OWASSO™

The City Without Limits.

TRANSPORTATION MASTER PLAN

prepared by

guernsey
ENGINEERS
ARCHITECTS
CONSULTANTS

ALLIANCE
TRANSPORTATION GROUP

KME, LLC
Traffic & Transportation

PROJECT OVERVIEW

A well planned and coordinated transportation system will enhance mobility and facilitate the movement of people and goods in a safe and efficient manner. The City of Owasso (City) has prepared a Transportation Master Plan (TMP) to identify current and further transportation needs and improvements within the City. The Owasso TMP will identify critical components of the transportation system including infrastructure and special generators. Improvements are prioritized according to the objectives of the study and the feasibility of project implementation. Public involvement is an important component of this study and includes coordination with other local and regional agencies including the City Planning Commission, Indian Nations Council of Government (INCOG) and Rogers County Commissioners.

STUDY AREA

The study area encompasses the City of Owasso, which includes an area of approximately 16 square miles. The City is located in northeastern Oklahoma, approximately five miles north of Tulsa. Major thoroughfares in the community include US Highway 169, which traverses the City in a north-south direction, and State Highway 20, which traverses the City in an east-west direction. The local network is made up of 67-lane miles of existing arterials, and 16-lane miles of collector streets. An exterior major thoroughfare impacting the City is US Highway 75, which runs north-south to the west of Owasso.

KEY ISSUES

One of the key issues of the plan is to ensure that the city has adequate facilities to accommodate not only existing but future traffic needs as well. Owasso continues to face pressures of increased growth and development which results in traffic and congestion problems. The majority of commercial growth in the community is occurring along US 169, while the majority of residential growth is occurring along the eastern and western areas within Owasso's fenceline. As part of the study process, future growth is projected and its impact on the transportation system is evaluated and used to help determine mobility needs in the area.

PROJECT PROCESS

The existing physical features and transportation system in the City are important inputs in developing the transportation plan and in making recommendations regarding future improvements. The Owasso 2030 Comprehensive Master Plan, environmental and development constraints, roadway network, functional classification, traffic control and operations, and other existing factors were considered in the development of the TMP.

Once the consultant team understood the existing conditions of the City, a travel demand model was developed to simulate existing traffic patterns and projected future travel demand. Major inputs for the travel demand model included demographic data, special generators, and internal and external networks. Once the model was calibrated and validated, the model results were used to evaluate the traffic impacts of build scenarios as compared to no-build scenarios. These scenarios were then evaluated to determine the future transportation needs of the City of Owasso.

The overall recommendations for the TMP are presented in **Figure A**. This plan includes roadway capacity, intersection and interchange improvements. These recommendations are based on future traffic volumes and level-of-service, municipal policies, community impact on land development, community goals and objectives, and many other inputs described in the TMP.

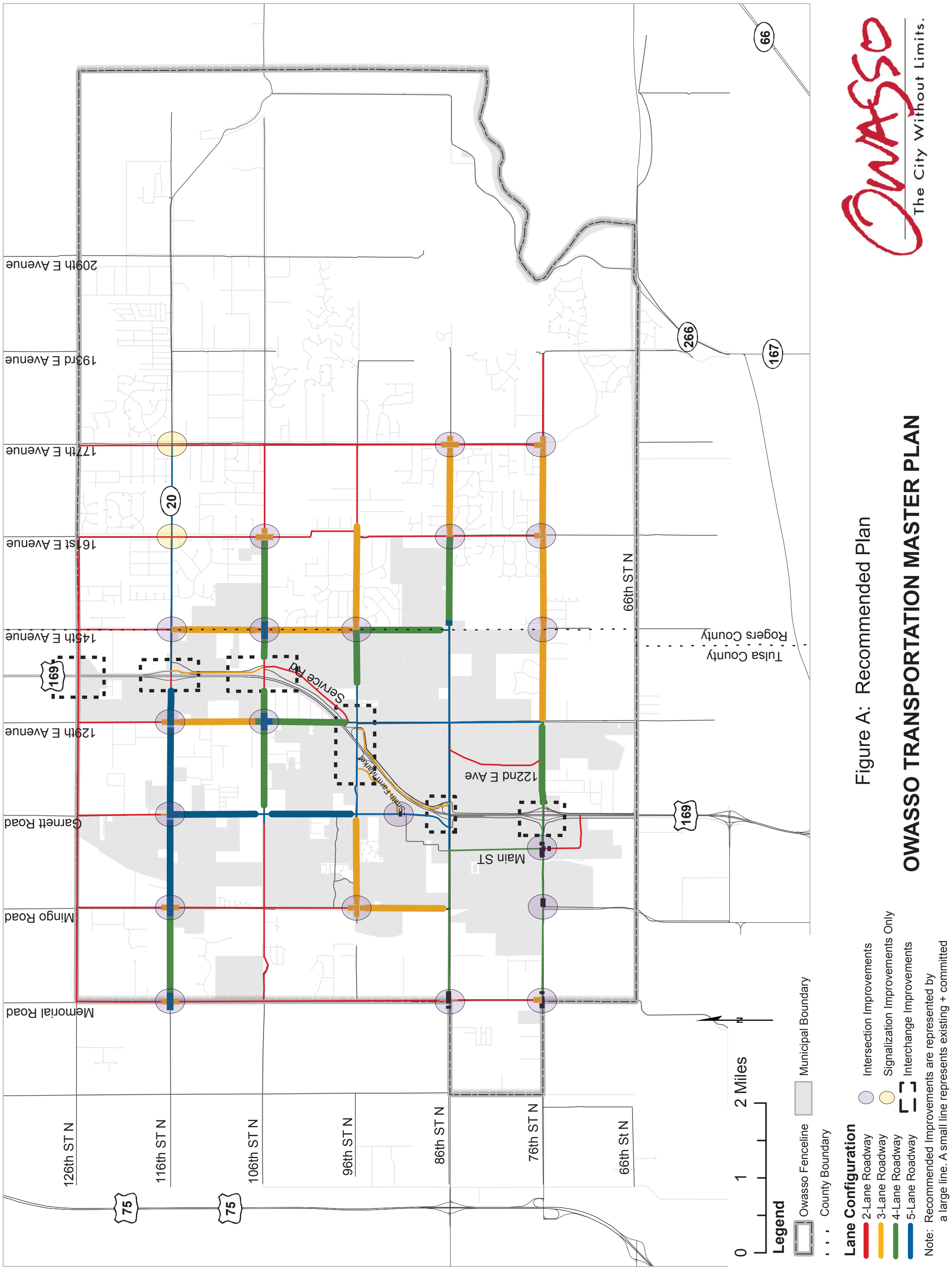


Figure A: Recommended Plan

OWASSO TRANSPORTATION MASTER PLAN

TABLE OF CONTENTS

1 INTRODUCTION

The transportation network is an important part of a community's basic infrastructure as it provides for the movement of people and goods through and within the community. The logical development of the transportation network and the choices of modes that it offers have a strong influence on a community's social, physical and economic development pattern. Therefore, a well coordinated and planned transportation system is instrumental in enhancing mobility, providing for economic development opportunities and increasing a community's quality of life.

With continued growth and development occurring throughout the community, the City of Owasso is experiencing increased congestion and other transportation and safety related Issues along area roadways. To address these issues and accommodate future growth, the City requires the preparation of a Transportation Master Plan (TMP) to identify current and future transportation needs and improvements within the community. The TMP will evaluate the existing transportation system and identify needed improvements to accommodate projected growth within the area.

1.1 STUDY PURPOSE

With an increasing level of development activity and no current City transportation plan, it has become evident that the City is in need of a study that encompasses all aspects of determining improvement needs for current and future transportation conditions. New development continues to be constructed along the existing infrastructure and development is expected to further continue in emerging growth areas around the City as identified in the Owasso 2030 Comprehensive Master Plan. Current development issues consist of the inability to provide public sanitary sewer system to areas within the fenceline, rapid growth, congestion, budget constraints and flood-prone areas.

The purpose of the TMP is to identify recommended transportation improvements needed to accommodate future travel demands. The plan will include an implementation program which will prioritize improvements according to short- and long-term objectives of the study and the feasibility of project implementation. The TMP ensures the preservation of future corridors for transportation system development, as the need arises, but does not recommend or prioritize the timing for future land use development. Potential roadway development includes the widening of some roadways, extensions of others, and construction of new facilities.

1.2 STUDY AREA

As shown in **Figure 1-1**, the study area encompasses the City, which includes an area of approximately 16 square miles. The City is located in northeastern Oklahoma, approximately five miles north of Tulsa. Major thoroughfares in the community include US Highway 169, which traverses the City in a north-south direction, and State Highway 20, which traverses the City in an east-west direction. The local network is made up of 67 lane miles of existing arterials, and 16 lane miles of collector streets. An exterior major thoroughfare impacting the City is US Highway 75, which runs north-south to the west of the City.

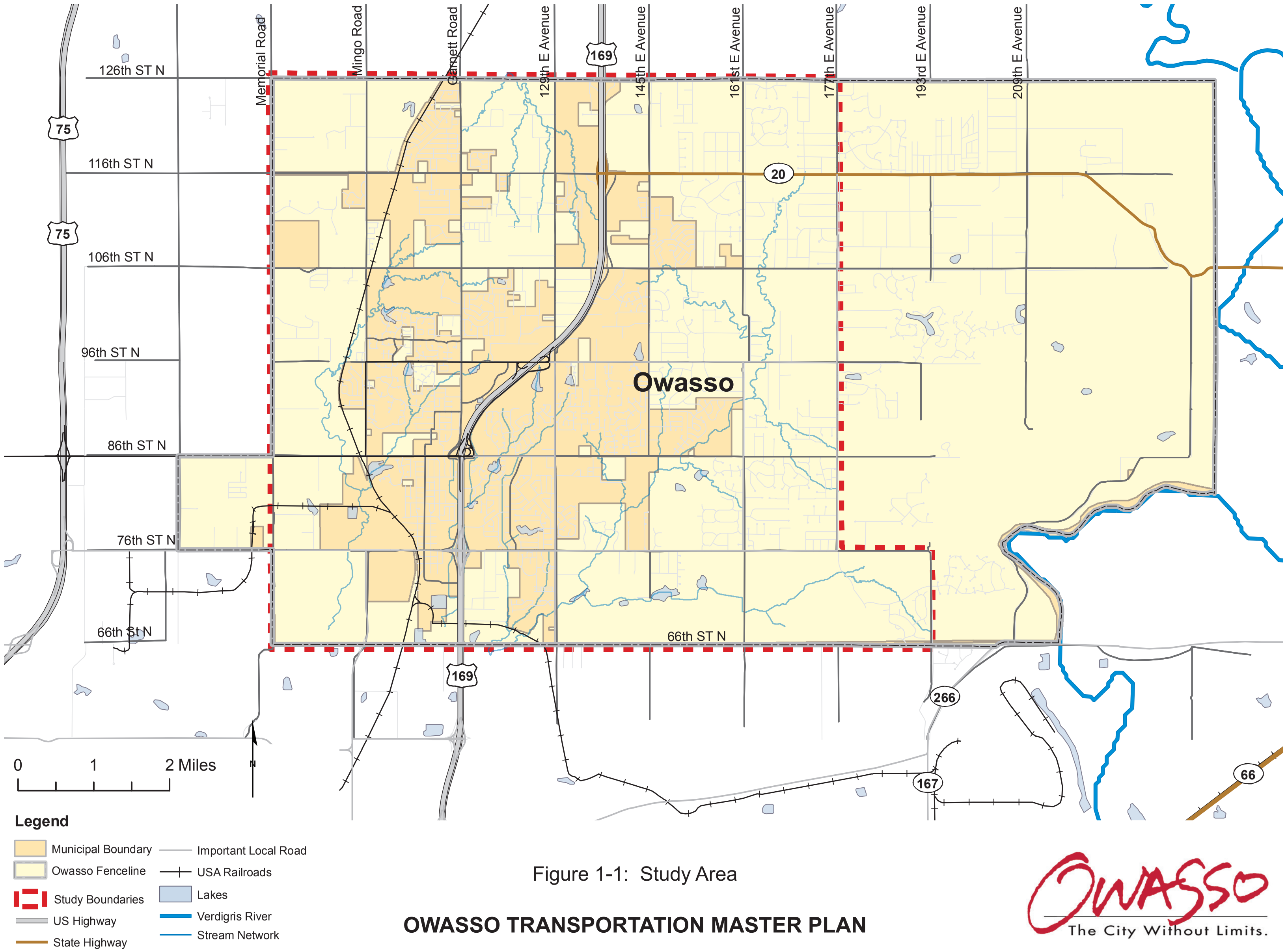


Figure 1-1: Study Area

OWASSO TRANSPORTATION MASTER PLAN

OWASSO
The City Without Limits.

1.3 GOALS AND OBJECTIVES

One of the initial tasks of this study was to establish a series of goals and objectives that would serve as a framework for developing and evaluating alternative transportation systems. Goals and objectives provide a long-term vision for a desired transportation system in the community and they set forth value judgments and direction to guide staff and local government officials in planning and implementing transportation improvements.

Goal:

- To provide an improved transportation system able to accommodate projected growth so that citizens have access to essential services

Objectives:

- Establish acceptable levels of service (LOS) for the various elements of the transportation system
- Analyze the current arterial and collector street system and identify current and future capacity enhancement needs to meet the acceptable levels of service
- Evaluate current and projected land uses using current City planning documents
- Determine projections based on current and future land uses and projected population growth
- Identify specific projects and the projected date/time frame when the projects would be completed including cost estimates

1.4 PURPOSE AND BENEFITS OF TRANSPORTATION PLANNING

Transportation planning is the process used by municipalities and other governmental entities to provide for the development of an efficient and appropriate transportation system to meet existing and future travel needs. The primary purpose is to ensure the orderly and progressive development of the urban and rural street system to serve the mobility and access needs of the public. Transportation planning is interrelated with other components of the urban planning and development process.

The TMP is a 5, 10, 15 and 20-year transportation planning document that provides a framework for addressing the area's transportation needs. The plan will serve as the City's guide for transportation system improvements, including the existing and planned extension of major roadways. The transportation system is comprised of existing and planned freeways/expressways, arterials, collectors and local streets, which could require wider or new rights-of-way for needed improvements and bicycle and pedestrian facilities. One objective of the TMP is to ensure the preservation of adequate right-of-way (ROW) on appropriate alignments and of sufficient width to allow the orderly and efficient expansion and improvement of the transportation system to serve existing and future transportation needs.

The benefits provided by effective transportation planning are realized by achieving the following objectives:

- Maximizing mobility while minimizing the negative impacts of street widening and construction on neighborhood areas and the overall community by recognizing where future improvements may be needed and incorporating thoroughfare needs
- Preservation of adequate rights-of-way for future long-range transportation improvements

- Making efficient use of available resources by designating and recognizing the major streets that will likely require improvements
- Minimizing the amount of land required for street and highway purposes
- Identifying the functional role that each street should be designed to serve in order to promote and maintain the stability of traffic and land use patterns
- Informing citizens of the streets that are intended to be developed as arterial and collector streets, so that private land use decisions can anticipate which streets will become major traffic facilities in the future
- Providing information on thoroughfare improvement needs, which can be used to determine priorities and schedules in the city's Capital Improvement Program (CIP)
- Providing an implementation program to prioritize improvements and identify funding sources

1.5 ELEMENTS OF THE TRANSPORTATION PLAN

The TMP delineates a system of thoroughfare classes, representing the location, alignment, and functional relationship for different types of roadways, including freeways, arterial streets, collectors and local streets. It consists of an officially adopted thoroughfare system map, along with supporting design criteria and implementation policies. Typically, thoroughfare system maps indicate the planned extensions of thoroughfares on new alignments where right-of-way needs to be acquired in the future. Development of the TMP involved careful consideration of the community's growth and traffic patterns, availability of right-of-way and impacts on surrounding land uses.

An implementation program was also developed, which prioritizes improvements for short-term and long-term projects. Order-of-magnitude construction costs were developed for the improvements and environmental impacts were evaluated.

1.6 RELATIONSHIP BETWEEN TRANSPORTATION AND LAND USE PLANNING

Coordinating land use and transportation decisions serves as an important role in improving mobility needs, promoting economic development, and enhancing quality of life. Recommended future roadway alignments, street cross sections, and the location and design of major intersections will influence future development patterns in a community and potentially benefit or adversely impact existing neighborhoods and developed areas. Transportation improvements require careful consideration of impacts to:

- Neighborhood quality and integrity
- Pedestrian and bicycle mobility and safety
- Community aesthetics
- Corridor quality
- Accessibility to shopping and entertainment districts

- Accessibility to major public facilities including linear park and trail opportunities coordinated with the roadway network

The basic aim of thoroughfare planning is to ensure the orderly and progressive development of roadways to serve mobility and access needs. But such planning is also critical to future land use, housing, environmental protection, public utilities management, and other key components of urban and regional planning. Roadway functional classifications, design, and access management strategies must all be directed toward the prospective development and associated development regulations for the area to be served. This ranges from high-capacity, controlled access facilities for longer distances to local streets, possibly with sidewalks, trails or bike-ways, accommodating limited vehicular traffic and encouraging safe, enjoyable short-distance trips close to home or work.

Land use impacts and growth patterns were carefully considered in the development of the TMP. The TMP along with other development tools, such as the City's 2030 Land Use Master Plan, will help the City effectively continue to coordinate land use and transportation decisions.

1.7 PUBLIC INVOLVEMENT

Public involvement is an important component of the TMP and included several activities to involve the general public, public agencies, and stakeholders throughout the plan development process. Public involvement activities focus on obtaining meaningful input from key stakeholders and users on transportation issues in the area.

Public outreach and involvement activities for the TMP included the following:

- **Questionnaires –** Questionnaires were distributed to the citizens of Owasso to solicit input and gather any available information on existing traffic conditions and future growth expectations and desires

- **Presentations to Advisory Committee** – Periodic meetings were held with the Advisory Committee at key milestones through the Plan development process. These meetings served as a forum to identify transportation issues and improvements, review elements of the Plan, and prioritize improvements

- **Public Meetings** – A public meeting was held on January 30, 2014 to introduce the TMP project and solicit input from the public on key issues and trends in the community. Approximately 14 people attended the meeting and comments were received regarding transportation issues throughout the City

2 EXISTING CONDITIONS

Understanding the existing physical features and transportation system in the City is an important step in developing the transportation plan and in making recommendations regarding future improvements. Existing environmental and physical features may impact transportation improvements while the existing street network and traffic patterns serve as the basis in identifying future transportation conditions and needs.

2.1 GENERAL FEATURES AND TOPOGRAPHY

The City is located in Rogers County and Tulsa County approximately five miles north of Tulsa, Oklahoma. The City has many unique features that create varying environmental settings throughout the City. The region is characterized by irregular plains with gently rolling topography and generally fertile soil. Scattered pools create habitat for aquatic fauna. Major surface water resources include Elm Creek, Ranch Creek, and the Verdigris River on or nearby the City's eastern fenceline.

2.2 LAND USE

Future development trends within a community are partially influenced by current land use patterns, development regulations and policy, and the Owasso 2030 Comprehensive Master Plan. A review of existing and proposed land uses within the City helped guide projected growth and directed transportation needs within the community.

Over the past decade, the City has grown 56 percent from a population of 18,502 in 2000 to 28,915 in 2010. The City currently serves over 30,000 residents. As shown in **Figure 2-1**, the majority of this growth has occurred in central and northern portions of the City's fenceline with singlefamily residential homes as the primary land use. Commercial development has occurred primarily along the US Highway 169 corridor. Large amounts of undeveloped agriculture land lie scattered throughout the City's fenceline, concentrating mostly on the outer southern and eastern boundaries.

The City will continue to experience growth and development over the next several decades. The majority of this development, both residential and commercial, is anticipated to occur in the northern and central city limits. However, based on the Potential Growth Corridors Map provided by the City, potential growth may also occur south of 86th Street North, stretching from west of 177th East Avenue to east of 93th East Avenue, and around the Memorial Drive and 86th Street North intersection. Future land use and potential growth corridors can be seen in **Figure 2-2**.

2.3 ENVIRONMENTAL AND DEVELOPMENT CONSTRAINTS

There are some environmental features that could create constraints to development or warrant additional study. There are floodplains associated with Ranch Creek, Elm Creek, Blackjack Creek, and the Verdigris River. **Figure 2-3** shows the location of the floodplains in the Owasso fenceline. The US Fish and Wildlife Service (USFWS) identified Tulsa and Roger Counties as providing favorable habitat for federally protected species, including the Interior Least Tern, Piping Plover, and American Burying Beetle. Planning or development activities in areas favorable to these species should be sensitive to the potential presence of the species. Historical sites are typical occurrences in urbanized areas; however, no documented historical sites exist in Owasso according to the National Historical Geographic Information System.

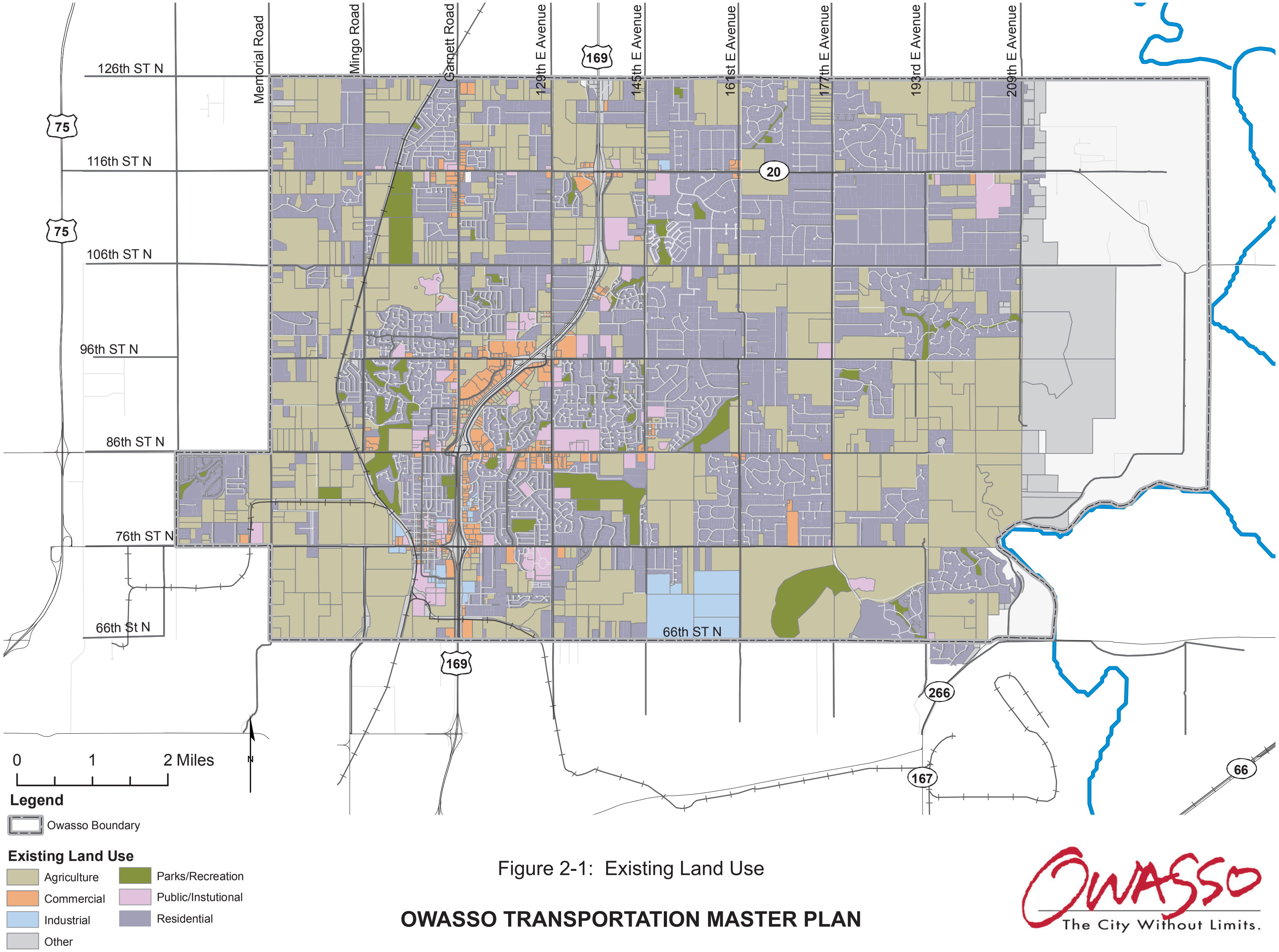


Figure 2-1: Existing Land Use

OWASSO TRANSPORTATION MASTER PLAN

OWASSO
The City Without Limits.

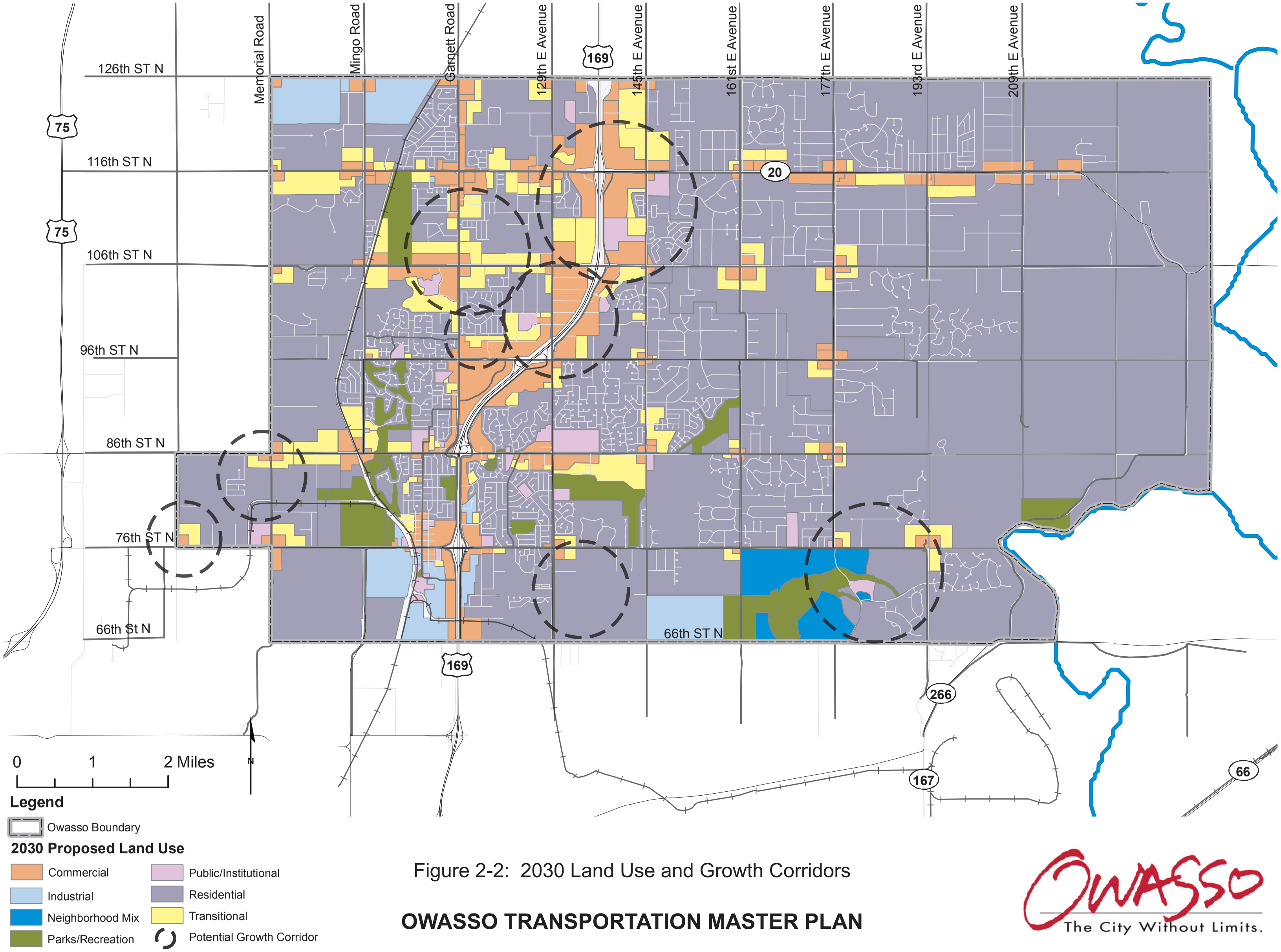


Figure 2-2: 2030 Land Use and Growth Corridors

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

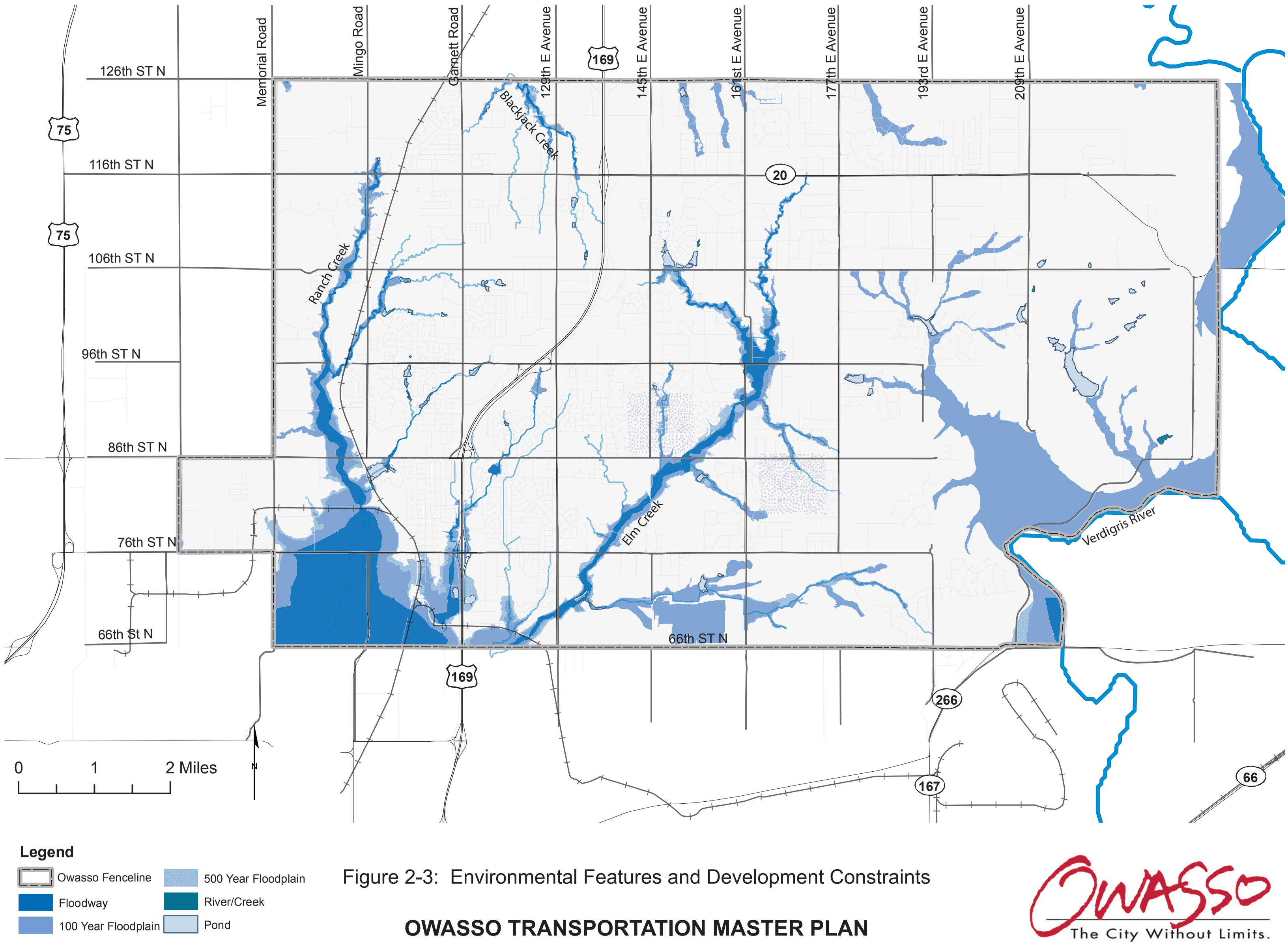


Figure 2-3: Environmental Features and Development Constraints

OWASSO TRANSPORTATION MASTER PLAN

2.4 ROADWAY NETWORK

The City is served by a network of roadways which includes one US highway, one state highway and an arterial grid system that serves as the basic transportation network in the City. There is another US highway just west of Owasso that impacts travel. The Oklahoma Department of Transportation (ODOT) maintains the state facilities. Within the study area, primary roadways range from four-lane highways to two-lane local streets. Existing travel lanes for the roadway network are shown in **Figure 2-5**.

2.4.1 US and State Highways

US Highway 169 serves the entire City aligning north-south through the center of town. US 169 is a four-lane arterial with posted speed limits between 65 to 70 mph and offers a direct route to Tulsa approximately five miles south of the City. US Highway 75 is approximately two miles west of the City's fenceline and serves as a north-south arterial to Tulsa. State Highway (SH)20 also serves the City and runs in an east-west direction on the northern boundaries of the city. SH 20 is a four-lane arterial that offers a direct route to US Highway 66 and Interstate 44, approximately 16 miles east of Owasso.

2.4.2 Arterials and Collector Streets

The road network for the City primarily consists of a grid system. The 67 lane miles of the arterial system connects 16 lane miles of collector streets within each grid to retail centers and special generators. Owasso's arterial roadways range from two-lane undivided paved streets to four-lane streets with turn lanes, right turn lanes, curbs and gutters. **Table 2-1** lists major arterials of the study area by direction of travel.

Table 2-1: Major Arterials

East-West	North-South
76th Street North	Garnett Road
86th Street North	129th East Avenue
116th Street North	

2.5 EXISTING FUNCTIONAL CLASSIFICATION

Functional classification of transportation facilities describes the hierarchical arrangement and interaction among various roadways. Classification is based on each roadway's functional role in the overall network, including traffic movement and access. These classifications may change over time, as the function of roadways changes to serve different land uses or other transportation facilities. As an area becomes more developed, roads that have previously been classified in one category may be reclassified to a higher category. **Figure 2-4** displays the relationships and hierarchy between traffic, volume, speed, and property access across the functional classifications. The current functional classification system for the City of Owasso is shown in **Figure 2-6** and is described by the following categories:

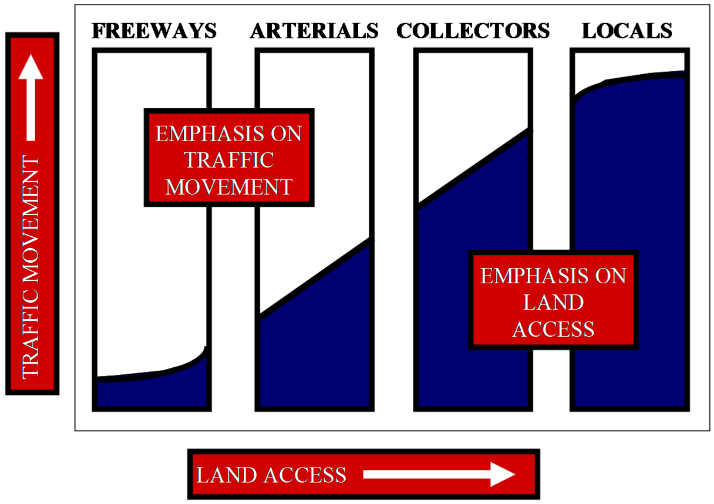


Figure 2-4: Functional Classification System Hierarchy

2.5.1 Arterials

Arterials primarily provide for traffic movement with a secondary function being the provision of direct access to abutting property. Major arterials typically serve as connections between major traffic generators and land use concentrations, and facilitate large volumes of through traffic traveling across the community. Minor arterials typically serve as connections between local/collector streets and major arterials, and facilitate the movement of large traffic volumes over shorter distances within the community. Because direct access to abutting property is a secondary function of arterial streets, access should be carefully managed to avoid adverse impacts on the movement function intended for these facilities.

2.5.2 Collector Streets

Collector streets provide for a balance of the traffic movement and property access functions. Traffic movement is often internal to local areas and connects residential neighborhoods, parks, churches, etc., with the arterial street system. As compared to arterial streets, collector streets accommodate smaller traffic volumes over shorter distances.

2.5.3 Local Streets

Local streets function to provide access to abutting property and to collect and distribute traffic between parcels of land and collector or arterial streets. The primary function of local streets is to provide access, so travel speeds and traffic volumes are low and travel distances on local streets are short.

2.6 TRAFFIC CONTROL

Facilitation of traffic flow on the roadway network is provided through the application of traffic control devices such as traffic signals, traffic signs, pavement markings, and maximum speed limits. Of these, traffic signals and speed limits have the greatest impact on traffic flow and roadway capacity. The City has approximately 29 lighted intersections within the City limits as shown in **Figure 2-7**. The existing speed limits are shown in **Figure 2-8**.

2.7 TRAFFIC VOLUMES

Figures 2-9 and 2-10 display existing daily traffic volumes along major roadways in the study area. These volumes were derived from counts provided by the City spanning the years 2007 to 2014. Count information prior to 2014 were subsequently replaced with newer traffic count data when available. As shown, existing daily traffic volumes along major roadway facilities within the study area range from 65,693 vehicles per day (vpd) on US 169, south of 76th Street North to 318 vpd along E 4th Street west of the US 169 Service Road. Traffic volumes along the most heavily traveled roadways in the City's study area are discussed below:

- **96th Street North** – Average daily traffic volumes along 96th Street North range from 29,528 vpd between US 169 and Garnett Road to 4,008 vpd at the intersection east of Mingo Road
- **86th Street North** – Average daily traffic volumes along 86th Street North range from 21,760 vpd east of US 169 to 9,558 vpd towards the western edge of the City
- **Garnett Road** – Traffic volumes range from 16,485 vpd north of 86th Street North, to 4,307 vpd north of 116th Street North

2.8 TRAFFIC ACCIDENTS

The City has collected accident data since 1998, including information about the number of collisions per location, the number of fatalities and injuries, and pedestrian involvement.

The data provided by the City was analyzed to discover the total accidents per year and injury accidents per year at intersections in the study area. The number of intersection accidents was also compared to the traffic volumes along Owasso's arterial and collector system to determine a collision rate, in number of collisions per million vehicles entering the intersection. **Table 2-2 and Figure 2-11** show the top 25 intersections per collision rate per million vehicles entering the intersections.

2.9 EXISTING TRAFFIC OPERATIONS

Existing traffic operations were evaluated by conducting a capacity/level-of-service analysis. Roadway capacity is defined as the maximum number of vehicles that can be accommodated on a roadway facility during a particular time period under prevailing roadway, traffic, and control conditions. An important result of a capacity analysis is the determination of Level-of-Service (LOS).

LOS is a qualitative measure of operating conditions at a location and is directly related to the volume-to-capacity ratio along roadways, as shown in **Table 2-3**. LOS is given a letter designation ranging from A to F (free flow to heavily congested), with LOS D considered in most urban areas as the limit of acceptable operation. For example, LOS can be related to the grading scale of a report card: A – Excellent, B – Good, C – Average, D – Acceptable, E – Needs improvement, and F – Failing. The level-of-service was determined for major roadways within the study area utilizing procedures identified in the 2000 Highway Capacity Manual and the available traffic data identified previously.

Figure 2-12 identifies existing LOS for project roadways within the City. As shown, the majority of roadways are operating at an LOS of A to D, meaning that traffic volumes are below capacity and the roadways are providing acceptable traffic operations. Roadways approaching with an LOS of E are located on North 106th Street between 145th East Avenue and 161st East Avenue, 5th East Avenue, North Ash Street, East 14th Street, and portions of North Birch Street.

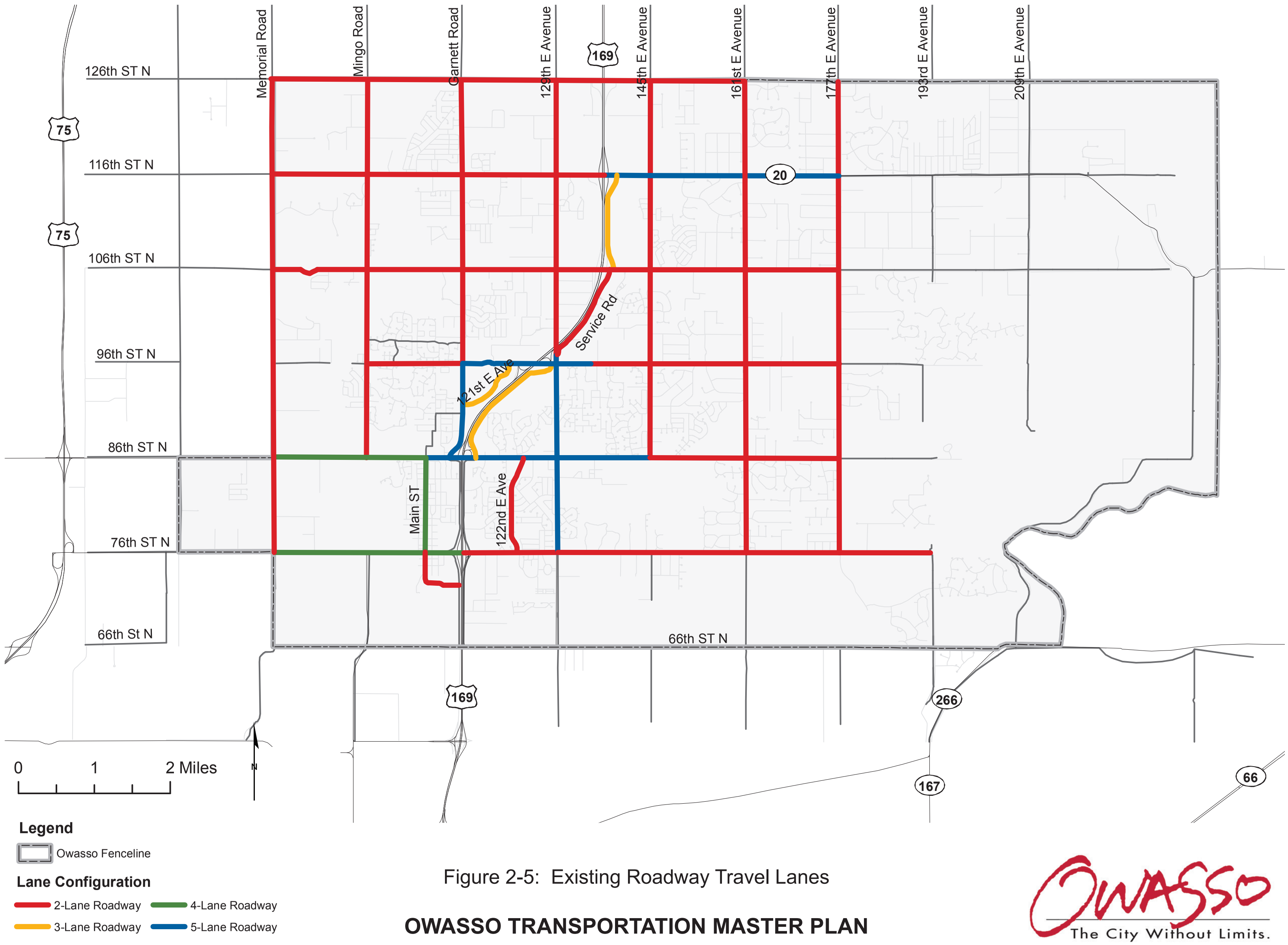


Figure 2-5: Existing Roadway Travel Lanes

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

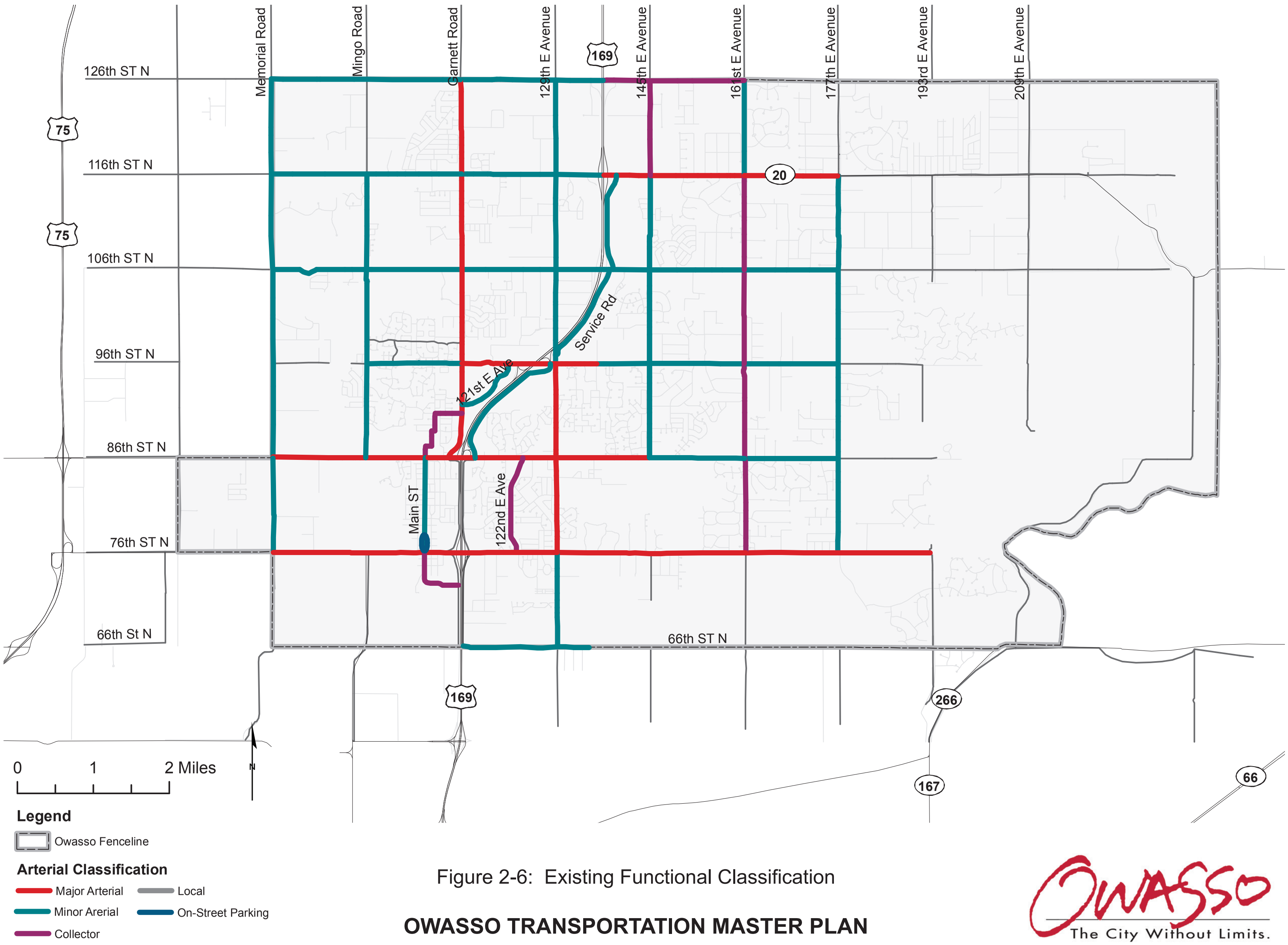


Figure 2-6: Existing Functional Classification

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

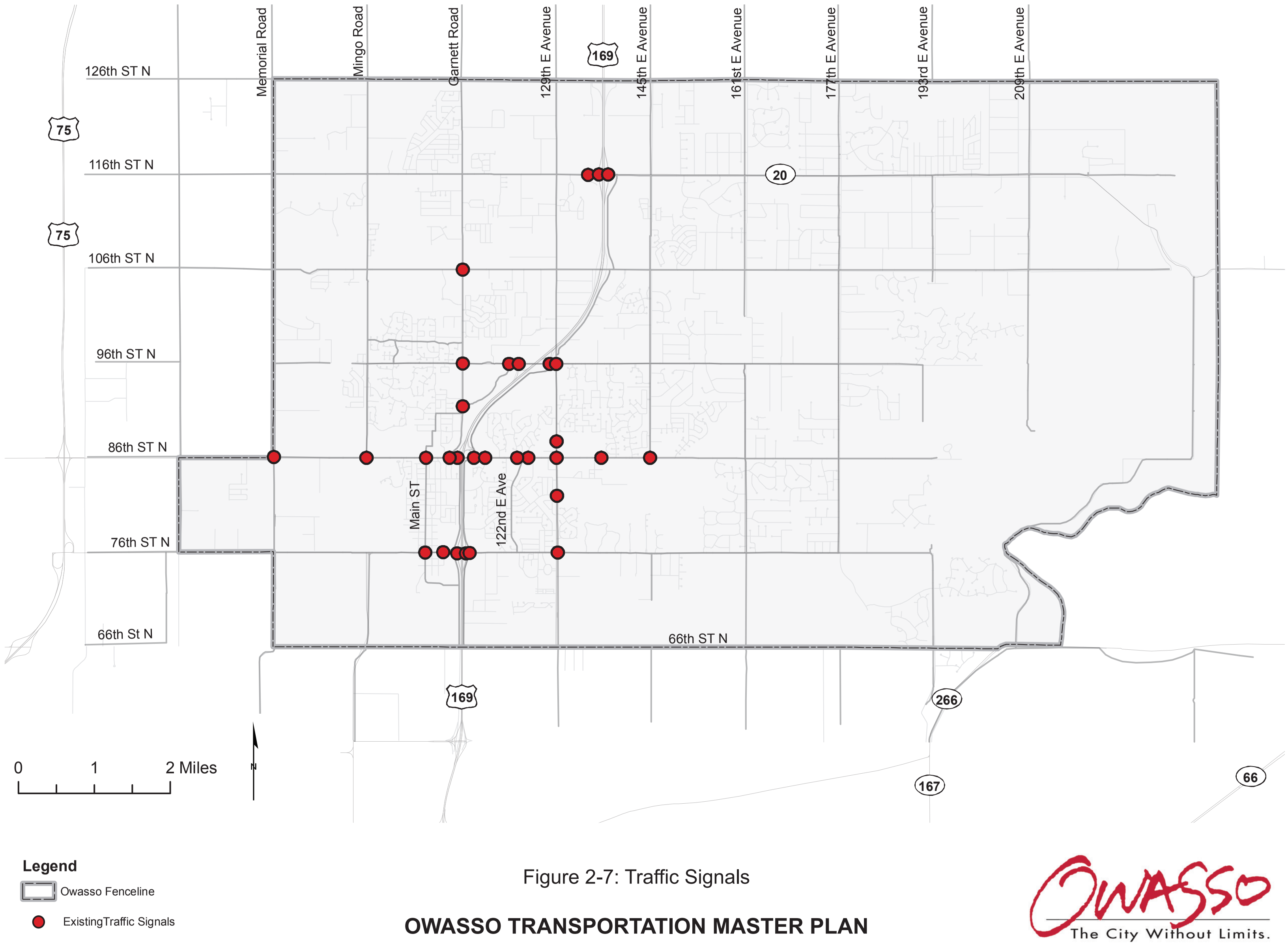


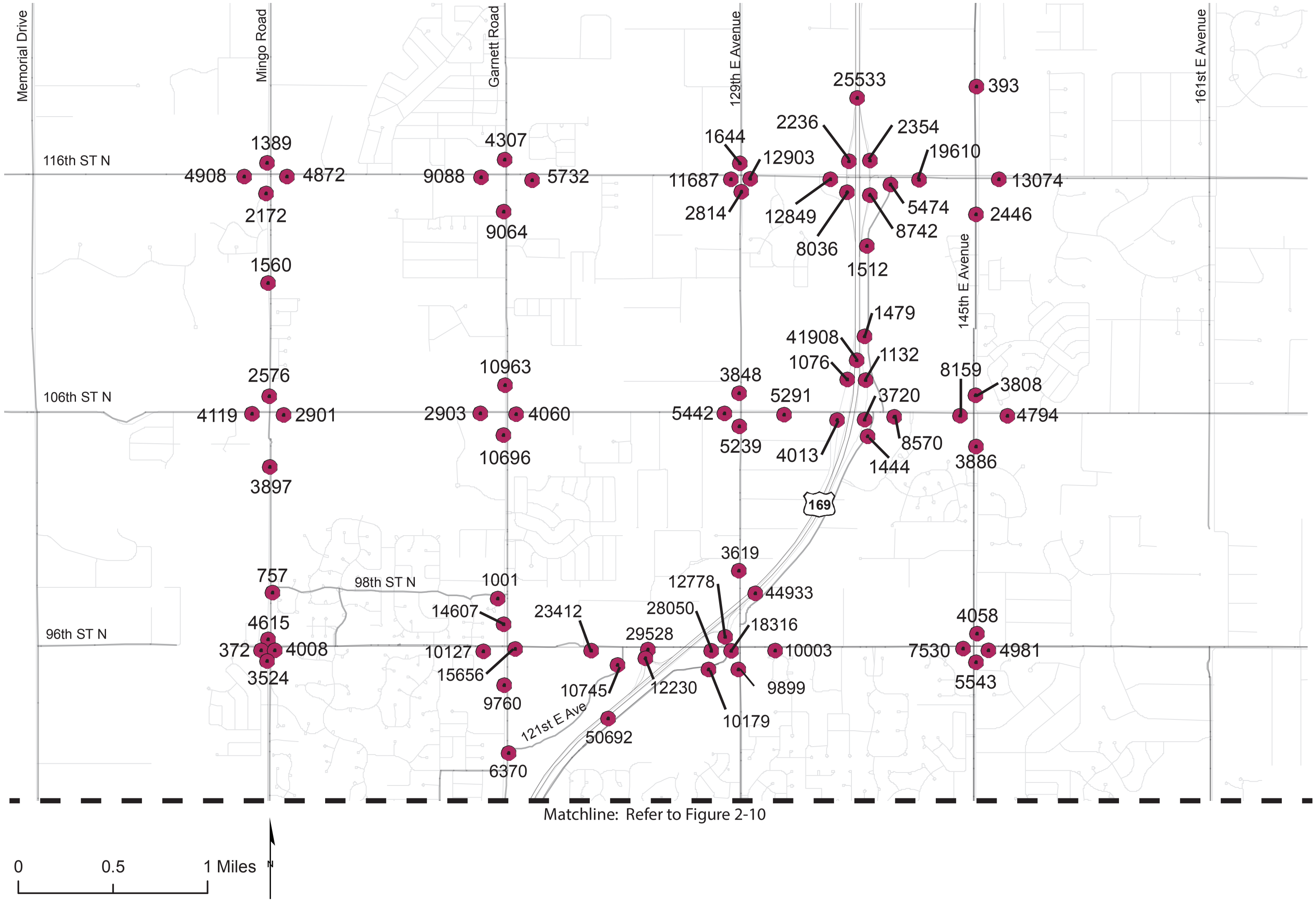
Figure 2-7: Traffic Signals

OWASSO TRANSPORTATION MASTER PLAN

Figure 2-8: Existing Roadway Speed Limit

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.



Legend
Owasso Fenceline
24-Hour Traffic Count

Figure 2-9: Existing Daily Traffic Volumes - North Area

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

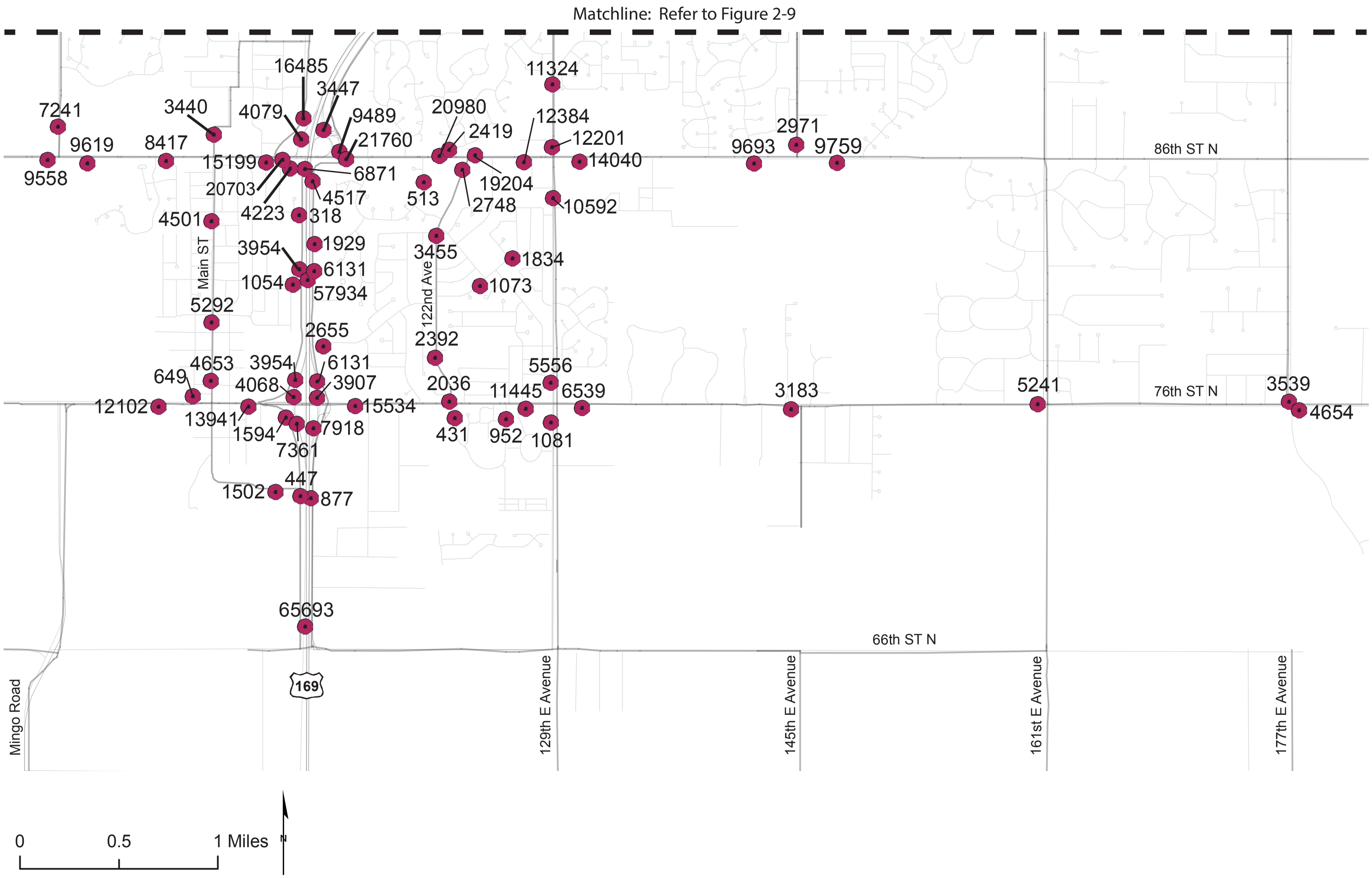


Figure 2-10: Existing Daily Traffic Volumes - South Area

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

Table 2-2: Top 25 Intersection by Number of Collision

Location	Number of Collisions	Fatality	Pedestrian Involved	Injury Accident	Date of Collection	Collisions/ Year	Injury/ Year	Collision Rate/One Million Vehicles Entering
Memorial Dr. and 106th St. N.	34	2	0	20	Since 2001	2.62	1.54	2.69
129th E. Ave. and 86th St. N.	286	0	1	70	Since 1998	17.88	4.38	1.67
Mingo (97th E. Ave.) and 116th St.	57	1	0	28	Since 2002	4.75	2.33	1.59
129th E. Ave. and 116th St. N.	82	0	0	41	Since 2002	6.83	3.42	1.59
129th E. Ave. and 96th St. N.	138	0	1	35	Since 1998	8.63	2.19	1.24
Garnett Rd. and 106th St. N.	89	1	0	26	Since 2001	6.85	2.00	1.22
Garnett Rd. and 86th St. N.	178	0	0	43	Since 1998	12.56	2.69	1.14
Garnett Rd. and 116th St. N.	83	0	2	27	Since 1998	5.19	1.69	1.01
123rd E. Ave. and 86th St. N.	119	0	2	46	Since 1998	7.44	2.88	0.92
Garnett Rd. and 96th St. N.	126	0	1	31	Since 1998	7.88	1.94	0.82
Mingo (97th E. Ave.) and 106th St.	7	0	0	4	Since 2009	1.40	0.80	0.74
Main St. and 86th St. N.	64	0	0	18	Since 2000	4.57	1.29	0.65
121st E. Ave. and 96th St. N.	107	0	0	24	Since 2002	8.92	2.00	0.55
Mingo (97th E. Ave.) and 86th St.	47	0	0	11	Since 1999	3.13	0.73	0.53
Mingo (97th E. Ave.) and 76th St. N. (2nd Ave.)	13	1	1	18	Since 1999	2.87	1.20	0.49
129th E. Ave. and 76th St. N. (2nd Ave.)	31	0	0	11	Since 2000	2.21	2.21	0.49
Mingo (97th E. Ave.) and 96th St.	19	0	0	6	Since 1998	1.19	0.38	0.48
129th E. Ave. and 106th St. N.	12	0	0	3	Since 2006	1.50	0.38	0.44
145th E. Ave. and 106th St. N.	14	0	0	3	Since 2005	1.56	0.33	0.44
US 169 E. Frontage Rd. and 86th St. N.	77	0	0	19	Since 1998	4.81	1.19	0.42
122nd E. Ave. and 76th St. N. (2nd Ave.)	24	0	0	7	Since 1998	1.50	0.44	0.34
US 169 E. Frontage Rd. and 66th St. N.	1	0	0	0	Since 2009	0.20	0.00	0.33
US 169 E. Frontage Rd. and 76th St. N. (2nd Ave.)	41	0	0	8	Since 1999	2.73	0.53	0.33
145th E. Ave. and 96th St. N.	13	0	0	0	Since 2004	1.30	0.00	0.32
145th E. Ave. and 86th St. N.	21	0	1	9	Since 1999	1.40	0.60	0.30

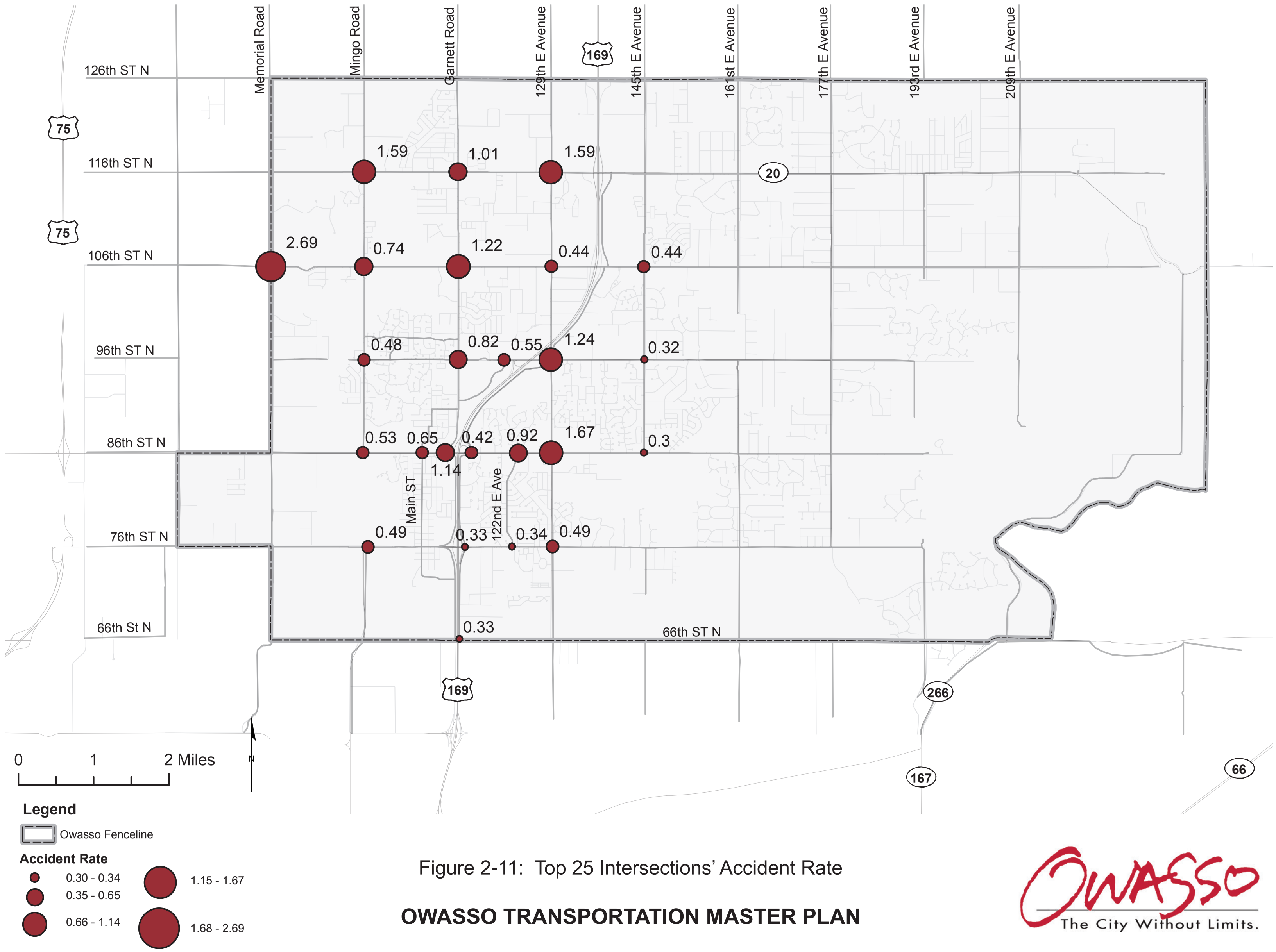


Figure 2-11: Top 25 Intersections' Accident Rate

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

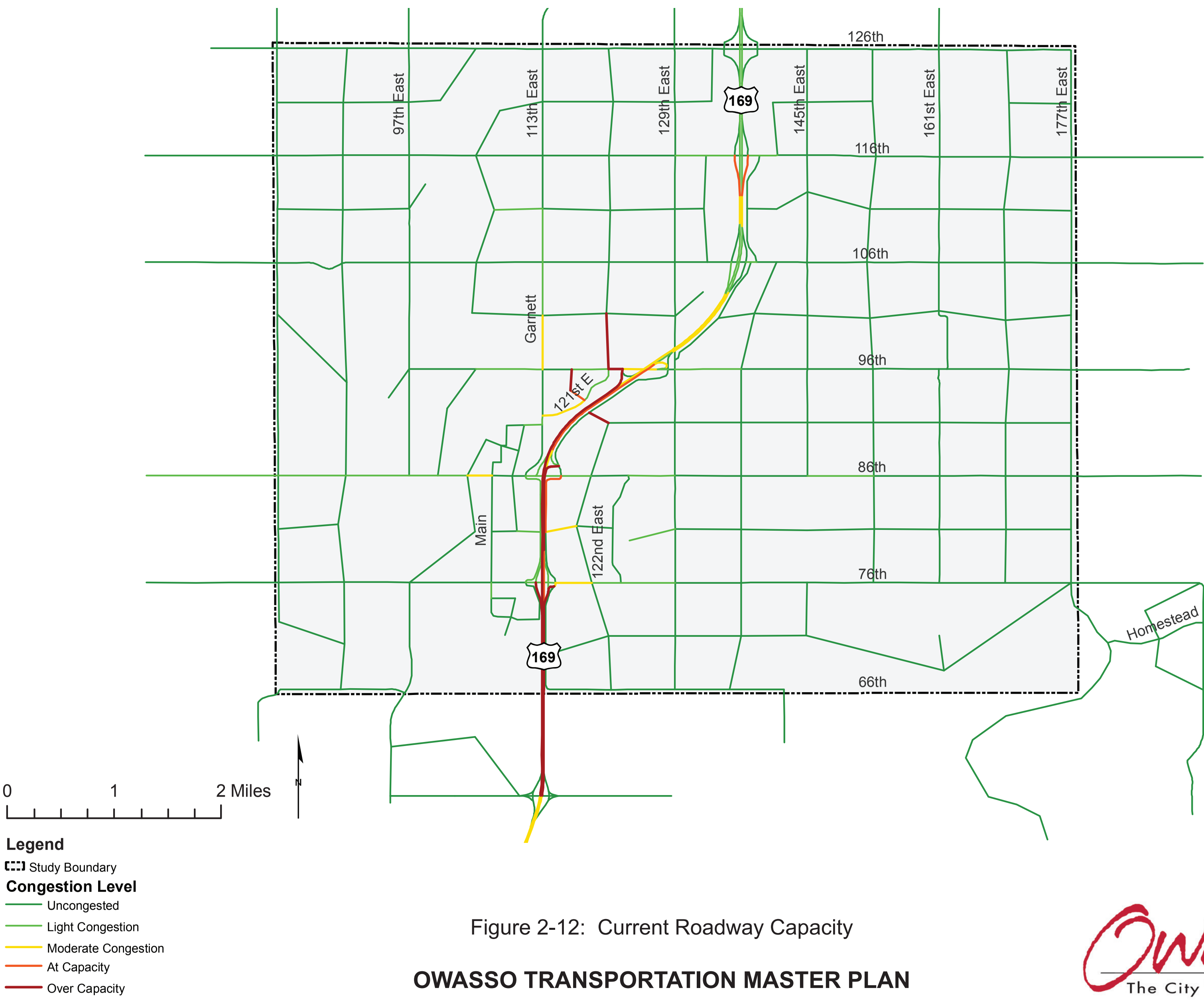


Figure 2-12: Current Roadway Capacity

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

Table 2-3: Level-of-Service Definitions for Principal Roadways

Level-of-Service (LOS)	Maximum Volume-to-Capacity Ratio (v/c)			Description
	Two-Lane Roadways	Multi-Lane Arterials	Freeways	
A	0.10	0.35	0.35	Very low vehicle delays, traffic signal progression extremely favorable, free flow, most vehicles arrive during given signal phase.
B	0.25	0.50	0.50	Good signal progression, more vehicles stop and experience higher delays than for LOS A.
C	0.40	0.65	0.70	Stable flow, fair signal progression, significant number of vehicles stop at signals.
D	0.60	0.80	0.85	Congestion noticeable, longer delays and unfavorable signal progression, many vehicles stop at signals.
E	1.00	1.00	1.00	Limit of acceptable delay, unstable flow, poor signal progression, traffic near roadway capacity, frequent cycle failures
F	>1.00	>1.00	>1.00	Unacceptable delay, extremely unstable flow, and congestion, traffic exceeds roadway capacity, stop-n-go conditions.

Source: Adapted from Highway Capacity Manual, Transportation Research Board, 2000

The LOS currently provided in Owasso is comparably set higher than other similar communities in Oklahoma. The citizens of Owasso are accustomed to these standards and are taken into consideration in the Transportation Master Plan.

2.10 EXISTING RAILROAD FACILITIES

The City has one railroad track that begins in the southwest part of the City in-between Mingo Road and US Highway 169 and runs in a northern direction until exiting the City near Garnett Road. Two tracks come off the main track and go in a west-east direction before turning south out of the City. Two of the tracks are property of South Kansas & Oklahoma Railroad. The Port of Catoosa Railway connects to the north-south track north of 66th Street North.

2.11 SPECIAL GENERATORS

Tulsa Technology Center (TTC) and Tulsa Community College recently completed a 160,000 SF facility, which opened for classes in August 2013. The Wal-Mart Corporation is constructing a new Sam's Club on 96th Street North, east of U.S. Hwy 169, which will generate a large volume of traffic. Five out-parcels in front of the new Sam's Club will add to the traffic volume along the 96th Street North and US-169 corridor. The Owasso Medical Campus located north of the Super Wal-Mart facility, when fully developed, along with a new 105-bed senior housing center and new 280-unit apartment project could potentially create a critical situation for the City in the 96th St. N. and US-169 corridor.

2.12 OWASSO PUBLIC SCHOOLS

Currently, the Owasso School District has the following number of schools and enrollment by school type:

- Eight elementary schools (Pre-K through grade 5) with 4,071 students
- Three middle schools (grade 6 though grade 8) with 2,132 students
- One middle high school (grade 9 through grade 10) with 1,376 students
- One high school (grade 11 through grade 12) with 1,262 students. An arterial, North 129th East Avenue, runs through the middle high school campus separating the two buildings
- Two alternatives to the traditional school setting are available at Rejoice Christian School Inc. (Pre-K through grade 12) and Portroad Christian Academy (grade 1 through grade 11).

2.13 BICYCLE AND PEDESTRIAN INFRASTRUCTURE

Bicycle and pedestrian facilities are important components of the City's transportation system. They service as alternative modes of travel and provide for recreational opportunities for local residents. Bicycle and pedestrian planning should be highly coordinated with thoroughfare planning to ensure bicycle and pedestrian routes are safe and efficient and serve the varying needs of the community. The City should utilize opportunities to improve bicycle facilities in areas that are developing or redeveloping, or where roadway improvements are occurring. Future opportunities for bicycle and pedestrian improvements should therefore be planned for in conjunction with the recommended thoroughfare improvements in the Plan.

The *Owasso Quality of Life* Initiative envisions a trail network with local and regional linkages. Section Four: Owasso Quality of Life Enhancement recommends long- and short-term goals for bicycle and pedestrian improvements. In this initiative, it was recommended to coordinate trail development with the Indian Nations Council of Governments' (INCOG) regional trail system, create a new trail head, and establish a complete local bicycle and pedestrian system. **Figure 2-13** identifies current and proposed trails in the City.

The Owasso map for the Tulsa Regional Bicycle and Pedestrian Master Plan, otherwise commonly known as the GO Plan, is found in **Appendix B.**

2.14 OWASSO COMPLETE STREET POLICY

The City of Owasso adopted a Complete Street Resolution in March 2015. This policy is a guideline for future roadway development to include the consideration of all modes of transportation; pedestrian, bicycle, motorize vehicle and transit. The resolution is found in **Appendix B**.

2.15 TRANSIT SERVICES

The City receives rural transit service from Pelivan Transit. This service is a demand response curb-to-curb service within six counties of Craig, Delaware, Mayes, northern Tulsa, Ottawa, and Rogers. Pelivan Transit is owned and operated by Grand Gateway Economic Development Association. In conjunction with the rural public transportation service, Pelivan Transit also provides tribal transit services for 10 tribes; Cherokee Nation, Eastern Shawnee, Miami, Modoc, Ottawa, Peoria, Quapaw, Seneca-Cayuga, Shawnee and Wyandotte. Pelivan Transit offers 25 routes with 28 vans which provide employment transportation and intercity connections.

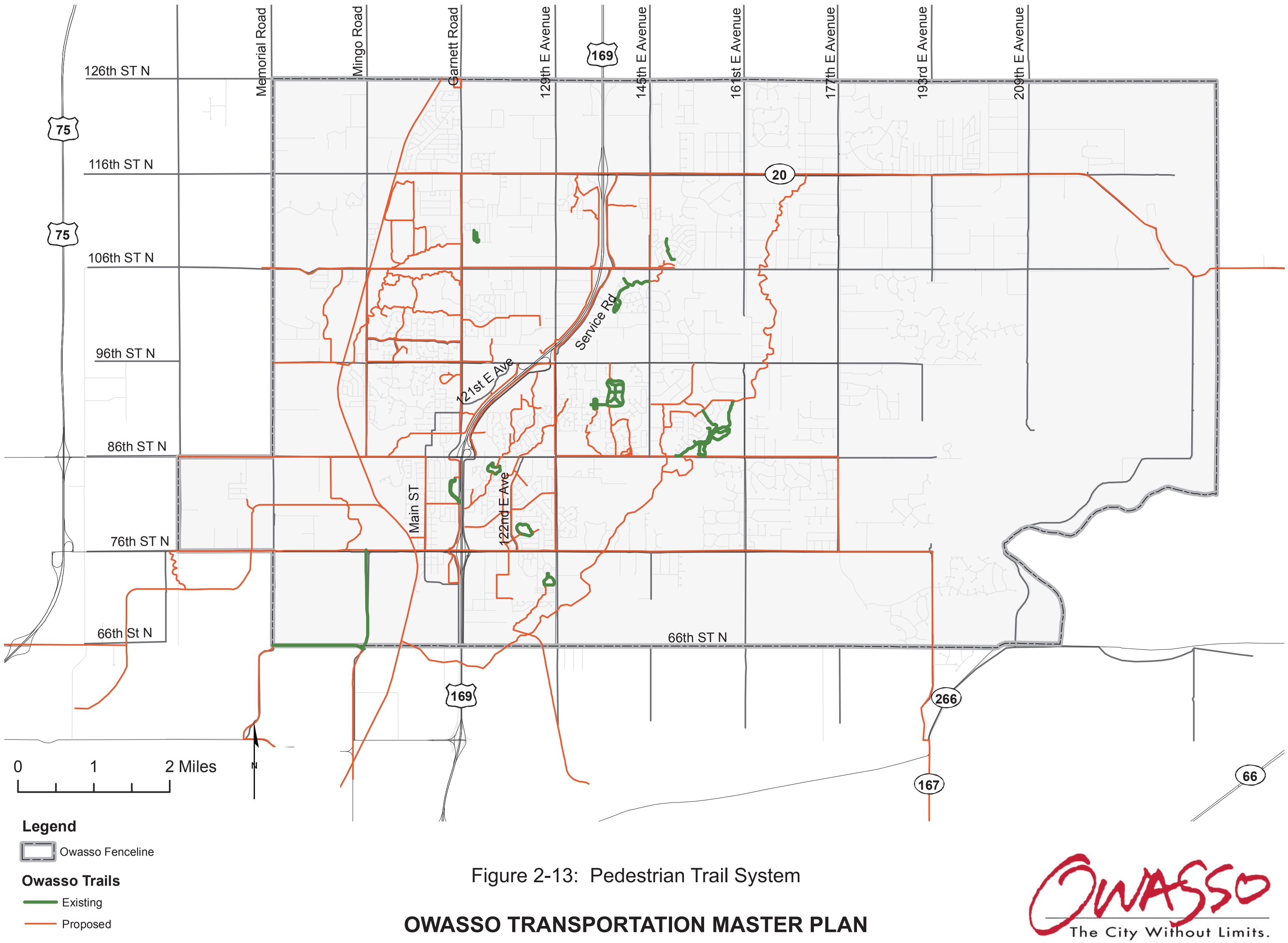


Figure 2-13: Pedestrian Trail System

OWASSO TRANSPORTATION MASTER PLAN

3 DEMOGRAPHICS AND TRAVEL DEMAND MODEL

As part of the TMP, a travel demand model was developed to simulate existing traffic patterns and projected future travel demand. One of the major inputs for the travel demand model included existing and projected demographic data, which was used to generate vehicle trips on the roadway network. This chapter describes the development and calibration of the transportation model and the development of the socioeconomic forecasts which serve as the basis for determining future transportation demands in Owasso.

3.1 DEMOGRAPHIC DATA

The purpose of this section is to review existing and future demographic characteristics that were used as inputs to the area travel demand computer model. Demographic variables discussed in this section include population and employment. Analysis of these variables and development of forecasts assisted in evaluating and identifying future transportation needs in Owasso. The transportation networks and travel demand model developed for this study are discussed in further detail later in this chapter.

3.1.1 Methodology

This Chapter addresses existing and future conditions that are closely associated with travel demand and trip generation characteristics of the Owasso area. Demographic estimates were prepared for the base year 2010 and forecasts were prepared for 2035. Base year estimates and forecasts were developed for the Owasso area at the Traffic Analysis Zone (TAZ) level. Traffic Analysis Zones (TAZs) define geographic areas (similar to Census block groups) which are used to relate travel demand to socioeconomic characteristics.

INCOG prepares and maintains the Regional Transportation Plan (Tulsa Transportation Management Area - TMA) for the Tulsa Metropolitan Statistical Area (MSA), which includes the City. As part of the TMA plan, demographic forecasts at the TAZ level were developed. These TAZ boundaries and associated forecasts served as the basis for the TMP. However, because of INCOG's transportation plan forecasts travel demand at a more regional scale, for the purposes of the TMP, INCOG's TAZ boundaries and associated forecasted demographics were adjusted to allow for a more focused evaluation of local conditions. Demographic variables examined with each TAZ include:

- Population
- Households
- Total Employment
- Retail Employment
- Basic Employment
- Other Employment

3.1.2 Base Year Data

An initial step in developing 2035 estimates for population involved analyzing INCOG's 2010 population and employment data for the 49 TAZs in the Owasso area. This was accomplished utilizing a Geographic Information System (GIS) to collect 2010 US Census Bureau block level data to the TAZ level. **Figures 3-1** and **Figures 3-2** display 2010 total population and employment by TAZ for the Owasso area.

3.2 SPECIAL GENERATORS

Special generators are major employers, institutions and attractants which create unique travel patterns. Post-secondary schools have peak travel times other than the typical rush hours. Regional shopping malls also have heavy traffic during mid-day rather than from 7:00 to 9:00 a.m. and 4:00 to 6:00 p.m. Local parks and entertainment centers also create unique traffic patterns and peak times. Additionally, hospitals work around the clock creating heavier-than-usual traffic in the off-hours. The primary special generator identified for the City are the retail shopping centers along North 121st East Avenue and East 96th Street North.

3.2.1 Forecast

Initially, INCOG's 2035 population and employment forecasts were used as control totals for the Owasso area. To analyze local conditions in the Owasso area, INCOG's allocation of growth was reviewed and revised as necessary to account for recent and planned developments and current trends within the community. Upon review of the data, it was found that INCOG's regional forecasts allocated the majority of the population growth to be centrally located within Owasso's current municipal boundaries along Highway 169. Even though growth is occurring in this area, developers are focused primarily on commercial and retail development along Highway 169 and adjacent areas. Input from committee leaders and developers indicated that development of residential additions, such as Park Place at the Preston Lakes and Stone Canyon, will shift population growth further east and west within the Owasso fenceline. The adjusted total for 2035 population and population growth from 2010 to 2035 for each TAZ is displayed in **Figure 3-3** and **Figure 3-4**. The total 2035 employment growth was not altered significantly from INCOG's forecasted employment areas of growth, which were focused along Highway 169. However, according to the projected 2030 land use and growth corridors recently provided by the City, concentrations of commercial and transitional development will extend employment growth further north of the Owasso fenceline along Highway 169. The adjusted total for 2035 employment and employment growth from 2010 to 2035 for each TAZ is displayed in **Figure 3-5** and **Figure 3-6**.

3.2.2 Development Of Growth Scenario

In order to accurately project the future population growth for the study area, census tracts for the Owasso area where extracted from the United States Census Bureau decennial data. Due to the size of the census tracts, population growth outside of the Owasso fenceline was included in the population totals. An examination of historical aerial photos determined that population growth outside of the Owasso fenceline would not skew the growth numbers. As the population grew in the Owasso area, the census tracts were divided into smaller tracts. **Table 3-1** shows the population for each 10-year interval, percentage of growth per year for each 10-year period and census tract divisions.

Table 3-1: Owasso Area Population 1980 to 2010

1980		1990		2000		2010	
Tract	**Population**	**Tract**	**Population**	**Tract**	**Population**	**Tract**	**Population**
58.02	5,245	58.04	4,714	58.04	7,015	58.08	2,521
						58.07	12,083
		58.03	5,463	58.05	7,265	58.05	6,925
				58.06	3,356	58.06	5,194
58.01	4,511	58.01	4,044	58.01	4,079	58.01	4,098
*504	5,474	504.01	7,710	504.06	2,128	504.06	2,263
				504.04	3,232	504.04	5,805
				504.03	2,961	504.03	5,193
				504.05	2,256	504.05	3,676
Totals	**15,230**		**21,931**		**32,292**		**47,758**
	Population Change	1980 to 1990 +6,611 +371% per year		1990 to 2000 +10,361 +3.95%per year		2000 to 2010 +15,466 +3.99% per year	

* Estimate. Population estimate is based on the area north of Hwy 266 in order to align with the census tract 504.01

When projecting the future population growth, it is beneficial to compare the historical growth of Owasso to peer cities that have already experienced similar growth patterns. The two cities that have experienced similar growth patterns and have also maintained a constant city limit boundary over the analysis period were Edmond and Norman. The growth percentages are shown in **Table 3-2** below.

Table 3-2: Cities with Similar Growth Patterns Comparison

Edmond, OK Population Comparison 1960 to 2010						
	1960	**1970**	**1980**	**1990**	**2000**	**2010**
Total Population	8,577	16,663	34,637	52,315	68,315	81,405
Population Change	1960 to 1970 +8,086 +6.87% per year	1970 to 1980 +17,974 +7.59% per year	1980 to 1990 +17,678 +4.21% per year	1990 to 2000 +16,000 +2.70% per year	2000 to 2010 +13,090 +1.77% per year	

Table 3-2: Cities with Similar Growth Patterns Comparison (Cont)

Norman, OK Population Comparison 1960 to 2010						
	1960	1970	1980	1990	2000	2010
Total Population	33,412	52,117	68,020	80,071	95,694	110,925
Population Change	1960 to 1970 +18,705 +4.55% per year	1970 to 1980 +15,903 +2.70% per year	1980 to 1990 +12,051 +1.64% per year	1990 to 2000 +15,623 +1.80% per year	2000 to 2010 +15,231 +1.49% per year	

Owasso's 2010 population of 47,758 is comparable to Edmond's population of 52,315 in 1990 and Norman's population of 52,117 in 1970. In the decade prior for each of the comparable cities, growth was approximately 4.35% per year. Owasso's growth since 1990 has been approximately 4% per year. The population change of the comparable cities averaged approximately 15,000 for each 10-year period once reaching 50,000. The result of the constant population growth of approximately 15,000 per 10-years resulted in a decline in the growth rate. **Figure 3-7** compares the developed residential area within the Owasso fenceline to the undeveloped area that is projected to be residential use based on the 2030 Land Use Plan. Residential development within the fenceline should start to slow based on the limited amount of undeveloped land available and the constraints that may be associated with the undeveloped land.

3.2.3 Forecast Year Data

A summary of forecast year data is presented in **Table 3-3**. Refined socioeconomic data estimates for 2035 captured recent and anticipated development with the Owasso study area. The development of 2015 and 2025 milestone year estimates were prepared for use in the travel demand model.

Table 3-3: Overview of Demographic Model Inputs

	2010	2015	2025	2035
Population	39,378	43,883	51,374	57,451
Households	14,446	16,111	18,884	21,126
Total Employment	13,254	16,890	22,933	27,831
Retail Employment	5,226	6,794	9,397	11,494
Basic Employment	1,447	1,772	2,312	2,803
Other Employment	6,581	8,324	11,224	13,534

3.3 TRAVEL DEMAND MODEL DEVELOPMENT

In identifying appropriate and effective transportation improvements for the Owasso area, a series of alternative scenarios, comprised of varying transportation projects, were developed in order to evaluate their impacts on travel demand in the area. Projects identified in the scenarios included roadway capacity improvements and intersection improvements. The Owasso Travel Demand Model played an important role in evaluating the alternatives and was used to develop future travel demand forecasts based on projected land use and development patterns in the area. In addition to traffic service, factors such as maximum utilization of the existing transportation system, community acceptance, impact on land development, and conformance with growth policies and community goals and objectives were considered in developing and evaluating transportation plan alternatives.

For this study, a qualitative review of the INCOG travel demand model (TDM) was used as the basis for updating the network for the City of Owasso. Although the model performed well in the aggregate for the purposes of regional systems planning, it revealed several challenges to scaling the regional model components to a more detailed sub-area for use in the TMP development. Therefore, a traditional four-step travel demand model was designed by using components of the INCOG TDM, including the network, link attributes, and TAZ structure, along with TransCAD default parameters to develop a stand-alone sub-area model for the TMP study area.

Based on professional experience with small area models, an Origin-Destination Matrix Estimation (ODME) procedure was used. The ODME procedure is a "step" between distribution and assignment to enhance model performance by using a delta vector to derive a final base year trip table from the original trip table in order to better represent the traffic pattern. This delta vector is obtained from the base year validation process by applying the TransCAD functionality, which assigned traffic to the network by tightly matching the model to the observed data - traffic counts, and ultimately resulted in a validated and trustful tool for use in the analysis of future year traffic forecasts and build scenarios.

This report outlines the methodologies used in the development of the sub-area travel demand model for the City, including the set up of the traditional four-step travel demand modeling process, the ODME procedure, and subsequent model validation. The report also includes a section that details the model usage for the testing of the alternatives, as well as a conclusion detailing the model run results for the milestone and horizon year scenarios.

3.3.1 Model Networks

The model network used in this study is a geographical depiction of the regional roadway system. A travel demand model compares demand for travel to the supply of the roadway system within a defined study area. Travel demand is derived from population and employment, while the supply side of the equation is the roadway system on which travel occurs. Similar to socioeconomic and demographic data previously described, network attributes describe the characteristics of the roadway system.

The two basic building blocks of a travel demand model are the transportation system networks and the TAZs.

- The networks represent the multi-modal transportation system, and account for different categories of roads (such as freeways, arterials, collectors, ramps, etc.), along with their respective information on facility speed, capacity, travel time from zone to zone, and user cost expressed as tolls or operating cost

- The TAZs are geographical areas that link land uses with the transportation system. The data describing socioeconomic and demographic characteristics of the TAZs are tied to the transportation system using zonal centroids and their associated centroid connectors. The network and zonal densities (granularity) of these two elements should be relatively consistent in order to produce realistic loading of traffic onto the transportation system

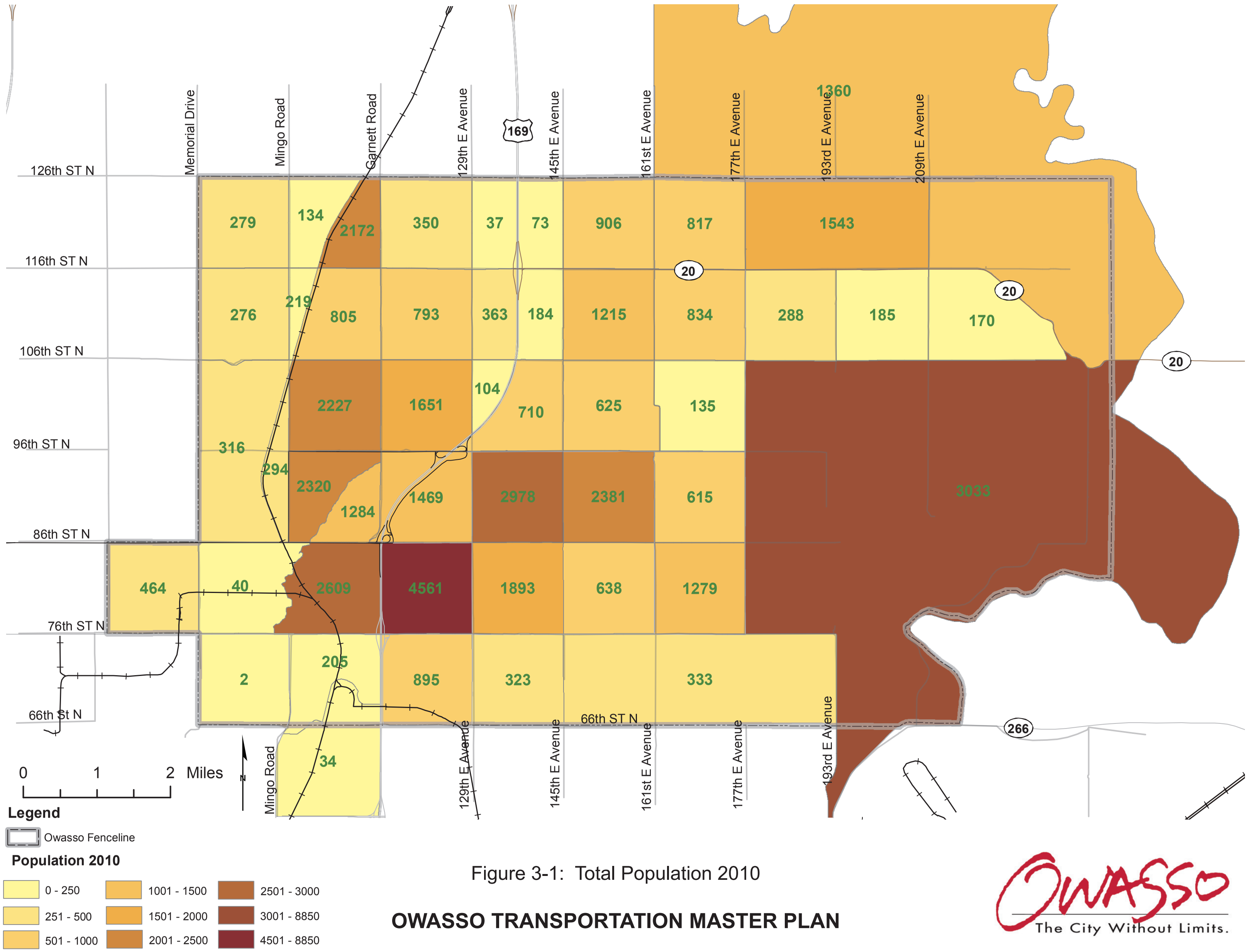


Figure 3-1: Total Population 2010

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

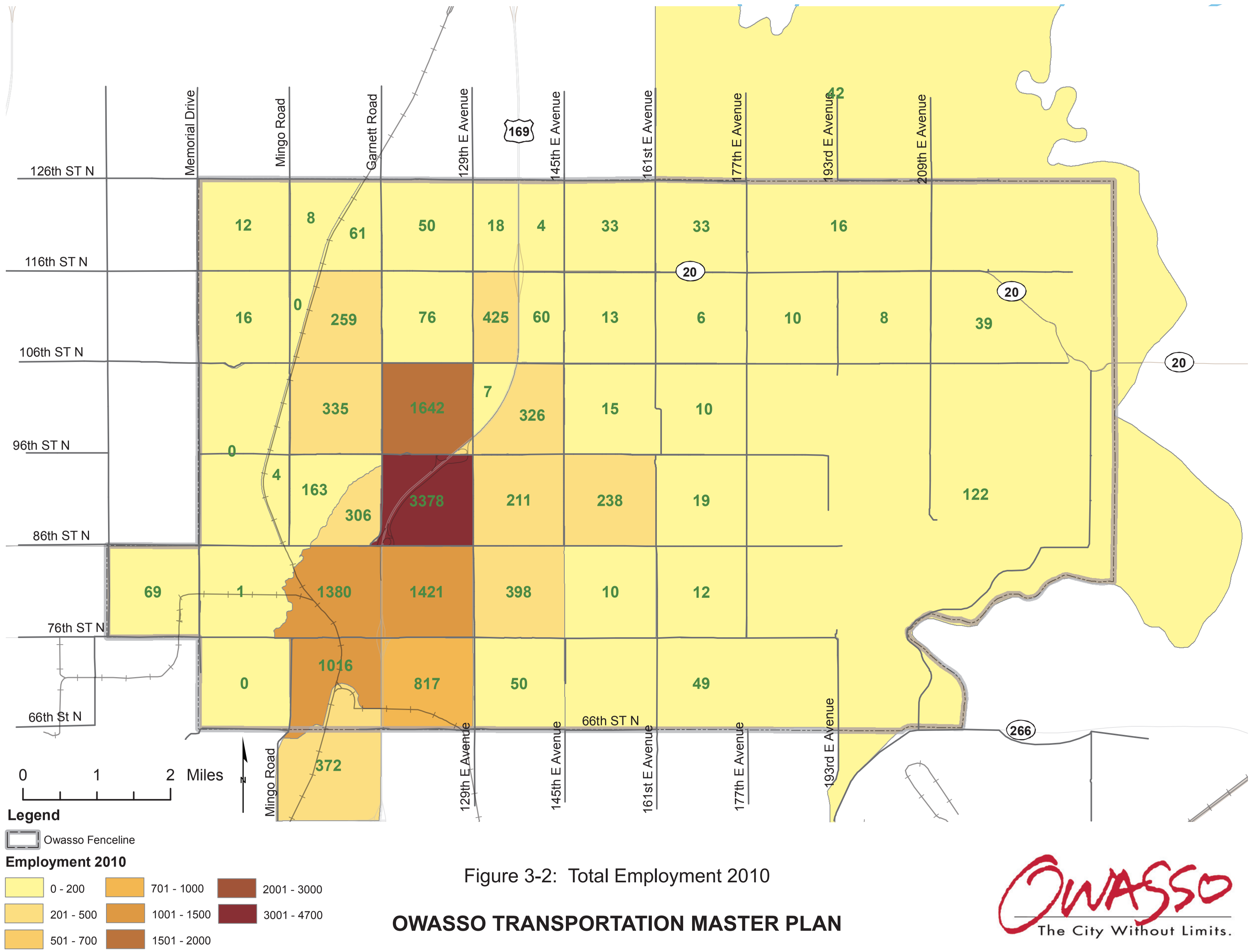


Figure 3-2: Total Employment 2010

OWASSO TRANSPORTATION MASTER PLAN

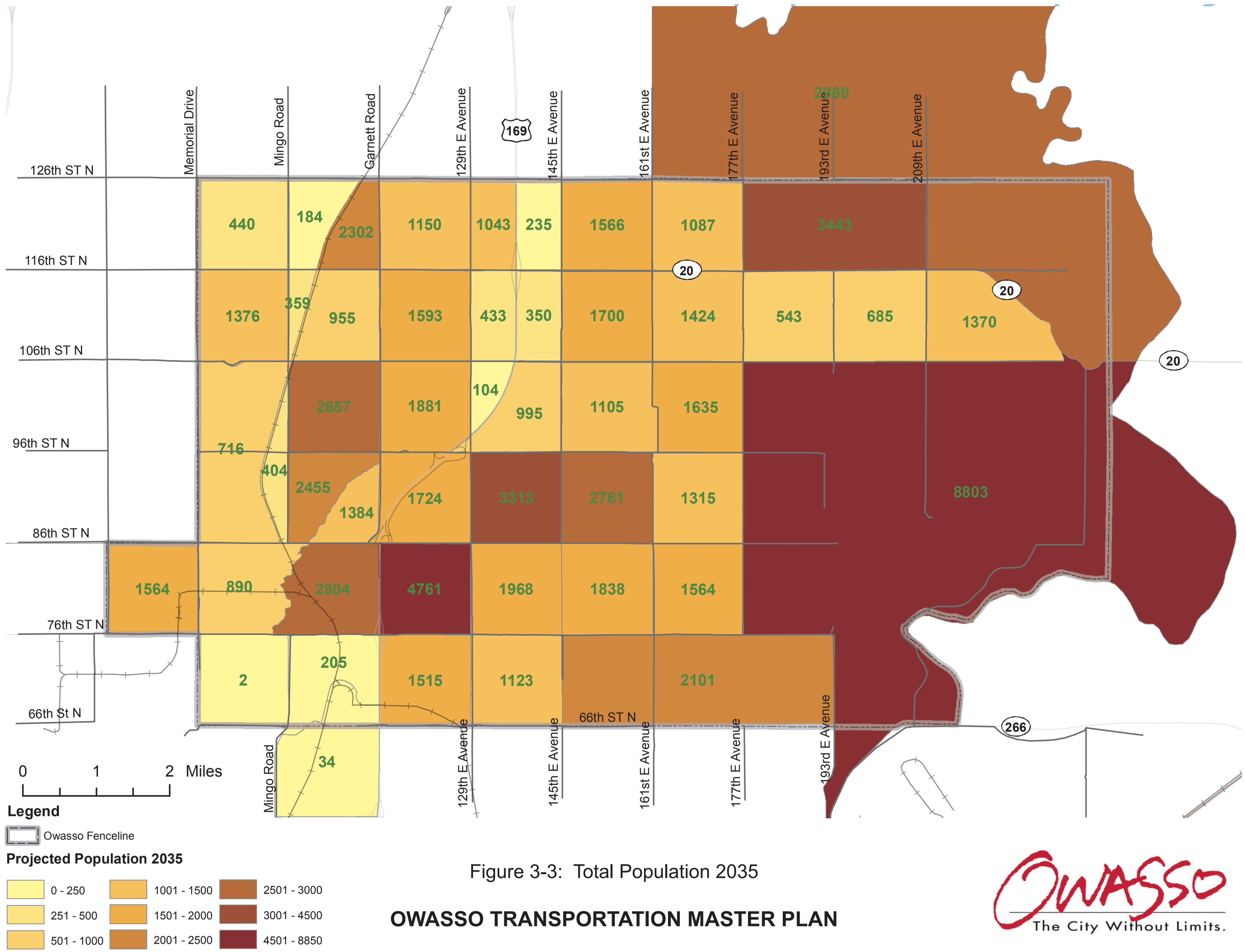


Figure 3-3: Total Population 2035

OWASSO TRANSPORTATION MASTER PLAN

Owasso
The City Without Limits.

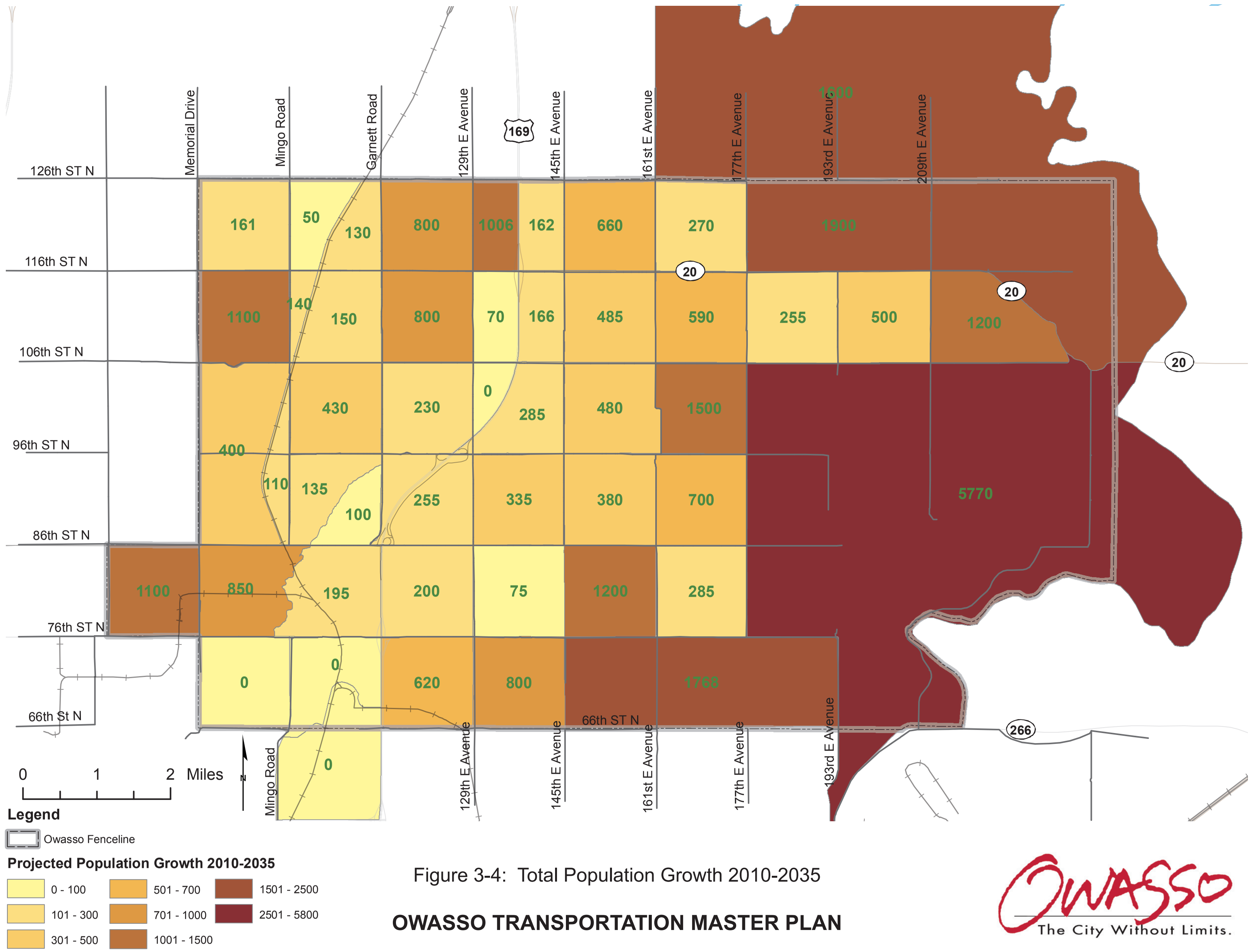


Figure 3-4: Total Population Growth 2010-2035

OWASSO TRANSPORTATION MASTER PLAN

Owasso The City Without Limits.

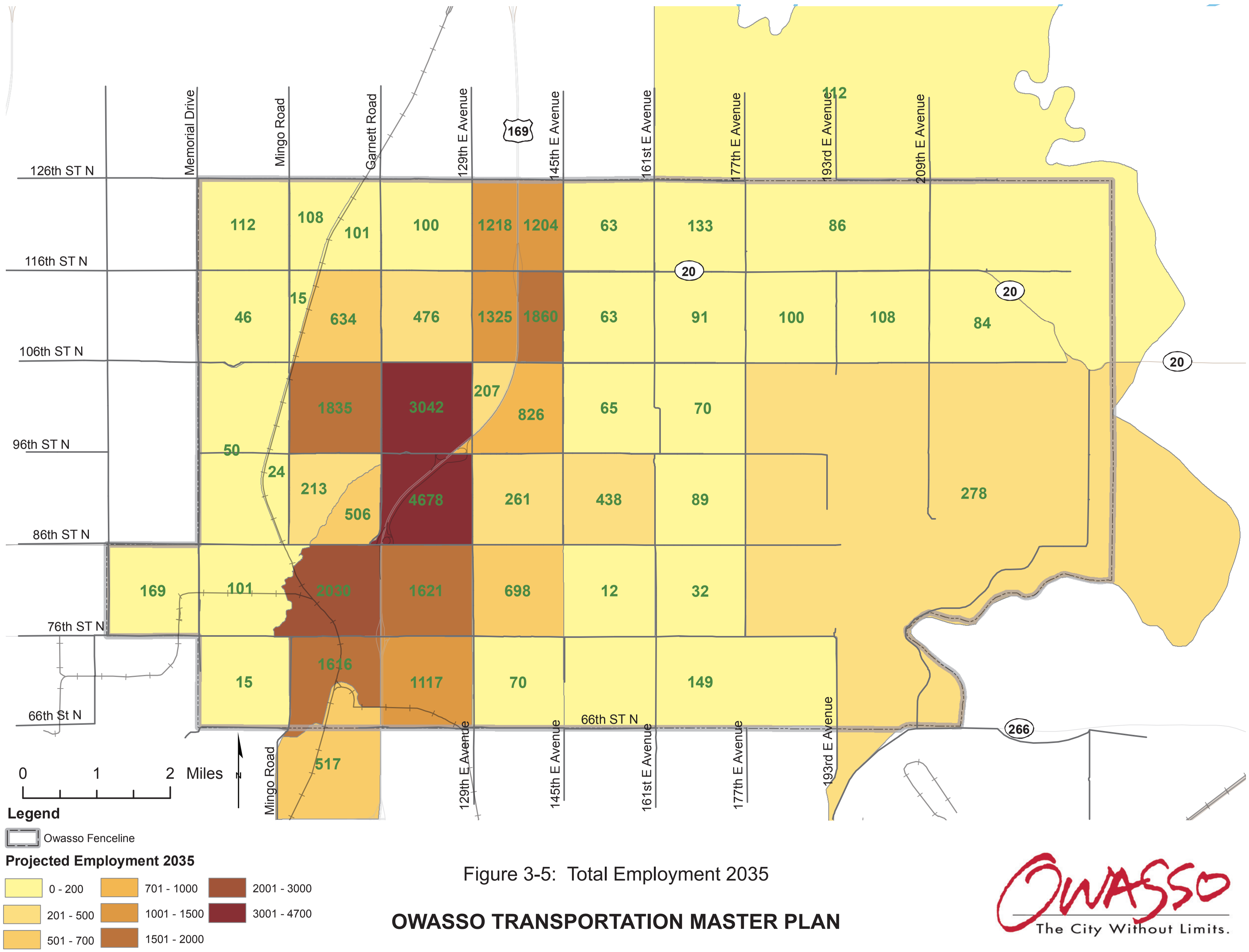
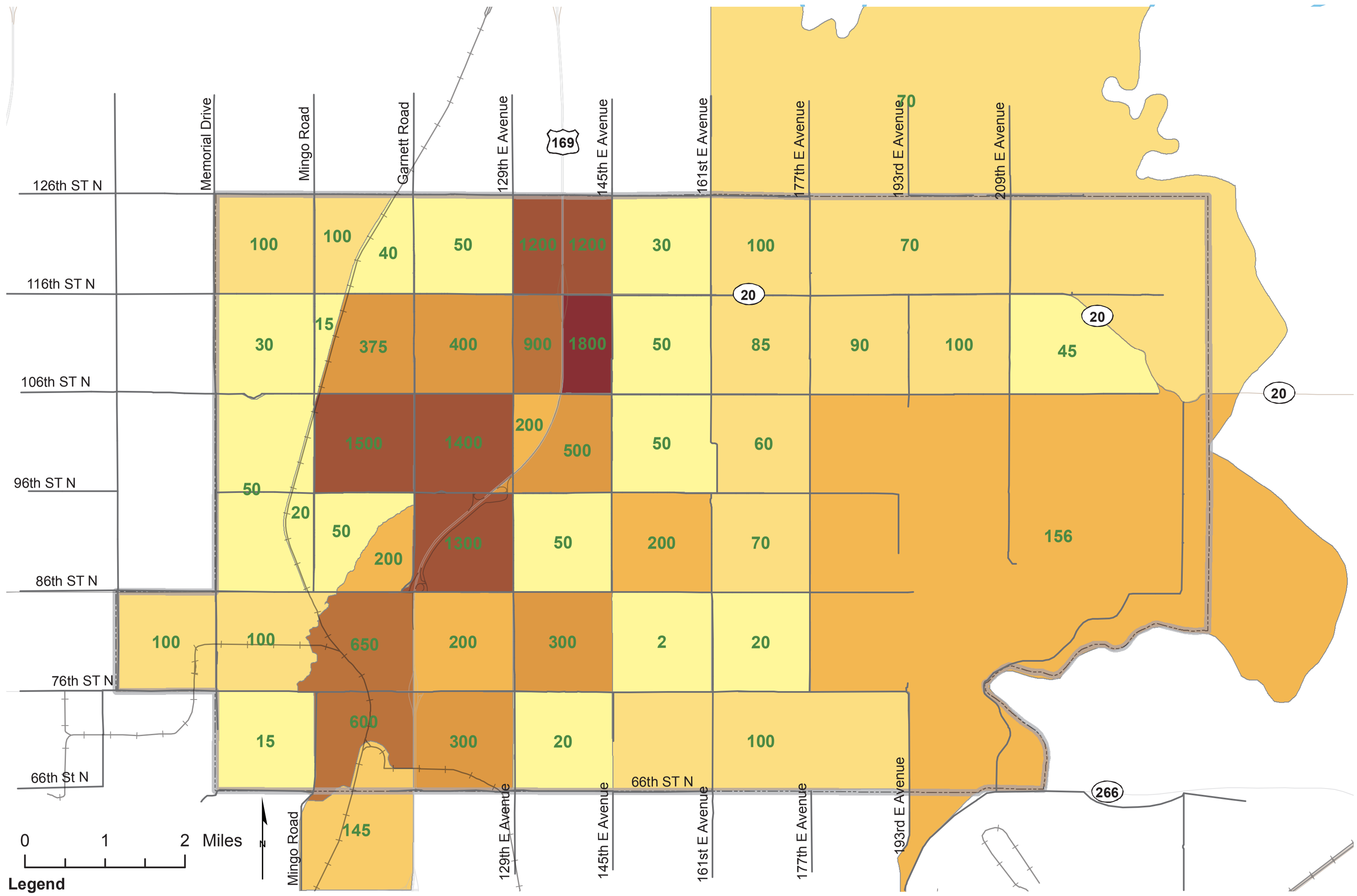


Figure 3-5: Total Employment 2035

OWASSO TRANSPORTATION MASTER PLAN

OWASSO
The City Without Limits.



Legend

Owasso Fenceline

Projected Employment Growth 2010-2035

0 - 50
51 - 100
101 - 150
151 - 200
201 - 500
501 - 900
901 - 1500
1501 - 1800

Figure 3-6: Total Employment Growth 2010-2035

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

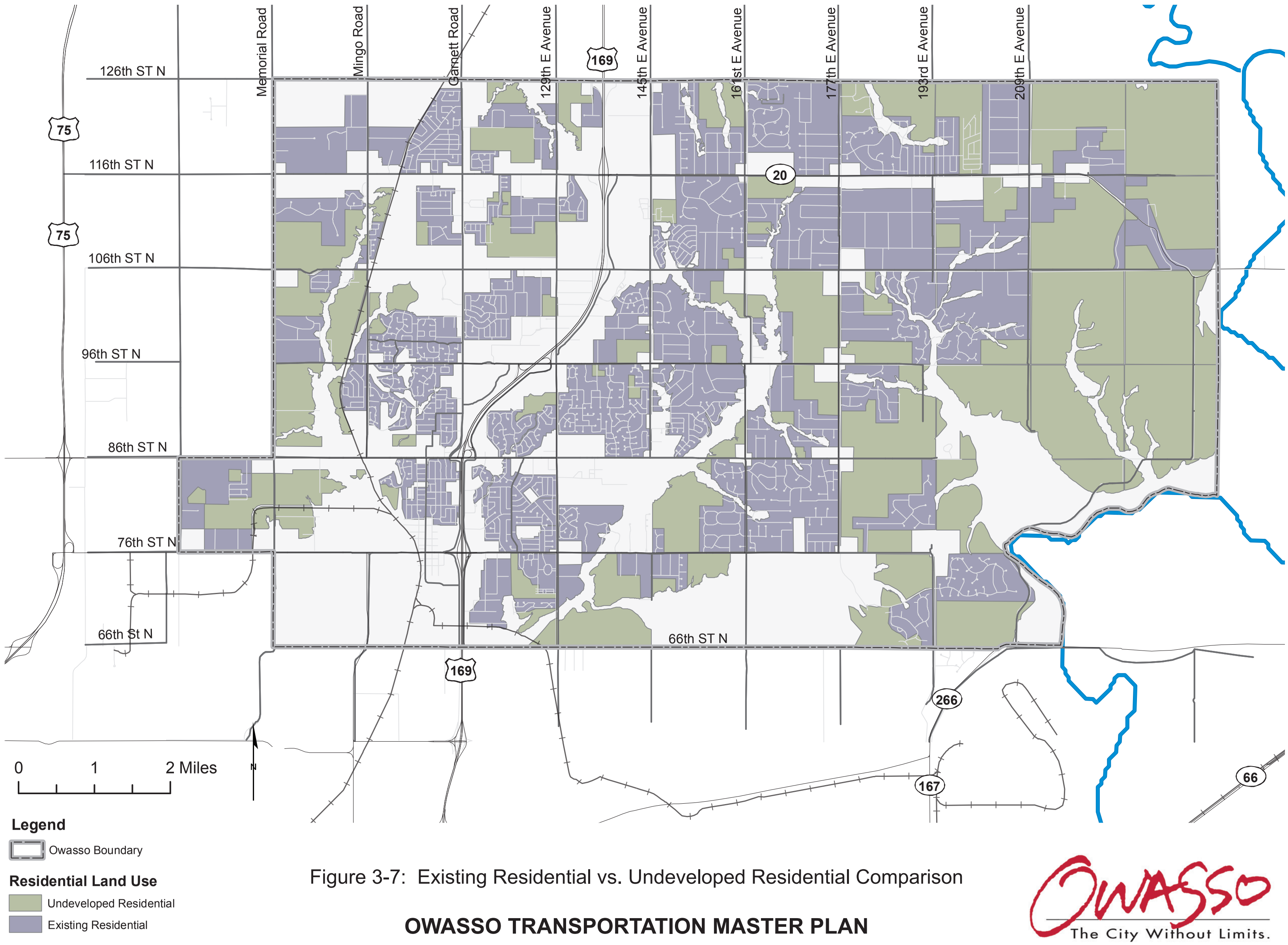


Figure 3-7: Existing Residential vs. Undeveloped Residential Comparison

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

3.3.2 Traffic Analysis Zones

Because the INCOG model was designed to perform regional analysis, it was necessary to modify the traffic analysis zone structure of the INCOG TAZ to allow for a more detailed view of the study area. To this end, existing TAZs were split along the US 169 and wherever a locally significant roadway was added to the model, so demographic and traffic data could be analyzed at a finer resolution. As shown in **Figure 3-8**, INCOG's original 42 zones within Owasso's study area were split to 49 zones.

- TAZ 97 was split into TAZs 97 and 893
- TAZ 99 was split into TAZs 99 and 894
- TAZ 116 was split into TAZs 116 and 895
- TAZ 117 was split into TAZs 117 and 896
- TAZ 118 was split into TAZs 118 and 897
- TAZ 711 was split into TAZs 711, 898, and 899

3.3.3 External Stations

Every trip has both an origin and a destination. A portion of trips considered within the Owasso sub-area model are likely to begin or end outside of the study area. Since external trips outside of the study area are not produced by the model, they must be assessed quantitatively, and their associated data provided as model inputs. Their information is tied to external stations, which are located at each point where a roadway included in the model crosses the study boundary. For that purpose, an additional 22 TAZs were added to the layer to represent the identified External Station locations. The external TAZs can be seen in **Figure 3-9**. The associated facilities and average daily traffic (ADT) volumes are shown in **Table3-4**.

Table 3-4: External Station Facilities and Volumes

TAZ	Facilities	ADT 2010
1001	Memorial Dr	1,610
1002	97th E Ave	1,450
1003	N Garnett Rd	4,555
1004	129th E Ave	2,200
1005	US 169	24,400
1006	161st E Ave	450
1007	SH 20	13,200
1008	106th St	2,500
1009	96th St	1,350
1010	86th St	200
1011	193rd E Ave	3,705
1012	177th E Ave	200
1013	145th E Ave	3,610
1014	56th St	295
1015	US 169	65,600
1016	97th E Ave	6,000
1017	Memorial Dr	95
1018	76th E Ave	10,205
1019	86th St	10,285
1020	106th St	1,140
1021	116th St	5,310
1022	126th St	660

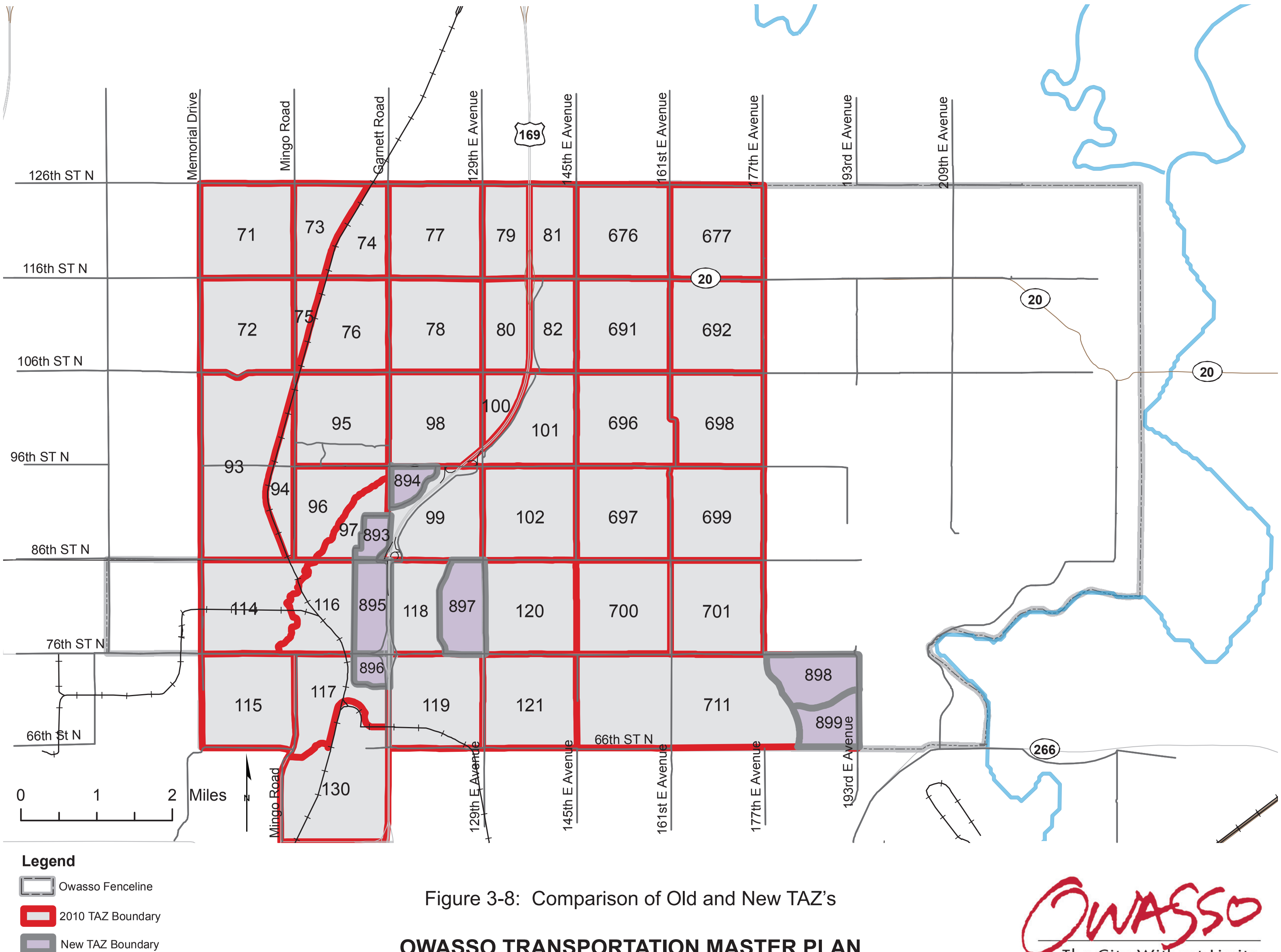


Figure 3-8: Comparison of Old and New TAZ's

OWASSO TRANSPORTATION MASTER PLAN

OWASSO
The City Without Limits.

