

City Council Work Session Handouts

March 21, 2016

- I. Review and Discuss Traffic & Transportation Department

Traffic and Transportation Department's Facility Tour



**City Council Meeting
March 21, 2016**

Presentation and Tour Outline

- Presentation at City Hall
- Tour at Service Center
 - Traffic Management Center
 - Traffic Signal Shop
 - Traffic Sign Shop
- Presentation wrap up at Service Center

Traffic Department Background

- The City maintains and operates
 - 127 signalized intersections,
 - 84 school zones for 28 schools,
 - 700 city owned street lights,
 - 50 traffic observation cameras,
 - 21,500 signs
 - 400 linear miles of pavement markings, crosswalks, etc.

Traffic Management Center



TMC Daily Operation

- Staff occupies TMC from 6am-6pm each weekday.
- Receive and respond to citizen phone calls and service requests
- Monitor cameras particularly in areas of construction activity and recurring congestion.
- Actively supports Police, Fire and EMS with video monitoring of incidents and emergencies.
- Make signal timing adjustments as needed for emergency situations.
- Coordinate with traffic signal and sign technicians.
- Coordinate activities with other traffic management centers such as Dallas, Plano and TxDOT (distributed TMC concept)



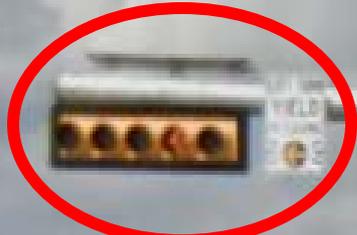
Traffic Signal Shop

Traffic Signal Shop

- Inside testing facility
 - Cabinets
 - Controllers
 - Cameras
 - Detector Cards
 - Conflict Monitors
 - Power supplies
 - Wiring options
 - Hardware
 - Signal Timing
 - Etc....



Components of a new Traffic Signal



Flashing Yellow Arrow Display



Opticom Preemption



PTZ Camera

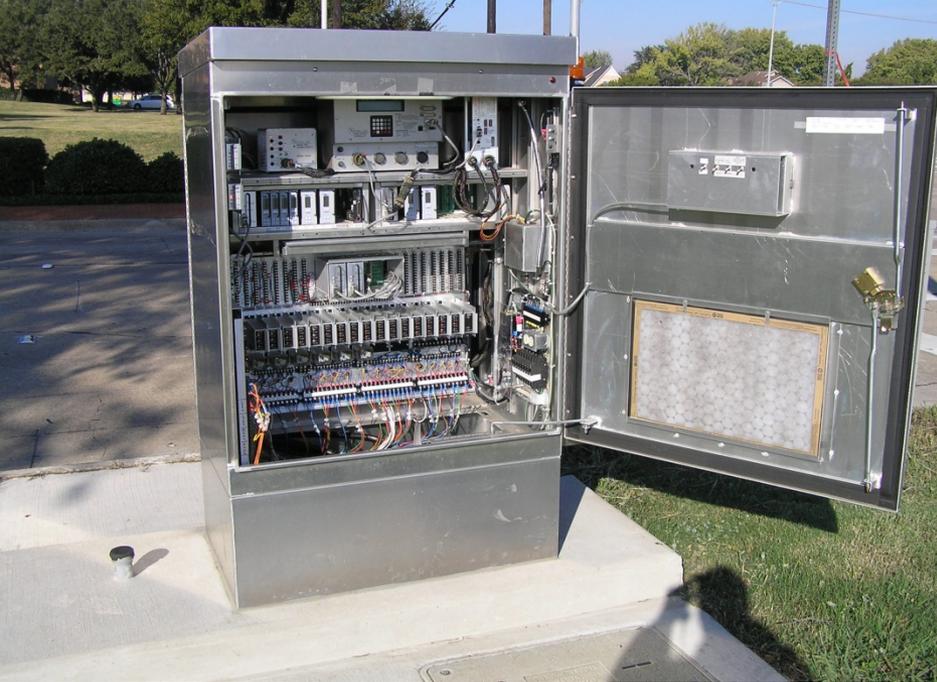


WiMax Antenna



**New Cabinet/
Battery Backup
& Power Meter**

- New Poles and Mast Arms on corners
- Underground – new conduits, cable, loop detectors, pull boxes, etc.
- Barrier Free Ramps for ADA compliance



New Cabinet and Battery Backup Unit (68 of 127 Intersections)



New Intelight Advanced Traffic Controller will replace TS2 at New Cabinet Locations

Traffic Sign Shop





Traffic Sign Shop

- The city maintains ~21,500 traffic signs which are all itemized in an asset management database.
- The sign supervisor oversees the database and the procurement of signs for installation.
- On average we replace 1500 to 2000 signs per year.
- Most signs are ordered from a vendor and stored in the warehouse as inventory in order to minimize cost and maximize productivity of the sign technicians.
- Specialty and quick turn around items are designed and made in the Sign Shop to expedite small projects.

Tour at Service Center

- Meet in Service Center Lobby
- Parking - You can park in any space that is available near building.





After Tour Briefing

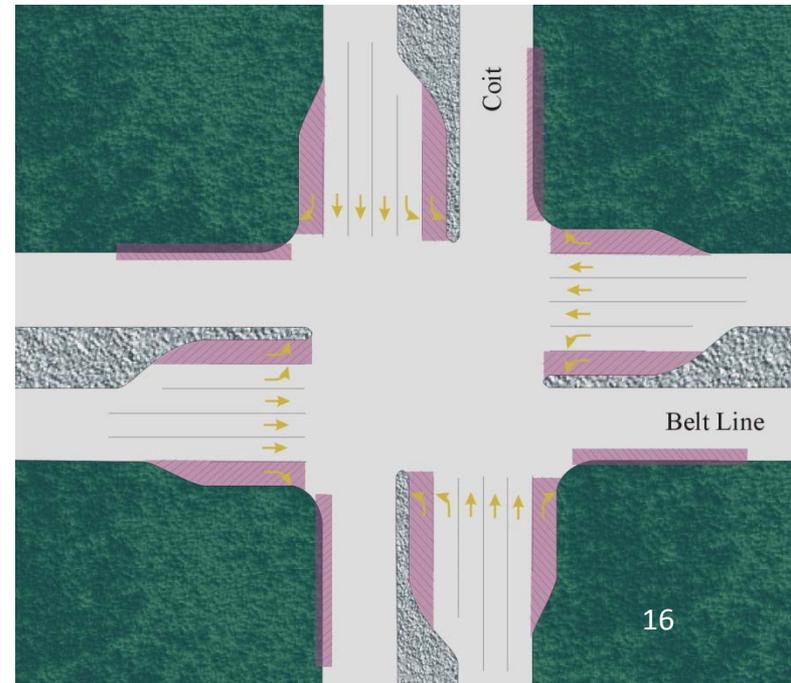
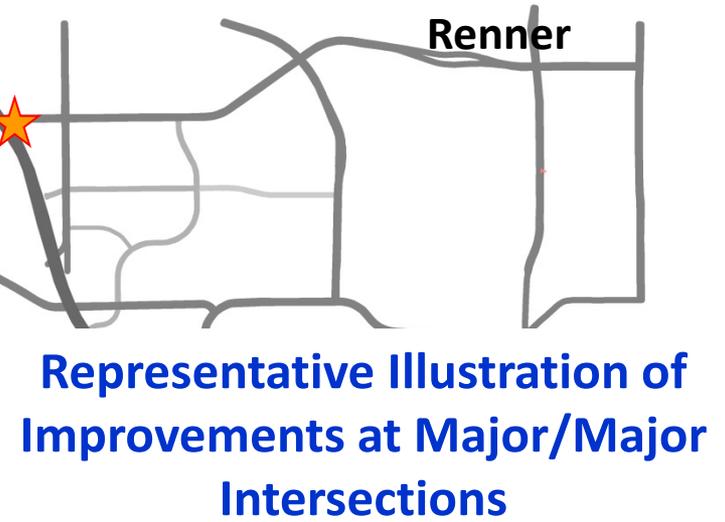
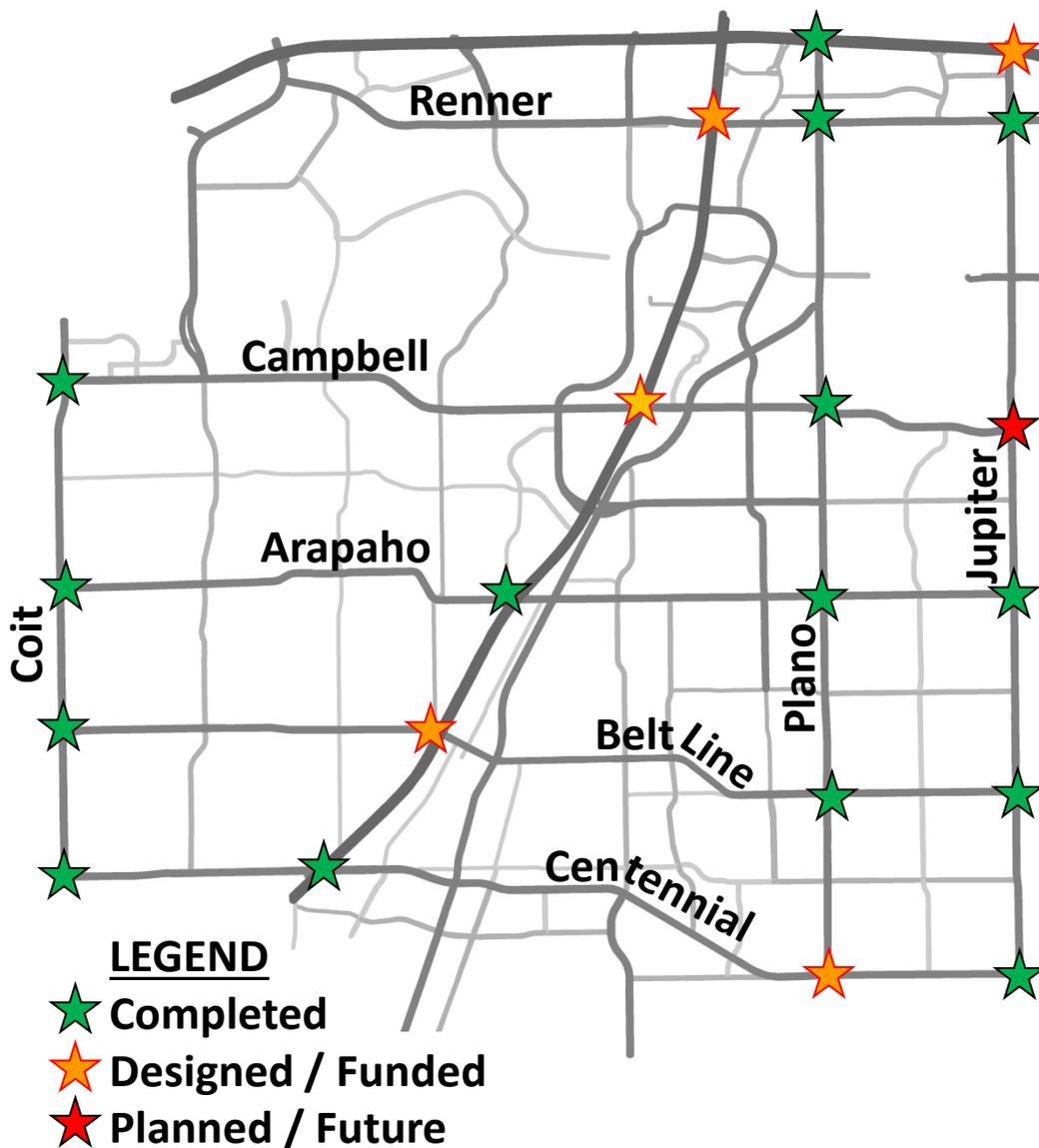
Presentation Outline

- Richardson System Attributes
 - Traffic Flow (Daily, Peak Period, High Volume areas)
 - Dominant Traffic Movements
 - Impacts of US75, PGBT
 - Typical Intersection Operations
- Traffic Management System Approach
- Regional Coordination
- Signal Timing Principles / Progression
- Traffic Signal System Upgrades
- Summary

