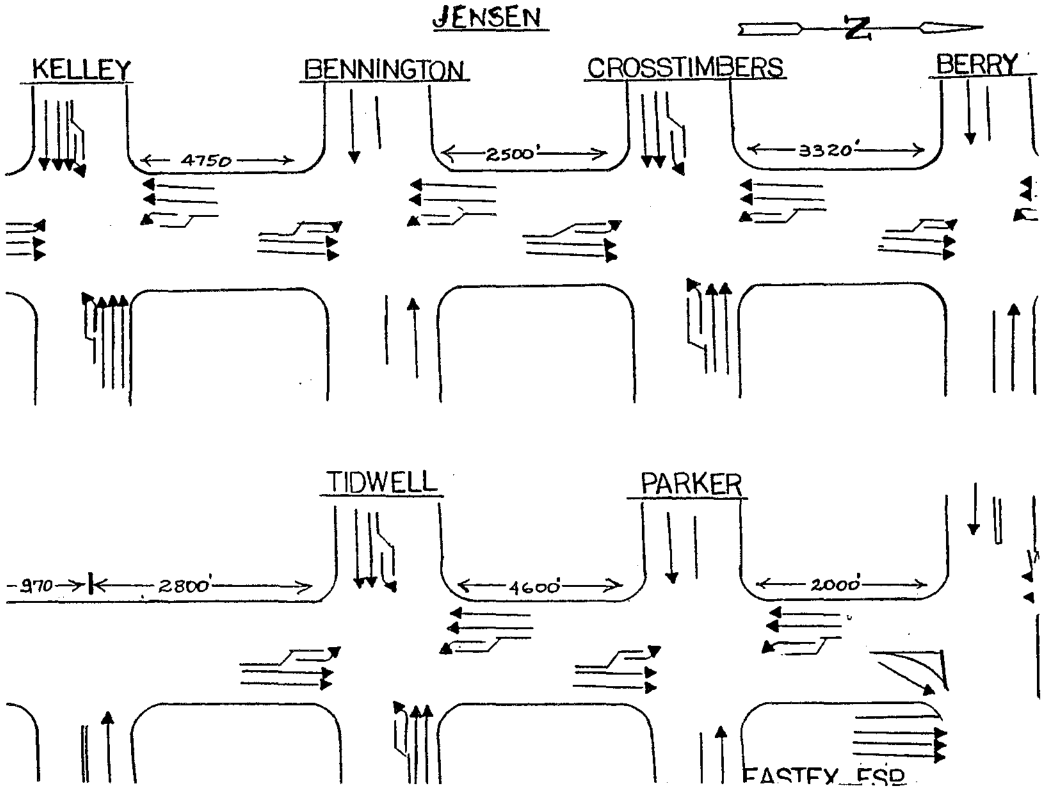
BELLFORT / GESSNER



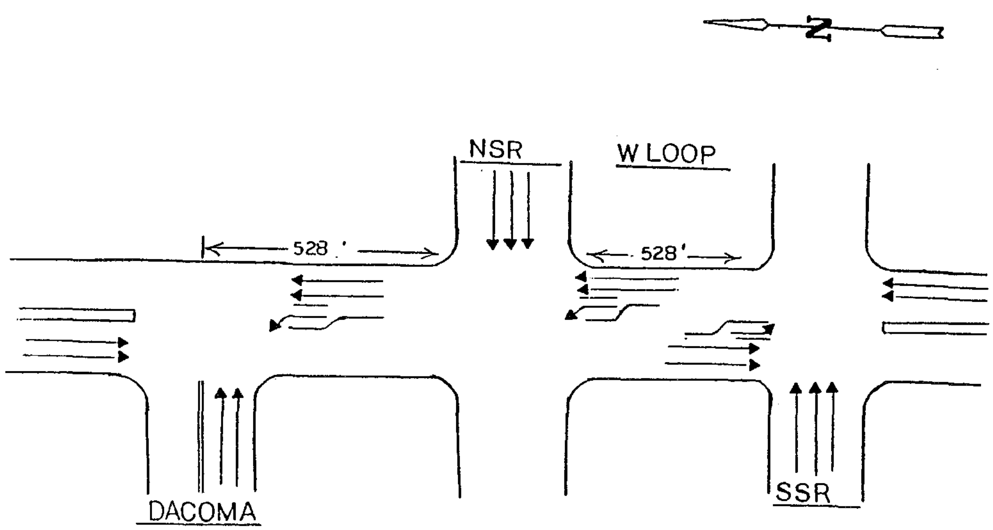
HILLCROFT



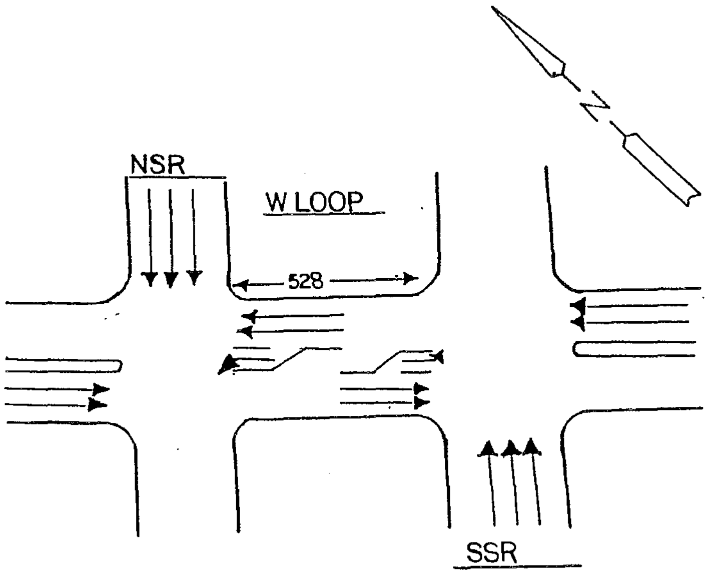
JENSEN



TC JESTER W



T C JESTER E



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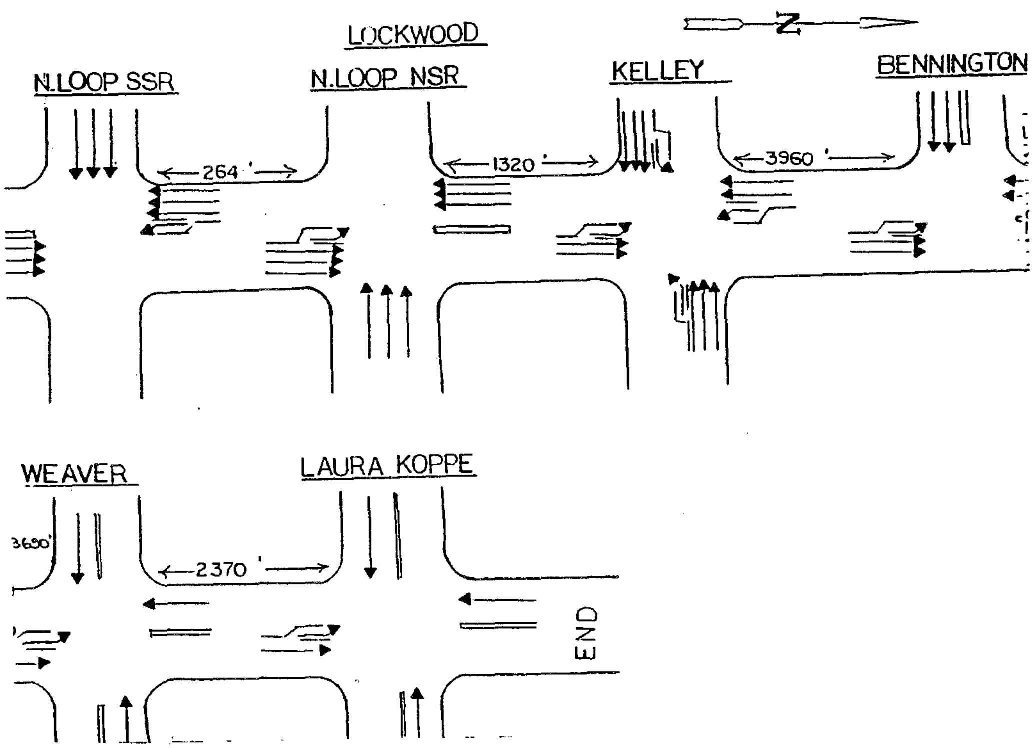
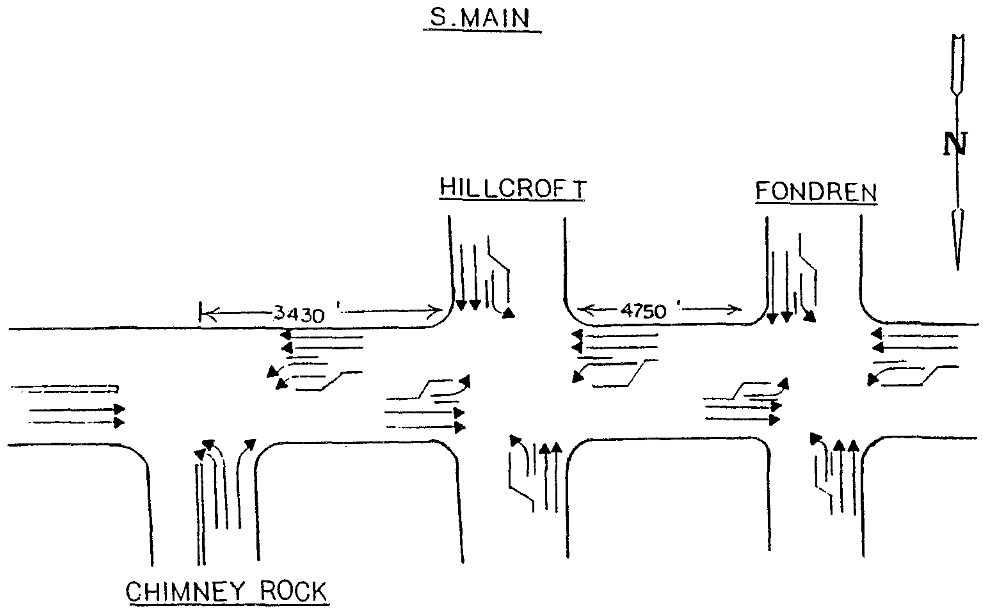
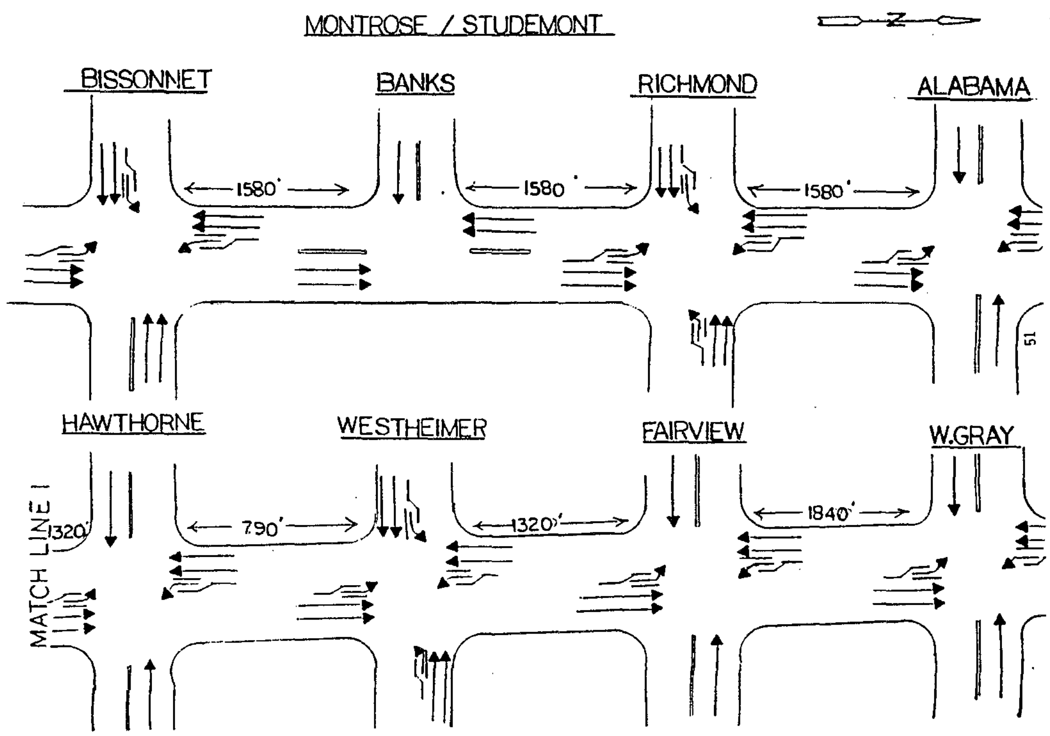
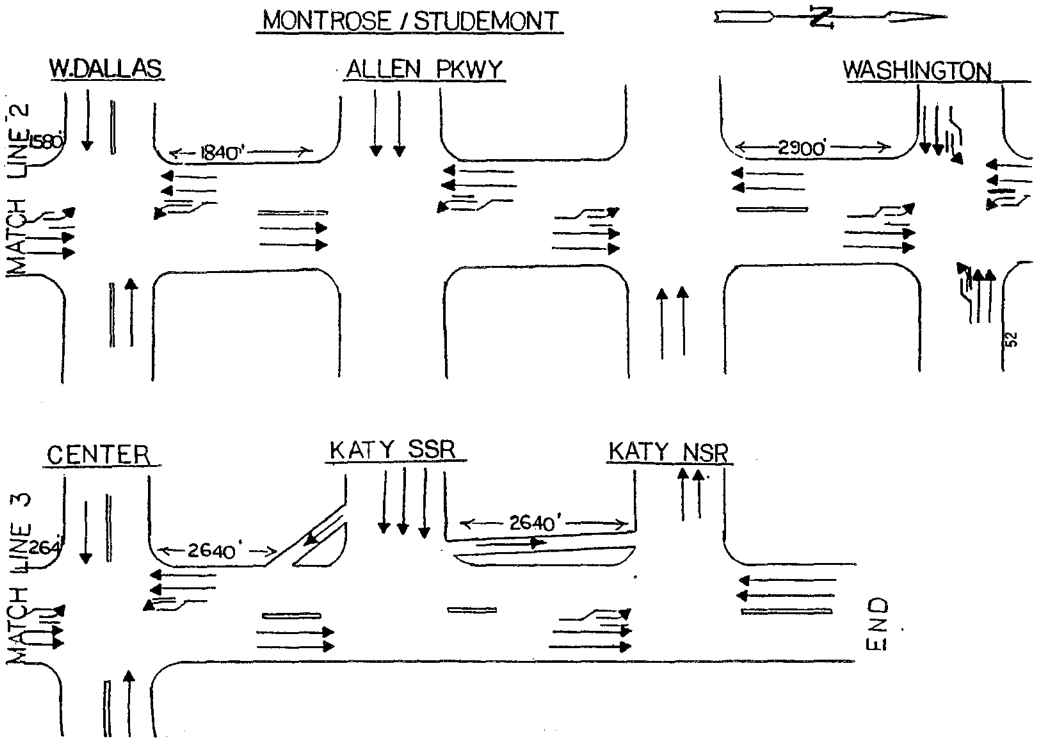


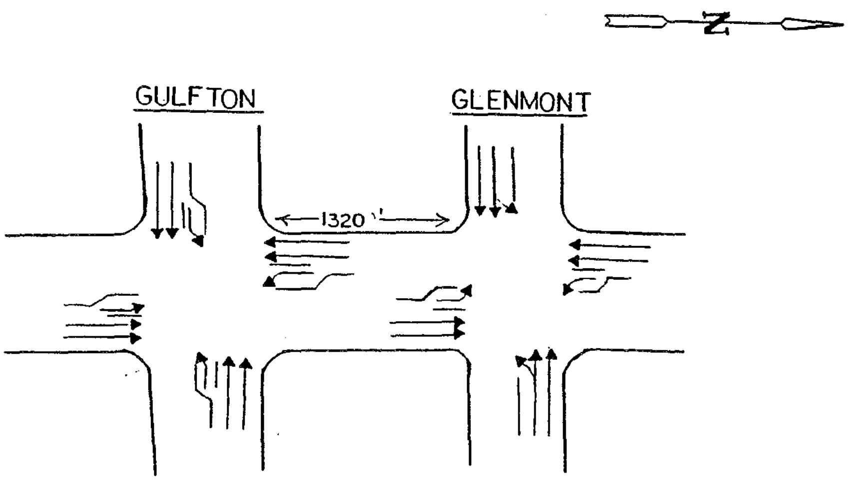

S.MAIN
N
HILLCROFT
FONDREN
3430'
4750'
CHIMNEY ROCK

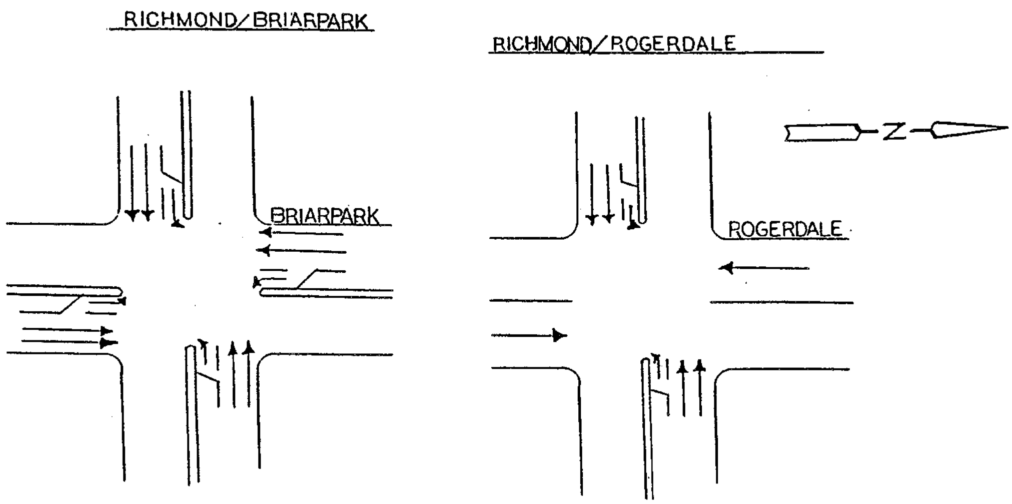

MONTROSE / STUDEMONT
N
BISSONNET
BANKS
RICHMOND
ALABAMA
1580'
1580'
1580'
HAWTHORNE
WESTHEIMER
FAIRVIEW
W.GRAY
MATCH LINE 1
1320'
790'
1320'
1840'

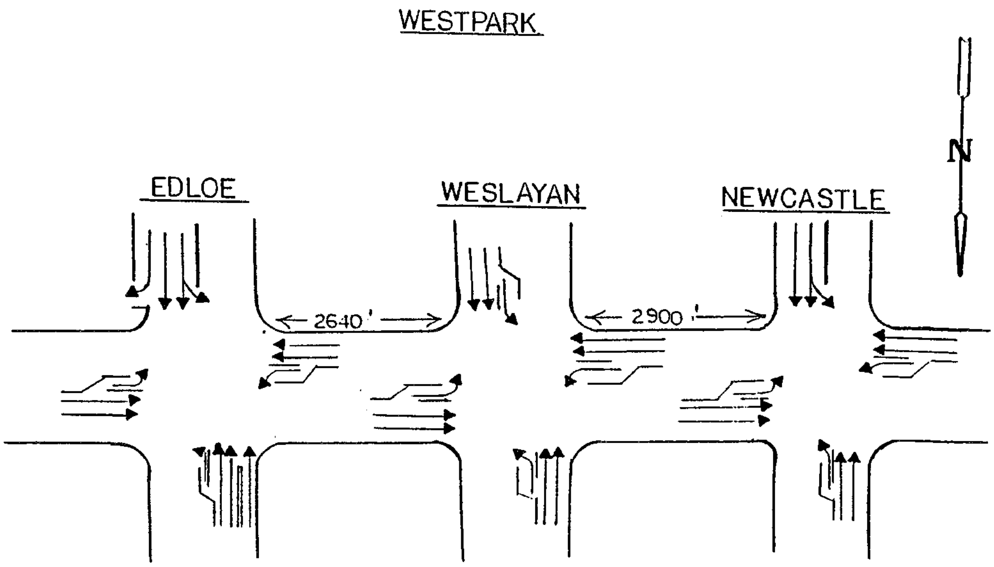
MONTROSE / STUDEMONT



S.RICE




RICHMOND/BRIARPARK
RICHMOND/ROGERDALE
BRIARPARK
ROGERDALE
N


WESTPARK
EDLOE
WESLAYAN
NEWCASTLE
2640'
2900'
N

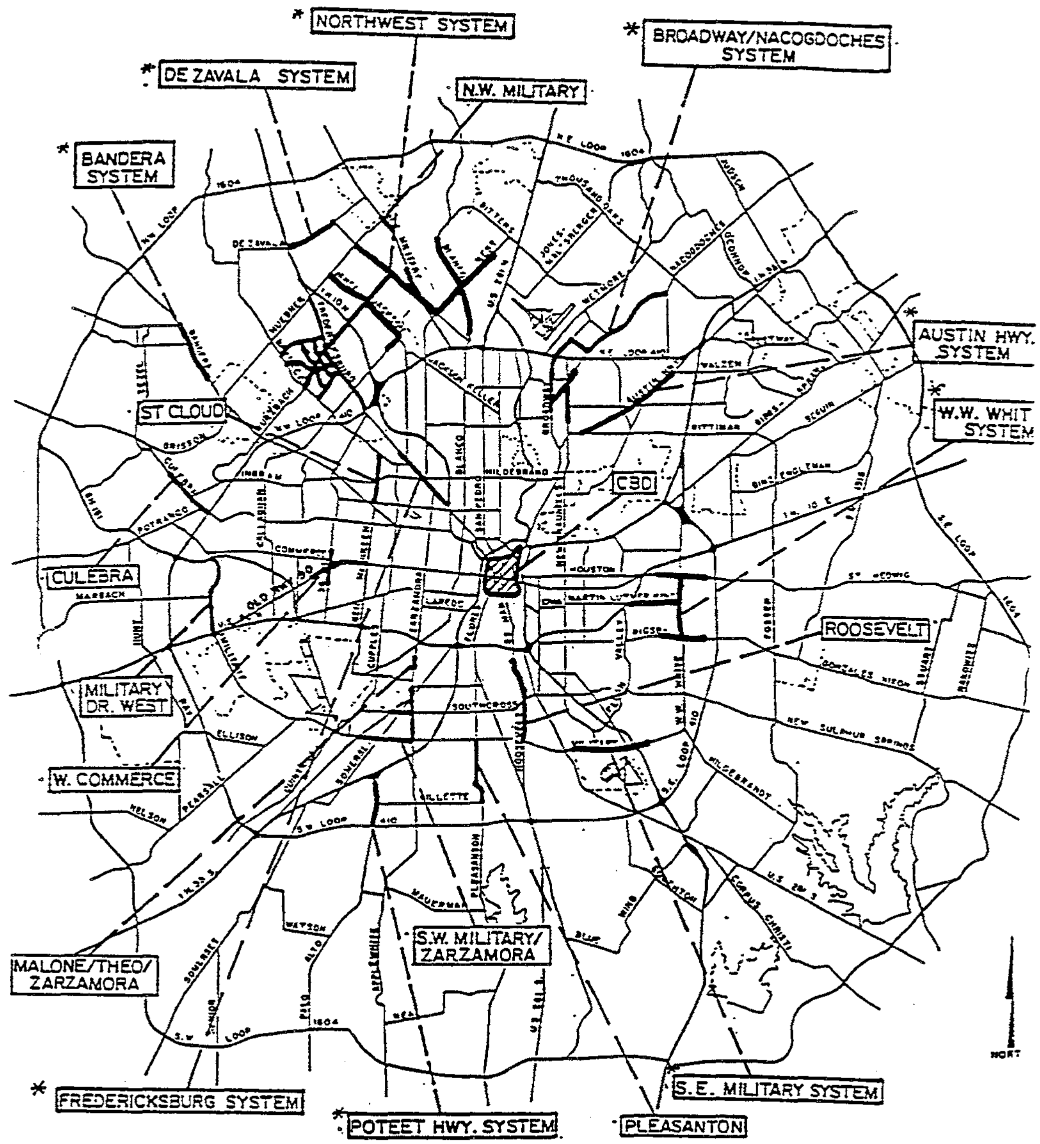
Various Intersections

The City of San Antonio Department of Public Works and Transportation worked on the following project. The project is divided into three basic categories. The first category consists of the same locations covered under the Traffic Management Program (TM). These projects developed the AM and OFF-peak timing plans which were not covered under TM and are called the "TM Locations" in this report. The second category consists of nine new traffic signal systems covering 57 intersections. This category is called the "New Systems." The final category consists of a single project which was largely performed by the University of Texas at Arlington as a consultant. This project will be referred to as CBD. The attached figure shows the project locations.

This project includes 295 intersections. Many of the intersections in the systems were previously uncoordinated, and consequently could not be analyzed using signal network software. For these intersections, PASSER II-90 was used to evaluate the previously existing conditions, and fuel consumption was determined. For most systems, PASSER II-90 was employed in the simulation mode to evaluate the previously coordinated portions and the entire systems after improvements. TRANSYT-7F was used for the remaining systems. The TM Locations were evaluated in the morning and OFF-peak periods; the New Systems were evaluated in the morning and afternoon peaks, and in the OFF-peak hours. The CBD was evaluated using the Two-Fluid model, and used NETSIM to identify improvements. Grid network timings in the CBD were developed manually, with aid from TRANSYT-7F. Travel time information was obtained by the floating car technique. Six runs were made on each link in each time period, and the mean travel times were determined.

Based on the PASSER II-90, TRANSYT-7F, and NETSIM simulation, the project resulted in an estimated $11,068,092 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 192,228,000 stops (a 18.8 percent reduction), a total annual fuel savings of 607,500 gallons (a 10 percent reduction), and an annual delay savings of 2,301,900 veh-hrs (a 9.4 percent reduction). The commuters along major streets such as Bandera Road, Fredericksburg Road (north of IH-410), Poteet Jourdanton Highway, Southwest Military Drive, and St. Cloud Road are now enjoying a dramatic 67-85 percent reduction in moving delay and an improvement in average speed of up to 20 mph, and motorists on all the streets are enjoying significant improvements. The total cost of the project was $375,924, and the resultant benefit to cost ratio was 29 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	350075	289873	2573	2188	8695	7782
	OFF	234167	188143	1320	1197	5571	5041
	PM	128617	114482	900	818	2874	2674
DIFFERENCES	AM		60202		385		913
	OFF		46024		123		530
	PM		14135		82		200
HRS/DAY	AM		1		1		1
	OFF		12		12		12
	PM		2		2		2
DAILY TOTALS	AM		60202		385		913
	OFF		552288		1476		6360
	PM		28270		164		400
	TOTAL		640760		2025		7673
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$2,691,192		$6,075,000		$2,301,900
PROJECT COST:			$375,924.00	TOTAL ANNUAL SAVINGS:			$11,068,092
BENEFIT/COST RATIO:			29				


NORTHWEST SYSTEM
BROADWAY/NACOGDOCHES SYSTEM
DE ZAVALA SYSTEM
N.W. MILITARY
BANDERA SYSTEM
AUSTIN HWY. SYSTEM
W.W. WHIT SYSTEM
ST CLOUD
CBD
CULEBRA
ROOSEVELT
MILITARY DR. WEST
W. COMMERCE
MALONE/THEO/ ZARZAMORA
S.W. MILITARY/ ZARZAMORA
FREDERICKSBURG SYSTEM
POTEET HWY. SYSTEM
PLEASANTON
S.E. MILITARY SYSTEM

APPENDIX E

INDIVIDUAL PROJECT SUMMARIES

MEDIUM CITIES

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Table E-1. Individual Project Summaries - Medium Cities.

		Reduction in Daily Totals						
City	System	Stops	Delay (veh-hrs)	Fuel (gals)	Total Annual Savings($)	Total Cost($)	B/C Ratio	Page
Baytown	Alexander Drive	71,921	450.70	(1,058.00)	1,336,768	38,137.00	35.05	E-5
Brownsville	CBD & Ringgold System	84,100	254.00	460.00	1,253,220	99,930.00	12.54	E-8
Bryan	City-Wide	42,666	769.89	894.28	2,757,154	116,945.00	23.58	E-11
Carrollton	Carrollton Signal System	33,751	2,382.01	2,751.83	8,113,334	56,465.14	143.69	E-14
College Station	City-Wide	2,086	41.50	41.41	145,684	77,887.00	1.87	E-17
Denton	Carroll Blvd.	41,942	55.00	548.80	505,796	22,800.00	22.18	E-20
	Downtown CBD System	24,006	64.00	142.00	335,425	55,000.00	6.10	E-23
Grand Prarie	NE/SE 8th/9th St.	21,750	4,294.00	3,196.00	13,932,150	14,922.47	933.64	E-26
Laredo	San Bernardo Ave.	12,178	167.91	184.60	610,258	61,107.00	9.99	E-29
	Saunders St.	17,024	99.94	145.36	414,929	63,007.00	6.59	E-32
Longview	Gilmer Rd.	43,295	292.60	(1,770.50)	528,489	117,001.61	4.52	E-35
	South St. & Cotton Street	3,934	35.70	40.00	135,623	60,686.88	2.23	E-38
McAllen	10th St./Pecan Blvd.	72,846	380.00	778.00	1,679,353	127,315.00	13.19	E-41
Midland	Midland Dr./Wall St.	(48,298)	3,091.20	563.42	9,239,766	54,015.75	171.06	E-44
Odessa	Dixie Blvd.	44,521	585.00	803.00	2,182,888	158,436.00	13.78	E-47
Port Arthur	Jefferson Dr./Highway 347	11,624	809.30	2,043.60	3,089,801	65,400.00	47.24	E-50
San Angelo	Beauregard Avenue	8,988	89.90	211.80	370,988	95,332.00	3.89	E-53
	Chadbourne Triangle	532	38.10	34.12	126,770	35,979.00	3.52	E-56
	Sherwood Way	39,163	300.00	519.10	1,220,213	146,092.00	8.35	E-59
	19th Street	290	13.72	12.42	46,104	36,367.00	1.27	E-62
Waco	CBD	31,719	192.00	435.00	839,720	23,081.00	36.38	E-65
	Franklin Avenue	6,323	1,101.75	1,147.25	3,675,980	13,893.00	264.59	E-68
Wichita Falls	Southwest Pkwy.	4,200	40.00	82.54	162,402	65,680.96	2.47	E-71

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Alexander Drive (SH 146)

The City of Baytown Department of Public Works and Transportation worked on the following project. Alexander Drive serves as a major arterial that distributes traffic to the residential areas and provides access to the numerous commercial businesses located along its corridor. Traffic volumes are heavy during the peak periods with flow being distributed to the surrounding areas. The attached figure shows the project network, cross streets, and link distances.

A total of eleven signalized intersections were included in this project. In the before conditions, the traffic signal system was equipped with various solid state controllers. All the signals were operating in actuated mode except the signal at McKinney, which was operating in pretimed mode. The signals were not equipped with pedestrian controls. The intersections had between three and five phases.

The improvements to the signals included utilization of the existing hard wire interconnect cable for communications to provide remote monitoring capability and closed-loop system technology. The existing controller at McKinney was also replaced so that this intersection could be included in the closed-loop system.

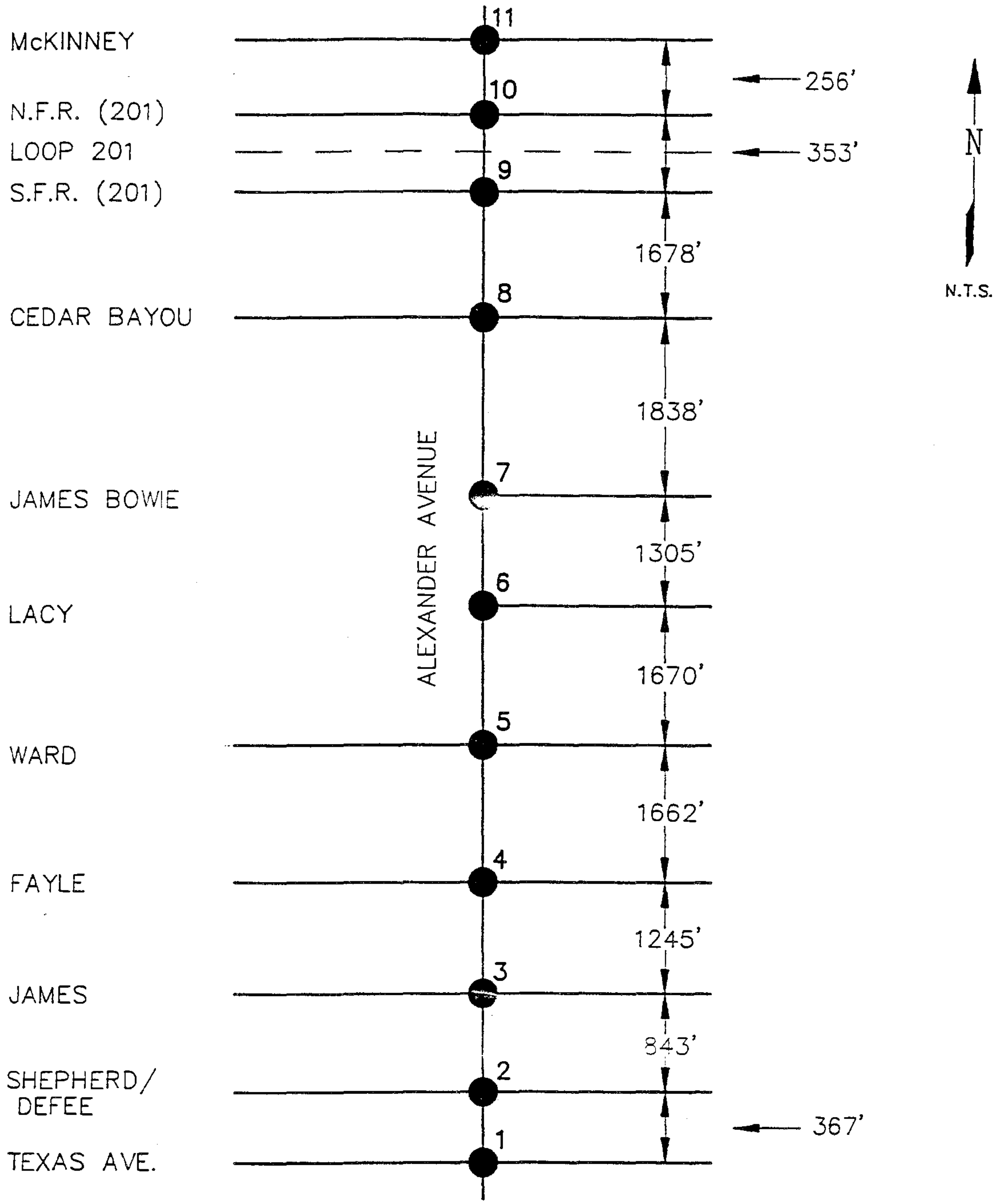
In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Optimum cycle lengths were determined using PASSER II for each of the AM, OFF, and PM peak periods. Travel time information was obtained by the test car method. Six runs were made on each link in each time period (AM, NOON, and PM), and the mean travel times and delays were determined.

Based on the PASSER II simulation, the project resulted in an estimated $1,336,768 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 21,576,300 stops (a 39.3 percent reduction), a total annual fuel increase of 317,400 gallons (a 64.2 percent increase), and a delay annual savings of 135,210 veh-hrs (a 39.3 percent reduction). The changes in the signal timing for this system reduced stops and delay. However, there was an increase in fuel consumption for all the peak periods. This was due to the increase in side street delay. The increase in fuel consumption was offset by the improvements on the arterial street. The overall travel time decreased by 10 percent. In many cases, the travel times measured in the field experienced no delay at all, and the test vehicle was able to progress from one end of the arterial to the other without having to stop. The total cost of the project was $38,137, and the resultant benefit to cost ratio was 35 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	15370	9333	90	59.5	134	225.6
	NOON	21401	9780	151	54.6	203	238
	PM	16288	13078	108	85.8	152	325.4
DIFFERENCES	AM		6037		30.5		-91.6
	NOON		11621		96.4		-35
	PM		3210		22.2		-173.4
HRS/DAY	AM		7		7		7
	NOON		2		2		2
	PM		2		2		2
DAILY TOTALS	AM		42259		213.5		-641.2
	NOON		23242		192.8		-70
	PM		6420		44.4		-346.8
	TOTAL		71921		450.7		-1058
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$302,068		$1,352,100		($317,400)

PROJECT COST: $38,137.00 TOTAL ANNUAL SAVINGS: $1,336,768

BENEFIT/COST RATIO: 35



McKINNEY
N.F.R. (201)
LOOP 201
S.F.R. (201)
CEDAR BAYOU
JAMES BOWIE
LACY
WARD
FAYLE
JAMES
SHEPHERD/ DEFEE
TEXAS AVE.
ALEXANDER AVENUE
11
10
9
8
7
6
5
4
3
2
1
256'
353'
1678'
1838'
1305'
1670'
1662'
1245'
843'
367'
N
N.T.S.

Central Business District & Ringgold Street
Traffic Signal Systems

The City of Brownsville Department of Public Works and Transportation and Texas Department of Transportation worked on the following project. The system consists of the Central Business District and the Ringgold Street traffic signal systems.

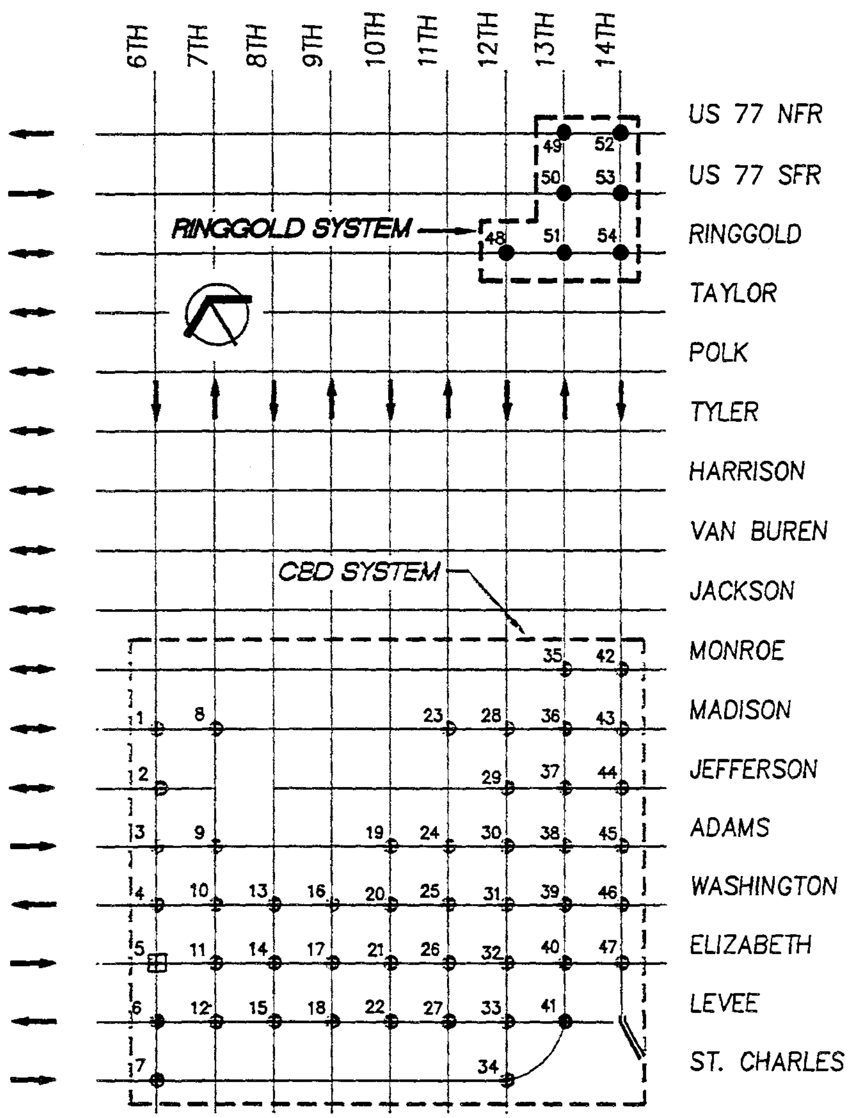
The CBD system consists of electromechanical controllers at 43 intersections and 4 solid state controllers, one of which serves as the master controller located at 6th Street and Elizabeth Street. In order to accommodate the new volumes and the new traffic patterns found in the system, new timings were implemented with two different sets of offsets for the 50 second cycle operating during the AM and OFF peak periods. An additional 70 second cycle was implemented to accommodate the heavy traffic during the NOON and PM peak periods. To achieve optimum progression in both north/south bound and east/west bound directions during the 70 second cycle, a simultaneous green "pattern" was implemented. An all red interval was added for both the 50 and 70 second cycles.

The Ringgold Street system consists of seven intersections including four intersections at the US 77/83 interchanges with 13th and 14th Streets. The improvements at these intersections include: 1) replacement of electromechanical controllers with solid state controllers, 2) traffic signal interconnect-connecting 12th, 13th and 14th streets, and 3) new timing plans. A 60 second cycle was found to be most efficient for the Ringgold system for all periods of the day. The improvements along Ringgold Street were critical to provide the best progression possible in both the north/south bound and east/west bound directions.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Optimum cycle lengths were determined using TRANSYT-7F for each of the AM, NOON, OFF, and PM peak periods. Six runs were made on each major link in each time period (AM peak, PM peak, and NOON), and the mean travel times and delays were determined. Travel time information was obtained by the test car method.

