Executive Summary
Regional Traffic Signal Retiming Program
Phase III

Prepared for:

North Central Texas Council of Governments

Prepared by:

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REGIONAL TRAFFIC SIGNAL RETIMING PROGRAM PHASE III
EXECUTIVE SUMMARY

Introduction

In 2010, the North Central Texas Council of Governments (NCTCOG) launched the Regional Traffic Signal Retiming Program (RTSRP), the goal of which is to maximize the capacity of the existing roadway system by improving traffic operations through signal retiming along selected corridors, in addition to reducing mobile source emissions, improving mobility, and enhancing safety. Phase III of RTSRP started in September 2014 and included corridors in Grand Prairie, Irving, and Fort Worth. A team of consultants led by Kimley-Horn and Associates, Inc. was selected to complete all 282 RTSRP Phase III signalized intersections.

Figure 1 through **Figure 4** illustrate the locations of these traffic signals. This project has achieved interlocking, seamless progression along 83 miles of arterial streets without regard to jurisdictional boundaries.

Project Scope

The assigned intersections were grouped into designated corridors that ranged in size from 7 to 26 intersections. For each corridor, the scope included the following tasks:

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

Data Collection

The project included extensive data collection:

- For intersections, peak-hour turning movement counts were made by human observers who used electronic count boards to record the number of vehicles by approach direction and by movement (i.e., left turn, straight through, or right turn). Video data collection methods were also utilized.

- Approximately 84 bi-directional machine counts were made with pneumatic tube-type counters that digitally record the number of vehicles in 15-minute increments, totaled on an hourly basis. These included 41 seven-day counts, two 24-hour counts, and 41 24-hour vehicle classification counts.

- As one means of measuring benefits of the project, approximately 3,300 miles of travel time runs were made with an instrumented vehicle. Software electronically recorded the vehicle's speed, distance traveled, and the number and elapsed time of each stop.

Signal Timing Plans

For all corridors, new timing plans were developed for four time periods – the weekday AM, Midday and PM peaks plus the Saturday peak. In many cases, separate versions of the AM and midday plans were

required for times when school speed zones are in operation. After new timing plans were operational, extensive "fine-tuning" was performed to improve actual on-street performance.

Corridor Recommendations

The following signal control equipment improvements and signing, striping, or geometric modifications were recommended in the final reports for each project corridor or group of corridors. Some of the improvements have been implemented. Future timing plan updates should be scheduled at intervals of three to five years for all project corridors.

Grand Prairie Corridors

No recommendations were made for these corridors, as any modifications related to minor improvements were made prior to the implementation of new timing.

Fort Worth Corridors

All intersections along the Bryant Irvin corridor have protected-only left turns for the northbound and southbound approaches. Changing the appropriate intersections from protected-only left turns to protected/permitted left turns is expected to improve operations along the corridor. It was recommended that Dutch Branch Blvd be changed from having protected-only left turns to protected/permitted left turns. Flashing yellow arrow signal heads can be installed to make this change and do not require geometric improvements.

Bellaire Drive South is a three-legged intersection with three southbound through lanes. During initial field visits to the Bryant Irvin corridor, multiple vehicles were observed making a southbound U-turn. This movement requires the turning vehicle to stop or slow down significantly in the left-most southbound through lane. It was recommended that U-turns be prohibited for the southbound approach of Bryant Irvin at Bellaire Drive South.

Cross streets often require a greater split to cover pedestrians crossing Bryant Irvin than the vehicular volume indicates. Allowing pedestrians to only cross on one side of the intersection can improve operations and lower pedestrian exposure. It was recommended that the following intersections have changes made to the existing pedestrian crosswalk locations.

- Bellaire/Country Day – eliminate east/west crosswalk on south side of intersection
- Crossings Dr – eliminate east/west crosswalk on south side of intersection
- Cityview Blvd – eliminate east/west crosswalk on south side of intersection.
- Mira Vista Blvd – eliminate east/west crosswalk on north side of intersection

Irving Corridors

No recommendations were made for these corridors, as any modifications related to minor improvements were made prior to the implementation of new timing.