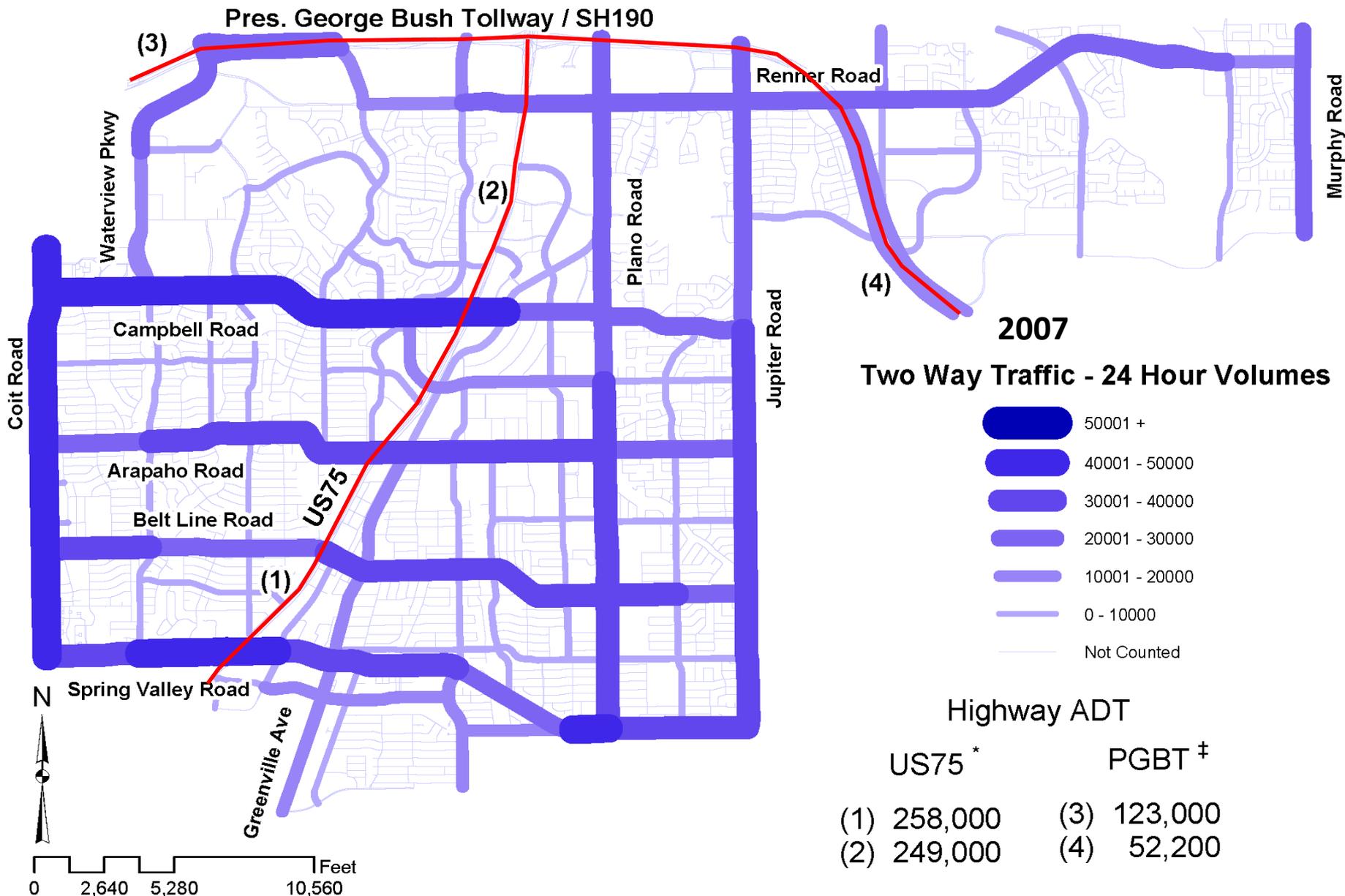
Richardson System Attributes

- Traffic volumes have fluctuated over the past several decades but most Arterials have lower daily traffic now than in the 1990s due to:
 - SH190 Frontage Roads and US75 interchange added in 1990s
 - PGBT main lanes opening in 1999
 - DART Light Rail opened in 2002
 - High 5 completed in 2005
 - PGBT Eastern Extension completed in 2012
- Most Major Arterial intersections have been expanded
 - Dual Left-Turn Lanes and Exclusive Right-turn Lanes
- Peak Hour Congestion exists at Major intersections due to high commuter traffic demands which exceed capacity of the traffic signals
- Once an intersection is overly congested, signal timing changes cannot reduce the overall delay or improve progression

Location of Intersection Improvements



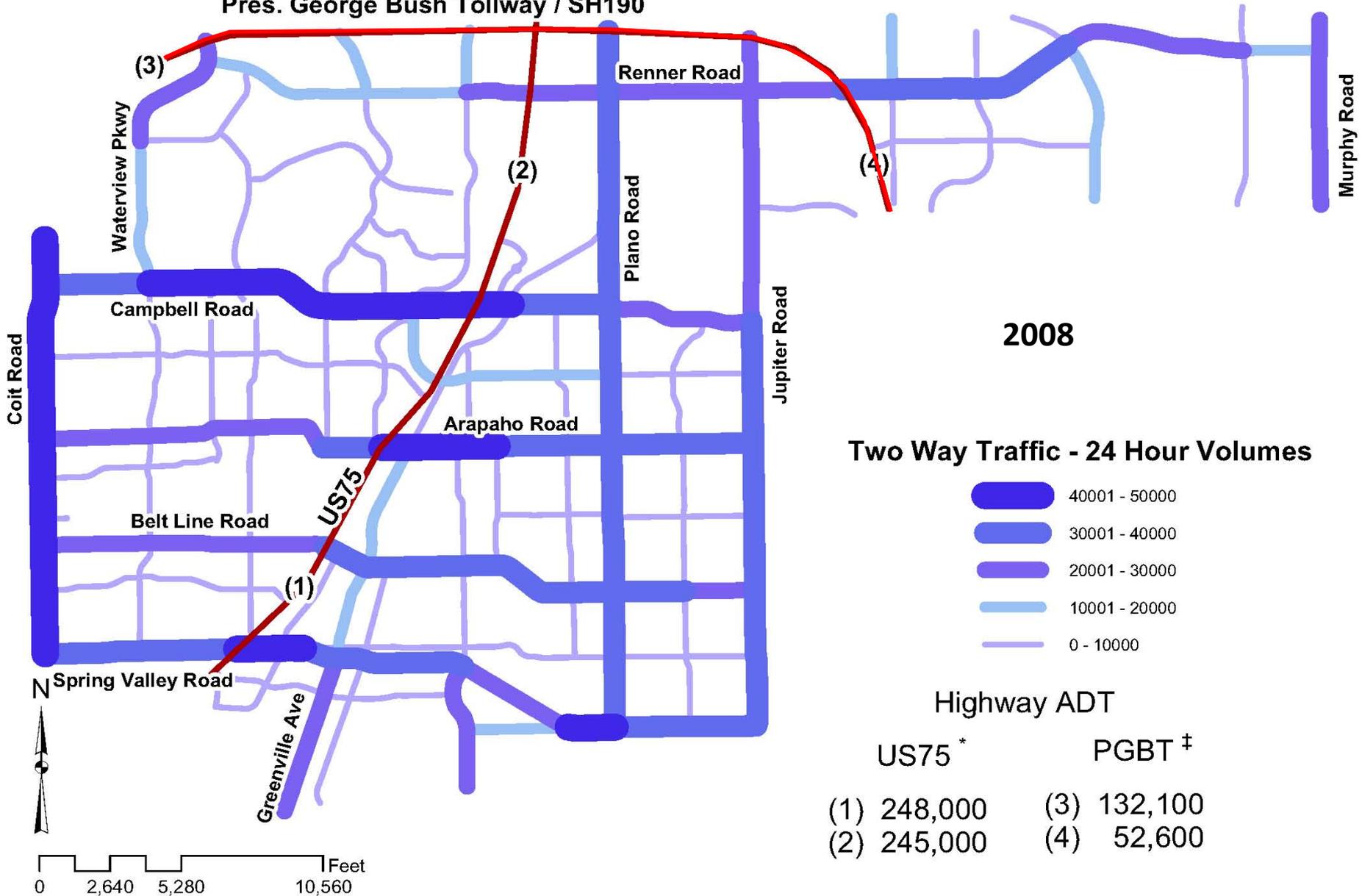
City of Richardson - Traffic Volume Flow Map