Based on the TRANSYT-7F simulation, the project resulted in an estimated $1,25 3,220 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 25,230,000 stops (a 33.59 percent reduction), a total annual fuel savings of 138,000 gallons (a 14.48 percent reduction), and a delay annual savings of 76,200 veh-hrs (a 19.81 percent reduction). The total cost of the project was $99,930, and the resultant benefit to cost ratio was 13 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	17738	13332	82	67	226	200
	NOON	24955	16418	131	104	321	273
	PM	32595	20562	166	135	399	339
DIFFERENCES	AM		4406		15		26
	NOON		8537		27		48
	PM		12033		31		60
HRS/DAY	AM		2		2		2
	NOON		6		6		6
	PM		2		2		2
DAILY TOTALS	AM		8812		30		52
	NOON		51222		162		288
	PM		24066		62		120
	TOTAL		84100		254		460
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$353,220		$762,000		$138,000
PROJECT COST:			$99,930.00	TOTAL ANNUAL SAVINGS:			$1,253,220
BENEFIT/COST RATIO:			13				


6TH
7TH
8TH
9TH
10TH
11TH
12TH
13TH
14TH
US 77 NFR
US 77 SFR
RINGGOLD
TAYLOR
POLK
TYLER
HARRISON
VAN BUREN
JACKSON
MONROE
MADISON
JEFFERSON
ADAMS
WASHINGTON
ELIZABETH
LEVEE
ST. CHARLES
RINGGOLD SYSTEM
CBD SYSTEM

Bryan - City Wide

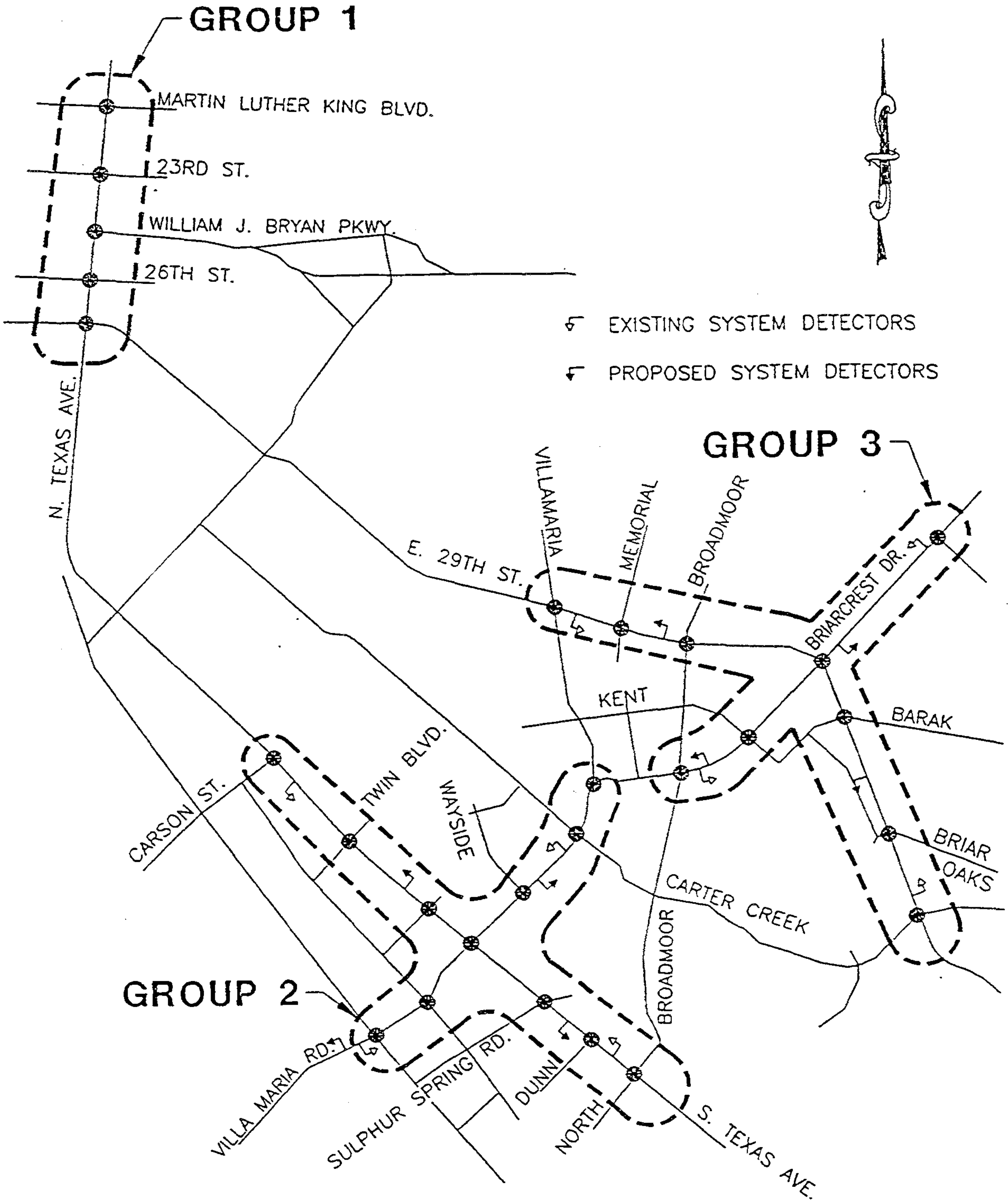
The City of Bryan Department of Public Works and Transportation worked on the following project. The project area is shown on the attached figure. The project has been divided up into three separate groups, each linked to one of the other four major arterials involved. Before implementation of this project, the three groups operated with only one peak period and one OFF-peak period timing plan between 6:00 A.M. and 6:00 P.M. The signals were then flashed or operated on the OFF-peak cycle throughout the remaining twelve hours of the day. This project called for the implementation of five separate timing plans during the day. One plan has been provided for each group for each of the following periods: AM peak, AM OFF-peak, NOON, PM OFF-peak, and PM peak.

The following data were collected to provide input for the PASSER II-90 before and after simulations. These same data were also used in the PASSER II-90 model to generate optimal timing plans. Before and after travel time data were collected to quantify the on-street performance of the new timing plans. Arterial link distance, posted speed data, existing signal timing data, and traffic volumes were collected for all project intersections. Saturation flow rates were calculated using an ideal saturation flow rate of 1800 vphg. Floating car travel time runs were made on each arterial link in each time period to estimate the level of benefit and to calibrate the PASSER II data sets for each arterial.

The PASSER II-90 simulation data sets were modified to determine the optimal cycle lengths and calculate phase splits and offsets. A range of cycle lengths were analyzed to determine which cycle lengths maximized progression and minimized vehicular delay. Acceptable cycle lengths for Groups 2 and 3 (consisting of crossing arterial streets) were analyzed to determine optimal cycle lengths. Resulting final cycle lengths were used for comparison with the cycle lengths associated with the before conditions. In each case, the cycle lengths either decreased or were already operating at optimal cycle length. The PASSER II-90 optimization data sets were modified to simulate the adjusted timing plans. In several instances, the initial simulation results were used to further refine the timing plans. Final results were used for comparison of before and after conditions and to summarize the savings gained from the project.

Based on the PASSER II-90 simulation, the project resulted in an estimated $2,757,154 savings per year on total operating costs, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 12,799,714 stops (a 9.9 percent reduction), a total annual fuel savings of 268,285 gallons (a 14.4 percent reduction), and a delay annual savings of 230,967 veh-hrs (a 32.5 percent reduction). The total cost of the project was $116,945. Hence, the resulting benefit to cost ratio computed was 24 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY	AM	46783	41671	465.0	336.1	989.8	855.7
	AM OFF	30813	28291	169.1	157.4	585.9	564.0
	OFF	39296	38209	295.5	263.0	829.8	797.8
	PM OFF	37436	33822	222.8	217	726.9	687
	PM	58495	51104	681.5	401.3	1318.1	1063
DIFFERENCES	AM		5112		128.9		134.1
	AM OFF		2522		11.7		21.9
	OFF		1087		32.5		32
	PM OFF		3614		5.8		39.9
	PM		7391		280.2		255.1
HRS/DAY	AM		1.25		1.25		1.25
	AM OFF		2.75		2.75		2.75
	OFF		1.25		1.25		1.25
	PM OFF		4		4		4
	PM		1.83		1.83		1.83
DAILY	AM		6390		161.12		167.62
	AM OFF		6936		32.17		60.22
	OFF		1359		40.63		40.00
	PM OFF		14456		23.20		159.60
	PM		13526		512.77		466.83
	TOTAL		42666		769.89		894.28
UNIT VALUES			$0.014		10.00		1.00
ANNUAL SAVINGS			$179,196		$2,309,673		$268,285
PROJECT COST:			$116,945.00	TOTAL ANNUAL SAVINGS:			$2,757,154
BENEFIT/COST RATIO:			24				


GROUP 1
MARTIN LUTHER KING BLVD.
23RD ST.
WILLIAM J. BRYAN PKWY.
26TH ST.
N. TEXAS AVE.
EXISTING SYSTEM DETECTORS
PROPOSED SYSTEM DETECTORS
GROUP 3
VILLAMARIA
MEMORIAL
BROADMOOR
E. 29TH ST.
BRIARCREST DR.
KENT
BARAK
BRIAR OAKS
CARTER CREEK
BROADMOOR
TWIN BLVD.
WAYSIDE
CARSON ST.
GROUP 2
VILLA MARIA RD.
SULPHUR SPRING RD.
DUNN
NORTH
S. TEXAS AVE.

Carrollton Signal System

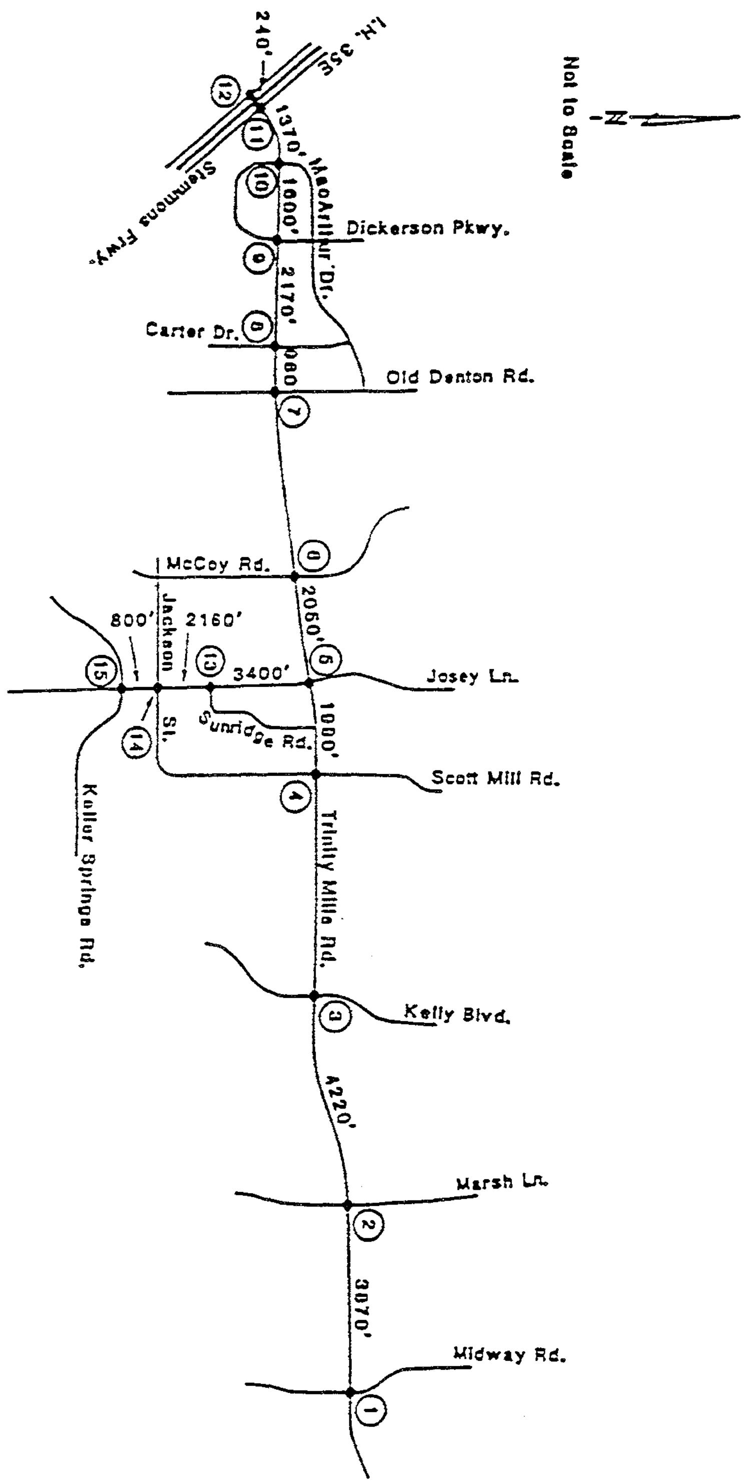
The City of Carrollton Department of Public Works and Transportation worked on the following project. The project network is comprised of three subsystems located along two arterials within the City. The City of Carrollton has a population of approximately 82,170 people and is a suburban community in north Dallas County. The network as a whole has 15 intersections. All intersections currently have EAGLE EPAC 300 controllers that provide progression along arterials using time-based coordination.

In order to evaluate the performance, the before TLS traffic conditions were monitored and various field data were collected. The data included arterial data, peak hour turning movement volumes, signal phasing and timing, and network travel time data using the floating car technique. All of this data was collected to evaluate and calibrate before and after conditions. Intersection approach configurations and lane assignments for all 15 intersections were used to derive saturation flows needed as input into the TRANSYT-7F modeling program. TRANSYT-7F and PASSER II were utilized to evaluate and optimize the network, respectively.

The existing AM, NOON/OFF, and PM peak turning movement volumes, saturation flow rates, as well as signal phasing and timing data were input into the TRANSYT-7F model to simulate before and after conditions. PASSER II-90 was used to develop optimum signal phasing patterns and intersection offsets. Implementation of the new timing plans and fine tuning of system signal timings were carried out in part by the City of Carrollton. Minor offset changes were required at some intersections. This was due in part to the variability in vehicular speeds between intersections. The revised final timings plans for all intersections were simulated with TRANSYT-7F to obtain the final measures of effectiveness.

Based on the TRANSYT-7F and PASSER III simulation, the project resulted in an estimated $8,113,334 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 10,125,357 stops (a 9.8 percent reduction), a total annual fuel savings of 825,549 gallons (an 18.7 percent reduction), and a delay annual savings of 714,460 veh-hrs (a 29.6 percent reduction). The total cost of the project was $56,465.14, and the resultant benefit to cost ratio was 144 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	38631	37357	1503.23	1345.93	2016.37	1814.7
	NOON	26368	23265	464.47	291.44	1023.35	827.61
	PM	41438	39991	1905.4	1410.99	2436.98	1844.22
DIFFERENCES	AM		1274		157.3		201.67
	NOON		3103		173.03		195.74
	PM		1447		494.41		592.76
HRS/DAY	AM		1		1		1
	NOON		10		10		10
	PM		1		1		1
DAILY TOTALS	AM		1274		157.3		201.67
	NOON		31031		1730.3		1957.4
	PM		1447		494.41		592.76
	TOTAL		33751		2382.01		2751.83
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$141,755		$7,146,030		$825,549
PROJECT COST:			$56,465.14	TOTAL ANNUAL SAVINGS:			$8,113,334
BENEFIT/COST RATIO:			144				


I.H. 35E
240'
Stemmons Frwy.
1370'
1000'
MacArthur Dr.
Dickerson Pkwy.
2170'
Carter Dr.
Old Denton Rd.
McCoy Rd.
2060'
800'
2160'
Jackson St.
3400'
Josey Ln.
Sunridge Rd.
1000'
Scott Mill Rd.
Keller Springs Rd.
Trinity Mills Rd.
Kelly Blvd.
4220'
Marsh Ln.
3070'
Midway Rd.
Not to Scale
N

City of College Station

The City of College Station Department of Public Works and Transportation worked on the following project. A total of 37 signalized intersections were included in the project. Four of these intersections are currently isolated from the others. The remaining intersections are broken into five subsystems. Six of the seven arterials in this project are on TxDOT roadways. The signals, however, are maintained and operated by the city. The attached figure displays the project network and cross streets.

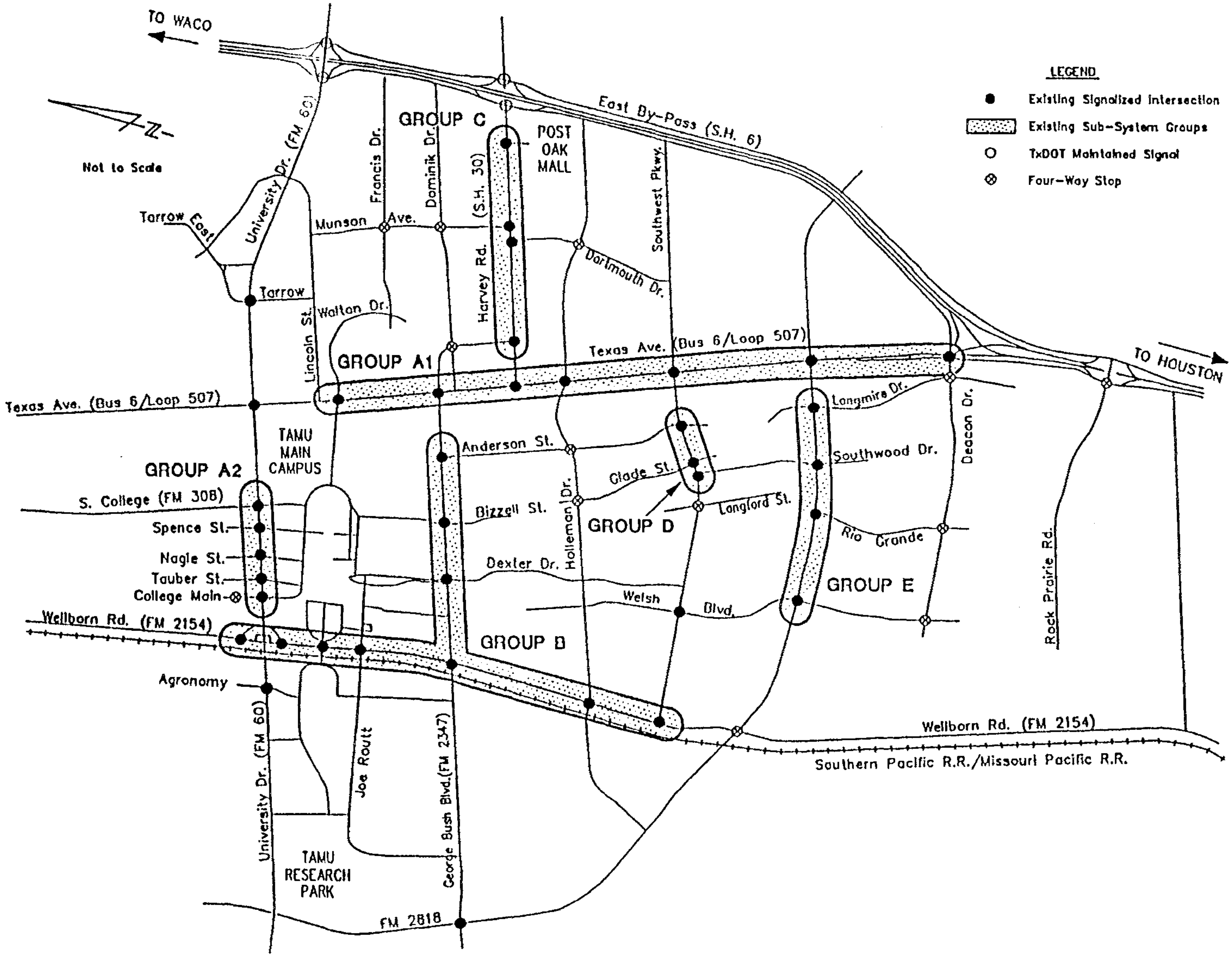
The signals in this system were controlled by fully actuated Eagle EPAC300 signal controllers. The phases of the signals ranged from 2 to 8. Twenty two of the intersections had no pedestrian controls, thirteen of the intersections had limited pedestrian controls, and only two intersections had full pedestrian controls. None of the intersections have any other special features attributed to them.

Recently in a previous project under the State's Traffic Management Program on the same 37 intersections, 14 outdated Eagle controller cabinets were replaced with new Hi-tech NEMA cabinets. All new cabinets came with an updated conflict motor, load switches, flasher units, transfer relays, and communications panel. A few NEMA Conflict Motors and harnesses were installed at several locations. At locations where new cabinets were not installed, a communication panel with a "D" harness was retro-fitted into many existing cabinets. A majority of changes made in signal phasing were the conversion from protected only left turns to protected/permissive left turns. New signal cable, signal heads, and signing were installed as a result of these signal phasing modifications.

In order to evaluate the system performance, the before and after TLS traffic conditions were monitored and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. The floating car technique was used for collecting the required data. TRANSYT-7F was used to optimize cycle lengths and phase splits to simulate actuated operations.

Based on TRANSYT-7F simulation, the project resulted in an estimated $145,684 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total savings of 625,800 stops (a 0.5 percent reduction), a total annual fuel savings of 12,423 gallons (a 0.3 percent reduction), and an annual delay savings of 12,450 veh-hrs (a 1.2 percent reduction). Typically, travel times decreased on all routes. When times did increase, it was mainly in the OFF-peak direction. The total cost of the project was $77,887, and the resultant benefit to cost ratio was 2 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	33058	33938	285.13	290.1	1160.41	1165.44
	OFF	31925	31339	270.82	263.88	1159.9	1151.6
	NOON	36132	37191	321.56	328.65	1299.36	1309.65
	PM	51772	53021	569.74	578.64	1823.72	1841.69
DIFFERENCES	AM		-880		-4.97		-5.03
	OFF		586		6.94		8.3
	NOON		-1059		-7.09		-10.29
	PM		-1249		-8.9		-17.97
HRS/DAY	AM		1		1		1
	OFF		9		9		9
	NOON		1		1		1
	PM		1		1		1
DAILY TOTALS	AM		-880		-4.97		-5.03
	OFF		5274		62.46		74.7
	NOON		-1059		-7.09		-10.29
	PM		-1249		-8.9		-17.97
	TOTAL		2086		41.5		41.41
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$8,761		$124,500		$12,423
PROJECT COST:			$77,887.00	TOTAL ANNUAL SAVINGS:			$145,684
BENEFIT/COST RATIO:			2				


TO WACO
TO HOUSTON
Not to Scale
LEGEND
Existing Signalized Intersection
Existing Sub-System Groups
TxDOT Maintained Signal
Four-Way Stop
East By-Pass (S.H. 6)
GROUP C
GROUP A1
GROUP A2
GROUP B
GROUP D
GROUP E
POST OAK MALL
TAMU MAIN CAMPUS
TAMU RESEARCH PARK
Tarrow East
University Dr. (FM 60)
Tarrow
Francis Dr.
Dominik Dr.
Harvey Rd. (S.H. 30)
Southwest Pkwy.
Munson Ave.
Dartmouth Dr.
Lincoln St.
Walton Dr.
Texas Ave. (Bus 6/Loop 507)
Texas Ave. (Bus 6/Loop 507)
Longmire Dr.
Deacon Dr.
Anderson St.
Glade St.
Southwood Dr.
S. College (FM 308)
Spence St.
Nagle St.
Tauber St.
College Main
Bizzell St.
Holleman Dr.
Langford St.
Rio Grande
Dexter Dr.
Welsh Blvd.
Rock Prairie Rd.
Wellborn Rd. (FM 2154)
Agronomy
University Dr. (FM 60)
Joe Routt
George Bush Blvd.(FM 2347)
Wellborn Rd. (FM 2154)
Southern Pacific R.R./Missouri Pacific R.R.
FM 2818

Carroll Boulevard

The City of Denton Department of Public Works and Transportation worked on the following project. Carroll Boulevard is a major six-lane arterial running north-south through the City, and the system identified in this project is composed of seven intersections. The attached figure shows the project network, cross streets, and link distances.

The system was previously operated with three timing plans, all of which were 60 second cycles. The previous system consisted of six intersections and did not include Eagle Drive which was included as the seventh intersection in this project.

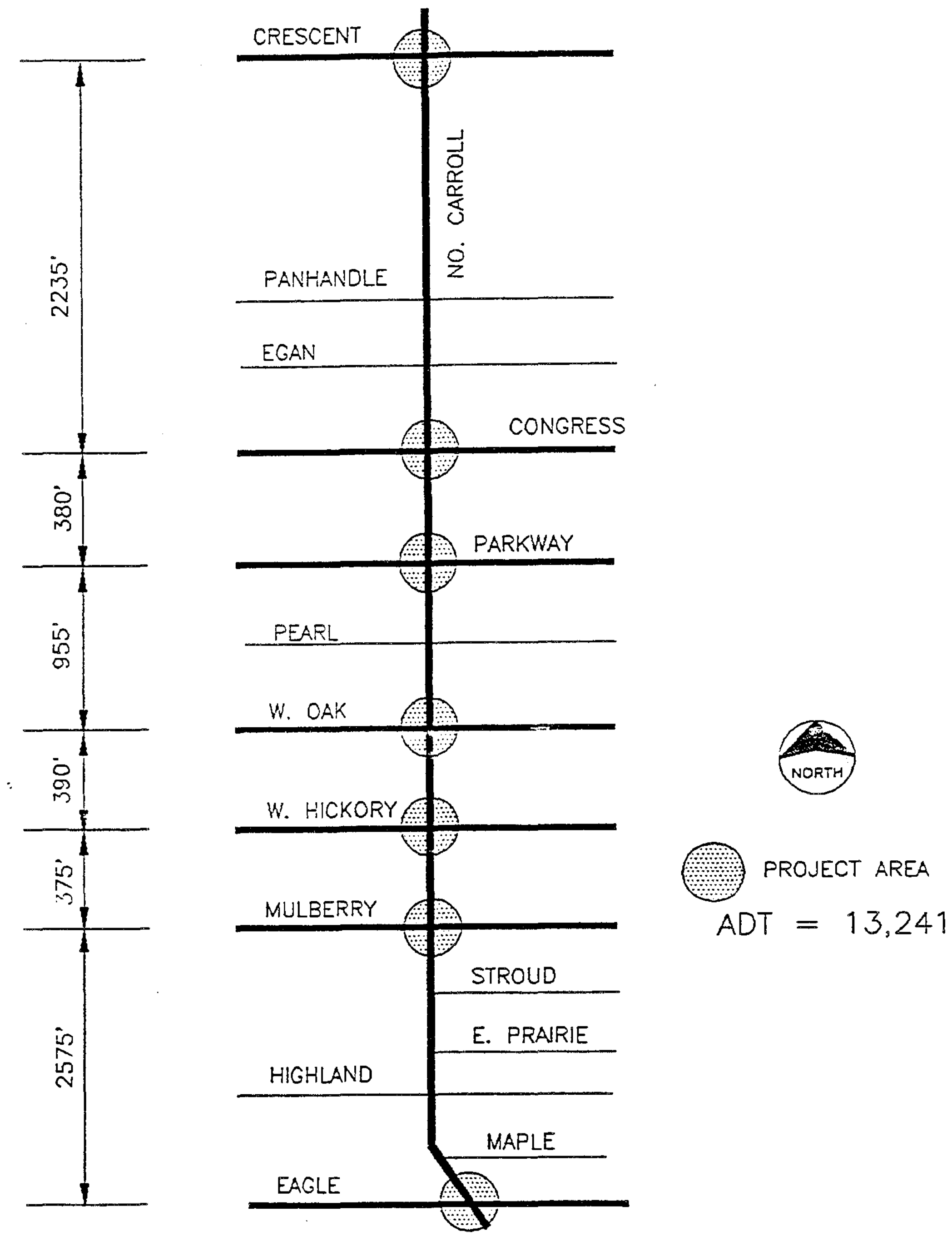
The new system coordination is provided through a hardwire interconnect and utilizes Transyt controllers model 1880EL. All installations utilize mast arms and poles along with protected/permissive left turn phasing and pedestrian controls at selected intersections.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Optimum cycle lengths were determined using TRANSYT-7F for each of the AM, OFF, and PM peak periods. Travel time information was obtained by the floating car technique. Six runs were made on each link in each time period (AM, NOON, and PM), and the mean travel times were determined.

Based on the TRANSYT-7F simulation, the project resulted in an estimated $505,796 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 12,582,600 stops (a 23.7 percent reduction), a total annual fuel savings of 164,640 gallons (a 15.2 percent reduction), and a delay annual savings of 16,500 veh-hrs (a 5.8 percent reduction). Average speeds were increased by 14.7 percent and 9 percent for the PM and OFF peak periods. However, the average speed was decreased by 8.2 percent for the AM peak period. The total cost of the project was $22,800, and the resultant benefit to cost ratio was 22 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	8545	7038	39.7	42.2	179	156.9
	OFF	12395	9518	62.9	63.9	253.4	218.8
	PM	17879	12800	122.6	87.6	360.2	280.9
DIFFERENCES	AM		1507		-2.5		22.1
	OFF		2877		-1		34.6
	PM		5079		35		79.3
HRS/DAY	AM		2		2		2
	OFF		10		10		10
	PM		2		2		2
DAILY TOTALS	AM		3014		-5		44.2
	OFF		28770		-10		346
	PM		10158		70		158.6
	TOTAL		41942		55		548.8
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$176,156		$165,000		$164,640
PROJECT COST:			$22,800.00	TOTAL ANNUAL SAVINGS:			$505,796
BENEFIT/COST RATIO:			22				

CARROLL BLVD. SYSTEM



Downtown CBD System

The City of Denton Department of Public Works and Transportation worked on the following project. The system is composed of ten intersections along Elm Street and Locust Street which are both one-way arterials. Within the project area, these arterials are intersected by five streets at which traffic signals have been installed. These streets intersect Elm Street and Locust Street at right angles to form a simple grid network. The attached figure shows the project network, cross streets, and link distances.

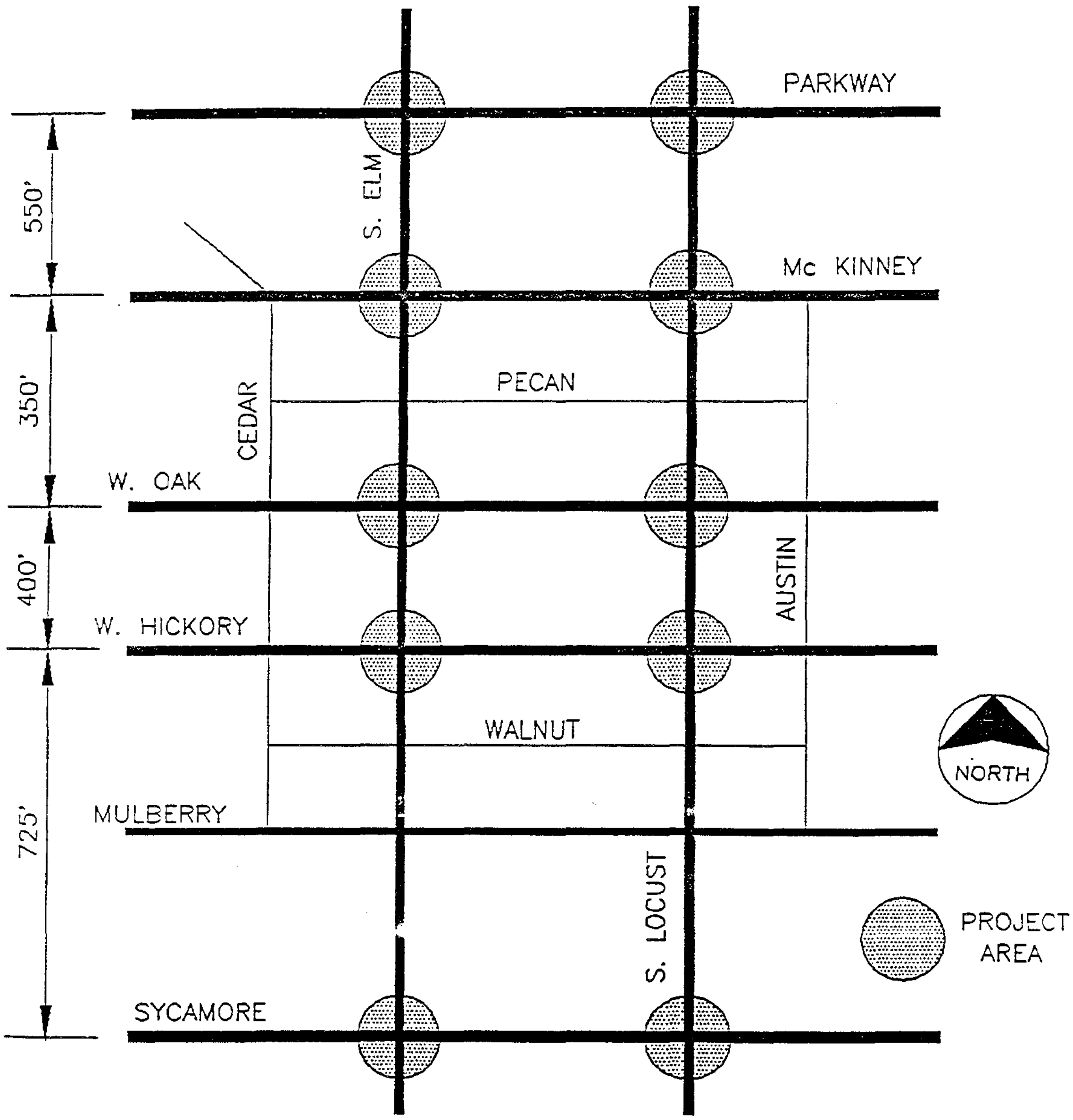
The intersections were being operated as isolated intersections with cycle lengths ranging from approximately 50 to 60 seconds with the exception of two intersections. The intersections of McKinney at Elm and McKinney at Locust were being operated as a two-signal coordinated system at a cycle length of 60 seconds. That coordination between the two signals on McKinney has been maintained.

The new system coordination is provided through a hardwire interconnect and utilizes Transyt controllers model 1880EL. The traffic signals utilize mast arms and poles, pedestal poles and span wire installations, along with protected/permissive left turn phasing and pedestrian controls at selected intersections.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Optimum cycle lengths were determined using TRANSYT-7F for each of the AM, OFF, and PM peak periods. Travel time information was obtained by the floating car technique. Six runs were made on each link in each time period (AM, NOON, and PM), and the mean travel times were determined.

Based on the TRANSYT-7F simulation, the project resulted in an estimated $335,425 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 7,201,800 stops (a 23.8 percent reduction), a total annual fuel savings of 42,600 gallons (a 11.0 percent reduction), and a delay annual savings of 19,200 veh-hrs (a 12.3 percent reduction). Average speeds were increased by 48.8 percent, 32.2 percent, and 94.3 percent for the AM, PM, and OFF peak periods, respectively. The total cost of the project was $55,000, and the resultant benefit to cost ratio was 6 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	4350	3384	23	20	57	51
	OFF	7429	5660	38	34	95	85
	PM	9042	6850	47	38	114	99
DIFFERENCES	AM		966		3		6
	OFF		1769		4		10
	PM		2192		9		15
HRS/DAY	AM		2		2		2
	OFF		10		10		10
	PM		2		2		2
DAILY TOTALS	AM		1932		6		12
	OFF		17690		40		100
	PM		4384		18		30
	TOTAL		24006		64		142
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$100,825		$192,000		$42,600
PROJECT COST:			$55,000.00	TOTAL ANNUAL SAVINGS:			$335,425
BENEFIT/COST RATIO:			6				


PARKWAY
S. ELM
550'
Mc KINNEY
350'
PECAN
CEDAR
W. OAK
400'
AUSTIN
W. HICKORY
WALNUT
NORTH
725'
MULBERRY
S. LOCUST
PROJECT AREA
SYCAMORE

NE/SE 8th/9th Street

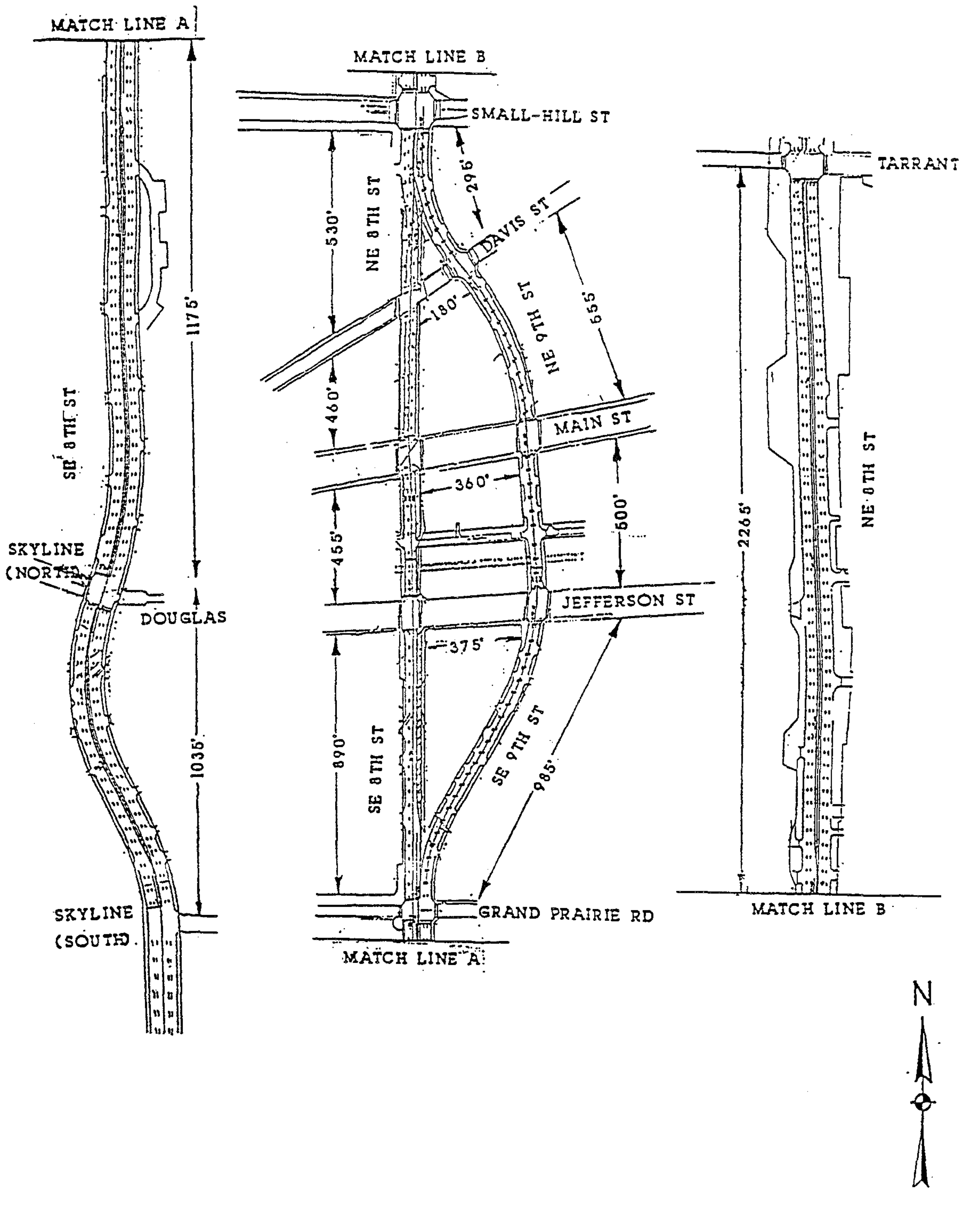
The City of Grand Prairie Department of Public Works and Transportation worked on the following project. NE/SE 8th/9th Street is unique in that the roadway divides from a seven-lane arterial into a pair of three-lane, one-way arterials -- one-way couplets -- as they cross Jefferson Street, Main Street, and the Union Pacific railroad corridor. The couplets then merge back into a seven-lane road at their intersection at Small-Hill. Jefferson Street and Main Street run east and west parallel to each other, with Union Pacific railroad between them. The attached figure shows the project network, cross streets, and link distances.

A total of 11 signalized intersections were included in this project. New traffic signal hardware was installed at 7 of the 11 intersections along the corridor. These seven intersections were full-actuated signals, controlled by NEMA type controller units. The traffic signals at the intersections with Main Street (S.H. 180) and Jefferson Street were part of a interconnected traffic signal system. All signals were equipped with pedestrian controls. All intersections had between two and four signal phases.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Optimum cycle lengths were determined using PASSER II-90 and TRANSYT-7F for each of the AM, OFF, and PM peak periods. The phase sequence recommended by PASSER II was utilized in TRANSYT when developing signal timing plans for the subject arterial. Travel time runs were input into TRANSYT-7F as link approach speeds and to calibrate the simulation model.

Based on the PASSER II and TRANSYT-7F simulation, the project resulted in an estimated $13,932,150 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 6,525,000 stops (a 18.9 percent reduction), a total annual fuel savings of 958,800 gallons (a 55.5 percent reduction), and a delay annual savings of 1,288,200 veh-hrs (a 73.9 percent reduction). The total cost of the project was $14,922, and the resultant benefit to cost ratio was 934 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	14005	12024	1751	158	1465	309
	OFF	6926	4695	61	96	137	152
	PM	15821	15851	912	218	869	367
DIFFERENCES	AM		1981		1593		1156
	OFF		2231		-35		-15
	PM		-30		694		502
HRS/DAY	AM		2		2		2
	OFF		8		8		8
	PM		2		2		2
DAILY TOTALS	AM		3962		3186		2312
	OFF		17848		-280		-120
	PM		-60		1388		1004
	TOTAL		21750		4294		3196
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$91,350		$12,882,000		$958,800
PROJECT COST:			$14,922.47	TOTAL ANNUAL SAVINGS:			$13,932,150
BENEFIT/COST RATIO:			934				



MATCH LINE A
SE 8TH ST
1175'
SKYLINE (NORTH)
DOUGLAS
1035'
SKYLINE (SOUTH)
MATCH LINE B
SMALL-HILL ST
NE 8TH ST
530'
296'
DAVIS ST
180'
NE 9TH ST
655'
460'
MAIN ST
360'
600'
455'
JEFFERSON ST
375'
890'
SE 8TH ST
SE 9TH ST
985'
GRAND PRAIRIE RD
MATCH LINE A
TARRANT
2265'
NE 8TH ST
MATCH LINE B
N

San Bernardo Avenue and Park Street

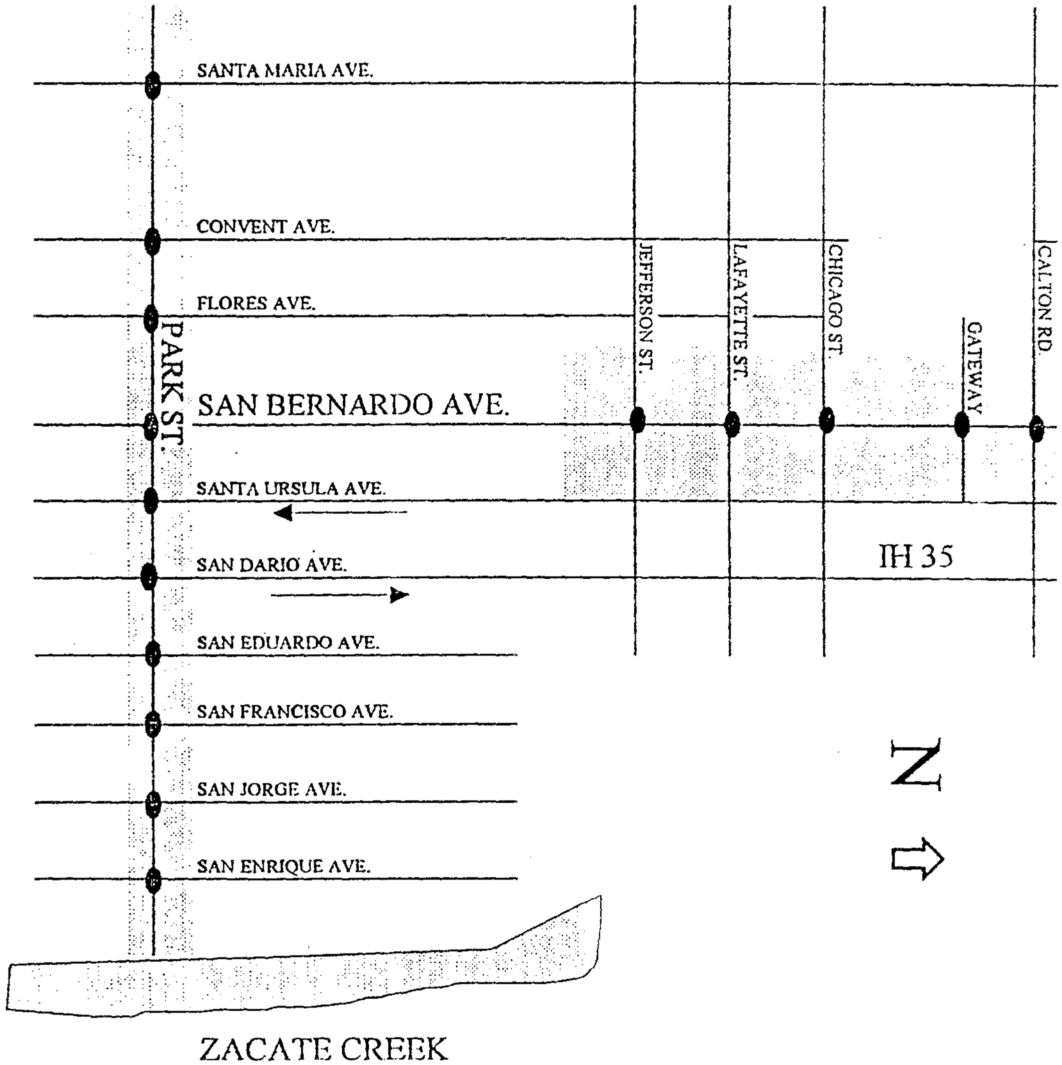
The City of Laredo Department of Public Works and Transportation worked on the following project. The traffic signal network is composed of a total of 15 signalized intersections including two frontage road intersections. San Bernardo Avenue is a four-lane undivided two-way major arterial with left turn lanes at signalized intersection approaches and parking permitted on both sides. It provides access to the CBD on the south and to many businesses, restaurants, and hotels on the north and, thus, carries significant amounts of traffic throughout the day. Except for Gateway which serves a shopping center driveway on the west and a bank driveway on the east, all other signalized cross intersections provide access to IH 35 one block away. Park Street is a major east/west arterial which provides access to Interstate 35. It services businesses, residences, and a junior high and high school located along this road. It is a two-way, four-lane road with left turn bays at San Bernardo Avenue and the IH 35 interchange, with parking lanes on both sides. The attached figure shows the project network and cross streets.

