

Road Safety Audit

County Road 250 E and County Road 430 S

Area Plan Commission of Tippecanoe County

July 2015

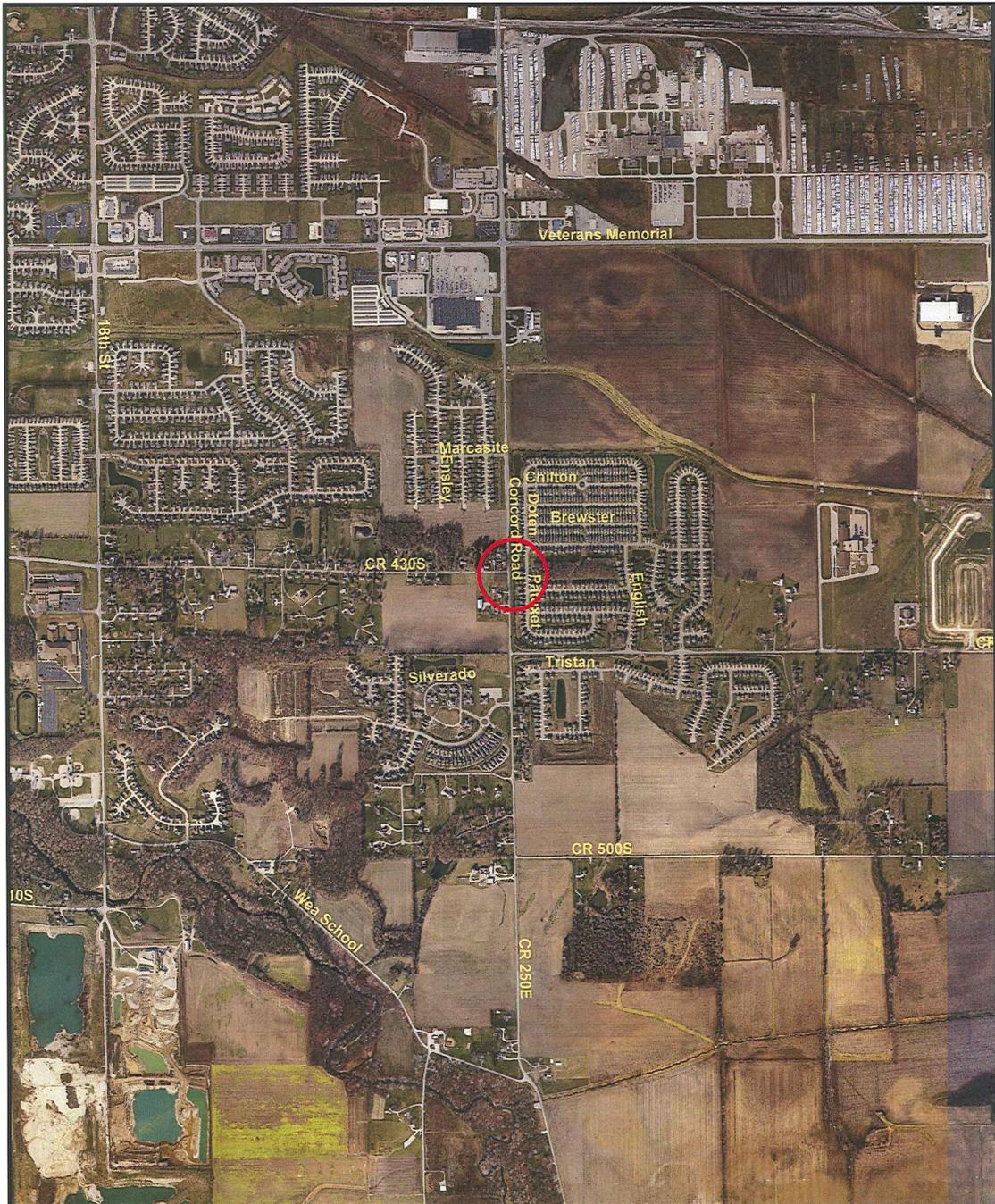


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RSA Background

Location: County Road 250 East (Concord Road) and its intersection with County Road 430 South, south east of Lafayette, Indiana in Tippecanoe County.

Owner: Tippecanoe County

Purpose: Develop preventive countermeasures to improve safety, and assist in scoping a proposed road and intersection Highway Safety Improvement Program project.

RSA Process: The RSA was conducted on June 18, 2015. The RSA team members received the Background Information report (which contained all the data in this report) and a more detailed Appendix (copy attached) prior to the RSA. Team members met at the Tippecanoe County Office Building and were briefed before carpooling to the site. All intersection approaches were driven, team members completed checklists as they walked and observed the site. Members then carpooled back to the County Office Building and met for a debriefing, discussion of their observations and the development of recommendations.

Geographic Scope: The RSA extends approximately 500' north, south and west of the intersection.

Team Members:

- Jim Hawley, previous Executive Director of the Area Plan Commission and the Metropolitan Planning Organization
- Capt. Brian Sterner, County Sheriff's Department
- Mike Parks, Traffic Supervisor for the Tippecanoe County Highway Department
- Gregory Haltom, Transportation Director for the Tippecanoe School Corporation
- Dave Buck, PE, Public Works Director for the City of West Lafayette
- Laura Slusher, PE, HELPERS Project Manager for the Local Technical Assistance Program at Purdue
- Jim Knapp, PE, Senior Civil Engineer in Facilities Planning at Purdue
- Tim Stroshine, EIT, Transportation Planner at the Area Plan Commission of Tippecanoe County
- Jon Fricker, PE, Professor at Purdue in the Civil Engineering Department



The Team

Resource Personnel:

- Opal Kuhl, PE, Executive Director of the Tippecanoe County Highway Department
- John Thomas, Assistant Director for Transportation Planning, APC
- Doug Poad, Senior Transportation Planner, APC
- Mike Spencer, Assistant Director of the Tippecanoe County Highway Department

Existing conditions: (See Maps and Summaries that follow)

CR 250 E is a two lane rural road functionally classified as a Minor Collector. The pavement condition is “good” (72, out of 100 scale, south and 79 north of CR430S) with two 10.5’ lanes and less than 1’ earth/gravel shoulders. The road descends 45 feet in elevation from 400 feet south of the intersection to 400 feet north of the intersection. The intersection is in a rapidly developing residential area with significant development directly to the east and within 1000 feet both north and south. Veterans Memorial Parkway (a Major Arterial with significant commercial and industrial land uses) is three-quarters of a mile to the north.