* 2007 numbers provided by TxDOT
 † 2007 numbers provided by NTTA

City of Richardson - Traffic Volume Flow Map

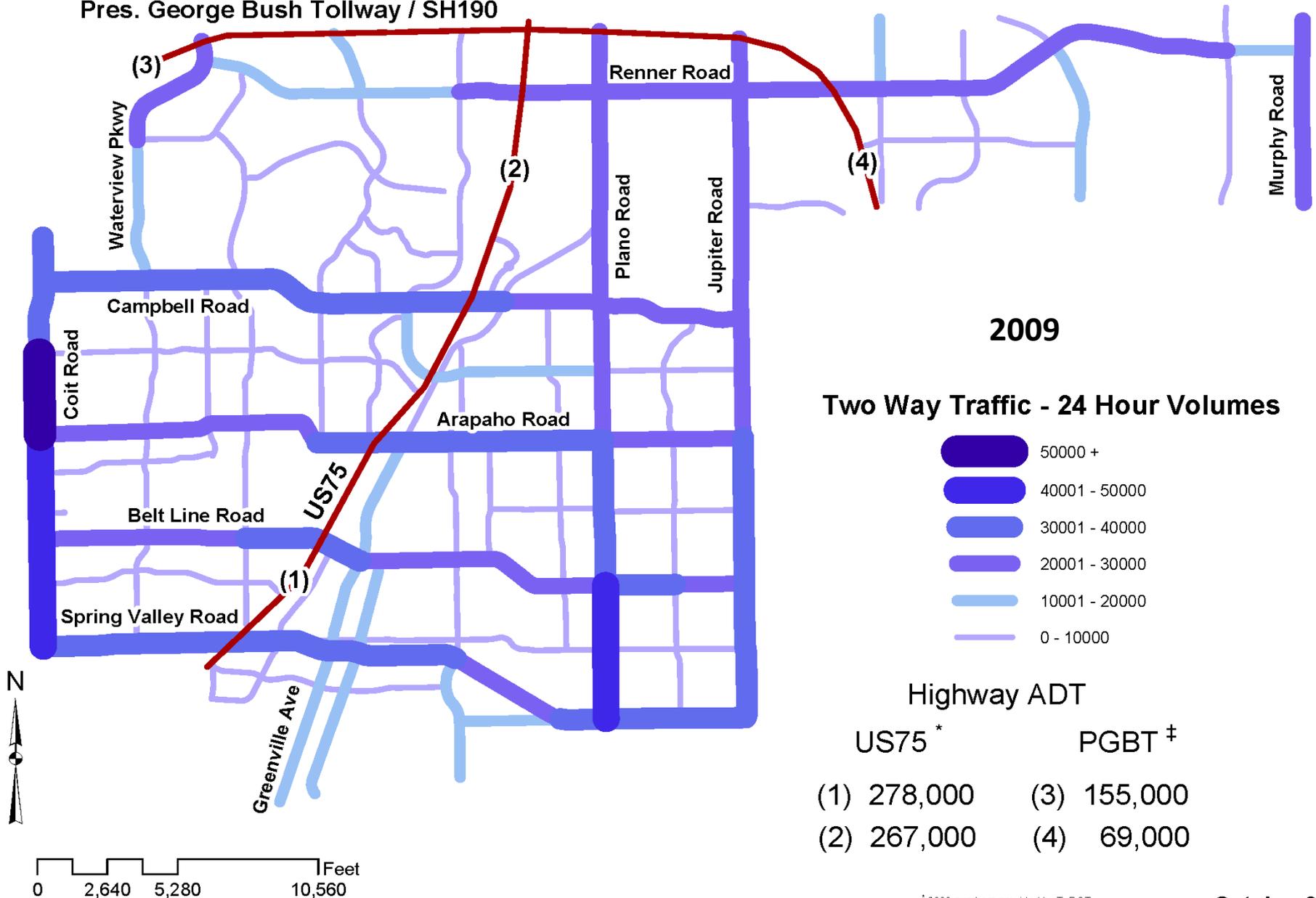
Pres. George Bush Tollway / SH190



* 2008 numbers provided by TxDOT
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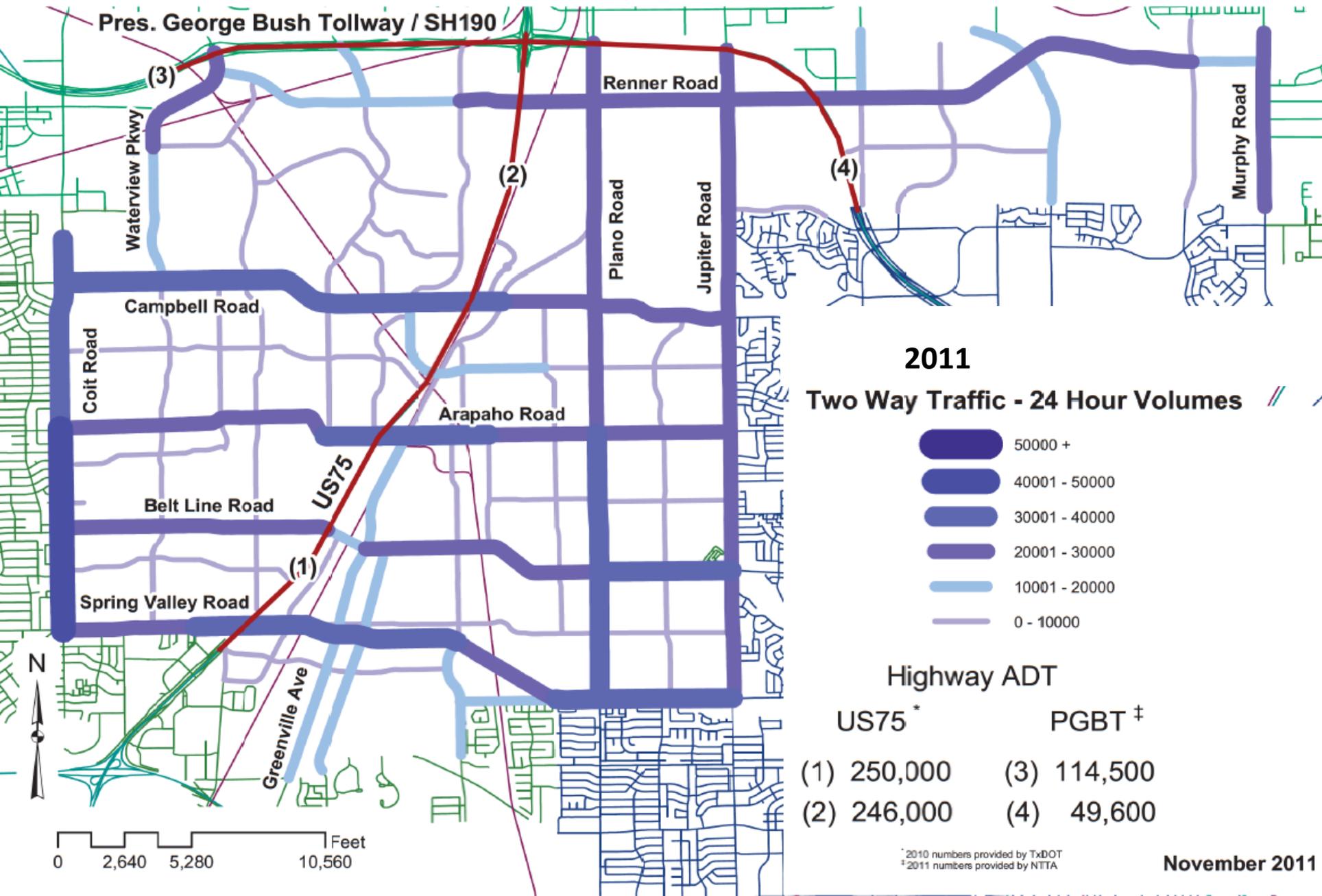
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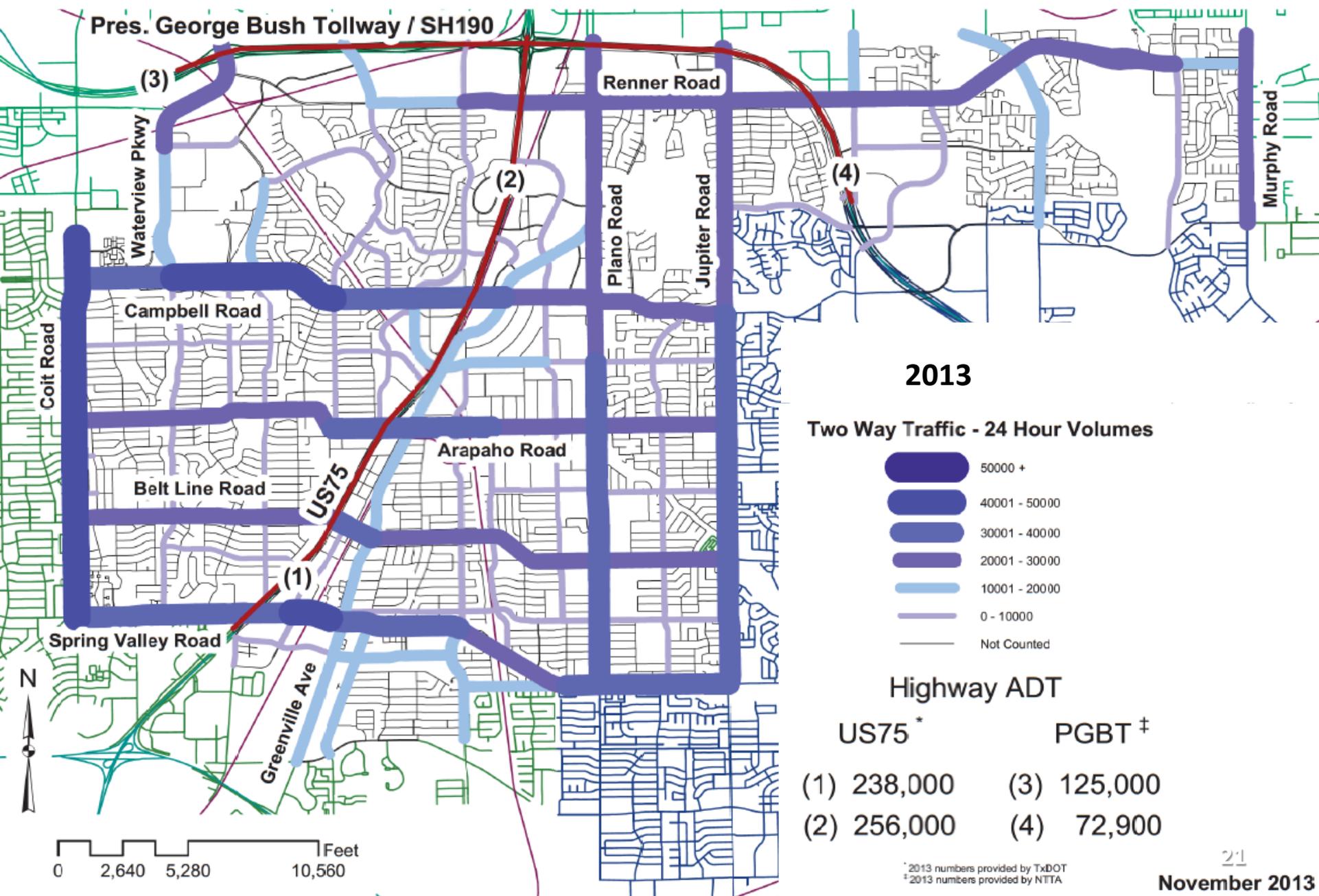


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City of Richardson - Traffic Volume Flow Map

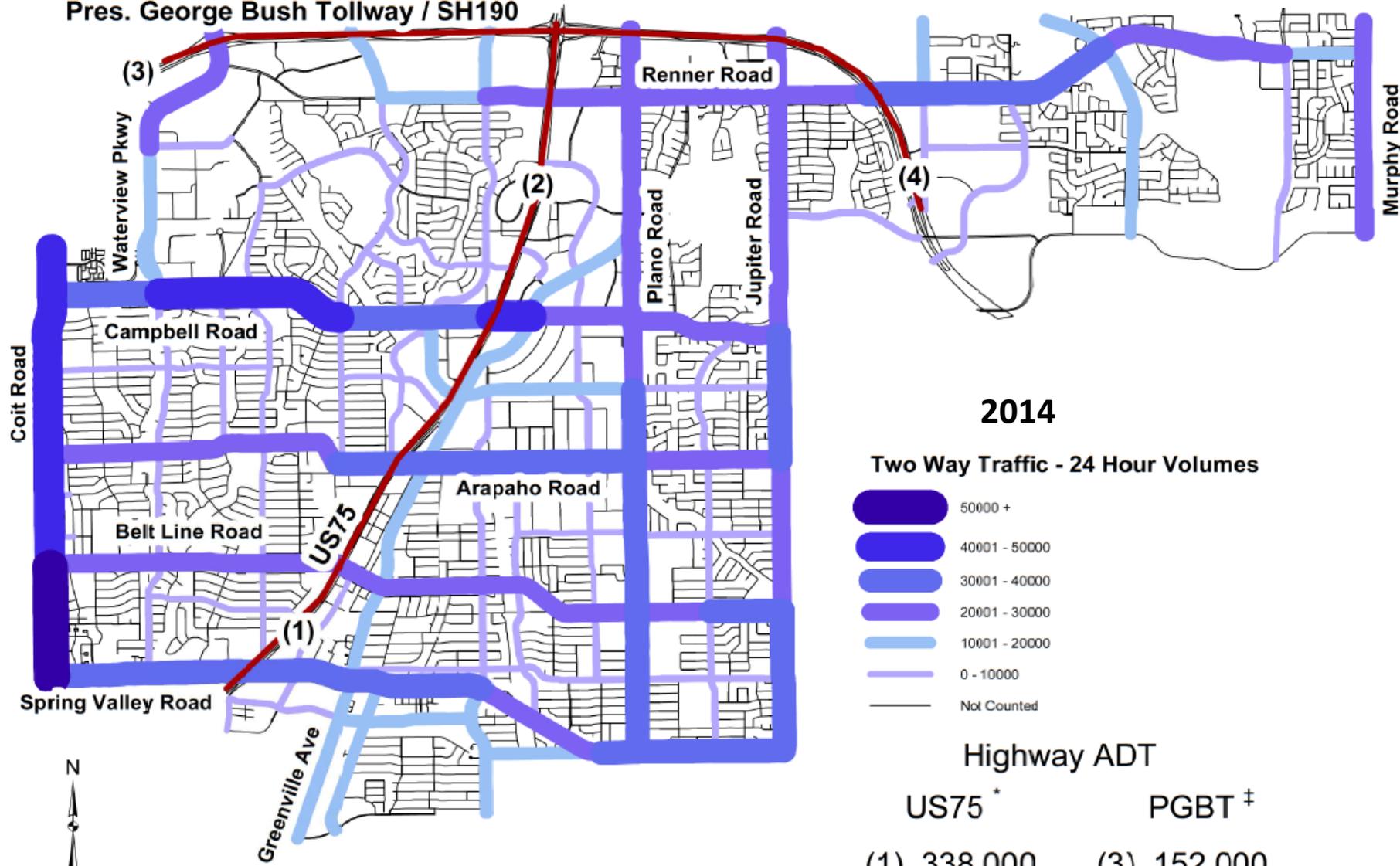


City of Richardson - Traffic Volume Flow Map, 2013



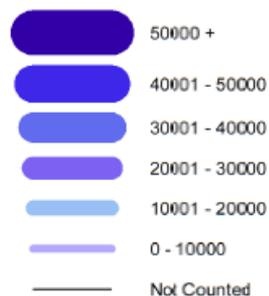
City of Richardson - Traffic Volume Flow Map

