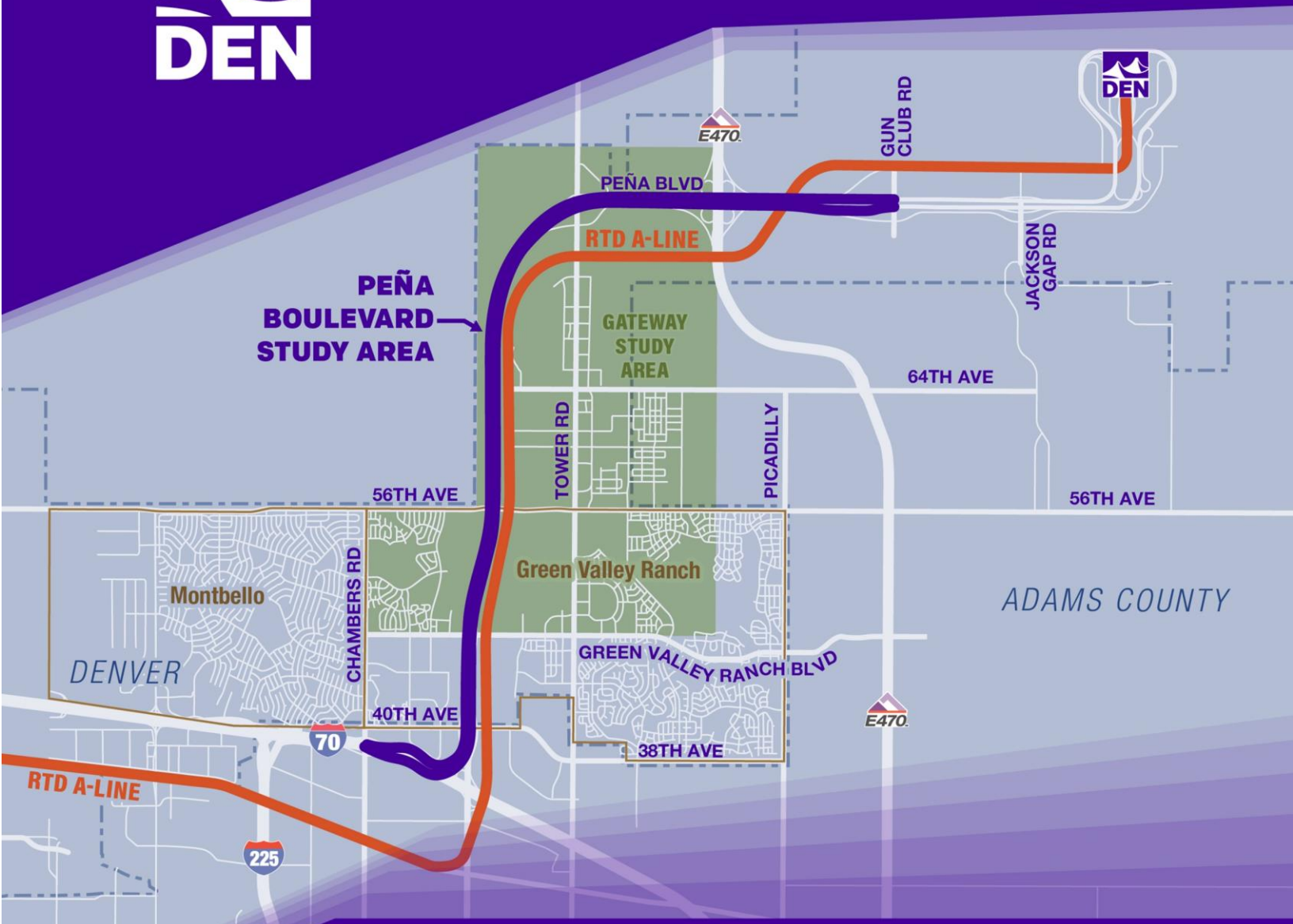


PEÑA BOULEVARD TRANSPORTATION AND MOBILITY MASTER PLAN

Attachment C

Existing Traffic Conditions and Needs Technical Report

February 2024

DENVER INTERNATIONAL AIRPORT

Contents

Tables

Figures

Acronyms

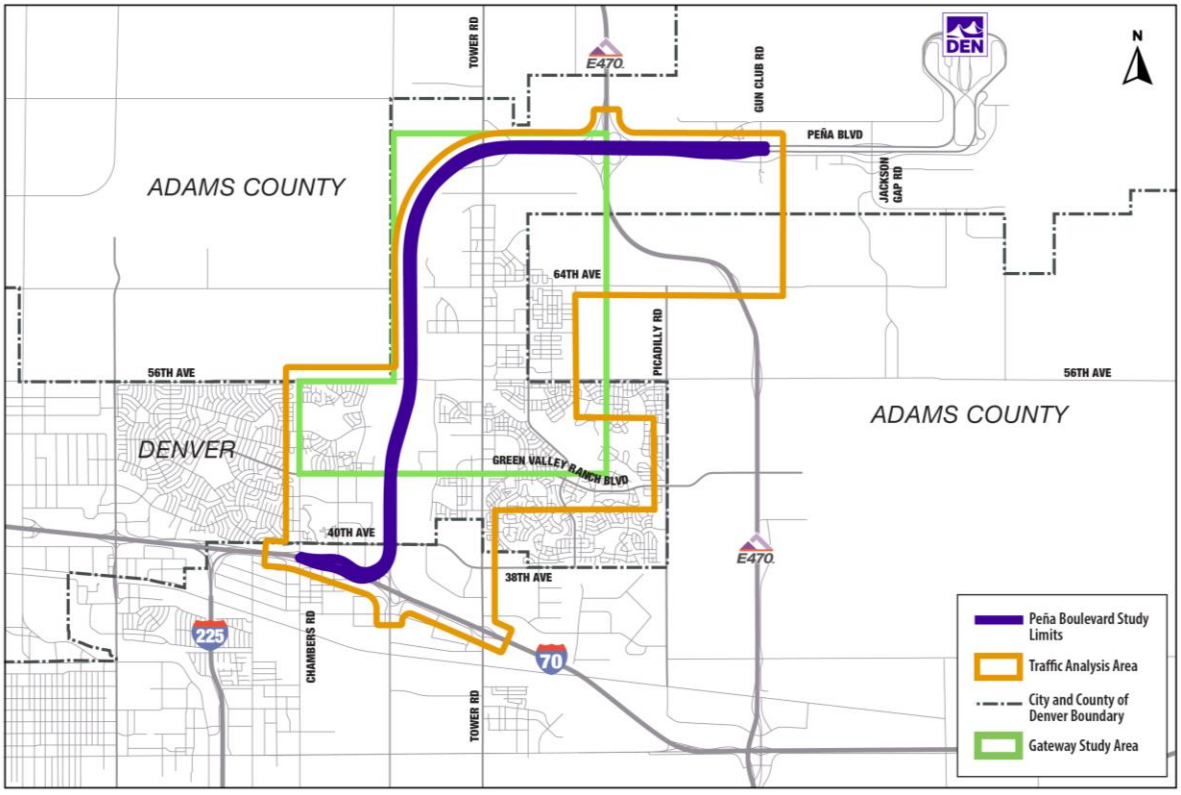
ADT	Average Daily Traffic
CCD	City and County of Denver
CDOT	Colorado Department of Transportation
DEN	Denver International Airport
DOTI	Department of Transportation and Infrastructure
DRCOG	Denver Regional Council of Governments
EB	Eastbound
Gateway Study	Denver Moves Gateway Area Travel Study
GP	General-Purpose
GVR	Green Valley Ranch
HCM	Highway Capacity Manual
HOT	High-Occupancy Toll
LOS	Level of Service
MOE	Measure of Effectiveness
NB	Northbound
NCHRP	National Cooperative Highway Research Program
Peña Boulevard Study	Peña Boulevard Transportation and Mobility Master Plan Study
PPV	Person Per Vehicle
RTP	Regional Transportation Plan
SB	Southbound
TMC	Turning Movement Count
TDM	Travel Demand Model
TRB	Transportation Research Bureau
VPD	Vehicle Per Day
WB	Westbound

1. Introduction

Denver International Airport (DEN) scoped the Peña Boulevard Transportation and Mobility Master Plan Study (Peña Boulevard Study) to investigate potential improvements in mobility and safety along Peña Boulevard for passengers, employees, freight, and visitors and to future-proof Peña Boulevard to accommodate DEN growth and development. The City and County of Denver's (CCD) Department of Transportation and Infrastructure (DOTI) simultaneously scoped the Denver Moves Gateway Area Travel Study (Gateway Study) to better understand the travel demands and needs in the Gateway Area, with more recent changes in land usage, current/planned transit services, current/planned bike network, and growing traffic volumes. DEN and DOTI recognized that there was significant overlap between the two studies and agreed to combine them into one study, co-managed by these two agencies.

The study areas for both the Peña Boulevard Study and the Gateway Study are in Figure 1-1. Given the desire to understand linkages between Peña Boulevard and local transportation facilities within the Gateway Study area, all traffic analyses were completed using a single, expanded traffic analysis area that encompassed the limits of both studies. The boundary of this traffic analysis area is also in Figure 1-1.

Figure 1-1 – Study Areas for the Peña Boulevard and Gateway Area



The combined study area spans the jurisdictions of CCD and the City of Aurora. The proposed solutions for Peña Boulevard and the Gateway Area will be developed holistically to ensure they complement each other and provide regional benefits by considering other plans for the area, such as the *Advancing Adams Comprehensive Plan* (Adams, 2022), *Aurora Places: Planning Tomorrow's City* (Aurora, 2018a), the draft *Commerce City 2045 Comprehensive Plan*, CCD's *Far Northeast Area Plan* (CCD, 2019), and City of Aurora's *Northeast Area Transportation Study* (Aurora, 2018b).

This report documents the existing traffic conditions within the study area based on collected traffic count data and subsequent microsimulation traffic modeling and documents future forecasted operations of the roadway network. The information presented within this report builds upon information presented in previous study documents. A list of these documents is below. Relevant information from these documents is repeated within this report, as needed, and references to these documents are made throughout this report.

- *Peña Boulevard Transportation and Mobility Master Plan Study Data Collection Plan Memorandum (May 2022)*
- *Peña Boulevard Study and Gateway Study Traffic Modeling Methodology and Land Use Assessment Memorandum (September 2022)*
- *Peña Boulevard Master Plan Study Vehicle Occupancy Data Results Memorandum (May 2023)*

Information presented within this report will be used to develop and evaluate potential build alternatives and to address the identified needs. The results of this alternative analysis process will be documented in future reports.

2. Summary of Data Collection and Analysis

To support the traffic analysis, in-field data was collected and reviewed. This data included information on vehicle volumes and classifications, turning movements at intersections, vehicle occupancy, and corridor travel times. The findings of the data collection effort, as they relate to the traffic analysis, are presented within this chapter. Additional evaluation of the data, including an analysis of historical traffic volumes and travel patterns, are provided in the *Peña Boulevard Transportation and Mobility Master Plan and Denver Moves Gateway Area Travel Study Data Collection Summary and Existing Conditions Report* (September 2022).

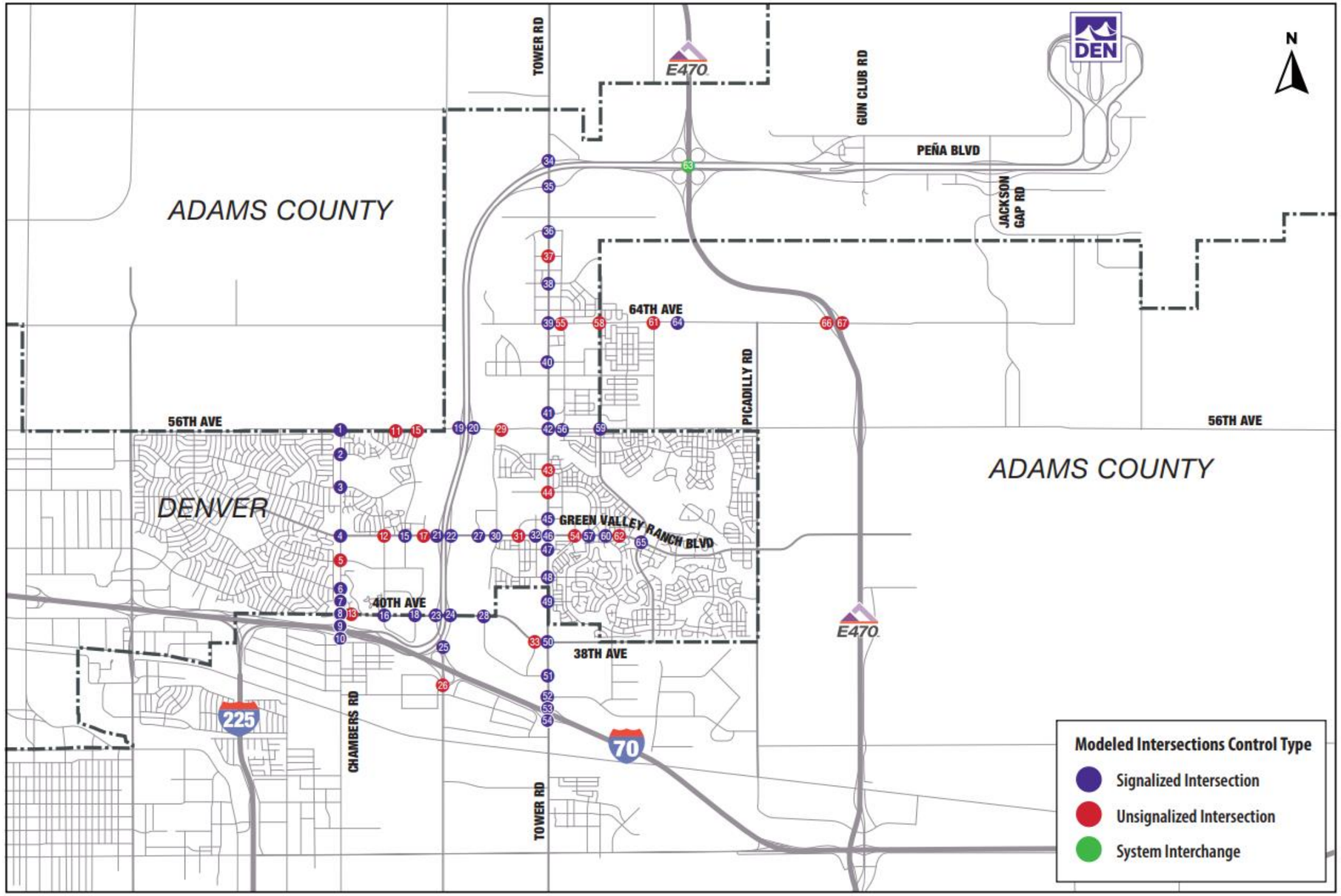
2.1. Volumes

Average daily traffic (ADT) counts with vehicle classifications for all major roadways and tuning movement counts at all signalized intersections within the traffic analysis area were collected. The details about locations and dates of daily traffic count collection are in Table 2-1. All TMCs were collected during both AM (7:00 AM and 9:00 AM) and mid-day/PM (2:30 PM to 6:30 PM) peak periods on either Thursday, May 19, 2022, or Thursday, May 26, 2022. The location of all TMC data collection points is in Figure 2-1.

Table 2-1 – Daily Traffic Count Data Collection Locations and Dates

ID	Location	Source	Date of Data Collection
1	Chambers Road south of Green Valley Ranch (GVR) Boulevard	In-Field Counts	Wednesday, May 18, 2022 – Friday, May 20, 2022
2	Tower Road north of 56th Avenue	In-Field Counts	Wednesday, May 25, 2022 – Friday, May 27, 2022
3	64th Avenue east of Gaylord Rockies Boulevard	In-Field Counts	Wednesday, May 25, 2022 – Friday, May 27, 2022
4	Eastbound I-70 off-ramp to northbound Airport Boulevard	In-Field Counts	Wednesday, June 8, 2022 – Friday, June 10, 2022
5	Westbound I-70 off-ramp to southbound Airport Boulevard	In-Field Counts	Wednesday, June 8, 2022 – Friday, June 10, 2022
6	Southbound E-470 off-ramp to eastbound Peña Boulevard	In-Field Counts	Wednesday, June 1, 2022 – Friday, June 3, 2022
7	Northbound E-470 off-ramp to westbound Peña Boulevard	In-Field Counts	Wednesday, June 8, 2022 – Friday, June 10, 2022
8	Northbound E-470 to eastbound Peña Boulevard	In-Field Counts	Wednesday, June 1, 2022 – Friday, June 3, 2022
9	Westbound Peña Boulevard off-ramp to southbound E-470	In-Field Counts	Wednesday, June 8, 2022 – Friday, June 10, 2022
10	Eastbound Peña Boulevard to northbound E-470	In-Field Counts	Wednesday, June 1, 2022 – Friday, June 3, 2022
11	Peña Boulevard between I-70 and 40th Avenue	Permanent Count Station	June 2022
12	Peña Boulevard between 40th Avenue and GVR Boulevard	Permanent Count Station	June 2022
13	Peña Boulevard between GVR Boulevard and 56th Avenue	Permanent Count Station	June 2022
14	Peña Boulevard between 56th Avenue and Tower Road	Permanent Count Station	June 2022
15	Peña Boulevard between Tower Road and E-470	Permanent Count Station	June 2022

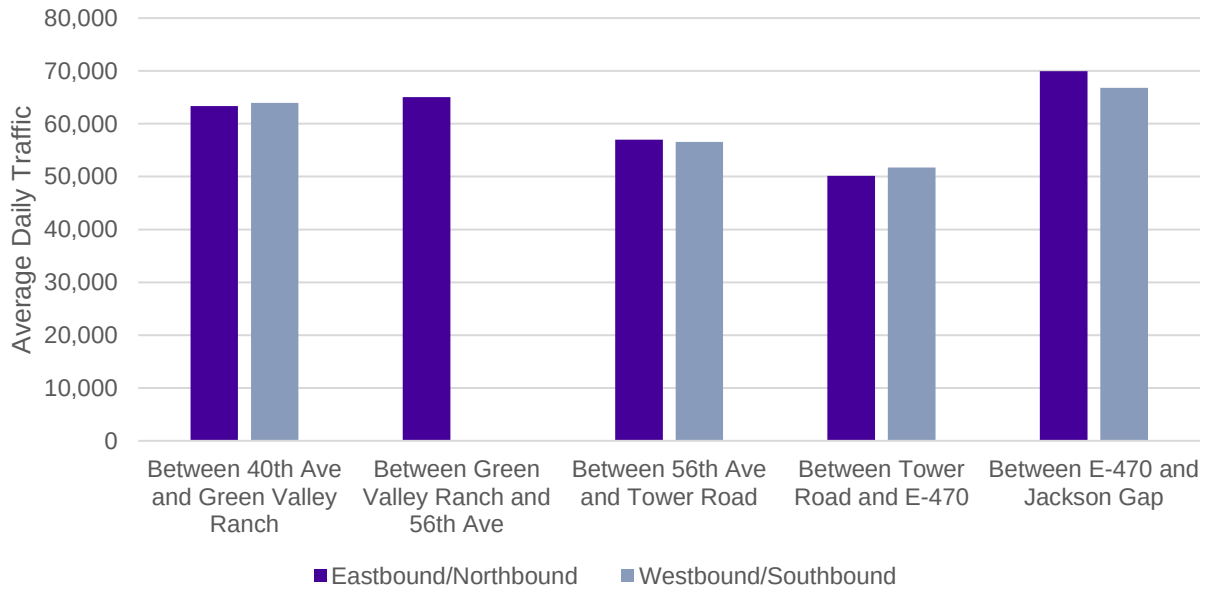
Figure 2-1 – Turning Movement Count Data Collection Locations



2.1.1. Link Volumes

The average daily traffic on Peña Boulevard ranges between approximately 101,900 vehicles per day (vpd) and 136,750 vpd, with the highest volumes observed between E-470 and Jackson Gap, and the lowest volumes observed between Tower Road and E-470. Figure 2-2 shows the variation in ADT along Peña Boulevard.

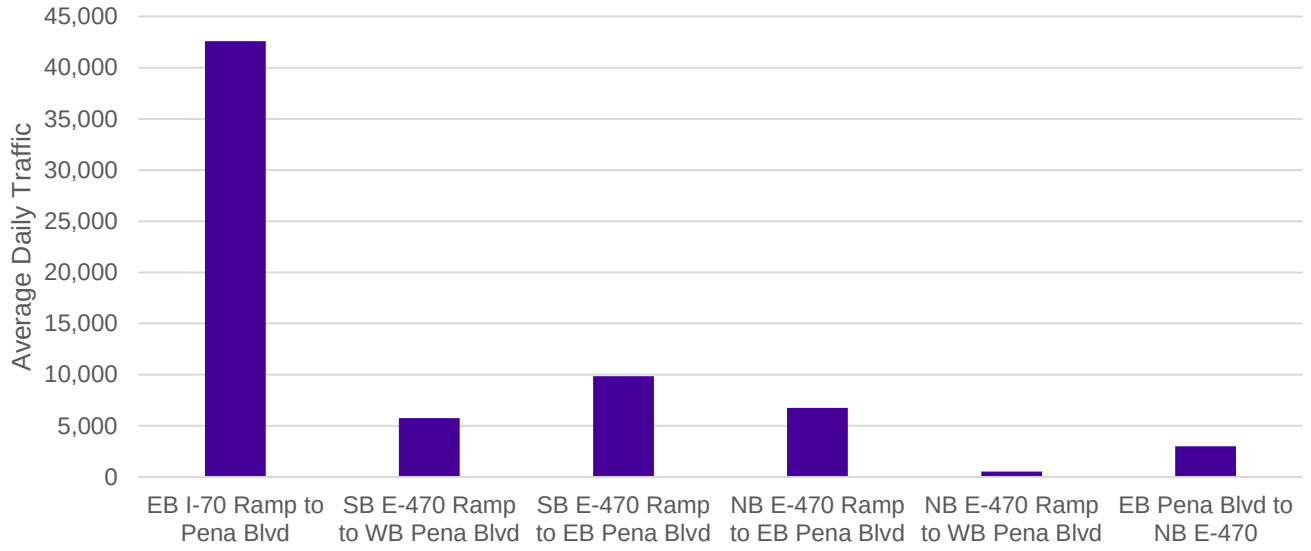
Figure 2-2 – Daily Traffic along Peña Boulevard



Note: The DEN counter on southbound Peña Boulevard between GVR Boulevard and 56th Avenue was out of commission during June 2022.

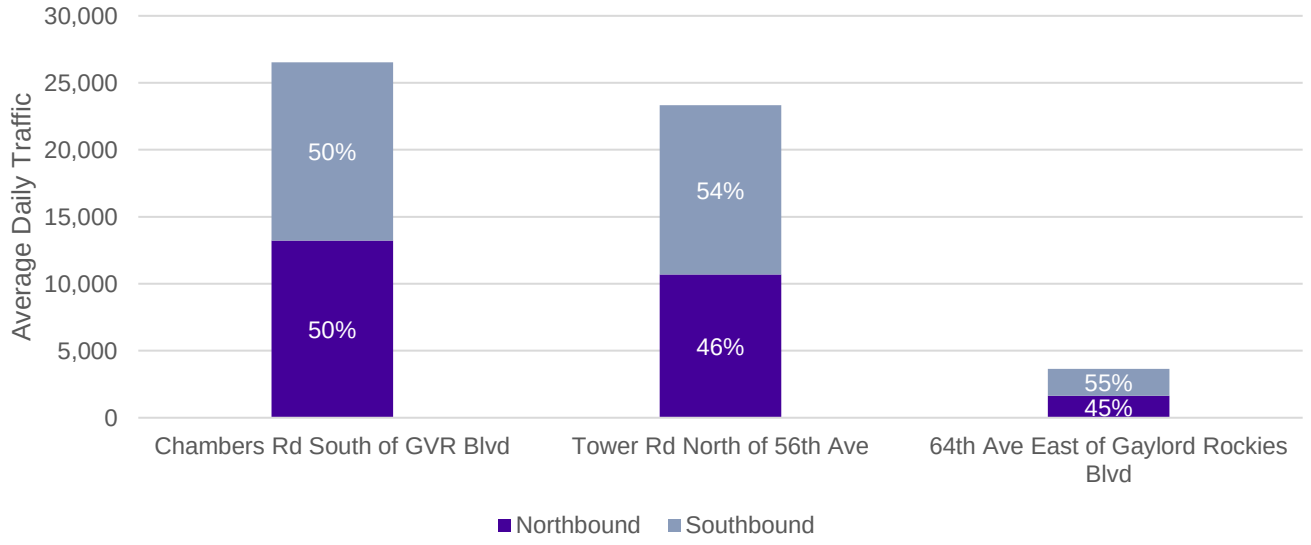
Of the observed ramps, freeway ramp volumes show that the ramp from eastbound I-70 to Peña Boulevard carries the most traffic (approximately 42,600 vpd). At the E-470 and Peña Boulevard interchange, ramps carry between approximately 500 vpd and 9,900 vpd. Data shows that more traffic enters Peña Boulevard from southbound E-470 than from northbound E-470. Observed ramp volumes are in Figure 2-3.

Figure 2-3 – Daily Freeway Ramp Traffic



Daily traffic on local roadways ranges between approximately 3,600 vpd on 64th Avenue and 26,500 vpd on 56th Avenue. Figure 2-4 shows daily traffic on these facilities.