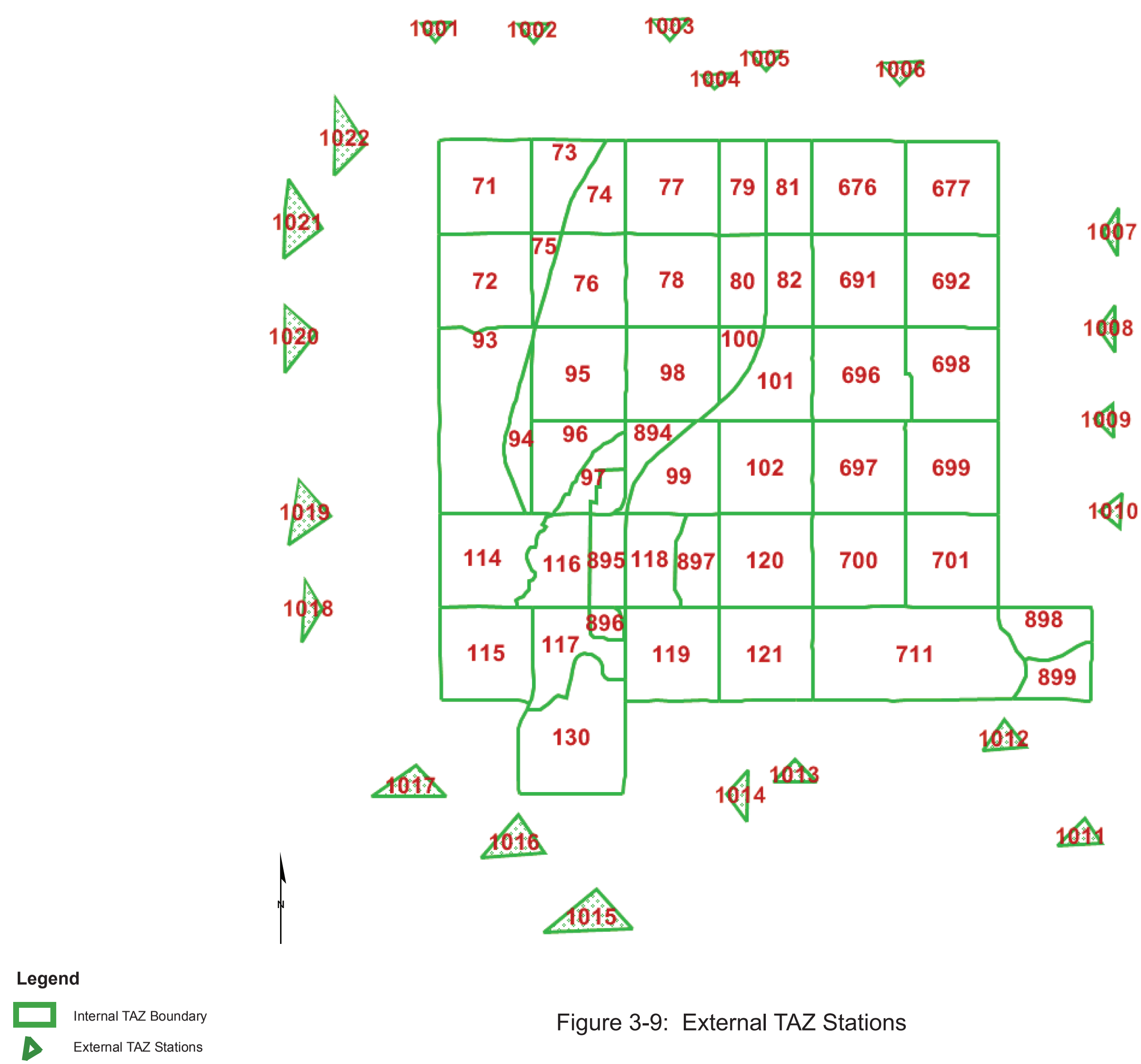


Figure 3-9: External TAZ Stations

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

3.3.4 TAZ Attributes

The TAZ attributes include socioeconomic and demographic data such as population, households, household size and employment, most of which were provided previously in this chapter. These data must be forecast for each milestone year to which the travel model is applied. Other attributes, such as Area Type, were also used to forecast future travel volumes and patterns.

Area Types are used to provide an estimate of land use intensity, activity characteristics, and other values that are not inherently provided in the definitions of the transportation system infrastructure. Area Types are used to help the model discriminate among facilities. The Area Type designation of a roadway can be combined with Functional Class to define capacity, speed and other operating characteristics of similarly defined roadways (e.g. a major arterial in a central business district (CBD) vs. a major arterial in a suburban area.)

The Area Types for the Owasso model were based on the Area Types identified within the INCOG model and are generally based on the activity densities of each zone. Activity density is a function of the size of population and employment in the zone as well as the size of the zone. The **Table 3-5** presents the four Area Types used in the INCOG model.

Table 3-5: Area Types

Area Types	Area Type Number
CBD	1
Urban	2
Suburban	3
Rural	4

Within the INCOG TDM, the City area was identified as “rural” Area Type.

3.3.5 Roadway Network

The networks represent the transportation system, including different categories of roads (such as freeways, arterials, collectors, ramps, etc.). The current INCOG model was developed on Citilabs’ CUBE platform. The network was exported to TransCAD as part of the development of the Owasso sub-area model. To make the anticipated editing of the networks as easy as possible, the model used the state-of-the-practice technique of having a master network from which networks for various years and modes can be extracted.

Figure 3-10 presents the layout for the Year 2010 base network. The following model network features are used to develop a geographical representation of a road thoroughfare system:

- Links
- Nodes
- Centroid Connectors
- Centroids

Links are used to represent roadway sections. Nodes are used to split links where roadway

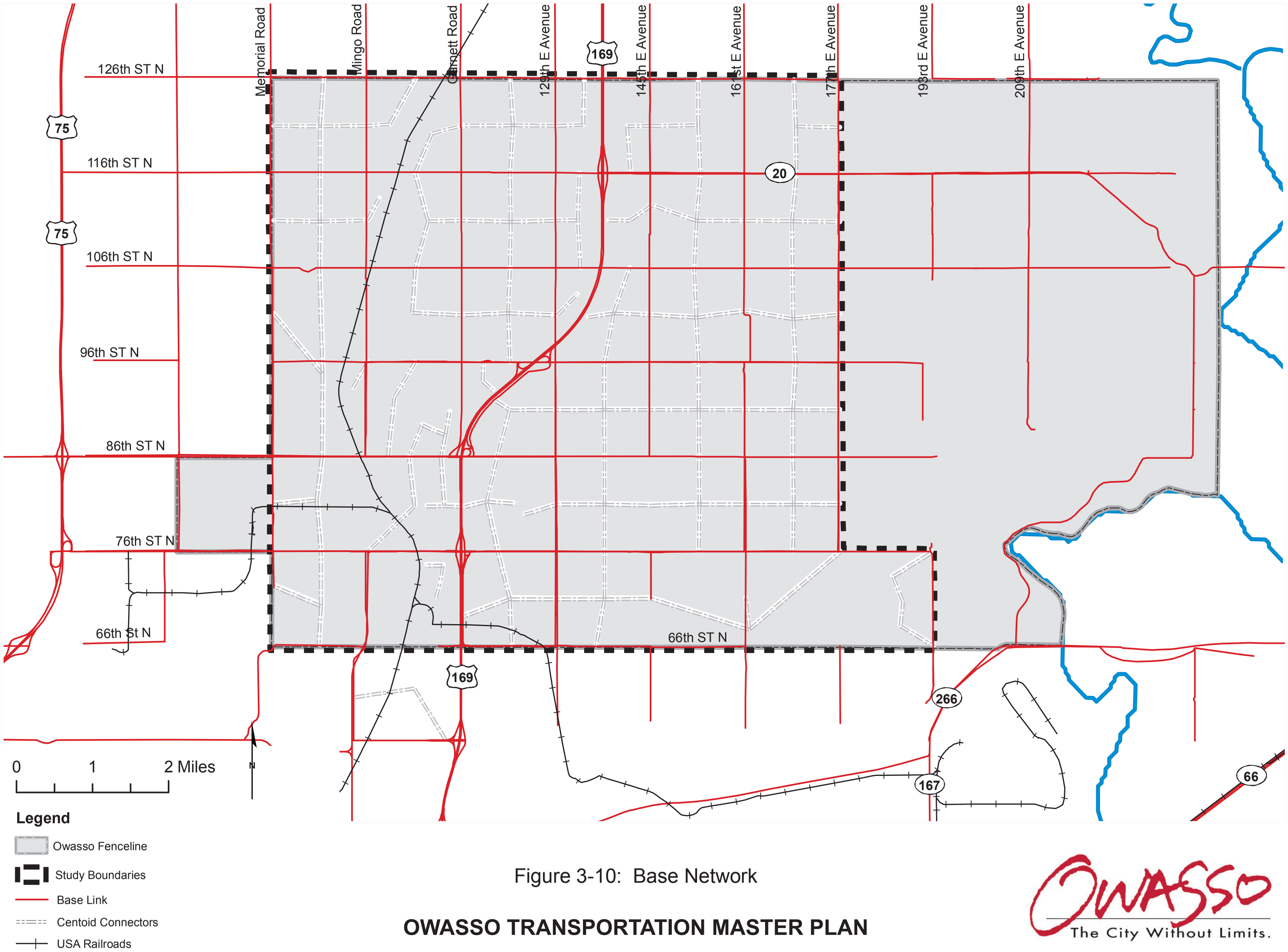


Figure 3-10: Base Network

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

attributes differ (i.e., speed limits, number of lanes, or facility type) or where intersections or interchanges occur. Interchanges differ from intersections in that multiple links and nodes are needed. Interchanges require links representing access and egress ramps and require nodes where those ramp connections occur with the intersecting roadway.

Special links and nodes are used to “load” traffic onto the network. Traffic originates from and is destined to geographic areas called traffic analysis zones (TAZs). Special nodes called “centroids” are used to represent TAZs in the network. Special links called “centroid connectors” are used to represent local streets contained in a TAZ and provide access between centroids and the network. Also, a centroid can have more than one centroid connector.
To ensure that the model is sufficiently detailed for this study, the INCOG model network was evaluated as to how well it captured locally significant roadways within the study area, and it was determined that the following roadways should be added:

- N Owasso Expressway Frontage Roadway – E 116th St N to E 96th St N
- N 122nd/123rd E Ave – E 86th St N to E 76th St N (required a split of TAZ 118)
- N 121st E Ave – E 96th St N to N Garnett Rd (required a split of TAZ 99)
- E 19th St, N Birch St, W 16th St, N Ash St, Main St and 5th Ave – US 169 in the north to US 169 in the south (required a split of TAZs 97 and 116)

Establishing an important connection between the demographic data “stored” in the TAZs and the demand it places on the roadway network, the number and placement of centroid connectors play an important role in how well the travel demand model can replicate current travel patterns as well as project future transportation needs in the study area.
According to the review of INCOG TAZ structure, the following centroid connector related findings were made:

- Multiple centroid connectors cross train tracks and TAZ boundaries (i.e. TAZ 71, 73, 74; 72, 75, 76; and 93, 94, 95);
- Multiple centroid connectors cross major section line roads (i.e. 82, 101; 78, 98; as well as 77, 79, and 81); and
- Multiple zones have no centroid connectors (I.e. 71, 74, 79, 81, 676, 677, 80, 691, 692, 100, 696, 115, and 130).

Although the noted centroid connector characteristics may be statistically less important in a regional analysis, they can significantly affect the outcome of a detailed analysis within a sub-area, and therefore, had to be addressed in the TMP. In order to correct these centroid connector issues, a complete revision of the centroids was undertaken, which also aided in the integration of the recently split TAZs:

- TAZ 97 and TAZ 893
- TAZ 99 and TAZ 894
- TAZ 116 and TAZ 895
- TAZ 117 and TAZ 896

- TAZ 118 and TAZ 897
- TAZ 711 and TAZs 898/899

3.3.6 Network Attribute

Network attributes define how the transportation system interacts with its various components given a specific travel demand. The attributes define the volume delay equations that are used in the traffic assignment to divert traffic, the capacity of the roadway, and the initial speeds (free flow speeds) present on each of the links. The Facility Type and Number of Lane attributes combined with the Area Type attribute from the TAZ layer are used in conjunction with the speed/capacity lookup table to populate the speed and capacity fields.

The number of lanes is an important roadway feature, representing network supply. Generally speaking, the more lanes a facility has; the greater its carrying capacity. These three variables (functional class, area type, and number of lanes) are used to assign speed and capacity values to a network link. In the Owasso model, the link speeds are used by functional classification and are summarized below in **Table 3-6**.

Table 3-6: Daily Link Capacities by Functional Classification and Number of Lanes

Functional Classification	Number of Lanes			
	2 lanes (vpd)	4 lanes (vpd)	5 lanes (vpd)	6 lanes (vpd)
Interstate/Turnpike	22,000	42,500	-	64,000
US Highway	16,000	31,500	33,500	48,000
Principal/Major Arterial	13,500	27,000	30,400	40,500
Minor Arterial	12,500	25,000	28,100	34,500
Collector	11,500	23,000	-	-
Unimproved Collector	8,500	17,500	-	-

Source: Wilbur Smith Associates

The Number of Lane and Functional Classification data for the study area was collected from the INCOG model and from the City and proceeded to develop a consistent set of functional classification codes. As shown in **Table 3-7,** these classes were coded onto the network, along with related attributes, such as numbers of lanes as determined through review of recent aerial photographs and Google Earth.

Table 3-7: Function Roadway Classes

Functional Classification	Description
1	Freeway
2	Principal Arterial
3	Minor Arterial
4	Major Collector
6	Ramp
9	Centroid Connector

For a transportation model to maintain its predictive value and provide credible traffic forecasts, adjustments to the attributes and parameters must be consistent with the overall strategic architecture of the model. The use of a speed capacity lookup table provides the required consistency and makes it possible to objectively determine the attributes of new roadway links added during scenario testing or alternatives analysis. **Table 3-8** shows the speed capacity values, based on available data from similar areas and facilities:

Table3-8: Speed and Capacity Lookup Table

Functional Classification	Capacity per Lane	Peak Hr. % of travel over a daily period	24 Hr. Per Lane Capacity	Free-Flow Speeds (MPH)
1	1,750	15.0%	11,667	70
2	1,400	15.0%	9,333	45
3	1,400	15.0%	9,333	40
4	1,200	15.0%	8,000	45
6	1,000	15.0%	6,667	55
9	3,000	10.0%	30,000	25

To develop an accurate traffic forecast, it is important to understand the quantity and quality of traffic counts available. Counts for 171 locations in the Owasso study area provided with the INCOG model were reviewed, dated between 1993 and 2008. Out of the 171 locations described, 22 locations were External Stations. External Stations counts are shown in **Table 3-9**. Count information for years prior to 2007 were subsequently replaced with newer City traffic count data and augmented through 2010 or newer traffic counts found on the INCOG GIS website.

Projected External Station volumes for 2035 were based on historical traffic data by determining the growth rate for each count location, as well as taking into account anticipated population and employment growth nearby. The projected milestone year traffic volume data for the External Stations was also based on expected population and employment growth in nearby TAZs and in areas beyond the study boundary.

Table 3-9: External Counts and Volumes

External Station	2010 Count	2015 Volume	2025 Volume	2035 Volume
1001	1,610	1,783	2,065	2,300
1002	1,450	1,575	1,780	1,950
1003	4,555	4,966	5,641	6,200
1004	2,200	3,050	4,444	5,600
1005	24,400	28,350	34,828	40,200
1006	450	538	681	800
1007	13,200	16,650	22,308	27,000
1008	2,500	3,000	3,820	4,500
1009	1,350	1,638	2,109	2,500
1010	200	775	1,718	2,500
1011	3,705	3,627	4,812	7,200
1012	200	3,000	3,984	800
1013	3,610	2,759	3,659	7,000
1014	295	303	315	325
1015	65,600	77,950	98,204	115,000
1016	6,000	6,375	6,990	7,500
1017	95	184	329	450
1018	10,205	12,654	16,670	20,000
1019	10,285	12,214	15,377	18,000
1020	1,140	1,605	2,368	3,000
1021	5,310	6,458	8,339	9,900
1022	660	733	851	950

3.3.7 Model Validation

The entire network development and review process described above is often referred to as network coding. Once network coding is completed, the model network is used as an input to the travel demand model. Prior to forecasting travel demand, the base year model results should be compared to existing traffic patterns of the base year, which is a process referred to as model validation.

In order to test the ability of the model to predict future behavior, validation requires comparing the model predictions with information other than that used in estimating the model. This step is typically an iterative process linked to model calibration. It involves checking the model results against observed data and adjusting parameters until model results fall within an acceptable range of error.

The ability of travel demand models to forecast future year traffic and other travel behavior are predicated on their ability to estimate “known” traffic volumes and travel patterns under base year conditions for which data is available. There are two process components to matching model results to the observed base year travel data – calibration and validation.

Calibration refers to the process of estimating model variables such as trip rates, friction factors, mean trip length, and trip length frequency distributions. All variables are ideally based on surveyed or observed data. Validation refers to the process of using a calibrated model to estimate travel assignments for the base year and comparing these travel assignments to observed travel data. The typical comparison, when sufficient data is available, is between modeled traffic assignments and actual traffic volumes derived from count data. Therefore, extensive traffic counts must be available to validate a model. Validation of the model to counted traffic flows is important to the model effort in two areas. First, it shows whether the calibration tools used in the model process and assumptions were reasonable. Second, the validation shows what level of confidence the user can have in the forecast results. Because the quality of the seed trip table has an effect on the final trip table the validation statistics for both are provided.

3.3.8 Calibration

In the absence of household travel survey data, trip rates, friction factors, and trip lengths were derived from national data as well as models used in similar areas as previously stated.

3.3.9 Validation

Validation generally refers to the process of using a calibrated model to estimate travel assignments for the base year and comparing these travel assignments to observed travel data. The typical comparison, when sufficient data is available, is between roadway traffic assignments and actual traffic volumes derived from traffic count data.

Traffic assignment results for the validation year (2010) were compared to these traffic counts by two indices: Percent of Count and Percent Root Mean Squared Error (%RMSE), each of which was aggregated and tabulated across roadway facility types. Percent of Count was used to measure the overall difference between modeled and counted flows. Percent Root Mean Squared Error (%RMSE) was used to measure the difference between modeled flows and counted volumes on a link-by-link basis, which gave a better picture of the "closeness" between model flows versus counts. The Percent of Count and Percent RMSE calculation are described by the following equations

$$Percent\ of\ Count = \frac{\sum_{j=1}^{n} Modeled_j}{\sum_{j=1}^{n} Counted_j}$$

$$\%RMSE = \frac{\sqrt{\sum_{j=1}^{n} \frac{(Modeled_j - Counted_j)^2}{n-1}}}{\frac{\sum_{j=1}^{n} Counted_j}{n}} \times 100$$

Since the ODME process in base year was a part of the validation procedure, the validated assignment (final trip table) and the original assignment (seed trip table) were also compared. **Tables 3-10 and 3-11** depict the volume produced by the model and the observed traffic counts, and provides a statistical comparison to demonstrate the quality of the match.

Table 3-10: Counts vs. Modeled Volume (Seed Trip Table)

Criteria	Detail
Total Modeled Volume On Counted Links	1,136,772
Total Count On Counted Links	1,467,985
Count Percentage	77.4%
RMSE	53.0%

Table 3-11: Counts vs. Modeled Volume (Final Trip Table)

Criteria	Detail
Total Modeled Volume On Counted Links	1,467,985
Total Count On Counted Links	1,460,855
Count Percentage	99.5%
RMSE	11.6%

3.3.10 Counts by Facility Type

Another criterion for model validation is to compare assigned traffic volumes to traffic counts aggregated by facility type. The comparison of assigned volumes to counted volumes is considered successful if the value for the percent error falls within the ranges suggested by the Federal Highway Administration (FHWA), as depicted in **Table 3-12**.

Table 3-12: FHWA Facility Type Validation Targets

Facility Type	FHWA TARGETS
Freeway	+/- 7%
Major Arterial	10%
Minor Arterial	15%
Collector	25%

The following **Table 3-13** and **Table 3-14** show that the model matches counts by facility type within the FHWA Facility Type Validation Targets. Note that there were only four counts on "Major Arterial" facilities so the importance of those counts is diminished.

Table 3-13: Counts vs. Modeled Volume by Facility Type (Seed Trip Table)

Functional Class	Facility Type	Count Percentage
1	Freeway	84.9%
2	Major Arterial	81.7%
3	Minor Arterial	69.8%
4	Collector	143.3%

Table 3-14: Counts vs. Modeled Volume by Facility Type (Final Trip Table)

Functional Class	Facility Type	Count Percentage
1	Freeway	99.3%
2	Major Arterial	106.3%
3	Minor Arterial	99.8%
4	Collector	101.7%

3.3.11 Model Forecasting

The Owasso model forecasting process is based on the traditional four-step analysis. This forecasting process includes trip generation, trip distribution, and traffic assignment steps, as well as a model validation procedure previously described.

3.3.12 Trip Generation

Trip generation is the initial modeling step, which provides an estimation of the amount of travel. This method determines the number of trip ends produced from and attracted to each TAZ, and also classifies these trip ends by trip purposes. The generation step is based on a set of default trip purposes developed for similar small area models. The trip generation model used for the Owasso area uses five-trip purposes:

- Home-Based Work (HBW)
- Non-Home Based (NHB)
- Home-Based Other (HBO)
- Commercial Vehicle (CMV)
- External-Internal / Internal-External (EI)

The subsequent trip generation model was developed based on trip generation equations derived from reported national averages and available survey data from similar areas.

The external stations volumes and external-to-external (EE) flows, for the base year, were developed. The EE trip tables were forecasted using Fratar, a doubly constrained growth factor methodology. Once the EE trip tables were established, the EE trips were deducted from the external station totals to establish External-to-Internal (EI) trip productions. The resulting EE and EI trip tables were reviewed and tested for reasonableness.

3.3.13 Trip Distribution

Trip distribution is the second step performed by the model. Trip distribution uses the TAZ productions and attractions output from trip generation, and assigns each production to a destination and each attraction to an origin for all possible zones in the study area. The Owasso area model uses the gravity model for distribution of internal-internal and internal-external trips. The gravity model analyzes the frequency of trip interchange between zone pairs based on the relationship between each zone's productions and attractions and the travel time between the zones.

For the Owasso sub-area model, a traditional gravity model was used, which distributes trips according to characteristics of land use and the transportation system in the study area. The number of trips traveling between any zone pair is a function of the magnitude of the total productions and attractions in the two zones and the travel impedance between the zones. The highway network attributes describe the transportation system characteristics used to measure travel impedance (e.g. distance, travel time, etc;). The model can be mathematically stated as:

$$T_{ij} = A_j \times \{(P_i \times F_{ij}) / (\sum (P_i \times F_{ij}))\}$$

where:

T_{ij} = forecast flow produced by zone i and attracted to zone j
P_i = the forecast number of trips produced by zone i
A_j = the forecast number of trips attracted to zone j
F_{ij} = Impedance between zone i and zone j (F-Factors)

Although this method is borrowed from Newton's Law of Gravity, which states that force is inversely proportional to the distance between two bodies, the effect of distance is not as strong a determinant of travel between zones as travel time. Therefore, travel time is typically used as the measurement of separation between zones for the purposes of applying the gravity model, with trip lengths measured in minutes.

The trip distribution procedures used in the Owasso study area resulted in an acceptable performance of the model. Gamma distributions were used to match the general shape of typical trip length frequency distributions derived from available survey data from areas of similar size and character. The gamma trip length frequency distribution curves are used to develop travel impedances, called friction factors (F-Factors) for each trip purpose. F-Factors are calibrated by comparing the trip length frequencies in the model to observed data from surveys or other sources. The resulting average trip lengths for the Owasso model are presented in **Table 3-15**.

Table 3-15: Owasso Average Trip Length

Purpose	Owasso Average Trip Length (minutes)
HBW	3.5
HBO	3.1
NHG	4.4
CMV	2.8
EI	5.3

3.3.14 Traffic Assignment

Traffic assignment is the final step in the traditional modeling process. It estimates the flow of traffic on a network. The trip productions and attractions (from trip generation) are converted to origins and destinations (from trip distribution). The output of trip distribution is an origin-destination (O-D) matrix which contains total vehicle trips for each O-D pair. The O-D matrix is assigned to the network using a minimum path algorithm based on travel time and capacity restraints. The assignment methodology selected for the Owasso model is of the User Equilibrium type and runs in TransCAD 5.0. The equilibrium assignment procedure uses a maximum of 20 iterations and convergence criteria of 0.01. The highway assignment was run through the TransCAD interface based on the final trip table obtained from the ODME procedure. The interface was also used to rerun the assignment step to test various project combinations using the established demographic assumptions.

Link delays increase as a result of congestion on a particular link. As link volumes approach link capacity, the V/C ratio increases for that link. The result is a decrease in the LOS on that link and travel time is reduced. As travel time is reduced due to congestion, vehicles divert to other links with faster travel times. This process is continued until no one vehicle can further reduce their travel time. At this point, the assignment is said to have reached “equilibrium.” The results of the equilibrium assignment are displayed in the network database for further analysis and for presentation purposes.

The results obtained from the assignment are then compared to the ground counts for validation of the base model (previously discussed). Once the model has been validated, through feedback loops, it is ready for use in the planning and development of forecast networks.

3.3.15 Mode Choice

The trip interchanges defined in trip distribution are still defined in terms of person trips between zones. To be assigned to the roadway network, these trips must be converted to vehicle trips. Since no mode choice model was included in the model process, the following process was used.

To convert the person trips table output to vehicle trips, an auto occupancy factor is applied. The auto occupancy factors are presented in the **Table 3-16**. It should be noted that the trips for the Commercial Vehicle and External-Internal purposes are derived from traffic count data or other vehicle based sources and are therefore produced as vehicle trips that are not factored.

Table 3-16: Auto Occupancy Factors

Purpose	Auto Occupancy Factor
HBW	1.08
HBI	1.20
NHB	1.15
CMV	1.00
EI	1.00

The use of auto occupancy factors in lieu of a full mode choice model is common practice where transit ridership represents a small portion of the overall number of trips in the region.

3.3.16 Origin-Destination Matrix Estimation

This project called for the development of a sub-area model that uses an Origin-Destination Matrix Estimation (ODME) procedure to enhance the model performance. This procedure is generally easier and less costly to implement than the development of a full modeling process. The ODME procedure can build upon a loosely calibrated travel demand model from a similar study area, and based on local traffic count data, produces accurate model results.

The ODME is an additional “step” between trip distribution and assignment, which uses a delta vector, based on the difference between an assigned model volume and known traffic counts, to adjust the trip table and create a corrected trip table for use in the traffic assignment step. In other words, the ODME procedure solves the assignment step in reverse and creates a trip table which, when assigned to the network, closely reproduces the observed traffic counts. In this study, the same delta vector derived from the base year was applied across all forecast years, i.e. year 2015/2025/2035. This is due to the assumption that individual cell correction delta hold constant over time. The equation below shows the procedure for obtaining the final trip table from the ODME procedure:

$$Final\ TripTable_{ij} = deltaij + Modeled\ TripTable_{ij}, \quad \forall i,j$$

In this equation, the delta vector was developed from the base year scenario through a sophisticated assignment procedure, where the assigned traffic is tightly matching the counts. By comparing the output trip table from the ODME procedure and the trip table generated within the full base year model, the delta vector was calculated as below:

$$delta_{ij} = FinalTripTableBase_{ij} + Modeled\ TripTableBase_{ij}, \quad \forall i,j$$

In the Owasso sub-area model, this delta vector was based on a trip table generated from the model trip distribution step in the base year as a seed trip table. This seed trip table results in smaller delta vectors being applied to correct the trip table, a more accurate traffic assignment, and a stronger connection to the underlying demographic inputs. In this study, the traditional four-step travel demand model was developed to provide the basis for obtaining a more accurate delta vector.

4 MODEL APPLICATION

4.1 INTRODUCTION

This section of the report provides the results of the travel demand model runs that were used to evaluate the traffic impacts of build scenarios as compared to no-build scenarios, which only include existing or financially committed projects for the various milestone years and the horizon year:

- 2015 Existing + Committed (E+C)
- 2025 Existing + Committed (E+C)
- 2035 Existing + Committed (E+C)
- 2035 Build

The Owasso sub-area model was designed as a multi-year network to facilitate easy network management by adding, removing or modifying links from the roadway network. After coding the alternative scenario and populating the required attributes the model, the network update procedures are necessary for most network alternatives. By running the travel demand model, the original trip table will be adjusted by using the delta vector to obtain the final trip table. Then the final step was run for assigning the adjusted trip table in the study area.

4.2 MODEL RESULTS

An overview of the projects included in the various scenarios is contained in **Table 4-1.** The results of the various build and no-build scenarios are shown in the **Figures 4-1 through 4-14**. The travel demand model information is depicted by the number of lanes, 24-hour traffic volumes, and congestion level for each scenario.

Table 4-1: Overview of Roadway Improvements included in the Various Scenarios

Project ID	Street	From	To	Improvement	Comment
2015 E+C					
1	N Garnett Rd	E 116th St N	E 96th St N	Widen to 5 lanes (2 per direction with center turn lane)	City of Owasso
2	E 76th St N	N 129th E Ave	US 169 (Owasso Expressway)	Widen to 5 lanes (2 per direction and center turn lane)	2013-2016 TIP
3	E 86th St N	West of Main St	Memorial Dr	4 lanes (2 per direction)	City of Owasso
4	E 116th St N	US 169 (Owasso Expwy)	N 129th E Ave	Widen to 4-lane arterial	Source: INCOG MTP and City of Owasso
5	E 116th St N	Intersection with Garnett Rd		Intersection Improvements	City of Owasso
6	N 145th E Ave	Intersection with E 116th St N (SH 20)		Intersection Improvements	City of Owasso
7	N 177th E Ave	Patriot Dr	SH 266	Extension as 2- and 3-lane roadway	Rogers County
2025 E+C (Includes all projects listed in the 2015 (E+C)					
8	US 169 - Bridge over 76th	66th St N	76th St N	Bridge and approaches- – includes 6-laning of US 169	Listed for completeness Source: ODOT 8-yr Construction Plan
9	US 169 - Bridge over Bird Creek	56th St N	66th St N	Bridge and approaches- – includes 6-laning of US 169	Listed for completeness Source: ODOT 8-yr Construction Plan
No additional projects listed for the 2035 E+C (Includes all projects listed in the 2025 E+C)					
2035 Build Scenario (Includes all projects listed in the 2025 E+C and Build)					
10	E 66th St N	N 145th E Ave	E 161st E Ave	Planned 2-lane facility	Source: INCOG MTP (Suggested 4-lane; downgraded to a 2-lane by the City of Owasso)
11	E 86th St N	N 145th E Ave	N 161st E Ave	Widen to 4-lane arterial	Source: INCOG MTP (Not listed on P.12, but shown on map on P. 10; there are no immediate plans by the City of Owasso)
12	E 106th St N	N Garnett Rd	N 145th E Ave	Widen to 4-lane arterial	Source: INCOG MTP (No immediate plans by the City of Owasso)
13	N 161st E Ave	E 66th St N	E 76th St N	Extend and widen to 4 lanes	Source: INCOG MTP (No immediate plans by the City of Owasso)

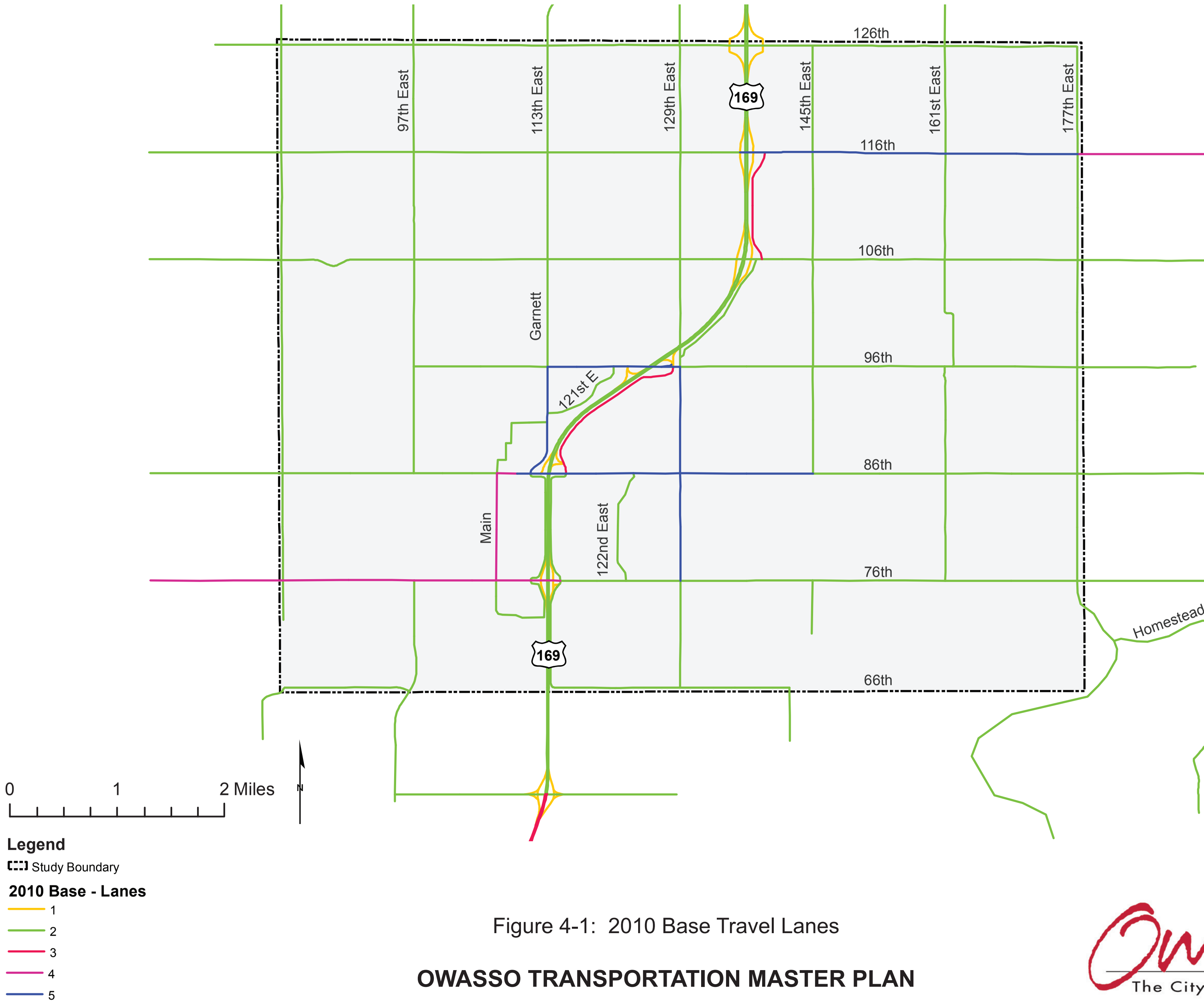


Figure 4-1: 2010 Base Travel Lanes

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

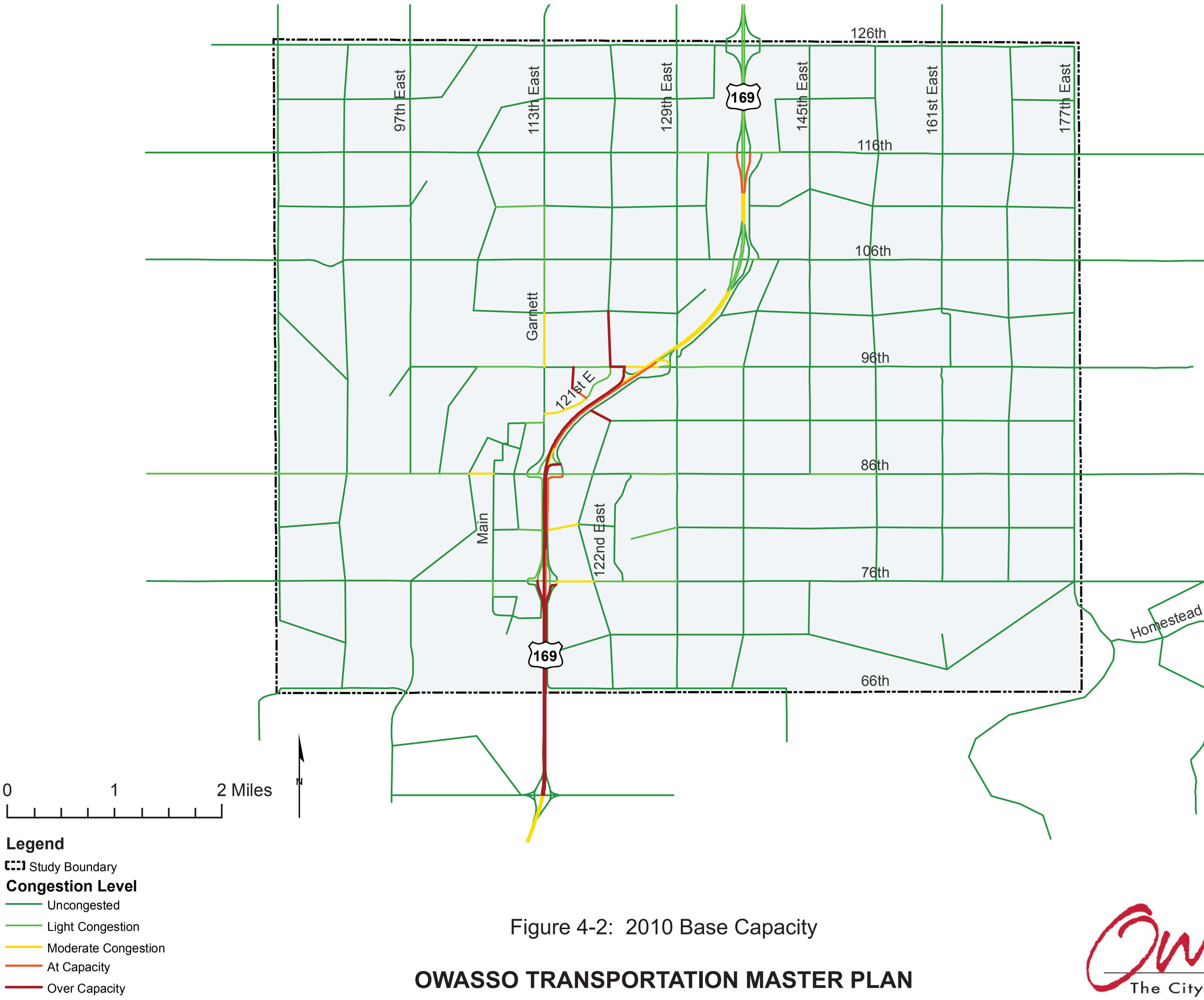


Figure 4-2: 2010 Base Capacity

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

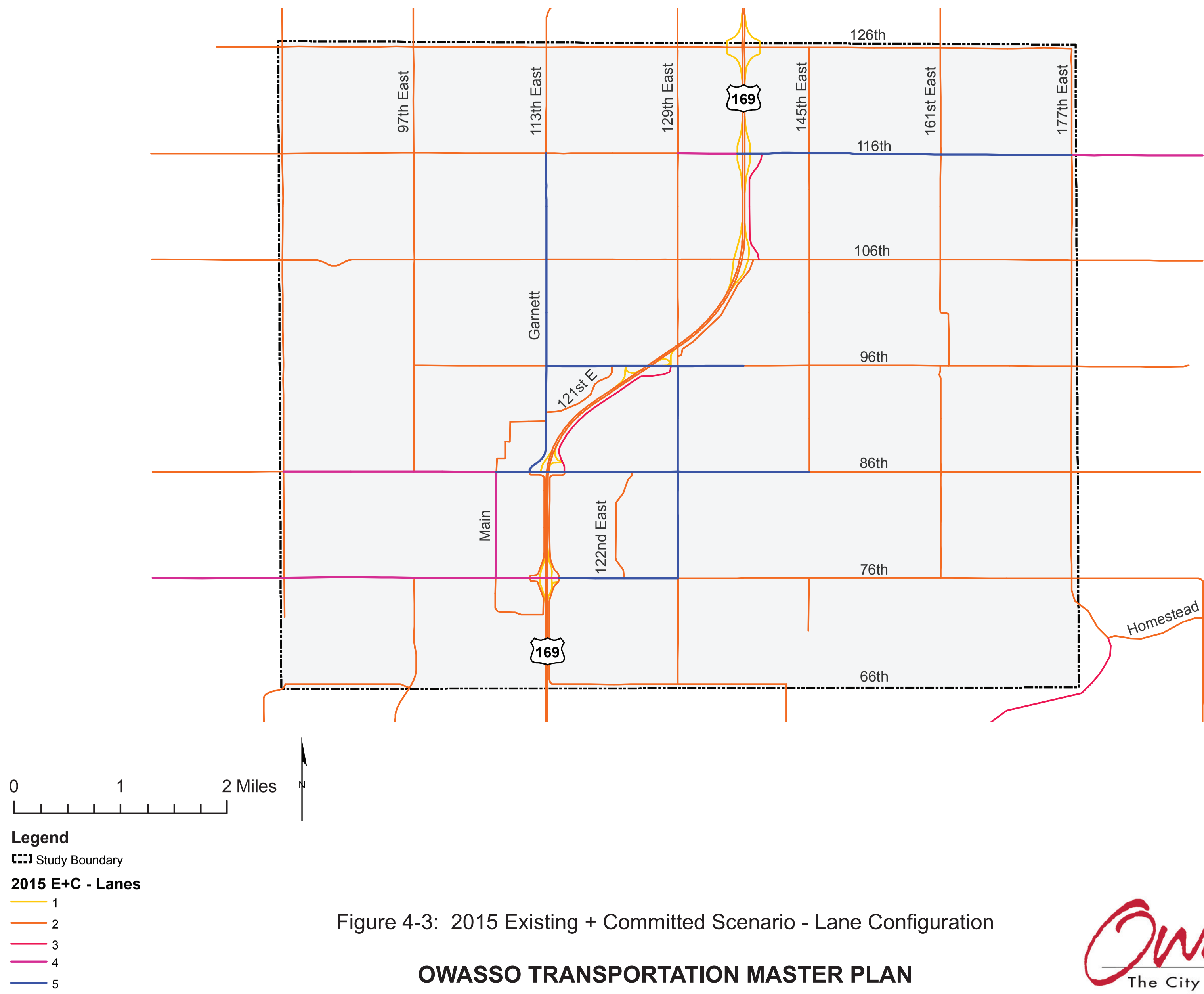


Figure 4-3: 2015 Existing + Committed Scenario - Lane Configuration

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

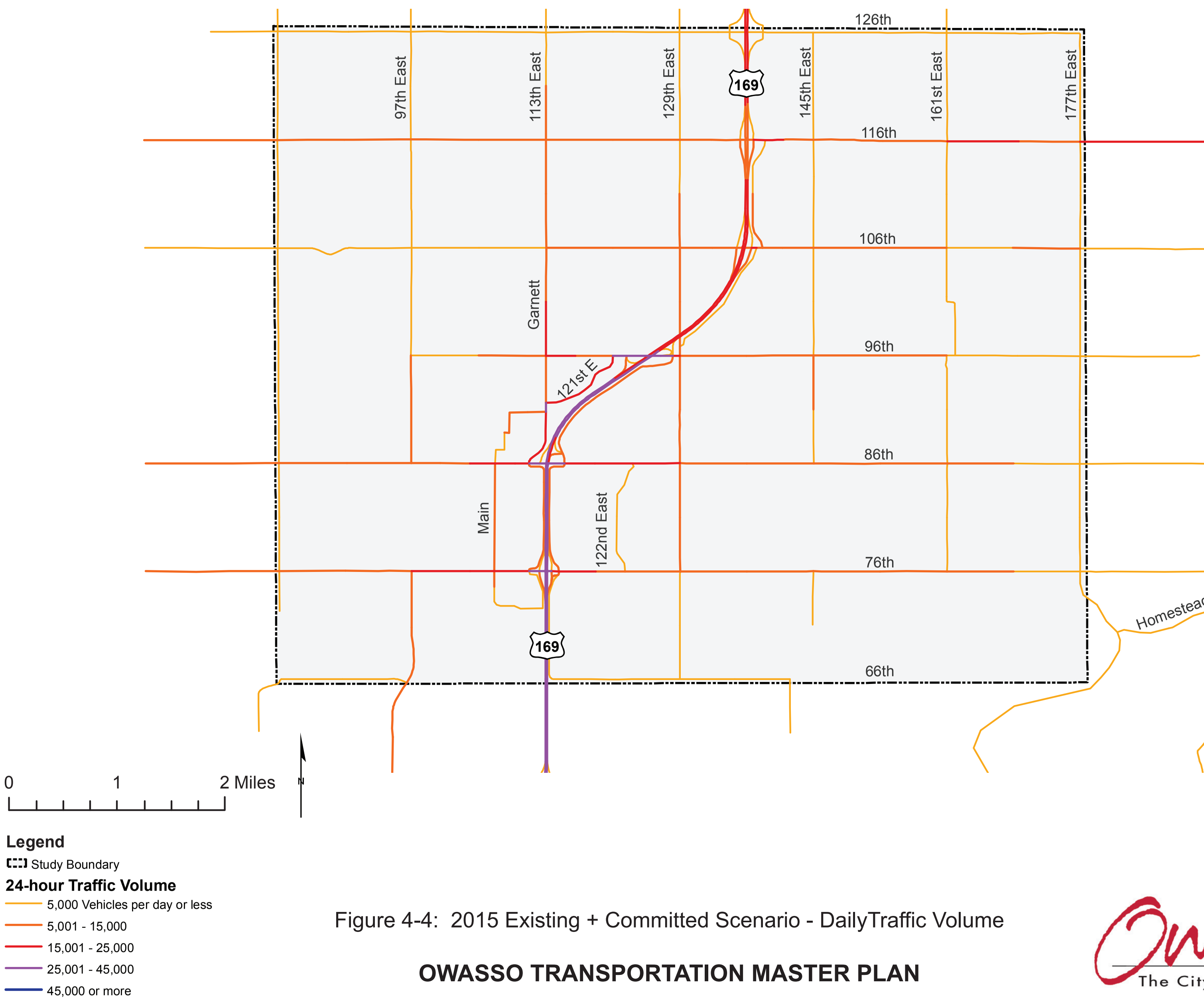


Figure 4-4: 2015 Existing + Committed Scenario - DailyTraffic Volume

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

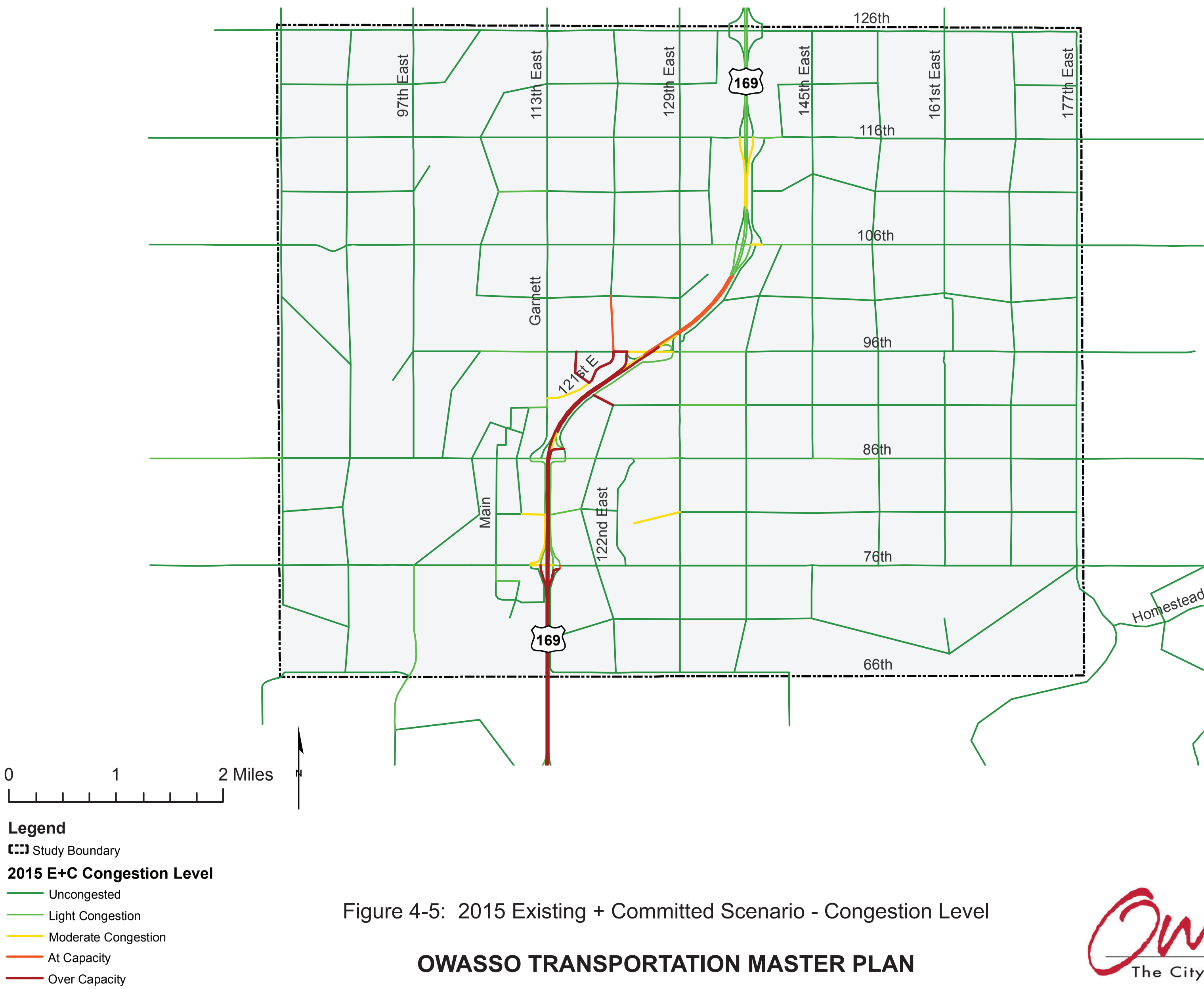


Figure 4-5: 2015 Existing + Committed Scenario - Congestion Level

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

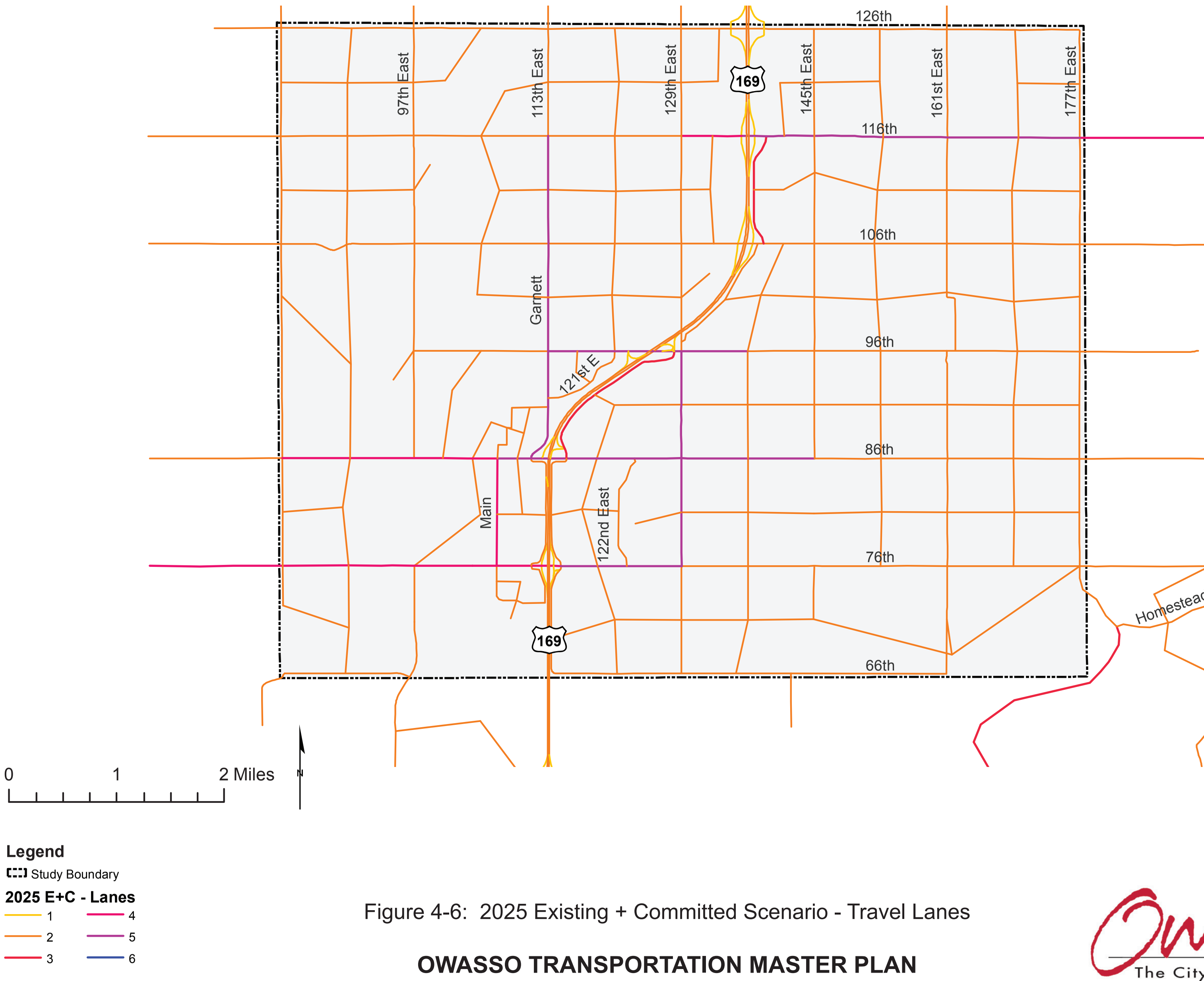


Figure 4-6: 2025 Existing + Committed Scenario - Travel Lanes

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

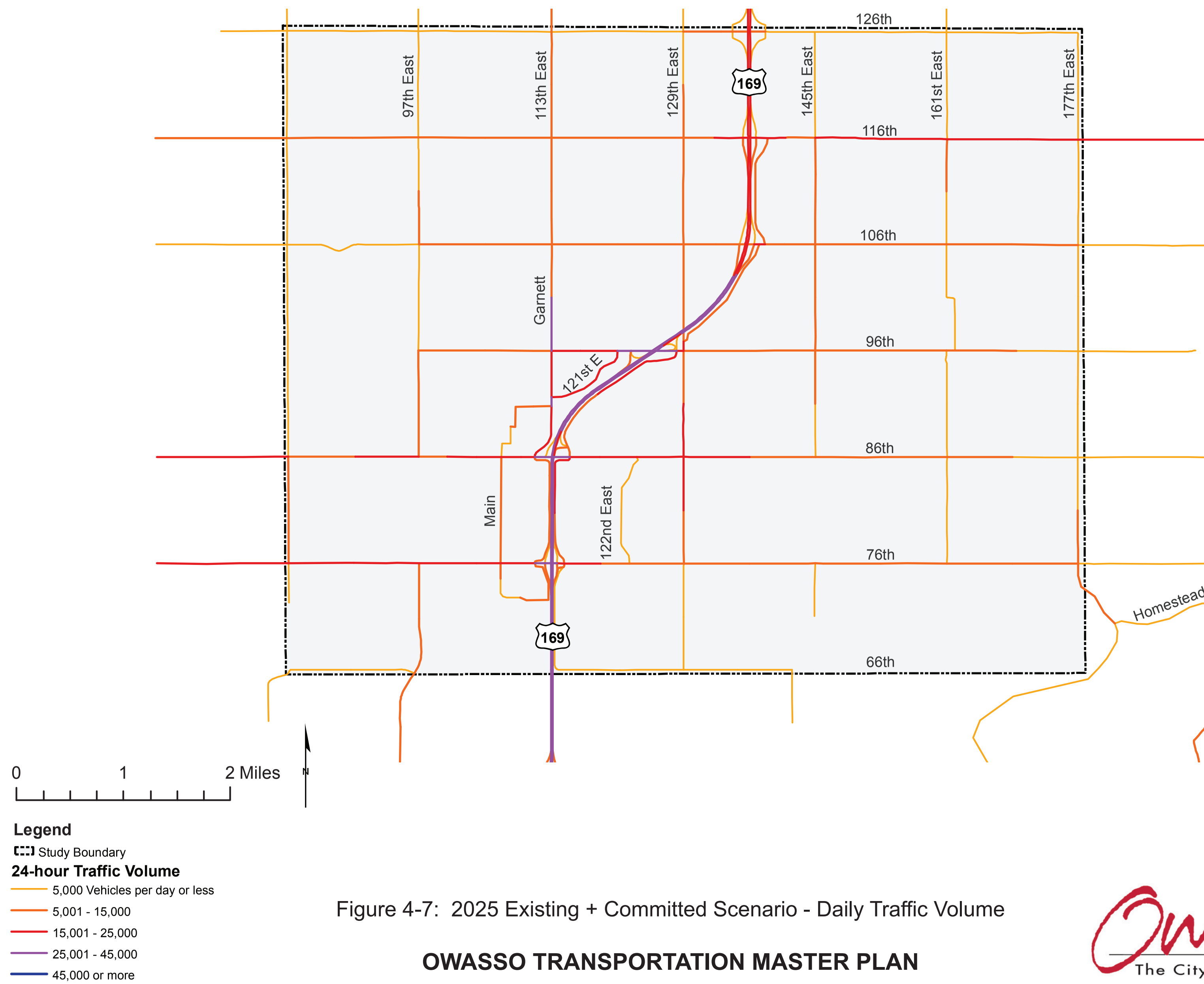


Figure 4-7: 2025 Existing + Committed Scenario - Daily Traffic Volume

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

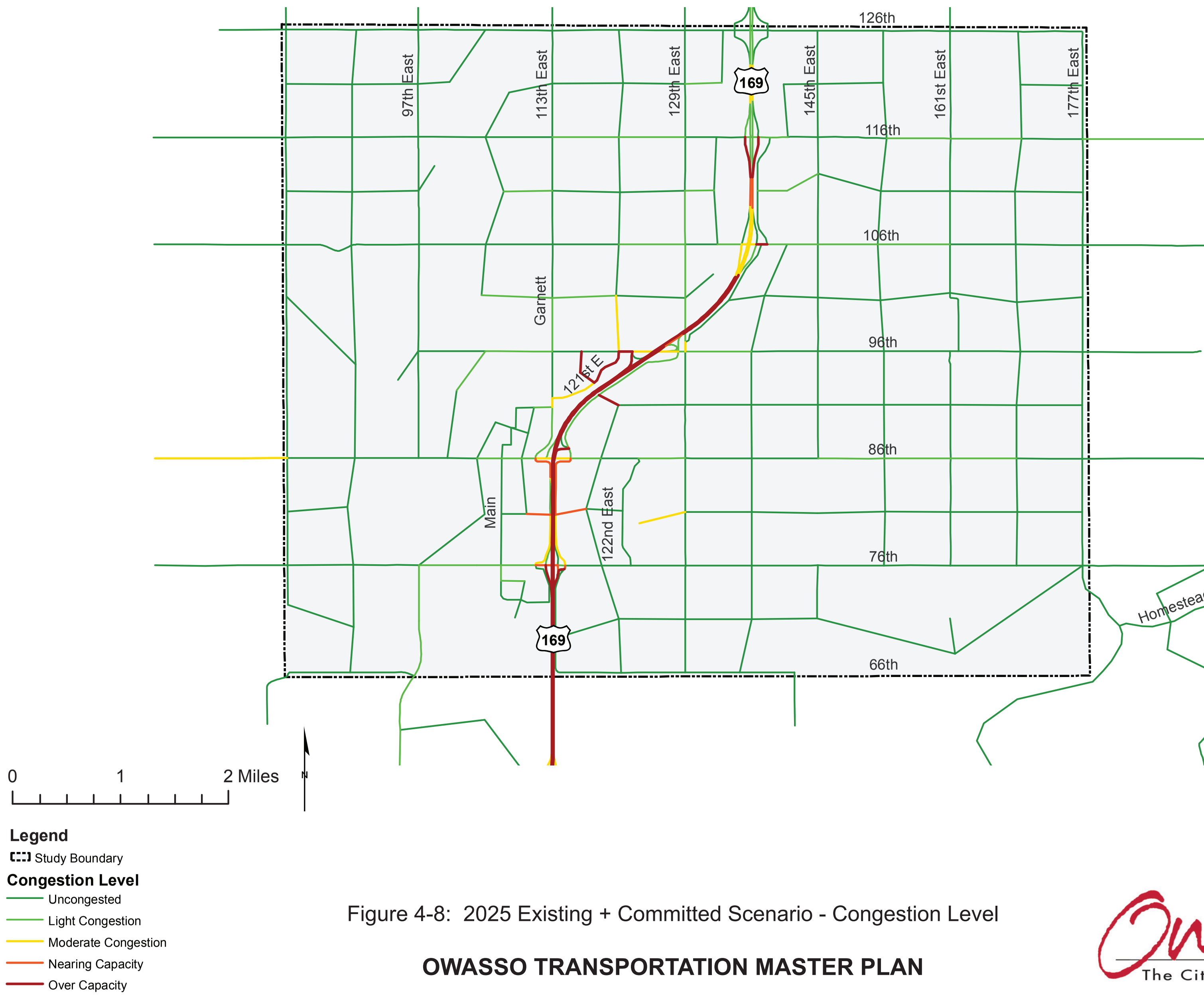


Figure 4-8: 2025 Existing + Committed Scenario - Congestion Level

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

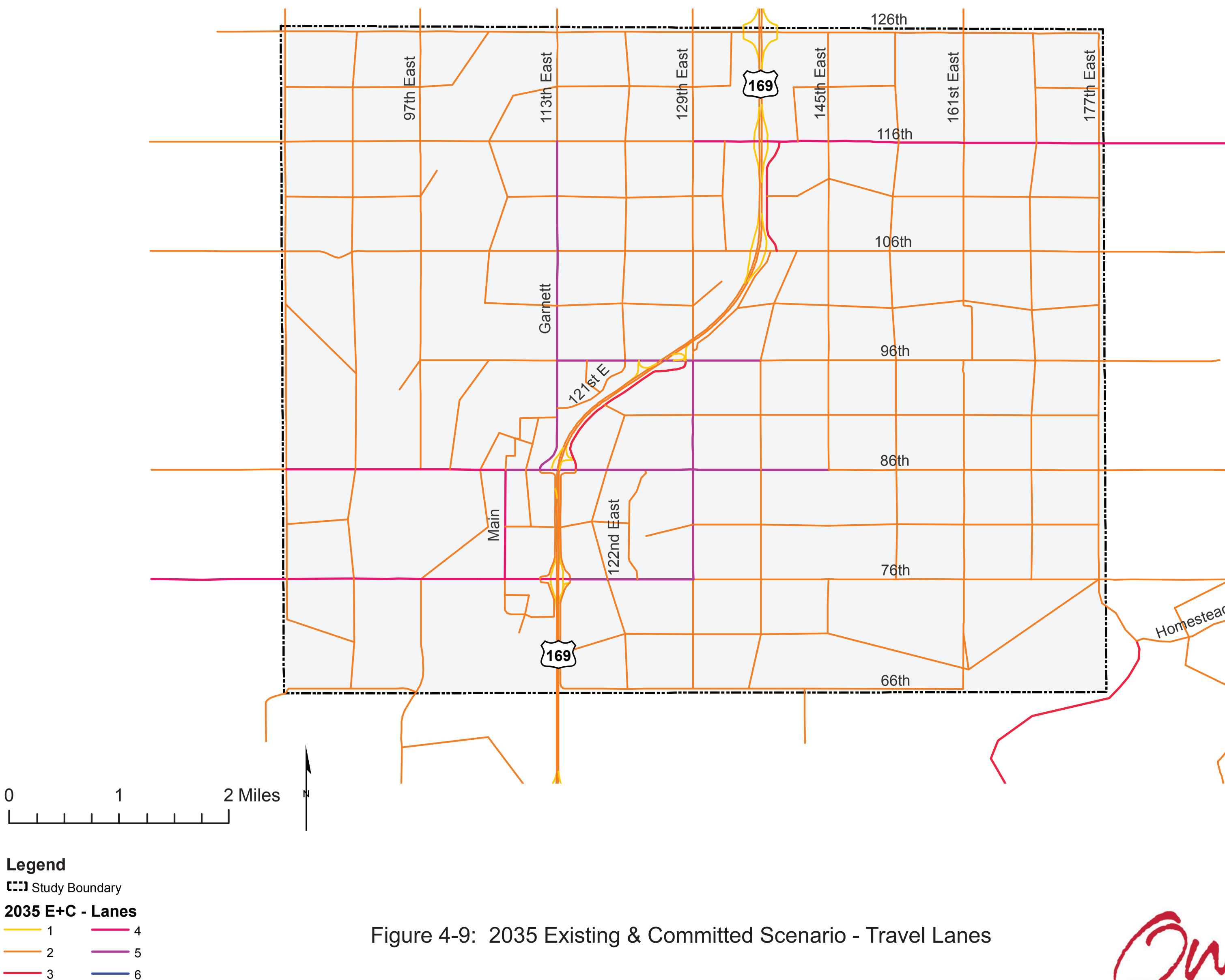


Figure 4-9: 2035 Existing & Committed Scenario - Travel Lanes

OWASSO TRANSPORTATION MASTER PLAN

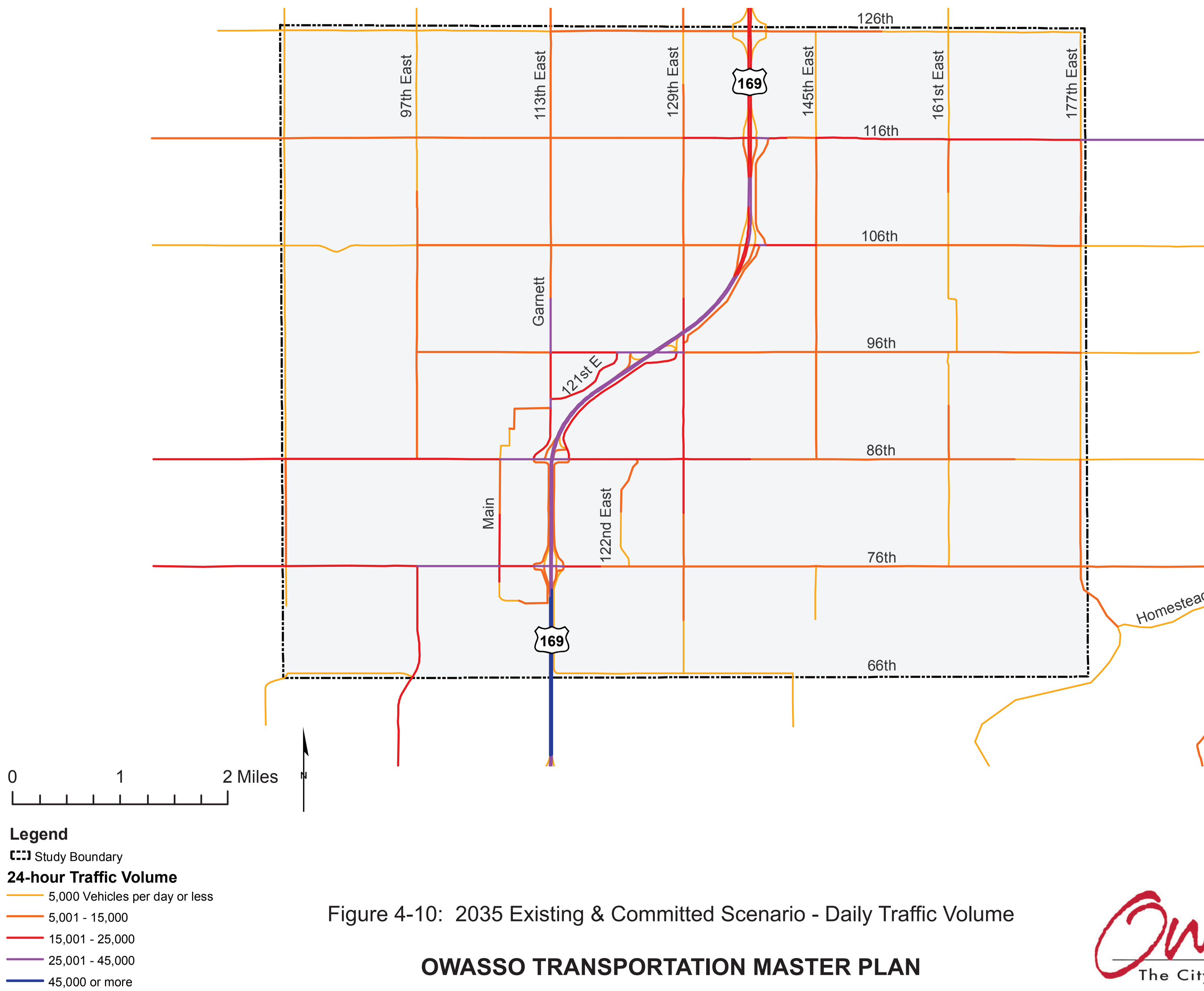


Figure 4-10: 2035 Existing & Committed Scenario - Daily Traffic Volume

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

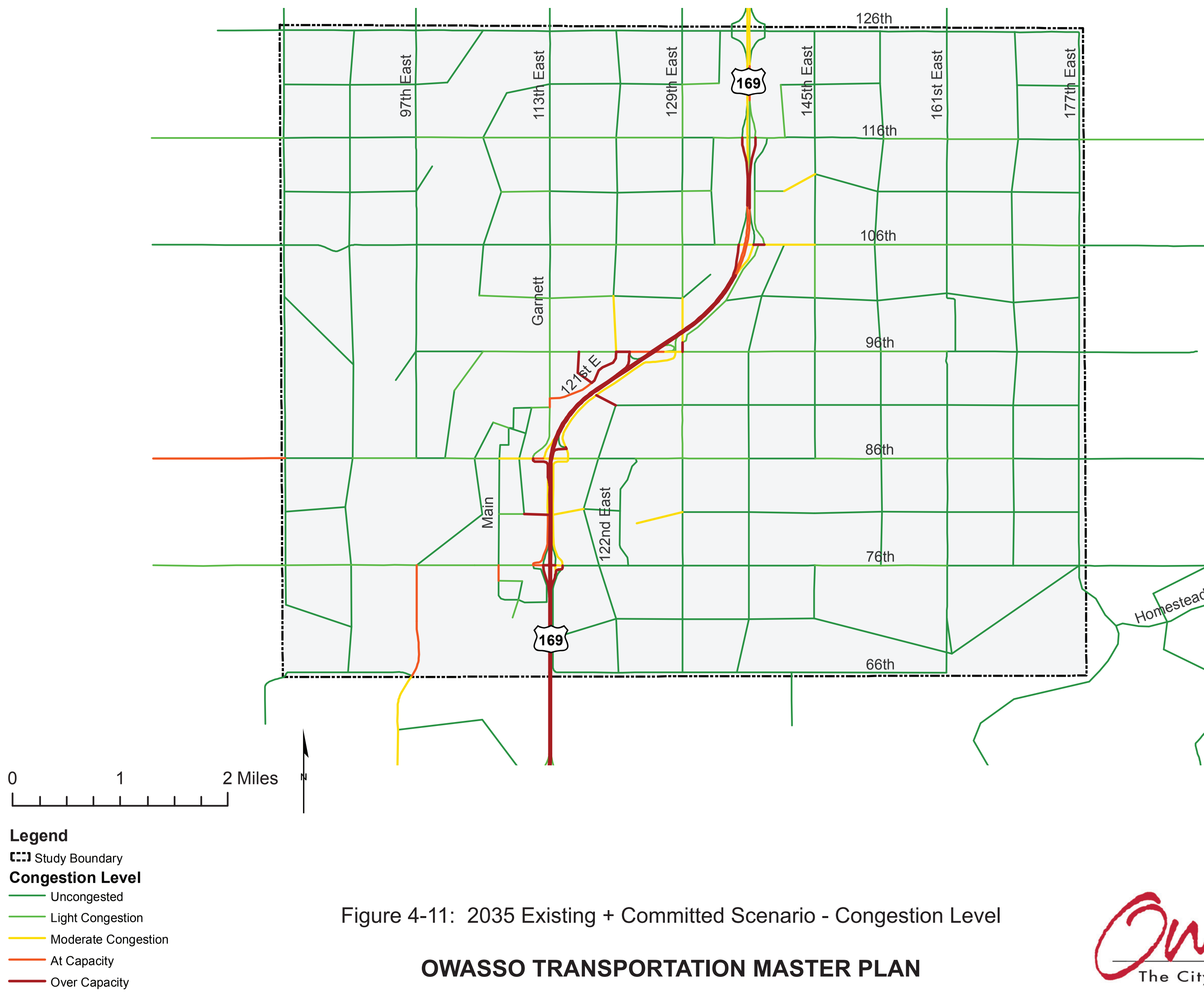


Figure 4-11: 2035 Existing + Committed Scenario - Congestion Level

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

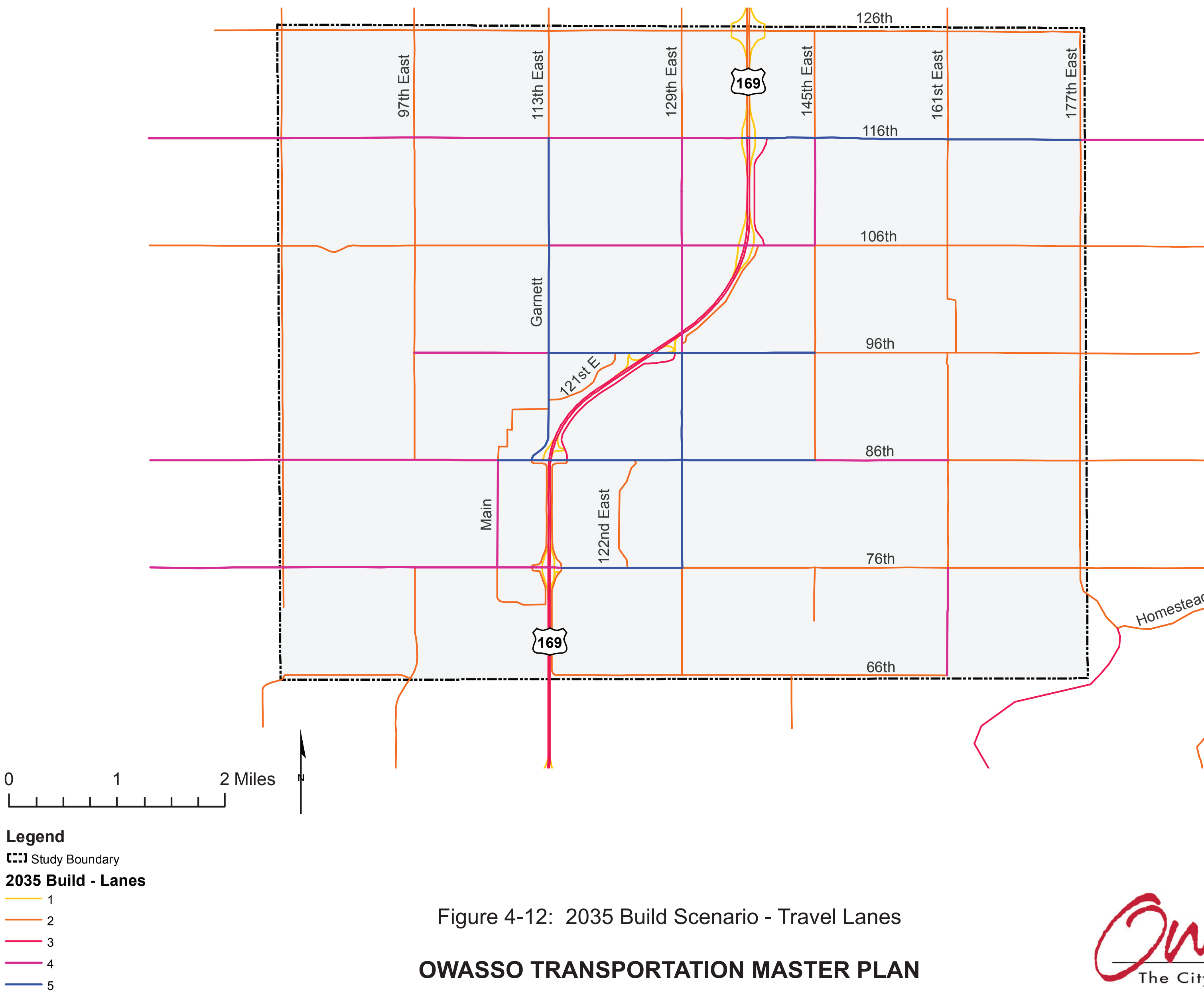


Figure 4-12: 2035 Build Scenario - Travel Lanes

OWASSO TRANSPORTATION MASTER PLAN

Owasso The City Without Limits.

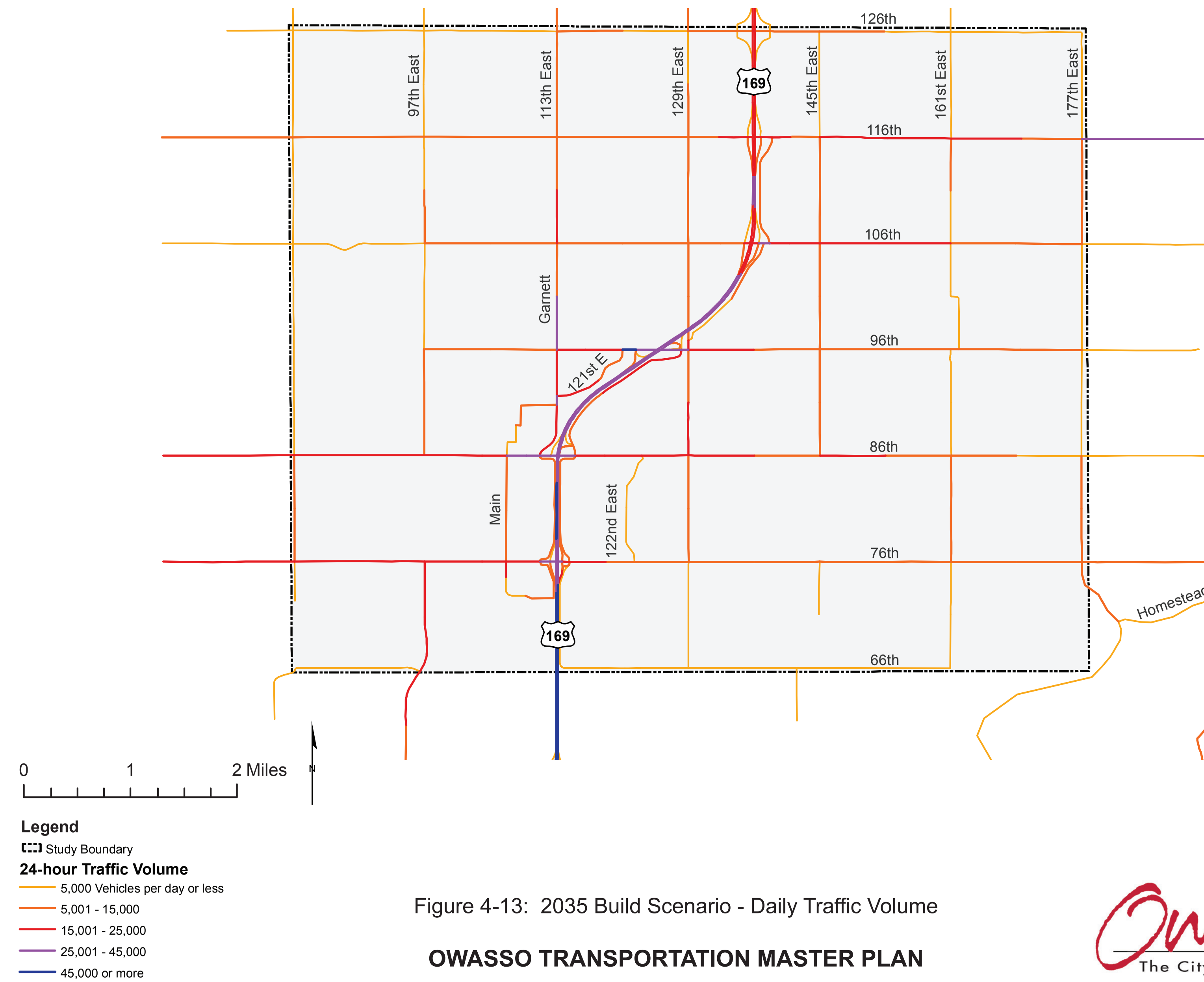


Figure 4-13: 2035 Build Scenario - Daily Traffic Volume

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

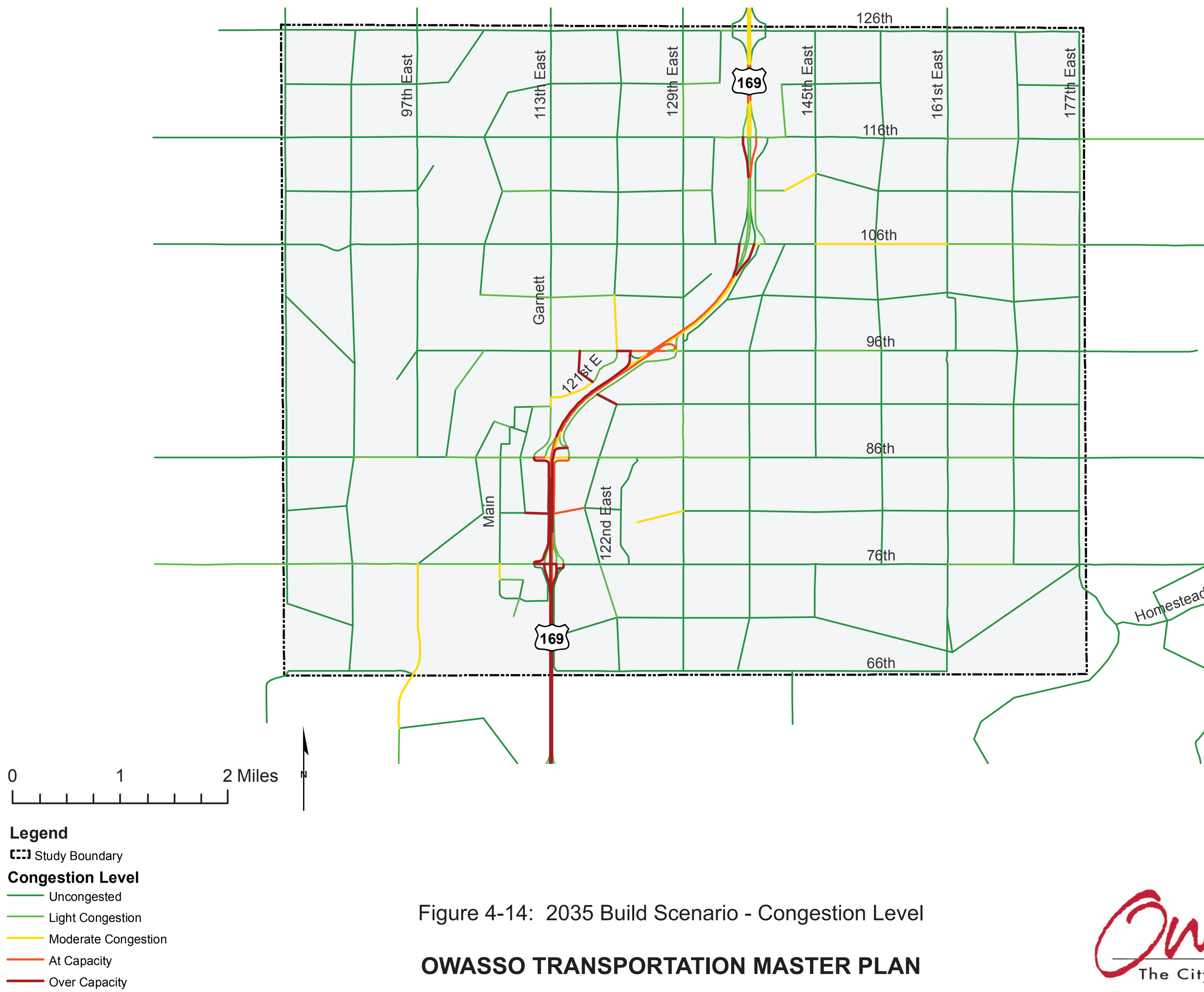


Figure 4-14: 2035 Build Scenario - Congestion Level

OWASSO TRANSPORTATION MASTER PLAN

Owasso The City Without Limits.

The Owasso subarea model provides information regarding daily congestion levels and adequacy of the physical roadway network. The model results provided a sequencing of the roadway widening projects to accommodate the growing traffic volumes associated with the projected population and employment growth through 2035.

However, certain trouble spots remain – particularly in the vicinity of interchanges with US 169, where the physical roadway capacity is not sufficient. Furthermore, although daily traffic volumes can be accommodated with the anticipated network improvements, peak period traffic issues might still arise, especially at or near intersections. It would therefore be beneficial to select high-volume intersections to do a detailed operational analysis, including a review of associated turning movements. Based on the findings of such an analysis, additional operational, channelization, or other improvements can be suggested that would further improve the flow of traffic. Analysis of these high volume intersections is included in Section 5.

5 RECOMMENDED TRANSPORTATION PLAN

5.1 INTRODUCTION

The recommended Transportation Enhancement Plan for the City consists of improvements that best meet the projected mobility needs of the community over the next 20 years. The development of the recommended plan was based on future traffic volumes and level-of-service, transportation network continuity, environmental constraints, community acceptance, impact on land development, and conformance with growth policies and community goals and objectives. This section identifies the recommended transportation enhancement plan as well as other recommendations for improving traffic conditions such as implementation of transportation system management measures, intelligent transportation systems technology, and access management measures.

5.2 POLICY GUIDANCE

Certain policy guidelines common with most municipalities are reflected in the Recommended Transportation Plan. These guidelines are:

- Potential right-of-way acquisitions that would require purchases of large numbers of houses or businesses should be avoided. These purchases are typically triggered when the depth of the right-of-way take includes all of a home's front or back yard, or a significant portion of a businesses' parking space
- Curb cut policies should be formally adopted by the City. The Access Management and Driveway Control section chapter gives suggested criteria
- Connectivity policies, other than by the section line streets, should be formally adopted by the City. The Access Management and Driveway Control section also gives suggested criteria
- Traffic impact analysis (TIA) for development activity should be formally adopted by the City. Criteria should be developed for what type of activity will trigger the need for a TIA (zoning, subdivision platting, site plan approval, etc.), what level of development will trigger the need for a TIA (acreage, number of units, square footage of buildings, etc.), and who will perform the TIA (developer's consultant, on-call consultant, City staff, etc.)

5.3 RECOMMENDED TRANSPORTATION MASTER PLAN

The recommended transportation plan for the City includes roadway capacity, intersection, and railroad crossing improvements.

Roadway capacity improvements provide for additional travel lanes to relieve congested roadway conditions and were recommended in locations where future projected traffic volumes were approaching or exceeding capacities. Roadway widenings provide for more efficient travel and in most cases were recommended in locations where additional right-of-way could be acquired with minimal impact to adjacent land uses. In Owasso, roadway capacity improvements were recommended along major and minor arterials if warranted by future volumes. The recommended plan is shown in **Figures 5-1 through 5-5**.

5.3.1 Recommended Roadway and Intersection Improvements

Improvements in Owasso include roadway capacity improvements along several major and minor arterials and intersections to accommodate growth over the next 20 years. The recommended projects for implementation provide adequate capacity and level-of-service to most of the transportation system, as shown in **Table 5-1 and Table 5-2**. The roadway and intersection improvements are first presented in order of the east/west streets, starting from the south and continuing north. Each street is discussed in order from west to east. The north/south streets are then presented, starting from the west and continuing east. Each street is discussed in order from south to north. For the north/south streets, the intersections discussed with the east/west streets are not repeated.

LOS is discussed in Section 2 of this report. Critical intersections and all of the US 169 interchanges within the study area were analyzed in enough detail to determine individual movement LOS and overall intersection LOS for both the AM and PM peak hour 2035 volumes. The calculated LOS is shown for signalized intersections. For unsignalized intersections, the percent of capacity is used in-lieu-of a LOS. When percent of capacity nears or exceeds 100%, the intersection is considered as failing to handle the assigned traffic volumes.

5.3.2 Recommended E 76th Street N Improvements

The following roadway and intersection improvements are recommended for E 76th Street N.

5.3.2.1 76th Street N and Memorial Road Intersection Improvements

There is a four-lane section on 76th Street with a two-lane section on Memorial Road. This intersection is stop controlled for Memorial Road. This intersection should be signalized in the future. Turn lanes should be added on 76th Street and on the north leg of Memorial to improve the LOS and safety of the intersection. Peak hourly volumes and LOS estimates are not shown in the figures for this intersection.

5.3.2.2 76th Street N and Mingo Road Intersection Improvements

There is a four-lane section on 76th Street with a two-lane section on Mingo Road. This is a T-intersection with an exclusive right turn with minimal storage for northbound Mingo Road. It is stop controlled for Mingo Road. This intersection should be signalized in the future. An optional left turn lane for westbound traffic onto Mingo Road would improve the LOS and safety of the intersection. Even without the dedicated westbound left turn lane, the intersection will have a LOS B for both the AM and PM peaks. Peak hourly volumes and LOS estimates are shown in **Figure A-1-1, a through h**.

5.3.2.3 76th Street N and Main Street Intersection Improvements

This intersection has a traffic signal and four lanes east-west and three lanes north-south. There are exclusive left turn lanes north-south at the intersection. With the existing geometry and 2035 volumes it operates at LOS F for the northbound left turn. It is recommended that exclusive right turn lanes be added for the northbound and southbound movements. The traffic signal should be equipped with protective-permissive signal heads for the north-south left turns. The recommended improvements will need to be weighed against the loss of on-street parking that would result from these improvements. The intersection will have a LOS C for the AM peak and a LOS B for the PM peak. Peak hourly volumes and LOS estimates are shown in **Figure A-1-2, a through h**.

5.3.2.4 76th Street N & US 169 Interchange Improvements

The optimal configuration for 76th Street at US 169 interchange is a single-point diamond interchange (SPDI). The existing diamond interchange will work, however several additional lanes will need to be added.

For the SPDI, the number of lanes approaching the interchange on the eastbound and westbound side from Cedar and N 117th E Avenue respectively is five lanes. This would be composed of two thru lanes plus a westbound left turn lane and an eastbound right turn lane at 117th. At Cedar, the left turn and the right turn could be from the through lanes, however, a westbound left turn lane would be recommended in order to not reduce the capacity of the inside westbound thru lane. It would be recommended that a traffic signal be installed at N Cedar Street.

The number of lanes from the west frontage road to the east frontage road would be six lanes. This would include channelization for left and right turn lanes. The west frontage road would need a four-lane section for the north leg and a five-lane section for the south leg. The westbound traffic would have a left turn lane and two thru lanes with the right turn lane sharing the outside thru lane. The east frontage road would require a six-lane section for the north leg and a five-lane section for the south leg. The eastbound section would have a double left turn lane and two thru lanes with the right turn sharing the outside thru lane. The single point diamond would require one lane on-ramps and off-ramps, i.e., single left turns on each approach. Right turn ramps would be used in all quadrants for access to the either the on-ramps or the off-ramps for arterial access. This configuration would require that 76th Street have six lanes in each direction from the east frontage road to west frontage road. Most of the six-lane section exists from the west frontage road to the east frontage road. With a SPDI, the lowest LOS is D at the west frontage road intersection with the PM peak.

For the existing diamond interchange, on the west frontage road, a double left turn will be needed for southbound and northbound traffic. On the east ramp junction northbound US 169, a double left turn is needed for the westbound traffic. There appears to be enough of a pavement section existing to accommodate the double left turn without major construction. With a diamond interchange, the lowest LOS is C at several intersections in both the AM and PM peaks.

In addition to the number of lanes recommended, traffic signals would need to be installed at Cedar and N 117th E Avenue to prevent an unacceptable LOS. It would be recommended that the traffic signals be installed as part of the interchange upgrade. Peak hourly volumes and LOS estimates are shown in **Figure A-1-3, a through I**.

5.3.2.5 76th Street N, US-169 Interchange to 129th E Avenue, Roadway Improvement

This section of two-lane roadway will be replaced with a four-lane roadway.

5.3.2.6 76th Street N and 129th E Avenue Intersection Improvements

This intersection has four-lane approaches for eastbound and westbound traffic, and a five-lane approach for southbound traffic. Exclusive left turn lanes are provided for all movements. The southbound and westbound movements also have exclusive right lanes. The northbound approach is a three-lane approach with a single lane for thru and right turn movements. Except for the northbound traffic on 129th Avenue, all other movements revert to a two-lane section once they pass through the intersection.

The 76th Street N four-lane improvement to the west will tie into the west leg of this intersection with little additional intersection improvement. On the east leg, the turn lane widening should extend east into the 76th Street N three-lane improvement. No additional improvement is recommended on the north and south legs of this intersection. The intersection will have a LOS of B in both the AM and PM peaks. Peak hourly volumes and LOS estimates are shown in **Figure A-1-4, a through d.**

5.3.2.7 76th Street N, 129th E Avenue to 145th E Avenue, Roadway Improvement

This section of two-lane roadway will be replaced with a three-lane roadway.

5.3.2.8 76th Street N and 145th E Avenue Intersection Improvements

This intersection has two-lane approaches for eastbound, westbound and northbound traffic. Exclusive left turn lanes will be provided on the west and east legs, with these legs tied into the three-lane roadway improvements to the west and east. The south leg will remain two-lane. Peak hourly volumes and LOS estimates are not shown in the figures for this intersection.

5.3.2.9 76th Street N, 145th E Avenue to 161st E Avenue, Roadway Improvement

This section of two-lane roadway will be replaced with a three-lane roadway.

5.3.2.10 76th Street N and 161st E Avenue Intersection Improvements

This intersection has two-lane approaches for all four directions of traffic. Exclusive left turn lanes will be provided on the west, east and north legs. The west and east legs will be tied into the three-lane roadway improvements to the west and east. The south leg will remain two-lane. Peak hourly volumes and LOS estimates are not shown in the figures for this intersection.

5.3.2.11 76th Street N, 161st E Avenue to 177th E Avenue, Roadway Improvements

This section of two-lane roadway will be replaced with a three-lane roadway.

5.3.2.12 76th Street N and 177th E Avenue Intersection Improvements

This intersection has two-lane approaches for all four directions of traffic. Exclusive left turn lanes will be provided on the west, east and north legs. The west leg will be tied into the three-lane roadway improvements to the west. The south leg will remain two-lane. Peak hourly volumes and LOS estimates are not shown in the figures for this intersection.

5.3.3 Recommended E 86th Street N Improvement

The following roadway and intersection improvements are recommended for E 86th Street N.

5.3.3.1 86th Street N and Memorial Road Intersection Improvements

There is a four-lane section on 86th Street with a three-lane section on Memorial Road. This intersection is signalized. Turn lanes should be added on 86th Street to improve the LOS and safety of the intersection. Peak hourly volumes and LOS estimates are not shown in the figures for this intersection.

5.3.3.2 86th Street N and Mingo Road Intersection – No Improvement

This is a T-intersection with a four-lane section on 86th Street and a three-lane section on Mingo Road, extending north. This intersection is signalized. The north leg on Mingo Road will tie into the three-lane roadway improvement to the north. No further improvements are recommended.

5.3.3.3 86th Street N and Main Street Intersection Improvements

The intersection of 86th and Main is signalized with exclusive left turn lanes in all directions. They are controlled by a protective permissive turn signal. It has a four-lane approach in each direction for thru and right-turn movements. When the 2035 traffic volumes were applied to the existing configuration, most of the movements have a LOS of E or F.

86th Street has recently been widened from two-lanes to four lanes west of Main Street due to growth in the area. To eliminate the LOS F and reduce the LOS E to only the AM peak, a double left turn is recommended for the east leg. Right of way restrictions make this widening difficult, so the AM peak LOS needs to be weighed against the modification cost. No additional intersection improvements are recommended. Peak hourly volumes and LOS estimates are shown in **Figure A-2-1, a through h**.

5.3.3.4 86th Street N and US 169 Interchange Improvements

The optimal configuration for the 86th Street N interchange with US 169 is a half-diamond interchange that is the current configuration. The west ramps would need to be re-aligned to match the southbound off ramp with the southbound on ramp. This is a very tight configuration but it is possible to move the southbound off ramp and the southbound on ramp each approximately 100 feet to accomplish this. It is a similar situation as 76th Street due to the growth in traffic mainly in the commercial area surrounding the frontage roads. The 2035 traffic, with the additional residential traffic during the AM and PM peak hours, will overload the intersections within the interchange using the current configuration without adding additional turning lanes.

At the Garnett Road / West Frontage Road intersection, 86th Street N will need a six-lane section for eastbound traffic and a six-lane section for westbound traffic, along with multiple turn lanes. The westbound approach would have two exclusive double left turn lanes, three thru lanes and an exclusive right turn lane. The eastbound approach would require two exclusive left turn lanes, three thru lanes and an exclusive right turn lane. The northbound approach would have a six-lane section and the southbound approach a six-lane section. The northbound would require two exclusive left turn lanes, two thru lanes with a shared outside lane for right turns. The southbound approach would require a double left turn, a separate thru lane and a right turn lane. Right-of-way limitations will need to be very carefully examined to determine if the required configuration will fit in the space available.

At the east frontage road intersection, 86th Street would require a six-lane section westbound and a six-lane section eastbound, with multiple turn lanes. The westbound approach would have an exclusive left turn lane, three thru lanes and a separate right turn lane. The eastbound approach would require a double left turn lane and three thru lanes with a shared outside lane for right turns. The northbound approach would have a seven-lane section and the southbound approach a six-lane section. The northbound would require a double left turn lane, two thru lanes and a right turn lane. The southbound approach would require a double left turn and two thru lanes with a shared lane for right turns on the outside lane.

For the loop and trumpet section that has access to the east frontage road, either a traffic signal will be required to accommodate the northbound on and off ramps, or additional lanes and lane separation will be required on the frontage road. Currently there is approximately 100 foot separation between the on and off ramps. This may be sufficient distance to place a traffic signal for both ramps. If not, a slight re-alignment of the northbound off ramp may be required so that the off ramp and on ramp would be on the same signal. The configuration shown in this plan uses un-signalized ramp / frontage road intersections as there appears to be sufficient right-of-way to accommodate additional lanes and lane separation. The configuration shown uses a four-lane section on the east frontage road north of 86th Street N, divided by a median. The northbound to westbound loop would require a deceleration lane on 86th Street N which could be accommodated within the six-lane section needed for the west leg of the east frontage road intersection.

At the west off ramp for southbound traffic from US 169, the westbound approach would require a double left turn with three thru lanes. The southbound ramp would require an exclusive left turn and two right turn lanes. The south leg of the ramp would be two receiving lanes for the westbound double left turn. These two-lanes would be tapered down to a one lane on ramp with an acceleration lane at US 169. Using a half diamond configuration, the LOS at each intersection is at least C for both the AM and PM peaks.

In addition to the half diamond configuration, this report also considered a complete reconstruction of the interchange as a single point interchange. The results of applying the 2035 traffic to this configuration are also shown. With a SPDI, the main intersection operates at a LOS D in the AM peak. Peak hourly volumes and LOS estimates are shown in **Figure A-2-2, a through I**.

5.3.3.5 86th Street N & 129th E Avenue Intersection Improvements

The intersection is signalized with a five-lane section on each quadrant. The left turn lanes are controlled by protective-permissive signal heads allowing for additional left turn capacity. This is located in a built up area with little growth potential due to a lack of vacant developable land. With the 2035 traffic volumes applied to the existing configuration, some movements have a LOS of F. If right-of-way can be secured, which will be difficult due to the improvements in each quadrant of the intersection, a double left turn lane should be added to each leg of the intersection. By adding these lanes, the intersection will operate at a LOS D in the future AM peak, with some LOS E in various movements. Peak hourly volumes and LOS estimates are shown in **Figure A-2-3, a through h**.

5.3.3.6 86th Street N and 145th E Avenue Intersection Improvements

This intersection is signalized and has left turn lanes in each direction. There is a five-lane section on the west leg which continues to the west. A short (200-foot) five-lane section on the east leg transitions to a two-lane, but is recommended to transition into the four-lane improvement of 86th Street N to the east. There is a five-lane section to the north that tapers to a three-lane, but is recommended to transition into the four-lane improvement of 145th E Avenue to the north. If development continues as planned to the south, the south leg of this intersection will need to be rebuilt to four lanes. Additionally, to avoid LOS E and F in the PM peak, a double left turn lane for the west leg should be considered. This would raise the overall intersection LOS from D to C in the PM peak. Peak hourly volumes and LOS estimates are shown in **Figure A-2-4, a through h**.

5.3.3.7 86th Street N, 145th E Avenue to 161st E Avenue, Roadway Improvement

This section of two-lane roadway will be replaced with a four-lane roadway.

5.3.3.8 86th Street N and 161st E Avenue Intersection Improvements

This intersection has two-lane approaches for all four directions of traffic. Exclusive left turn lanes will be provided on all legs. The west leg will be tied into the four-lane roadway improvements to the west and the east leg will be tied into the three-lane roadway improvements to the east. Peak hourly volumes and LOS estimates are not shown in the figures for this intersection.

5.3.3.9 86th Street N, 161st E Avenue to 177th E Avenue, Roadway Improvement

This section of two-lane roadway will be replaced with a three-lane roadway.

5.3.3.10 86th Street N and 177th E Avenue Intersection Improvements

This intersection has two-lane approaches for all four directions of traffic. Exclusive left turn lanes will be provided on all legs. The west leg will be tied into the three-lane roadway improvements to the west. Peak hourly volumes and LOS estimates are not shown in the figures for this intersection.

5.3.4 Recommended E 96th Street N Improvements

The following roadway and intersection improvements are recommended for E 96th Street N.

5.3.4.1 96th Street N and Mingo Road Intersection Improvements

This intersection has two-lane approaches for all four directions of traffic. Exclusive left turn lanes will be provided on all legs. The south leg will be tied into the three-lane roadway improvements to the south and the east leg will be tied into the three-lane roadway improvements to the east. Peak hourly volumes and LOS estimates are not shown in the figures for this intersection.

5.3.4.2 96th Street N, Mingo Road to Garnett, Roadway Improvement

This section of two-lane roadway will be replaced with a three-lane roadway.

5.3.4.3 96th Street N and Garnett Road Intersection Improvements

The intersection of 96th Street and Garnett has a five-lane section on each leg with a three-lane approach from each direction. The five lanes narrow to two-lanes when heading north or west. This intersection is approximately 1.5 miles from the US 169 interchange.

The intersection is at capacity: applying the 2035 traffic volumes renders a LOS D. Some intersection timing improvement is necessary to optimize the intersection capacity.

It is anticipated that the two-lane section west of this intersection will be widened to three lanes, tying into the existing five-lane section. The two-lane section north of this intersection will be widened to five lanes, also tying into the existing five-lane section. Peak hourly volumes and LOS estimates are shown in **Figure A-3-1, a through h**.

5.3.4.4 96th Street N and US 169 Interchange Improvements

The optimal configuration for 96th Street and US 169 would be to convert the folded diamond to a tight diamond on the east side of US 169. This would eliminate the folded diamond and separate the frontage road from the northbound on and off ramps. Currently there is only about 300 feet between the northbound ramps and the frontage road.

Acceleration and deceleration lanes would be required due to the volume of traffic on US 169 during the peak hours. The traffic volumes on the ramps are not at capacity but the volume of traffic on US 169 would be delayed and possibly a safety issue without the acceleration and deceleration lanes.

A six-lane section would be required on 96th Street from 121st Avenue to 129th Avenue under the current interchange configuration. A six-lane section would be required on 96th from just east of

129th Avenue to just west of the northbound on/off ramps to accommodate the turn lanes for the tight diamond constructed on the east side of US 169.

The northbound approach at 121st Avenue would be exclusive right, thru and left turn lanes which currently exist. The southbound approach would remain as is with a left turn lane and a shared right turn and thru lane. On the eastbound and westbound approaches, the lane configuration will remain the same. There would be an exclusive left turn lane, two thru lanes and an exclusive right turn lane for the eastbound and a left turn lane and two thru lanes with a shared right turn lane for the westbound. If possible, a double left turn lane for the westbound to southbound movement should be considered for periods of extreme traffic (weekends and holiday shopping).

At the southbound on and off ramps with US 169, it would remain as it is today with a six-lane section east-west on 96th Street. Northbound traffic would have exclusive left, thru and right turn lanes and southbound would have a left turn lane and combined thru and right turn lane.

For the northbound on and off ramps, if the existing configuration remains the same, there would only be an acceleration lane for the northbound off ramp loop. A traffic signal would need to be installed at the east frontage road and 129th E Avenue when warranted. Under the tight diamond configuration, the backup from 129th Avenue through the northbound on-off ramp intersection would be eliminated. The tight diamond would be a six-lane section that exists today on part of the intersection. The six-lane section would need to be extended a short distance to accommodate a double left turn for eastbound traffic. A westbound exclusive right turn lane would be terminated at the northbound entrance onto US 169. The traffic signals for the northbound and southbound on-off ramps could be run off of one traffic controller as a diamond interchange; however due the distance between the ramps, this would not be very feasible. A traffic signal coordination system on 96th Street for all of the signalized intersection would definitely help facilitate future traffic. One added benefit to the tight diamond configuration is the fact that approximately four acres would be available for development on the northwest corner of 96th Street and 129th Avenue. This would be subject to ODOT being willing to sell the parcel. The LOS under the current configuration would be at LOS D whereas the tight diamond configuration would be at LOS C with the coordination in place.

The configuration of 129th Avenue and 96th Street would need a left turn lane, three thru lanes with a shared thru/right turn lane for eastbound traffic. The same configuration would apply to the westbound traffic. On the north side of the intersection, the two-lane section heading northbound should be extended to the frontage road with a right turn drop lane at the intersection of the frontage road with 129th. Similarly, the southbound two-lane section should be extended to the frontage road. The north/south configuration will remain the same as it is today. A traffic signal should be planned for the East Frontage Road and 129th Avenue intersection when traffic warrants. Peak hourly volumes and LOS estimates are shown in **Figure A-3-2, a through h**.

5.3.4.5 96th Street N, 135th E Avenue to 145th E Avenue, Roadway Improvement

This section of two-lane roadway extending from the end of the existing widening east of 129th E Avenue, at 135th E Avenue, will be replaced with a four-lane roadway.

5.3.4.6 96th Street N and 145th E Avenue Intersection Improvements

This intersection has two-lane roadways for a one lane approach in all directions. It is operated as a four-way stop. Under this configuration, it operates at LOS F for the 2035 traffic volumes. Installing signals alone would raise the intersection to a LOS D. If left turn lanes were added on the approaches where the most left turns occur, the intersection would be raised to a LOS B with signalization. Therefore, the north and east legs will be three lanes, matching the roadway improvements abutting each of these legs. The four lanes of 145th E Avenue south of 96th Street N will continue into a four-lane south leg. Similarly, the four lanes of 96th Street N west of 145th E Avenue will continue into at least a four-lane west leg, with a five-lane west leg being optimal. Peak hourly volumes and LOS estimates are shown in **Figure A-3-3, a through h**.

5.3.4.7 96th Street N, 145th E Avenue to 161st E Avenue, Roadway Improvement

This section of two-lane roadway will be replaced with a three-lane roadway. This widening will extend to 300 feet past the north leg of the offset 161st E Avenue intersection. The north and south legs of 161st E Avenue will be tied in without further widening.

5.3.5 Recommended E 106th Street N Improvements

The following roadway and intersection improvements are recommended for E 106th Street N.

5.3.5.1 106th Street N and Garnett Road Intersection Improvements

This intersection was recently signalized and widened to six lanes (one left turn, two through, one right turn and two receiving lanes). The resulting LOS is B for the AM peak and C for the PM peak. Peak hourly volumes and LOS estimates are shown in **Figure A-4-1, a through d**.

5.3.5.2 106th Street N, Garnett Road to 129th E Avenue, Roadway Improvement

This section of two-lane roadway will be replaced with a four-lane roadway.

5.3.5.3 106th Street N and 129th E Avenue Intersection Improvements

This intersection is currently a 4-way stop with two-lanes in each direction. It will operate at a LOS F with future traffic under this configuration. The intersection should be signalized with left turn lanes in each direction. The west, south and east legs will transition to four-lane roadways, making a five-lane approach desirable. The north leg will transition to a three-lane roadway, with either a five-lane approach to match the other approaches, or a four-lane approach. With these improvements, an LOS A is achieved for both AM and PM peaks. Peak hourly volumes and LOS estimates are shown in **Figure A-4-2, a through h**.

5.3.5.4 106th Street N, 129th E Avenue to West of the US169 interchange, Roadway Improvement

This section of two-lane roadway will be replaced with a four-lane roadway.

5.3.5.5 106th Street N and US 169 Interchange Improvements

The frontage roads should be realigned on the east side of US 169. It is possible to realign it given that sufficient right of way exist. The realignment along with signalization will significantly improve the overall operation and safety versus the offset intersections. Both north and south legs of the frontage road need to be three lanes.

106th Street N will need to be widened to a five-lane section throughout the interchange, with left turn lanes at each intersection and two through lanes in each direction. Where appropriate, the outside through lane will be shared for right turns.

The diamond interchange as constructed will function adequately with the interchange as a whole having a LOS B. All three intersections should be signalized with one controller operating the diamond and coordinated with the East Frontage Road. Peak hourly volumes and LOS estimates are shown in **Figure A-4-3, a through h**.

5.3.5.6 106th Street N, East of the US169 interchange to 145th E Avenue, Roadway Improvement

This section of two-lane roadway will be replaced with a four-lane roadway.

5.3.5.7 106th Street N and 145th E Avenue Intersection Improvements

The intersection of 106th Street N and 145th E Avenue has two-lanes in all directions and is currently operated with a 4-way stop. This intersection will operate at LOS F in the future with 2035 volumes.

The recommendation for the intersection would be to add a traffic signal. This would bring all movements up to an acceptable LOS. Future lane improvements include five lanes on the east and west legs, transitioning from the four-lane widening on 106th Street N, and three lanes on the south and north legs to match the widening on 145th E Avenue. These improvements will bring the overall intersection LOS up to B in both AM and PM peaks. Peak hourly volumes and LOS estimates are shown in **Figure A-4-4, a through h**.

5.3.5.8 106th Street N, 145th E Avenue to 161st E Avenue, Roadway Improvement

This section of two-lane roadway will be replaced with a four-lane roadway.

5.3.5.9 106th Street N and 161st E Avenue Intersection Improvements

The intersection of 106th Street N and 161st E Avenue has two-lanes in all directions. The four-lane widening from the west will be continued on the west leg of the intersection. Three-lane legs will be constructed on the north, east and south legs. Peak hourly volumes and LOS estimates are not shown in the figures for this intersection.

5.3.6 Recommended @ 116th Street N Improvements

The following roadway and intersection improvements are recommended for E 116th Street N. These recommendations are based upon extending a four-lane roadway to US 75 west of the study area.

5.3.6.1 116th Street N and Memorial Road Intersection Improvements

This intersection has two-lane approaches for all four directions of traffic. With the four-lane widening of 116th Street N, the west and east legs will be constructed with five lanes. Exclusive left turn lanes will be provided on the north and south legs. The north and south legs will transition to the existing two-lane roadway. Peak hourly volumes and LOS estimates are not shown in the figures for this intersection.

5.3.6.2 116th Street N, Memorial Road to Mingo Road, Roadway Improvement

This section of two-lane roadway will be replaced with a four-lane roadway.

5.3.6.3 116th Street N and Mingo Road Intersection Improvements

This intersection has two-lane approaches for all four directions of traffic. With the four-lane widening of 116th Street N, the west and east legs will be constructed with five lanes. Exclusive left turn lanes will be provided on the north and south legs. The north and south legs will transition to the existing two-lane roadway. Peak hourly volumes and LOS estimates are not shown in the figures for this intersection.

5.3.6.4 116th Street N, Mingo Road to Garnett Road, Roadway Improvement

This section of two-lane roadway will be replaced with a five-lane roadway.

5.3.6.5 116th Street N and Garnett Road Intersection

This intersection has left turn lanes on all approaches. The eastbound movement has an exclusive right turn lane. It is operated by a traffic signal and uses protective permissive phasing for all left turns. Under this configuration, the signal operates at LOS B for the 2035 traffic volumes. The roadway reverts to two-lanes in all directions after passing through the intersection. It is located in a moderately built up residential area.

With widening of 116th Street N, the intersection approaches will be constructed as five lanes on the east and west legs. The south leg will also be constructed to five lanes to match the Garnett Road widening. The north leg can remain as three lanes. These improvements will provide a small increase in the intersection LOS. Peak hourly volumes and LOS estimates are shown in **Figure A-5-1, a through h**.

5.3.6.6 116th Street N, Garnett Road to 129th E Avenue, Roadway Improvement

This section of two-lane roadway will be replaced with a five-lane roadway.

5.3.6.7 116th Street N and 129th E Avenue Intersection Improvements

The intersection of 116th Street North and 129th East Avenue is currently a two-way stop with two lanes in all directions. It will operate at a LOS F with future traffic under this configuration.

The intersection should be signalized with left turn lanes in each direction. The intersection with these changes will operate at LOS C. The east and west legs will be constructed as five lanes to match the 116th Street N widening. The north and south legs should be constructed as three lanes. With this configuration, the intersection LOS is A for the AM peak and B for the PM peak. Peak hourly volumes and LOS estimates are shown in **Figure A-5-2, a through h**.

5.3.6.8 116th Street N, 129th E Avenue to West of the US169 interchange, Roadway Improvement

This section of two-lane roadway will be replaced with a five-lane roadway.

5.3.6.9 116th Street N and US 169 Interchange Improvements

The 116th Street interchange is a standard diamond with a frontage road on the east side. The 2035 traffic volumes cause several intersections and approaches to reach capacity or over capacity conditions. A few modifications to the intersection will bring the LOS up to acceptable levels.

The westbound left turn at the west ramps will need to be a double left turn. At the east ramps, a single left turn for eastbound traffic turning onto northbound US 169 is required. The left turns at the East Frontage Road will need a left turn also. Basically, there are two thru lanes throughout the interchange. The improvements need to extend to the 135th E Avenue intersection. With these improvements, the intersections within the interchange will function at LOS B in the AM peak and LOS C in the PM peak. Peak hourly volumes and LOS estimates are shown in **Figure A-5-3, a through h**.

5.3.6.10 116th Street N and 145th E Avenue Intersection Improvements

The intersection of 116th and N 145th Street is a five-lane section east-west and a two-lane section north-south. It is currently operated with a two-way stop north-south. This intersection will operate at a less than desirable LOS for 145th E Avenue in the future with 2035 volumes.

The recommendation for the intersection is to add a traffic signal. This would bring all movements up to a LOS A, LOS B or LOS C in future. The overall intersection would be LOS B in the AM peak and LOS A in the PM peak. There are no lane improvements recommended, other than extending the three-lane south leg into the three-lane 145th E Avenue widening. The signal and at least some of the intersection modifications are being designed by the Oklahoma Department of Transportation (ODOT). Peak hourly volumes and LOS estimates are shown in **Figure A-5-4, a through h**.

5.3.6.11 116th Street N and Major Intersections East of 145th E Avenue Improvements

The recommendation for each of these intersections is to add a traffic signal.

5.3.7 Recommended E 126th Street N Improvements

The following interchange improvement is recommended for E 126th Street N.

5.3.7.1 126th Street N and US 169 Interchange Improvements

The current diamond configuration will be adequate to handle the 2035 traffic volumes. The only recommendation would be to add acceleration and deceleration lanes for the ramps on US 169 as traffic increases there will be additional delays to vehicles trying to get into the flow of traffic. Peak hourly volumes and LOS estimates are shown in **Figure A-6-1, a through d**.

5.3.8 Recommended Mingo Road Improvements

The following roadway improvement is recommended for Mingo Road.

5.3.8.1 Mingo Road, 86th Street N to 96th Street N, Roadway Improvement

This section of two-lane roadway will be replaced with a three-lane roadway.

5.3.9 Recommended Garnett Road Improvements

The following roadway and intersection improvements are recommended for Garnett Road.

5.3.9.1 Garnett Road and Smith Farm Market Intersection Improvements

The intersection of Garnett Road and Smith Farm Market is a T-intersection with a driveway to the west that is part of the traffic signal. Smith Farm Market provides access to a shopping area and has a two-lane approach for westbound traffic composed of a left turn lane and a thru and right turn lane. The thru movement is rarely used except to access the car wash west of Garnett. The traffic on Garnett has four lanes in the north-south direction with left turns at the intersection. A lane addition for westbound traffic would add a second left turn lane. Providing this additional capacity will significantly increase the LOS of the intersection. A detailed traffic study should determine if an exclusive right turn lane from northbound Garnett would be worth the cost. The traffic signal phasing would have to be split phased east-west. Peak hourly volumes and LOS estimates are shown in **Figure A-7-1, a through h**.

5.3.9.2 Garnett Road, 96th Street N to 106th Street N, Roadway Improvement

This section of two-lane roadway will be replaced with a five-lane roadway.

5.3.9.3 Garnett Road, 106th Street N to 116th Street N, Roadway Improvement

This section of two-lane roadway will be replaced with a five-lane roadway.

5.3.10 Recommended 129th E Avenue Improvements

The following roadway improvements are recommended for 129th E Avenue.

5.3.10.1 129th E Avenue, 96th Street N to 106th Street N, Roadway Improvement

This section of two-lane roadway will be replaced with a four-lane roadway from the existing four-lane section immediately south of the US 169 bridge to 106th Street N. This includes the widening of the bridge over US 169 to four lanes.

5.3.10.2 129th E Avenue, 106th Street N to 116th Street N, Roadway Improvement

This section of two-lane roadway will be replaced with a three-lane roadway.

5.3.11 Recommended 145th E Avenue Improvements

5.3.11.1 145th E Avenue, 86th Street N to 96th Street N, Roadway Improvements

There is a five-lane section to the north of 86th Street N that tapers to a three-lane. This three-lane continues until just south of E 88th Place N, where it tapers into a four lane. North of 89th Street N, the four-lane tapers to a two-lane, and remains a two-lane to 96th Street N. The entire length will be reconstructed as a four-lane.

5.3.11.2 145th E Avenue, 96th Street N to 106th Street N, Roadway Improvements

This section of two-lane roadway will be replaced with a three-lane roadway.

5.3.11.3 145th E Avenue, 106th Street N to 116th Street N, Roadway Improvements

This section of two-lane roadway will be replaced with a three-lane roadway.

5.3.12 Railroad Crossing Improvements

Two at-grade railroad crossings are located on 76th Street and 86th Street respectively with the Southern Kansas Oklahoma Railroad (SKOL) previously known as the Atchison Topeka Santa Fe (ATSF) Railroad. The purpose of analyzing the two crossings is to determine if a grade separated crossing is feasible given the geometric constrains for both the roadway and railway.

On 76th Street, a rail switching yard prevents the possibility of raising the rail grade to allow for a railroad overpass. The second possibility is a railroad underpass where the roadway would pass over the railroad tracks allowing vehicles unimpaired travel when rail cars are passing through Owasso. The analysis of this alternative shows that several driveways and access points to businesses would have to be eliminated. The grades on the roadway are too steep to meet current roadway standards, i.e., 7.5% and 11% for westbound and eastbound traffic, respectively. This is due to a design standard set by the railroad that 25 feet of vertical clearance is required through the bridge section. **Figure 5-6** shows the plan and profile view of a roadway overpass at 76th Street depicting the grades and intersecting driveways as described above. Therefore, 76th Street should remain an at-grade crossing due to geometric and economic restraints that make it not feasible.

On 86th Street, there are also geometric restrictions on the roadway due to a cross street (Mingo Road) and several driveway access points making a roadway overpass not feasible. However, a railroad overpass is feasible to construct based upon having no geometric constraints other than Owasso Lake. A railroad track must not exceed 2% grade in order to meet current railroad design standards. **Figure 5-7** shows the layout of a railroad overpass at 86th Street. The maximum grade criteria can be met for both northbound and southbound trains. The south leg of the rail realignment would require the maximum 2% grade in order to avoid the Owasso Lake dam and spillway. The cost will need to be estimated in order to determine the financial feasibility of constructing the railroad overpass.

5.3.13 Multi-Modal Considerations

Expansion of public transportation, as a percentage of total trips, will decrease the projected traffic volumes on some street segments. Investment in on-demand bus transit and other rubber to street transportation is a viable option for Owasso during the life of the TMP.

Fixed guide-way transit within the City, such as scheduled bus routes, street car and light rail, will require a major mind-set change that cannot be foreseen at this time. Should social or economic conditions change during or beyond the life of this plan such that transit use increases markedly, modifications to the plan will be necessary.

Bicycle and pedestrian facilities are also important components to the City’s transportation system. The regional and local Trails Master Plan and Owasso’s Complete Street Resolution should be incorporated into the TMP and future roadway development.

5.3.14 Roundabout Consideration

Roundabouts are designed to make intersections safer and more efficient for motorists. A single-lane traffic circle should be considered at intersections classified as minor to minor with a lane configuration intended to be no wider than 3 lanes. This circular intersection will contain compact, one-way lanes in which traffic flows in a counterclockwise around a center island. As seen in **Figure 5-8**, intersections best suited for a roundabout are listed for consideration. To ensure the success of circular intersections, the community acceptance should be obtain before planning.