Pres. George Bush Tollway / SH190



2014

Two Way Traffic - 24 Hour Volumes



Highway ADT

US75 *

PGBT †

(1) 338,000

(3) 152,000

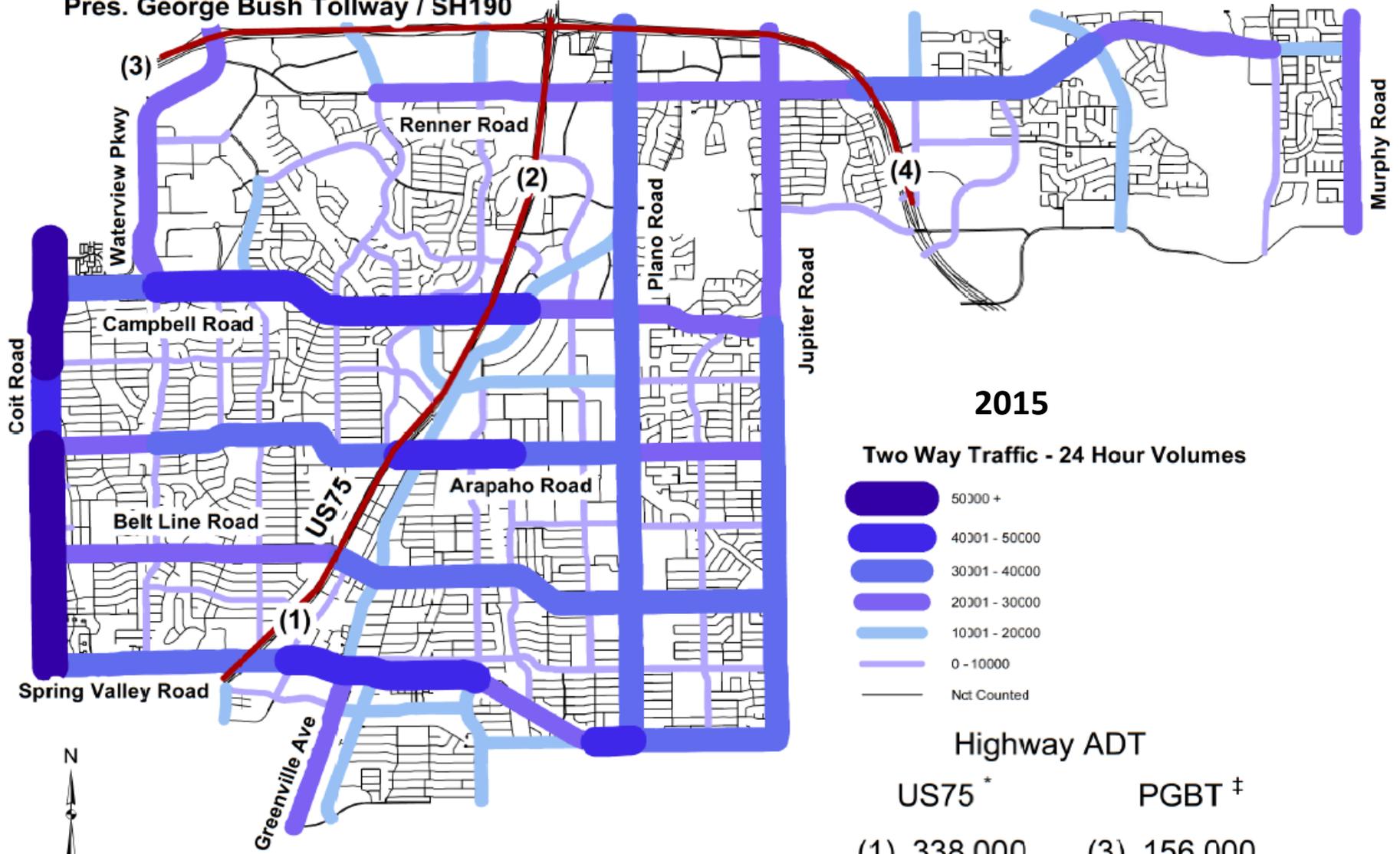
(2) 269,000

(4) 74,000

* 2014 numbers provided by TxDOT
 † 2014 numbers provided by NTTA

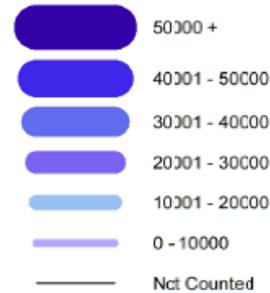
City of Richardson - Traffic Volume Flow Map

Pres. George Bush Tollway / SH190



2015

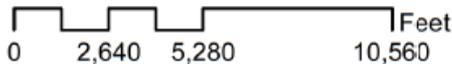
Two Way Traffic - 24 Hour Volumes



Highway ADT

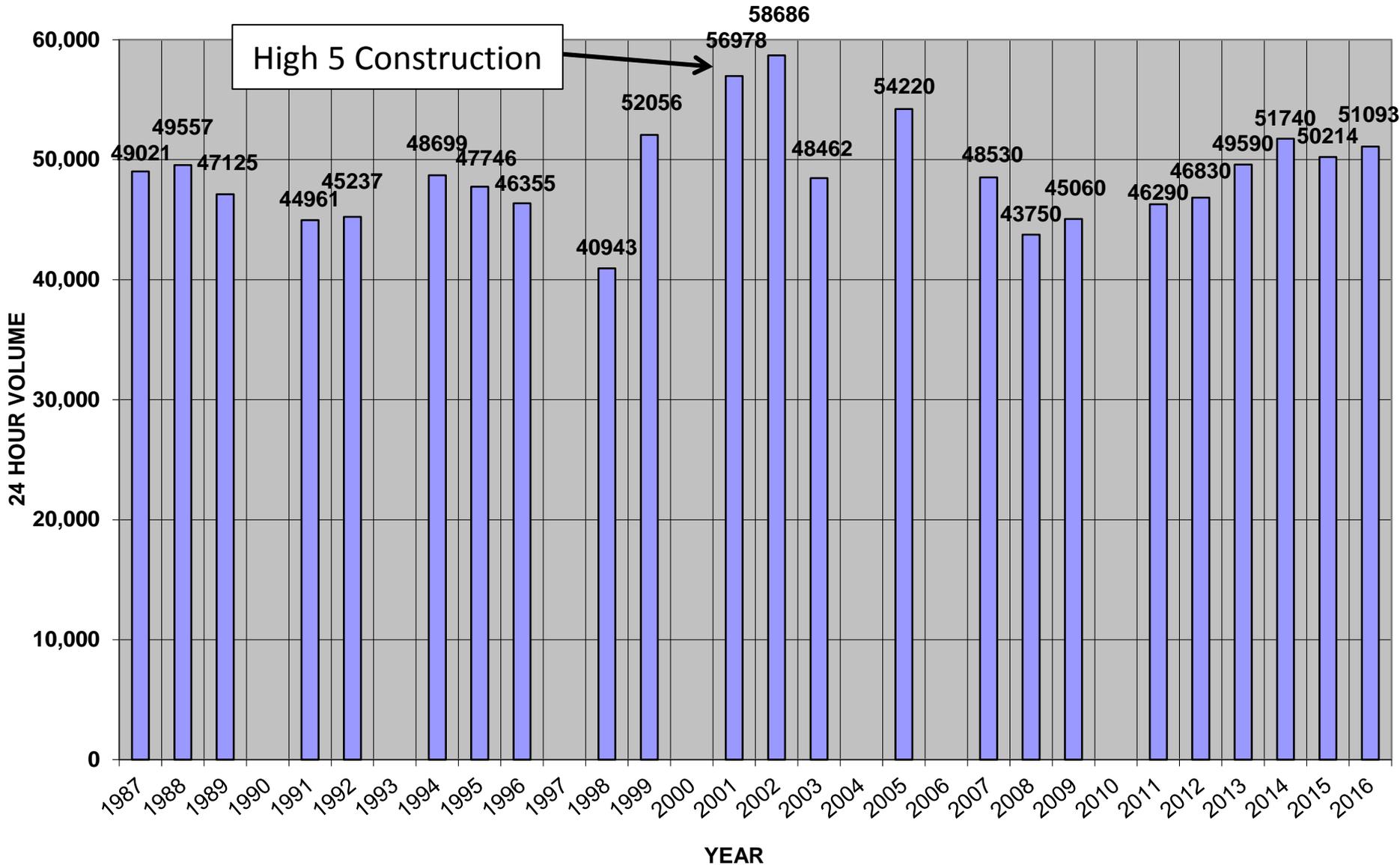
	US75 *	PGBT †
(1)	338,000	(3) 156,000
(2)	269,000	(4) 86,000

*2014 numbers provided by TxDOT
 †2015 numbers provided by NTTA



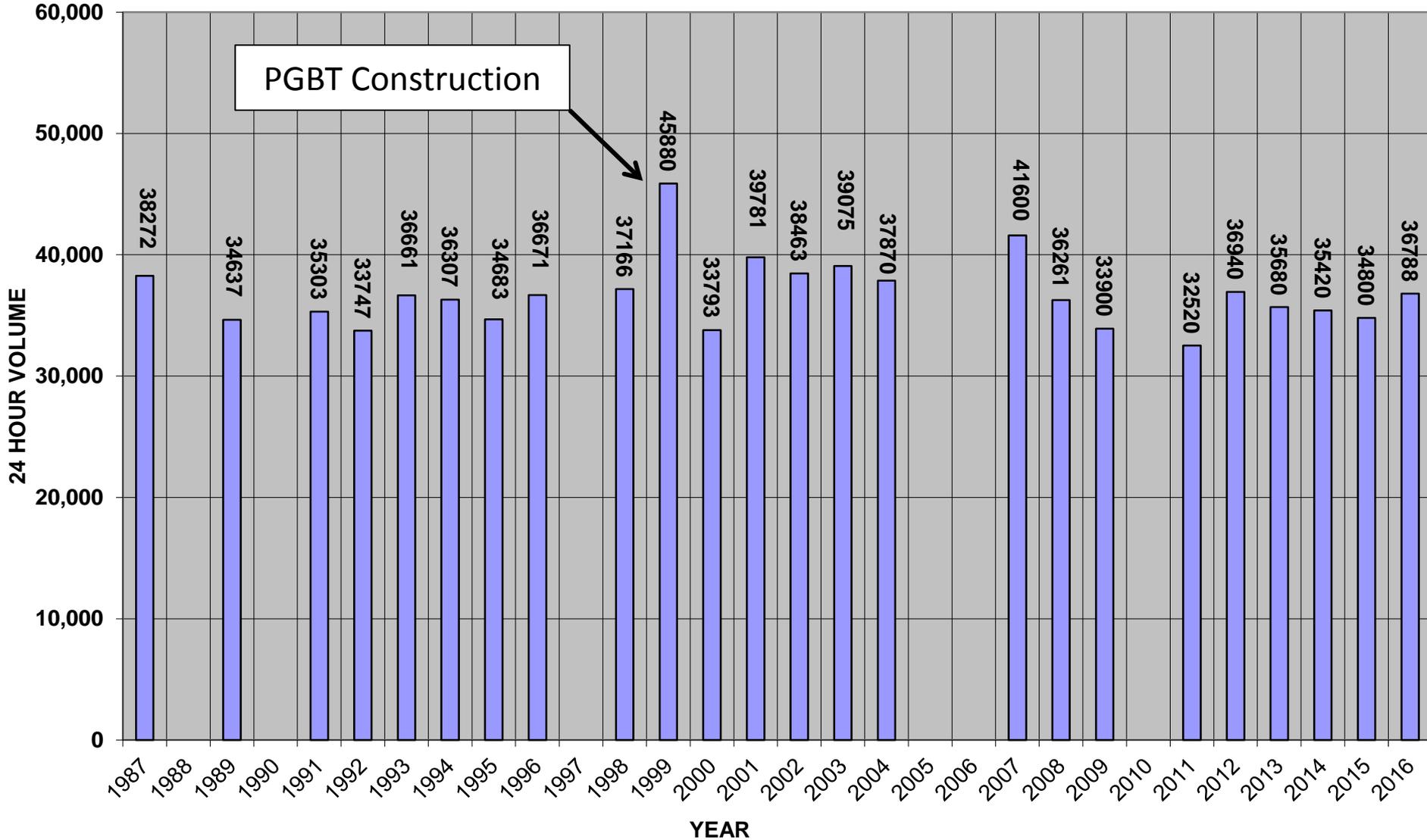
Coit Road Daily Traffic Volumes

(2-way Daily Traffic Between Haymeadow and Spring Valley)