A total of 5 new Naztec 900 NEMA traffic signal cabinets and controllers and 7 Non-NEMA controllers were purchased and installed by the Traffic Safety Division for this project. The new controllers were installed at Calton Road, Chicago Street, Lafayette Street, and Jefferson Street. The NEMA signal control equipment installed at San Bernardo Avenue was utilized as a master location for the other eight locations along Park Street. Interconnect cable was installed between all signals, and signal timing was developed and implemented for this arterial. Loop detectors were installed on intersecting cross streets and on left turn lanes. Except for signals at IH 35, San Bernardo, and Santa Maria, all other low volume intersections along Park Street were placed on yellow/red night flash after 11:00 PM.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Timing plans were developed using PASSER II-90. Test car travel time studies were made along this arterial both before and after the new plans were implemented. Reduction in total delay, travel time, and running time, as well as an increase in average run speed occurred in both directions for each of the peak periods evaluated.

Based on the PASSER II-90 simulation, the project resulted in an estimated $610,258 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 3,653,400 stops (a 9.15 percent reduction), a total annual fuel savings of 55,380 gallons (a 8.2 percent reduction), and an annual delay savings of 50,373 veh-hrs (a 20.44 percent reduction). The total cost of the project was $61,107, and the resultant benefit to cost ratio was 10 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	17043	14654	141.73	108.75	296.34	263.95
	OFF	9988	9209	55.25	44.33	166.6	154.99
	PM	16212	14213	127.2	101.47	288.93	252.82
DIFFERENCES	AM		2389		32.98		32.39
	OFF		779		10.92		11.61
	PM		1999		25.73		36.11
HRS/DAY	AM		1		1		1
	OFF		10		10		10
	PM		1		1		1
DAILY TOTALS	AM		2389		32.98		32.39
	OFF		7790		109.2		116.1
	PM		1999		25.73		36.11
	TOTAL		12178		167.91		184.6
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$51,148		$503,730		$55,380
PROJECT COST:			$61,107.00	TOTAL ANNUAL SAVINGS:			$610,258
BENEFIT/COST RATIO:			10				


SANTA MARIA AVE.
CONVENT AVE.
FLORES AVE.
PARK ST.
SAN BERNARDO AVE.
SANTA URSULA AVE.
SAN DARIO AVE.
SAN EDUARDO AVE.
SAN FRANCISCO AVE.
SAN JORGE AVE.
SAN ENRIQUE AVE.
JEFFERSON ST.
LAFAYETTE ST.
CHICAGO ST.
GATEWAY
CALTON RD.
IH 35
N
ZACATE CREEK

Saunders Street (US 59)

The City of Laredo Department of Public Works and Transportation worked on the following project. The traffic signal network is composed of a total of 11 signalized intersections, including one diamond type interchange. Saunders Street is a five lane undivided two-way major arterial with left turn lanes. It extends from San Bernardo Avenue on the west to Arkansas Avenue on the east. It provides access to IH 35 from the east and services commercial development in the area. The cross streets are mainly two-lane undivided two-way roadways, some of which include left turn bays. US 59 is a designated truck route and hence there is a significant amount of truck traffic in this area. The attached figure shows the project network and cross streets.

A total of seven new Naztec 900 traffic signal cabinets and controllers were purchased and installed for this project. Five pole mounted cabinets, one base mounted cabinet, and one diamond base mounted cabinet were also installed. The existing NEMA traffic controllers at Arkansas Avenue and Barlett Avenue were replaced with NAZTEC 900 controllers. Left turn signal indications were installed northbound and southbound at Springfield Avenue. Left turn indication was also installed at McPherson Avenue for southbound traffic travelling east. Except for San Bernardo Avenue for which connection to the master controller exists, all controllers operate under time-based coordination.

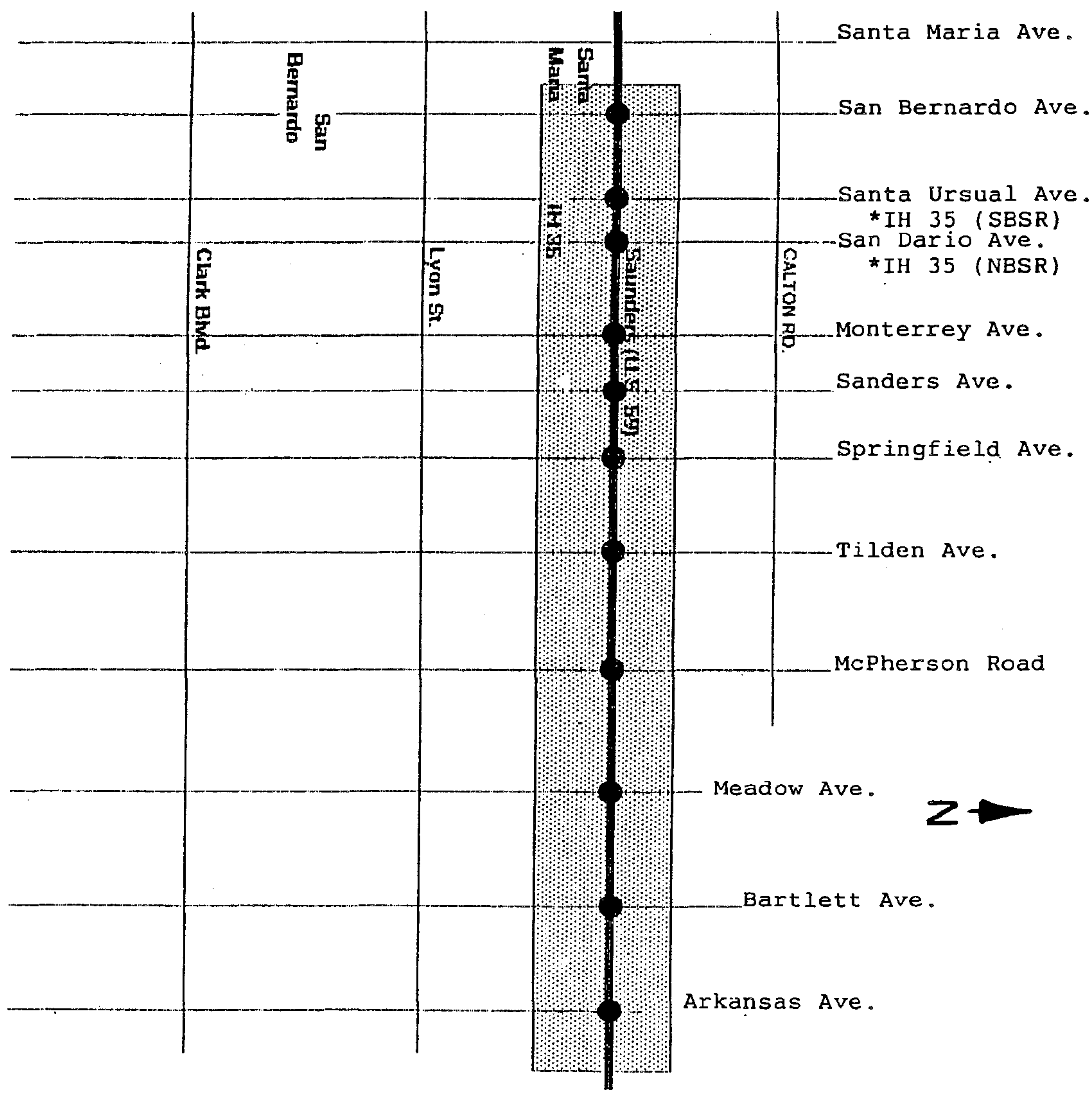
In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Timing plans were developed using PASSER II-90. Test car travel time studies were made along this arterial both before and after the new plans were implemented. Reduction in total delay, travel time, and running time as well as an increase in average run speed occurred in both directions for each of the peak periods evaluated.

Based on the PASSER II-90 simulation, the project resulted in an estimated $414,929 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 5,107,200 stops (a 12.05 percent reduction), a total annual fuel savings of 43,608 gallons (a 4.7 percent reduction), and an annual delay savings of 29,982 veh-hrs (a 9.42 percent reduction). The total cost of the project was $63,007, and the resultant benefit to cost ratio was 7 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	15173	12165	156.47	124.24	345.65	309.38
	NOON	10874	9894	77.06	73.4	239.42	232.07
	PM	17383	13167	133.35	102.24	353	317.41
DIFFERENCES	AM		3008		32.23		36.27
	NOON		980		3.66		7.35
	PM		4216		31.11		35.59
HRS/DAY	AM		1		1		1
	NOON		10		10		10
	PM		1		1		1
DAILY TOTALS	AM		3008		32.23		36.27
	NOON		9800		36.6		73.5
	PM		4216		31.11		35.59
	TOTAL		17024		99.94		145.36
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$71,501		$299,820		$43,608

PROJECT COST: $63,007.00 TOTAL ANNUAL SAVINGS: $414,929

BENEFIT/COST RATIO: 7


Santa Maria Ave.
San Bernardo Ave.
Santa Ursual Ave.
*IH 35 (SBSR)
San Dario Ave.
*IH 35 (NBSR)
Monterrey Ave.
Sanders Ave.
Springfield Ave.
Tilden Ave.
McPherson Road
Meadow Ave.
Bartlett Ave.
Arkansas Ave.
San Bernardo
Santa Maria
IH 35
Saunders (U.S. 59)
Clark Blvd.
Lyon St.
CALTON RD.
N

Gilmer Road

The City of Longview Department of Public Works and Transportation worked on the following project. Gilmer Road is a major north/south street connecting Loop 281 to residential areas north and south of Loop 281. Gilmer Road serves as a major connector road that distributes traffic to these residential areas and provides access to the downtown Longview area. The traffic volumes are heavy during the morning and afternoon peak periods with flow being distributed to the areas connected to downtown. The attached figure shows the project network, cross streets, and link distances.

A total of seven signalized intersections were included in this project. In the before conditions, the intersections were equipped with various electro-mechanical and solid state controllers. All intersections were operating in an isolated mode.

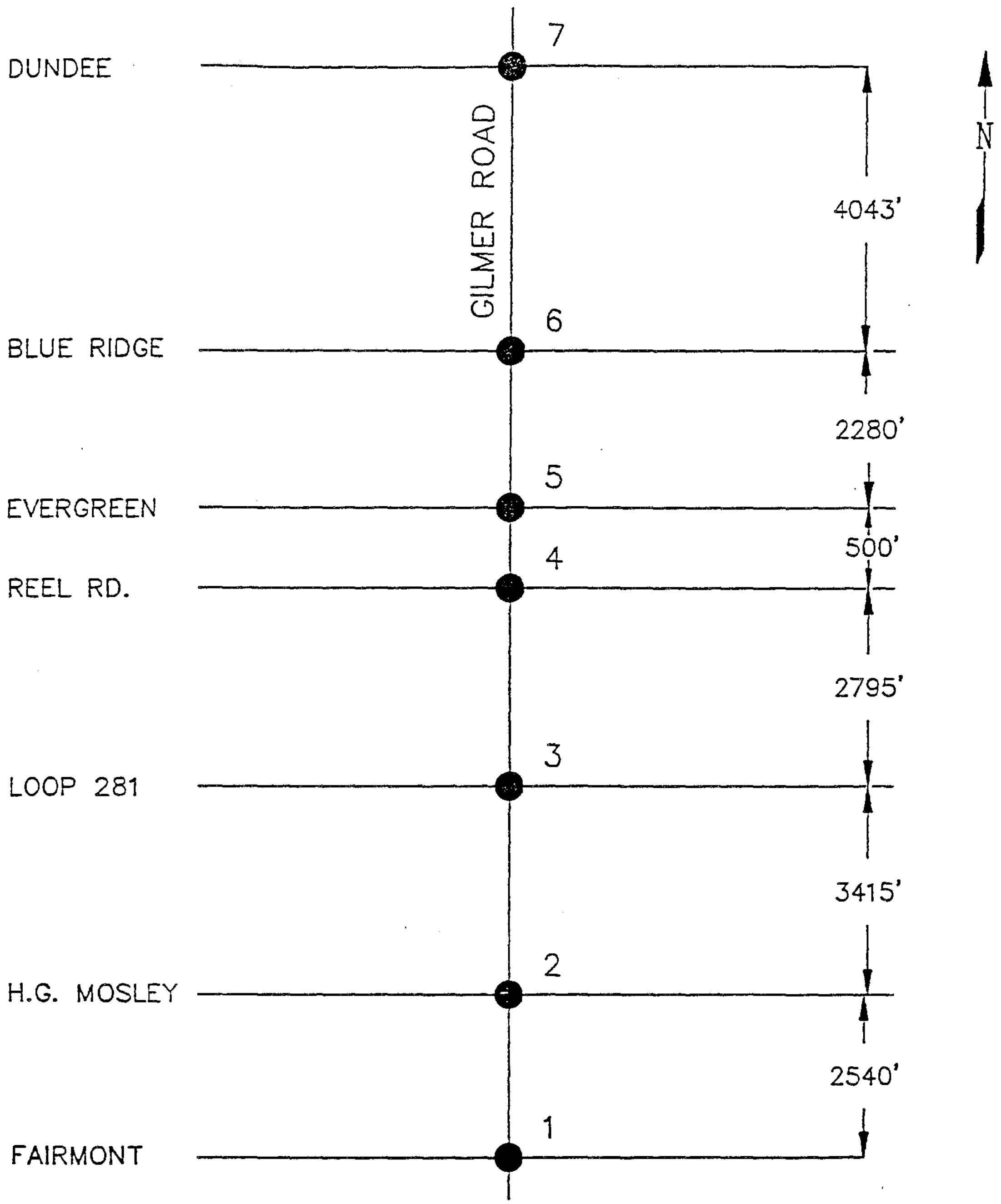
New solid state NEMA controllers were installed at each of the seven intersections. A new communications cable was also installed encompassing these seven intersections. This allowed the intersections to be incorporated into the City's closed-loop signal system. All signals were actuated and were not equipped with pedestrian controls. All intersections had either three or four signal phases.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Optimum cycle lengths were determined using TRANSYT-7F for each of the AM, OFF, and PM peak periods. Travel time information was obtained by the floating car technique. Six runs were made on each link in each time period (AM, NOON, and PM), and the mean travel times were determined. The computer model was run for each daily peak period utilizing cycle lengths ranging from 70 to 95 seconds, incremented in 5 second intervals. The optimized timing plans were programmed into the controllers via closed-loop communication. Fine tuning was done by adjusting the offsets and splits in the field.

Based on the TRANSYT-7F simulation, the project resulted in an estimated $528,489 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 12,988,500 stops (a 26.5 percent reduction), a total annual fuel increase of 531,150 gallons (a 102.0 percent increase), and a delay annual savings of 87,780 veh-hrs (a 21.9 percent reduction). The changes in the signal timing for this system reduced delay and stops. However, there was an increase in fuel consumption for all the peak periods. Overall, travel times along Gilmer Road were reduced by 15 percent. The total cost of the project was $117,002, and the resultant benefit to cost ratio was 5 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	13814	9911	108.2	82	142.5	308.2
	NOON	14419	11338	122.4	110.1	157.6	257.3
	PM	19046	14140	167.8	125.5	211.6	417.2
DIFFERENCES	AM		3903		26.2		-165.7
	NOON		3081		12.3		-99.7
	PM		4906		42.3		-205.6
HRS/DAY	AM		7		7		7
	NOON		2		2		2
	PM		2		2		2
DAILY TOTALS	AM		27321		183.4		-1159.9
	NOON		6162		24.6		-199.4
	PM		9812		84.6		-411.2
	TOTAL		43295		292.6		-1770.5
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$181,839		$877,800		($531,150)

PROJECT COST:	$117,001.61	TOTAL ANNUAL SAVINGS:	$528,489
BENEFIT/COST RATIO:	5		


7
DUNDEE
GILMER ROAD
N
4043'
6
BLUE RIDGE
2280'
5
EVERGREEN
500'
4
REEL RD.
2795'
3
LOOP 281
3415'
2
H.G. MOSLEY
2540'
1
FAIRMONT

South Street and Cotton Street

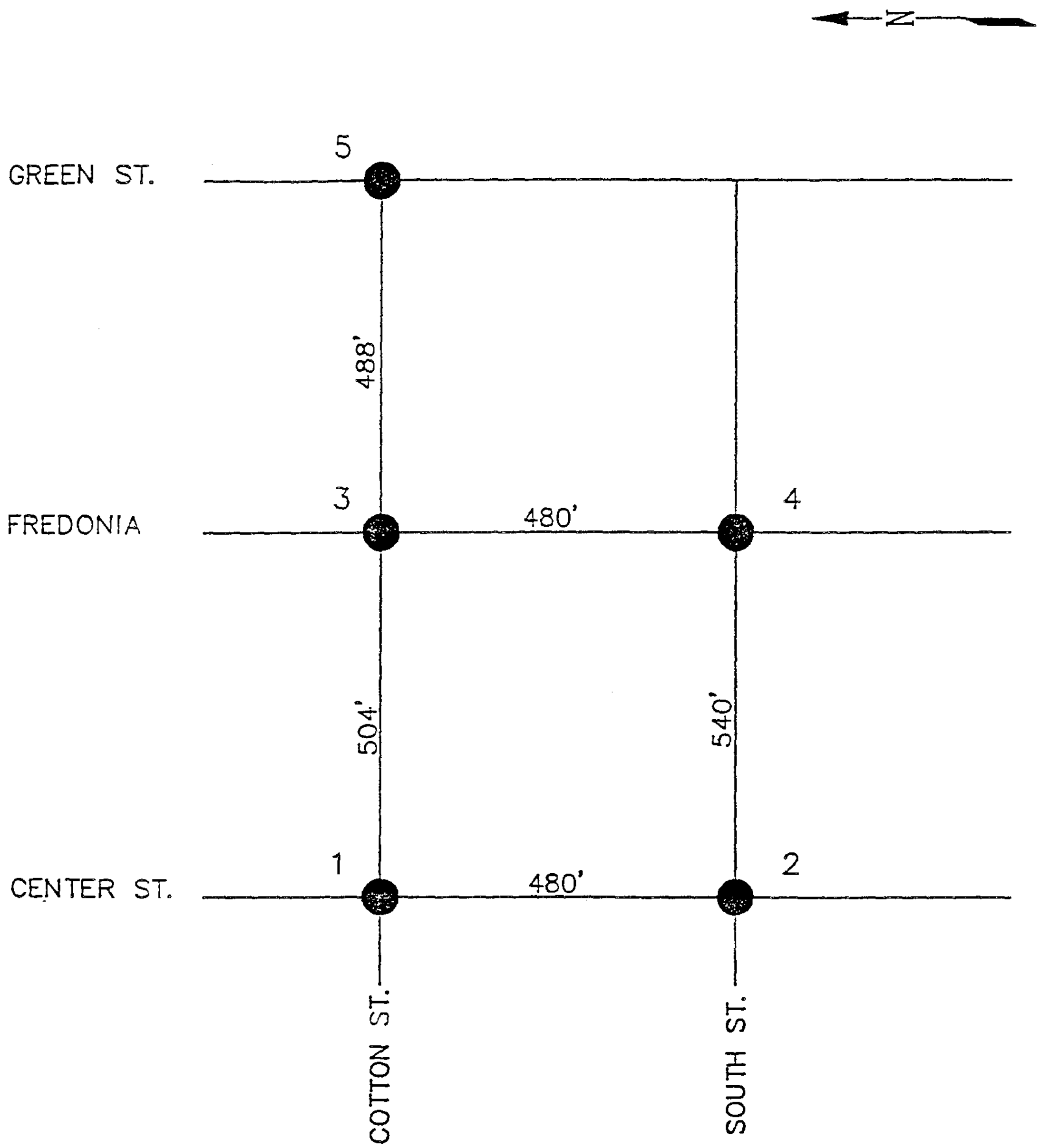
The City of Longview Department of Public Works and Transportation worked on the following project. South Street and Cotton Street are two major east/west streets connecting Highway 31 and FM 1845, respectively, to the downtown area in Longview. South Street and Cotton Street serve as major connector roads that distribute traffic to the Longview downtown area. Traffic volumes are heavy during the morning and afternoon peak periods. The attached figure shows the project network, cross streets, and link distances.

A total of five signalized intersections were included in this project. New solid state NEMA controllers were installed at each of the five intersections. A new communications cable was also installed encompassing these five intersections. This allowed the intersections to be incorporated into the City's closed-loop signal system. All the signals were pretimed and equipped with pedestrian controls. All intersections had two signal phases, except the intersection at South/Center which has three signal phases.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Optimum cycle lengths were determined using TRANSYT-7F for each of the AM, OFF, and PM peak periods. Travel time information was obtained by the floating car technique. Six runs were made on each link in each time period (AM, NOON, and PM), and the mean travel times were determined. The computer model was run for each daily peak period utilizing cycle lengths ranging from 45 to 60 seconds, incremented in 5 second intervals. The optimized timing plans were programmed into the controllers via closed-loop communication. Fine tuning was done by adjusting the offsets and splits in the field.

Based on the TRANSYT-7F simulation, the project resulted in an estimated $135,623 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 1,180,200 stops (a 13.6 percent reduction), a total annual fuel savings of 12,000 gallons (a 11.9 percent reduction), and a delay annual savings of 10,710 veh-hrs (a 23.0 percent reduction). Travel times within the grid were reduced by an average of 12 percent. The total cost of the project was $60,687, and the resultant benefit to cost ratio was 2 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	2874	2455	15.5	12.3	33	30
	NOON	2472	2118	13.2	9.9	29	25
	PM	2955	2646	15.9	12.8	34	31
DIFFERENCES	AM		419		3.2		3
	NOON		354		3.3		4
	PM		309		3.1		3
HRS/DAY	AM		2		2		2
	NOON		7		7		7
	PM		2		2		2
DAILY TOTALS	AM		838		6.4		6
	NOON		2478		23.1		28
	PM		618		6.2		6
	TOTAL		3934		35.7		40
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$16,523		$107,100		$12,000
PROJECT COST:			$60,686.88	TOTAL ANNUAL SAVINGS:			$135,623
BENEFIT/COST RATIO:			2				


N
5
GREEN ST.
488'
3
4
FREDONIA
480'
504'
540'
1
2
CENTER ST.
480'
COTTON ST.
SOUTH ST.

10th Street and Pecan Avenue

The City of McAllen Department of Public Works and Transportation and Texas Department of Transportation worked on the following project. The TLS II project for McAllen included the two major thoroughfares which bisect the city, namely 10th Street and Pecan Avenue. Tenth Street is a major north-south arterial in McAllen with traffic volumes in the range of 33,500 vehicles per day north of Pecan Avenue. Eighteen of the 29 signals which make up this project are on 10th Street between Dove and Wichita. Pecan Avenue is a major east-west arterial that traverses the northern portion of McAllen. Traffic volumes are in the order of 15,000 vehicles per day east of 10th Street. Pecan Avenue has a four-lane undivided cross-section west of 6th Street, while it is transitioned to a five lane cross-section east of 6th Street.

Installation of vehicle loop detectors, pedestrian push buttons, and the replacement of selected controllers with solid state controllers allowed traffic progression and provided flexibility to the system in terms of efficiency of operation for the varying levels of traffic demand. Most controllers along 10th Street were recently replaced with 8-phase NEMA controllers that can accommodate multiple timing plans. However, one timing plan was in operation throughout the daytime hours. Most intersections in the project were synchronized under cycle lengths between 60 and 85 seconds, while the few critical intersections requiring longer and variable cycles were set free. These critical intersections were equipped with loop detectors on all approaches, if they were not already existing in order to achieve fully actuated operation.

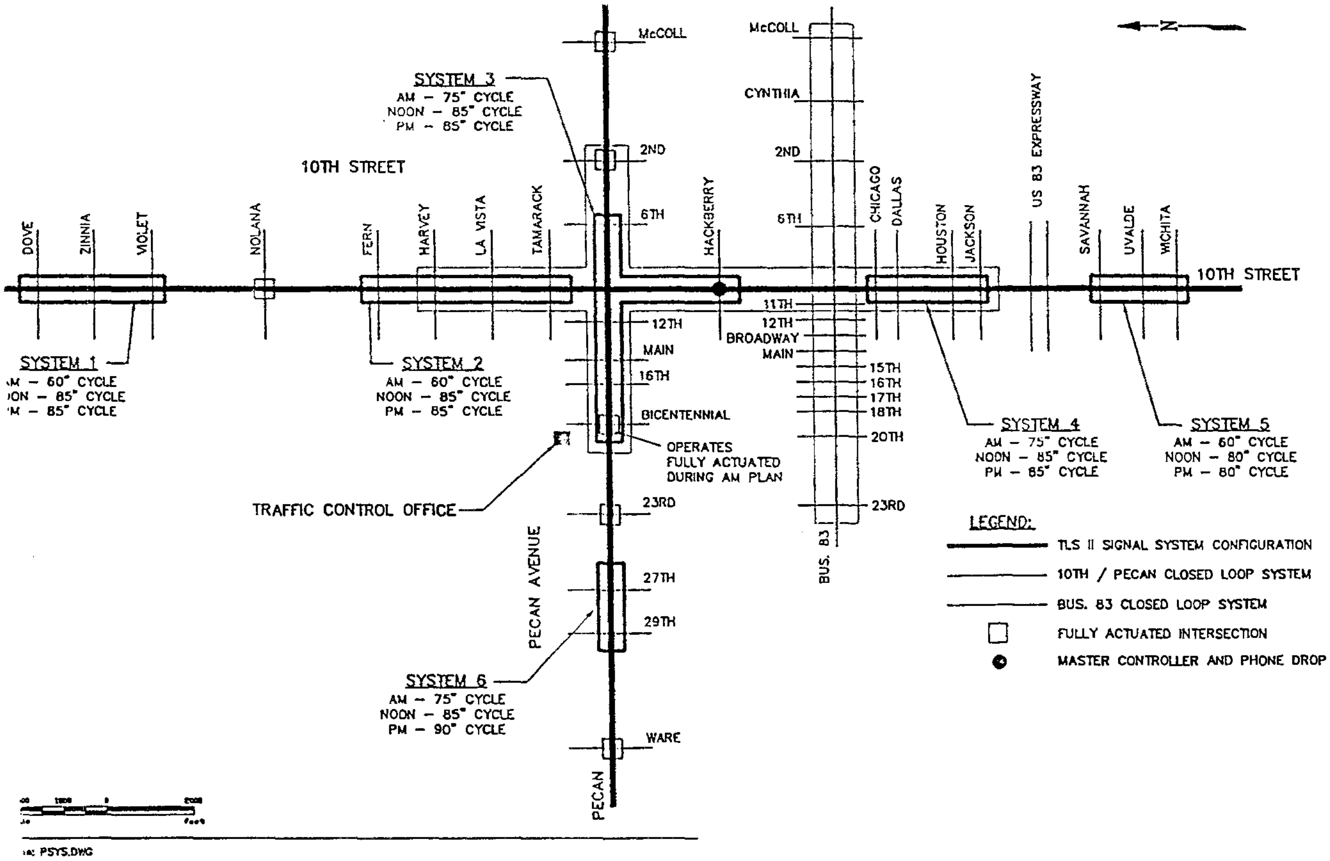
In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Optimum cycle lengths were determined using TRANSYT-7F for each of the AM, NOON, OFF, and PM peak periods. Travel time information was obtained by the test car method.

Based on the TRANSYT-7F, the project resulted in an estimated $1,679,353 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 21,853,800 stops (a 13.63 percent reduction), a total annual fuel savings of 233,400 gallons (a 6.02 percent reduction), and a delay annual savings of 114,000 veh-hrs (a 7.45 percent reduction). The total cost of the project was $127,315, and the resultant benefit to cost ratio was 13 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	43464	36710	465	403	1063	975
	NOON	52968	44386	466	432	1251	1171
	PM	64915	60992	689	663	1648	1587
DIFFERENCES	AM		6754		62		88
	NOON		8582		34		80
	PM		3923		26		61
HRS/DAY	AM		2		2		2
	NOON		6		6		6
	PM		2		2		2
DAILY TOTALS	AM		13508		124		176
	NOON		51492		204		480
	PM		7846		52		122
	TOTAL		72846		380		778
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$305,953		$1,140,000		$233,400

PROJECT COST: $127,315.00 TOTAL ANNUAL SAVINGS: $1,679,353

BENEFIT/COST RATIO: 13


10TH STREET
SYSTEM 1
AM - 60" CYCLE
NOON - 85" CYCLE
PM - 85" CYCLE
SYSTEM 2
AM - 60" CYCLE
NOON - 85" CYCLE
PM - 85" CYCLE
SYSTEM 3
AM - 75" CYCLE
NOON - 85" CYCLE
PM - 85" CYCLE
SYSTEM 4
AM - 75" CYCLE
NOON - 85" CYCLE
PM - 85" CYCLE
SYSTEM 5
AM - 60" CYCLE
NOON - 80" CYCLE
PM - 80" CYCLE
SYSTEM 6
AM - 75" CYCLE
NOON - 85" CYCLE
PM - 90" CYCLE
DOVE
ZINNIA
VIOLET
NOLANA
FERN
HARVEY
LA VISTA
TAMARACK
HACKBERRY
CHICAGO
DALLAS
HOUSTON
JACKSON
US 83 EXPRESSWAY
SAVANNAH
UVALDE
WICHITA
McCOLL
CYNTHIA
2ND
6TH
11TH
12TH
BROADWAY
MAIN
15TH
16TH
17TH
18TH
20TH
23RD
BICENTENNIAL
27TH
29TH
WARE
PECAN AVENUE
PECAN
BUS. 83
OPERATES FULLY ACTUATED DURING AM PLAN
TRAFFIC CONTROL OFFICE
LEGEND:
TLS II SIGNAL SYSTEM CONFIGURATION
10TH / PECAN CLOSED LOOP SYSTEM
BUS. 83 CLOSED LOOP SYSTEM
FULLY ACTUATED INTERSECTION
MASTER CONTROLLER AND PHONE DROP
PSYS.DWG

Midland Drive and Wall Street

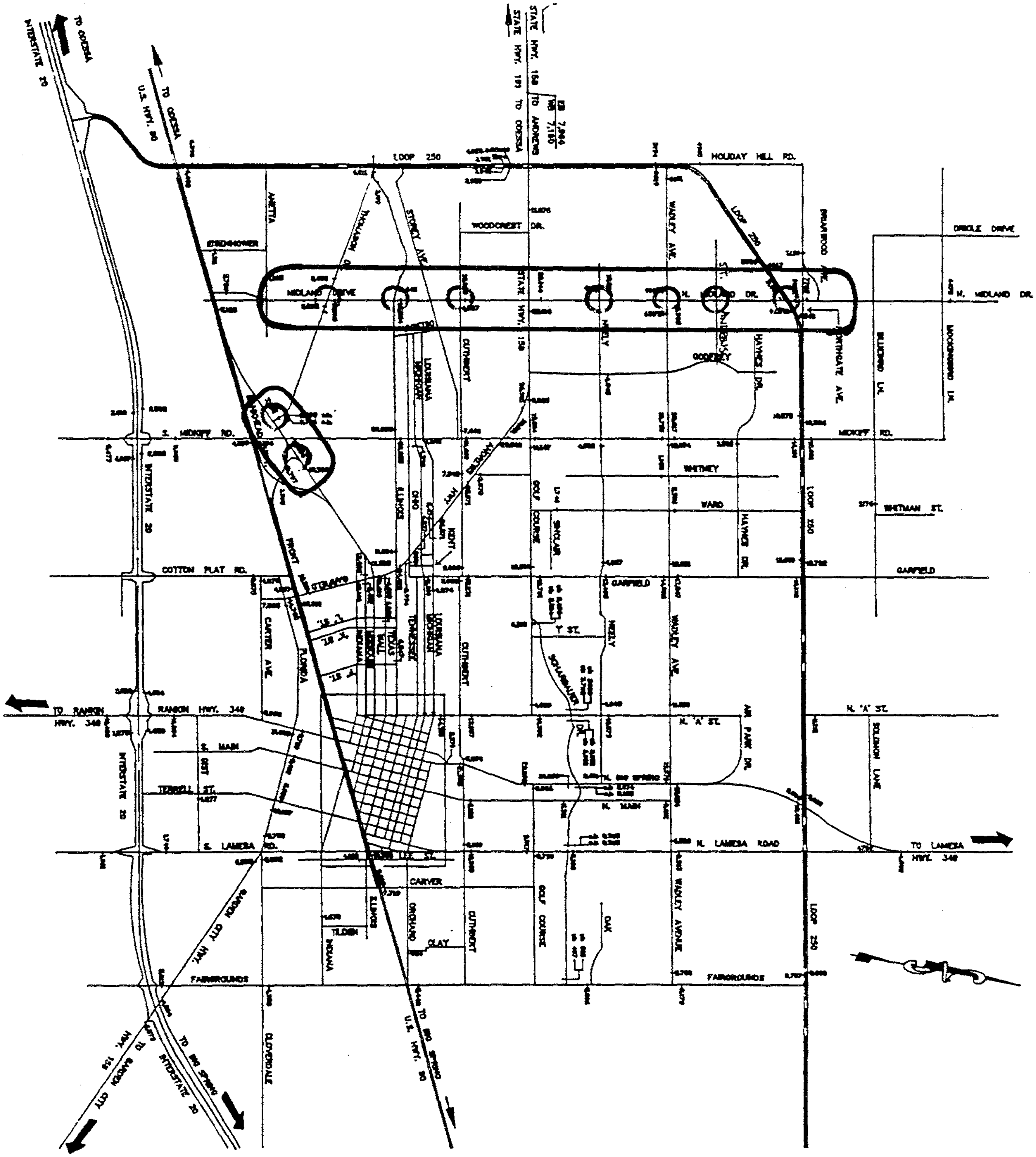
The City of Midland Department of Public Works and Transportation worked on the following project. The Midland Drive arterial is comprised of eight intersections. Seven intersections are included in this project. The arterial has not had coordination of any kind. Traffic generators along the arterial include schools, shopping centers, and residential areas. The Wall Street arterial is comprised of three intersections on Business Loop 20. Two of these are included in this project. Traffic generators consist of motels and auto dealerships, as well as being a major link from the Midland CBD to Odessa. The attached figure shows the project network and cross streets.

New traffic signal hardware was installed at seven intersections along Midland Drive. The signals at Thomason/Midland Drive were pretimed. All other intersections along Midland Drive were semi-actuated signals. New traffic signal hardware was also installed at two intersections along Wall Street. All intersections had between four and eight signal phases.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Optimum cycle lengths were determined using PASSER II-90 for each of the AM, OFF, and PM peak periods. The travel time information was obtained by the test car method. Six runs were made during each of the three time periods, and mean travel times and delays were determined.

Based on the PASSER II simulation, the project resulted in an estimated $9,239,766 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual increase of 14,489,400 stops (a 23.8 percent increase), a total annual fuel savings of 169,026 gallons (a 10.0 percent reduction), and an annual delay savings of 927,360 veh-hrs (a 65.1 percent reduction). The changes in the signal timing for this system reduced fuel consumption, delay, and travel time. However, there was an increase in the number of stops for all the study periods. Reduction in travel times implied that progression along the main street has improved. Improving progression along the main street may have caused an increase in delay and stops for the cross streets. But the increase in delay for the cross streets may have been offset by the reduction of delay for the main street, hence, an increase in stops for the project. The total cost of the project was $54,016, and the resultant benefit to cost ratio was 171 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	12116	13184	346.55	87.1	353.43	283.1
	OFF	8301	11101	161.26	60.1	238.4	231
	PM	15787	18523	415.31	163.6	390.63	330.2
DIFFERENCES	AM		-1068		259.45		70.33
	OFF		-2800		101.16		7.4
	PM		-2736		251.71		60.43
HRS/DAY	AM		3.5		3.5		3.5
	OFF		12.25		12.25		12.25
	PM		3.75		3.75		3.75
DAILY TOTALS	AM		-3738		908.08		246.15
	OFF		-34300		1239.21		90.65
	PM		-10260		943.91		226.61
	TOTAL		-48298		3091.20		563.42
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			($202,852)		$9,273,593		$169,025
PROJECT COST:			$54,015.75	TOTAL ANNUAL SAVINGS:			$9,239,766
BENEFIT/COST RATIO:			171				


TO ODESSA
INTERSTATE 20
U.S. HWY. 80
LOOP 250
HOLIDAY HILL RD.
WOODCREST DR.
ORIOLE DRIVE
MIDLAND DRIVE
N. MIDLAND DR.
STATE HWY. 158
S. MIDKIFF RD.
MIDKIFF RD.
WHITNEY
WARD
WHITMAN ST.
COTTON FLAT RD.
GARFIELD
CUTHBERT
WADLEY AVE.
TO RANKIN HWY. 349
RANKIN HWY. 349
N. 'A' ST.
S. MAIN
TERRELL ST.
N. MAIN
S. LAMESA RD.
N. LAMESA ROAD
TO LAMESA HWY. 349
CARVER
TILDEN
CLAY
FAIRGROUNDS
TO BIG SPRING

Dixie Boulevard

The City of Odessa Department of Public Works and Transportation worked on the following project. The City of Odessa currently has 163 signalized intersections, of which 13 are on Dixie Boulevard. The 13 signals in this system were coordinated via time-base with 40, 46, 68, 80, and 92 second cycle lengths. Several major streets that intersect the Dixie Boulevard arterial are also coordinated via time-base with multiple offsets, cycles, and splits programmed as part of other arterial systems.

This project includes the replacement of controllers at 12 signalized intersections on Dixie Boulevard to provide the cycle lengths and splits necessary for minimizing delays for through and turning movements. One intersection was upgraded through the Traffic Management Program.

Improvements were achieved in signal timing and operation on Dixie Boulevard. The new signal timing also enabled other safety improvements to be implemented relating to the clearance intervals and pedestrian timing. The controller software was upgraded twice to accommodate the improvements. The vehicle detector loops and the system detector loops installed on this project will further improve the signal timing.

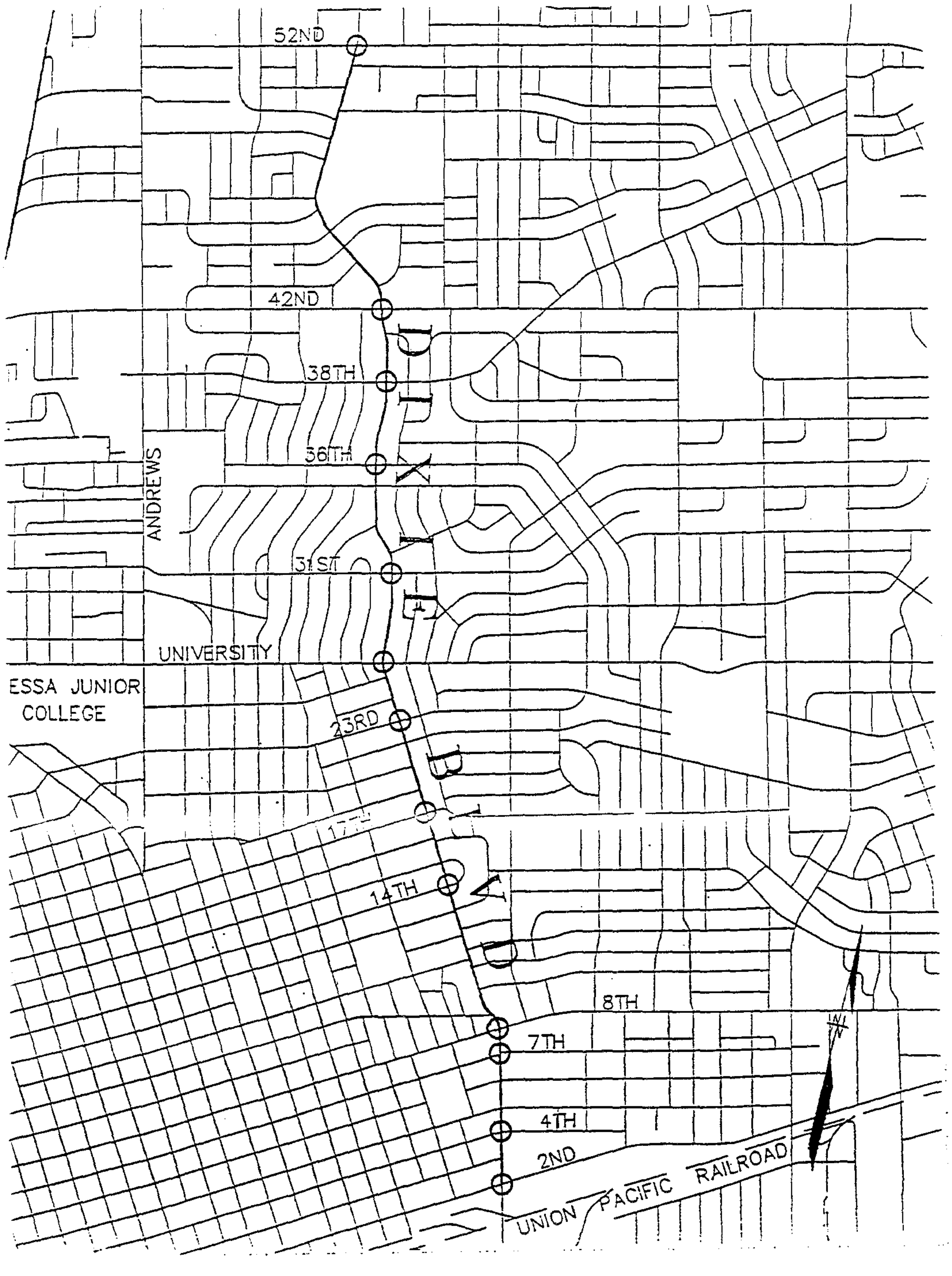
In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Timing plans were developed using PASSER II. Travel time information was obtained by using laptop computers connected to an electronic "Distance Measuring Instrument" (DMI) and utilizing the "Moving Vehicle Run Analysis" software. Fifty-four runs were made on each link in each time period (AM, NOON, and PM), and the mean travel times were determined.