Figure 2-4 – Daily Traffic on Local Roadways

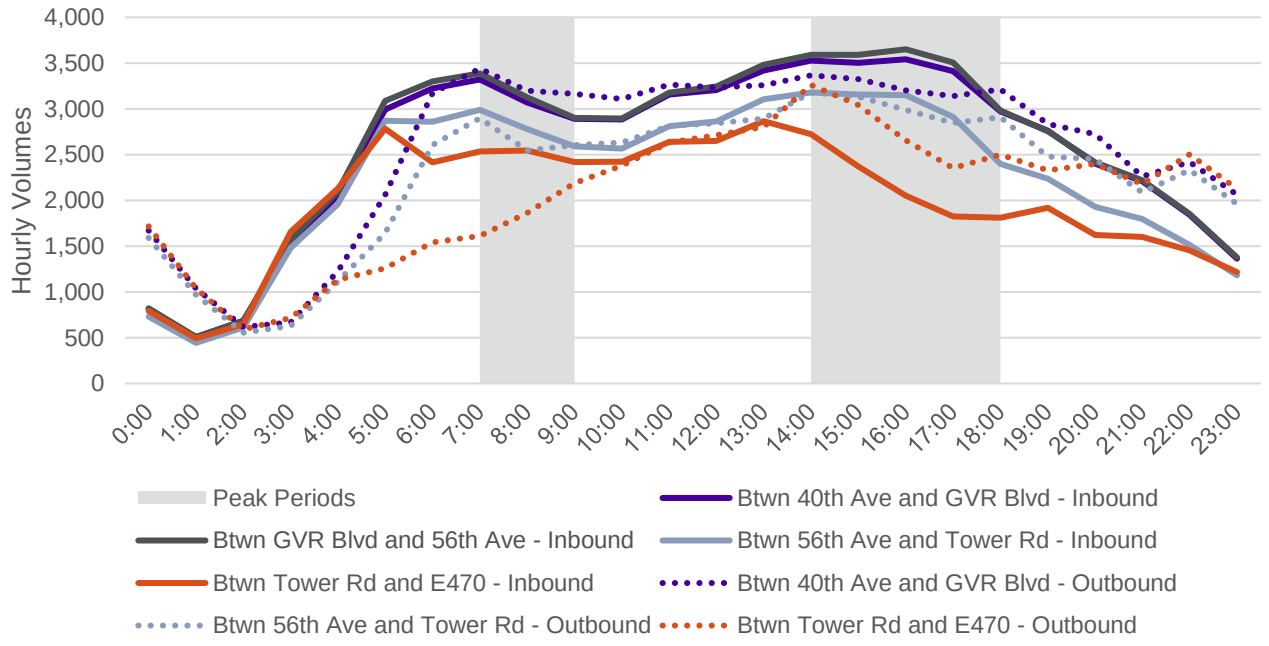


Note: Percentages shown indicate the directional split in traffic.

2.1.2. Peak Hours

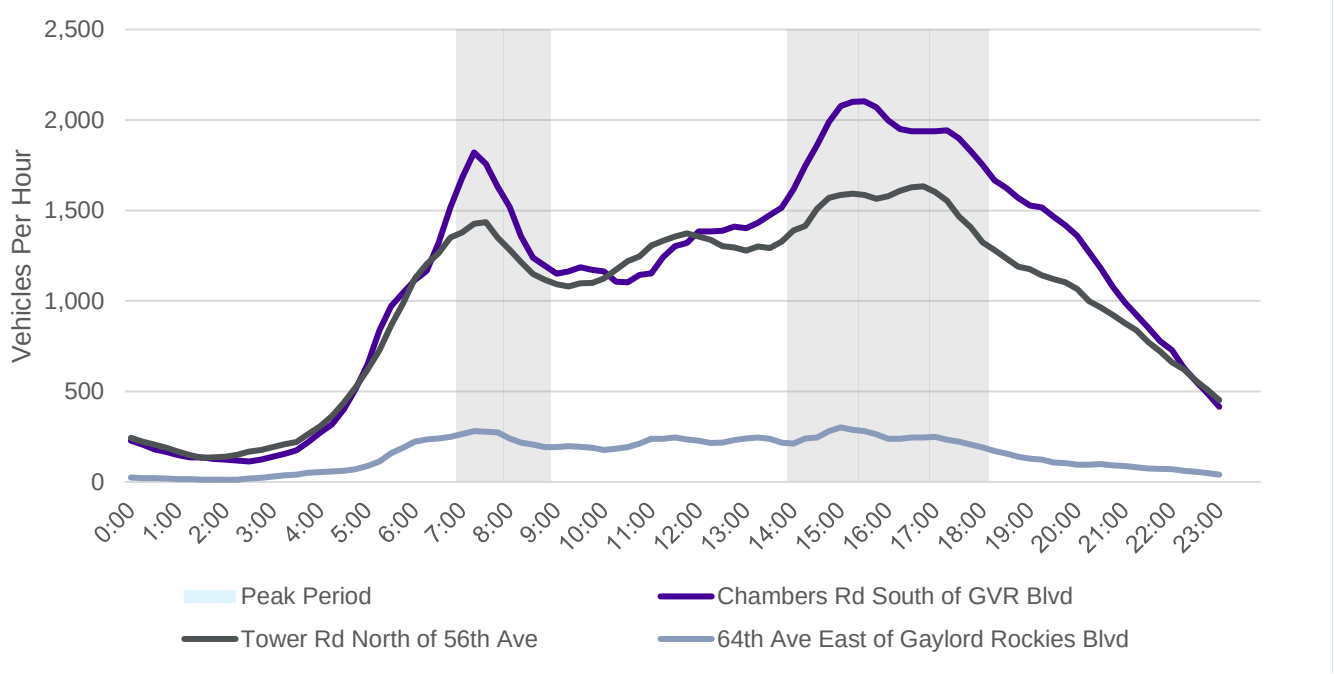
Hourly weekday traffic data along Peña Boulevard shows two distinct patterns (Figure 2-5). Along the southern/western end of the corridor (between approximately I-70 and 56th Avenue), traffic follows a typical commuting pattern with morning and evening peak periods. This pattern is observed in both northbound/eastbound (inbound) and southbound/westbound (outbound) directions. The second pattern is observed along the northern/eastern portion of the corridor closer to the airport. In this location, inbound traffic peaks earlier in the morning as compared to the rest of the corridor (around 5:00 AM), and outbound traffic peaks in the middle of the day (around approximately 1:00 PM). This location experiences a different travel pattern as compared to the southern/western portion of the corridor due to its proximity to DEN. Given that almost all traffic on Peña Boulevard east of E-470 is headed to DEN, traffic patterns in this location are highly influenced by work shifts and flight schedules at DEN.

Figure 2-5 – Hourly Weekday Volumes and Peak Periods on Peña Boulevard



Note: The DEN counter on southbound Peña Boulevard between GVR Boulevard and 56th Avenue was out of commission during June 2022.

Figure 2-6 – Hourly Weekday Volumes and Peak Periods on Local Roadways



It should be noted that peak periods for Peña Boulevard do not perfectly match peak periods for local roadways. For the purposes of the traffic analysis, peak periods used in the analysis were chosen to best capture peaks on both facilities, to the maximum extent possible. These peak periods are in Table 2-2. Given that the mid-day peak period does not fully recover before the start of the PM peak period, these two peaks have been combined into a mid-day/PM peak period for the purpose of traffic analysis.

Table 2-2 – Peak Hours and Peak Periods for the Traffic Analysis

Time of Day	Peak Hour	Peak Period
AM	7:00 AM – 8:00 AM	7:00 AM – 9:00 AM
Mid-day	2:30 PM – 3:30 PM	2:30 PM – 6:30 PM
PM	5:00 PM – 6:00 PM	2:30 PM – 6:30 PM

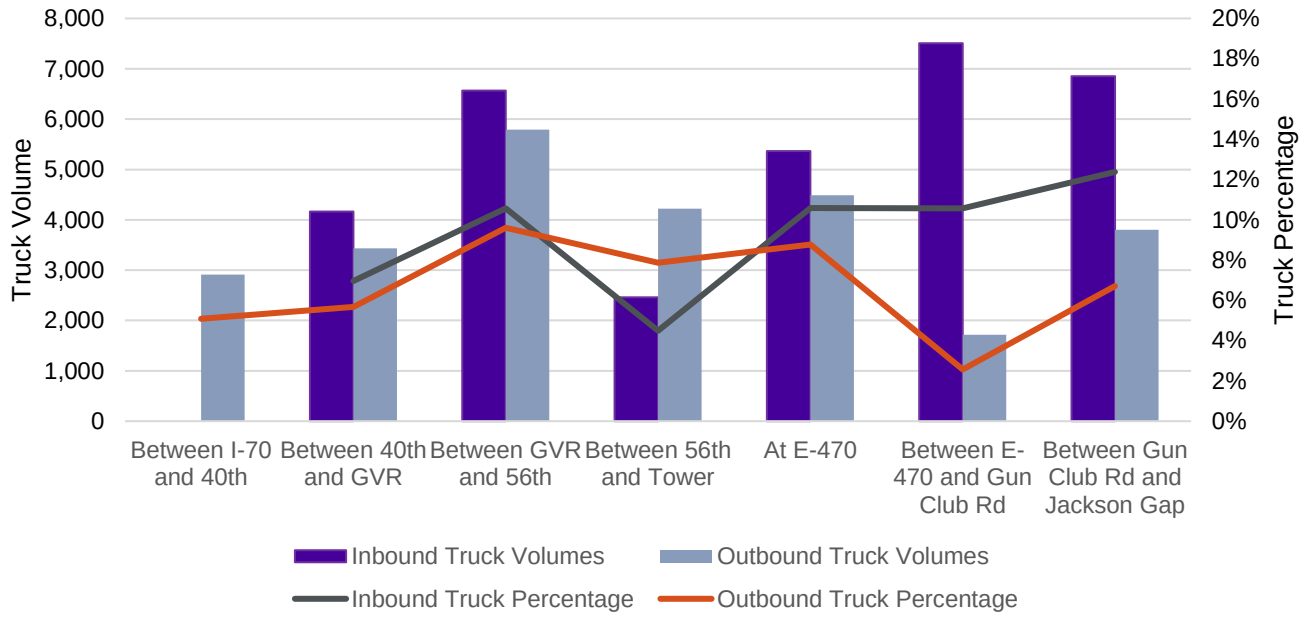
2.1.3. Truck Percentages

Vehicle classifications were reviewed to obtain truck percentages along major corridors within the study area. Along local roadways, vehicle classification data was collected at the same time as vehicle volume data. However, on Peña Boulevard, automated traffic counters were not fully functional during the June 2022 data collection period and therefore, only collected volume data and not vehicle classification data. To complete the truck percentage analysis for Peña Boulevard, additional data was reviewed from count stations along Peña Boulevard

for Friday, November 4, 2022. During this time, the counters had been corrected and vehicle classification data was available.

Daily truck volumes on Peña Boulevard range between approximately 6,700 trucks per day and 12,400 trucks per day, which represents between 6 percent and 10 percent of daily traffic on Peña Boulevard depending on location and direction. Figure 2-7 shows truck volumes along Peña Boulevard.

Figure 2-7 – Daily Truck Volumes on Peña Boulevard



Note: Truck data for inbound Peña Boulevard between I-70 and 40th Avenue was not available because of the in-field automated counter being non-functional during the data collection period.

Table 2-3 summarizes truck percentages for different facilities within the traffic analysis area. Note, for Peña Boulevard where data was available for multiple locations, truck data was averaged across various locations to provide a corridor wide average.

Table 2-3 – Peak Period Truck Percentages

Location	Period	Single-unit Trucks	Multi-unit Trucks	Total
Chambers Road south of Green Valley Ranch (GVR) Boulevard	AM	5%	4%	9%
Chambers Road south of Green Valley Ranch (GVR) Boulevard	PM	4%	4%	8%
Tower Road north of 56th Avenue	AM	7%	7%	14%
Tower Road north of 56th Avenue	PM	4%	6%	11%
64th Avenue east of Gaylord Rockies Boulevard	AM	8%	11%	19%
64th Avenue east of Gaylord Rockies Boulevard	PM	4%	13%	17%
Inbound Peña Boulevard *	AM	9%	1%	10%
Inbound Peña Boulevard *	PM	9%	1%	10%
Outbound Peña Boulevard *	AM	6%	1%	7%
Outbound Peña Boulevard *	PM	6%	1%	7%

* Averaged over 5 locations on Peña: (1) between I-70 and 40th Avenue, (2) between 40th Avenue and GVR Boulevard, (3) between GVR Boulevard and 56th Avenue, (4) between 56th Avenue and Tower Road, and (5) between Tower Road and E-470.

2.1.4. Turning Movement Counts

TMC data was collected at all major intersections within the study area on either Thursday, May 19, 2022, or Thursday, May 26, 2022, during both AM and PM peak periods. This data is summarized in Appendix D of this report.

2.2. Vehicle Occupancy on Peña Boulevard

Vehicle occupancy data was collected on Peña Boulevard on November 10, 2022, between 6:00 AM and 5:00 PM at two locations:

Peña Boulevard between 40th Avenue and GVR Boulevard

Peña Boulevard between E-470 and Gun Club Road

The results of this data collection effort are in Table 2-4. This data indicates that vehicle occupancy is slightly higher on Peña Boulevard between E-470 and Gun Club Road than it is on Peña Boulevard between 40th Avenue and GVR Boulevard. This pattern indicates that airport bound vehicle traffic has an overall higher occupancy than of non-airport bound traffic within the study area. Additional details about this occupancy data collection effort

can be found in the *Peña Boulevard Transportation Master Plan Vehicle Occupancy Data Results Memorandum* (May 2023).

Table 2-4 – Vehicle Occupancy on Peña Boulevard

Location	Direction	1 Occupant	2 Occupants	3+ Occupants
Peña Boulevard Between 40th Ave. and Green Valley Ranch	Inbound	57.3%	38%	4.7%
Peña Boulevard Between 40th Ave. and Green Valley Ranch	Outbound	58.2%	36.1%	5.7%
Peña Boulevard Between E-470 and Gun Club Rd	Inbound	57.4%	36.6%	6%
Peña Boulevard Between E-470 and Gun Club Rd	Outbound	54.8%	37.9%	7.3%
Average	Both	57%	37%	6%

2.3. Corridor Travel Times

Multiple travel time runs were conducted within the study area on Wednesday, November 2, 2022, and Thursday, November 3, 2022, using the floating car methodology. Travel times were collected for each major roadway during the AM peak period and the mid-day/PM peak period. Along Peña Boulevard, three travel time runs were taken in each direction. On local roadways, between one run and three runs were taken in each direction depending on local conditions. For example, along 64th Avenue, no congestion was observed during travel time runs, and therefore, only a single run in each direction was collected.

Table 2-5 summarizes the results from this effort. Note: Reported travel times represent the average of all runs collected.

Table 2-5 – Peak Period Travel Time Results

Roadway	Direction	From	To	Distance	Period	Average Travel Time (minutes)
Peña Boulevard	Inbound (NB/EB)	40th Avenue on-ramp	Gun Club Road off-ramp	6.7 miles	AM	6.4
Peña Boulevard	Inbound (NB/EB)	40th Avenue on-ramp	Gun Club Road off-ramp	6.7 miles	PM	6.1

Roadway	Direction	From	To	Distance	Period	Average Travel Time (minutes)
Peña Boulevard	Outbound (WB/SB)	Gun Club Road on-ramp	40th Avenue off-ramp	6.6 miles	AM	9.8
Peña Boulevard	Outbound (WB/SB)	Gun Club Road on-ramp	40th Avenue off-ramp	6.6 miles	PM	11.7
64th Avenue	EB	Tower Road	Himalaya Street	1.0 mile	AM	1.6
64th Avenue	EB	Tower Road	Himalaya Street	1.0 mile	PM	1.8
64th Avenue	WB	Himalaya Street	Tower Road	1.0 mile	AM	1.6
64th Avenue	WB	Himalaya Street	Tower Road	1.0 mile	PM	1.8
56th Avenue	EB	Chambers Road	Dunkirk Street	2.4 miles	AM	4.0
56th Avenue	EB	Chambers Road	Dunkirk Street	2.4 miles	PM	5.7
56th Avenue	WB	Dunkirk Street	Chambers Road	2.4 miles	AM	5.3
56th Avenue	WB	Dunkirk Street	Chambers Road	2.4 miles	PM	5.2
Green Valley Ranch Boulevard	EB	Chambers Road	Himalaya Street	3.9 miles	AM	5.8
Green Valley Ranch Boulevard	EB	Chambers Road	Himalaya Street	3.9 miles	PM	8.9
Green Valley Ranch Boulevard	WB	Himalaya Street	Chambers Road	3.9 miles	AM	6.6
Green Valley Ranch Boulevard	WB	Himalaya Street	Chambers Road	3.9 miles	PM	8.4

Roadway	Direction	From	To	Distance	Period	Average Travel Time (minutes)
40th Avenue	EB	Chambers Road	Tower Road	2.0 miles	AM	4.5
40th Avenue	EB	Chambers Road	Tower Road	2.0 miles	PM	4.4
40th Avenue	WB	Tower Road	Chambers Road	2.0 miles	AM	5.6
40th Avenue	WB	Tower Road	Chambers Road	2.0 miles	PM	5.3
Chambers Road	NB	40th Avenue	56th Avenue	1.7 miles	AM	4.2
Chambers Road	NB	40th Avenue	56th Avenue	1.7 miles	PM	3.2
Chambers Road	SB	56th Avenue	40th Avenue	1.7 miles	AM	5.5
Chambers Road	SB	56th Avenue	40th Avenue	1.7 miles	PM	3.2
Tower Road	NB	32nd Avenue	Peña Boulevard	5.1 miles	AM	9.3
Tower Road	NB	32nd Avenue	Peña Boulevard	5.1 miles	PM	12.5
Tower Road	SB	Peña Boulevard	32nd Avenue	5.1 miles	AM	12.2
Tower Road	SB	Peña Boulevard	32nd Avenue	5.1 miles	PM	18.0

3. Existing Conditions Traffic Analysis

Existing traffic operations were evaluated by using PTV's VISSIM® 2022 microsimulation traffic analysis software. This chapter documents the details of the following: (1) the building/coding process of the microsimulation model, (2) the microsimulation model calibration and validation process and results, and (3) microsimulation model results.

3.1. Development of the Base Year Model

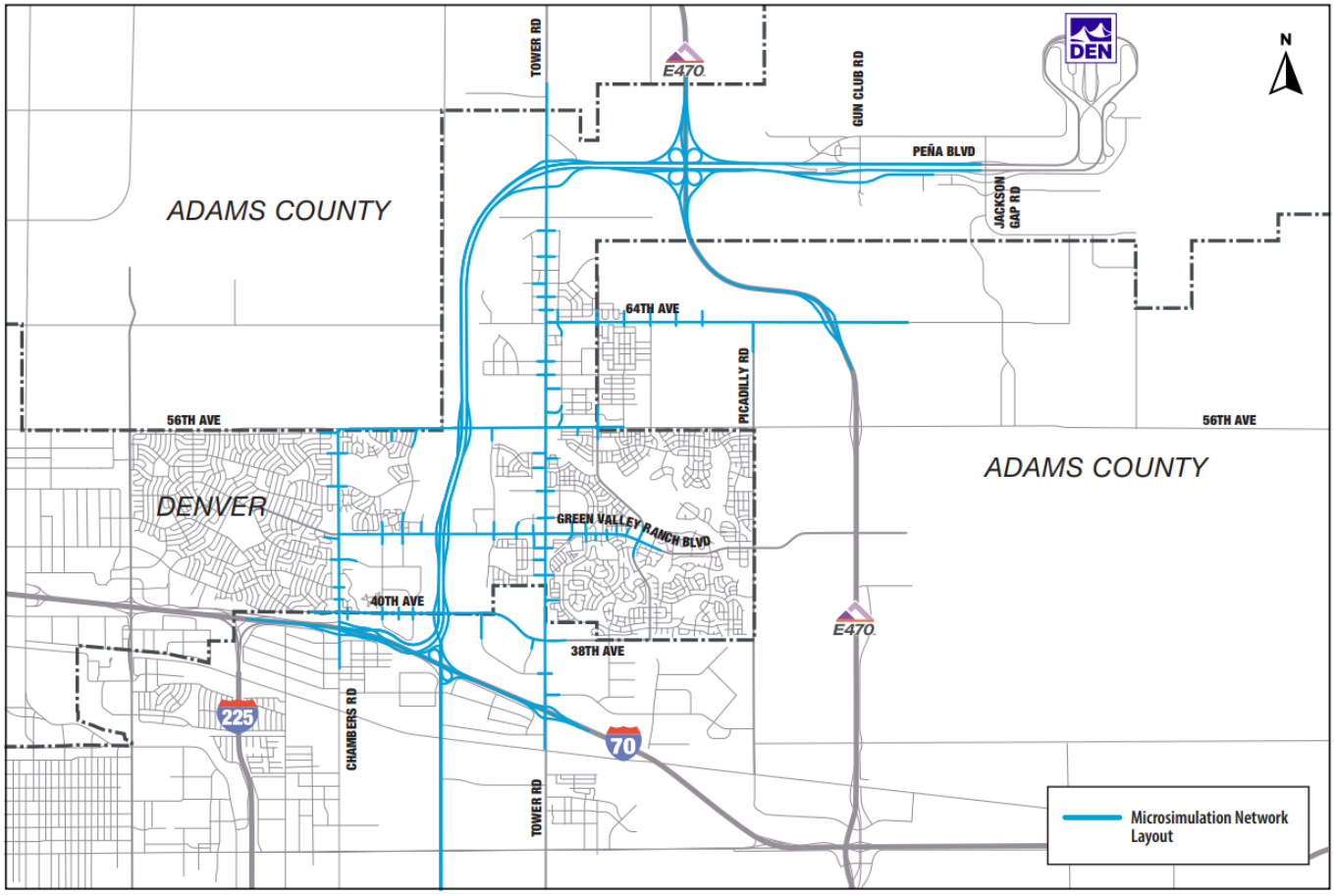
To evaluate the existing roadway operations, a base year 2022 model was developed. Based on collected traffic data, three time periods of the day were chosen to be modeled, reflecting various volume peaks: AM (6:30 AM – 9:00 AM), mid-day (2:30 PM – 3:30 PM) and PM (3:30 PM – 6:00 PM). Given that congestion in the mid-day peak period continues to build and influence congestion occurring in the following PM peak period, it was decided to model both periods within a single model to capture spillover effects of congestion starting in the mid-day period and continuing to build into the PM peak period. Therefore, two time periods were evaluated for existing 2022 conditions, including an AM peak period model (6:30 AM – 9:00 AM) and a combined mid-day/PM peak period model (2:00 PM – 7:00 PM).

3.2. Traffic Analysis Extents

Major links were included in the model with intersections along those major links. A list of the links included in the microsimulation analysis is below and in Figure 3-1. Peña Boulevard from I-70 to east of Gun Club Road and all interchanges along its length.

- I-70 between Chambers Road and Tower Road
- Chambers Road between I-70 and 56th Avenue
- Tower Road between I-70 and Peña Boulevard
- 64th Avenue between E-470 and Tower Road
- 56th Avenue between Chambers Road and Dunkirk Street
- GVR Boulevard between Chambers Road and Himalaya Road
- 40th Avenue between Chambers Road and Tower Road

Figure 3-1 – Microsimulation Model Extents



3.2.1. Geometry of the Model

Roadways in the microsimulation network, including turn-bays and intersection configurations, were coded based on existing satellite imagery. The primary purpose of the traffic model was to understand vehicular operations, and therefore, pedestrian walkways, bike paths, and bus stops were not explicitly modeled.

3.2.2. Intersection Control

Table 3-1 summarizes the intersections and how they are configured in the microsimulation model. Traffic signals were coded into the model based on DOTI's existing signal timing plans.

Table 3-1 – Intersection Control Overview

Intersection Name	Control Type	Intersection Name	Control Type
I-70 & Chambers Rd. (EB Ramp)	Signalized	54th Ave. & SB Tower Rd.	One-Way Stop Controlled
I-70 & Chambers Rd. (WB Ramp)	Signalized	54th Ave. & NB Tower Rd.	One-Way Stop Controlled
40th Ave. & Chambers Rd.	Signalized	57th Ave. & Tower Rd.	One-Way Stop Controlled
Andrews Dr. & Chambers Rd.	Signalized	59th Ave. & Tower Rd.	One-Way Stop Controlled
46th Ave. & Chambers Rd.	Signalized	60th Ave. & Tower Rd.	Signalized
Bolling Dr. & Chambers	Two-Way Stop Controlled	61st Ave. & Tower Rd.	Signalized
GVR Blvd. & Chambers Rd.	Signalized	64th Ave & Tower Rd.	Signalized
53rd Ave. & Chambers Rd.	Signalized	65th Ave. & Tower Rd.	Two-Way Stop Controlled
Maxwell Pl. & Chambers Rd.	Signalized	66th Ave. & Tower Rd.	Two-Way Stop Controlled
56th Ave. & Chambers Rd.	Signalized	High Point Blvd. & Tower Rd.	Signalized
56th Ave. & Laredo St.	One-Way Stop Controlled	68th Ave. & Tower Rd.	One-Way Stop Controlled
56th Ave. & Memphis St.	One-Way Stop Controlled	69th Ave. & Tower Rd.	Two-Way Stop Controlled
56th Ave. & Peña Blvd. (SB Ramp)	Signalized	71st Ave. & Tower Rd.	Signalized
56th Ave. & Peña Blvd. (NB Ramp)	Signalized	Peña Blvd. (EB Ramp) & Tower Rd.	Signalized
56th Ave. & Telluride St.	One-Way Stop Controlled	Peña Blvd. (WB Ramp) & Tower Rd.	Signalized
56th Ave. & Tower Rd.	Signalized	64th Ave. & Argonne St.	Two-Way Stop Controlled
56th Ave. & Argonne St.	Signalized	64th Ave. & Dunkirk St.	Two-Way Stop Controlled
56th Ave. & Cathay St.	One-Way Stop Controlled	64th Ave. & Fundy St.	Two-Way Stop Controlled

Intersection Name	Control Type	Intersection Name	Control Type
56th Ave. & Dunkirk St.	Signalized	64th Ave. & Himalaya Rd.	Two-Way Stop Controlled
40th Ave. & Andrews Dr.	Two-Way Stop Controlled	64th Ave. & Gaylord Rockies Blvd.	Signalized
40th Ave. & Kittredge St.	Signalized	64th Ave. & Lisbon St.	Two-Way Stop Controlled
40th Ave. & Lewiston St.	Two-Way Stop Controlled	64th Ave. & Picadilly Rd.	One-Way Stop Controlled
40th Ave. & Airport Way	Signalized	64th Ave. & E-470 (SB Ramps)	One-Way Stop Controlled
40th Ave. & Peña Blvd. (SB Ramp)	Signalized	64th Ave. & E-470 (NB Ramp)	One-Way Stop Controlled
40th Ave. & Peña Blvd. (NB Ramp)	Signalized	GVR Blvd. & Kittredge St.	Two-Way Stop Controlled
40th Ave. & Salida St.	Signalized	GVR Blvd. & Memphis St.	Signalized
40th Ave. & Walden St.	One-Way Stop Controlled	GVR Blvd. & Airport Blvd.	One-Way Stop Controlled
40th Ave./38th Ave. & Tower Rd.	Signalized	GVR Blvd. & Peña Blvd. (NB Ramp)	Signalized
Salida St. & Tower Rd.	Signalized	GVR Blvd. & Telluride St.	Signalized
32nd Ave. & Tower Rd.	Signalized	GVR Blvd. & Walden St.	HAWK
I-70 (WB Ramp) & Tower Rd.	Signalized	GVR Blvd. & Yampa St.	Signalized
I-70 (EB Ramp) & Tower Rd.	Signalized	GVR Blvd. & Andes Ct.	Two-Way Stop Controlled
43rd Ave. & Tower Rd.	Signalized	GVR Blvd. & Argonne St.	Signalized
45th Ave. & Tower Rd.	Signalized	GVR Blvd. and Ceylon St.	One-Way Stop Controlled
46th Ave. & Tower Rd.	One-Way Stop Controlled	GVR Blvd. & Flanders Way	Signalized
47th Ave. & Tower Rd.	Signalized	GVR Blvd. & Genoa St.	One-Way Stop Controlled
GVR Blvd. & Tower Rd.	Signalized	GVR Blvd. & 48th Dr.	One-Way Stop Controlled
49th Ave. & Tower Rd.	Signalized	GVR Blvd. & Himalaya Rd.	Signalized

Intersection Name	Control Type	Intersection Name	Control Type
51st Ave. & Tower Rd.	Two-Way Stop Controlled	I-70 (WB Ramp) & SB Airport Blvd.	Signalized
Elmendorf Dr. & Tower Rd.	Two-Way Stop Controlled	I-70 (EB Ramp) & Airport Blvd.	Uncontrolled

3.2.3. Loading the Microsimulation Model

Microsimulation models were loaded by using balanced TMC volumes at each intersection. These balanced TMC inputs were created by taking the in-field TMC data (discussed in Chapter 0 of this report) and adjusting the values between adjacent intersections to balance the network. In general, left-turning and right-turning movements remained constant at all intersections, and, where needed, through volumes were adjusted to achieve a balanced network. The resulting balanced corridor volumes for Peña Boulevard for each peak hour are in Figure 3-2 through Figure 3-4. Balanced TMC diagrams for local roadways are in Appendix B. Balanced Existing Conditions TMCs of this report.