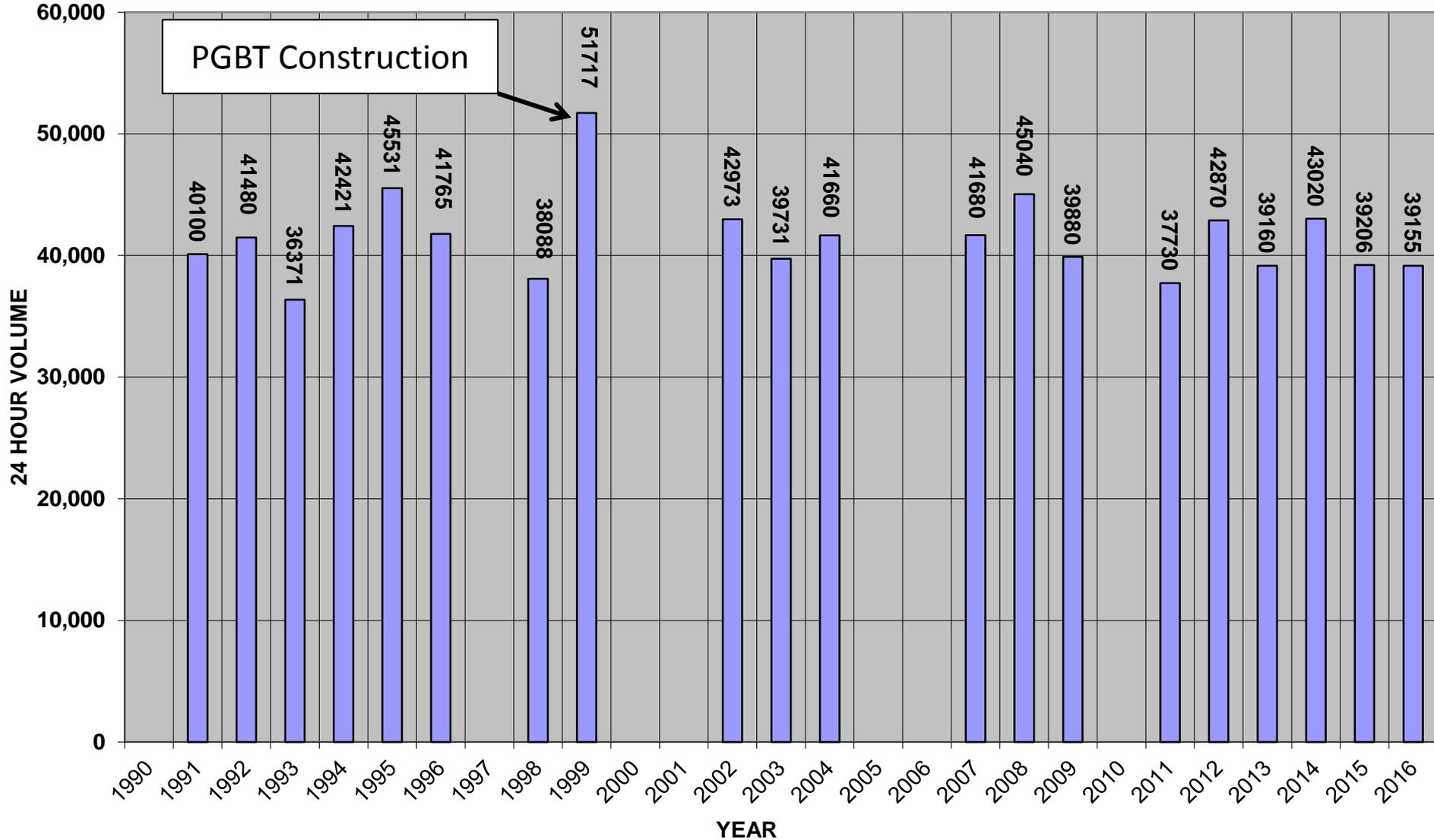
Campbell Road Daily Traffic Volumes

(2-way Daily Traffic Between Coit and Mimosa)



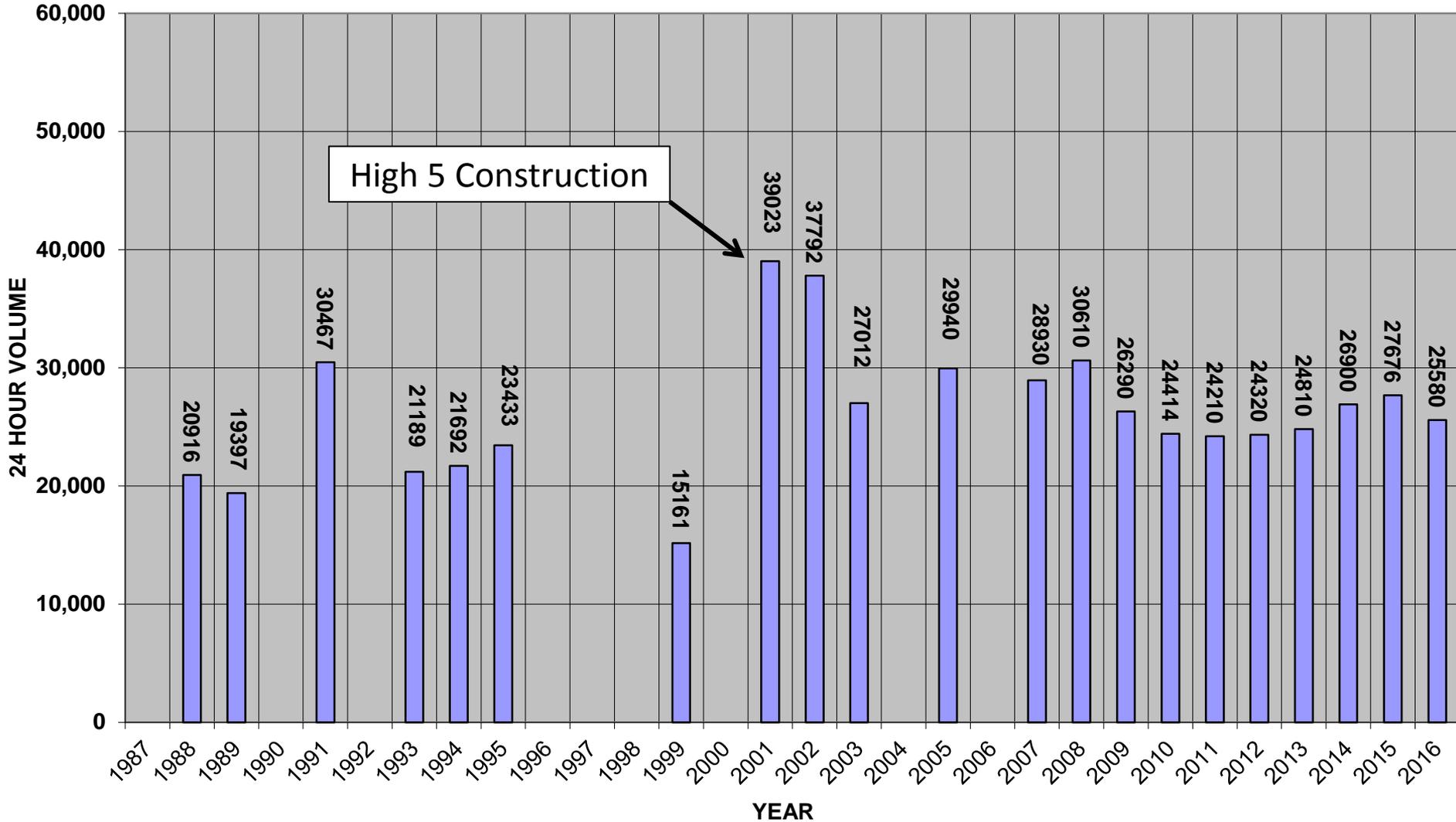
Campbell Road Daily Traffic Volumes

(2-way Daily Traffic Between US75 and Lakeside)



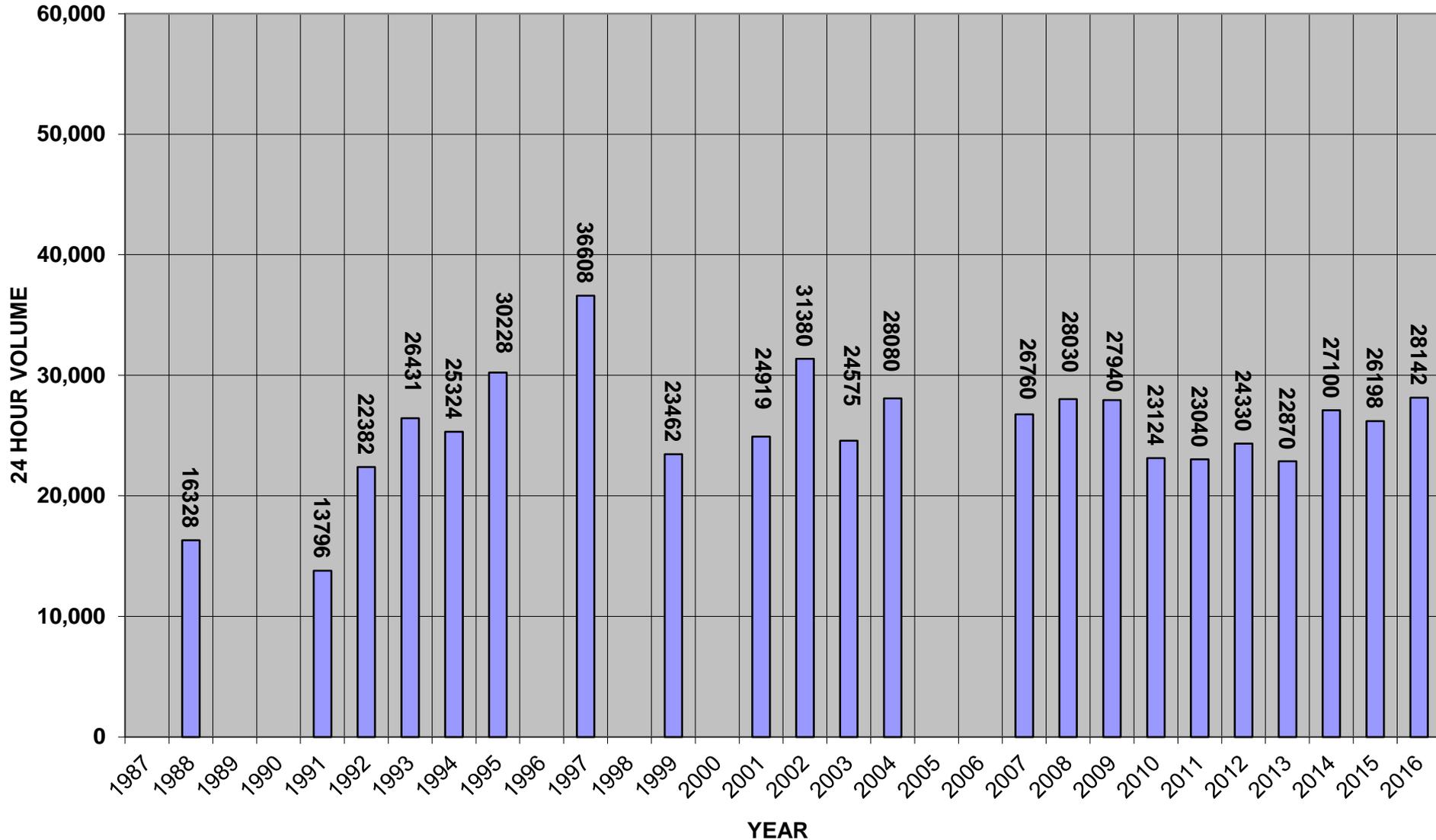
Plano Road Daily Traffic Volumes

(2-way Daily Traffic Between Renner and Broadmoor)