Project Results

Travel Time Runs

Project results were measured quantitatively through travel time runs made with an instrumented vehicle traveling at the pace set by other traffic. The "before" runs were made at the start of the project, prior to any changes in the previous signal timing. Later, after new signal timing plans had been installed and fine-tuned, "after" runs were made. Averaging both directions for all corridors and all peak periods (total of 83 miles of test routes), a comparison of *before* and *after* travel time runs determined that the following improvements had been attained:

- Average travel time savings of more than 6 percent
- Average reduction in stops of more than 20 percent
- Average speed increase of more than 7 percent
- Average reduction in delay of nearly 17 percent.

The *after* travel time runs were not made for the Bryant Irvin corridor, due to clock-drift/cellular modem issues and current on-going construction efforts. *Before* travel time information has been provided to NCTCOG. Additional comparison of *before* and *after* conditions will be performed by NCTCOG and results will be included as an addendum to final project documentation. An assessment based on initial conditions will serve as a benchmark from which to measure the operational improvements realized with the implementation of the project's recommendations.

The following rationale was used to estimate the annual reduction in delay from the new timing plans, based on travel time runs:

- Total reduction in delay in both directions
- Average peak period bidirectional traffic volume
- On each weekday there will be:
    - Two hours of benefit from the AM peak timing plan
    - Two hours of benefit from the PM peak timing plan
    - Five hours of benefit from the midday timing plan
- On each Saturday, there will be five hours of benefit from the Saturday timing plan
- To be conservative, no benefit is assumed from other hours of the day even though most of the corridors operate the new timing plans for at least 12 hours per day.
- For calculations, 5 weekdays and 1 Saturday per week were used, with 52 weeks per year, resulting in 260 weekdays per year and 52 Saturdays per year.

Based on measured travel time results and the assumptions listed above, RTSRP Phase III efforts reduced delay by more than **2.5 million vehicle hours per year** (or more than 287 years of vehicle delay annually). In terms of delay savings, more than **$52.2 million annually** in driver delay savings is realized. For the purpose of economic analysis of transportation improvements, the cost of delay was assumed to be $20.75 per vehicle-hour (as reflected in NCTCOG's Mobility 2045 value of time).

Synchro™ Measures of Effectiveness

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

- Total signal delay was reduced by 17.4 percent
- Total travel time was reduced by 11.5 percent
- Fuel consumption was reduced by 6.1 percent
    - Reduction of nearly 2 million gallons annually
- Emissions were reduced by 7.3 percent
    - CO reduction of 140,504 kilograms annually
    - NOx reduction of 27,358 kilograms annually
    - VOC reduction of 32,589 kilograms annually

The attached **Table 1** shows project benefits based on collected travel time data. The data provided include the following statistics per travel time route: route limits, number of signals, route length (miles), average reduction in delay (vehicle-hours), peak hour annual delay savings, average daily traffic volume, and project benefits (reductions in travel time, stops, and delay). Values are detailed for each corridor and summarized by municipality.

Table 2 details the annual benefits calculated from Synchro™ Version 10, including Total Signal Delay (veh-hrs), stops, Total Travel Time (veh-hrs), Fuel Consumed (gal), CO Emissions (kg), NOx Emissions (kg). and VOC Emissions (kg). Values are summarized by municipality.

The goal of the Regional Traffic Signal Retiming Program is to maximize the capacity of the existing roadway system by improving traffic operations through signal retiming along selected corridors, in addition to reducing mobile source emissions, improving mobility, and enhancing safety.

Overall, the efforts under RTSRP Phase III have successfully achieved the overall goals of the RTSRP.