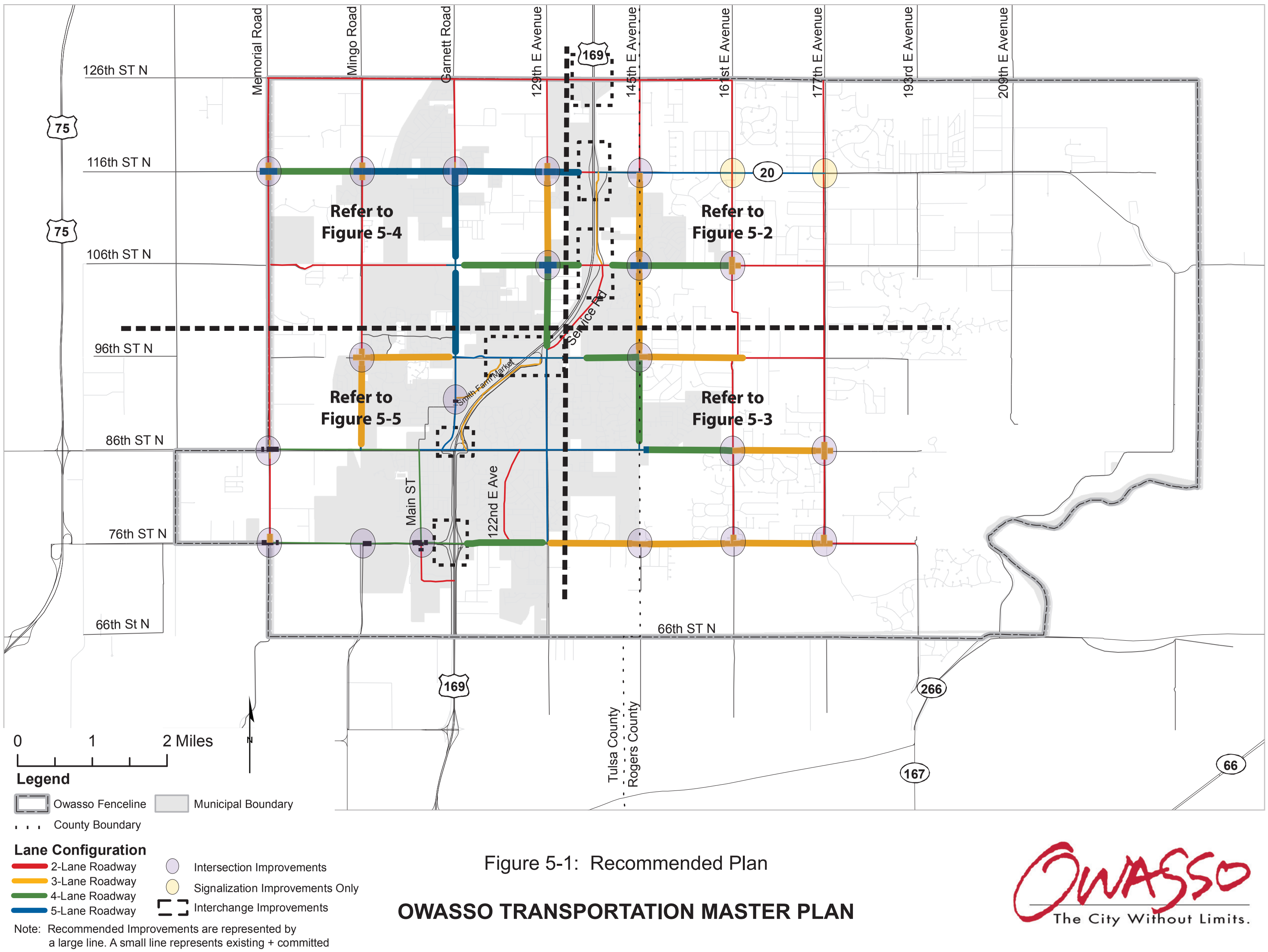


Figure 5-1: Recommended Plan

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

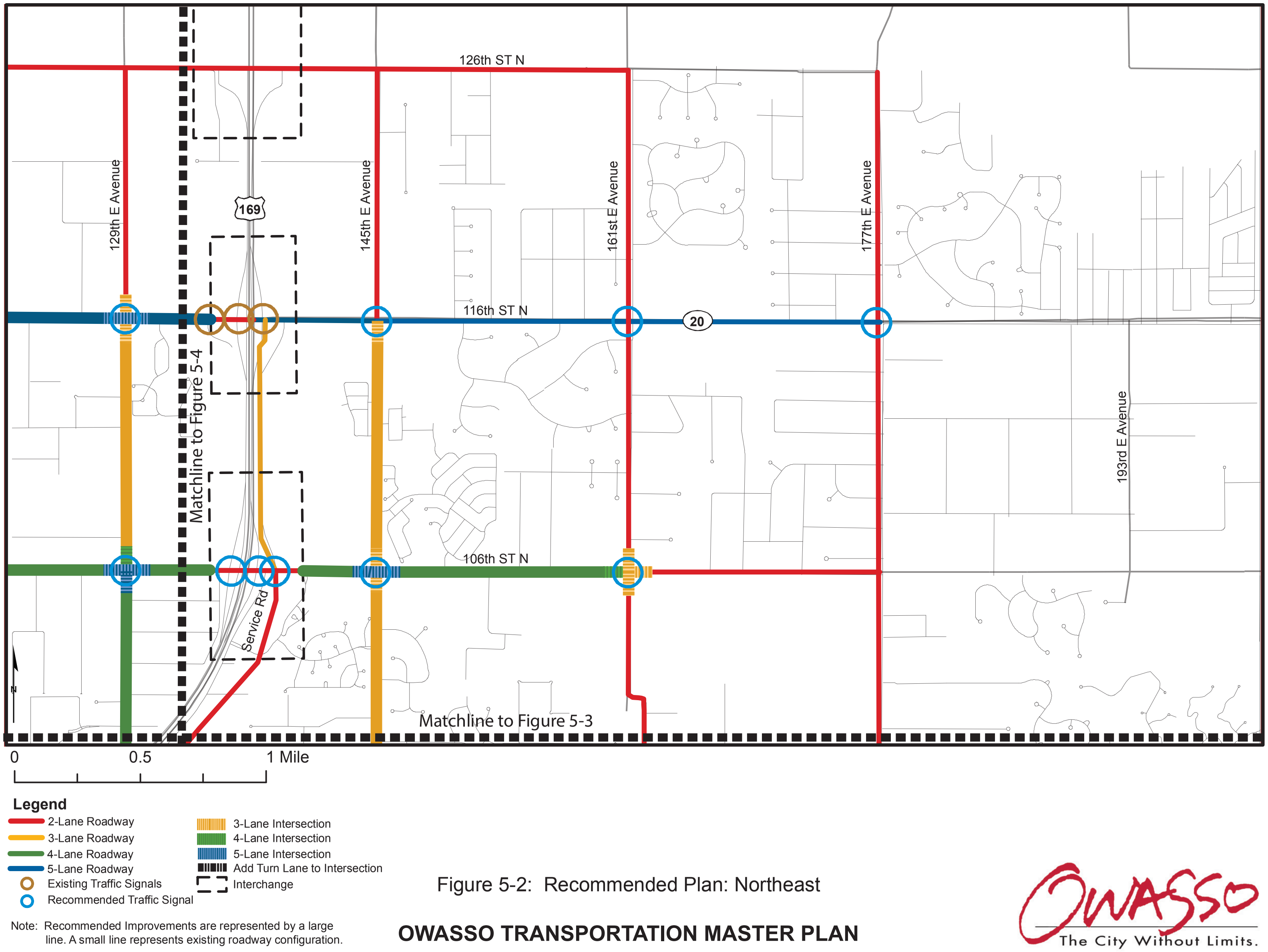


Figure 5-2: Recommended Plan: Northeast

OWASSO TRANSPORTATION MASTER PLAN

OWASSO
The City Without Limits.

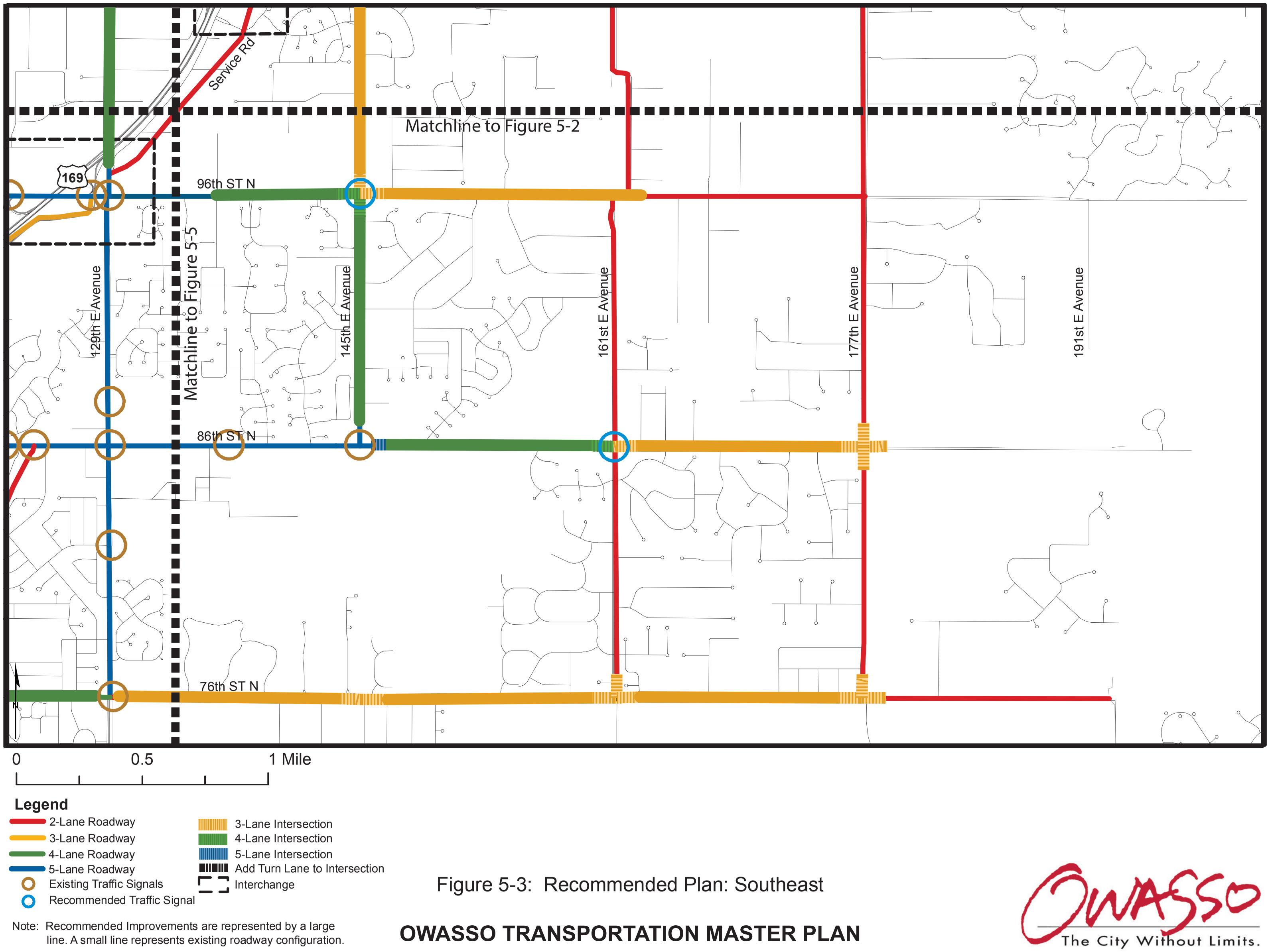


Figure 5-3: Recommended Plan: Southeast

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

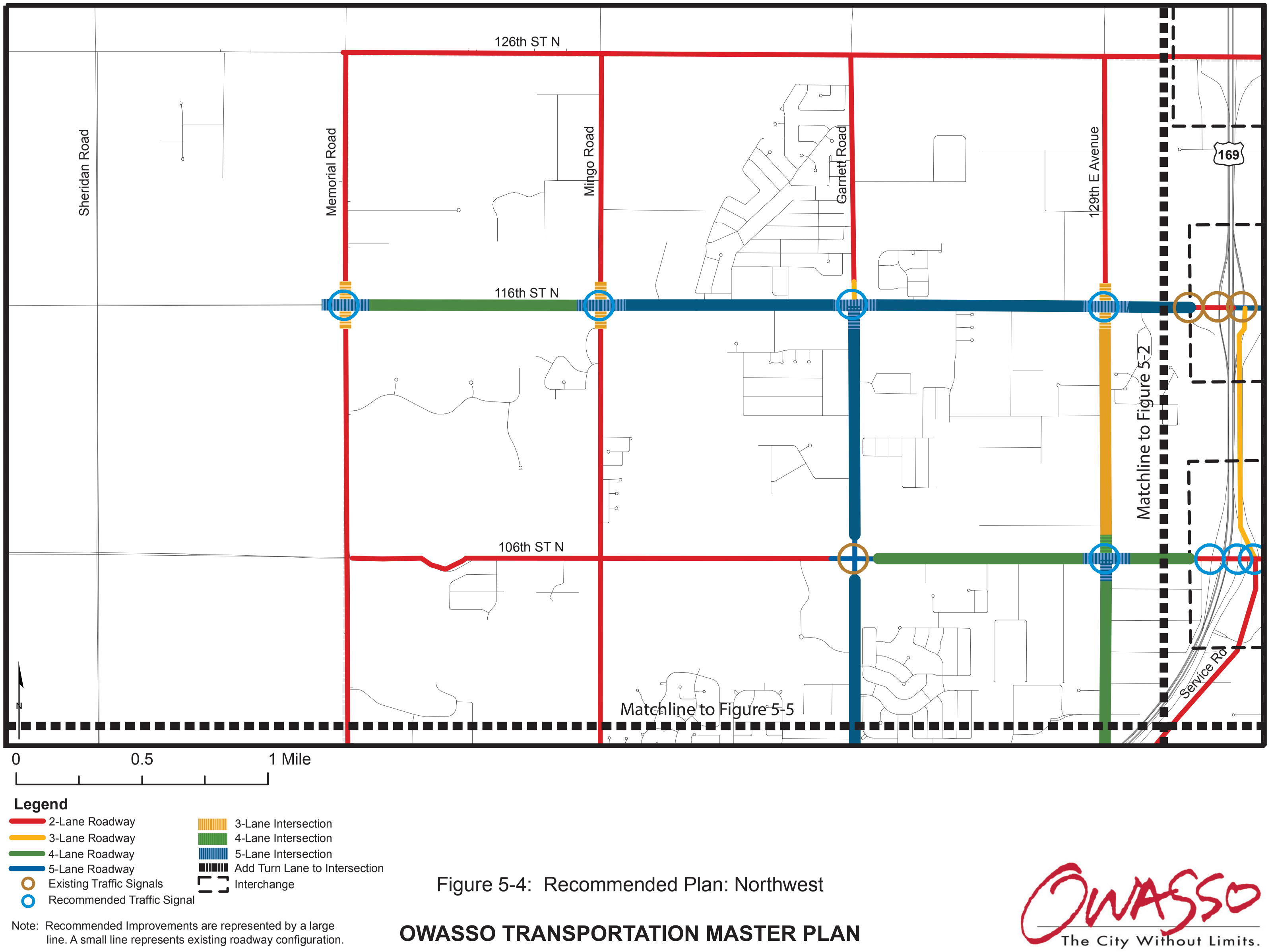
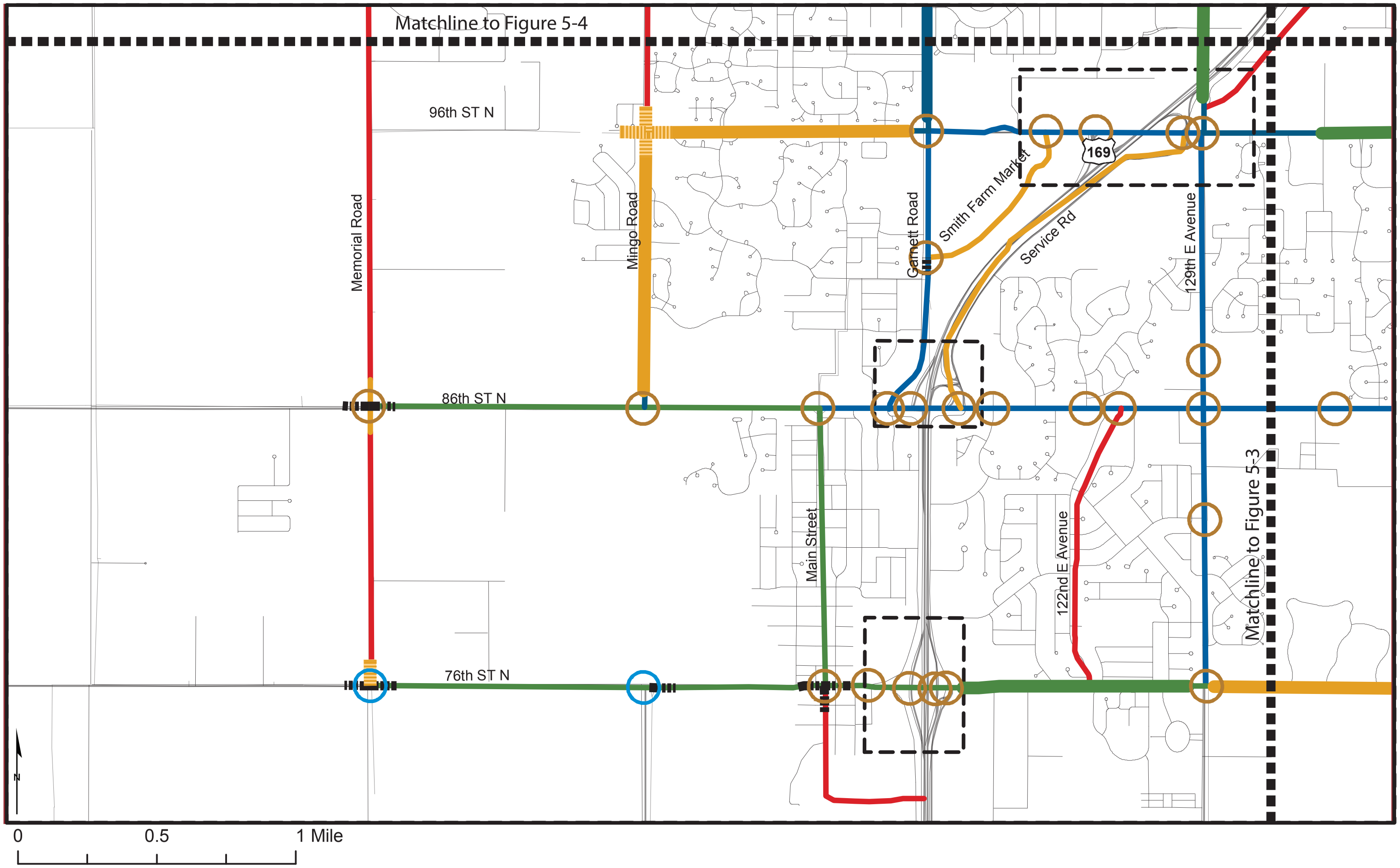


Figure 5-4: Recommended Plan: Northwest

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.



Legend

- 2-Lane Roadway
- 3-Lane Roadway
- 4-Lane Roadway
- 5-Lane Roadway
- Existing Traffic Signals
- Recommended Traffic Signal
- 3-Lane Intersection
- 4-Lane Intersection
- 5-Lane Intersection
- Add Turn Lane to Intersection
- Interchange

Note: Recommended Improvements are represented by a large line. A small line represents existing roadway configuration.

Figure 5-5: Recommended Plan: Southwest

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

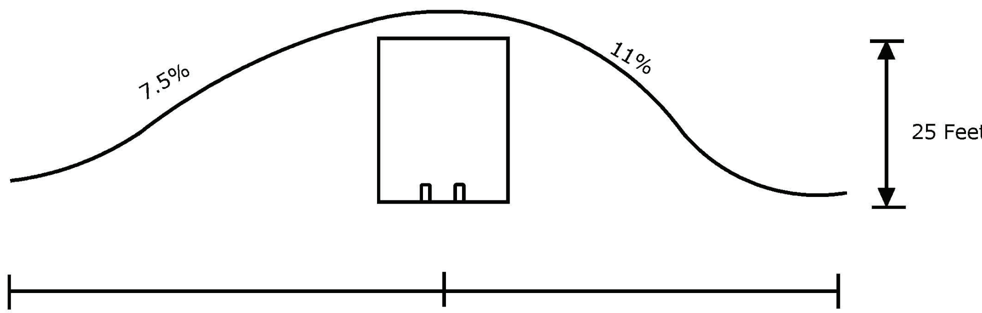
Table 5-1: Recommended Roadway Improvements

Street	From	To	Description	Year	Current Jurisdiction
76th Street N	US 169 Interchange	129th E Avenue	4 Lane	2015	City of Owasso
76th Street N	129th E Avenue	145th E Avenue	3 Lane	2020	City of Owasso/Tulsa County
76th Street N	145th E Avenue	161st E Avenue	3 Lane	2025	Rogers County
76th Street N	161st E Avenue	177th E Avenue	3 Lane	2030	Rogers County
86th Street N	145th E Avenue	161st E Avenue	4 Lane	2020	City of Owasso/Rogers County
86th Street N	161st E Avenue	177th E Avenue	3 Lane	2025	Rogers County
96th Street N	Mingo Road	Garnett Road	3 Lane	2025	City of Owasso/Tulsa County
96th Street N	135th E Avenue	145th E Avenue	4 Lane	2020	City of Owasso
96th Street N	145th E Avenue	161st E Avenue	3 Lane	2025	Rogers County
106th Street N	Garnett Road	129th E Avenue	4 Lane	2020	City of Owasso/Tulsa County
106th Street N	129th E Avenue	US-169	4 Lane	2020	City of Owasso
106th Street N	US-169 Interchange	145th E Avenue	4 Lane	2020	City of Owasso
106th Street N	145th E Avenue	161st E Avenue	4 Lane	2025	City of Owasso/Rogers County
116th Street N	Memorial Road	Mingo Road	4 Lane	2030	Tulsa County
116th Street N	Mingo Road	Garnett Road	5 Lane	2025	City of Owasso/ Tulsa County
116th Street N	Garnett Road	129th E Avenue	5 Lane	2020	City of Owasso/Tulsa County
116th Street N	129th E Avenue	US-169 Interchange	5 Lane	2025	City of Owasso
Mingo Road	86th Street N	96th Street N	3 Lane	2025	City of Owasso/Tulsa County
Garnett Road	96th Street N	106th Street N	5 Lane	2025	City of Owasso/Tulsa County
Garnett Road	106th Street N	116th Street N	5 Lane	2025	City of Owasso/Tulsa County
129th E Avenue	96th Street N	106th Street N	4 Lane	2025	City of Owasso/Tulsa County
129th E Avenue	106th Street N	116th Street N	3 Lane	2025	City of Owasso/Tulsa County
145th E Avenue	86th Street N	96th Street N	4 Lane	2025	City of Owasso/Rogers County
145th E Avenue	96th Street N	106th Street N	3 Lane	2030	City of Owasso/Rogers County
145th E Avenue	106th Street N	116th Street N	3 Lane	2035	City of Owasso/Rogers County

Table 5-2: Recommended Intersection Improvements

Intersection	Description	Year	Current Jurisdiction
76th Street N and Memorial Road	Signalize, Add Turn Lanes, 3 Lane	2025	Tulsa County
76th Street N and Mingo Road	Signalize, Add Turn Lane	2020	City of Owasso
76th Street N and Main Street	Add Turn Lanes, Add Protective-Permissive Signal	2025	City of Owasso
76th Street N and US-169 Interchange	Add Additional Lanes and Turn Lanes	2020	ODOT/City of Owasso
76th Street N and 129th E Avenue	Extend Turn Lane Widening	2020	Tulsa County
76th Street N and 145th E Avenue	3 Lane	2020	City of Owasso/Rogers County/Tulsa County
76th Street N and 161st E Avenue	3 Lane	2025	Rogers County
76th Street N and 177th E Avenue	3 Lane	2030	Rogers County
86th Street N and Memorial Road	Add Turn Lanes	2020	Tulsa County
86th Street N and US-169 Interchange	Realign, Add Additional Lanes and Turn Lanes	2020	ODOT/City of Owasso
86th Street N and 145th E Avenue	Transition Intersection from 5 Lane to 4 Lane	2025	City of Owasso
86th Street N and 161st E Avenue	Signalize, 4 Lane, 3 Lane	2020	Rogers County
86th Street N and 177th E Avenue	3 Lane	2025	Rogers County
96th Street N and Mingo Road	3 Lane	2025	City of Owasso/Tulsa County
96th Street N and Garnett Road	Timing	2020	City of Owasso
96th Street N and US-169 Interchange	Add Lanes and Turn Lanes	2020	ODOT/City of Owasso
96th Street N and 145th E Avenue	Signalize, 4 Lane, 3 Lane	2020	City of Owasso/Rogers County
106th Street N and 129th E Avenue	Signalize, 4 Lane, 5 Lane	2020	City of Owasso/Tulsa County
106th Street N and US 169 Interchange	Realign, Add Lanes and Turn Lanes	2025	ODOT/City of Owasso
106th Street N and 145th E Avenue	Signalize, 5 Lane, 3 Lane	2020	City of Owasso/Rogers County
106th Street N and 161st E Avenue	Signalize, 4 Lane, 3 Lane	2025	City of Owasso/Tulsa County
116th Street N and Memorial Road	Signalize, 5 Lane, 3 Lane	2025	Tulsa County
116th Street N and Mingo Road	Signalize, 5 Lane, 3 Lane	2025	City of Owasso/Tulsa County
116th Street N and Garnett Road	5 Lane	2025	City of Owasso/Tulsa County
116th Street N and 129th E Avenue	5 Lane, 3 Lane	2020	City of Owasso/Tulsa County
116th Street N and US 169 Interchange	Add Turn Lanes	2025	ODOT/City of Owasso
116th Street N and 145th E Avenue	Signalize, 3 Lane	2035	City of Owasso/Rogers County/Tulsa County
116th & East of 145th E Avenue	Signalize	2020	Rogers County
126th Street N and US-169 Interchange	Add Lanes	2030	ODOT/City of Owasso/Tulsa County
Garnett Road and Smith Farm Market	Add Turn Lane	2025	City of Owasso

Railroad Crossing Plan View on 76th Street



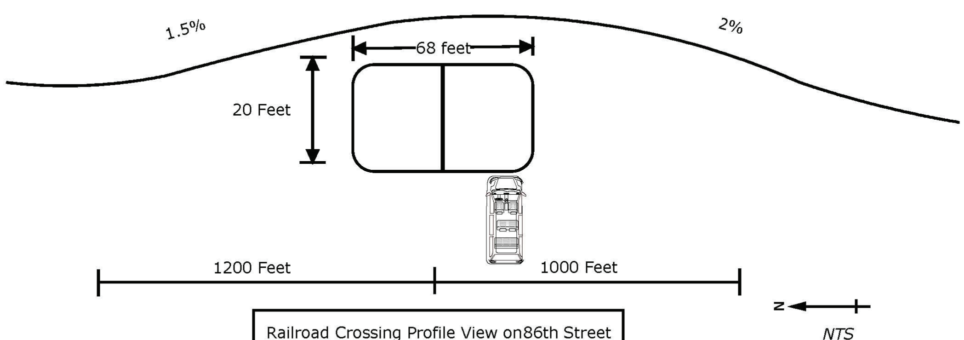
Railroad Crossing Profile View on76th Street

Figure 5-6: 76th Street North and Railroad Crossing Long-Range Improvement

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

Railroad Crossing Plan View on86th Street



Railroad Crossing Profile View on86th Street

Figure 5-7: 86th Street North and Railroad Crossing Long-Range Improvement

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

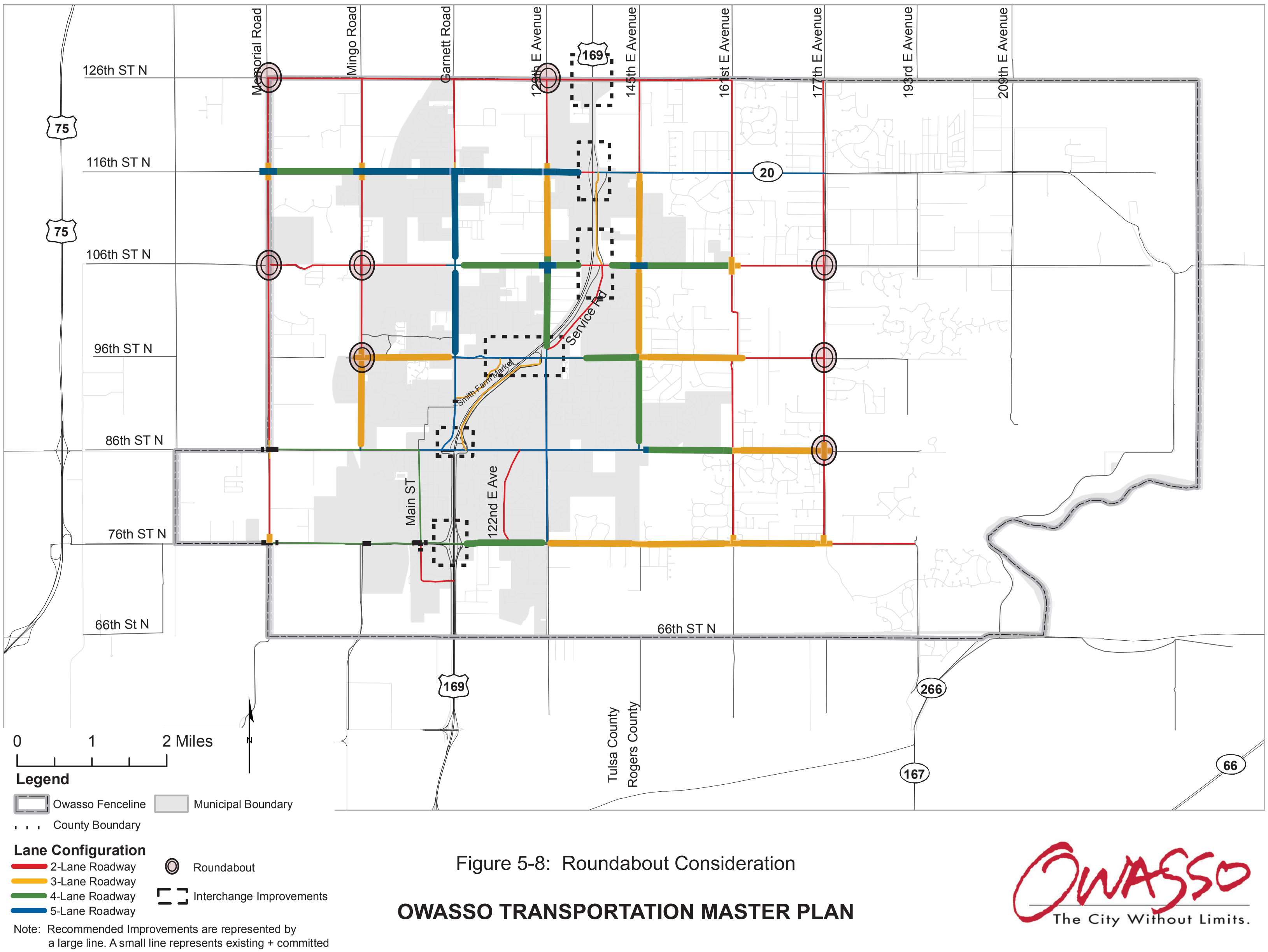


Figure 5-8: Roundabout Consideration

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

5.3.15 Construction Cost Estimates

Construction costs included in **Tables 5-3 and 5-4** are based on 2015 dollars and should be considered to be order-of-magnitude estimates. As seen in **Figure 5-9**, development of the estimates are based on square yards of roadway and intersection. Recent bid prices and discussions with both City and State officials determined unit cost. Changes in material and labor costs in future years will need to be taken into account in budgeting these projects. Budgets will need to be established for design-related activities, such as geotechnical investigations, surveying, and engineering. Additionally, budgets will need to be established for construction-related activities, such as supervision, inspection, and overhead.

Table 5-3: Roadway Sections Cost Estimate Basis

5-Lane Roadway					
No	Description	Unit	Quantity	Unit Cost	Total Cost
1	Pavement	SY	30,436	$ 106.88	$ 3,252,940.37
2	Utility Relocation	LF	4,280	$ 162.58	$ 695,840.43
3	Right-of-Way	SF	372,360	$ 1.20	$ 446,832.00
				5Lane Roadway Section Grand Total	$4,395,612.80
4-Lane Roadway					
No	Description	Unit	Quantity	Unit Cost	Total Cost
1	Pavement	SY	23,778	$ 106.88	$ 2,541,346.30
2	Utility Relocation	LF	4,280	$ 162.58	$ 695,840.43
3	Right-of-Way	SF	286,760	$ 1.20	$ 344,112.00
				4-Lane Roadway Grand Total	$3,581,298.74
3-Lane Roadway					
No	Description	Unit	Quantity	Unit Cost	Total Cost
1	Pavement	SY	19,022	$ 106.88	$ 2,033,034.29
2	Utility Relocation	LF	4,280	$ 162.58	$ 695,840.43
3	Right-of-Way	SF	286,760	$ 1.20	$ 344,112.00
				3-Lane Roadway Grand Total	$3,072,986.72

Table 5-4: Intersection Legs Cost Estimate Basis

No	Description	Unit	Quantity	Unit Cost	Total Cost
5-Lane to 4-Lane Intersection Leg					
1	Pavement	SY	3,389	$ 107.06	$ 362,837.35
2	Utility Relocation	LF	500	$ 162.58	$ 81,289.77
3	Right-of-Way	SF	43,500	$ 1.20	$ 52,200.00
				5-Lane to 4-Lane Intersection Leg Grand Total	$496,327.12
4-Lane to 4-Lane Intersection Leg					
No	Description	Unit	Quantity	Unit Cost	Total Cost
1	Pavement	SY	2,762	$ 107.06	$ 295,708.70
2	Utility Relocation	LF	500	$ 162.58	$ 81,289.77
3	Right-of-Way	SF	43,500	$ 1.20	$ 52,200.00
				4-Lane to 4-Lane Intersection Leg Grand Total	$429,198.47
3-Lane to 3-Lane Intersection Leg					
No	Description	Unit	Quantity	Unit Cost	Total Cost
1	Pavement	SY	2,237	$ 107.06	$ 239,500.49
2	Utility Relocation	LF	500	$ 162.58	$ 81,289.77
3	Right-of-Way	SF	33,500	$ 1.20	$ 40,200.00
				3-Lane to 3-Lane Intersection Leg Grand Total	$360,990.26
3-Lane to 2-Lane Intersection Leg					
No	Description	Unit	Quantity	Unit Cost	Total Cost
1	Pavement	SY	2,121	$ 107.06	$ 227,081.15
2	Utility Relocation	LF	500	$ 162.58	$ 81,289.77
3	Right-of-Way	SF	33,500	$ 1.20	$ 40,200.00
				3-Lane to 2-Lane Intersection Leg Grand Total	$348,570.92
Signalization					
No	Description	Unit	Quantity	Unit Cost	Total Cost
1	Signalization	LS	1	$ 145,341.00	$ 145,341.00
				Signalization Grand Total	$145,341.00

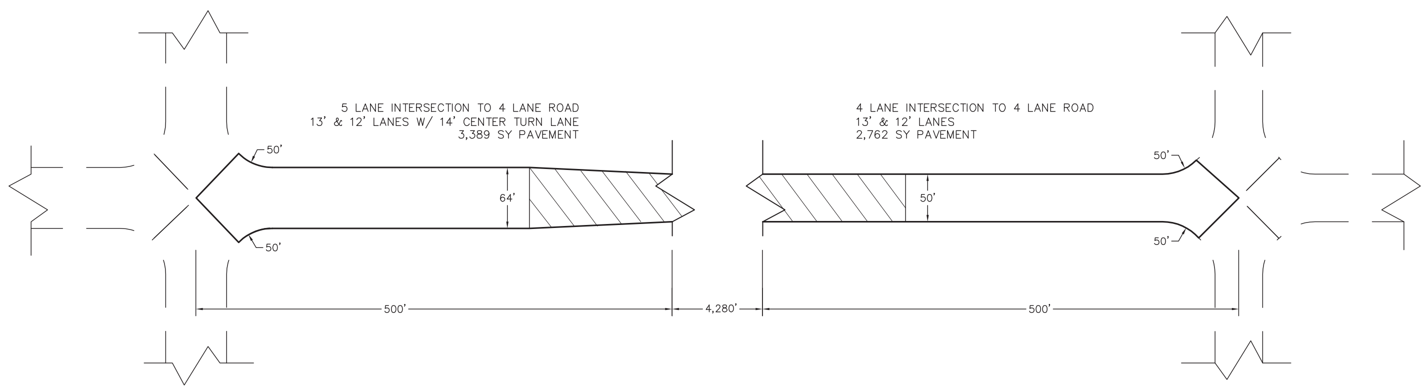


Figure 5-9: Intersection and Roadway Cost Estimate Basis

OWASSO TRANSPORTATION MASTER PLAN

The City Without Limits.

5.3.16 Right-of-Way and Utility Relocation Needs

The listed projects will require a wide range of right-of-way and utility relocations. To the extent possible, adequate right-of-way should be obtained from developers based on the ultimate functional classification of the adjacent street as discussed in the next section. Due to the extent of existing development, some right-of-way purchases will be required for almost all projects. The budget for each individual project needs to include the anticipated right-of-way purchases and the professional services required to develop right-of-way plans and make the acquisitions. Utility relocations must also be budgeted for each individual project. This will entail relocation of City-owned utilities and private utilities to the ultimate build-out of a major arterial. Payment must be made for private utilities with previously-established rights. The budget also needs to allow for utility relocation coordination.

5.4 FUNCTIONAL CLASSIFICATIONS

The functional classification system is a hierarchical organization of streets and highways that facilitates the safe and efficient operation of vehicles along different types of facilities. As indicated in **Figure 5-10**, a functional roadway system facilitates a progressive transition in the flow of traffic from the provision of access to the provision of movement. Freeway and arterial facilities are at one end of the spectrum, primarily providing the function of moving vehicles. Collector and local streets are at the opposite end of the spectrum, providing access to property. **Figure 5-11** shows schematically how various street classifications relate to each other in terms of movement and access.

To enable streets and highways to accomplish their intended function, the planning and design of the facilities should consider those elements that support the intended functions. Descriptions of the various roadway functional types and related planning and design considerations are provided in the following section.

5.4.1 Freeways

These facilities include interstate highways, freeways, expressways and parkways, and provide for the rapid and efficient movement of large volumes of traffic between regions and within one region. Direct access to abutting property is not an intended function of these facilities. Design characteristics support the function of traffic movement by providing multiple travel lanes, a high degree of access control, and no at-grade intersections.

5.4.2 Arterials

Arterials primarily provide for traffic movement, with a secondary function of providing direct access to abutting property. Major arterials typically serve as connections between major traffic generators and land use concentrations,

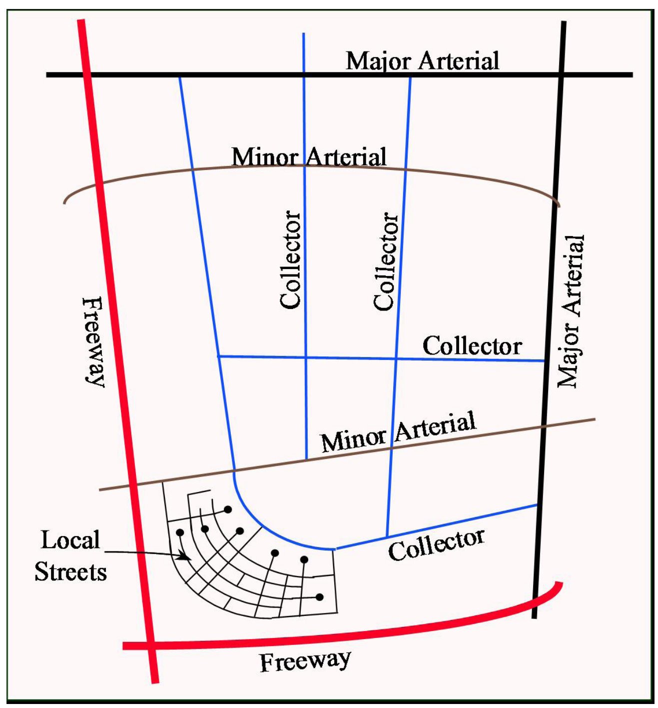


Figure 5-10: Hierarchical Functional Classification System

and facilitate large volumes of through traffic traveling across a community. Minor arterials typically serve as connections between local and collector streets and the major arterials, and facilitate the movement of large traffic volumes over shorter distances within the community. Because direct access to abutting property is a secondary function of arterial streets, access should be carefully managed to avoid adverse impacts on the movement function intended for these facilities.

5.4.3 Major Arterials

Major arterials are streets and highways that provide a high degree of mobility, serve relatively high traffic volumes, have high operational speeds (45 mph or greater), and serve a significant portion of through travel or long-distance trips. They are continuous over long distances and serve trips entering and leaving the area as well as trips within it. These facilities generally serve high volume travel corridors that connect major traffic generators, but lower volume roadways that are continuous over long distances may also function as major arterials, particularly in fringe and rural areas. They may vary from multi-lane roadways with four to six lanes or more, down to two-lane roadways in developing fringe and rural areas, where traffic volumes have not increased to the point that additional travel lanes are needed. Functional classification is not dependent on the existing number of lanes, since the functional role served by a roadway typically remains constant over time, while the roadway's cross section is improved to accommodate increasing traffic volumes. Major arterials form an interconnecting network for citywide and regional movement of traffic, including connections to freeways and expressways, and to minor arterials and collectors. A one- to two-mile spacing is generally desirable between major arterials, with a one-mile spacing between a major arterial and a minor arterial or freeway.

Since traffic movement, not land access, is the primary function of major arterials, access management is essential. The number of driveways connecting directly onto a major arterial should be minimized to avoid traffic congestion and delays caused by turning movements for vehicles entering and exiting driveways. Off-peak travel speeds on major arterials are typically 40 to 55 mph, and peak period speeds are about 30 to 40 mph. Intersections with other public streets and private access should be designed to limit speed differentials between turning vehicles and other traffic to no more than 10 to 15 mph. Signalized intersection spacing should be long enough to allow a variety of signal cycle lengths and timing plans that can be adjusted to meet changes in traffic volumes and maintain traffic progression (desirably one-third to one-half mile consistent spacing). Also, major arterials should be constructed or retrofitted with raised medians where possible to increase roadway safety and improve traffic operations.

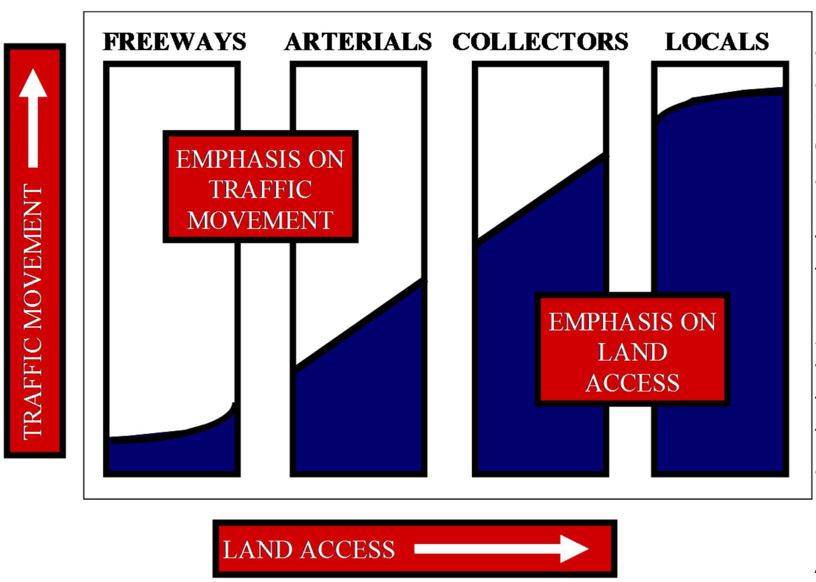


Figure 5-11:
Functional Classification System Hierarchy

5.4.4 Minor Arterials

Minor arterials are similar in function to major arterials, except that they provide a higher degree of local access than major arterials. Minor arterials include all remaining arterial streets and highways in the urbanized area and serve less concentrated traffic generating areas, such as neighborhood shopping centers and employment centers. Although minor arterials are very similar in function to major arterials, this class typically distributes medium traffic volumes for shorter distance trips than major arterials. In general, the projected future traffic volumes on minor arterials will be lower than the volumes carried by major arterials.

Minor arterials are generally continuous over shorter distances than major arterials. Travel speeds along minor arterials are typically 30 to 45 mph in off-peak periods, and 20 to 35 mph in peak periods. Minor arterials serve as boundaries to neighborhoods and collect traffic from collectors and local streets. Although a minor arterial typically provides more local access than a major arterial, the primary function is still traffic movement. Major and minor arterials are generally spaced at one mile intervals in an alternating grid pattern. In addition, any minor arterial that currently exceeds a daily ADT of 20,000 or is forecasted to reach that traffic volume should have a raised median for safety and to improve traffic operations.

5.4.5 Collectors

Collector streets provide for a balance of traffic movement and property access functions. Traffic movement is often internal to localized areas, with collectors connecting residential neighborhoods, parks, churches, etc. with the arterial system. As compared to arterial streets, collectors accommodate smaller traffic volumes over shorter distances. Collector streets are the connectors between arterials and local streets that serve to collect traffic and distribute it to the arterial network. Collectors also serve to provide direct access to a wide variety of residential, commercial and other land uses, and their design involves site-specific considerations. They provide service to neighborhoods and other local areas, and may border or traverse neighborhood boundaries. Parking may be permitted on-street in residential areas.

Since collectors are used for short distance trips between local streets and arterials, they should be continuous in the spaces between arterials. Collectors may also extend across arterials. To provide efficient traffic circulation and preserve amenities of neighborhoods, collectors should desirably be spaced at about one-quarter to one-half mile intervals. Subdivision street layout plans should include collectors as well as local streets in order to provide efficient traffic access and circulation. Operating speeds for collectors are typically about 30 to 35 mph. Since speeds are slower and more turning movements are expected, a higher speed differential and much closer intersection/access spacing can be used than on arterials. On-street parking may be permitted in residential areas. Direct access to abutting land is essential; parking and traffic controls may be necessary for safe and efficient through movement of moderate to low traffic volumes at key intersections.

Collectors may be constructed with or without center turn lanes, and may permit or restrict parking, depending on the cross section design chosen. Collectors serve an important role in collecting and distributing traffic between major/minor arterials and local streets. Their identification is essential in planning and managing traffic ingress/egress and movement within residential neighborhoods as well as commercial and industrial areas.

5.4.6 Local Streets

Local streets function to provide access to abutting property and to collect and distribute traffic between individual parcels of land and collector or arterial streets. Local streets include all other streets and roads that are not included in higher functional classes. They include internal and access streets that allow direct access to residential and commercial properties, and similar traffic destinations. Direct access to abutting land is their primary role, for all traffic originates or is destined to abutting land. On-street parking may be permitted. Trip lengths on local streets are short, volumes are low, and speeds are slow (generally between 20 and 30 mph). Local streets typically comprise between 65 to 80 percent of the total roadway system.

Through traffic and excessive speeds should be discouraged on local streets by using appropriate geometric designs, traffic control devices, curvilinear alignments, and discontinuous streets. Local streets should be designed for low speed traffic with an emphasis on providing access. One factor in the functional classification of roadways is their existing and proposed traffic volumes. **Table 5-5** shows ranges of vehicles per day along with the corresponding roadway functional classification.

Table 5-5: Traffic Volumes and Functional Classification

Functional Classification	Vehicles Per Day (vpd)
Local Streets	< 2,500 vpd
Residential Collectors	2,500 to 5,000 vpd
Major Collectors	5,000 to 8,500 vpd
Minor Arterials	8,500 to 24,000 vpd
Major Arterials	24,000 to 36,000 vpd
Freeways/Expressways	> 36,000 vpd

5.5 RECOMMENDED FUNCTIONAL CLASSIFICATIONS

The proposed functional classification system is shown in **Figure 5-12**. The City's existing functional classification system is shown in **Figure 2-6** in Chapter 2. This existing functional classification system was used as the basis for developing the recommended Functional Classification System, which also incorporates the recommended improvements discussed earlier in this chapter. This proposed system was developed based upon field reconnaissance, physical characteristics, traffic volumes, and input from City Staff and the Advisory Committee.

Key recommended changes to the existing Functional Classification System include revising functional classification so it is based on function rather than number of lanes and consolidating collectors into one category. Major roadways primarily used for through movement and that carry higher volumes of traffic were classified as Major Arterials. In Owasso these roadways include Garnett Road and 76th Street N and potions of 129th E Avenue, 116th Street N, 96th Street N, and 86th Street N. The remaining section line roadways were classified as minor arterials and collectors.

5.6 RECOMMENDED ROADWAY DESIGN STANDARDS FOR MAJOR ARTERIALS

Major arterial standards need to reflect the primary function of a major arterial – movement of vehicles through the corridor. As discussed in earlier chapters of this report, all of the major arterials can be justified to be six lanes. However, existing improvements along most of the length of each street prevents the use of six lanes. If it is determined that some segments can be built to this standard, the typical section shown in **Figure 5-13** should be adopted. With the total traffic volumes that warrant a six-lane street, a dividing median as shown for this typical section should be used. This median is wide enough to protect most vehicles that would be trying to make a left turn from an intersecting street. The median also allows sufficient width for left turn lanes and can accommodate most U-turn movements.

Major arterials that are four lanes need to have either a median or a continuous left turn lane, also as shown on **Figure 5-13**. The median width will allow functions similar to those mentioned above for the six-lane typical section. Only if additional right-of-way absolutely cannot be obtained should a narrower median width be used. Implementation of an access management policy should minimize the need for continuous left turn lane sections. Where existing development has resulted in closely spaced streets and drives, the five-lane section may be the only viable alternative. The standards applicable to major arterials are summarized as follows:

- Medians 30 feet to 50 feet wide
- Utilities and sidewalks accommodated between the curb and the property line
- Double left turn and right turn lanes at major (section line) intersections
- Requires 180-foot right-of-way; major intersections require 200-foot right-of-way extending 500 feet in both directions from the section line

5.7 RECOMMENDED ROADWAY DESIGN STANDARDS FOR MINOR ARTERIALS

Figure 5-13 also shows the recommended standards for minor arterials. These sections can typically be built in a 140-foot right-of-way, even with sloping terrain. For locations with higher traffic volumes and a number of street or drive intersections, the five-lane section will be appropriate. The character of the land development and traffic volumes in the arterial corridor will dictate if the “urban” or “rural” typical section will be used. Even in “rural” areas, these standards recommend the addition of a paved shoulder for all two-lane arterials.

Minor arterials are the highest classification of street for which bike lanes should be considered. **Figure 5-14** shows the additional pavement that is required for a bike lane. This additional widening will be needed on both sides of the street. A critical feature is to pave the bike lane continuously with the same material, thereby minimizing edges. This results in offsetting the bike lane from the curb when a standard concrete gutter pan is used on an asphalt street.

5.8 RECOMMENDED ROADWAY DESIGN STANDARDS FOR COLLECTORS

Figure 5-14 shows the recommended typical sections for collectors. The 32-foot wide section can be used for access and parking. A 32-foot to 36-foot wide collector can be used for access and bike lanes. As shown, a wider section is required if access, parking and bike lanes are to be accommodated.

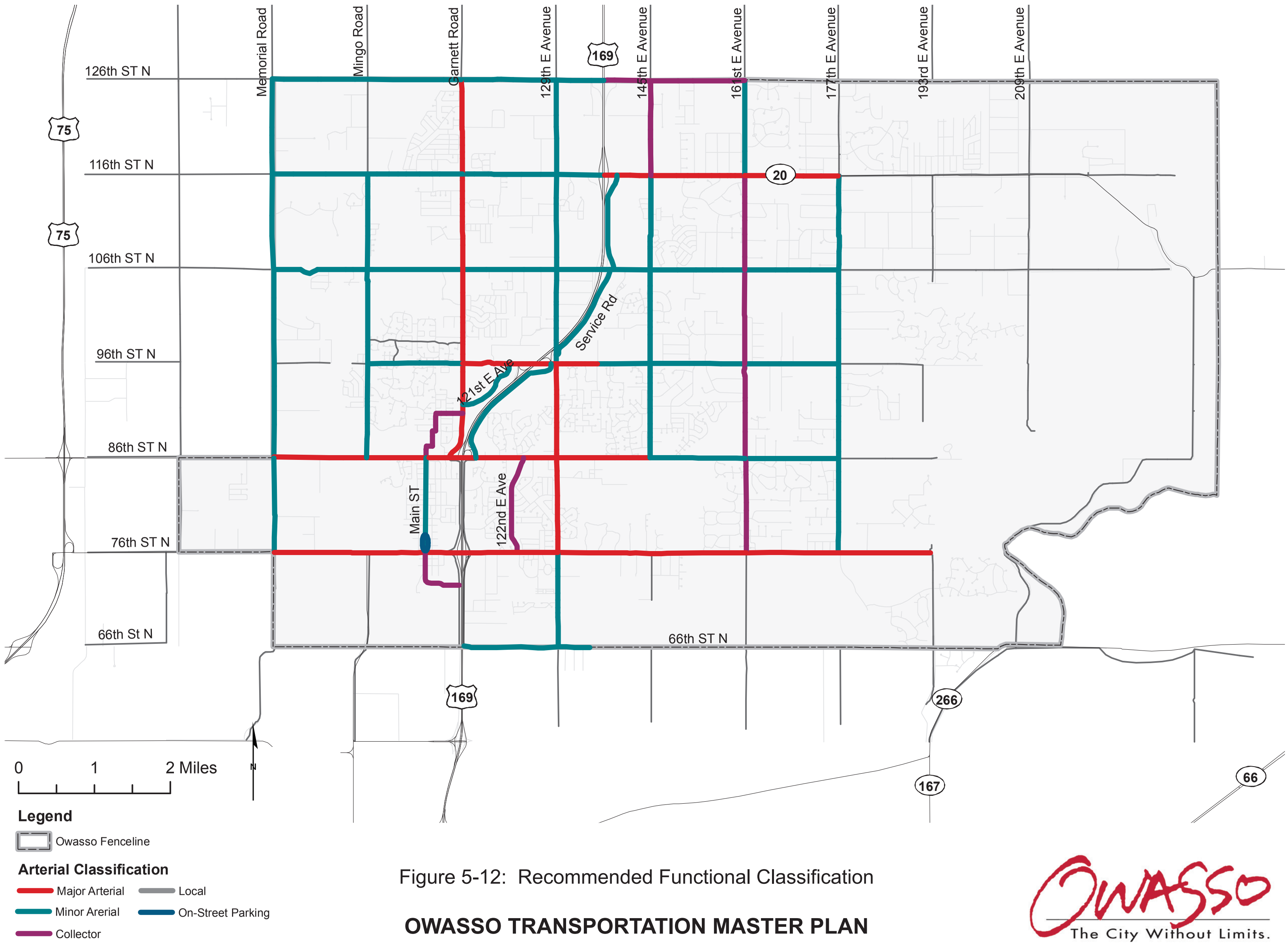


Figure 5-12: Recommended Functional Classification

OWASSO TRANSPORTATION MASTER PLAN

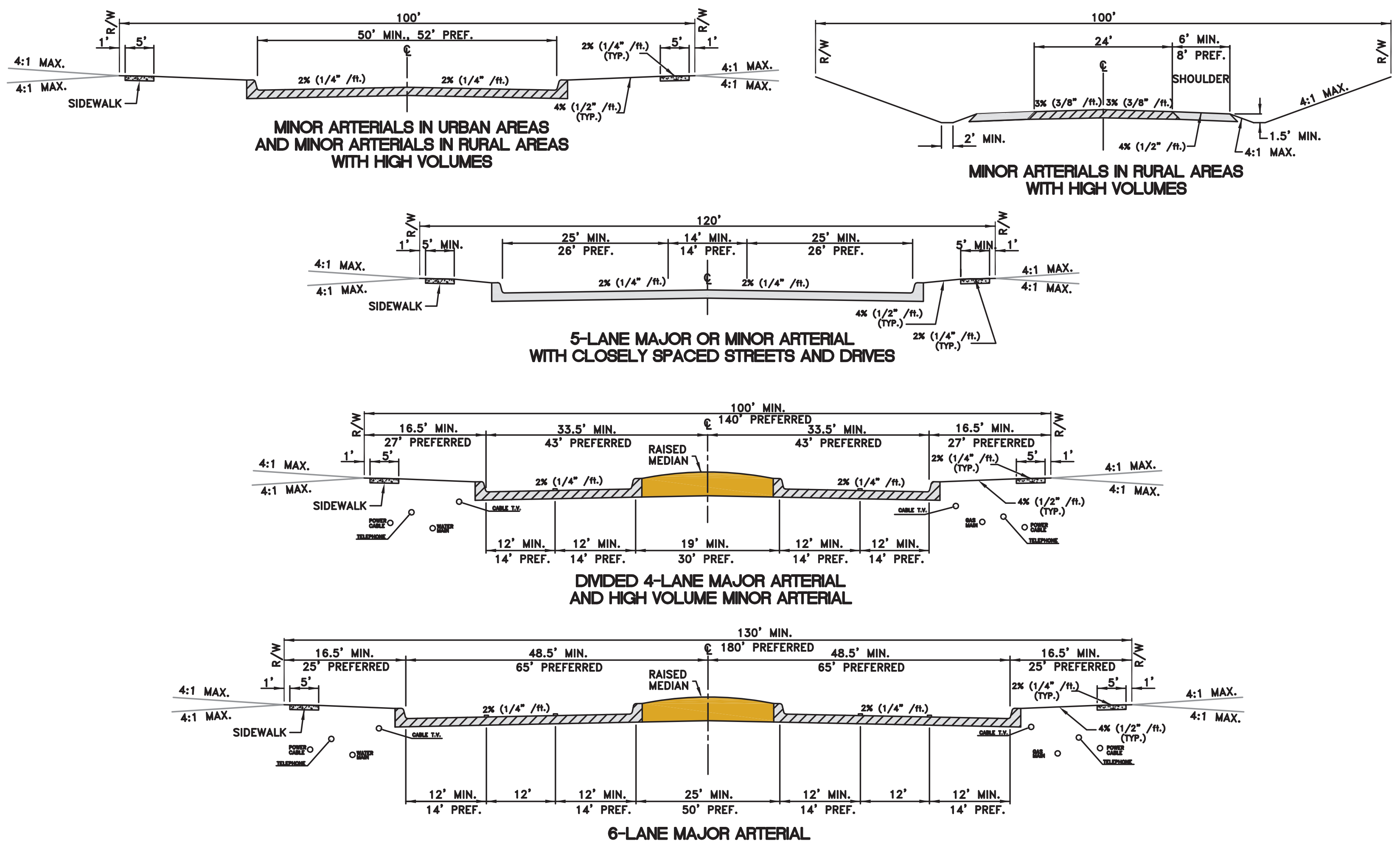


Figure 5-13: Typical Sections Proposed Arterial Standards

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

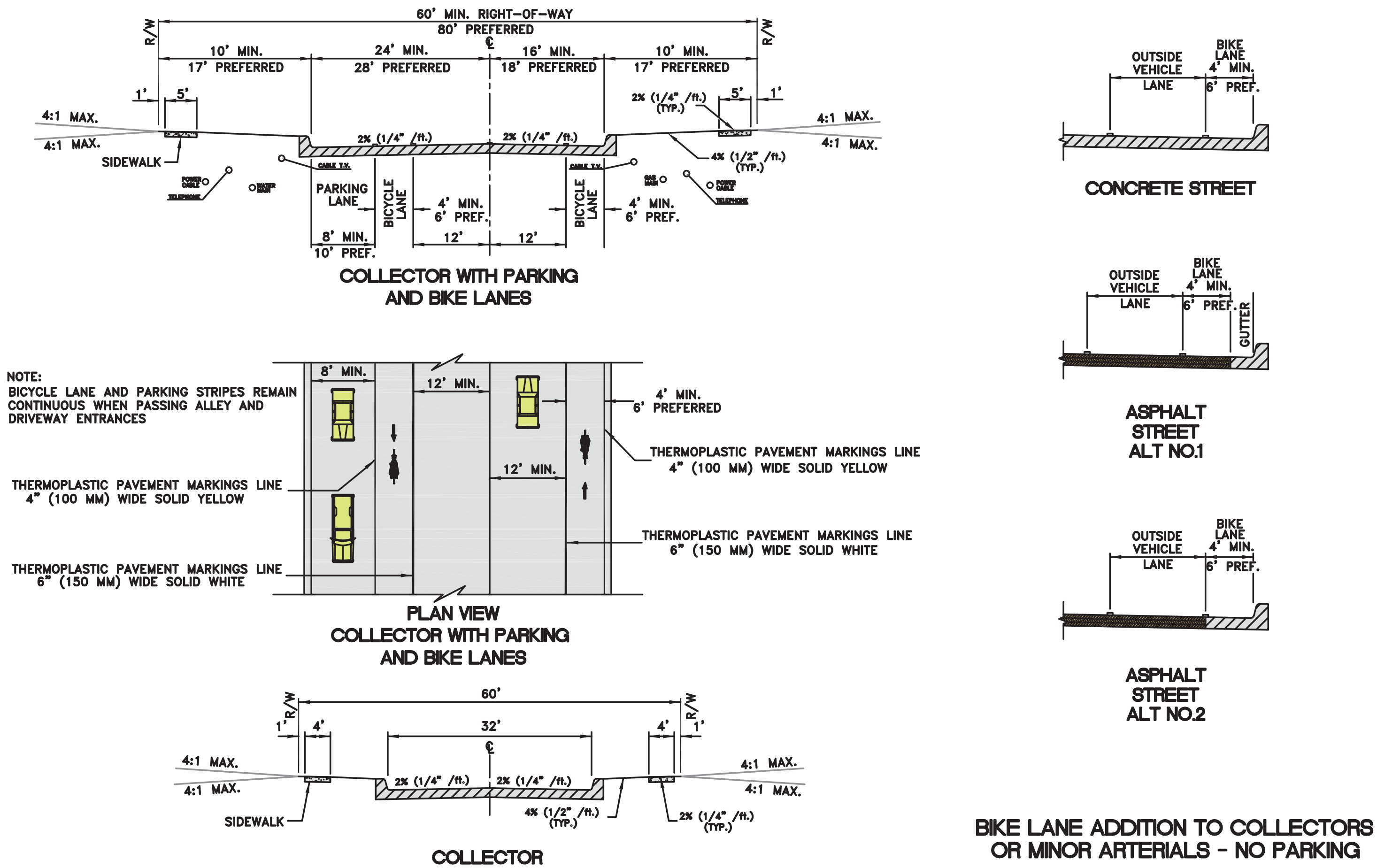


Figure 5-14: Typical Sections Proposed Collector Standards and Bike Lane Standards

OWASSO TRANSPORTATION MASTER PLAN

OWASSO The City Without Limits.

5.9 POLICY AND PERFORMANCE RECOMMENDATIONS

5.9.1 Transportation System Management Improvements

In addition to the recommended roadway improvements, it is recommended that traditional traffic operational practices and transportation system management (TSM) techniques be employed at critical locations to alleviate deficiencies that may remain with the Transportation Plan improvements. These types of improvements are typically cost effective methods that improve traffic flow by making better use of the existing transportation system. Examples of these improvements include provisions of intersection turn lanes and other geometric improvements, coordinated signal systems that efficiently accommodate travel demands and improve safety, effective utilization of traffic control devices, lane channelization, on-street parking prohibitions, and turn restrictions. Operational improvements are also important considerations in the interim when partial implementation of some thoroughfare improvements may cause capacity overloads on other system facilities. This discussion of TSM-type improvements is general in nature as more detailed studies are required on a case by case basis to identify the specific locations and what type of improvements and programs will be needed.

5.9.2 Access Management and Driveway Access Control

In addition to the proposed roadway improvements identified in this plan, there are other non-capacity transportation-related recommendations that can enhance the transportation system in Owasso, such as access management and driveway control. Access management is defined as the protecting of the capacity of existing transportation routes and systems by controlling access rights from adjacent properties. Access management techniques serve to limit and separate vehicle (and pedestrian) conflict points, reduce locations requiring vehicle deceleration, remove vehicle turning movements from through lanes, create intersection spacings that facilitate signal progression, and provide adequate on-site capacity to accommodate ingress and egress traffic movements. Limiting access of new developments will not require additional cost from the City. However, elimination of access rights will require compensation by the City.

Access management techniques are extremely important for managing congestion on existing transportation facilities. The implementation of applicable techniques, or a combination of techniques, can eliminate the need for expensive roadway widenings or potential right-of-way acquisitions. Studies have shown that increasing the signalized intersection spacing to uniform intervals of one-half mile and the use of a non-traversable median to restrict left-turns will increase the capacity of a four-lane urban arterial by about 50 percent as compared to quarter-mile signal spacing and unrestricted left-turns. This is the same increase in capacity that can be obtained by widening a four-lane divided arterial to six lanes. Also, safety will be increased and congestion reduced to a greater extent than by the roadway widening. Research has consistently shown that access management helps to reduce the rate and severity of traffic accidents and improves pedestrian and bicycle safety
.

From a land development perspective, access management assists in the orderly layout and use of land and helps to discourage poor subdivision and site design. Poorly designed entrances and exits to major developments not only present a traffic hazard, but also cause increased congestion, which can create a negative image of the development. In addition, access management techniques, such as reducing the number and frequency of driveways and median openings, improve the appearance of major corridors. Scenic and environmental features can be increased, which improves the image of streetscapes and can attract additional economic development.

Access management relies on a variety of access control techniques to promote efficient vehicular movements. These include the following:

- Limit number of conflict points
- Separate conflict points
- Limit deceleration
- Remove turning vehicles from through lanes
- Space major intersections to facilitate progressive travel speeds along arterials
- Provide adequate on-site storage to accommodate both ingress and egress traffic

The City currently enforces some of these access management techniques through a variety of policies and guidelines. Other access management techniques are applied through other means, such as the Subdivision Regulations, while other access management techniques are not enforced at the present time. **Table 5-6** identifies access management techniques that are recommended to be implemented within the City of Owasso.

5.9.3 Driveway Access Control

Driveway access control should be considered by the City, including appropriate recommendations regarding the location, spacing, width, radius, and other design considerations for driveways on arterials, collectors, and local streets. The development of this type of policy or ordinance should include input from local officials, local residential developers, and local commercial developers and should be compatible with the TMP.

5.10 TRAFFIC IMPACT ASSESSMENT (TIA)

A Traffic Impact Assessment (TIA - also referred to as a Traffic Impact Analysis) is developed to help assess the impact to the transportation system of a specific development that is considered to be a significant generator of traffic. A TIA is typically required for a zoning change, PUD, special use permit, plat approval, and site plan approval. A TIA should accomplish four primary goals, including 1) ensure that development does not adversely affect the transportation network, 2) identify traffic problems associated with the development, 3) delineate solutions to potential problems, and 4) incorporate solutions into development plans. It is recommended that a TIA be prepared by the Owner's or Developer's engineer and submitted to the City for approval.

A TIA is recommended when one of the three conditions is met:

- The total potential development generates 100 or more trips (in + out) during the adjacent roadway's peak hour
- The total potential development generates 100 or more trips (in + out) during the development's peak hour,
- The total potential development generates less than 100 rips (in + out), but the City Engineer determines there are localized safety or capacity deficiencies

Table 5-6: Access Management Recommendation

Strategy	Specification	Application/Purpose
Signal Coordination and Signalized Intersection Spacing		
Signal Coordination	Traffic Signal Synchronization Programs and Actuated Signal Control	Improved progression on existing arterial streets
Signal Spacing	Major Arterials - Consistent ½ mile, Minor Arterials - Consistent ¼ to ½ mile	New signal installations and proposed arterial roadways
Medial Access		
Median Type	Major Arterials - Raised Medians, Minor Arterials - Raised Medians (future volume > 20,000 vpd) or CTWLTL (future volume < 20,000 vpd	Develop designated major arterials with raised medians and minor arterials with appropriate median type
Median Width	Major Arterials - Minimum 25 feet, Minor Arterials - Minimum 19 feet	Median widths consistent with recommended roadway cross section standards
Median Channelization (Left-Turn Bays)	Major Arterials - At cross streets and major mid-block median openings, Minor Arterials - Primarily at cross streets	Left-turn channelization provided to remove turning vehicles from traffic stream to improve vehicle flow
Spacing of Median Openings	Major Arterials - Minimum 600 feet, Minor Arterials - Minimum 450 feet	Minimum median spacing needed to limit speed differential between vehicles and reduce accident rate
Marginal Access		
Driveway/ Unsignalized Intersection Spacing	The number of unsignalized intersections/driveways should be limited to 12 to 15 per mile for Arterials (minimum of 325 feet between intersections)	Reduces speed differential between through and turning vehicles and reduces accident rate
Right-Turn Bays	Provided at major intersections and major mid-block developments with high turning volumes (generally greater than 100 vph)	Improved traffic operations and reduced delay at signalized and unsignalized intersections
Subdivsion Access		
Collector Streets within a Subdivision	Connectivity through large subdivisions should be provided with collector streets that provide multiple access points to the arterial street system.	Reduces congestion at arterial access points and better distributes traffic flow to the adjacent roadway system

5.10.1 Trip Generation

The Institute of Transportation Engineers (ITE) publishes and updates a Trip Generation Manual which can be used for estimating the number of trips a particular development is likely to generate. It is recommended the City adopt the most recent edition as the standard for trip generation. Some examples taken from the current edition are show in **Table 5-7** below.

Table 5-7: ITE Trip Manual Examples

Land Use and Peak Hour	100 Peak Hour Trips
Single Family Residential (PM)	100 units
Apartments (PM)	160 units
Shopping Center (PM)	26,700 sq. ft.
Fast Food Restaurant (AM)	1,900 sq. ft.
C-Store with Fuel	7 pumps

5.10.2 Pass-By Trips

The ITE trip generation rates are considered 'at the driveway', but not all of these trips represent new trips added to the system. A 'pass-by' trip is an intermediate stop by a vehicle that is already on the system and reduces the number of new trips added to the system, depending upon the development type. **Table 5-8** lists several examples.

Table 5-8: Pass-By Trip Rate Examples

Land Use	Pass-By Percentage
Large Shopping Center (>400,000 sq. ft.)	20%
Small Shopping Center (<100,000 sq. ft.)	35%
Sit-Down Restaurant	15%
Fast Food Restaurant	40%

5.10.3 Internal Trips

The issue of an 'internal trip' only applies for a large multi-use development. A 'capture rate' is established based on the mix of uses in the development. The number of new trips applied to the system and the number of driveway and side street turn movements are reduced.

5.10.4 Amending A TIA

An existing TIA should be amended based on changes to a proposed development whose access has changed or the trip generation has increased by more than 15%. If the original TIA is less than two years old, an amendment identifying and discussing those items that have changed should be prepared and submitted to the City for approval. If the original TIA is more than two years old, or it no longer complies with current standards, a new TIA should be prepared and submitted to the City for approval.

A proposed development whose access has not changed and trip generation has increased by less than 15% requires less modification of an existing TIA. If the original TIA is less than two years old, a letter documenting the change should be prepared and submitted to the City for approval. If the original TIA is more than two years old, or no longer conforms to current standards, an amendment should be prepared to five years for portions of a master PUD.

5.10.5 TIA Outline

The following outline is recommended for the preparation of a TIA:

1) Introduction
    a) Existing and Proposed Site Description and Uses
    b) Study Area Boundaries (as approved by the City Engineer prior to commencing the preparation of the TIA)
    c) Existing and Proposed Nearby Uses
    d) Existing and Proposed Roadways and Intersections
    e) Identification of Peak Hours and Access Points

2) Existing Conditions
    a) Daily and Peak Hour Traffic Volume
    b) Capacity Analyses at Critical Points
    c) Levels of Service at Critical Points

3) Future Conditions Without Development
    a) Daily and Peak Hour Traffic Volume
    b) Capacity Analyses at Critical Points
    c) Levels of Service at Critical Points

4) Trip Generation
    a) Trip Generation Rates and Source
    b) Traffic Generated During Peak Hours and Total
    c) Pass-By Traffic Analysis

5) Trip Distribution
    a) Method Used to Distribute Traffic
    b) Internal Capture Rate
    c) Estimated Traffic Movements by Direction

6) Traffic Assignment
    a) Assignment of Traffic to Intersections and Drives
    b) Recommended Access Design Improvements

7) Future Conditions With Development
    a) Daily and Peak Hour Traffic Volume

b) Capacity Analyses at Critical Points
c) Levels of Service at Critical Points

8) Recommended System Improvements
a) Proposed Recommended Improvements
b) Responsible Party for Improvements
c) Capacity Analyses at Critical Points
d) Level of Service at Critical Points

9) Conclusion

5.11 COORDINATING TRANSPORTATION PLANNING ACTIVITIES AND CURRENT DEVELOPMENT ACTIVITIES

Transportation planning activities including the implementation of the Owasso Transportation Master Plan should be highly coordinated with current and future development activities within the community. As previously mentioned, coordinating development activities including land use planning and transportation decisions serves as an important role in improving mobility needs, promoting economic development and enhancing quality of life. The extent to which future land uses follow the year 2030 development projections will determine, to a large degree, the actual implementation schedule of the transportation plan. Conversely, the extent to which major components of future land use projections are realized will be dependent upon the adequacy of the transportation system.

Additionally, improved coordination and cooperative efforts among various local and state officials, including the City of Owasso, Tulsa, Tulsa and Rogers Counties, INCOG and ODOT, must be continued to fully realize the benefits of the Transportation Plan. Coordinating with these local and state officials on their current and future development activities and transportation improvements and needs will contribute to a regionally efficient and effective transportation system.

5.12 IMPORTANCE OF ADOPTING A TRANSPORTATION PLAN

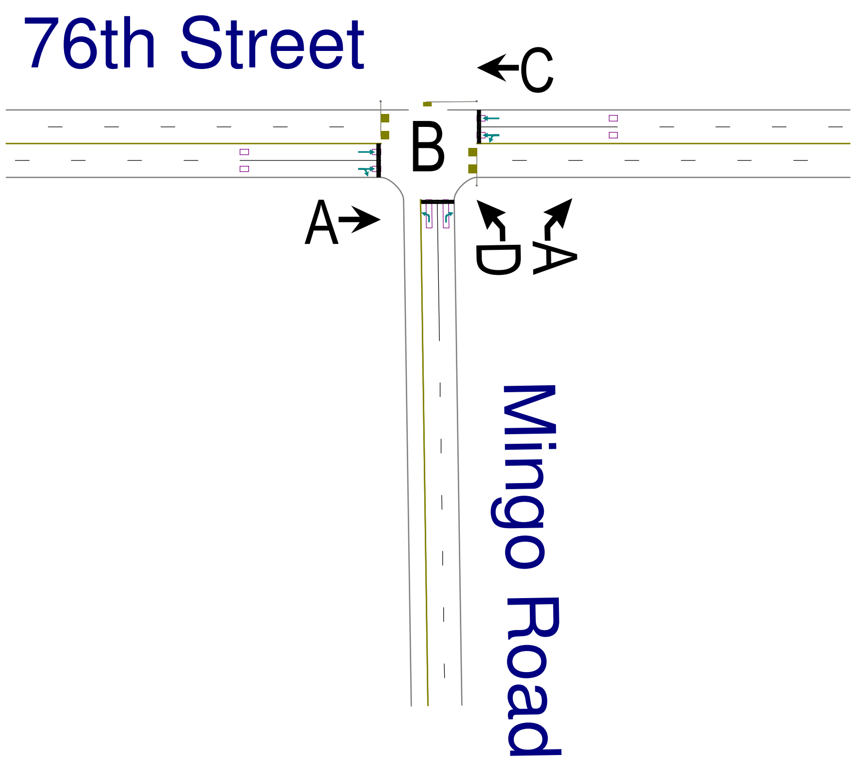
The Owasso Transportation Master Plan will be formally considered for adoption by the City Council, in accordance with the City's policies and procedures. Adoption of the Transportation Plan is necessary to officially recognize and confirm the status of the plan as a part of the policies of the local community. While it is recognized that unforeseen developments can and do call for periodic revisions to the Transportation Plan, this does not invalidate the need for the plan to be officially adopted and enforced.

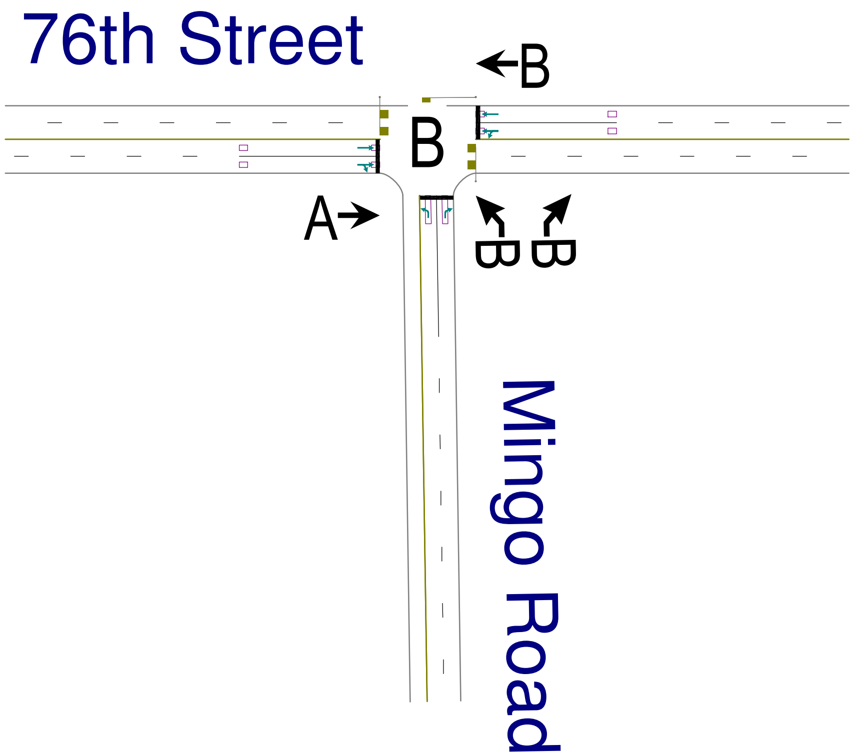
APPENDIX A: INTERSECTION IMPROVEMENT FIGURES

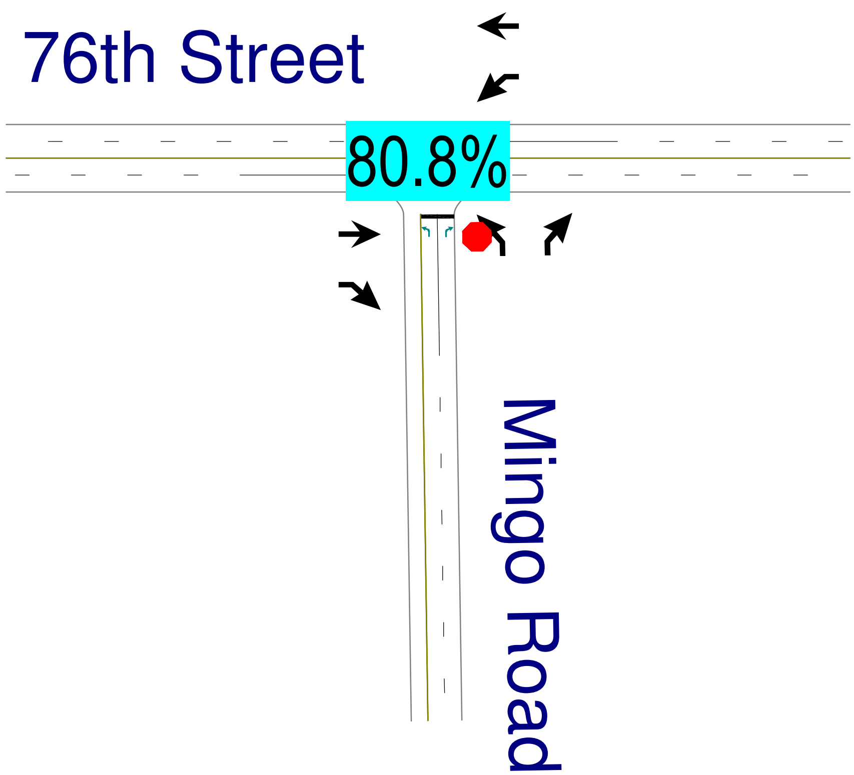
Figure A-1-1

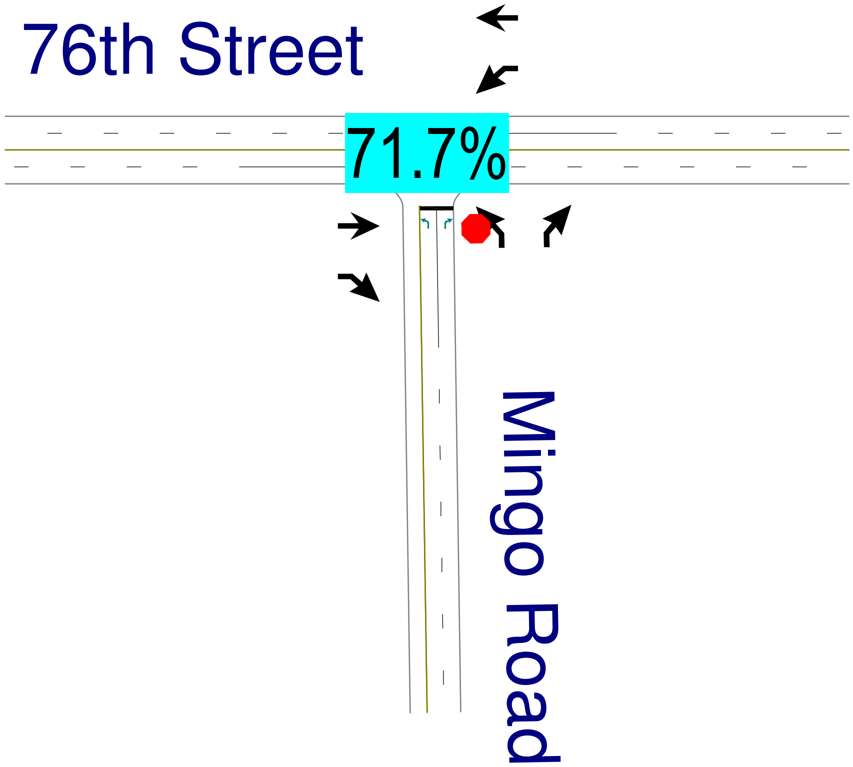
76th Street N & Mingo Road Intersection

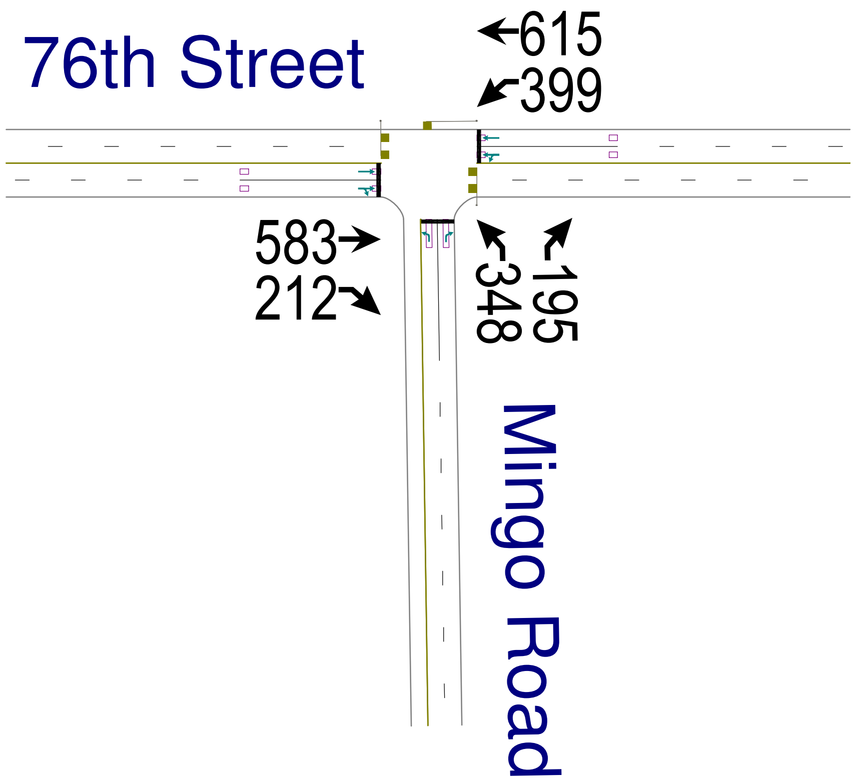
a. Future Improvements & 2035 Traffic Level of Service – AM Peak
b. Future Improvements & 2035 Traffic Level of Service – PM Peak
c. No-Build & 2035 Traffic Level of Service – AM Peak
d. No-Build & 2035 Traffic Level of Service – PM Peak
e. Future Improvements with 2035 Volumes – AM Peak
f. Future Improvements with 2035 Volumes – PM Peak
g. No-Build with 2035 Volumes – AM Peak
h. No-Build with 2035 Volumes – PM Peak

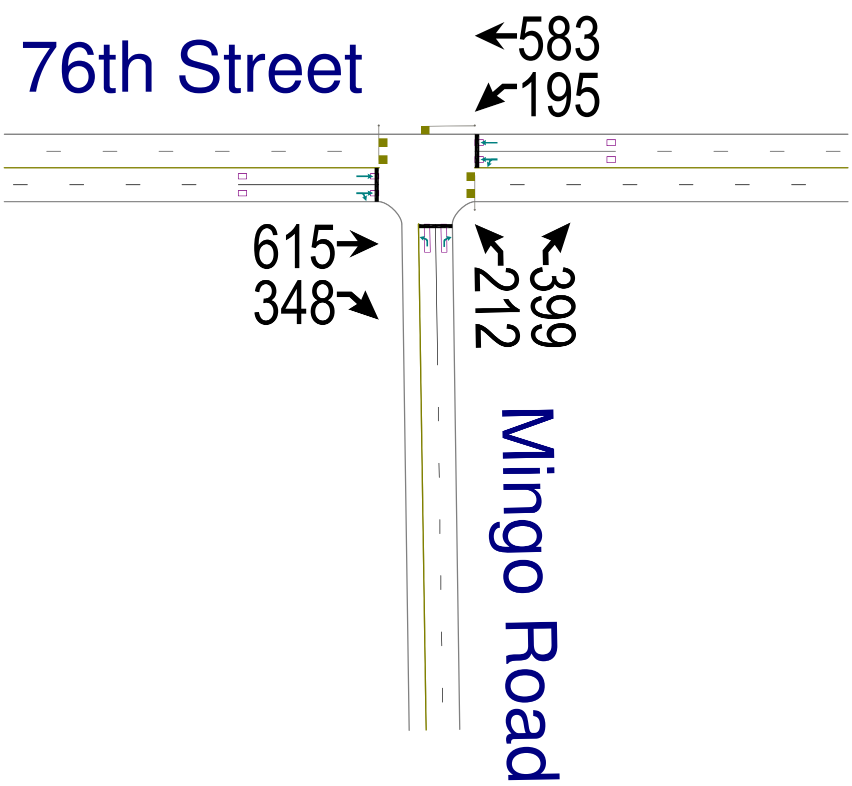

76th Street
C
B
A
D
A
Mingo Road

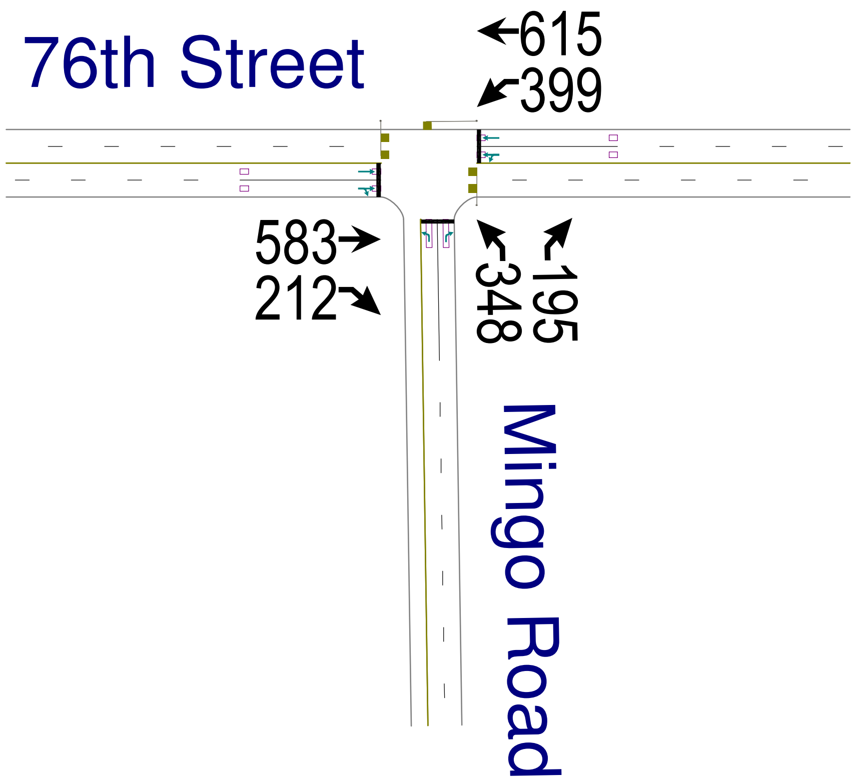

76th Street
B
B
A
B
B
Mingo Road


76th Street
80.8%
Mingo Road


76th Street
71.7%
Mingo Road


76th Street
615
399
583
212
348
195
Mingo Road


583
195
76th Street
615
348
212
399
Mingo Road


76th Street
615
399
583
212
348
195
Mingo Road

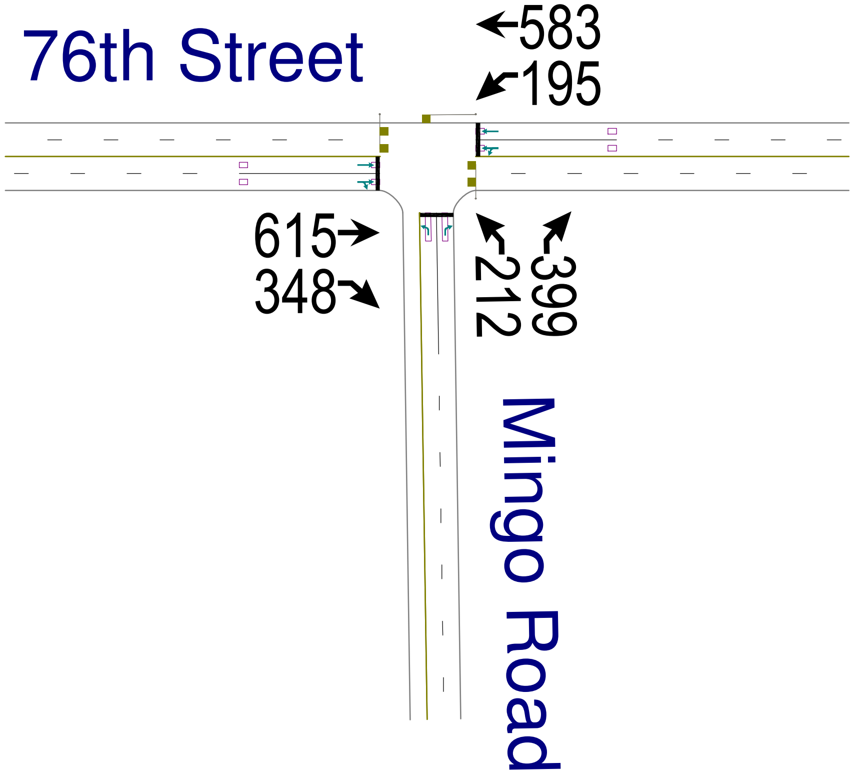
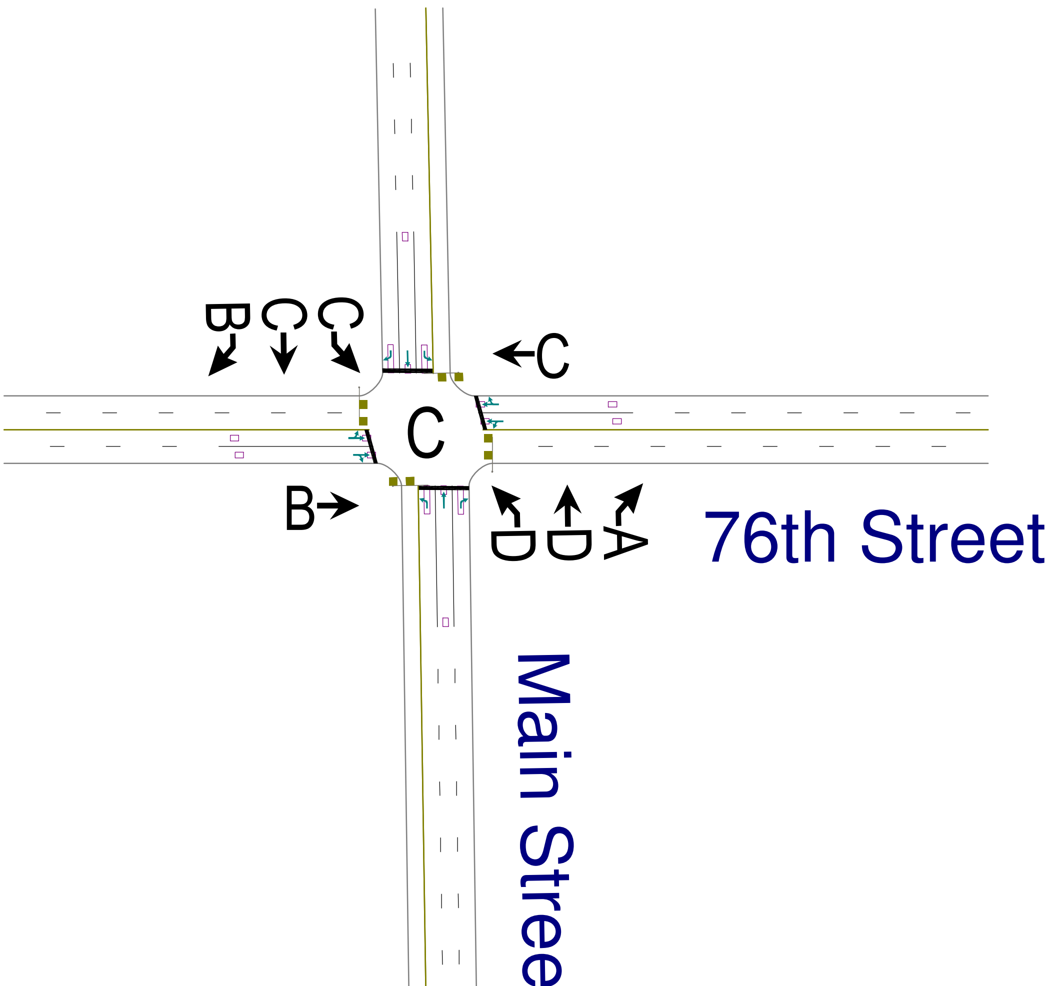
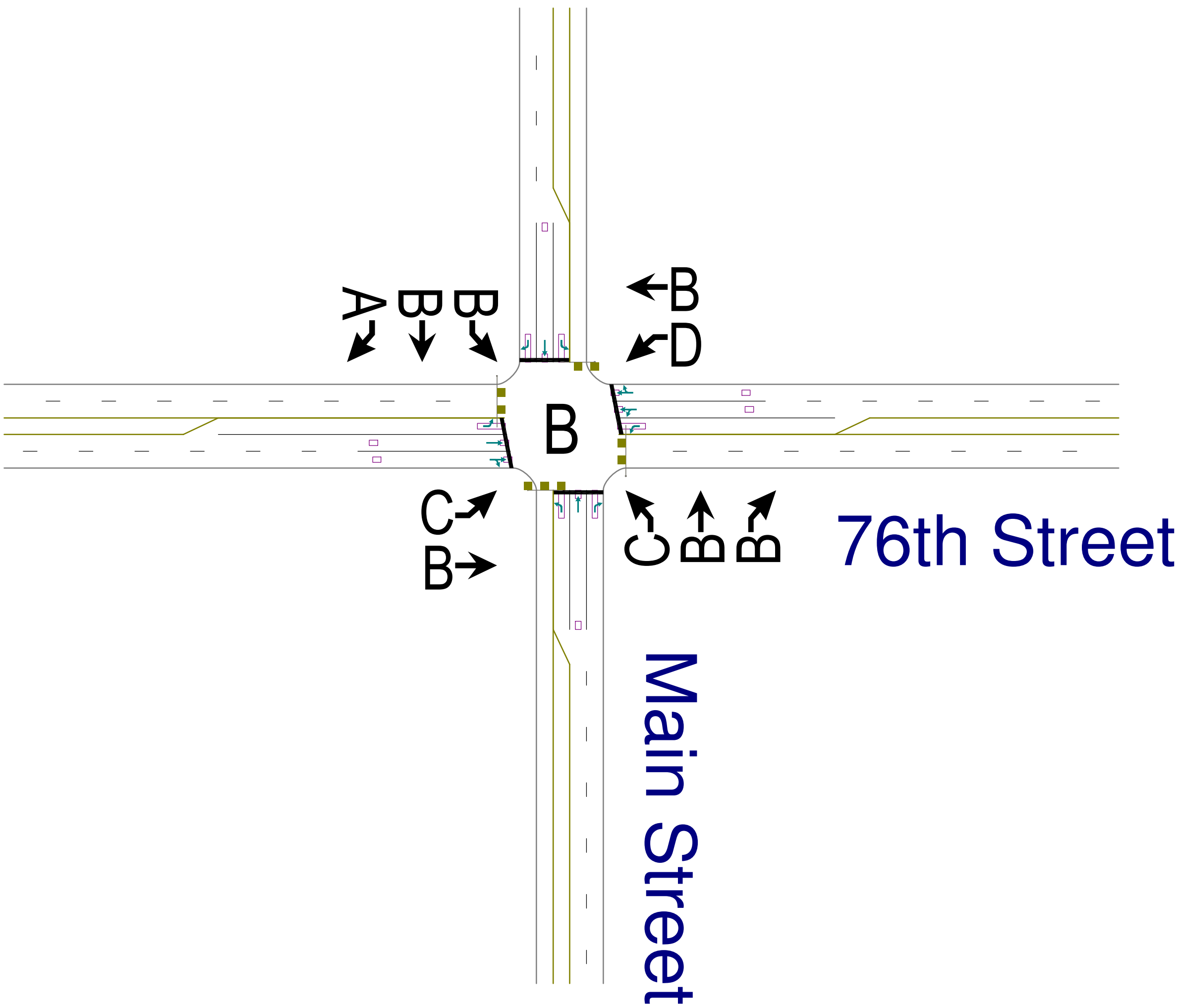

76th Street
583
195
615
348
212
399
Mingo Road

Figure A-1-2

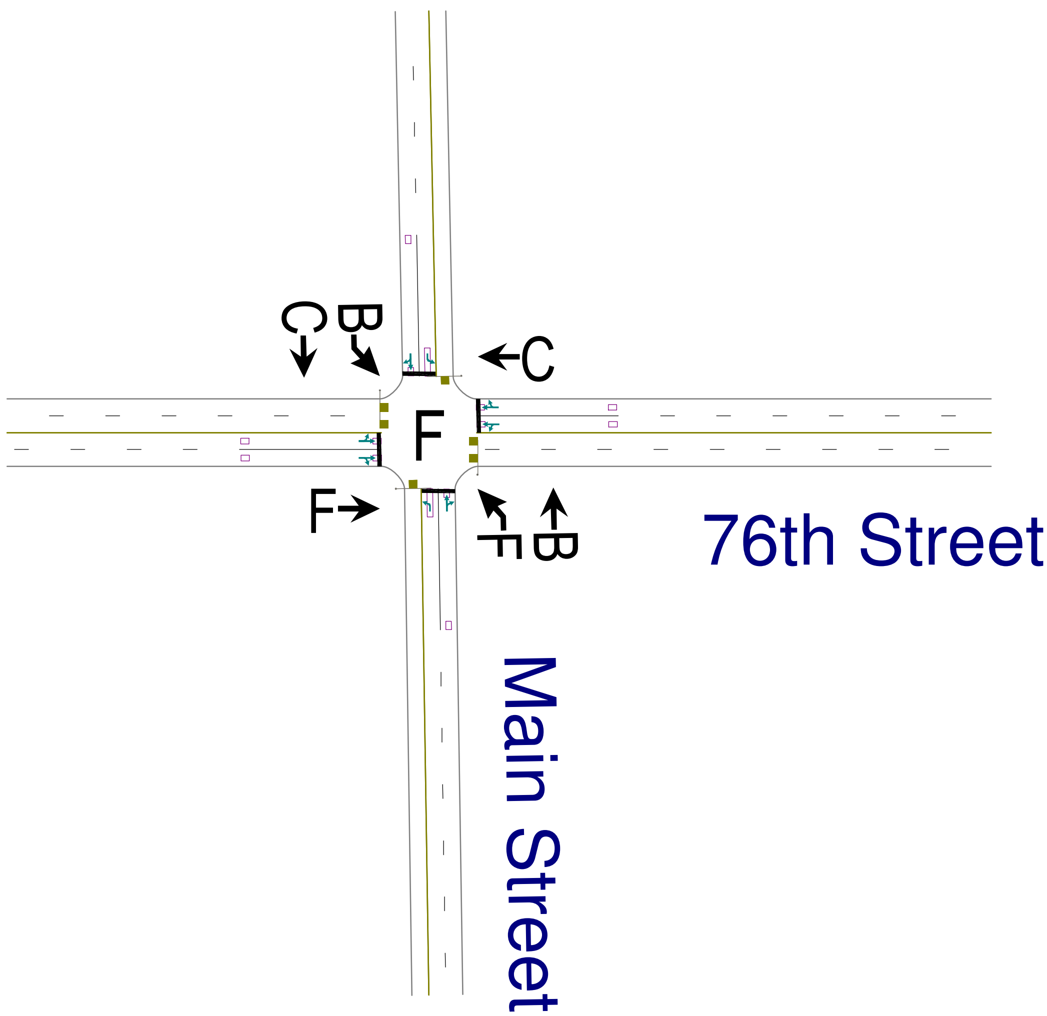
76th Street N & Main Street Intersection

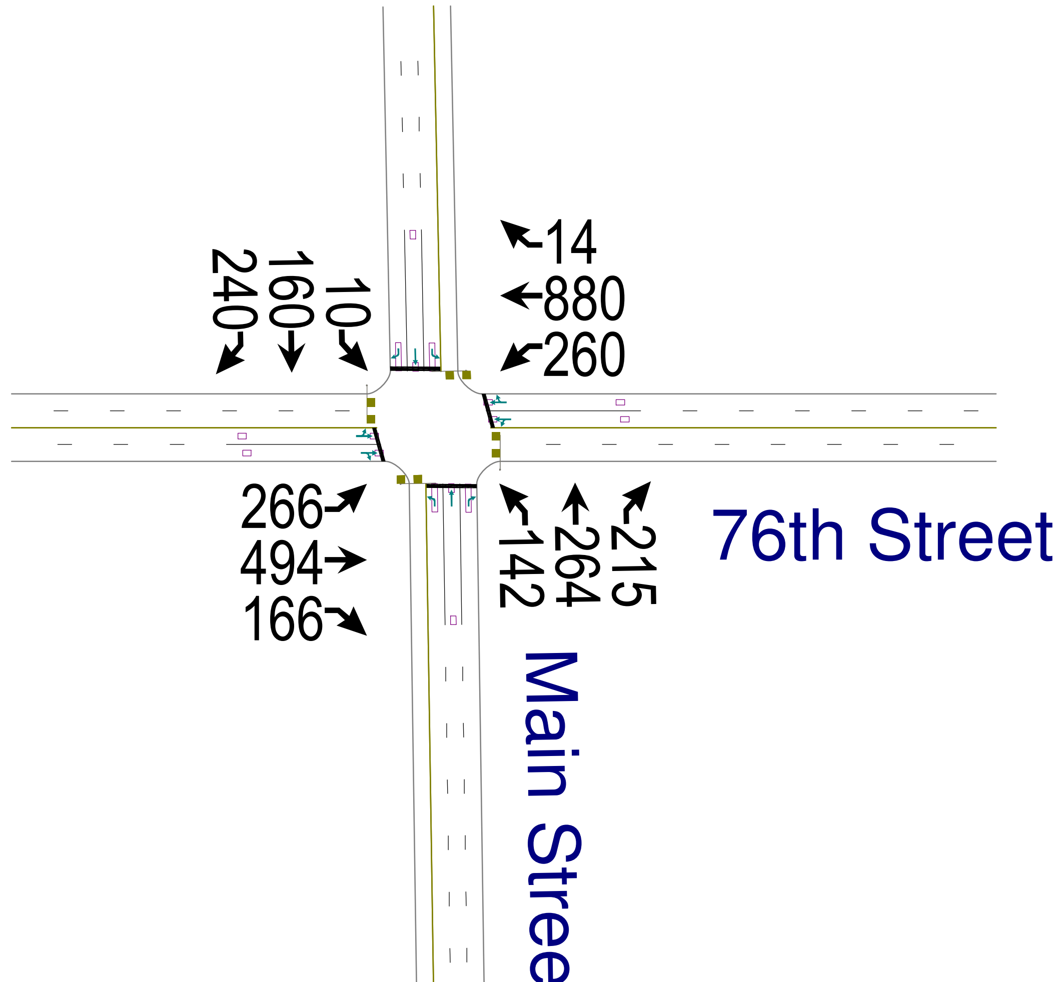
a. Future Improvements & 2035 Traffic Level of Service – AM Peak
b. Future Improvements & 2035 Traffic Level of Service – PM Peak
c. No-Build & 2035 Traffic Level of Service – AM Peak
d. No-Build & 2035 Traffic Level of Service – PM Peak
e. Future Improvements with 2035 Volumes – AM Peak
f. Future Improvements with 2035 Volumes – PM Peak
g. No-Build with 2035 Volumes – AM Peak
h. No-Build with 2035 Volumes – PM Peak

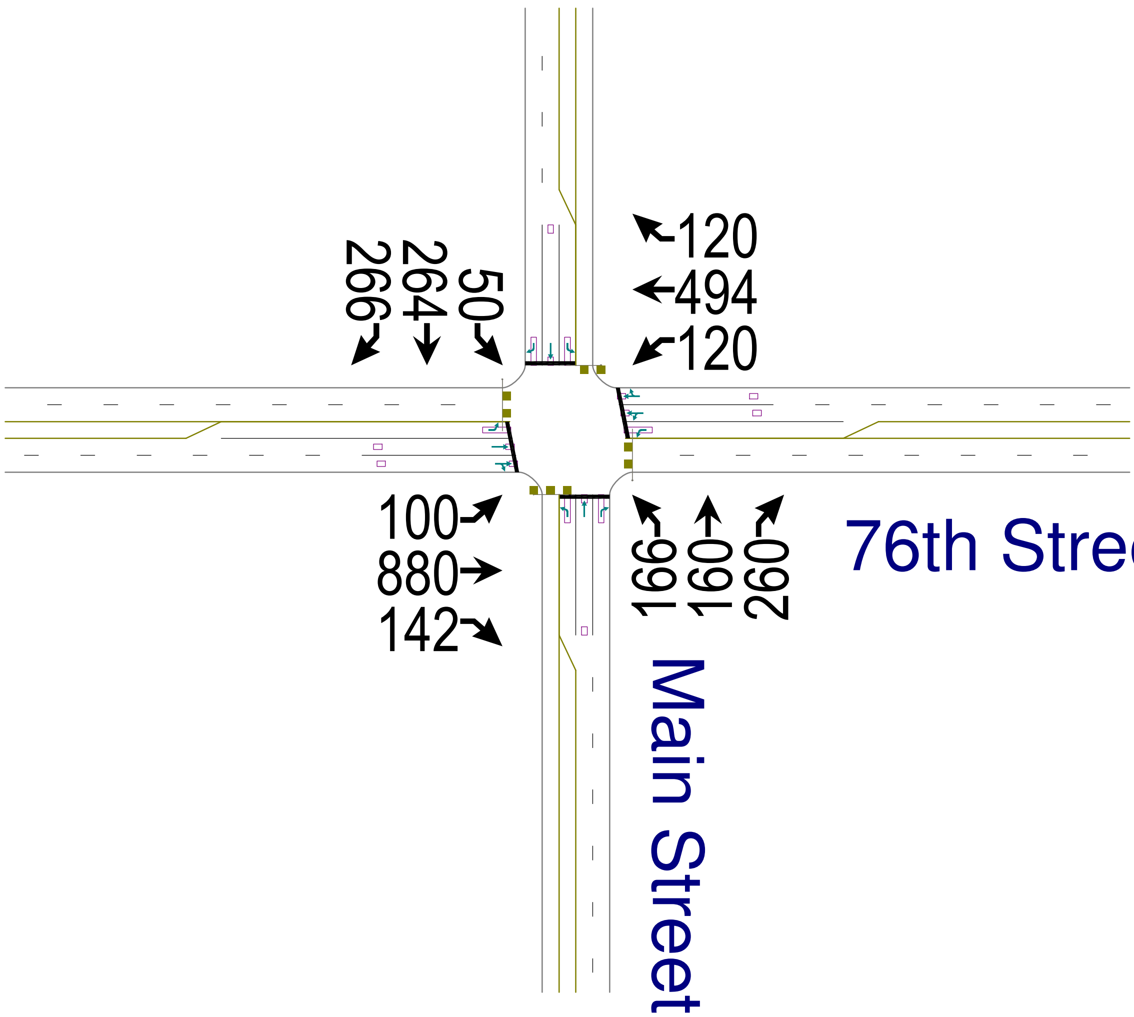

B
C
C
C
C
C
B
D
D
A
76th Street
Main Street

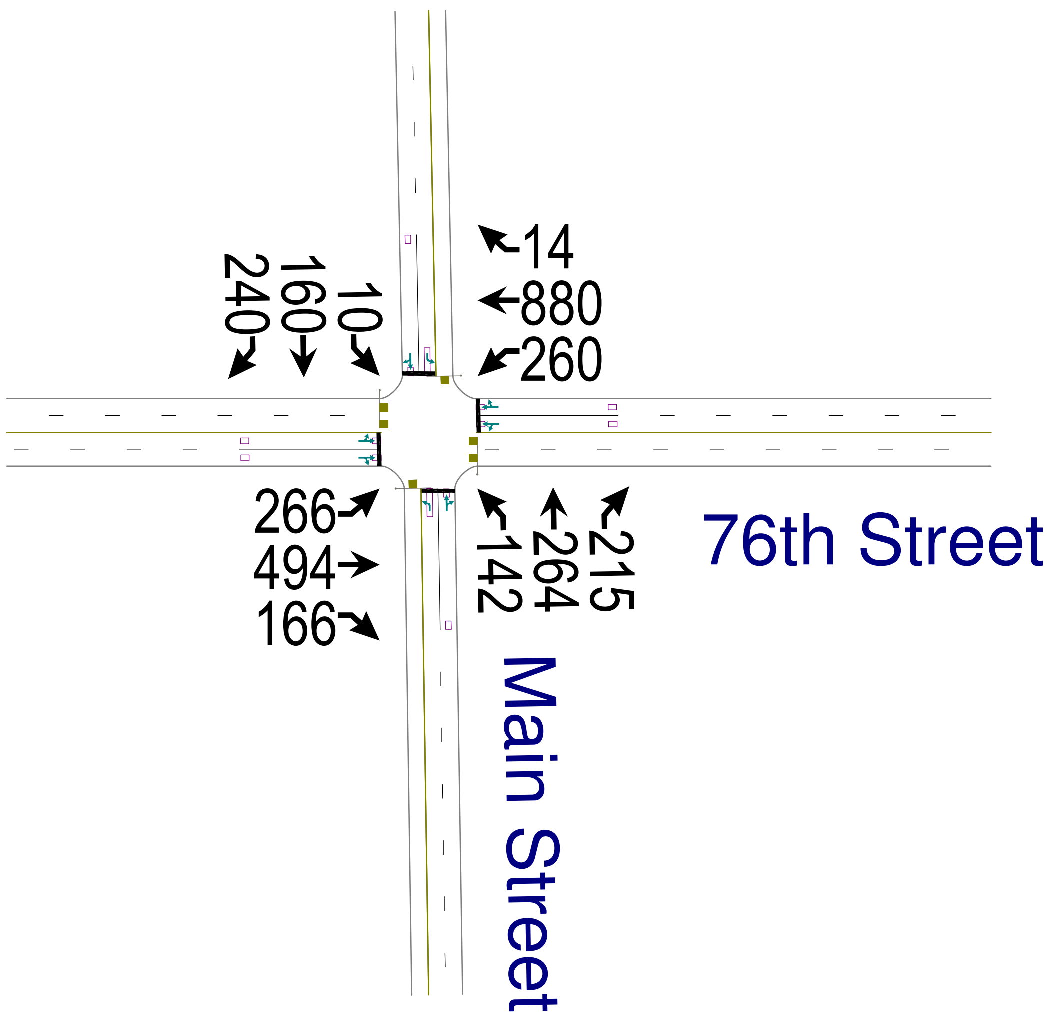

B
A
B
B
B
D
C
B
C
B
B
76th Street
Main Street


C
B
E
E
C
F
D
76th Street
Main Street


C
B
C
F
F
F
B
76th Street
Main Street


14
880
260
240
160
10
266
494
166
142
264
215
76th Street
Main Street


266
264
50
120
494
120
100
880
142
166
160
260
76th Street
Main Street

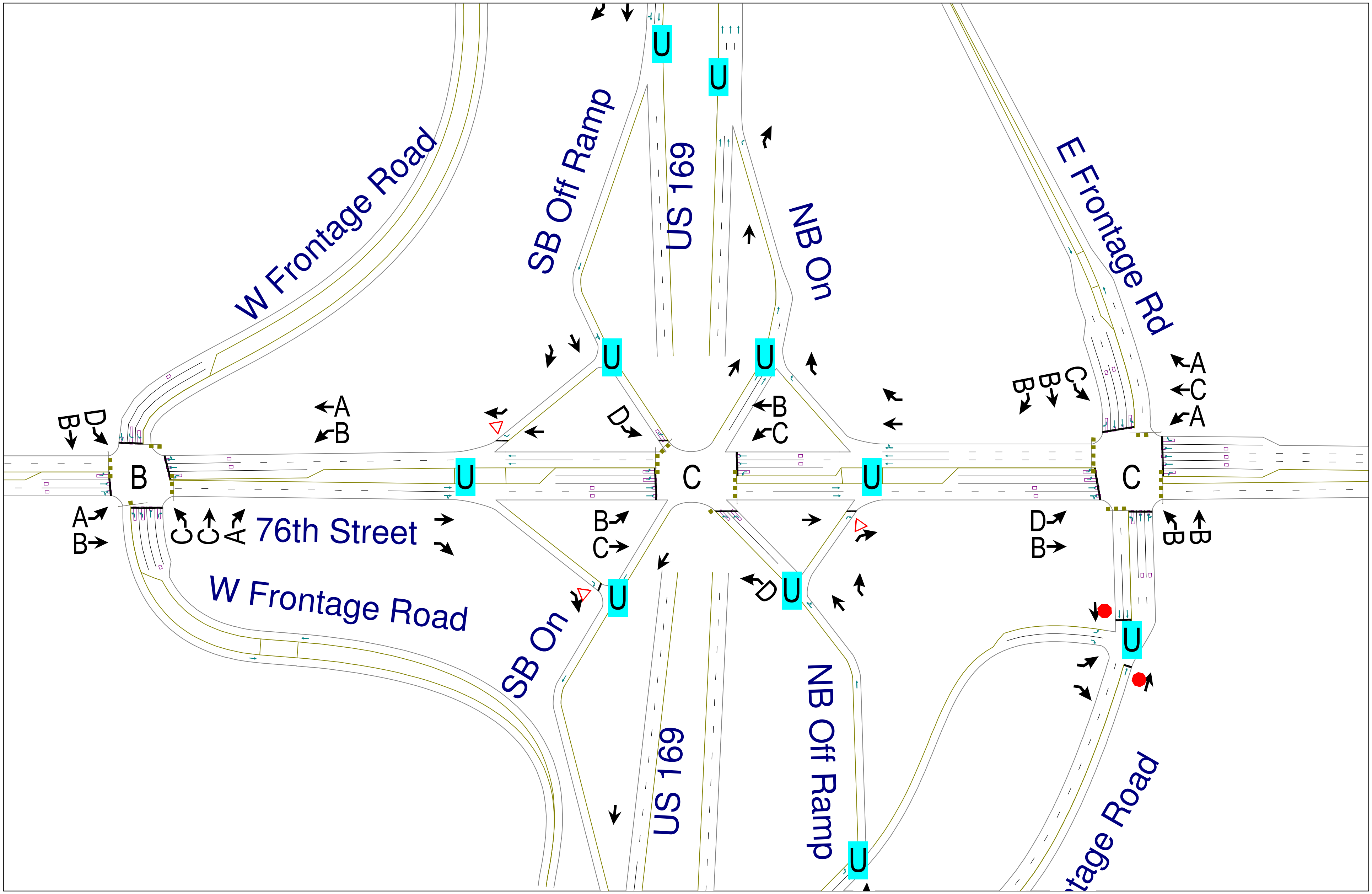

14
880
260
240
160
10
266
494
166
142
264
215
76th Street
Main Street

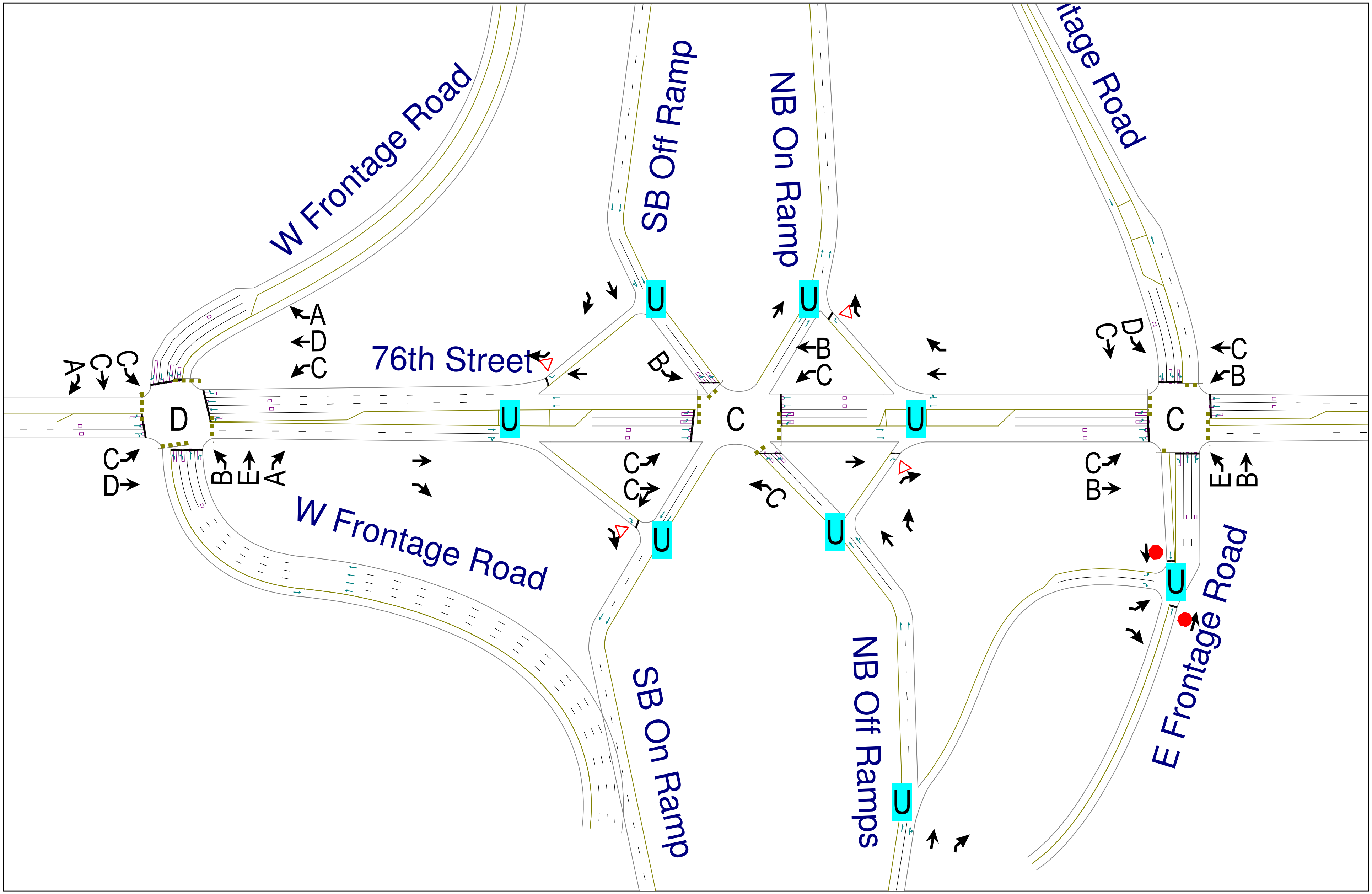

10
494
215
266
264
14
240
880
142
166
160
260
76th Street
Main Street

Figure A-1-3

76th Street N & US 169 Interchange

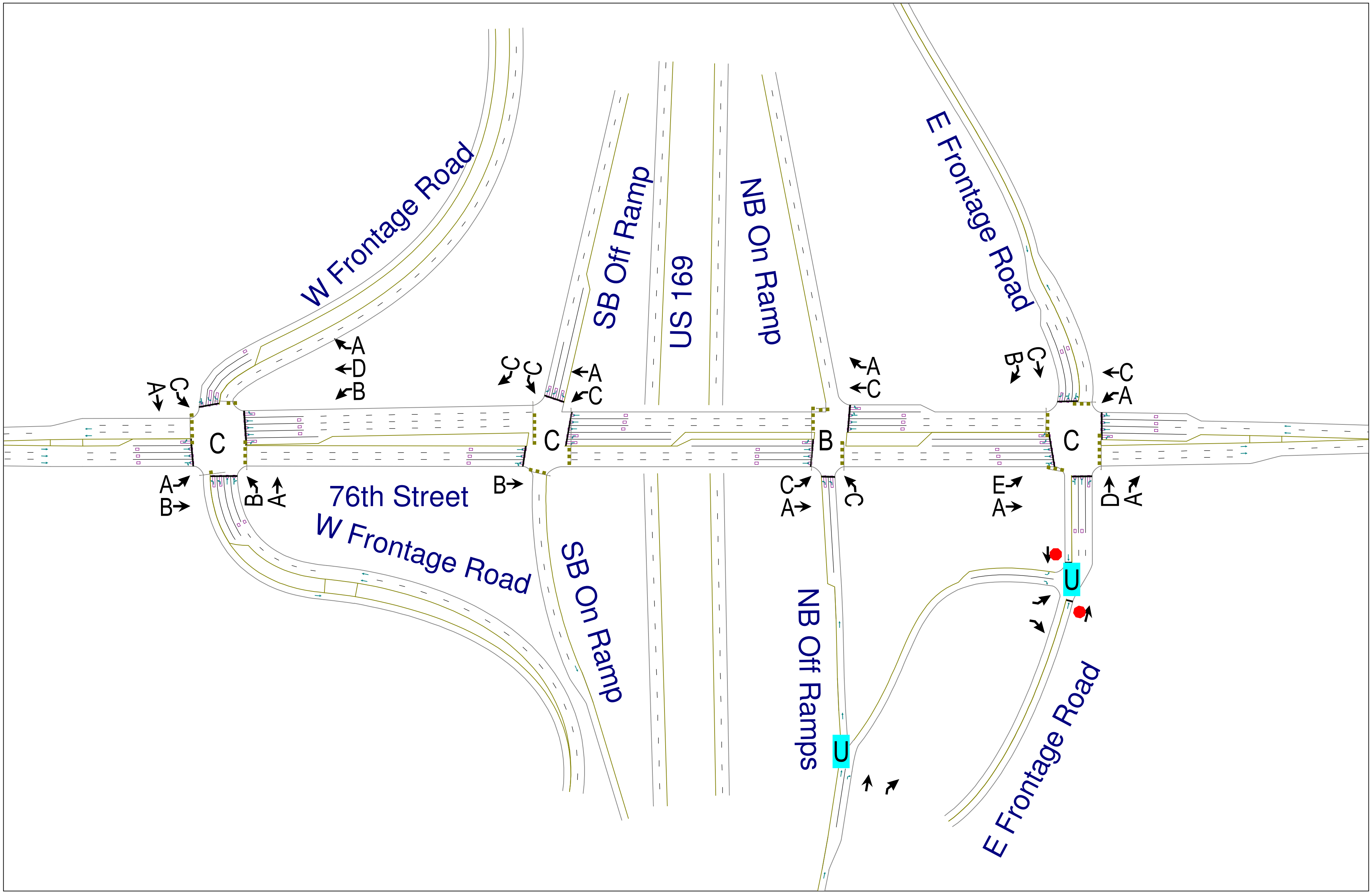
a. Future Single Point Option & 2035 Traffic Level of Service – AM Peak
b. Future Single Point Option & 2035 Traffic Level of Service – PM Peak
c. Future Diamond Option & 2035 Traffic Level of Service – AM Peak
d. Future Diamond Option & 2035 Traffic Level of Service – PM Peak
e. No-Build & 2035 Traffic Level of Service – AM Peak
f. No-Build & 2035 Traffic Level of Service – PM Peak
g. Future Single Point Option with 2035 Volumes – AM Peak
h. Future Single Point Option with 2035 Volumes – PM Peak
i. Future Diamond Option with 2035 Volumes – AM Peak
j. Future Diamond Option with 2035 Volumes – PM Peak
k. No-Build with 2035 Volumes – AM Peak
l. No-Build with 2035 Volumes – PM Peak