Figure 3-2 – Corridor Traffic Volumes – AM Peak Hour

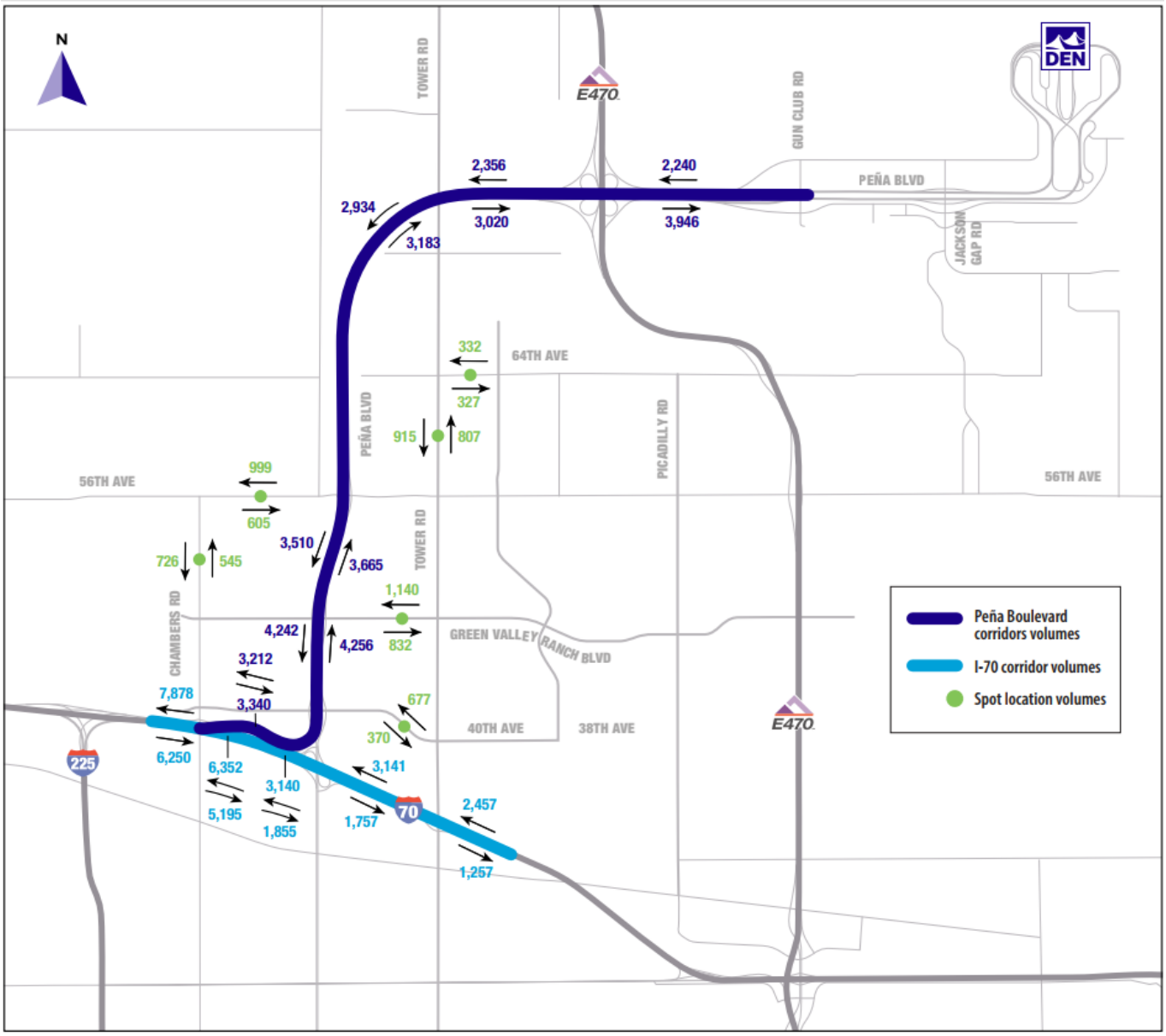


Figure 3-3 – Corridor Traffic Volumes – Mid-day Peak Hour

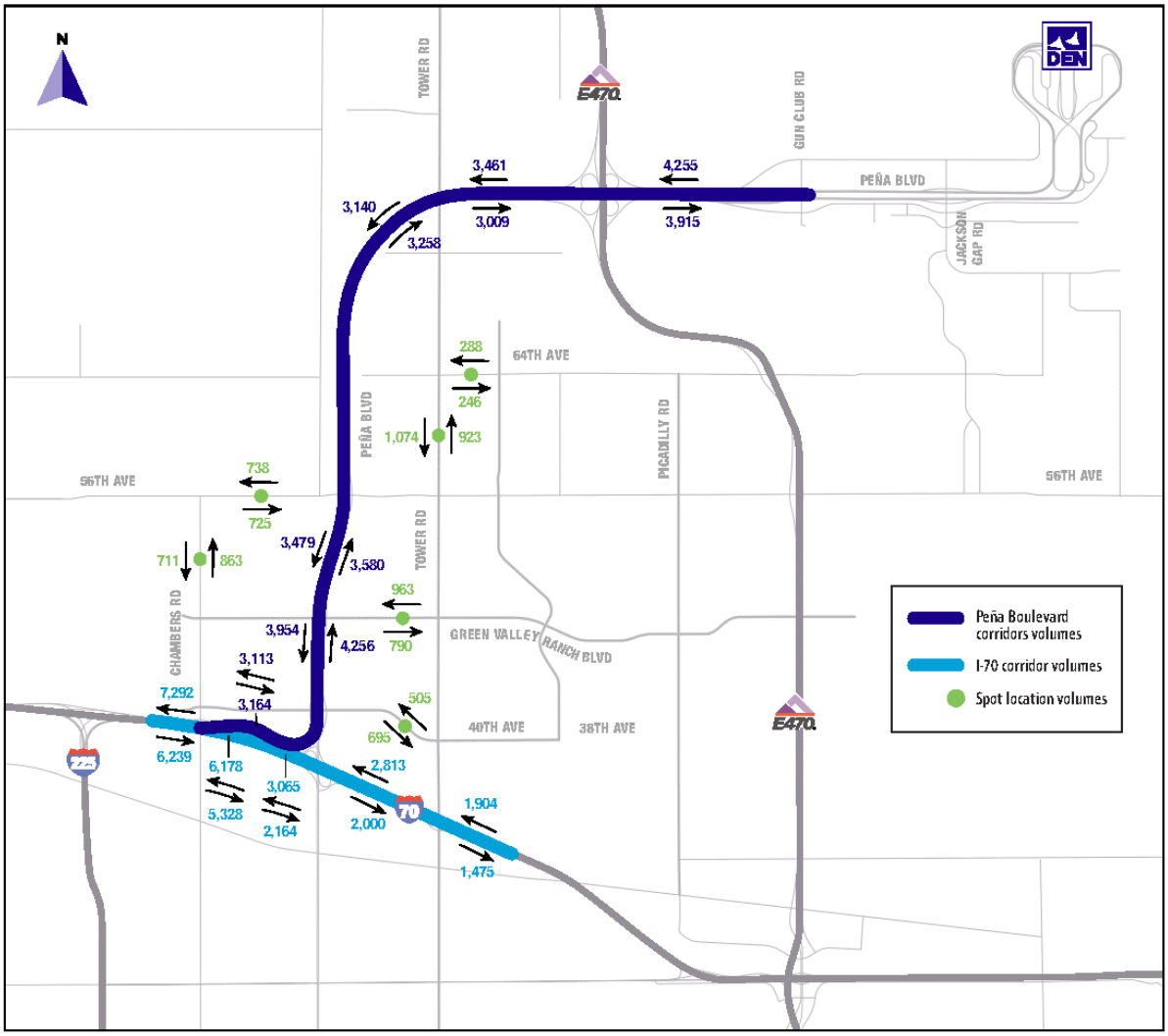
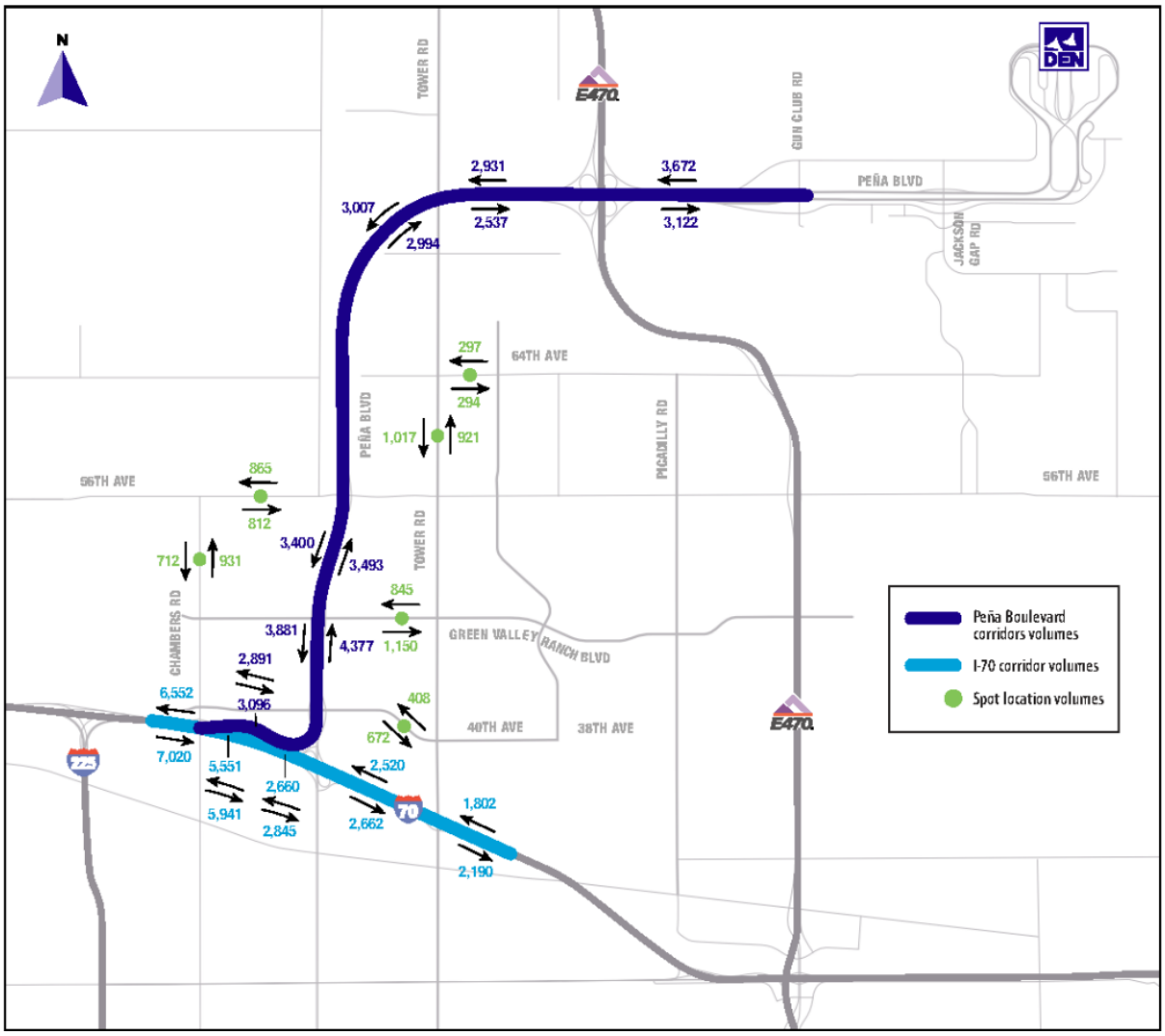


Figure 3-4 – Corridor Traffic Volumes – PM Peak Hour



3.2.3.1. Vehicle Occupancy within the Microsimulation Model

The regional travel demand model was used to determine an overall vehicle occupancy distribution for the peak period within the microsimulation model. These occupancy values used are in Table 3-2.

Table 3-2 – Vehicle Occupancy Distribution for Passenger Vehicles

Peak Period	SOV	HOV2	HOV3+	Average Occupancy*
AM	75%	16%	9%	1.4 ppv
PM	80%	15%	5%	1.3 ppv

*ppv = persons per vehicle

3.2.3.2. Truck Volumes within the Microsimulation Model

Microsimulation model extents included multiple, connected corridors, and so it was not possible to set specific truck percentages to each corridor. Instead, truck volumes were loaded by using a two-step approach to best reflect in-field conditions. First, a global truck percentage was established for different facility types. These values shown in Table 3-3 were synthesized based on in-field data collection and agreed to by both DEN and DOTI.

Table 3-3 – Generalized Truck Percentages

Location	Period	Single-unit Trucks	Multi-unit Trucks	Total
Arterials and Driveways	AM	5%	4%	9%
Arterials and Driveways	PM	4%	4%	8%

Specific truck percentages were also assigned to entry nodes of major corridors to get corridor truck percentages as close to in-field observations (shown in Table 3-4).

Table 3-4 – Corridor Specific Truck Percentages

Location	Period	Single-unit Trucks	Multi-unit Trucks	Total
Chambers Road south of Green Valley Ranch (GVR) Boulevard	AM	5%	4%	9%
Chambers Road south of Green Valley Ranch (GVR) Boulevard	PM	4%	4%	8%
Tower Road north of 56th Avenue	AM	7%	7%	14%
Tower Road north of 56th Avenue	PM	4%	6%	11%
64th Avenue east of Gaylord Rockies Boulevard	AM	8%	11%	19%

Location	Period	Single-unit Trucks	Multi-unit Trucks	Total
64th Avenue east of Gaylord Rockies Boulevard	PM	4%	13%	17%
Inbound Peña Boulevard *	AM	9%	1%	10%
Inbound Peña Boulevard *	PM	9%	1%	10%
Outbound Peña Boulevard *	AM	6%	1%	7%
Outbound Peña Boulevard *	PM	6%	1%	7%

3.3. Microsimulation Model Calibration

This section documents the microsimulation model calibration process, including the list of adjustments made, the specific location of these adjustments, the rationale behind these adjustments, and calibration results.

3.3.1. Calibration Measures and Targets

The *Peña Boulevard Transportation and Mobility Master Plan* and *Denver Moves Gateway Area Travel Study Traffic Modeling Methodology and Land Use Assessment Memorandum* framework were used to perform the calibration process. The *2018 CDOT Traffic Analysis and Forecasting Guidelines* methodology was followed to ensure adequate calibration. This approach uses both traffic volumes and travel times for calibration. The respective calibration targets are in Table 3-5.

Table 3-5 – Microsimulation Calibration Targets

Microsimulation Model Calibration Targets	
Simulated Traffic Volume Served 85% of network links, or additional critical links or movements as determined, must meet the calibration target.	• For < 100 vph, within ± 20% of observed traffic volumes • For 100 to 1,000 vph, within ± 15% of observed traffic volumes • For 1,000 to 5,000 vph, within ± 10% of observed traffic volumes • For > 5,000 vph, within 5% of observed traffic volumes
Simulated Travel Times (Segments/Links) 85% of network links or additional critical links or movements as, must meet the calibration target.	• For >7mins, within ± 15%, • Else, within 60 seconds

Source: 2018 CDOT Traffic Analysis and Forecasting Guidelines

3.3.2. Parameters Modified for Calibration

To calibrate the microsimulation model, certain parameters needed adjustments. These included adjustments to lane-changing distance and general driver behavior. Each of these is discussed in the following sections.

3.3.2.1. Lane-Change Distance

The "lane-change distance" feature allows VISSIM® to decide how far ahead a vehicle needs to get into a particular lane to make a required downstream-turning movement.

The default value within VISSIM for this parameter is 656 feet. This value was adjusted in certain locations. First, because of queues observed within the existing conditions model, the default value sometimes led to vehicles waiting too long to drive into the appropriate lane. If queues extended beyond approximately 600 feet, then vehicles would not try to change lanes until after the queue formed. This resulted in vehicles stopping in adjacent lanes and causing grid-lock conditions. It was observed that when long queues begin to form in the field, drivers tend to pre-position themselves well in advance in anticipation of the queue. Therefore, where such extended queues were observed, the default lane-changing distance was increased. This increase varied by location and observed queue length, but no location exceeded a lane-changing distance of 2,650 feet (or approximately 0.5 miles).

The second rationale for adjusting the lane-changing parameter was for locations with closely spaced intersections. In these instances, the default lane-changing distance was observed to exceed the length of the link. To avoid this, the lane changing distance was reduced. This reduction varied based on site-specific conditions, but no location had a lane-changing distance less than 400 feet.

3.3.2.2. General Driver Behavior

The car-following mode parameters dictate the driving behavior of vehicles in the model. By default, the Urban (motorized) setting using the *Wiedemann 74* approach was applied to all local roadways. For freeway facilities (i.e., Peña Boulevard and I-70), the default *Wiedemann 99* was applied.

Using these default values, it was observed that atypical queueing was occurring at on-ramp merge points within mainline freeways. At these locations, vehicles coming from on-ramps could not find sufficient gaps in traffic flow to enter the mainline freeway and were therefore coming to a stop onto the on-ramp.

To account for this behavior, a customized, cooperative lane-changing driver behavior was created. This modified behavior increased the allowable deceleration and speed differentials to better reflect in-field observations (Table 3-6). All modifications were made within limits set by the *2023 Colorado Department of Transportation (CDOT) Traffic Analysis and Forecasting Guidelines*. This modified set of parameters was applied to all freeway merge locations within the microsimulation model. This resulted in smoother merging behavior and eliminating vehicles coming to a stop onto on-ramps at merge locations.

Table 3-6 – Customized Cooperative Lane Changing Parameters

Parameter		Default Value on Freeways	Modified Value on Freeways
Maximum Deceleration (ft/s^2)	Leading Vehicle (called "own" vehicle in VISSIM)	13.12	15.00
Maximum Deceleration (ft/s^2)	Trailing Vehicle	9.84	12.00
Maximum Deceleration (ft/s^2)	Cooperative Braking	9.84	12.00
Maximum speed difference for lane change (mph)		6.71	10.00

3.3.3. Microsimulation Calibration Results

Table 3-7 shows calibration targets for all model time periods, including both freeway and non-freeway links. Additional details for each individual link are in Microsimulation Model Calibration Results of this report.

Table 3-7 – Calibration Results: Traffic Volume

Simulated traffic volume criteria	Model Time Period	Percentage of network meeting the criteria (target: 85% or higher)
• For < 100 vph, within ± 20% of observed traffic volumes • For 100 to 1,000 vph, within ± 15% of observed traffic volumes	AM	95%
• For 1,000 to 5,000 vph, within ± 10% of observed traffic volumes • For > 5,000 vph, within 5% of observed traffic volumes	Mid-day and PM	98%

Note: Cells highlighted in green indicate that the relevant calibration target was met.

Travel times calibration targets required 85 percent of all links to be either within 15 percent of observed travel times (for travel times greater than seven minutes) or within 60 seconds (for travel times less than seven minutes). Table 3-8 and Table 3-9 show the model achieved this criterion for both Peña Boulevard (100 percent of links meeting target) and local roadways (86 percent of links meeting targets).

Table 3-8 – Calibration Results: Travel Time on Peña Boulevard

Model Time Period	Travel Time Segment	Field Travel Time (minutes)	Model Travel Time (minutes)	Criteria Satisfying Range (minutes)	Criteria Met?
AM Peak	Inbound Peña	6.4	6.7	5.4–7.4	Yes
AM Peak	Outbound Peña	9.8	8.8	8.33–11.27	Yes
Mid-day/PM Peak	Inbound Peña	6.1	6.9	5.1–7.1	Yes
Mid-day/PM Peak	Outbound Peña	11.7	11.4	9.95–13.45	Yes

Table 3-9 – Calibration Results: Travel Time on Major Corridors Other than Peña Boulevard

				AM Peak Period				Mid-Day & PM Peak Period			
Street Name	Start	End	Direction	Field Time (s)	VISSIM Time (s)	Calibration Range (s)	Criteria Met?	Field Time (s)	VISSIM Time (s)	Calibration Range (s)	Criteria Met?
56th Ave.	Chambers Rd.	Peña SB Ramps	EB	99.0	120.6	39–159	Yes	132.5	117.6	72.5–192.5	Yes
56th Ave.	Peña SB Ramps	Tower Rd.	EB	98.0	126.4	38–158	Yes	148.5	133.3	88.5–208.5	Yes
56th Ave.	Tower Rd.	Dunkirk Rd.	EB	44.0	58.2	0–104	Yes	59.5	50.2	0–119.5	Yes
56th Ave.	Dunkirk Rd.	Tower Rd.	WB	89.0	174.5	29–149	No	96.7	106.4	36.7–156.7	Yes
56th Ave.	Tower Rd.	Peña SB Ramps	WB	94.0	153.3	34–154	Yes	92.3	119.7	32.3–152.3	Yes
56th Ave.	Peña SB Ramps	Chambers Rd.	WB	133.0	118.8	73–193	Yes	121.0	116.5	61–181	Yes
GVR	Chambers Rd.	Peña SB Ramps	EB	130.0	123.9	70–190	Yes	115.0	114.0	55–175	Yes
GVR	Peña SB Ramps	Tower Rd.	EB	125.0	194.6	65–185	No	286.5	206.3	226.5–346.5	No
GVR	Tower Rd.	Himalaya Rd.	EB	93.0	113.6	33–153	Yes	134.0	109.7	74–194	Yes
GVR	Himalaya Rd.	Tower Rd.	WB	142.0	151.6	82–202	Yes	123.0	152.1	63–183	Yes
GVR	Tower Rd.	Peña SB Ramps	WB	115.0	144.9	55–175	Yes	238.0	139.8	178–298	No
GVR	Peña SB Ramps	Chambers Rd.	WB	139.0	139.6	79–199	Yes	143.5	143.2	83.5–203.5	Yes
40th Ave.	Chambers Rd.	Peña SB Ramps	EB	128.0	155.2	68–188	Yes	126.0	149.7	66–186	Yes
40th Ave.	Peña SB Ramps	Tower Rd.	EB	140.0	160.3	80–200	Yes	136.0	168.7	76–196	Yes
40th Ave.	Tower Rd.	Peña SB Ramps	WB	186.0	135.1	126–246	Yes	133.0	139.5	73–193	Yes
40th Ave.	Peña SB Ramps	Chambers Rd.	WB	151.0	184.3	91–211	Yes	182.0	167.4	122–242	Yes
64th Ave.	Tower Rd.	Dunkirk Rd.	EB	51.0	55.3	0–111	Yes	53.0	55.2	0–113	Yes
64th Ave.	Dunkirk Rd.	Himalaya Rd.	EB	47.0	44.6	0–107	Yes	56.0	44.4	0–116	Yes
64th Ave.	Himalaya Rd.	Dunkirk Rd.	WB	46.0	45.9	0–106	Yes	58.0	45.1	0–118	Yes
64th Ave.	Himalaya Rd.	Tower Rd.	WB	47.0	100.3	0–107	Yes	48.0	98.3	0–108	Yes
Chambers Rd.	40th Ave.	GVR Blvd.	NB	73.0	79.6	13–133	Yes	69.0	79.6	9–129	Yes
Chambers Rd.	GVR Blvd.	56th Ave.	NB	181.0	157.4	121–241	Yes	120.0	160.7	60–180	Yes
Chambers Rd.	56th Ave.	GVR Blvd.	SB	173.0	103.3	113–233	No	110.5	80.6	50.5–170.5	Yes
Chambers Rd.	GVR Blvd.	40th Ave.	SB	155.0	137.3	95–215	Yes	80.5	85.0	20.5–140.5	Yes
Tower Rd.	32nd Ave.	38th Ave.	NB	62.5	75.2	2.5–122.5	Yes	201.0	93.8	141–261	No
Tower Rd.	38th Ave.	GVR Blvd.	NB	105.5	151.8	45.5–165.5	Yes	123.5	139.8	63.5–183.5	Yes
Tower Rd.	GVR Blvd.	56th Ave.	NB	122.0	101.9	62–182	Yes	143.0	124.1	83–203	Yes
Tower Rd.	56th Ave.	64th Ave.	NB	95.5	112.1	35.5–155.5	Yes	108.5	94.7	48.5–168.5	Yes

				AM Peak Period				Mid-Day & PM Peak Period			
Street Name	Start	End	Direction	Field Time (s)	VISSIM Time (s)	Calibration Range (s)	Criteria Met?	Field Time (s)	VISSIM Time (s)	Calibration Range (s)	Criteria Met?
Tower Rd.	64th Ave.	EB Peña Blvd.	NB	122.5	130.0	62.5–182.5	Yes	131.5	130.8	71.5–191.5	Yes
Tower Rd.	EB Peña Blvd.	WB Peña Blvd.	NB	52.0	28.4	0–112	Yes	43.5	34.7	0–103.5	Yes
Tower Rd.	WB Peña Blvd.	EB Peña Blvd.	SB	31.5	26.2	0–91.5	Yes	33.5	32.1	0–93.5	Yes
Tower Rd.	EB Peña Blvd.	64th Ave.	SB	118.5	136.7	58.5–178.5	Yes	156.5	137.6	96.5–216.5	Yes
Tower Rd.	64th Ave.	56th Ave.	SB	232.0	113.5	172–292	No	401.5	126.9	341.5–461.5	No
Tower Rd.	56th Ave.	GVR Blvd.	SB	151.5	135.4	91.5–211.5	Yes	171.5	109.3	111.5–231.5	No
Tower Rd.	GVR Blvd.	38th Ave.	SB	128.5	121.3	68.5–188.5	Yes	139.0	130.0	79–199	Yes
Tower Rd.	38th Ave.	32nd Ave.	SB	68.0	58.1	8–128	Yes	179.0	75.3	119–239	No

4. Existing Conditions Microsimulation Results

This section summarizes the findings of the microsimulation modeling effort. The results examined three measures of effectiveness (MOEs), including serviced volumes on Peña Boulevard, speeds along Peña Boulevard, delays at local roadway intersections, and queues within the network. Each of these MOEs are discussed in the following sections.