Based on the PASSER II simulation, the project resulted in an estimated $2,182,888 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 13,356,300 stops (a 12.81 percent reduction), a total annual fuel savings of 240,900 gallons (a 11.59 percent reduction), and a delay annual savings of 175,500 veh-hrs (a 17.18 percent reduction). Travel times were reduced for all the peak periods for the northbound and southbound directions. The total cost of the project was $158,436, and the resultant benefit to cost ratio was 14 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	22553	19475	236	194	457	401
	NOON	20395	19077	104	98	352	335
	PM	22816	21166	116	104	404	374
DIFFERENCES	AM		3078		42		56
	NOON		1318		6		17
	PM		1650		12		30
HRS/DAY	AM		13.5		13.5		13.5
	NOON		1		1		1
	PM		1		1		1
DAILY TOTALS	AM		41553		567		756
	NOON		1318		6		17
	PM		1650		12		30
	TOTAL		44521		585		803
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$186,988		$1,755,000		$240,900

PROJECT COST: $158,436.03 TOTAL ANNUAL SAVINGS: $2,182,888

BENEFIT/COST RATIO: 14


52ND
42ND
38TH
36TH
31ST
UNIVERSITY
ANDREWS
ESSA JUNIOR
COLLEGE
23RD
14TH
8TH
7TH
4TH
2ND
UNION PACIFIC RAILROAD
DIXIE BLVD

Jefferson Drive/Highway 347

The City of Port Arthur Department of Public Works and the Texas Department of Transportation worked on the following project. The project area involves the traffic signal system on Jefferson Drive/Highway 347 from Merriman Street to Gulfway Drive. The Jefferson Drive/Highway 347 signal system consists of 12 traffic signals, 6 of which are under the City of Port Arthur jurisdiction, and 6 are under the State's jurisdiction. Jefferson Drive/Highway 347 is a major north-south traffic corridor located in the eastern sector of Port Arthur. It serves the cities of Port Arthur, Nederland, Port Neches, and Groves. Traffic volumes along this corridor are in the range of 26,000 vehicles per day.

Part of the TLS II program was to upgrade the controllers at Saba Lane, Hogaboom Road, and Dryden Road in order to provide solid state menu driven units capable of time-base coordination (TBC) in the rest of the system. The six State intersections from Monroe to 25th Street were modernized to similar type controllers operating on an 80 second cycle all day. 75th Street and Gulfway Drive already had menu driven controllers with TBC. The City of Port Arthur replaced an older controller with TBC at Merriman with a new menu driven unit during the implementation phase of the program. As a result, all 12 intersections in the project now have similar menu driven NAZTEC units.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Optimum cycle lengths were determined using PASSER II-90 for each of the AM, NOON, and PM peak periods. Six runs were made on each major link in each time period (AM peak, PM peak, and NOON), and the mean travel times and delays were determined. Travel time information was obtained by the test car method.

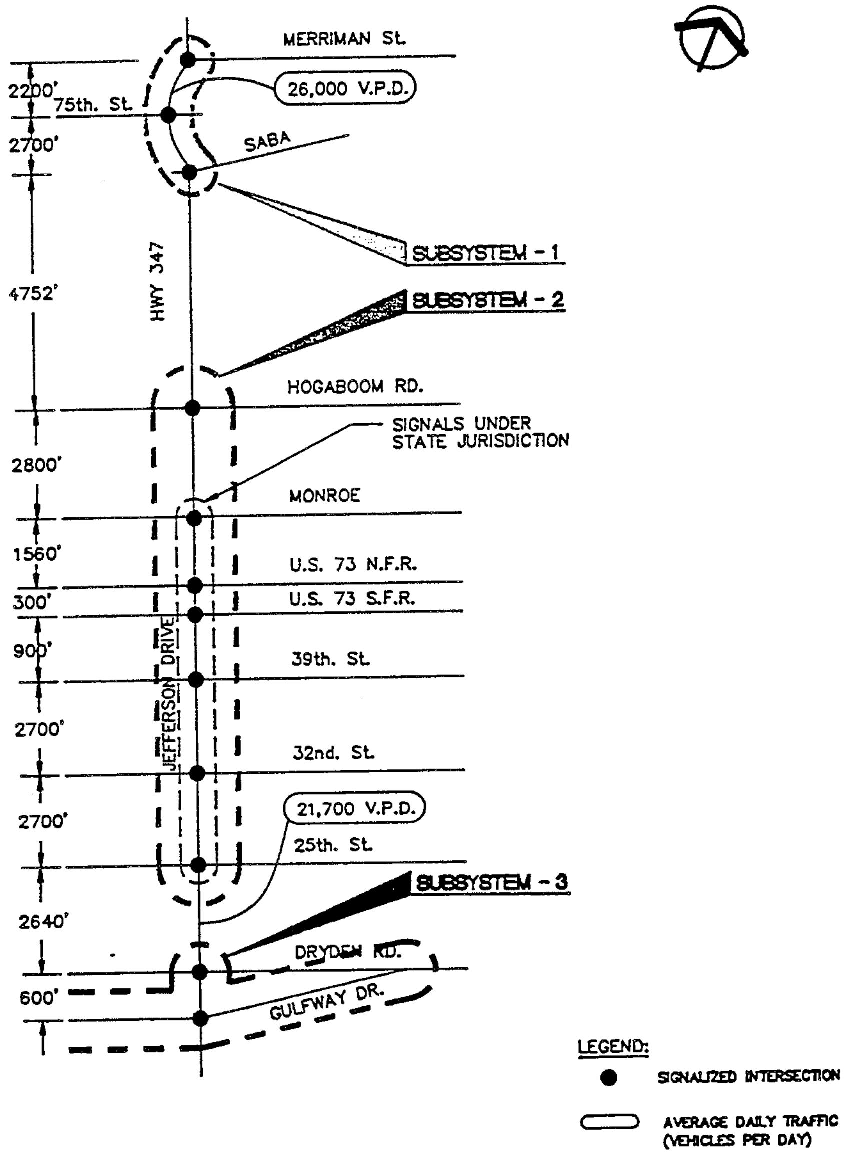
Based on the PASSER II-90 simulation, the project resulted in an estimated $3,089,801 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 3,487,200 stops (a 4.81 percent reduction), a total annual fuel savings of 613,080 gallons (a 26.97 percent reduction), and a delay annual savings of 242,790 veh-hrs (a 34.60 percent reduction). The total cost of the project was $65,400, and the resultant benefit to cost ratio was 47 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	17695	17906	145.4	114.8	547	428.2
	NOON	23901	23344	214.5	154.6	745.3	561.4
	PM	30996	27653	348.2	188.9	985	667.8
DIFFERENCES	AM		-211		30.6		118.8
	NOON		557		59.9		183.9
	PM		3343		159.3		317.2
HRS/DAY	AM		3		3		3
	NOON		4		4		4
	PM		3		3		3
DAILY TOTALS	AM		-633		91.8		356.4
	NOON		2228		239.6		735.6
	PM		10029		477.9		951.6
	TOTAL		11624		809.3		2043.6
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$48,821		$2,427,900		$613,080

PROJECT COST: $65,400.00 TOTAL ANNUAL SAVINGS: $3,089,801

BENEFIT/COST RATIO: 47

JEFFERSON DRIVE / HIGHWAY 347 SYSTEM



Beauregard Avenue

The City of San Angelo and Barton-Aschman Associates, Inc. worked on the following project. San Angelo has a population of approximately 84,500 people and is approximately 220 miles southwest of Ft. Worth, and 210 miles northwest of San Antonio. The Beauregard Avenue system runs east-west from Sherwood Way to Washington west of downtown San Angelo. This section of Beauregard serves as a major arterial with daily traffic volumes of approximately 21,000 vehicles. The system presently operates as a hardware interconnected system.

This project includes four intersections along Beauregard Avenue. The project consisted of implementing closed-loop signal system technology for four intersections along Beauregard Avenue by installing new Naztec 900 series controllers and communication cables. Other items installed as part of this project included vehicle detection, pedestrian control, and traffic signal heads. The new signal system provides a means of coordinating traffic flow with the ability to monitor and respond to changes on a real-time basis.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included arterial data, peak hour turning movement volumes, signal phasing and timing, and network travel time data using the floating car technique. All of this data was collected to evaluate and calibrate before and after conditions. Intersection approach configurations and lane assignments for all 15 intersections were used to derive saturation flows needed as input into the TRANSYT-7F modeling program. TRANSYT-7F and PASSER II were utilized to evaluate and optimize the network, respectively.

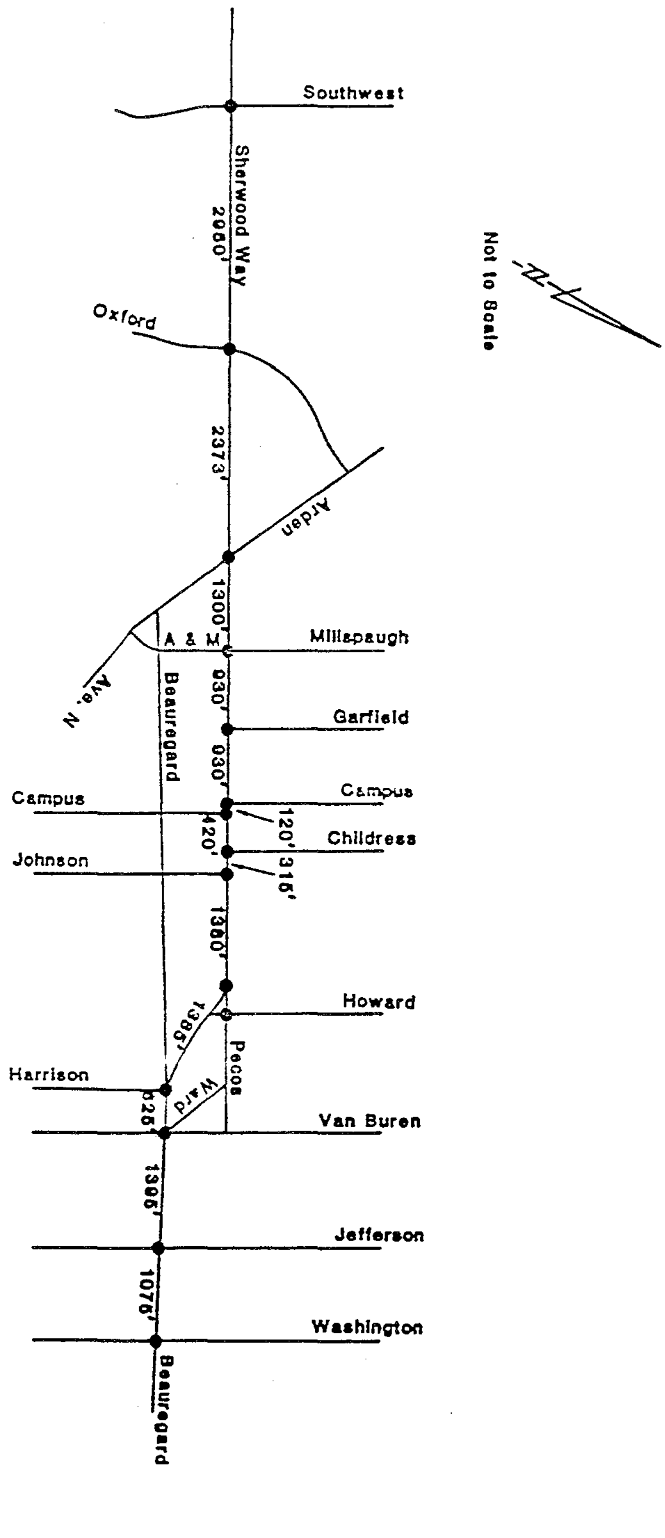
The existing AM, NOON/OFF, and PM peak turning movement volumes, saturation flow rates, as well as signal phasing and timing data were input into the TRANSYT-7F model to simulate before and after conditions. PASSER II-90 was used to develop optimum signal phasing patterns and intersection offsets. Implementation of the new timing plans and fine tuning of system signal timings were carried out in part by the City of San Angelo. Minor offset changes were required at some intersections. This was due in part to the variability in vehicular speeds between intersections. The revised final timing plans for all intersections were simulated with TRANSYT-7F to obtain the final measures of effectiveness.

Based on the TRANSYT-7F and PASSER III simulation, the project resulted in an estimated $370,988 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 2,696,400 stops (a 29.05 percent reduction), a total annual fuel savings of 63,540 gallons (an 25.56 percent reduction), and a delay annual savings of 26,970 veh-hrs (a 43.03 percent reduction). The total cost of the project was $95,332 and the resultant benefit to cost ratio was 4 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	2274	1731	16	9.2	59.2	50.1
	NOON	2759	1692	18.1	9.4	76.2	47.3
	PM	2886	2416	19.2	13	75.9	65
DIFFERENCES	AM		542		6.8		9.1
	NOON		1067		8.7		28.9
	PM		470		6.2		10.9
HRS/DAY	AM		5		5		5
	NOON		5		5		5
	PM		2		2		2
DAILY TOTALS	AM		2711		34		45.5
	NOON		5337		43.5		144.5
	PM		940		12.4		21.8
	TOTAL		8988		89.9		211.8
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$37,748		$269,700		$63,540

PROJECT COST: $95,332.00 TOTAL ANNUAL SAVINGS: $370,988

BENEFIT/COST RATIO: 4


Southwest
Sherwood Way
2050'
Not to Scale
N
Oxford
2373'
Arden
1300'
A & M
Millspaugh
Ave. N
Beauregard
030'
Garfield
030'
Campus
Campus
120'
420'
Childress
Johnson
315'
1360'
Howard
1385'
Pecos
Harrison
Ward
525'
Van Buren
1395'
Jefferson
1075'
Washington
Beauregard

Chadbourne Triangle

The City of San Angelo and Barton-Aschman Associates, Inc. worked with TxDOT and TTI to carry out the project. The Chadbourne Triangle is located in southeast San Angelo. Chadbourne Triangle includes the intersections of Chadbourne Street/Avenue L, Chadbourne Street/Avenue N-Oakes Street, and Avenue L/Oakes Street. Each roadway is a secondary arterial. The City of San Angelo has a population of approximately 84,500 people and is located approximately 250 miles southwest of Dallas and 210 miles northwest of San Antonio. The traffic signal controllers included one Crouse-Hines PNC and two Safetran CF-330 solid state units.

The project consisted of installing new Naztec 900 traffic signal controllers, vehicle detection, and pedestrian detection for the three intersections. The new traffic control equipment also allows the project intersections to be incorporated into the City's existing closed-loop signal system that was installed in 1991. The traffic signals are operated in a fully-actuated mode.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included arterial data, peak hour turning movement volumes, signal phasing and timing, and network travel time data using the floating car technique. All of this data was collected to evaluate and calibrate before and after conditions. Intersection approach configurations and lane assignments for all 15 intersections were used to derive saturation flows needed as input into the TRANSYT-7F modeling program. TRANSYT-7F and PASSER II were utilized to evaluate and optimize the network, respectively.

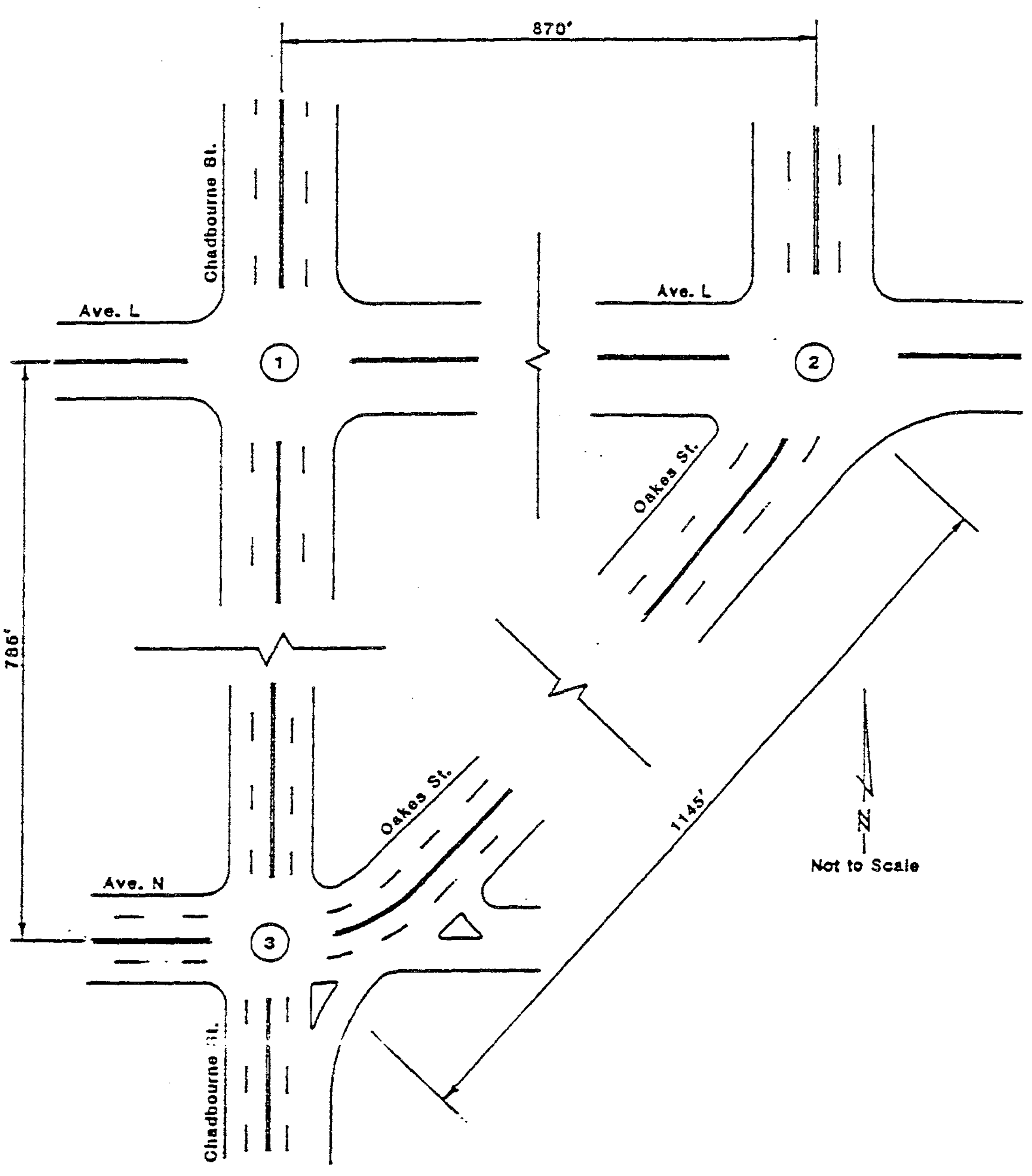
TRANSYT-7F was used to simulate before and after conditions. PASSER II-90 was used to develop optimum signal phasing patterns and intersection offsets. Implementation of the new timing plans and fine tuning of system signal timings were carried out in part by the City of San Angelo. Minor offset changes were required at some intersections. This was due in part to the variability in vehicular speeds between intersections. The revised final timing plans for all intersections were simulated with TRANSYT-7F to obtain the final measures of effectiveness.

Based on the TRANSYT-7F and PASSER II simulation, the project resulted in an estimated $126,770 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 159,600 stops (a 0.80 percent reduction), a total annual fuel savings of 10,236 gallons (an 8.47 percent reduction), and an annual delay saving of 11,430 veh-hrs (a 28.33 percent reduction). The total cost of the project was $35,979, and the resultant benefit to cost ratio was 4 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	1525	1433	10.33	7.06	26.98	24.04
	OFF	1670	1596	11.62	8.87	29.92	26.96
	NOON	1785	1818	12.27	9.09	31.1	28.96
	PM	2200	2215	15.52	11.17	38.47	35.37
DIFFERENCES	AM		92		3.27		2.94
	OFF		74		2.75		2.96
	NOON		-33		3.18		2.14
	PM		-15		4.35		3.1
HRS/DAY	AM		2		2		2
	OFF		6		6		6
	NOON		2		2		2
	PM		2		2		2
DAILY TOTALS	AM		184		6.54		5.88
	OFF		444		16.5		17.76
	NOON		-66		6.36		4.28
	PM		-30		8.7		6.2
	TOTAL		532		38.1		34.12
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$2,234		$114,300		$10,236

PROJECT COST: $35,979.00 TOTAL ANNUAL SAVINGS: $126,770

BENEFIT/COST RATIO: 4


870'
Chadbourne St.
Ave. L
Ave. L
1
2
Oakes St.
786'
Oakes St.
Ave. N
3
Chadbourne St.
1145'
N
Not to Scale

Sherwood Way

The City of San Angelo and Barton Aschman Associates, Inc. worked on the following project. San Angelo has a population of approximately 84,500 people and is approximately 220 miles southwest of Ft. Worth, and 210 miles northwest of San Antonio. The network as a whole has 11 intersections.

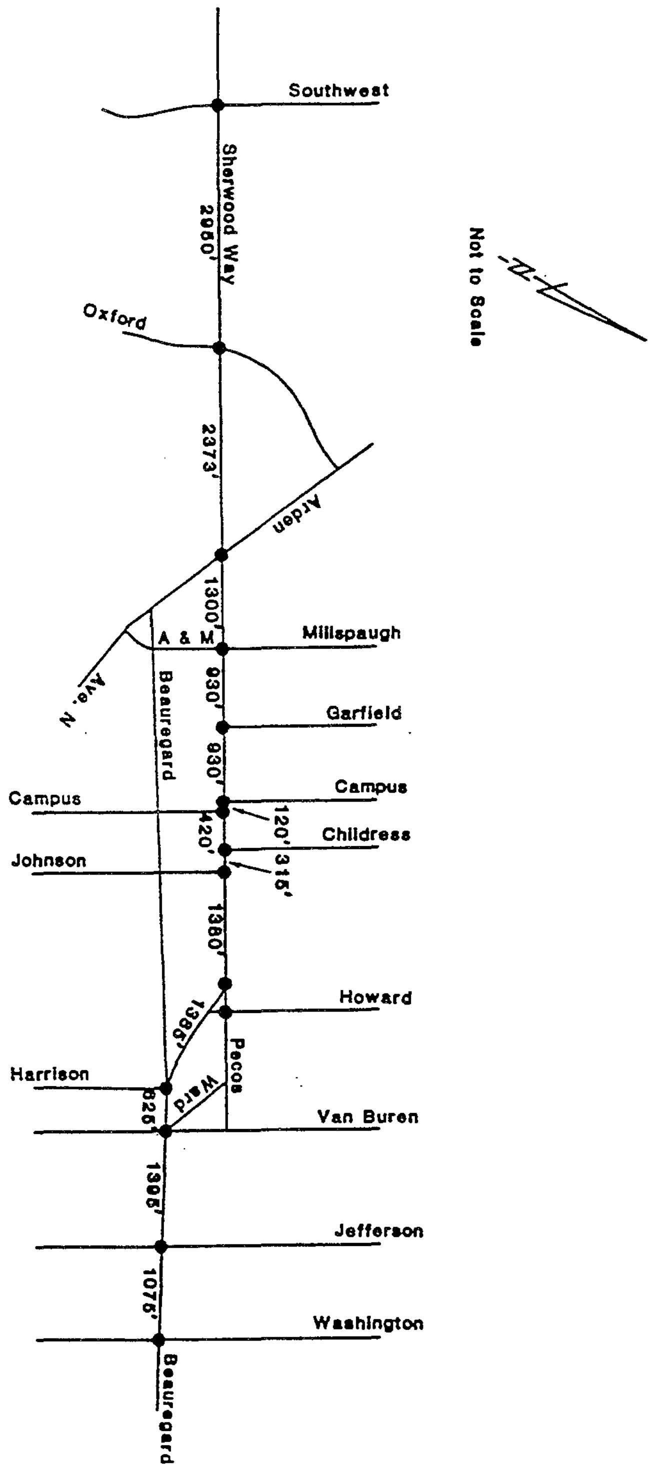
The project consisted of implementing closed-loop signal system technology for ten intersections along Sherwood Way by installing new NAZTEC 900 series controllers and communications cable. The project also provided vehicle detection, pedestrian control, and traffic signal heads. A cycle length of 80 seconds was used.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included arterial data, peak hour turning movement volumes, signal phasing and timing, and network travel time data using the floating car technique. All of this data was collected to evaluate and calibrate before and after conditions. Intersection approach configurations and lane assignments for all 15 intersections were used to derive saturation flows needed as input into the TRANSYT-7F modeling program. TRANSYT-7F and PASSER II were utilized to evaluate and optimize the network, respectively.

The existing AM, NOON/OFF, and PM peak turning movement volumes, saturation flow rates, as well as signal phasing and timing data were input into the TRANSYT-7F model to simulate before and after conditions. PASSER II-90 was used to develop optimum signal phasing patterns and intersection offsets. Implementation of the new timing plans and fine tuning of system signal timings were carried out in part by the City of San Angelo. Minor offset changes were required at some intersections. This was due in part to the variability in vehicular speeds between intersections. The revised final timings plans for all intersections were simulated with TRANSYT-7F to obtain the final measures of effectiveness.

Based on the TRANSYT-7F and PASSER II-90 simulation, the project resulted in an estimated $1,220,213 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 11,748,780 stops (a 37.22 percent reduction), a total annual fuel savings of 115,730 gallons (an 20.34 percent reduction), and a delay annual savings of 90,000 veh-hrs (a 44.46 percent reduction). The total cost of the project was $146,092, and the resultant benefit to cost ratio was 8 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	6606	3717	41.4	21.9	144.9	115.4
	NOON	9717	6571	62.8	35.9	247.5	202.1
	PM	11806	7311	76.9	42.9	295	222.7
DIFFERENCES	AM		2889		19.5		29.5
	NOON		3146		26.9		45.4
	PM		4494		34		72.3
HRS/DAY	AM		5		5		5
	NOON		5		5		5
	PM		2		2		2
DAILY TOTALS	AM		14445		97.5		147.5
	NOON		15729		134.5		227
	PM		8989		68		144.6
	TOTAL		39163		300		519.1
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$164,483		$900,000		$155,730
PROJECT COST:			$146,092.00	TOTAL ANNUAL SAVINGS:			$1,220,213
BENEFIT/COST RATIO:			8				



Southwest
Sherwood Way
2950'
Not to Scale
N
Oxford
2373'
Arden
1300'
A & M
Millspaugh
Ave. N
Beauregard
930'
Garfield
930'
Campus
Campus
120'
420'
Childress
Johnson
315'
1380'
Howard
1385'
Pecos
Harrison
Ward
826'
Van Buren
1305'
Jefferson
1075'
Washington
Beauregard

19th Street

The City of San Angelo worked with TxDOT and TTI to carry out the project. The project network runs east-west from Bryant Boulevard to Chadbourne Street north of downtown San Angelo and consists of three intersections. The City of San Angelo has a population of approximately 84,500 people and is approximately 250 miles southwest of Dallas and 210 miles northwest of San Antonio. The intersection with Randolph Street, Martin Luther King (MLK), and Chadbourne Street operate with fixed-time single dial controllers using a 60 second cycle timing plan throughout the day. The intersection with Bryant Boulevard currently operates as part of the Bryant Boulevard closed-loop signal system installed in conjunction with TxDOT's TLS I Program.

The project consisted of installing new Naztec 900 traffic signal controllers, vehicle detection, pedestrian detection, and new 12" traffic signal heads for two intersections that are located along 19th Street. Also, as part of this project, the existing diagonal span-wire installations were replaced with box-span installations. Interconnect cable was installed along 19th Street.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included arterial data, peak hour turning movement volumes, signal phasing and timing, and network travel time data using the floating car technique. All of this data was collected to evaluate and calibrate before and after conditions. Intersection approach configurations and lane assignments for all 15 intersections were used to derive saturation flows needed as input into the TRANSYT-7F modeling program. TRANSYT-7F and PASSER II were utilized to evaluate and optimize the network, respectively.

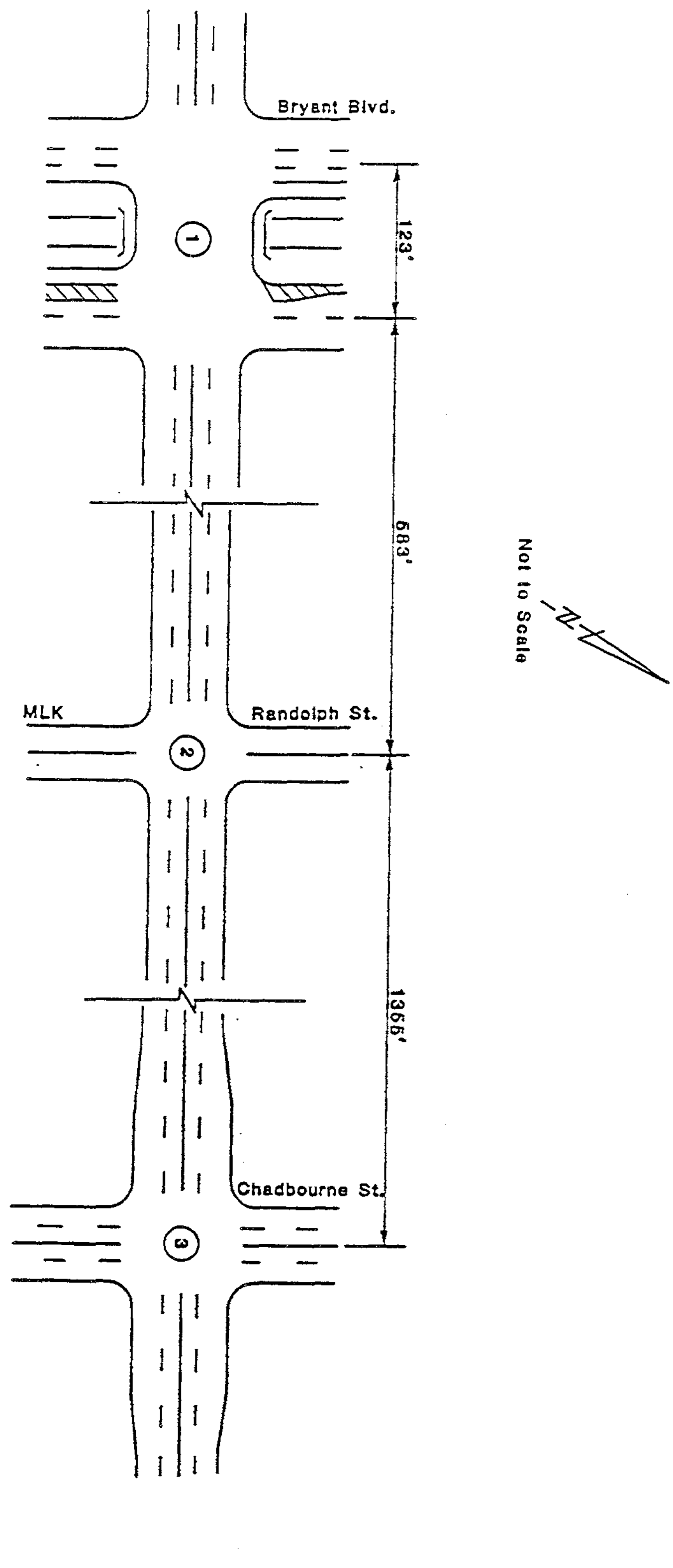
TRANSYT-7F was used to simulate before and after conditions. PASSER II-90 was used to develop optimum signal phasing patterns and intersection offsets. Implementation of the new timing plans and fine tuning of system signal timings were carried out in part by the City of San Angelo. Minor offset changes were required at some intersections. This was due in part to the variability in vehicular speeds between intersections. The revised final timings plans for all intersections were simulated with TRANSYT-7F to obtain the final measures of effectiveness.

Based on the TRANSYT-7F and PASSER III simulation, the project resulted in an estimated $46,104 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 87,000 stops (a 0.83 percent reduction), a total annual fuel savings of 3,726 gallons (an 2.05 percent reduction), and a delay annual savings of 4,116 veh-hrs (a 4.74 percent reduction). The total cost of the project was $36,367, and the resultant benefit to cost ratio was 1 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	2790	2747	22.41	21.5	48.77	47.76
	NOON	2830	2831	24.48	23.03	49.66	48.59
	PM	3425	3385	27.42	26.46	57.2	56.19
DIFFERENCES	AM		43		0.91		1.01
	NOON		-1		1.45		1.07
	PM		40		0.96		1.01
HRS/DAY	AM		5		5		5
	NOON		5		5		5
	PM		2		2		2
DAILY TOTALS	AM		215		4.55		5.05
	NOON		-5		7.25		5.35
	PM		80		1.92		2.02
	TOTAL		290		13.72		12.42
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$1,218		$41,160		$3,726

PROJECT COST: $36,367.00 TOTAL ANNUAL SAVINGS: $46,104

BENEFIT/COST RATIO: 1


Bryant Blvd.
1
123'
683'
MLK
Randolph St.
2
1355'
Chadbourne St.
3
Not to Scale
N

Central Business District

The City of Waco Department of Public Works and Transportation worked on the following project. A total of 32 signalized intersections were included in the project. The project encompasses two existing north-south one-way pair arterials, 4th/5th and 11th/12th Streets, and one existing east-west one-way pair arterial, Franklin/Washington Avenues. Franklin Avenue connects the larger west Waco residential neighborhoods, as well as outlying communities with the CBD. The north-south arterial pairs, 4th/5th and 11th/12th, provide most of the remaining access to the CBD, with 4th and 5th carrying the greater volumes. The attached figure displays the project network system, cross streets, and link distances.

All the signals in this network are two-phase with the exception of Washington at 8th and Lake Brazos at Elm. Almost all the signals are pretimed with only Franklin at Lake Brazos and Elm at Lake Brazos being actuated. Most of the intersections are pedestrian controlled with the exceptions being Franklin at Lake Brazos, Austin at 13th, Columbus at 9th, and Columbus at 8th. The controllers used were Econolite "F", Multisonics 820A, Traftek ACT400, Traftek PCT40, and Traftek ACT800. The master controller for the CBD network is located at 4th and Austin. The signal program is based on a one period strategy and late night system flash. A ten conductor cable(#14 AWG) is used for interconnection in this network.

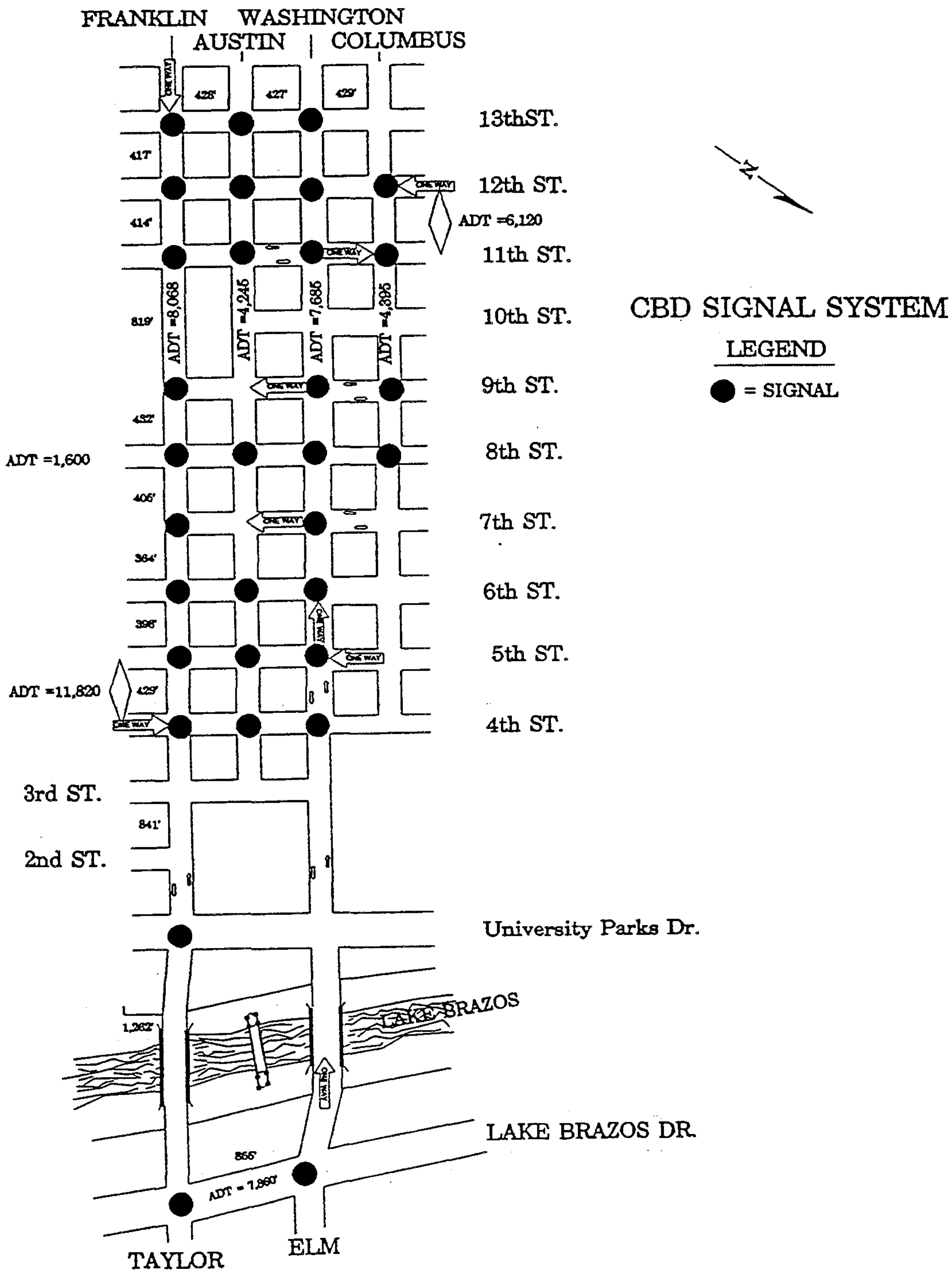
In order to evaluate the system performance, the before and after TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, link distances, saturation flows, and lost time and extension of green. The speed/travel time information was obtained by the test car method, and seven hour turning movement counts were obtained at all intersections in the project. Optimum cycle lengths were determined using TRANSYT-7F. The input data required for TRANSYT-7F were coded and entered on a traffic services microcomputer using EZ-TRANSYT PLUS input screens. A total of 21 runs were made to determine recommended timing plans. The results of the most optimum TRANSYT-7F run were input to Time Space/Platoon Progression (TS/PP)-Draft version 1.05 to refine platoon progression before implementing the timing plans.

Based on TRANSYT-7F simulation, the project resulted in an estimated $839,720 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total savings of 9,515,700 stops (a 23.13 percent reduction), a total annual fuel savings of 130,500 gallons (a 18.77 percent reduction), and an annual delay savings of 57,600 veh-hrs (a 21.33 percent reduction). The total cost of the project was $23,081, and the resultant benefit to cost ratio was 36 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	12100	8826	77	56	201	154
	OFF	13656	10582	88	67	230	186
	PM	15779	11926	119	116	277	241
DIFFERENCES	AM		3274		21		47
	OFF		3074		21		44
	PM		3853		3		36
HRS/DAY	AM		1		1		1
	OFF		8		8		8
	PM		1		1		1
DAILY TOTALS	AM		3274		21		47
	OFF		24592		168		352
	PM		3853		3		36
	TOTAL		31719		192		435
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$133,220		$576,000		$130,500

PROJECT COST: $23,081.06 TOTAL ANNUAL SAVINGS: $839,720

BENEFIT/COST RATIO: 36


FRANKLIN
WASHINGTON
AUSTIN
COLUMBUS
13thST.
12th ST.
11th ST.
10th ST.
9th ST.
8th ST.
7th ST.
6th ST.
5th ST.
4th ST.
3rd ST.
2nd ST.
University Parks Dr.
LAKE BRAZOS
LAKE BRAZOS DR.
TAYLOR
ELM
N
ADT =6,120
ADT =8,068
ADT =4,245
ADT =7,685
ADT =4,395
ADT =1,600
ADT =11,820
ADT = 1,860
426'
427'
429'
417'
414'
819'
432'
406'
364'
396'
429'
841'
1,262'
856'
CBD SIGNAL SYSTEM
LEGEND
= SIGNAL

Franklin Avenue

The City of Waco Department of Public Works and Transportation worked on the following project. Waco has a thriving industrial area in the southern quadrant of the city. Franklin Avenue is a major traffic carrier connecting this area with the eastern part of Waco and the Central Bussiness District (CBD). The flow during OFF-peak periods are also significant since Franklin Avenue connects outlying areas with the business and industrial concentrations in the City of Waco. There are four traffic signals in the Franklin Avenue signal system, extending 1.16 miles from Valley Mills Drive on the east to Lake Air Drive on the west. Franklin Avenue is a median-divided east-west arterial, carrying three traffic lanes east bound from New Road to Valley Mills Drive and two lanes each way between all other segments. The arterial features left turn bays at all major and minor cross streets. There are median openings at regular intervals providing crossovers between the frontage roads and main lanes. Valley Mills Drive frontage roads intersect Franklin at the east end of the project. These intersections, operating as a diamond interchange, present a unique challenge to conventional two-way arterial signal progression techniques. The attached figure displays the project network system, cross streets, and link distances.

The signals in this network are actuated with their phases ranging from 4 to 8. None of the intersections are pedestrian controlled. All the controllers used were solid state actuated. The master controller for the CBD network located at Valley Mills Drive, operates under the programming of an external solid state coordinator. A ten conductor cable(#14 AWG) is used for interconnection in this network.