W Frontage Road
SB Off Ramp
US 169
NB On
E Frontage Rd
76th Street
W Frontage Road
SB On
US 169
NB Off Ramp
tage Road
B
C
C

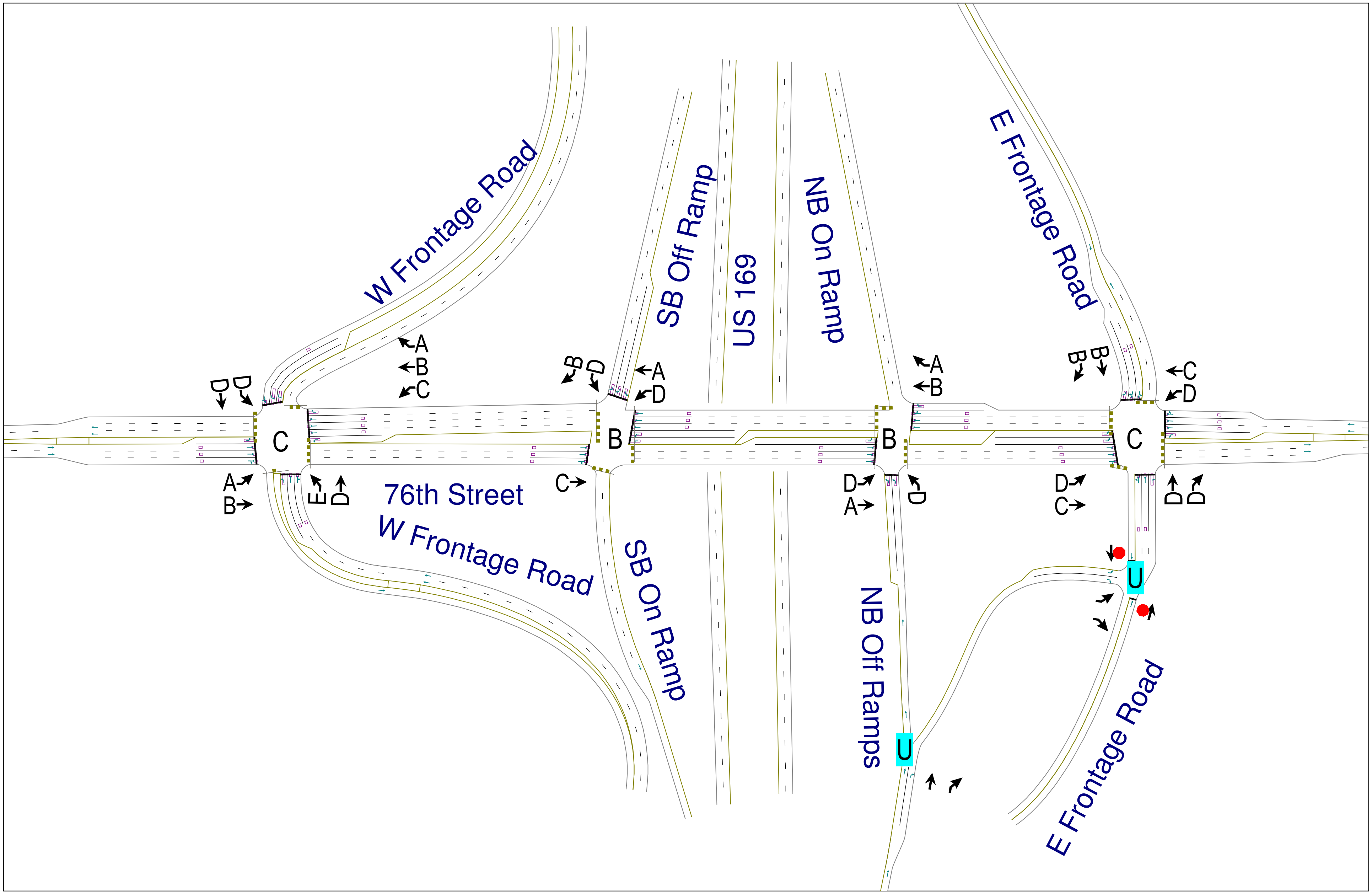

W Frontage Road
SB Off Ramp
NB On Ramp
tage Road
76th Street
W Frontage Road
SB On Ramp
NB Off Ramps
E Frontage Road
D
C
C

Map - 76th Street and US 169
Level of Service

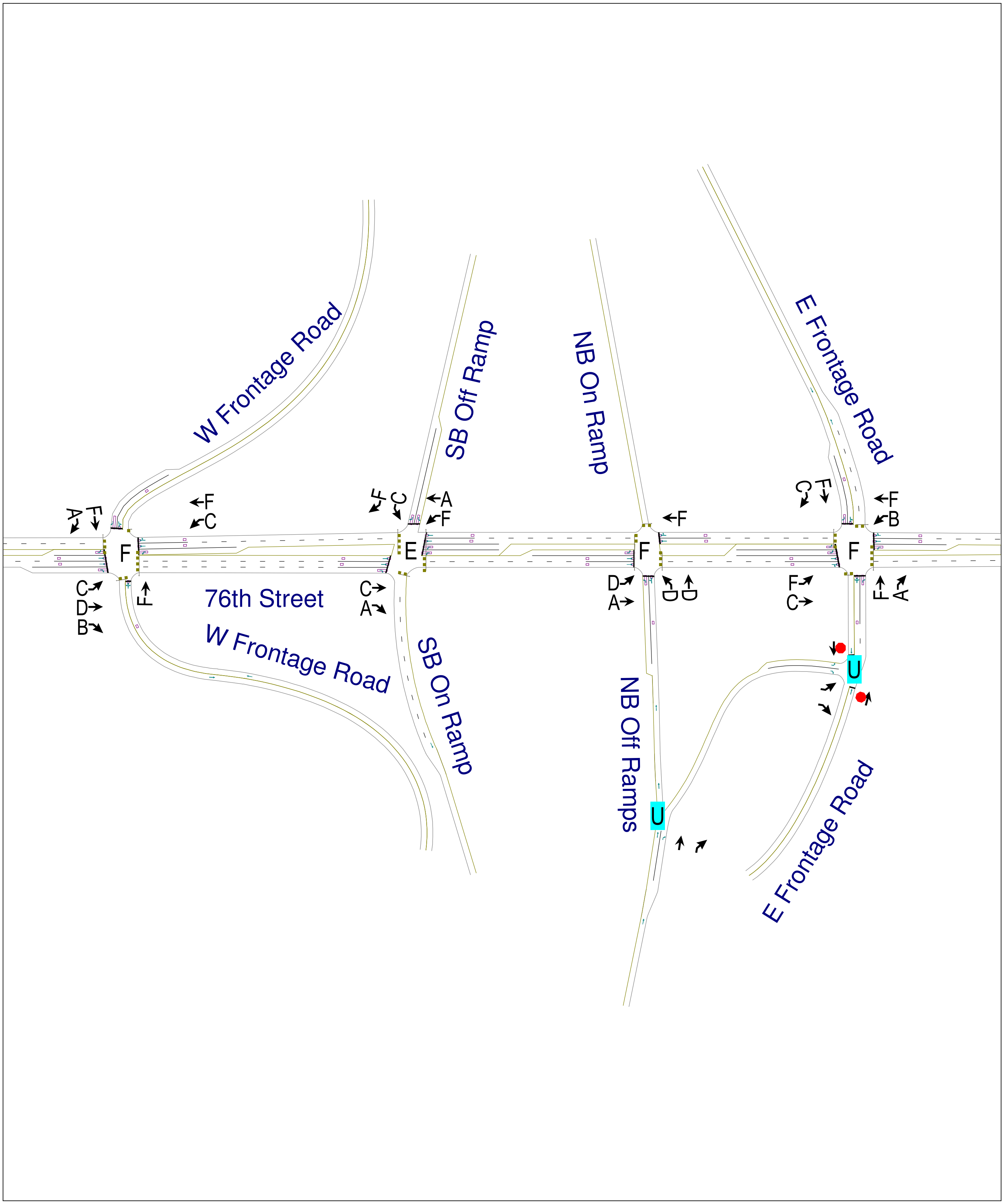
4/25/2015

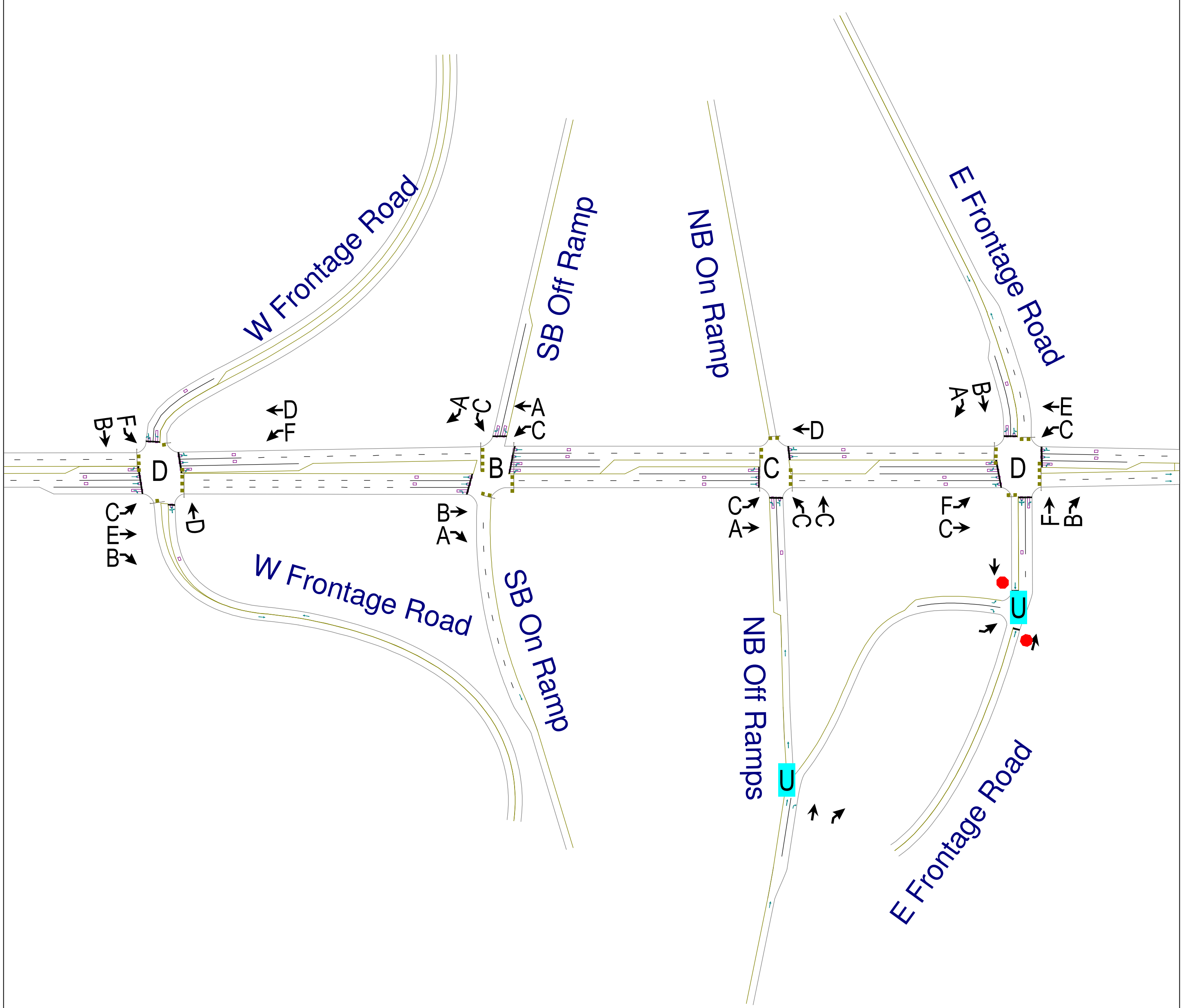


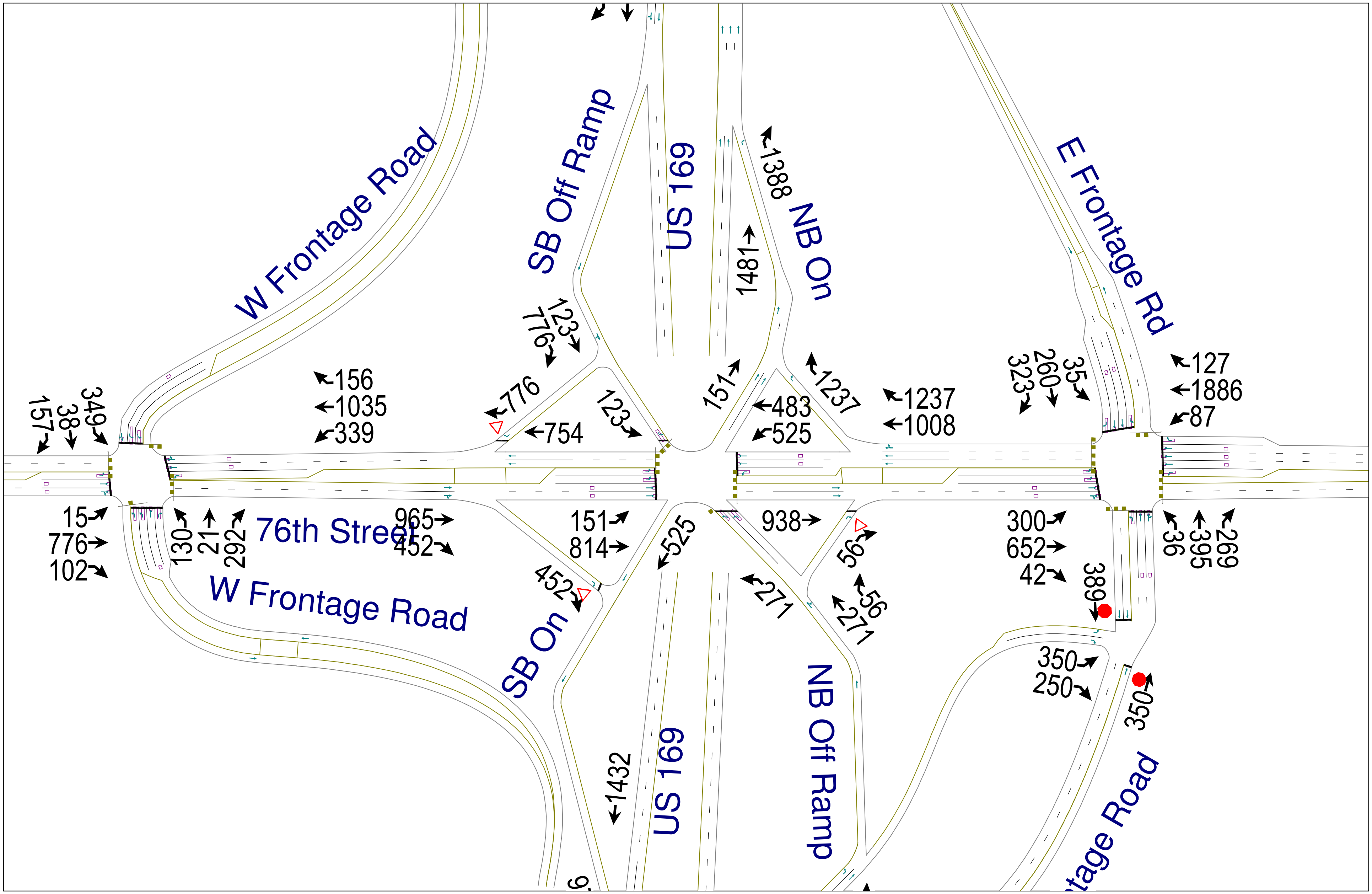
76th Street and US 169 Future Lanes with 2035 Volumes - AM Peak
Timing Plan: AM Peak

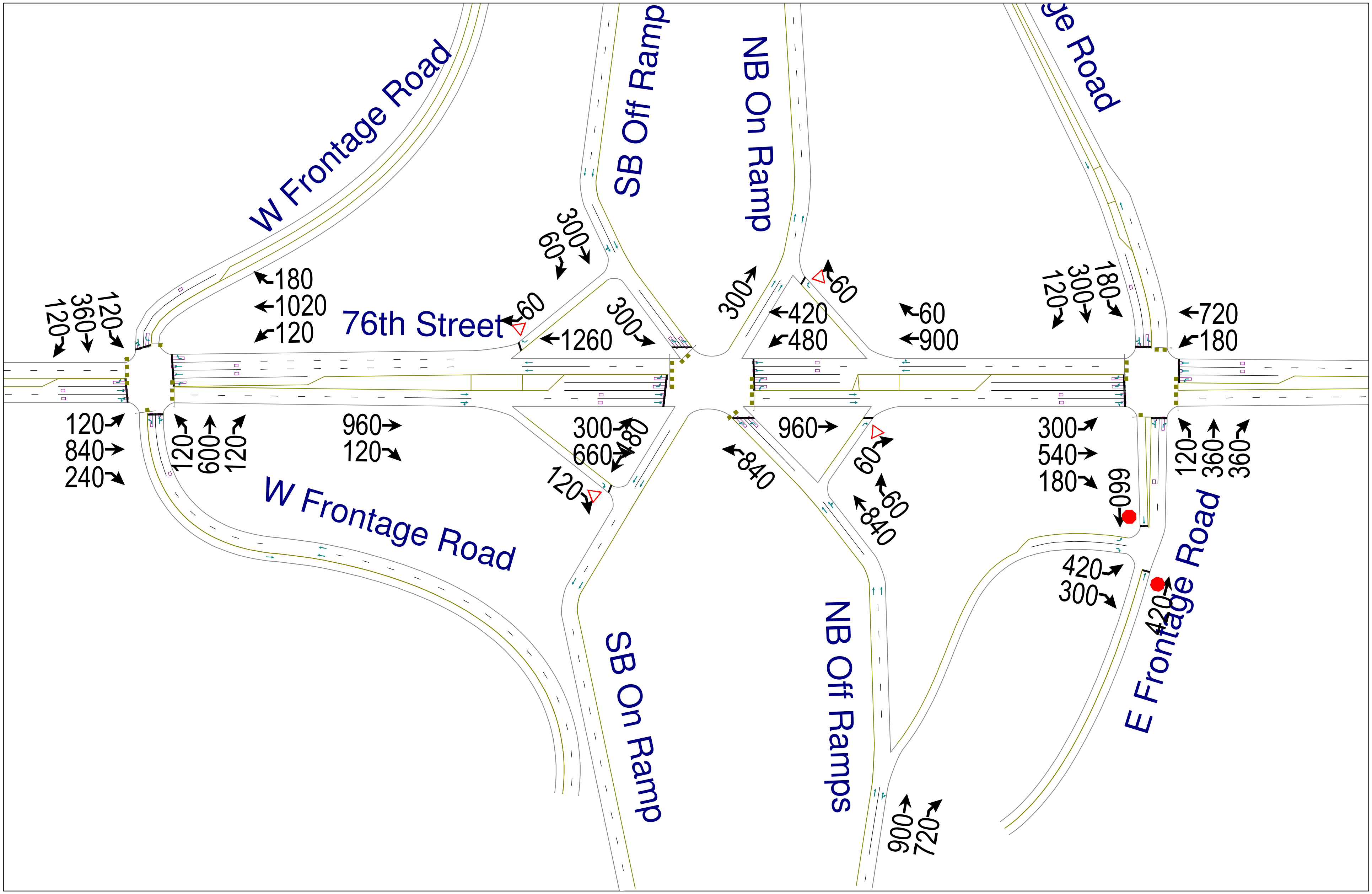


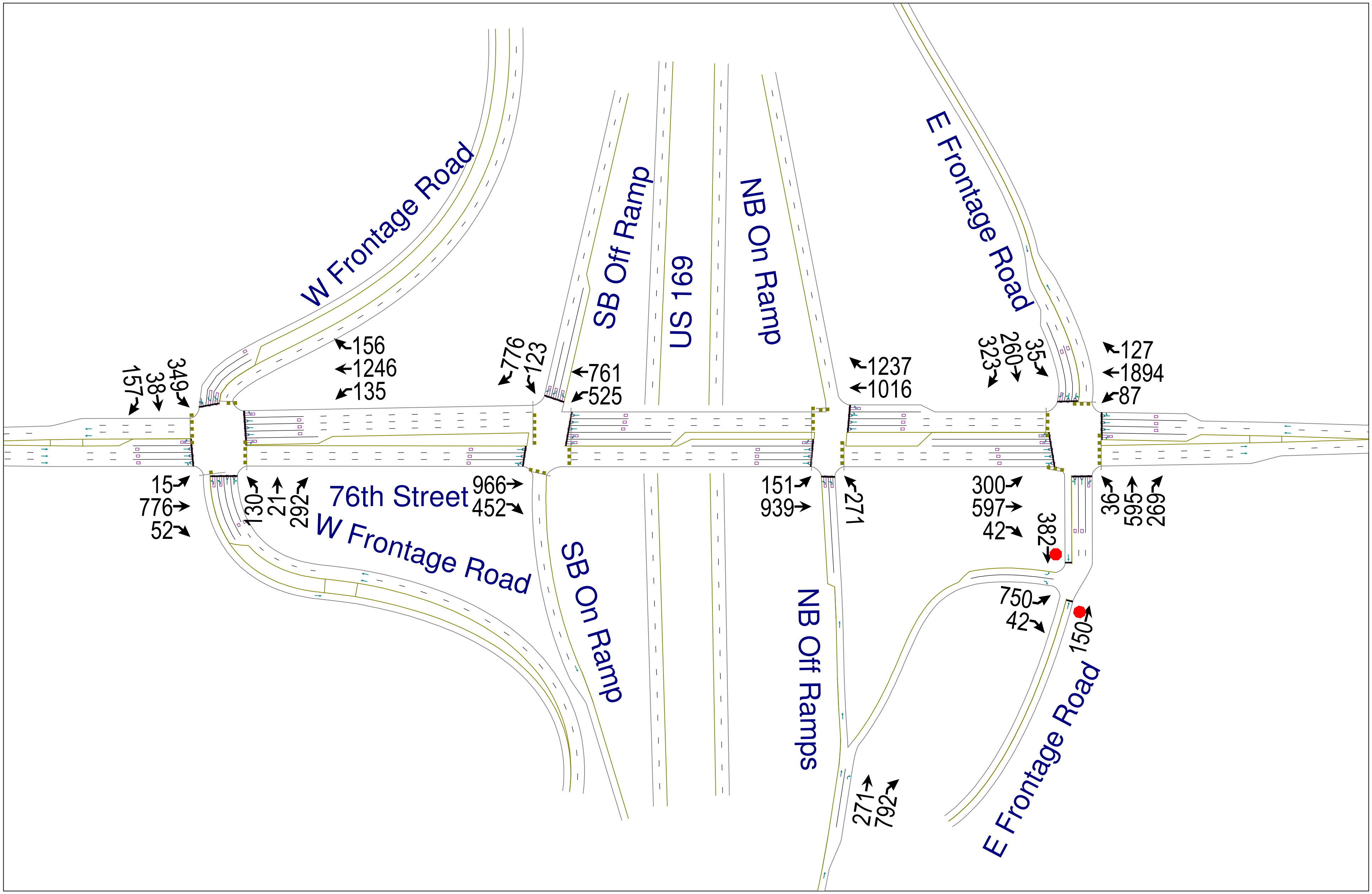
76 Street and US 169 Future Lanes with 2035 Volumes - PM Peak
Timing Plan: PM Peak

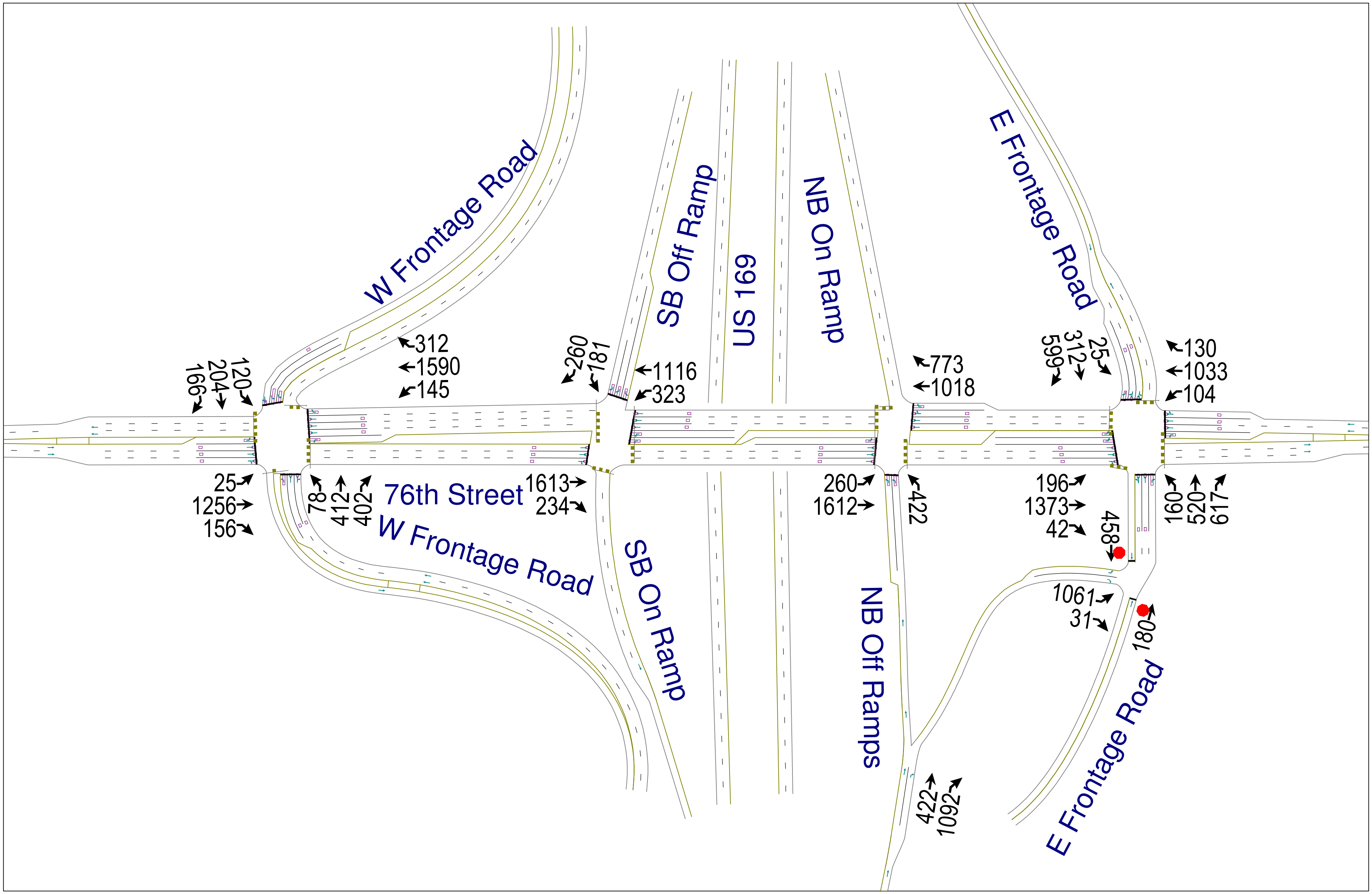

W Frontage Road
SB Off Ramp
NB On Ramp
E Frontage Road
76th Street
W Frontage Road
SB On Ramp
NB Off Ramps
E Frontage Road
F
E
F
F
U
U


W Frontage Road
SB Off Ramp
NB On Ramp
E Frontage Road
W Frontage Road
SB On Ramp
NB Off Ramps
E Frontage Road
D
B
C
D
U
U

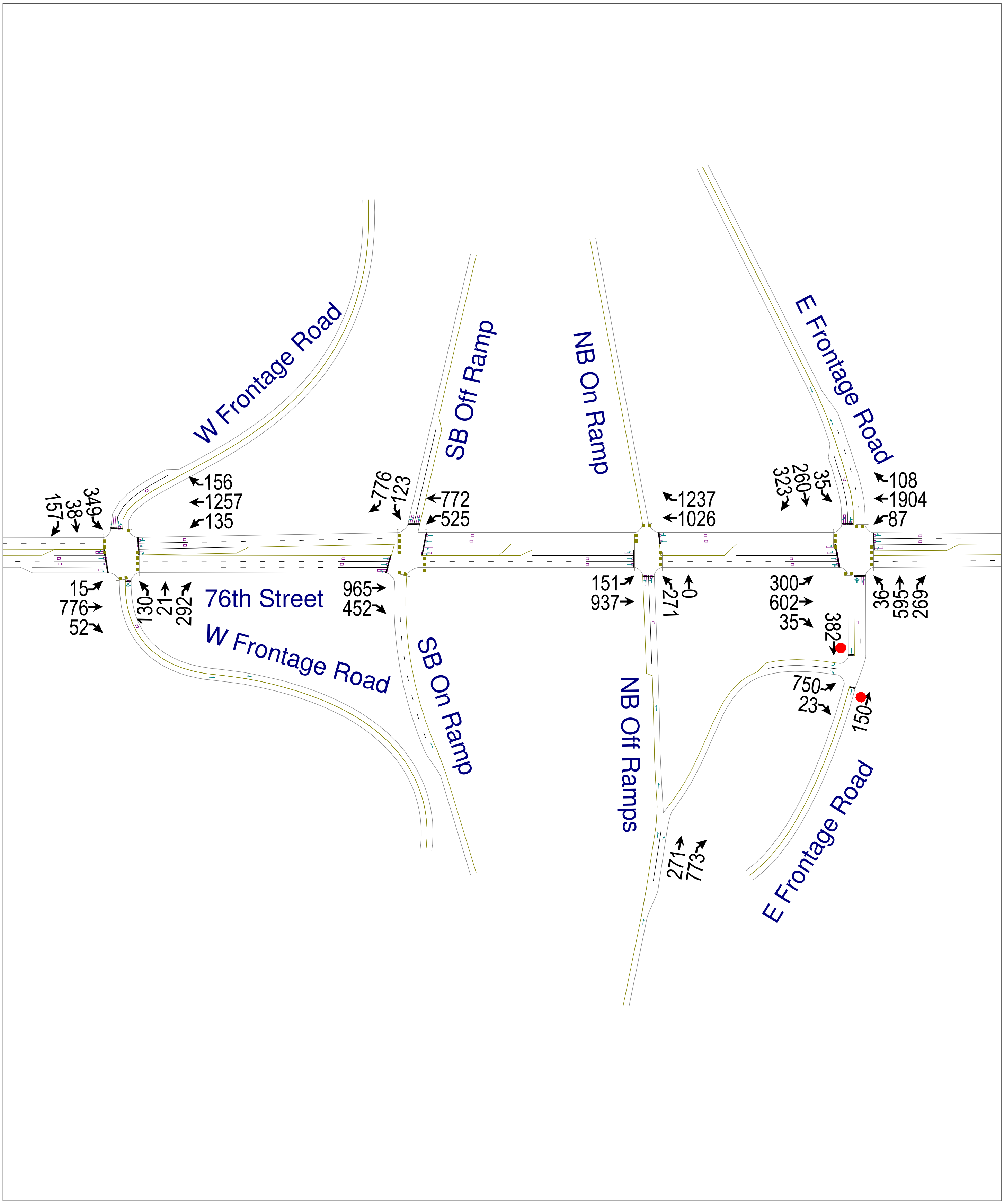

W Frontage Road
SB Off Ramp
US 169
NB On
E Frontage Rd
76th Street
W Frontage Road
SB On
US 169
NB Off Ramp
tage Road
157
38
349
15
776
102
130
21
292
156
1035
339
965
452
123
776
776
754
123
151
814
452
525
1432
1388
1481
151
483
525
1237
938
56
56
271
271
1237
1008
323
260
35
127
1886
87
300
652
42
36
395
269
389
350
250
350


W Frontage Road
SB Off Ramp
NB On Ramp
76th Street
W Frontage Road
SB On Ramp
NB Off Ramps
E Frontage Road


W Frontage Road
SB Off Ramp
US 169
NB On Ramp
E Frontage Road
76th Street
W Frontage Road
SB On Ramp
NB Off Ramps
E Frontage Road
157
38
349
156
1246
135
15
776
52
130
21
292
776
123
761
525
966
452
1237
1016
151
939
271
323
260
35
300
597
42
382
127
1894
87
36
595
269
750
42
150
271
792



76 Street and US 169 Future Lanes with 2035 Volumes - PM Peak
Timing Plan: PM Peak


W Frontage Road
SB Off Ramp
NB On Ramp
E Frontage Road
76th Street
W Frontage Road
SB On Ramp
NB Off Ramps
E Frontage Road
157
38
349
156
1257
135
776
123
772
525
1237
1026
323
260
35
108
1904
87
15
776
52
130
21
292
965
452
151
937
271
0
300
602
35
382
36
595
269
750
23
150
271
773

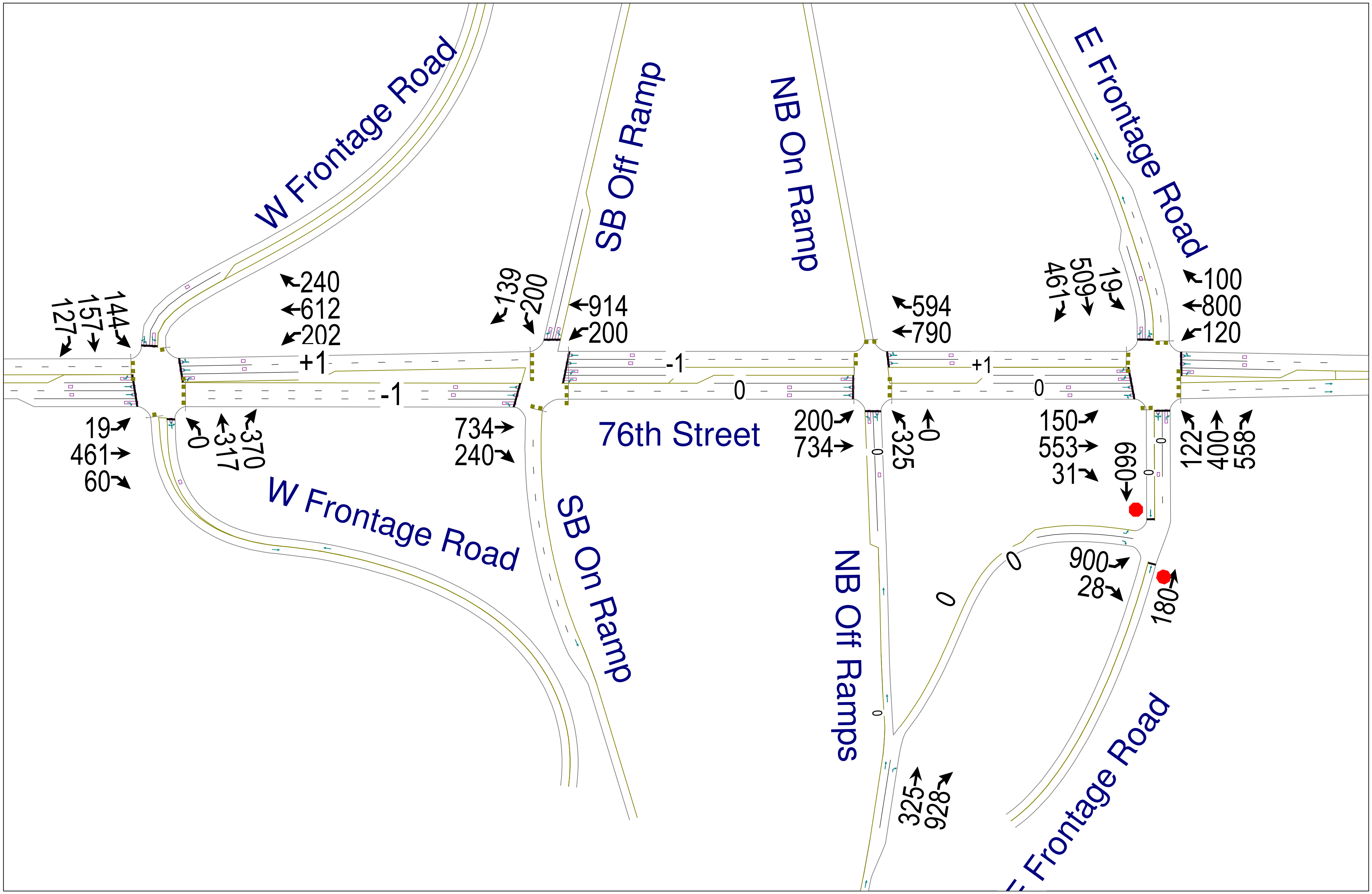
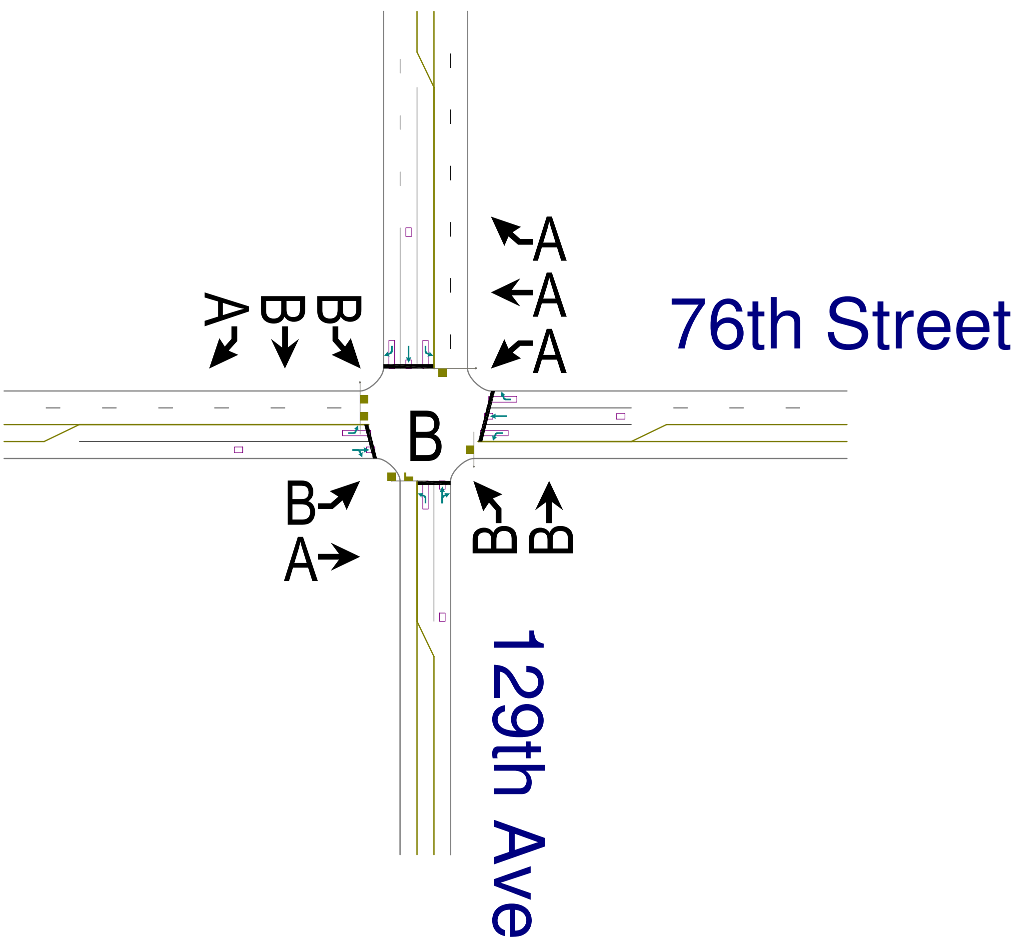
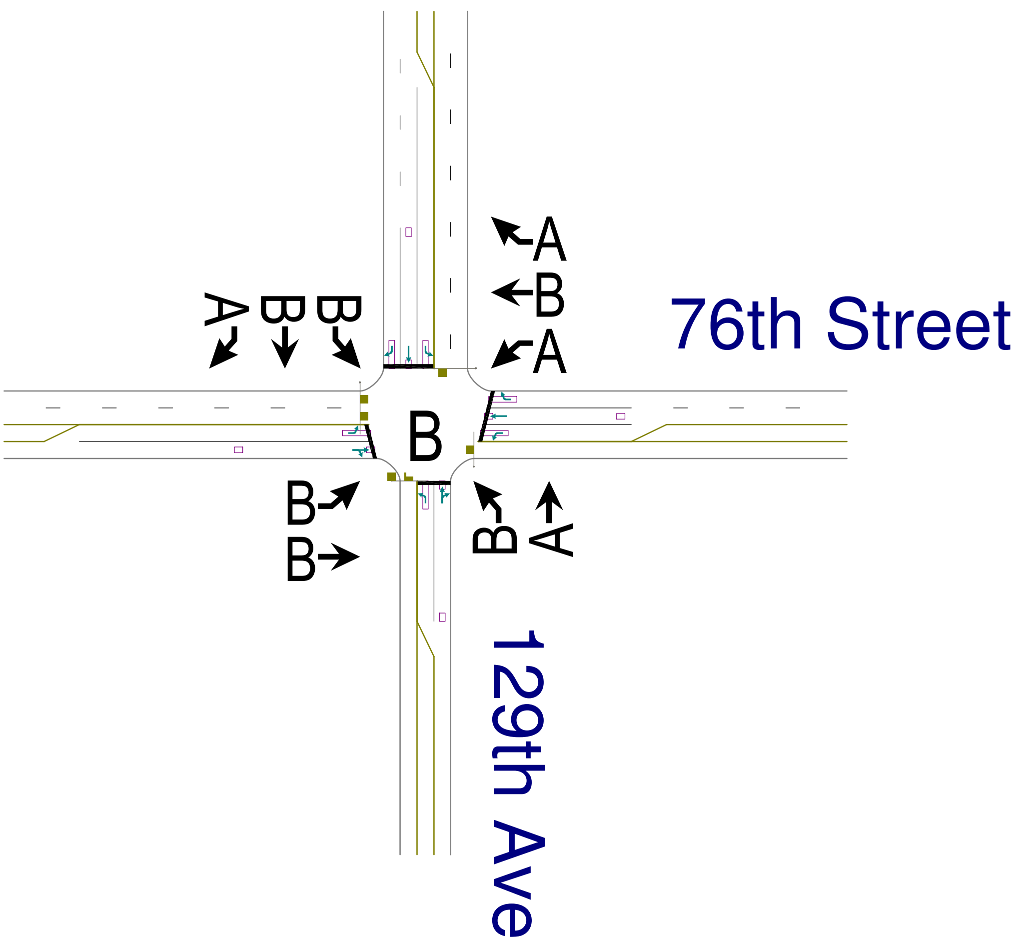

W Frontage Road
SB Off Ramp
NB On Ramp
E Frontage Road
76th Street
W Frontage Road
SB On Ramp
NB Off Ramps
E Frontage Road
127
157
144
19
461
60
240
612
202
0
317
370
+1
-1
139
200
914
200
734
240
-1
0
594
790
200
734
325
0
+1
0
461
509
19
100
800
120
150
553
31
660
122
400
558
900
28
180
0
0
0
325
928

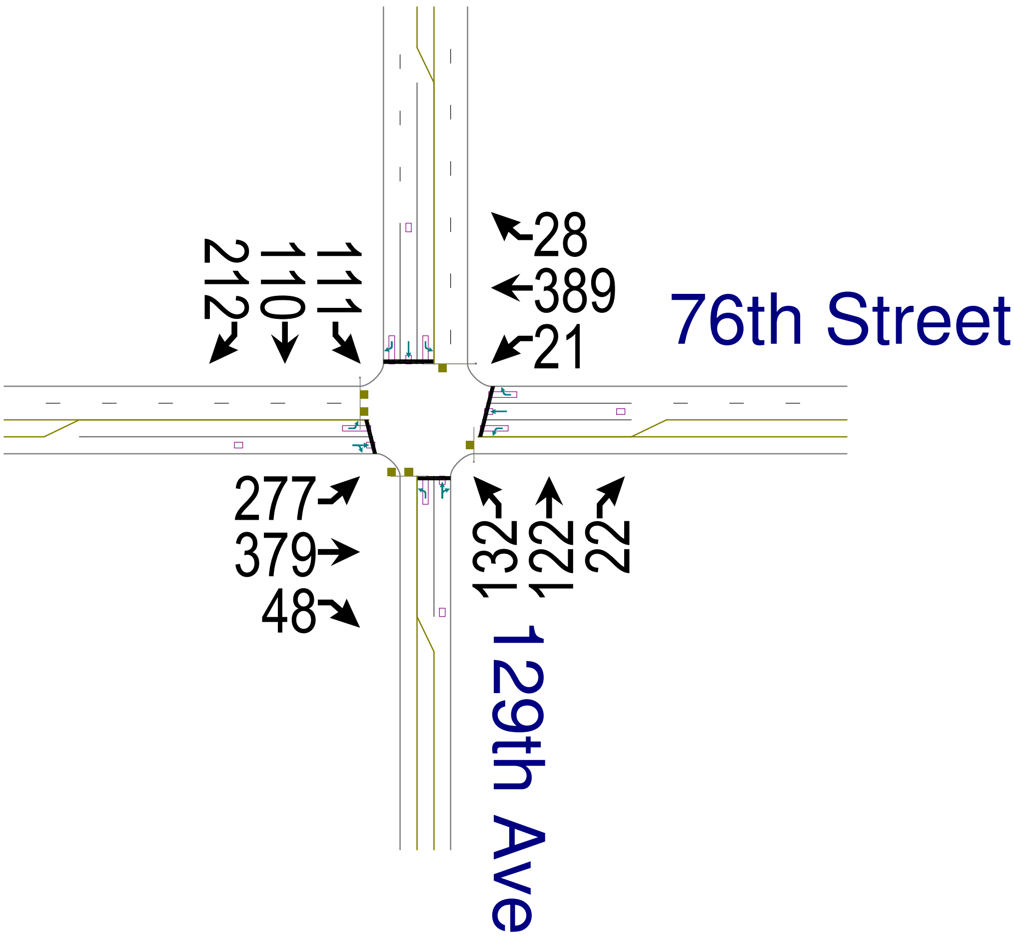
Figure A-1-4

76^{th} Street N & 129th E Avenue Intersection

a. No-Build & 2035 Traffic Level of Service – AM Peak
b. No-Build & 2035 Traffic Level of Service – PM Peak
c. No-Build with 2035 Volumes – AM Peak
d. No-Build with 2035 Volumes – PM Peak


76th Street
129th Ave
B
A
A
A
B
A
B
B
B
B
A


76th Street
129th Ave
B
A
B
A
A
B
B
B
B
B
A


76th Street
129th Ave
28
389
21
111
110
212
277
379
48
132
122
22

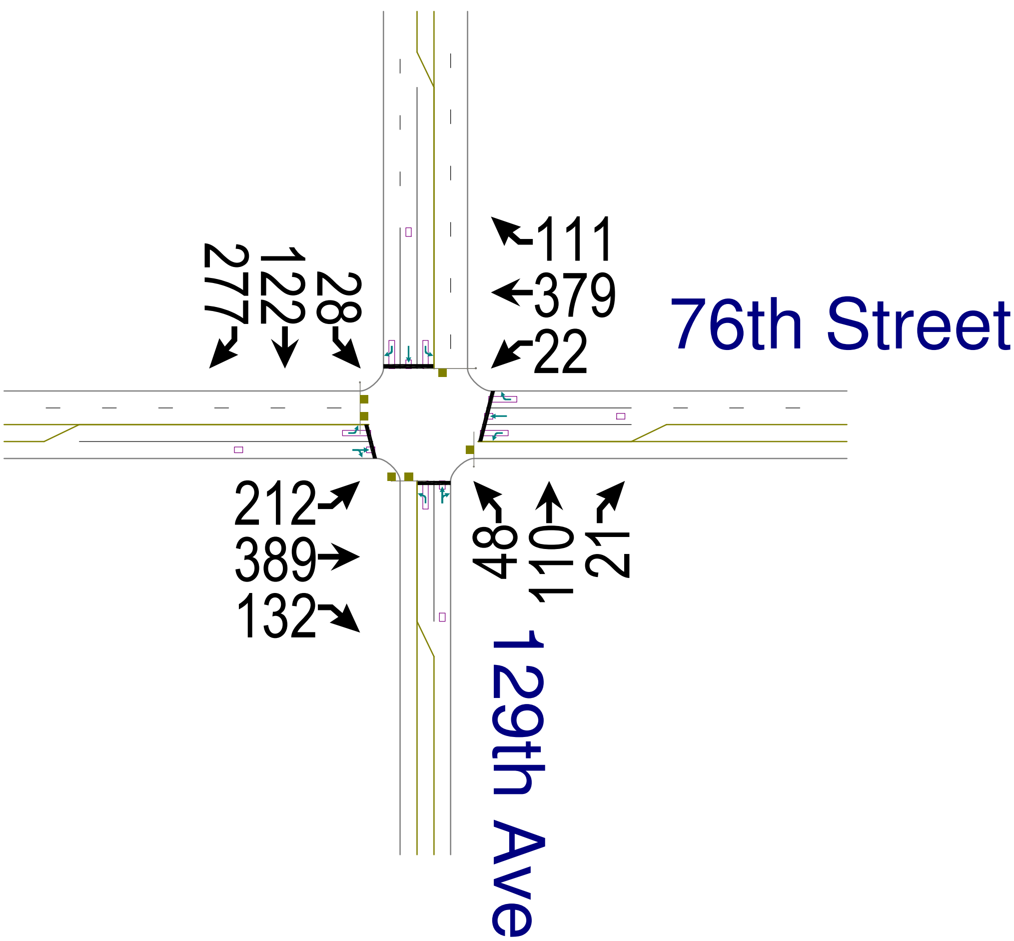
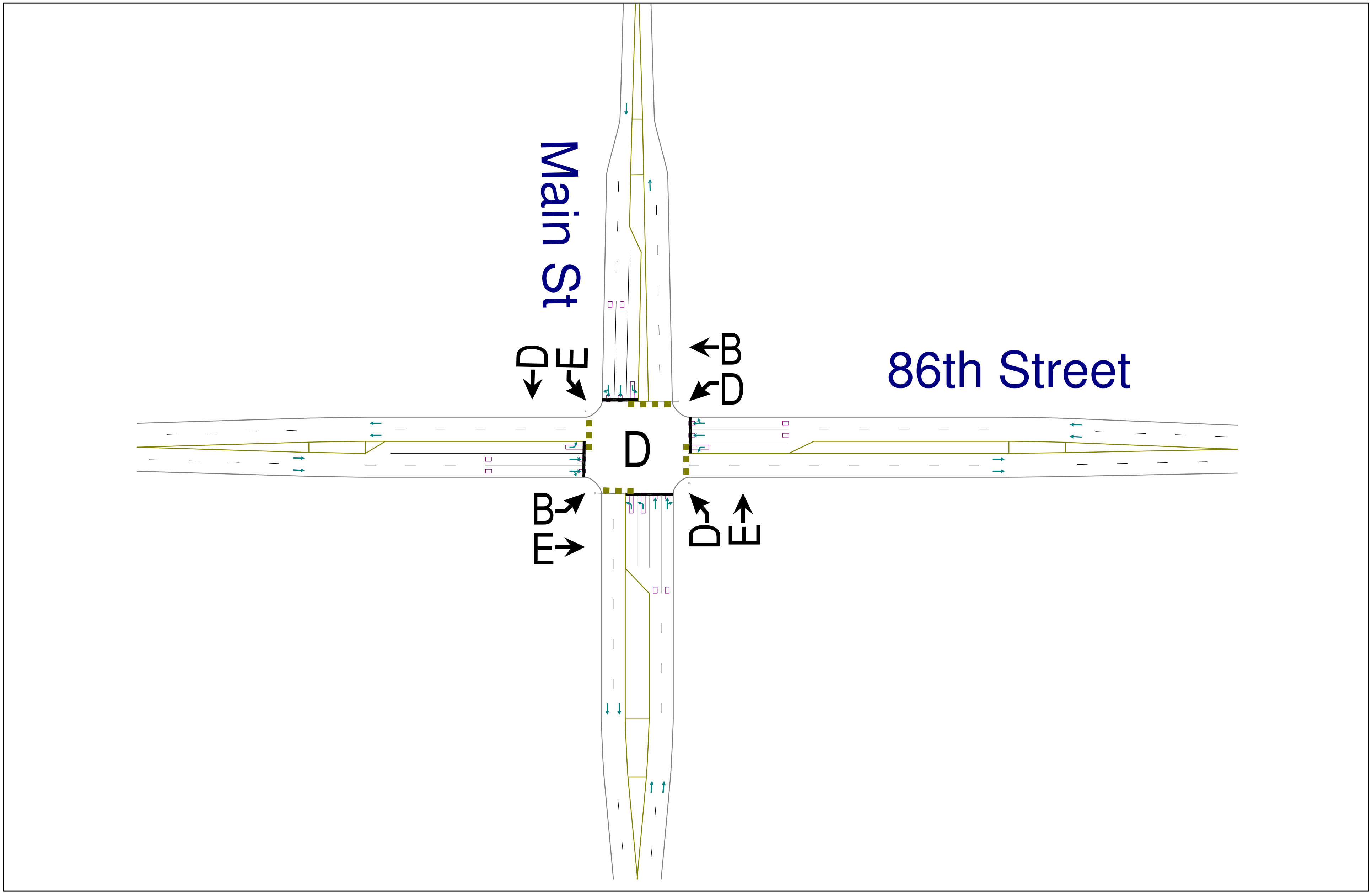
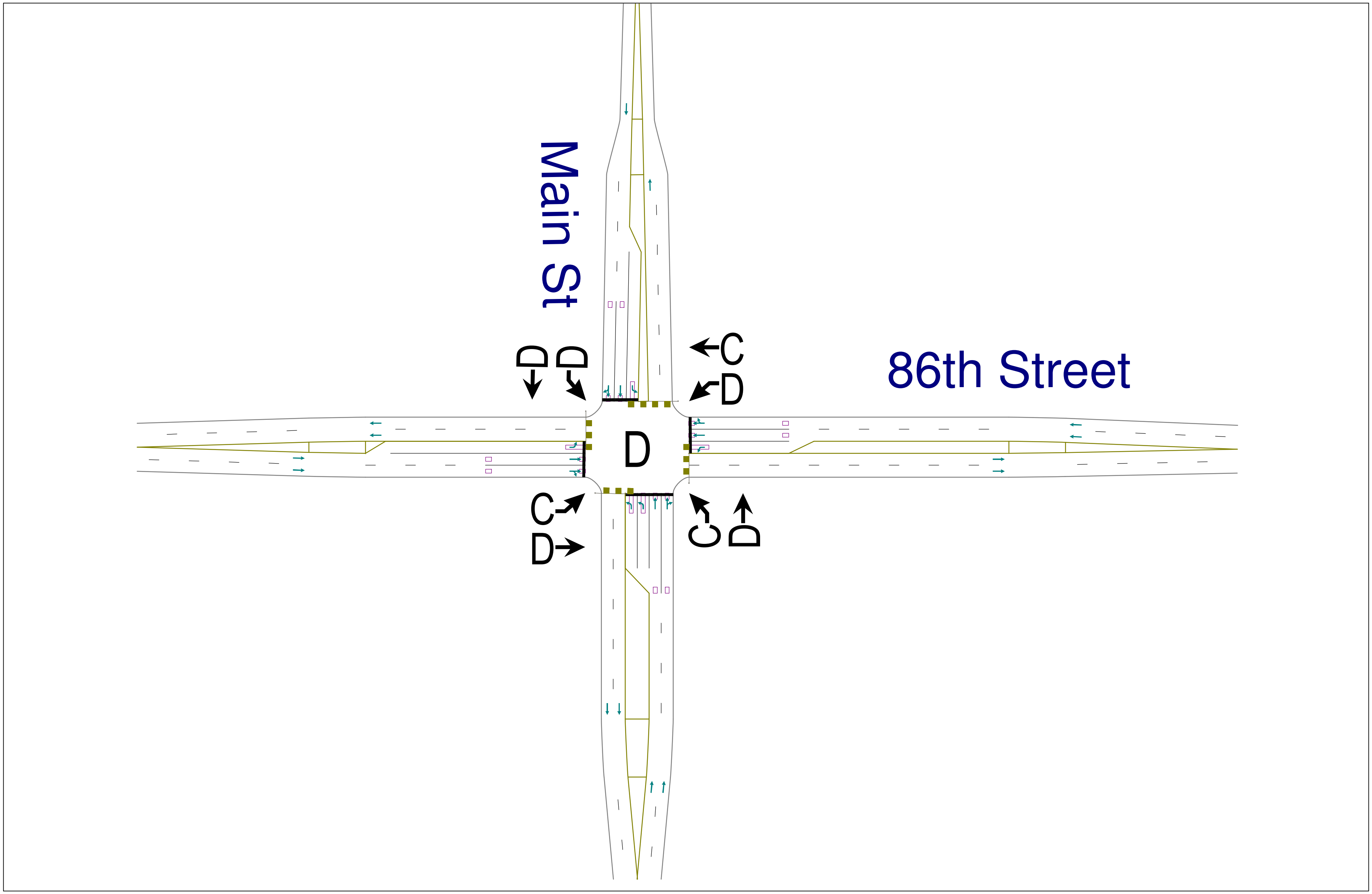

111
379
22
76th Street
277
122
28
212
389
132
48
110
21
129th Ave

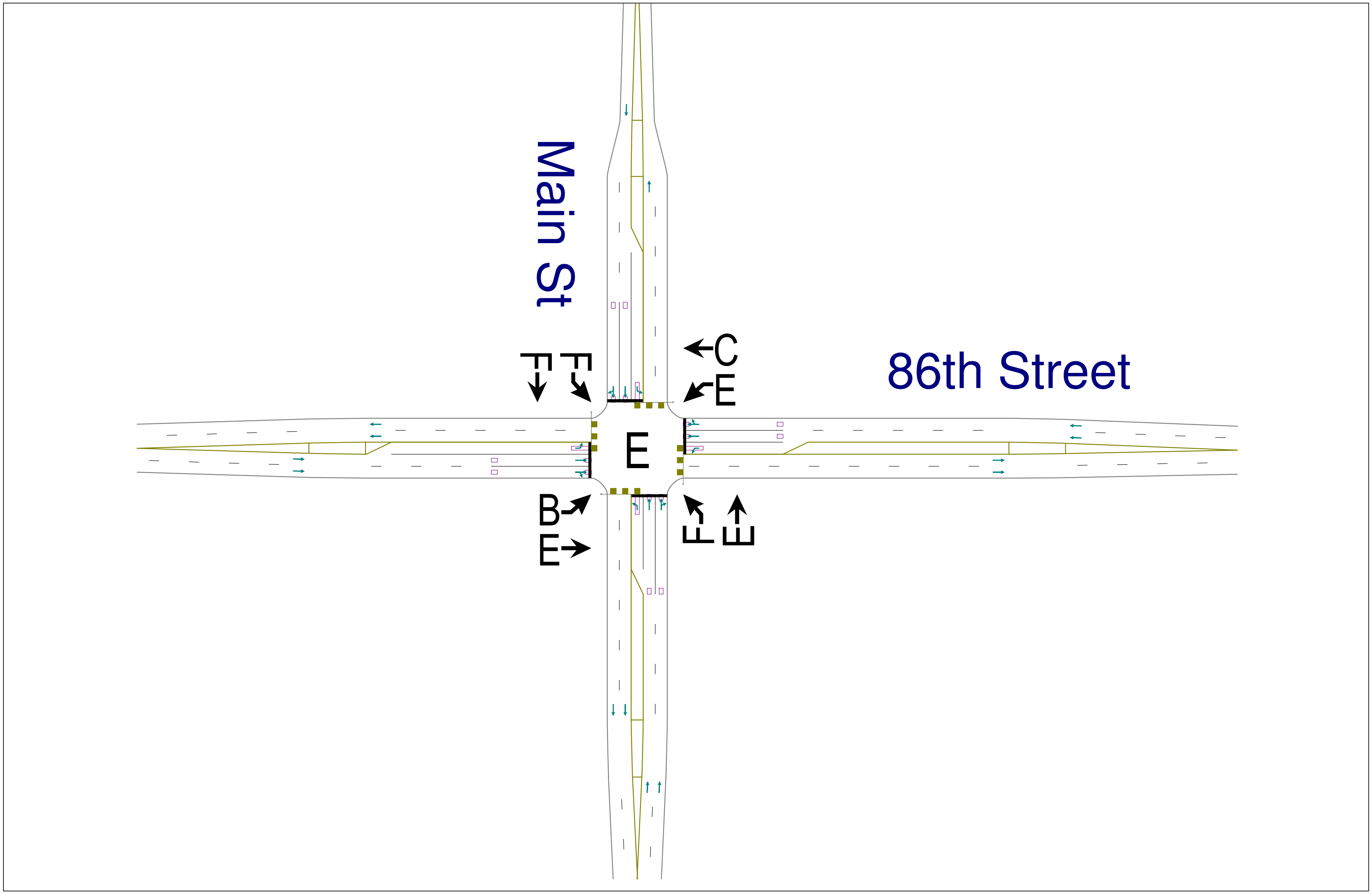
Figure A-2-1

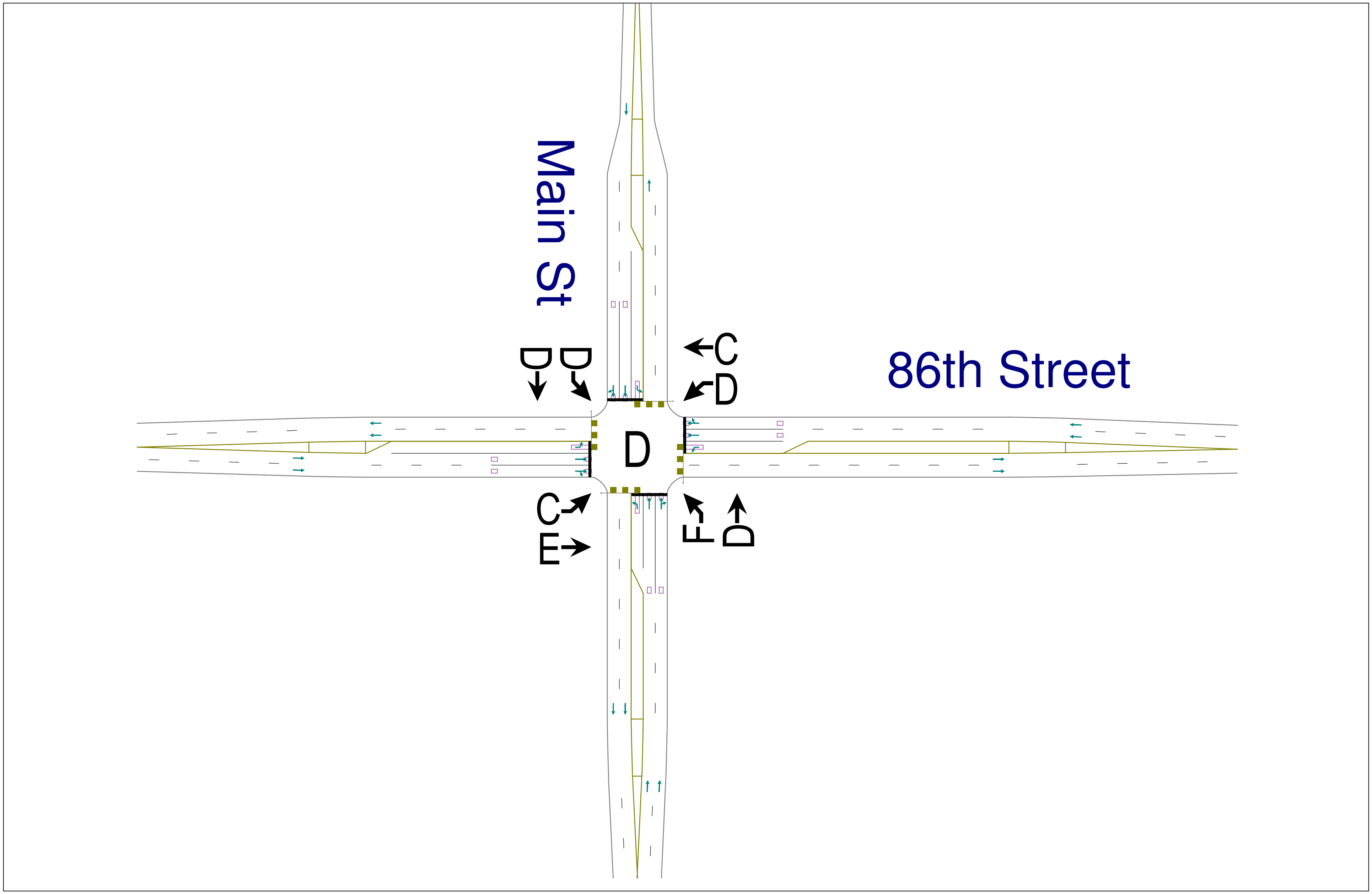
86th Street N & Main Street Intersection

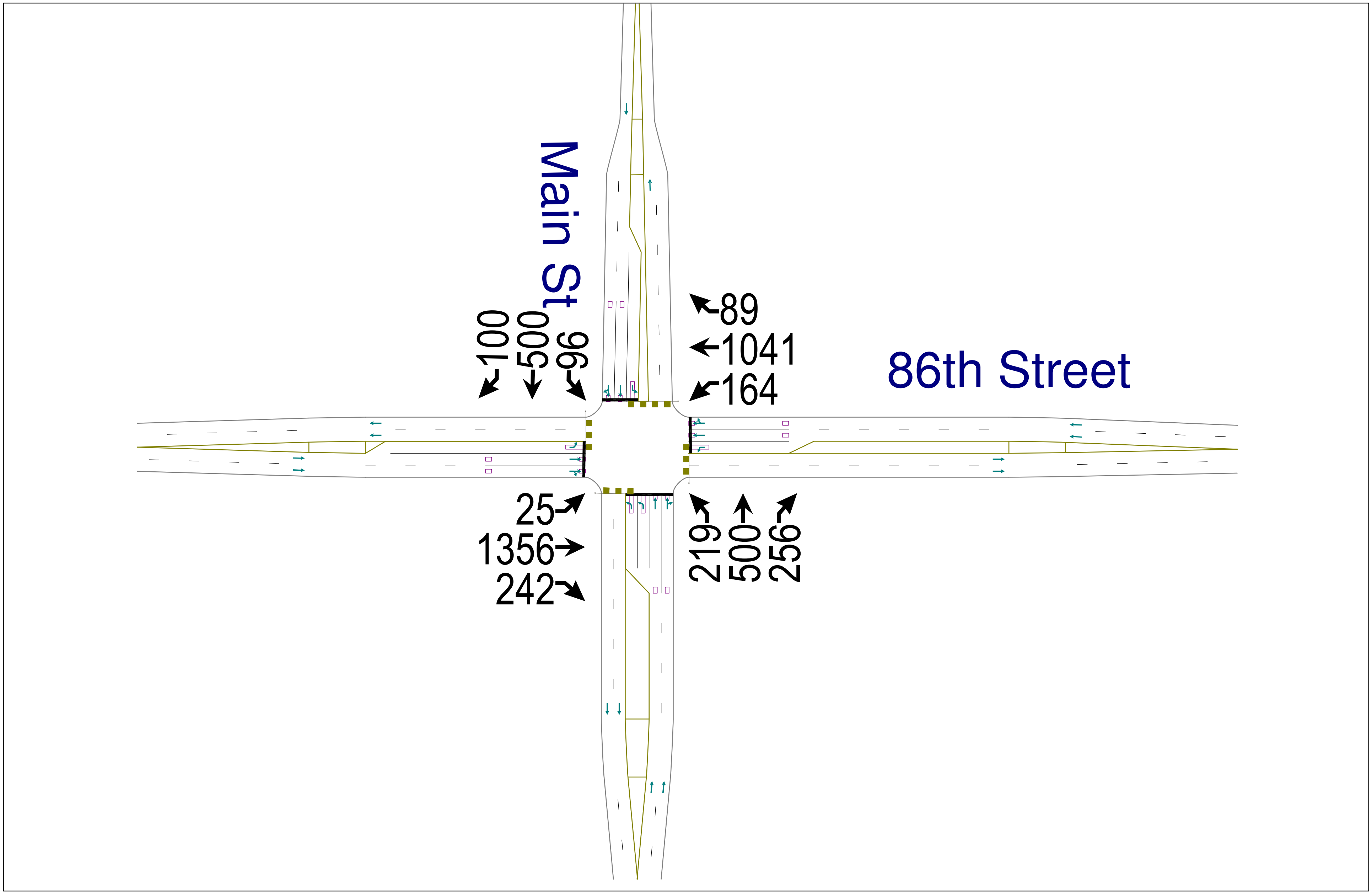
a. Future Improvements & 2035 Traffic Level of Service – AM Peak
b. Future Improvements & 2035 Traffic Level of Service – PM Peak
c. No-Build & 2035 Traffic Level of Service – AM Peak
d. No-Build & 2035 Traffic Level of Service – PM Peak
e. Future Improvements with 2035 Volumes – AM Peak
f. Future Improvements with 2035 Volumes – PM Peak
g. No-Build with 2035 Volumes – AM Peak
h. No-Build with 2035 Volumes – PM Peak

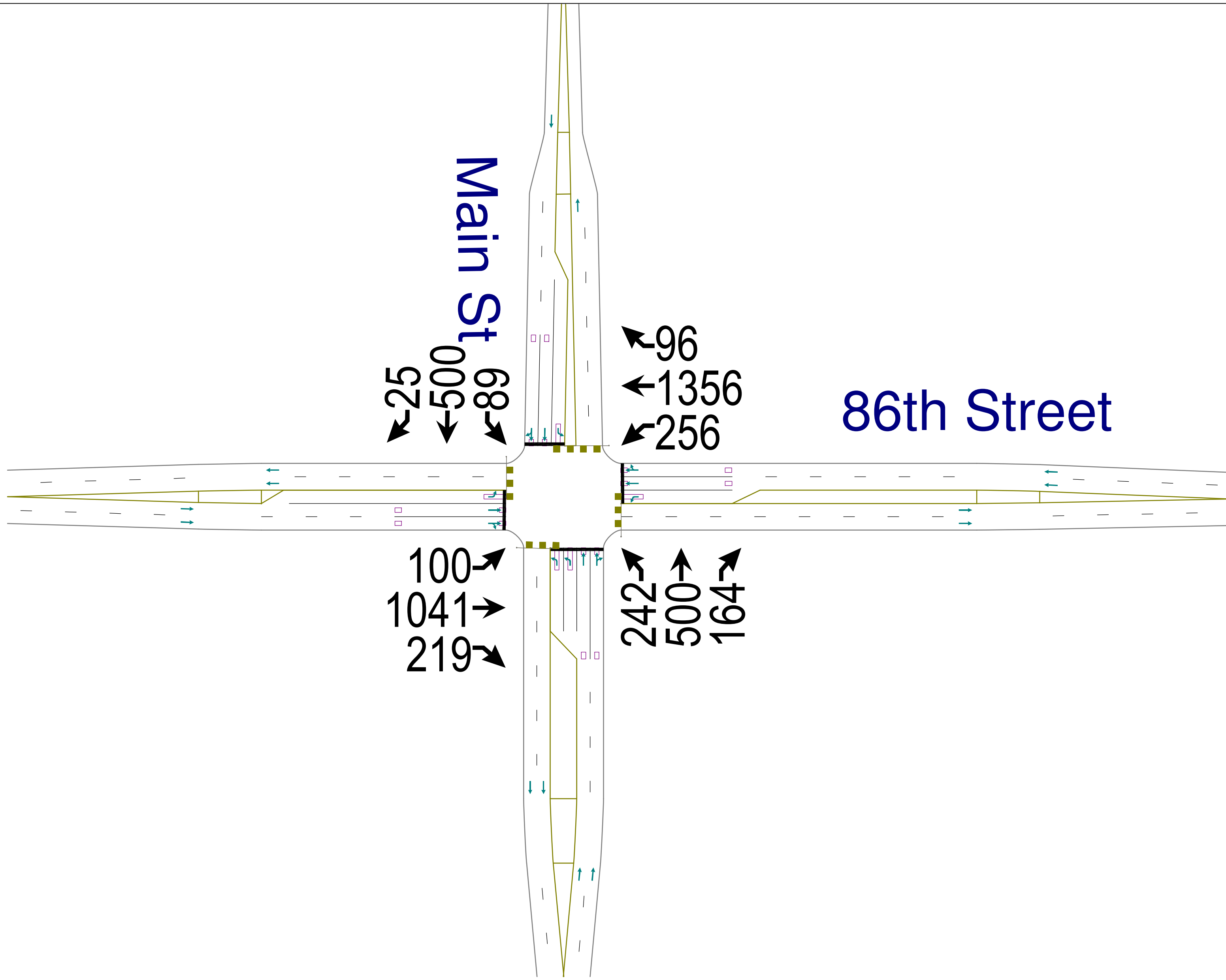

Main St
86th Street
D
B
D
E
D
B
E
D
E

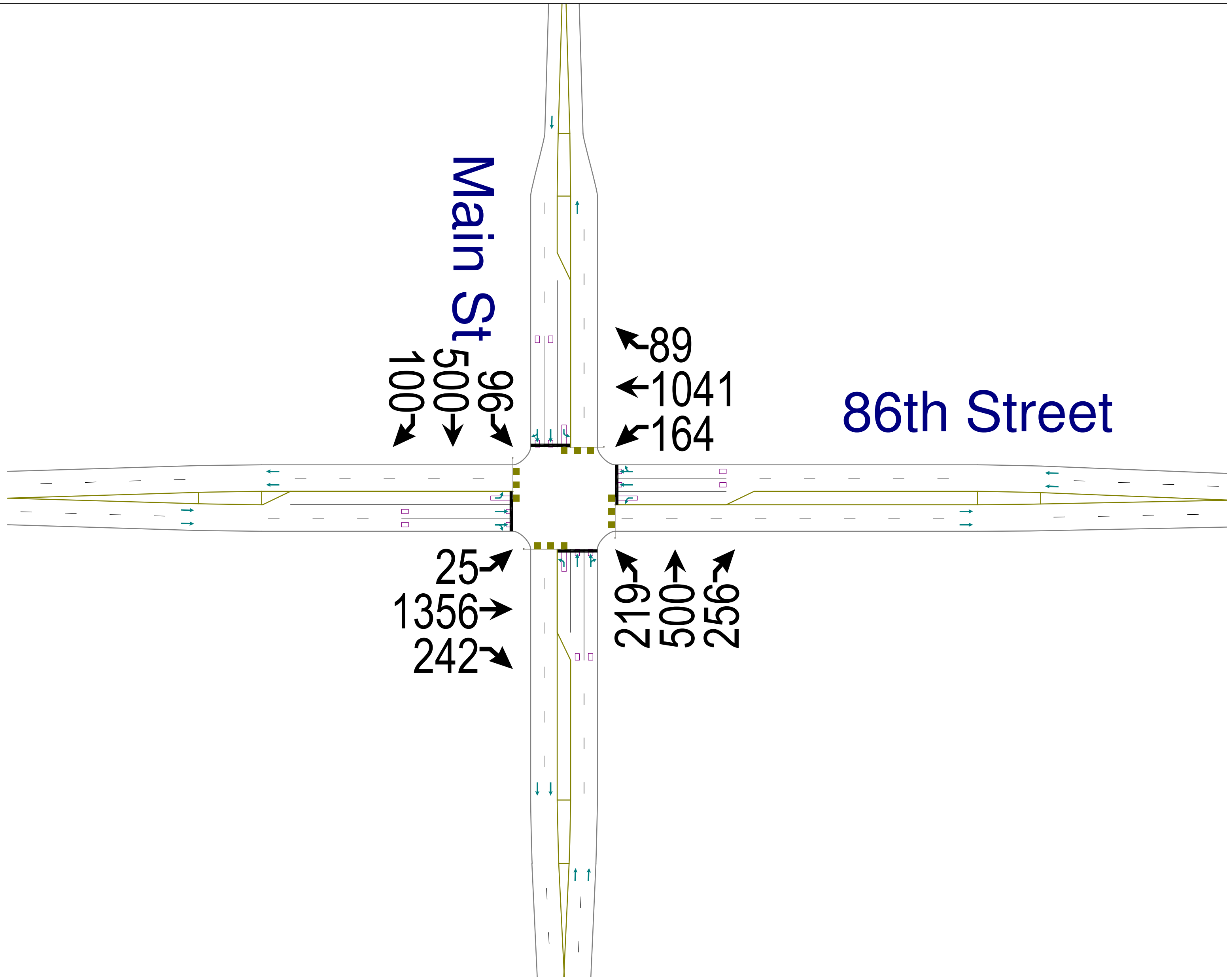

Main St
86th Street
D
C
D
C
D
C
D
C
D


Main St
86th Street
E
C
E
F
F
B
E
F
E


Main St
86th Street
D
C
D
D
D
C
E
F
D


Main St
86th Street
89
1041
164
100
500
96
25
1356
242
219
500
256


Main St
86th Street
25
500
89
96
1356
256
100
1041
219
242
500
164


Main St
86th Street
96
500
100
89
1041
164
25
1356
242
219
500
256

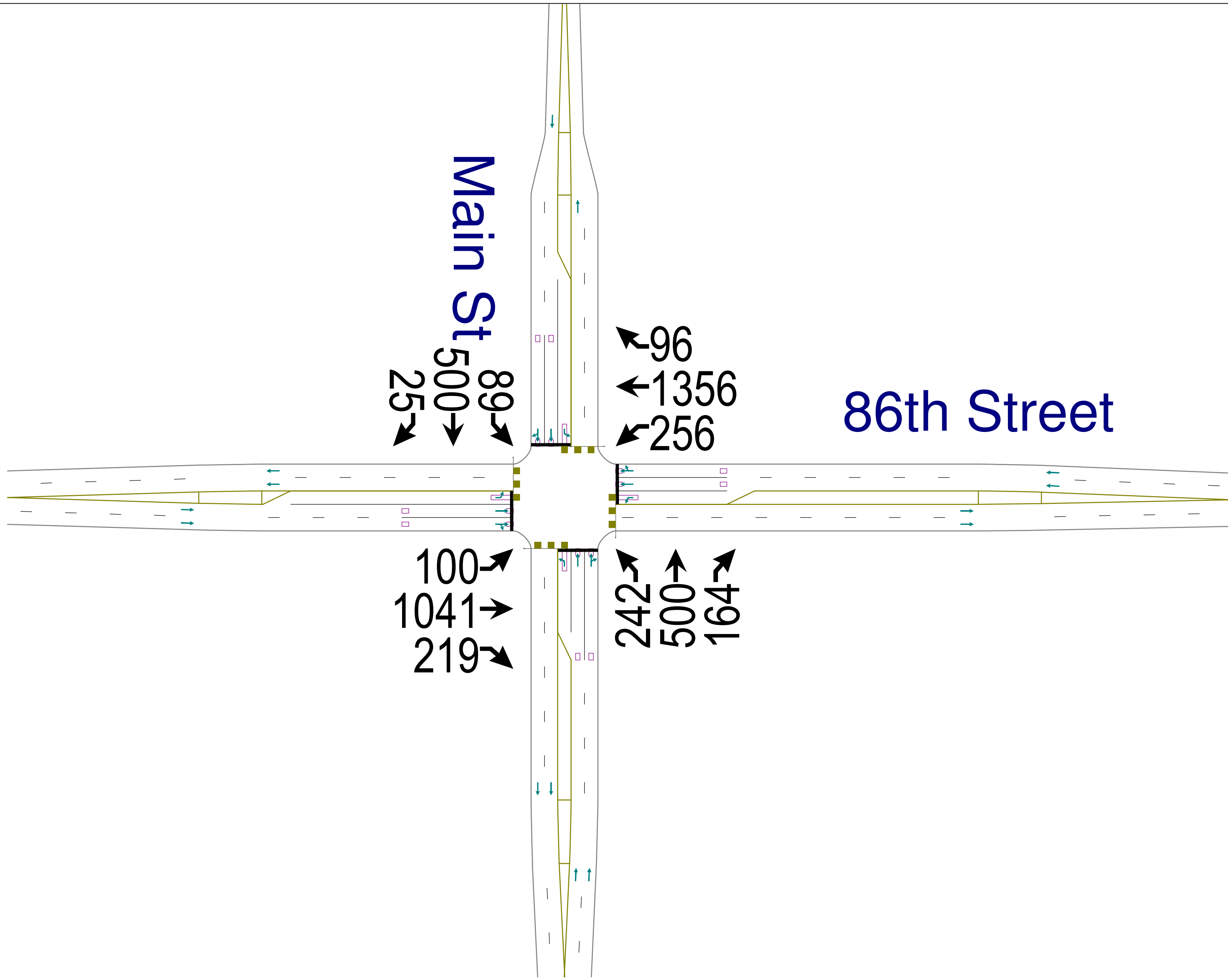
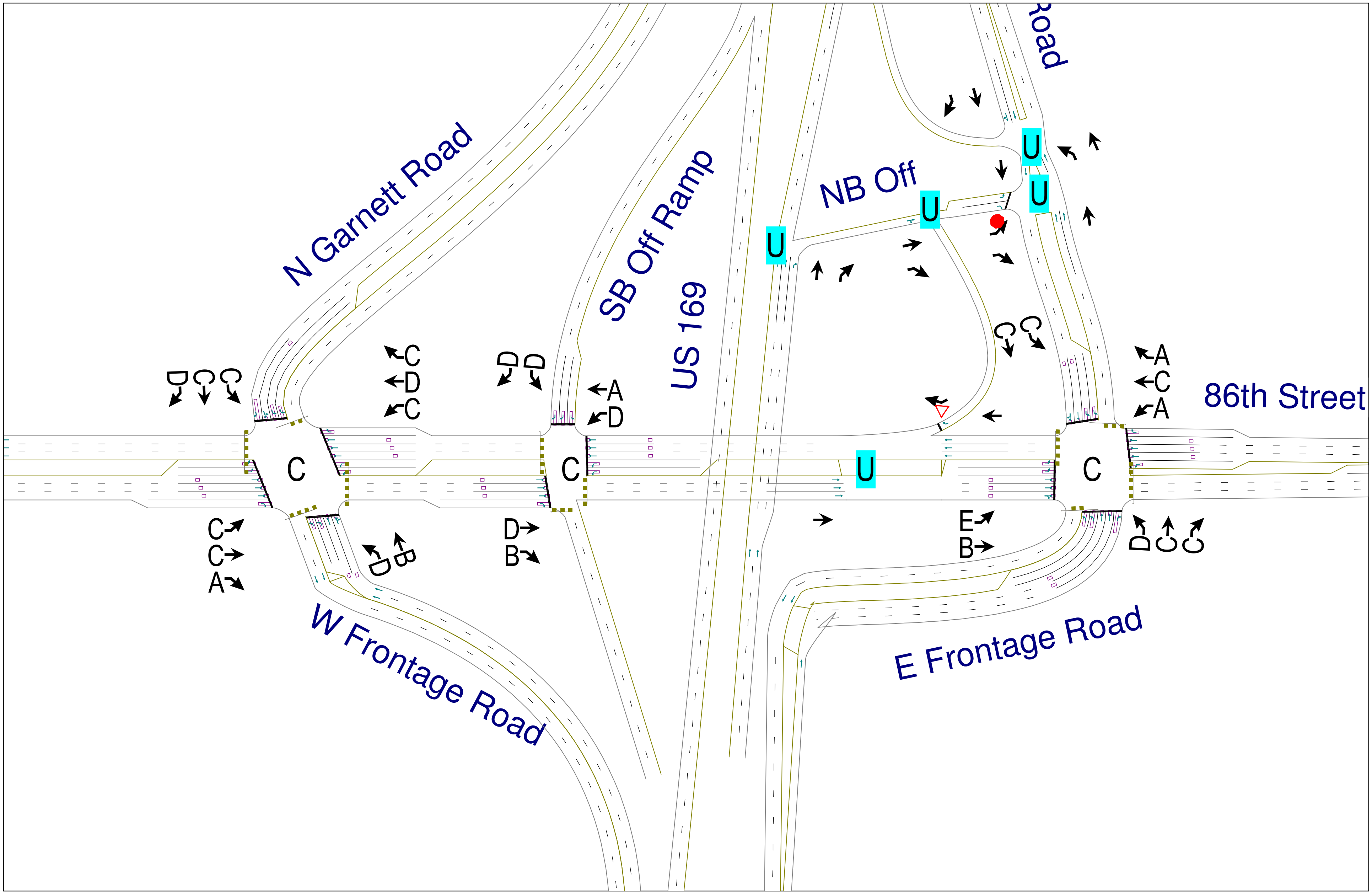

Main St
86th Street
89
500
25
96
1356
256
100
1041
219
242
500
164

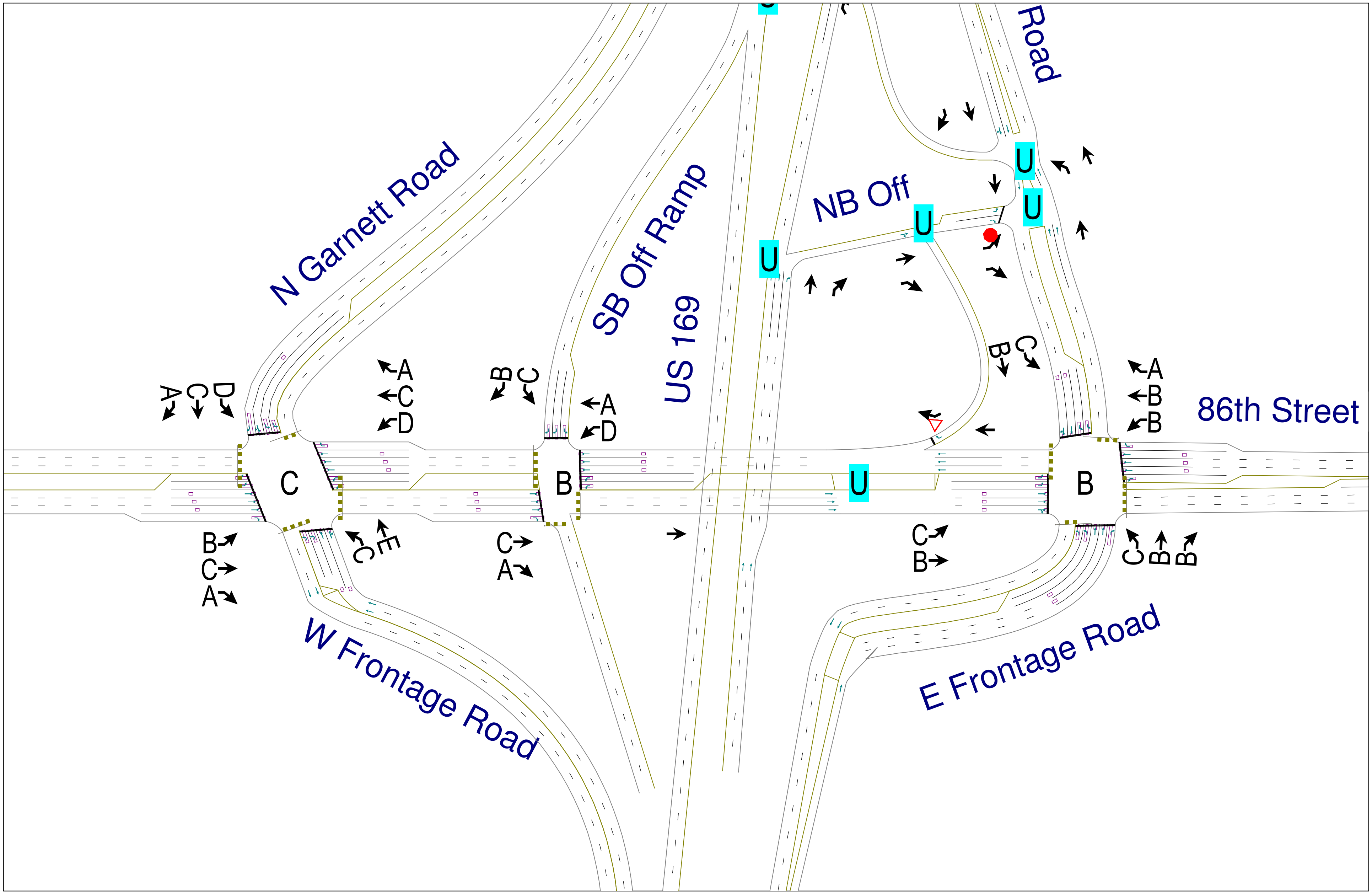
Figure A-2-2

86th Street N & US 169 Interchange

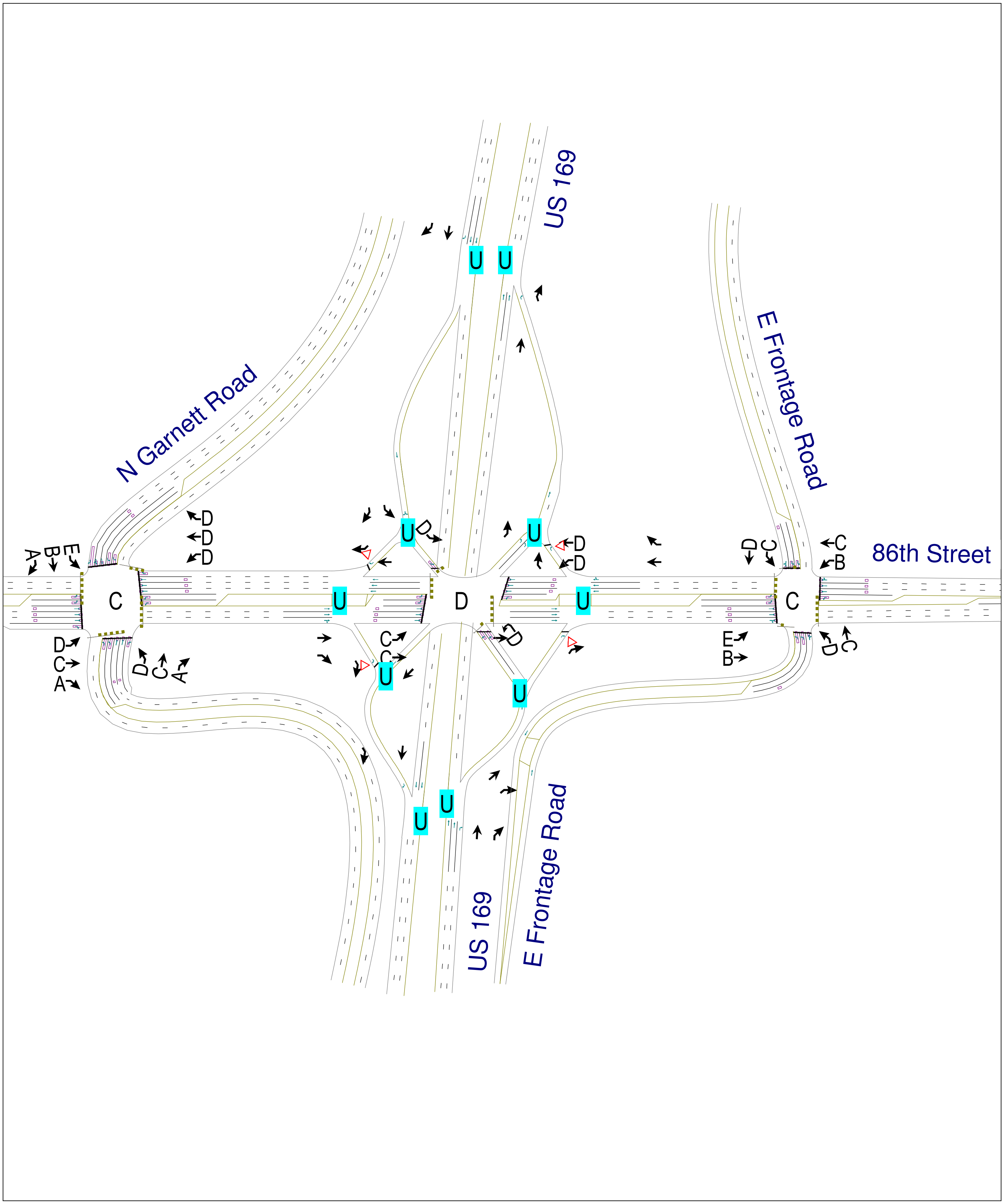
a. Future Diamond Option & 2035 Traffic Level of Service – AM Peak
b. Future Diamond Option & 2035 Traffic Level of Service – PM Peak
c. Future Single Point Option & 2035 Traffic Level of Service – AM Peak
d. Future Single Point Option & 2035 Traffic Level of Service – PM Peak
e. No-Build & 2035 Traffic Level of Service – AM Peak
f. No-Build & 2035 Traffic Level of Service – PM Peak
g. Future Diamond Option with 2035 Volumes – AM Peak
h. Future Diamond Option with 2035 Volumes – PM Peak
i. Future Single Point Option with 2035 Volumes – AM Peak
j. Future Single Point Option with 2035 Volumes – PM Peak
k. No-Build with 2035 Volumes – AM Peak
l. No-Build with 2035 Volumes – PM Peak

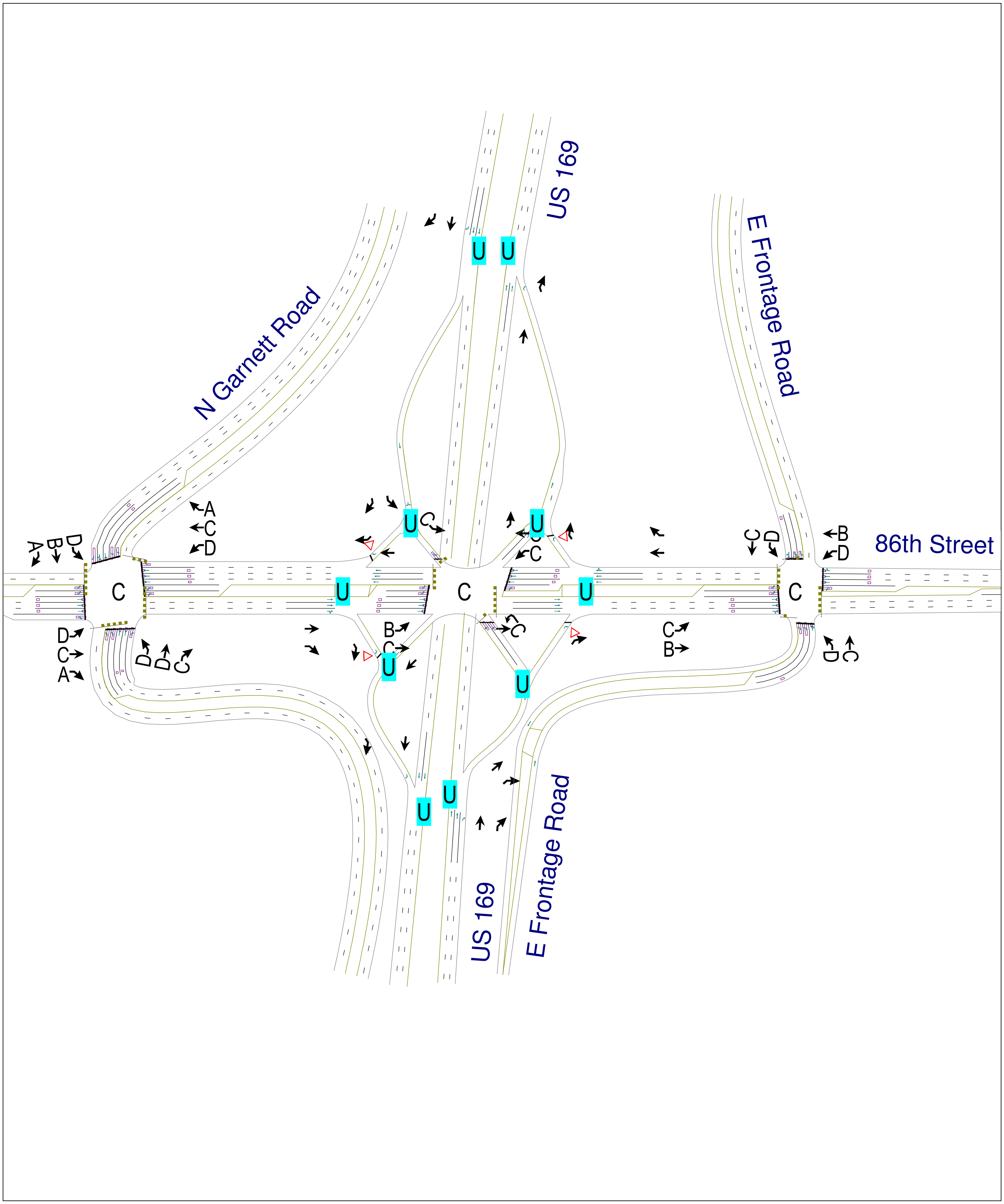


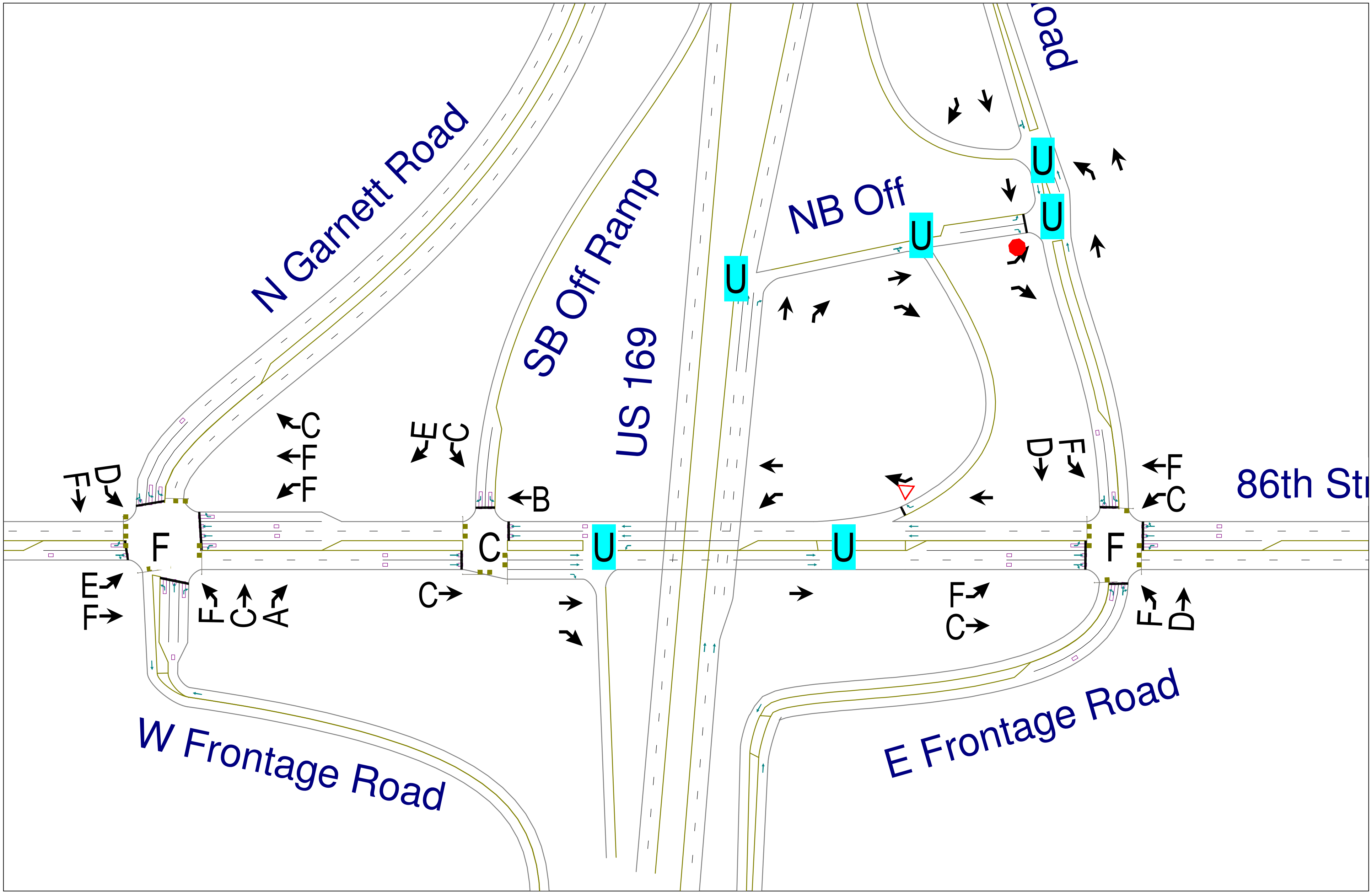
86th Street & US 169 Future Lanes with 2035 Volumes - AM Peak
Timing Plan: AM Peak

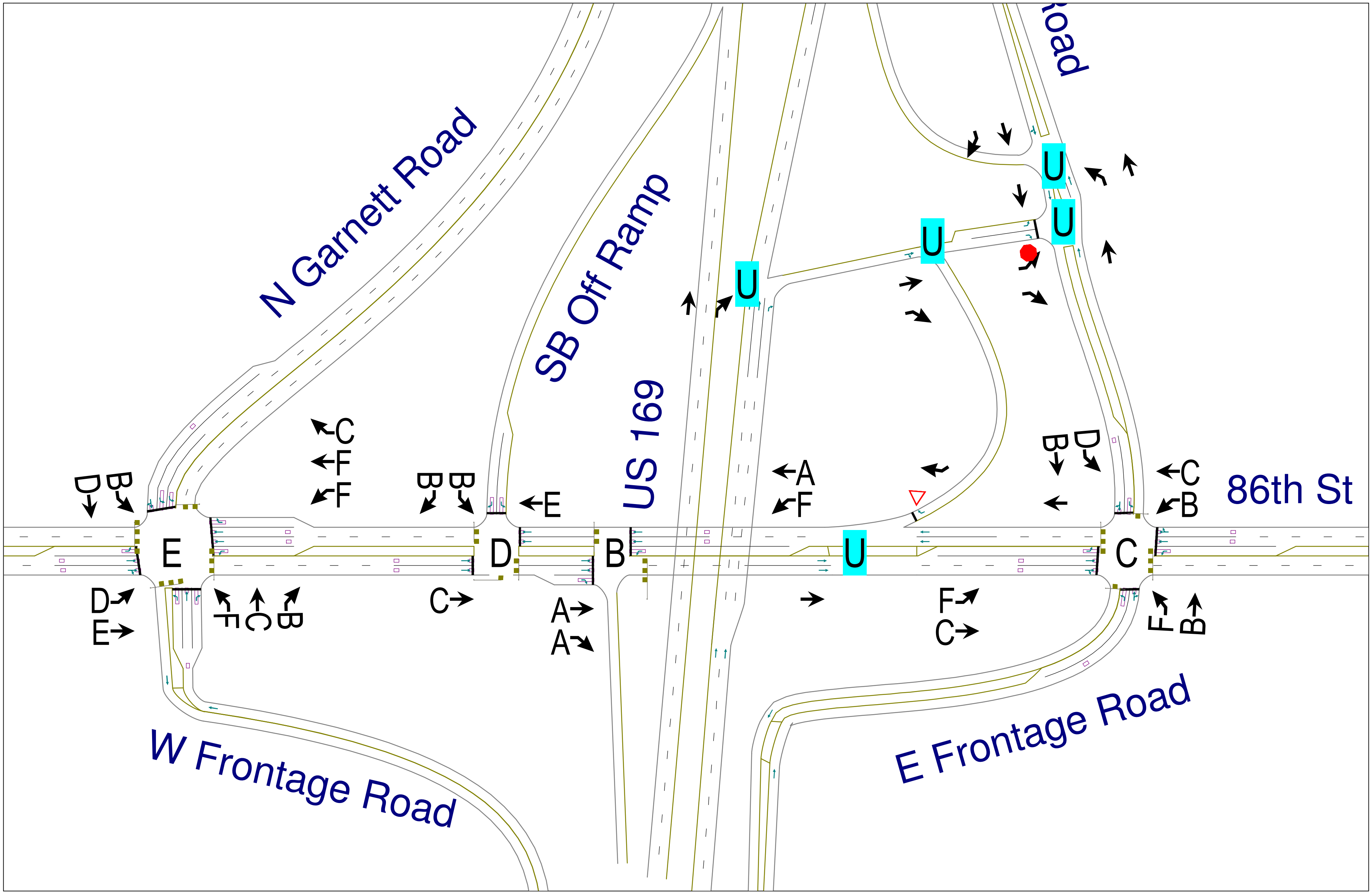


86th Street & US 169 Future Lanes with 2035 Volumes - PM Peak
Timing Plan: PM Peak


US 169
N Garnett Road
E Frontage Road
86th Street
E Frontage Road
US 169
C
D
C
U

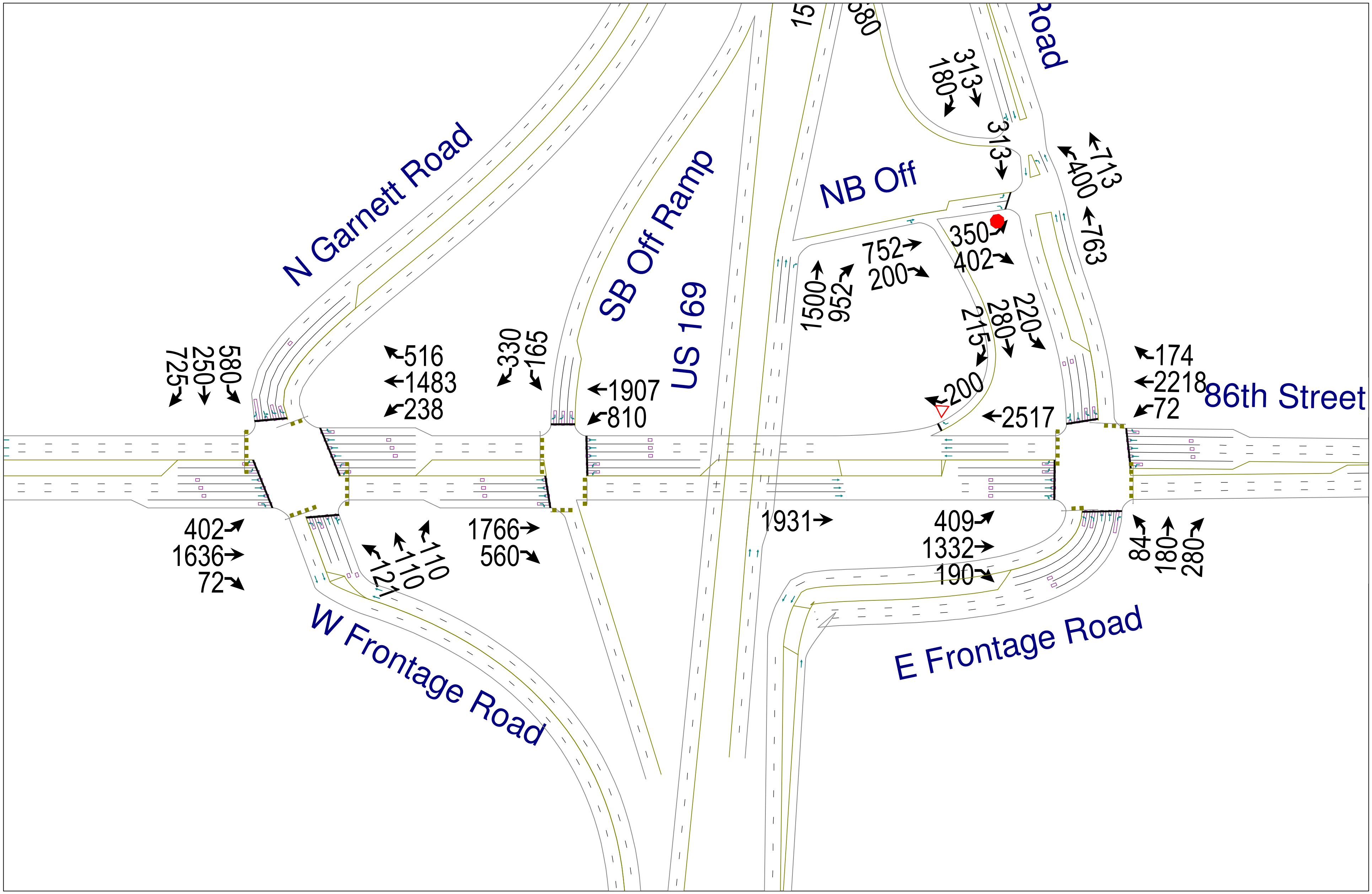

US 169
N Garnett Road
E Frontage Road
86th Street
C
C
C
US 169
E Frontage Road


N Garnett Road
SB Off Ramp
US 169
NB Off
oad
86th Str
W Frontage Road
E Frontage Road
F
C
F
U
U
U
U
U
U
B
C
E
D
A

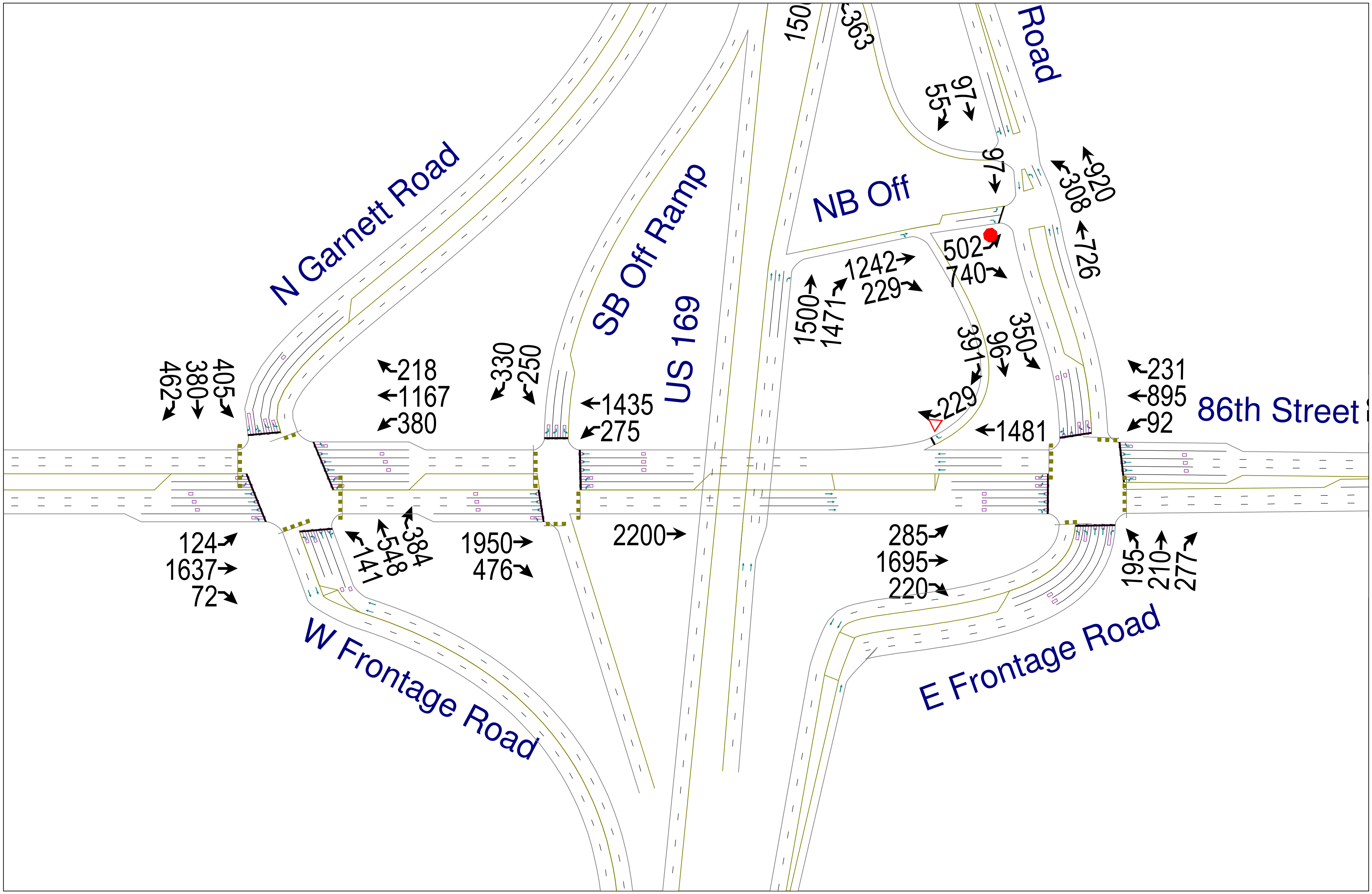

N Garnett Road
SB Off Ramp
US 169
86th St
W Frontage Road
E Frontage Road
Road
E
D
B
C
U

Map - 86th Street & US 169
Volumes

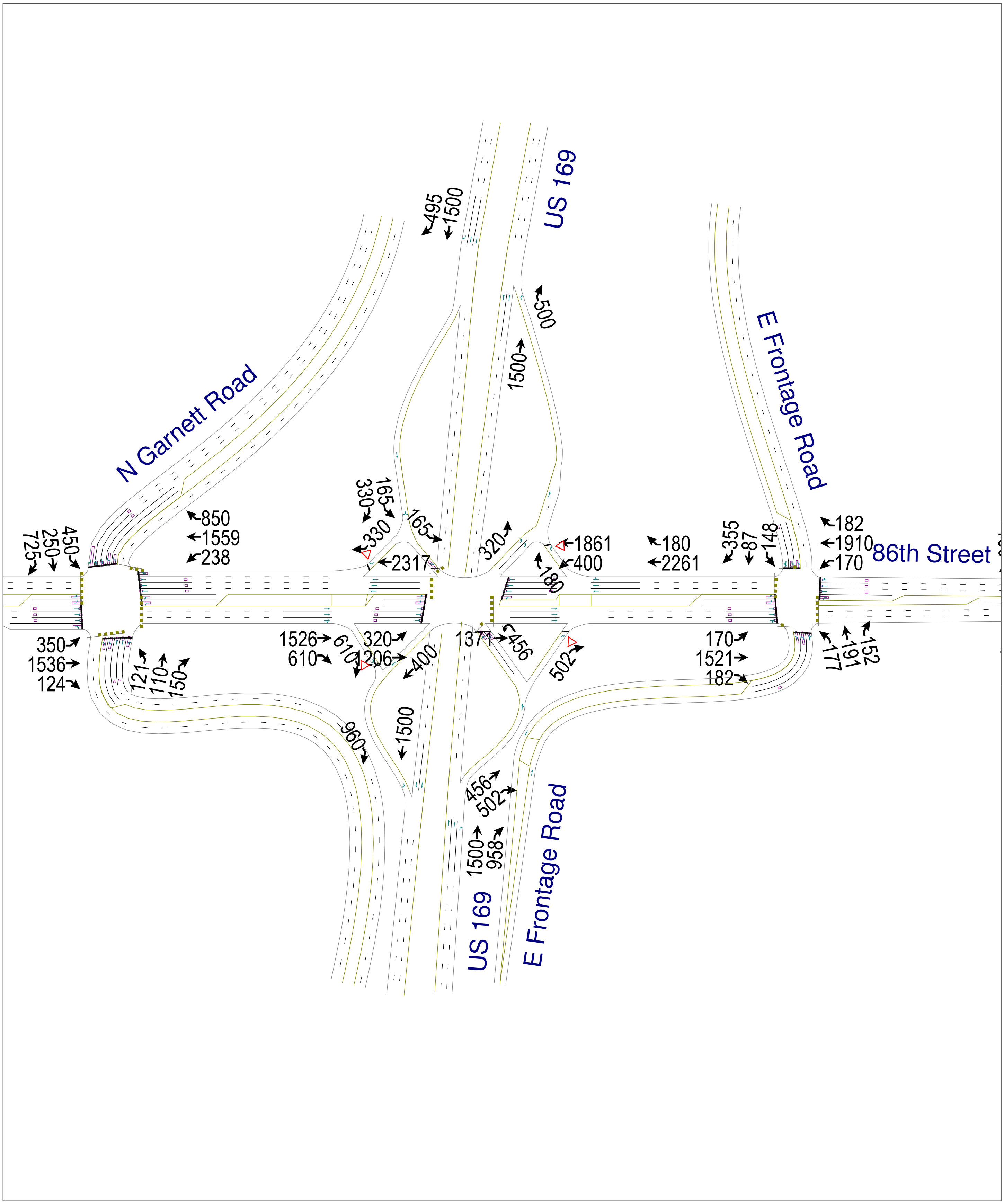
4/25/2015



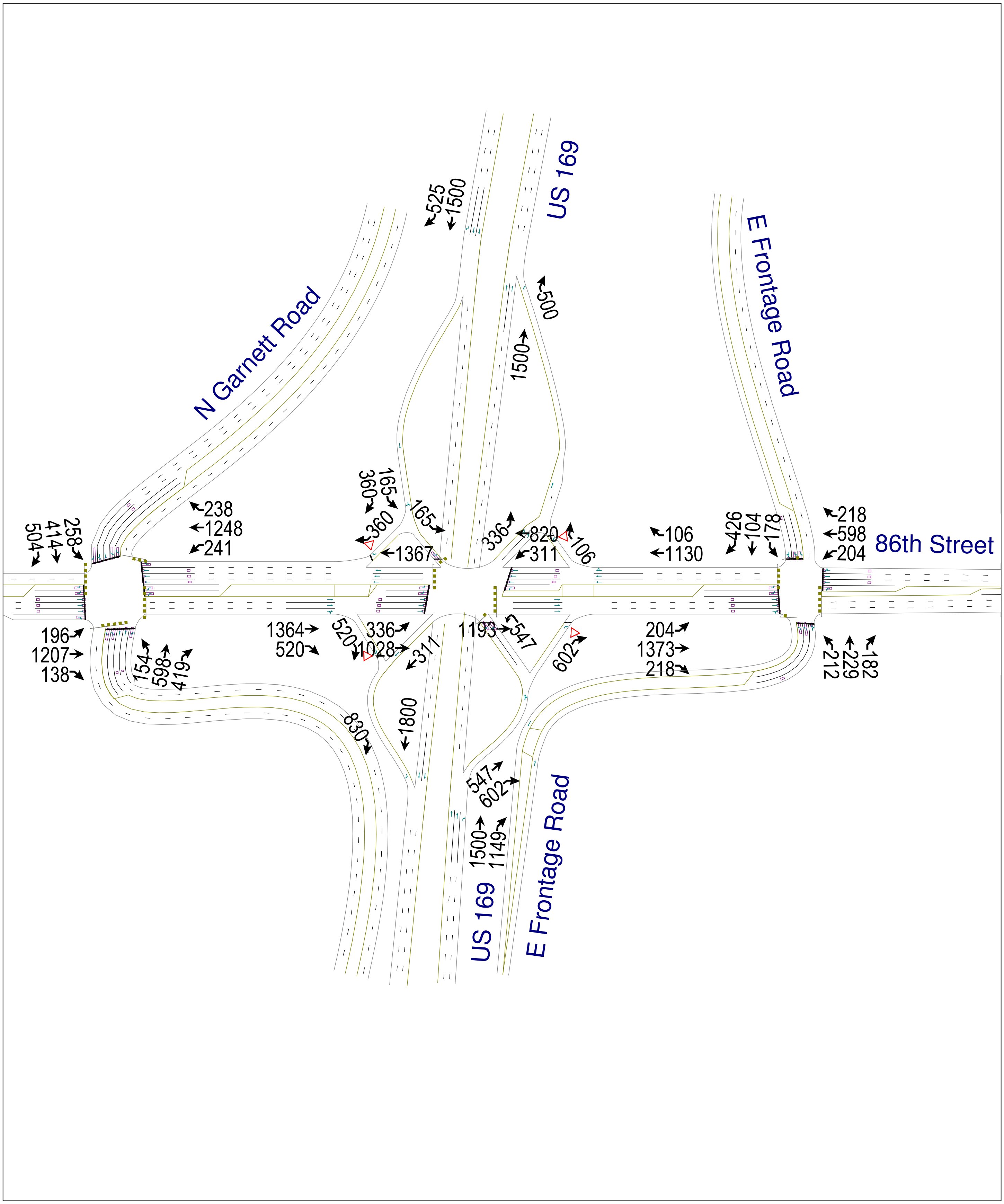
86th Street & US 169 Future Lanes with 2035 Volumes - AM Peak
Timing Plan: AM Peak