CR 430 S is a two lane rural road functionally classified as a Local road with a “good” pavement condition (67). There are two 10.5’ lanes with less than 1’ earth/gravel shoulders. There are drainage issues and an old headwall at the intersection. The land gently undulates down in elevation from west to east. Land use is residential along the road frontages but in agricultural production behind the homes.

Traffic Characteristics and Area Plans: (See Maps and Summaries that follow)

CR 250 E carries 6,125 vehicles per day north of the intersection and 5,249 vehicles per day to the south (2013) with slightly more than 3% heavy trucks. The posted speed limit is 40 MPH and the 85th percentile speed is 49 MPH. The road is used by school buses but there are no visible signs of bicyclist or pedestrian use; however there is a regional middle school and elementary school located one mile to the west. In 2014 Tippecanoe County constructed a multi-use trail from the entrance of a major residential subdivision 1000’ north of the intersection to Veterans Memorial Parkway.

CR 430 S carries 3,511 vehicles per day (2013) with less than 2% heavy trucks. The road is used by school buses going to a regional middle school and elementary school one mile to the west. There are Stop and Street Name signs at the intersection with CR250E. The posted speed limit is 40 MPH and the 85th percentile speed is 39 MPH.



Looking west onto CR 430S

Crash History: (See Maps and Summaries that follow)

There were 21 crashes between January 2010 and February 2015 injuring 15 people with no fatalities. Five of the crashes involved an injury and sixteen were property damage only. The majority of crashes occurred during the daylight hours in clear weather. Proportionately there is an overrepresentation of Rear End, Ran off the Road, Right Angle and Speed too Fast, as well as Wet and Ice Surface Conditions compared to all crashes in Tippecanoe County.

The collision diagram shows the greatest number (nine) occurred when a vehicle was traveling northbound and did not see the secondary vehicle waiting to turn left onto CR 430S. Of those nine, three involved an injury. Four resulted in the vehicle rear-ending the waiting vehicle and the remaining five involved the vehicle running off the road. Four of the five Right Angle crashes involved vehicles pulling out from CR 430S. Two of those four were due to icy roads. The fifth crash involved a south bound turning vehicle making too wide of a turn. The other notable crash type involved vehicles traveling east on CR 430S disregarding the Stop sign. Two of those were related to icy road conditions.

RSA Observations and Analysis

The RSA team reviewed the enclosed information and following the on-site investigation made the following observations and analysis:

CR 250 E

Sight distance is inadequate on the south leg of the intersection because of a rise in the elevation of the road. North bound drivers don't see the intersection until they crest and start to descend the hill. The rear end and run off the road (to avoid the left turning vehicles) crashes are a direct result of the inadequate sight distance. Speeds are high with the 85th percentile at 49 mph; however, the speed limits were lowered in the area several years ago in an attempt to reduce crashes. Wet pavements contributed to 75% of the crashes involving two vehicles. The road width, shoulder width and intersection radius do not meet current standards. There is a driveway on the north side of the intersection just 55' from the intersection.

CR 430 S

Crash history shows two patterns: a right angle pattern and disregarding the Stop sign. A relatively high proportion of crashes occurred in icy conditions. Sight distance to the north and particularly to the south is obstructed by vegetation. There is a slight dip and road undulation just prior to the intersection, there is no stop bar and again both the road width, shoulder width and intersection radius do not meet current standards. Speeds on the intersection approach seemed high and the intersection seems to come up quickly for drivers.

Hill on the south leg of the Intersection



Sight distance obstruction on the north west corner

RSA Recommendations

Following the site investigation the RSA team came to the following recommendations for consideration by Tippecanoe County.

Short-Term Recommendations – To minimize rear end and right angle crashes the County should take steps to increase driver awareness of the intersection. In the near term significantly improving sight distances is not possible. However, additional driver information about the intersection ahead and slowing left turning vehicles is recommended to improve driver predictability and reduce crashes.

CR 250E

Greater intersection awareness is needed for north bound vehicles because of inadequate sight distance which is caused by a hill that obstructs the view of the intersection. Advanced intersection signing on the south leg is recommended to provide greater awareness of the approaching intersection.

CR 430S

Greater intersection awareness is needed for east bound vehicles. This can be accomplished with the installation of advanced intersection signing, possibly a stop bar, a larger Stop sign and a double arrow on the far side of the intersection. Vegetation on the west side of the intersection should be trimmed, particularly the northwest corner where it may be in the public right-of-way.

Long-Term Recommendations – To reduce the rear end and run off the road type crashes the County should make significant improvements to the intersections and approaches. These measures will improve sight distance, remove the slower turning traffic from the higher speed through traffic and reduce crashes.

CR 250E

To address the rear end crashes the intersection should be reconstructed. The hill on the south approach should be removed to improve sight distance and a passing blister should be constructed on the east side of the intersection. The lane and minimal shoulder widths should be widened to current standards and the new pavement should be a high friction surface to address the slippery pavement crash history. The recently completed Lafayette Trail Master Plan recommends a multi-use trail on this section of CR 250E and provisions for the trail should be included in any reconstruction.

CR 430S

The road needs to be reconstructed so the approach eliminates the slight dip and road undulations just prior to the intersection. The lane and minimal shoulder widths should be widened to current standards and the new pavement should be a high friction surface to address the slippery pavement crash history. The 2040 Metropolitan Transportation Plan recommends a trail on CR430S that would connect the proposed trail on CR250E to the elementary and middle school a mile to the west. Provisions for the trail should be included in any reconstruction.

Relocation of CR 430 S

In addition to reconstructing the intersection in its current location, there was discussion of completely relocating the intersection a half mile south so it would line up with CR450S on the east side of CR250E. This would eliminate the need to reconstruct the existing intersection, allow for the construction of a new intersection in a location with better sight distance and provide a better network for future traffic in this growing area. Depending upon available funding realigning CR430S should be considered by Tippecanoe County.