4.1. Serviced Volumes on Peña Boulevard

Serviced volumes on Peña Boulevard in existing conditions reflect demand patterns, with the highest serviced volumes observed on the southern portion of the corridor, near 40th Avenue and the lowest volumes near the northern end of the corridor around E-470. Figure 4-1 and Figure 4-2 show serviced volumes on Peña Boulevard for AM and Mid-Day/PM peak periods, respectively.

Figure 4-1 – Peña Boulevard Existing Conditions AM Peak Period Serviced Volumes

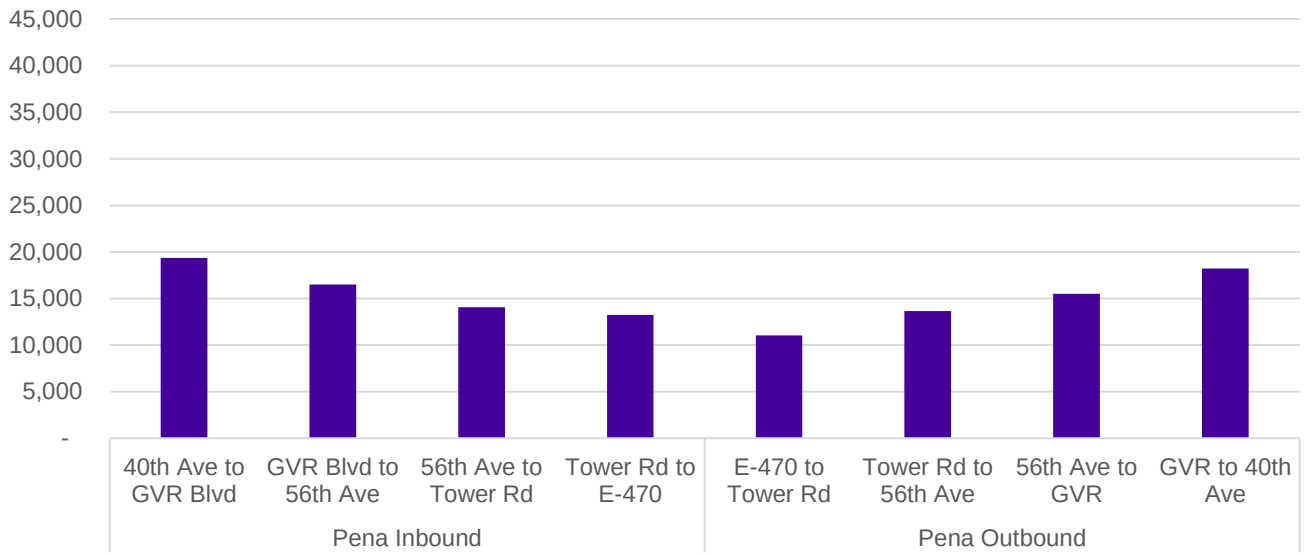
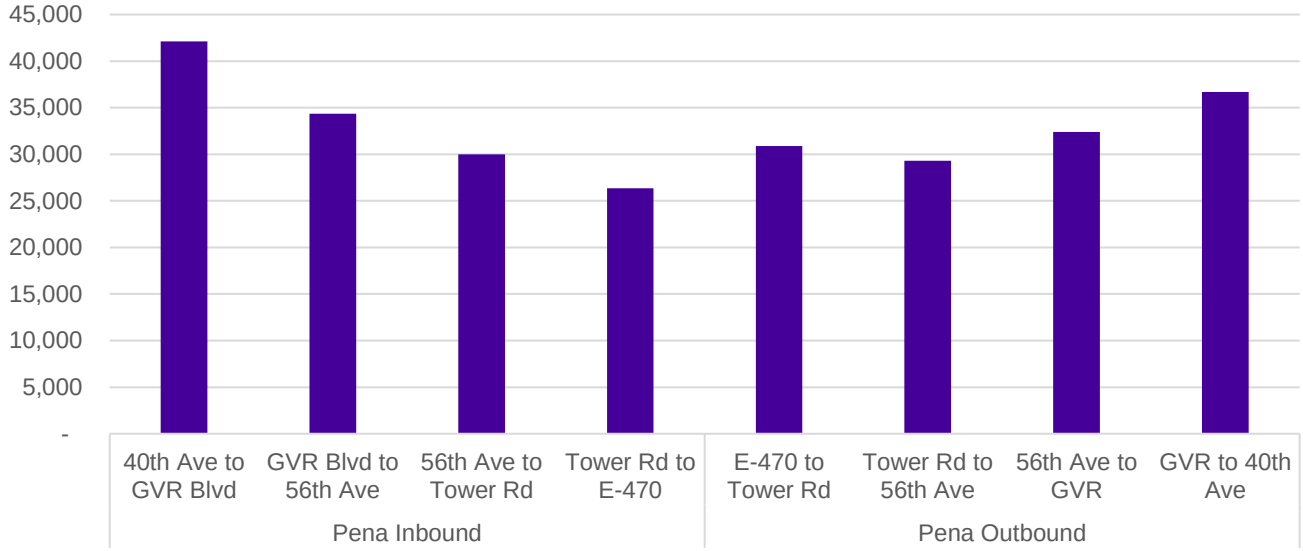


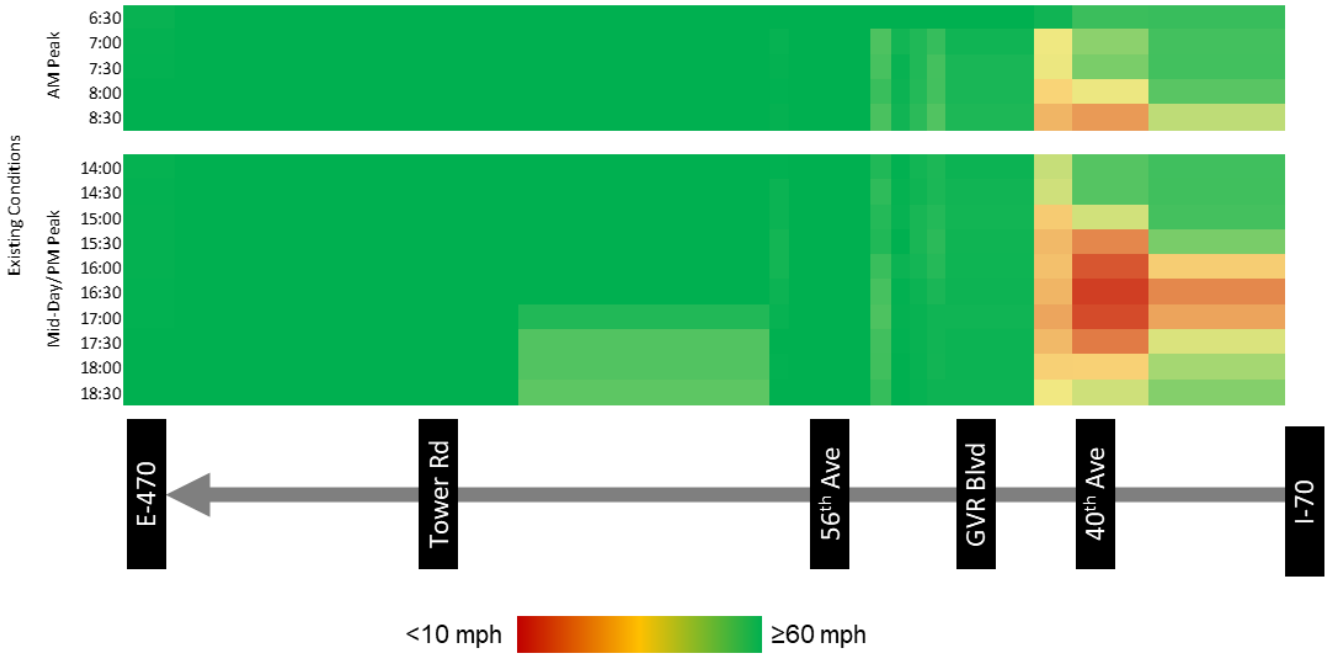
Figure 4-2 – Peña Boulevard Existing Conditions PM Peak Period Serviced Volumes



4.2. Speeds Along Peña Boulevard

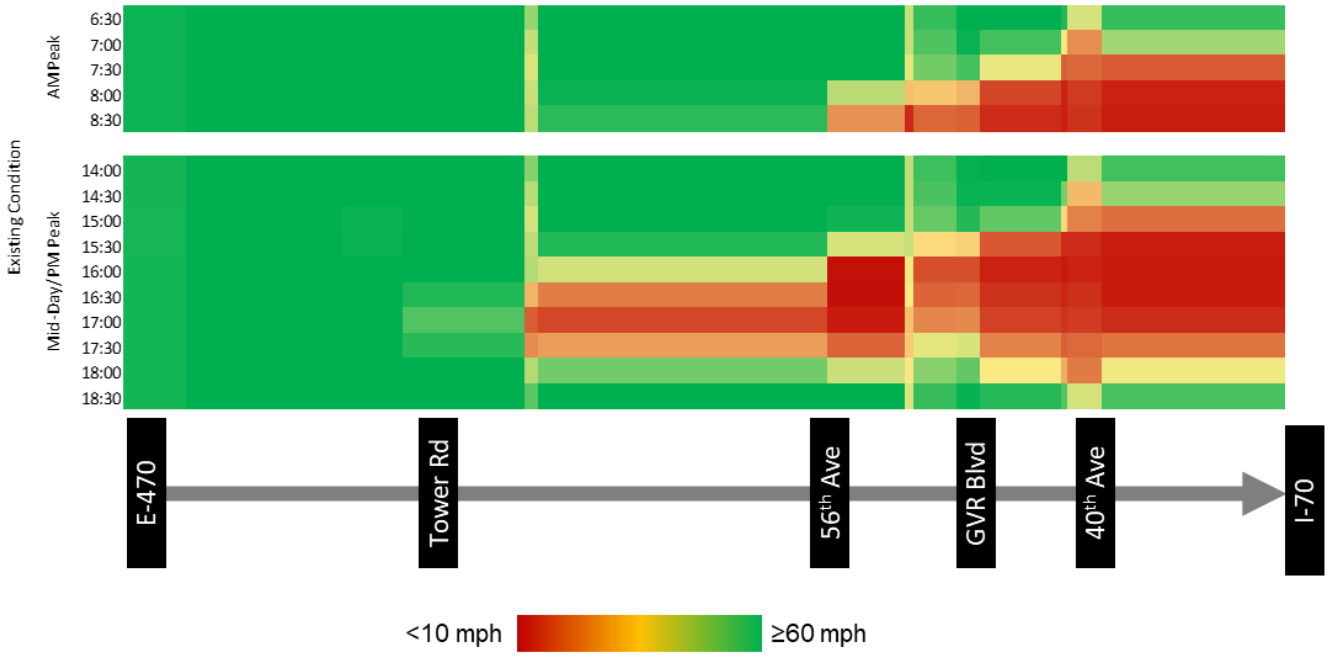
Speeds along Peña Boulevard were reviewed to understand where existing bottlenecks are occurring. In the inbound direction (heading from I-70 toward DEN), congestion is observed only near the southern portion of Peña Boulevard near 40th Avenue. This congestion is a result of on-ramp traffic from 40th Avenue (and Airport Boulevard) merging in with Peña Boulevard traffic. This merging causes traffic on Peña Boulevard to slow. In the morning peak period, this slowing is generally localized to the 40th Avenue interchange. However, during mid-day and evening peak periods, this congestion spills back to the I-70 mainline. Figure 4-3 shows average speeds along Peña Boulevard for the inbound direction.

Figure 4-3 – Existing Conditions Speeds Along Peña Boulevard Inbound (Toward DEN)



Speeds on Peña Boulevard are slower/more congested in the outbound direction than the inbound direction (see Figure 4-4). This is because traffic in the inbound direction is metered by the existing two-lane ramp from eastbound I-70 to Peña Boulevard. Once reaching Peña Boulevard, more traffic exits Peña Boulevard than enters it. This results in lessening congestion along Peña Boulevard moving away from I-70. However, in the outbound direction, the reverse pattern is observed with more traffic entering at Tower Road, 56th Avenue, and GVR Boulevard than exiting. The existing two lanes on Peña Boulevard, including the two-lane ramp from Peña Boulevard to westbound I-70, meters traffic trying to reach I-70.

Figure 4-4 – Existing Conditions Speeds Along Peña Boulevard Outbound (Away from DEN)



4.3. Delay at Intersections

The Highway Capacity Manual (HCM) Level of Service (LOS) methodology was used to evaluate intersection delays. An LOS is a measurement of the average delay per vehicle at an intersection. Based on this delay, a score of A through F is assigned, with A representing the best conditions (or smallest delay), and F reflecting the worst conditions (or greatest delay).

Figure 4-7 to Figure 4-10 show the LOS and average delays at each intersection included in the microsimulation model. The results show that all intersections within the network operate at an LOS D or better in both AM and mid-day/PM peak periods.

Figure 4-5 – Microsimulation Analysis: Level of Service: AM Peak (Intersections 1–35)

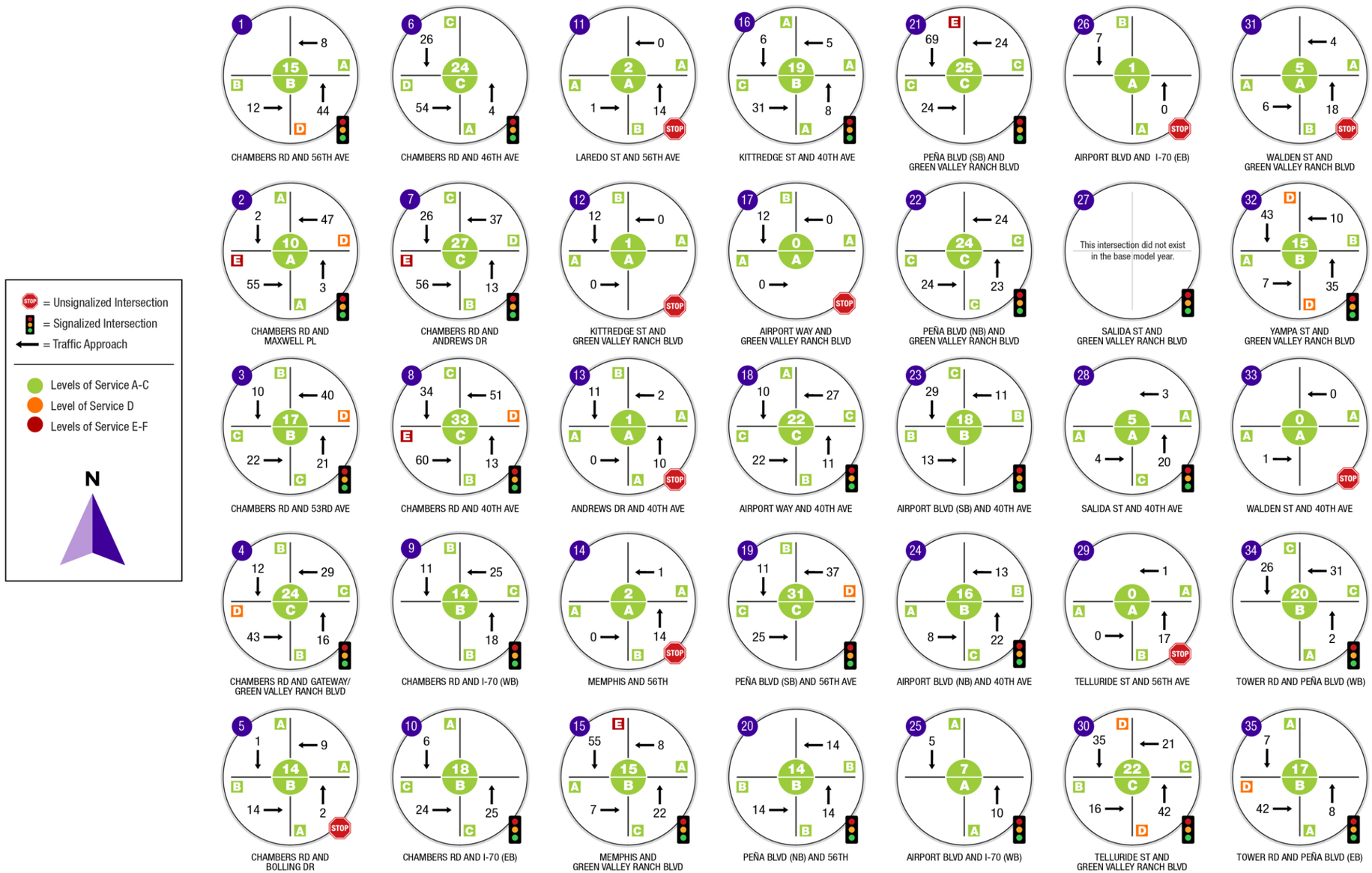


Figure 4-6 – Microsimulation Analysis: Level of Service: AM Peak (Intersections 36–67)

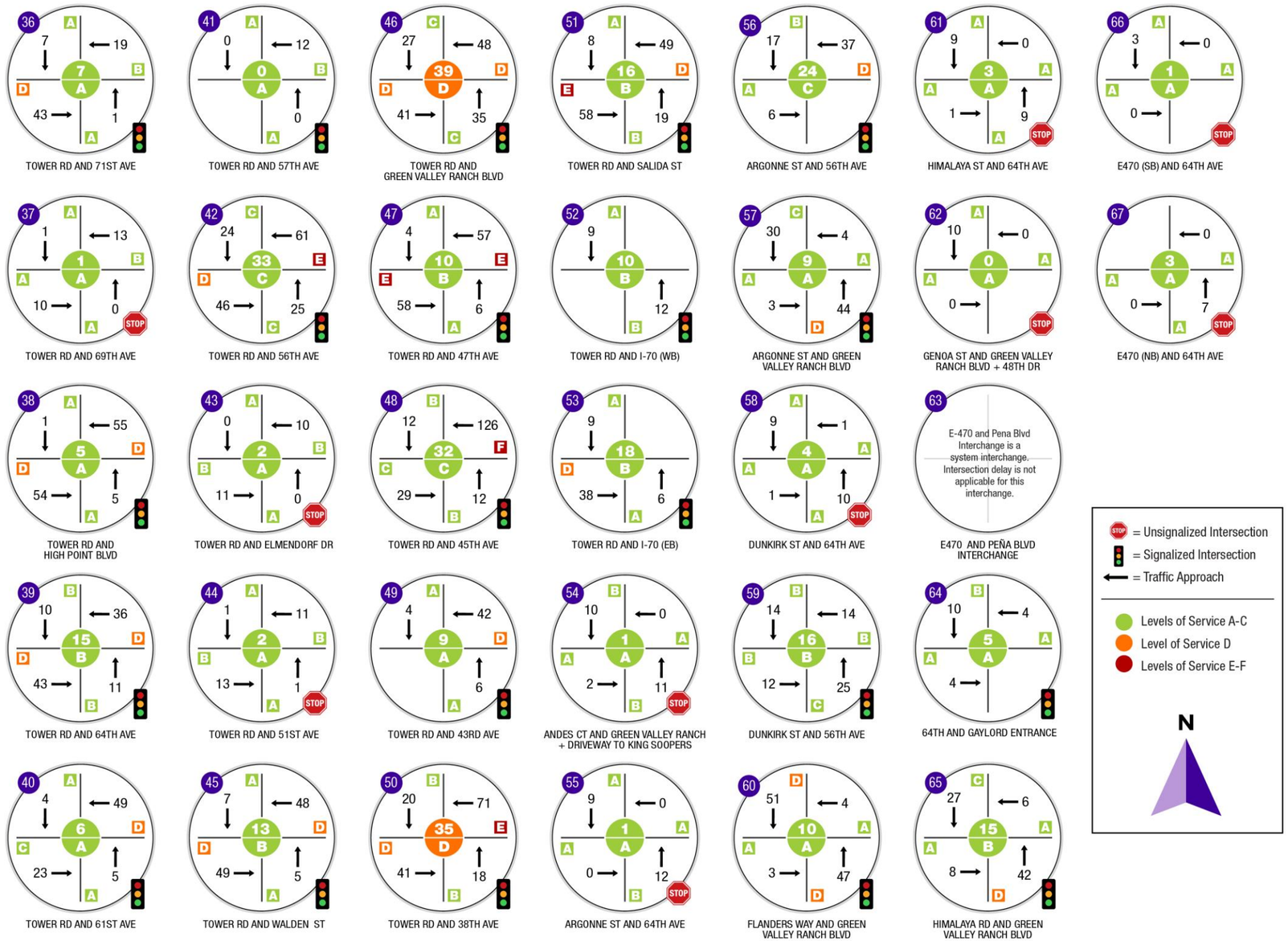
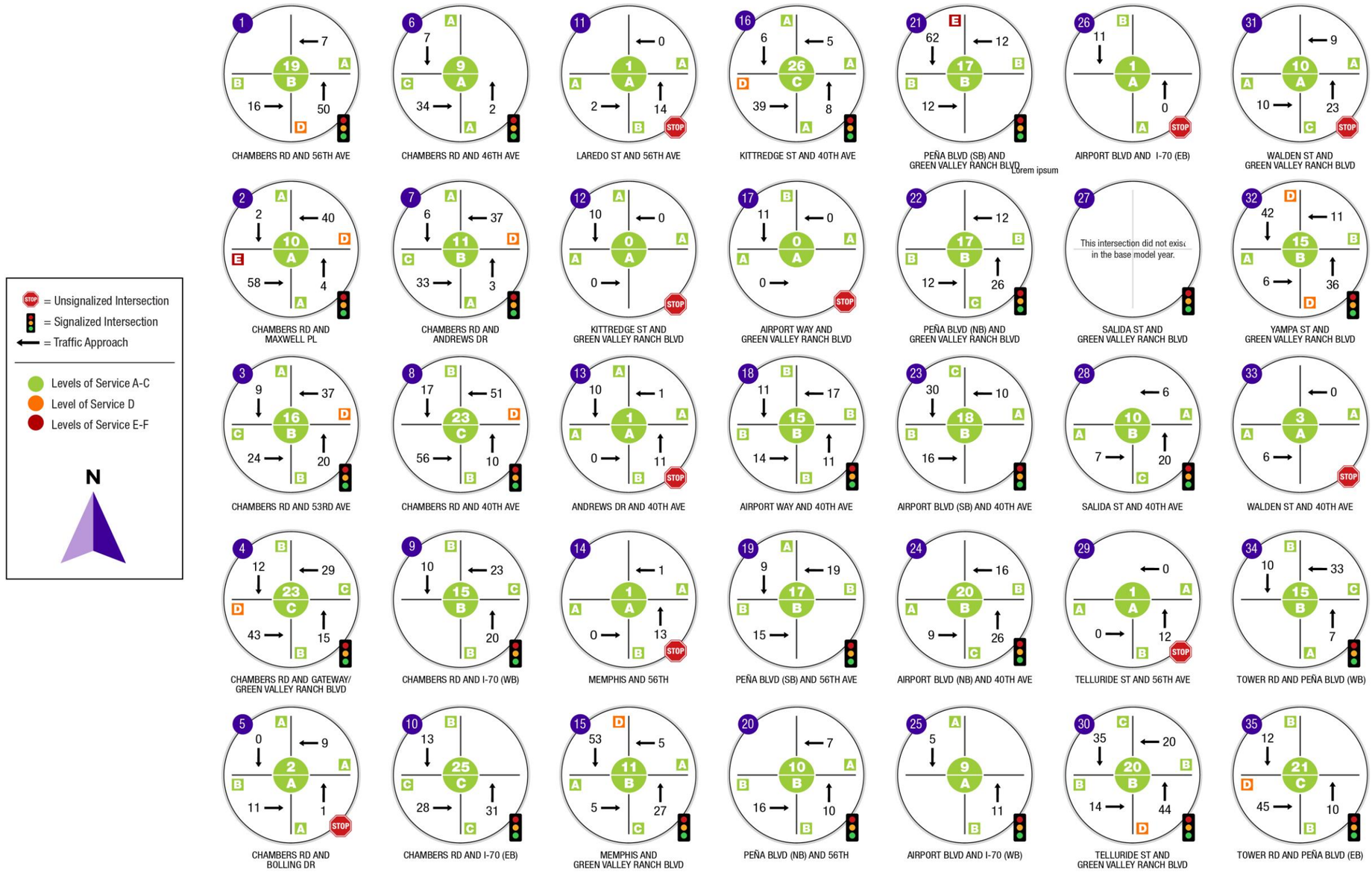


Figure 4-7 – Microsimulation Analysis: Level of Service: Mid-day Peak (Intersections 1–35)



Lorem ipsum

Figure 4-8 – Microsimulation Analysis: Level of Service: Mid-day Peak (Intersections 36–67)