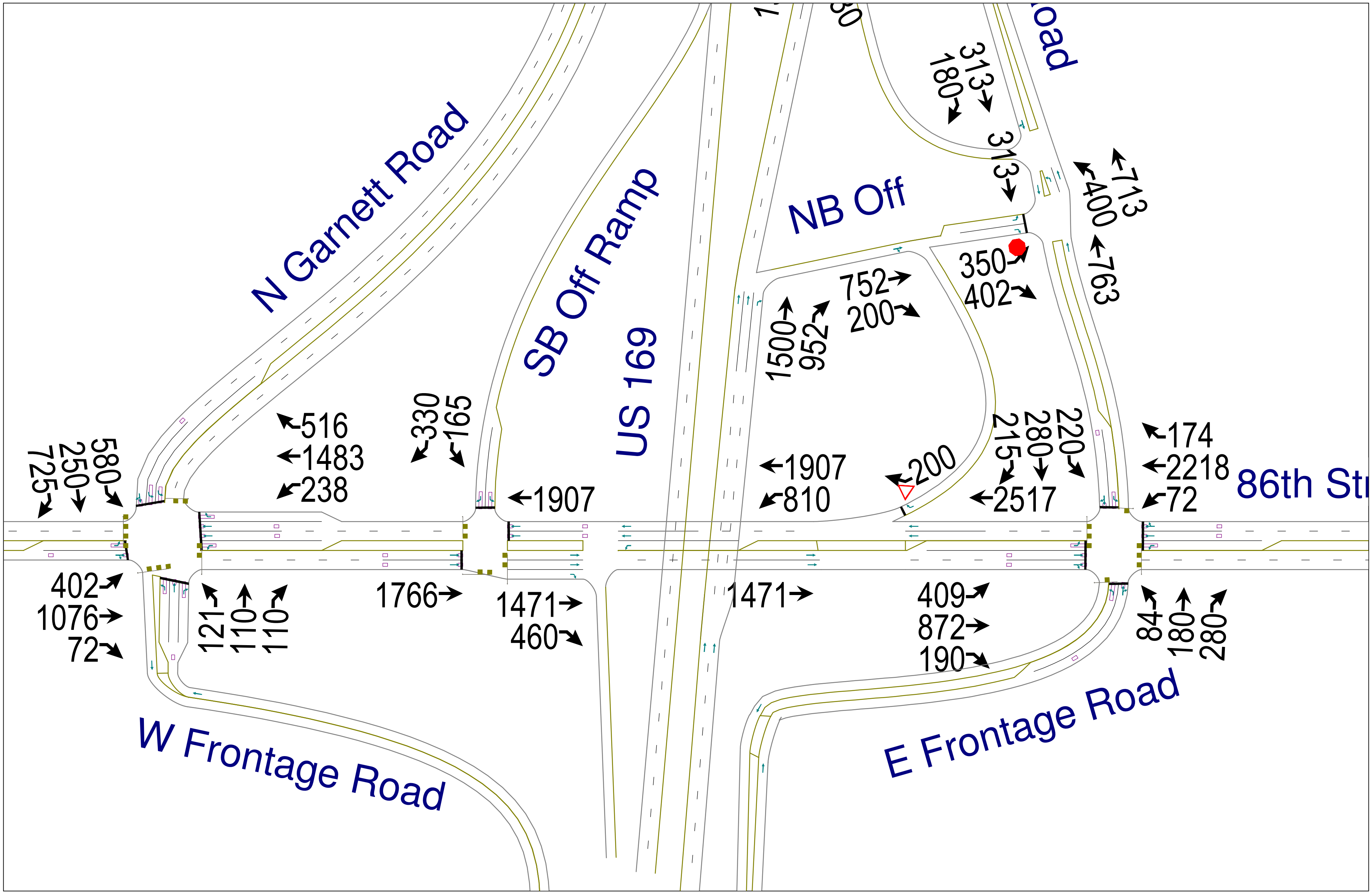


86th Street & US 169 Future Lanes with 2035 Volumes - PM Peak
Timing Plan: PM Peak


US 169
N Garnett Road
E Frontage Road
86th Street
US 169
E Frontage Road
495
1500
500
1500
330
165
330
165
850
1559
238
2317
320
1861
400
180
180
2261
355
87
148
182
1910
170
450
250
725
350
1536
124
121
110
150
1526
610
610
320
1206
400
1371
456
502
170
1521
182
177
191
152
960
1500
456
502
1500
958

Map - 86th Street Single Point Interchange
Volumes
4/25/2015





86th Street & US 169 Existing Lanes 2014 with 2035 Volumes - AM Peak
Timing Plan: AM Peak

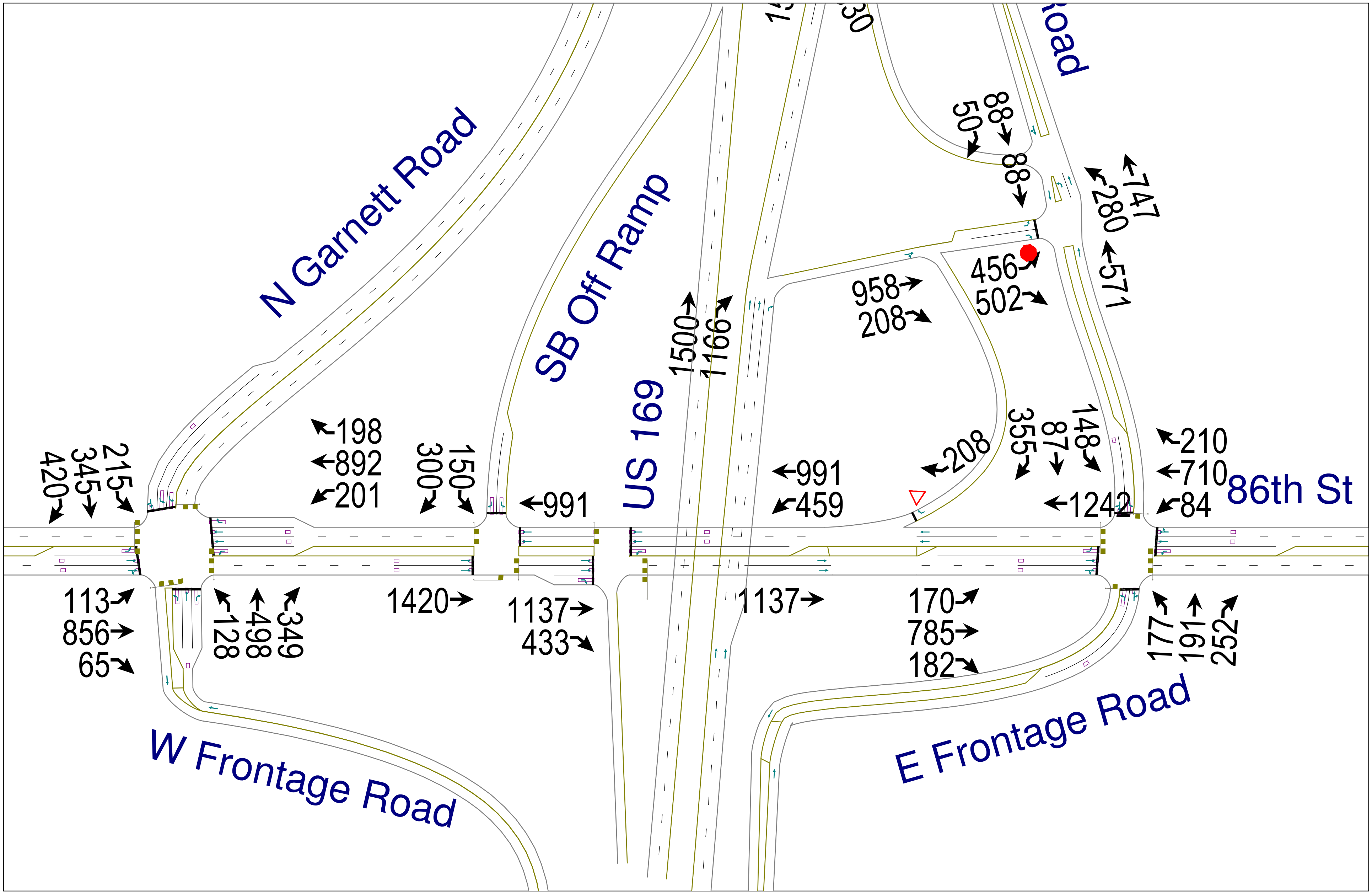
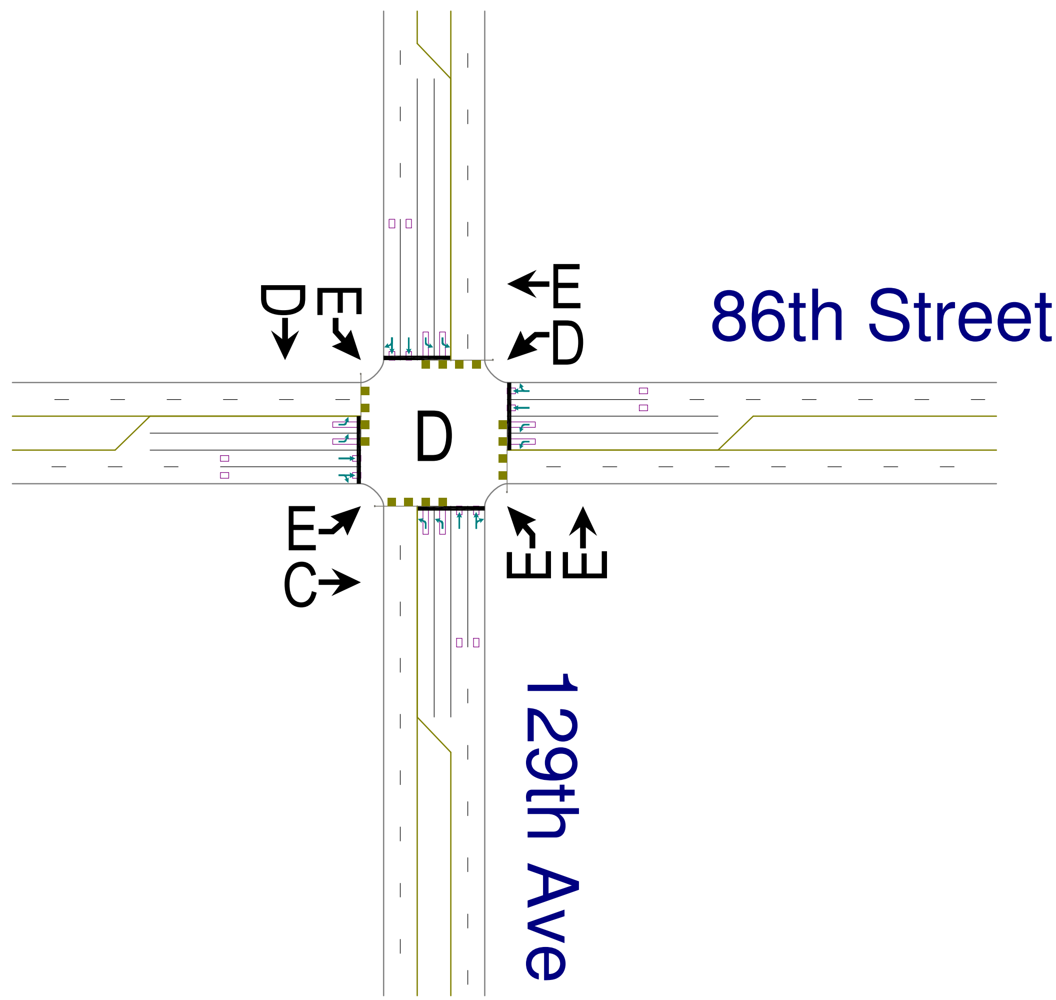
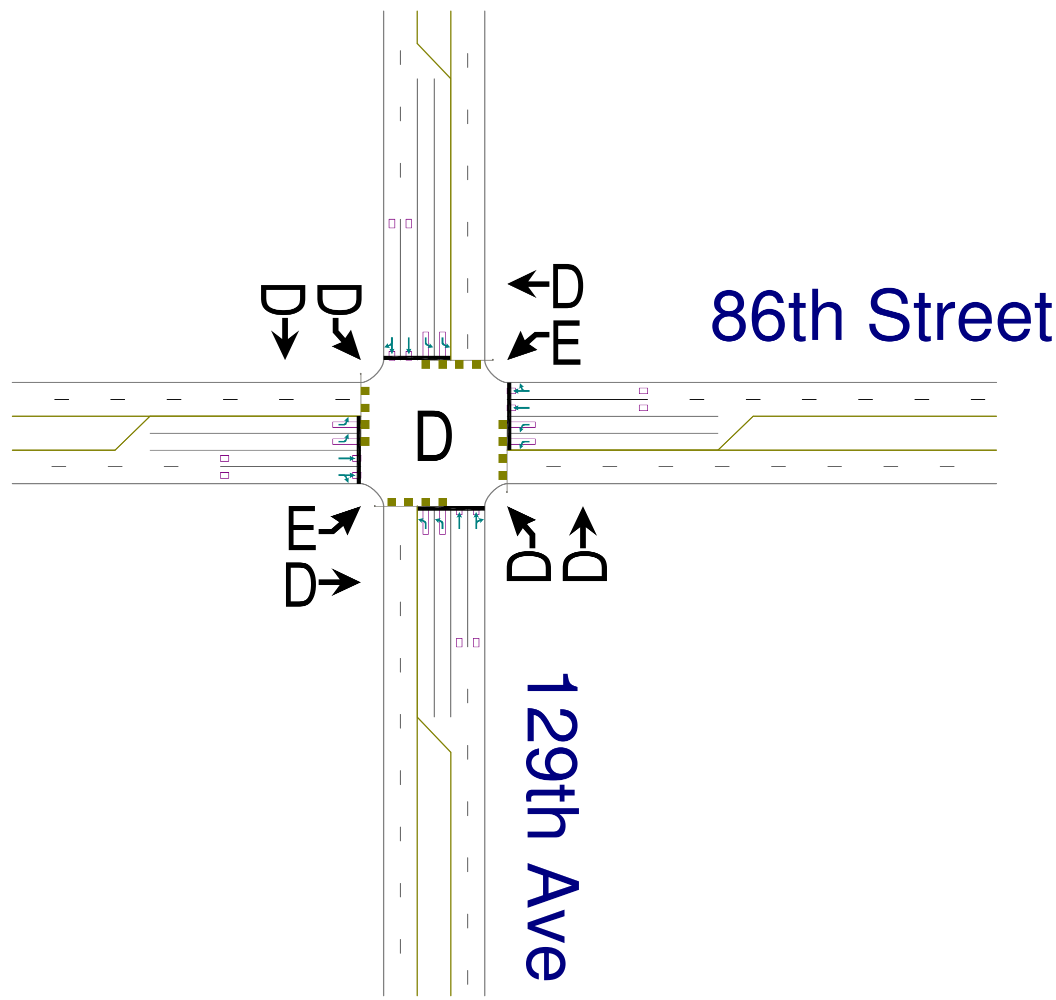

N Garnett Road
SB Off Ramp
US 169
86th St
W Frontage Road
E Frontage Road
Road
215
345
420
198
892
201
113
856
65
128
498
349
300
150
1420
991
1137
433
1500
1166
991
459
1137
958
208
456
502
88
50
88
747
280
571
208
355
87
148
1242
170
785
182
210
710
84
177
191
252

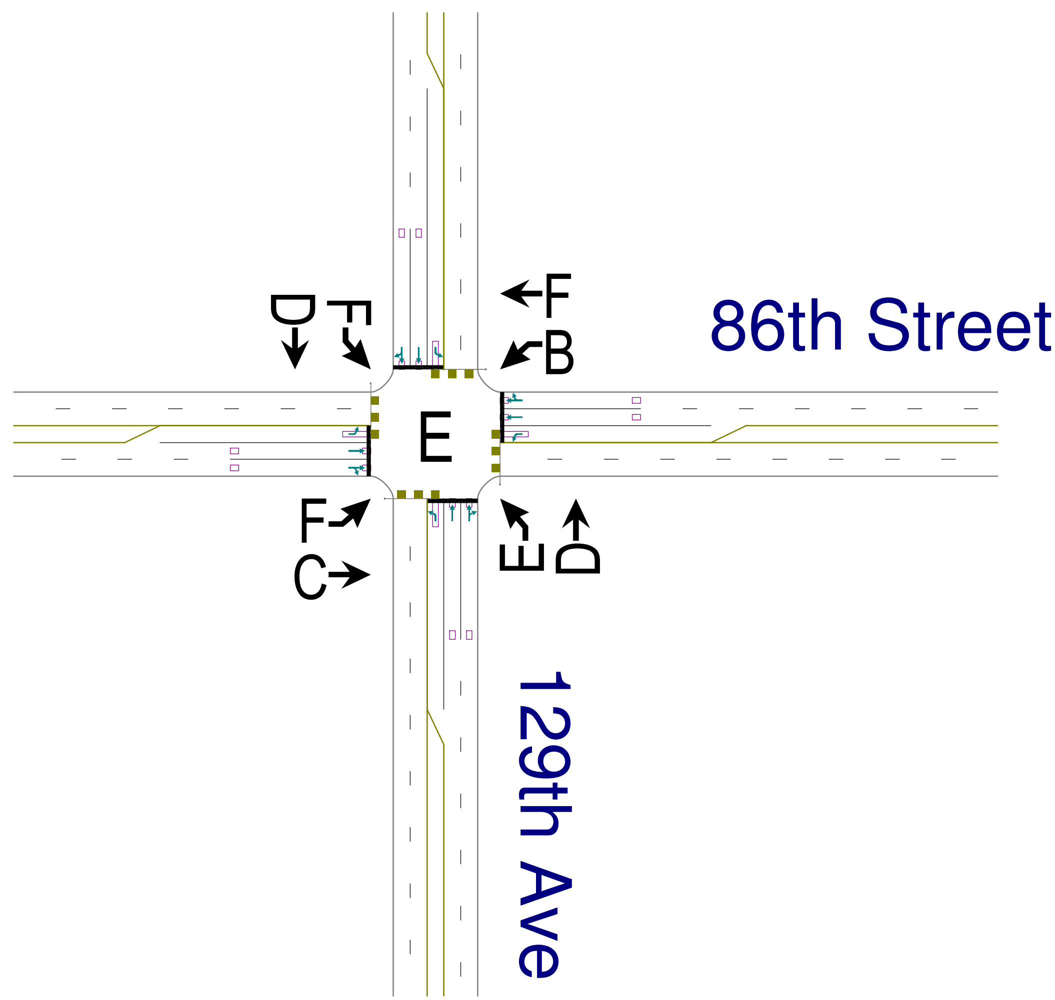
Figure A-2-3

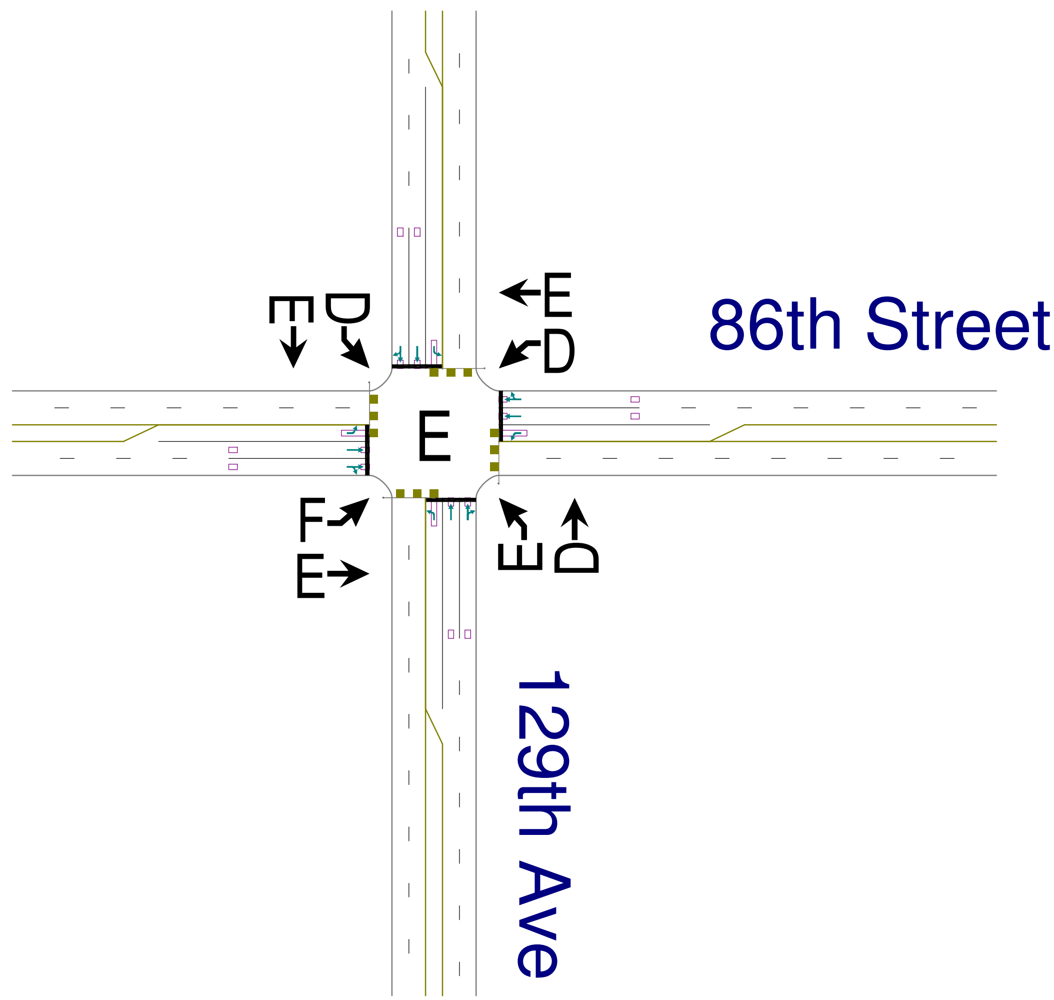
86th Street N & 129th E Avenue Intersection

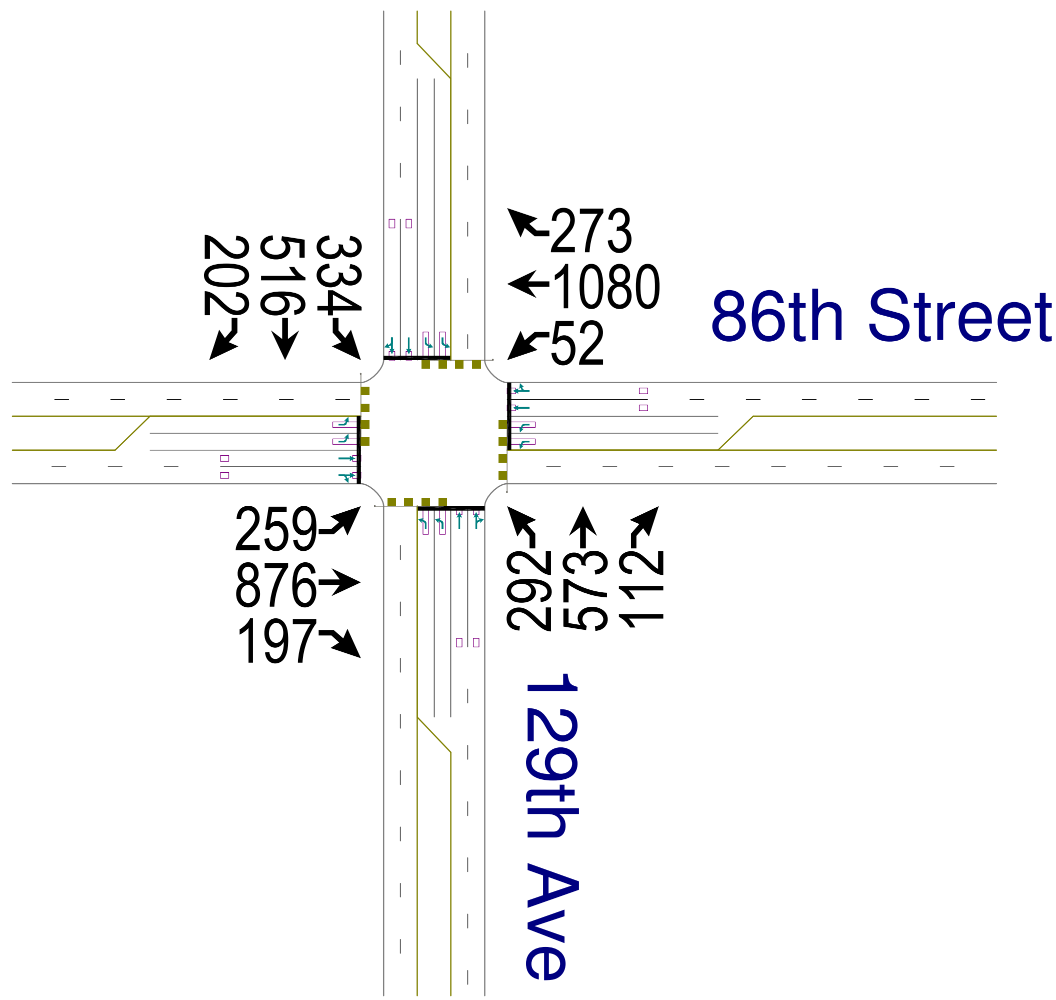
a. Future Improvements & 2035 Traffic Level of Service – AM Peak
b. Future Improvements & 2035 Traffic Level of Service – PM Peak
c. No-Build & 2035 Traffic Level of Service – AM Peak
d. No-Build & 2035 Traffic Level of Service – PM Peak
e. Future Improvements with 2035 Volumes – AM Peak
f. Future Improvements with 2035 Volumes – PM Peak
g. No-Build with 2035 Volumes – AM Peak
h. No-Build with 2035 Volumes – PM Peak

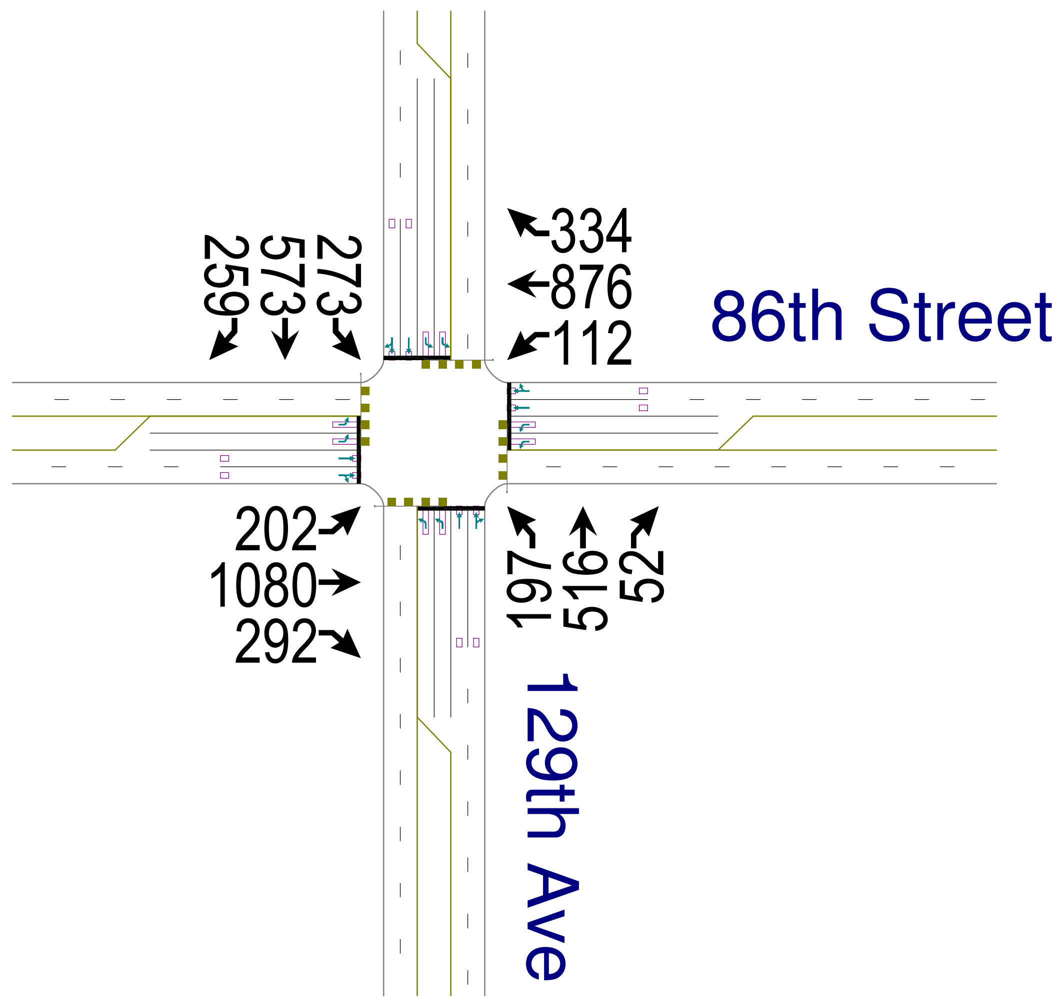

86th Street
129th Ave
D
E
D
E
D
E
E
E
C

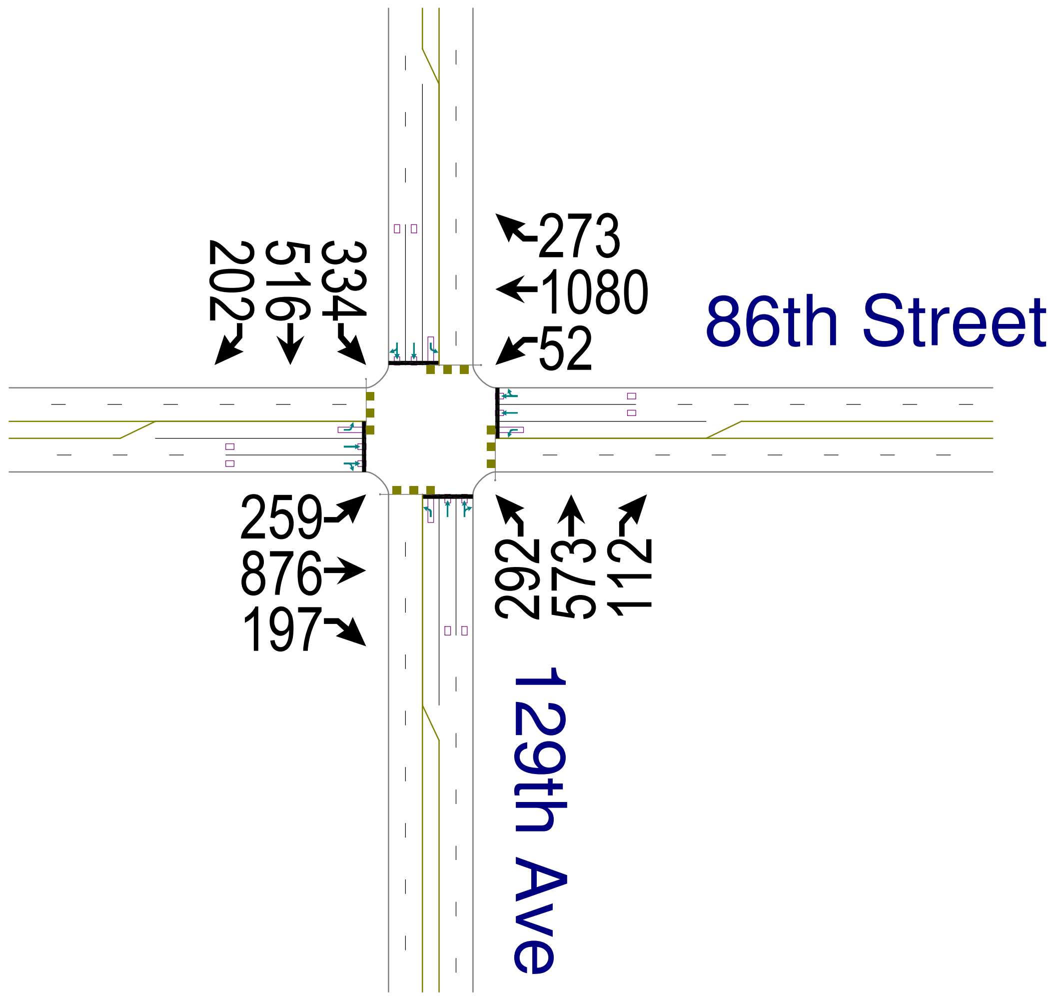

86th Street
129th Ave
D
D
D
E
D
E
E
D
D
D
D


86th Street
129th Ave
E
F
B
D
F
F
C
E
D


86th Street
129th Ave
E
D
E
D
E
F
E
D
E


86th Street
129th Ave
273
1080
52
334
516
202
259
876
197
292
573
112


86th Street
129th Ave
334
876
112
273
573
259
202
1080
292
197
516
52


273
1080
52
86th Street
334
516
202
259
876
197
292
573
112
129th Ave

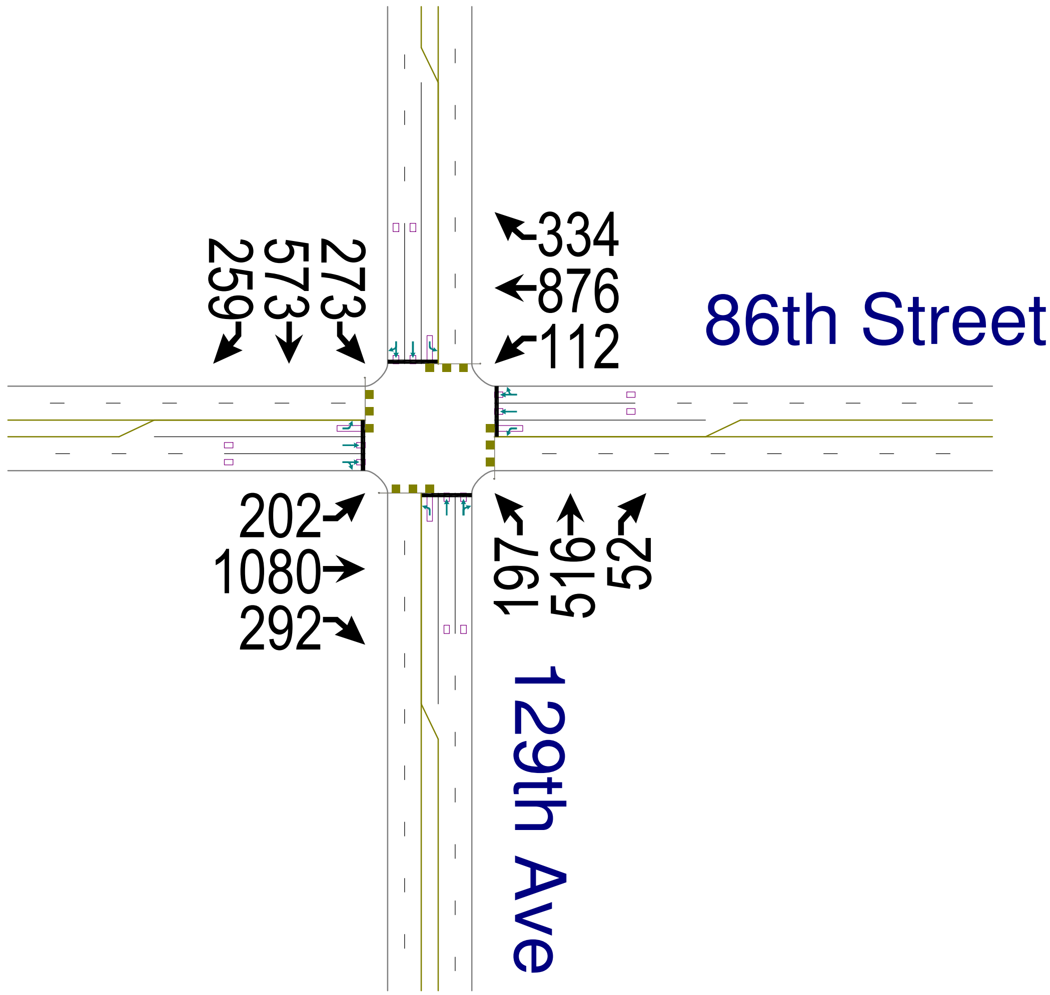
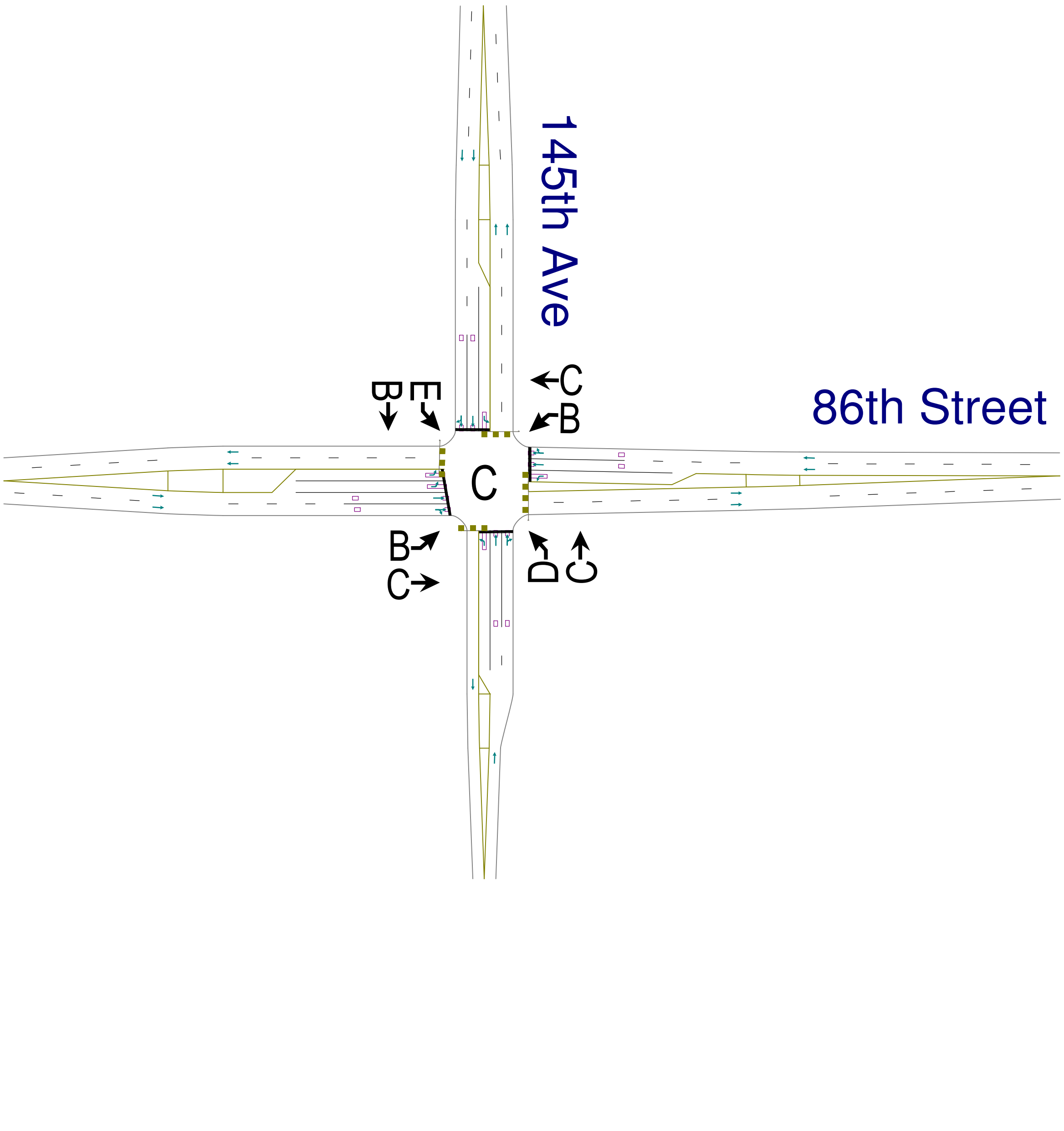
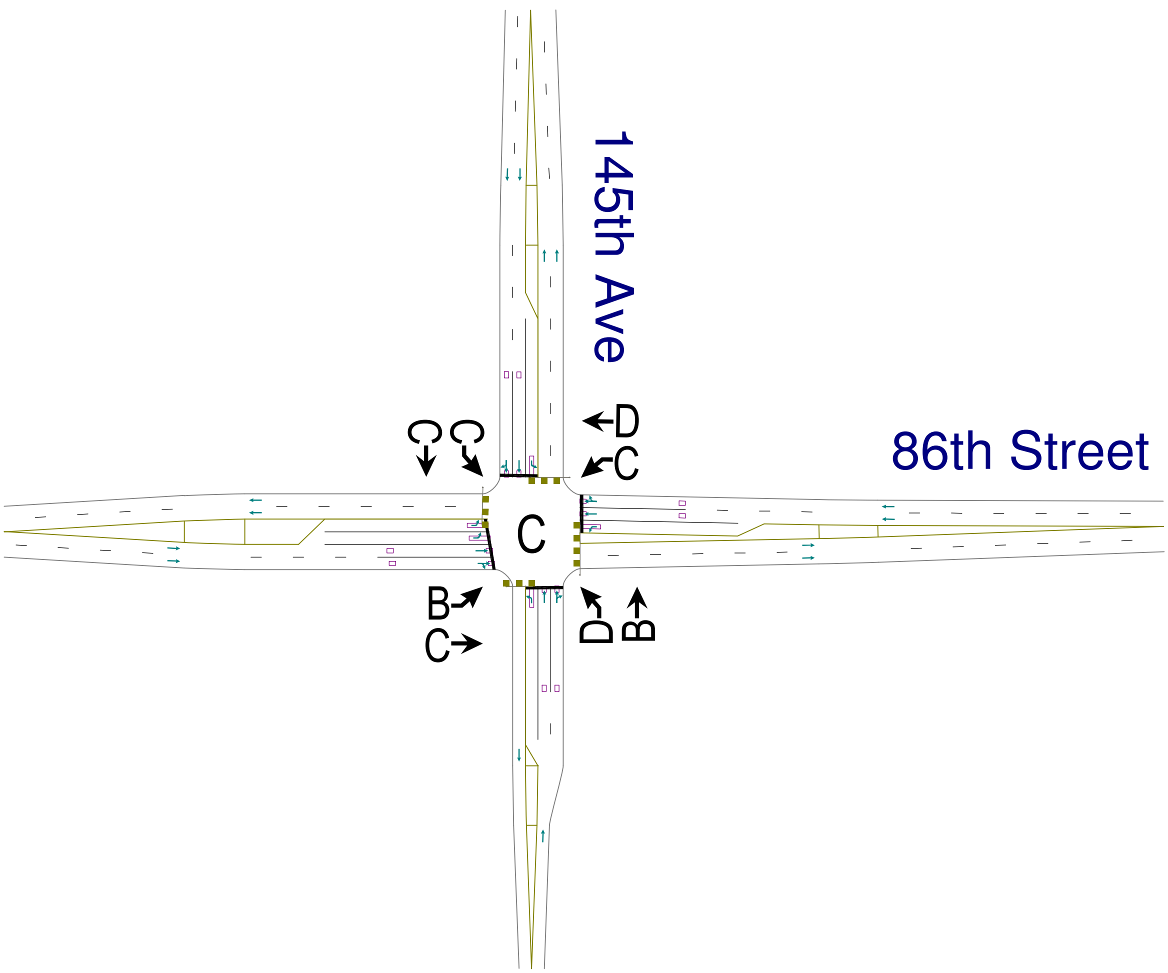

86th Street
129th Ave
334
876
112
273
573
259
202
1080
292
197
516
52

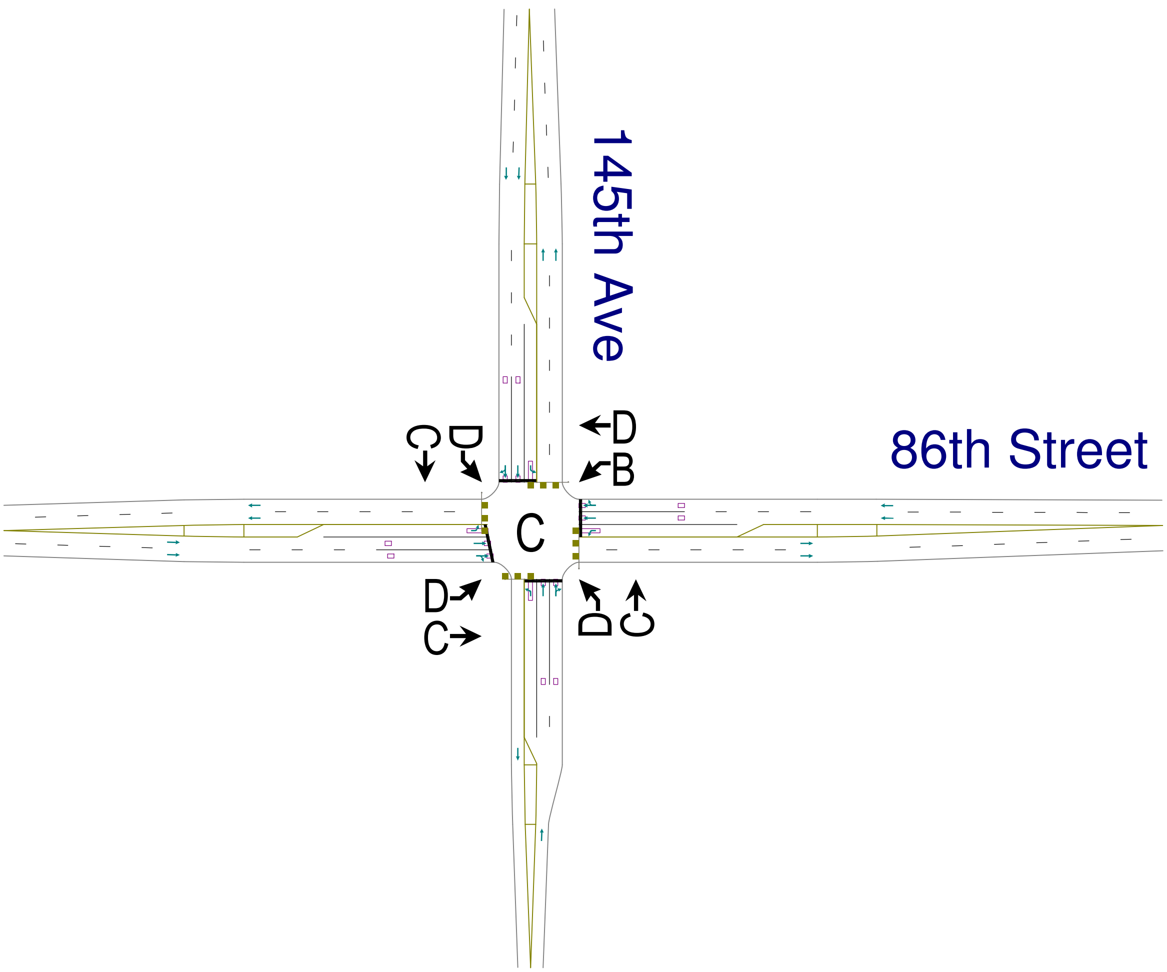
Figure A-2-4

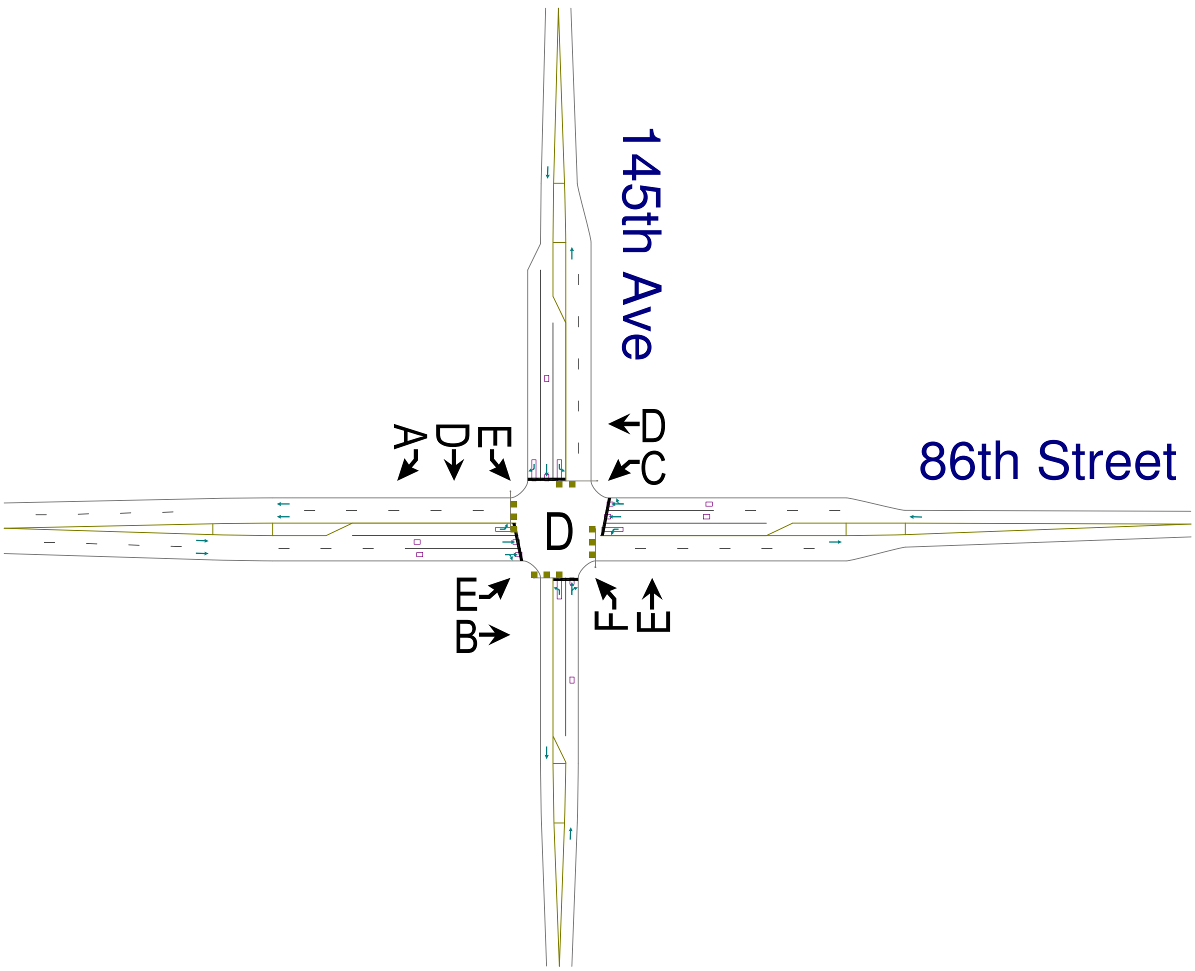
86^{th} Street N & 145^{th} E Avenue Intersection

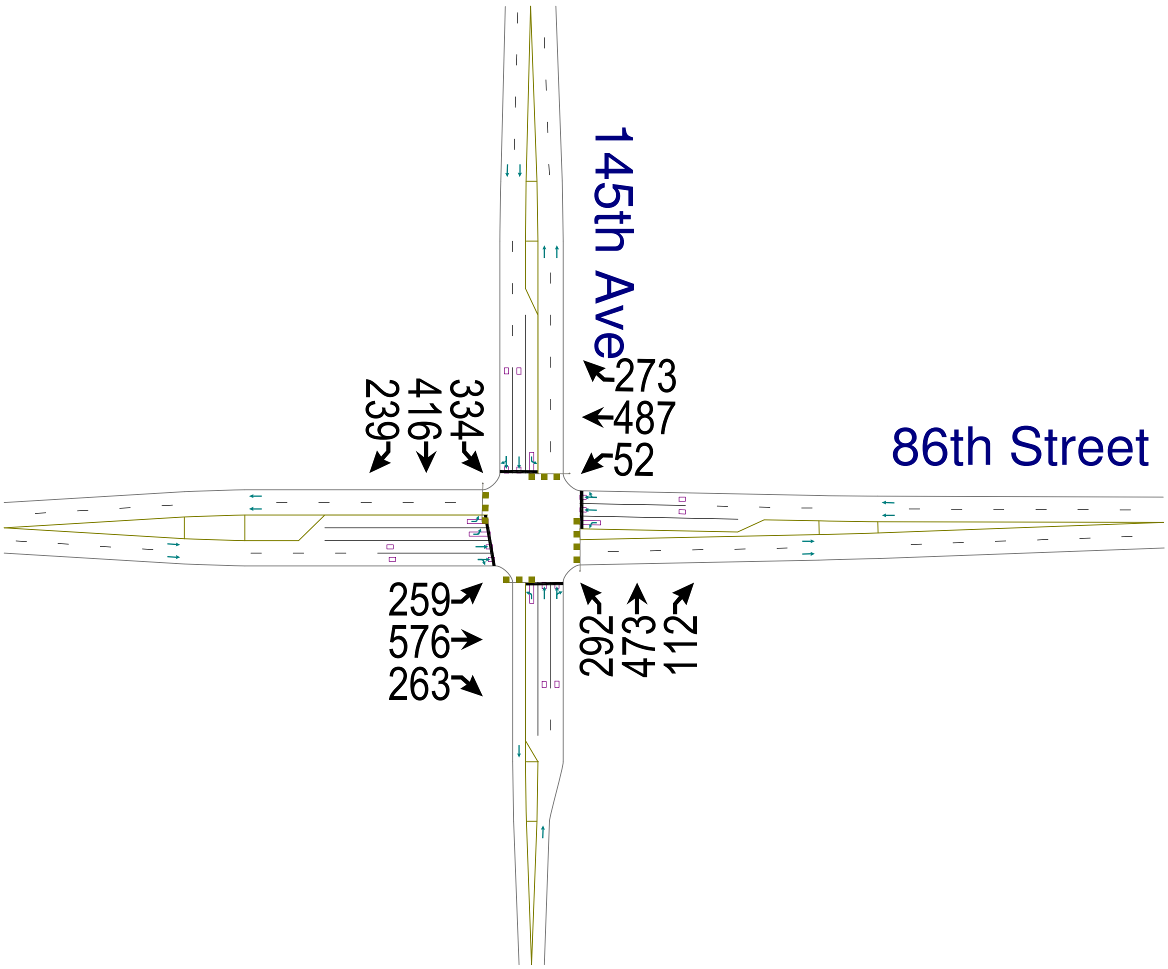
a. Future Improvements & 2035 Traffic Level of Service – AM Peak
b. Future Improvements & 2035 Traffic Level of Service – PM Peak
c. No-Build & 2035 Traffic Level of Service – AM Peak
d. No-Build & 2035 Traffic Level of Service – PM Peak
e. Future Improvements with 2035 Volumes – AM Peak
f. Future Improvements with 2035 Volumes – PM Peak
g. No-Build with 2035 Volumes – AM Peak
h. No-Build with 2035 Volumes – PM Peak

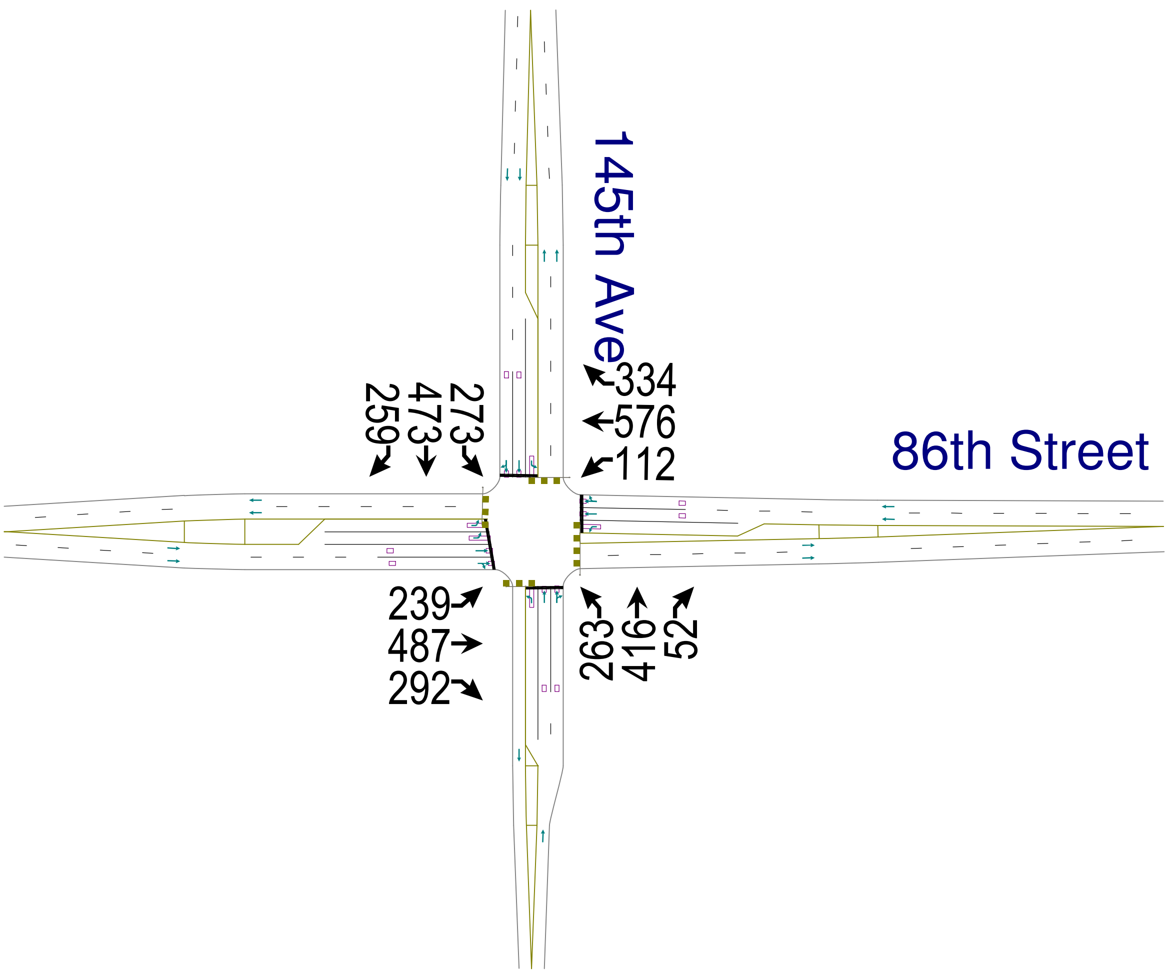

145th Ave
86th Street
C
B
E
C
B
B
C
D
C

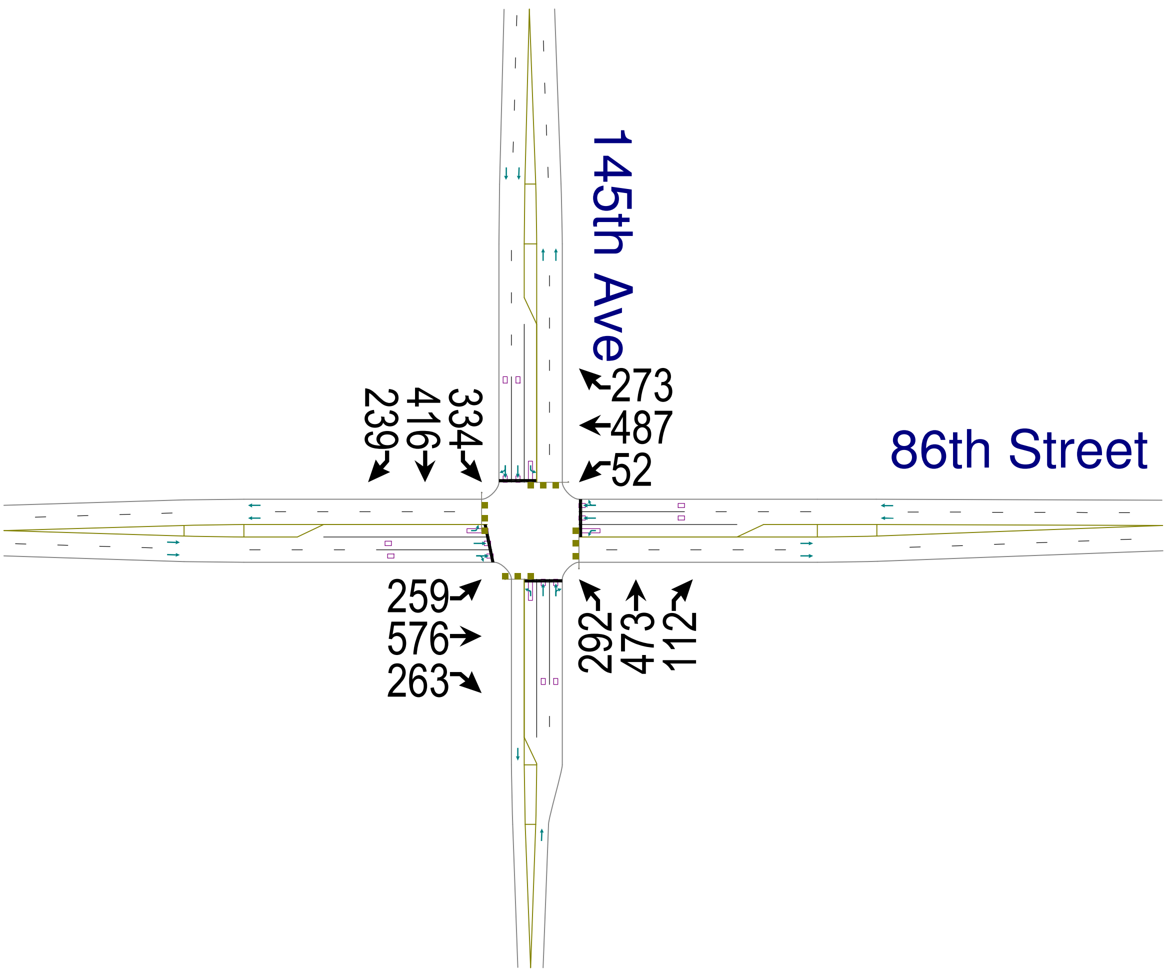

145th Ave
86th Street
C
D
C
C
C
B
C
D
B


145th Ave
86th Street
C
D
D
B
C
D
C
D
C


145th Ave
86th Street
A
D
E
D
C
D
E
B
F
E


145th Ave
86th Street
273
487
52
334
416
239
259
576
263
292
473
112


145th Ave
86th Street
334
576
112
273
473
259
239
487
292
263
416
52


145th Ave
86th Street
273
487
52
334
416
239
259
576
263
292
473
112

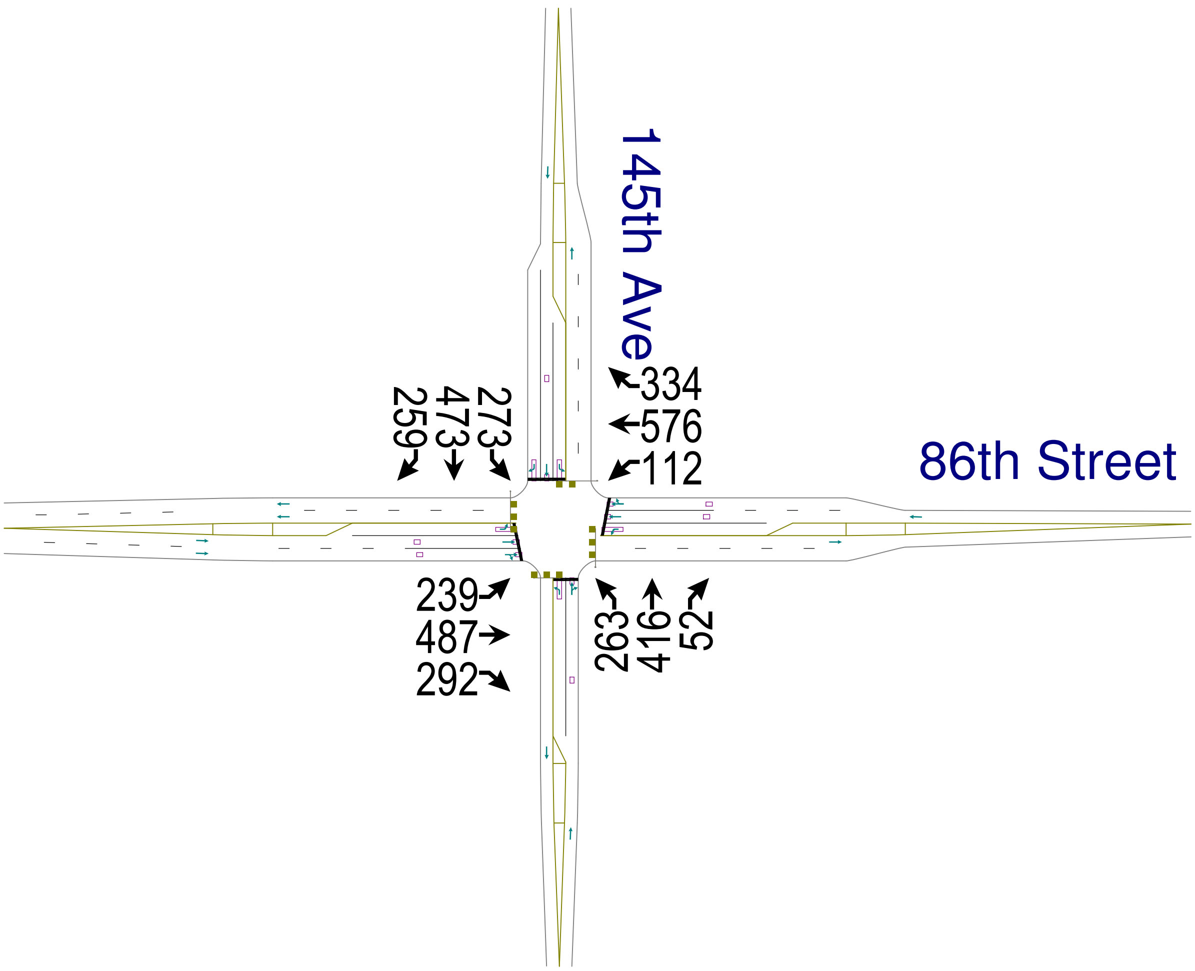
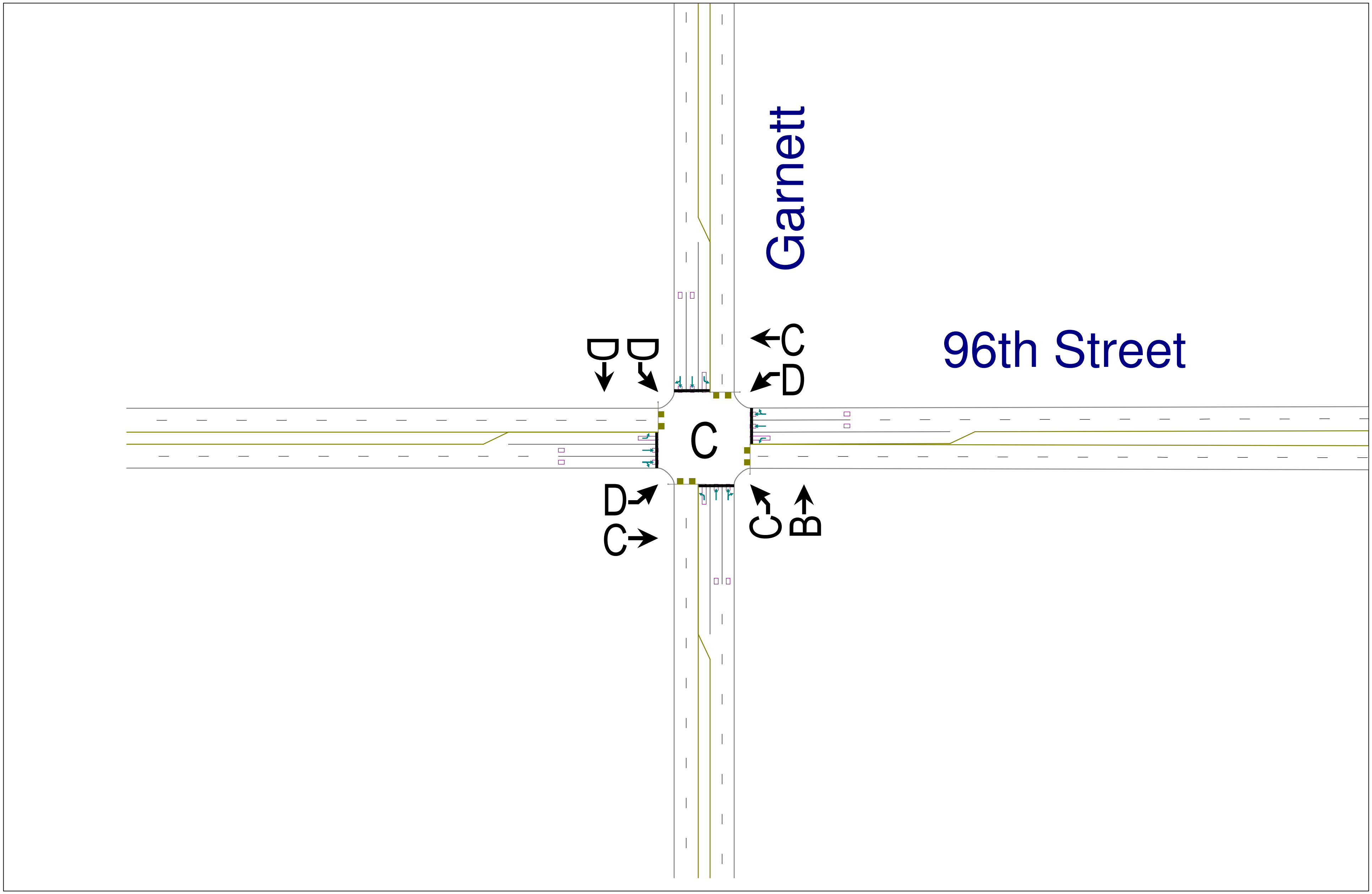
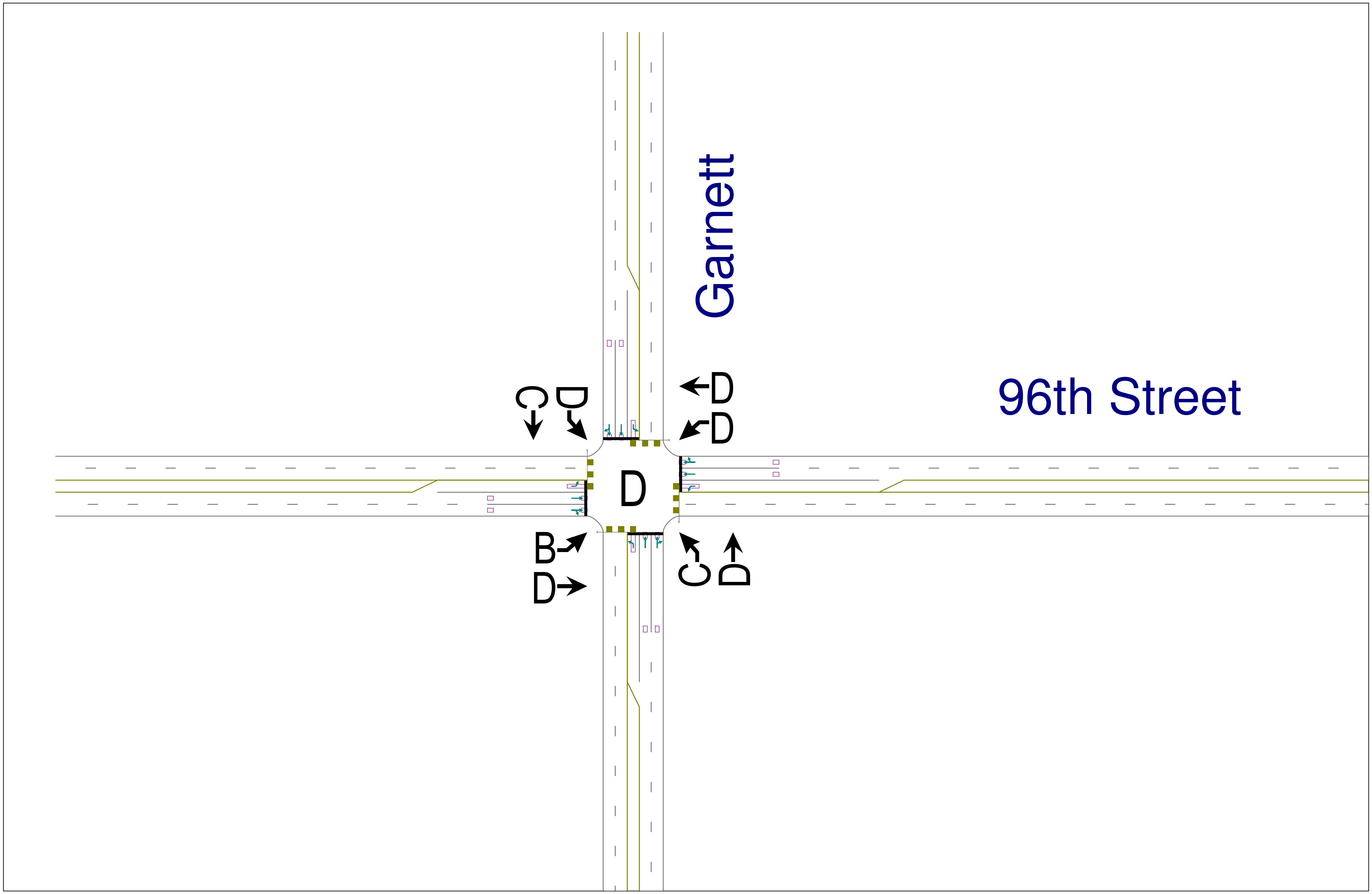

145th Ave
86th Street
334
576
112
259
473
273
239
487
292
263
416
52

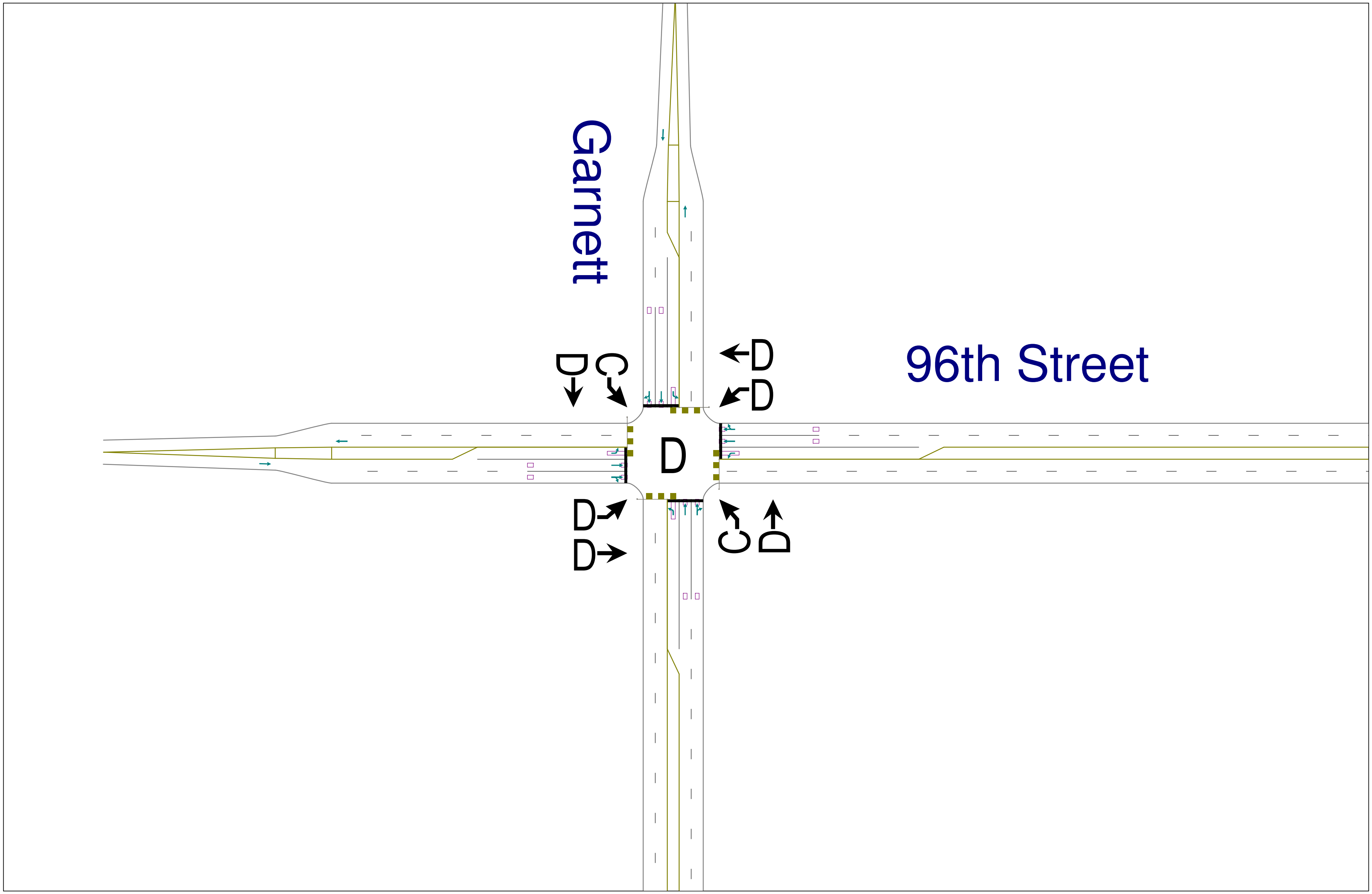
Figure A-3-1

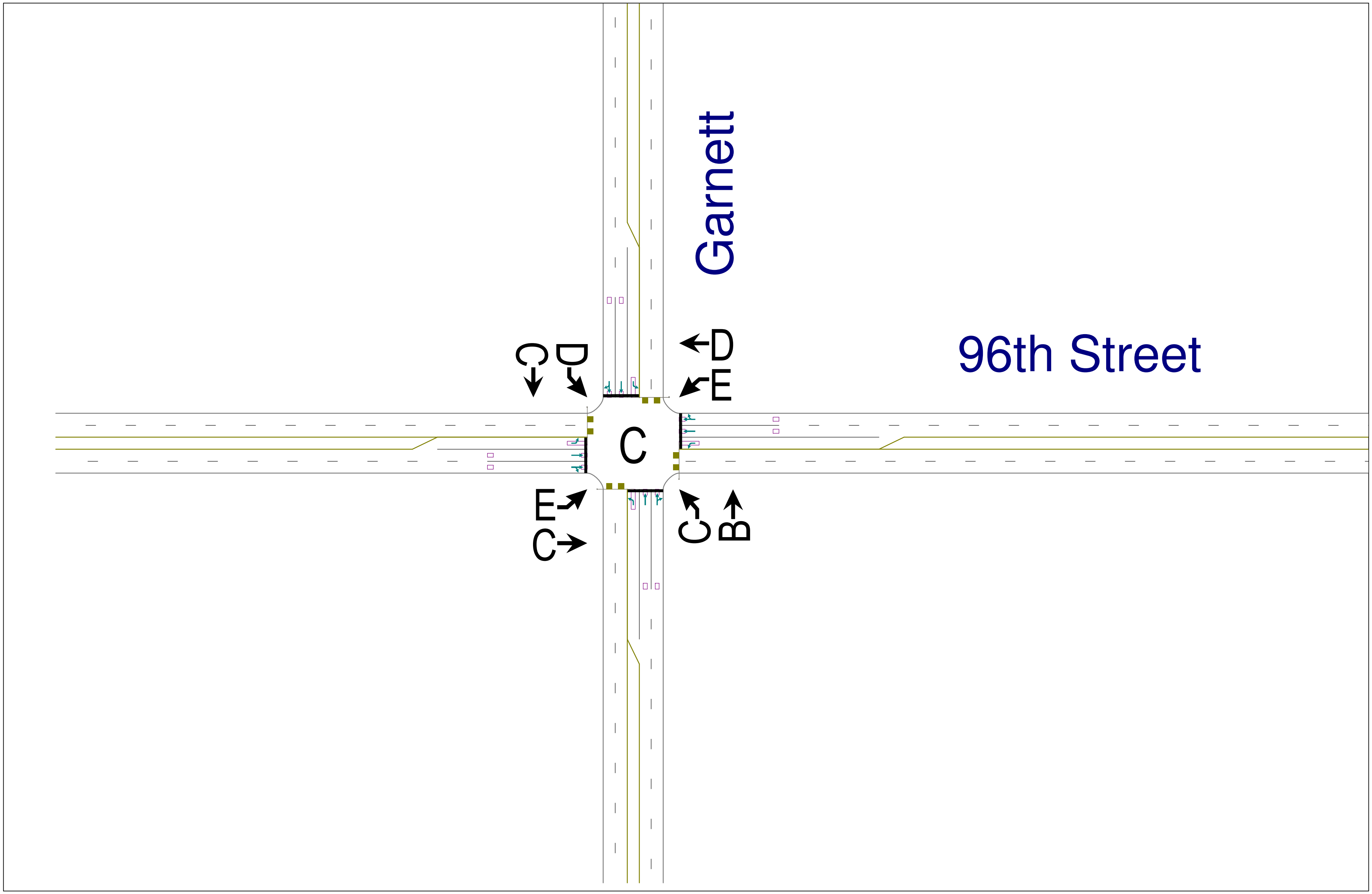
96th Street N & Garnett Road Intersection

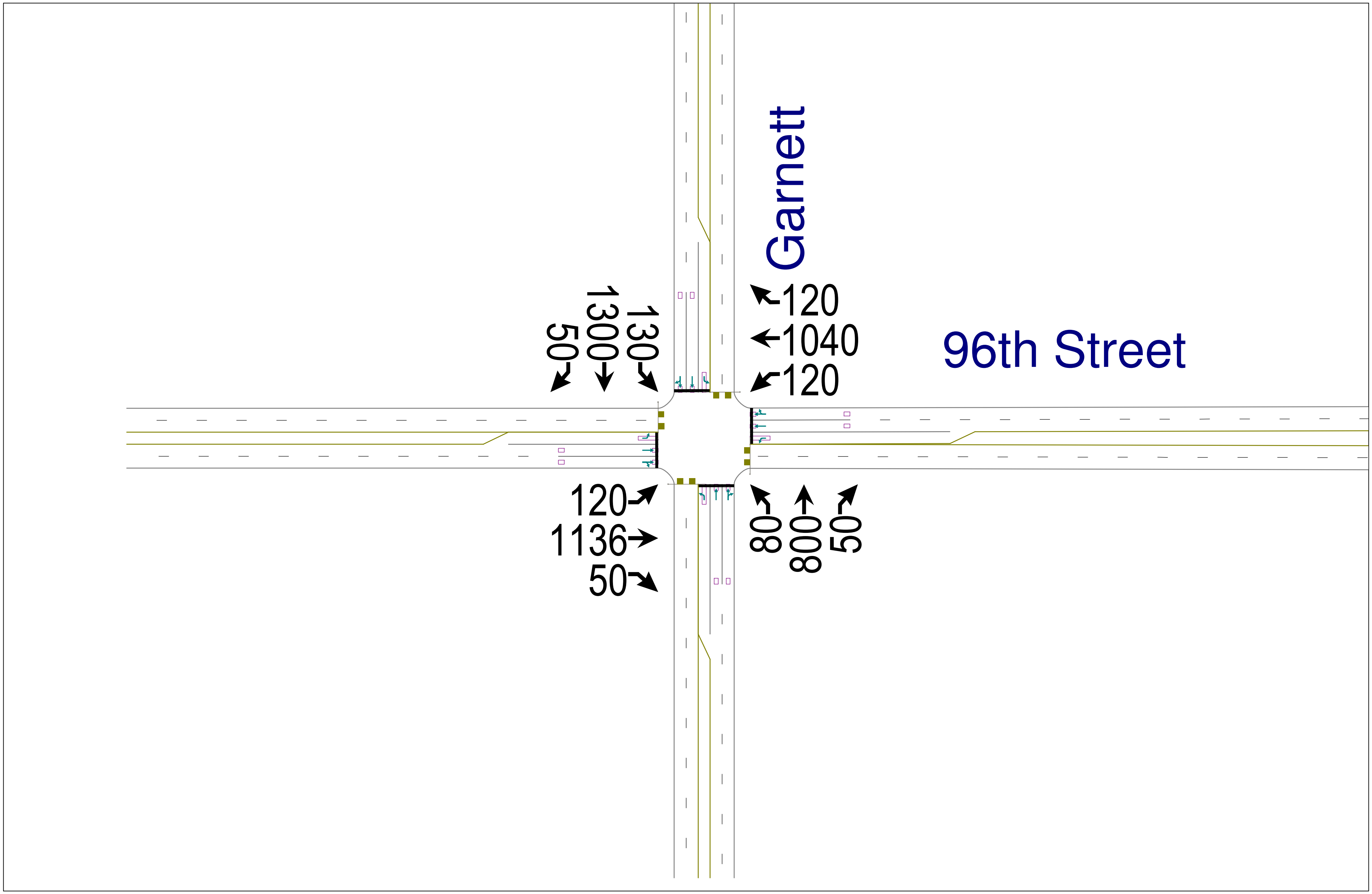
a. Future Improvements & 2035 Traffic Level of Service – AM Peak
b. Future Improvements & 2035 Traffic Level of Service – PM Peak
c. No-Build & 2035 Traffic Level of Service – AM Peak
d. No-Build & 2035 Traffic Level of Service – PM Peak
e. Future Improvements with 2035 Volumes – AM Peak
f. Future Improvements with 2035 Volumes – PM Peak
g. No-Build with 2035 Volumes – AM Peak
h. No-Build with 2035 Volumes – PM Peak

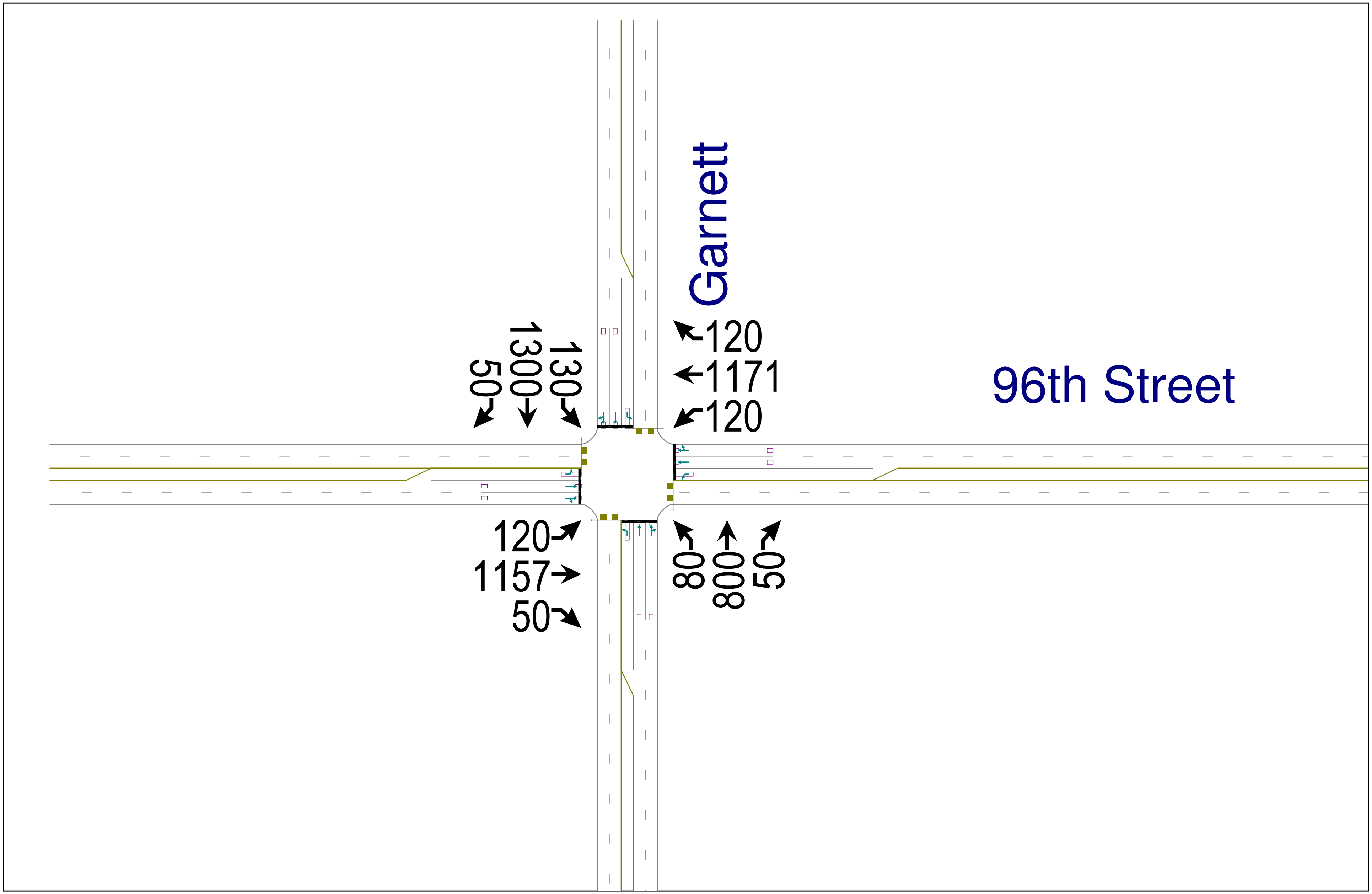

Garnett
96th Street
D
D
C
D
C
D
C
C
B

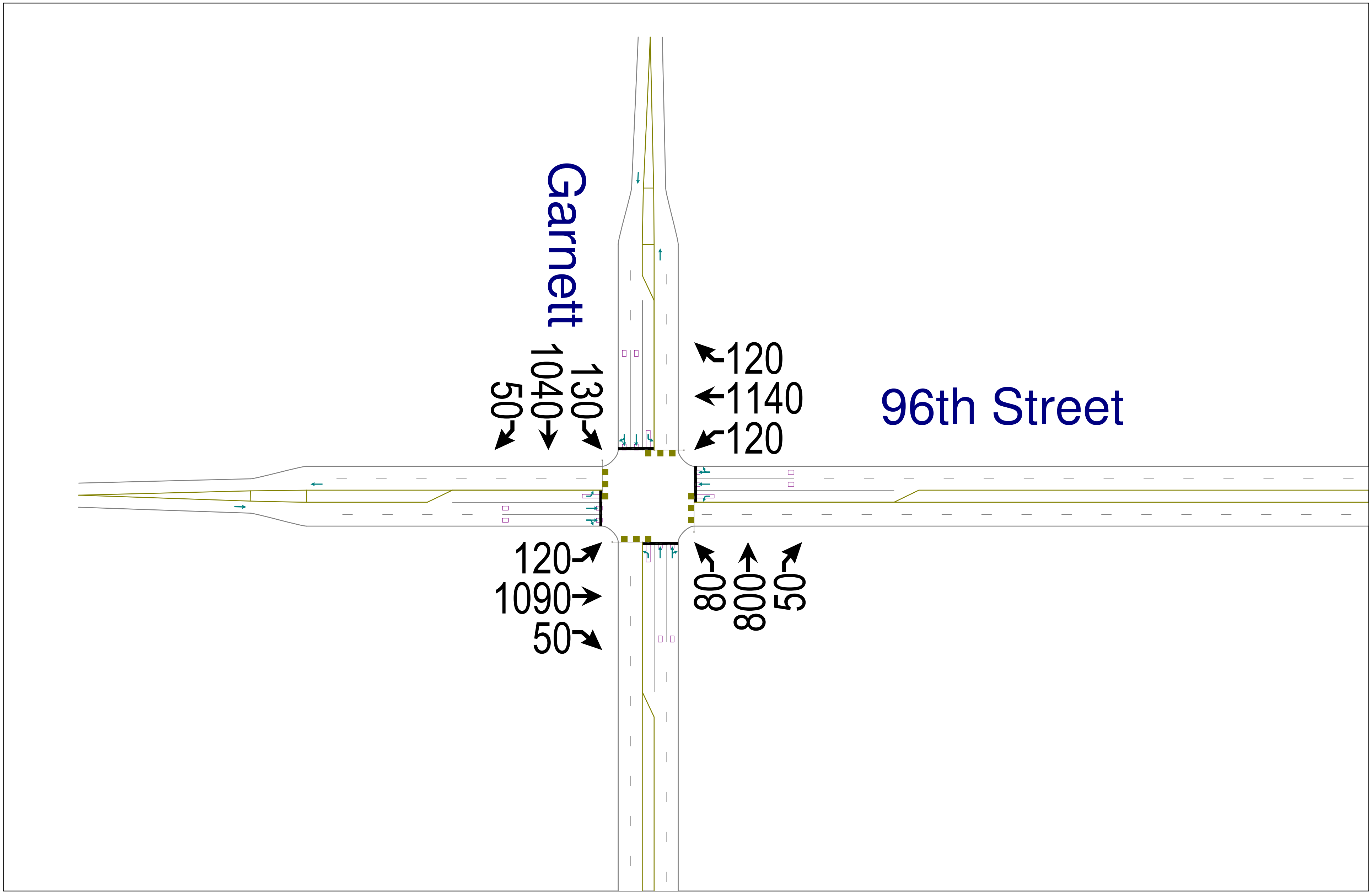

Garnett
96th Street
D
C
D
D
D
B
D
C
D


Garnett
96th Street
D
C
D
D
D
D
D
C
D


Garnett
96th Street
C
D
E
C
D
E
C
C
B


Garnett
96th Street
130
1300
50
120
1040
120
120
1136
50
80
800
50


Garnett
96th Street
120
1171
120
130
1300
50
120
1157
50
80
800
50


Garnett
96th Street
130
1040
50
120
1140
120
120
1090
50
80
800
50

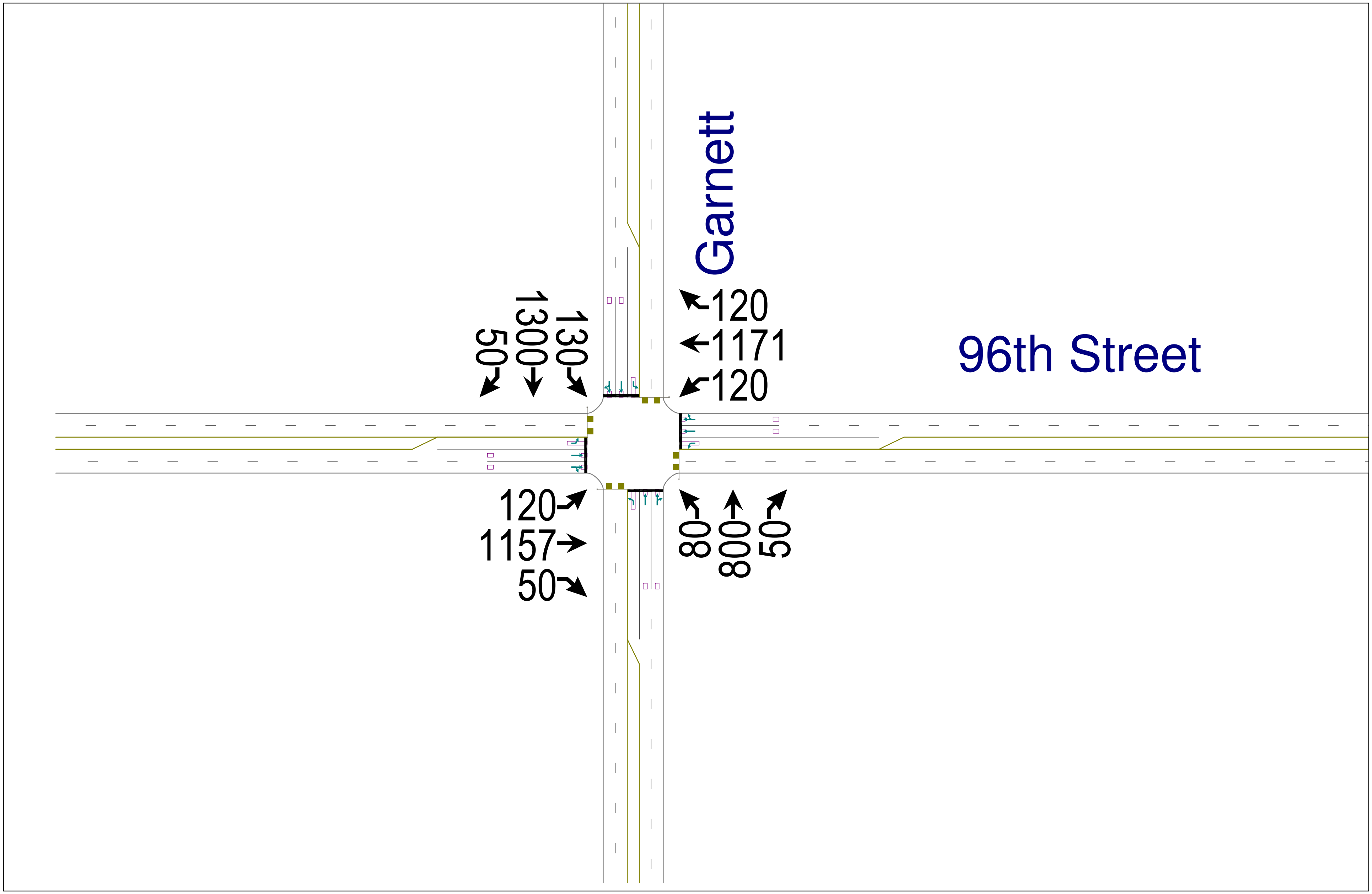
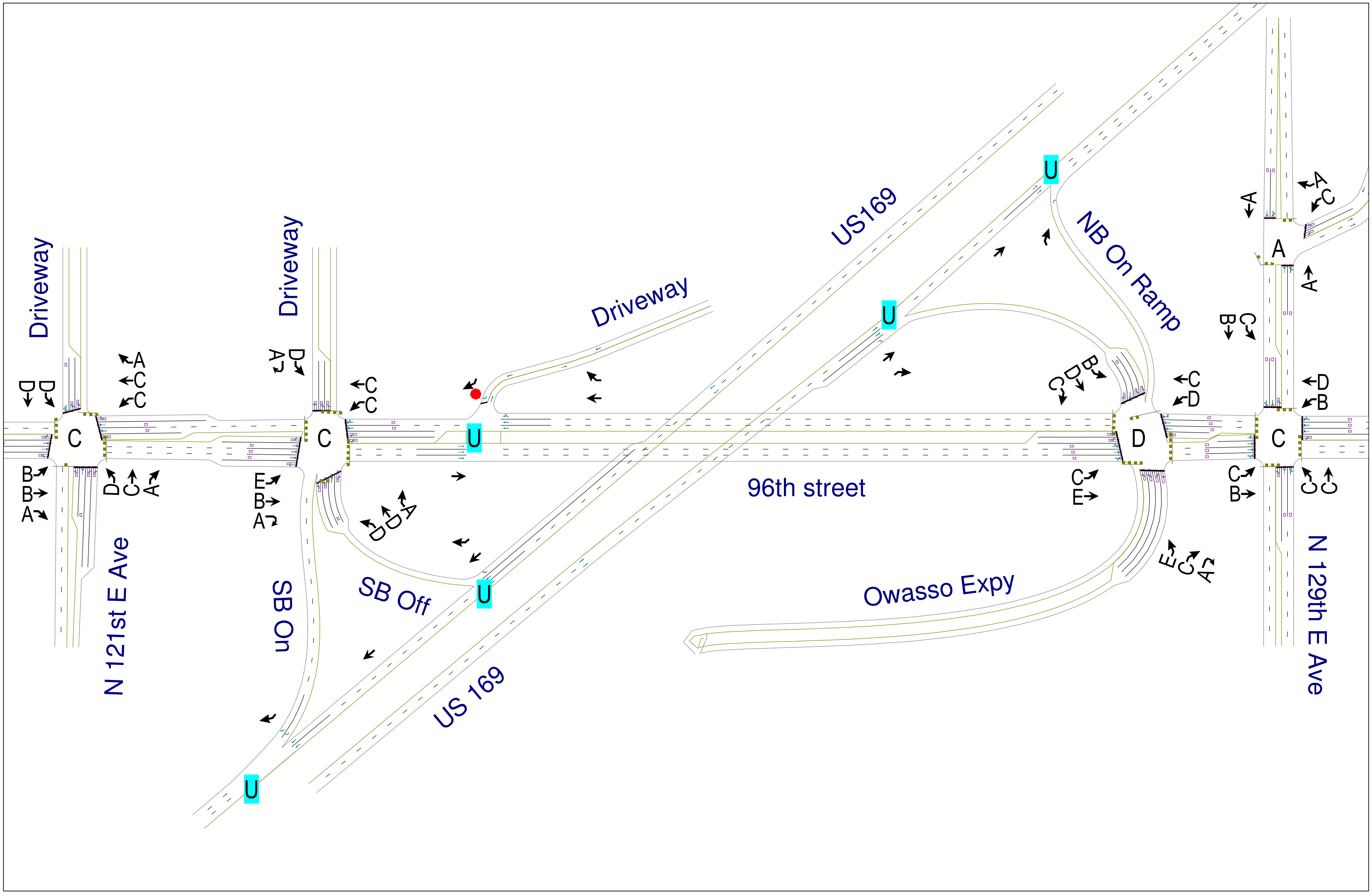

Garnett
96th Street
130
1300
50
120
1171
120
120
1157
50
80
800
50

Figure A-3-2

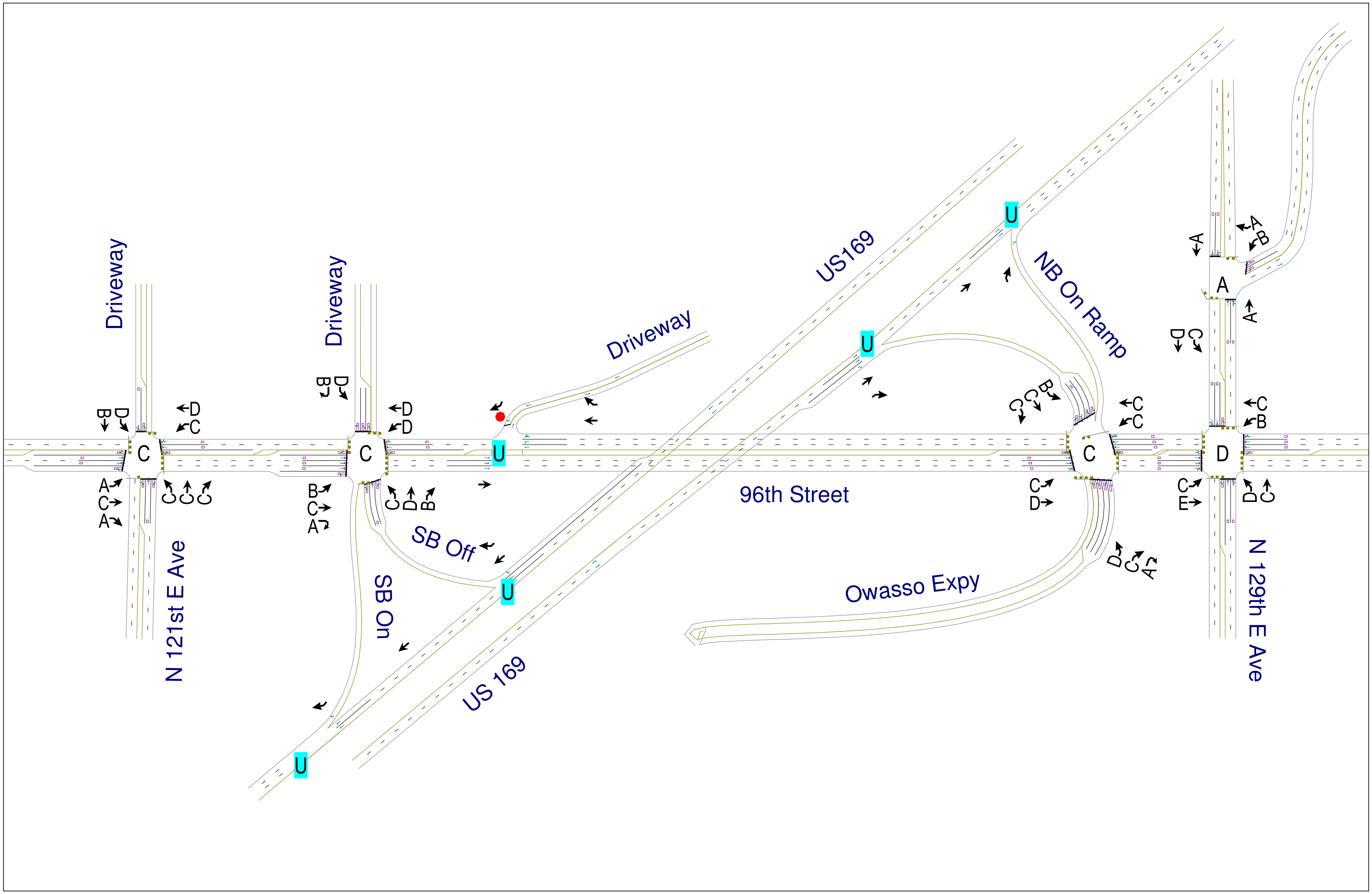
96^{th} Street N & US 169 Interchange

a. Future Folded Diamond Option & 2035 Traffic Level of Service – AM Peak
b. Future Folded Diamond Option & 2035 Traffic Level of Service – PM Peak
c. Future Partially Folded Diamond Option & 2035 Traffic Level of Service – AM Peak
d. Future Partially Folded Diamond Option & 2035 Traffic Level of Service – PM Peak
e. No-Build & 2035 Traffic Level of Service – AM Peak
f. No-Build & 2035 Traffic Level of Service – PM Peak
g. Future Folded Diamond Option with 2035 Volumes – AM Peak
h. Future Folded Diamond Option with 2035 Volumes – PM Peak
i. Future Partially Folded Diamond Option with 2035 Volumes – AM Peak
j. Future Partially Folded Diamond Option with 2035 Volumes – PM Peak
k. No-Build with 2035 Volumes – AM Peak
l. No-Build with 2035 Volumes – PM Peak


Driveway
Driveway
Driveway
US169
US 169
NB On Ramp
SB Off
SB On
N 121st E Ave
N 129th E Ave
96th street
Owasso Expy
C
C
D
C
A
U
U
U
U
U

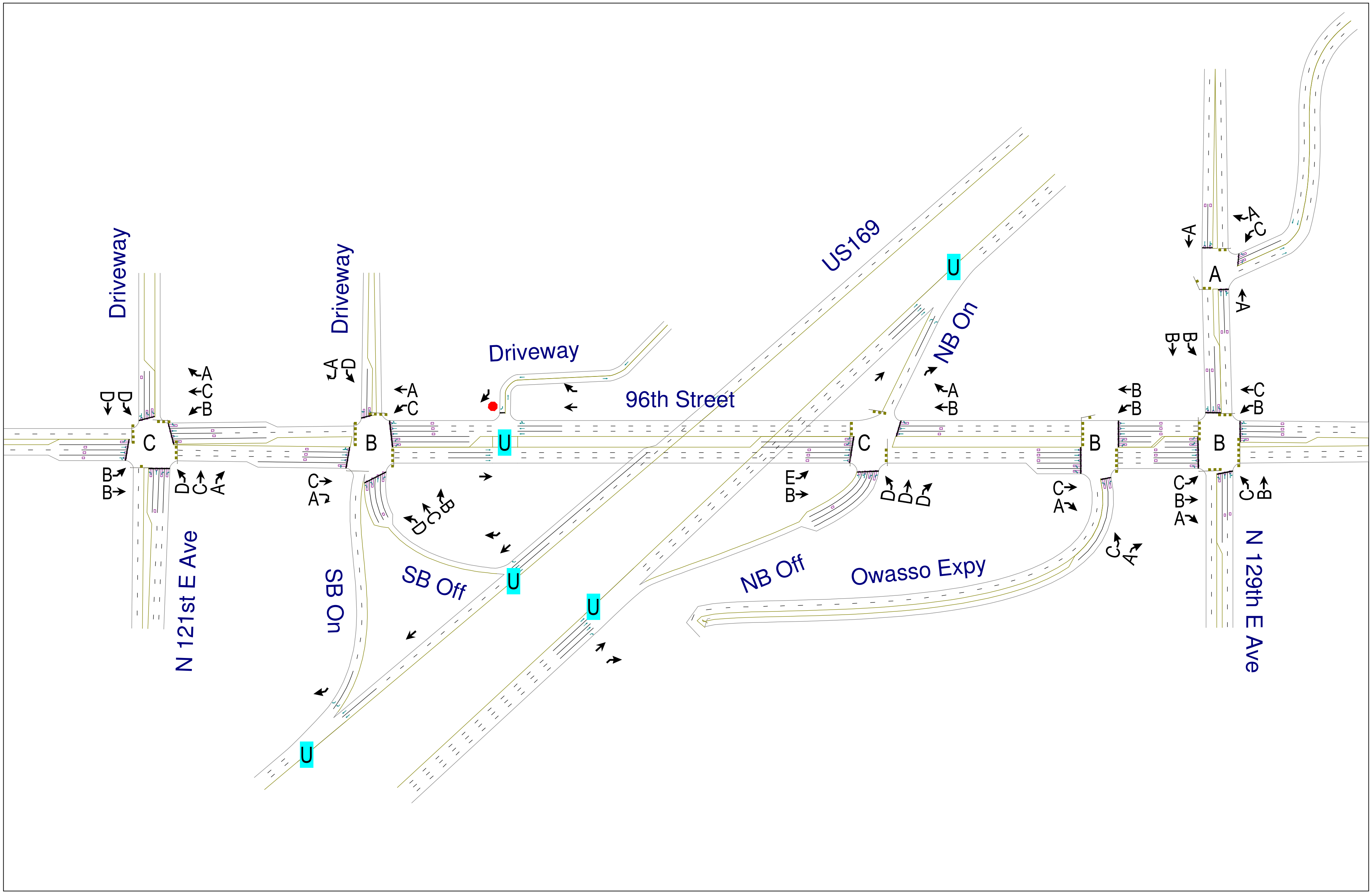
Map - 96th Street and US 169
Level of Service

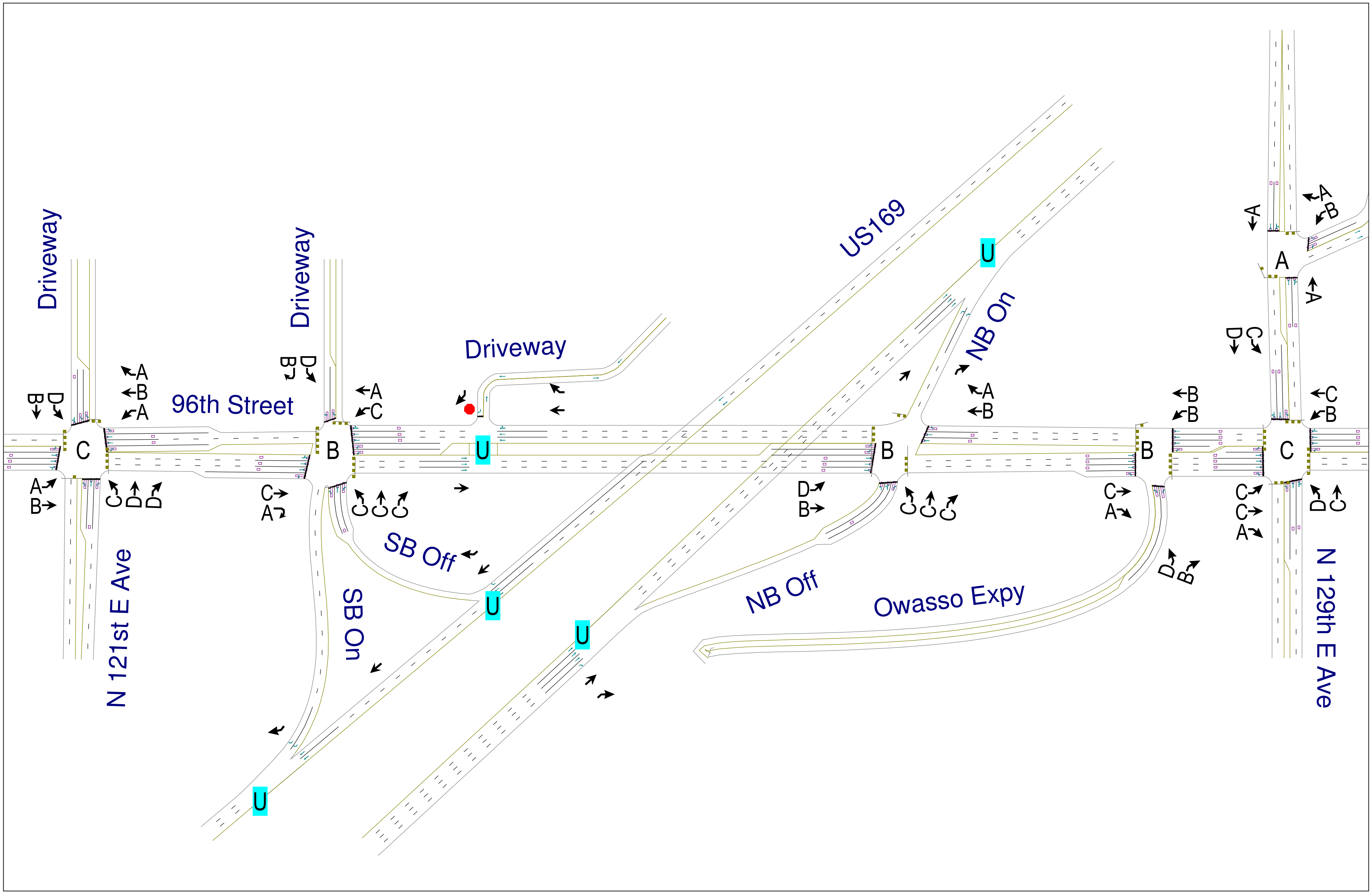
5/5/2015

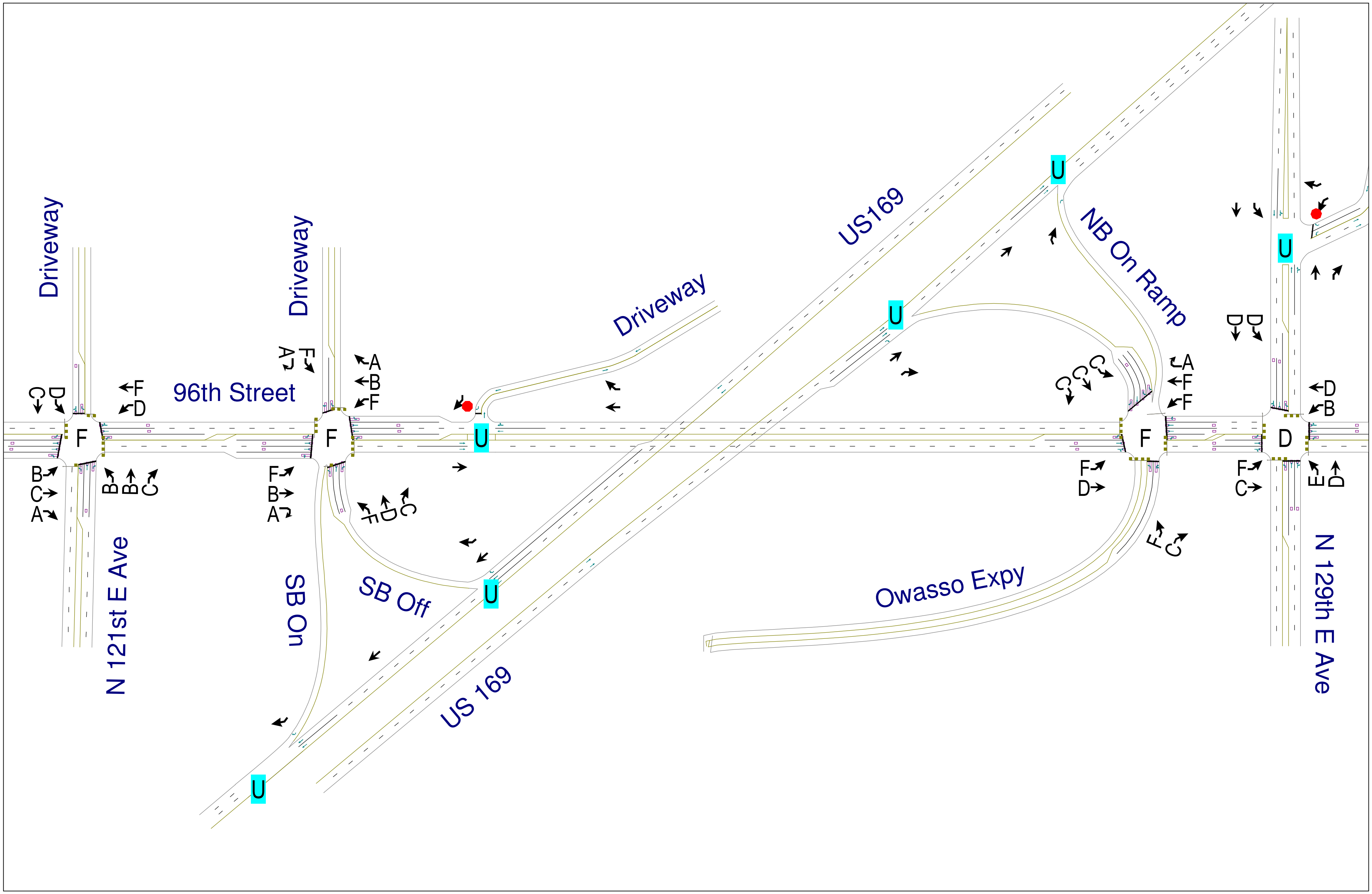


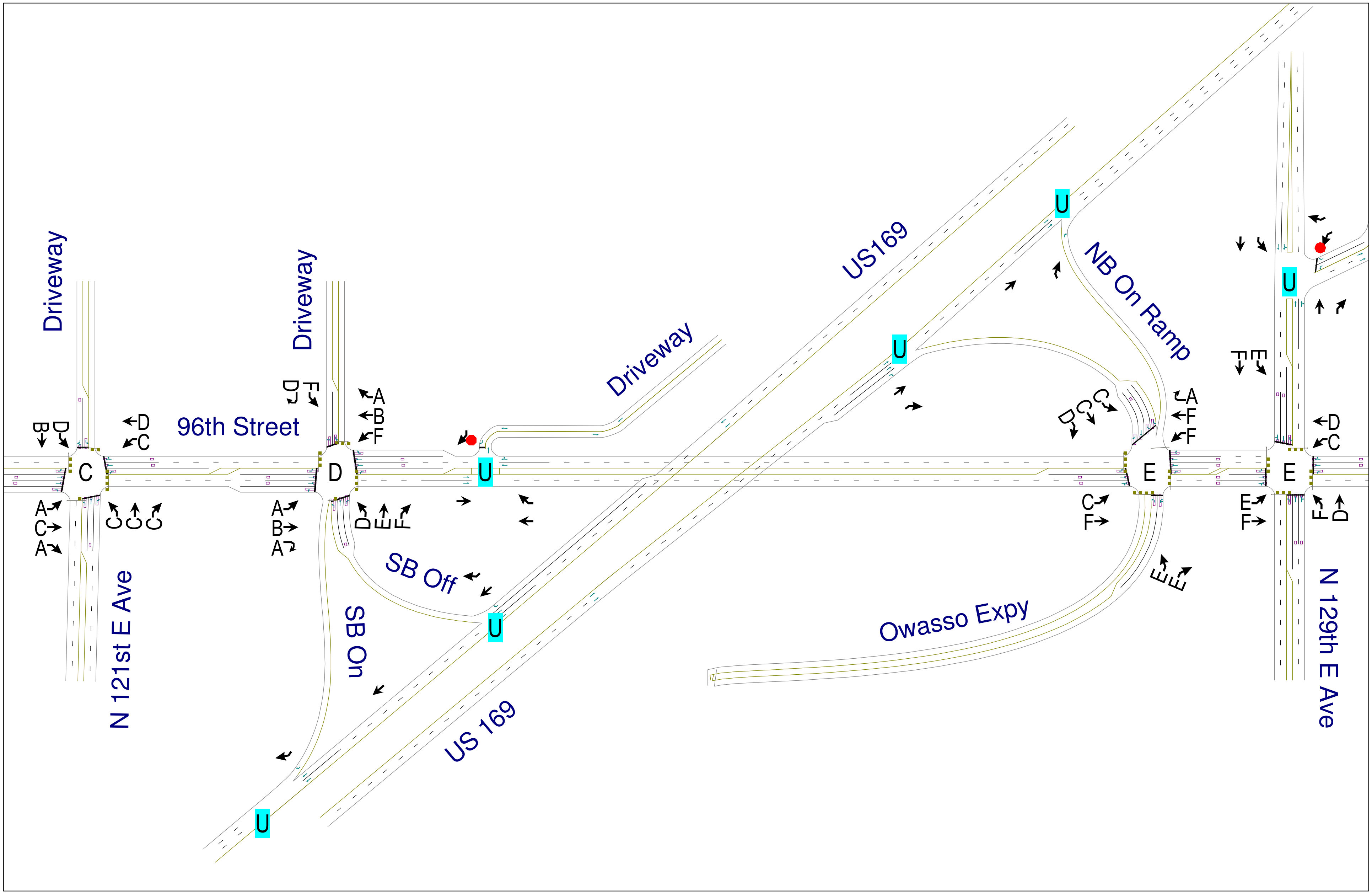
96th Street and US 169 Future Lanes with 2035 Volumes - PM Peak
Timing Plan: PM Peak

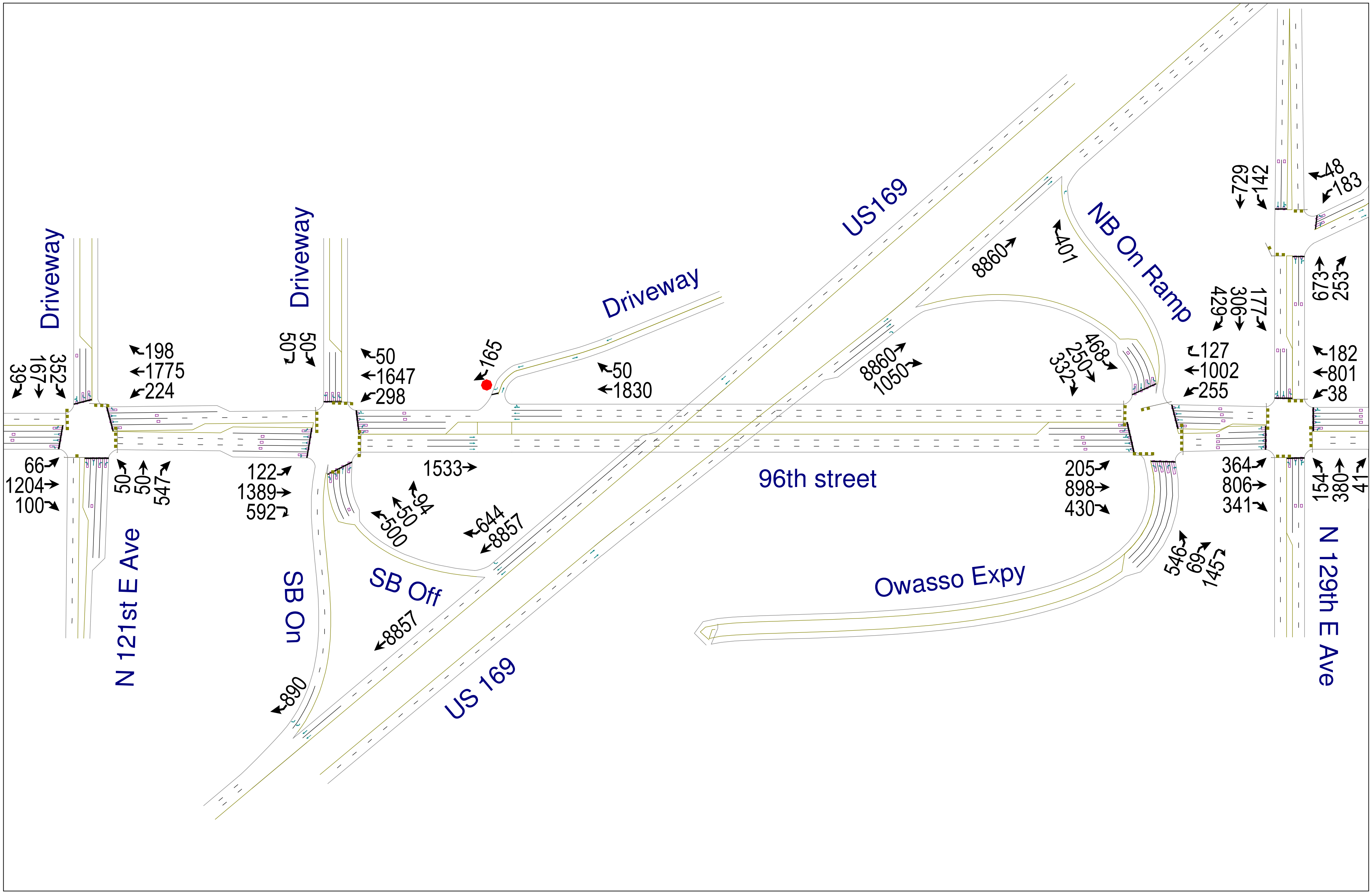
96th Street and US 169
Future Lanes with 2035 Volumes - PM Peak