Site Map



Roadway Inventory

CR250E (Concord) at CR430S

•CR430S

- Functional Class = Local
- Lane widths averages 21', two 10.5' lanes
- Earth/gravel shoulders, 1'-2' wide
- Pavement condition is "Good", Overall Condition Index = 67 (100 Scale)
- Posted Speed Limit = 40 mph, 34 mph Ave., 39 mph 85%
- Vehicle Class
 - Motorcycles = 1%
 - Cars/light trucks = 92.1%
 - 2-3 axle, single frame trucks = 2.9%
 - Semi w/2 or more units = 1.9%
 - Unknown = 2.1%
- Signage = Stop and Street Name signs eastbound (southwest corner)

•CR 250E (south leg)

- Functional Class = Minor Collector
- Lane widths averages 21', two 10.5' lanes
- Earth/gravel shoulders, 1'-2' wide
- Pavement condition is "Good", Overall Condition Index = 72 (100 Scale)
- Posted Speed Limit = 40 mph, 43 mph Ave., 49 mph 85%
- Vehicle Class
 - Motorcycles = .08%
 - Cars/light trucks = 88.7%
 - 2-3 axle, single frame trucks = 4.3%
 - Semi w/2 or more units = 3.2%
 - Unknown = 2.9%
- Signage = 40 MPH sign 700' south of CR430S

•CR 250E (north leg)

- Functional Class = Major Collector
- Lane widths averages 21', two 10.5' lanes
- Earth/gravel shoulders, 1'-2' wide
- Pavement condition is "Good", Overall Condition Index = 79 (100 Scale)
- Posted Speed Limit = 40 mph
- Vehicle Class
 - Motorcycles = .08%
 - Cars/light trucks = 88.7%
 - 2-3 axle, single frame trucks = 4.3%
 - Semi w/2 or more units = 3.2%
 - Unknown = 2.9%
- Signage = 40 MPH sign 400' north of CR430S

Concord at CR 430S

Crash Report Information, January 2010 through February 2015

Crash Summary

#	Date	Time	# of Vehicles Involved	Number Injured	Number Dead	Manner of Collision	Primary Factor	Light Condition	Weather Condition	Surface Condition	Damage Estimate
1	5/3/2010	1735	1	1	0	RAN OFF ROAD	SPEED TOO FAST FOR WEATHER CONDITIONS	DAYLIGHT	RAIN	WET	\$1001 TO \$2500
2	5/11/2010	0916	2	1	0	REAR END	FOLLOWING TOO CLOSELY	DAYLIGHT	CLOUDY	WET	\$2501 TO \$5000
3	5/14/2010	0344	1	0	0	RAN OFF ROAD	RAN OFF ROAD RIGHT	DARK (NOT LIGHTED)	CLEAR	WET	\$5001 TO \$10000
4	6/16/2010	1746	1	1	0	RAN OFF ROAD	FOLLOWING TOO CLOSELY	DAYLIGHT	CLEAR	DRY	\$1001 TO \$2500
5	9/1/2010	1448	2	1	0	REAR END	BRAKE FAILURE OR DEFECTIVE	DAYLIGHT	RAIN	WET	\$1001 TO \$2500
6	3/21/2011	0857	2	0	0	REAR END	OTHER (DRIVER) - EXPLAIN IN NARRATIVE	DAYLIGHT	CLEAR	DRY	\$1001 TO \$2500
7	5/26/2011	1649	1	0	0	RAN OFF ROAD	SPEED TOO FAST FOR WEATHER CONDITIONS	DAYLIGHT	RAIN	WET	\$1001 TO \$2500
8	10/16/2011	0249	1	0	0	RAN OFF ROAD	RAN OFF ROAD RIGHT	DARK (LIGHTED)	CLEAR	DRY	\$2501 TO \$5000
9	11/3/2011	1548	1	0	0	RAN OFF ROAD	SPEED TOO FAST FOR WEATHER CONDITIONS	DAYLIGHT	RAIN	WET	\$2501 TO \$5000
10	11/3/2011	1626	2	0	0	REAR END	SPEED TOO FAST FOR WEATHER CONDITIONS	DAYLIGHT	RAIN	WET	\$5001 TO \$10000
11	12/18/2011	0510	1	0	0	RAN OFF ROAD	OTHER (DRIVER) - EXPLAIN IN NARRATIVE	DARK (LIGHTED)	CLEAR	DRY	\$5001 TO \$10000
12	1/12/2012	1621	2	0	0	RIGHT ANGLE	LEFT OF CENTER	DAWN/DUSK	SNOW	ICE	\$5001 TO \$10000
13	1/17/2012	0850	2	0	0	REAR END	SPEED TOO FAST FOR WEATHER CONDITIONS	DAYLIGHT	CLOUDY	WET	\$1001 TO \$2500
14	2/17/2013	1547	2	0	0	RIGHT ANGLE	FAILURE TO YIELD RIGHT OF WAY	DAYLIGHT	CLEAR	DRY	\$2501 TO \$5000
15	10/7/2013	1449	2	0	0	RIGHT ANGLE	FAILURE TO YIELD RIGHT OF WAY	DAYLIGHT	CLEAR	DRY	\$10001 TO \$25000
16	11/28/2013	1214	2	0	0	SAME DIRECTION SIDESWIPE	BRAKE FAILURE OR DEFECTIVE	DAYLIGHT	CLEAR	DRY	\$2501 TO \$5000
17	3/2/2014	1649	2	0	0	RIGHT ANGLE	ROADWAY SURFACE CONDITION	DAYLIGHT	CLOUDY	ICE	\$10001 TO \$25000
18	3/2/2014	1731	2	0	0	RIGHT ANGLE	ROADWAY SURFACE CONDITION	DAYLIGHT	CLOUDY	ICE	\$5001 TO \$10000
19	3/3/2014	0845	1	0	0	RAN OFF ROAD	SPEED TOO FAST FOR WEATHER CONDITIONS	DAYLIGHT	CLEAR	ICE	\$2501 TO \$5000
20	8/28/2014	0035	1	1	0	RAN OFF ROAD	DISREGARD SIGNAL/REG SIGN	DARK (LIGHTED)	CLEAR	DRY	\$10001 TO \$25000
21	2/2/2015	1521	2	0	0	REAR END	FAILURE TO YIELD RIGHT OF WAY	DAYLIGHT	CLEAR	DRY	\$2501 TO \$5000

General Summary

Number of Crashes	21
Property Damage Only	16
Injury Crashes	5
Fatalities	0

Manner of Collision

Ran Off Road	9
Rear End	6
Right Angle	5
Same Direction Sideswipe	1

Primary Factor

Speed too Fast	6
Failure to Yield Right of Way	3
Following Too Closely	2
Ran Off Road Right	2
Brake Failure	2
Other, Explain in Narrative	2
Roadway Surface Condition	2
Disregard Signal/Reg Sign	1
Left of Center	1