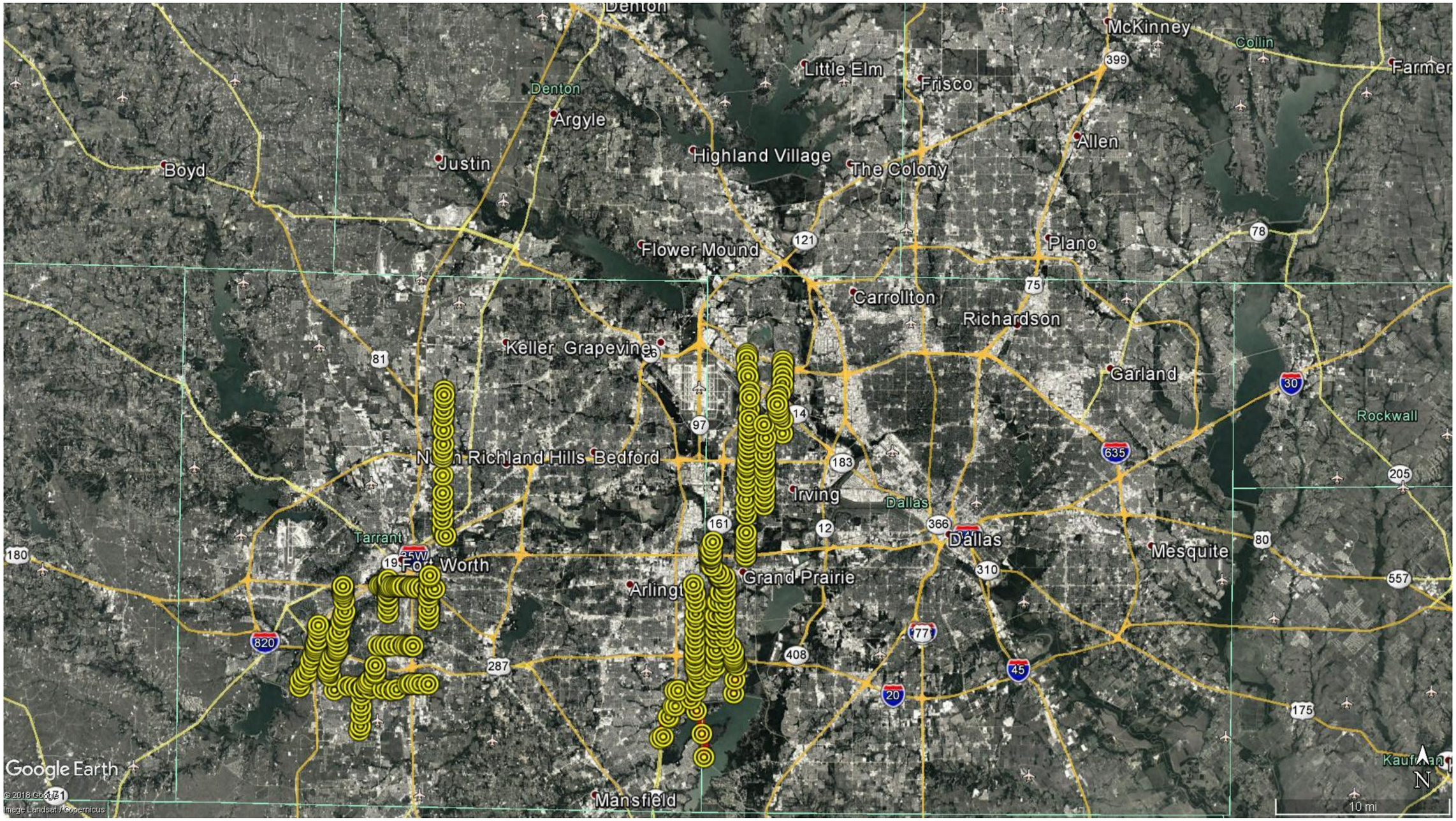

Figure 1. RTSRP III Signalized Intersections

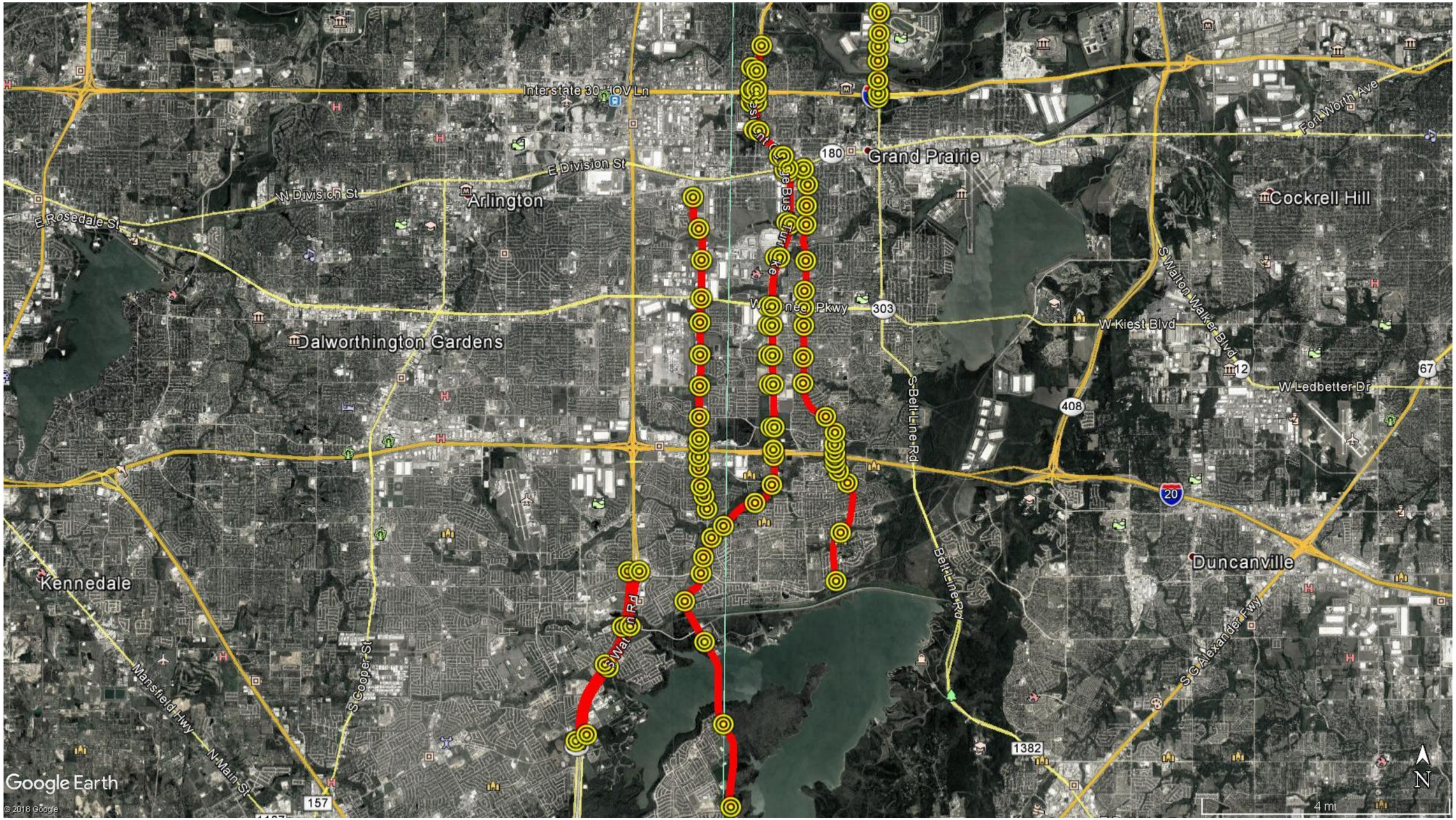

Figure 2. RTSRP III Grand Prairie Corridors

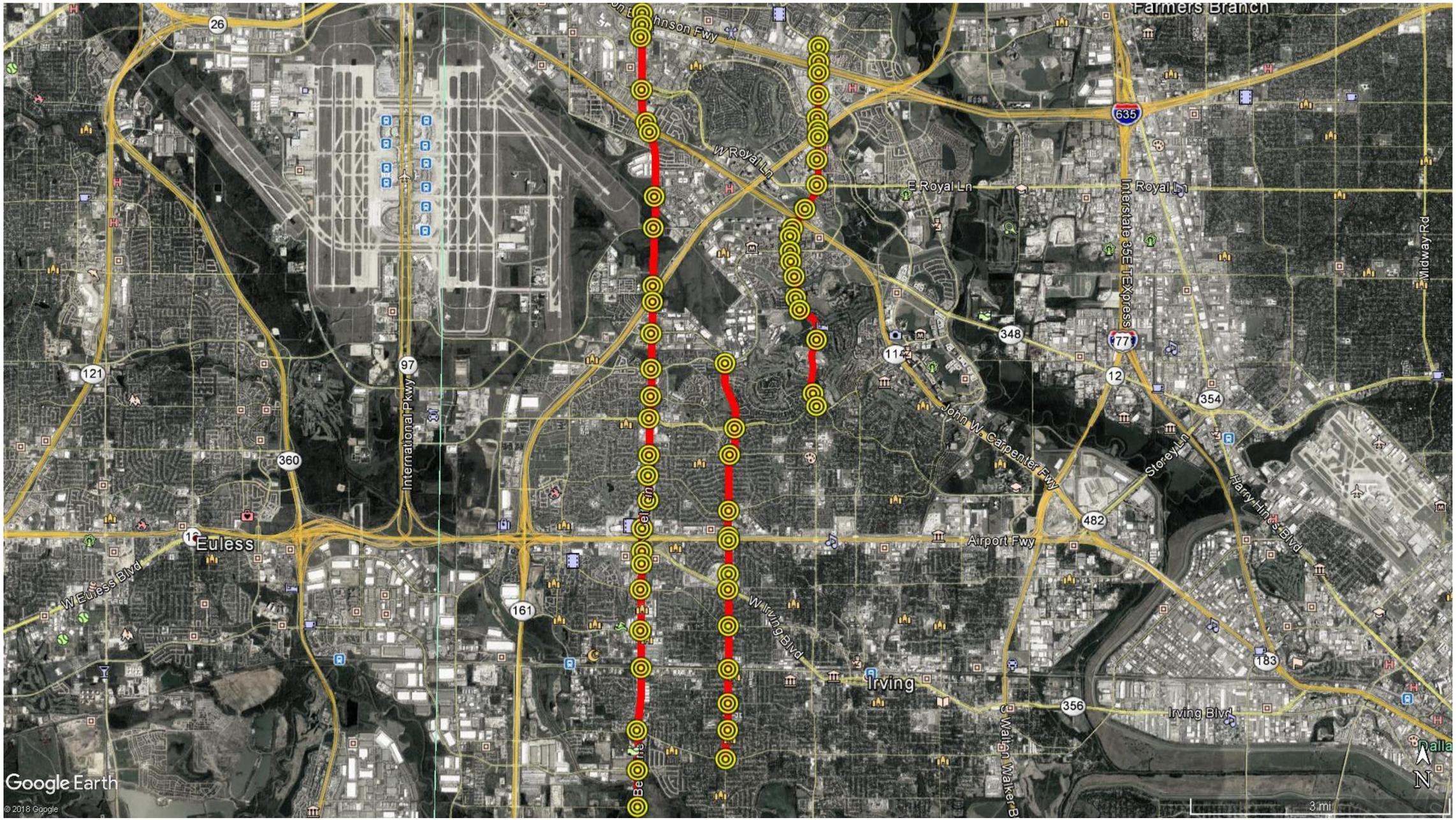

Figure 3. RTSRP III Irving Corridors

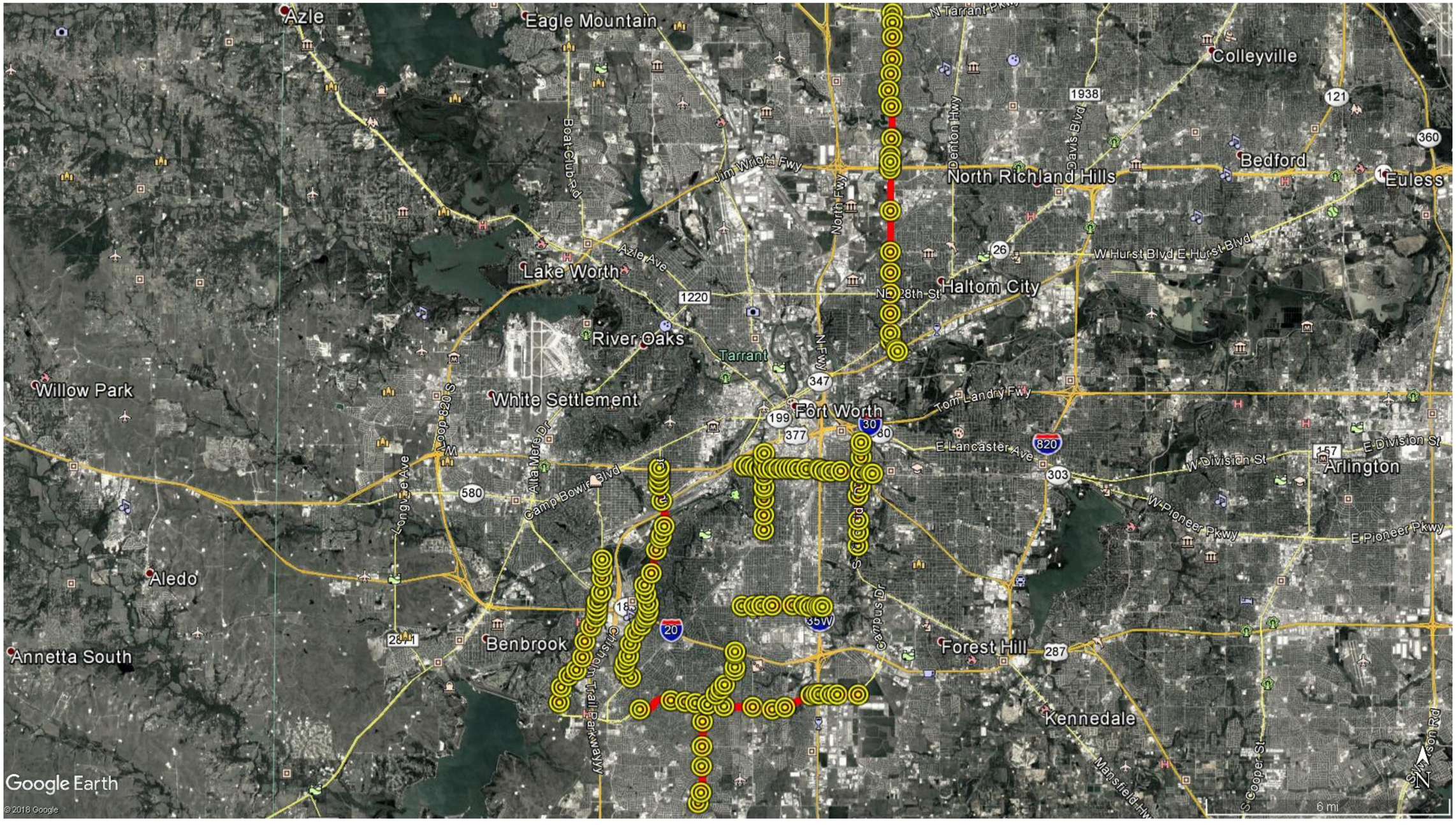

Figure 4. RTSRP III Fort Worth Corridors

Table 1. Measured Travel Time Benefits

Corridor Information						Annual Benefits	
						From Travel Times	
City	Corridor	From	To	Signals	Length (mi)	Annual Reduction in Delay (veh-hr) [A]	Peak Hour Annual Delay Savings [B]
Grand Prairie	Carrier Parkway	Jefferson St	Camp Wisdom Rd	20	7.0	46,259	$959,874.25
	SH 161	Carrier Pkwy	Forum Dr	21	6.3	104,408	$2,166,466.00