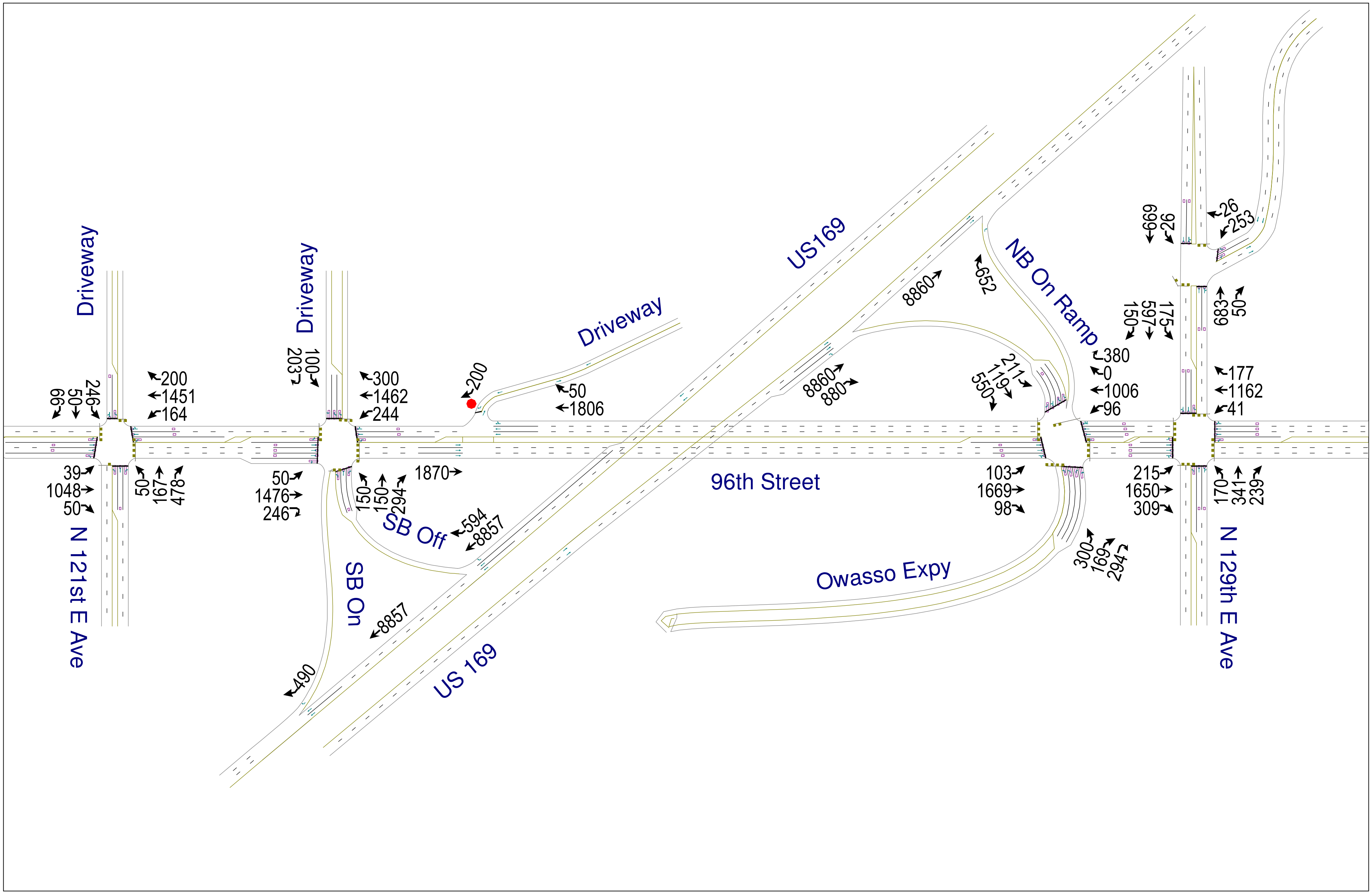

Driveway
Driveway
Driveway
96th Street
US169
NB On
NB Off
Owasso Expy
SB Off
SB On
N 121st E Ave
N 129th E Ave
C
B
C
B
B
A
U
U
U
U
U

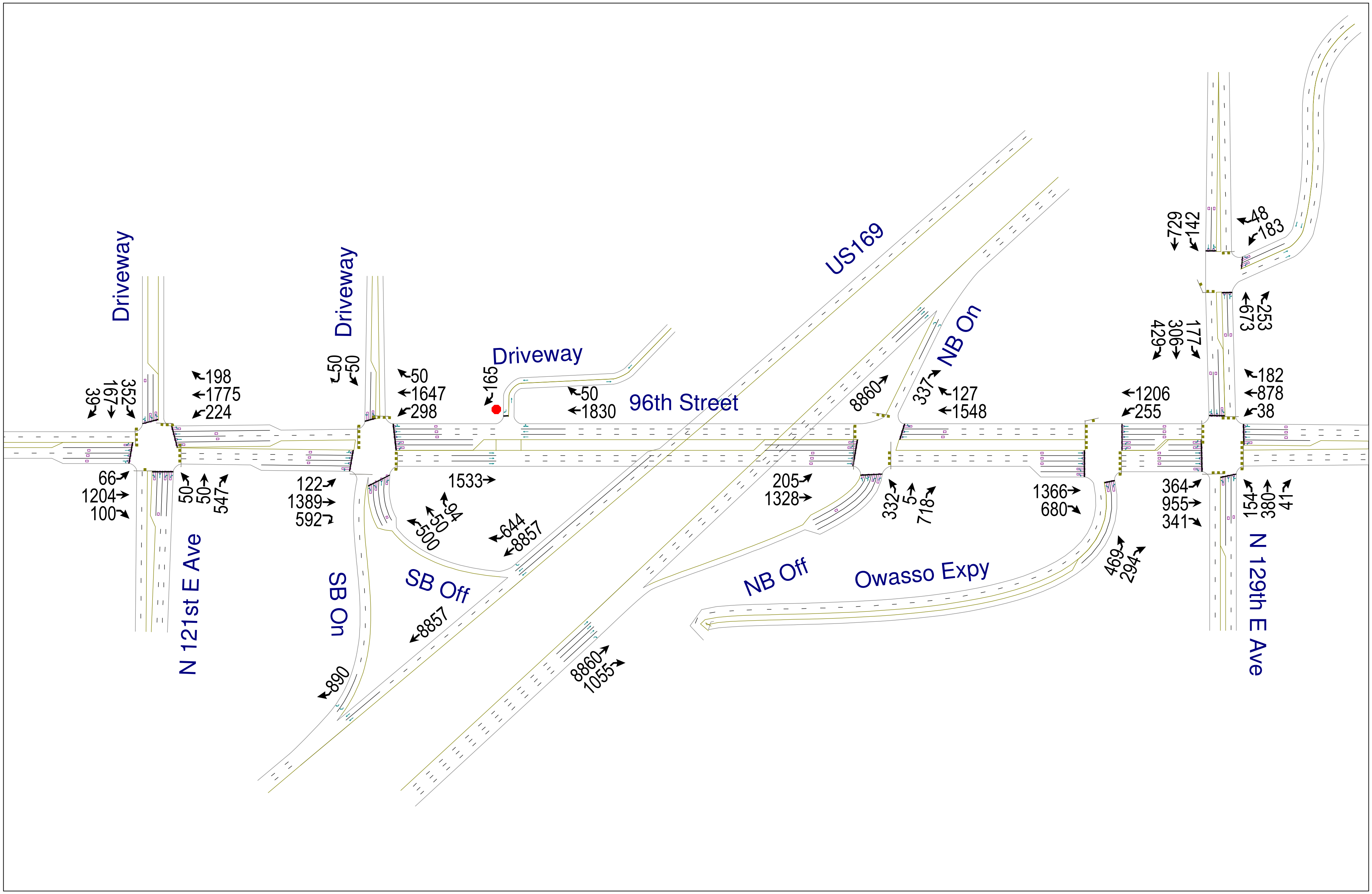

Driveway
Driveway
Driveway
96th Street
US169
NB On
SB Off
SB On
NB Off
Owasso Expy
N 121st E Ave
N 129th E Ave

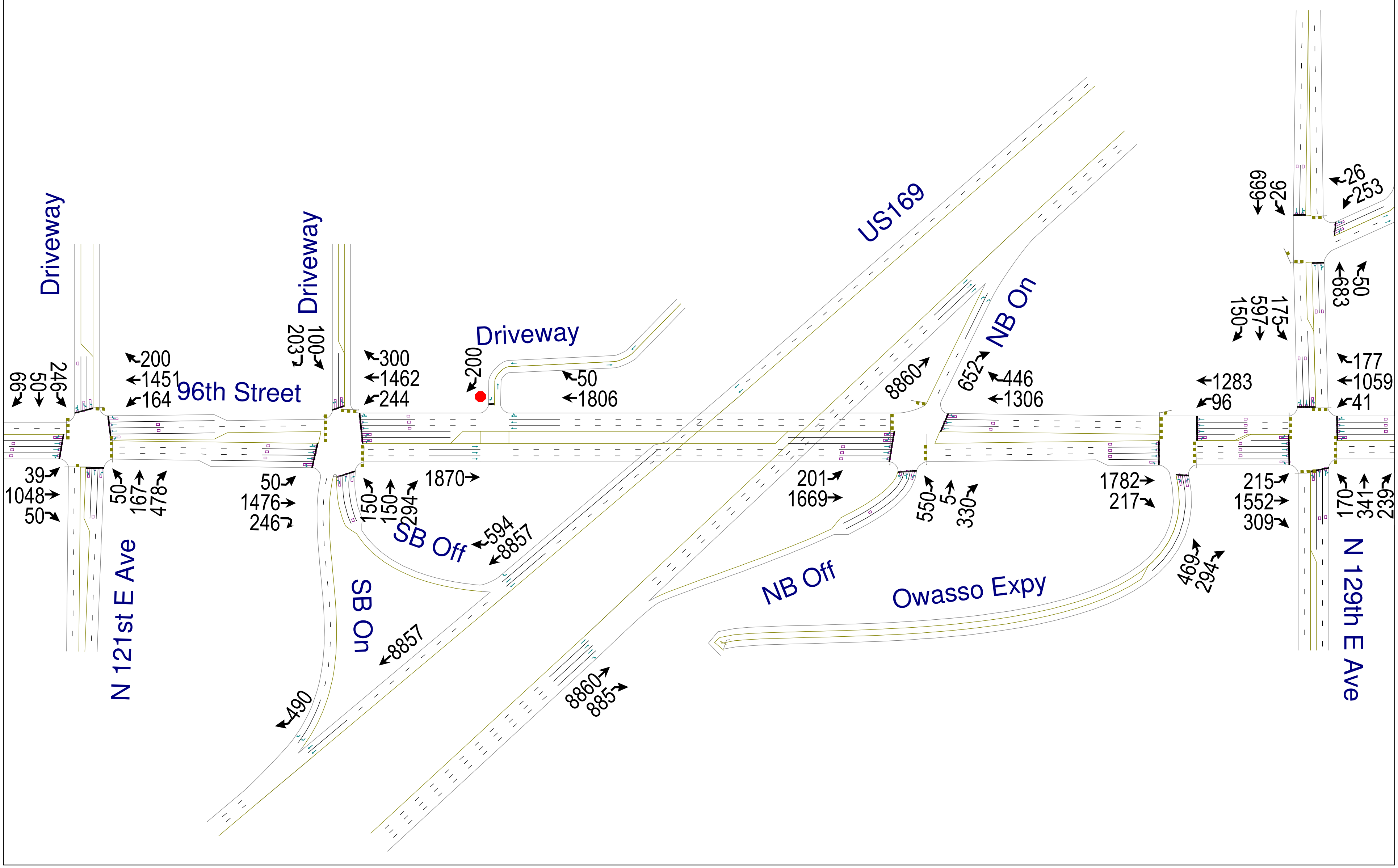

Driveway
Driveway
Driveway
96th Street
N 121st E Ave
SB On
SB Off
US 169
US169
NB On Ramp
Owasso Expy
N 129th E Ave
F
F
F
D
U

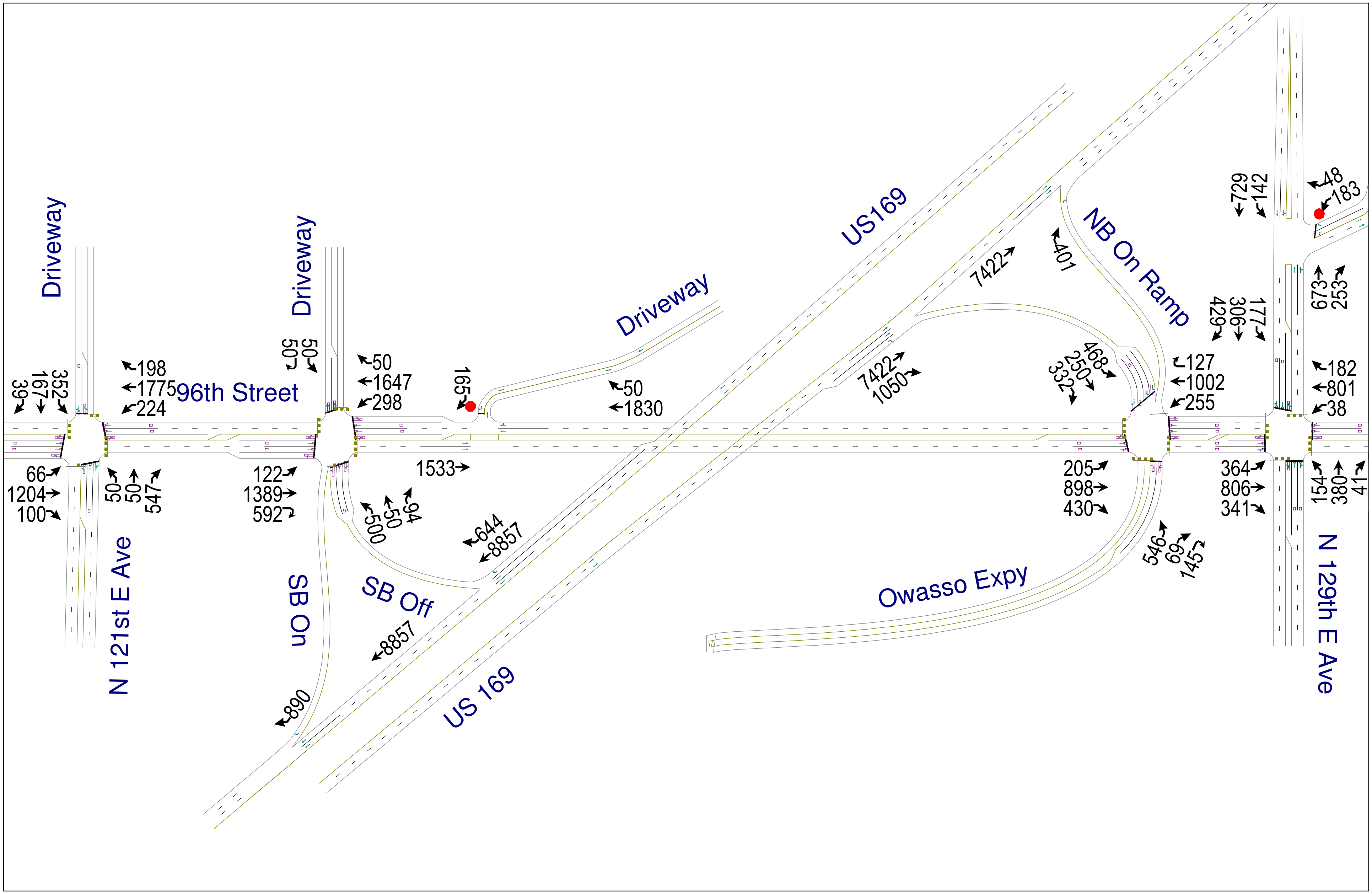

Driveway
Driveway
Driveway
96th Street
N 121st E Ave
SB Off
SB On
US 169
US169
NB On Ramp
Owasso Expy
N 129th E Ave
C
D
E
E
U


Driveway
Driveway
Driveway
N 121st E Ave
SB On
SB Off
US 169
US169
NB On Ramp
96th street
Owasso Expy
N 129th E Ave
39
167
352
198
1775
224
66
1204
100
50
50
547
50
50
50
1647
298
122
1389
592
165
50
1830
1533
94
50
500
644
8857
8857
890
8860
1050
8860
401
468
250
332
205
898
430
546
69
145
429
306
177
127
1002
255
364
806
341
729
142
48
183
673
253
182
801
38
154
380
41


Driveway
Driveway
Driveway
US169
NB On Ramp
96th Street
N 121st E Ave
SB Off
SB On
US 169
Owasso Expy
N 129th E Ave
66
50
246
200
1451
164
39
1048
50
50
167
478
203
100
300
1462
244
50
1476
246
150
150
294
1870
200
50
1806
594
8857
8857
490
8860
880
8860
652
211
119
550
380
0
1006
96
103
1669
98
300
169
294
150
597
175
669
26
26
253
683
50
177
1162
41
215
1650
309
170
341
239


Driveway
Driveway
Driveway
96th Street
US169
NB On
NB Off
Owasso Expy
SB Off
SB On
N 121st E Ave
N 129th E Ave
39
167
352
198
1775
224
66
1204
100
50
50
547
50
50
50
1647
298
122
1389
592
165
50
1830
1533
94
50
500
644
8857
8857
890
8860
1055
8860
337
127
1548
205
1328
332
5
718
1206
255
1366
680
469
294
729
142
48
183
253
673
429
306
177
182
878
38
364
955
341
154
380
41


Driveway
Driveway
Driveway
96th Street
N 121st E Ave
N 129th E Ave
US169
NB On
NB Off
SB Off
SB On
Owasso Expy
246
50
66
39
1048
50
200
1451
164
50
167
478
100
203
50
1476
246
300
1462
244
150
150
294
1870
200
50
1806
594
8857
8857
490
8860
652
446
1306
201
1669
550
5
330
8860
885
1283
96
1782
217
469
294
669
97
26
253
50
683
175
597
150
177
1059
41
215
1552
309
170
341
239


Driveway
Driveway
Driveway
96th Street
N 121st E Ave
SB On
SB Off
US 169
US169
NB On Ramp
Owasso Expy
N 129th E Ave
39
167
352
198
1775
224
66
1204
100
50
50
547
50
50
122
1389
592
50
1647
298
165
50
1830
1533
500
50
94
644
8857
8857
890
7422
7422
1050
401
468
250
332
127
1002
255
205
898
430
546
69
145
429
306
177
729
142
48
183
673
253
182
801
38
364
806
341
154
380
41

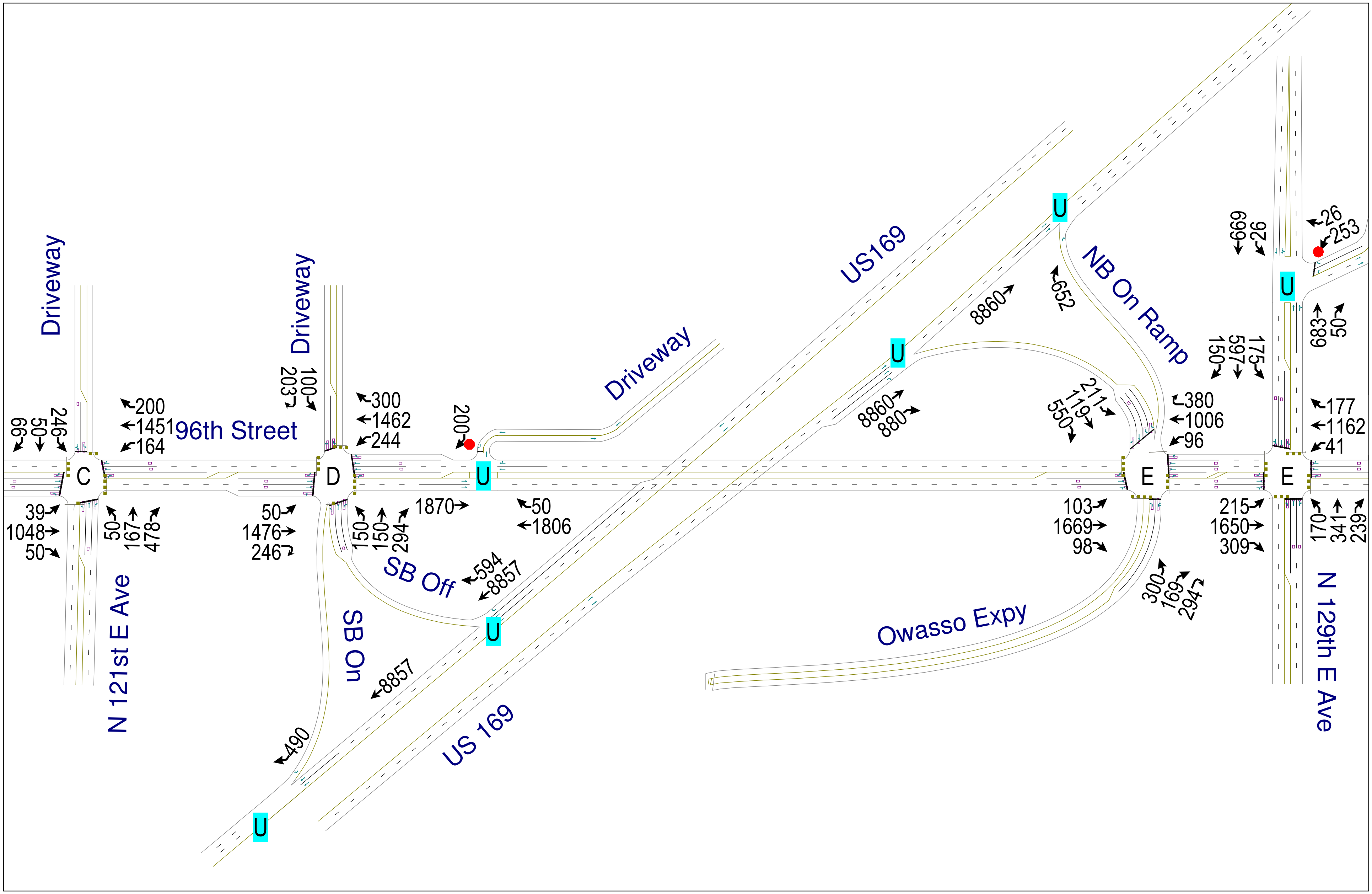
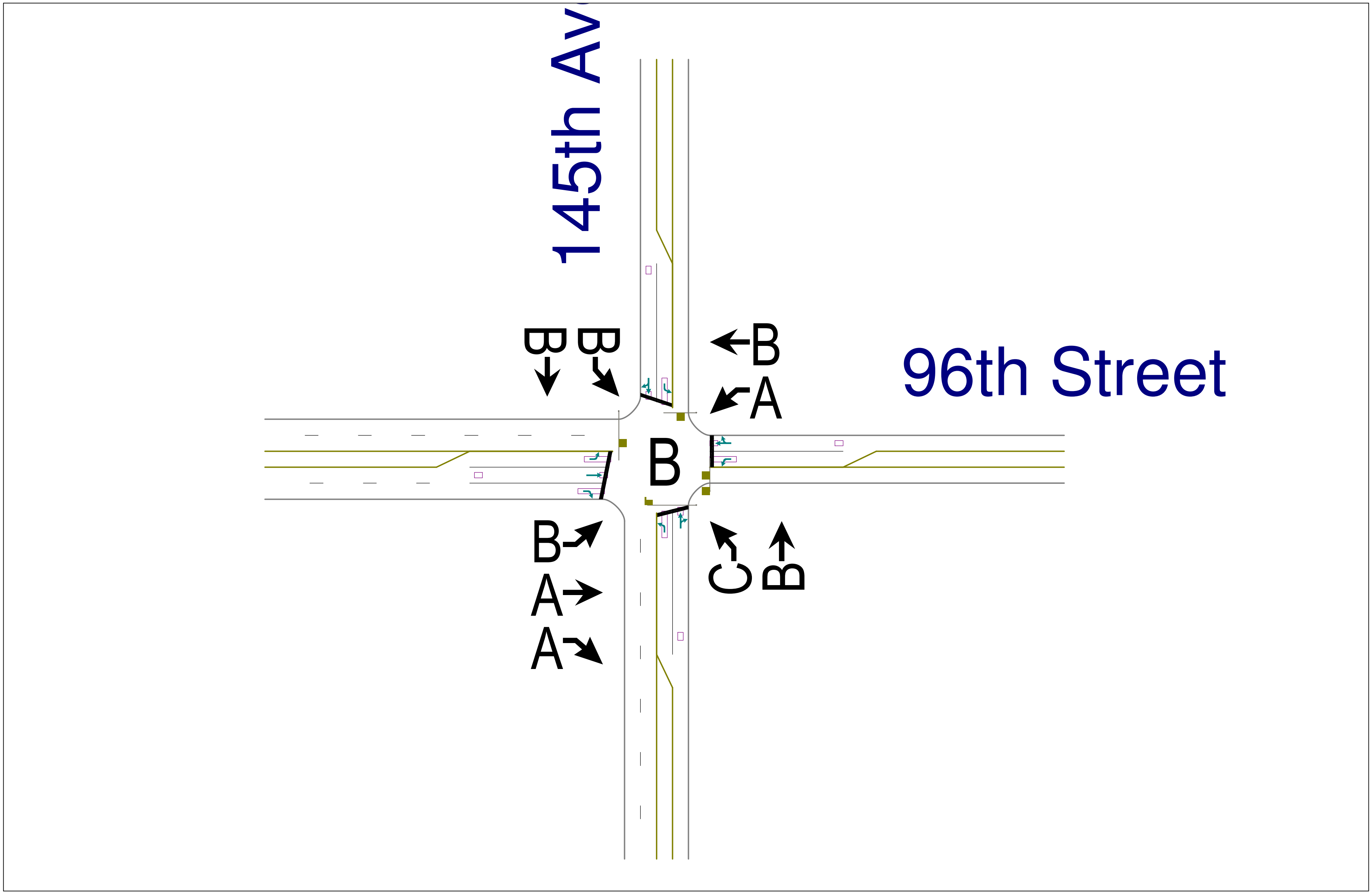
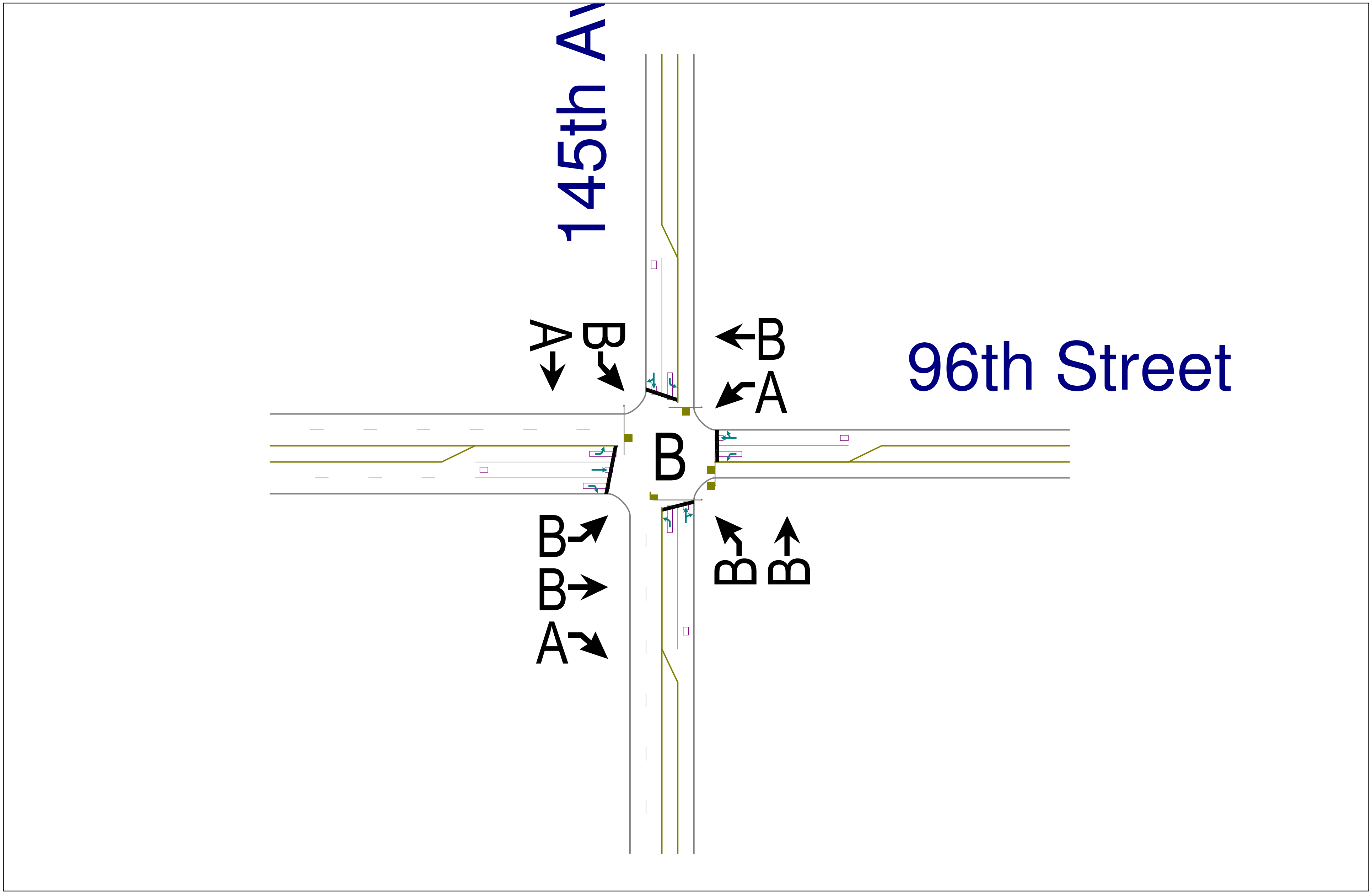

Driveway
Driveway
Driveway
96th Street
N 121st E Ave
SB On
SB Off
US 169
US169
NB On Ramp
Owasso Expy
N 129th E Ave
C
D
E
E
U
66
50
246
200
1451
164
39
1048
50
50
167
478
203
100
300
1462
244
50
1476
246
150
150
294
1870
200
50
1806
594
8857
8857
490
8860
880
8860
652
211
119
550
380
1006
96
103
1669
98
300
169
294
150
597
175
215
1650
309
699
26
26
253
683
50
177
1162
41
170
341
239

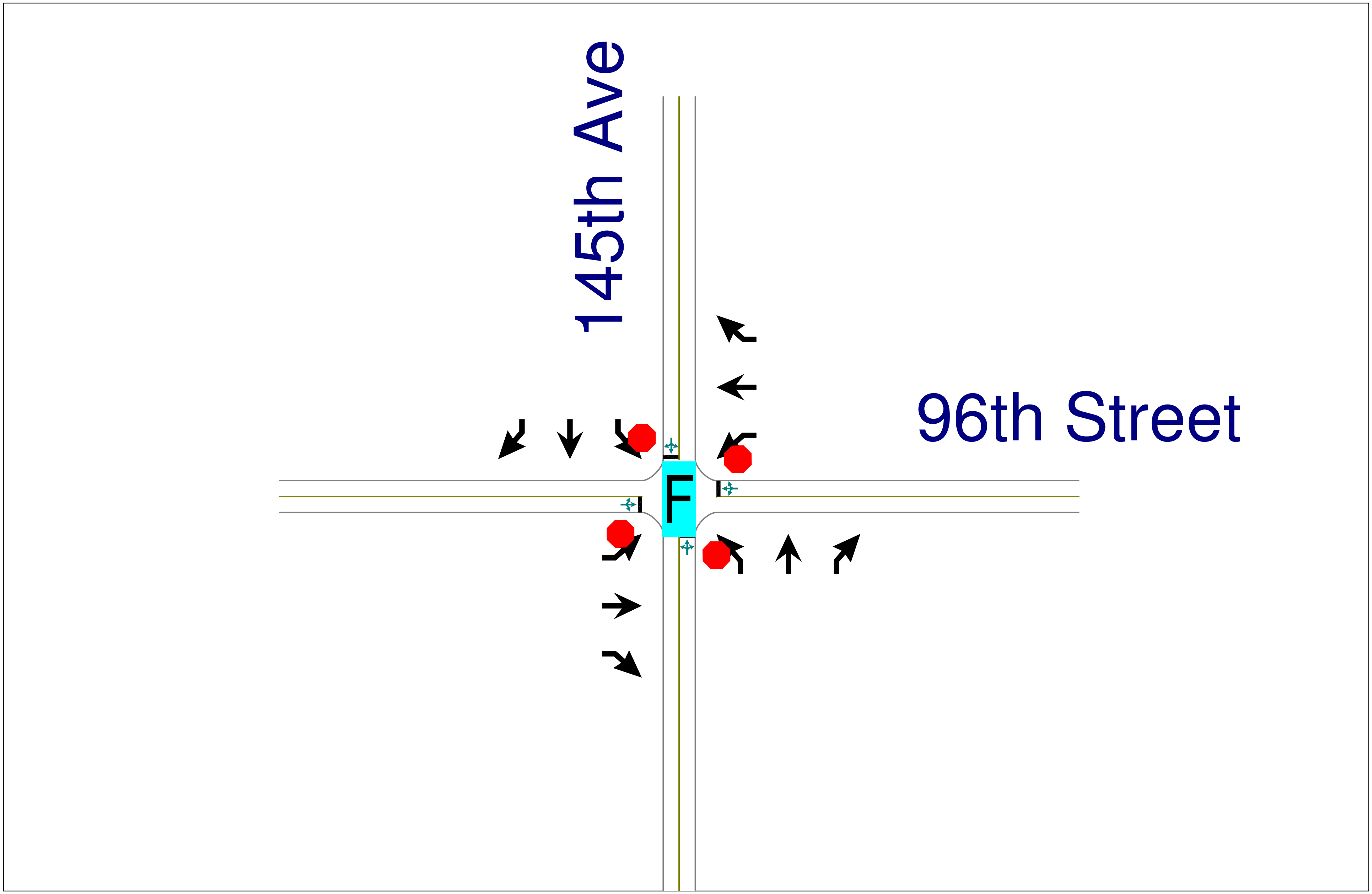
Figure A-3-3

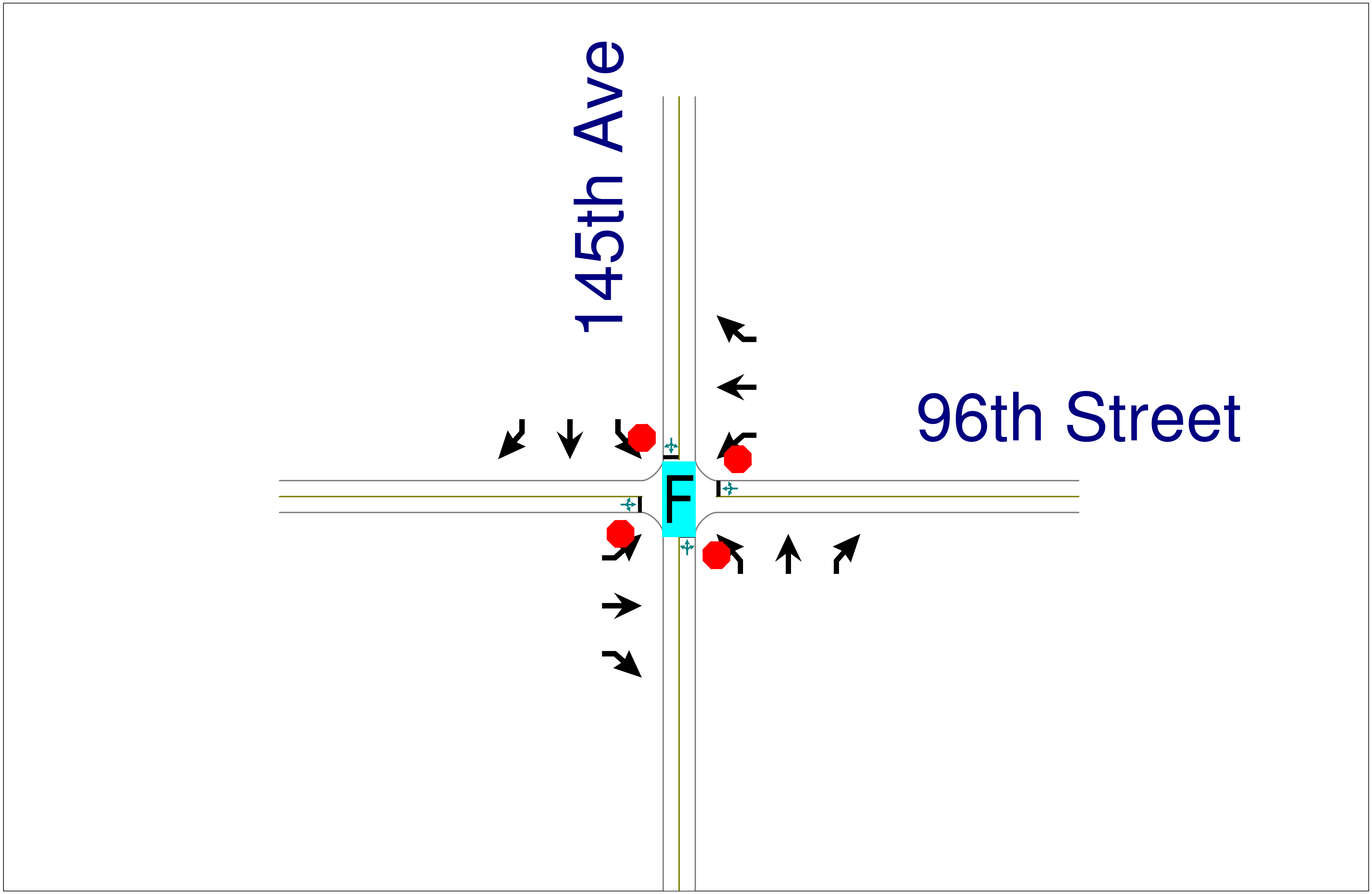
96^{th} Street N & 145^{th} E Avenue Intersection

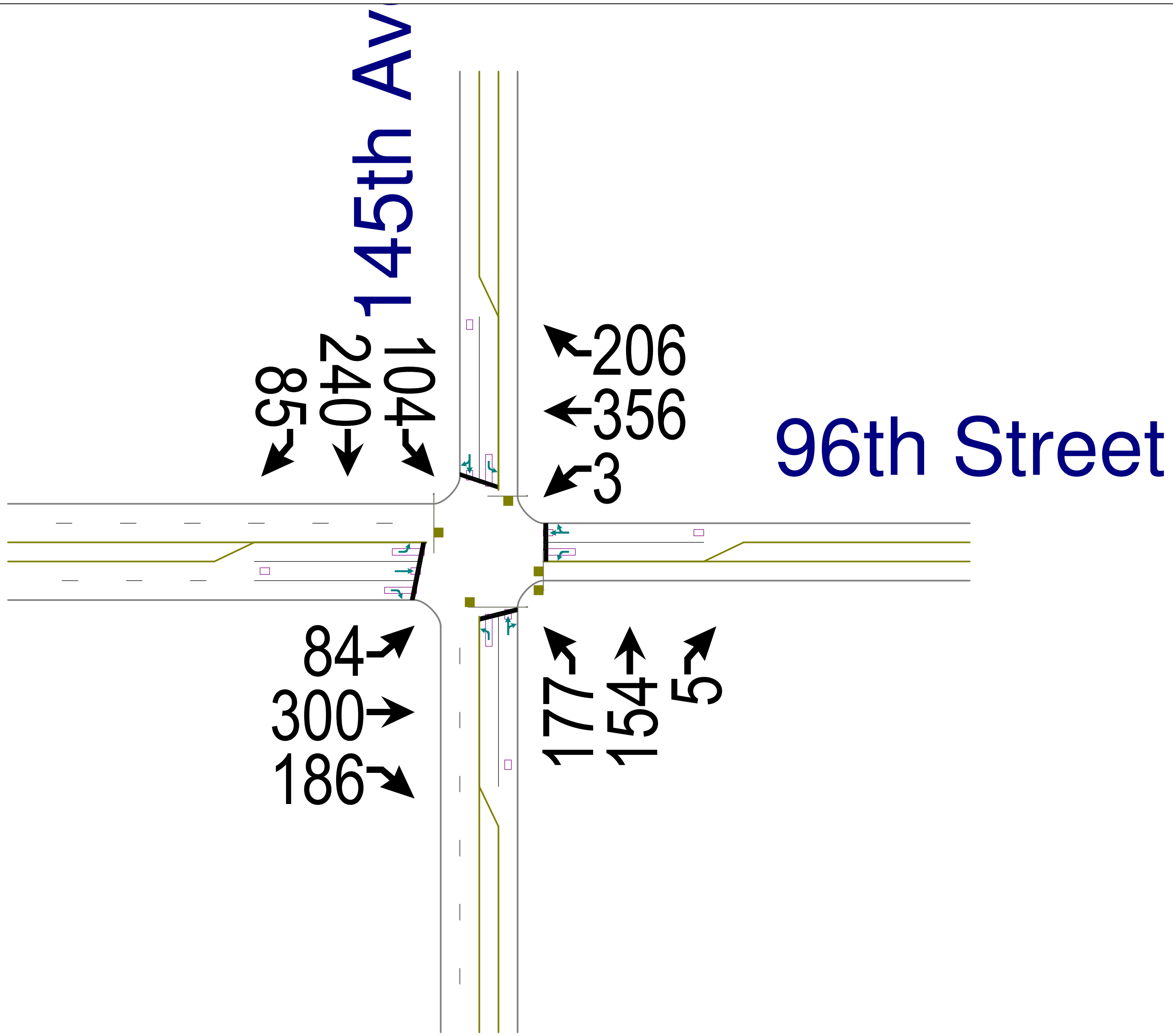
a. Future Improvements & 2035 Traffic Level of Service – AM Peak
b. Future Improvements & 2035 Traffic Level of Service – PM Peak
c. No-Build & 2035 Traffic Level of Service – AM Peak
d. No-Build & 2035 Traffic Level of Service – PM Peak
e. Future Improvements with 2035 Volumes – AM Peak
f. Future Improvements with 2035 Volumes – PM Peak
g. No-Build with 2035 Volumes – AM Peak
h. No-Build with 2035 Volumes – PM Peak

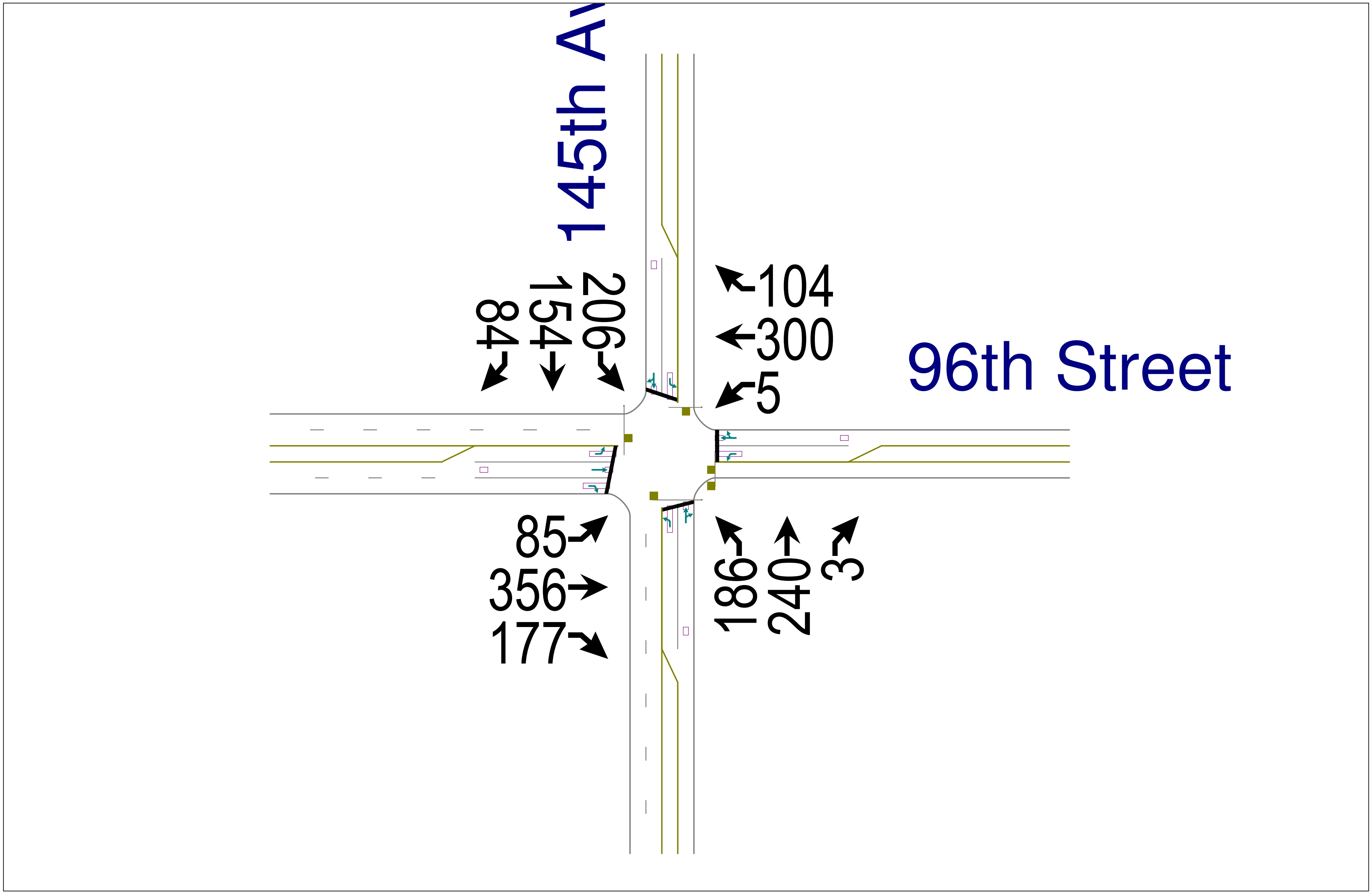

145th Ave
96th Street
B
A
B
B
B
A
A
C
B
B

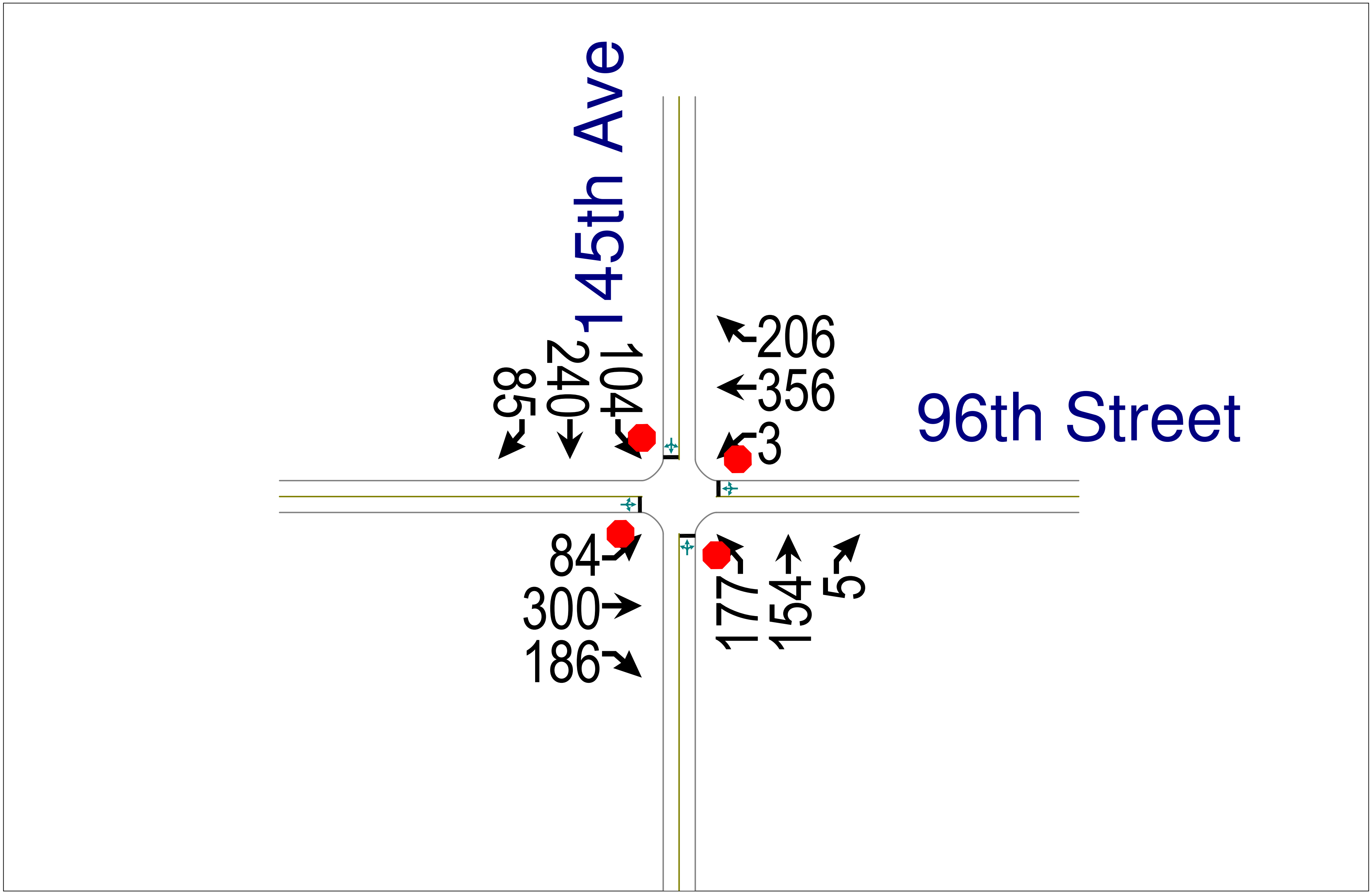

145th Av
96th Street
B
A
B
B
A
B
B
A
B
B


145th Ave
96th Street
F


145th Ave
96th Street
F


145th Ave
96th Street
104
240
85
206
356
3
84
300
186
177
154
5


145th Av
96th Street
206
154
84
104
300
5
85
356
177
186
240
3


145th Ave
96th Street
104
240
85
206
356
3
84
300
186
177
154
5

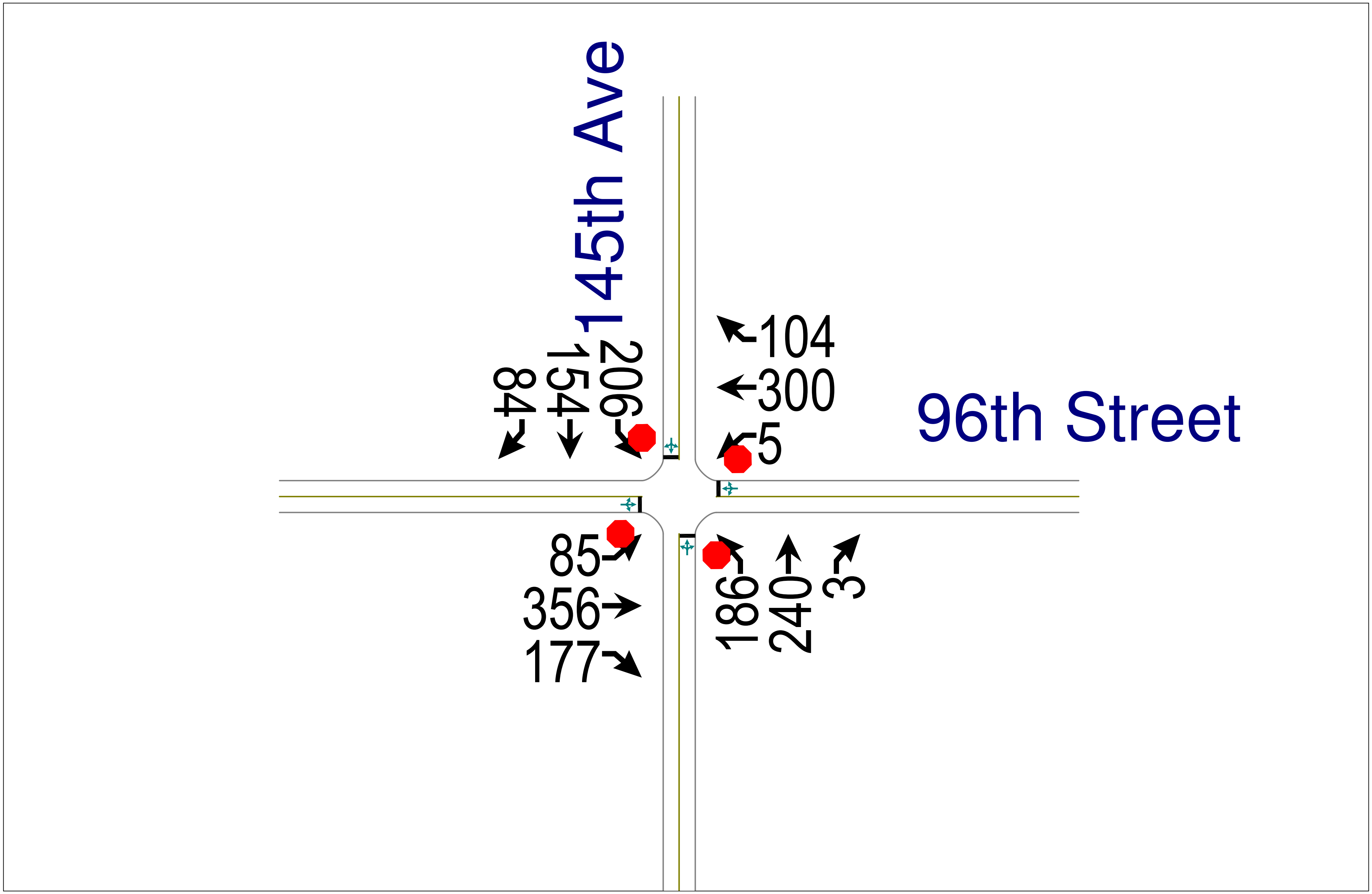
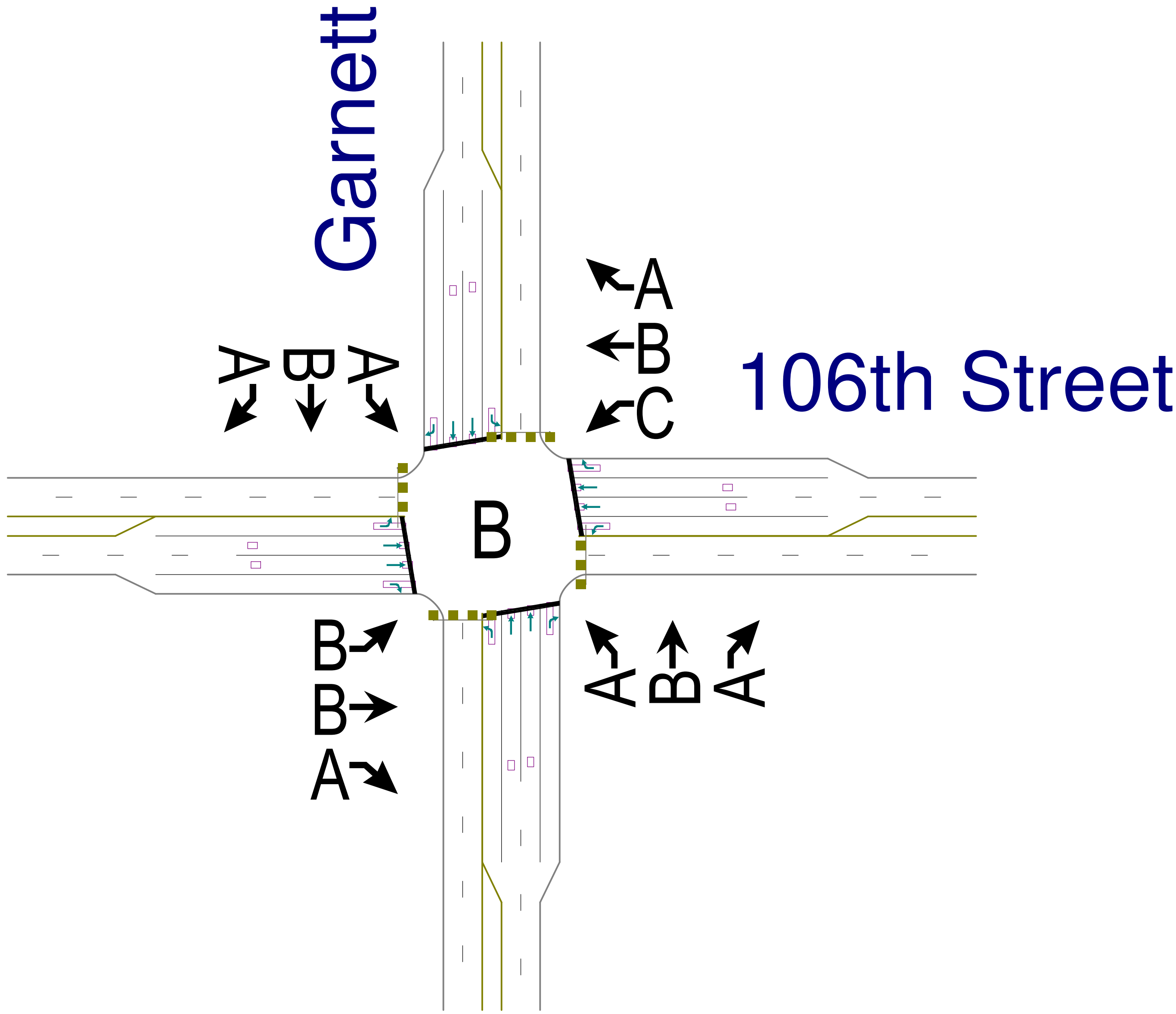
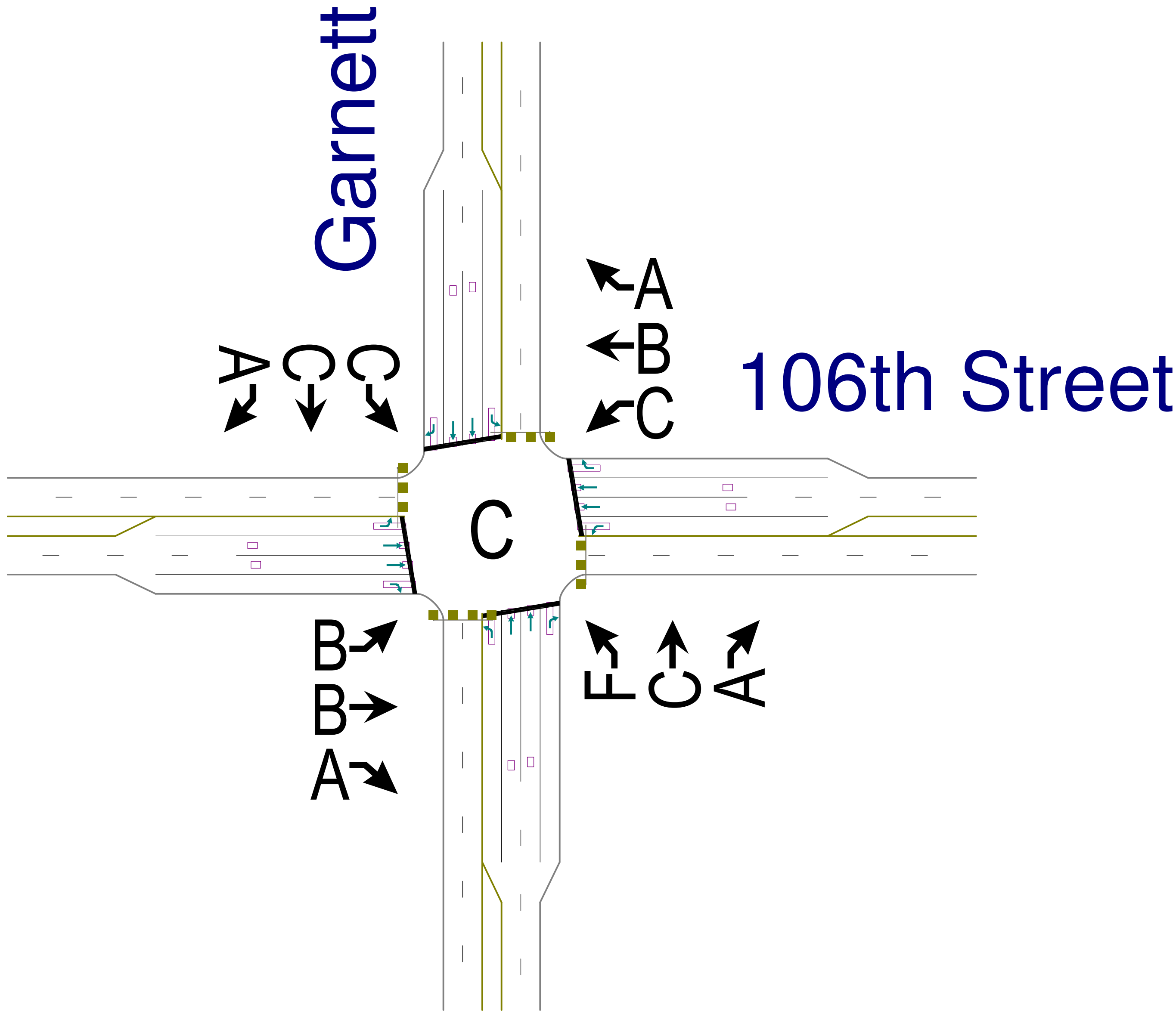

145th Ave
96th Street
104
300
5
206
154
84
85
356
177
186
240
3

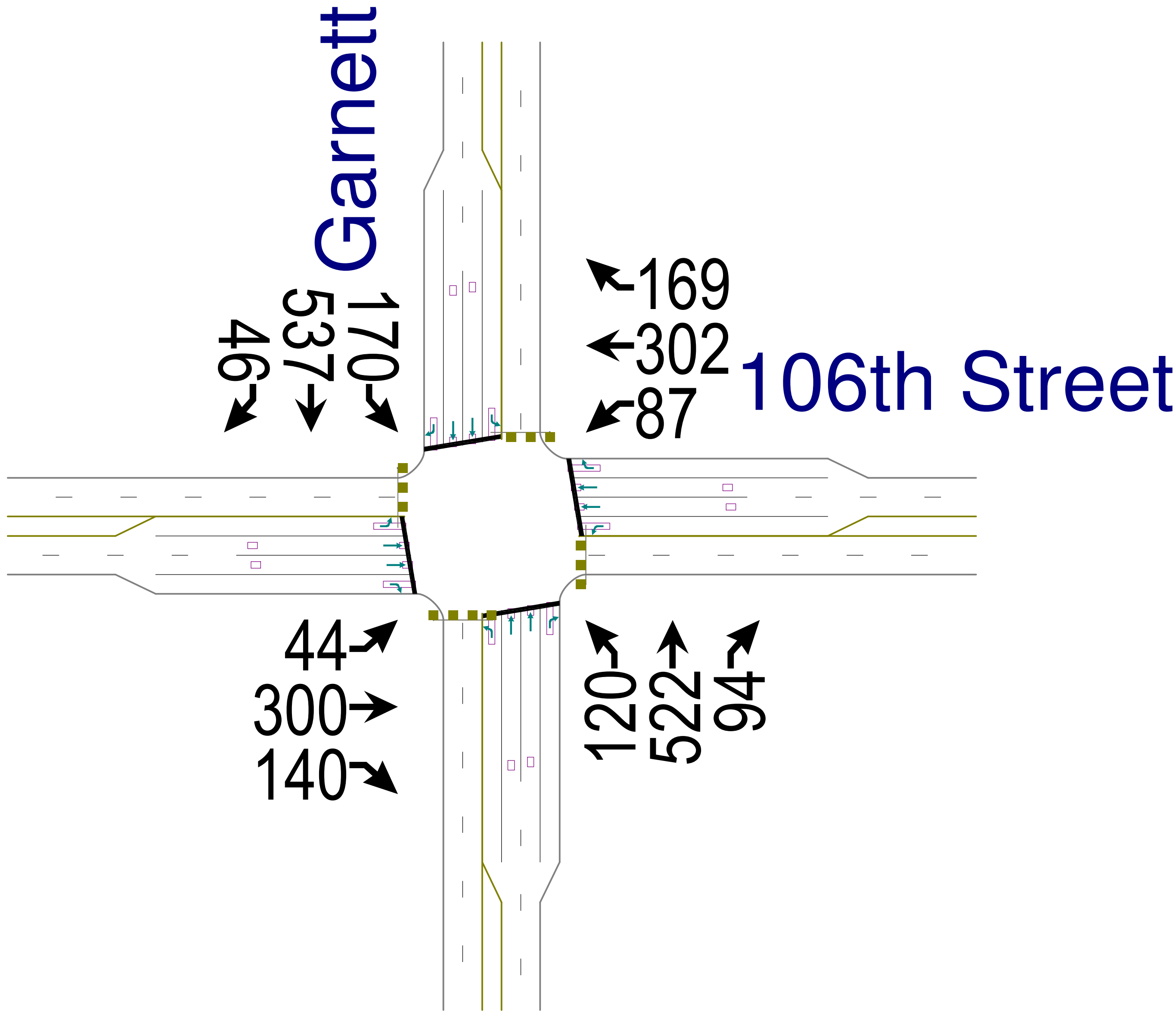
Figure A-4-1

106th Street N & Garnett Road Intersection

a. No-Build & 2035 Traffic Level of Service – AM Peak
b. No-Build & 2035 Traffic Level of Service – PM Peak
c. No-Build with 2035 Volumes – AM Peak
d. No-Build with 2035 Volumes – PM Peak


Garnett
106th Street
A
B
C
A
B
A
B
B
A
A
B
A
B


Garnett
106th Street
A
B
C
A
C
C
C
B
B
A
F
C
A


Garnett
106th Street
46
537
170
169
302
87
44
300
140
120
522
94

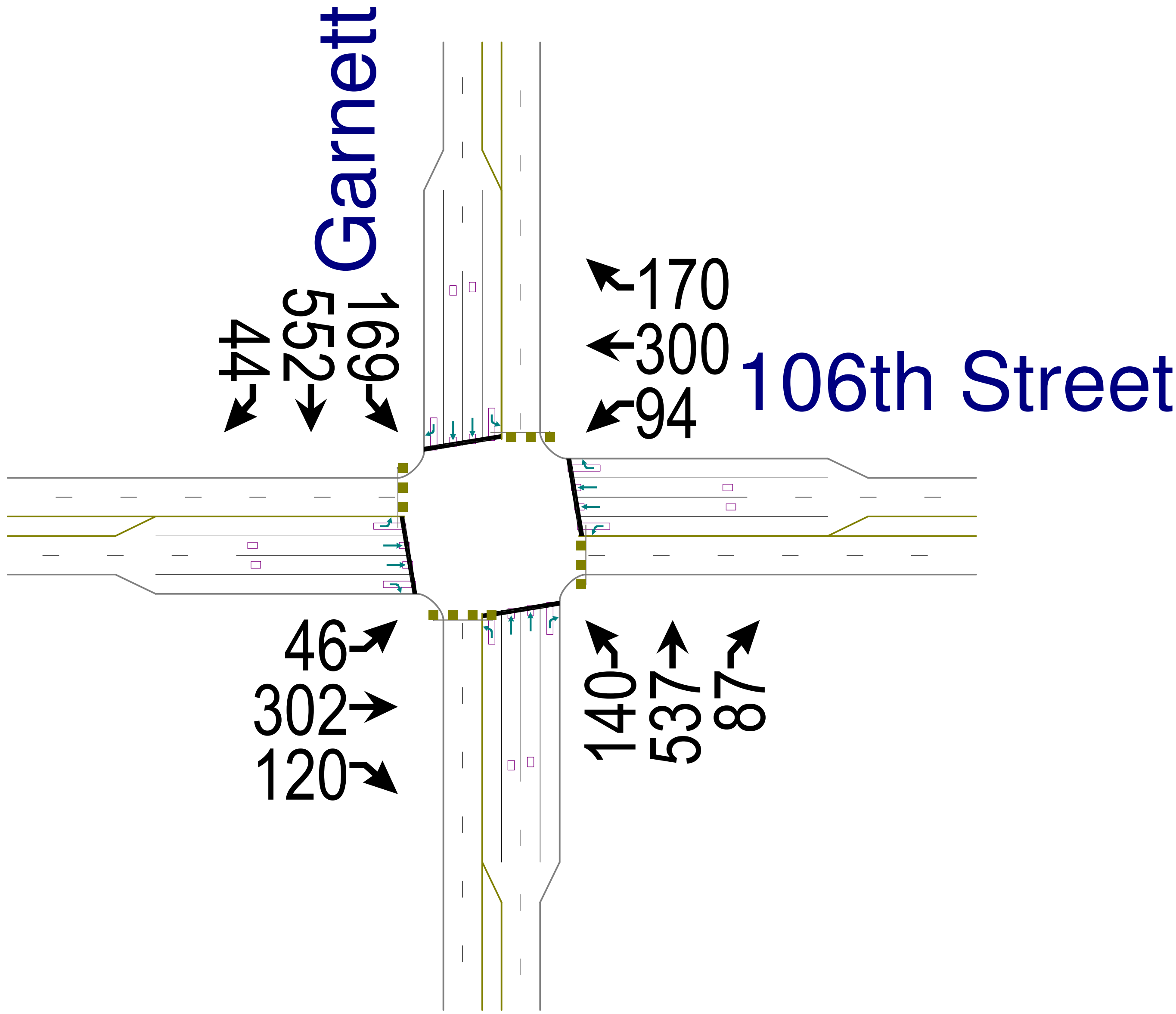
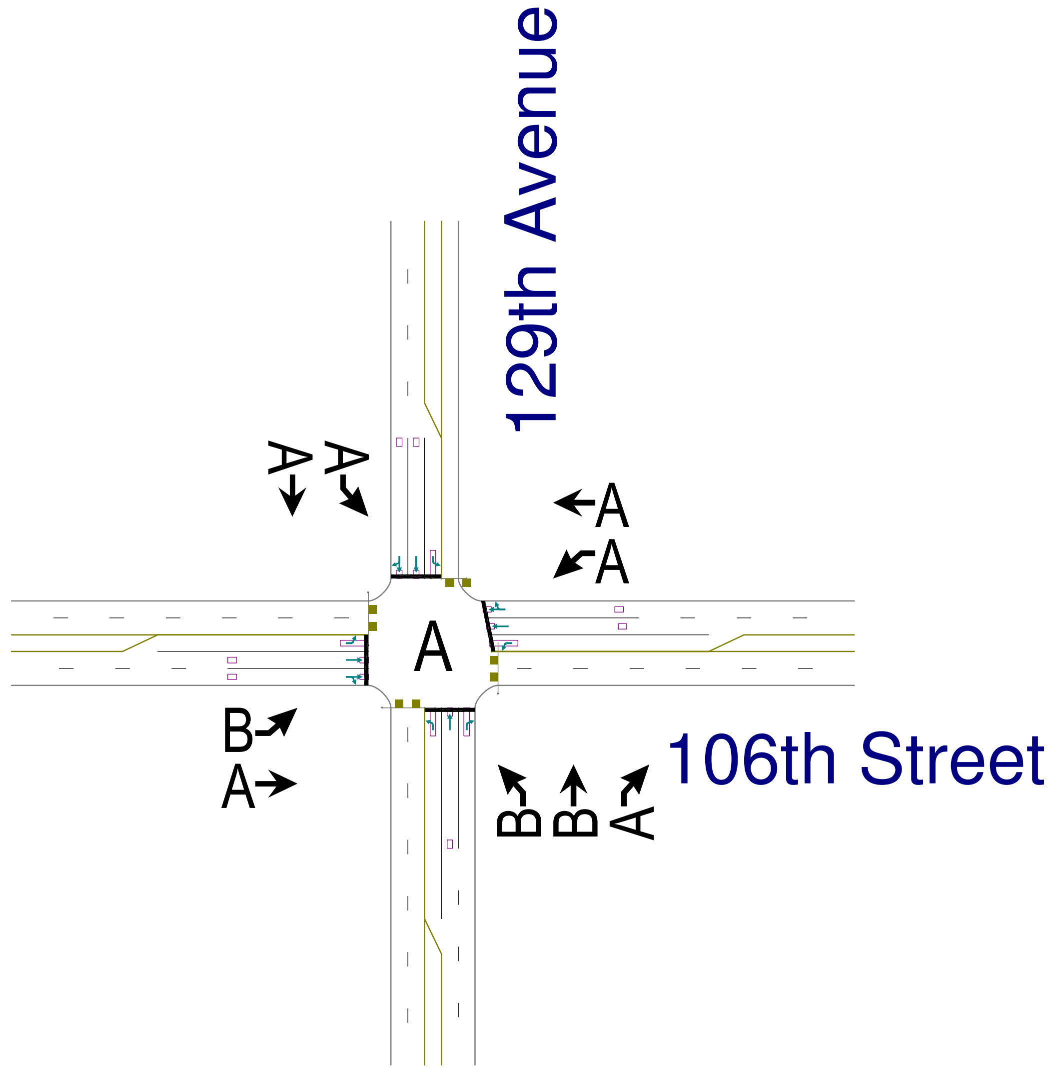
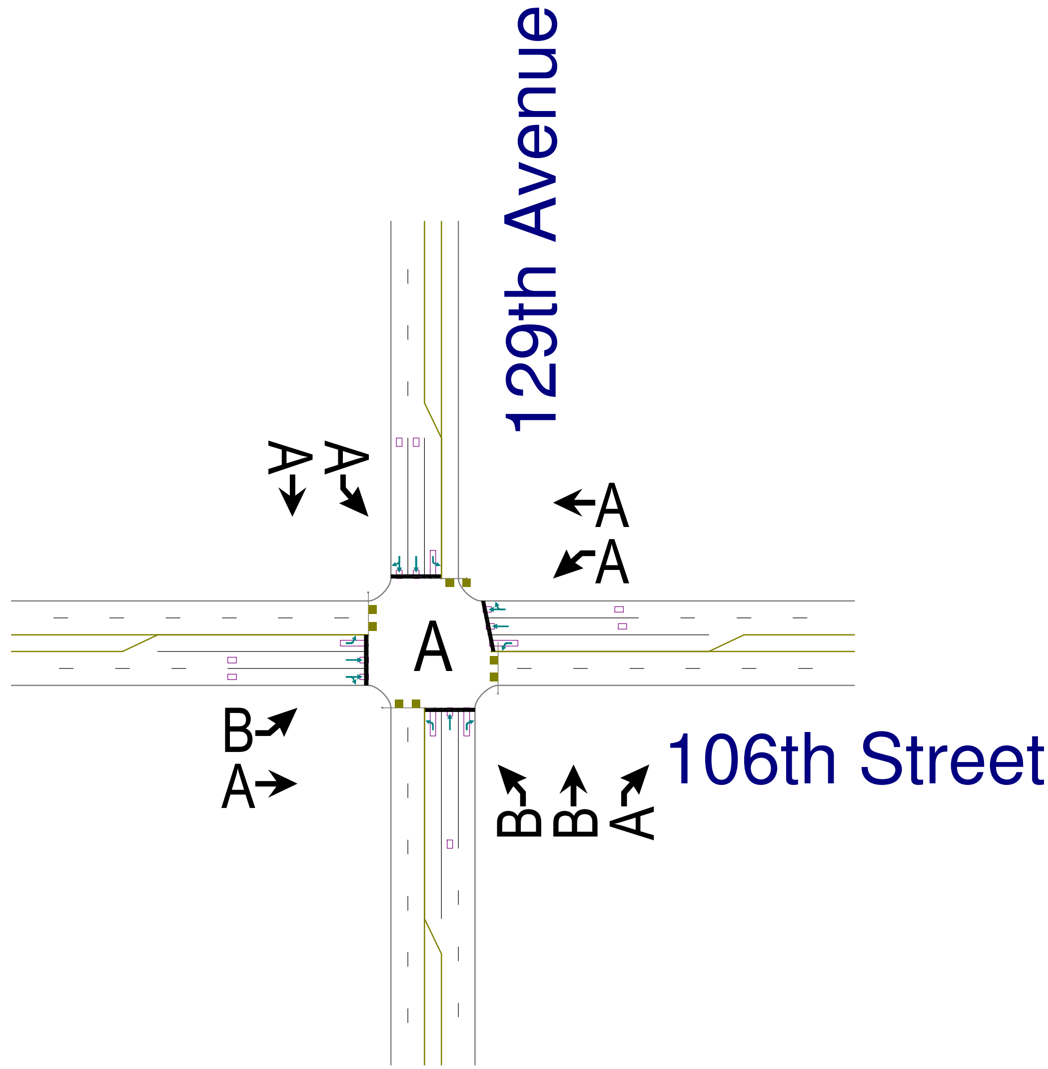

Garnett
106th Street
44
552
169
170
300
94
46
302
120
140
537
87

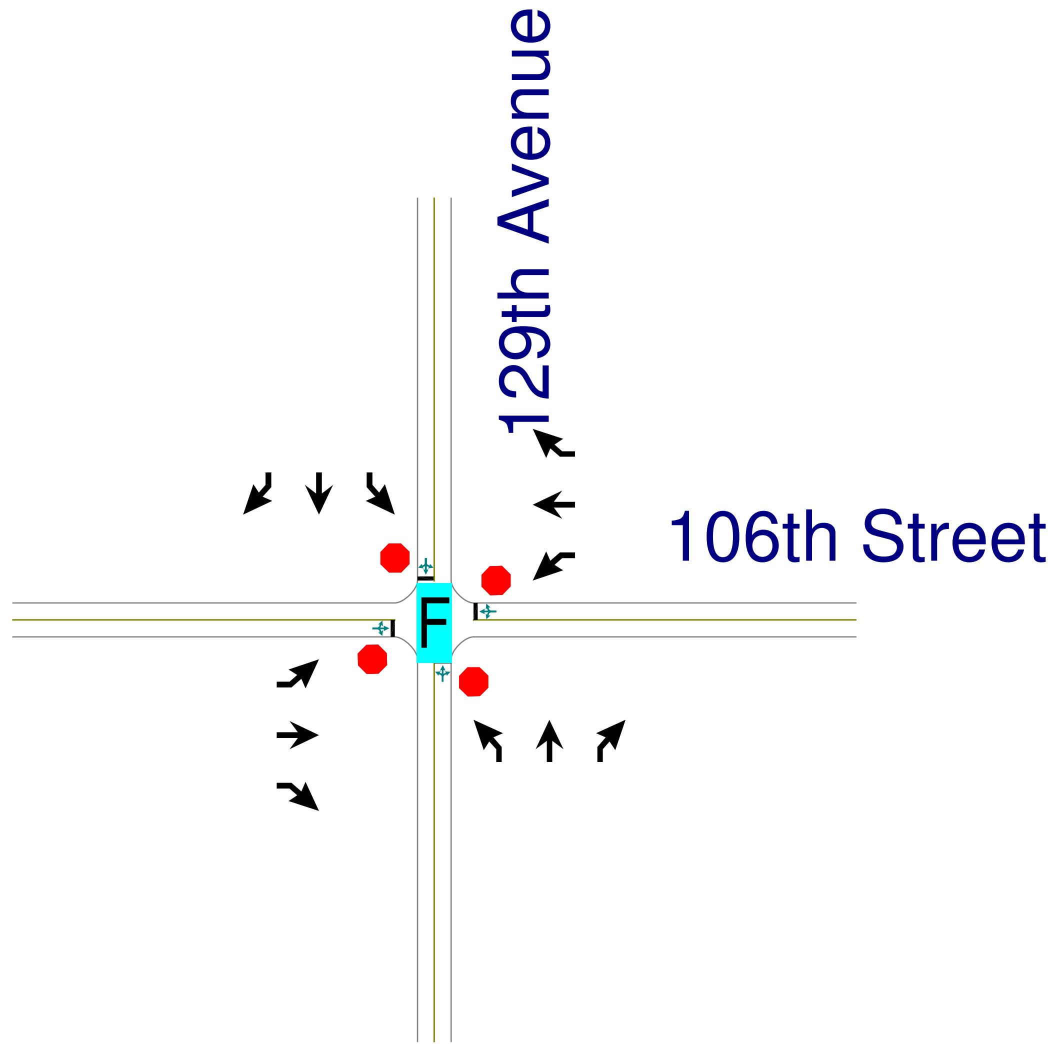
Figure A-4-2

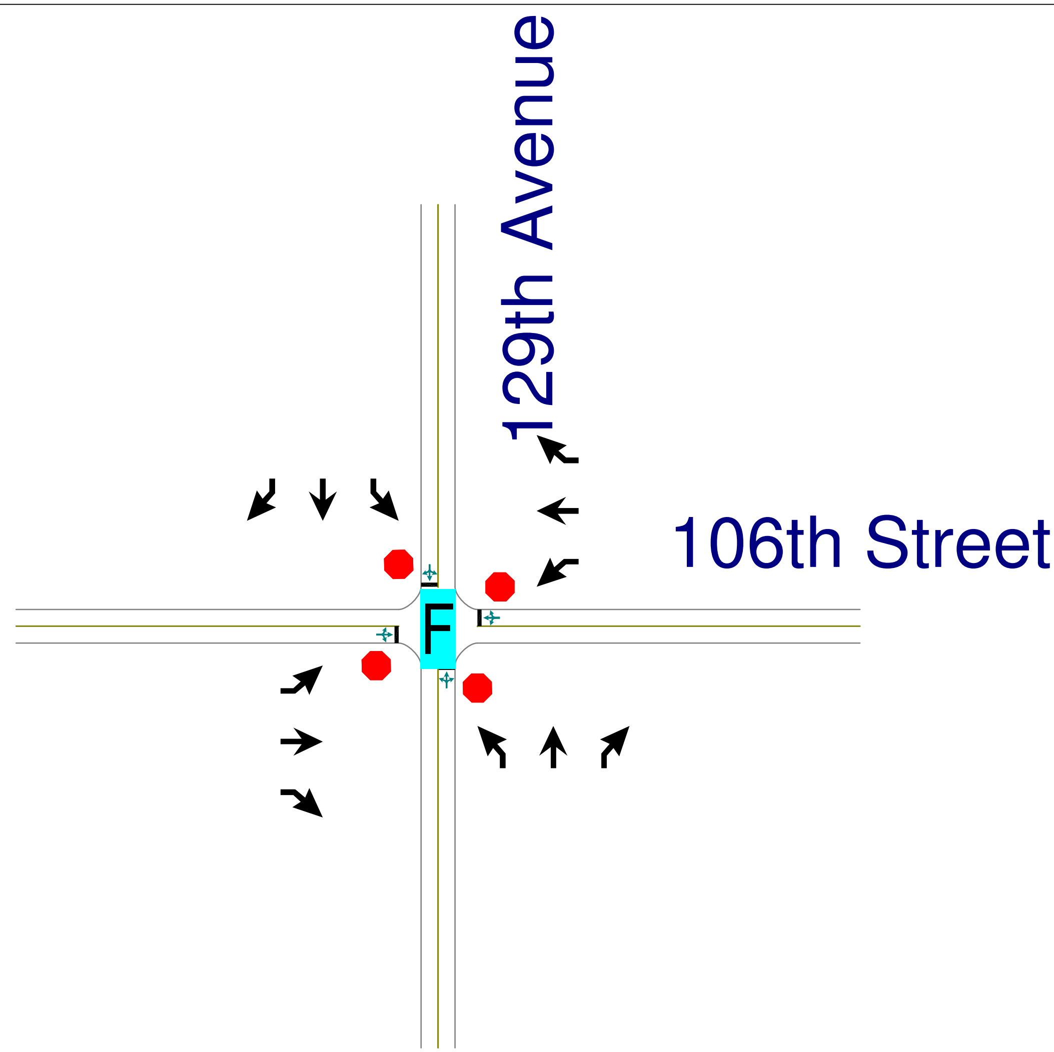
106th Street N & 129th E Avenue Intersection

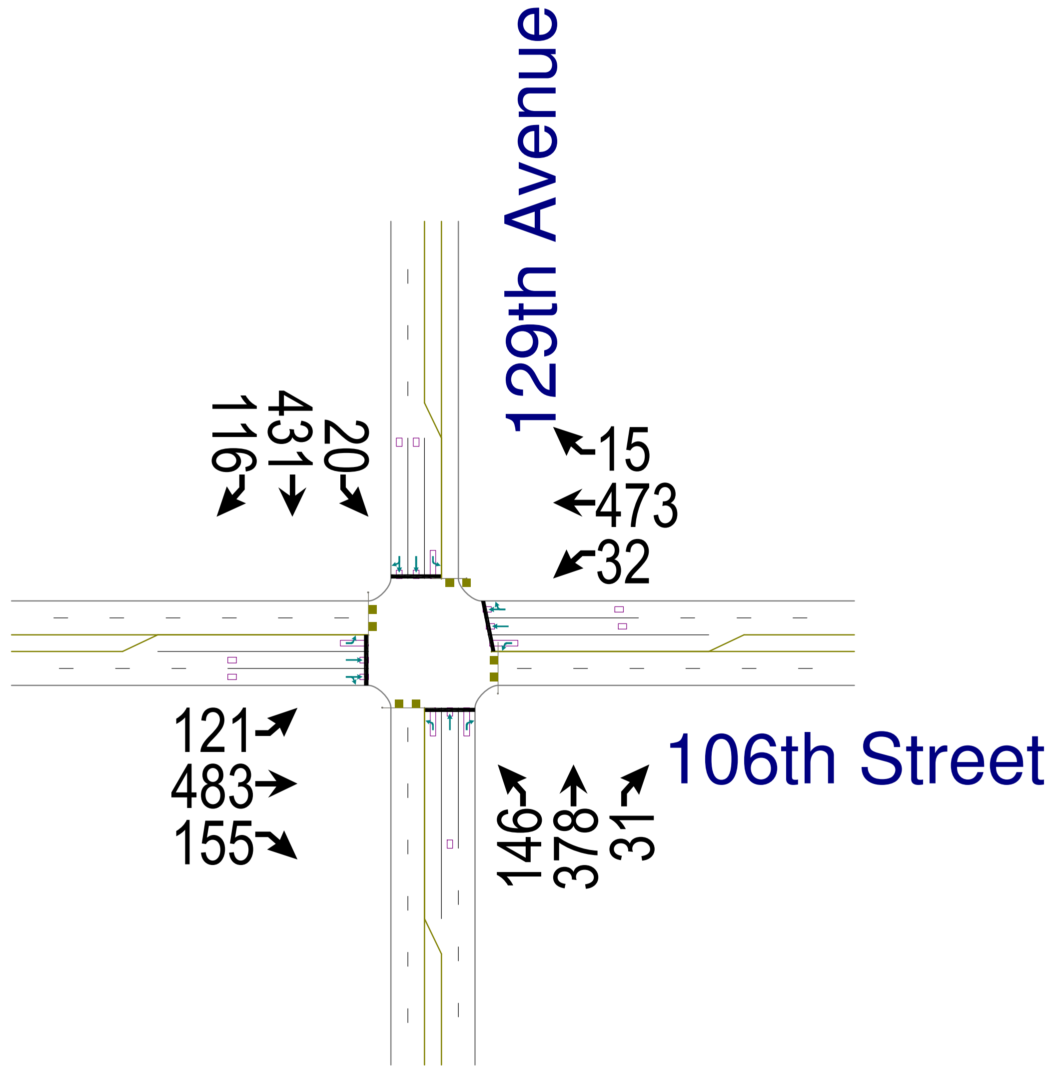
a. Future Improvements & 2035 Traffic Level of Service – AM Peak
b. Future Improvements & 2035 Traffic Level of Service – PM Peak
c. No-Build & 2035 Traffic Level of Service – AM Peak
d. No-Build & 2035 Traffic Level of Service – PM Peak
e. Future Improvements with 2035 Volumes – AM Peak
f. Future Improvements with 2035 Volumes – PM Peak
g. No-Build with 2035 Volumes – AM Peak
h. No-Build with 2035 Volumes – PM Peak

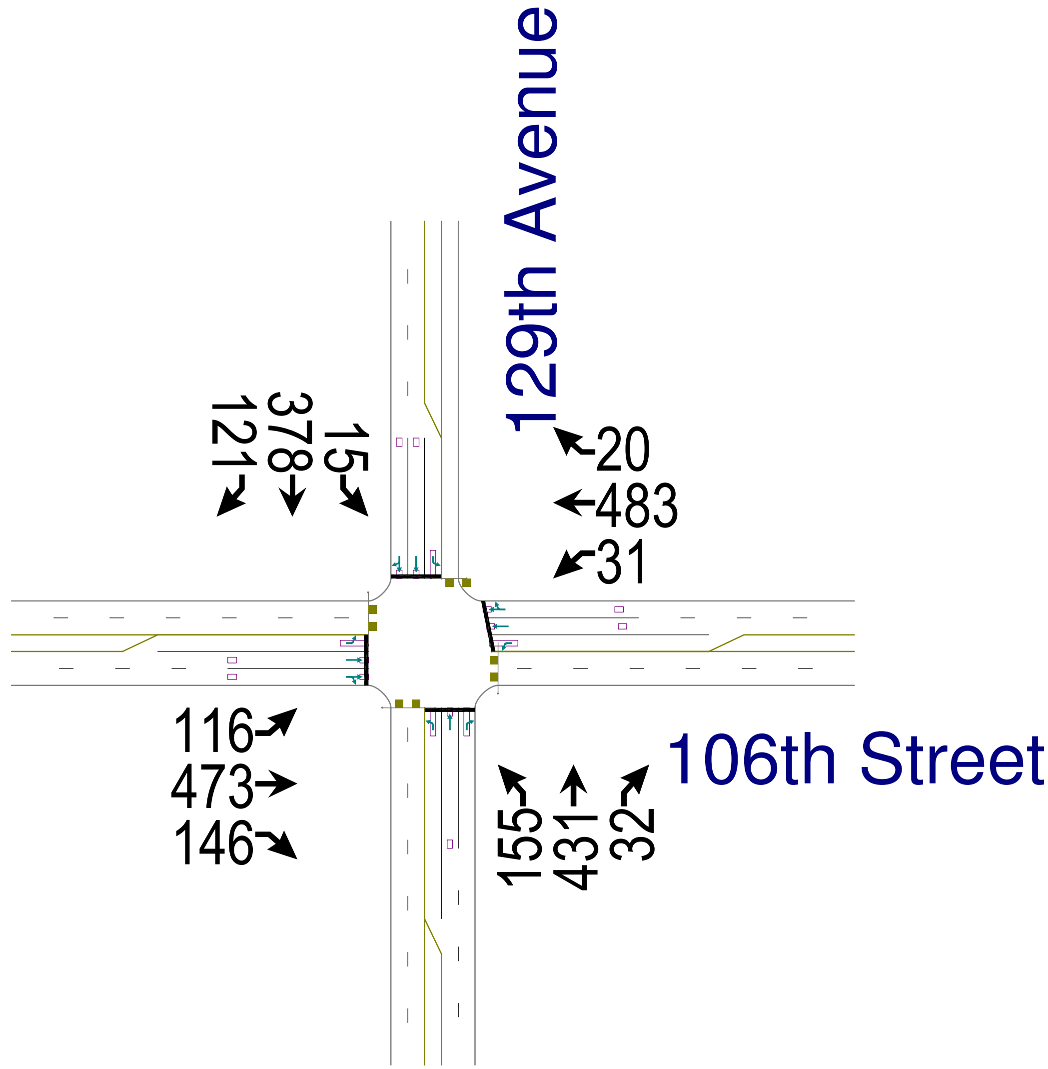

129th Avenue
106th Street
A
A
A
A
A
B
A
B
B
A

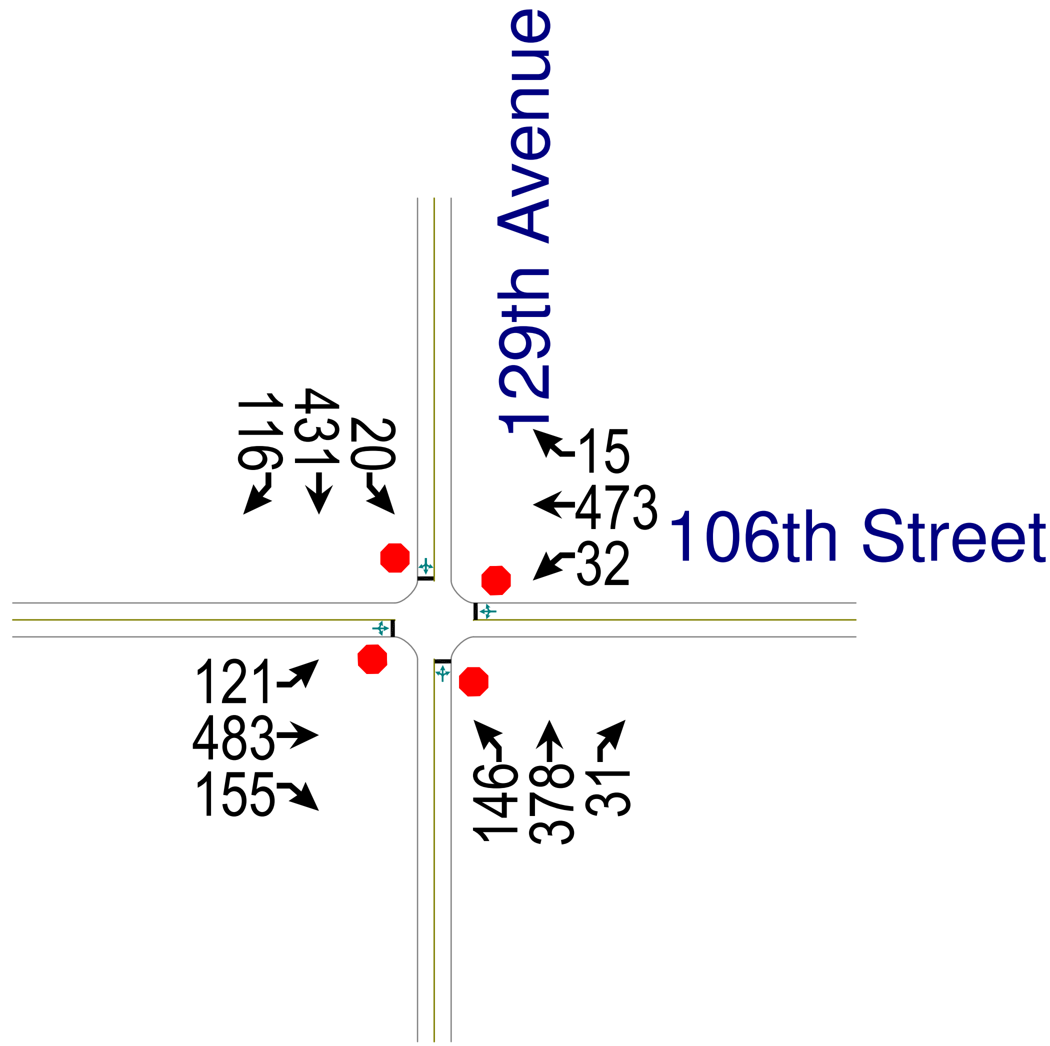

129th Avenue
106th Street
A
A
A
A
A
B
A
B
B
A
A


129th Avenue
106th Street
F


129th Avenue
106th Street
F


129th Avenue
106th Street
20
431
116
15
473
32
121
483
155
146
378
31


129th Avenue
106th Street
121
378
15
20
483
31
116
473
146
155
431
32


129th Avenue
106th Street
116
431
20
15
473
32
121
483
155
146
378
31

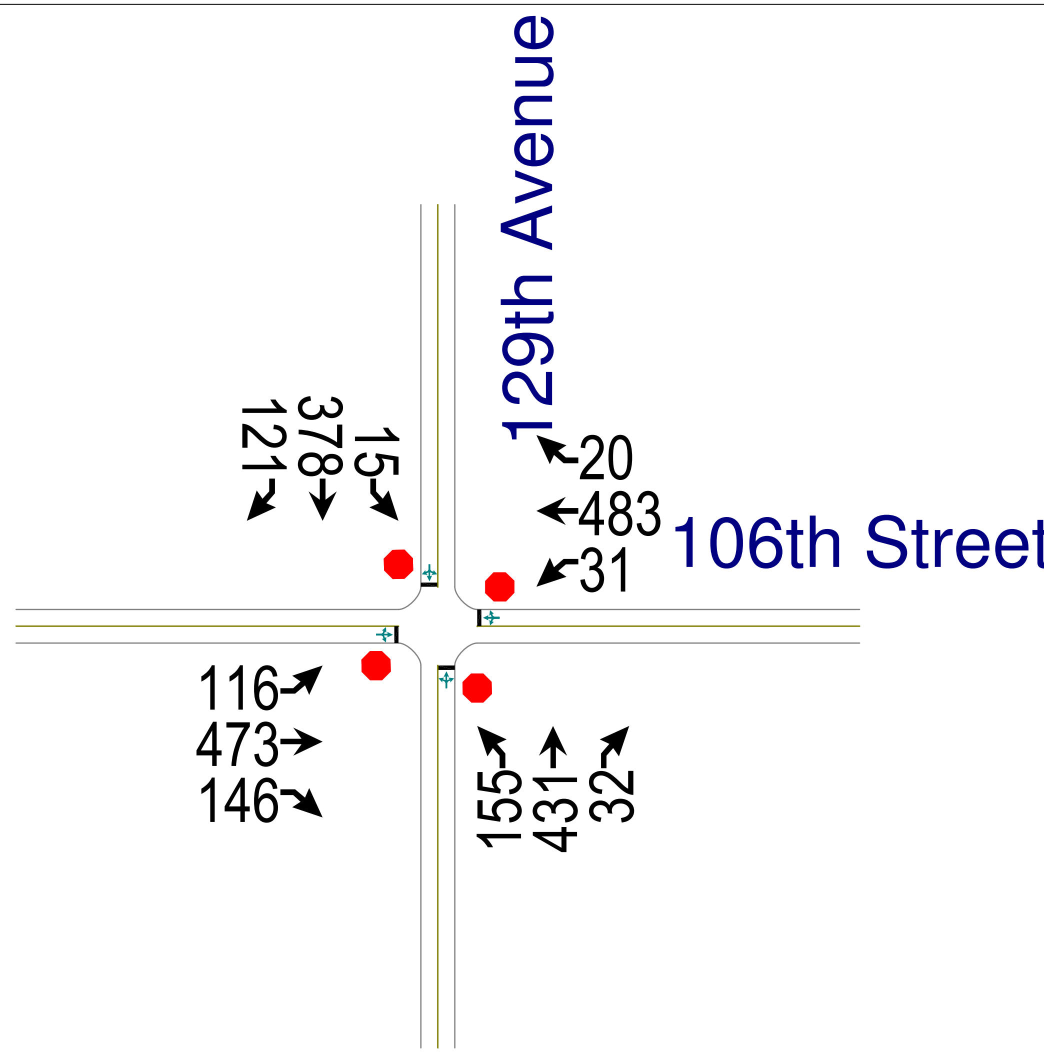
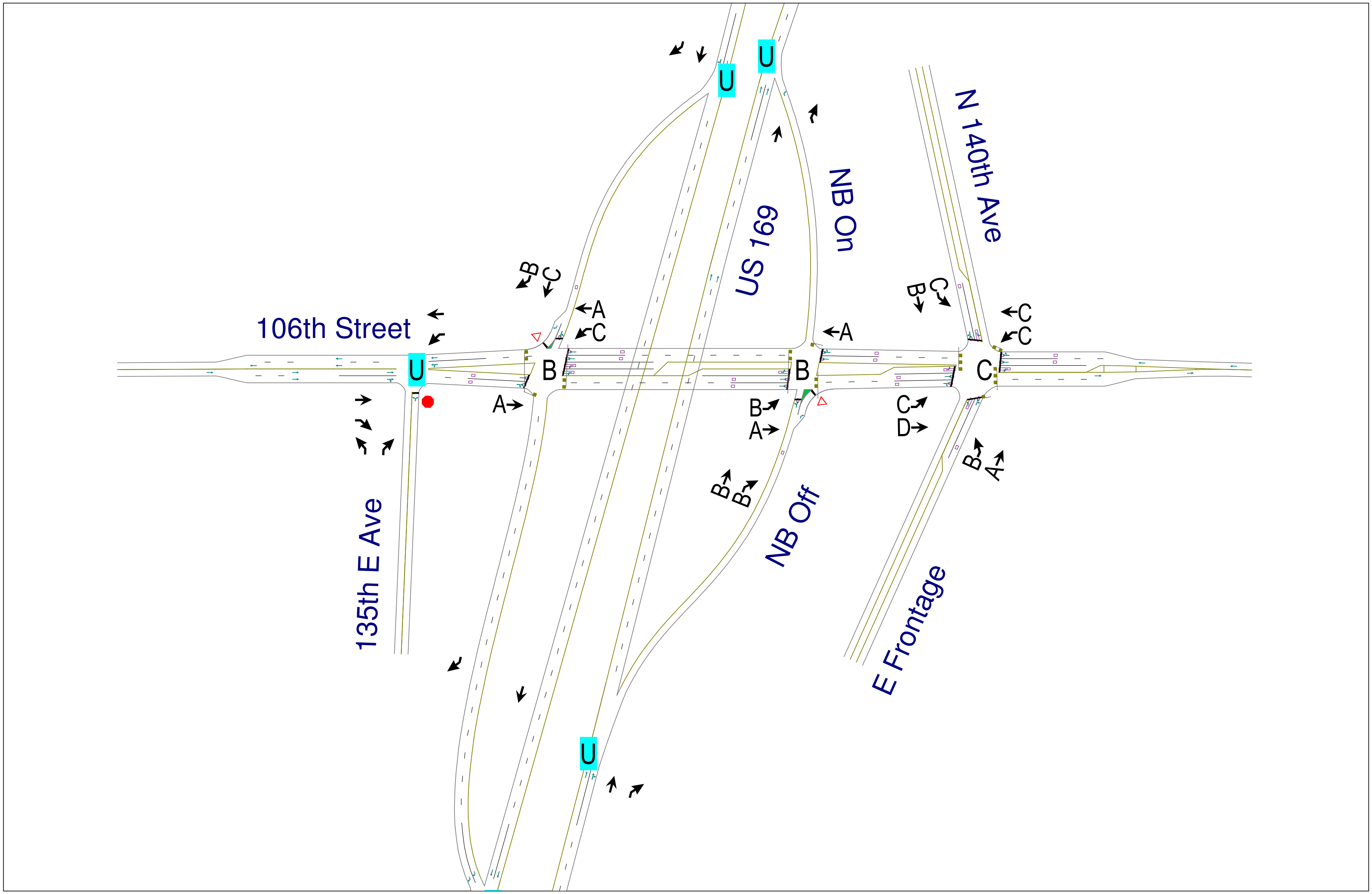
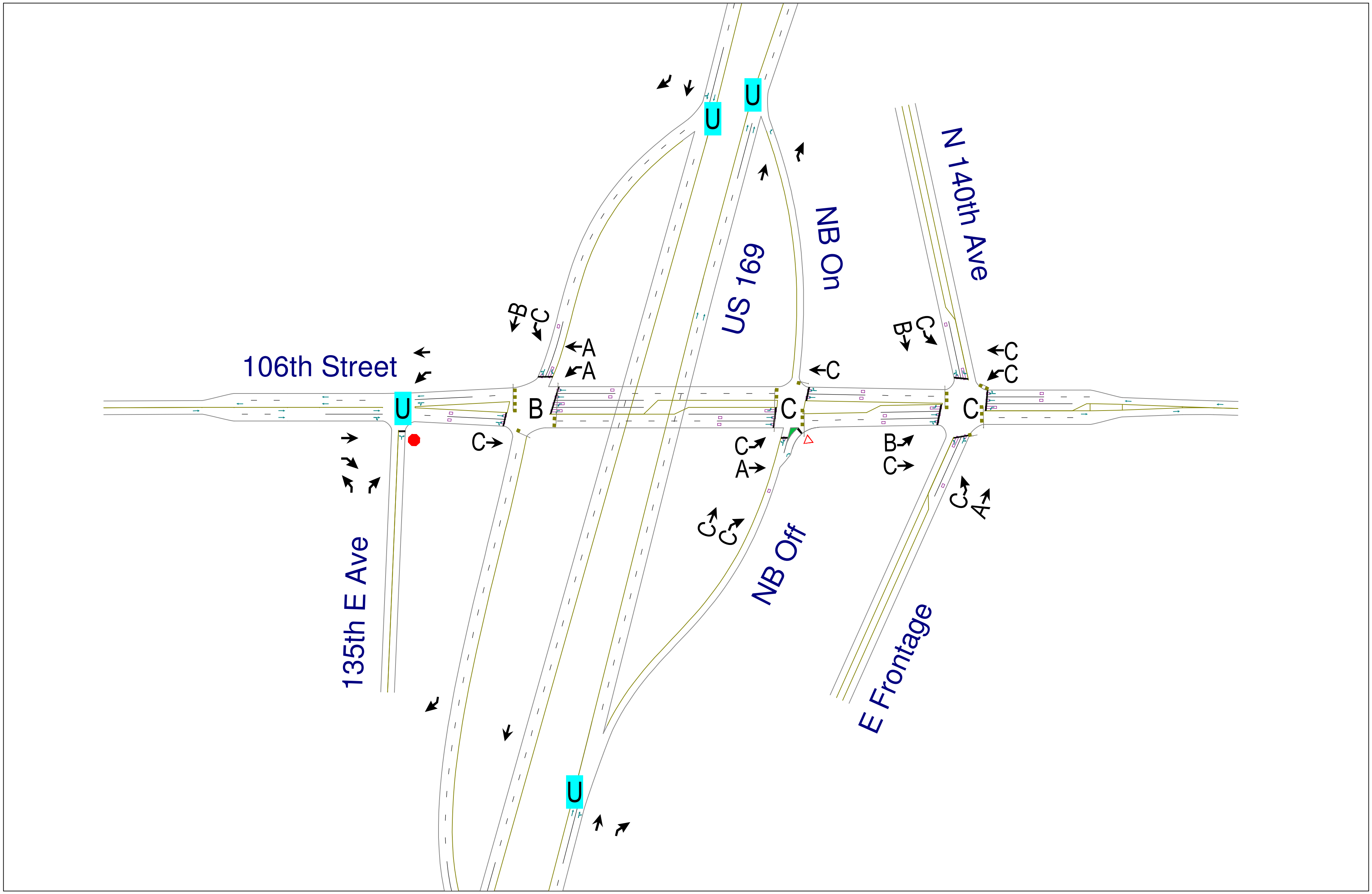

129th Avenue
106th Street
15
378
121
20
483
31
116
473
146
155
431
32

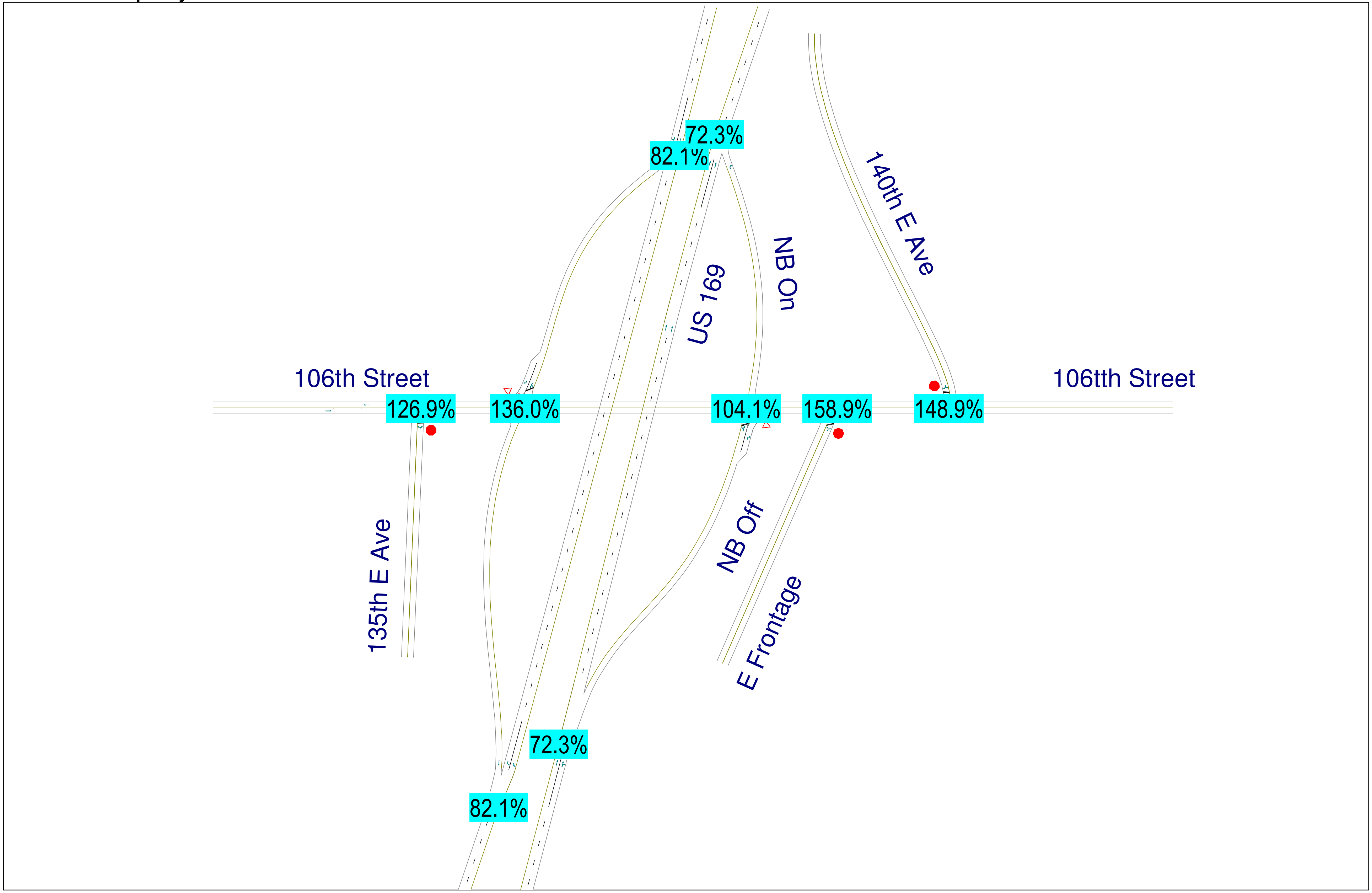
Figure A-4-3

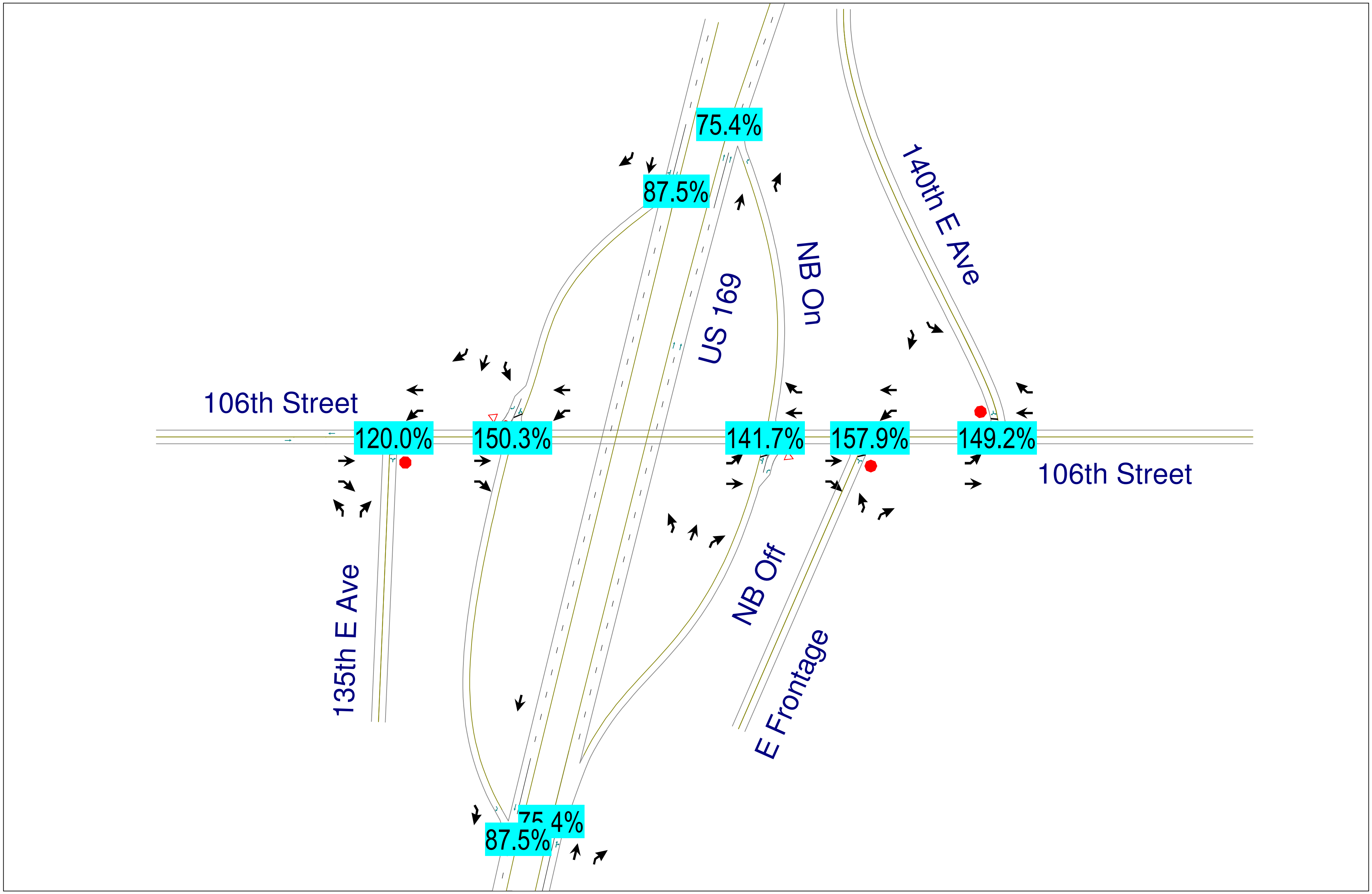
106th Street N & US 169 Interchange

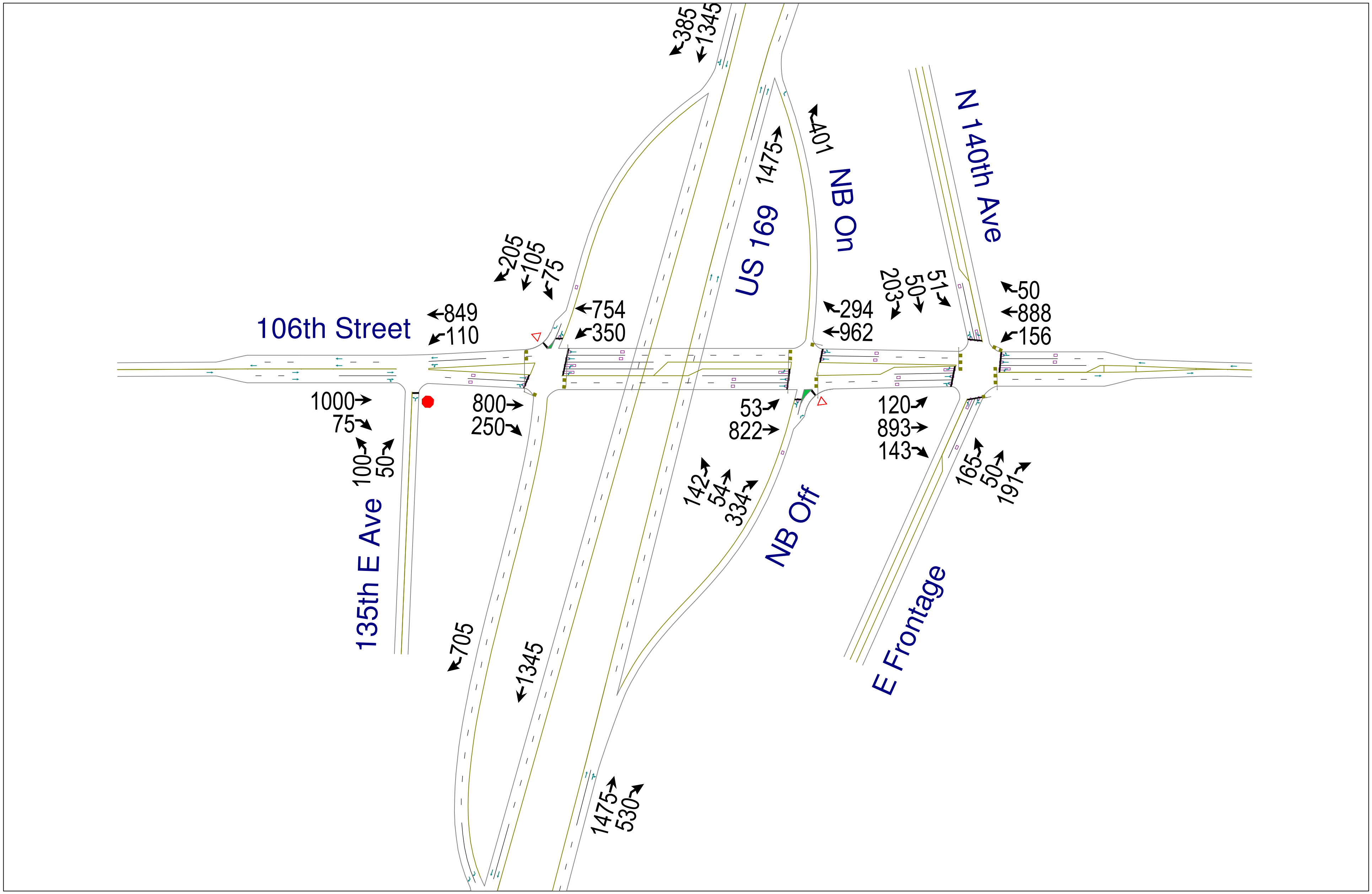
a. Future Improvements & 2035 Traffic Level of Service – AM Peak
b. Future Improvements & 2035 Traffic Level of Service – PM Peak
c. No-Build & 2035 Traffic Level of Service – AM Peak
d. No-Build & 2035 Traffic Level of Service – PM Peak
e. Future Improvements with 2035 Volumes – AM Peak
f. Future Improvements with 2035 Volumes – PM Peak
g. No-Build with 2035 Volumes – AM Peak
h. No-Build with 2035 Volumes – PM Peak