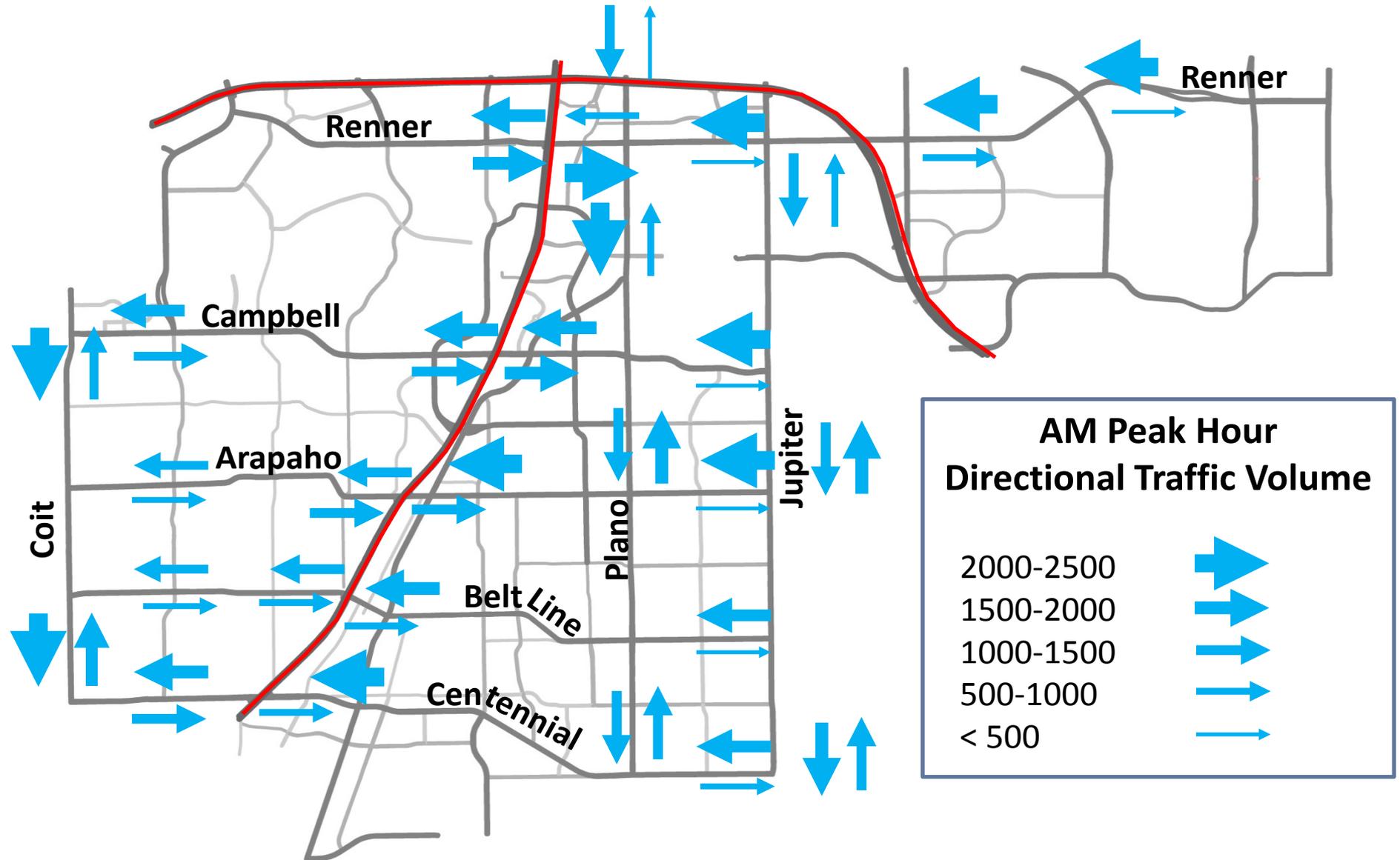


Renner East Road Daily Traffic Volumes

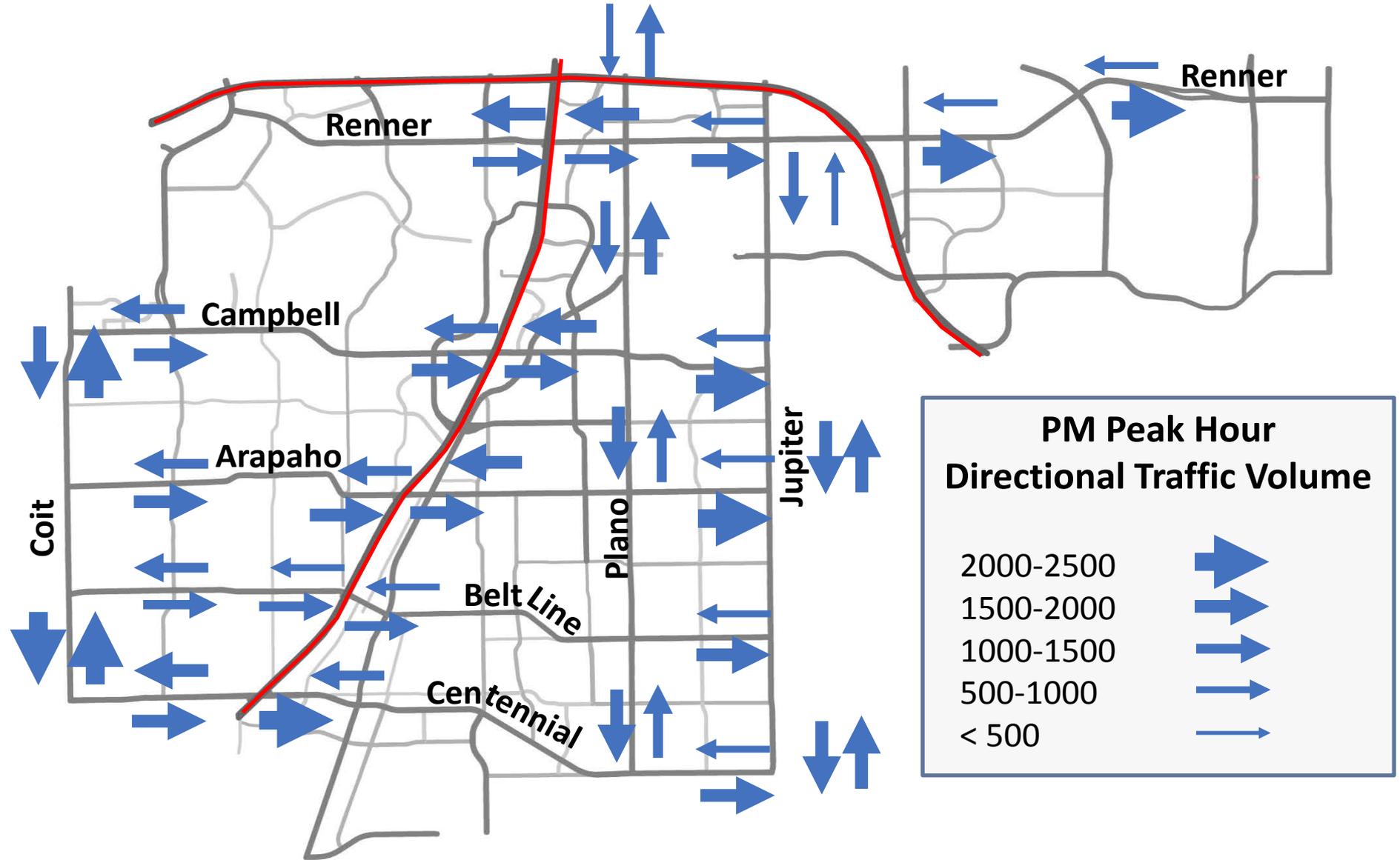
(2-way Daily Traffic Between US 75 and Plano Road)



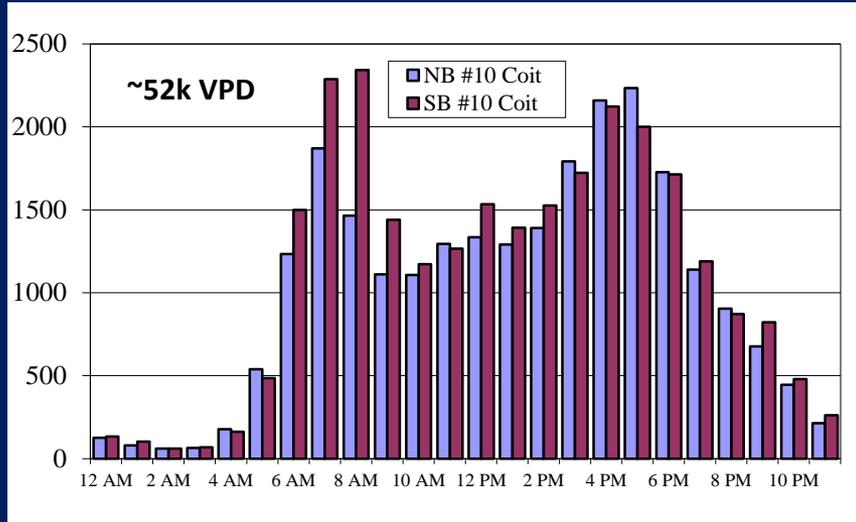
AM Peak Hour Traffic Volumes



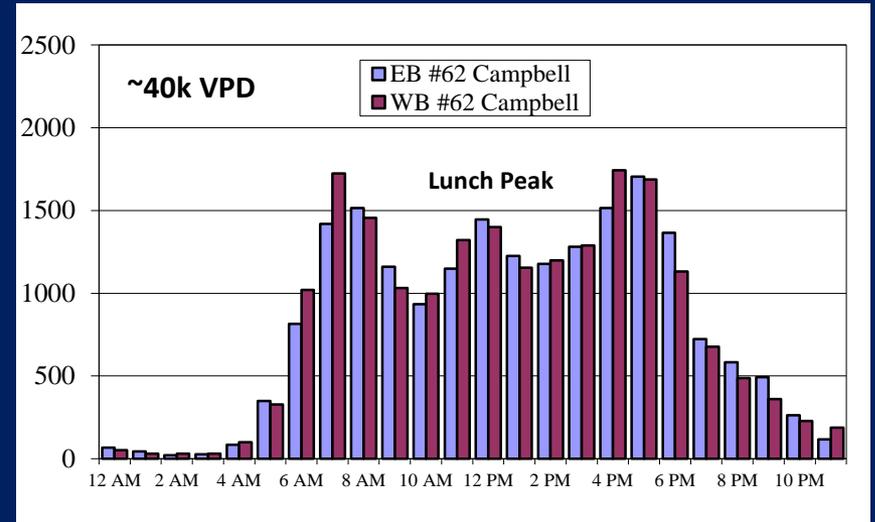
PM Peak Hour Traffic Volumes



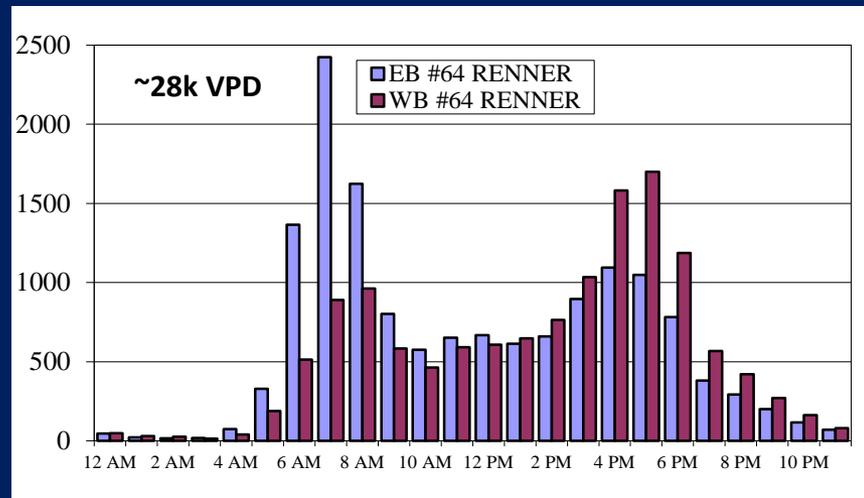
Hourly Volume Distribution Comparisons



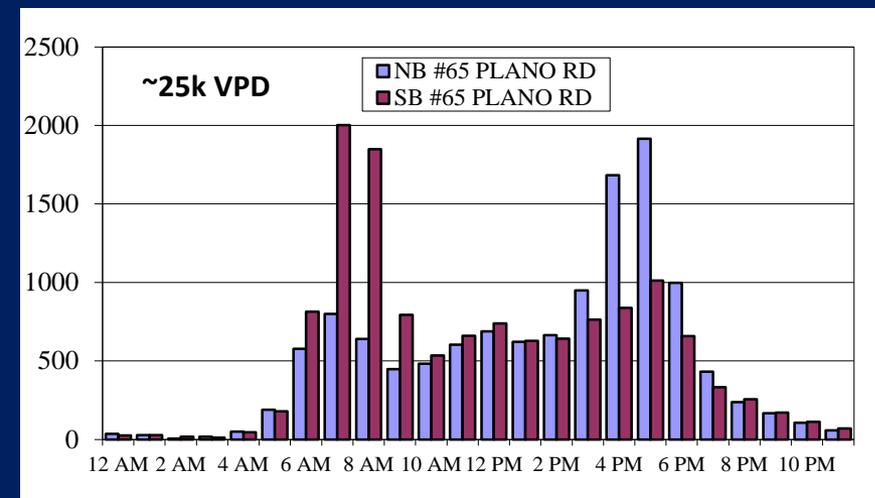
Coit North of Spring Valley



Campbell East of US 75



Renner West of Plano Rd.