	Great Southwest Parkway	Sherman St	Fairmont Dr	15	5.0	73,474	$1,524,585.50
	Lake Ridge Parkway	IH 20	England Pkwy	12	6.5	35,138	$729,113.50
	SH 360	Camp Wisdom Rd	Ragland Rd	8	2.8	76,240	$1,581,980.00
	Belt Line Road	Wildlife Pkwy	IH 30	7	1.4	26,722	$554,481.50
			Total	*83*	*29.0*	*362,241*	*$7,516,500.75*
Fort Worth	Seminary Drive	McCart Ave	Evans Ave	10	2.0	71,139	$1,476,134.25
	Bryant Irvin Road	Recreation Dr	Dutch Branch Rd	16	3.8	N/A	N/A
	Beach Street	North Tarrant Pkwy	SH 121	21	8.3	781,781	$16,221,955.75
	Rosedale Street	Forest Park Blvd	US 287	21	3.2	-21,749	-$451,291.75
	Altamesa Boulevard	Hulen Street	Oak Grove Rd	15	5.8	97,141	$2,015,675.75
	Hulen Street	IH 30	Granbury Rd	25	5.5	236,269	$4,902,581.75
	Riverside Drive	US 287	Berry St	9	2.7	97,267	$2,018,290.25
	8th Avenue	Pennsylvania Ave	Cantey St	10	1.9	-40,425	-$838,818.75
	McCart Avenue	Walton Ave	Risinger Rd	13	3.8	137,668	$2,856,611.00
			Total	*140*	*37.0*	*1,359,091*	*$28,201,138.25*
Irving	Story Road	Walnut Hill Ln	Shady Grove Rd	13	4.6	140,583	$2,917,097.25
	Belt Line Road	IH 635	Oakdale Rd	26	8.2	372,294	$7,725,100.50
	MacArthur Boulevard	Ranchview Dr	Northgate Dr	20	4.4	282,756	$5,867,187.00
			Total	*59*	*17.2*	*795,633*	*$16,509,384.75*
RTSRP III Total				*282*	*83.2*	*2,516,965*	*$52,227,023.75*

Note A: Based on the following:
- Bidirectional Delay Reduction
- Average Peak Period Bidirectional Volume
- 2 hours per AM peak period per weekday
- 5 hours per MD peak period per weekday
- 2 hours per PM peak period per weekday