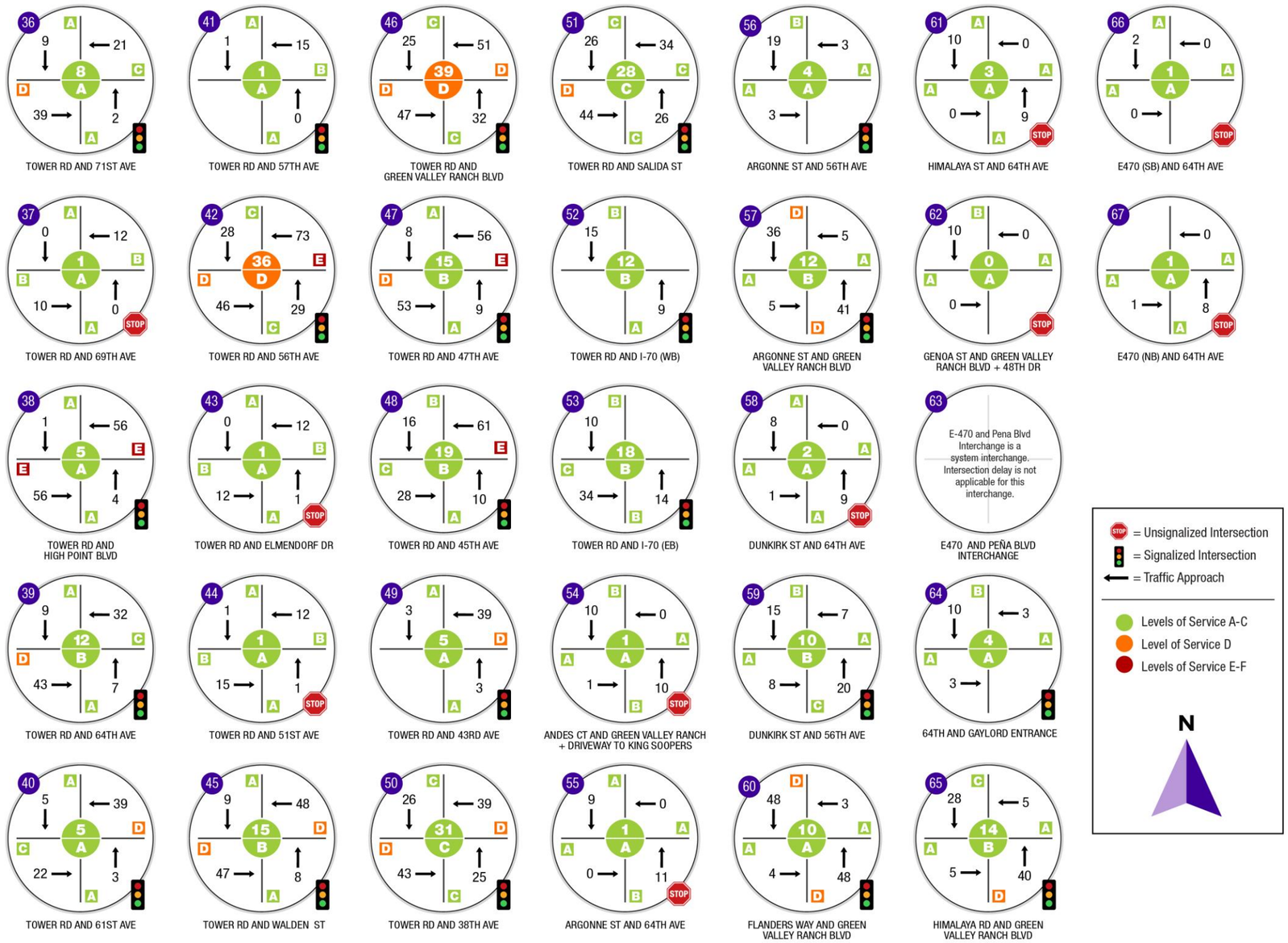


Figure 4-9 – Microsimulation Analysis: Level of Service: PM Peak (Intersections 1–35)

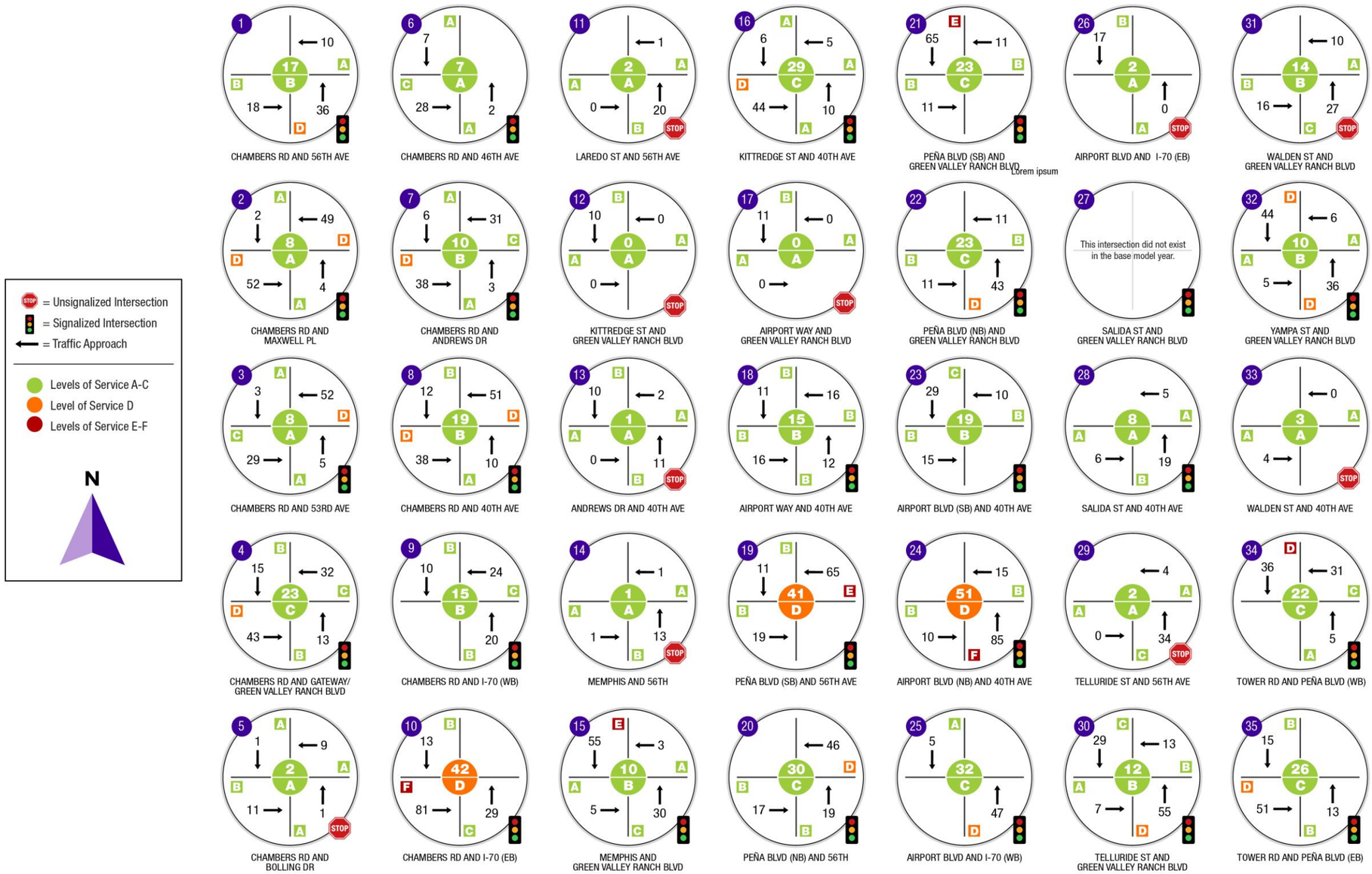
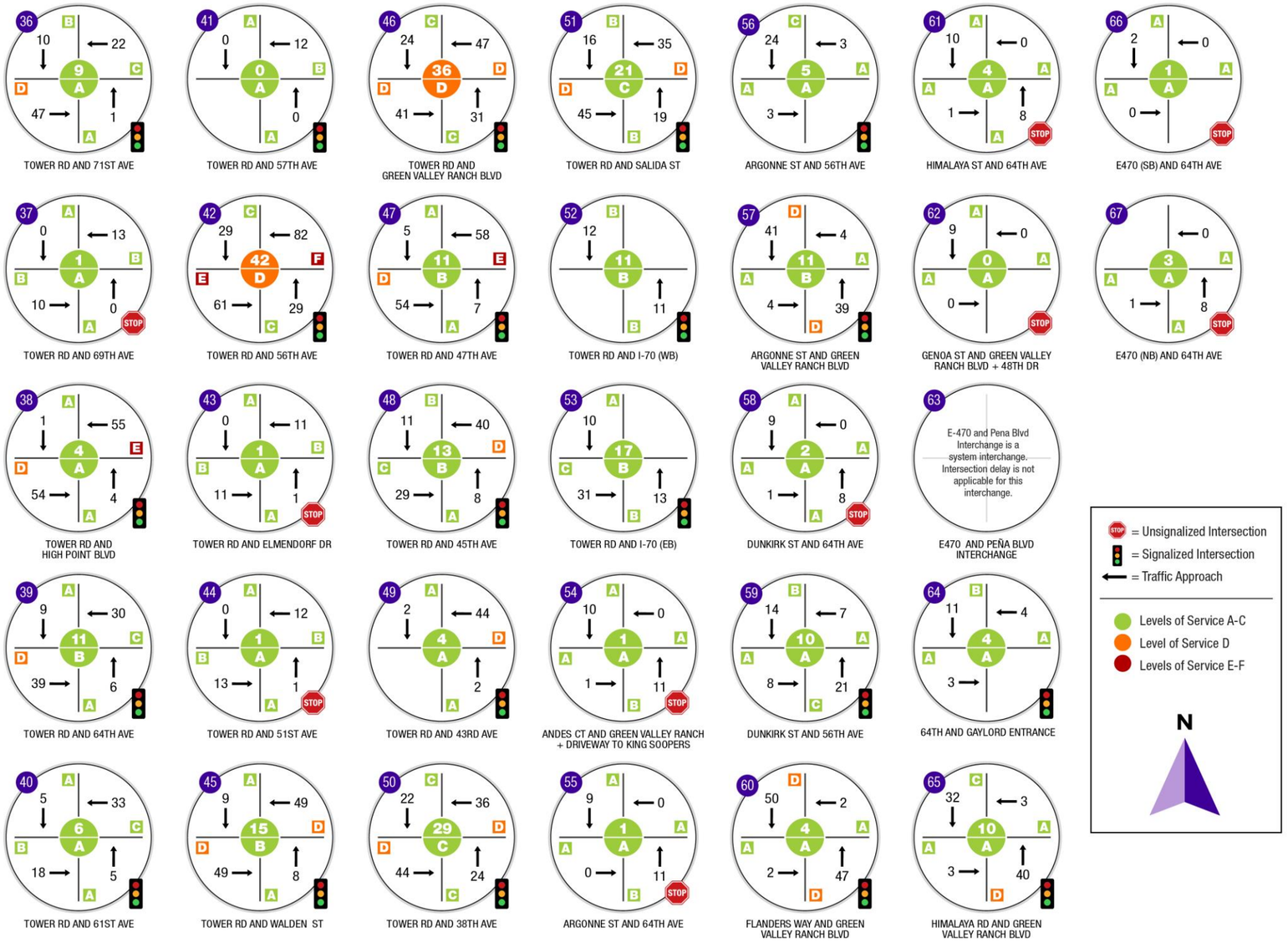


Figure 4-10 – Microsimulation Analysis: Level of Service: PM Peak (Intersections 36–67)



4.4. Queues

Figure 4-11 and Figure 4-12 show maximum observed queue lengths for AM and mid-day/PM peak periods, respectively. Note that for legibility only queues of significant length are depicted in these diagrams. All other queues were determined to be minor in nature and did not affect overall roadway operations.

In the AM peak period, the longest queues were observed at the Chambers Road and 56th Avenue intersection, at 56th Avenue and Peña Boulevard ramp terminals, and Tower Road and I-70 ramp terminals. In the PM peak period, the longest queues were observed on the Peña Boulevard to westbound I-70 ramp, the inbound Peña Boulevard off-ramp to Tower Road, and at the Tower Road and 38th Avenue intersection. In all cases, queues were observed to be localized to these singular locations and did not impede operations of other links within the roadway network.

Figure 4-11 – Existing Conditions: AM Peak Period

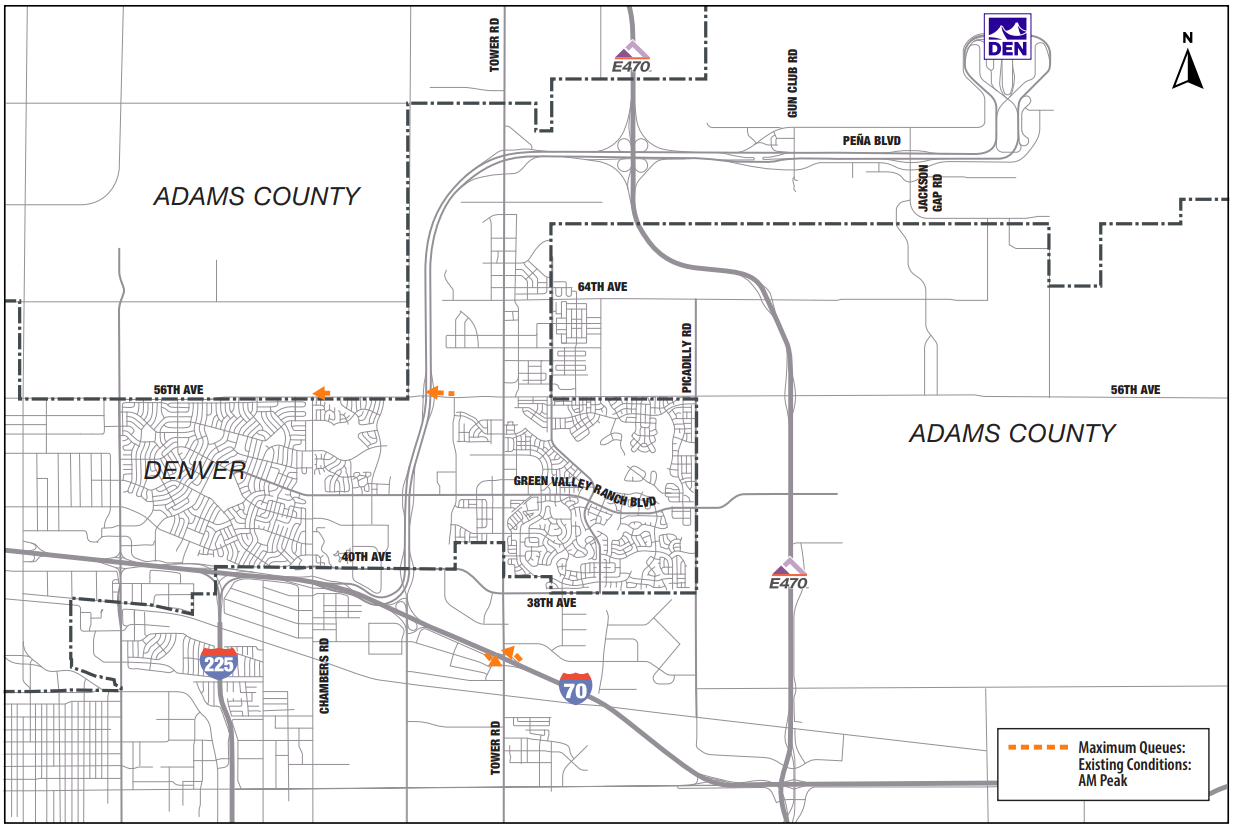
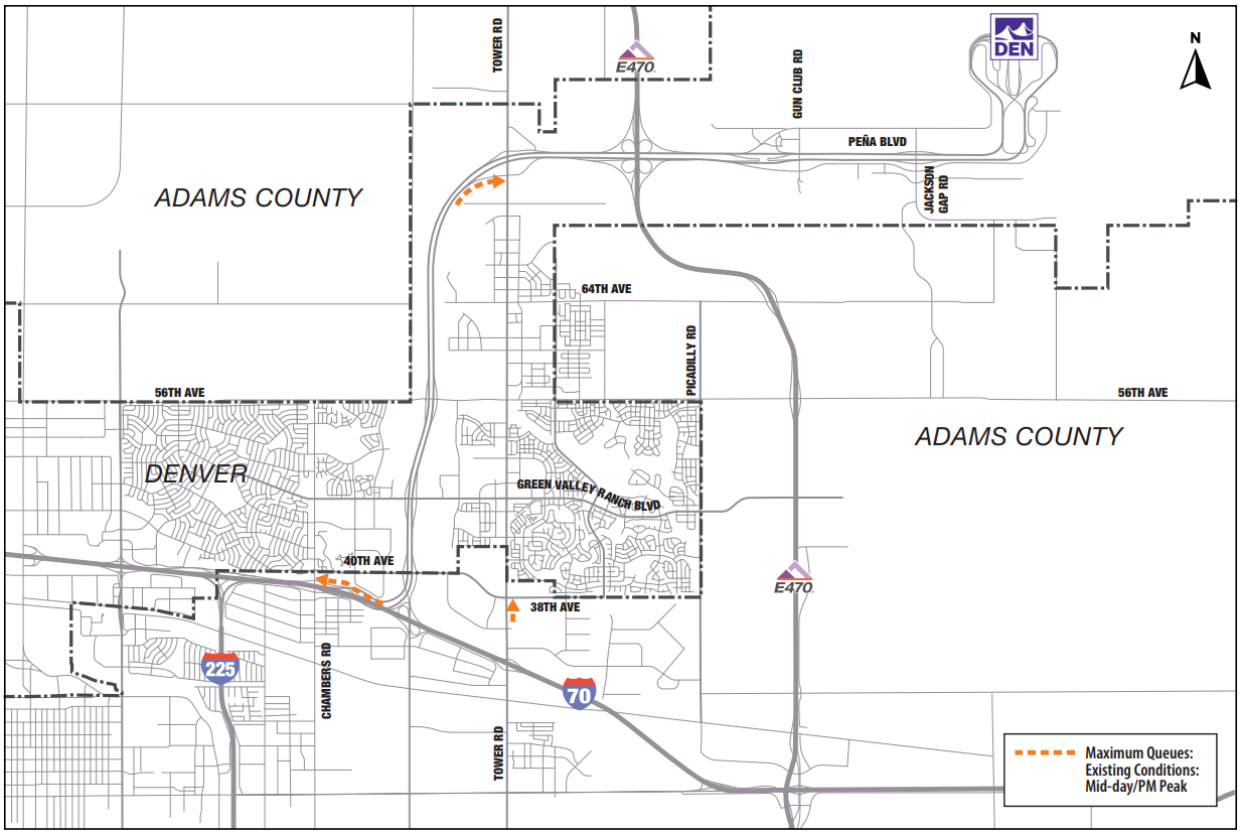


Figure 4-12 – Existing Conditions: Mid-day/PM Peak Period



5. 2050 No Action Conditions

This chapter discusses the expected future traffic conditions within the traffic analysis area in 2050 should no action—beyond what is already planned to occur—be taken. It is important to note that this condition, hereafter referred to as the 2050 No Action scenario, is not the same as doing nothing. This is because even without implementing any improvements due to this study, certain changes to the transportation network are already planned to occur, as defined in Denver Regional Council of Governments' (DRCOG) *2050 Metro Vision Regional Transportation Plan* (2050 RTP), adopted in April 2021. These changes, the methodology for their evaluation, and the predicted impacts of them on the transportation network are in the following sections.

5.1. Changes Included in the 2050 No Action Scenario

Table 5-1 summarizes the changes to the roadway network included in the 2050 No Action scenario. These changes come from the DRCOG 2050 RTP or, if not included in the RTP, were included in the DRCOG 2050 regional Travel Demand Model (TDM). Note, the regional TDM includes some additional minor changes to the transportation network, such as the extension of local roadways, which are important to the traffic analysis area but are not considered regionally significant and therefore, are not included in the RTP.

It should be noted that the DRCOG 2050 RTP includes plans to add one high-occupancy toll (HOT) lane direct connect to/from I-70 and Peña Boulevard in each direction, add one HOT lane to Peña Boulevard from I-70 to E-470 in each direction, and add one additional general-purpose (GP) lane in each direction to Peña Boulevard from E-470 to DEN terminals. Because the purpose of this study is to evaluate potential improvements to Peña Boulevard, some of which may differ from what is currently included in the RTP, additional HOT lanes on Peña Boulevard from I-70 to E-470 and additional GP lanes east of E-470 are not included as part of the No Action scenario. However, the HOT direct connect between I-70 and Peña Boulevard is included in the No Action scenario, as it may be constructed regardless of any other changes made to Peña Boulevard.

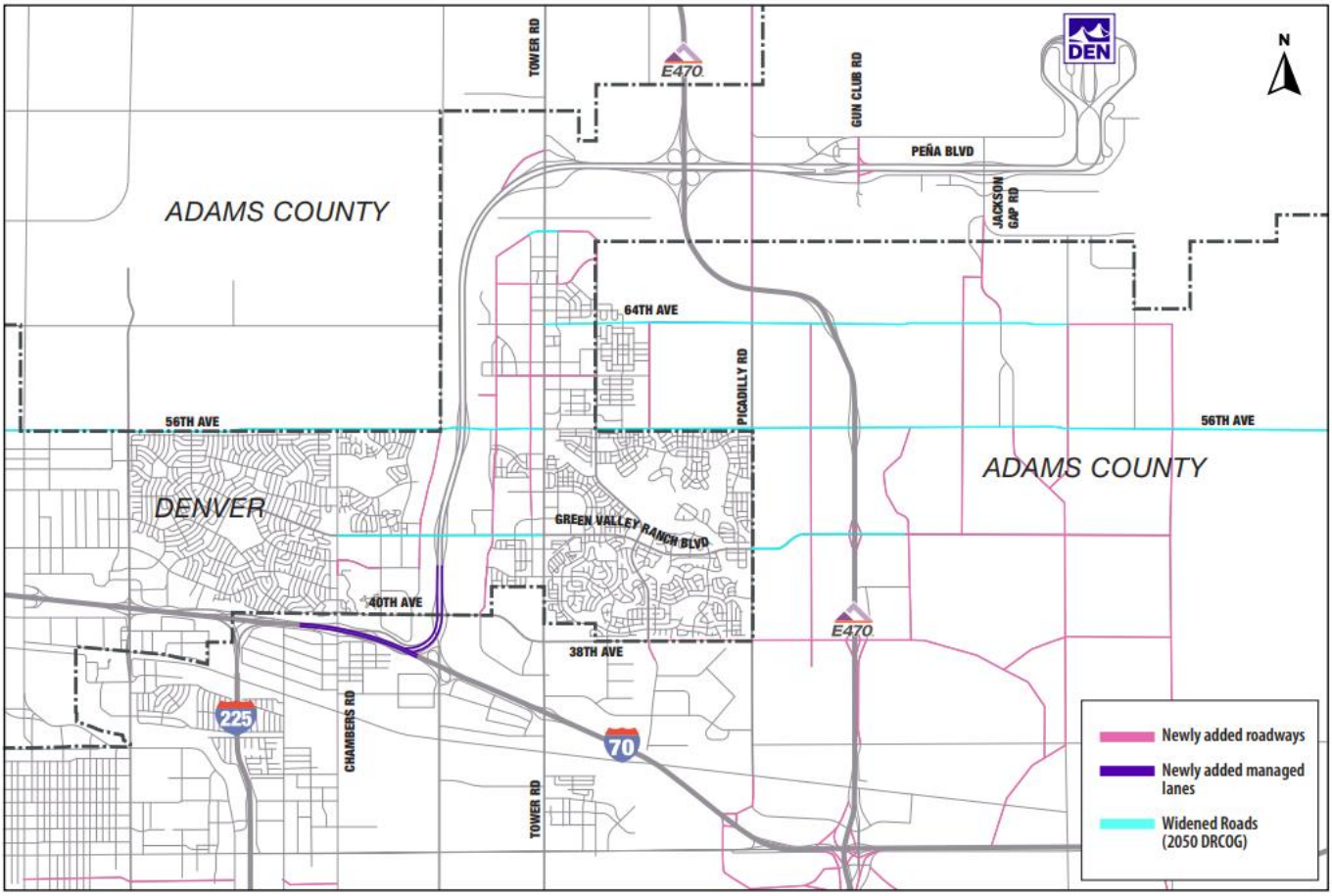
Table 5-1 – Changes Included in the 2050 No Action Scenario

Facility	Changes	Source
Peña Boulevard	Add a direct connect from the eastbound I-70 managed lanes to Peña Boulevard Add a direct connect from Peña Boulevard to the westbound I-70 managed lanes	DRCOG 2050 RTP
Tower Road	Widen from four to six lanes from 45th Avenue to 106th Avenue	DRCOG 2050 RTP
40th Avenue	Widen from four to six lanes from Chambers Road to Tower Road	DRCOG 2050 RTP

Facility	Changes	Source
56th Avenue	Widen from four to six lanes from Havana Street to Tower Road Widen to six consistent lanes from Genoa Street to Powhaton Road	DRCOG 2050 RTP
64th Avenue	Widen from two to four lanes from Tower Road to Dunkirk Road Widen from four to six lanes from Dunkirk Road to Harvest Mile Road	DRCOG 2050 RTP
Telluride Way	Extended to be continuous from 40th Avenue to 71st Avenue	DRCOG Regional TDM
Yampa Street	Extended to be continuous from 45th Avenue to 71st Avenue	DRCOG Regional TDM
Airport Way	Extended to be continuous from 40th Avenue to 56th Avenue	DRCOG Regional TDM

Modifications on the existing network along with changes in the roadways by 2050 are in Figure 5-1.

Figure 5-1 – 2050 No Action: Changes in the Network



5.2. Future Travel Demand

The project team used DRCOG's Focus 2.3.1 travel demand model (DRCOG model) to develop 2050 volumes for the study area. The latest copy of the calibrated and validated DRCOG model was obtained from DRCOG to estimate future volumes. This version of the DRCOG model is updated for the base year of 2020 and a future year of 2050. The 2050 model network was verified and updated to ensure it included all projects contained within the DRCOG 2050 RTP within the traffic analysis area (shown in Table 5-1) as well as other major projects and planned land use changes in the surrounding area, such as Jackson Gap improvements and the Aerotropolis project.

5.3. 2050 Microsimulation Traffic Volume Inputs

The No Action microsimulation model was loaded using forecasted TMC volumes derived from the 2050 DRCOG TDM outputs. These forecasted volumes were created through a multi-stepped process, which started by extracting the 2020 and 2050 link volumes from the DRCOG TDM. The 2020 and 2050 volume assignments from the DRCOG model were used to calculate the growth, in terms of the absolute growth in volume (difference in

volumes) and proportion of growth (ratio between volumes). Final 2050 volumes were calculated by using a hybrid of the difference method and the ratio method, as prescribed by the *NCHRP 765* guidance document published by the *Transportation Research Bureau* (TRB), to ensure that future volumes were not overestimated.