Light Condition

Daylight	16
Dark (Lighted)	3
Dark (Not Lighted)	1
Dawn/Dusk	1

Weather Condition

Clear	11
Rain	5
Cloudy	4
Snow	1

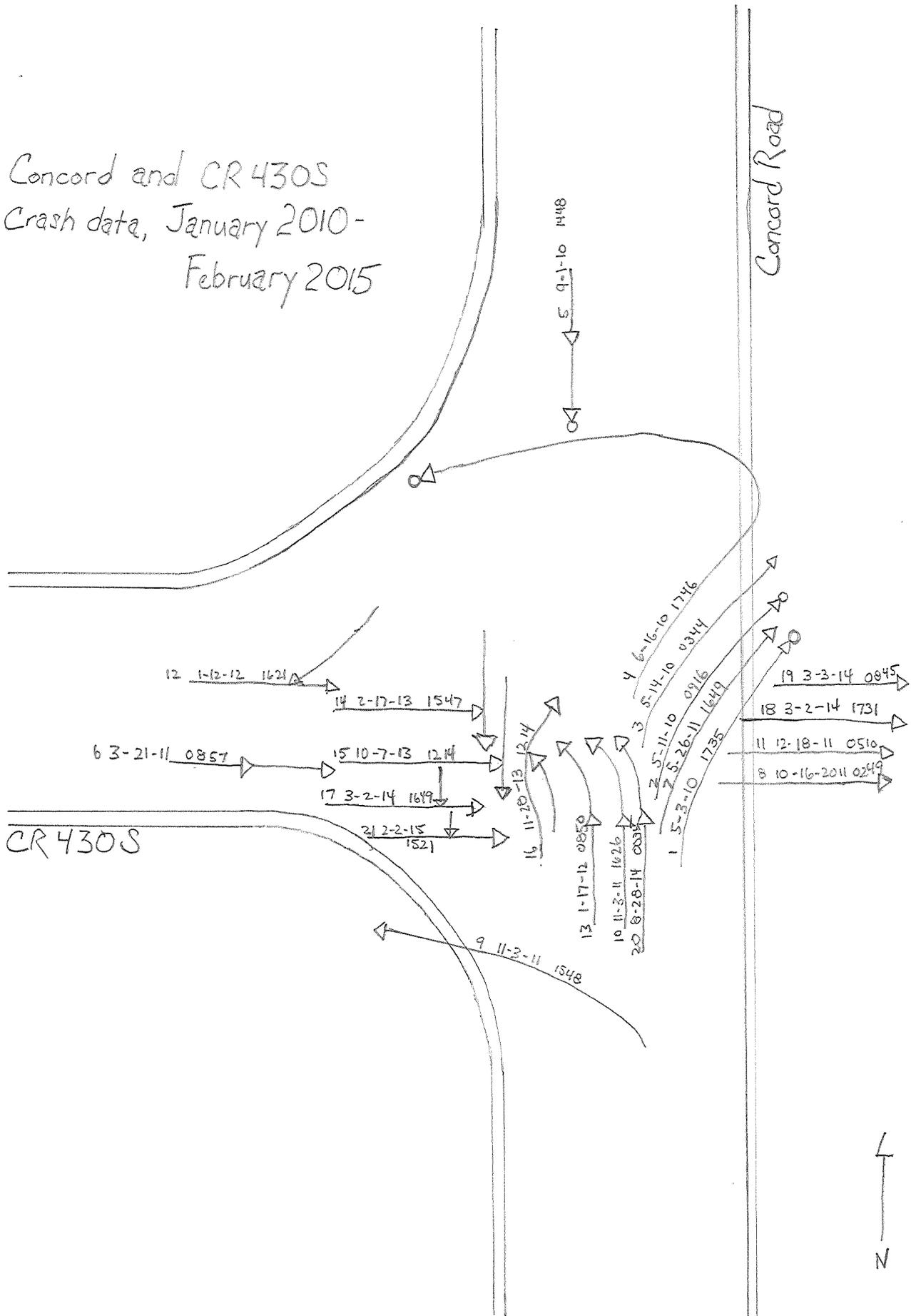
Surface Condition

Dry	9
Wet	8
Ice	5

Damage Estimate

\$10001 TO \$25000	3
\$5001 TO \$10000	5
\$2501 TO \$5000	7
\$1001 TO \$2500	6

Concord and CR 430S
 Crash data, January 2010-
 February 2015

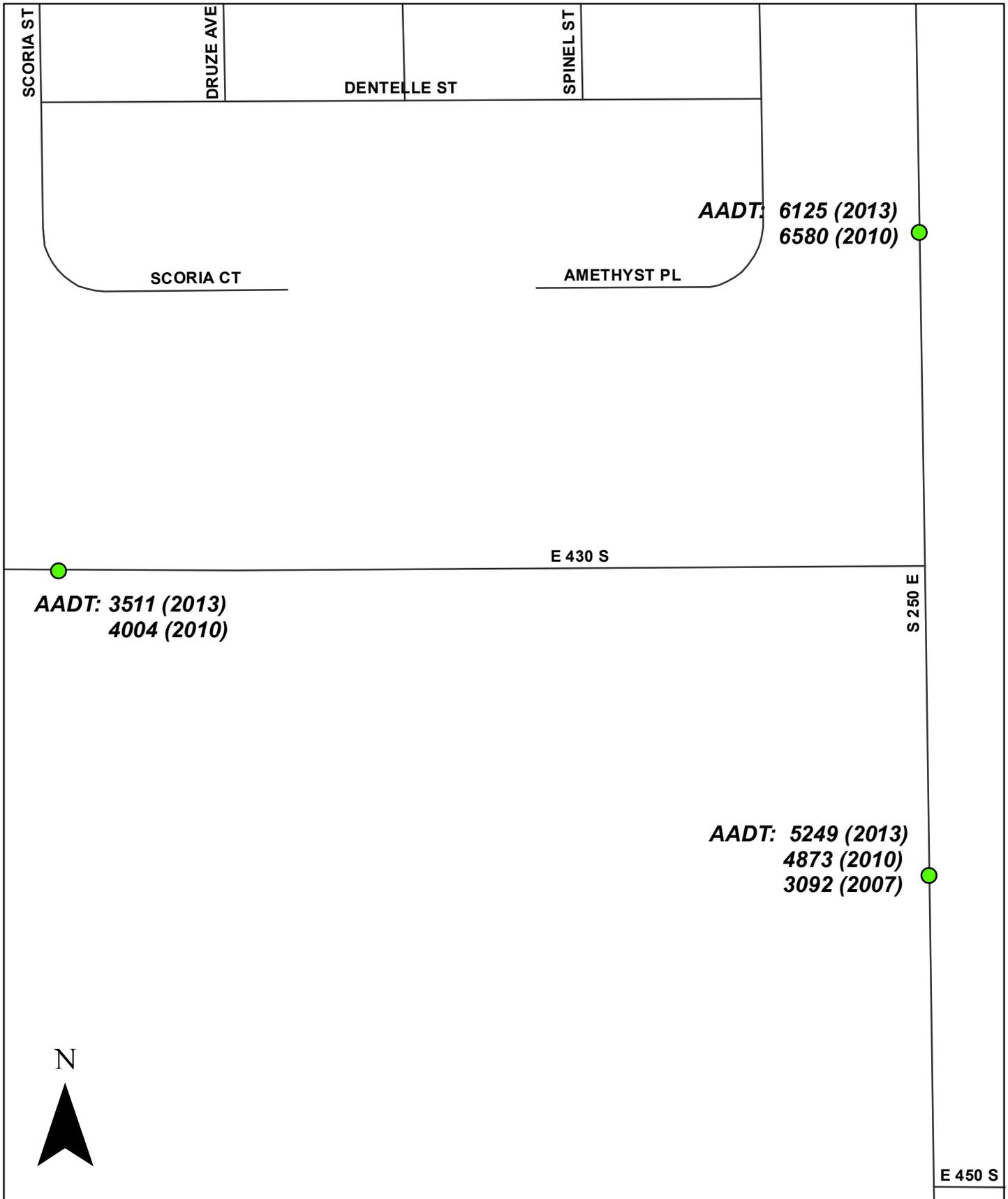


Concord and CR 430S

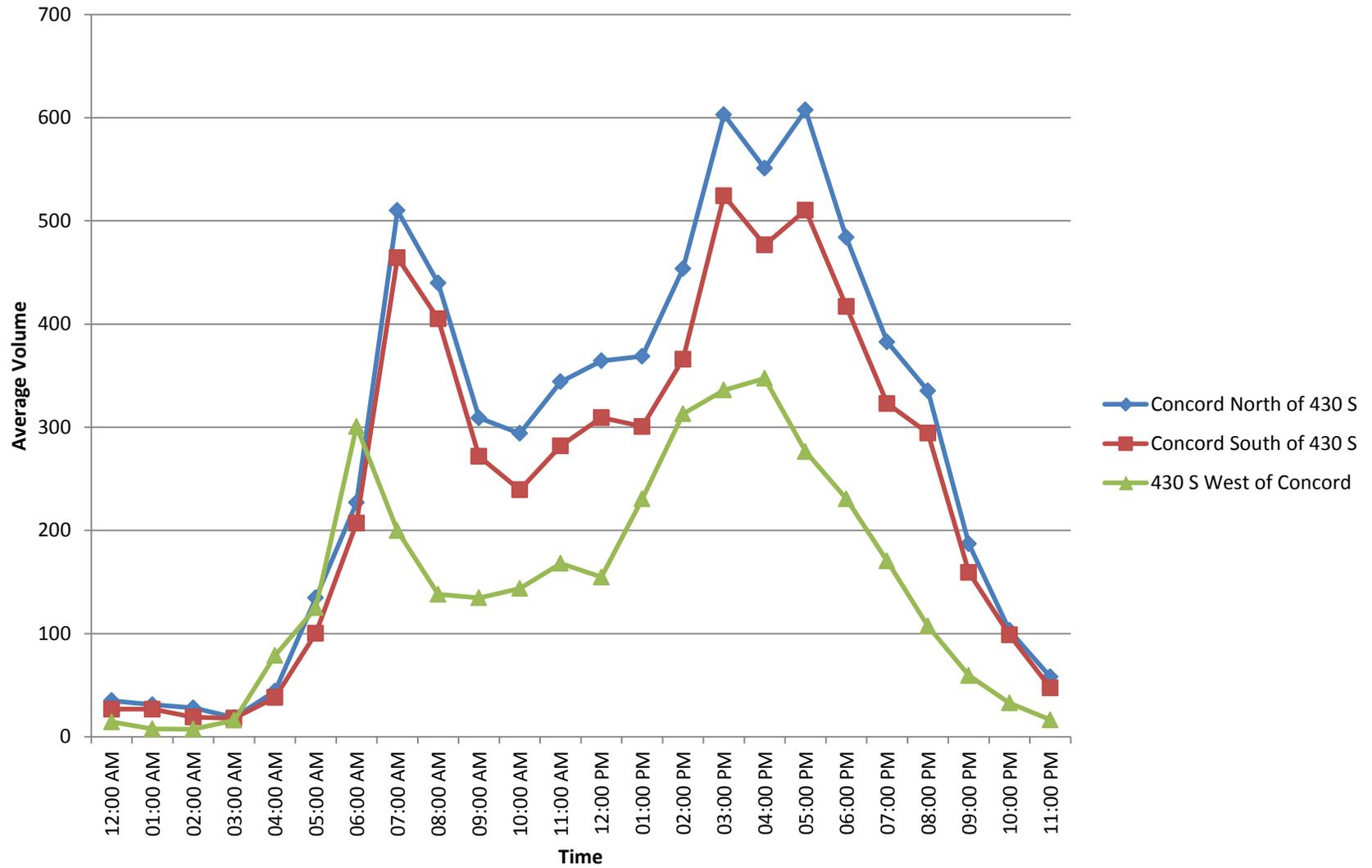
Crash Data Summary

Crash Number	Summary
1	Vehicle traveling too fast for wet pavement. Tried to avoid stopped vehicle in front of them, ran off road and hit rock.
2	Did not see vehicles turn signal in front of them. Swerved, ran off road and hit utility box.
3	Car in front stopped suddenly. Vehicle swerved and ran off road.
4	Driver left scene (intoxicated). Vehicle went off road, over corrected and flipped vehicle at least once.
5	Rear end collision. Brakes failed.
6	Rear-end collision. Vehicle started to go but stopped suddenly. Vehicle behind rear ended the vehicle.
7	A vehicle was stopped to turn left. The other vehicle tried to stop, slid on wet pavement and went off the road. Hit utility box and rock.
8	Driver did not see stop sign, went through intersection and struck tree on other side of road.
9	Vehicle tried to stop for school bus. Brakes failed, went left and hit guide wires and utility pole.
10	A vehicle was stopped to turn left. The other vehicle was unable to stop and rear-ended vehicle.
11	Drove through intersection and hit rock. Driver fled scene.
12	Vehicle turned too wide and hit stopped vehicle. Road was ice covered and slick.
13	Vehicle crested hill and did not see stopped vehicle until too late. Rear-ended stopped vehicle.
14	Vehicle pulled out and struck southbound vehicle.
15	Vehicle pulled out and struck southbound vehicle. The report did state that the driver of vehicle did look before turning.
16	Vehicle was making a left turn. Second vehicles brakes failed and then they tried to pass left of the first vehicle.
17	Vehicle slid into intersection due to ice on road.
18	Vehicle hit ice, went through intersection and hit guide wire.
19	Vehicle went through intersection and hit guide wire and tree.
20	A vehicle was stopped to turn left. Second vehicle did not see the stopped vehicle and rear-ended it.
21	Vehicle hit ice and slid into intersection and hit southbound vehicle.