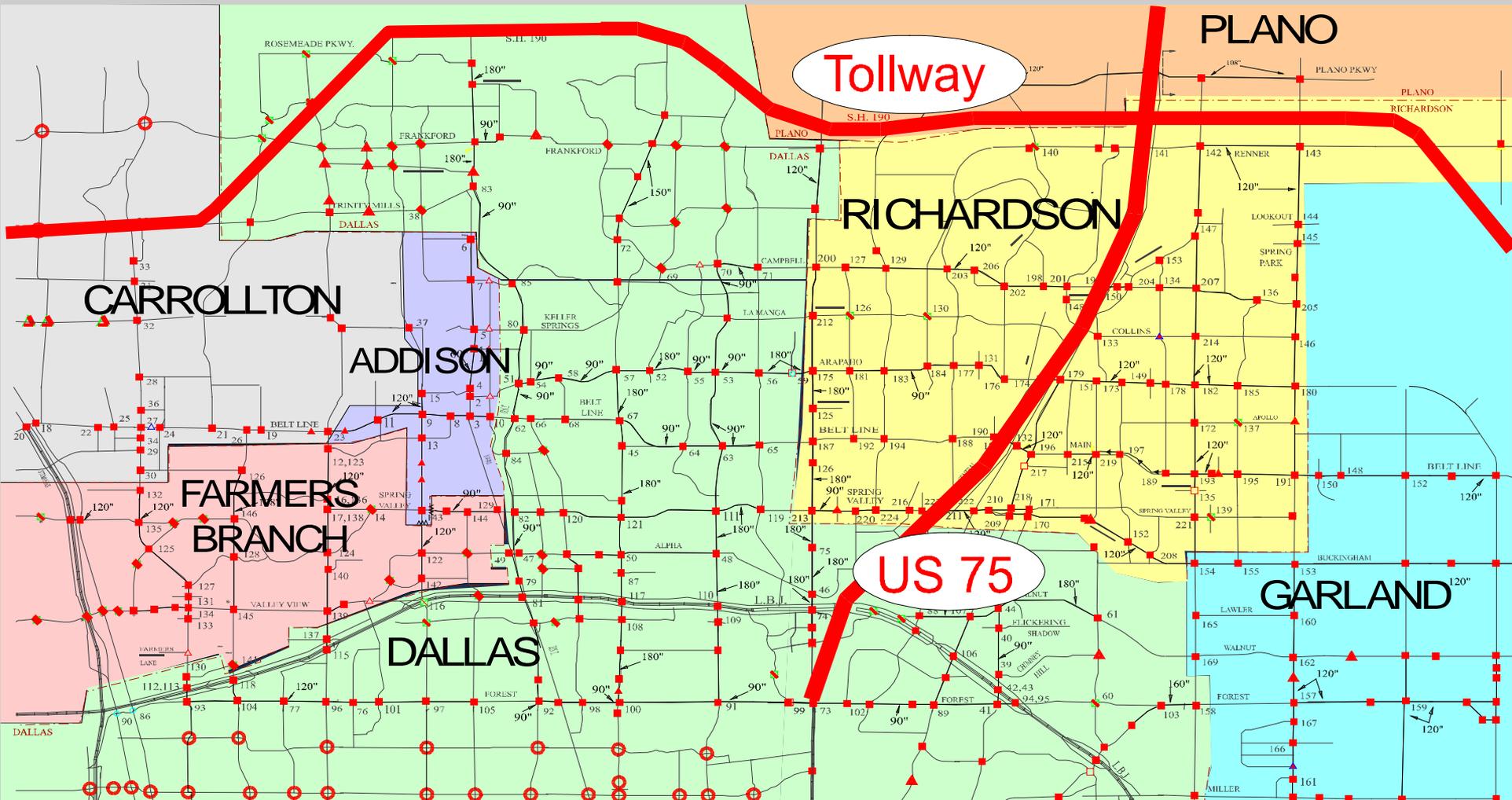
Plano South of Renner

Traffic Mgmt System Approach

An integrated system of

- Travel Demand Management
 - Alternative work schedules, Van-Pools, Transit, etc.
 - Public Information
 - Roadway and Utility construction projects
 - Website, Newsletter, Email
 - Multimodal access to DART Transit stations (shuttles, bike facilities, trails and sidewalks)
- Traffic signal system equipment upgrades,
- Signal timing synchronization and coordination
- Interagency cooperation with TxDOT, Dallas, Garland and Plano to create a unified system that extends beyond the City limits.

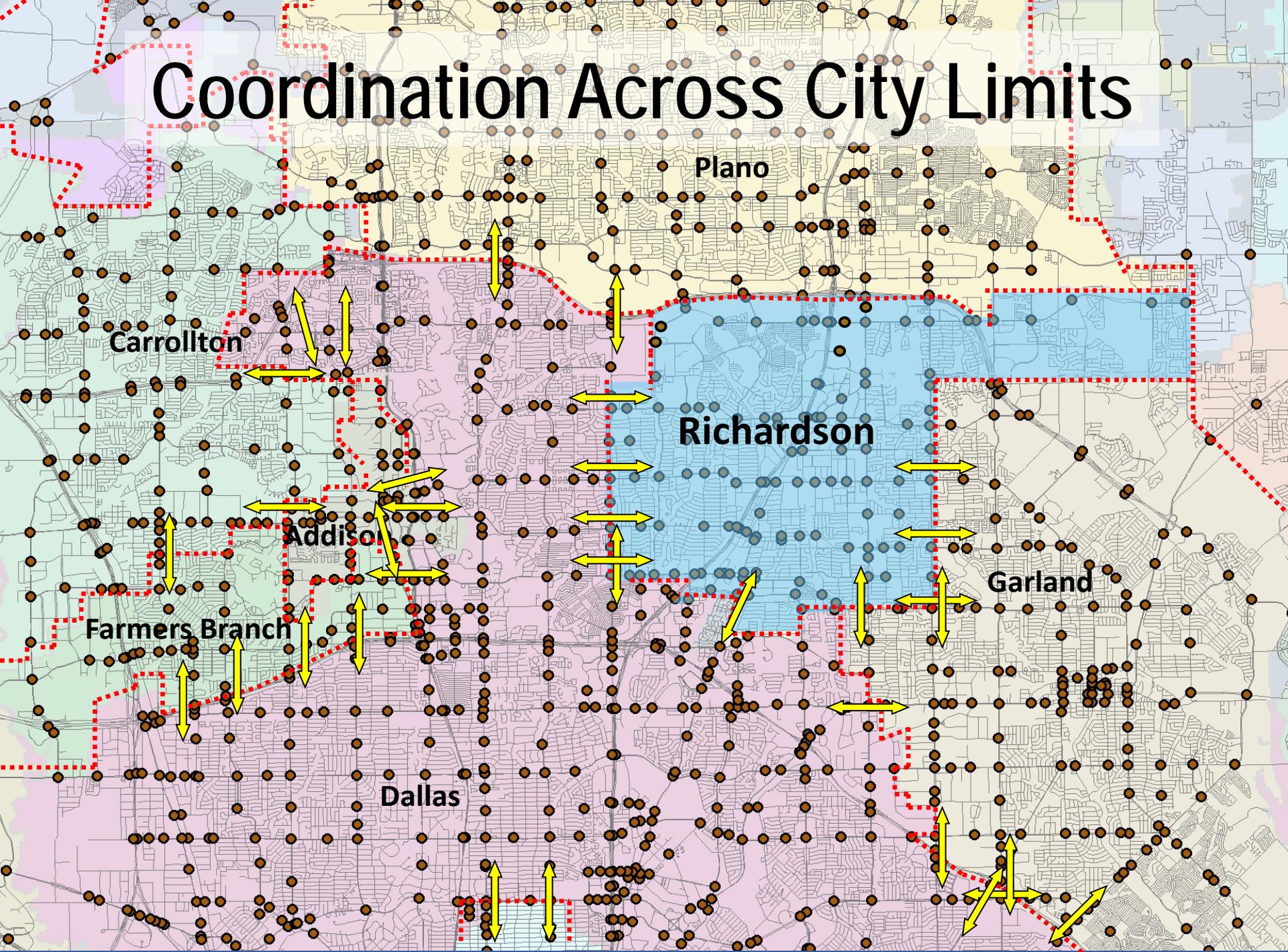
Regional Transportation Network



1990s - 253 signals in 7 cities synchronized using time-base coordination

2000s – NCTCOG led effort to coordinate 1400+ signals across multiple boundaries, Richardson system completed in 2010 and coordinated with Garland and Dallas

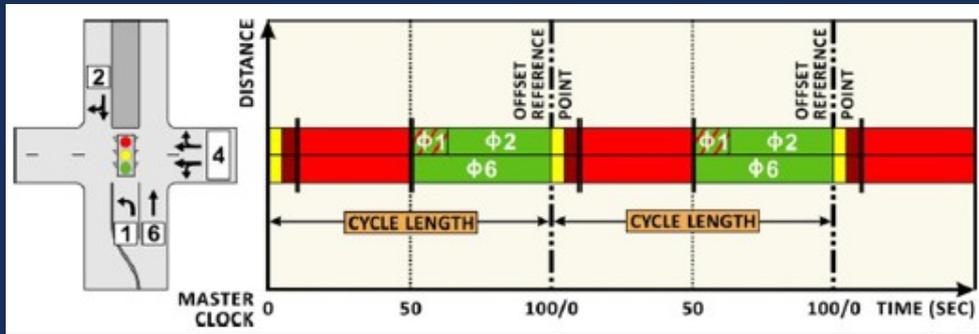
Coordination Across City Limits



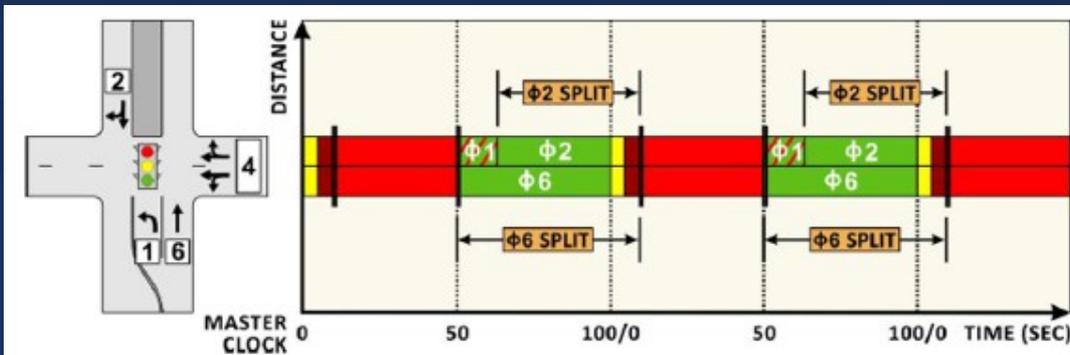
Basic Principles of Signal Timing

- Signal timing is a balance of several Measures of Effectiveness :
 - Progression (thru traffic proceeds through multiple greens)
 - Total Delay (overall intersection, each approach & movement)
 - Queue Length (turn-bay storage, spillback to other signals)
 - Stops, Fuel Consumption and emissions
- Optimizing signals solely for major corridor progression often increases overall delay, queuing, stops and fuel consumption for other movements including minor side-street traffic and left-turn traffic

Signal Timing 101 Definitions



Cycle Length is the total time required to service all conflicting phases and is based on best solution for the entire system and is dictated by traffic volumes at major intersections.



Split Time is the max green plus yellow time assigned to each phase.