These 2050 link volumes were then converted into TMCs to input into the microsimulation model. This conversion was done by first, taking the approach link volumes to each intersection in the microsimulation model extents and then distributing them proportionally to the left-turning movements, through movements, and right-turning movements based on the existing TMC movement splits. At new intersections or intersections with new movements for which there are no existing TMC splits, engineering judgment was used to estimate the proportion of left-turning movements, through movements, and right-turning movements.

The resulting TMCs represented unbalanced volumes, as the volumes coming from a previous intersection did not equal volumes approaching the next intersection. Because VISSIM requires balanced TMC volumes, further manual processing of these tables was required. To do this, first, the total imbalance in volumes was calculated for each corridor in each direction. If overall imbalance was less than approximately 400 vehicles, then the net imbalance of vehicles was added or subtracted from through movements at the first intersection on either side of the corridor, and that change was propagated along the corridor, changing only through volumes. If the imbalance was greater than approximately 400 vehicles, then the difference was split, and half of the trips were added to one end of the corridor, and the other half were removed from the opposite end. This change was then propagated along the corridor from both ends until volumes balanced in the middle. Left-turning volumes and right-turning volumes were not adjusted. The resulting balanced corridor volumes for Peña Boulevard of each peak hour are in Figure 5-2 through Figure 5-4. The balanced, 2050 TMC tables used in the microsimulation analysis are in Appendix D. Balanced 2050 No Build TMCs of this report.

Figure 5-2 – 2050 No Action: Corridor Volumes: AM Peak Hour

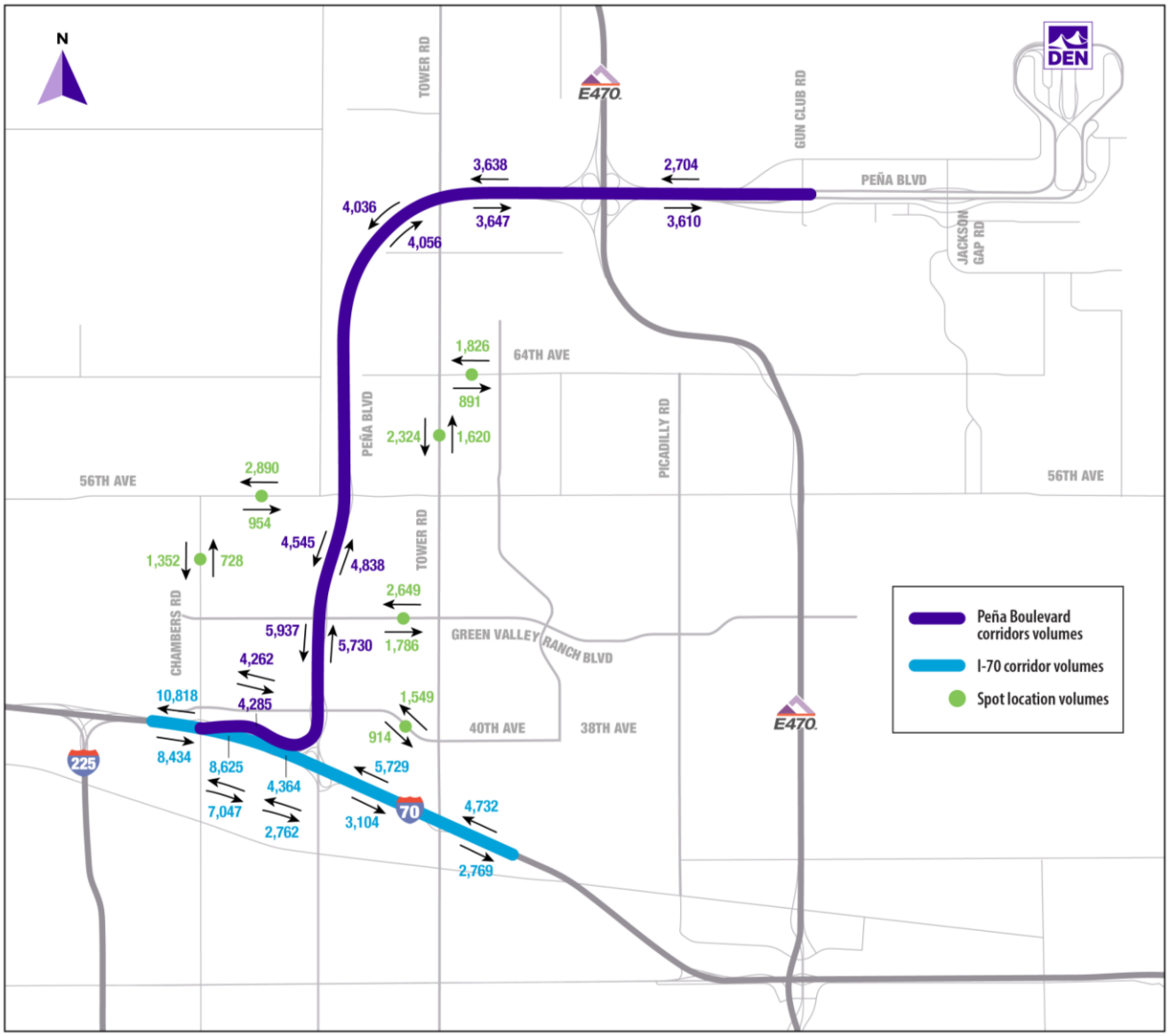


Figure 5-3 – 2050 No Action: Corridor Volumes: Mid-day Peak Hour

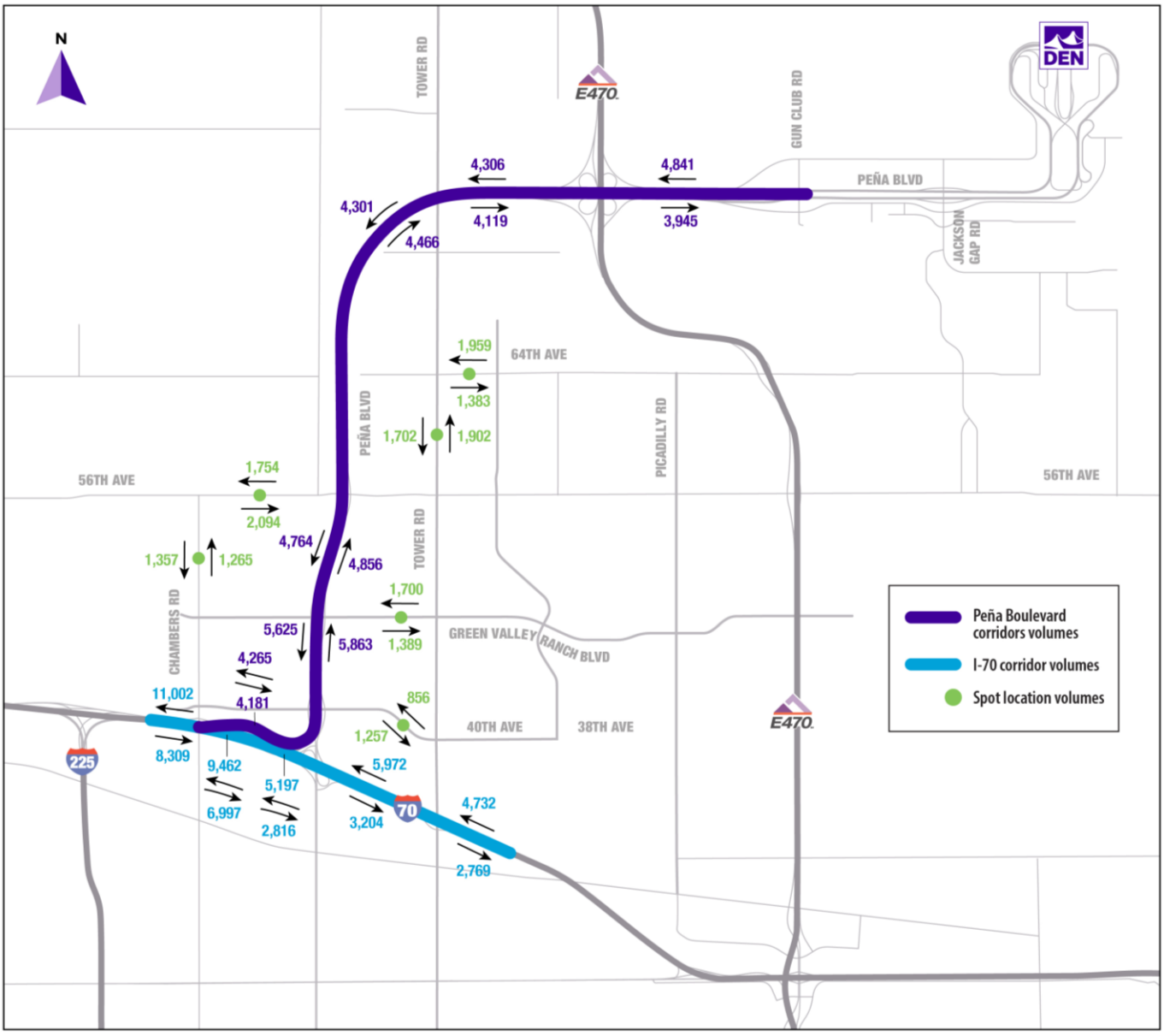
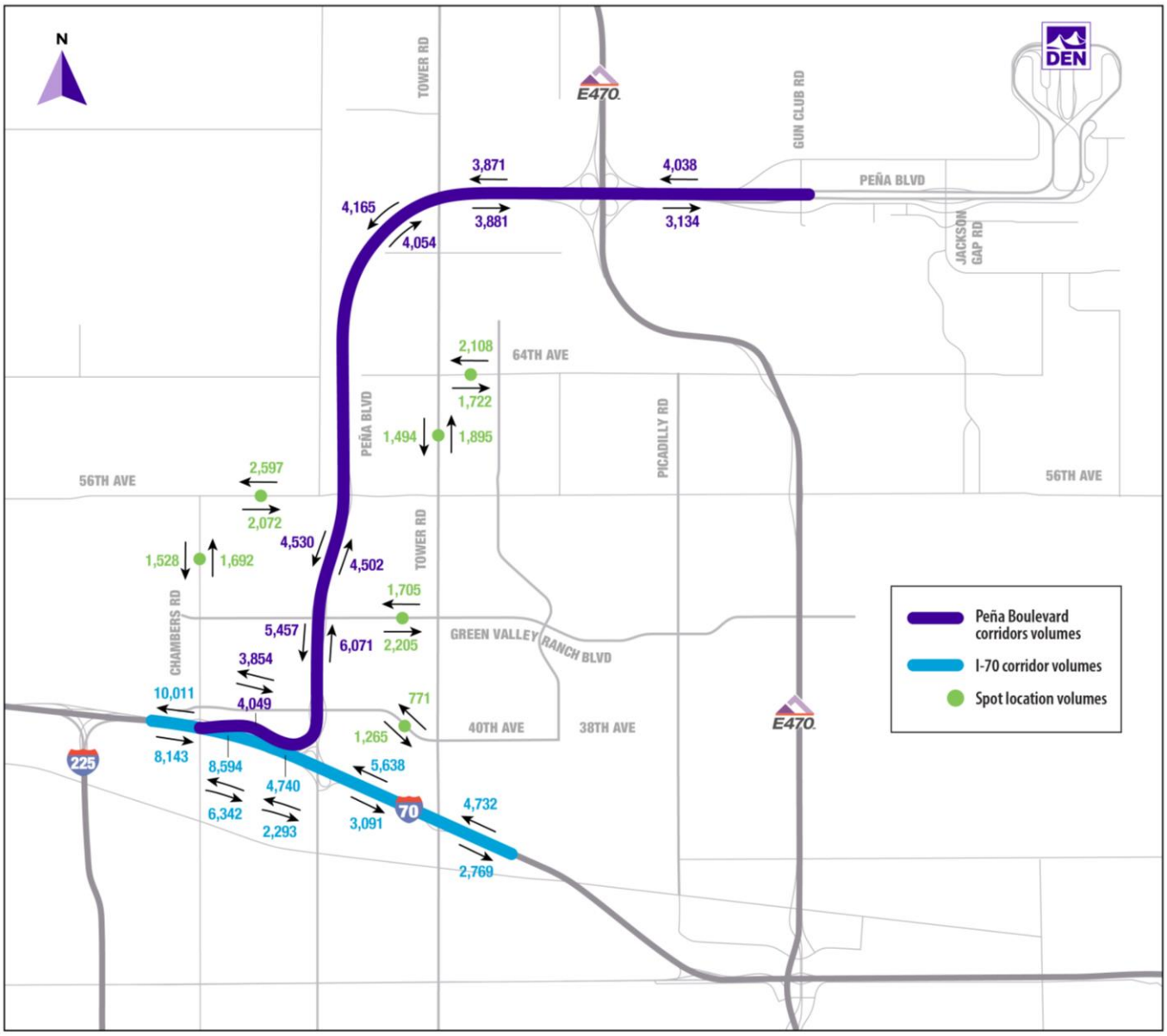


Figure 5-4 – 2050 No Action: Corridor Volumes: PM Peak Hour



5.4. 2050 No Action Microsimulation Model Updates

Because of changed conditions included in the No Action scenario, several features within the microsimulation model were revised between the existing conditions model and the No Action model. The following section describes these changes.

5.4.1. Traffic Signal Timing Optimizations

In response to improvements included in the No Action scenario, new intersections were created, and existing intersections were modified. These new and modified intersections were created based on an engineering judgement using the following principles:

- Turn lanes, including number and storage lengths, were maintained if, based on a visual inspection of the specific location, there were no clear site constraints (such as an adjacent building or other obstruction) that would require removing or modifying turn lanes.
- In locations where roadways are to be widened, existing unsignalized intersections were reviewed to see if the intersection should be signalized. Signalization was based on an engineering judgment and the overall size of the intersection and anticipated volumes. No signal warrant analysis was completed. A similar approach was applied when creating new intersections.

After coding the geometrics of all new and modified intersections, new (and updated existing) signal timing plans were created for all signalized intersections within microsimulation model extents. Synchro version 11.1 was used to create and optimize signal timings and offsets. This data was then fed back into VISSIM models. The following principles were used to develop new signal timing plans:

- Permissive, protected-permissive, and protected left-turn signal phasing was maintained at all existing intersections. At new intersections, engineering judgement was used to determine if new left-turn movements were likely to be permissive, protected-permissive, or protected.
- All lead-lag sequencing was maintained.
- All signal cycle lengths were set to 120 seconds.
- Although pedestrian crossing volumes were not included in the models, for any roadway that was widened or for any new signalized intersections that were created, revised/new pedestrian clearance times were calculated and used to ensure no signals ran with pedestrian timing violations.
- All signal timings were optimized based on 2050 TMCs as discussed in section 5.2 of this report.

5.4.2. Driver Behavior Parameter Refinements

Upon loading 2050 volumes into the microsimulation model, it was noticed that the additional demand in 2050 resulted in extensive queueing and unreasonable behaviors along the local roadway network. In many locations, it was observed that long turning queues would form and spill back upstream along roadways. In turn, this impact would make it very difficult for drivers to change lanes, resulting in them either missing their turns or coming to a full stop along a roadway and blocking through traffic. During the PM peak period, this issue became so extensive it resulted in the model becoming gridlocked.

The primary cause for that unreasonable behavior was identified to be drivers being less aggressive than what would be expected in congested, urban conditions. To correct for this, the average standstill distance parameter,

which governs the distance between two stationary vehicles, was adjusted from its defaulted value of 6.56 feet to a revised value of 5 feet. This revised value is within the range of suggested values, given by CDOT's *2023 Traffic Analysis and Forecasting Guidelines* and was found to better reflect more natural congested queueing behaviors, as determined by engineering judgement.

5.4.3. Coding of Managed Lanes

As part of the No Action scenario, new HOT direct connects are included, connecting the existing managed lanes on I-70 to the GP lanes on Peña Boulevard. Within the model, the toll price was used to manage the utilization of these direct connect lanes. The toll price during each modeling period was set to achieve a balanced, per-lane utilization between the available GP and managed lanes.

5.5. 2050 No Action Microsimulation Model Results

This section summarizes the findings of the Existing and 2050 No Action microsimulation modeling effort. The results examined three MOEs, including serviced volumes on Peña Boulevard, speeds along Peña Boulevard, delays at local roadway intersections, and queues within the network. Each of these MOEs are discussed in the following sections.

5.5.1. Serviced Volumes on Peña Boulevard

Although overall travel demand within the traffic analysis area is expected to increase in 2050, microsimulation results indicate that overall peak period serviced volumes on Peña Boulevard decrease in the 2050 No Action scenario as compared to the Existing Conditions. This reduction in serviced volumes is the result of extreme congestion within the microsimulation model, causing queues at intersections to spill back and block adjacent intersections resulting in gridlock conditions. Due to this gridlock, vehicles are not able to proceed, meaning they are not actually serviced by a facility and are therefore not counted in serviced volumes.

Figure 5-5 and Figure 5-6 show the serviced volumes on Peña Boulevard for the AM and mid-day/PM peak periods, respectively. An additional discussion about these queues and their impact on the roadway network is in Section 5.5.4 of this report.

Figure 5-5 – Peña Boulevard AM Peak Period Serviced Volumes

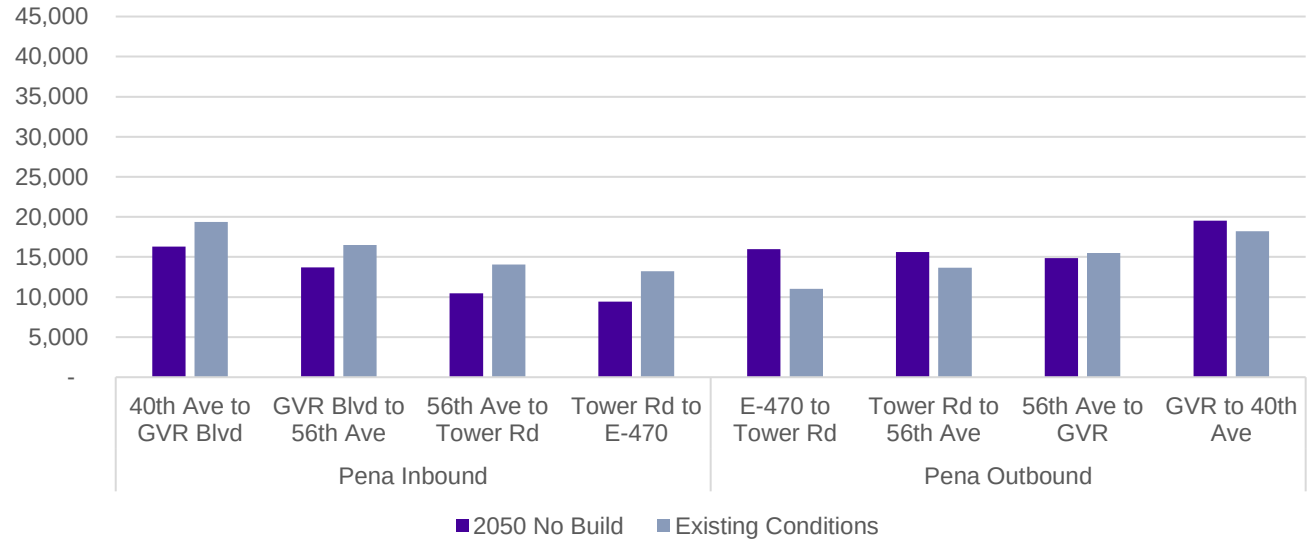
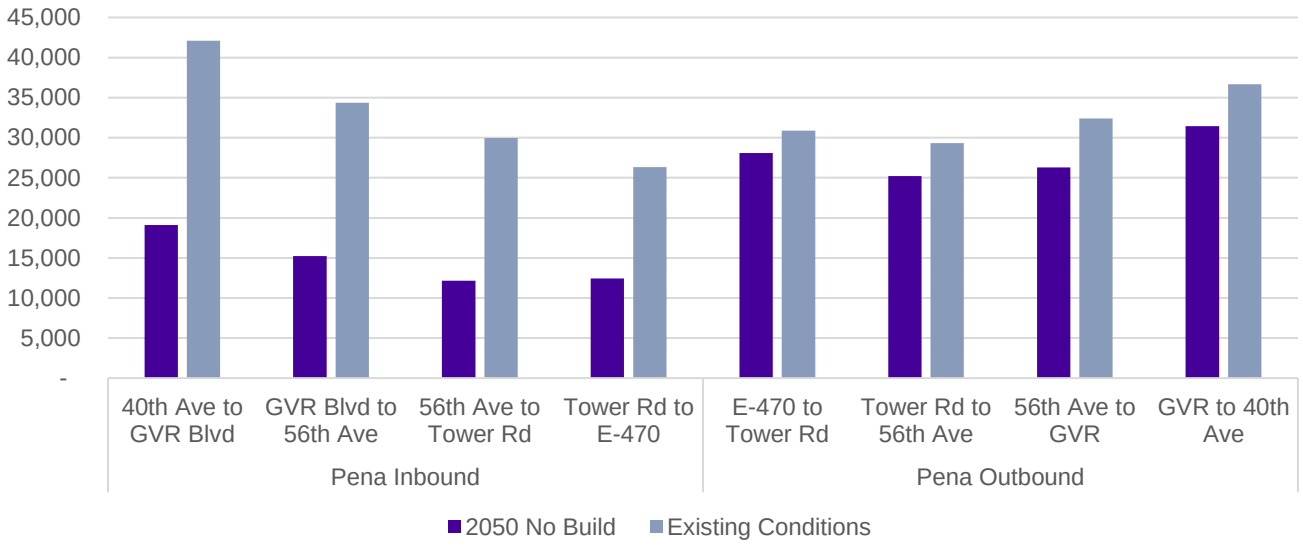


Figure 5-6 – Peña Boulevard Mid-Day/PM Peak Period Serviced Volumes



5.5.2. Speeds Along Peña Boulevard

Figure 5-7 shows the speeds along Peña Boulevard in the inbound direction for both existing and 2050 No Action conditions. In 2050, two bottlenecks form along inbound Peña Boulevard. The first occurs between 40th Avenue and GVR Boulevard due to the end of the managed lane direct connect from I-70. The end of the direct connect reduces the capacity on Peña Boulevard (from two GP lanes and one managed lane down to two GP lanes) and

results in slower speeds and a queue to form. This behavior is observed in both AM and mid-day/PM peak periods.

The second bottleneck forms at 56th Avenue. A spillback queue causes this slowdown at the 56th Ave off-ramp, which due to congestion at the ramp terminal, spills back onto the mainline freeway and blocks traffic on the freeway. This bottleneck only forms during the midday/PM peak period. An additional discussion about spillback queues at the 56th Avenue ramp terminals is in Section 5.5.4 of this report.