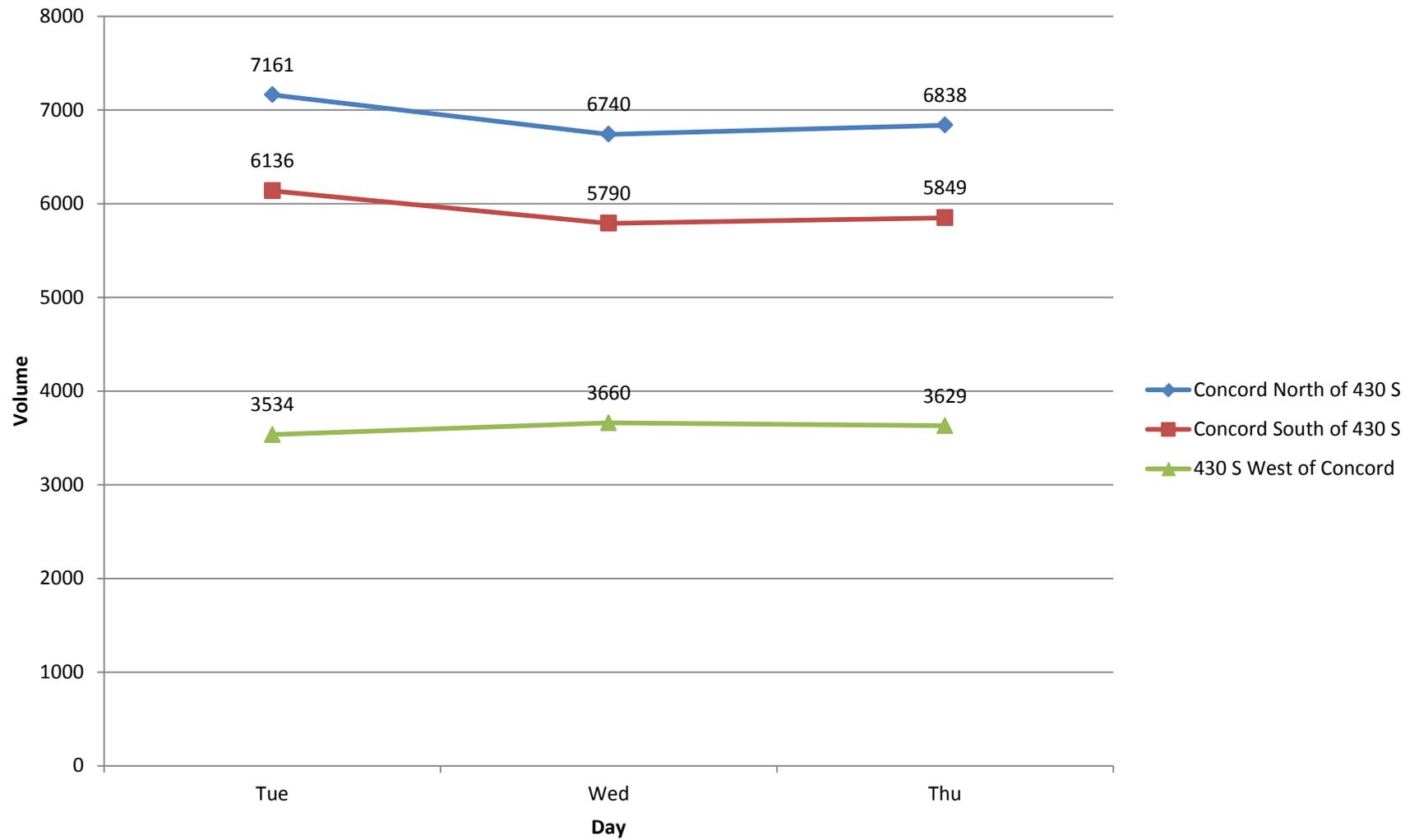
Traffic Counts



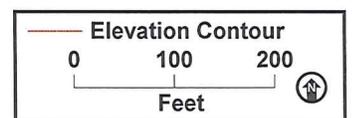
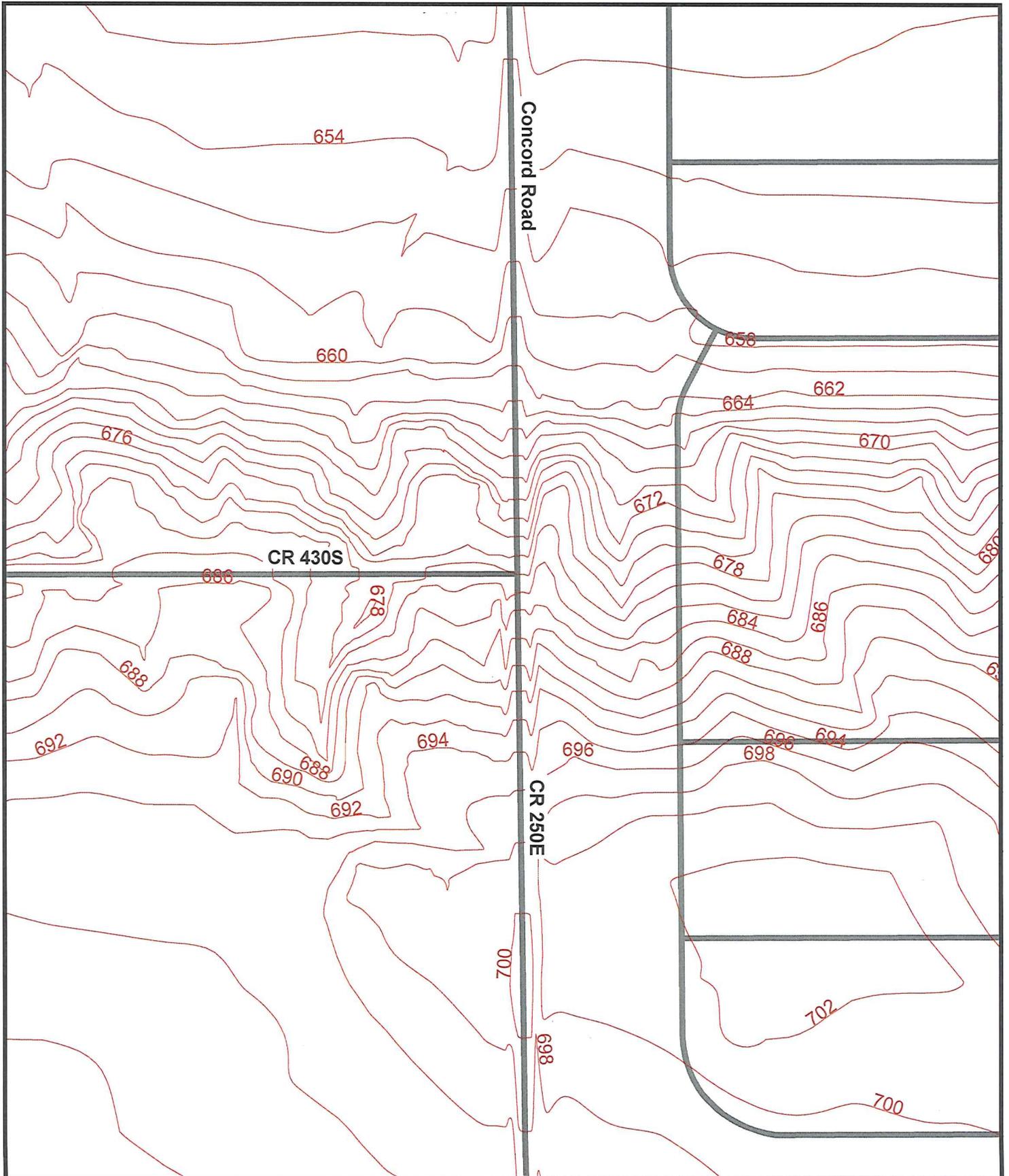