- 5 hours per SAT peak period per Saturday
- 5 weekdays and 1 Saturday per week
- 52 weeks per year
- 260 weekdays per year
- 52 Saturdays per year
Note B: Based on NCTCOG's Mobility 2045 value of time of $20.75 per passenger car hour

Table 2. Modeled Synchro Benefits (Annual Values)

Corridor Information		Annual Benefits						
		From Synchro™ [A]						
City	Corridor	Total Signal Delay (veh-hrs)	Stops	Total Travel Time (veh-hrs)	Fuel Consumed (gal)	CO Emissions (kg)	NOx Emissions (kg)	VOC Emissions (kg)
Grand Prairie	Carrier Parkway	291,200	5,729,880	242,580	222,040	15,470	3,015	3,597
	SH 161							
	Great Southwest							
	Lake Ridge Parkway							
	SH 360							
	Belt Line Road							
Fort Worth	Seminary Drive	1,868,880	17,770,480	1,805,440	1,261,754	90,054	17,528	20,885
	Bryant Irvin Road							
	Beach Street							
	Rosedale Street							
	Altamesa Boulevard							
	Hulen Street							
	Riverside Drive							
	8th Avenue							
	McCart Avenue							
Irving	Story Road	483,600	20,111,520	433,420	500,500	34,980	6,815	8,107
	Belt Line Road							
	MacArthur Boulevard							
RTSRP II Total		*2,643,680*	*43,611,880*	*2,481,440*	*1,984,294*	*140,504*	*27,358*	*32,589*

Note A: Based on the following:
- 2 hours per AM peak period per weekday
- 5 hours per MD peak period per weekday
- 2 hours per PM peak period per weekday
- 5 hours per SAT peak period per Saturday
- 5 weekdays and 1 Saturday per week
- 52 weeks per year
- 260 weekdays per year
- 52 Saturdays per year