Figure 5-7 – 2050 No Action Speed Heat Map for Peña Boulevard Inbound (Toward DEN)

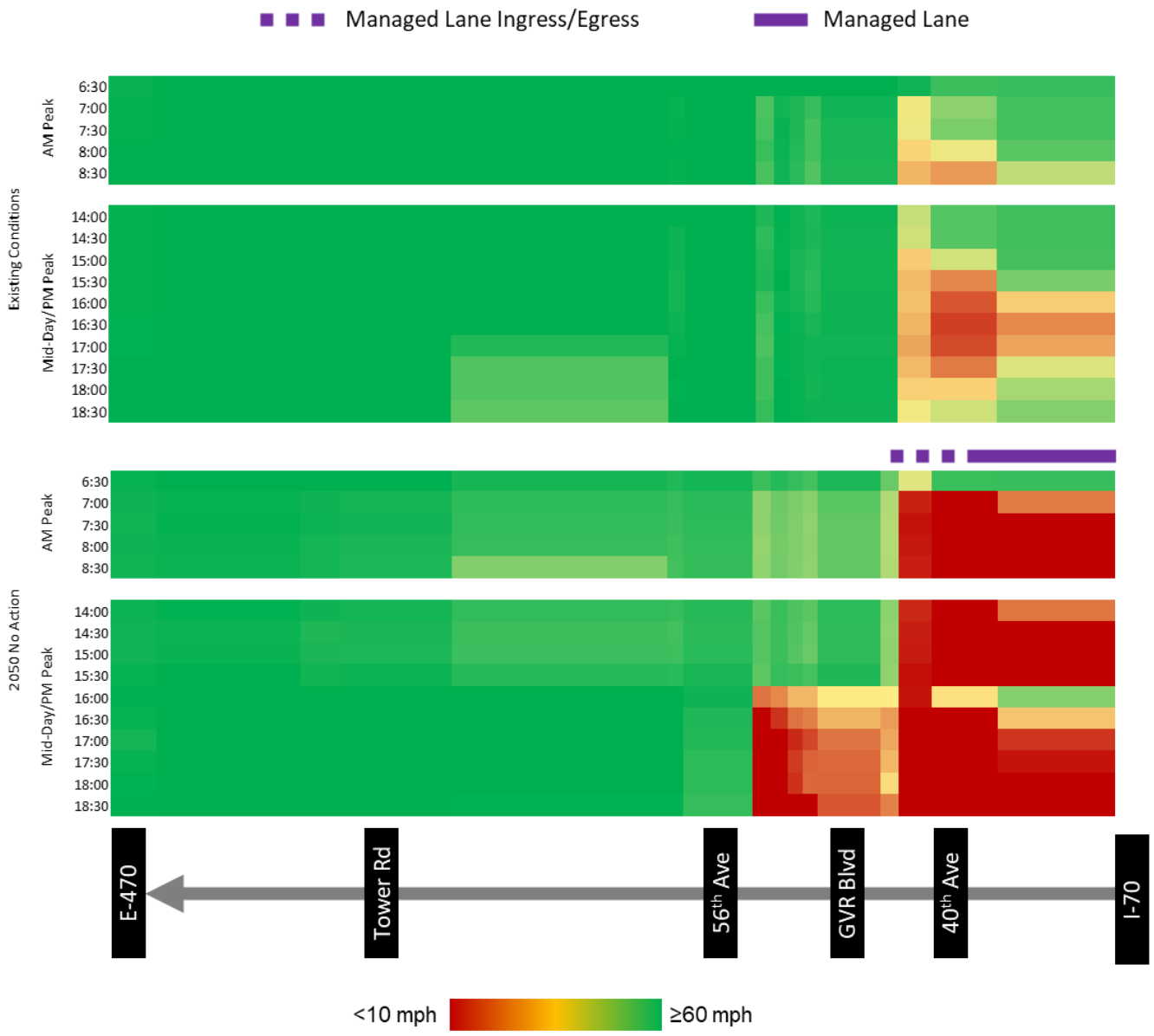
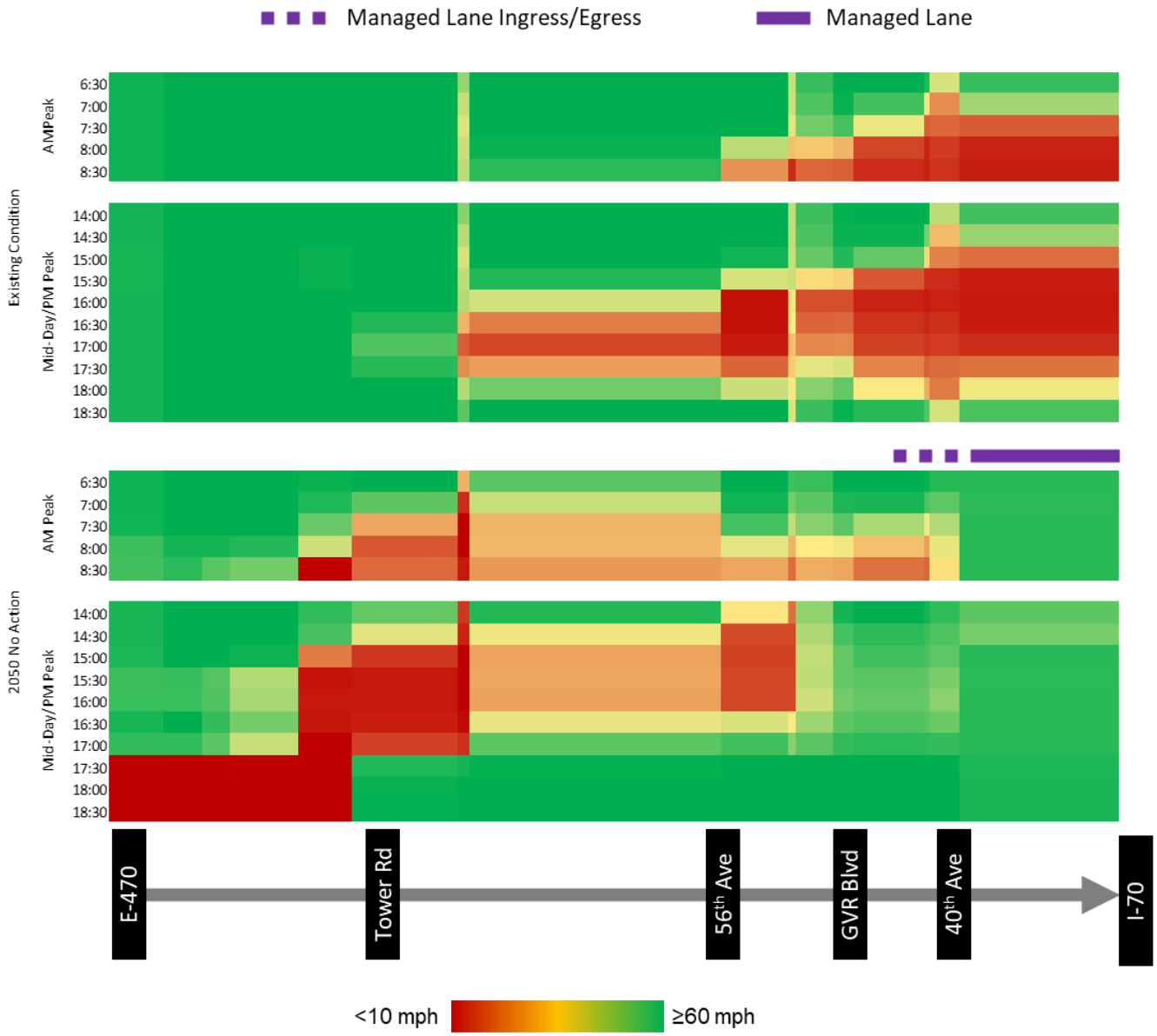


Figure 5-8 shows the speeds along Peña Boulevard in the outbound direction in 2050. Congestion along Peña Boulevard is expected to be most impacted by increasing ramp volumes and adding the managed lane direct connect from Peña Boulevard to westbound I-70. From a ramp volume perspective, increasing on-ramp volumes at Tower Road are expected to result in congestion at the interchange. This congestion will create a localized bottleneck at the Tower Road interchange and will result in higher volumes (and lower speeds) between Tower Road and approximately GVR Boulevard in both AM and, in particular, mid-day/PM peak periods.

South of GVR Boulevard, congestion in 2050 is expected to decrease as compared to the existing conditions because of the addition of the manage lane direct connect to I-70. The direct connect increases the Peña Boulevard capacity through the interchange and improves the increases in traffic speeds south of GVR Boulevard compared to existing conditions.

Note that, near the end of the mid-day/PM peak period, the queue at the Tower Road off-ramp is expected to spill back onto Peña Boulevard and block freeway traffic. This queue is a result of a series of local roadway queues and grid lock. An additional discussion about this queue is in Section 5.5.4 of this report.

Figure 5-8 – 2050 No Action Speed Heatmap for Peña Boulevard Outbound (Away from DEN)



5.5.3. Delay at Intersections

LOS for the 2050 No Action intersections are in Figure 5-9 through Figure 5-14 for different peak periods of the day. Due to increasing demand, intersection operations are expected to worsen in the No Action conditions as compared to the Existing Conditions. Note that operations and delays at many minor intersections are the result of spill back queues from adjacent major intersections. A discussion about these queues and their impacts is in Section 5.5.4 of this report.

Figure 5-9 – Microsimulation Analysis: Level of Service: 2050 No Action AM Peak (Intersections 1–35)

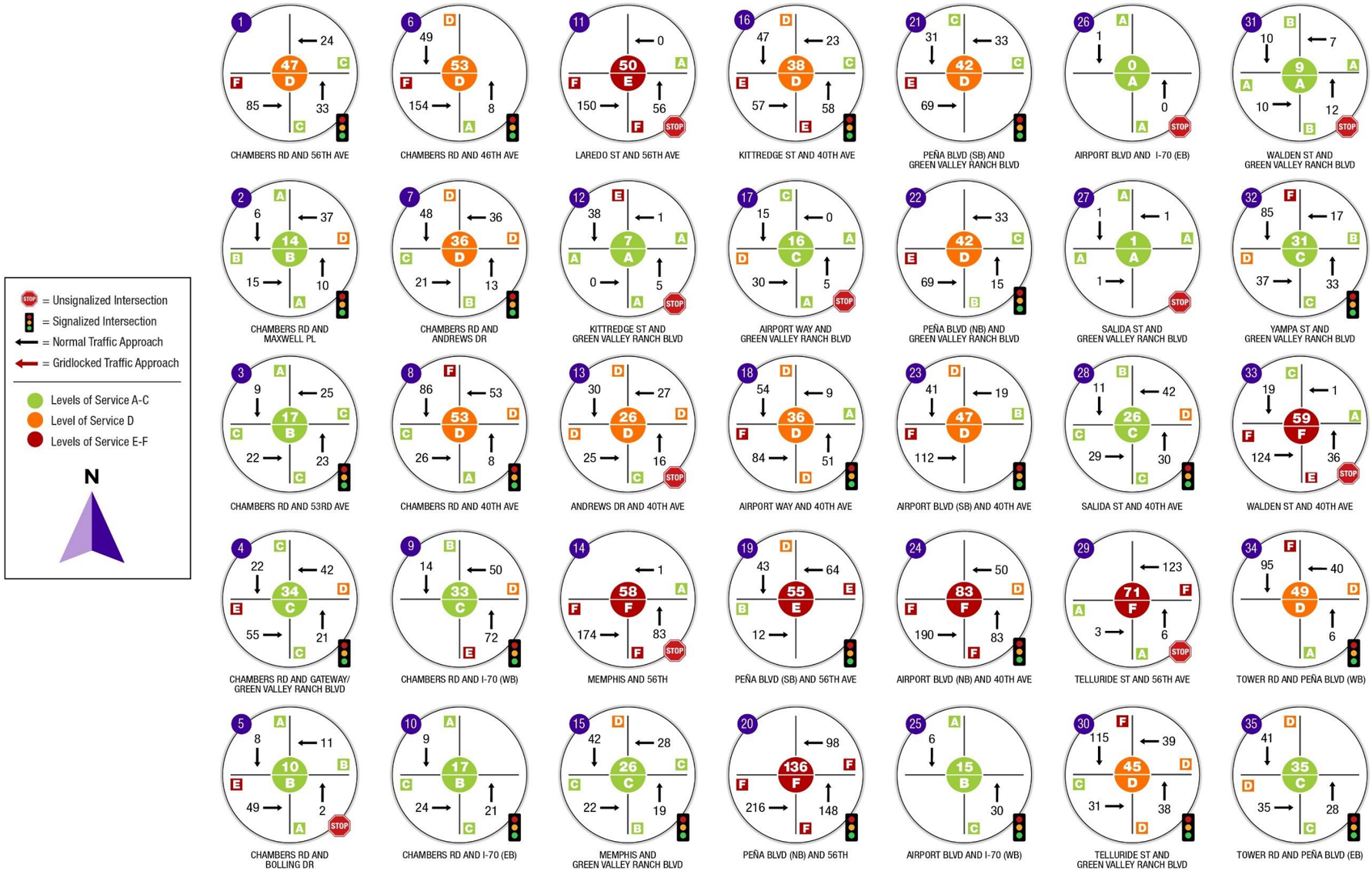


Figure 5-10 – Microsimulation Analysis: Level of Service: 2050 No Action AM Peak (Intersections 36–73)

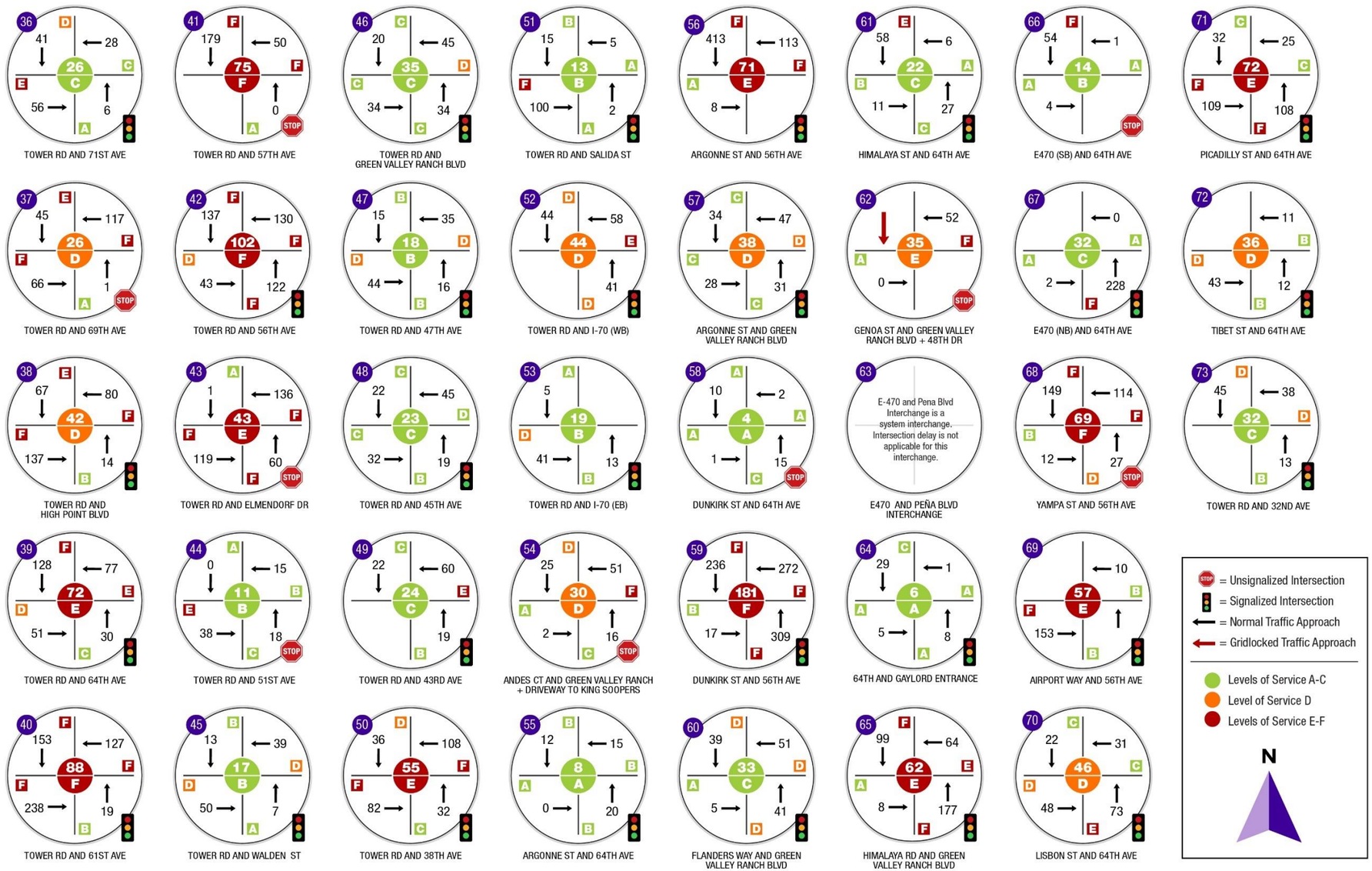


Figure 5-11 – Microsimulation Analysis: Level of Service: 2050 No Action Mid-day Peak (Intersections 1–35)

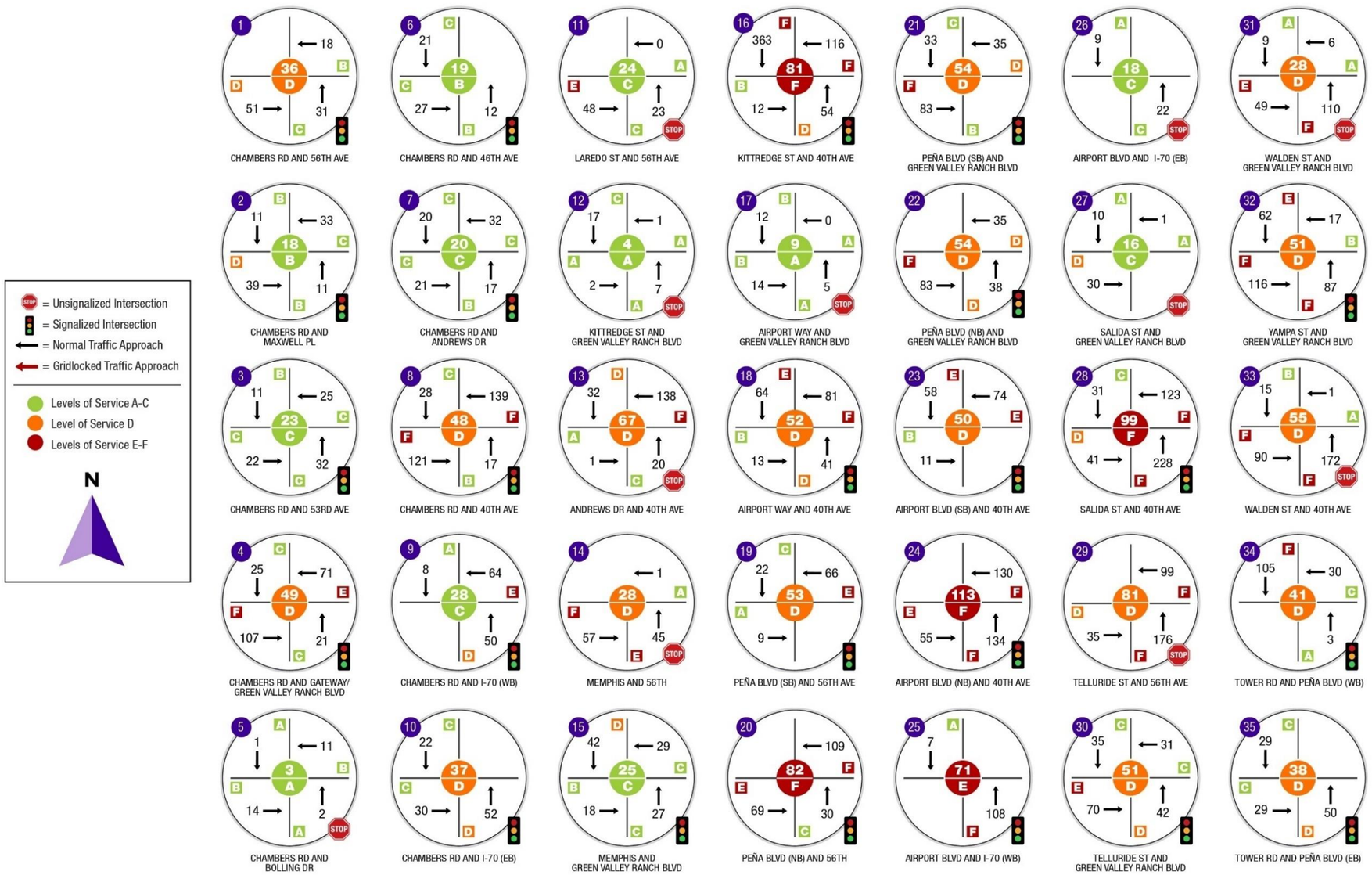


Figure 5-12 – Microsimulation Analysis: Level of Service: 2050 No Action Mid-day Peak (Intersections 36–73)

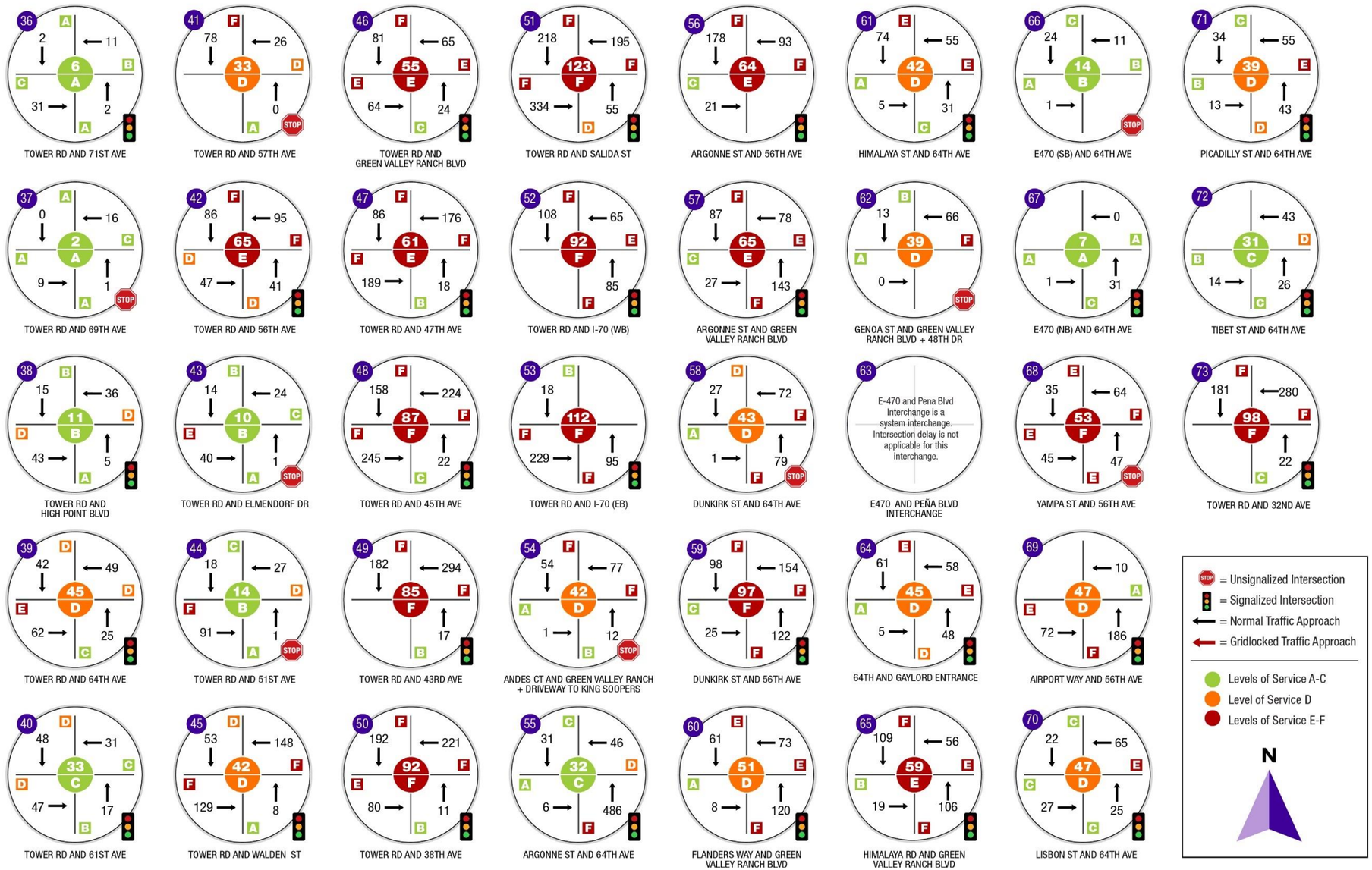


Figure 5-13 – Microsimulation Analysis: Level of Service: 2050 No Action PM Peak (Intersections 1–35)

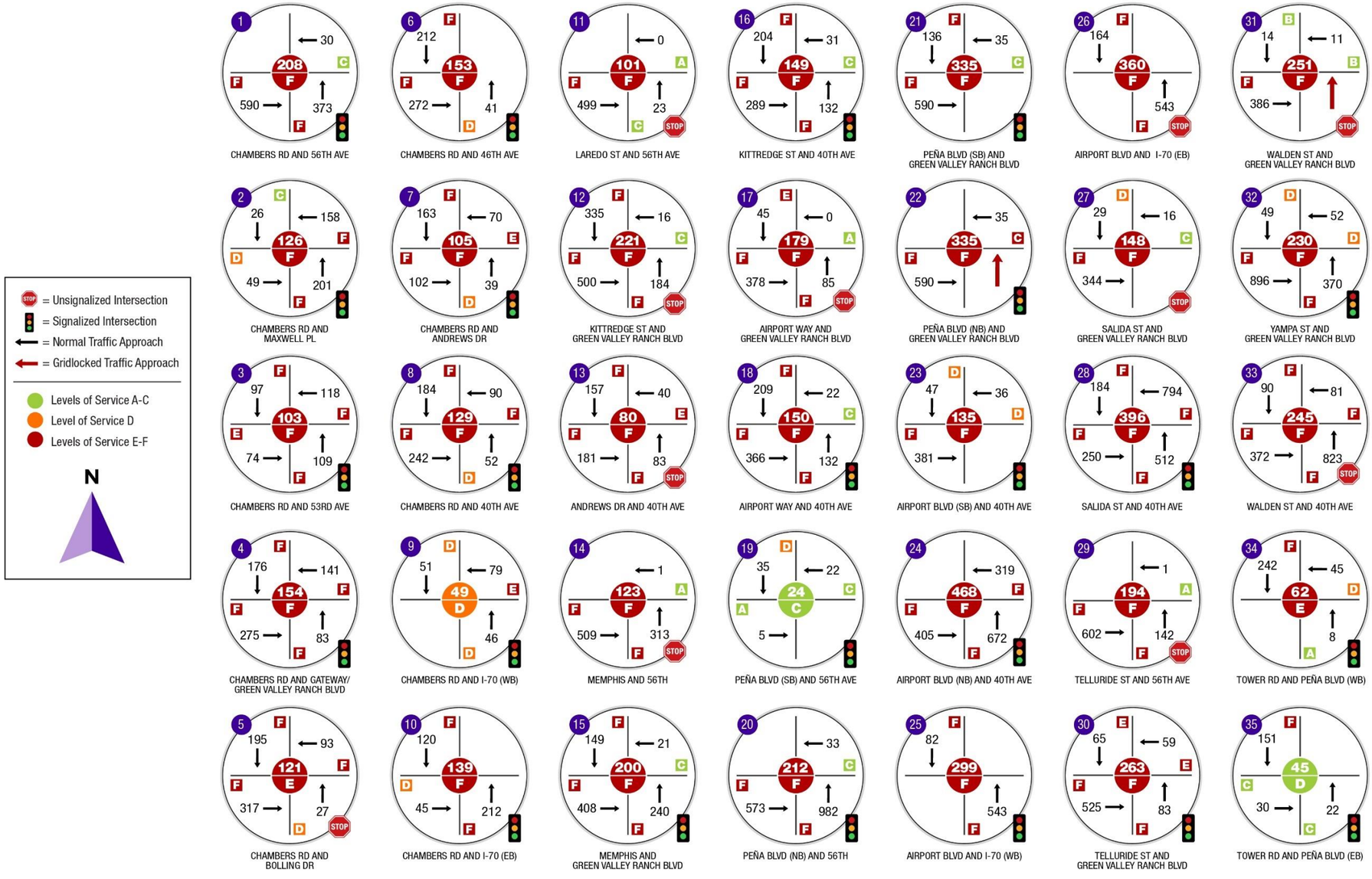
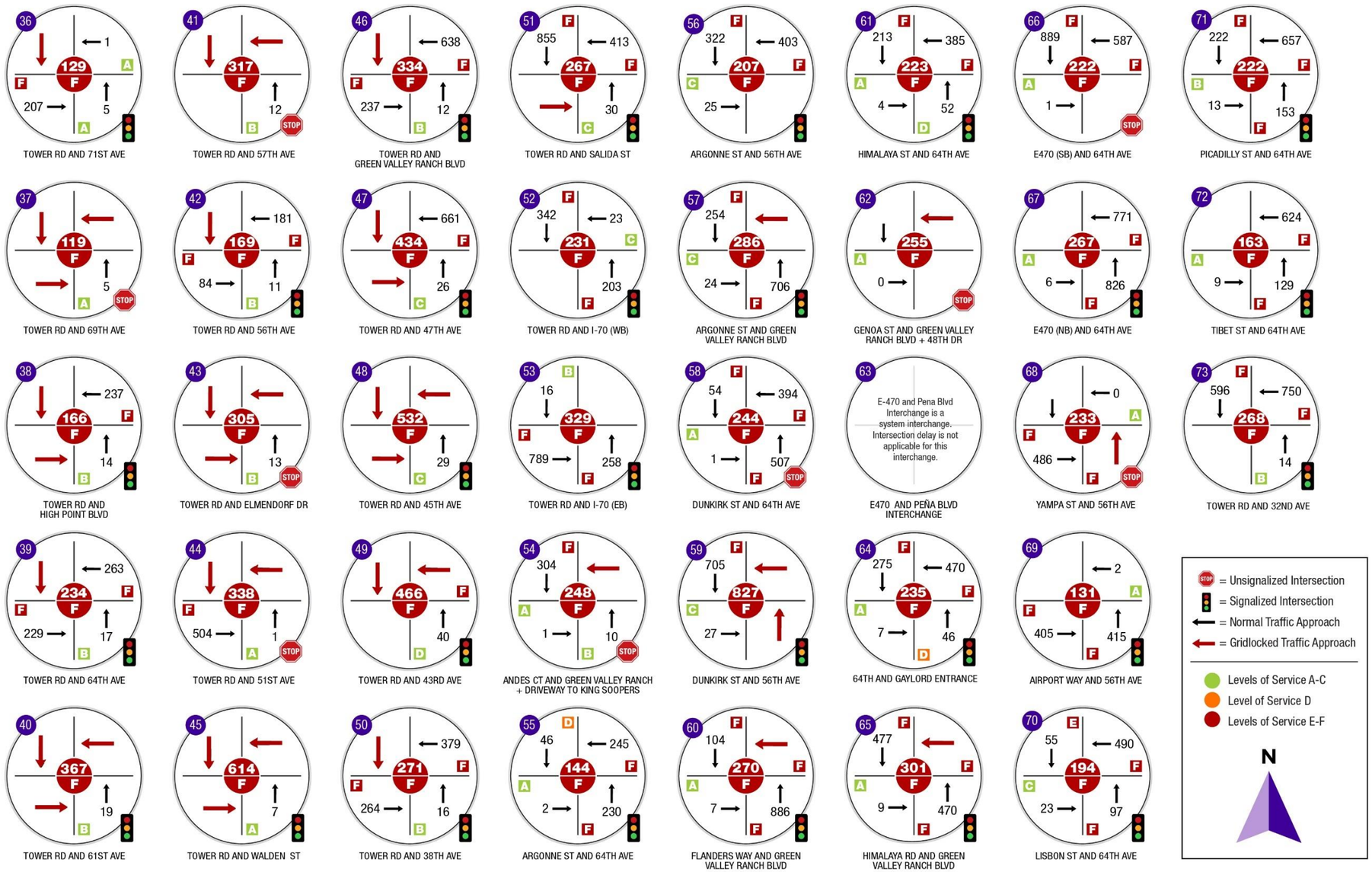


Figure 5-14 – Microsimulation Analysis: Level of Service: 2050 No Action PM Peak (Intersections 36–73)



5.5.4. Queues

Due to congestion throughout the roadway network in 2050 No Action, overall roadway operations at any location will be highly influenced by the upstream and downstream queues and bottlenecks. Based on the microsimulation modeling, several key bottlenecks have been identified, including:

56th Avenue and Peña Boulevard ramp terminals

Chambers Road between I-70 and 40th Avenue

Tower Road and westbound I-70 ramp terminal

These bottlenecks do not represent all locations of congestion in 2050 No Action; however, they have been identified as having the largest impact on overall operations of the traffic analysis area. Figure 5-15 and Figure 5-16 show the extents of maximum queues observed at key locations throughout the microsimulation model during both AM and mid-day/PM peak periods. A discussion about the cause and effect of each of the key queue locations is in the following sections.