2013 Average Hourly Volume (Concord and 430 S)



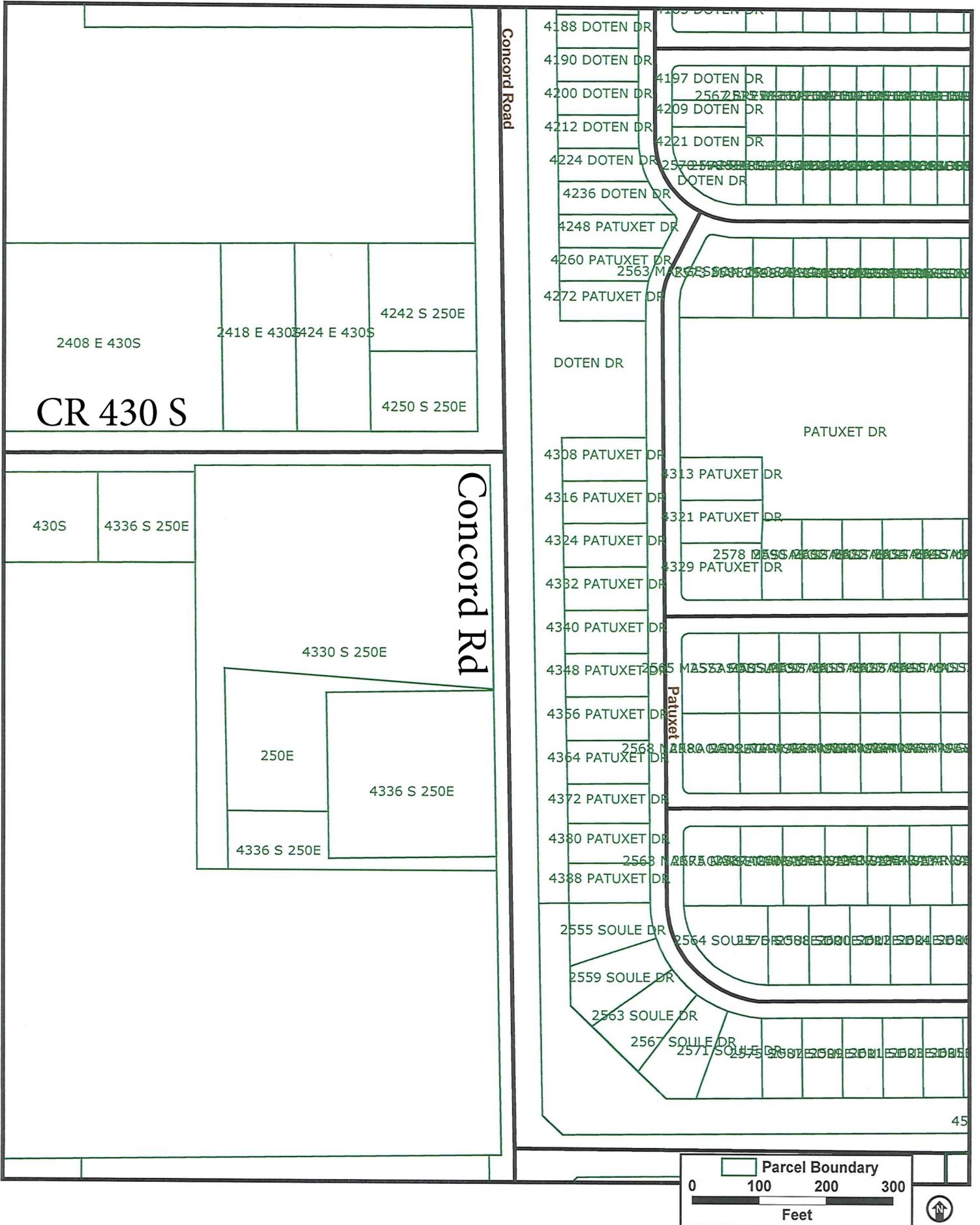
2013 Daily Counted Volumes (Concord and 430 S)