Typical Timing Plan by time of day

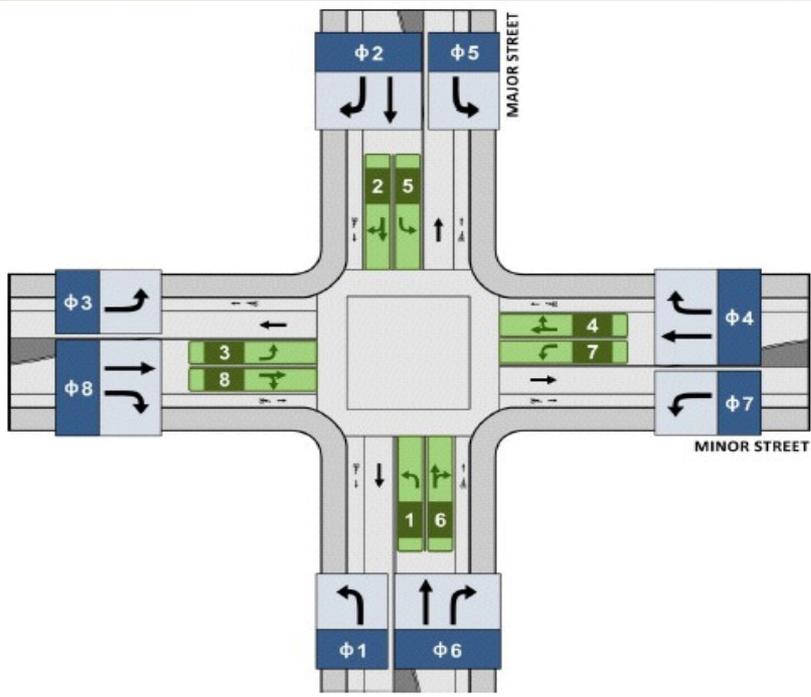
Monday – Friday (School in Session)

- 5:45 a.m. to 6:30 a.m. – 100 second cycle (Early AM)
- 6:30 a.m. to 8:45 a.m. – 160 second cycle (AM Peak Period)
- 8:45 a.m. to 2:45 p.m. – 100 second cycle (Off –Peak)
- 2:45 p.m. to 4:00 p.m. – 130 second cycle (Pre PM Peak Period)
- 4:00 p.m. to 7:15 p.m. – 160 second cycle (PM Peak Period)
- 7:15 p.m. to 11:00 p.m. – 100 second cycle (Off –Peak)
- 11:00 p.m. to 5:45 a.m. – Free / Fully Actuated Operation
(much safer than night flash)

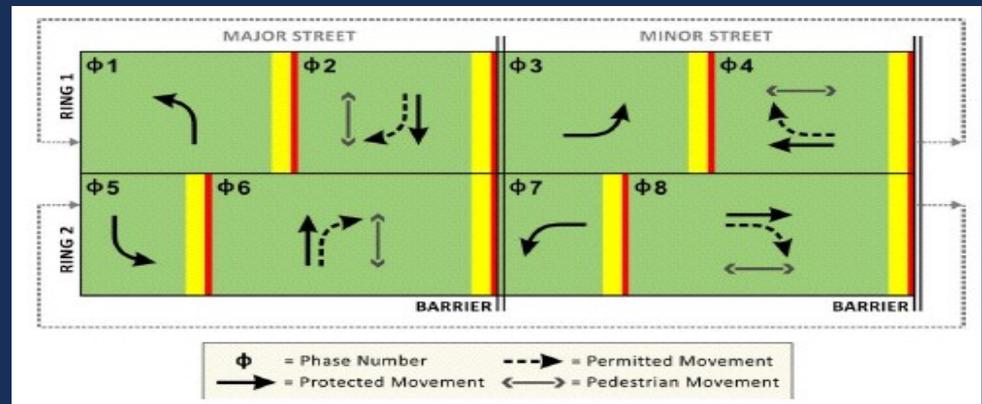
Note:

1. Some locations also have a Lunch Time Plan and a separate plan for when school is not in session
2. The new timing plans allow for multiple green phases per cycle at some locations. This extra green time is limited in length and may not include left-turn arrows and pedestrian phases each time.

Typical 8 Phase Movement Numbers



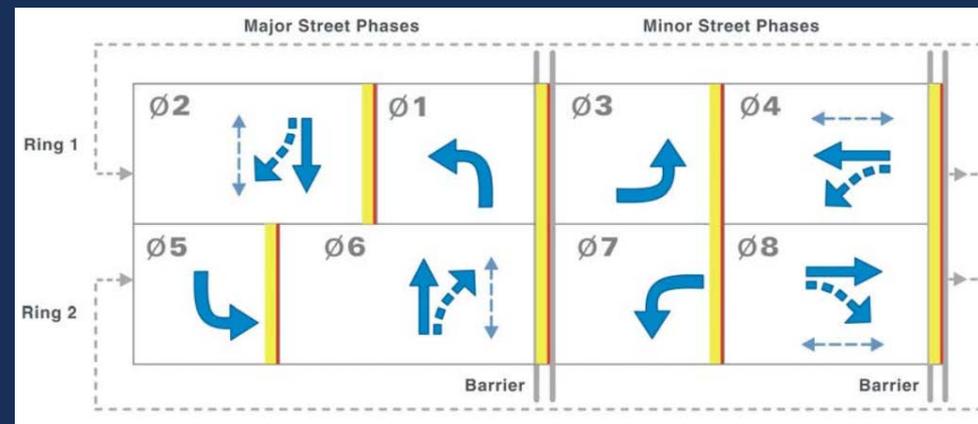
Phases 1, 3, 5, 7 (left-turns)
Phases 2, 4, 6, 8 (thru signals)



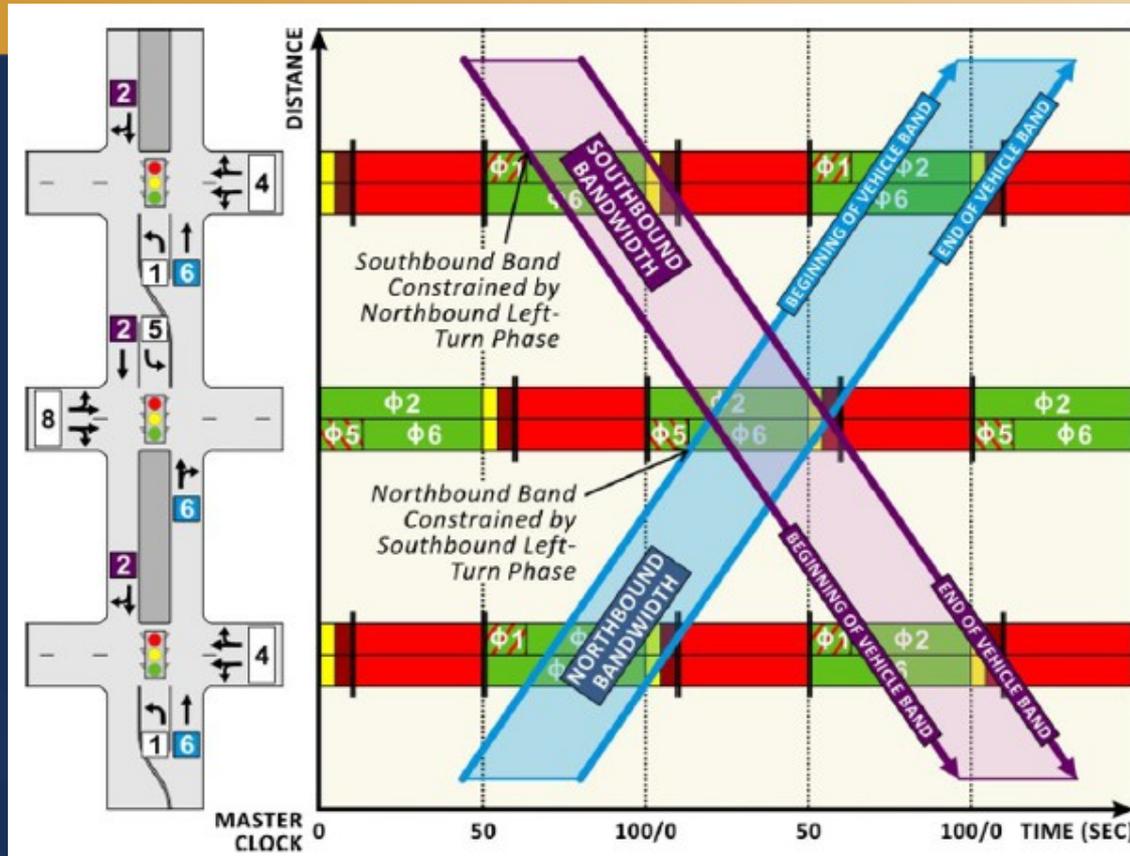
- **Signal Phase** - Each traffic signal movement controlled by a separate signal indication is called a signal phase
- **Green time** may extend from a preset minimum green to some maximum value based on vehicle detection and split times.
- **Clearance times** and pedestrian walk/clear times are constant.

Advanced Signal Timing Operations

- Flashing Yellow Arrows,
- Lead-Lag Left-turns,
- Right-turn arrow overlaps,
- Double Cycles,
- Uneven Double Cycles,
- Multiple Service Greens



Coordinated Signal Operation



Time/Space Diagram

Progression- Adjacent traffic signals may be coordinated at a common cycle length to progress thru traffic in green bands without stopping at the downstream signal

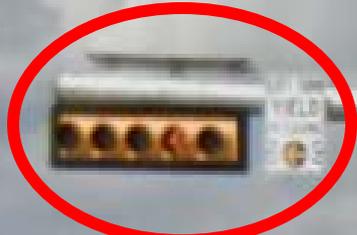
Progression is impacted by:

- Congestion and Residual queuing at major intersections
 - Once an intersection is overly congested, signal timing changes cannot reduce the overall delay or improve progression
- Speed and starting location of vehicles
 - Most progression plans are setup for straight through traffic starting at major intersections and driving in a platoon at the speed limit,
- Emergency vehicle preemption -
 - Opticom activates a green phase for Ambulances and/or Fire Trucks which requires 5 to 10 minutes to transition back into coordination,
- Transition between timing plans –
 - Changing time of day plans requires some time to get back into synch,
- Pedestrians –
 - Pushbutton provides more time for pedestrians than is normally needed for the vehicles and forces the intersection out of coordination

Traffic Signal System Upgrades

- Traffic Signal Rebuilds
 - New Poles on corners instead of in narrow medians
 - Underground – new pull boxes, conduits, cable, loop detectors, etc.
 - Barrier Free Ramps for ADA compliance
- Cabinet Replacements with Battery Backups
- Controller Replacements
- Advanced Traffic Management System (ATMS)
Software Replacement for TMC

Components of a new Traffic Signal



Flashing Yellow Arrow Display



Opticom Preemption



PTZ Camera

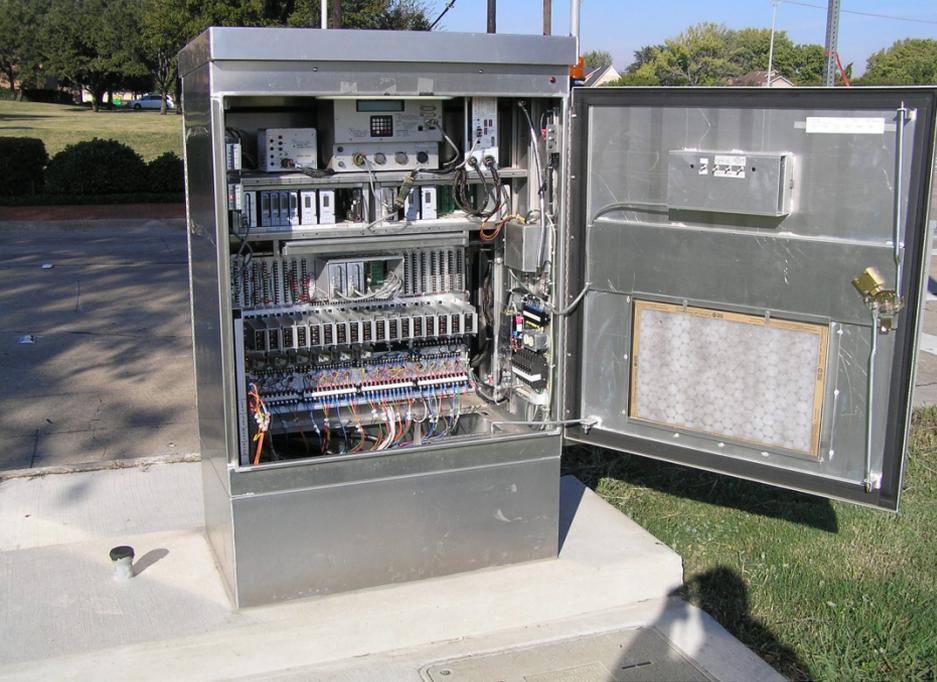


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- New Poles and Mast Arms on corners
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New Cabinet and Battery Backup Unit (68 of 127 Intersections)



New Intelight Advanced Traffic Controller will replace TS2 at New Cabinet Locations

Status of System Upgrades

- Older model Traffic Signal Controllers are being replaced with new Intelight Controllers at locations with New Cabinets.
 - 5 have been successfully installed and tested
 - Procurement of the remaining is underway on-going
- Traffic Signal Cabinets have been upgraded at 68 intersections but are required at all 127 intersections to achieve the flexibility and functionality of new controllers.
- Traffic Signal Rebuilds and Cabinet Upgrades proposed in the 2015 bond program will achieve that operational goal at all 127 locations by ~2022.
- Staff really appreciates the Council's support of the Bond Programs and Maintenance initiatives to date.



Summary

- “Strong economies, population growth, higher employment and declining gas prices have resulted in more drivers on the road — and more time waiting in traffic.” - The INRIX 2015 Traffic Scorecard reveals the cities most impacted by tough traffic conditions are those that have benefited from economic improvements.
- Optimizing the efficiency of our local system is a dynamic challenge that requires us to regularly monitor and tweak the signal system and roadway infrastructure as well as proactively work with other agencies, employers and the public.
- Richardson has a growing economy and we will continue to experience peak period congestion. We cannot “build” our way out of congestion. Promoting a Multimodal system that encourages Transit, Travel Demand Management and denser Mixed-Use Developments will be key to our continued success.