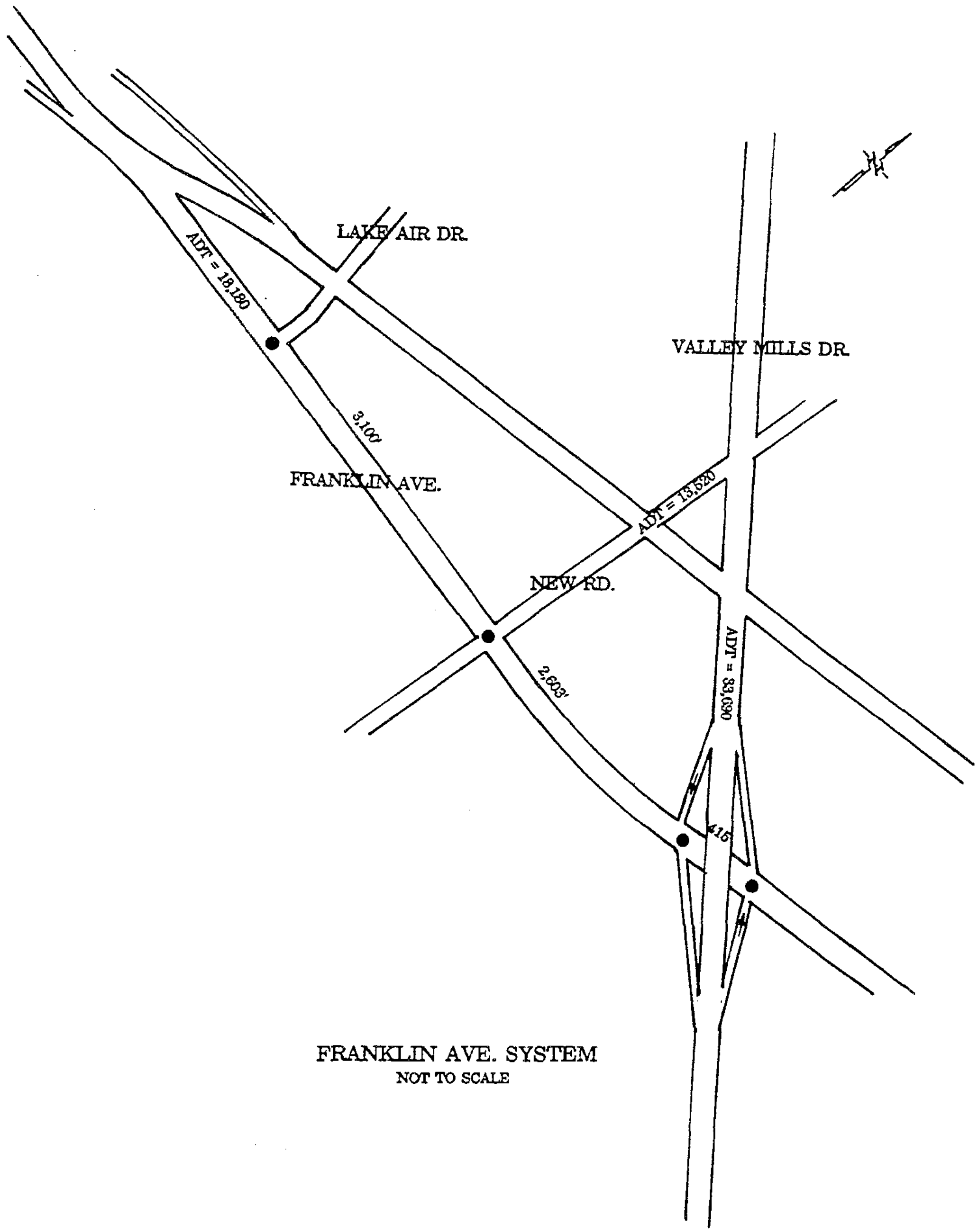
In order to evaluate the system performance, the before and after TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, link distances, saturation flows, and lost time and extension of green. The speed/travel time information was obtained by the test car method. Optimum cycle lengths were determined using PASSER-II. A total of 30 runs were made to determine recommended timing plans.

Based on PASSER-II simulation, the project resulted in an estimated $3,675,980 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total savings of 1,896,750 stops (a 10.66 percent reduction), a total annual fuel savings of 344,175 gallons (a 42.97 percent reduction), and an annual delay savings of 330,525 veh-hrs (a 77.61 percent reduction). The total cost of the project was $13,893, and the resultant benefit to cost ratio was 265 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	9801	5007	197	28	308	134.6
	OFF	4133	3595	20.7	16.7	108.6	98.3
	NOON	4792	4446	26.1	26.3	129	118.8
	PM	4133	6010	374.9	44.2	498.4	176.4
DIFFERENCES	AM		4794		169		173.4
	OFF		538		4		10.3
	NOON		346		-0.2		10.2
	PM		-1877		330.7		322
HRS/DAY	AM		1.5		1.5		1.5
	OFF		5.5		5.5		5.5
	NOON		2.5		2.5		2.5
	PM		2.5		2.5		2.5
DAILY TOTALS	AM		7191		253.5		260.1
	OFF		2959		22		56.65
	NOON		865		-0.5		25.5
	PM		-4693		826.75		805
	TOTAL		6323		1101.75		1147.25
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$26,555		$3,305,250		$344,175

PROJECT COST: $13,892.99 TOTAL ANNUAL SAVINGS: $3,675,980

BENEFIT/COST RATIO: 265



FRANKLIN AVE. SYSTEM
NOT TO SCALE

FM 369

The City of Wichita Falls Department of Public Works and Transportation worked on the following project. A total of seven signalized intersections were included in the project. FM 369 is a six-lane divided facility located on the south side of Wichita Falls. The attached figure displays the project network system, cross streets, and link distances.

In the before conditions, all seven intersections within the purview of the project acted as a system during the AM and PM peak periods. During the NOON and OFF peak periods, the signals operated as isolated intersections. All seven intersections are fully actuated with their phases ranging from 6 to 8. The intersections at Barnett, Cypress, Rhea, and Taft have pedestrian controls. The cycle lengths for all the intersections for the AM, PM, NOON, and OFF peak periods were 80, 80, 70, and 60 seconds, respectively. None of the intersections have any other special features attributed to them.

The controllers of the system were upgraded with seven NAZTEC NT900-TX. One of the NT900-TX's was upgraded to operate as the system master. New set-back detectors were installed for extensive testing of the communication system.

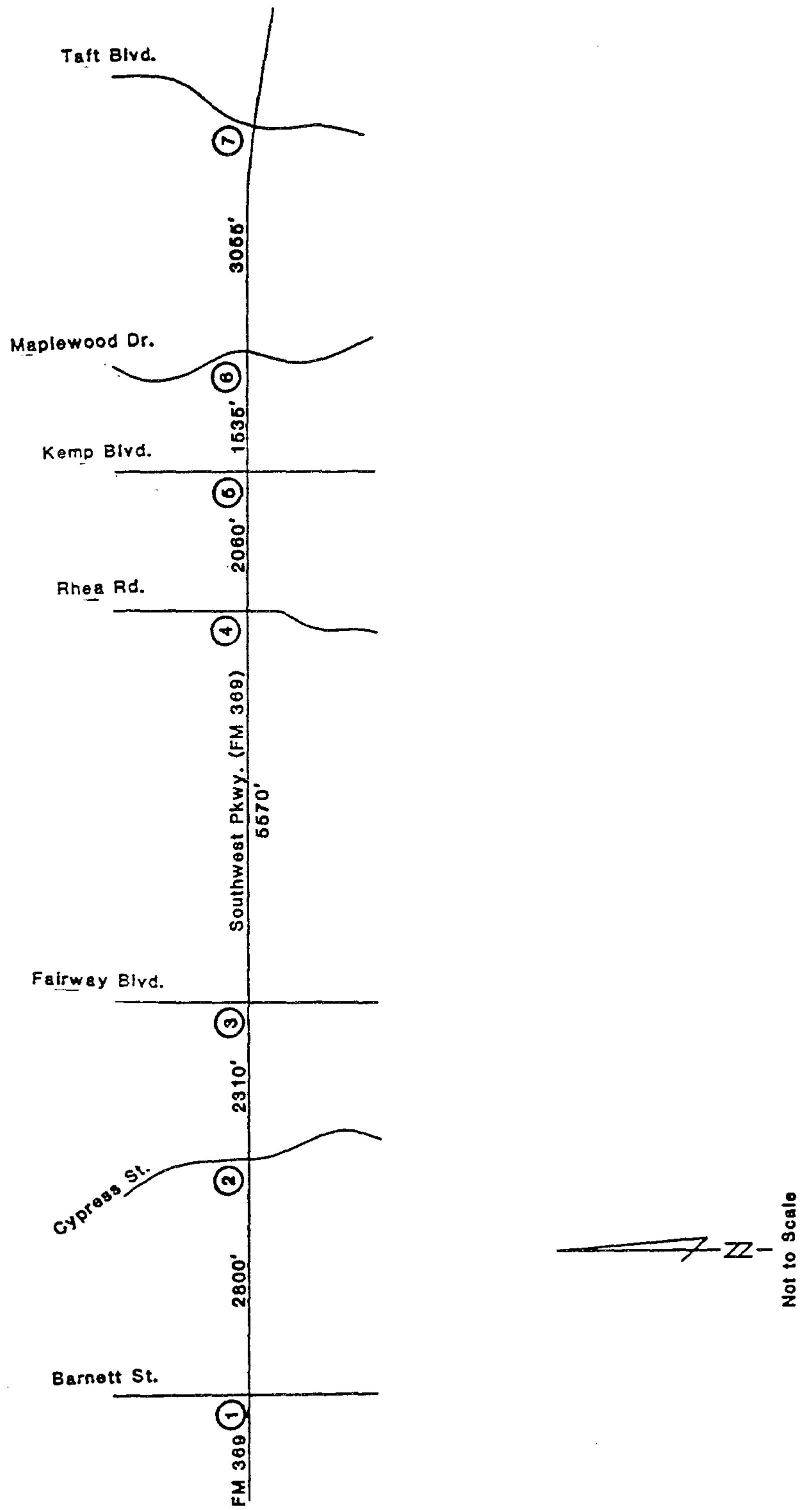
In order to evaluate the system performance, the before and after TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, peak hour turning movement volumes, signal phasing and timing, intersection geometrics, traffic signal installations, and travel time data. The floating car technique was used for collecting the required data. TRANSYT-7F was used to optimize cycle lengths and phase splits to simulate actuated operations. PASSER II was not used to develop arterial timing plans due to the high percentage of turning movement volumes.

Based on TRANSYT-7F simulation, the project resulted in an estimated $162,402 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total savings of 1,260,000 stops (a 6.07 percent reduction), a total annual fuel savings of 24,762 gallons (a 3.42 percent reduction), and an annual delay savings of 12,000 veh-hrs (a 7.3 percent reduction). The total cost of the project was $65,681, and the resultant benefit to cost ratio was 2 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	10874	9063	96.85	81.76	396.28	362.26
	OFF	6149	6149	43	43	208.75	208.75
	NOON	8625	7779	71.68	63.07	303.77	286.76
	PM	12837	11294	121.56	105.26	459.65	428.14
DIFFERENCES	AM		1811		15.09		34.02
	OFF		0		0		0
	NOON		846		8.61		17.01
	PM		1543		16.3		31.51
HRS/DAY	AM		1		1		1
	OFF		9		9		9
	NOON		1		1		1
	PM		1		1		1
DAILY TOTALS	AM		1811		15.09		34.02
	OFF		0		0		0
	NOON		846		8.61		17.01
	PM		1543		16.3		31.51
	TOTAL		4200		40		82.54
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$17,640		$120,000		$24,762

PROJECT COST: $65,680.96 TOTAL ANNUAL SAVINGS: $162,402

BENEFIT/COST RATIO: 2


Taft Blvd.
7
3055'
Maplewood Dr.
6
1535'
Kemp Blvd.
5
2060'
Rhea Rd.
4
Southwest Pkwy. (FM 369)
5570'
Fairway Blvd.
3
2310'
Cypress St.
2
2800'
Barnett St.
1
FM 369
N
Not to Scale

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APPENDIX F

INDIVIDUAL PROJECT SUMMARIES

SMALL CITIES

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Table F-1. Individual Project Summaries - Small Cities.

		Reduction in Daily Totals						
City	System	Stops	Delay (veh-hrs)	Fuel (gals)	Total Annual Savings($)	Total Cost($)	B/C Ratio	Page
Brownwood	Various Intersections	(311)	22.25	15.16	69,992	51,753.00	1.35	F-5
Colleyville	S.H. 26	1,740	114.00	86.40	375,228	15,488.00	24.23	F-8
Coppell	Belt Line/Denton/MacArthur	5,815	391.64	413.28	1,323,327	66,007.00	20.05	F-11
Diboll	US 59	481	66.10	57.13	217,459	24,429.73	8.90	F-14
Edinburg	Center Grid	5,897	558.00	454.00	1,834,967	141,558.82	12.96	F-17
	South Closner	23,946	40.00	303.00	311,473	116,159.43	2.68	F-20
	W. University Dr.	5,010	502.00	668.00	1,727,442	73,041.50	23.65	F-23
Forest Hill	Forest Hill Dr.	(2,957)	1,480.86	1,067.87	4,750,522	46,679.00	101.77	F-26
Georgetown	RM 2338/IH-35	14,916	233.75	952.44	1,049,628	33,366.56	31.46	F-29
Harlingen	City Wide	24,778	302.00	434.00	1,140,268	55,086.00	20.70	F-32
Huntsville	11th St.	16,414	294.40	(697.60)	742,859	49,535.00	15.00	F-35
Hurst	Precinct Line Road	4,931	537.33	446.88	1,766,763	32,263.53	54.76	F-38
	SH 26	636	13.80	18.00	49,471	20,472.00	2.42	F-41
Lampasas	Five Intersections	6,751	104.20	119.53	376,810	97,315.81	3.87	F-44
Lufkin	Loop 266	312	9.15	8.10	31,190	134,792.46	0.23	F-47
	SH 94	15,847	390.80	709.90	1,451,927	205,272.03	7.07	F-50
Mineral Wells	CBD	(82)	1.72	0.96	5,104	12,352.00	0.41	F-53
Nacogdoches	FM 1275	86	162.85	120.56	525,078	241,269.26	2.18	F-56
	North Street	6,365	317.35	399.66	1,098,681	312,483.80	3.52	F-59
New Braunfels	Union Ave./Castell Ave.	1,068	6.20	12.40	26,806	62,116.00	0.43	F-62
N. Richland Hills	Davis Boulevard System	6,434	65.87	96.90	253,703	22,582.81	11.23	F-65
	S.H. 26 North System	7,371	574.68	469.30	1,895,788	21,034.41	90.13	F-68
	SH 26 South System	559	73.28	30.50	231,338	24,281.00	9.53	F-71
Sonora	Loop 467	1,440	14.39	17.89	54,574	24,749.00	2.21	F-74
Texas City	Ninth Avenue	11,688	64.60	(173.20)	190,930	60,884.00	3.14	F-78
Tyler	Broadway Avenue	37,672	6,543.00	5,066.00	21,307,022	94,322.15	225.90	F-81
	Gentry Parkway	30,717	708.00	1,005.00	2,554,511	46,594.00	54.82	F-84
	Palace Avenue	7,905	646.00	557.00	2,138,301	47,297.00	45.21	F-87

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Various Intersections

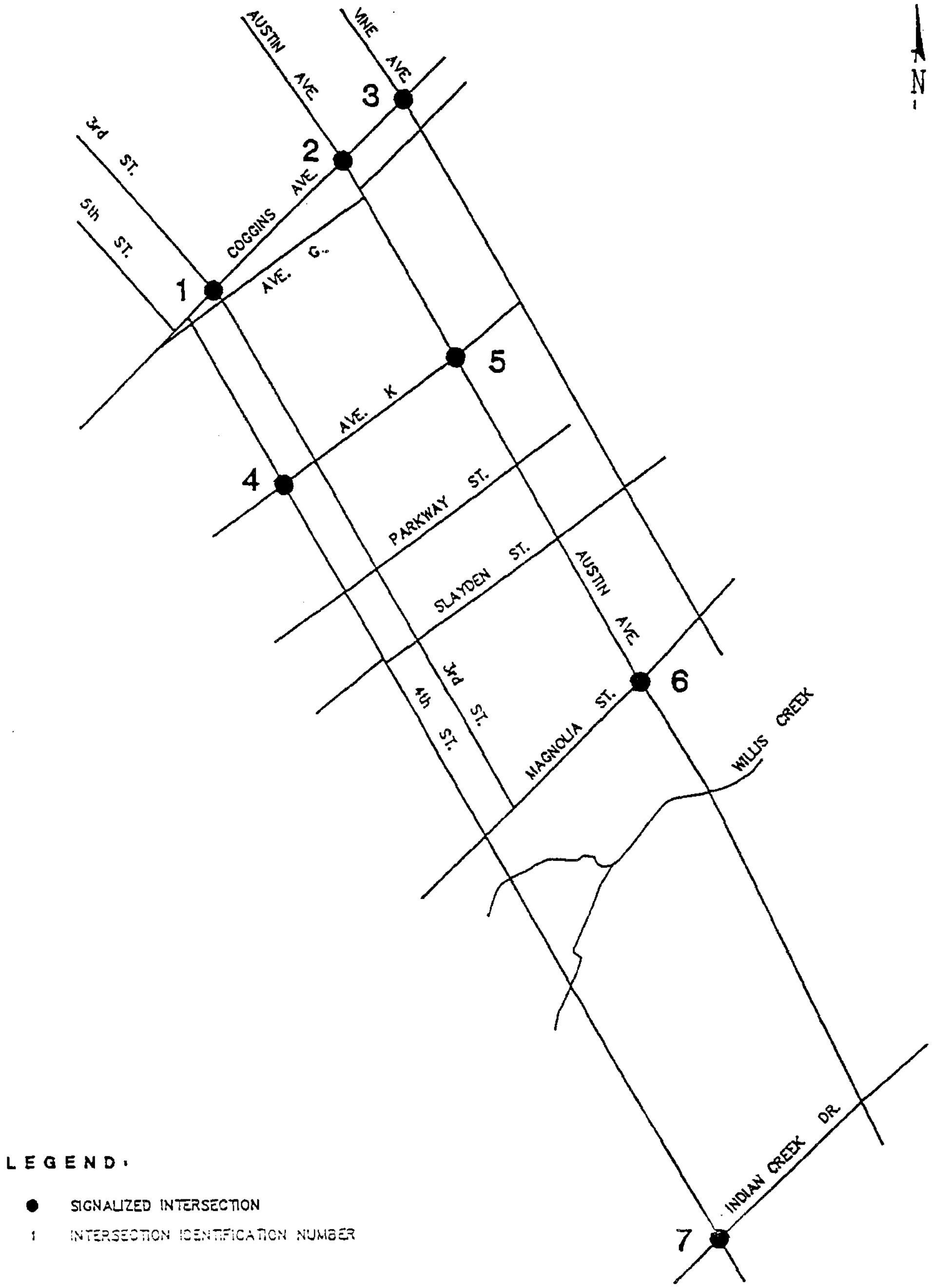
The City of Brownwood Department of Public Works and Transportation worked on the following project. A total of seven signalized intersections were included in the project. All these intersections are isolated from each other. The attached figure displays the project network system and cross streets.

The signals in this system were converted from two-phase, pre-timed signals to semi-actuated or fully actuated controls. At the Coggin/Third intersection, loop detectors and Naztec controllers were installed, and the average cycle was reduced to between 34 and 41 seconds from 55 seconds. At the Coggin/Austin intersection, the average cycle was reduced from between 47 and 100 seconds to between 40 and 78 seconds. At Coggin/Vine, loop detectors and Naztec controllers were installed, and the average cycle was reduced to between 37 and 41 seconds from 55 seconds. At Ave K/Fourth, loop detectors and Naztec controllers were installed, and the average cycle was reduced from 55 seconds to between 32 and 56 seconds. At Avenue K/Austin, the average cycle was reduced to between 33 and 59 seconds from between 50 and 55 seconds. At Magnolia/Austin, the average cycle was reduced from 55 seconds to between 50 and 55 seconds. At Indian Creek/Fourth, loop detectors and Naztec controllers were installed, and the average cycle was reduced from 55 seconds to between 32 and 36 seconds.

In order to evaluate the system performance, the before and after TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, signal timings and phasing, intersection geometrics, and an operating cost study. PASSER II was used to optimize cycle lengths and phase splits to simulate actuated operations.

Based on PASSER II simulation, the project resulted in an estimated $69,992 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included an increase of 93,300 stops (a 1.41 percent increase), a total annual fuel savings of 4,548 gallons (an 8.33 percent reduction), and an annual delay savings of 6,675 veh-hrs (a 24.04 percent reduction). The total cost of the project was $51,753, and the resultant benefit to cost ratio was 1 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	4294	4296	18.4	13.1	35.78	31.99
	NOON	3992	4131	15	11.9	31.55	29.64
	PM	5046	5066	23.3	17.9	43.55	39.78
DIFFERENCES	AM		-2		5.3		3.79
	NOON		-139		3.1		1.91
	PM		-20		5.4		3.77
HRS/DAY	AM		1.5		1.5		1.5
	NOON		2		2		2
	PM		1.5		1.5		1.5
DAILY TOTALS	AM		-3		7.95		5.685
	NOON		-278		6.2		3.82
	PM		-30		8.1		5.655
	TOTAL		-311		22.25		15.16
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			($1,306)		$66,750		$4,548
PROJECT COST:			$51,753.00	TOTAL ANNUAL SAVINGS:			$69,992
BENEFIT/COST RATIO:			1				


N
AUSTIN AVE.
VINE AVE.
3rd ST.
5th ST.
COGGINS AVE.
AVE. G.
AVE. K
PARKWAY ST.
SLAYDEN ST.
AUSTIN AVE.
3rd ST.
4th ST.
MAGNOLIA ST.
WILLIS CREEK
INDIAN CREEK DR.
1
2
3
4
5
6
7
LEGEND:
SIGNALIZED INTERSECTION
1 INTERSECTION IDENTIFICATION NUMBER

State Highway 26

The City of Colleyville Department of Public Works and Transportation worked on the following project. State Highway 26 is a major five-lane arterial running north-south through the cities of Hurst and Colleyville. The attached figure shows the project network, cross streets, link distances, and average daily traffic volumes.

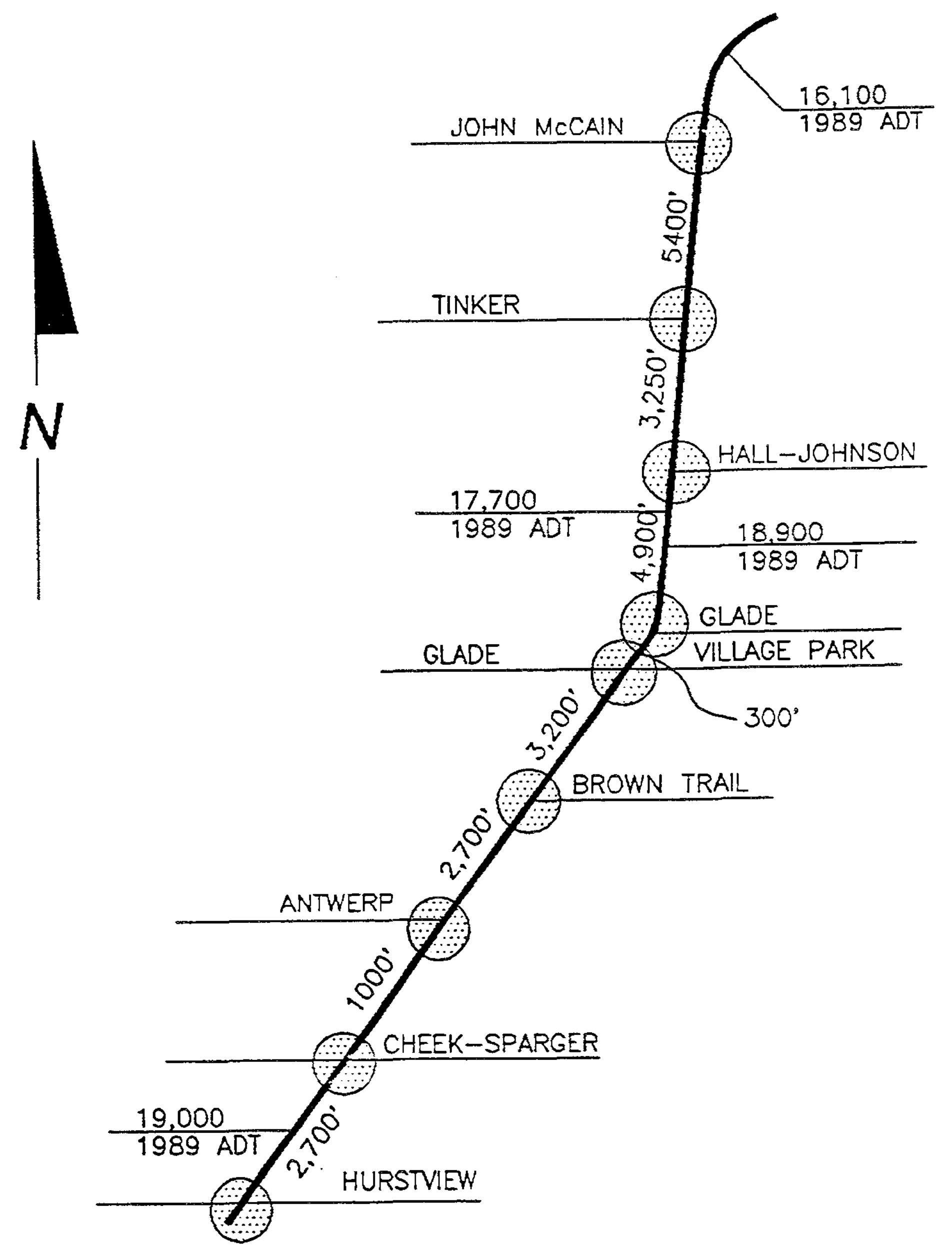
This project includes nine intersections, three in Hurst and six in Colleyville. All nine intersections were previously operated as isolated intersections with cycle lengths ranging from approximately 80 seconds to 200 seconds. The distances between the intersections range from 300 feet to approximately one mile.

The system coordination was provided through a time-based means using Eagle controllers in Hurst and Naztec controllers in Colleyville. Two new Naztec controllers were installed in Colleyville and three new Eagle controllers in Hurst. All installations utilize mast arms and poles along with pedestrian controls at selected locations. Protected/permissive phasing was allowed at Hurstview while all others were either permissive left turn phasing or protected only left turn phasing. Two of the intersections - Brown Trail and Glade/Village Park were operated as split phase operations due to the poor geometrics at these locations.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Optimum cycle lengths were determined using PASSER II-90 for each of the AM, OFF, and PM peak periods. Travel time information was obtained by the floating car technique. Six runs were made on each link in each time period (AM, OFF, and PM), and the mean travel times were determined.

Based on the PASSER II simulation, the project resulted in an estimated $375,228 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 522,000 stops (a 2.94 percent reduction), a total annual fuel savings of 25,920 gallons (a 5.86 percent reduction), and a total annual delay savings of 34,200 veh-hrs (a 9.12 percent reduction). The total cost of the project was $15,488, and the resultant benefit to cost ratio was 24 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	6288	6210	130.8	126.6	156	153
	OFF	3168	3270	63	67.2	76.8	80
	PM	7416	6114	179.4	105.6	197	140.8
DIFFERENCES	AM		78		4.2		3
	OFF		-102		-4.2		-3.2
	PM		1302		73.8		56.2
HRS/DAY	AM		2		2		2
	OFF		10		10		10
	PM		2		2		2
DAILY TOTALS	AM		156		8.4		6
	OFF		-1020		-42		-32
	PM		2604		147.6		112.4
	TOTAL		1740		114		86.4
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$7,308		$342,000		$25,920
PROJECT COST:			$15,488.00	TOTAL ANNUAL SAVINGS:			$375,228
BENEFIT/COST RATIO:			24				


N
16,100
1989 ADT
JOHN McCAIN
5400'
TINKER
3,250'
HALL-JOHNSON
17,700
1989 ADT
4,900'
18,900
1989 ADT
GLADE
VILLAGE PARK
GLADE
300'
3,200'
BROWN TRAIL
2,700'
ANTWERP
1000'
CHEEK-SPARGER
19,000
1989 ADT
2,700'
HURSTVIEW

Belt Line/Denton/MacArthur

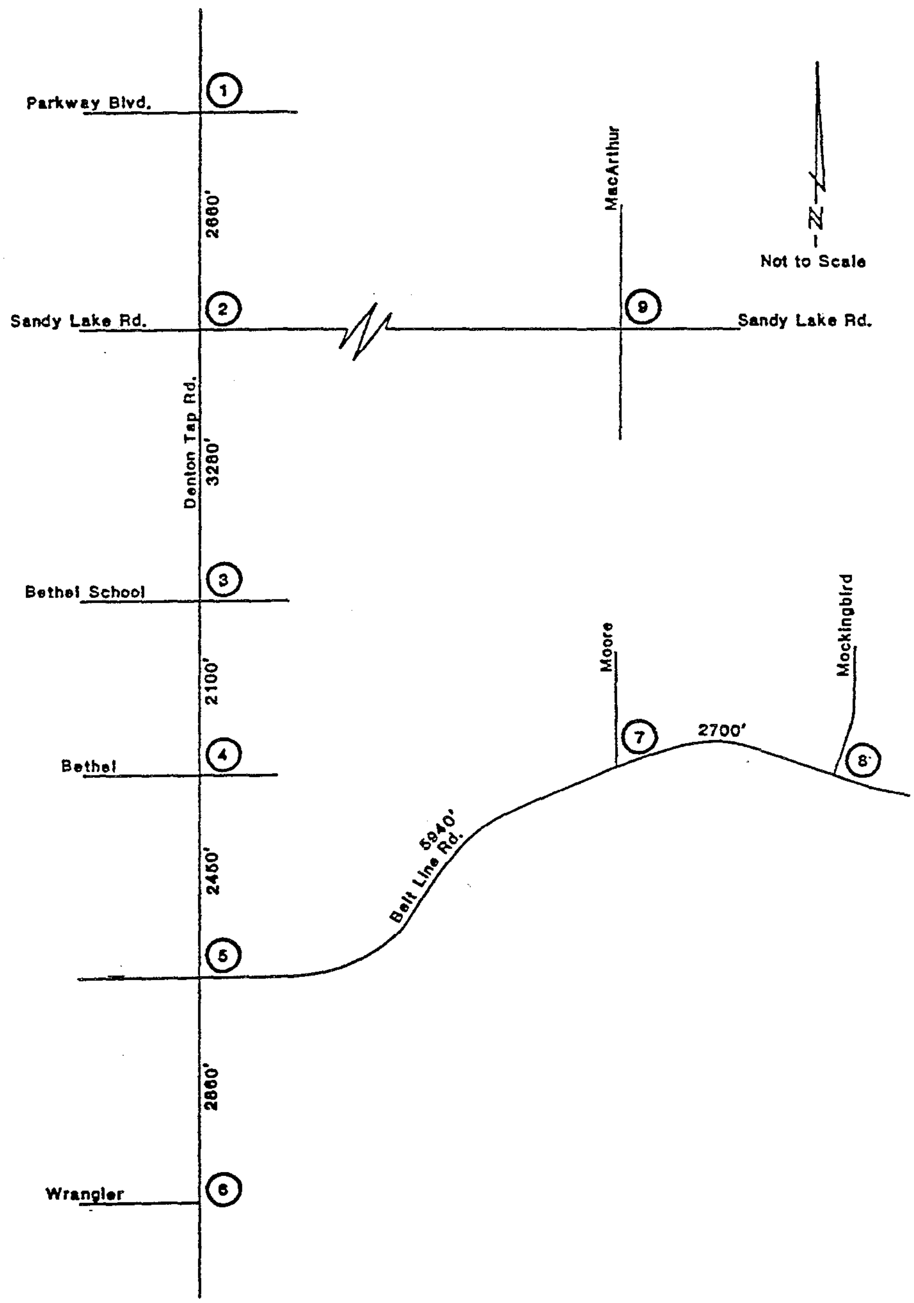
The City of Coppell Department of Public Works and Transportation worked on the following project. The City of Coppell enjoys the distinction of being the second fastest growing community in North Central Texas over the past ten years and the fastest growing among cities having a population of 10,000 or greater. All the intersections within the purview of the project are isolated and run "free" throughout the day. The attached figure shows the project network, cross streets, and link distances.

A total of nine signalized intersections were included in this project. The City of Coppell proposed to initiate progression along Denton Tap Road by coordinating the timing plans at each intersection through the implementation of a closed loop system. In order to implement this system, the addition of a microcomputer station with printer, 6-pair #19 AWG cable, and controller upgrades were proposed. The extension of MacArthur Boulevard propagated the need to retime the intersection of Sandy Lake Road and MacArthur Boulevard. To upgrade the operation at this intersection to fully actuated, a new eight phase, solid state controller was installed.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, and an operating cost study. Timing plans were developed using TRANSYT-7F. Travel time information was obtained by the floating car technique.

Based on the TRANSYT-7F simulation, the project resulted in an estimated $1,323,327 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 1,744,500 stops (a 5.91 percent reduction), a total annual fuel savings of 123,984 gallons (a 9.19 percent reduction), and an annual delay savings of 117,492 veh-hrs (a 23.06 percent reduction). The total cost of the project was $66,007, and the resultant benefit to cost ratio was 20 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	14180	12710	264.51	183.83	623.41	527.84
	OFF	5541	5541	94.98	94.98	274.46	274.46
	PM	12819	11381	204.86	89.72	528.07	417
DIFFERENCES	AM		1470		80.68		95.57
	OFF		0		0		0
	PM		1438		115.14		111.07
HRS/DAY	AM		2		2		2
	OFF		8		8		8
	PM		2		2		2
DAILY TOTALS	AM		2939		161.36		191.14
	OFF		0		0		0
	PM		2876		230.28		222.14
	TOTAL		5815		391.64		413.28
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$24,423		$1,174,920		$123,984
PROJECT COST:			$66,007.00	TOTAL ANNUAL SAVINGS:			$1,323,327
BENEFIT/COST RATIO:			20				


Parkway Blvd.
1
2680'
MacArthur
Not to Scale
Sandy Lake Rd.
2
9
Sandy Lake Rd.
Denton Tap Rd.
3280'
Bethel School
3
Mockingbird
Moore
2100'
7
2700'
8
Bethel
4
5940'
Belt Line Rd.
2450'
5
2860'
Wrangler
6

US 59

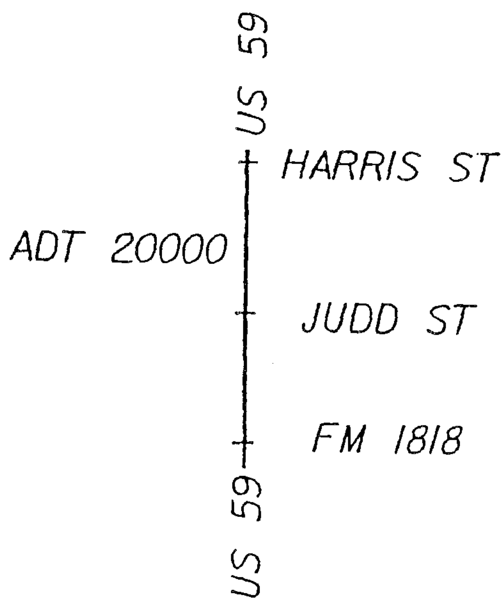
The Lufkin District of the Texas Department of Transportation worked on the following project. A total of three signalized intersections were included in the project. US 59 is a four-lane highway with protected left turn bays and is the main arterial passing through the city of Diboll. It is a very heavily travelled route from Houston with a large percentage of heavy truck traffic. The attached figure displays the project network system and cross streets.

Three intersections within the purview of the project are fully actuated with the range of their phases being 6. The intersection at Judd Street is fire pre-empt and the intersection on FM 1818 has pedestrian controls. No other special features have been included in any of the intersections. All these intersections are interconnected with communication cable.

In order to evaluate the system performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, saturation flow rate, signal timing and phasing, arterial data, and speed/travel times. Link distances were obtained during the execution of travel time studies. Signal timing data was obtained from traffic surveys and the TxDOT signal shop in Lufkin. The saturation flow rate was calculated using the assistant function in PASSER II-90. The speed/travel time data were obtained using the "Jamar" traffic counter. Speed profiles, travel time, number of stops, and distance between intersections were obtained during these studies. Simulation runs were executed using PASSER II-90 for AM, PM, and OFF peaks to simulate existing timing and phasing plans after the signals were upgraded.

Based on PASSER II-90 simulation, the project resulted in an estimated $217,459 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total savings of 144,300 stops (a 6.9 percent reduction), a total annual fuel savings of 17,139 gallons (a 24.28 percent reduction), and an annual delay savings of 19,830 veh-hrs (a 60.17 percent reduction). The total cost of the project was $24,430, and the resultant benefit to cost ratio was 9 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	889	801	11.3	6.1	26.61	21.65
	OFF	637	600	11.2	4	22.66	16.57
	PM	870	793	9.7	5.1	25.8	21.47
DIFFERENCES	AM		88		5.2		4.96
	OFF		37		7.2		6.09
	PM		77		4.6		4.33
HRS/DAY	AM		1		1		1
	OFF		7.5		7.5		7.5
	PM		1.5		1.5		1.5
DAILY TOTALS	AM		88		5.2		4.96
	OFF		278		54		45.675
	PM		116		6.9		6.495
	TOTAL		481		66.1		57.13
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$2,020		$198,300		$17,139
PROJECT COST:			$24,429.73	TOTAL ANNUAL SAVINGS:			$217,459
BENEFIT/COST RATIO:			9				


US 59
HARRIS ST
ADT 20000
JUDD ST
FM 1818
US 59

Center Grid

The City of Edinburg Department of Public Works and Transportation worked on the following project. The Center Grid consists of the Courthouse square bounded on the north by McIntyre Street, on the east by Twelfth Avenue, on the south by Cano Street, and on the west by Tenth Avenue. Within the project limits, each of these streets is 76 feet wide. Striping provides two lanes for moving traffic in each direction, a parking lane on each side, and a left turn lane approaching the signalized intersections. Closner Street, a major north-south arterial street, bisects the square. University Drive, a major east-west arterial street, "tees" into the square on each side. The attached figure displays the project network system and cross streets.

A total of six intersections are included in the project. Through the project, each intersection received a new NEMA closed loop system controller with internal communications telemetry. The field master controller for this traffic signal system was located in a cabinet at the Tenth and Cano intersections. The phases of signals at the intersections varied within a range of 2 to 5. None of the intersections have any special features attributed to them.

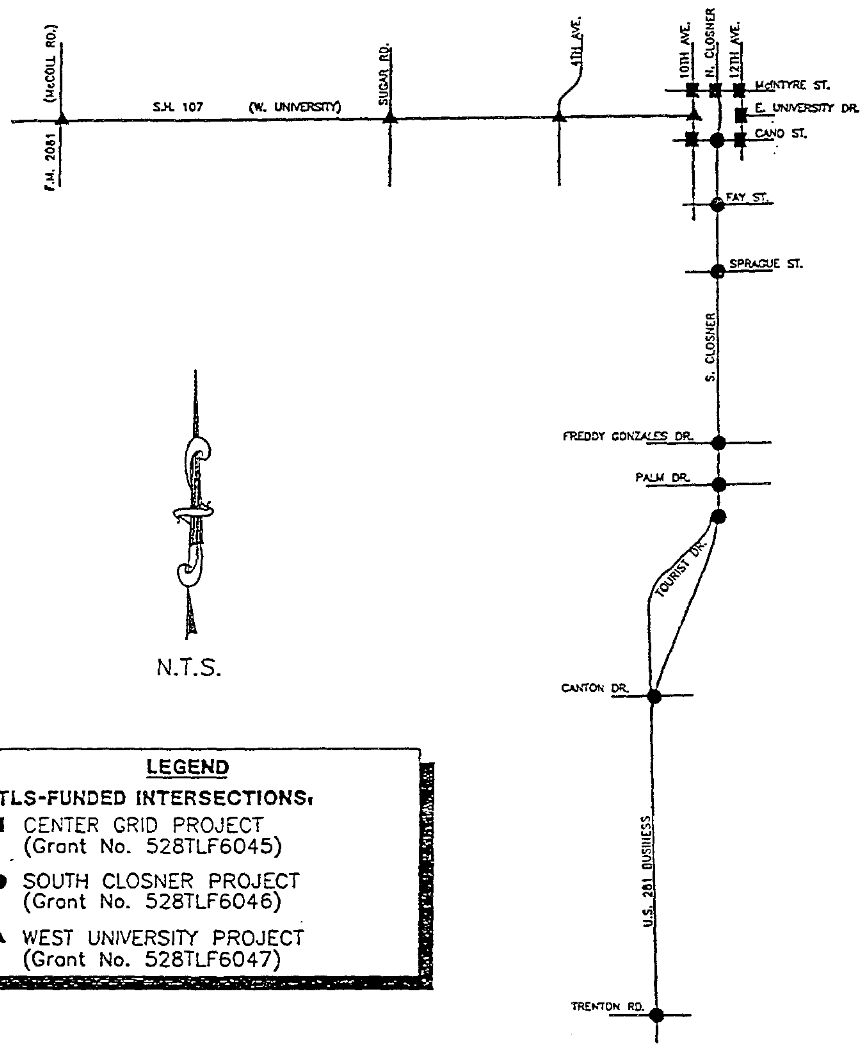
In order to evaluate the system performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, signal timing and phasing, arterial data, and speed/travel times. Free flow speeds were determined using the floating car techniques. TRANSYT-7F was used to evaluate and optimize cycle lengths and phase splits.

Based on TRANSYT-7F simulation, the project resulted in an estimated $1,834,967 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total savings of 1,769,100 stops (a 10.11 percent reduction), a total annual fuel savings of 136,200 gallons (a 38.28 percent reduction), and an annual delay savings of 167,400 veh-hrs (a 58.49 percent reduction). The total cost of the project was $141,559, and the resultant benefit to cost ratio was 13 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	3977	3454	24	22	51	38
	OFF	5558	4987	98	38	118	72
	PM	5738	5311	110	43	129	76
DIFFERENCES	AM		523		2		13
	OFF		571		60		46
	PM		427		67		53
HRS/DAY	AM		2		2		2
	OFF		7		7		7
	PM		2		2		2
DAILY TOTALS	AM		1046		4		26
	OFF		3997		420		322
	PM		854		134		106
	TOTAL		5897		558		454
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$24,767		$1,674,000		$136,200

PROJECT COST: $141,558.82 TOTAL ANNUAL SAVINGS: $1,834,967

BENEFIT/COST RATIO: 13


(McCOLL RD.)
F.M. 2081
S.H. 107
(W. UNIVERSITY)
SUGAR RD.
4TH AVE.
10TH AVE.
N. CLOSNER
12TH AVE.
McINTYRE ST.
E. UNIVERSITY DR.
CANO ST.
FAY ST.
SPRAGUE ST.
S. CLOSNER
FREDDY GONZALES DR.
PALM DR.
TOURIST DR.
CANTON DR.
U.S. 281 BUSINESS
TRENTON RD.
N.T.S.
LEGEND
TLS-FUNDED INTERSECTIONS:
CENTER GRID PROJECT (Grant No. 528TLF6045)
SOUTH CLOSNER PROJECT (Grant No. 528TLF6046)
WEST UNIVERSITY PROJECT (Grant No. 528TLF6047)

South Closner

The City of Edinburg Department of Public Works and Transportation worked on the following project. The intersections located on US 281 Business from Cano Street to south of the Tourist Drive signalized intersection, are included in this project. From Cano Street to south of Canton Drive, US 281 Business is 76 feet wide. Striping provides two lanes for moving traffic in each direction, a parking lane on each side, and a continuous two-way left turn lane. The attached figure displays the project network system and cross streets.

A total of eight intersections are included in the project. Through the project, each intersection received a new NEMA closed loop system controller with internal communications telemetry. The field master controller for this traffic signal system was located in a cabinet at the Canton Drive intersection. The phases of signals at the intersections varied within a range of 2 to 5. None of the intersections have any special features attributed to them.