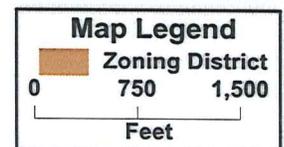
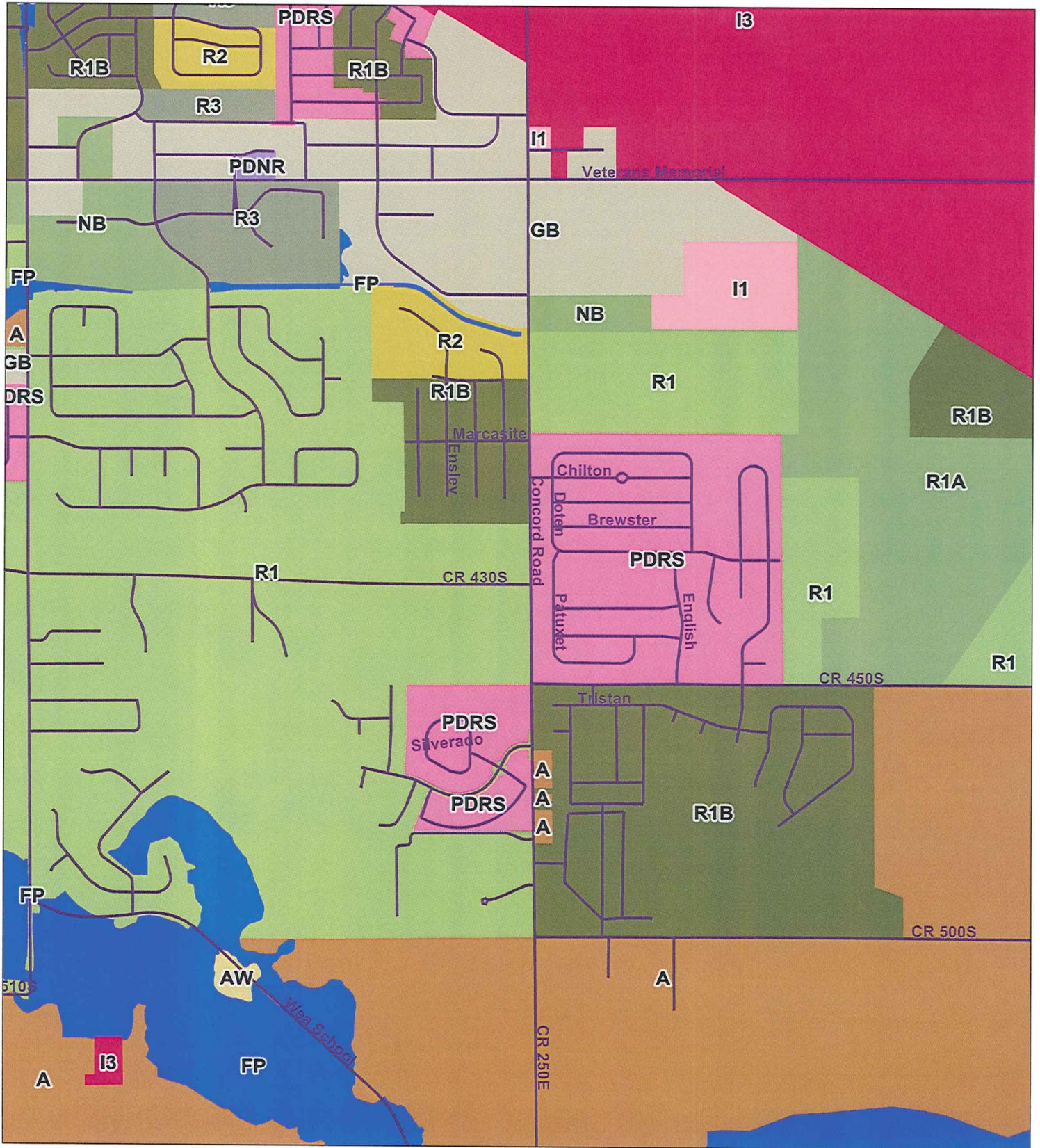
Topography



Property Boundaries



Zoning



Zoning District Definitions

A - Agriculture

AW – Agricultural Wooded

R1 – Residential, 10,000 sf minimum lot size

R2 –Residential, 7,500 sf minimum lot size

R3 –Residential, 5,000 sf minimum lot size

PDRS – Planned Development Residential

GB – General Business

NB – Neighborhood Business

I1 – Industrial, low impact, entirely indoors

I3 – Industrial, high impact, outdoor loading and storage of materials

FP – Flood Plain

Additional Pictures

On CR430S looking west



On CR 430S looking east at the intersection



On CR 430S at the intersection looking east



At the intersection looking south



At the intersection looking north up the hill



On CR250E looking south at the intersection



On CR250E looking south at the intersection



On CR250E looking south at the intersection



On CR250E looking north at the intersection



On CR250E looking north at the intersection



Old Headwall (southwest corner of intersection)



East side of the intersection



CR 250 E (Concord Rd) and CR 430 S

Road Safety Audit Check List

Light Conditions

- Inadequate visibility at night
- Severe headlight glare during night conditions
- Lights create glare on approach roadways
- Lighting interferes with traffic signs
- Inadequate lighting for signs

Yes	Maybe	No or N/A

Signs

- Inadequate visibility of signs
- Incorrect location, offset or height of signs
- Sign locations obstruct visibility
- Signs are missing, redundant, or don't meet specification
- Signs are not properly maintained
- Signs are contradictory
- Existing signs are not applicable
- Signs cannot be read from adequate safe distance
- Required warning or regulatory signs are not present

Sight Distance

- Inadequate sight distance
- Sight lines are obstructed by signs, building, vegetation, etc.
- Sight lines are obstructed temporarily (cars, snow, etc.)

Skid Resistance

- Some locations have inadequate skid resistance

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Pavement Defects

- Abrupt changes in pavement condition
- Pavement defects exist which could result in loss of control
- Pavement defects visible (potholes, rutting, etc.)
- Change in surface type
- Pavement has excessive drop offs or poor transitions
- Presence of loose aggregate in pavement
- Presence of bleeding pavement due to excessive asphalt

Drainage

- Presence of ponding or sheet flow on pavement
- Drainage inappropriate for topography
- Surface flooding or overflow from drainage structures or streams
- Unprotected culverts or other drainage structures
- Embankments or ditches are too steep

CR 250 E (Concord Rd) and CR 430 S

Road Safety Audit Check List

Barriers

- Clear zone is narrow
- Guardrail is damaged or inadequate

Yes	Maybe	No or N/A

Driver Behavior

- Overrepresentation of particular age group
- Many drivers violate the posted speed limit
- Skid marks
- Frequent off tracking
- Illegal parking

Initial Recommendations / Additional Comments:

Initial