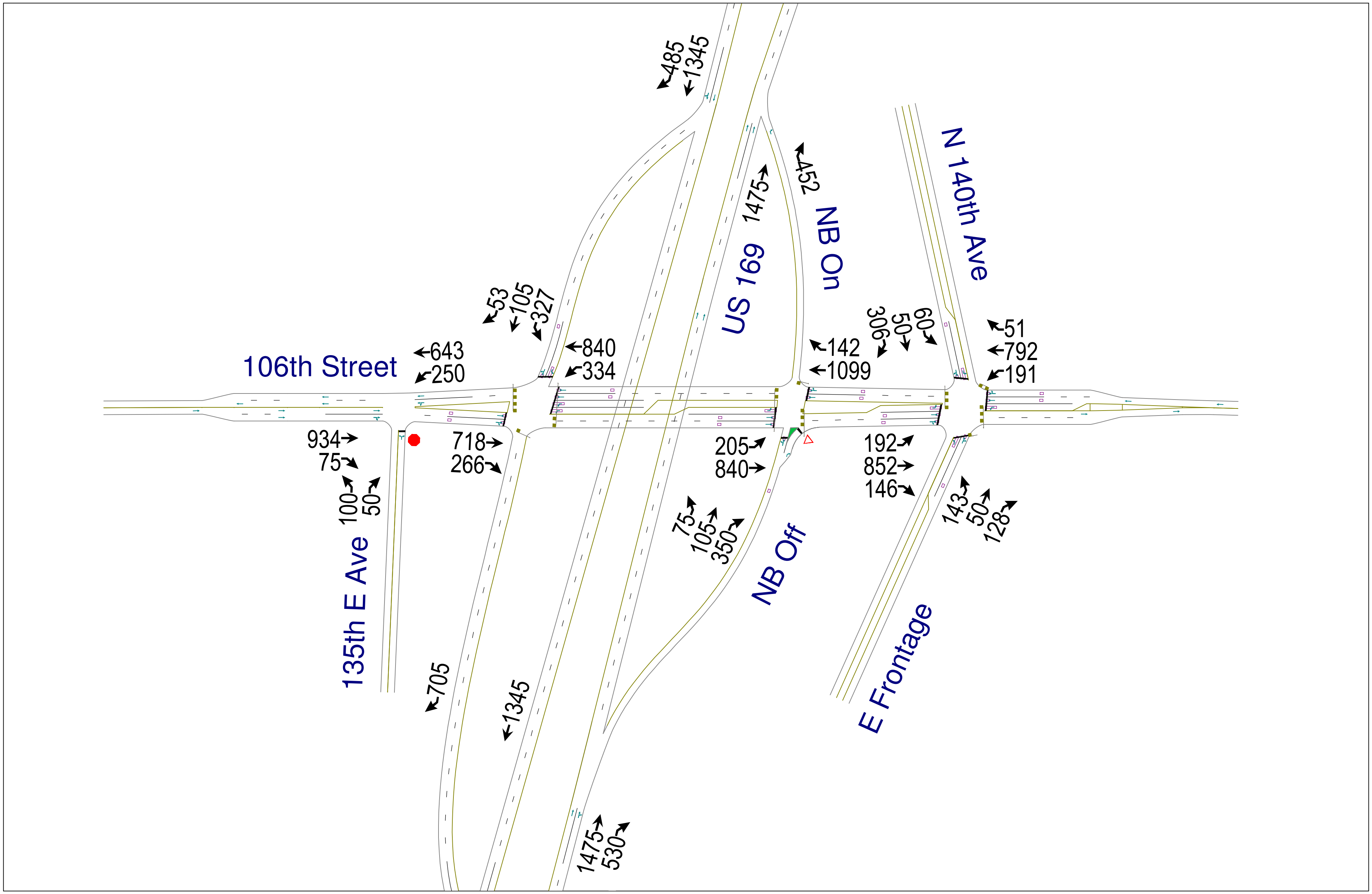

106th Street
135th E Ave
US 169
NB On
NB Off
N 140th Ave
E Frontage

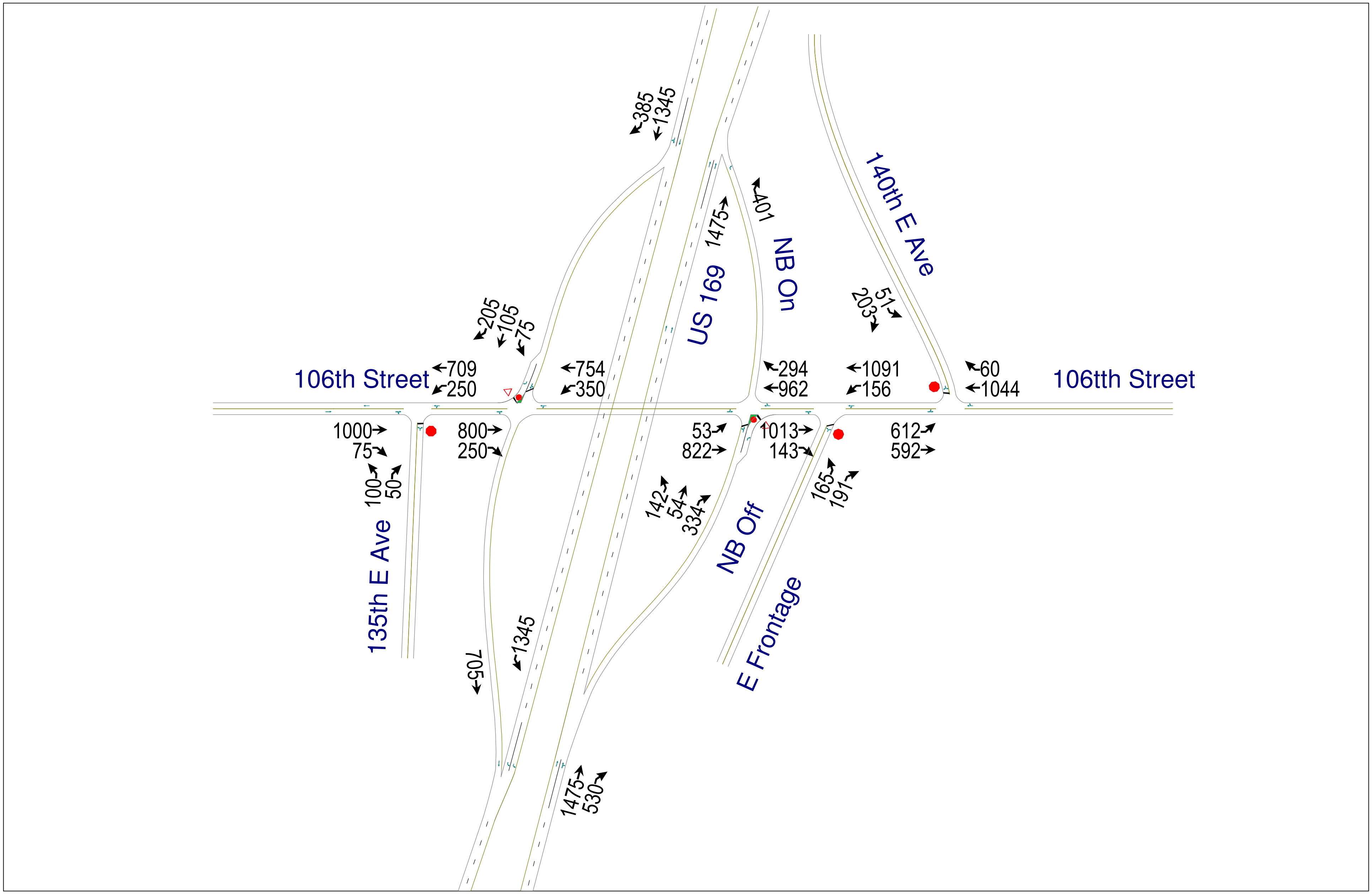

106th Street
135th E Ave
US 169
NB On
NB Off
N 140th Ave
E Frontage
U
B
C


72.3%
82.1%
140th E Ave
NB On
US 169
106th Street
106tth Street
126.9%
136.0%
104.1%
158.9%
148.9%
135th E Ave
NB Off
E Frontage
72.3%
82.1%


75.4%
87.5%
140th E Ave
NB On
US 169
106th Street
120.0%
150.3%
141.7%
157.9%
149.2%
106th Street
135th E Ave
NB Off
E Frontage
87.5%


385
1345
1475
401
NB On
N 140th Ave
US 169
205
105
75
754
350
106th Street
849
110
294
962
203
50
51
50
888
156
1000
75
100
50
800
250
53
822
120
893
143
165
50
191
135th E Ave
142
54
334
NB Off
E Frontage
705
1345
1475
530


485
1345
1475
452
NB On
US 169
N 140th Ave
53
105
327
840
334
643
250
106th Street
142
1099
306
50
60
51
792
191
934
75
100
50
718
266
205
840
192
852
146
143
50
128
75
105
350
NB Off
135th E Ave
E Frontage
705
1345
1475
530


106th Street
106tth Street
140th E Ave
135th E Ave
US 169
NB On
NB Off
E Frontage
385
1345
401
1475
205
105
75
709
250
754
350
294
962
1091
156
51
203
60
1044
1000
75
100
50
800
250
53
822
1013
143
612
592
142
54
334
165
191
705
1345
1475
530

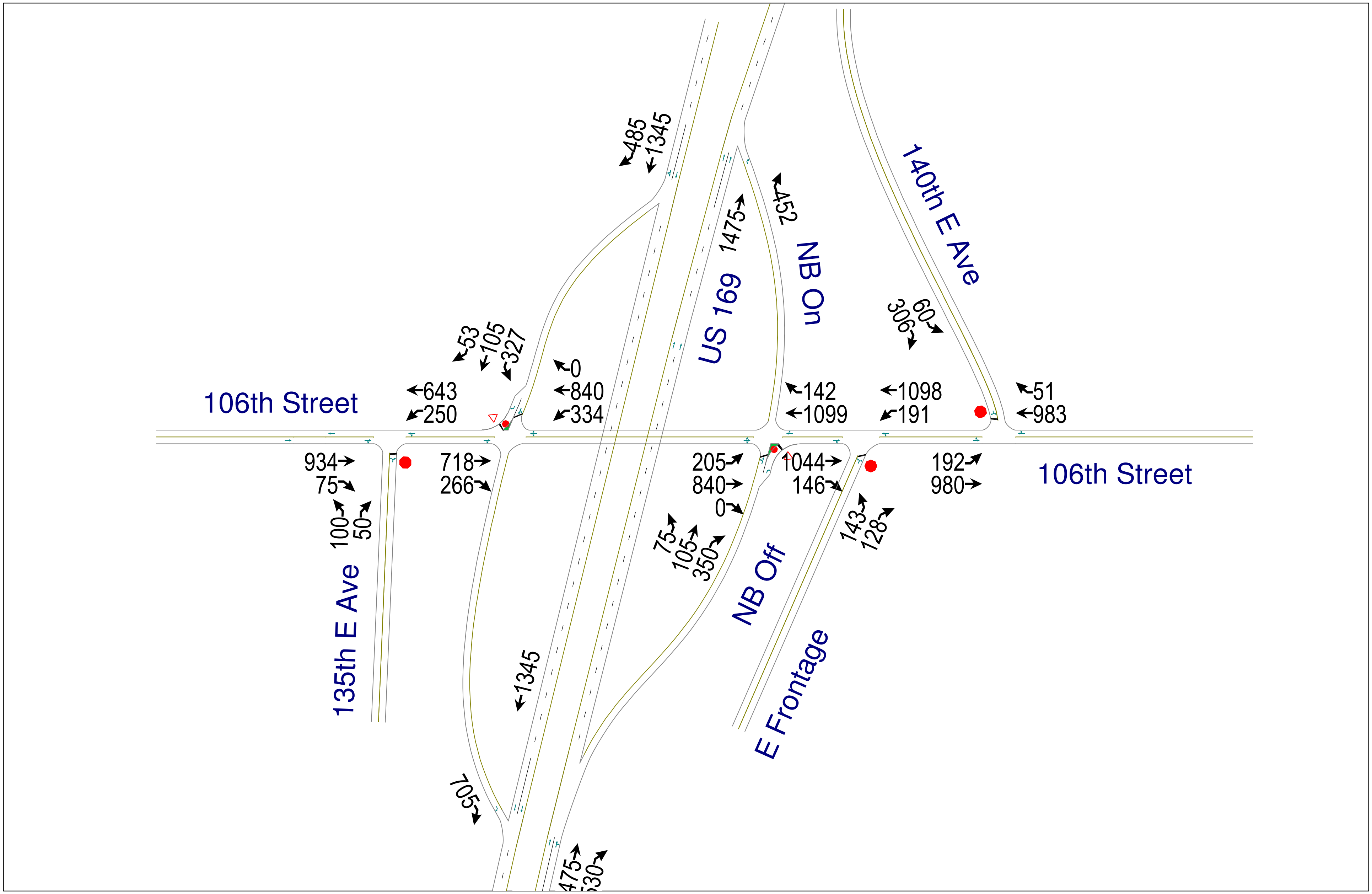
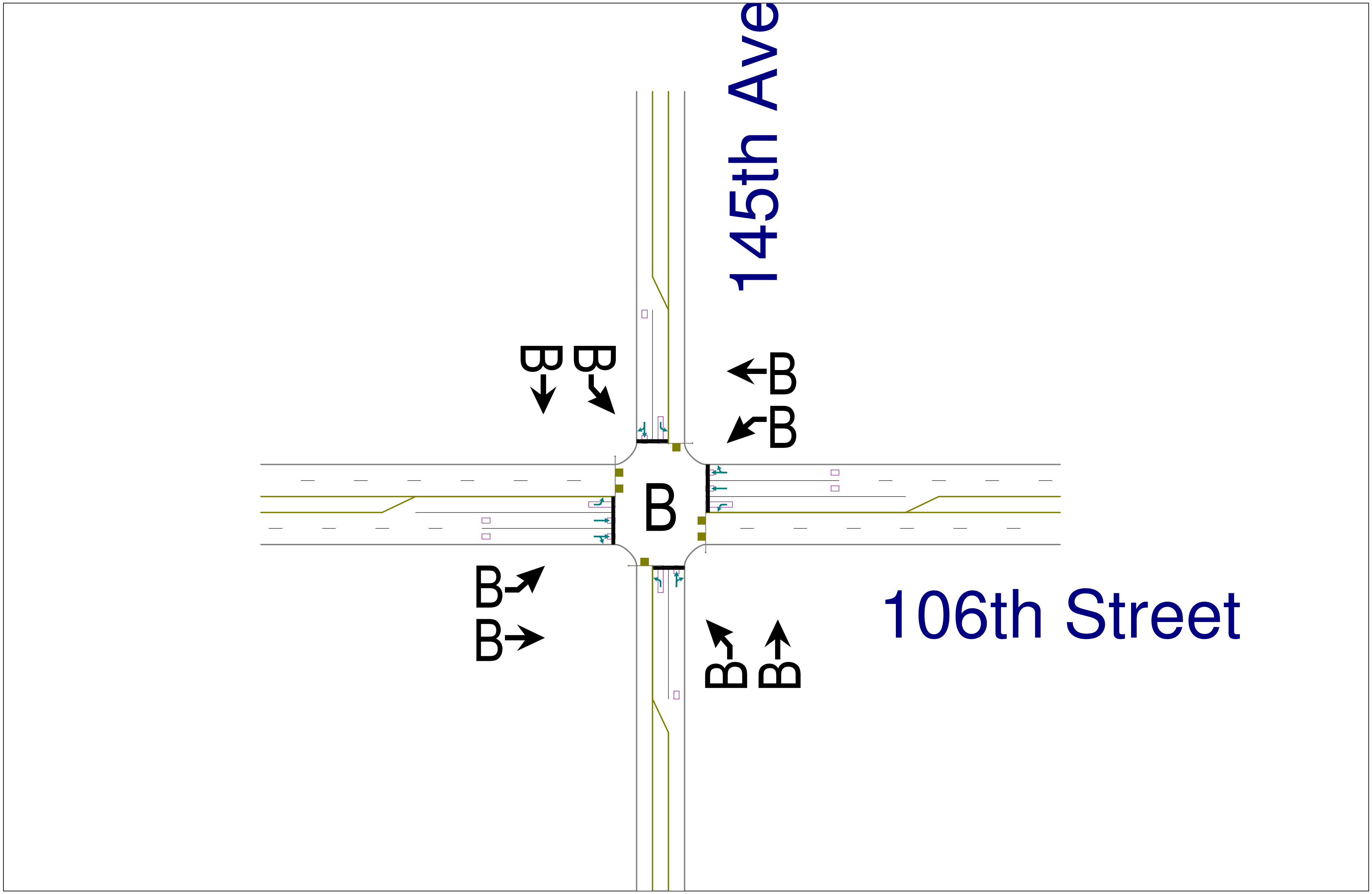
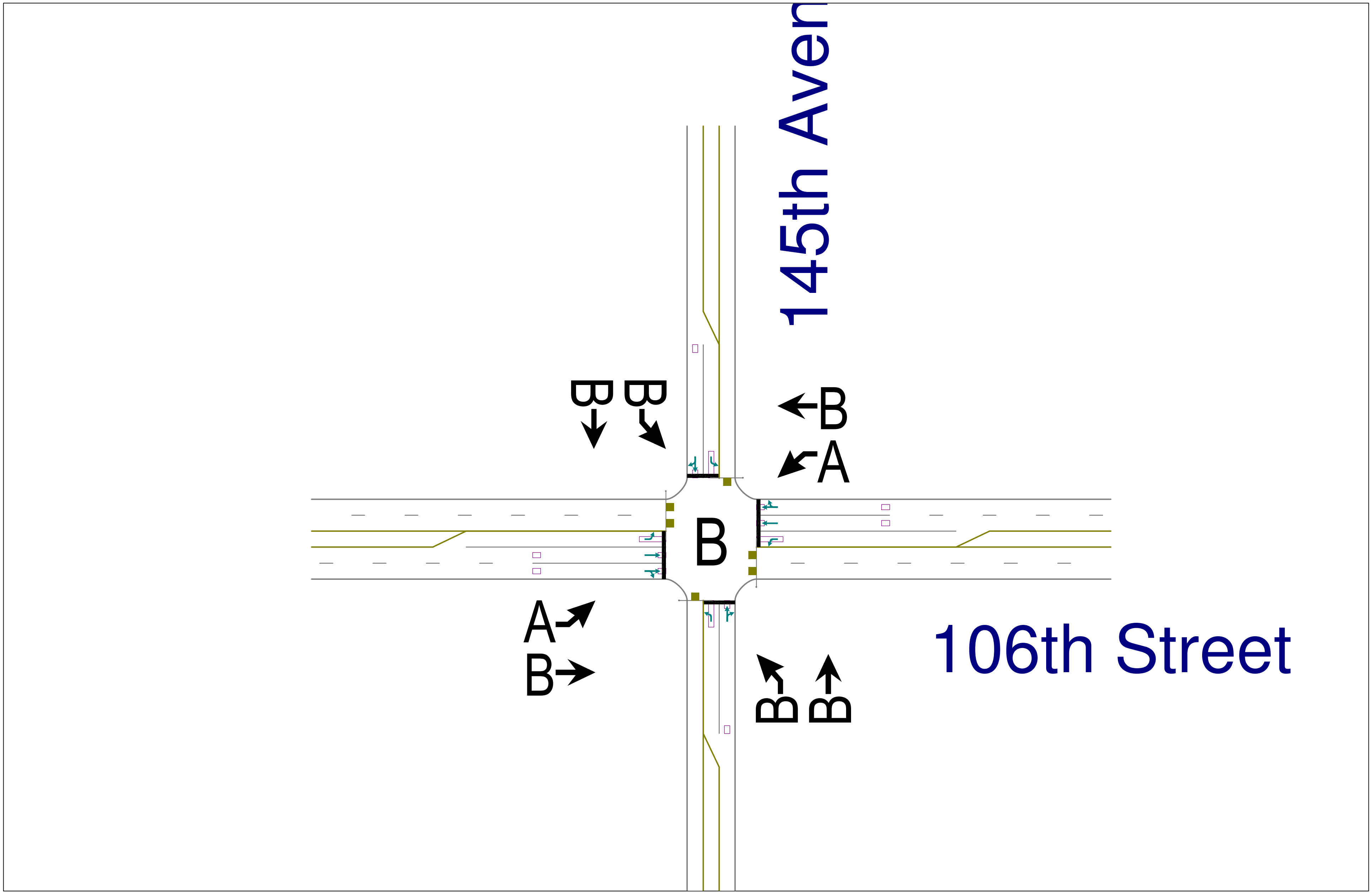

106th Street
140th E Ave
US 169
NB On
NB Off
E Frontage
135th E Ave
106th Street
485
1345
1475
452
53
105
327
643
250
0
840
334
142
1099
1098
191
51
983
60
306
934
75
100
50
718
266
205
840
0
1044
146
192
980
143
128
75
105
350
1345
705
475
530

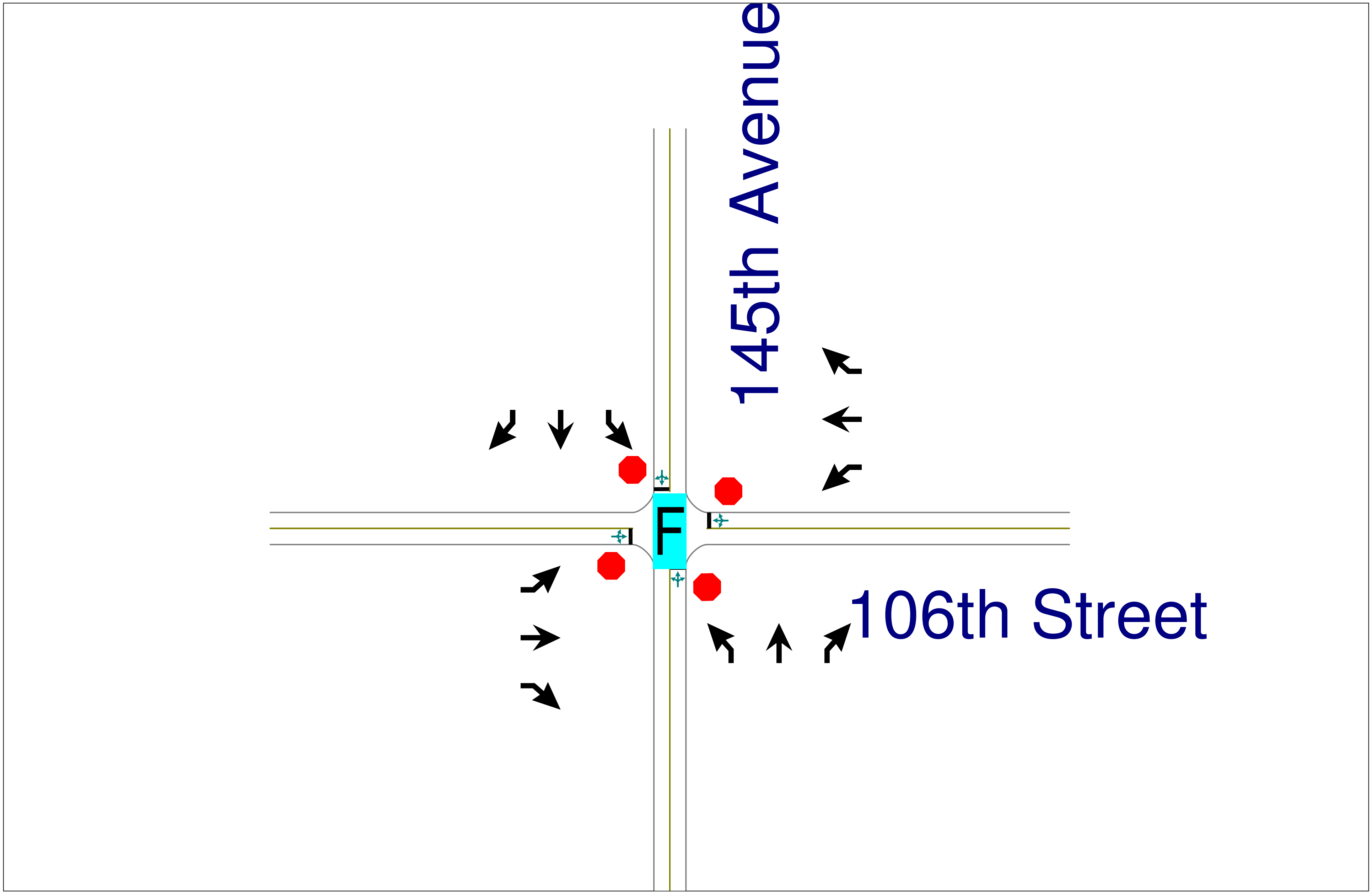
Figure A-4-4

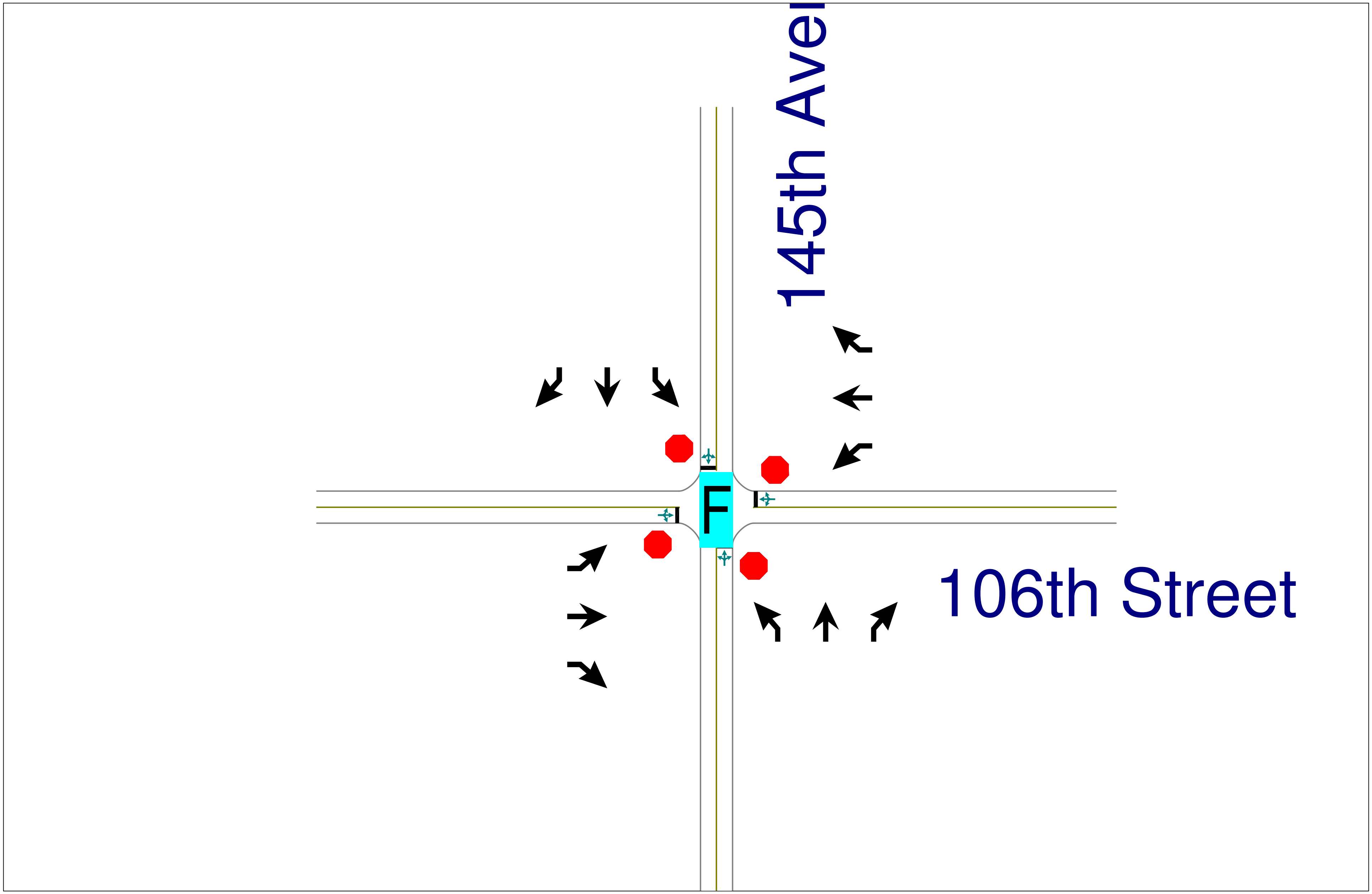
106th Street N & 145th E Avenue Intersection

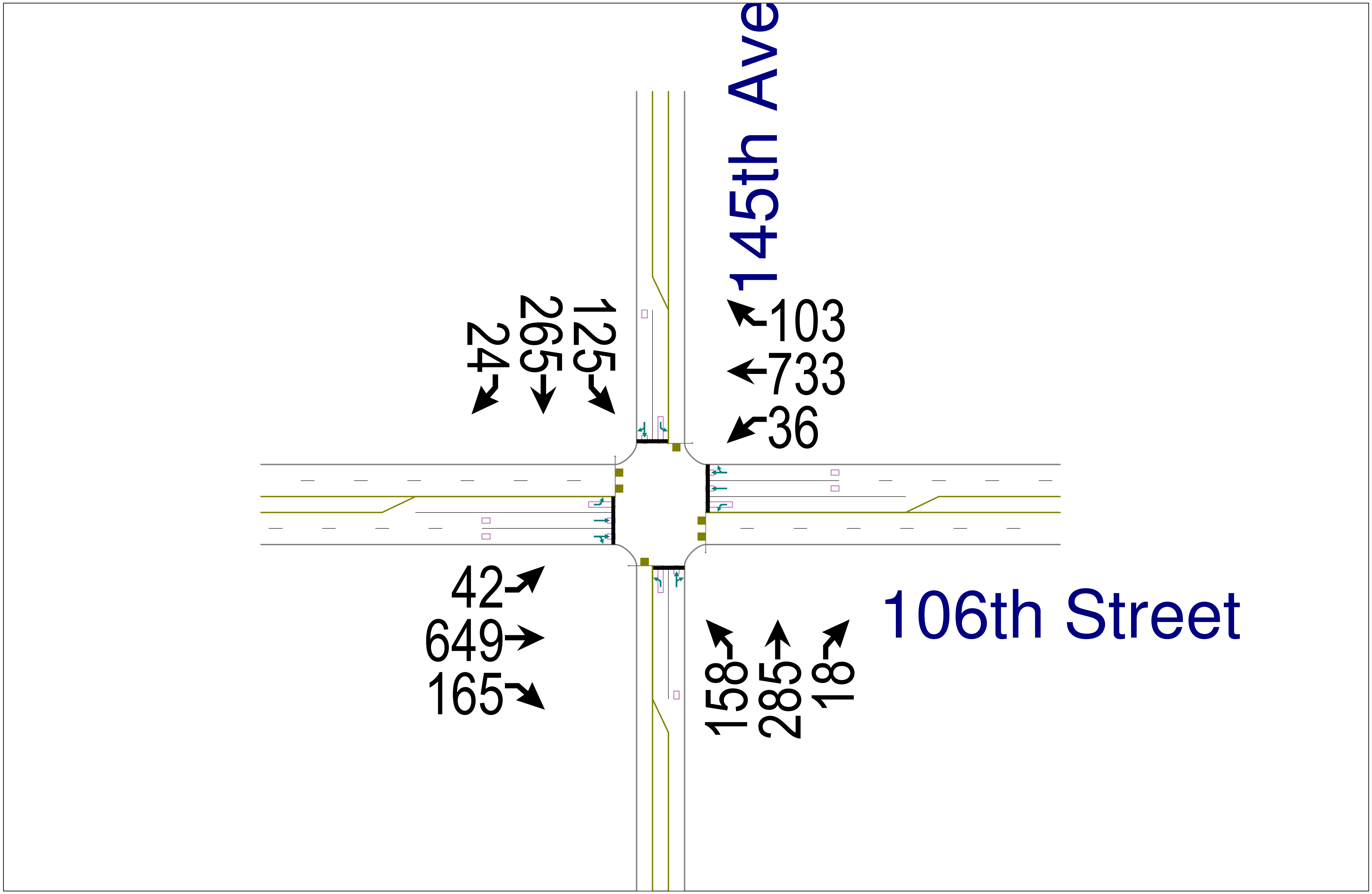
a. Future Improvements & 2035 Traffic Level of Service – AM Peak
b. Future Improvements & 2035 Traffic Level of Service – PM Peak
c. No-Build & 2035 Traffic Level of Service – AM Peak
d. No-Build & 2035 Traffic Level of Service – PM Peak
e. Future Improvements with 2035 Volumes – AM Peak
f. Future Improvements with 2035 Volumes – PM Peak
g. No-Build with 2035 Volumes – AM Peak
h. No-Build with 2035 Volumes – PM Peak

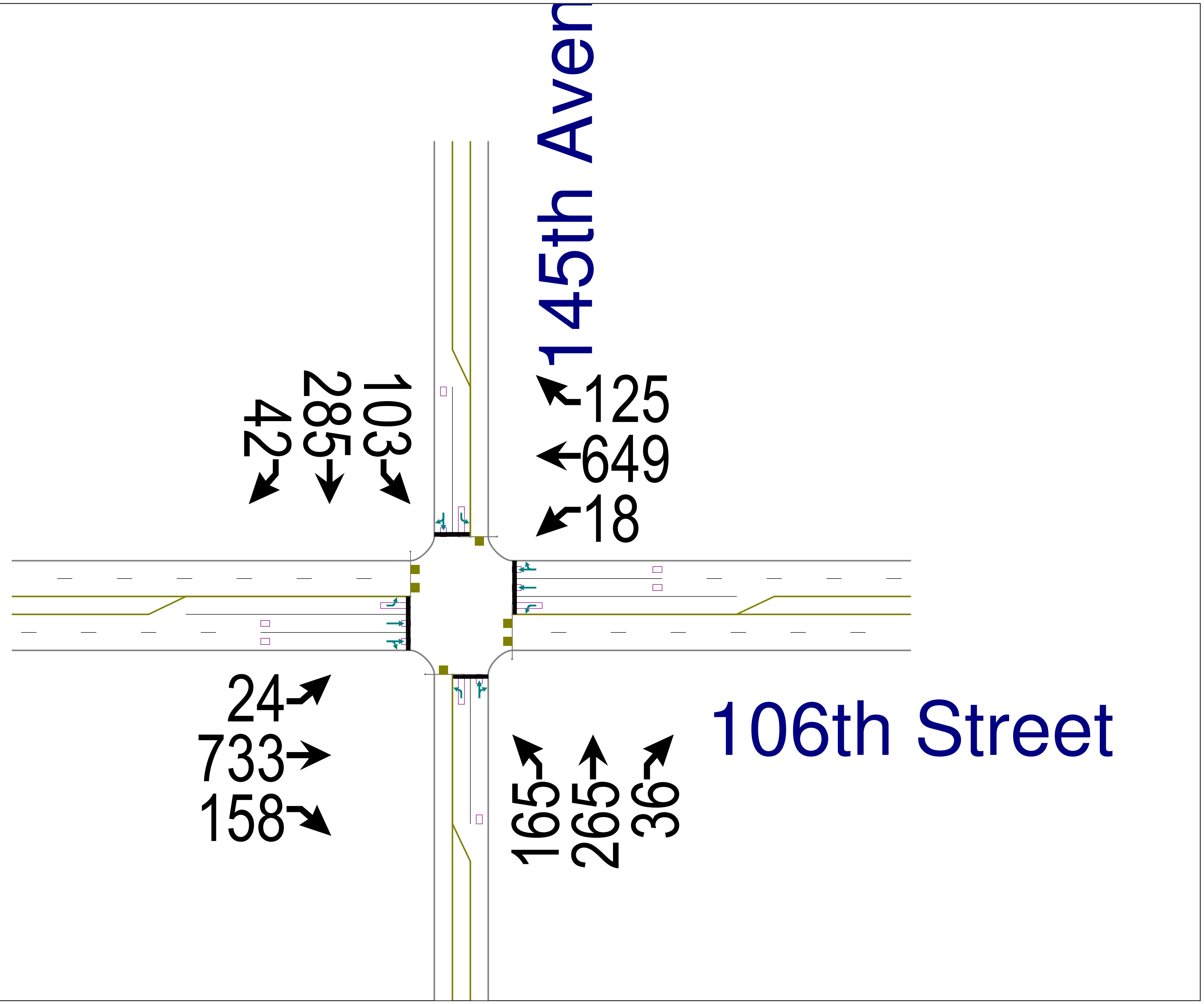

145th Ave
106th Street
B
B
B
B
B
B
B
B
B
B

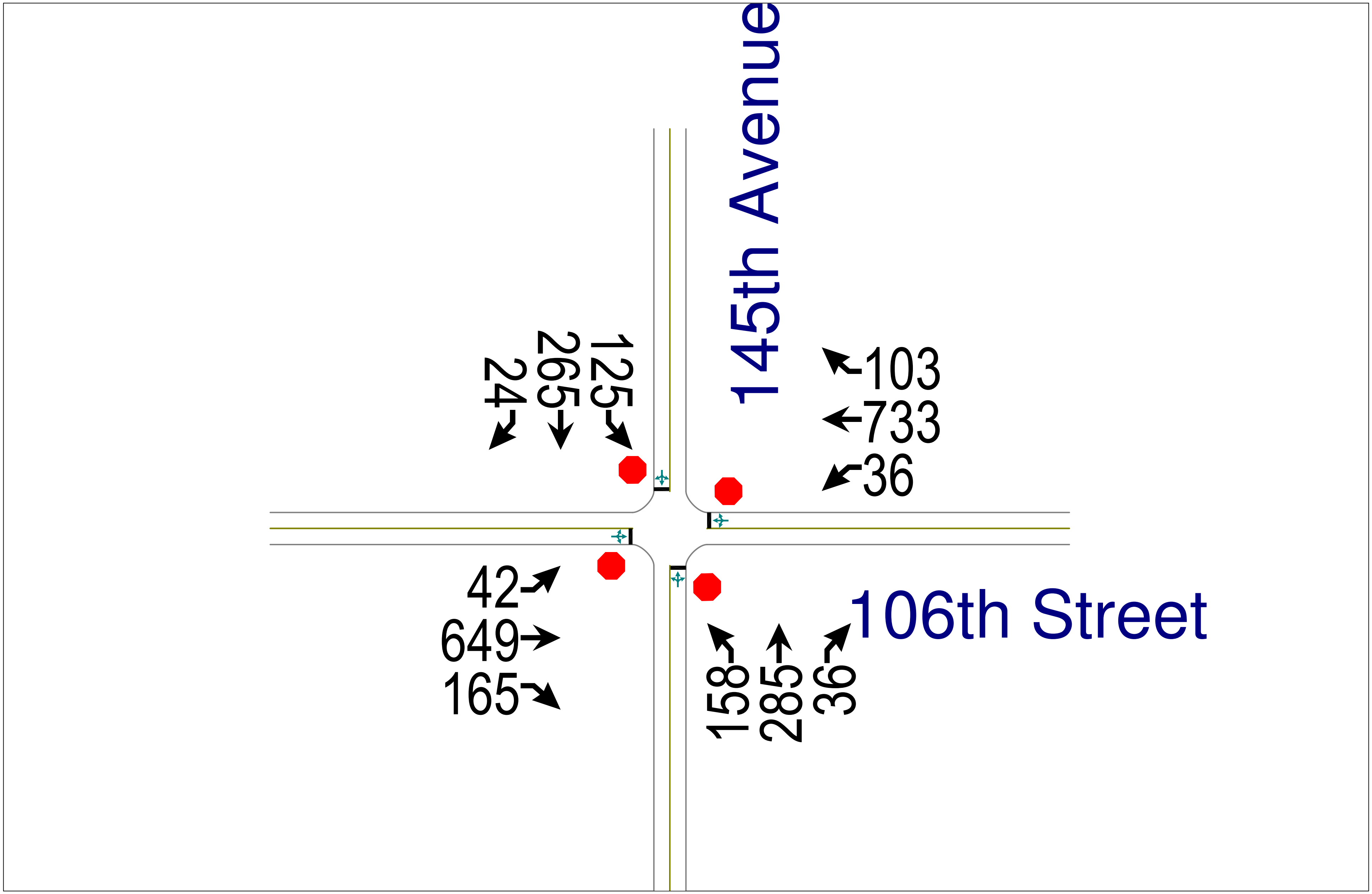

145th Aven
106th Street
B
B
B
B
A
A
B
B
B
B


145th Avenue
F
106th Street


145th Ave
106th Street
F


145th Ave
106th Street
125
265
24
103
733
36
42
649
165
158
285
18


145th Aven
106th Street
103
285
42
125
649
18
24
733
158
165
265
36


145th Avenue
106th Street
125
265
24
103
733
36
42
649
165
158
285
36

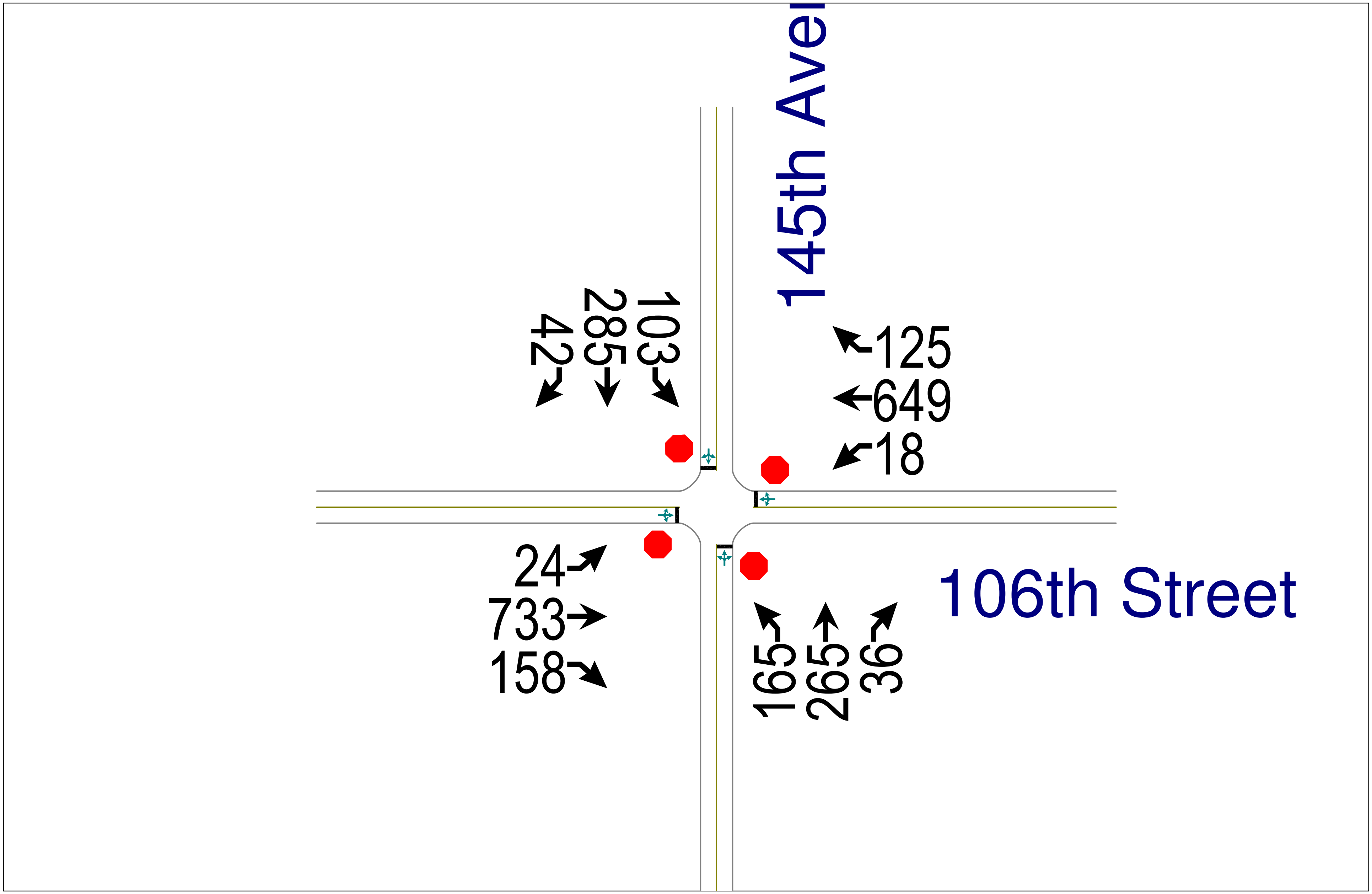
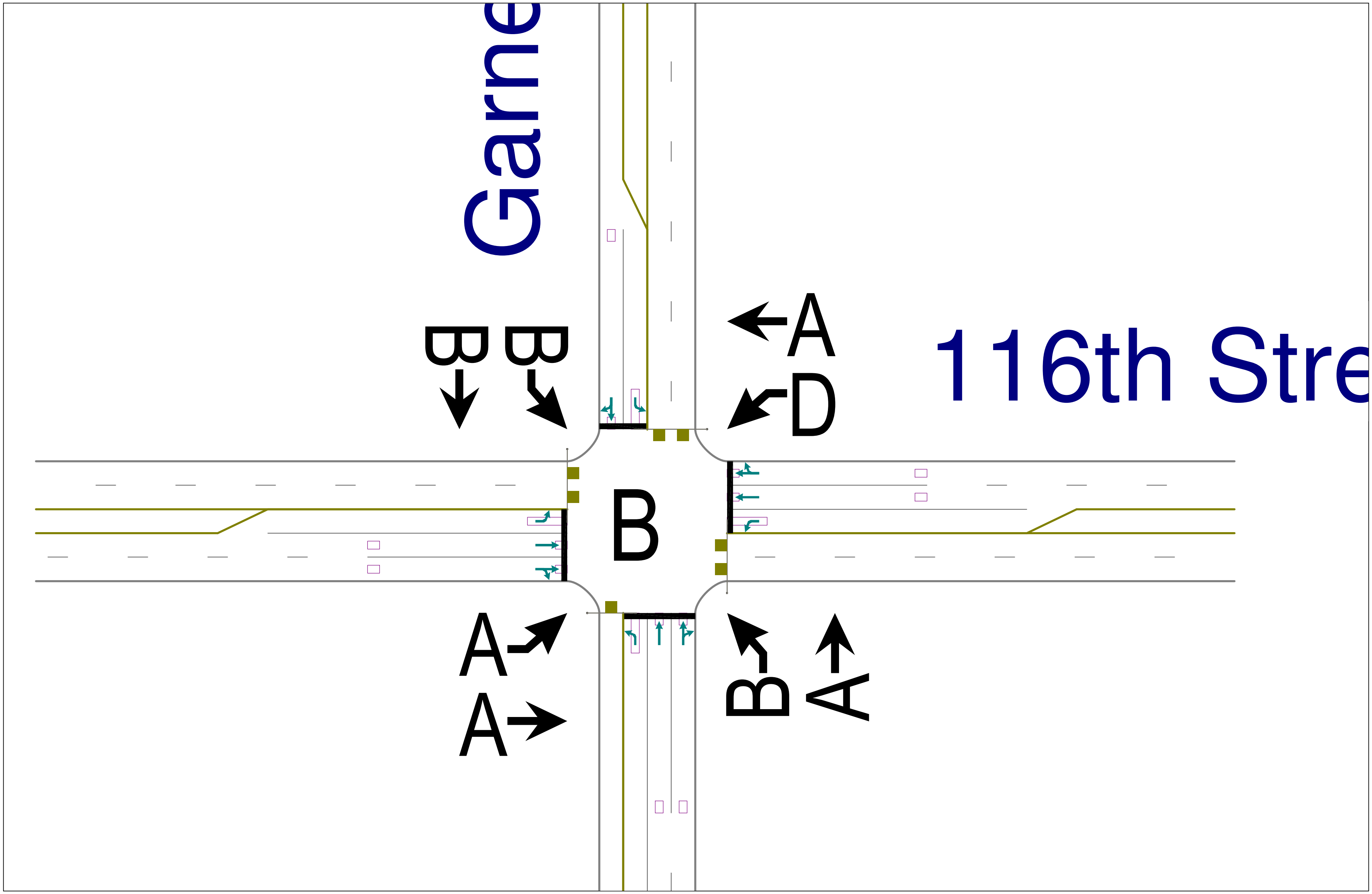
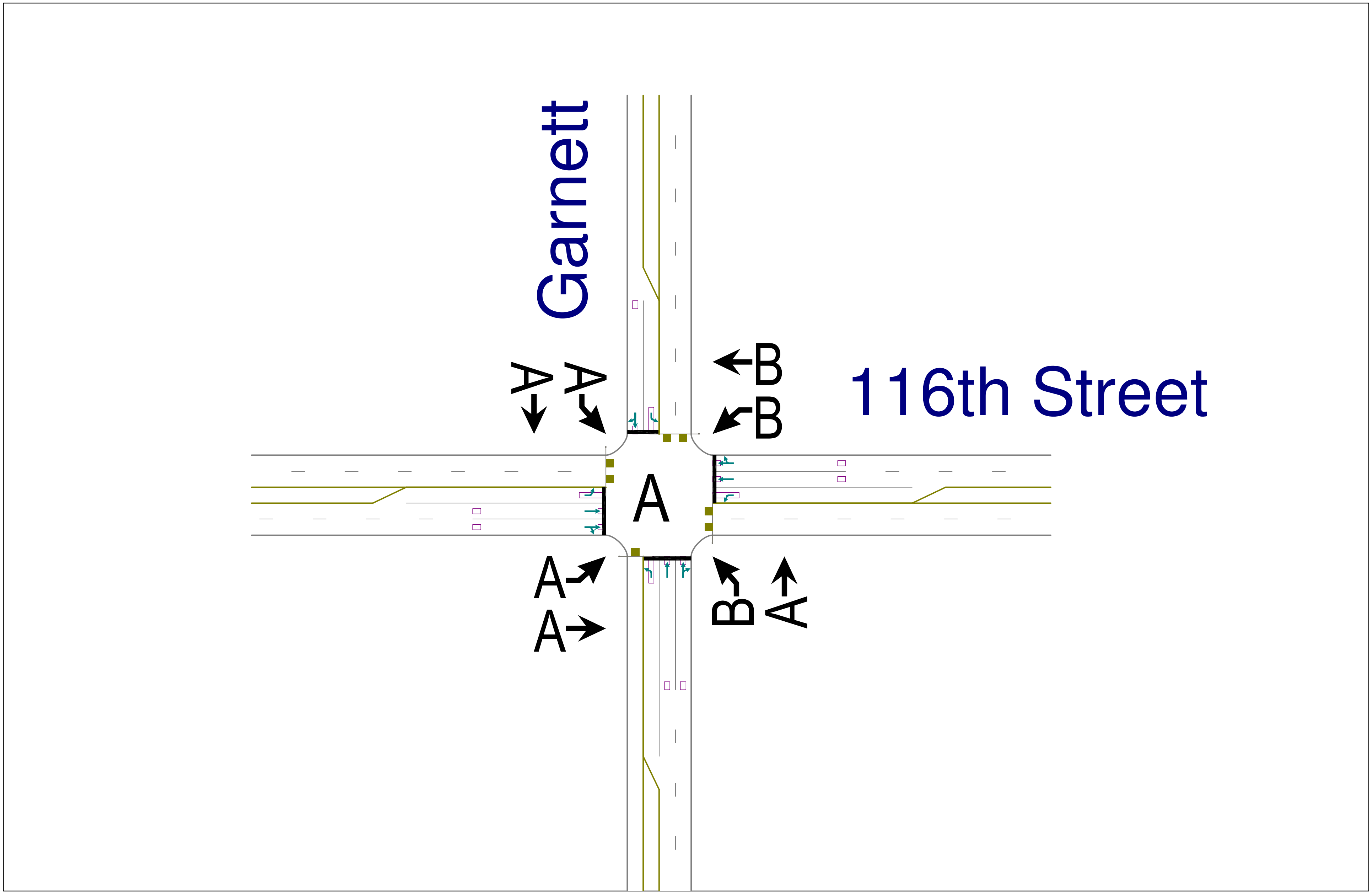

145th Ave
103
285
42
125
649
18
24
733
158
165
265
36
106th Street

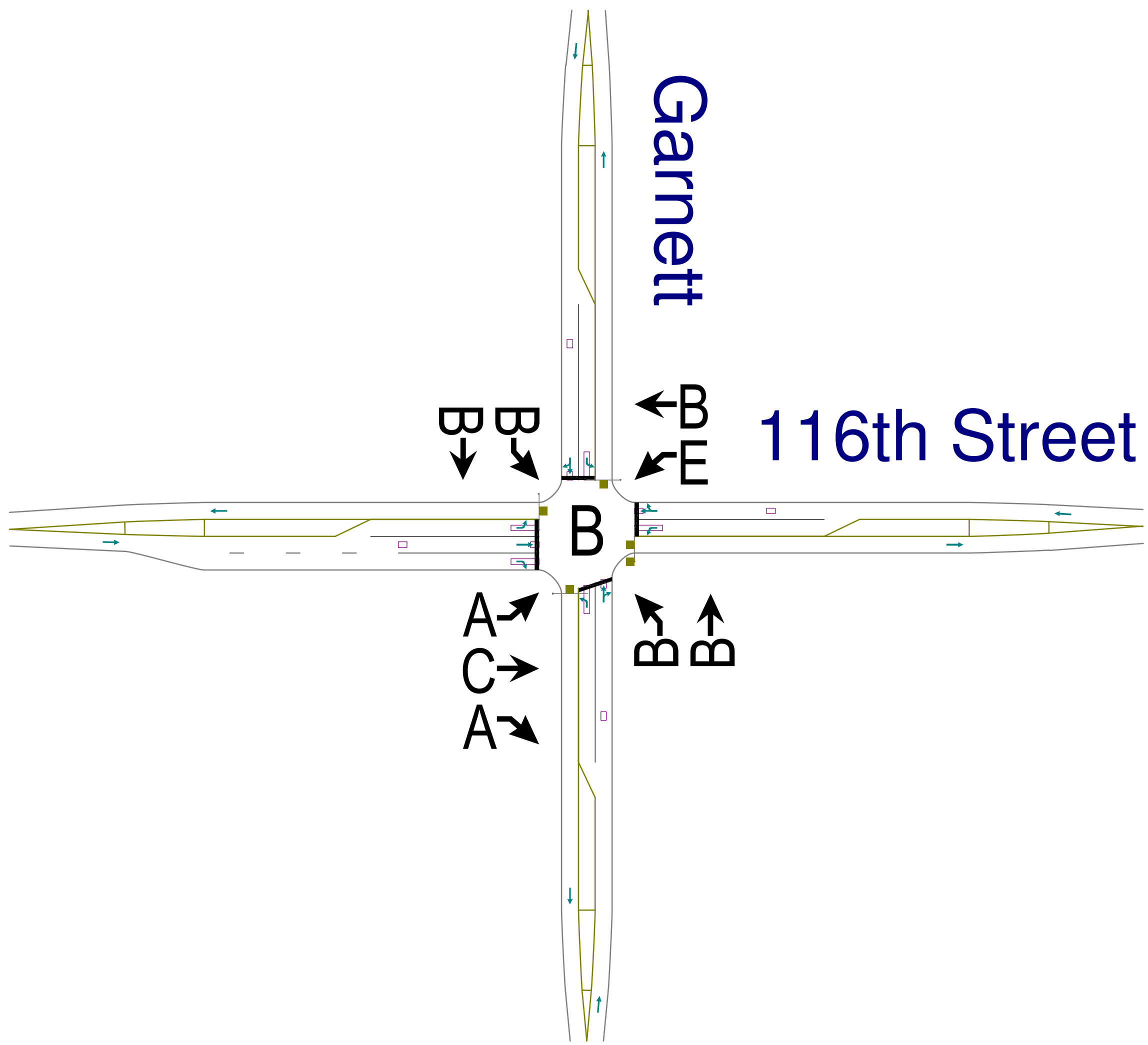
Figure A-5-1

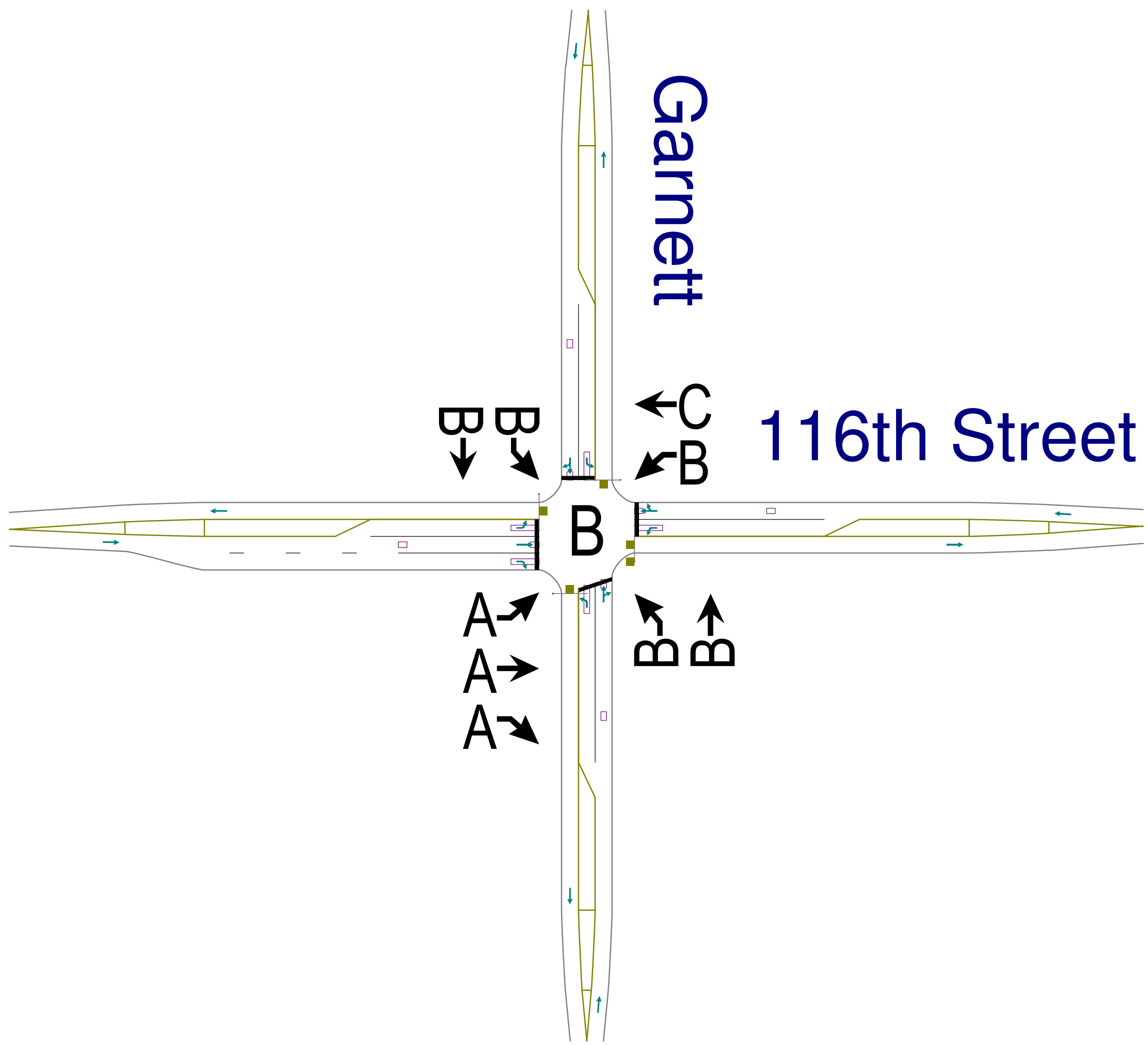
116th Street N & Garnett Road Intersection

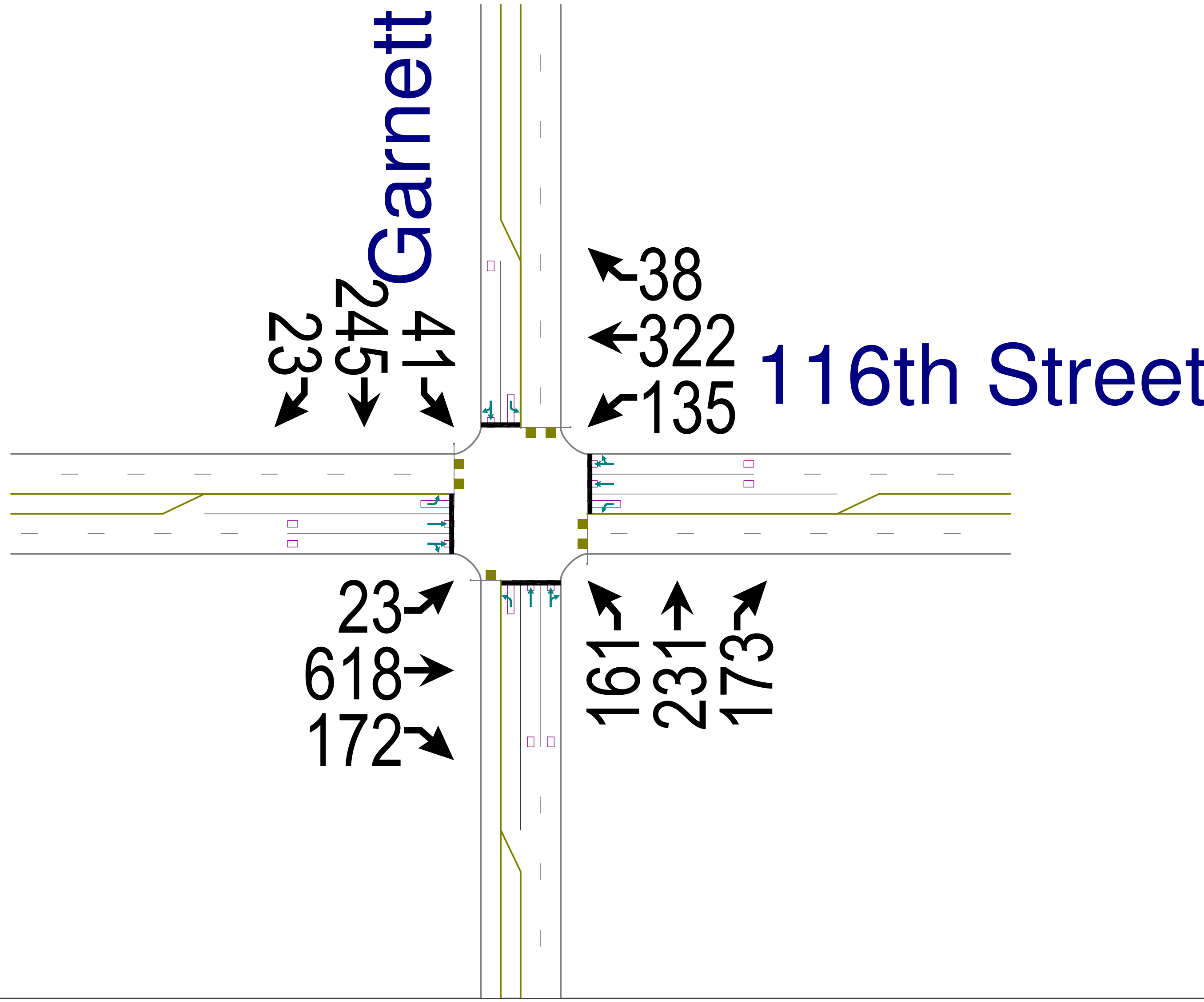
a. Future Improvements & 2035 Traffic Level of Service – AM Peak
b. Future Improvements & 2035 Traffic Level of Service – PM Peak
c. No-Build & 2035 Traffic Level of Service – AM Peak
d. No-Build & 2035 Traffic Level of Service – PM Peak
e. Future Improvements with 2035 Volumes – AM Peak
f. Future Improvements with 2035 Volumes – PM Peak
g. No-Build with 2035 Volumes – AM Peak
h. No-Build with 2035 Volumes – PM Peak

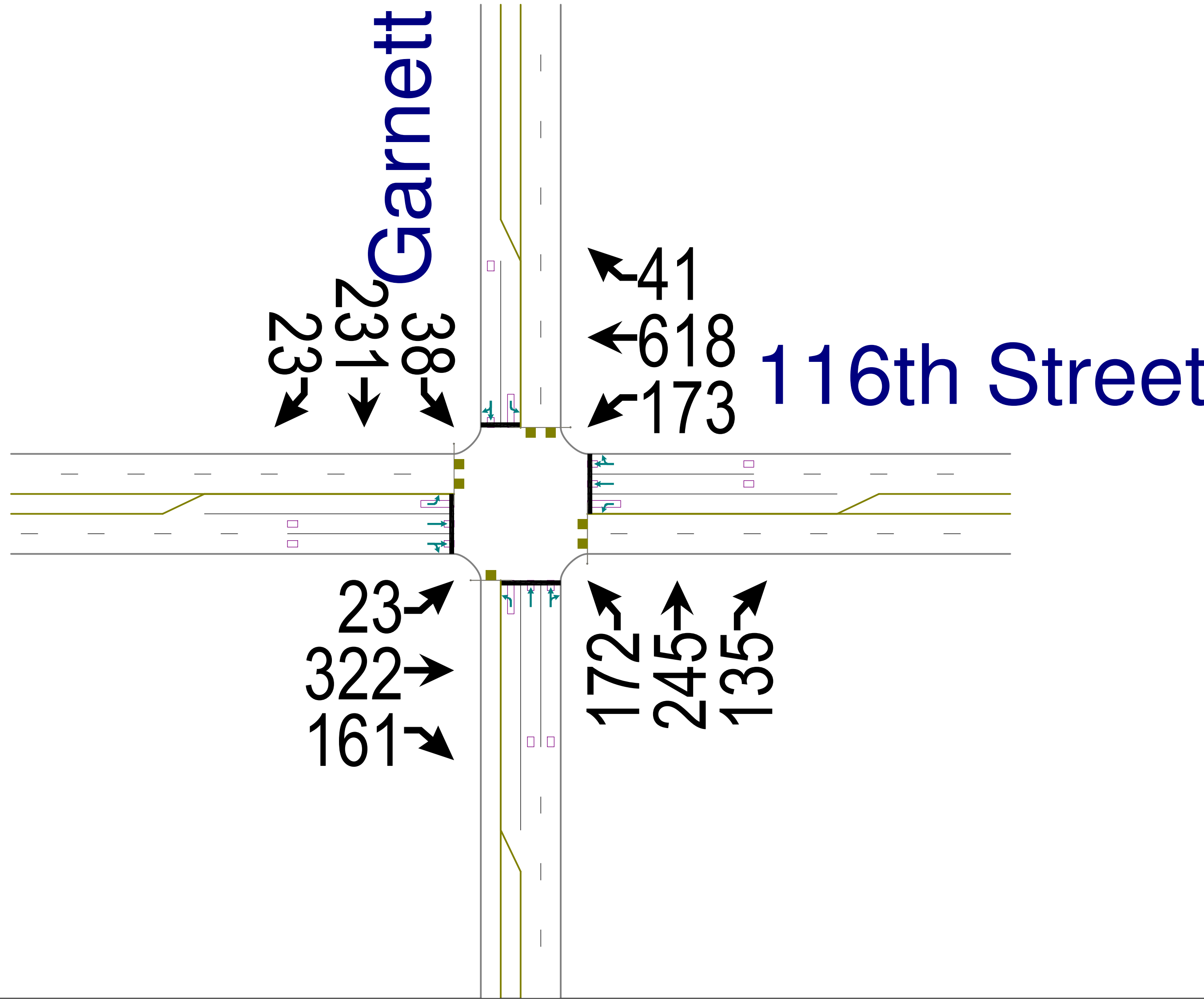

Garne
116th Stre
A
D
B
B
B
A
A
B
A

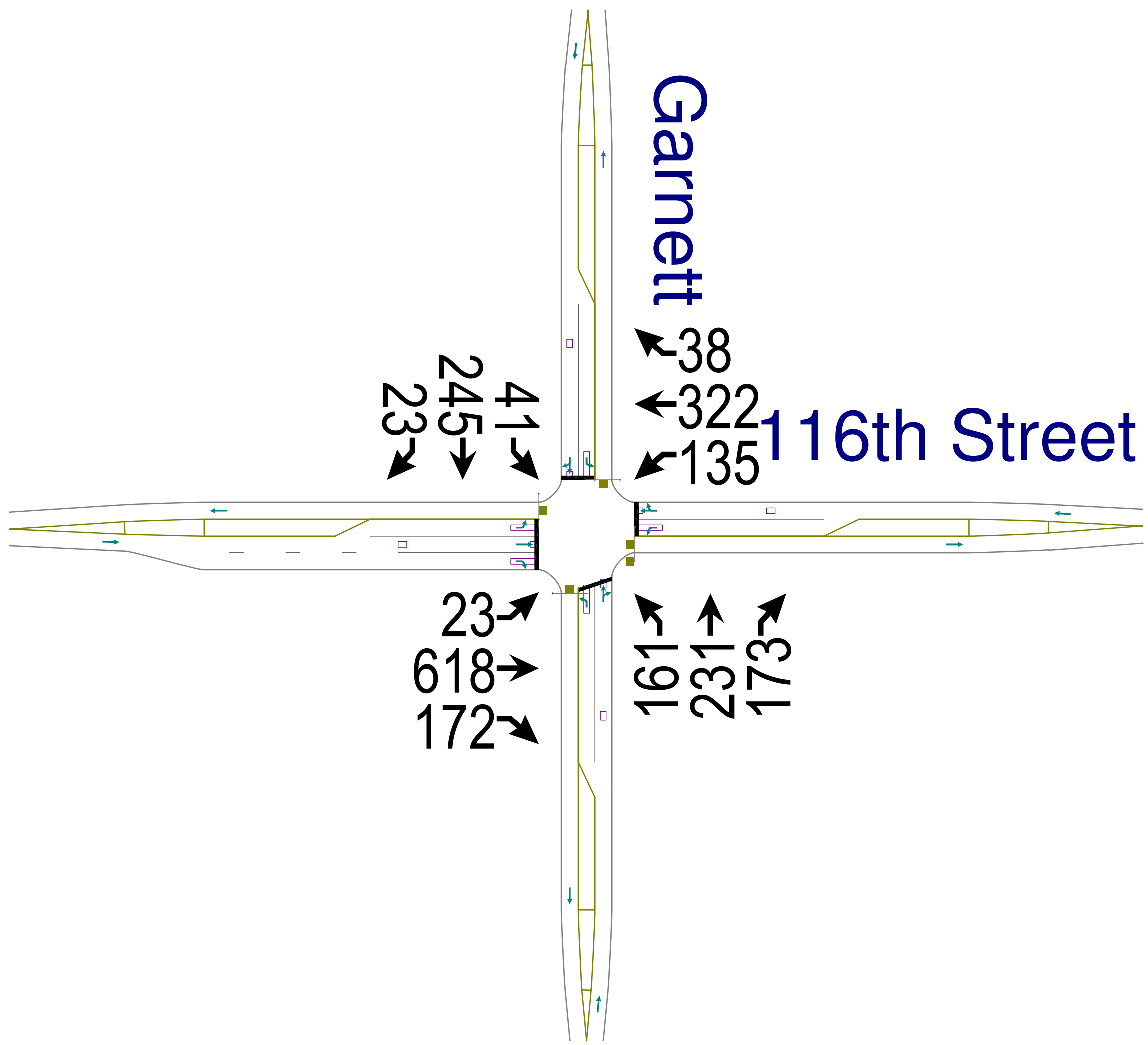

Garnett
116th Street
A
B
B
A
A
A
A
B
A
A


Garnett
116th Street
B
B
B
E
B
A
C
A
B
B
B


Garnett
116th Street
B
C
B
B
B
A
A
A
B
B


Garnett
116th Street
41
245
23
38
322
135
23
618
172
161
231
173


Garnett
116th Street
23
231
38
41
618
173
23
322
161
172
245
135


Garnett
116th Street
38
322
135
41
245
23
23
618
172
161
231
173

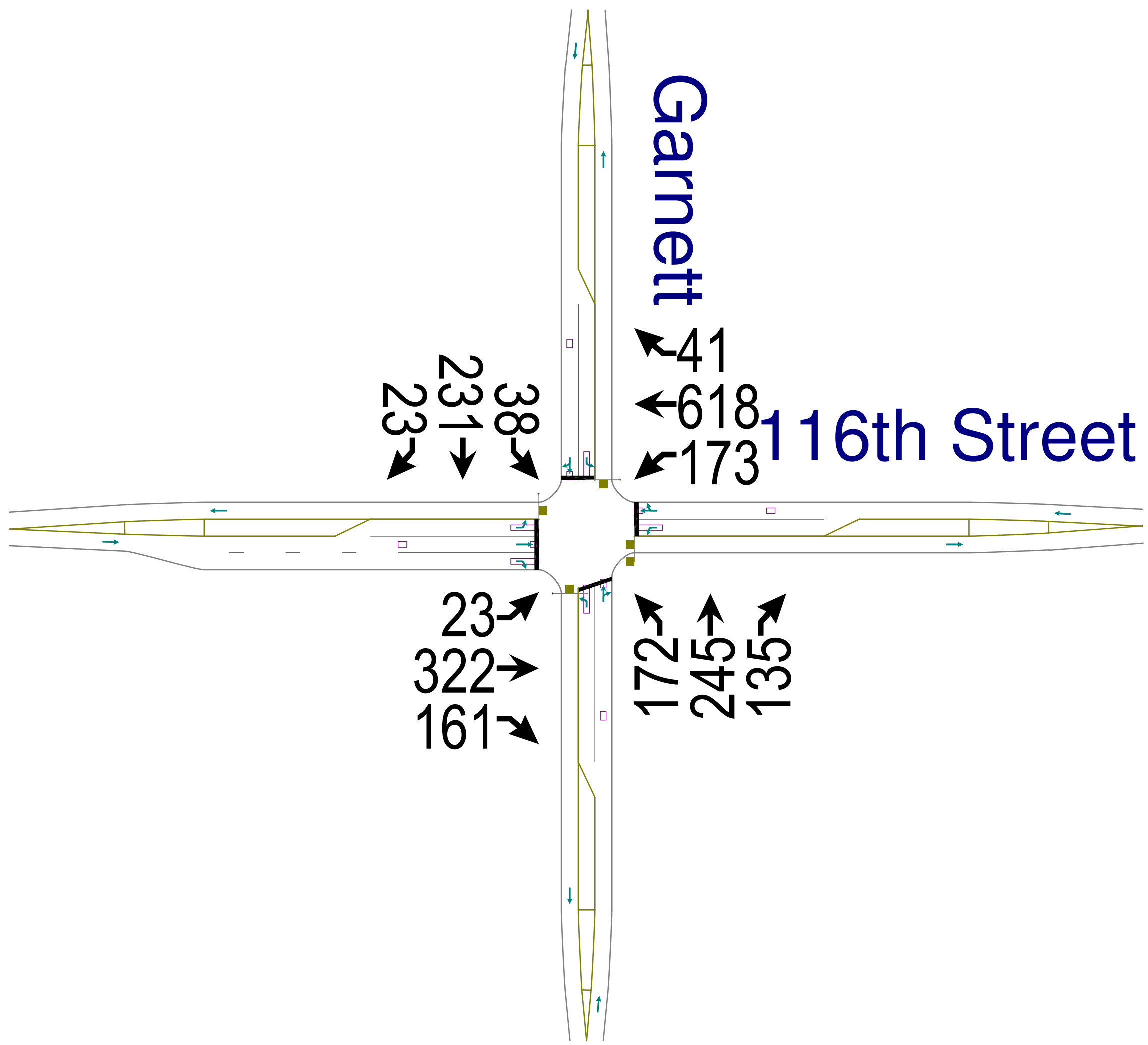
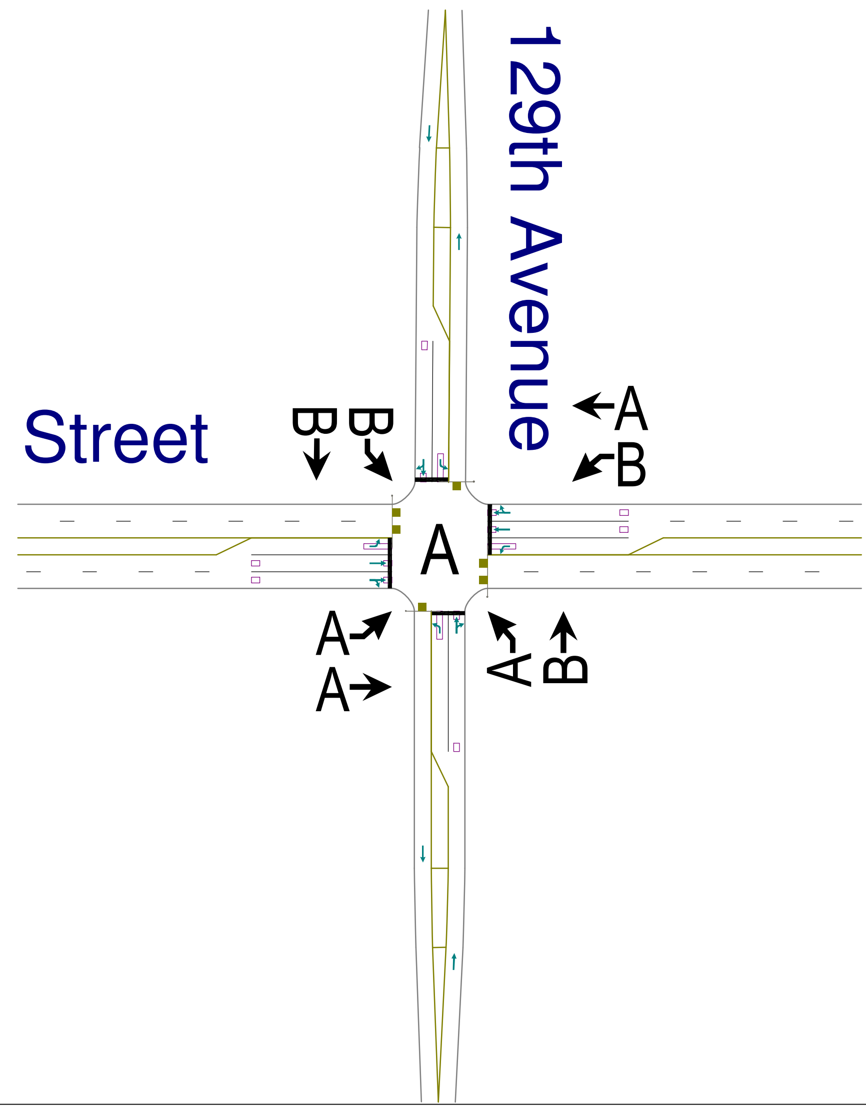
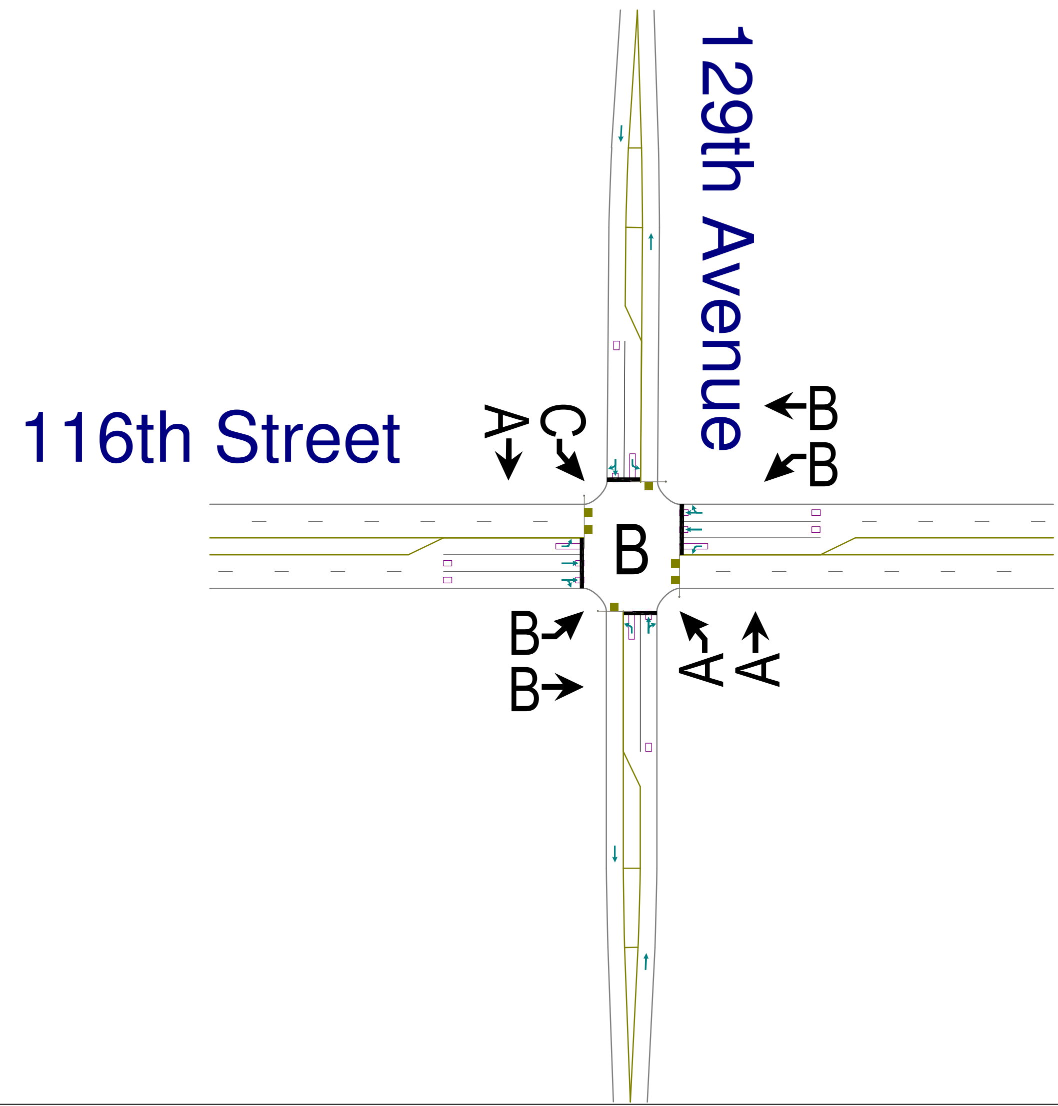

Garnett
116th Street
41
618
173
23
231
38
23
322
161
172
245
135

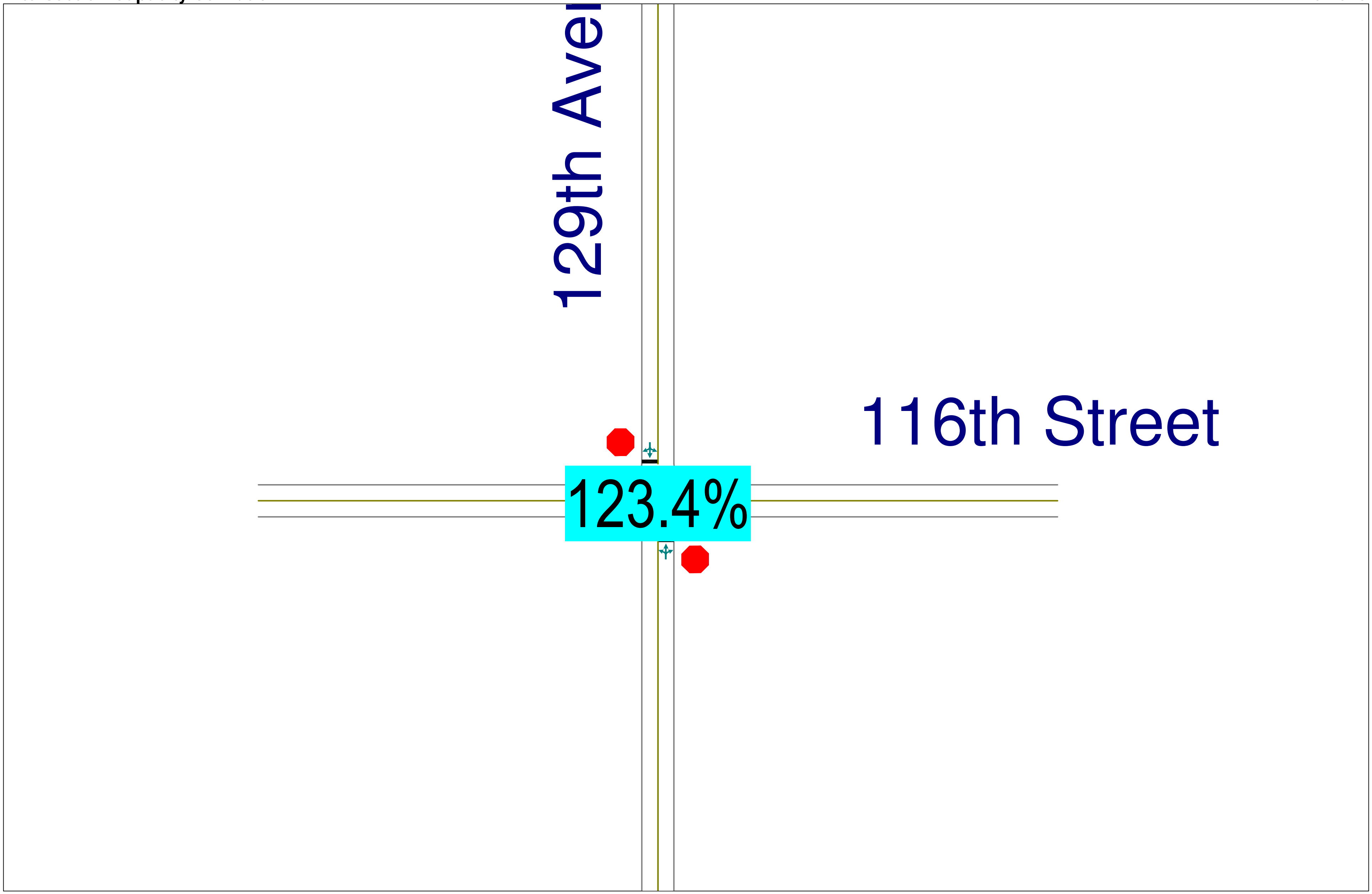
Figure A-5-2

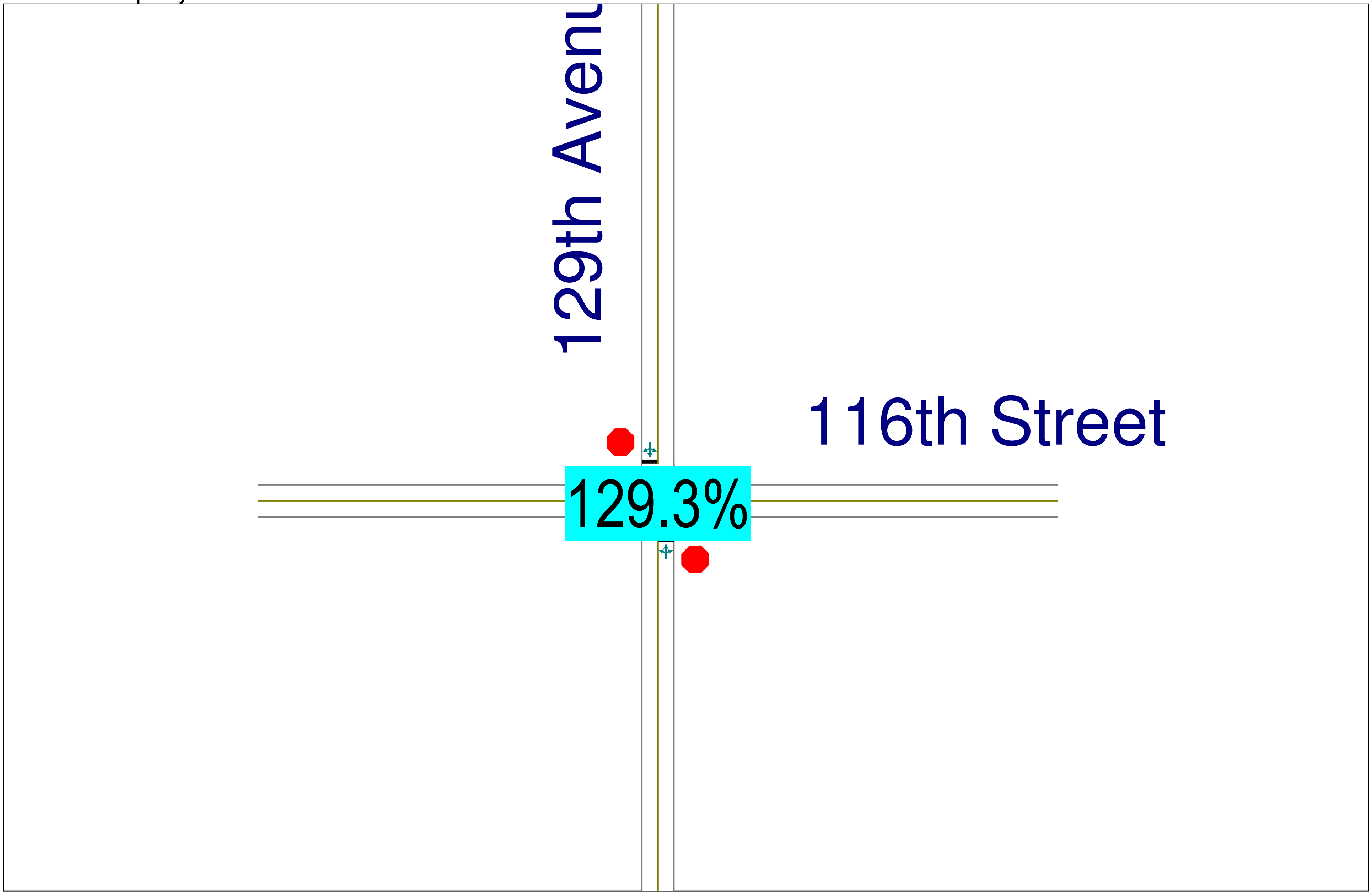
116th Street N & 129th E Avenue Intersection

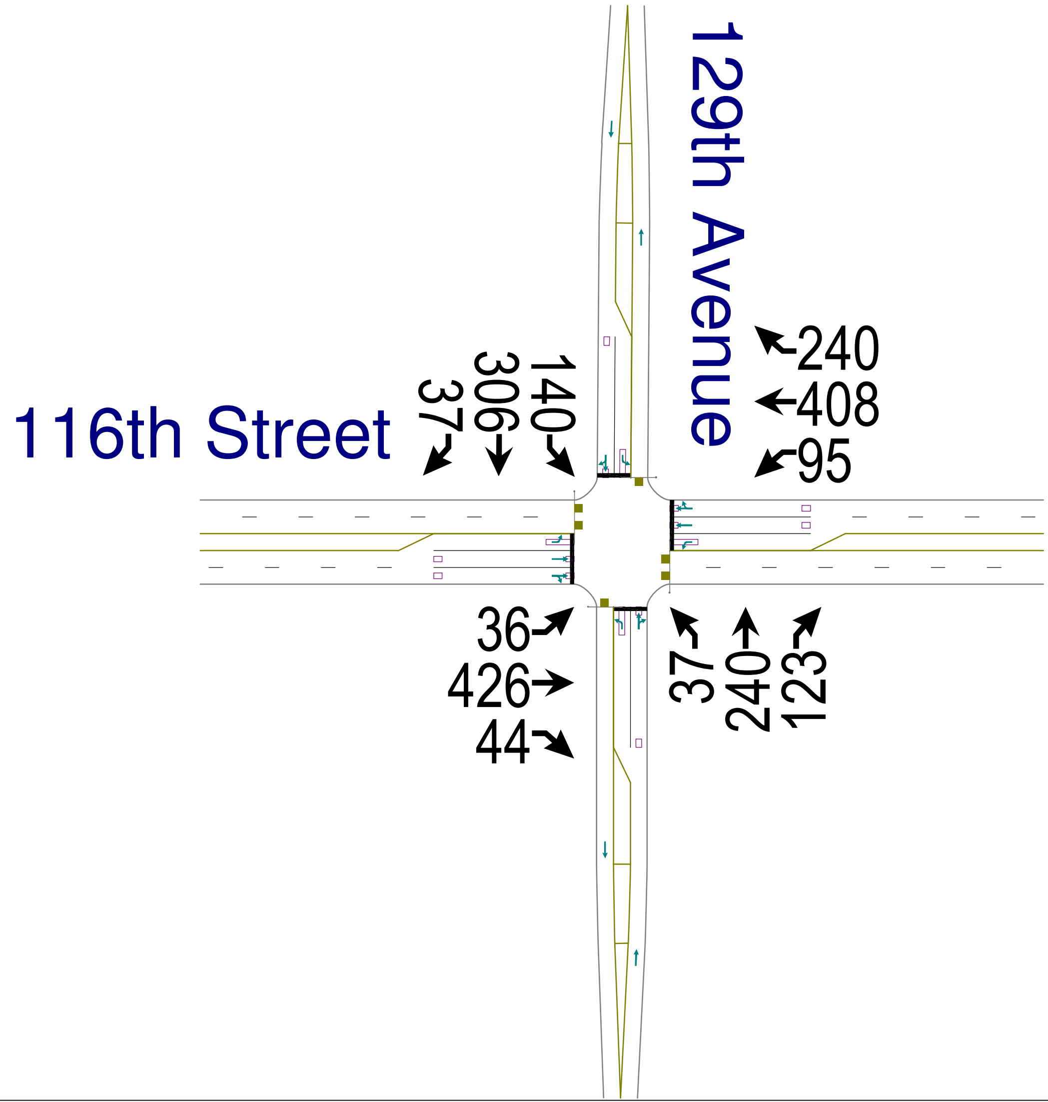
a. Future Improvements & 2035 Traffic Level of Service – AM Peak
b. Future Improvements & 2035 Traffic Level of Service – PM Peak
c. No-Build & 2035 Traffic Level of Service – AM Peak
d. No-Build & 2035 Traffic Level of Service – PM Peak
e. Future Improvements with 2035 Volumes – AM Peak
f. Future Improvements with 2035 Volumes – PM Peak
g. No-Build with 2035 Volumes – AM Peak
h. No-Build with 2035 Volumes – PM Peak

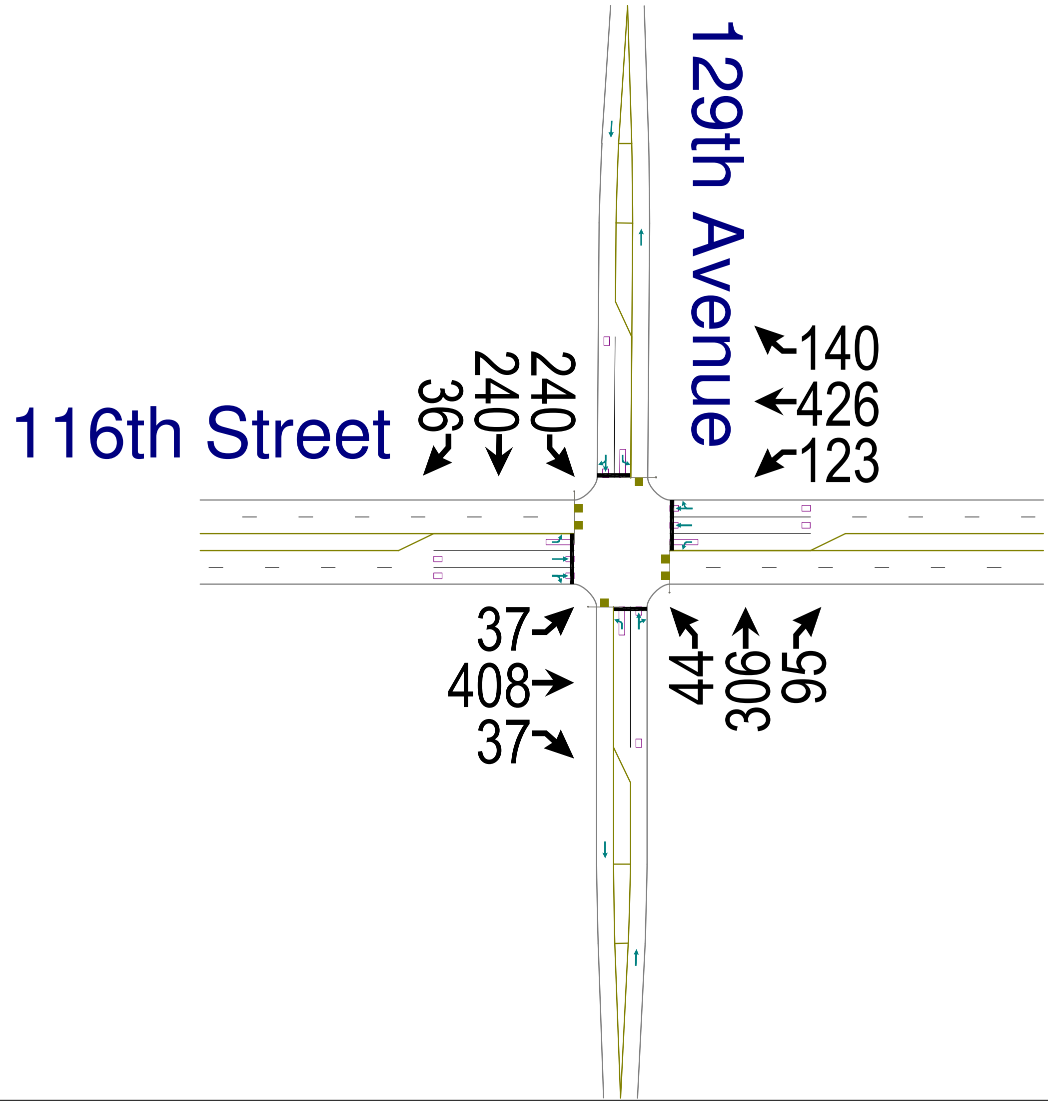

116th Street
129th Avenue
A
A
B
B
B
A
A
A
B

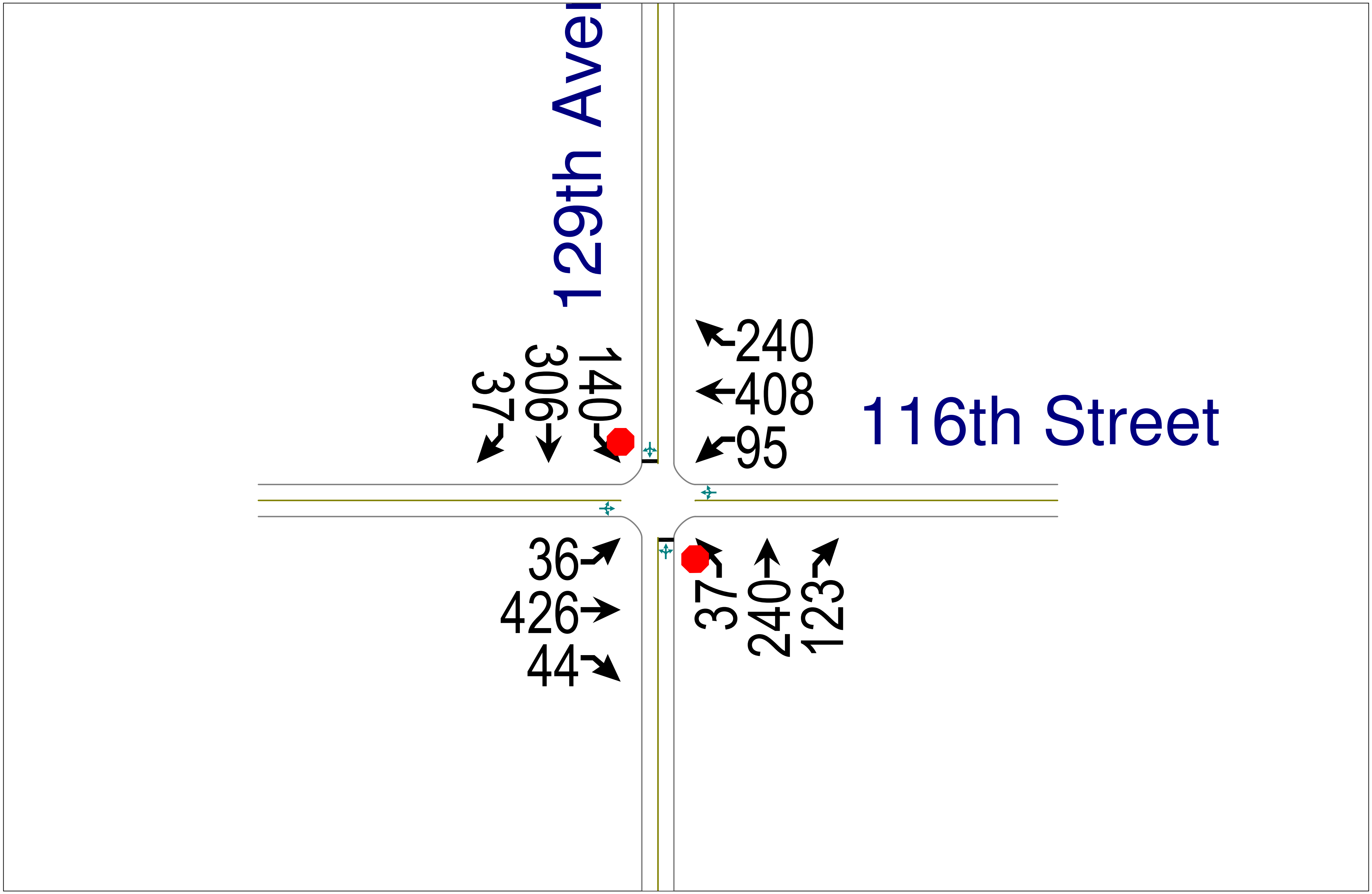

116th Street
129th Avenue
B
A
C
B
B
B
B
A
A


129th Ave
116th Street
123.4%


129th Avenu
116th Street
129.3%


116th Street
129th Avenue
140
306
37
240
408
95
36
426
44
37
240
123


129th Avenue
116th Street
140
426
123
240
240
36
37
408
37
44
306
95


129th Ave
116th Street
140
306
37
240
408
95
36
426
44
37
240
123

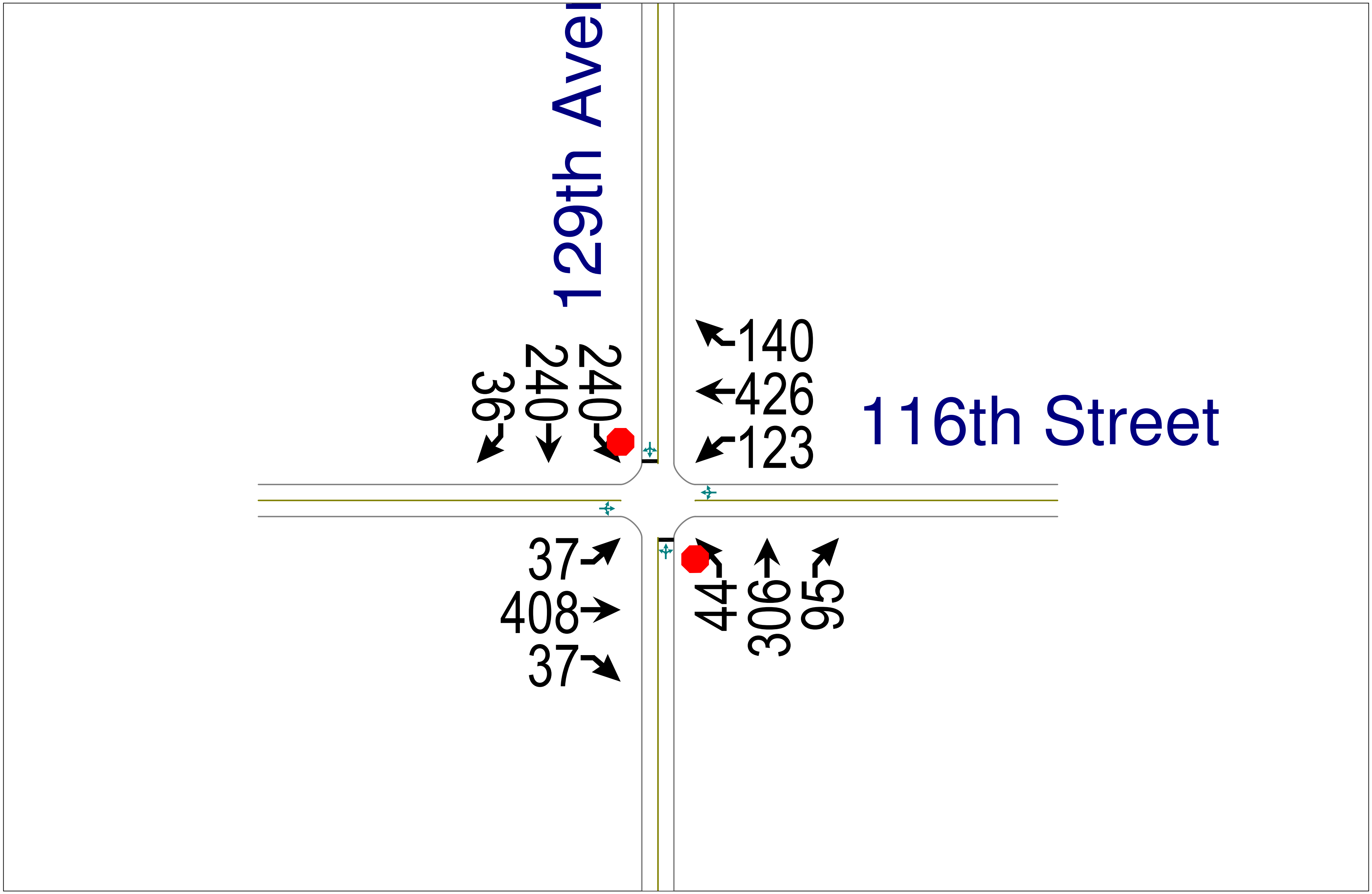
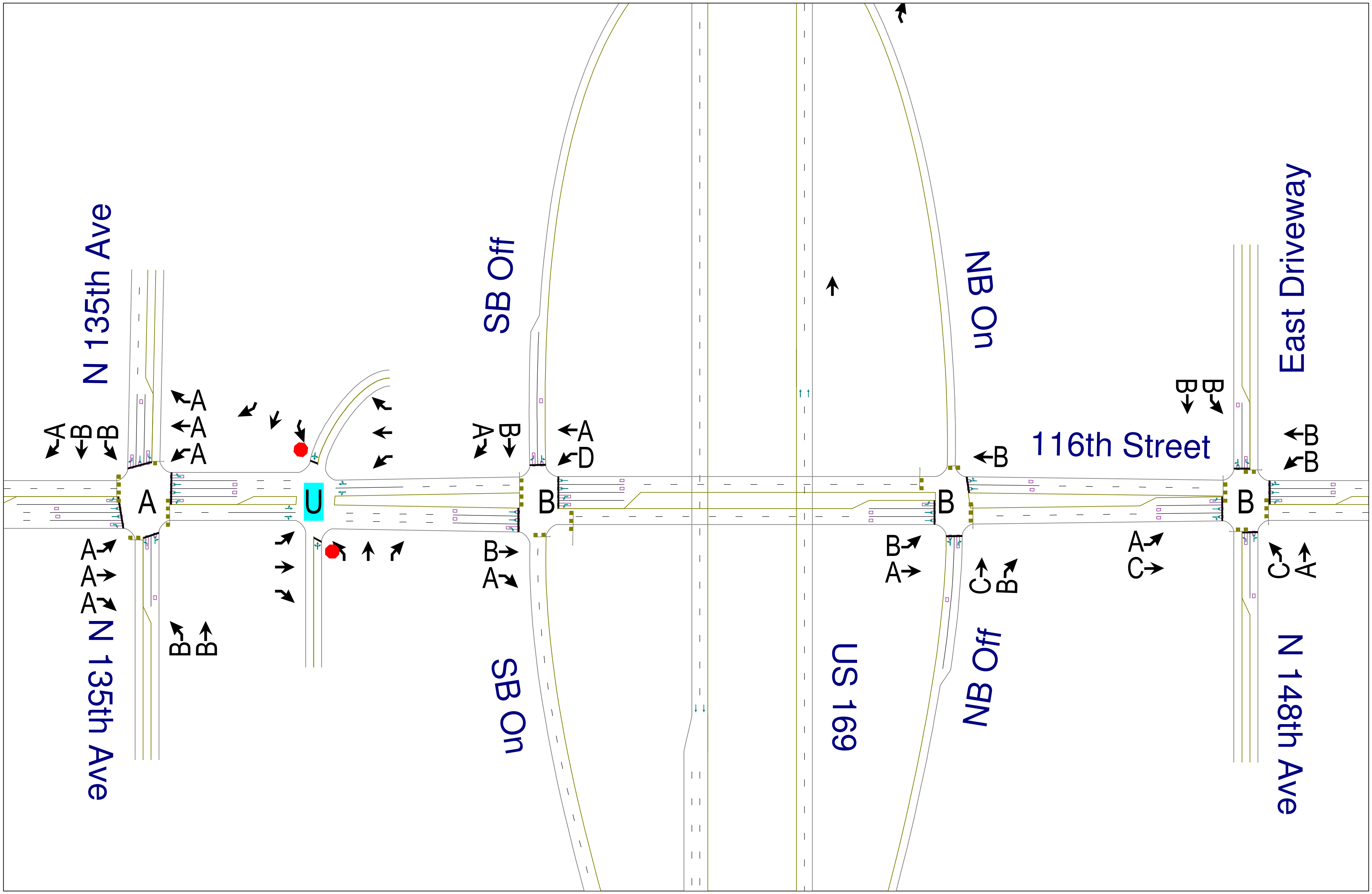
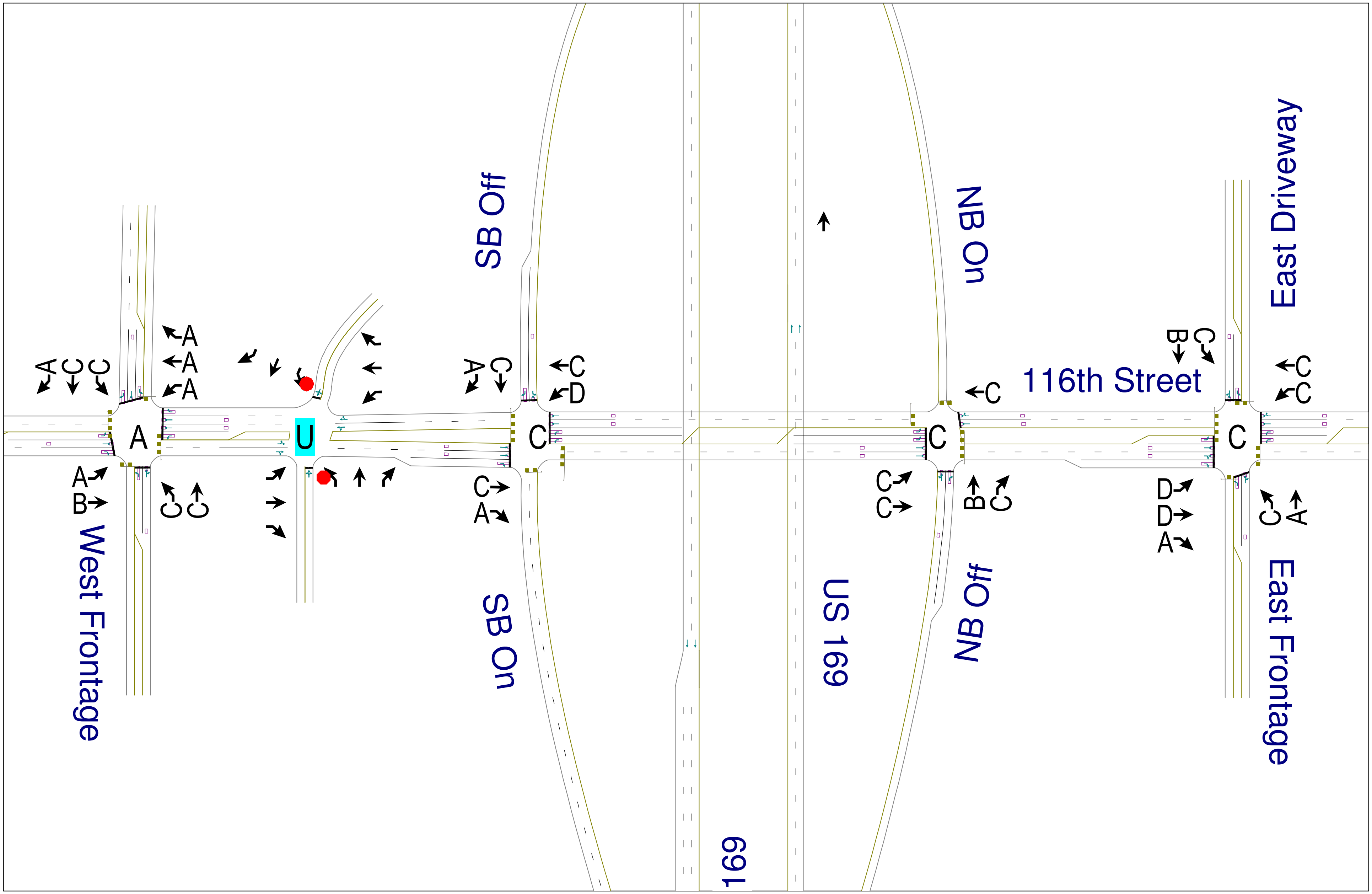

129th Ave
116th Street
240
240
36
140
426
123
37
408
37
44
306
95

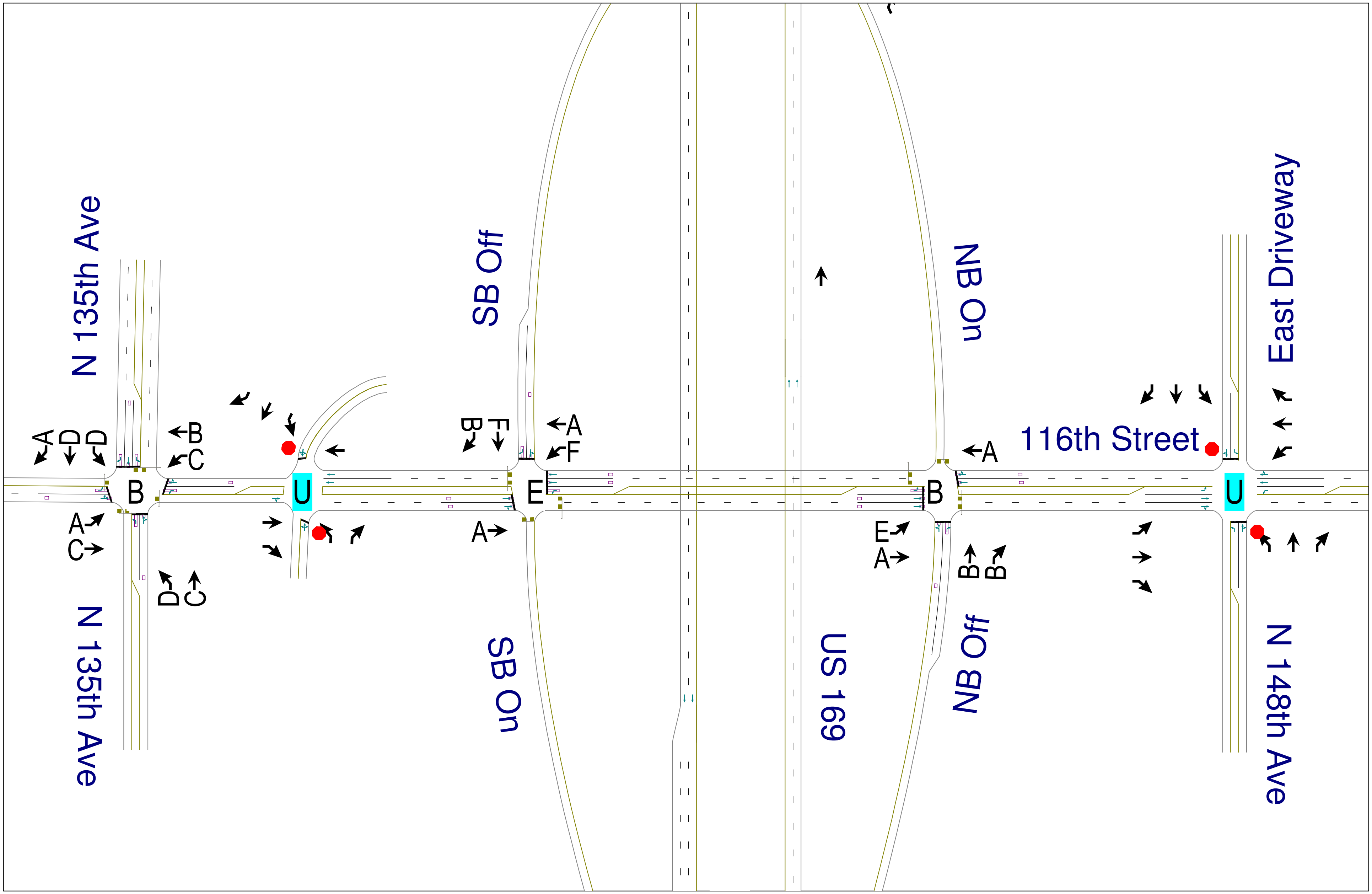
Figure A-5-3

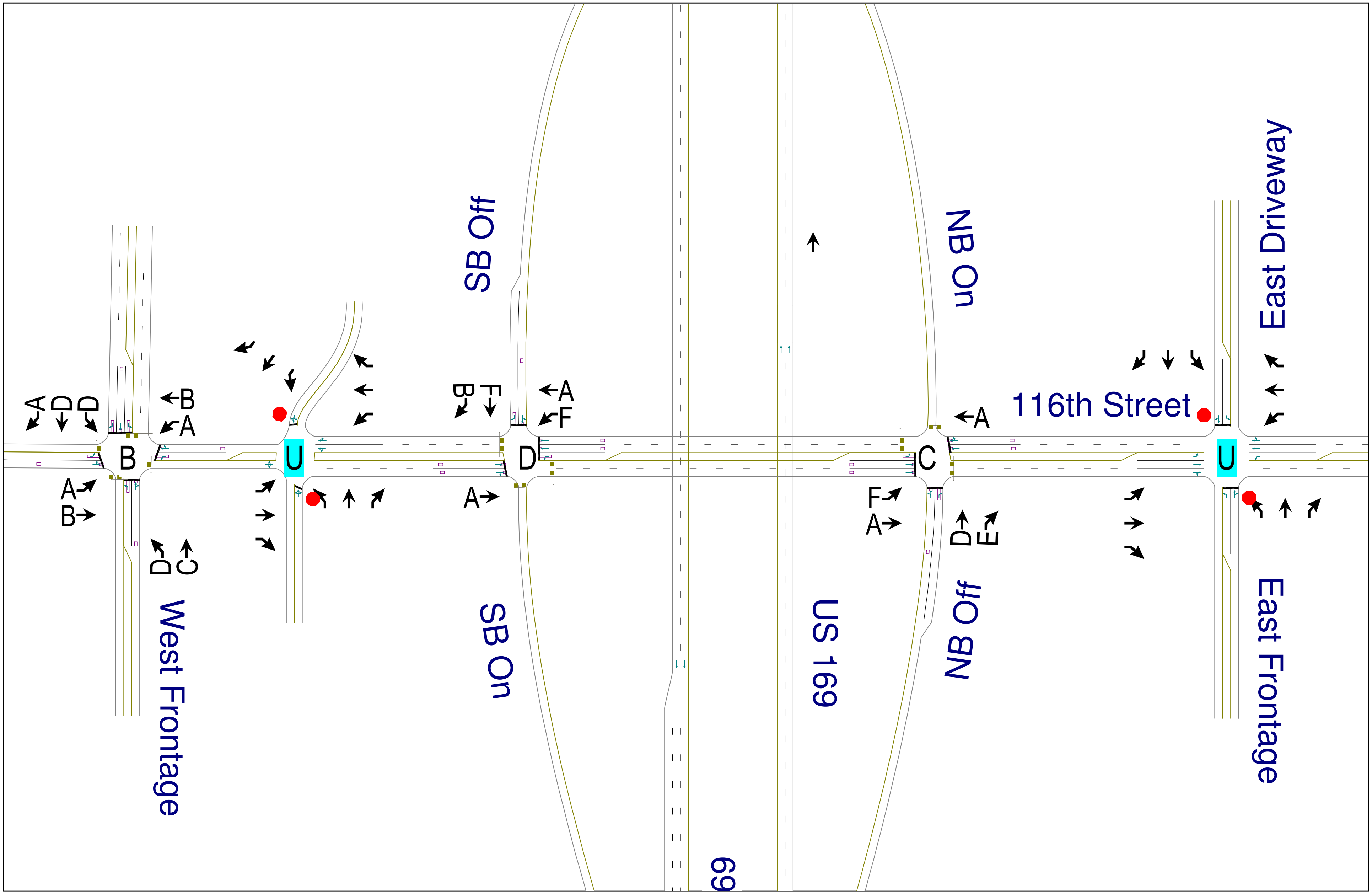
116th Street N & US 169 Interchange

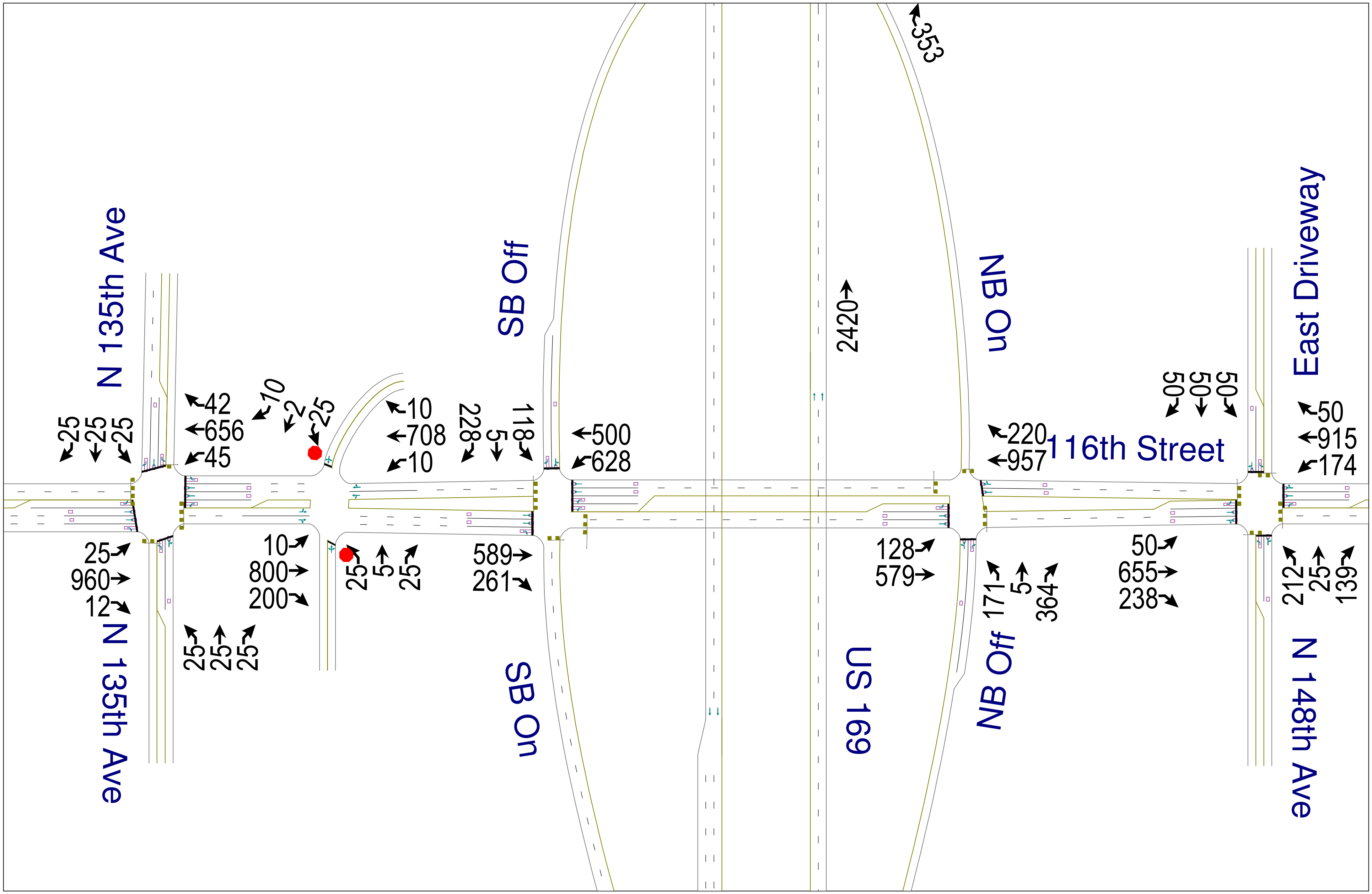
a. Future Improvements & 2035 Traffic Level of Service – AM Peak
b. Future Improvements & 2035 Traffic Level of Service – PM Peak
c. No-Build & 2035 Traffic Level of Service – AM Peak
d. No-Build & 2035 Traffic Level of Service – PM Peak
e. Future Improvements with 2035 Volumes – AM Peak
f. Future Improvements with 2035 Volumes – PM Peak
g. No-Build with 2035 Volumes – AM Peak
h. No-Build with 2035 Volumes – PM Peak