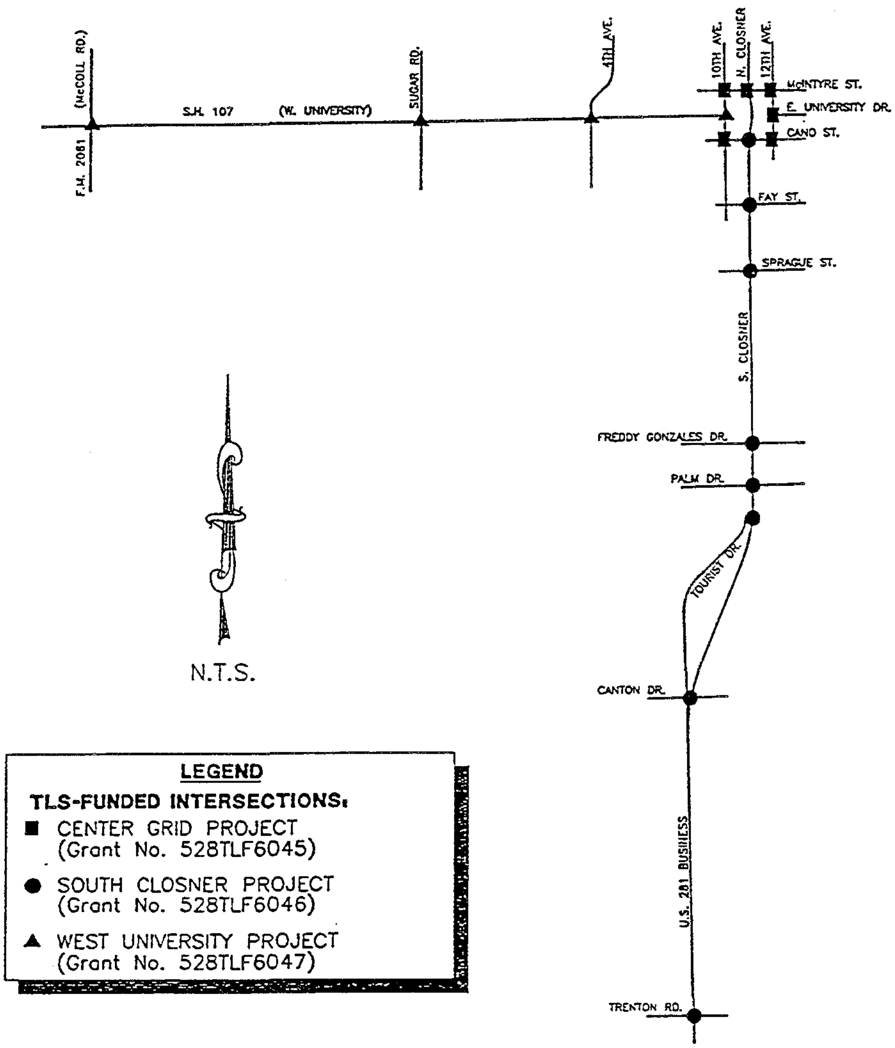
In order to evaluate the system performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, signal timing and phasing, arterial data, and speed/travel times. Free flow speeds were determined using the floating car techniques. TRANSYT-7F was used to evaluate and optimize cycle lengths and phase splits.

Based on TRANSYT-7F simulation, the project resulted in an estimated $311,473 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total savings of 7,183,800 stops (a 20.50 percent reduction), a total annual fuel savings of 90,900 gallons (a 9.02 percent reduction), and an annual delay savings of 12,000 veh-hrs (a 4.56 percent reduction). The total cost of the project was $116,159, and the resultant benefit to cost ratio was 3 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	8985	7041	57	61	268	251
	OFF	10874	9394	86	80	315	294
	PM	11374	6525	81	78	310	249
DIFFERENCES	AM		1944		-4		17
	OFF		1480		6		21
	PM		4849		3		61
HRS/DAY	AM		2		2		2
	OFF		7		7		7
	PM		2		2		2
DAILY TOTALS	AM		3888		-8		34
	OFF		10360		42		147
	PM		9698		6		122
	TOTAL		23946		40		303
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$100,573		$120,000		$90,900

PROJECT COST: $116,159.43 TOTAL ANNUAL SAVINGS: $311,473

BENEFIT/COST RATIO: 3


F.M. 2061
(McCOLL RD.)
S.H. 107
(W. UNIVERSITY)
SUGAR RD.
4TH AVE.
10TH AVE.
N. CLOSNER
12TH AVE.
McINTYRE ST.
E. UNIVERSITY DR.
CANO ST.
FAY ST.
SPRAGUE ST.
S. CLOSNER
FREDDY GONZALES DR.
PALM DR.
TOURIST DR.
CANTON DR.
U.S. 281 BUSINESS
TRENTON RD.
N.T.S.
LEGEND
TLS-FUNDED INTERSECTIONS:
■ CENTER GRID PROJECT (Grant No. 528TLF6045)
● SOUTH CLOSNER PROJECT (Grant No. 528TLF6046)
▲ WEST UNIVERSITY PROJECT (Grant No. 528TLF6047)

West University Drive

The City of Edinburg Department of Public Works and Transportation worked on the following project. West University Drive is a major east-west arterial street. From McColl Road to a point 0.4 miles west of Sugar Road, West University Drive is a divided highway. Each direction has two lanes for moving traffic plus striped shoulders on each side -- a four-foot inside shoulder and a ten-foot outside shoulder. Left turn bays are provided at two major intersections. From 0.4 miles west of Sugar Road to Fourth Avenue, West University Drive has an uncurbed cross-section which normally provides two lanes for moving traffic in each direction, a continuous two-way left turn lane, plus a ten-foot striped outside shoulder on each side. On each approach to the Sugar Road intersection, the shoulder area is used to provide a separate right turn lane. West University Drive has a curb-and-guttered cross-section which is 76 feet wide face-to-face. It is striped to provide two lanes for moving traffic in each direction, a continuous two-way left turn lane, plus a striped parking lane on each side. At Tenth Avenue, West University terminates at a "T" intersection. The attached figure displays the project network system and cross streets.

A total of four intersections are included in the project. The intersections at McColl and Sugar Road have NEMA SS TYPE controllers, with the intersections at Fourth and Tenth having Non-NEMA SS and EM-PT type controllers, respectively. The phases of signals at the intersections vary within a range of 2 and 8. None of the intersections have any special features attributed to them.

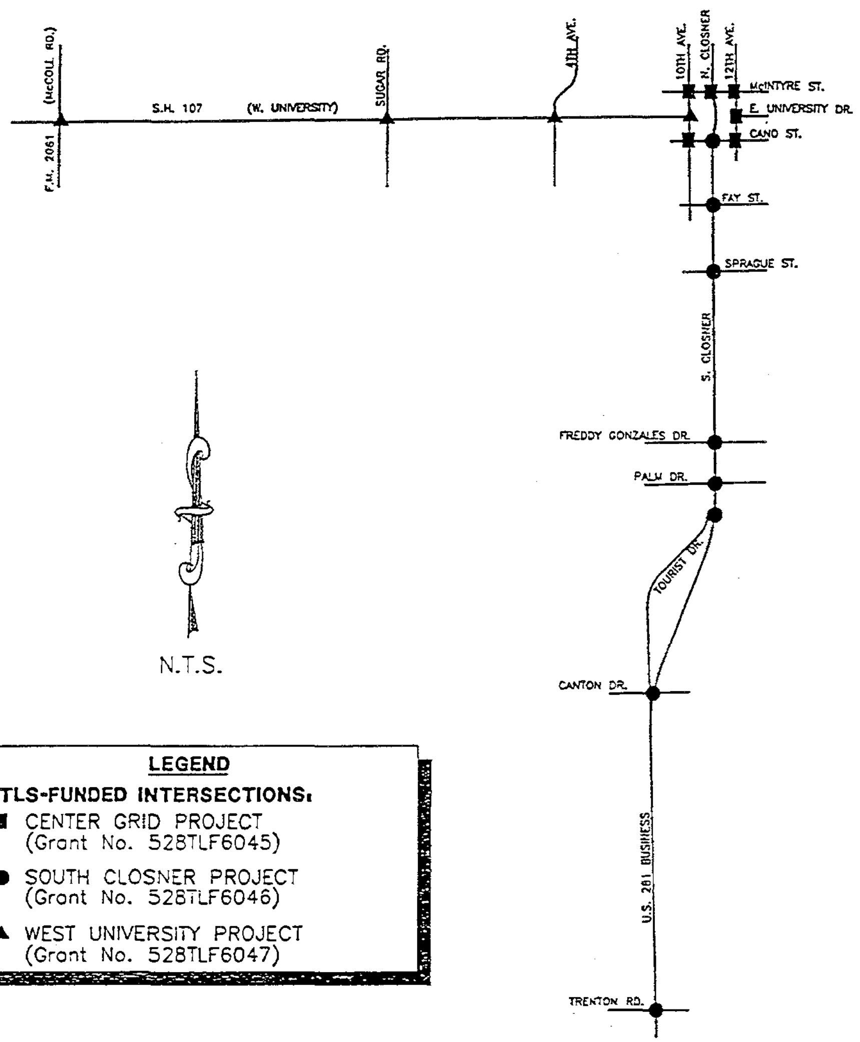
In order to evaluate the system performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, signal timing and phasing, arterial data, and speed/travel times. Free flow speeds were determined using the floating car techniques. TRANSYT-7F was used to evaluate and optimize cycle lengths and phase splits.

Based on TRANSYT-7F simulation, the project resulted in an estimated $1,727,442 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total savings of 1,503,000 stops (a 7.68 percent reduction), a total annual fuel savings of 200,400 gallons (a 25.08 percent reduction), and an annual delay savings of 150,600 veh-hrs (a 38.41 percent reduction). The total cost of the project was $73,042, and the resultant benefit to cost ratio was 24 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	4673	4343	128	128	215	216
	OFF	6193	5779	93	63	227	171
	PM	6283	5557	200	54	322	183
DIFFERENCES	AM		330		0		-1
	OFF		414		30		56
	PM		726		146		139
HRS/DAY	AM		2		2		2
	OFF		7		7		7
	PM		2		2		2
DAILY TOTALS	AM		660		0		-2
	OFF		2898		210		392
	PM		1452		292		278
	TOTAL		5010		502		668
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$21,042		$1,506,000		$200,400

PROJECT COST: $73,041.50 TOTAL ANNUAL SAVINGS: $1,727,442

BENEFIT/COST RATIO: 24


F.M. 2061
(McCOLL RD.)
S.H. 107
(W. UNIVERSITY)
SUGAR RD.
4TH AVE.
10TH AVE.
N. CLOSNER
12TH AVE.
McINTYRE ST.
E. UNIVERSITY DR.
CANO ST.
FAY ST.
SPRAGUE ST.
S. CLOSNER
FREDDY GONZALES DR.
PALM DR.
TOURIST DR.
CANTON DR.
U.S. 281 BUSINESS
TRENTON RD.
N.T.S.
LEGEND
TLS-FUNDED INTERSECTIONS:
■ CENTER GRID PROJECT (Grant No. 528TLF6045)
● SOUTH CLOSNER PROJECT (Grant No. 528TLF6046)
▲ WEST UNIVERSITY PROJECT (Grant No. 528TLF6047)

Forest Hill Drive

The City of Forest Hill Department of Public Works and Transportation worked on the following project. Forest Hill Drive is a major north-south arterial which stretches from the northern city limit at Mansfield Highway south beyond the city limit to Shelby Street. Between the south I-20 frontage road and Forest Hill Circle, Forest Hill Drive is a five-lane arterial with a posted speed limit of 30 mph. Between the north and south sides of the I-20 interchange, Forest Hill Drive is a four-lane undivided roadway. Commercial access is provided throughout the project area by extensive curb cuts. The attached figure shows the project network and cross streets.

A total of three signalized intersections were included in this project. California Parkway and the south I-20 Frontage Road are operated as a single diamond interchange with one traffic signal controller. In the before conditions, the signals at Forest Hill Drive/I-20 interchange were fully actuated with four phases. The cycle lengths used in the before conditions for the AM, OFF, and PM peak periods were 135, 115, and 160 seconds, respectively.

A new NEMA controller and a cabinet capable of actuated and time-based coordination were installed at the intersection of Forest Hill Drive and Forest Hill Circle. The intersection also has pedestrian actuation. The signals at Forest Hill Drive/I-20 were changed to coordinated with eight phases. All the traffic signals maintain coordination via internal time-based coordinators.

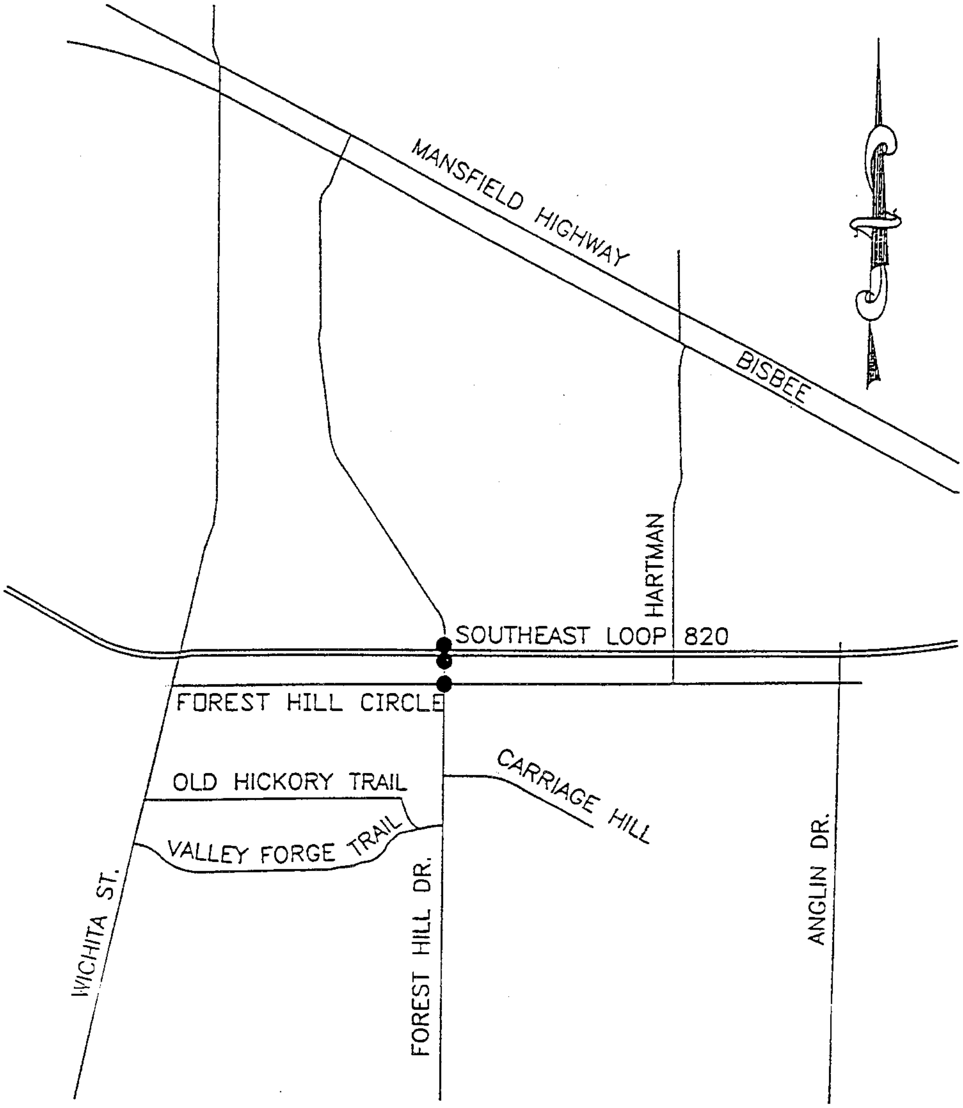
In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Optimum cycle lengths were determined using TRANSYT-7F and PASSER III for each of the AM, OFF, and PM peak periods. The new cycle lengths used for the after conditions for the AM, OFF, and PM peak periods were 80, 60, and 120 seconds, respectively.

Based on the TRANSYT-7F and PASSER III-90 simulation, the project resulted in an estimated $4,750,522 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual increase of 887,100 stops (a 10.8 percent increase), a total annual fuel savings of 320,361 gallons (a 55.1 percent reduction), and a delay annual savings of 444,258 veh-hrs (a 64.1 percent reduction). The changes in the signal timing for this system reduced delay and fuel consumption. However, there was an increase in the number of stops for all the peak periods. The total daily travel time decreased by 25 percent (208 to 155 hours), and the average vehicle speeds increased by 39 percent. The total cost of the project was $46,679, and the resultant benefit to cost ratio was 102 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	2292	2633	252.78	59.7	207.28	67.81
	NOON	2239	2486	148.65	15.89	128.72	32.87
	PM	3618	3891	381.28	298.59	311.96	252.97
DIFFERENCES	AM		-341		193.08		139.47
	NOON		-247		132.76		95.85
	PM		-273		82.69		58.99
HRS/DAY	AM		2		2		2
	NOON		7		7		7
	PM		2		2		2
DAILY TOTALS	AM		-682		386.16		278.94
	NOON		-1729		929.32		670.95
	PM		-546		165.38		117.98
	TOTAL		-2957		1480.86		1067.87
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			($12,419)		$4,442,580		$320,361

PROJECT COST: $46,679.00 TOTAL ANNUAL SAVINGS: $4,750,522

BENIFIT/COST RATIO: 102


MANSFIELD HIGHWAY
BISBEE
HARTMAN
SOUTHEAST LOOP 820
FOREST HILL CIRCLE
OLD HICKORY TRAIL
CARRIAGE HILL
VALLEY FORGE TRAIL
WICHITA ST.
FOREST HILL DR.
ANGLIN DR.

RM 2338/IH-35

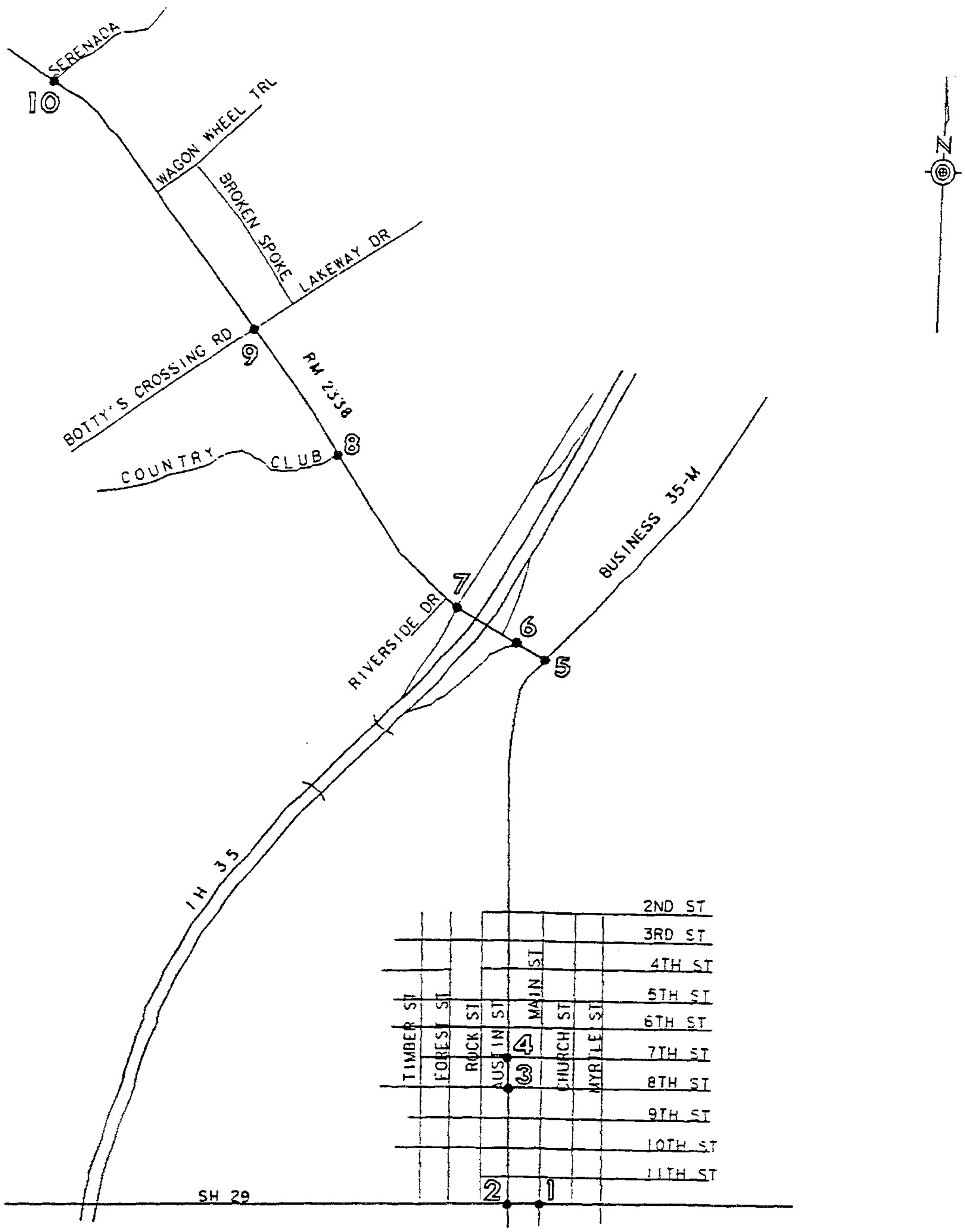
The Austin District of the Texas Department of Transportation and the City of Georgetown Department of Public Works and Transportation worked on the following project. The traffic signal network includes one intersection along SH 29, four along Business 35-M, and five on RM 2338. SH 29 and Business 35-M are four-lane, undivided, two-way roadways; however, the intersection of Business 35-M at RM 2338 has a left turn bay. RM 2338 is also a four-lane, undivided, two-way roadway, with a continuous left turn lane. The predominant land use along the three roadways is commercial and office development. Therefore, congestion is most pronounced during the morning and evening peak. The flow in the OFF-peak period is also significant due to the location of various restaurants in the area. The attached figure shows the project network and cross streets.

Five new controllers capable of time base coordination were installed at the RM 2338 intersections. Five-section signal heads were installed at RM 2338 and IH 35 in order to allow for protected-permissive movements. Also, pedestrian push buttons were installed at RM 2338 and Country Club in order to reduce the delay for RM 2338. The intersections were provided with pretimed, semi-actuated, and actuated control. The signals had between two and four phases. The intersection at RM 2338/Country Club has pedestrian control. Other intersections do not have pedestrian controls.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Optimum cycle lengths were determined using PASSER II and PASSER III for each of the AM, OFF, and PM peak periods. Travel time information was obtained by the floating car technique. Six runs were made on each link in each time period (AM, NOON, and PM), and the mean travel times were determined.

Based on the PASSER II and PASSER III simulation, the project resulted in an estimated $1,049,628 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 4,474,800 stops (a 12.1 percent reduction), a total annual fuel savings of 285,732 gallons (a 38.2 percent reduction), and a delay annual savings of 70,125 veh-hrs (a 30.1 percent reduction). Travel times were considerably reduced for the AM, PM, and OFF peak periods. The total cost of the project was $33,367, and the resultant benefit to cost ratio was 31 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	10910	8135	115.5	40.9	184.56	98.68
	OFF	10552	9754	58.8	47.9	216.91	135.66
	PM	10928	9416	54	50.7	242.04	157.27
DIFFERENCES	AM		2775		74.6		85.88
	OFF		798		10.9		81.25
	PM		1512		3.3		84.77
HRS/DAY	AM		2		2		2
	OFF		7		7		7
	PM		2.5		2.5		2.5
DAILY TOTALS	AM		5550		149.2		171.76
	OFF		5586		76.3		568.75
	PM		3780		8.25		211.92
	TOTAL		14916		233.75		952.44
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$62,647		$701,250		$285,731
PROJECT COST:			$33,366.56	TOTAL ANNUAL SAVINGS:			$1,049,628
BENEFIT/COST RATIO:			31				


SERENADA
10
WAGON WHEEL TRL
BROKEN SPOKE
LAKEWAY DR
BOTTY'S CROSSING RD
9
RM 2338
COUNTRY CLUB
8
BUSINESS 35-N
7
RIVERSIDE DR
6
5
IH 35
2ND ST
3RD ST
4TH ST
5TH ST
6TH ST
7TH ST
8TH ST
9TH ST
10TH ST
11TH ST
TIMBER ST
FOREST ST
ROCK ST
AUSTIN ST
MAIN ST
CHURCH ST
MYRTLE ST
4
3
2
1
SH 29
N

City Wide

The City of Harlingen Department of Public Works and Transportation worked on the following project. The project focused upon 17 intersections along Tyler Avenue, Harrison Avenue, Loop 448, and F Street. The fast paced development experienced by the City of Harlingen over the last five years has caused significant changes in traffic patterns throughout the city. Hence, improvements were made along Tyler Avenue and Harrison Avenue beginning at Dixieland Road on the west side of Harlingen and ending at Loop 448. Improvements included the installation of new traffic signal controllers and modification of signal timings to obtain progression along these roadways. The attached figure displays the project network system, cross streets, and link distances.

The Harlingen signal system consists of 17 signalized intersections that exist along key arterials in the city's transportation network. Three of the intersections are actuated, and the remaining fourteen are pretimed. The signal phases range from a minimum of 2 to a maximum of 8. Two of the intersections have pedestrian controls, and seven of the intersections have been equipped with an NEMA controller with TBC types for optimization of signal timings.

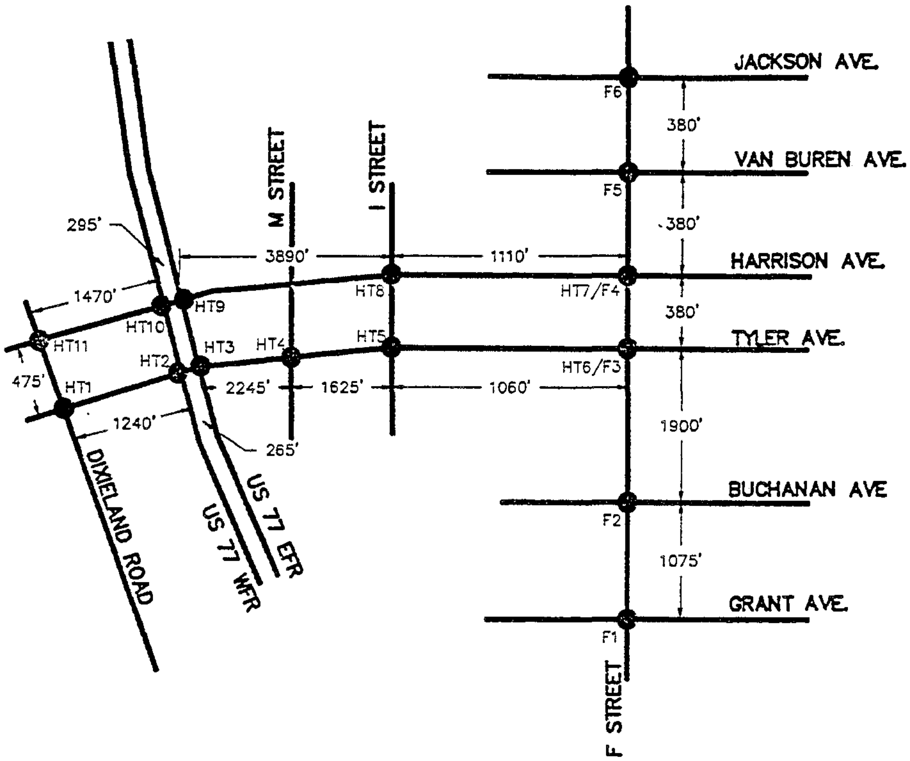
In order to evaluate the system performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, travel delays, and an operating cost study. The data for travel time and delay was collected using the test car method. Computer simulation was performed using the TRANSYT-7F computer model.

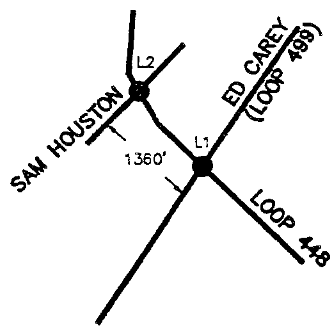
Based on TRANSYT-7F simulation, the project resulted in an estimated $1,140,268 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total savings of 7,433,400 stops (a 10.78 percent reduction), a total annual fuel savings of 130,200 gallons (a 8.42 percent reduction), and an annual delay savings of 90,600 veh-hrs (a 15.44 percent reduction). The total cost of the project was $55,086, and the resultant benefit to cost ratio was 21 to 1.

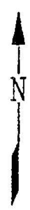
		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	20715	18884	198	146	487	431
	NOON	22166	19781	179	155	491	453
	PM	27663	24260	243	216	616	569
DIFFERENCES	AM		1831		52		56
	NOON		2385		24		38
	PM		3403		27		47
HRS/DAY	AM		2		2		2
	NOON		6		6		6
	PM		2		2		2
DAILY TOTALS	AM		3662		104		112
	NOON		14310		144		228
	PM		6806		54		94
	TOTAL		24778		302		434
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$104,068		$906,000		$130,200

PROJECT COST: $55,086.00 TOTAL ANNUAL SAVINGS: $1,140,268

BENEFIT/COST RATIO: 21


JACKSON AVE.
VAN BUREN AVE.
HARRISON AVE.
TYLER AVE.
BUCHANAN AVE
GRANT AVE.
F STREET
M STREET
I STREET
DIXIELAND ROAD
US 77 EFR
US 77 WFR
F6
F5
F2
F1
HT7/F4
HT6/F3
HT1
HT2
HT3
HT4
HT5
HT8
HT9
HT10
HT11
380'
380'
380'
1900'
1075'
295'
3890'
1110'
1470'
475'
2245'
1625'
1060'
1240'
265'


SAM HOUSTON
ED CAREY (LOOP 499)
LOOP 448
L1
L2
1360'


N

Eleventh Street

The City of Huntsville, along with TxDOT, worked on the following project. The Eleventh Street system consists of a combination of time-based and hardwire coordination as shown in the layout. Eleventh Street begins at the IH 45 service road and extends east to Avenue F. It is a major east-west arterial in Huntsville that connects the downtown business district with the IH 45 corridor. At the IH 45 service road, there are two through travel lanes in both directions with a continuous left turn lane.

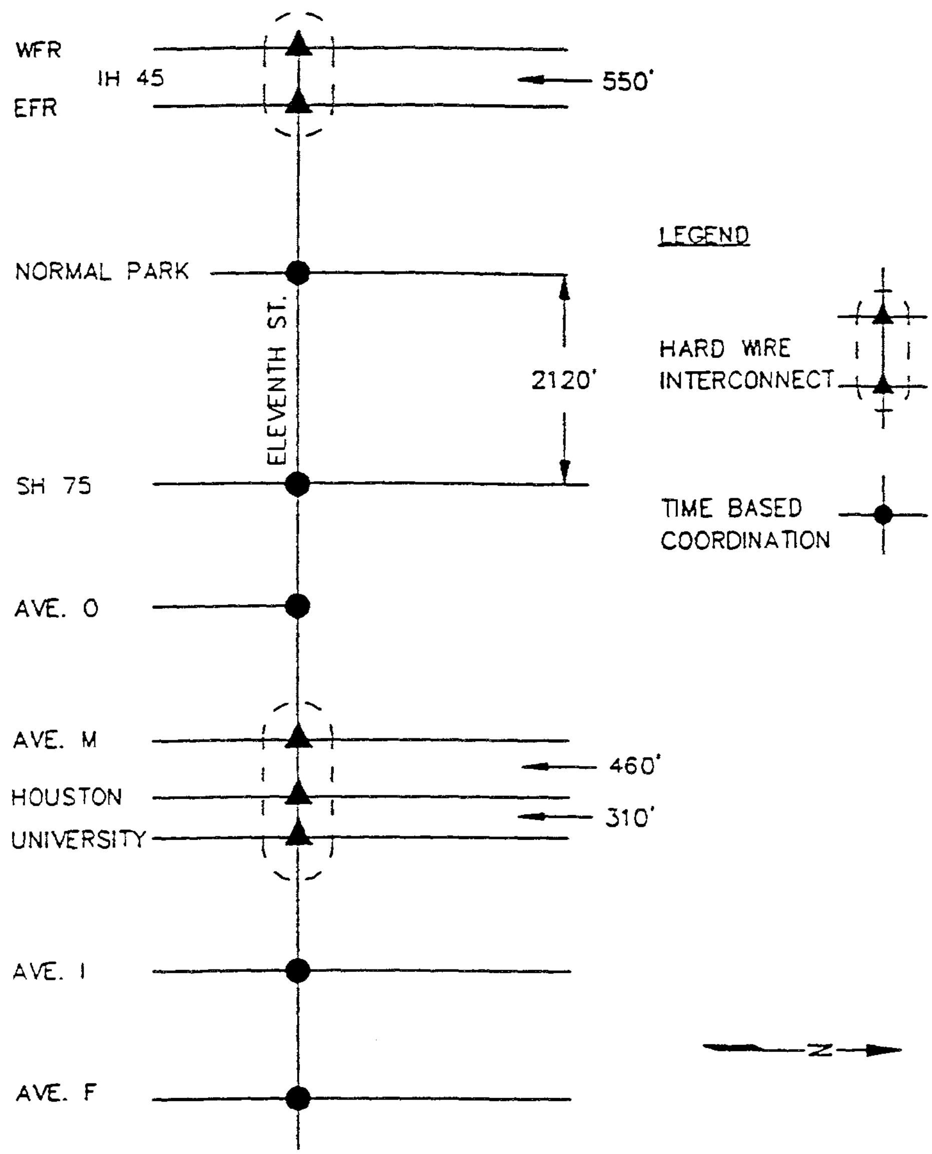
The project consisted of installing new traffic signal controllers, time clock, vehicle detection, and pedestrian detection along 11th Street. The addition of new controllers enabled time-based coordination to be implemented, and loop detection installation allowed the traffic signals to respond to actual traffic demand on the minor streets while maintaining coordination along the major street. The addition of pedestrian push buttons allowed flexibility in cycle length selection for the optimized timing plans.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included arterial data, peak hour turning movement volumes, signal phasing and timing, and network travel time data using the floating car technique. All of this data was collected to evaluate and calibrate before and after conditions. PASSER II was utilized to evaluate and optimize the network.

The existing AM, NOON/OFF, and PM peak turning movement volumes, saturation flow rates, as well as signal phasing and timing data were input into the PASSER II-90 to simulate before and after conditions. PASSER II-90 was used to develop optimum signal phasing patterns and intersection offsets. Minor offset and split adjustments were necessary due to the pedestrian requirements.

Based on the PASSER II simulation, the project resulted in an estimated $742,859 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 4,924,200 stops (a 9.65 percent reduction), a total annual fuel consumption increase of 209,280 gallons (an 34.81 percent increase), and a delay annual savings of 88,320 veh-hrs (a 25.56 percent reduction). Travel times along 11th Street were reduced by an average of 25 percent. The total cost of the project was $49,535, and the resultant benefit to cost ratio was 15 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	14416	14027	88.9	71.7	163.3	236.8
	NOON	19336	16670	130.6	95.7	226.3	303.9
	PM	22437	18063	178.5	117.8	285.7	336.4
DIFFERENCES	AM		389		17.2		-73.5
	NOON		2666		34.9		-77.6
	PM		4374		60.7		-50.7
HRS/DAY	AM		6		6		6
	NOON		2		2		2
	PM		2		2		2
DAILY TOTALS	AM		2334		103.2		-441
	NOON		5332		69.8		-155.2
	PM		8748		121.4		-101.4
	TOTAL		16414		294.4		-697.6
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$68,939		$883,200		($209,280)
PROJECT COST:			$49,535.00	TOTAL ANNUAL SAVINGS:			$742,859
BENEFIT/COST RATIO:			15				


WFR
IH 45
EFR
550'
LEGEND
NORMAL PARK
ELEVENTH ST.
2120'
HARD WIRE
INTERCONNECT
SH 75
TIME BASED
COORDINATION
AVE. O
AVE. M
460'
HOUSTON
310'
UNIVERSITY
AVE. I
N
AVE. F

Precinct Line Road

The City of Hurst Department of Public Works and Transportation worked on the following project. The City of Hurst has a population of approximately 34,250 people and is located in northeast Tarrant County. Precinct Line Road is an arterial within the City of Hurst. This arterial consists of nine signalized intersections, eight of which are part of an existing closed-loop system. The controller at the Grapevine Highway intersection is not compatible with the existing closed-loop system. The attached figure displays the project network system and cross streets.

A new controller, compatible with the existing system equipment, was installed at the intersection of Precinct Line Road and Grapevine Highway.

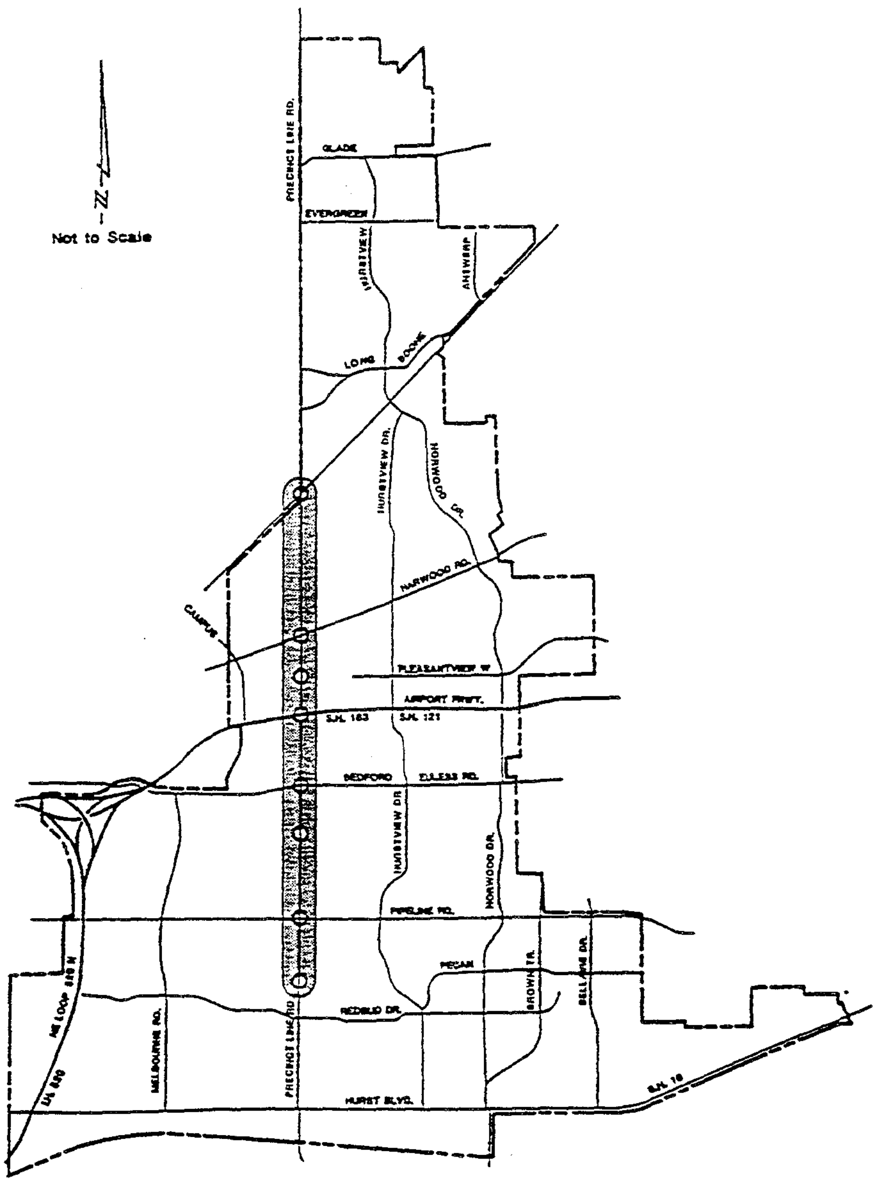
In order to evaluate the system performance, the before TLS traffic conditions were monitored, and field data were collected. Travel time studies were conducted using the floating car methodology. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Simulation runs were executed using PASSER II for AM, PM, and OFF peaks to simulate existing timing and phasing plans. Three timing plans were developed for the Precinct Line Road System to address the AM peak, OFF/NOON peak, and PM peak periods. The final optimized timing plans for the AM, OFF/NOON, and PM peak utilizes cycle lengths of 70 seconds, 76 seconds, and 80 seconds, respectively.

Based on PASSER II simulation, the project resulted in an estimated $1,766,763 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total savings of 1,479,300 stops (a 3.26 percent reduction), a total annual fuel savings of 134,062.5 gallons (a 9.79 percent reduction), and an annual delay savings of 161,199 veh-hrs (a 22.43 percent reduction). A phasing change recommendation was made for the intersection at Grapevine Highway. Currently, the north-south approaches run separately (split phasing). Concurrent phasing was recommended for the north-south approaches. The total cost of the project was $32,264, and the resultant benefit to cost ratio was 55 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	14752	13900	189.57	185.4	403.39	393.14
	OFF	14107	13667	225.23	178.73	431.94	392.39
	PM	20149	19767	356.54	219.49	624.62	521.52
DIFFERENCES	AM		852		4.17		10.25
	OFF		440		46.5		39.55
	PM		382		137.05		103.1
HRS/DAY	AM		1.5		1.5		1.5
	OFF		7		7		7
	PM		1.5		1.5		1.5
DAILY TOTALS	AM		1278		6.255		15.375
	OFF		3080		325.5		276.85
	PM		573		205.575		154.65
	TOTAL		4931		537.33		446.875
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$20,710		$1,611,990		$134,063

PROJECT COST: $32,263.53 TOTAL ANNUAL SAVINGS: $1,766,763

BENEFIT/COST RATIO: 55


Not to Scale
PRECINCT LINE RD.
GLADE
EVERGREEN
LONG
BOONE
CAMPUS
HARWOOD RD.
PLEASANTVIEW
AIRPORT FRWY.
S.H. 183
S.H. 121
BEDFORD
EULESS RD.
PIPELINE RD.
PECAN
REDBUD DR.
HURST BLVD.
MELBOURNE RD.
NORWOOD DR.
BROWN TR.
S.H. 10

SH 26

The City of Hurst Department of Public Works and Transportation worked on the following project. State Highway 26 is a major five-lane arterial running north-south through both Hurst and Colleyville, and the system identified in this project is composed of nine intersections. Three of the intersections are in Hurst, and the remaining six are in Colleyville. The attached figure displays the project network system, cross streets, link distances, and average daily traffic volumes.

All nine intersections within the purview of the project were previously operated as isolated intersections with cycle lengths ranging from 80 seconds to 200 seconds. The distances between the intersections range from 300 feet to approximately 1 mile. The system coordination is now provided through a time-based means using three Eagle controllers in Hurst and 2 Naztec controllers in Colleyville. All intersections utilize mast arms and poles along with pedestrian controls at selected locations. Protected/permissive phasing is allowed at Hurstview while all others are either permissive left turn phasing or protected only left turn phasing. Two of the intersections - Brown Trail and Glade/Village Park - are operated as split phase operations due to the poor geometrics at these locations.