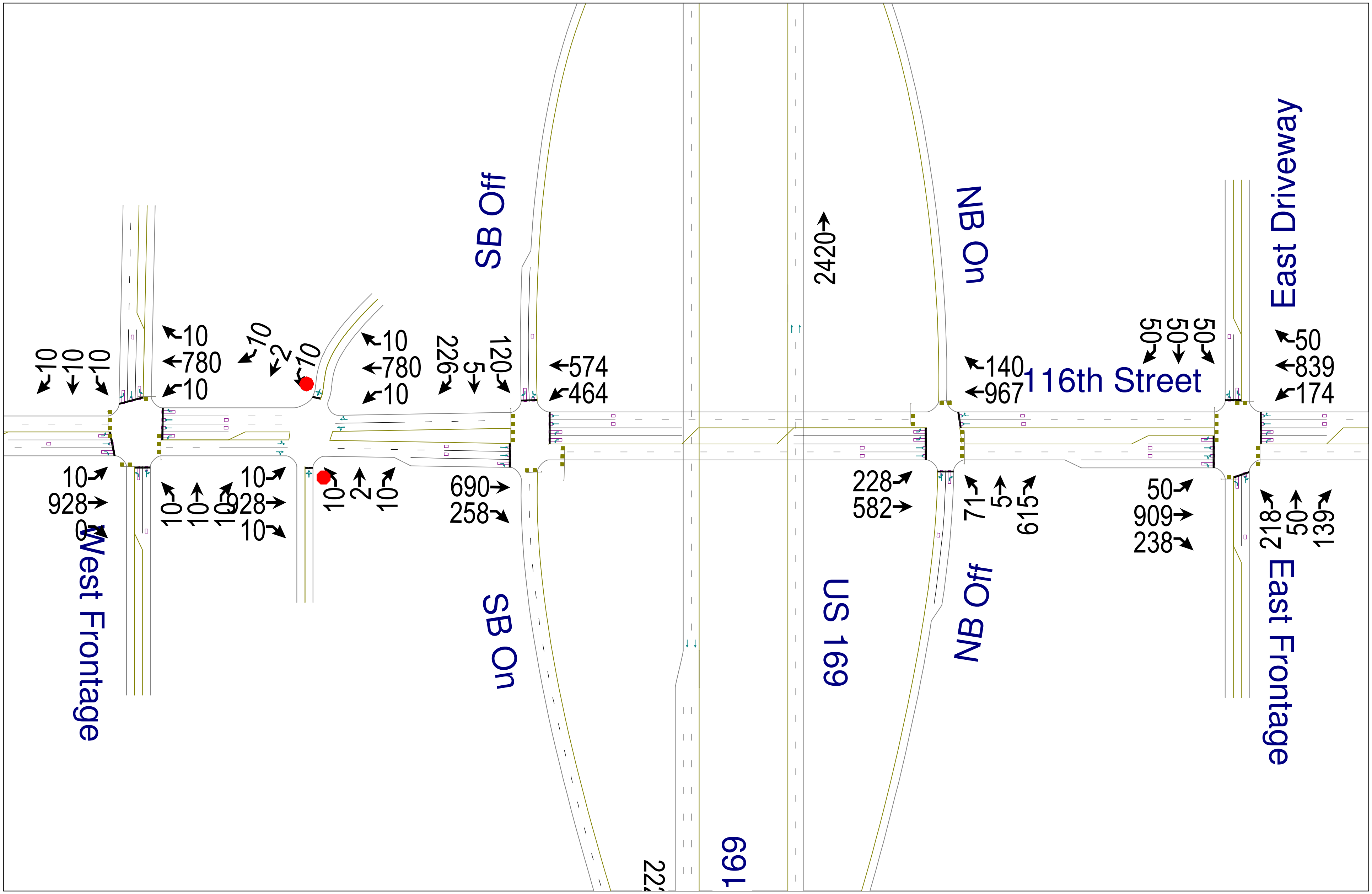

N 135th Ave
SB Off
NB On
East Driveway
116th Street
SB On
US 169
NB Off
N 148th Ave

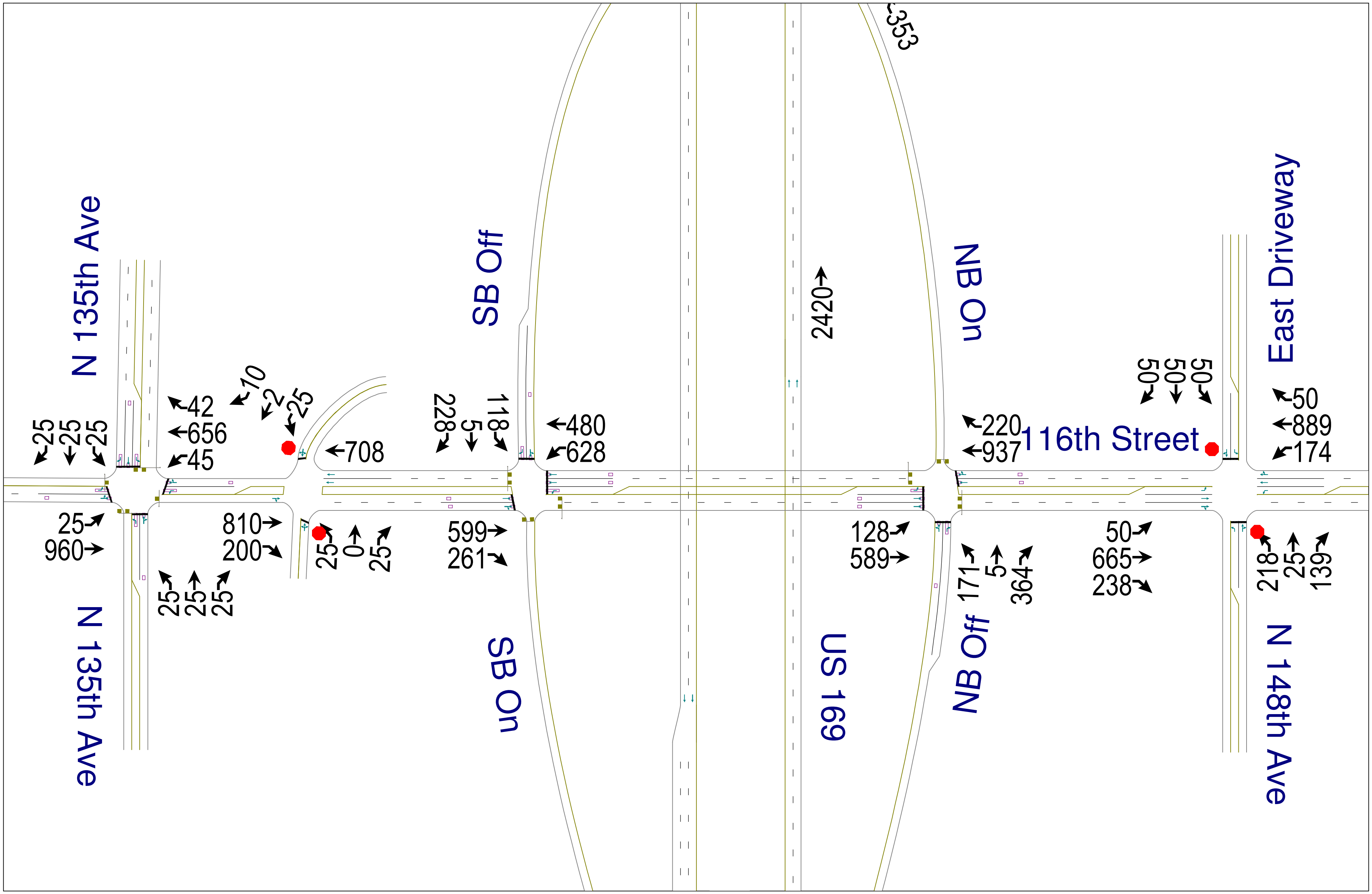

116th Street
West Frontage
SB Off
SB On
US 169
169
NB On
NB Off
East Driveway
East Frontage
A
U
C
C
C


N 135th Ave
SB Off
NB On
East Driveway
116th Street
B
U
E
B
U
SB On
US 169
NB Off
N 135th Ave
N 148th Ave


116th Street
West Frontage
SB Off
SB On
US 169
69
NB On
NB Off
East Driveway
East Frontage
B
U
D
C
U


N 135th Ave
SB Off
NB On
East Driveway
116th Street
SB On
US 169
NB Off
N 148th Ave
353
2420
25
25
25
42
656
45
10
2
25
10
708
10
228
5
118
500
628
220
957
50
50
50
50
915
174
25
960
12
25
25
25
10
800
200
25
5
25
589
261
128
579
171
5
364
50
655
238
212
25
139


West Frontage
SB Off
SB On
US 169
169
NB On
NB Off
116th Street
East Driveway
East Frontage
2420
10
780
10
10
10
10
10
928
0
10
10
10
10
928
10
10
2
10
10
2
10
10
780
10
226
5
120
574
464
690
258
140
967
228
582
71
5
615
50
50
50
50
839
174
50
909
238
218
50
139


N 135th Ave
SB Off
NB On
East Driveway
116th Street
US 169
SB On
NB Off
N 148th Ave
25
25
25
42
656
45
10
2
25
708
228
5
118
480
628
2420
353
220
937
50
50
50
50
889
174
25
960
810
200
25
0
25
25
25
25
599
261
128
589
171
5
364
50
665
238
218
25
139

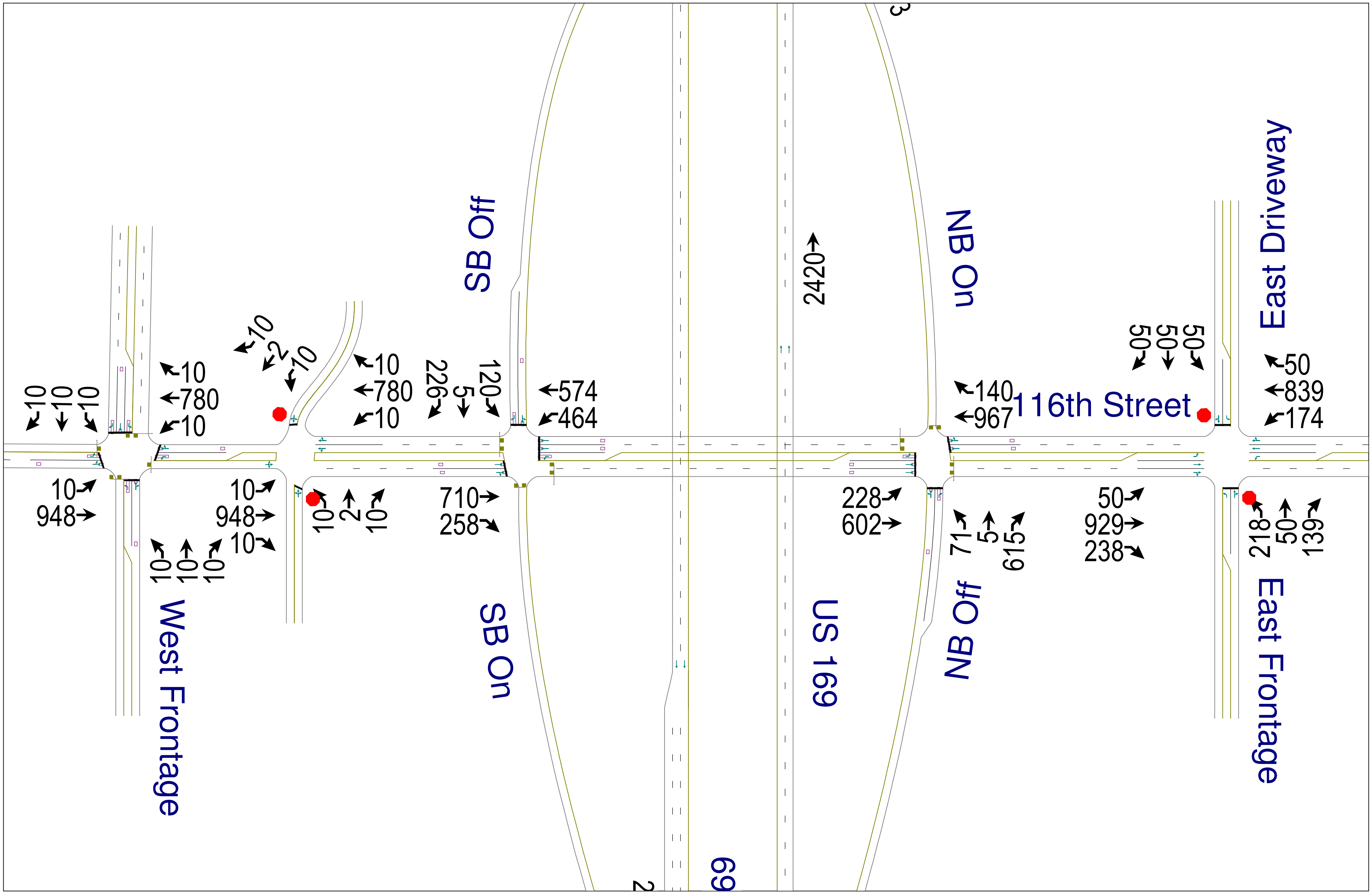
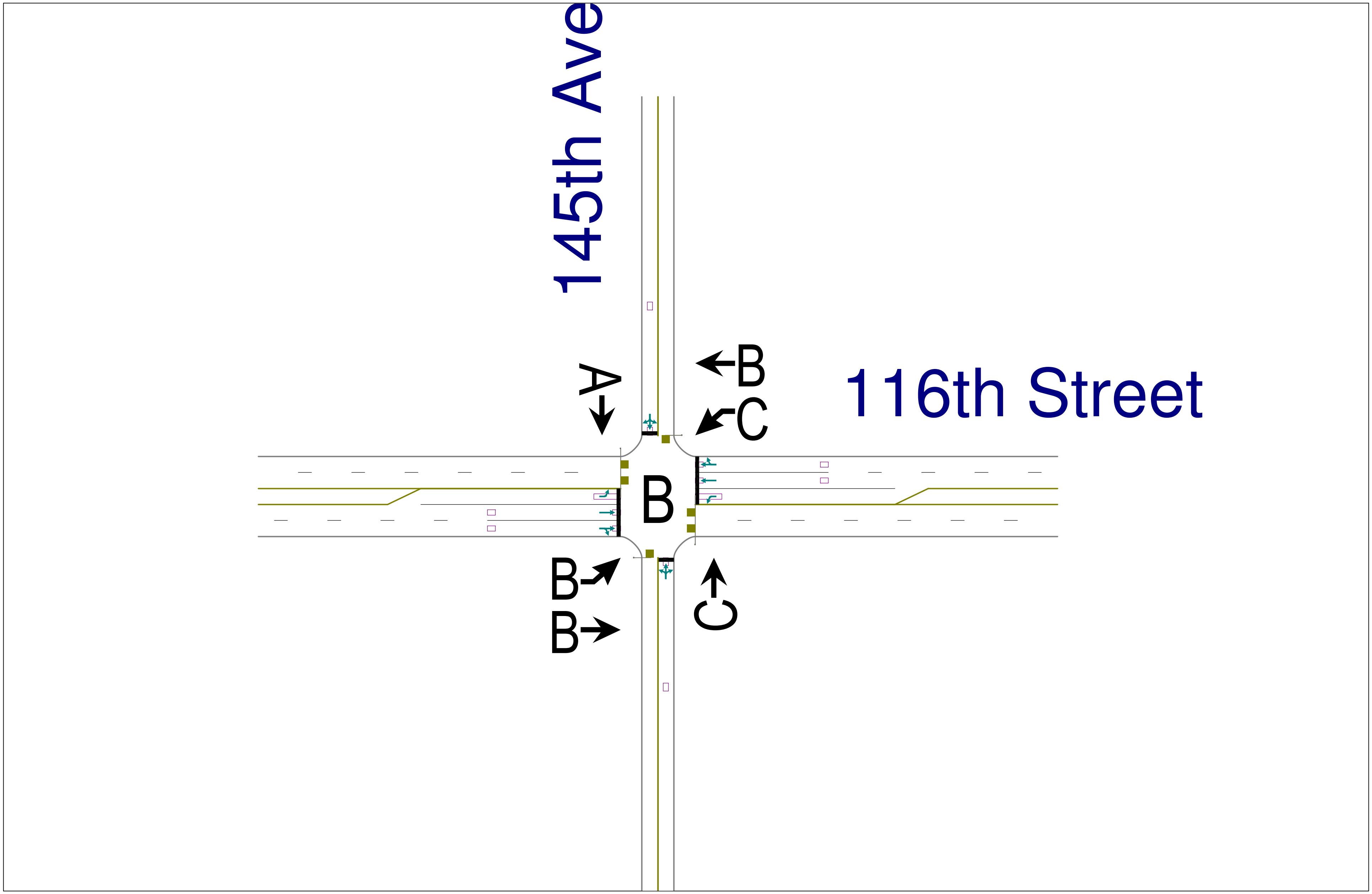
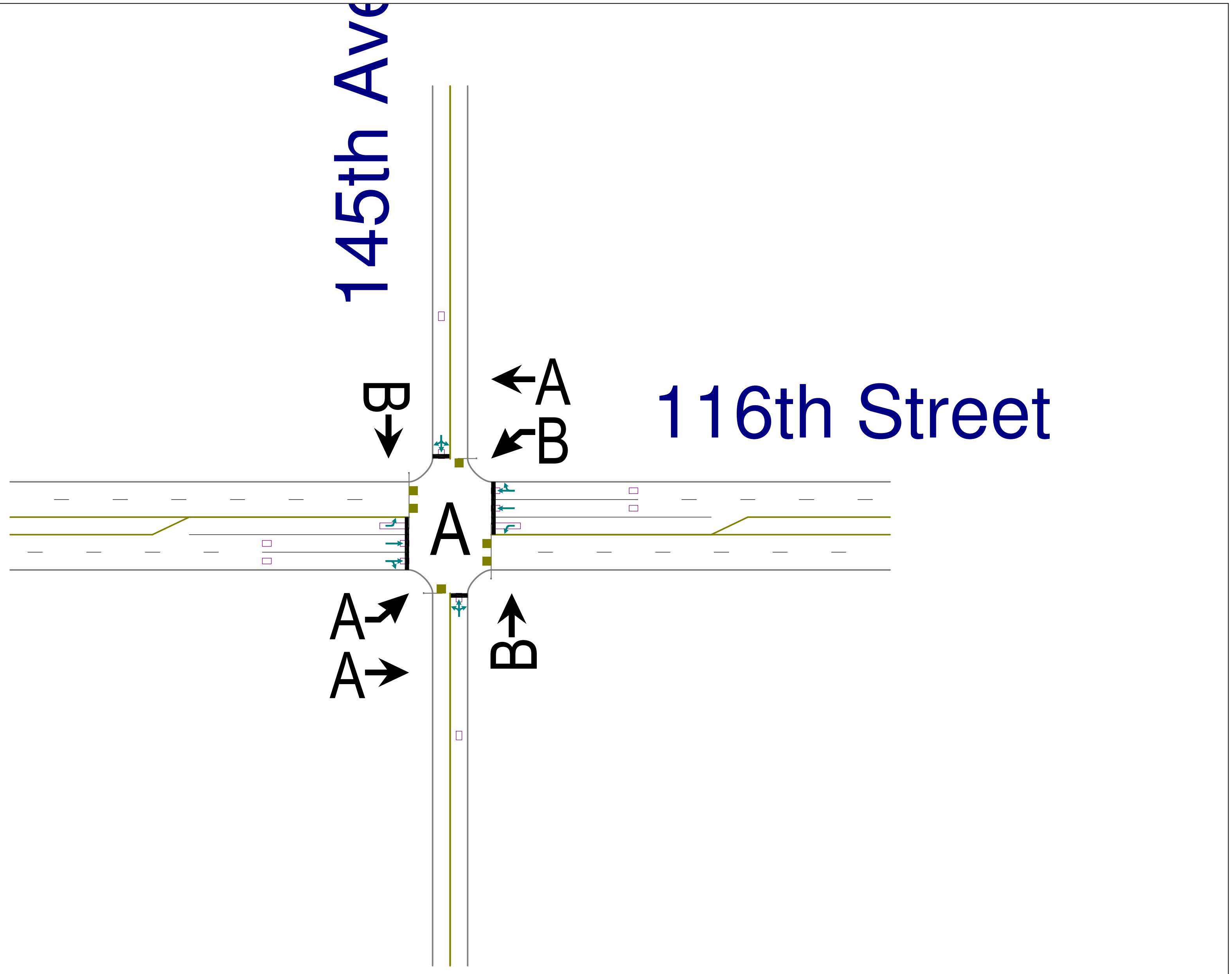

SB Off
SB On
NB On
NB Off
East Driveway
East Frontage
West Frontage
116th Street
US 169
2420
10
10
10
10
780
10
10
2
10
10
780
10
226
5
120
574
464
140
967
50
50
50
50
839
174
10
948
10
948
10
10
10
10
10
2
10
710
258
228
602
71
5
615
50
929
238
218
50
139

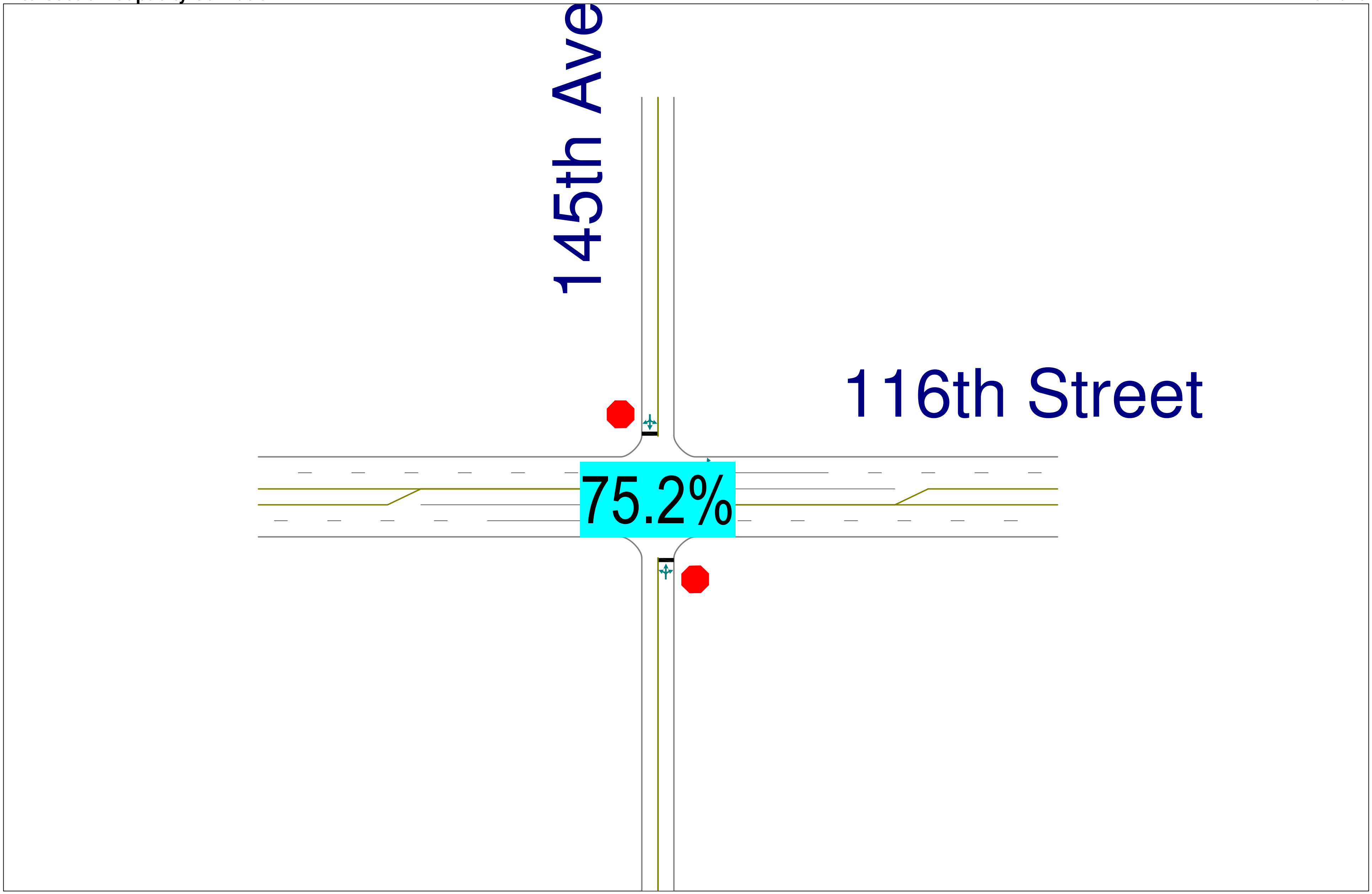
Figure A-5-4

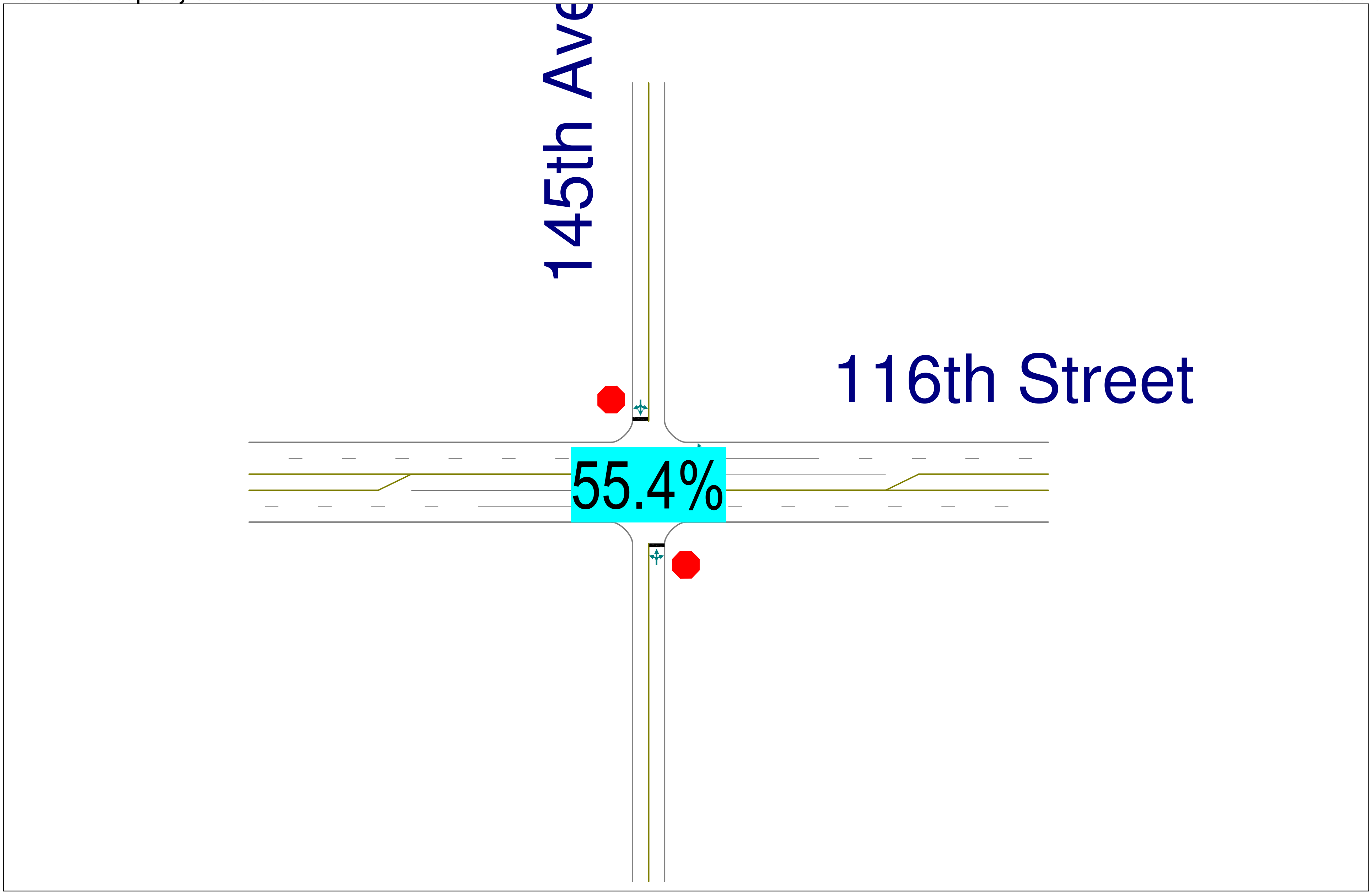
116th Street N & 145th E Avenue Intersection

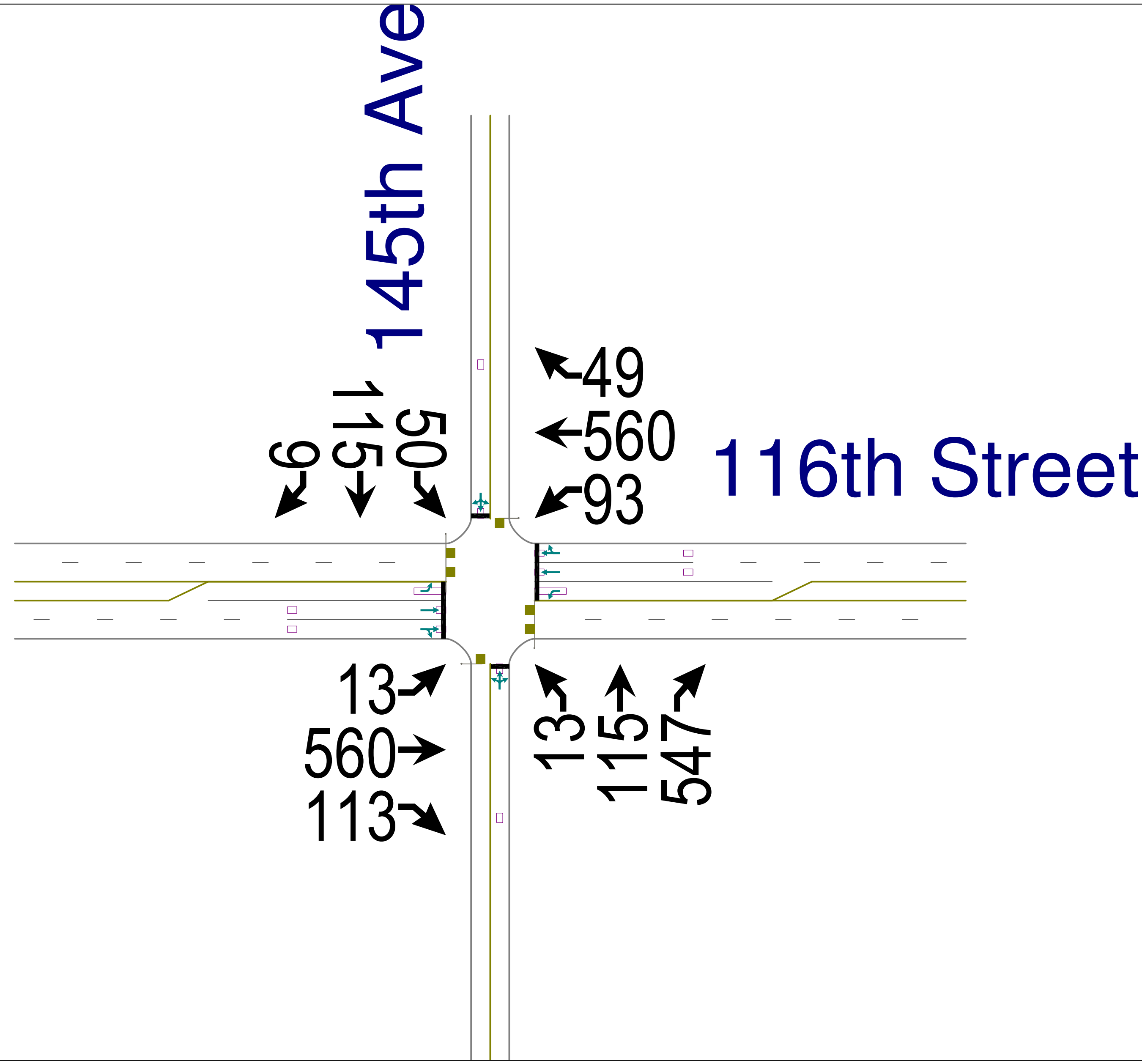
a. Future Improvements & 2035 Traffic Level of Service – AM Peak
b. Future Improvements & 2035 Traffic Level of Service – PM Peak
c. No-Build & 2035 Traffic Level of Service – AM Peak
d. No-Build & 2035 Traffic Level of Service – PM Peak
e. Future Improvements with 2035 Volumes – AM Peak
f. Future Improvements with 2035 Volumes – PM Peak
g. No-Build with 2035 Volumes – AM Peak
h. No-Build with 2035 Volumes – PM Peak


145th Ave
116th Street
A
B
C
B
B
B
C
B

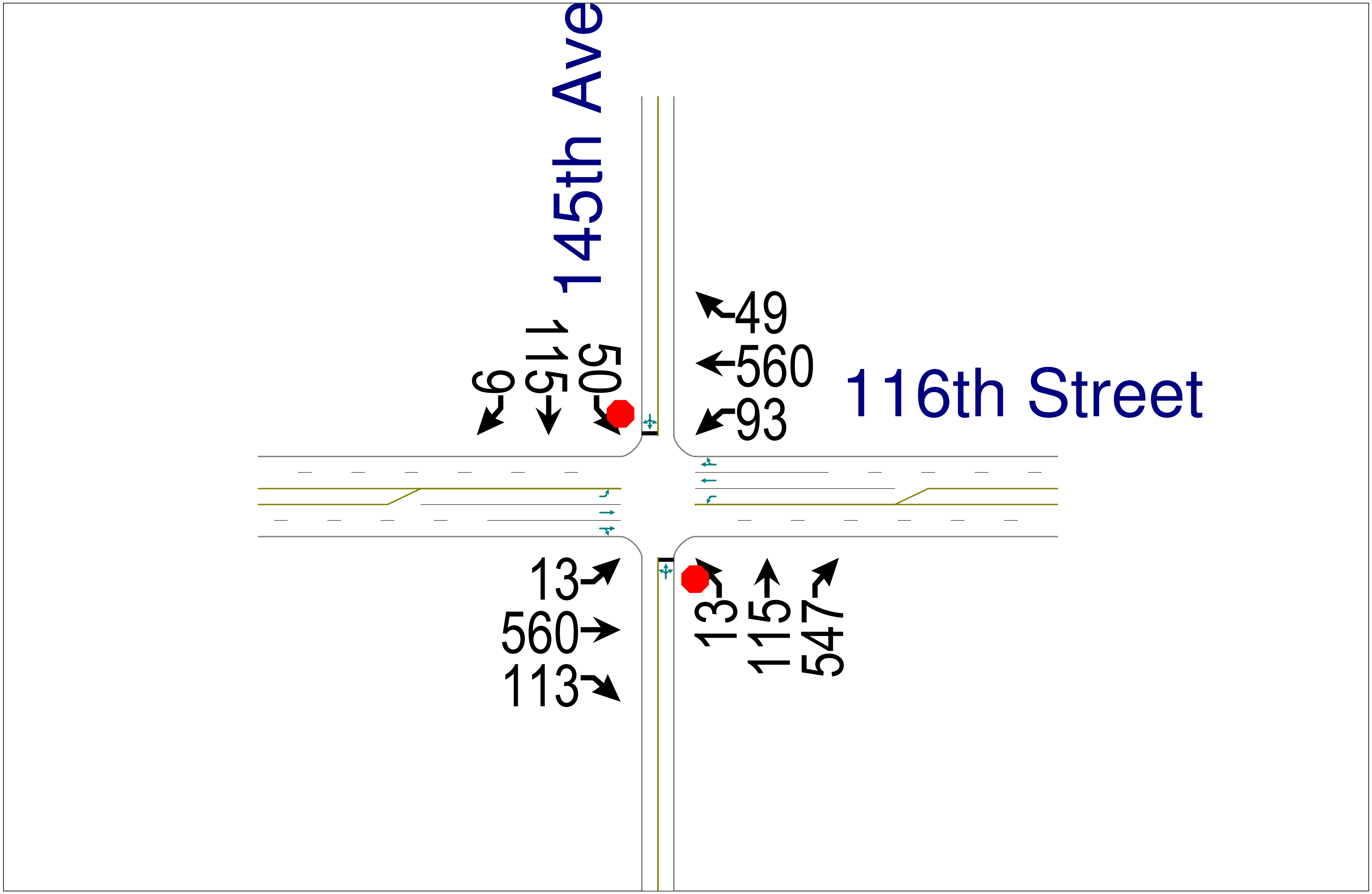

145th Ave
116th Street
A
B
A
B
A
A
B


145th Ave
116th Street
75.2%


145th Ave
116th Street
55.4%


145th Ave
116th Street
49
560
93
9
115
50
13
560
113
13
115
547


145th Ave
116th Street
50
560
233
13
113
49
9
547
13
34
115
93


145th Ave
116th Street
49
560
93
50
115
9
13
560
113
13
115
547

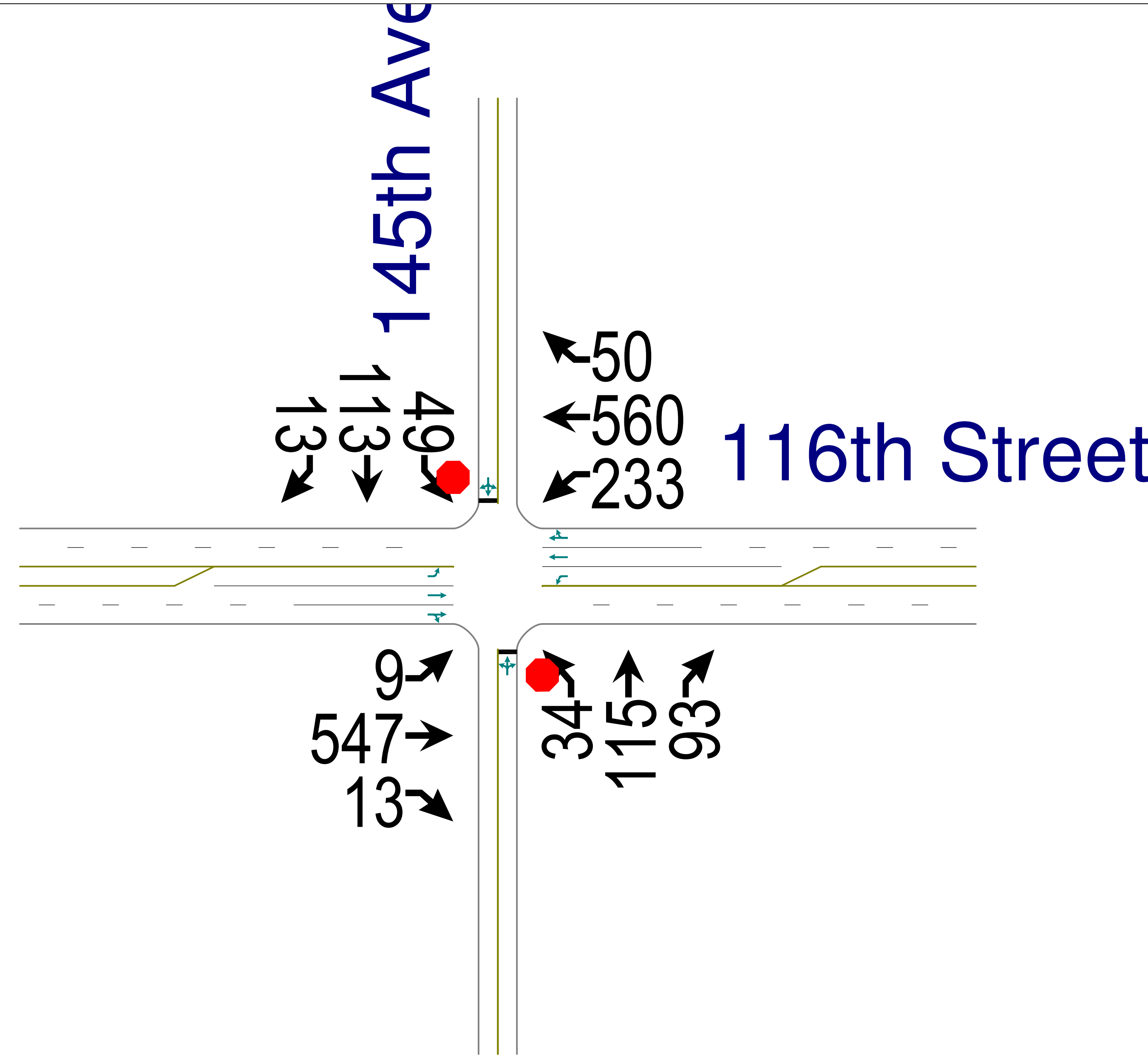
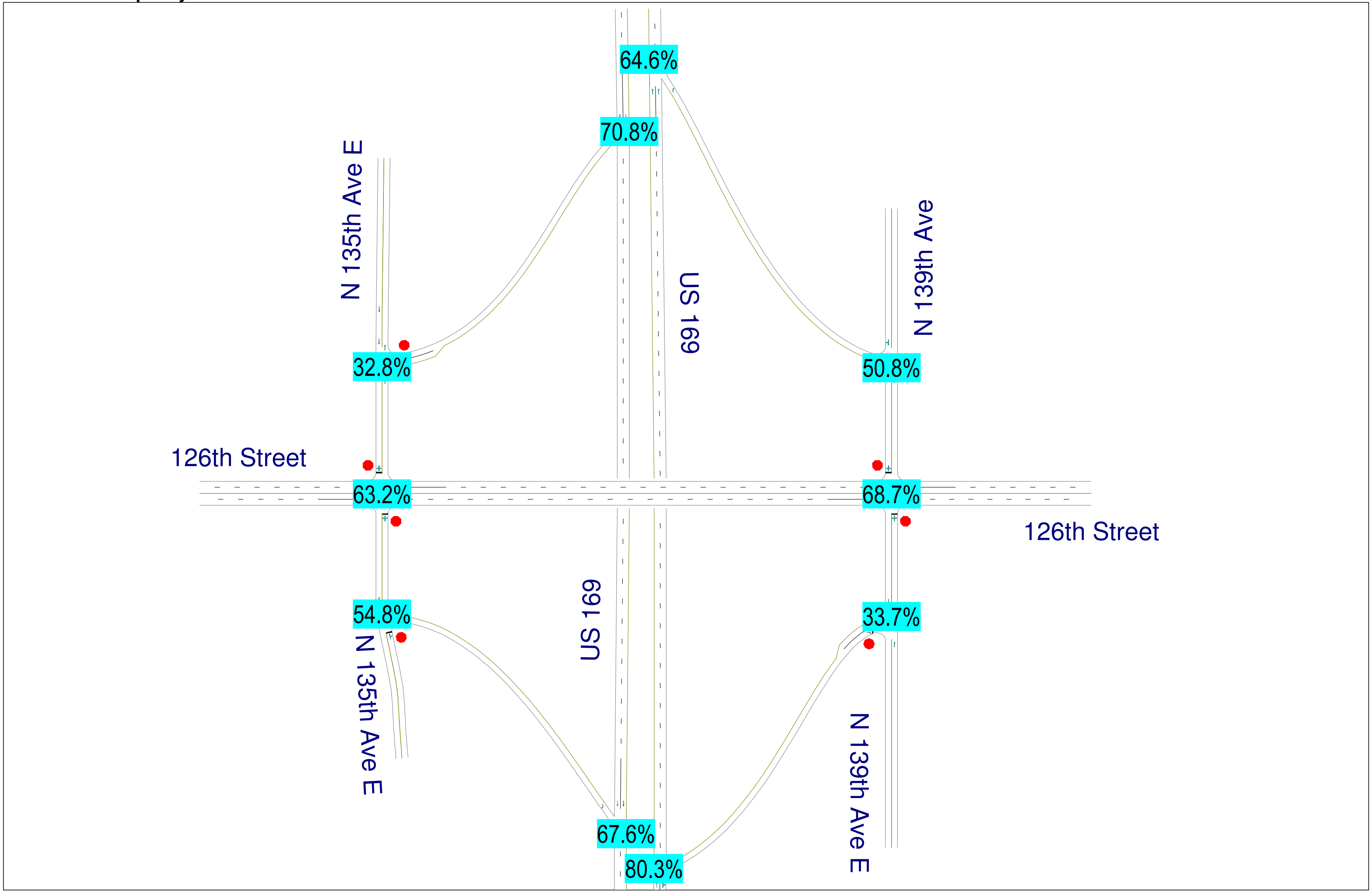

145th Ave
116th Street
50
560
233
13
113
49
9
547
13
34
115
93

Figure A-6-1

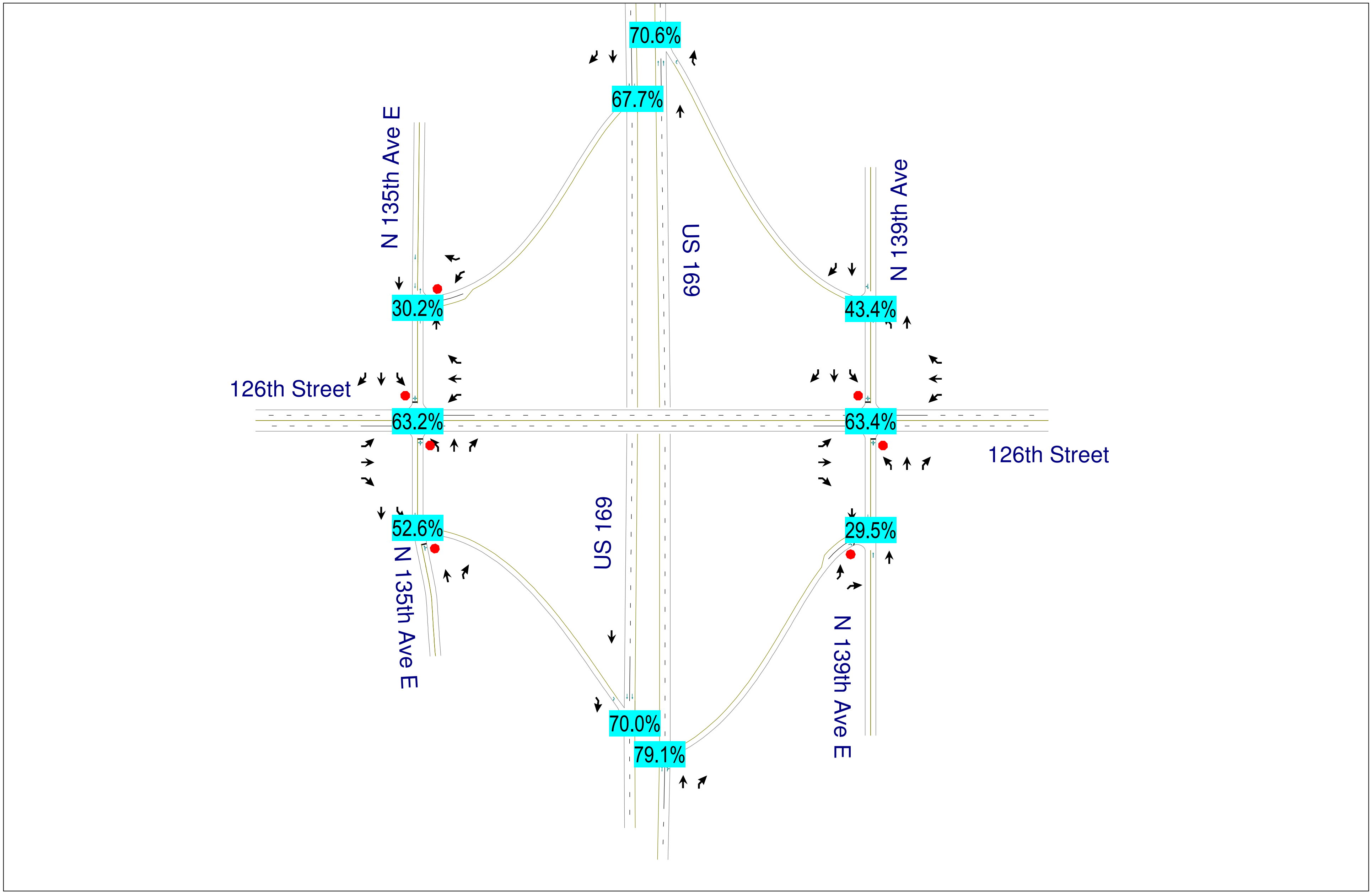
126th Street N & US 169 Interchange

a. No-Build & 2035 Traffic Level of Service – AM Peak
b. No-Build & 2035 Traffic Level of Service – PM Peak
c. No-Build with 2035 Volumes – AM Peak
d. No-Build with 2035 Volumes – PM Peak

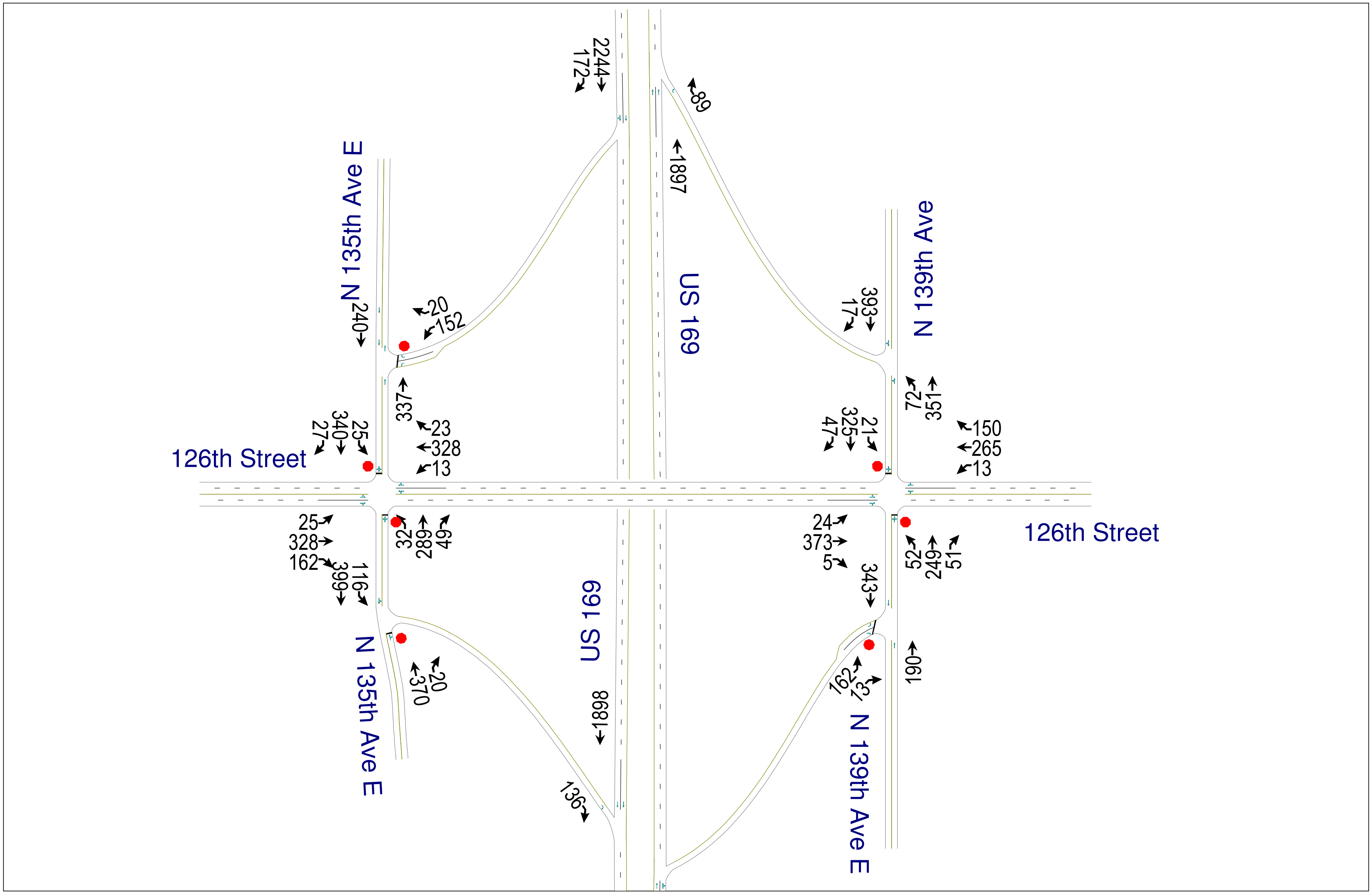

64.6%
70.8%
N 135th Ave E
US 169
N 139th Ave
32.8%
50.8%
126th Street
63.2%
68.7%
126th Street
US 169
54.8%
33.7%
N 135th Ave E
N 139th Ave E
67.6%
80.3%

Map - 126th Street & US 169
Level of Service

4/28/2015



126th Street & US 169 Existing Lanes with 2035 Volumes - PM Peak
Timing Plan: PM Peak



126th Street & US 169 Existing Lanes with 2035 Volumes - AM
Timing Plan: AM - Peak

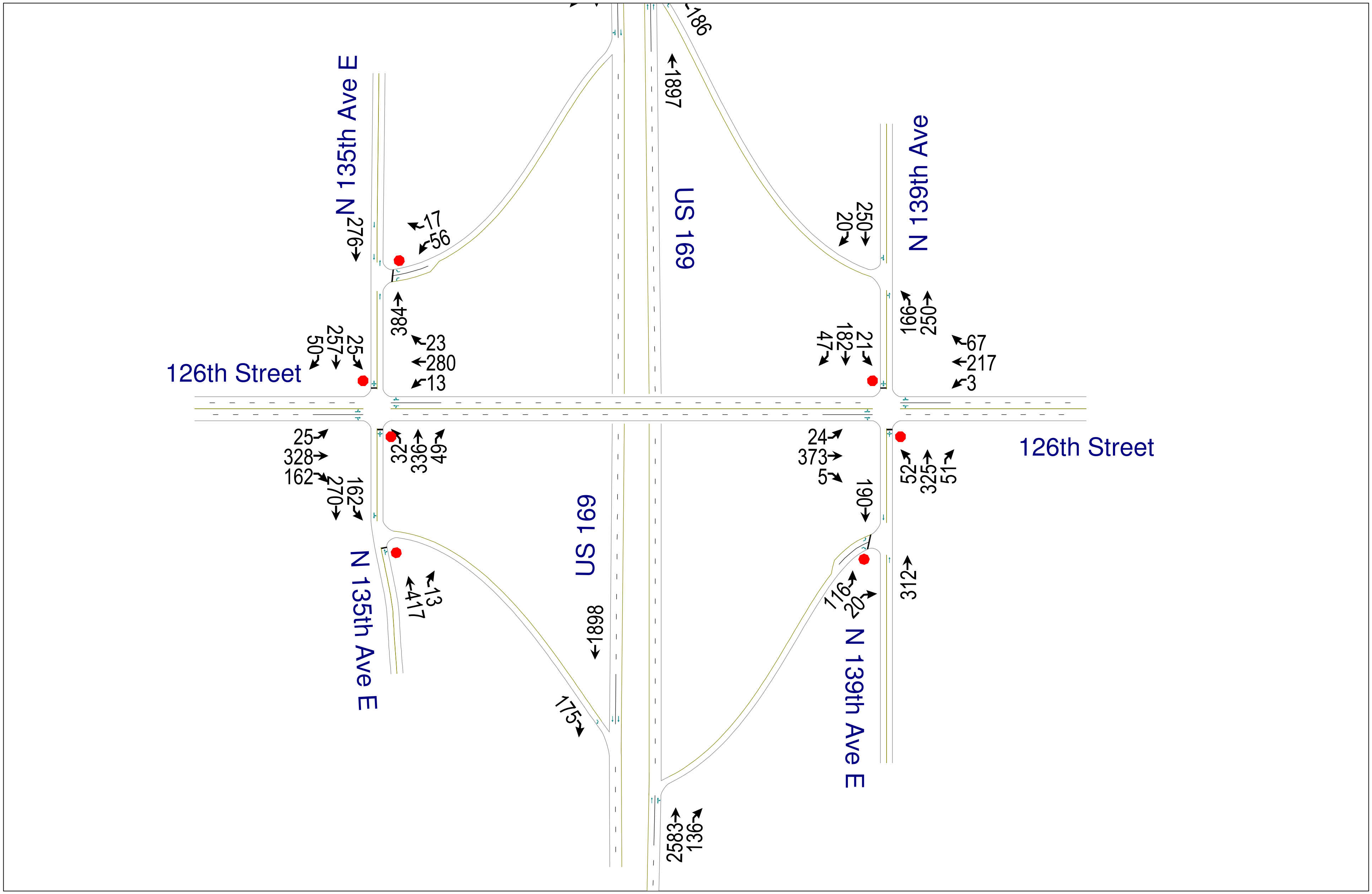
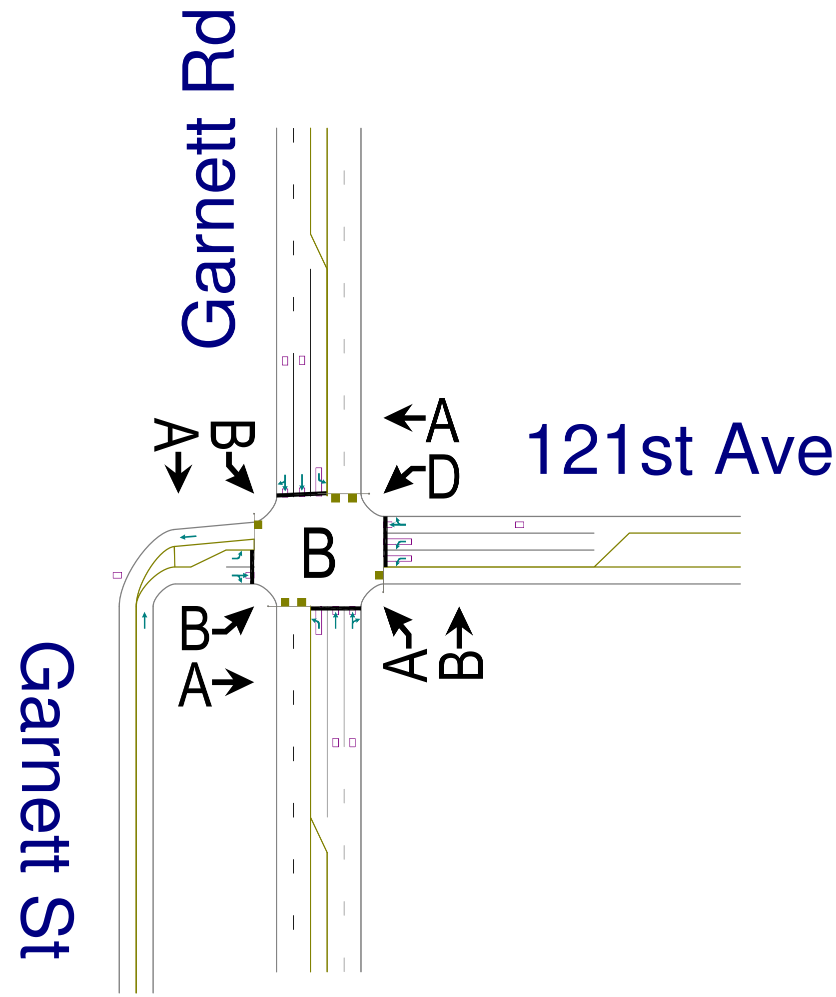
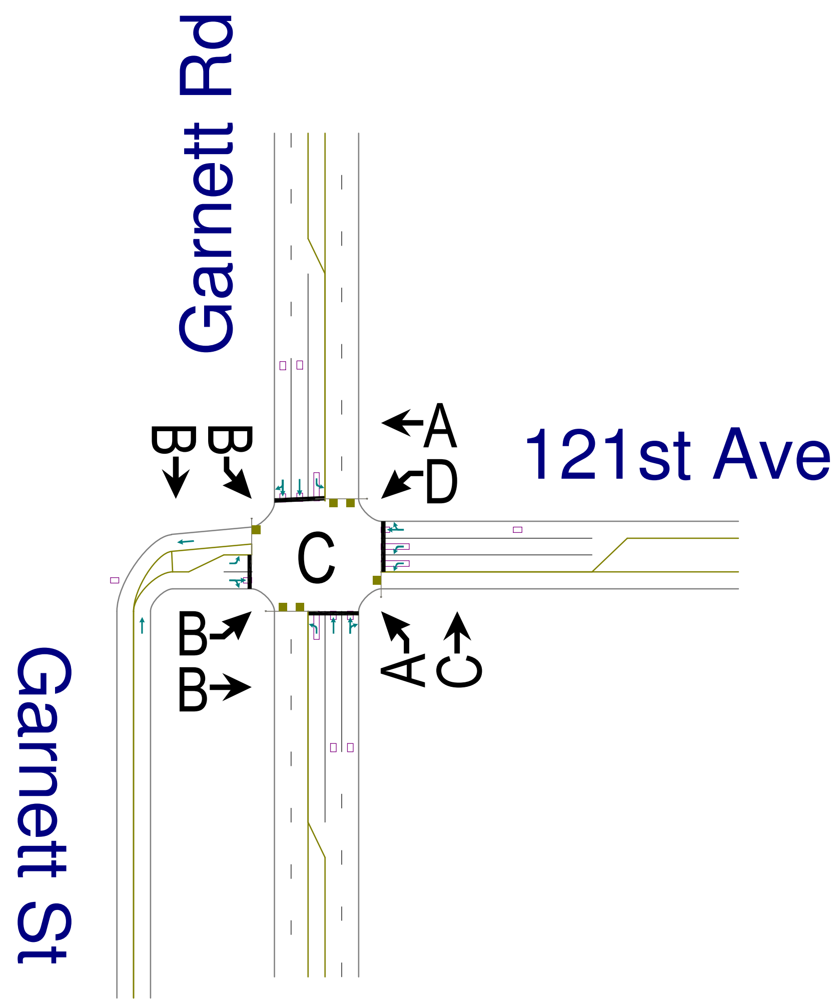

126th Street
126th Street
US 169
US 169
N 135th Ave E
N 135th Ave E
N 139th Ave
N 139th Ave E
186
1897
276
17
56
384
23
280
13
25
257
50
25
328
162
270
162
32
336
49
13
417
1898
175
250
20
166
250
67
217
3
21
182
47
24
373
5
52
325
51
190
312
116
20
2583
136

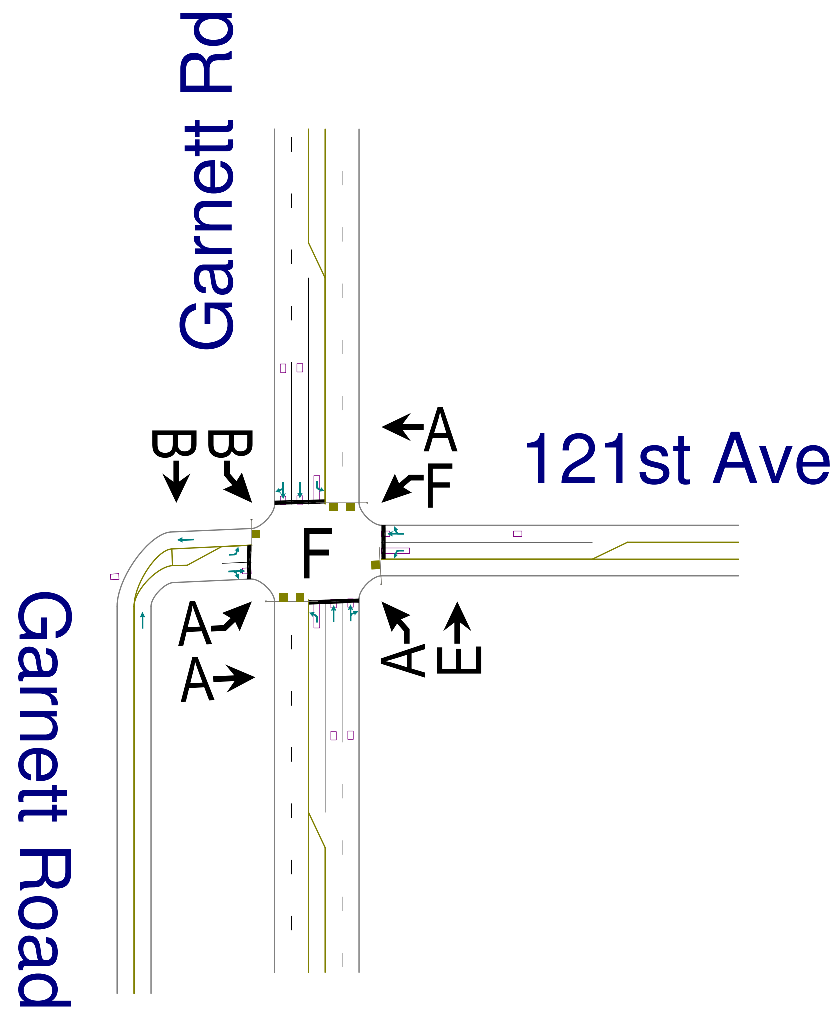
Figure A-7-1

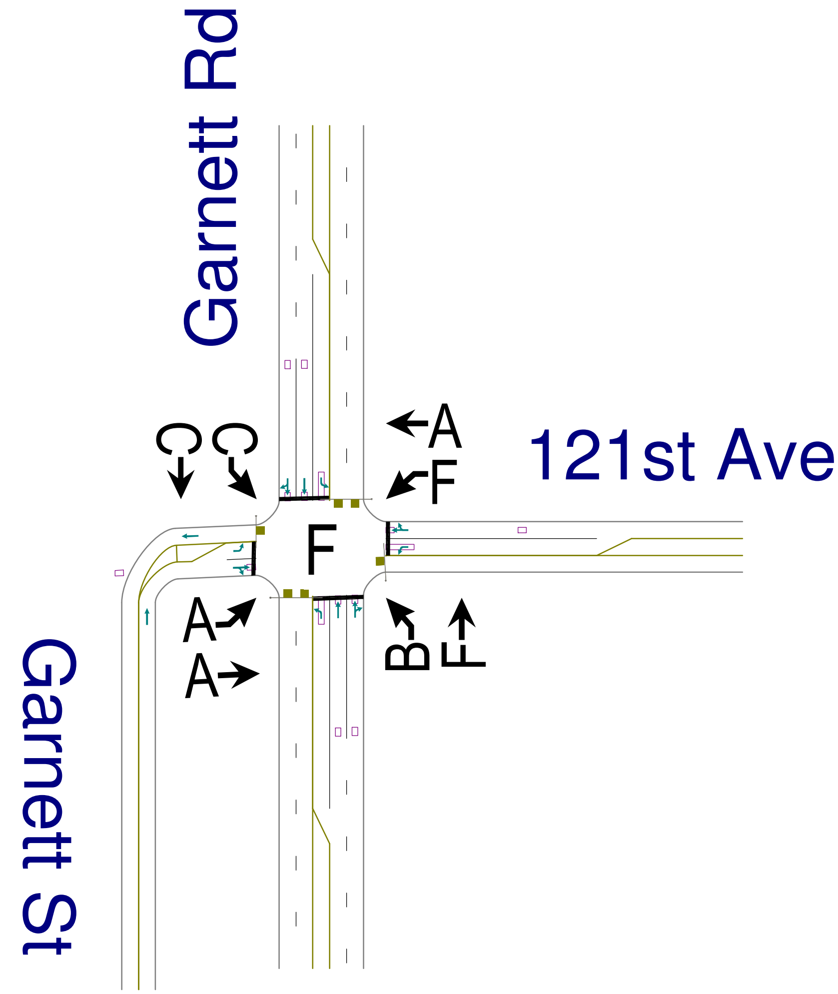
Garnett Road & Smith Farm Market Intersection

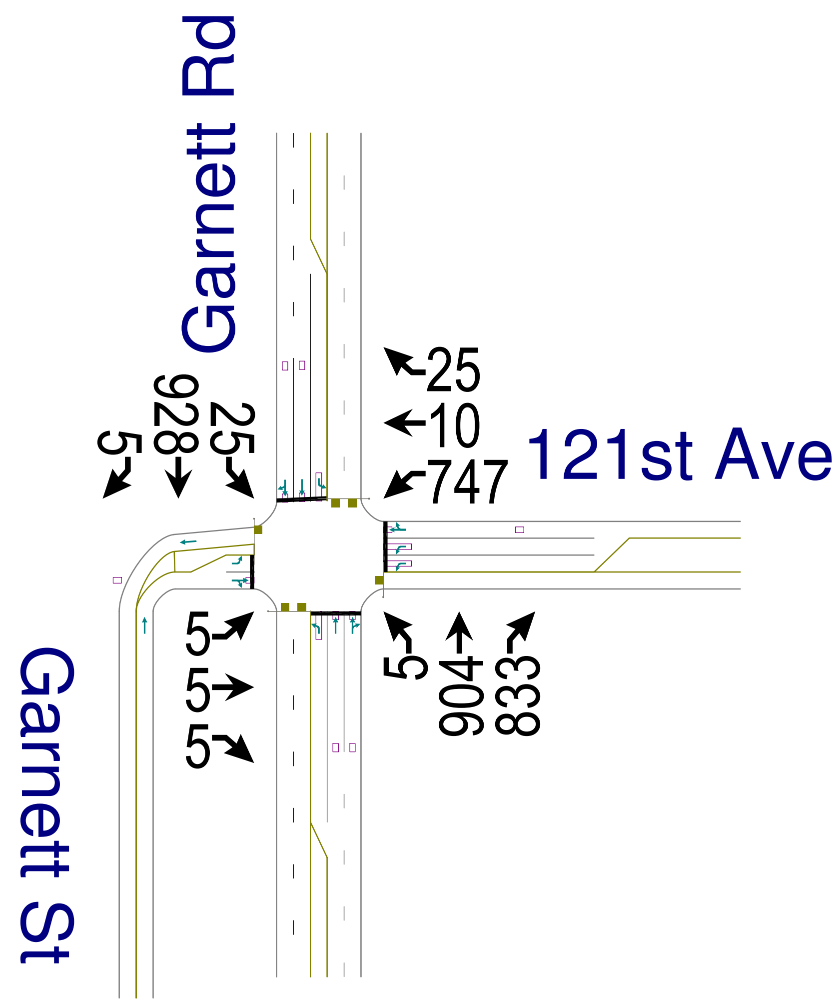
a. Future Improvements & 2035 Traffic Level of Service – AM Peak
b. Future Improvements & 2035 Traffic Level of Service – PM Peak
c. No-Build & 2035 Traffic Level of Service – AM Peak
d. No-Build & 2035 Traffic Level of Service – PM Peak
e. Future Improvements with 2035 Volumes – AM Peak
f. Future Improvements with 2035 Volumes – PM Peak
g. No-Build with 2035 Volumes – AM Peak
h. No-Build with 2035 Volumes – PM Peak

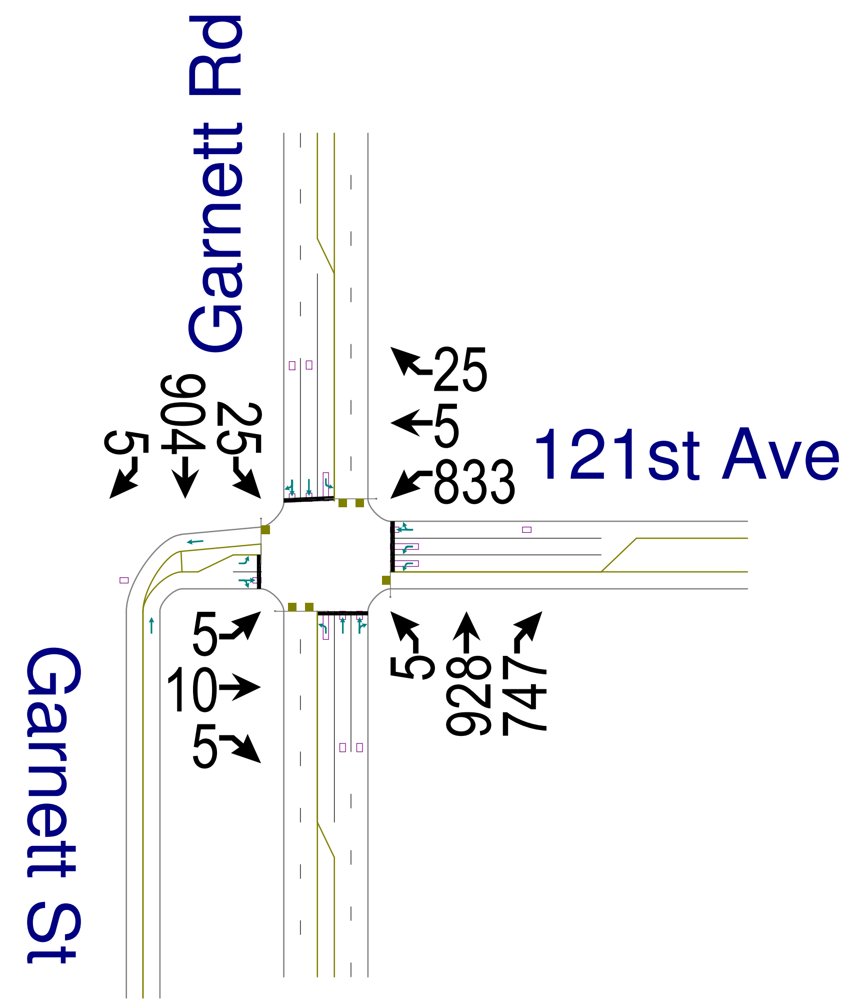

Garnett Rd
121st Ave
Garnett St
B
A
D
A
B
B
A
A
B

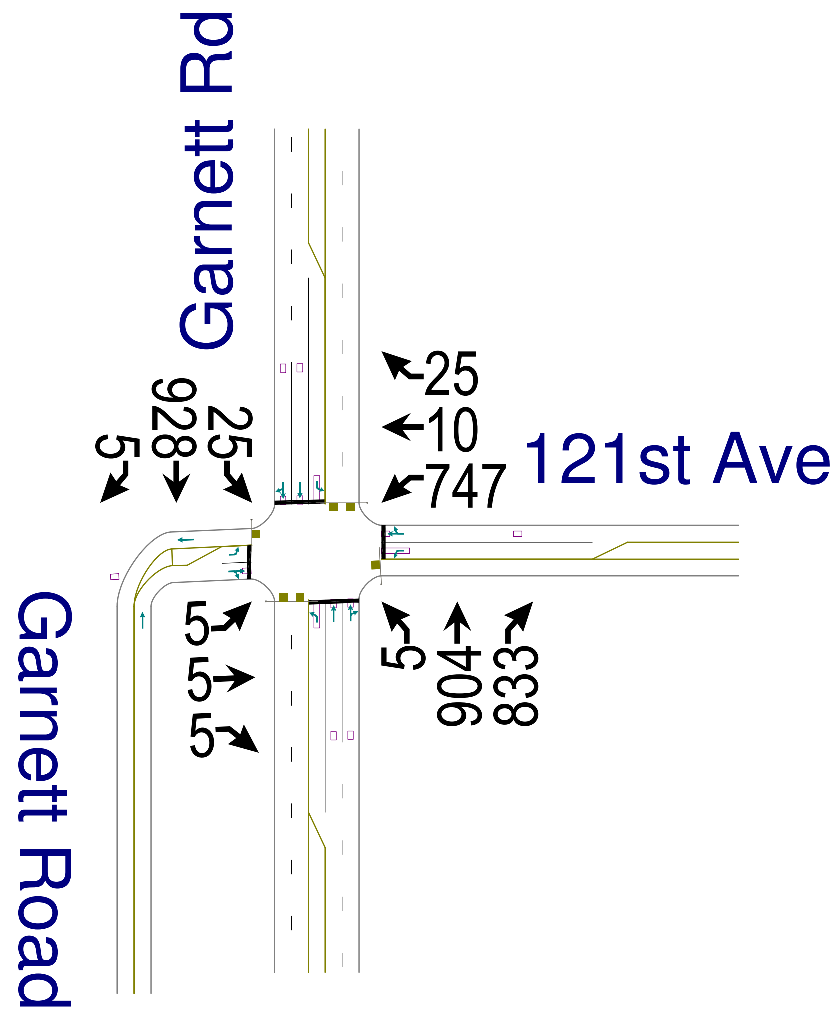

Garnett Rd
121st Ave
Garnett St
A
D
B
B
C
B
B
A
C

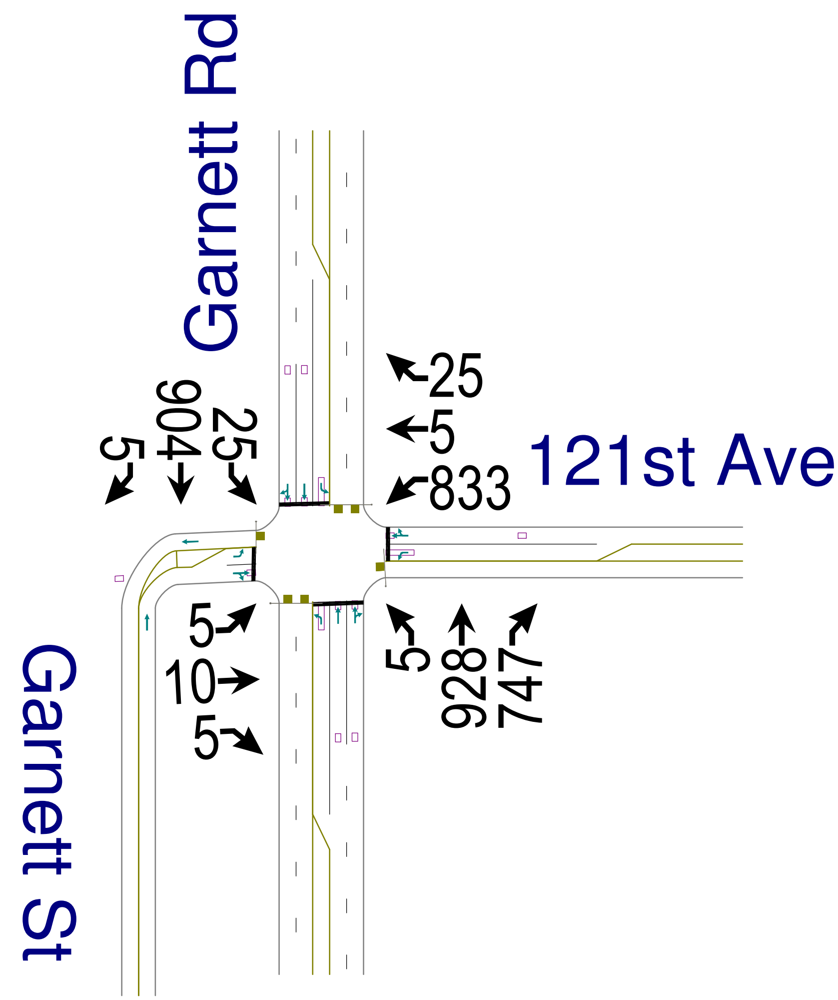

Garnett Rd
121st Ave
Garnett Road
F
A
F
B
B
A
A
A
E


Garnett Rd
121st Ave
Garnett St
C
C
A
F
F
A
A
B
F


Garnett Rd
121st Ave
Garnett St
25
10
747
5
928
25
5
5
5
5
904
833


Garnett Rd
121st Ave
Garnett St
25
5
833
5
904
25
5
10
5
5
928
747


Garnett Rd
121st Ave
Garnett Road
25
10
747
5
928
25
5
5
5
5
904
833


Garnett Rd
121st Ave
Garnett St
25
5
833
904
5
25
10
5
5
928
747

APPENDIX B: POLICY AND PLAN CONSIDERATIONS

CITY OF OWASSO, OKLAHOMA

RESOLUTION NO. 2015-03

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF OWASSO, OKLAHOMA, ESTABLISHING A COMPLETE STREETS POLICY FOR THE CITY OF OWASSO

WHEREAS, The City of Owasso embraces the transportation needs for all citizens and understands the need for equity among modes of transportation. Complete Streets are designed and operated to enable safe access for all modes of transportation including pedestrians, bicyclists, motorized vehicles and transit-riders. Complete streets are designed to safely accommodate users of all ages and abilities; and

WHEREAS, Complete Streets are defined as those that provide safe, accessible and convenient transportation facilities for multiple modes of travel and accommodate all users including pedestrians, bicyclists, public transit riders, freight providers, emergency responders and motorists that are safe and accessible for users of **all** mobility levels; and

WHEREAS, Complete Streets may enhance economic vitality by providing convenient pedestrian, bicycle, and public transit facilities that help create a sense of place in and around retail districts and provide safer connections between places of residence to centers of recreation, retail, education, and places of work; and

WHEREAS, Complete Streets objectives may be achieved through single construction projects or incrementally through a series of planned improvements; and

WHEREAS, the purpose of this policy is to set forth guiding principles to be considered in all transportation projects, where practicable, economically feasible and in accordance with applicable laws and ordinances in order to provide accommodation for walking, bicycling, other non-motorized forms of transportation, and motorized transportation including personal, freight and public transit vehicles; and

WHEREAS, a transportation system conducive to walking, bicycling and public transit, for all ages and abilities, reduces traffic congestion, improves public health, decreases air pollution enhances economic vitality, provides a more livable community and improves the overall quality of life for Owasso residents.

NOW, THEREFORE BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF OWASSO, OKLAHOMA THAT:

Street projects should be planned, designed and operated when physically and economically feasible in accordance with our Community Plans and Policies or any plan adopted in the future, giving consideration to the accepted standards for Complete Streets, as outlined by the National Complete Streets Coalition to provide for a balanced responsible and equitable way to accommodate and ensure travel for pedestrians, bicyclists, and public transit riders of all ages and abilities amongst vehicular traffic.

APPROVED AND ADOPTED this 3rd day of February, 2015 by the City Council of the City of Owasso, Oklahoma.

____

Jeri Moberly, Mayor

ATTEST

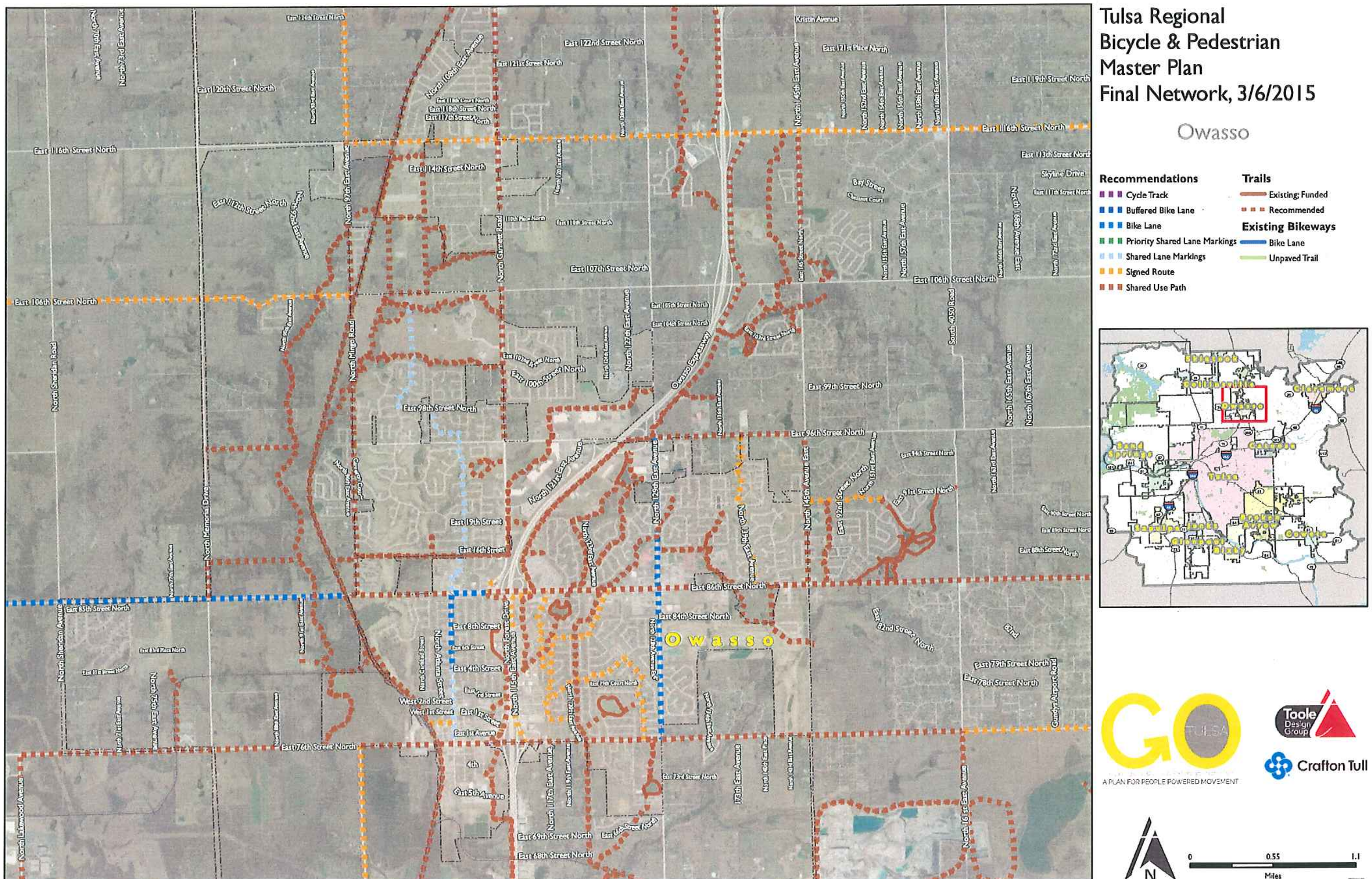
____

Sherry Bishop, City Clerk

Approved as to Form:

____

Julie Trout Lombardi, City Attorney


Tulsa Regional
Bicycle & Pedestrian
Master Plan
Final Network, 3/6/2015
Owasso
Recommendations
Cycle Track
Buffered Bike Lane
Bike Lane
Priority Shared Lane Markings
Shared Lane Markings
Signed Route
Shared Use Path
Trails
Existing; Funded
Recommended
Existing Bikeways
Bike Lane
Unpaved Trail
GO TULSA
A PLAN FOR PEOPLE POWERED MOVEMENT
Toole Design Group
Crafton Tull
N
0
0.55
1.1
Miles
Owasso

APPENDIX C: PROJECT PARTICIPANTS

Owasso Transportation Master Plan Committee

City of Owasso

Warren Lehr, City Manager	(918) 376-1515 wlehr@cityofowasso.com
Dwayne Henderson, City Engineer	(918) 272-4959 dhenderson@cityofowasso.com
Karl Fritschen, Chief Urban/Long Range Planner	(918) 376-1545 kfritschen@cityofowasso.com
Tim Doyle, General Services Superintendent	(918) 272-4959 tdoyle@cityofowasso.com
Scott Chambless, Chief of Police	(918) 272-2244 schambless@cityofowasso.com
Roger Stevens, Director of Public Works	(918) 272-4959 rstevens@cityofowasso.com
Doug Bonebrake, Council Member	(918) 830-1701 dbonebrake@ktol.com
Billy Oliver, Director of Public School Transportaion	(918) 272-2231 bill.oliver@owasso.k12.ok.us
David Vines, Planning Commissioner	(918) 272-2750 Vines.properties@gmail.com

Tulsa County

Harry Creech, Assistant Engineer	(918)596-5730 hcreech@tulsacounty.org

Roger County

Mike Helm, County Commissioner	(918) 638-3546 mhelm@rogerscounty.org

Citizen Advisor

Rob Haskins, Guy Engineering	(918) 437-0282 rob@guyengr.com

PROJECT PARTICIPANTS

Consultant Team

C.H. Guernsey & Company
5555 North Grand Boulevard
Oklahoma City, Oklahoma 73112

Project Manager
Karl E. Stickley, P.E., Vice President — (405) 416-8217, karl.stickley@guernsey.us

Darran Scott, RLA, ASLA — (405) 416-8180, darran.scott@guernsey.us

Leslie Novotny, MLA — (405) 416-8160, leslie.novotny@guernsey.us

Alliance Transportation Group
11500 Metric Boulevard, Building M1, Suite 150
Austin, Texas 78758

Andrea Wechmueller-Behringer, AICP — (214) 593-6500, ABehringer@emailatg.com

KME, LCC
307 East 13th Street
Edmond, Oklahoma 73034

Ken Morris, P.E., PTOE — (405) 990-9726, kmorris@kmetraffic.com

APPENDIX D: SCOPE OF SERVICES

Task 1 – Perform Project Management

The management of project activities will ensure the efficient and timely delivery of study results that are high quality and of practical use by the City.

Three objectives for the project management program are described below:

- Cost Control - Continuously track project expenditures versus the projected level of effort
- Schedule Control - Identify and track critical path activities and
- Quality Control - Systematic review of ongoing processes and project deliverables

Guernsey will be responsible for achieving the defined project management objectives through the following set of activities.

Sub-Task 1.1 – Provide Progress Reports and Schedule

Guernsey will prepare a detailed work schedule that will allow for the aggressive implementation of study activities while maintaining adequate opportunity for Owasso staff to review and comment. The project schedule identifies dates for key project milestones, meetings, and project deliverables. Updates on progress will be provided at the scheduled TMPC meetings.

Sub-Task 1.2 – Perform Project Planning and Discovery

On award of a Notice-to-Proceed from the City and prior to the kick-off meeting, Guernsey will undertake several required activities required to commence the project. These activities include the following:

- Perform duties to set-up/coordinate project management systems that will be used to monitor the project
- Identify and document communication network
- Mobilize and assemble the project team to review requirements and data; make assignments
- Collect preliminary information and assemble needed graphics for the kick-off meeting and site reconnaissance
- Schedule the kick-off meeting with the City

Sub-Task 1.3 - Project Kick-Off Meeting & Reconnaissance of the City

Guernsey will conduct a project kick-off meeting with the TMPC after receiving the notice-to-proceed. The meeting will provide a basis for establishing appropriate goals and objectives for the project in addition to the following:

- Clarify the limits and area of study
- Identify goals, strategies, and objectives of the study
- Identify and define special need areas and issues affecting transportation in Owasso

Subsequent to the kick-off meeting, Guernsey team members will conduct a windshield reconnaissance of the Owasso community. Our focus will be on the following:

- Observe conditions
- Record observations and general characteristics information
- Take photos/video
- Identify unique issues/concern

A summary of the kick-off meeting and community reconnaissance will be provided.

Sub-Task 1.4 - TMPC Meetings

Guernsey will organize and coordinate needed TMPC meetings throughout the duration of the project. It is anticipated that meetings will be held at regular intervals throughout the project, as identified in the project schedule. Close coordination will be maintained between Guernsey and the TMPC to ensure that project deliverables conform to project goals and objectives. The final TMPC meeting will include members of the City Council and Planning Commission and be conducted in the form of a workshop. The schedule identifies four TMPC meetings. Progress updates will be provided at each meeting.

Sub-Task 1.5 – Conduct Other Meetings

Aside from the meetings described above, there are potentially several other meetings required for the project. These meetings could/will include:

- Meet with INCOG very early in the process to address modeling and available data; Additionally, make a presentation to INCOG subsequent to approval of transportation master plan by the City
- As identified, update the City Council on plan progress and status. The fee estimate is based upon two intermediate Council meetings
- Meet with City Council upon completion of the plan in a detailed work session to address future formal action and requirements to be implemented

1. TASK 2 - PUBLIC INVOLVEMENT

Public involvement is an important part of the development of a transportation plan and will be accomplished with the following subtasks.

Sub-Task 2.1 - Public Meeting Number 1

A public workshop is tentatively scheduled to be held near the beginning of the project to describe the study goals and objectives, the study process, and study time schedule. In addition, the public will be invited to provide public comment on existing transportation problems or concerns within the City. Guernsey will provide information to assist the City in developing advertisements, mail-outs, and handouts for the meeting. Guernsey will develop the meeting presentation materials. The City will be responsible for posting all advertisements in appropriate newspapers/ publications, copying and distributing all mail-outs, and copying all meeting handouts. The City will also be responsible for securing the meeting location and making arrangements for appropriate accommodations, including sound equipment and refreshments, if desired. Following the public meeting, Guernsey will prepare a written summary of comments received at the meeting. Guernsey will provide a minimum of two staff members for the Public Meeting and will be assisted by City staff.

Sub-Task 2.2 - Public Meeting Number 2

A formal public meeting is also scheduled to be held near the end of the project prior to completion of the recommended transportation plan. This meeting will allow public input to be incorporated into the development of the recommended transportation plan. Guernsey will provide information to assist the City in developing advertisements, mail out's, and handouts for the meeting. Guernsey will develop the meeting presentation materials: The City will be responsible for posting all advertisements in appropriate newspapers/publications, copying and distributing all mail out's, and copying all meeting handouts. The City will also be responsible for securing the meeting location and making arrangements for appropriate accommodations, including sound equipment and refreshments, if desired. Following the public meeting, Guernsey will prepare a written summary of comments received at the meeting. Guernsey will provide a minimum of two staff members for the Public Meeting and will be assisted by City staff.

Task 3 - Data Collection and Existing Conditions

This task involves the identification and inventory of existing data, the collection of additional data needed for the completion of the study, and the evaluation of existing traffic operations.

Sub-Task 3.1 – Transportation Data Collection

Available data sources will provide important information, such as traffic counts, base maps, land use, socioeconomic data, and environmental data. Data compiled as part of this study will be maintained in a project database. Data collected will include, but not be limited to the following:

- Traffic Volumes - The City will provide available traffic volume counts and make additional counts as requested

- Functional Classification - The City will provide a list that identifies the existing functional classification of all roadways to be modeled within the City and roadway conditions

- Number of Travel Lanes - The City will identify the number of roadway travel lanes on all roadways to be modeled within the City, provided in the form of a hand-drawn or colored map

- Speed -Limits - The City will identify the existing speed limits along roadways to be modeled within the City, provided in the form of a hand drawn or colored map

- On-Street Parking - The City will identify locations of on-street parking along major roadways, such as arterial and collector streets, within the City

- Roadway Right-of- Way - During the development of the recommended roadway improvements in Task 5 and 6, the City will provide existing right-of-way information on selected roadways, as requested by Guernsey

- Accident Data - Guernsey will request existing accident data from the Oklahoma Department of Public Safety and/or Oklahoma Department of Transportation and the City Police Department

- Socioeconomic Data - Existing socioeconomic data, such as population, employment, and number of households is already included (per INCOG) in the latest update of the INCOG Travel Demand Model

Sub-Task 3.2 - Special Generator Surveys

Deleted, no special traffic generators have been identified.

Sub-Task 3.3 - Existing Conditions Evaluation

Guernsey will utilize the current INCOG Travel Demand Model to evaluate existing transportation conditions along major roadways in the study area to determine existing roadway LOS. The evaluation of existing conditions will provide a baseline of current traffic operations to use during the comparison and evaluation of alternative improvements. The LOS procedure will use volume-to-capacity ratio to calculate roadway LOS.
Additionally, a variety of other data sets will be collected from the City to assist in the overall development of the plan. Data to be collected includes land use (current and future projections), population, employment, environmental, and any other data applicable to the project.

Sub-Task 3.4 – Traffic Signal Field Verification

Deleted

Task 4 –Travel Demand Modeling and Travel Forecasting

This Task involves configuring and updating the existing INCOG Travel Demand Model, refining available existing inputs and analysis year forecasts to be consistent with project assumptions and using the revised model to perform traffic forecasts to produce level-of-service performance measures for use in evaluating the benefits of future transportation scenarios and infrastructure investment alternatives.

Sub-Task 4.1 – Travel Demand Model Preparation and Update

The Guernsey Team will meet with INCOG to review Travel Demand Model input data to determine if the model data including transportation system descriptions and socioeconomic estimates and forecasts for the base year and each forecast year are up to date and consistent with project assumptions. The traffic analysis zone (TAZ) geography will also be reviewed to ensure that the scale and resolution of the zone structure is shown in adequate detail for the analysis being performed in the study.

2.

Based upon this evaluation, the Guernsey Team will use the existing INCOG base year and 2035 horizon year TAZ socioeconomic attribute data to interpolate 2015 and 2025 TAZ socioeconomic attributes for the scenarios being evaluated in the study. Information on new or proposed development that has occurred or is about to occur, based upon the City staff's knowledge of local conditions, will be utilized and incorporated into a revised land use scenario for evaluation of future transportation conditions under anticipated growth. To the extent feasible, information from City staff on the growth scenarios and the future transportation system will be used to guide the disaggregation of the INCOG TAZ attributes to a more refined TAZ geography appropriate to the scale of the analysis.

Sub-Task 4.2 - Travel Demand Model Calibration and Validation

The Guernsey Team will use the data collected in Task 2 including existing traffic volumes, travel speeds, transit ridership and results of existing transit surveys, roadway travel lanes, socioeconomic data, existing roadway network, and the results of the special generator surveys to calibrate and validate the travel demand model to replicate existing transportation conditions in the Owasso area for the selected Base Year. Validation targets and criteria will be established prior to beginning the calibration process and will be based on published national standards such as the TRAVEL MODEL VALIDATION AND REASONABILITY CHECKING MANUAL, SECOND EDITION (Federal Highway Administration, February 2010.)

Sub Task 4.3 Transportation Deficiencies Analysis

Following development of a fully validated and calibrated Base Year travel demand model covering the City study area, the Guernsey Team will use the socioeconomic forecasts developed in Task 4.1 to prepare multimodal travel forecasts for each of the identified future milestone years and plan horizon year. To prepare the deficiency analysis, the Guernsey Team will carry out the following steps:

4.3.1 Work with the City and INCOG to develop a transportation system definition for each forecast year based upon the existing system plus committed highway and transit improvements certain to be completed and in operation by the respective analysis years. Use this existing plus committed (E+C) scenario to code a multimodal transportation system network reflecting the transportation system that would be in place if no additional transportation system investments were made other than those already committed.

4.3.2 Perform travel demand model runs using the socioeconomic forecasts for each respective analysis year and the E+C scenario network to identify those segments of roadway or transit route components that are anticipated to experience level-of-service deficiencies or performance failures if no further planned improvements are implemented. The results of these runs will be used as the no-build or baseline scenario against which proposed transportation improvements will be compared.

3. TASK 5 - EVALUATE FUTURE TRANSPORTATION SYSTEM

This task will include an iterative multi-modal travel demand modeling process, development of cost estimates, identification of mobility improvements, and evaluation of environmental impacts. Alternative improvements will be prioritized according to the short- and long-term objectives of the study and the feasibility of project implementation. This task will be accomplished with the following subtasks.

Sub-Task 5.1 - Identification of Mobility Improvements

Anticipated mobility and access improvements will be identified and modeled to determine their impact in improving the future transportation system. Roadway segments identified with a decreasing quality of level-of-service (LOS) will be investigated to determine if the deficiencies are caused by geometric constraints. Recommendations for improvements will be based on AASHTO's Policy on Geometric Design of Highways and Streets.

Sub-Task 5.2 - Travel Demand Modeling

The Guernsey Team will code the proposed multimodal mobility improvements into the travel demand model for each forecast year to produced a phased improvement program. The travel demand model will then be run to provide multimodal travel forecasts for each forecast year under the build scenario. The results of these build alternatives will be compared to the E+C scenario to quantify the benefits achieved in terms of level-of-service improvement above the baseline scenario. The performance measures used in the comparison will be selected in conjunction with the City and INCOG to be consistent with the regional, state, and federal performance management goals and performance measures.
The future year travel demand model developed in Task 4 will be utilized to evaluate future transportation needs. Quantification of the transportation problems and key issues is an important step in this study because it provides benchmarks against which the impacts of the tested transportation system alternatives can be measured.

Sub-Task 5.3 - Functional Classification System

A functional classification system will be developed for the City's transportation system. The classification system will identify typical cross sections and typical ROW widths. A system map will be produced identifying the City's proposed classification system.

4. SUB-TASK 5.4 - PRELIMINARY COST ESTIMATES

Preliminary cost estimates will be developed for each improvement alternative based on functional classification and unit costs from ODOT's average construction bids. Preliminary right-of-way (ROW) costs will be determined for all alternatives based upon existing data provided by the City using an average ROW cost for the region.

Sub-Task 5.5 - Environmental Impacts

Deleted

Sub-Task 5.6 - Traffic Impact Study/Guidelines

Identify thresholds, standards, and guidelines that would commonly trigger a requirement for a Traffic Impact Study for new commercial and residential developments.

Sub-Task 5.7 – Signalization Improvement Recommendations

Deleted

5. TASK 6 - DEVELOP TRANSPORTATION PLAN

This task involves the preparation of a Draft and Final Transportation Plan to be presented to the City. All study activities will be documented throughout the duration of the project so as to maintain accurate and consistent records of all data collection and forecast activities and alternative assessments and recommendations.

Sub-Task 6.1 - Prioritization of Improvements

The systematic and detailed analysis used to evaluate potential transportation improvements in Task 5 will provide important information regarding the prioritization of proposed improvements. The analysis will provide a clear systematic evaluation of each scenario, and a recommended ranking order for the alternative scenarios will be included in the report. This ranking order will be used to prioritize implementation in the short and long-term horizons, based on demand and feasibility. Preliminary cost estimates will be developed for the identified improvements.

Sub-Task 6.2 - Draft Final Report

Throughout the study, all activities will be documented. All data collected will be maintained in an electronic database, which will identify the source and date of each data element. The forecasting methodology and results will be recorded. All alternatives and recommendations will be described and documented. The documentation of study tasks in concurrence with ongoing study activities will allow for efficient integration of study information into the final report. A draft report documenting the methodology findings, and recommendations for the study effort, will be prepared and presented for approval. A proposed outline for the report is as follows:

- 1.0 Introduction
- 2.0 Existing Transportation System
- 3.0 Demographics and Model
- 4.0 Future Traffic Impacts
- 5.0 Recommended Transportation Plan

6.

Sub-Task 6.3 - Final Report

After receiving comments from the City, TMPC, City Council, and others, a final modified report will be prepared. The final report will be presented to the City Council, TMPC, and Planning Commission for final acceptance.

City of Owasso
Master Transportation Plan
Proposed Schedule

TASK	DELIVERABLES	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11
	Notice to Proceed											
	Project Management											
Task 1.1	Progress Reports & Schedule											
Task 1.2	Planning & Discovery											
Task 1.3	Project Kick-off Meeting/Reconnaissance											
Task 1.4	Transportation Master Plan Committee Meeting											
Task 1.5	Other Meetings											
Task 2	**Public Involvement**											
Task 2.1	Public Meeting #1											
Task 2.2	Public Meeting #2											
Task 3	**Data Collection & Existing Conditions**											
Task 3.1	Transportation Data Collection											
Task 3.2	Existing Conditions Evaluation											
Task 4	**Develop Travel Model Demand**											
Task 4.1	Travel Demand Model Preparation											
Task 4.2	Travel Demand Model Calibration											
Task 4.3	Transportation Deficiencies Analysis											
Task 5	**Evaluate Future Transportation System**											
Task 5.1	Identification of Mobility Improvements											
Task 5.2	Travel Demand Modeling											
Task 5.3	Functional Classification System											
Task 5.4	Preliminary Cost Estimates											
Task 5.5	Traffic Impact Study Guidelines											
Task 6	**Recommended Transportation Plan**											
Task 6.1a	Prioritization of Improvements											
Task 6.1b	Funding Plan & Resources											
Task 6.2	Draft Final Report											
Task 6.3	Owasso Review / Final Report											

APPENDIX E: MEETING MINUTES

guernsey
ENGINEERS
ARCHITECTS
CONSULTANTS

KICK OFF MEETING MINUTES

PROJECT NAME: Owasso Transportation Master Plan

Date: November 7th, 2013

Meeting Time: 9:30 AM

---

1. Introductions
2. Attendance Sheet – See attached sheet
3. Project Schedule
    a. Discussion of milestones and timeline – See attached schedule
4. TMPC – Transportation Master Plan Committee
    a. Members
        i. 8-10 from the community. Possible members to include: Police, Fire, School, Council Member, Planning Commission Member, Capitol Improvement Committee Member, Respected Member of the Community, ODOT employee living the community.
    b. Meeting Schedule
        i. The City will need to secure a meeting space. Guernsey would like to meet with the TMPC prior to the Public Meeting (afternoon).
5. Public Meeting #1
    a. Scheduling
        i. The City will need approximately two weeks for a room reservation
        ii. Thursday nights work the best
        iii. After the holidays. Possible dates – the evening of January 16th or January 23rd
    b. Location
        i. Community College discussed as a possible venue
        ii. Location will need to have a projector screen/flat panel TVs
    c. Discussion items needed
        i. Guernsey to provide maps/information boards to facilitate the public input process.
        ii. Purpose of the meeting is to gather information/public input
6. Clarify the limits and area of study
    a. Identify study boundaries on aerial
        i. The City identified the general study boundaries to be the following:
        North – 156th St.
        South- 66th St
        West – Memorial Dr.
        East – 177th E Ave.
    b. Identify any major areas of development not shown on aerial
7. Goals and Objectives
    a. Confirm goals and objectives identified in the scope
    b. Identify any additional goals and objectives
        i. The City requested that Guernsey identify roads that may be a good fit for Complete Streets and Road Diets
        ii. 2015 – Existing plus committed to be used as the Baseline

        iii. Projected growth to be based on soon to be adopted 2035 Land Use Plan

8. Special Need Areas
    a. Discuss any known areas of concern and identify on the aerial
        i. 96th St. and 86th St. North congested. Sam's Club opening will make it worse. Turning movement issues along 86th St. (morning and evening). No stacking space. Lights are synced but not helping as much as they should.
        ii. Owasso Sports Park area gets congested during events.
        iii. Train problem – 2nd/76th by Public Works building. The City to provide any information from the previous study of the railroad crossing/park and ride facility.
        iv. Hwy 20 at Hwy 169 – Lights and turn movements
        v. Potential Fossil Ridge Development
        vi. Widening of Hwy 169 from 56th St. bridge to 66th St.

9. Traffic Generators
    a. Discuss and locate on aerial generators identified in the scope
        i. Middle and Senior High Schools
        ii. Tulsa Technology Center & Community College
        iii. Wal-mart/Sam's Club
        iv. Five out-parcels in front of new Sam's Club
        v. Owasso Medical Campus
        vi. 105 Bed Senior housing center
        vii. 280 unit apartment project
    b. Identify any additional traffic generators not listed in the scope
10. Traffic Counts
    a. Existing counts
    b. Additional counts needed
        i. Guernsey Team will provide input after reviewing existing counts
    c. Identify any varying traffic patterns if any (weekday vs. weekend)
11. INCOG Model
    a. Schedule meeting with INCOG if needed
        i. Meeting to be scheduled when a regularly scheduled meeting with Owasso is needed.
    b. Process to acquire the model from INCOG
    c. Model last updated in 2010
    d. New or committed generators/development/road projects not shown in model
    e. Alliance to provide request letter for Owasso to send
        i. Guernsey to forward the request letter sent from Alliance to the City. The City to send request letter to INCOG on letterhead. INCOG is aware that a letter is coming

12. Data Collection Checklist
        i. Required Items & Responsibility
            1. Karl Fritshen to provide GIS data for projected growth
            2. The City to provide any previous master plans (water, wastewater, etc)
            3. The City is to provide the Toole Design Group/INCOG Trail & Bike Lane study
            4. The City is to provide Google Earth images from 80-95 to help with previous growth patterns.
            5. The City to provide all the GIS data that is relevant to the study
        ii. Priority/Completion Dates
            1. Guernsey provided a checklist with required items and will update completion and priority as the process goes along.

Owasso Transportation Master Plan
Kick-Off Meeting
Owasso
November 7, 2013

ATTENDANCE

	Name (please print)	Company	Phone	E-mail
1	Dwayne Henderson	City of Owasso	(918) 272-4959	dhenderson@cityofowasso.com
2	Daniel Dearing	City of Owasso	(918)272-4959	ddearing@cityofowasso.com
3	Karl Stickley	Guernsey	(405)416-8217	karl.stickley@guernsey.us
4	Darran Scott	Guernsey	(405)416-8180	darran.scott@guernsey.us
5	Brian Cales	Guernsey	(405)416-8164	brain.cales@guernsey.us
6	Karl Fritschen	City of Owasso	(918) 376-1545	kfritchen@cityofowasso.com
7	Roger Stevens	City of Owasso	(918) 272-4959	rstevens@cityofowasso.com
8	Jeff Bain	City of Owasso	(918)272-4959	jbain@cityofowasso.com
9	Jim Harvey (via teleconference)	Alliance Transportation Group	(512)821-2081	JHarvey@emailatg.com
10	Andrea Weckmueller-Behringer (via teleconference)	Alliance Transportation Group		AndreaB@emailatg.com

REALIZE THE DIFFERENCE

5555 North Grand Boulevard
Oklahoma City, OK 73112-5507
405.416.8100
guernsey.us

guernsey
ENGINEERS
ARCHITECTS
CONSULTANTS

PUBLIC MEETING MINUTES

PROJECT NAME: Owasso Transportation Master Plan

Date: January 30, 2014

Meeting Time: 7:00 p.m.

---

1. Introductions
2. Attendance Sheet – See attached sheet
3. Opening Remarks
4. Presentation from Guernsey – See attached pdf
    a. Transportation Planning Team Overview
    b. Relevant Experience
    c. Team Organization
    d. Benefits and Objectives of the Transportation Master Plan
    e. Proposed Schedule
    f. Work Program
    g. Terminology
    h. Study Area & Details
5. Input/Comment/Questions
    a. Presentation, Comment Sheets, and Questionnaires Availability Request
        i. Will be available on City website
    b. What experience in road diet
        i. Yes, will be applied if it is serves the community
        ii. Possible roads are 129th and 86th
        iii. Request to reduce speed limits to 25 mph city wide to decrease speed, noise pollution, and increase safety. Also decrease lane or lane width to make room for bike lanes or sidewalks
    c. Garnett and 76th bike plan does not create a complete bike system
    d. Pedestrian crosswalk signals are not long enough to safely cross
    e. Coordinate with INCOG Master Pedestrian and Bicycle Plan and Tulsa Transportation Plan
6. Breakout Session
7. Adjournment

guernsey
ENGINEERS
ARCHITECTS
CONSULTANTS

Owasso Transportation Master Plan

Public Meeting #1
January 30, 2014

Sign-In Sheet

	Name (please print)	Company	Phone	E-mail
1	Day Russell		918.272.3187	teteony@cox.net
2	Joe Schraor		918.272.7932	
3	Tim Raines		918.698.5003	TimRAINES1954@ATT.net
4	Carol Weatherly		918.272.5725	
5	Pam Beene		918.639.8441	Pam_beene@yahoo.com
6	Ron Beene		918.636.3719	altz@sbeene.com
7	Ed Wagner		918.407.9434	e.j.wagnerjr@gmail.com
8	Cyndi Knoten		918.274.1500	Cyndi@owassosms.org
9	Dean Knoten		918.274.1500	DeanKnoten@gmail.com
10	David Vines		918.272.2750	Vines.Properties@gmail.com
11	Vicki & Todd Wagner		918.693.7522	vlentz@hotmail.com
12	Mike Helar		918.443.2441	
13	Harry Creech		918.596.5733	hcreech@tulsacounty.org
14	Chris Eager		918.557.8441	
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				

REALIZE THE DIFFERENCE

5555 North Grand Boulevard
Oklahoma City, OK 73112-5507
405.416.8100

guernsey.us

Committee Member Meeting Minutes

Project Name: Owasso Transportation Master Plan

Date: January 30, 2013

Meeting Time: 4:00 p.m.

---

1. Introductions
2. Attendance Sheet
3. Presentation from Guernsey
   a. Transportation Planning Team Overview
   b. Relevant Experience
   c. Team Organization
   d. Benefits and Objectives of the Transportation Master Plan
   e. Proposed Schedule
   f. Work Program
   g. Terminology
   h. Study Area & Details
4. Input/Comment/Questions
   a. Possible Study Boundaries Expansion
      i. 76^{th} Street to 193^{rd} Street, south of 76^{th} Street
      ii. Mile section from 76^{th} Street to 86^{th} Street and from Sheridan Road to Memorial
      iii. Will include annex area?
   b. Potential/current growth spots and increase traffic
      i. Growth corridors will adjust with the completion of the 2030 Land Use Plan
      ii. 116^{th} Street
         1. Connection to HWY 75 & HWY 169
      iii. Macy's Development
      iv. 96^{th} Street
      v. Increase bicycle traffic
      vi. Stone Canyon development
      vii. 193^{rd} and 76^{th} street expansion
      viii. Votech
      ix. CED District
   c. Pedestrian and Trail Master Plan
      i. Trails plan will have adjustments made
      ii. Possible bicycle association/group involvement
      iii. Request/desire for ability to ride a bike from boundary to boundary of city
   d. Project commitments and promises
      i. 40 + projects not committed to
      ii. List generated in 2002
         1. All but 2 are completed
      iii. All projects voted on by citizens are either completed or in construction
      iv. INCOG plan-120^{th} street improvements by 2017
      v. CED District will add new projects this year
      vi. ODOT plans for HWY 169

e. Areas of Concern
    i. School congestion
f. Traffic study day events
    i. Agree with Saturday traffic because city is focusing on being known as a shopping destination
g. Access regulation
    i. Little to no regulation on residential
    ii. Regulation on commercial
        1. Small lots and property conflicts make it difficult to achieved desired results
h. Next meeting agenda
    i. Evaluation of existing conditions
    ii. Results found in the INCOG model
i. Request committee to review functional classification of road to ensure correct classification

COMMITTEE MEMBER MEETING MINUTES

PROJECT NAME: Owasso Transportation Master Plan

Date: April 10, 2014

Meeting Time: 4:00 p.m.

---

1. Introductions
2. Attendance Sheet – See attached sheet
3. Recap past meetings and data collected
    a. Committee and Public Meeting January 31, 2014
    b. Public Input – Questionnaires and Comment Form results
        i. Discussed possible City event to receive more input from the public. Event is held every first Thursday of the month. Guernsey can provide information that could be included at a display/informational booth
4. Review INCOG model information
    a. Members were concerned that 1.83% predicted growth within the fenceline was too low of a percentage.
    b. Highway 20 improvements may attract more commercial
    c. Eastside of Owasso is where the most growth is predicted
    d. Development, such as elementary school and residential, expected in northern city limits
    e. Macy's development will be incorporated in the growth projections
    f. Will consider outside consumers coming into to Owasso to shop
    g. Consideration of outside developments affect on TMP
5. Review Technical Memorandum from Alliance
    a. Discussed using a Owasso specific model and the schedule implications
6. Review and verify adjusted population and employment projections
    a. Model Base Year 2010 vs 2035 - INCOG Forecast for Population and Employment
    b. Adjusted Forecast based on City Determined Population and Employment
        i. South of 126th and West of Garnett growth should be reviewed
        ii. Past demographic growth will be reviewed and compared to similar cities to determine more accurate growth projections
        iii. Rural water District and Sanitary Sewer Maps will be analyzed and conclusions used in growth projections (Owasso to provide)
        iv. School District will be analyzed and conclusions used in the growth projections
7. Project Timeline
    a. Adjusted timeline based on Owasso specific model
        i. The timeline will be extended one month
        ii. Committee members did not object to adjusted timeline
8. Upcoming Milestones
    a. 2nd Public Meeting will be pushed back to Mid Summer or Fall. Discussed combining the public meeting with a First Thursday event to get more input from the public.

9. Input/Comments/Questions
    a. A traffic signal study was completed around four years prior. All traffic lights were adjusted.
    b. Owasso has experienced increase traffic accidents
    c. Dedicated turn lanes are desired to decrease congestion and collisions
    d. Fatalities occur mostly on outlaying areas where speeds increase
    e. Suggestion of decrease speeds will decrease injury and fatalities in accidents
    f. 96th street is observed as having the highest traffic accidents
    g. Two lane, no shoulder roadways are hazardous with higher speeds and increase congestion
    h. The power point presentation is attached as requested

guernsey
ENGINEERS
ARCHITECTS
CONSULTANTS

Owasso Transportation Master Plan

Committee Meeting #2

April 10, 2014

Sign-In Sheet

	Name (please print)	Company	Phone	E-mail
1	Scott Chambless	Owasso Police	918.376.1564	schambless@cityofowasso.com
2	Karl Kritschen	City of Owasso	918.376.1545	kfritschen@cityofowasso.com
3	Billy Oliver	Public School	918.606.4879	Bill.oliver@owasso.k12.ok.us
4	David Vines	Planning Commissioner	918.695.2579	vinesproperties@gmail.com
5	Rob Haskins	Citizen Member	918.636.2609	rob@guyengr.com
6	Mike Helm	Rogers County Commission	918.443.2441	mhelm@rogerscounty.org
7	Roger Stevens	City of Owasso	918.272.4959	rstevens@cityofowasso.com
8	Doug Bonebeake	Owasso City Council	918.830.1701	dbonebeake@gmail.com
9	Dwayne Henderson	City of Owasso	918.272.4959	dhenderson@cityofowasso.com
10	Harry Creech	Tulsa County	918.596.5737	hcreech@tulsacounty.org
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				

REALIZE THE DIFFERENCE

5555 North Grand Boulevard
Oklahoma City, OK 73112-5507
405.416.8100

guernsey.us

guernsey
ENGINEERS
ARCHITECTS
CONSULTANTS

Committee Member Meeting Minutes

Project Name: Owasso Transportation Master Plan

Date: August 21, 2014

Meeting Time: 4:30 p.m.

---

1. Introductions
2. Attendance Sheet – See attached sheet
3. Recap past meetings and data collected
    a. Committee and Public Meeting April 10, 2014
    b. Public Input – Questionnaires and Comment Form results
        i. Received 39 questionnaires and 3 comment forms. The additional public input reinforced previous public opinion.
4. Review Demographic Projections
    a. Reviewed Guernsey's method to establishing projected population and employee counts for 2035
    b. Compared Guernsey's findings with INCOG model findings
    c. Population maps will need to be adjusted to density in overlapping TAZ to account for area within fenceline.
    d. Discussed growth possibilities, predictions, and plans with committee
        i. Possible apartments construction near Macy's industrial development
        ii. Western part within Owasso's fenceline will see growth within the next 3 to 5 years
        iii. Eastern part within Owasso's fenceline will see immediate growth and long-term growth
        iv. Rogers County plans on roadway expansion in near future. List will provided to Guernsey to include in model calculations.
        v. Eastern development will be more 1 to 2 acre lots at the minimum because of the lack of city sanitary sewer services.
        vi. Macy's development will create 1,500 to 2,000 jobs
        vii. Confirmed overall growth rate projections and adjusted population and employment projections for each TAZ
5. Reviewed Specific Subarea Model Update
    a. Discussed updates made to an Owasso specific model, calibration, validation and the schedule implications
    b. Reviewed existing-plus committed network projects
        i. Roger County projects
        ii. Improvements will be made to 106th & Garnett Rd and 116th & 129th
        iii. E 86th St N-west of Main St to Memorial Dr project is completed
        iv. Bob Ball with the City of Owasso will be completing a Commuter Study
6. Project Timeline
    a. Adjusted timeline based on Owasso specific model
        i. The timeline will be extended a little over month from original timeline
        ii. Committee members did not object to adjusted timeline
7. Upcoming Milestones
    a. An additional committee meeting will be conducted to review model results

   b. A public meeting may be scheduled after 3rd committee meeting to present findings to public. If this meeting does not occur, findings will be presented to the public at the approving city council meeting.

8. Input/Comments/Questions

guernsey
ENGINEERS
ARCHITECTS
CONSULTANTS

Owasso Transportation Master Plan

Committee Meeting #3
August 21, 2014

Sign-In Sheet

	Name (please print)	Company	Phone	E-mail
1	Tim Doyle	City of Owasso	918.272.4959	tdoyle@cityofowasso.com
2	David Vinet	Vinet Properties	918.272.2750	Vines.properties@gmail.com
3	Dwayne Henderson	City of Owasso	918.272.4959	Dhenderson@cityofowasso.com
4	Scott Chambless	City of Owasso	918.376.1564	schambless@cityofowasso.com
5	Roger Stevens	City of Owasso	918.272.4959	rstevens@cityofowasso.com
6	Karl Fritschen	City of Owasso	918.376.1545	kfritschen@cityofowasso.com
7	Rob Haskins	Guy Engineering	918.437.0282	rob@guyengr.com
8	Harry Creech	Tulsa County	918.596.5737	hcreech@tulsacounty.org
9	Mike Helm	Rogers County Commission	918.638.3546	mhelm@rogerscounty.org
10	Doug Bonebrake	City of Owasso	918.830.1701	dbonebrake@ktol.com
11	Warren Lehr	City of Owasso	918.376.1515	wlehr@cityofowasso.com
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				

REALIZE THE DIFFERENCE

5555 North Grand Boulevard
Oklahoma City, OK 73112-5507
405.416.8100

guernsey.us

Committee Meeting #4 Agenda

Project Name: Owasso Transportation Master Plan

Date: May 15, 2015

Meeting Time: 3:00 PM

---

1. Introductions
2. Attendance Sheet– See attached sheet
3. Committee Meeting #3 August 21, 2014
    a. Reviewed
        i. Additional Public Input Results
    b. Verify Overall Demographic Growth Rate Projections
    c. Technical Memorandum from Alliance
    d. Verify Population and Employment Projections for each TAZ
    e. Update on Owasso Specific Subarea Model Progress
    f. Project Timeline and Upcoming Milestones
4. Roadway and Intersection Recommendations
    a. Comments
        i. The intersection of 76th Street and Mingo Road is the location of a trail crossing in the Trails Master Plan. The year of the intersection improvement should be changed from 2025 to 2020 to accommodate this trail crossing and pedestrian safety.
        ii. Adjust Smith Farm Market to reflect the updated roadway path in GIS.
        iii. Reevaluate the intersection of 106th Street and Mingo Road for improvement. Projected development may require signalization and other intersection improvements. This intersection could also be an opportunity for a round-a-bout.
        iv. Change the recommendation for 116th Street from Mingo Road to Garnett Road to 5-lane road instead of a 4-lane road transitioning into a 5-lane road.
        v. Include Complete Street Policy to TMP.
        vi. Attach Trails Master Plan to TMP.
        vii. Included Ultimate R/W statement in Section 5
        viii. Discuss transit traffic in Section 5
        ix. Implement statement about LOS the Owasso Residents have been provided versus what is the norm.
5. Interchange Recommendation
    a. Comments
        i. Discussed the possibility of the "Texas Turn Around" working in Owasso. One-way service roads are not believe to work well on Owasso's service roads.
        ii. Improvements made to 76th Street and 86th Street Interchange will begin sooner than 10-20 years. City preparing for 8-10 years by providing a percentage of improvement funds.
6. Project Timeline
    a. Comments

i. City requested to present plan to the City Council Study Session on June 9th. The Council will need the plan by June 3rd to be slotted for this date.

REALIZE THE DIFFERENCE

5555 North Grand Boulevard
Oklahoma City, OK 73112-5507
405.416.8100

guernsey.us

guernsey
ENGINEERS
ARCHITECTS
CONSULTANTS

Owasso Transportation Master Plan
Committee Meeting #4
May 15, 2015

Sign-In Sheet

	Name (please print)	Company	Phone	E-mail
1	Mike Helm	Rogers County	918.443.2441	
2	DeeAnn Cramer	Rogers County	918.443.2441	
3	Rogers Stevens	City of Owasso	918.272.4959	
4	David Vinet	Planning Commission	918.272.2750	
5	Karl Fritschen	City of Owasso	918.376.1545	
6	Warren Lehr	City of Owasso	918.376.1515	
7	Rob Haskins	Guy Engineering	918.437.0282	
8	Dwayne Henderson	City of Owasso	918.272.4959	
9	Doug Bonebrake	City of Owasso	918.274.7188	dbonebrake@gmail.com
10	Tim Doyle	City of Owasso	918.272.4959	tdoyle@CityofOwasso.com
11	Harry Creech	Tulsa County	918.596.5737	hrcreech@tulsacounty.org
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				

REALIZE THE DIFFERENCE

5555 North Grand Boulevard
Oklahoma City, OK 73112-5507
405.416.8100
guernsey.us