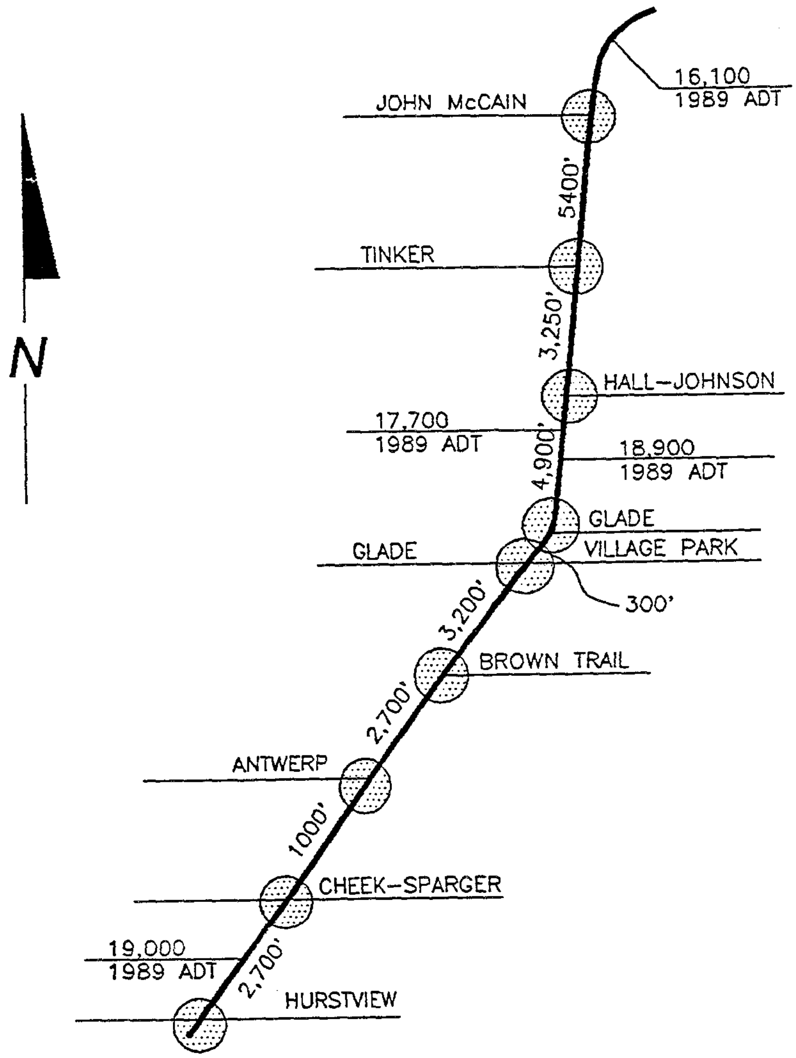
In order to evaluate the system performance, the before TLS traffic conditions were monitored, and field data were collected. Travel time studies were conducted using the floating car methodology. The data included travel times, stopped time along the route, reasons for stoppages, and free flow speeds. Traffic operation parameters were obtained by manual calculations using the method described in the Federal Highway Administration's report numbered FHWA-TS-81-210. Simulation runs were executed using PASSER II-90, for AM, PM, and OFF peaks to simulate existing timing and phasing plans.

Based on PASSER II-90 simulation, the project resulted in an estimated $49,471 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total savings of 190,800 stops (a 3.85 percent reduction), a total annual fuel savings of 5,400 gallons (a 5.42 percent reduction), and an annual delay savings of 4,140 veh-hrs (a 6.63 percent reduction). The total cost of the project was $20,472, and the resultant benefit to cost ratio was 2 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	1728	1716	25.8	25.5	32.7	32.3
	OFF	810	891	10.2	11.1	16.7	18.2
	PM	2490	1779	27.3	16.2	49.7	33.6
DIFFERENCES	AM		12		0.3		0.4
	OFF		-81		-0.9		-1.5
	PM		711		11.1		16.1
HRS/DAY	AM		2		2		2
	OFF		10		10		10
	PM		2		2		2
DAILY TOTALS	AM		24		0.6		0.8
	OFF		-810		-9		-15
	PM		1422		22.2		32.2
	TOTAL		636		13.8		18
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$2,671		$41,400		$5,400

PROJECT COST: $20,472.00 TOTAL ANNUAL SAVINGS: $49,471

BENEFIT/COST RATIO: 2



N
JOHN McCAIN
16,100
1989 ADT
5400'
TINKER
3,250'
HALL-JOHNSON
17,700
1989 ADT
4,900'
18,900
1989 ADT
GLADE
GLADE
VILLAGE PARK
300'
3,200'
BROWN TRAIL
2,700'
ANTWERP
1000'
CHEEK-SPARGER
19,000
1989 ADT
2,700'
HURSTVIEW

US 183/US 281

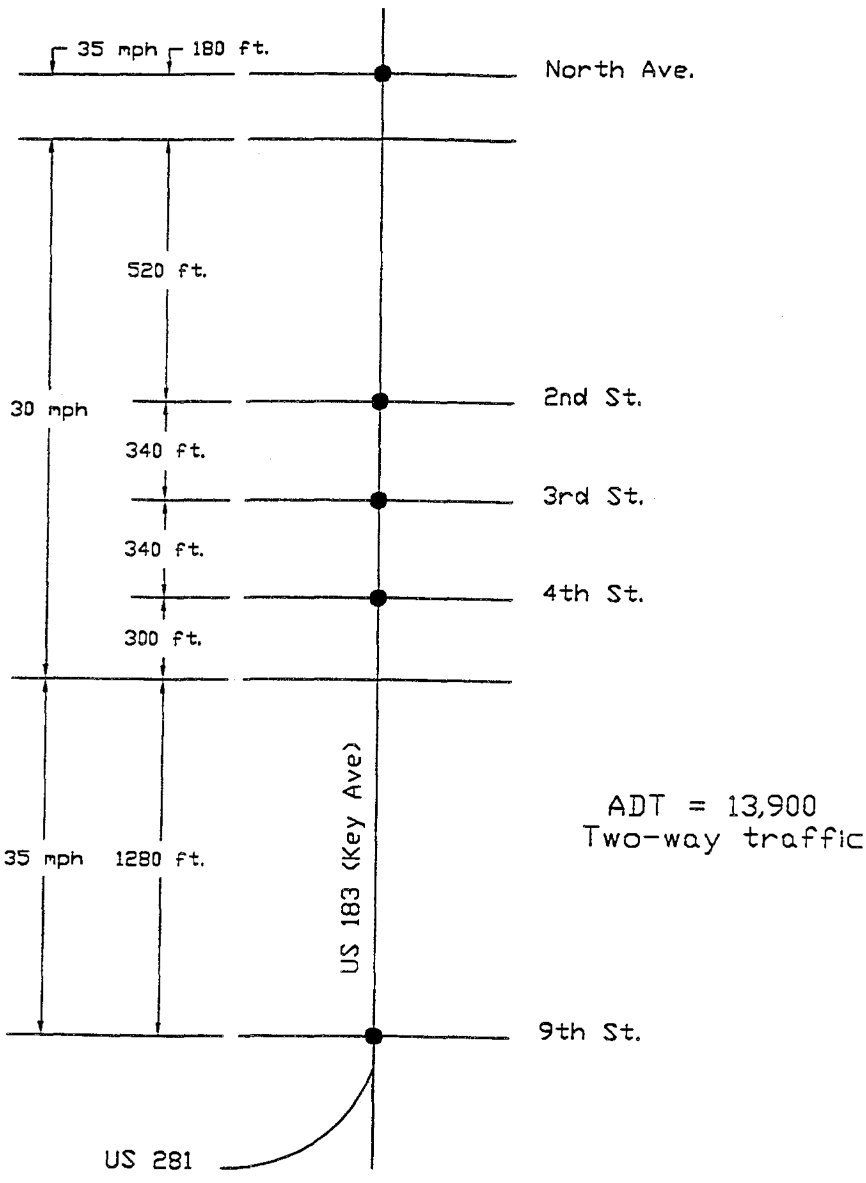
The Brownwood District of the Texas Department of Transportation worked on the following project. This project includes five signalized intersections within the city of Lampasas. These intersections were upgraded from semi-actuated controllers to fully actuated controllers. Also included in this project was the installation of additional loop detectors on the main street for fully actuated operation.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included peak hour turning movement volumes, signal timings and phasing, intersection geometrics, travel delay, and an operating cost study. All of these data were collected to evaluate and calibrate before conditions. Average cycle lengths and peak hour delay were measured in the field for the before and after conditions. The cycle lengths were then used in PASSER II, and phase splits were optimized to simulate actuated conditions.

The existing AM, NOON, and PM peak turning movement volumes, lane configurations, and signal phasing and timing were input into the PASSER II model to simulate existing conditions. The saturation flow rates used were calculated using PASSER II's assistant feature. To calibrate, the observed vehicular delays were compared to the delay values generated by the model and the percent difference calculated. It was the goal of the calibration study to have not more than a 2 second or 20 percent difference between the observed and the PASSER II model delay. In all five cases, the travel times fell within the acceptable range. Optimal cycle lengths for the intersections were determined as a result of the before calibration study and then input into the PASSER II model to simulate after conditions. Similar calibration of the after conditions were performed so that an accurate before and after comparison could be made.

Based on the PASSER II simulation, the project resulted in an estimated $376,810 annual savings on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 2,025,143 stops (a 26.17 percent reduction), a total annual fuel savings of 35,858 gallons (a 30.25 percent reduction), and a delay annual savings of 31,260 veh-hrs (a 36.54 percent reduction). The total cost of the project was $97,315.81. Hence, the resultant benefit to cost ratio was 4 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	4119	3808	55.8	36.2	61.08	55.11
	NOON	4324	3808	53	36.2	66.37	55.11
	PM	6563	3808	61	36.2	101.95	55.11
DIFFERENCES	AM		311		19.6		5.97
	NOON		516		16.8		11.26
	PM		2755		24.8		46.84
HRS/DAY	AM		1.5		1.5		1.5
	NOON		1.5		1.5		1.5
	PM		2		2		2
DAILY TOTALS	AM		467		29.4		8.955
	NOON		774		25.2		16.89
	PM		5510		49.6		93.68
	TOTAL		6751		104.2		119.525
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$28,352		$312,600		$35,858
PROJECT COST:			$97,315.81	TOTAL ANNUAL SAVINGS:			$376,810
BENEFIT/COST RATIO:			4				


35 mph
180 ft.
North Ave.
520 ft.
30 mph
2nd St.
340 ft.
3rd St.
340 ft.
4th St.
300 ft.
35 mph
1280 ft.
US 183 (Key Ave)
ADT = 13,900
Two-way traffic
9th St.
US 281

Loop 266

The Lufkin District of the Texas Department of Transportation worked on the following project. A total of five signalized intersections beginning at State Highway 94 and ending at Spur 278 were included in this project. It is a two-lane collector street running through the downtown section of the City of Lufkin. The downtown section throughout the project is 100 percent commercial. Parallel parking exists on both sides of the road from Frank Street to 300 feet past Spur 278. The attached figure displays the project network system and cross streets.

All five intersections within the purview of the project have been upgraded into fully actuated intersections with their phases ranging from 2 to 6. All the intersections have pedestrian controls. The intersection on Spur 278 is 5-legged, and none of the other intersections have any special features included in them. All these intersections are interconnected with communication cable.

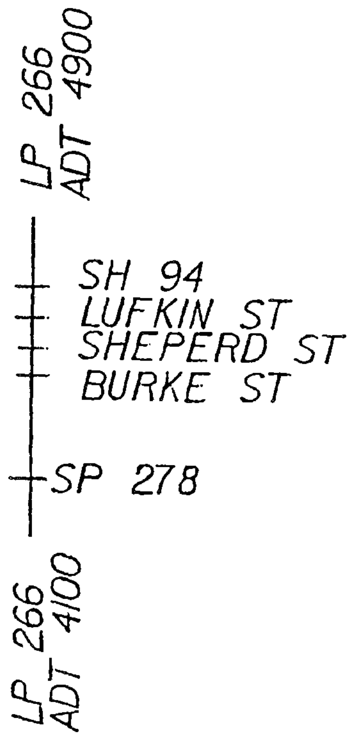
In order to evaluate the system performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, saturation flow rate, signal timing and phasing, arterial data, and speed/travel times. Link distances were obtained during the execution of travel time studies. Signal timing data was obtained from traffic surveys and the TxDOT signal shop in Lufkin. The saturation flow rate was calculated using the assistant function in PASSER II-90. The speed/travel time data were obtained using the "Jamar" traffic counter. Speed profiles, travel time, number of stops, and distance between intersections were obtained during these studies. Simulation runs were executed using PASSER II-90 for AM, PM, and OFF peaks to simulate existing timing and phasing plans after the signals were upgraded.

Based on PASSER II-90 simulation, the project resulted in an estimated $31,190 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total savings of 93,600 stops (a 3.74 percent reduction), a total annual fuel savings of 2430 gallons (a 7.69 percent reduction), and an annual delay savings of 2,745 veh-hrs (a 17.43 percent reduction). The total cost of the project was $134,792, and the resultant benefit to cost ratio was 0.2 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	845	794	3	3	9.13	9.13
	OFF	761	761	4.5	4.5	9.36	9.36
	PM	1192	1018	10.5	4.4	17.38	11.98
DIFFERENCES	AM		51		0		0
	OFF		0		0		0
	PM		174		6.1		5.4
HRS/DAY	AM		1		1		1
	OFF		7.5		7.5		7.5
	PM		1.5		1.5		1.5
DAILY TOTALS	AM		51		0		0
	OFF		0		0		0
	PM		261		9.15		8.1
	TOTAL		312		9.15		8.1
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$1,310		$27,450		$2,430

PROJECT COST: $134,792.46 TOTAL ANNUAL SAVINGS: $31,190

BENEFIT/COST RATIO: 0


LP 266
ADT 4900
SH 94
LUFKIN ST
SHEPERD ST
BURKE ST
SP 278
LP 266
ADT 4100

SH 94

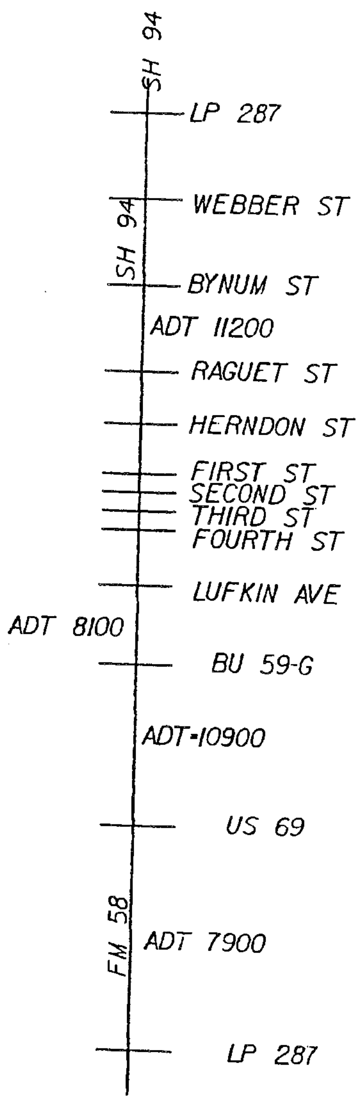
The Lufkin District of the Texas Department of Transportation worked on the following project. A total of 12 signalized intersections beginning at East Loop 287 and continuing through the City of Lufkin to West Loop 287 were included in the purview of the project. It is a four-lane arterial running east-west through the City of Lufkin. The attached figure displays the project network system and cross streets.

All 12 intersections within the purview of the project have been upgraded into fully actuated intersections with their phases ranging from 3 to 8. All the intersections, excluding the ones on East Loop 287, US 69, and Webber Street, have pedestrian controls. None of the intersections have any special features included in them. All these intersections are interconnected with communication cable.

In order to evaluate the system performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, saturation flow rate, signal timing and phasing, arterial data, and speed/travel times. Link distances were obtained during the execution of travel time studies. Signal timing data were obtained from traffic surveys and the TxDOT signal shop in Lufkin. The saturation flow rate was calculated using the assistant function in PASSER II-90. The speed/travel time data were obtained using the "Jamar" traffic counter. Speed profiles, travel time, number of stops, and distance between intersections were obtained during these studies. Simulation runs were executed using PASSER II-90 for AM, PM, and OFF peaks to simulate existing timing and phasing plans after the signals were upgraded.

Based on PASSER II-90 simulation, the project resulted in an estimated $1,451,927 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total savings of 4,754,100 stops (a 53.71 percent reduction), a total annual fuel savings of 212,970 gallons (a 75.29 percent reduction), and an annual delay savings of 117,240 veh-hrs (a 84.58 percent reduction). The total cost of the project was $205,272, and the resultant benefit to cost ratio was 7 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	3333	1439	54.5	8.7	107.44	26.61
	OFF	2683	1299	40.7	6.6	84.65	21.66
	PM	4032	1650	68.2	8.7	133.69	29.26
DIFFERENCES	AM		1894		45.8		80.83
	OFF		1384		34.1		62.99
	PM		2382		59.5		104.43
HRS/DAY	AM		1		1		1
	OFF		7.5		7.5		7.5
	PM		1.5		1.5		1.5
DAILY TOTALS	AM		1894		45.8		80.83
	OFF		10380		255.75		472.425
	PM		3573		89.25		156.645
	TOTAL		15847		390.8		709.9
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$66,557		$1,172,400		$212,970
PROJECT COST:			$205,272.03	TOTAL ANNUAL SAVINGS:			$1,451,927
BENEFIT/COST RATIO:			7				


SH 94
LP 287
WEBBER ST
SH 94
BYNUM ST
ADT 11200
RAGUET ST
HERNDON ST
FIRST ST
SECOND ST
THIRD ST
FOURTH ST
LUFKIN AVE
ADT 8100
BU 59-G
ADT-10900
US 69
FM 58
ADT 7900
LP 287

CBD System

The City of Mineral Wells Department of Public Works and Transportation worked on the following project. The two largest thoroughfares (in terms of traffic volumes) are US 281 and US 180. Side street traffic along these arterials is only 10 to 25 percent of the total intersection traffic. This creates many cycles where no side street traffic is present. With the exception of Oak Avenue and 7th Street, all intersections are currently operating in the pretimed mode. The intersection at Oak Avenue and 7th Street operates in actuated mode. A one time-of-day plan with a 65 second cycle length is currently in operation. All intersections have pedestrian signals. The absence of vehicle detection means a portion of green time must be given to the side street every cycle that could be used for the main arterial. Pedestrian walk time dictates the minimum split for the side street. The attached figure shows the project network, cross streets, and link distances.

The traffic signal network in this project has eight intersections. Each study intersection is controlled by a Naztec 900 actuated solid state controller. Seven Naztec 900 traffic signal controllers were bought and installed during TLS I project. During the TLS II project, pedestrian push buttons and vehicle detection were installed to increase the efficiency at Oak Avenue and 7th Street. The main street rests in green until a vehicle or pedestrian is detected on the cross street. Times given to the cross street will not be extended to the required pedestrian crossing time unless a pedestrian has pressed the button. Thus, in cycles where no pedestrians are crossing the street and the vehicular demand on the cross street is low, more green time will be given to the major street.

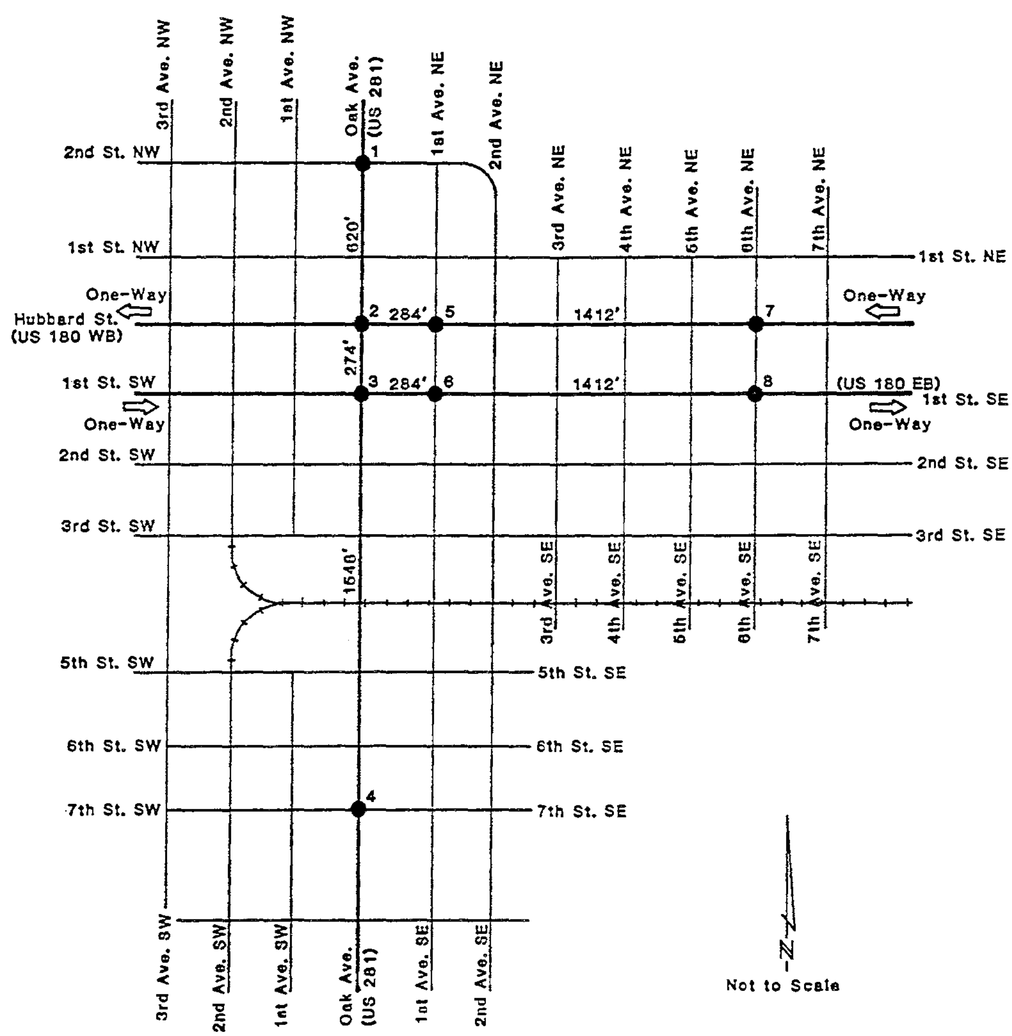
A comparison analysis was conducted for pedestrian actuation at Oak and 7th. This intersection has full vehicle actuation without pedestrian actuation. The comparison was conducted for two conditions: (1) without pedestrian actuation, and (2) with pedestrain actuation. Both conditions were analyzed using TRANSYT-7F and assumed the same traffic conditions. The only difference between the two models was the increased split time required for the cross street traffic pedestrian clearance interval under the "without pedestrian actuation" scenario.

Based on the TRANSYT-7F simulation, the project resulted in an estimated $5,104 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included an increase of 24,600 stops (a 1.7 percent increase), a total annual fuel savings of 288 gallons (a 0.98 percent reduction), and an annual delay savings of 516 veh-hrs (a 7.24 percent reduction). The increase in stops was due to the pedestrian actuation provided at the intersection. For a cycle with no pedestrian actuation and with low cross street vehicular demand, more time would be given to the main street. The total cost of the project was $12,352, and the resultant benefit to cost ratio was 0.4 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		W/O Ped. Act.	With Ped. Act.	W/O Ped. Act.	With Ped. Act.	W/O Ped. Act.	With Ped. Act.
HOURLY VALUES	NOON	441	431	2.16	2.06	8.99	8.88
	OFF	385	398	1.91	1.75	7.8	7.73
	PM	540	502	2.5	2.48	10.96	10.81
DIFFERENCES	NOON		10		0.1		0.11
	OFF		-13		0.16		0.07
	PM		38		0.02		0.15
HRS/DAY	NOON		1		1		1
	OFF		10		10		10
	PM		1		1		1
DAILY TOTALS	NOON		10		0.1		0.11
	OFF		-130		1.6		0.7
	PM		38		0.02		0.15
	TOTAL		-82		1.72		0.96
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			($344)		$5,160		$288

PROJECT COST: $12,352.00 TOTAL ANNUAL SAVINGS: $5,104

BENEFIT/COST RATIO: 0



3rd Ave. NW
2nd Ave. NW
1st Ave. NW
Oak Ave. (US 281)
1st Ave. NE
2nd Ave. NE
3rd Ave. NE
4th Ave. NE
5th Ave. NE
6th Ave. NE
7th Ave. NE
2nd St. NW
1st St. NW
1st St. NE
One-Way
Hubbard St. (US 180 WB)
1st St. SW
(US 180 EB) 1st St. SE
2nd St. SW
2nd St. SE
3rd St. SW
3rd St. SE
5th St. SW
5th St. SE
6th St. SW
6th St. SE
7th St. SW
7th St. SE
620'
284'
1412'
274'
1640'
1
2
3
4
5
6
7
8
3rd Ave. SE
4th Ave. SE
5th Ave. SE
6th Ave. SE
7th Ave. SE
3rd Ave. SW
2nd Ave. SW
1st Ave. SW
Oak Ave. (US 281)
1st Ave. SE
2nd Ave. SE
N
Not to Scale

FM 1275

The Lufkin District of the Texas Department of Transportation worked on the following project. A total of seven signalized intersections were included in the project. FM 1275 is a four-lane undivided roadway with protected left turn bays and is the arterial running north-south through the City of Nacogdoches. It is a very heavily travelled route from Houston with a large percentage of heavy truck traffic. The attached figure displays the project network system and cross streets.

All seven intersections within the purview of the project are fully actuated with their phases ranging from 2 to 8. All of the intersections have pedestrian controls. None of the intersections have any special features attributed to them. All these intersections are interconnected with communication cable.

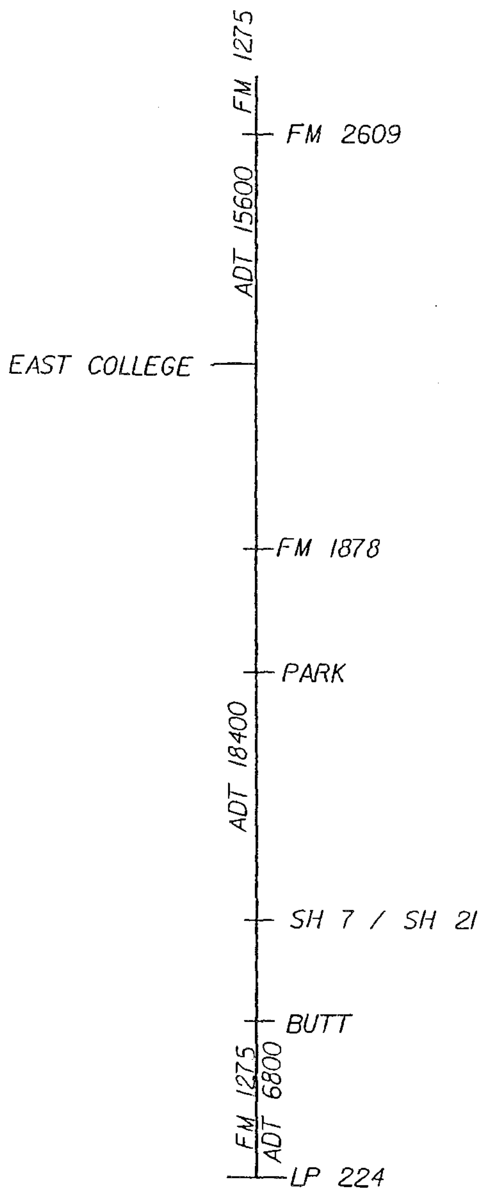
In order to evaluate the system performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, saturation flow rate, signal timing and phasing, arterial data, and speed/travel times. Link distances were obtained during the execution of travel time studies. Signal timing data was obtained from traffic surveys and the TxDOT signal shop in Lufkin. The saturation flow rate was calculated using the assistant function in PASSER II-90. The speed/travel time data were obtained using the "Jamar" traffic counter. Speed profiles, travel time, number of stops, and distance between intersections were obtained during these studies. Traffic counts were done from 6:00 a.m. to 6:00 p.m. for all intersections. Simulation runs were executed using PASSER II-90 for AM, PM, and OFF peaks to simulate existing timing and phasing plans after the signals were upgraded.

Based on PASSER II-90 simulation, the project resulted in an estimated $525,078 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total savings of 25,800 stops (a 0.41 percent reduction), a total annual fuel savings of 36,167 gallons (a 16.43 percent reduction), and an annual delay savings of 48,855 veh-hrs (a 52.58 percent reduction). The total cost of the project was $241,269, and the resultant benefit to cost ratio was 2 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	2619	2572	38.5	19.8	89.32	75.1
	OFF	1768	1783	24.9	11.9	62.01	52.64
	PM	3261	3160	56.3	25.2	119.55	95.51
DIFFERENCES	AM		47		18.7		14.22
	OFF		-15		13		9.37
	PM		101		31.1		24.04
HRS/DAY	AM		1		1		1
	OFF		7.5		7.5		7.5
	PM		1.5		1.5		1.5
DAILY TOTALS	AM		47		18.7		14.22
	OFF		-113		97.5		70.275
	PM		152		46.65		36.06
	TOTAL		86		162.85		120.555
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$361		$488,550		$36,166

PROJECT COST: $241,269.26 TOTAL ANNUAL SAVINGS: $525,078

BENEFIT/COST RATIO: 2


FM 1275
FM 2609
ADT 15600
EAST COLLEGE
FM 1878
PARK
ADT 18400
SH 7 / SH 21
BUTT
FM 1275
ADT 6800
LP 224

North Street

The Lufkin District of the Texas Department Department of Transportation worked on the following project. The arterial covered in this project, North Street (BU 59-F), is a four-lane arterial running north-south through the City of Nacogdoches. The project began at SH 7 (Fredonia Street) and continues through to Loop 224. A total of 16 signalized intersections were included in the project. The attached figure displays the project network system, cross streets, and link distances.

All 16 intersections within the purview of the project have been upgraded to fully actuated with their phases ranging from 2 to 8. Four of the intersections have pedestrian controls. None of the intersections have any special features attributed to them. All these intersections are interconnected with communication cable.

In order to evaluate the system performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, saturation flow rate, signal timing and phasing, arterial data, and speed/travel times. Link distances were obtained during the execution of travel time studies. Signal timing data were obtained from traffic surveys and the TxDOT signal shop in Lufkin. The saturation flow rate was calculated using the assistant function in PASSER II-90. The speed/travel time data were obtained using the "Jamar" traffic counter. Speed profiles, travel time, number of stops, and distance between intersections were obtained during these studies. Traffic counts were done from 6:00 a.m. to 6:00 p.m. for all intersections. Simulation runs were executed using PASSER II-90 for AM, PM, and OFF peaks to simulate existing timing and phasing plans after the signals were upgraded.

Based on PASSER II-90 simulation, the project resulted in an estimated $1,098,681 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total savings of 1,909,500 stops (a 13.93 percent reduction), a total annual fuel savings of 119,898 gallons (a 26.50 percent reduction), and an annual delay savings of 95,205 veh-hrs (a 48.19 percent reduction). The total cost of the project was $312,484, and the resultant benefit to cost ratio was 4 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	4733	3984	65.8	32.7	151.77	114.93
	OFF	4201	3661	58.1	32.1	137.23	102.91
	PM	6291	5247	104.7	45.2	218.23	147.95
DIFFERENCES	AM		749		33.1		36.84
	OFF		540		26		34.32
	PM		1044		59.5		70.28
HRS/DAY	AM		1		1		1
	OFF		7.5		7.5		7.5
	PM		1.5		1.5		1.5
DAILY TOTALS	AM		749		33.1		36.84
	OFF		4050		195		257.4
	PM		1566		89.25		105.42
	TOTAL		6365		317.35		399.66
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$26,733		$952,050		$119,898

PROJECT COST: $312,483.80 TOTAL ANNUAL SAVINGS: $1,098,681

BENEFIT/COST RATIO: 4

Figure not available.

Union Avenue/Castell Avenue

The City of New Braunfels Department of Public Works and Transportation worked on the following project. New Braunfels is a city of approximately 27,300 people, with the main commercial activities centered around water amusement parks, city parks and golf course, Wursfest and Comal Fair. These facilities generate more than 1.5 million visitors every year. The arterial streets covered in this project included four intersections. The Union Avenue system consists of two intersections, each of which has two approach lanes with a T-intersection at San Antonio Street. The Castell Avenue system consists of two intersections of which Coll Street and Castell Avenue consist of single approach lanes. Each of the San Antonio Street approaches has two lanes. The attached figure displays the project network systems.

The control network at the intersections consists of two systems with four Series 900 controllers of Naztec, Inc., two detector loops for OFF-peak semi-actuated operation and seven conductor cable with integral messenger for interconnection. The phases of signals at the intersections vary within a range of 2 and 4. The intersections of San Antonio Street at Union Avenue and at Castell Avenue have pedestrian controls. The intersection of Union Avenue with San Antonio Street is a T-intersection. The intersections of Castell Avenue at San Antonio Street and at Coll Street have parallel parking on both sides of each approach.

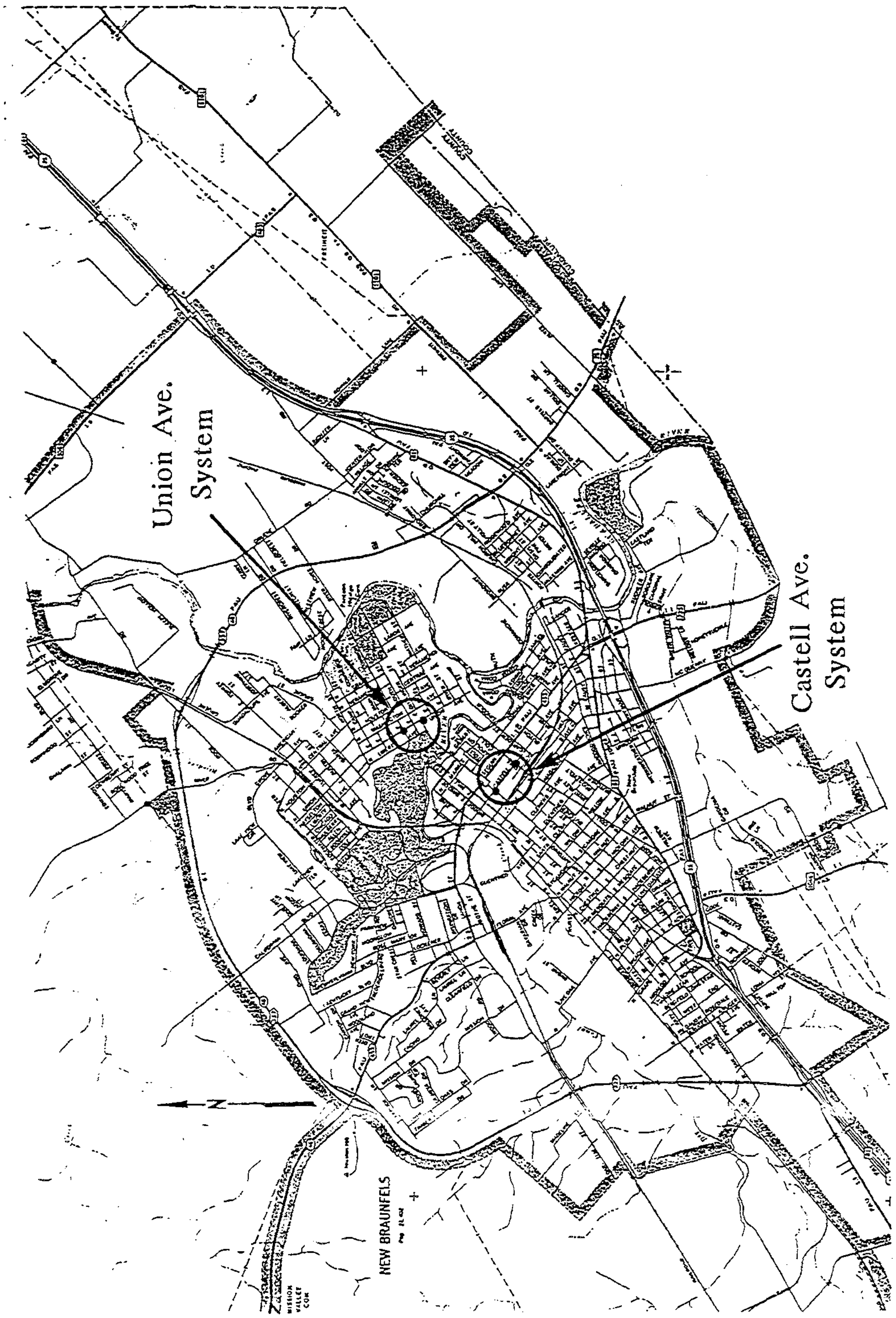
In order to evaluate the system performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, signal timing and phasing, saturation flow, arterial data, and speed/travel times. The speed/travel time information was determined using the test car method. New signal timing plans were developed using the PASSER II computerized traffic signal optimization model.

Based on PASSER II simulation, the project resulted in an estimated $26,806 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total savings of 320,400 stops (a 3.56 percent reduction), a total annual fuel savings of 3,720 gallons (a 4.23 percent reduction), and an annual delay savings of 1,860 veh-hrs (a 5.95 percent reduction). The total cost of the project was $62,116, and the resultant benefit to cost ratio was 0.4 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	2219	2290	7.3	8	21.8	22.5
	OFF	2848	2618	10.1	7.4	27.8	23.6
	PM	4257	4342	14.5	18.8	41.2	46.9
DIFFERENCES	AM		-71		-0.7		-0.7
	OFF		230		2.7		4.2
	PM		-85		-4.3		-5.7
HRS/DAY	AM		2		2		2
	OFF		6		6		6
	PM		2		2		2
DAILY TOTALS	AM		-142		-1.4		-1.4
	OFF		1380		16.2		25.2
	PM		-170		-8.6		-11.4
	TOTAL		1068		6.2		12.4
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$4,486		$18,600		$3,720

PROJECT COST: $62,116.00 TOTAL ANNUAL SAVINGS: $26,806

BENEFIT/COST RATIO: 0


Union Ave.
System
Castell Ave.
System
NEW BRAUNFELS
N

Davis Boulevard System

The City of North Richland Hills Department of Public Works and Transportation worked on the following project. Davis Boulevard (FM 1938) is a major arterial serving the northern half of the City of North Richland Hills. The traffic flows are heavily directional, southbound in the AM and northbound in the PM peak hour. Davis intersects SH 26 north of the interchange with IH 820. The attached figure shows the project network, cross streets, and link distances.

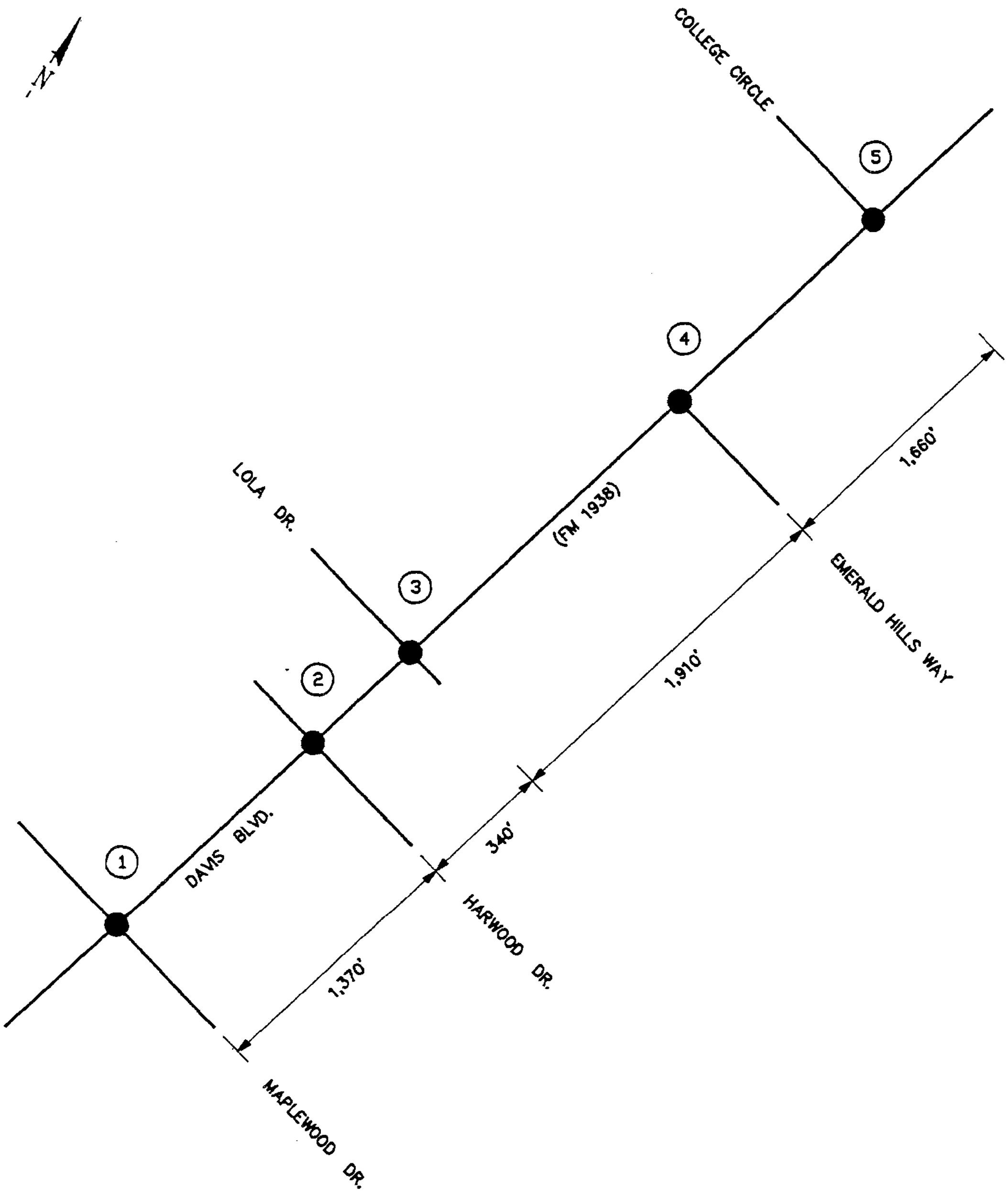
This project includes five signalized intersections from Maplewood Drive to College Circle. The intersections with Davis Boulevard at Harwood and Lola are controlled by one controller. The intersection at Emerald Hills is currently a T-intersection, but is planned to be a four leg intersection. All of the intersections, except those linked by one common controller, were operating as isolated intersections.

A new controller was installed in the existing cabinet at Maplewood. A new cabinet and controller was also installed at Harwood-Lola, and the intersection was re-phased. The existing equipment was utilized at other intersections.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Timing plans were developed using PASSER II and TRANSYT-7F. Optimum plans were first developed using the existing phasing patterns in TRANSYT-7F. Plans were then developed using PASSER II. The phasing patterns from PASSER II were coded into TRANSYT-7F. Optimum plans were then developed using PASSER II phasing patterns in TRANSYT-7F. The two plans for TRANSYT-7F were compared, and the preferred plan was selected. Travel time information was obtained by the floating car technique. Six runs were made on each link in each time period (AM, NOON, and PM), and the mean travel times were determined. The optimum cycle lengths used for the after conditions for the AM, OFF, and PM peak periods were 60, 70, and 60 seconds, respectively.

Based on the PASSER II and TRANSYT-7F simulation, the project resulted in an estimated $253,703 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 1,930,200 stops (a 16.7 percent reduction), a total annual fuel savings of 29,070 gallons (a 9.3 percent reduction), and a delay annual savings of 19,761 veh-hrs (a 26.0 percent reduction). The average travel times for the Davis Boulevard System were in the range of 97 to 125 seconds. The total cost of the project was $22,583, and the resultant benefit to cost ratio was 11 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	5972	4836	36.42	28.44	157.4	142.8
	NOON	4189	3323	22.64	19.73	114.5	104.8
	PM	7043	6261	56.36	35.77	190.1	170.8
DIFFERENCES	AM		1136		7.98		14.6
	NOON		866		2.91		9.7
	PM		782		20.59		19.3
HRS/DAY	AM		2		2		2
	NOON		3		3		3
	PM		2		2		2
DAILY TOTALS	AM		2272		15.96		29.2
	NOON		2598		8.73		29.1
	PM		1564		41.18		38.6
	TOTAL		6434		65.87		96.9
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$27,023		$197,610		$29,070
PROJECT COST:			$22,582.81	TOTAL ANNUAL SAVINGS:			$253,703
BENEFIT/COST RATIO:			11				



N
COLLEGE CIRCLE
5
4
1,660'
LOLA DR.
(FM 1938)
3
EMERALD HILLS WAY
2
1,910'
DAVIS BLVD.
1
340'
HARWOOD DR.
1,370'
MAPLEWOOD DR.

SH 26 North System

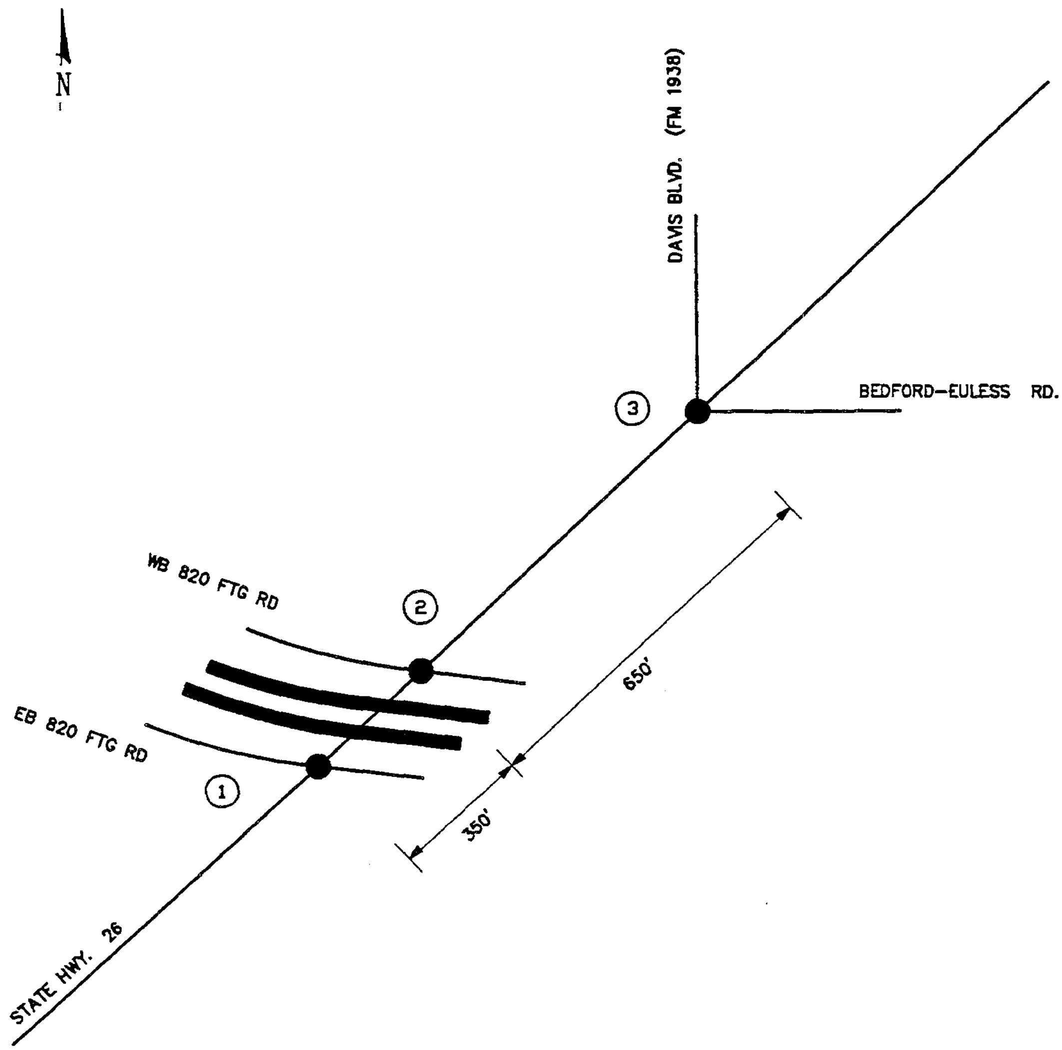
The City of North Richland Hills Department of Public Works and Transportation worked on the following project. SH 26 is a commercial corridor extending from Grapevine in the northeast to downtown Fort Worth in the southwest. The diamond interchange formed by the eastbound and westbound frontage roads at SH 26 are controlled by one controller. The intersection is a high volume, heavily congested location. The attached figure shows the project network, cross streets, and link distances.

This project includes a diamond interchange at SH 26/IH 820 and a signalized intersection at SH 26/Bedford-Euless. A new controller and a cabinet were installed at both these places. The interchange at IH 820 was re-phased. The existing phasing pattern was retained at the Bedford-Euless intersection.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Optimum cycle lengths were determined using TRANSYT-7F and PASSER III for each of the AM, OFF, and PM peak periods. Travel time information was obtained by the floating car technique. Six runs were made on each link in each time period (AM, NOON, and PM), and the mean travel times were determined. The optimum cycle lengths used for the after conditions for the AM, OFF, and PM peak periods were 90, 70, and 90 seconds, respectively.

Based on the TRANSYT-7F and PASSER III simulation, the project resulted in an estimated $1,895,788 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 2,211,300 stops (a 14.6 percent reduction), a total annual fuel savings of 140,790 gallons (a 39.1 percent reduction), and a delay annual savings of 172,404 veh-hrs (a 58.2 percent reduction). The average travel times for the SH 26 North System were in the range of 50 to 78 seconds. The total cost of the project was $21,034, and the resultant benefit to cost ratio was 90 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	6624	5734	83.81	58.8	124.4	100.1
	NOON	6974	5739	150.77	49.19	176.7	94.4
	PM	8204	7261	183.9	73.94	210.8	123.9
DIFFERENCES	AM		890		25.01		24.3
	NOON		1235		101.58		82.3
	PM		943		109.96		86.9
HRS/DAY	AM		2		2		2
	NOON		3		3		3
	PM		2		2		2
DAILY TOTALS	AM		1780		50.02		48.6
	NOON		3705		304.74		246.9
	PM		1886		219.92		173.8
	TOTAL		7371		574.68		469.3
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$30,958		$1,724,040		$140,790
PROJECT COST:		$21,034.41		TOTAL ANNUAL SAVINGS:			$1,895,788
BENEFIT/COST RATIO:		90					


N
DAVIS BLVD. (FM 1938)
BEDFORD—EULESS RD.
3
WB 820 FTG RD
2
650'
EB 820 FTG RD
1
350'
STATE HWY. 26

SH 26 South System

The City of North Richland Hills Department of Public Works and Transportation worked on the following project. SH 26 is a commercial corridor extending from Grapevine in the northeast to downtown Fort Worth in the southwest. The intersection of SH 26 with Glenview is a five leg intersection and drives the SH 26 South System. The attached figure shows the project network, cross streets, and link distances.

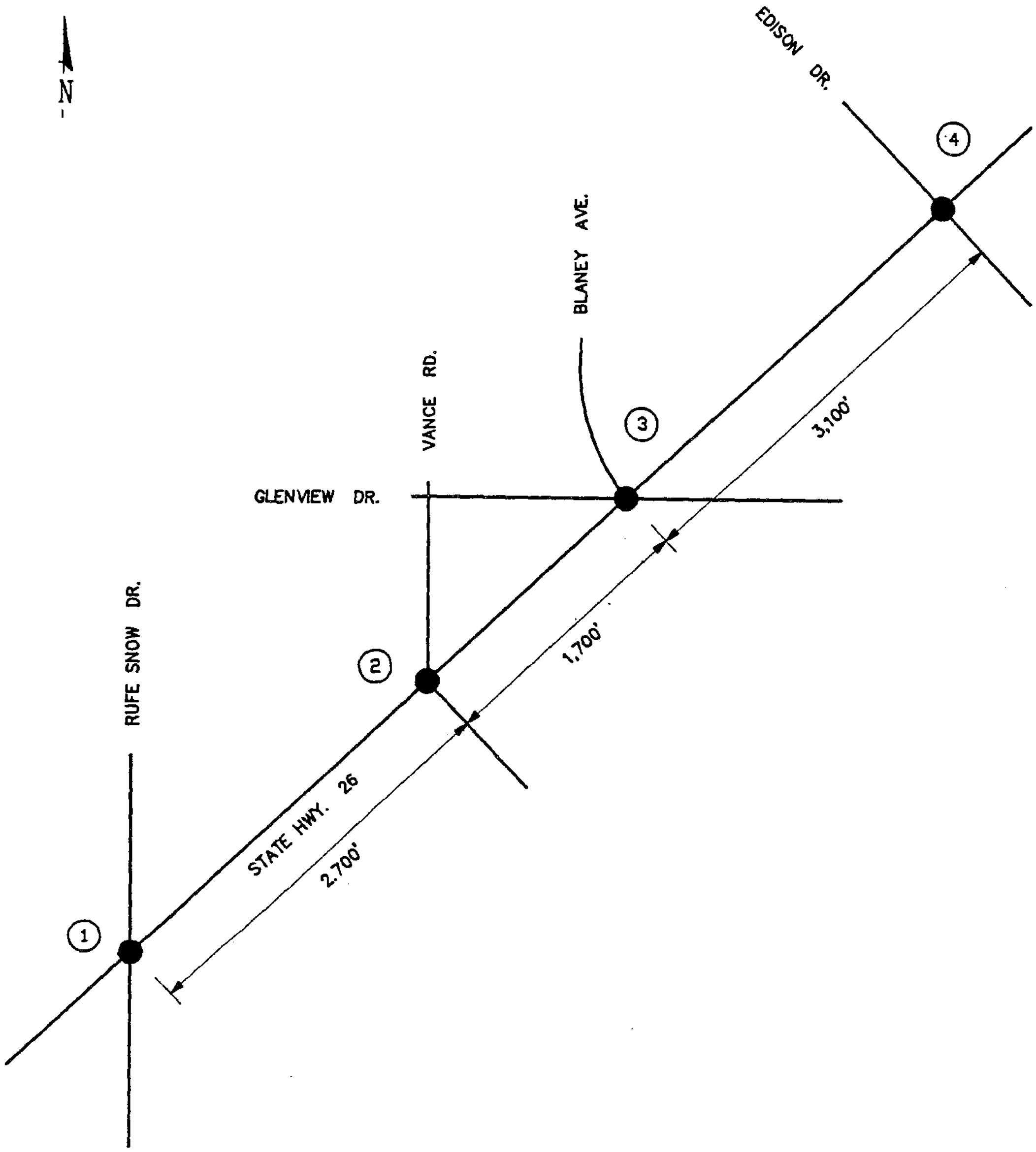
This project includes four signalized intersections from Rufe Snow Drive to Edison Drive. All the intersections were operating as isolated intersections. New cabinets and controllers were installed at the intersections at Vance, Glenview, and Edison. The intersection at Glenview was re-phased. The existing equipment was utilized at SH 26/Rufe Snow Drive.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, signal timings and phasing, arterial data, intersection geometrics, travel delays, and an operating cost study. Timing plans were developed using PASSER II and TRANSYT-7F. Optimum plans were first developed using the existing phasing patterns in TRANSYT-7F. Plans were then developed using PASSER II. The phasing patterns from PASSER II were coded into TRANSYT-7F. Optimum plans were then developed using PASSER II phasing patterns in TRANSYT-7F. The two plans for TRANSYT-7F were compared, and the preferred plan was selected. Travel time information was obtained by the floating car technique. Six runs were made on each link in each time period (AM, NOON, and PM), and the mean travel times were determined. The optimized cycle length used for the after conditions for each of the peak periods was 90 seconds.

Optimized timing plans could not be implemented at two intersections. Equipment limitation at Rufe Snow did not allow a time-based coordination plan to be implemented. The equipment was not changed out because it is relatively new and the intersection is located on the boundary between the cities of North Richland Hills and Richland Hills. The five leg intersection at Glenview/Blaney forced the cycle length to 90 seconds which is well above the optimum for the other intersections in the system.

Based on the PASSER II and TRANSYT-7F simulation, the project resulted in an estimated $231,338 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 167,700 stops (a 1.4 percent reduction), a total annual fuel savings of 9,150 gallons (a 2.7 percent reduction), and a delay annual savings of 21,984 veh-hrs (a 15.3 percent reduction). The average travel times for the SH 26 South System were in the range of 162 to 245 seconds. The total cost of the project was $24,281, and the resultant benefit to cost ratio was 10 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	4185	3882	40.04	37.95	113	109.8
	NOON	5943	6162	66.2	59.92	168.8	171.3
	PM	7139	6834	100.93	75.8	205.2	189.4
DIFFERENCES	AM		303		2.09		3.2
	NOON		-219		6.28		-2.5
	PM		305		25.13		15.8
HRS/DAY	AM		2		2		2
	NOON		3		3		3
	PM		2		2		2
DAILY TOTALS	AM		606		4.18		6.4
	NOON		-657		18.84		-7.5
	PM		610		50.26		31.6
	TOTAL		559		73.28		30.5
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$2,348		$219,840		$9,150
PROJECT COST:			$24,281.00	TOTAL ANNUAL SAVINGS:			$231,338
BENEFIT/COST RATIO:			10				


N
EDISON DR.
BLANEY AVE.
VANCE RD.
GLENVIEW DR.
RUFE SNOW DR.
STATE HWY. 26
1
2
3
4
2,700'
1,700'
3,100'

Loop 467

The City of Sonora and Barton Aschman Associates, Inc. worked on the following project. The arterial covered in this project, Loop 467, is the main arterial for Sonora, which runs through Sonora and connects to Interstate 10 at both ends. Loop 467 is a four-lane undivided roadway up to the East 3rd Street intersection; it then becomes a two-lane roadway.

Loop 467 has three signalized intersections. All three intersections were included in the project. The signals originally operated independently from each other. In order to achieve optimal timing, new controllers were installed at all three intersections. The system now consists of time-base solid state controllers and operates on a 50-second cycle. New loops were installed on the 7th Street approach.

In order to evaluate the performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included arterial data, peak hour turning movement volumes, signal phasing and timing, and network travel time data using the test car technique. All of this data was collected to evaluate and calibrate before and after conditions. PASSER II-87 was used to evaluate and optimize the network.

The existing AM, NOON/OFF, and PM peak turning movement volumes, saturation flow rates, as well as signal phasing and timing data were input into the PASSER II-87 model to simulate before and after conditions. PASSER II-87 was used to develop optimum signal phasing patterns and intersection offsets. Implementation of the new timing plans and fine tuning of system signal timings were carried out in part by the San Angelo District Office of the Texas Department of Transportation. The revised final timings plans for all intersections were simulated with PASSER II-87 to obtain the final measures of effectiveness.

Based on the PASSER II-87 simulation, the project resulted in an estimated $51,948 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total annual savings of 444,000 stops (a 9.02 percent reduction), a total annual fuel savings of 5,520 gallons (an 4.64 percent reduction), and a delay annual savings of 4,410 veh-hrs (a 18.75 percent reduction). The total cost of the project was $24,749, and the resultant benefit to cost ratio was 2 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	1078	1023	5.2	4.4	26	25.2
	PM	1743	1550	8.3	6.6	42.1	39.8
	OFF	552	505	2.6	2.1	14.3	13.7
DIFFERENCES	AM		55		0.8		0.8
	PM		193		1.7		2.3
	OFF		47		0.5		0.6
HRS/DAY	AM		4.68		4.68		4.68
	PM		5.57		5.57		5.57
	OFF		0.93		0.93		0.93
DAILY TOTALS	AM		257		3.744		3.744
	PM		1075		9.469		12.811
	OFF		44		0.465		0.558
	TOTAL		1376		13.678		17.113
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$5,780		$41,034		$5,134

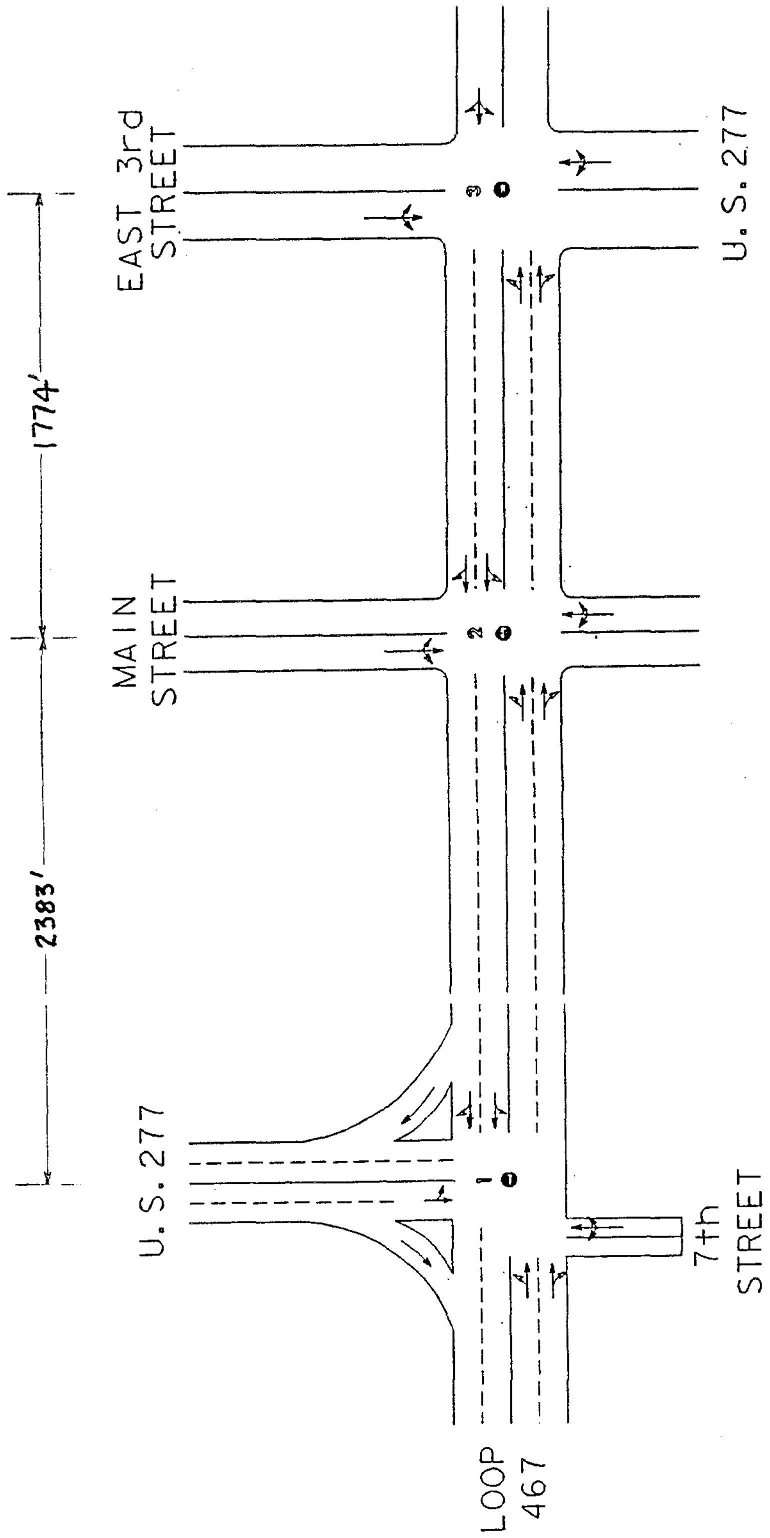
PROJECT COST: $24,749.00 TOTAL ANNUAL SAVINGS: $51,948

BENEFIT/COST RATIO: (Refer to Summary)

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	1078	1071	5.2	4.8	26	25.8
	PM	1743	1602	8.3	7	42.1	40.5
	OFF	552	531	2.6	2.3	14.3	14
DIFFERENCES	AM		7		0.4		0.2
	PM		141		1.3		1.6
	OFF		21		0.3		0.3
HRS/DAY	AM		0.32		0.32		0.32
	PM		0.43		0.43		0.43
	OFF		0.07		0.07		0.07
DAILY TOTALS	AM		2		0.128		0.064
	PM		61		0.559		0.688
	OFF		1		0.021		0.021
	TOTAL		64		0.708		0.773
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$270		$2,124		$232

PROJECT COST: $24,749.00 TOTAL ANNUAL SAVINGS: $2,626

BENEFIT/COST RATIO: (Refer to Summary)


EAST 3rd STREET
U.S. 277
1774'
MAIN STREET
2383'
U.S. 277
7th STREET
LOOP 467

Ninth Avenue

The Texas City Department of Public Works and Transportation worked on the following project. A total of five intersections were included in the project. The Ninth Avenue begins at Twelfth Street and extends to East Sixth Street. The five signals were recently modernized within this project. Ninth Avenue contains a four-lane cross section with two through lanes in both directions and a continuous left turn lane. Coordination was not feasible for the five intersections with those modernized by the state due to significant differences in traffic volumes on the two street segments. The attached figure displays the project network system and cross streets.

All five intersections within the purview of the project are controlled by NEMA traffic controllers. These controllers enabled time-based coordination to be implemented, and vehicle loop detection installation allowed the traffic signals to respond to actual traffic demand on minor streets while maintaining coordination along the major street.

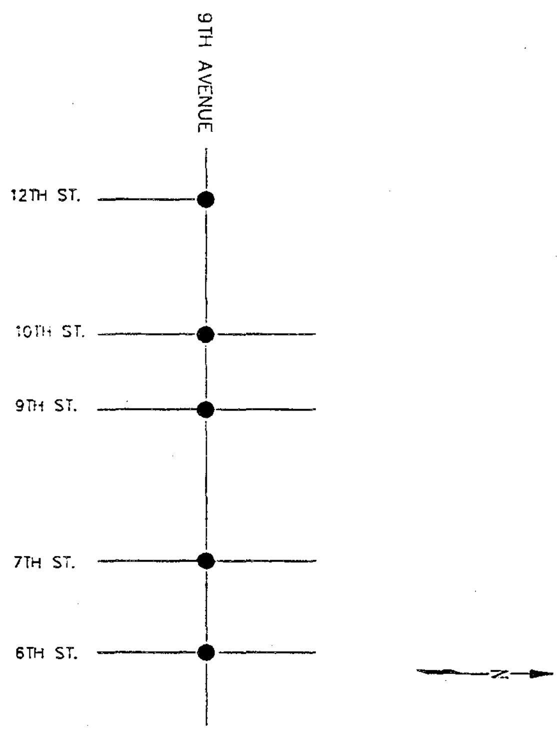
In order to evaluate the system performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, saturation flow rate, signal timing and phasing, arterial data, and speed/travel times. Link distances were obtained during the execution of travel time studies. The travel time data were obtained using the test car method. Speed profiles, travel time, number of stops, and distance between intersections were obtained during these studies. Simulation runs were executed using PASSER II-90 for AM, PM, and OFF peaks to simulate existing timing and phasing plans after the signals were upgraded.

Based on PASSER II-90 simulation, the project resulted in an estimated $190,930 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total savings of 3,506,400 stops (a 21.54 percent reduction), a total annual fuel increase of 51,960 gallons (a 38.13 percent increase), and an annual delay savings of 19,380 veh-hrs (a 23.32 percent reduction). The increase in fuel consumption is due to the increase in side street delay; however, this is offset by the improvements on the arterial street. The total cost of the project was $60,884, and the resultant benefit to cost ratio was 3 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	5364	4226	28.9	20.8	46.4	62
	NOON	5237	4164	25.7	19.5	42.8	60.3
	PM	6057	4570	32.5	26.9	52.3	70.8
DIFFERENCES	AM		1138		8.1		-15.6
	NOON		1073		6.2		-17.5
	PM		1487		5.6		-18.5
HRS/DAY	AM		2		2		2
	NOON		6		6		6
	PM		2		2		2
DAILY TOTALS	AM		2276		16.2		-31.2
	NOON		6438		37.2		-105
	PM		2974		11.2		-37
	TOTAL		11688		64.6		-173.2
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$49,090		$193,800		($51,960)

PROJECT COST: $60,884.00 TOTAL ANNUAL SAVINGS: $190,930

BENEFIT/COST RATIO: 3


9TH AVENUE
12TH ST.
10TH ST.
9TH ST.
7TH ST.
6TH ST.
N

Broadway Avenue

The City of Tyler Department of Public Works and Transportation worked on the following project. The project focused upon Broadway Avenue, a major north-south street located in the center of the City of Tyler. It connects the CBD with other commercial, business, retail, and residential areas. Traffic is heavy during the morning, noon hour and evening peak hours. The attached figure displays the project network system, cross streets, and link distances.

The Broadway Avenue signal system has been designated as subsystem #2 and consists of 15 signalized intersections. Controls consist of a combination of electromechanical single-dial controllers and solid state pretimed controllers. The system is interconnected using a nine-conductor cable with a master controller located at the intersection of Broadway Avenue and Fifth Street. The single-dial controllers were replaced with multiple-dial controllers which permit more efficient timing patterns. These new controllers were incorporated into the city's existing closed-loop traffic signal system. The range of the signal phases at these intersections vary with a minimum of 2 and a maximum of 5.

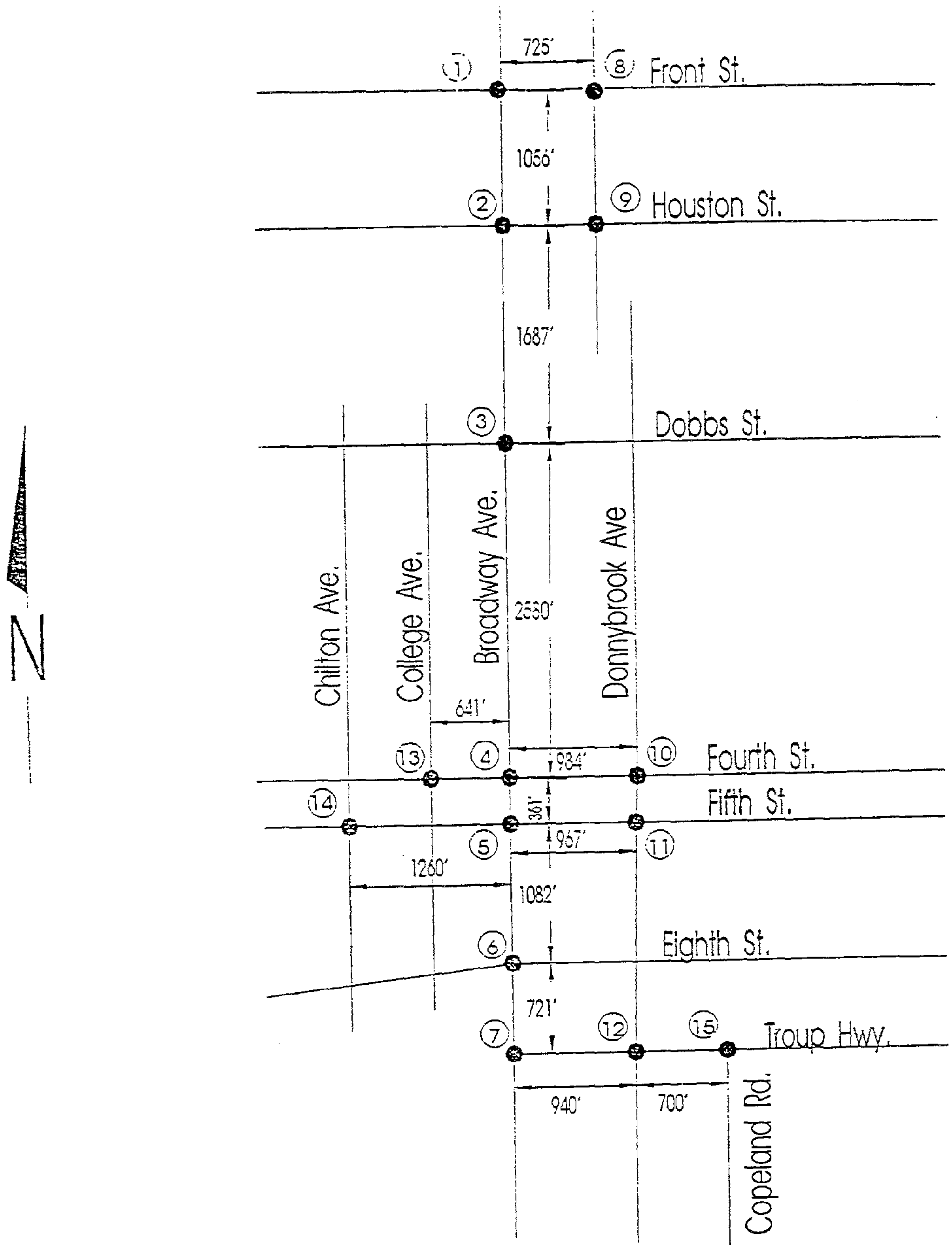
In order to evaluate the system performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, travel delays, arterial geometrics, signal phasing and timing, and an operating cost study. The data for travel time and delay was collected using the test car method. The PASSER II program was used to evaluate various signal phasing alternatives. Simulation runs were performed using the TRANSYT-7F computer model.

Based on TRANSYT-7F simulation, the project resulted in an estimated $21,307,022 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total savings of 11,301,600 stops (a 23.66 percent reduction), a total annual fuel savings of 1,519,800 gallons (a 62.16 percent reduction), and an annual delay savings of 1,962,900 veh-hrs (a 88.40 percent reduction). The total cost of the project was $94,322, and the resultant benefit to cost ratio was 226 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	12987	9239	615	68	666	238
	OFF	12968	10005	577	70	647	254
	PM	16583	12289	1017	91	1014	306
DIFFERENCES	AM		3748		547		428
	OFF		2963		507		393
	PM		4294		926		708
HRS/DAY	AM		1		1		1
	OFF		10		10		10
	PM		1		1		1
DAILY TOTALS	AM		3748		547		428
	OFF		29630		5070		3930
	PM		4294		926		708
	TOTAL		37672		6543		5066
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$158,222		$19,629,000		$1,519,800

PROJECT COST: $94,322.15 TOTAL ANNUAL SAVINGS: $21,307,022

BENEFIT/COST RATIO: 226



725'
1
8
Front St.
1056'
2
9
Houston St.
1687'
3
Dobbs St.
Chilton Ave.
College Ave.
Broadway Ave.
2530'
Donnybrook Ave
641'
13
4
934'
10
Fourth St.
14
361'
Fifth St.
5
967'
11
1260'
1082'
6
Eighth St.
721'
7
12
15
Troup Hwy.
940'
700'
Copeland Rd.
N

Gentry Parkway

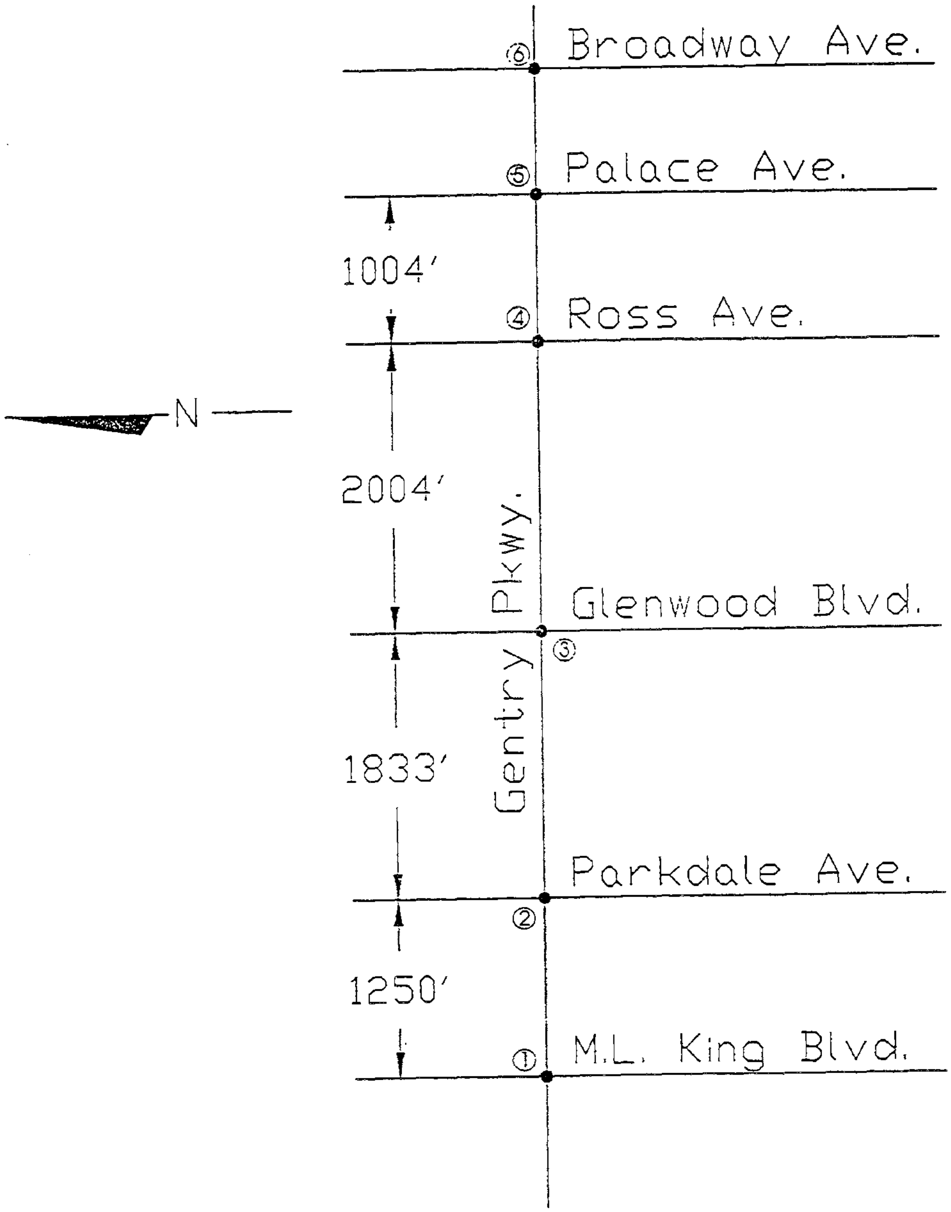
The City of Tyler Department of Public Works and Transportation worked on the following project. The project focused upon Gentry Parkway from M.L.King Boulevard to Broadway Avenue. Gentry Parkway is a major east-west street located in the northern portion of Tyler. The street serves as the route for a portion of US 69. It carries a significant amount of through traffic and connects to several other arterial streets and highways. Traffic is heavy during the morning and evening peak hours, and there is a steady traffic flow throughout the day. The attached figure displays the project network system, cross streets, and link distances.

Gentry Parkway's traffic signal system is designated as Subsystem No. 5 and consists of six signalized intersections. The signal system consists of six pretimed, electromechanical, single-dial controllers. Coordination is provided by a nine-conductor cable with a master controller at the intersection of Gentry Parkway and Parkdale. New solid state controllers were installed at all the six intersections. These controllers were incorporated into the city's existing closed-loop traffic signal system for control and monitoring purposes. The range of the signal phases at these intersections vary with a minimum of three and a maximum of four.

In order to evaluate the system performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, travel delays, arterial geometrics, signal phasing and timing, and an operating cost study. The data for travel time and delay was collected using the test car method. The PASSER II program was used to evaluate various signal phasing alternatives. Simulation runs were performed using the TRANSYT-7F computer model.

Based on TRANSYT-7F simulation, the project resulted in an estimated $2,554,511 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total savings of 9,215,100 stops (a 44.29 percent reduction), a total annual fuel savings of 301,500 gallons (a 41.46 percent reduction), and an annual delay savings of 212,400 veh-hrs (a 73.44 percent reduction). The total cost of the project was $46,594, and the resultant benefit to cost ratio was 55 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	6087	4646	43	33	189	151
	OFF	5442	3006	35	20	162	112
	PM	8850	3934	571	23	615	148
DIFFERENCES	AM		1441		10		38
	OFF		2436		15		50
	PM		4916		548		467
HRS/DAY	AM		1		1		1
	OFF		10		10		10
	PM		1		1		1
DAILY TOTALS	AM		1441		10		38
	OFF		24360		150		500
	PM		4916		548		467
	TOTAL		30717		708		1005
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$129,011		$2,124,000		$301,500
PROJECT COST:			$46,594.00	TOTAL ANNUAL SAVINGS:			$2,554,511
BENEFIT/COST RATIO:			55				


⑥ Broadway Ave.
⑤ Palace Ave.
1004′
④ Ross Ave.
N
2004′
Gentry Pkwy.
Glenwood Blvd.
③
1833′
Parkdale Ave.
②
1250′
① M.L. King Blvd.

Palace Avenue

The City of Tyler Department of Public Works and Transportation worked on the following project. The project focused upon Palace Avenue from Bow Street to Houston Street and on Front Street between Palace and Bonner Avenue. Palace Avenue is a major north-south street, and W. Front Street is a major east-west street located on the fringe of Tyler's Central Business District (CBD). The streets serve as connectors distributing traffic into the CBD as well as serving a significant volume of through traffic. The attached figure displays the project network system, cross streets, and link distances.

The Palace Avenue signal system consists of seven signalized intersections. The signal system consists of seven pretimed, electromechanical and solid state, single-dial controllers. A hard-wire system provides coordination with a master controller at Bow and Palace. The outdated controllers were replaced by solid state controllers at all the intersections. These controllers were incorporated into the city's existing closed loop traffic signal system for control and monitoring purposes. The range of the signal phases at these intersections vary with a minimum of two and a maximum of four.

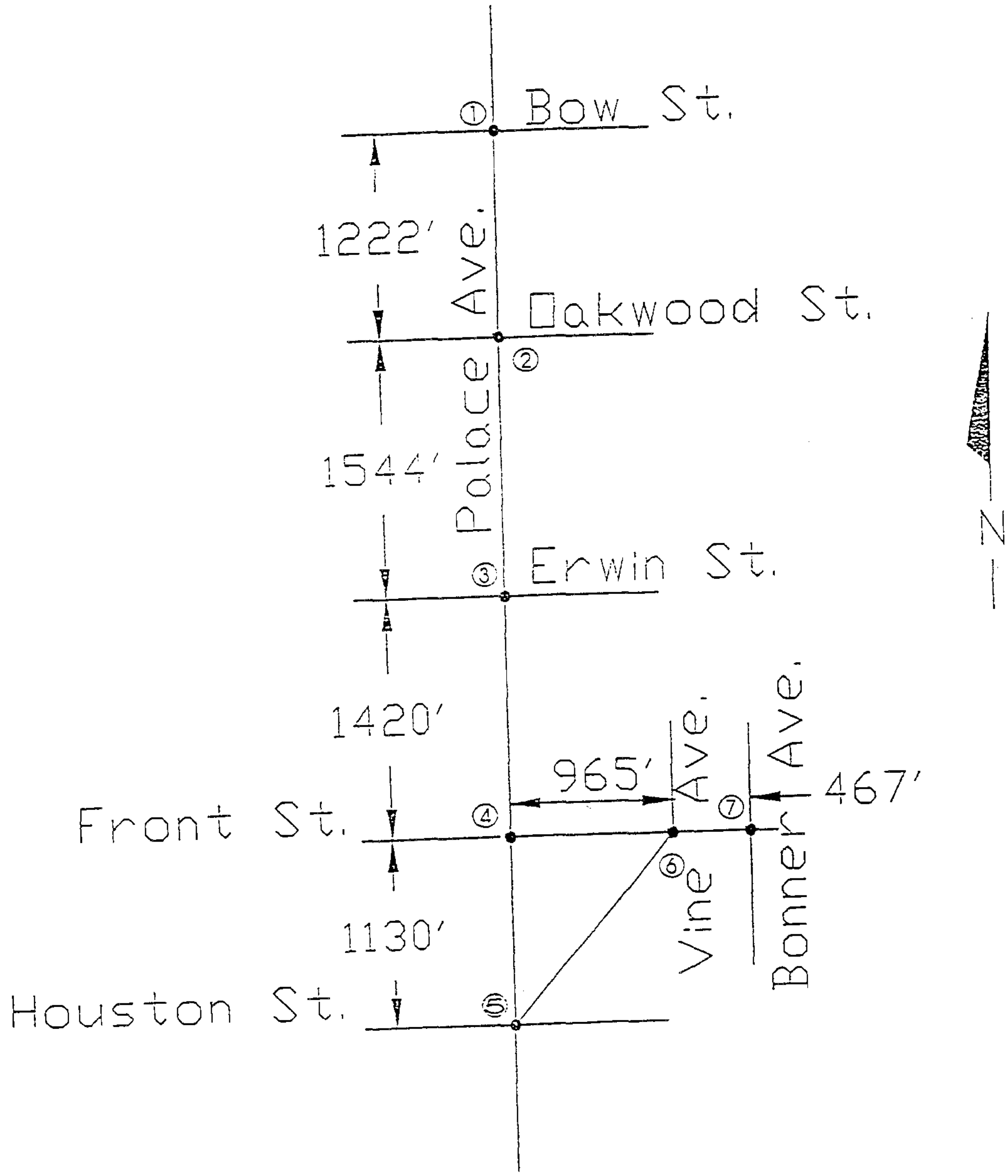
In order to evaluate the system performance, the before TLS traffic conditions were monitored, and various field data were collected. The data included traffic volumes, travel times, travel delays, arterial geometrics, signal phasing and timing, and an operating cost study. The data for travel time and delay were collected using the test car method. The PASSER II program was used to evaluate various signal phasing alternatives. Simulation runs were performed using the TRANSYT-7F computer model.

Based on TRANSYT-7F simulation, the project resulted in an estimated $2,138,301 savings per year on total operating cost, a direct benefit to motorists using these routes. This operating cost savings included a total savings of 2,371,500 stops (a 15.05 percent reduction), a total annual fuel savings of 167,100 gallons (a 36.15 percent reduction), and an annual delay savings of 193,800 veh-hrs (a 71.62 percent reduction). The total cost of the project was $47,297, and the resultant benefit to cost ratio was 45 to 1.

		STOPS		TOTAL SYSTEM DELAY (veh-hrs)		FUEL (gals)	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
HOURLY VALUES	AM	6516	6597	43	36	134	130
	OFF	3747	3456	24	20	76	71
	PM	8532	3456	619	20	647	144
DIFFERENCES	AM		-81		7		4
	OFF		291		4		5
	PM		5076		599		503
HRS/DAY	AM		1		1		1
	OFF		10		10		10
	PM		1		1		1
DAILY TOTALS	AM		-81		7		4
	OFF		2910		40		50
	PM		5076		599		503
	TOTAL		7905		646		557
UNIT VALUES			$0.014		$10.00		$1.00
ANNUAL SAVINGS			$33,201		$1,938,000		$167,100

PROJECT COST: $47,297.00 TOTAL ANNUAL SAVINGS: $2,138,301

BENEFIT/COST RATIO: 45



1
Bow St.
1222'
Palace Ave.
Oakwood St.
2
1544'
3
Erwin St.
1420'
965'
Vine Ave.
Bonner Ave.
467'
Front St.
4
7
6
1130'
Houston St.
5
N