Figure 5-15 – Queue Analysis: 2050 No Action: AM Peak Model

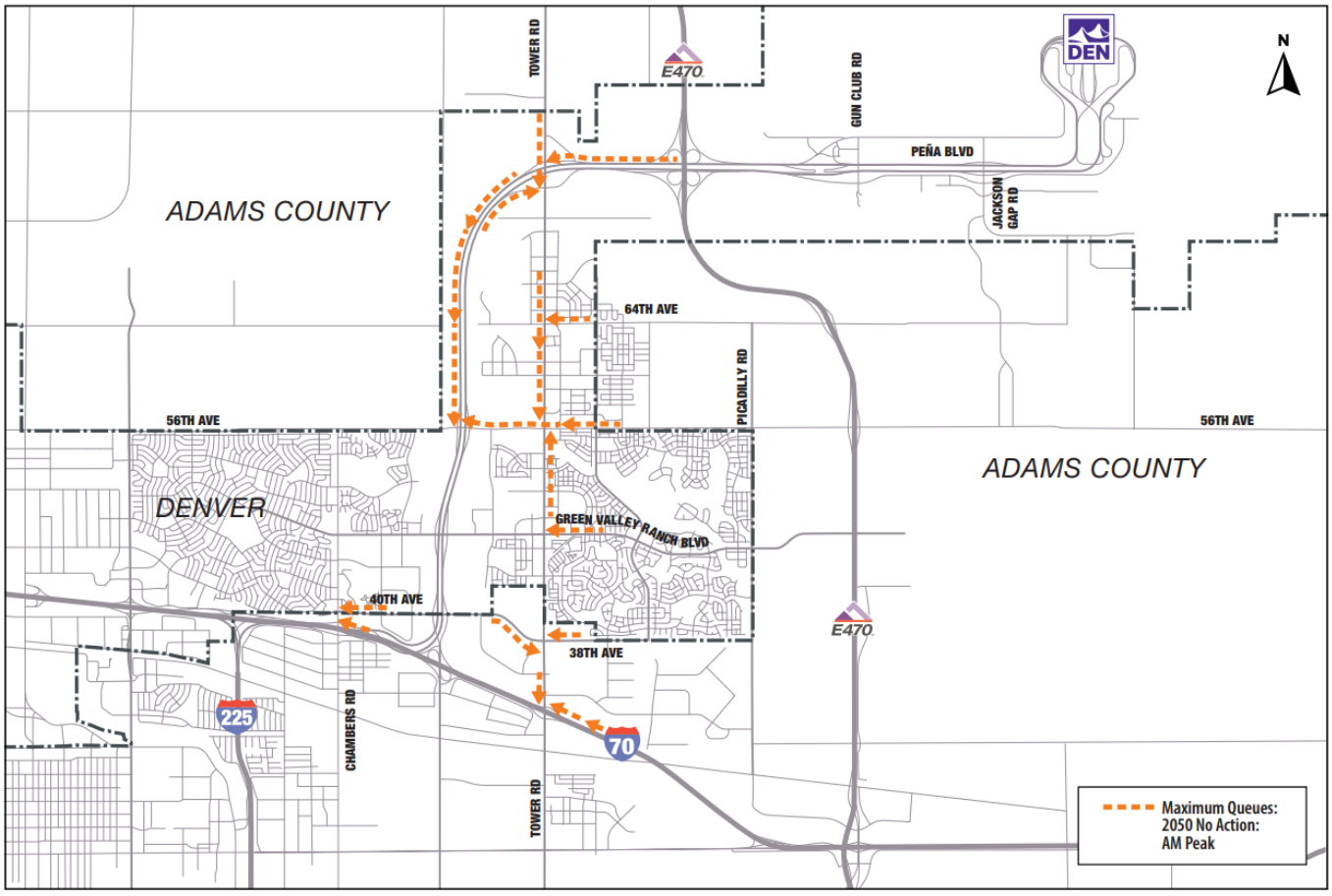
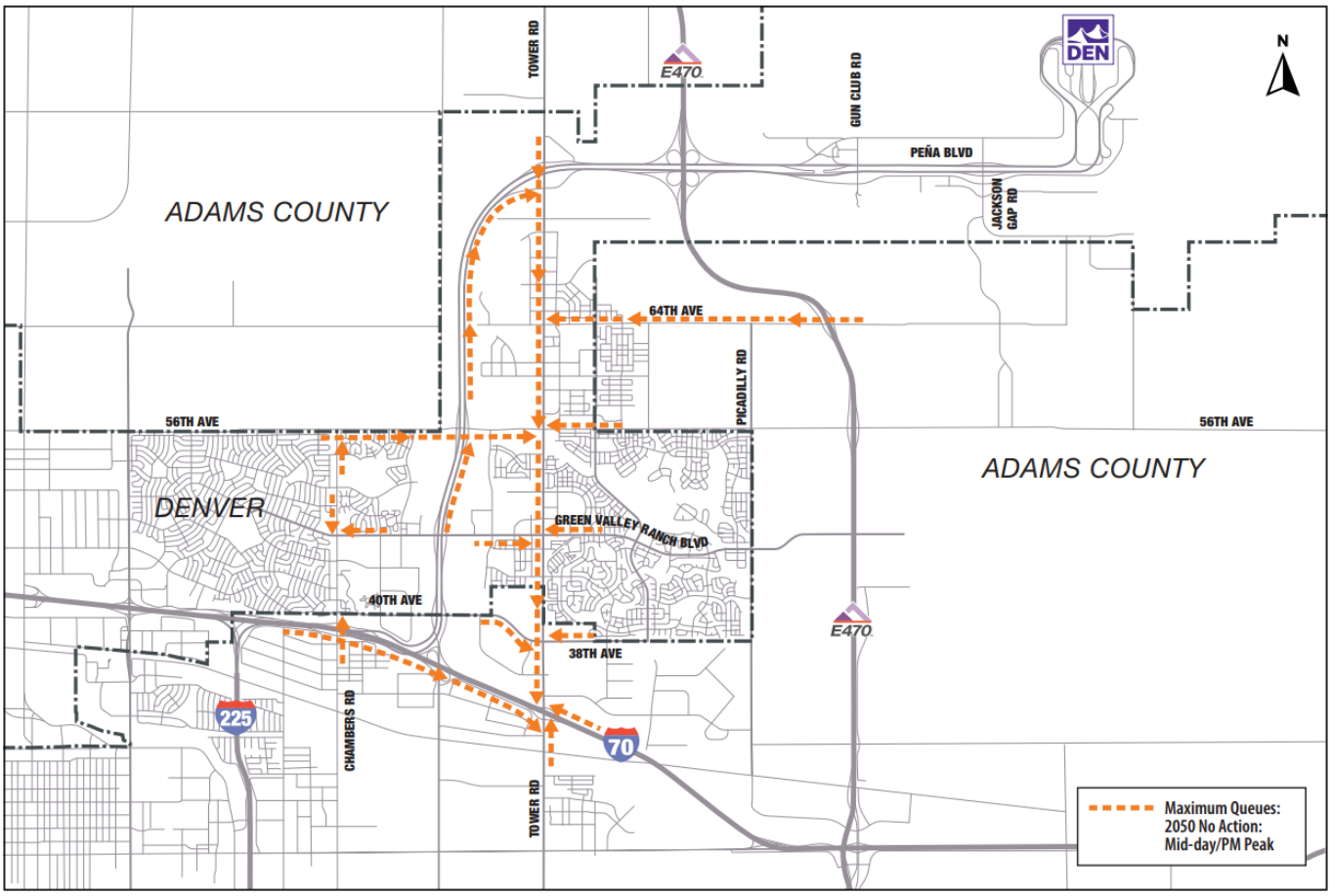


Figure 5-16 – Queue Analysis: 2050 No Action: Mid-day/PM Peak Model



5.5.4.1. Queues at the 56th Avenue and Peña Boulevard Ramp Terminals

Long queues at the 56th Avenue and Peña Boulevard ramp terminals, including both inbound and outbound Peña Boulevard ramp terminals, are observed in both AM and mid-day/PM peak periods in the 2050 No Action scenario. These queues are primarily caused by three turning movements, including the:

Westbound left-turn from 56th Avenue to the outbound Peña Boulevard on-ramp (during AM Peak)

Eastbound left-turn from 56th Avenue to the inbound Peña Boulevard on-ramp (during mid-day/PM Peak)

Southbound right-turn from the outbound Peña Boulevard off-ramp to westbound 56th Avenue (during AM Peak)

This queue starts with the westbound left-turn from 56th Avenue to the Peña Boulevard outbound on-ramp during AM Peak. This queue forms due to the high volume of left-turning traffic, which is unable to accommodate the existing single left-turn lane at the signal (the interchange was reconstructed in 2021 and plans for a dual left-

turn lane). This queue eventually blocks through traffic on 56th Avenue, resulting in a queue extending back past Tower Road to the edge of microsimulation model extents.

Along Tower Road, this queue prevents traffic on Tower Road from turning onto westbound 56th Avenue, causing the queue to extend to the north and south of the Tower Road and 56th Avenue intersection. In the northbound direction, lower traffic volumes on Tower Road minimize the impact of the 56th Avenue queue, resulting in mostly localized impacts to northbound Tower Road. However, higher southbound traffic volumes result in the southbound queue from at the 56th Avenue and Tower Road intersection extending back along Tower Road to the edge of microsimulation model extents, in both peak periods.

The spillback queues along Tower Road north of 56th Avenue block traffic at all side-streets along this segment of Tower Road. Within the microsimulation model, this included impacts to westbound 64th Avenue and the outbound Peña Boulevard off-ramp to Tower Road.

The second queue at the 56th Avenue and Peña Boulevard ramp terminals results from the eastbound 56th Avenue left-turn to the inbound Peña Boulevard on-ramp during the mid-day/PM peak. A combination of high traffic volumes with impacts of the westbound 56th Avenue queue causes the queue, which reduces overall operations at this intersection. During the AM peak period, this eastbound queue is generally localized and extends from the inbound Peña Boulevard ramp terminal to approximately Memphis Street. However, during the mid-day/PM peak period, this queue extends back past Chambers Road to the edge of microsimulation model extents. This queue impacts northbound operations along Chambers Road and causes a queue to form back along Chambers Road, eventually extending to I-70 and impacting freeway operations.

The third queue at the 56th Avenue and Peña Boulevard ramp terminals forms due to the southbound right-turn from outbound Peña Boulevard to westbound 56th Avenue during the AM peak. The high right-turning volumes not being accommodated in the single right-turn lane causes this queue. This queue extends back to the mainline of outbound Peña Boulevard and blocks through traffic. This impact results in a queue on Peña Boulevard extending back to E-470, in both peak periods.

5.5.4.2. Queues Along Chambers Road between I-70 and 40th Avenue

Due to high volumes of traffic—and in particular, left-turn movements—at the I-70 and Chambers Road interchange and at the Chambers Road and 40th Avenue intersection, spillback queues are expected to impact operations in the area. In the northbound direction, a queue starts at the Chambers Road and 40th Avenue intersection. This queue is a result of high northbound traffic volumes at this location and the limited green time available to service them due to the other high-volumes movements at the intersection, including westbound and southbound left-turns. This northbound queue extends back to eastbound I-70 ramp terminals and blocks traffic exiting eastbound I-70, causing the off-ramp queue to spill back onto the I-70 mainline.

In the southbound direction, a queue results from a combination of the southbound right-turn to enter westbound I-70 and high volumes of westbound left-turns at the Chambers Road and 40th Avenue intersection. Because a large volume of traffic from both southbound Chambers Road and westbound 40th Avenue wants to enter westbound I-70, the lane utilization on southbound Chambers Road between 40th Avenue and I-70 is

imbalanced, with most drivers wanting to use the outside lane to take the on-ramp to westbound I-70. Therefore, although southbound Chambers Road has three through lanes at the 40th Avenue intersection, these lanes are not being fully utilized. Furthermore, high left-turning volumes from westbound 40th Avenue to southbound Chambers Road exceed the capacity of two left-turn lanes.

5.5.4.3. Queues at the Tower Road and I-70 Ramp Terminals

Due to increasing traffic volumes, extensive queues are expected at both eastbound and westbound I-70 off-ramps to Tower Road in the 2050 No Action scenario. Along westbound I-70, the off-ramp queue spills back onto mainline I-70 and effectively meters traffic along I-70 entering the microsimulation modeling area. Along eastbound I-70, the off-ramp queue spills back onto mainline I-70 and eventually extends throughout the modeling area.

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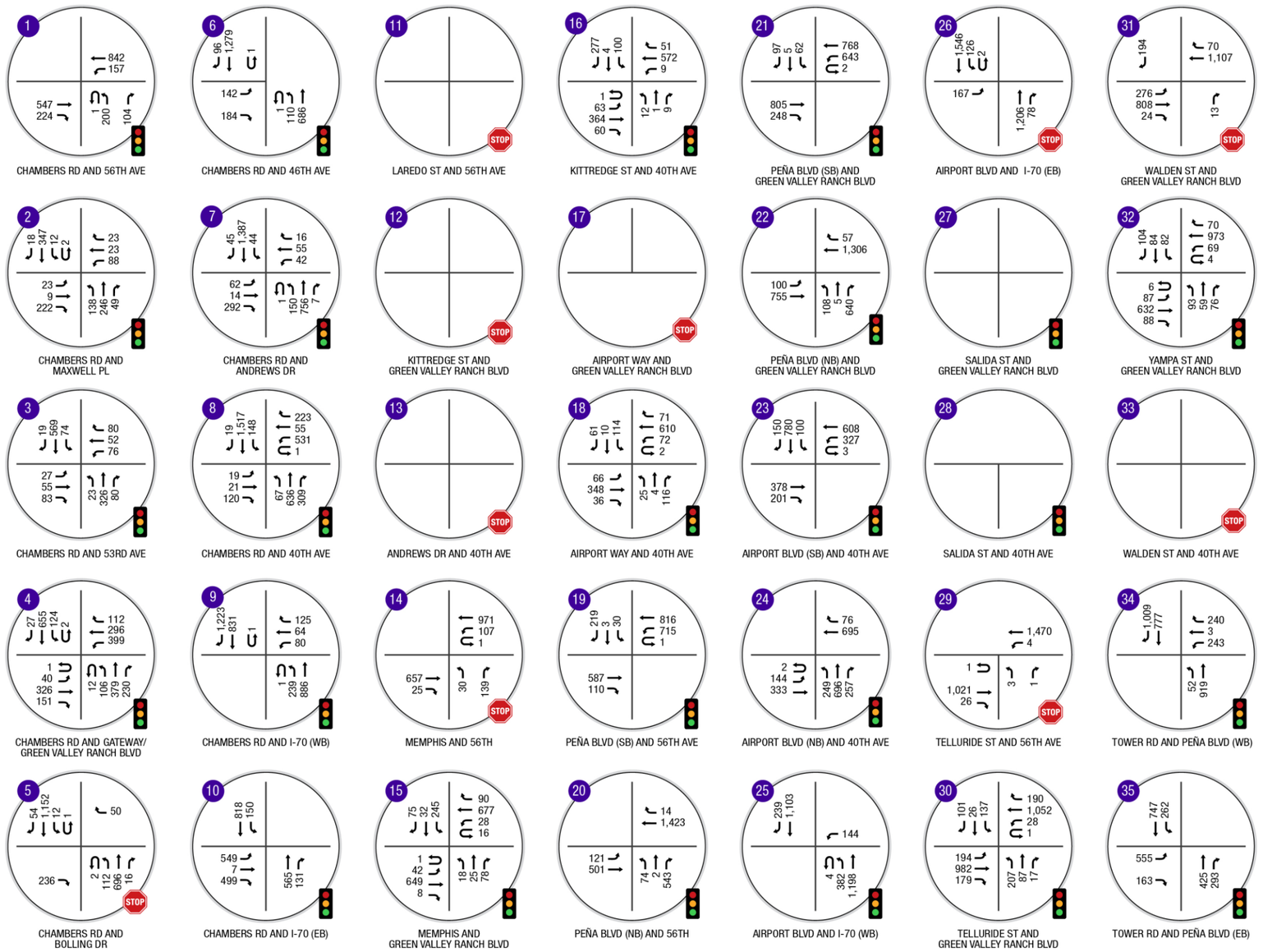
Appendices

Appendix A. Unbalanced Existing Conditions Turning Movement Counts (TMCs)

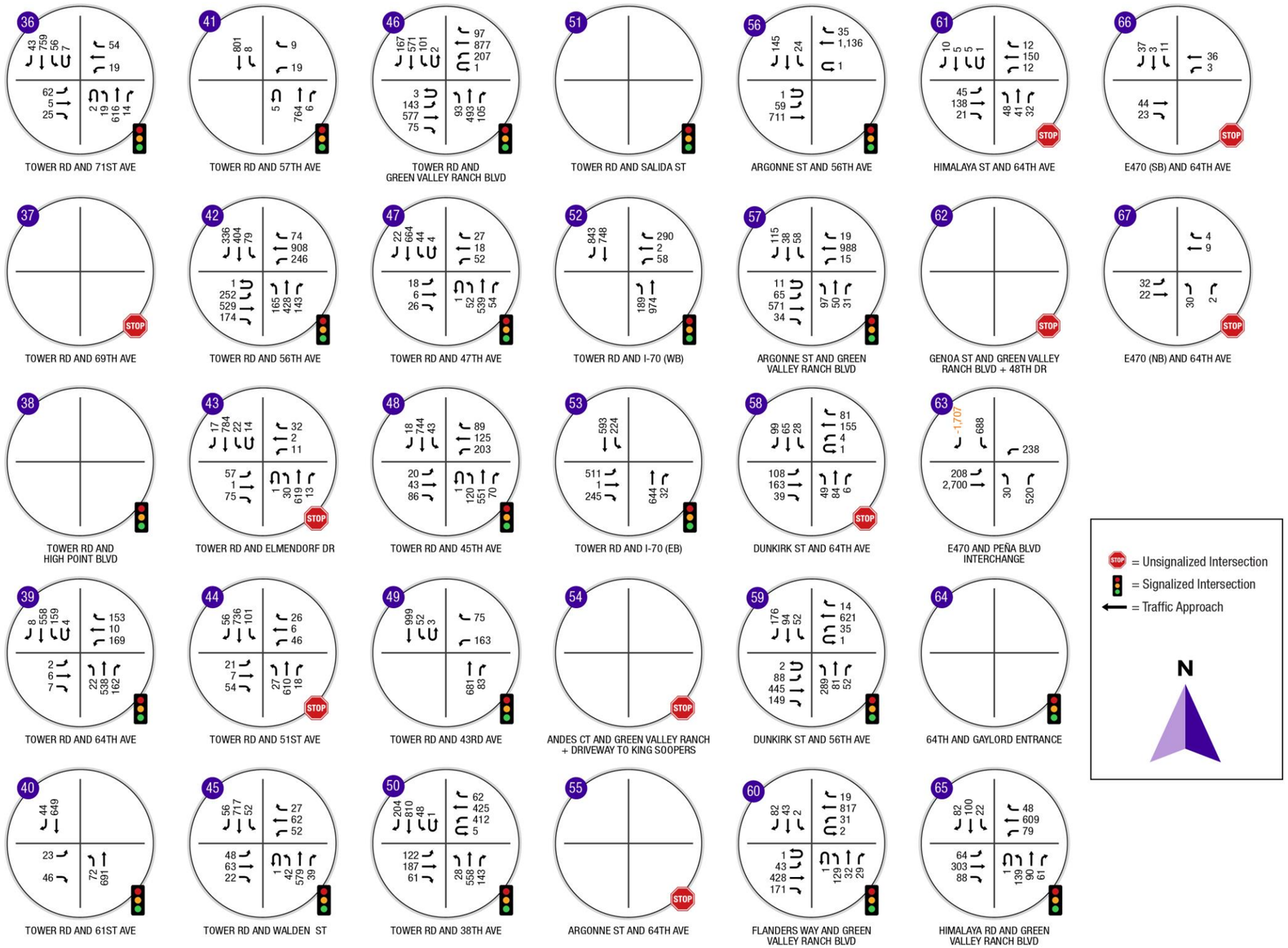
Unbalanced Volume TMCs: AM Peak Period (Intersections 1–35)

= Unsignalized Intersection
= Signalized Intersection
= Traffic Approach

N



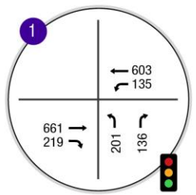
Unbalanced Volume TMCs: AM Peak Period (Intersections 36–67)



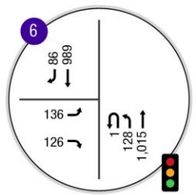
Unbalanced Volume TMCs: Mid-day Peak Period (Intersections 1–35)

= Unsignalized Intersection
= Signalized Intersection
= Traffic Approach

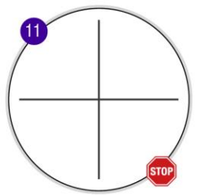
N



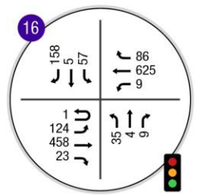
CHAMBERS RD AND 56TH AVE



CHAMBERS RD AND 46TH AVE

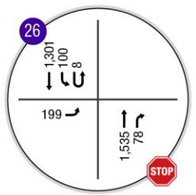


LAREDO ST AND 56TH AVE

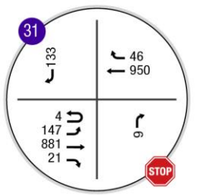


KITTREDGE ST AND 40TH AVE

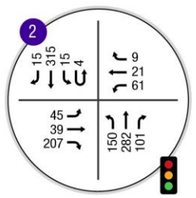
PEÑA BLVD (SB) AND
GREEN VALLEY RANCH BLVD



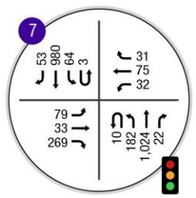
AIRPORT BLVD AND I-70 (EB)



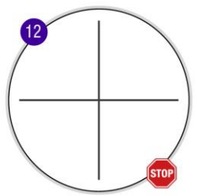
WALDEN ST AND
GREEN VALLEY RANCH BLVD



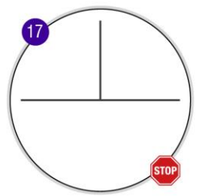
CHAMBERS RD AND
MAXWELL PL



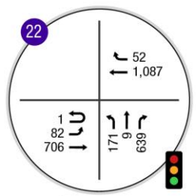
CHAMBERS RD AND
ANDREWS DR



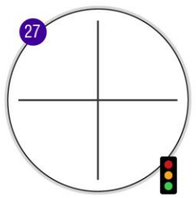
KITTREDGE ST AND
GREEN VALLEY RANCH BLVD



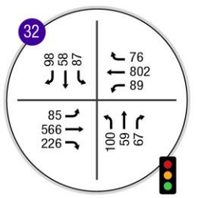
AIRPORT WAY AND
GREEN VALLEY RANCH BLVD



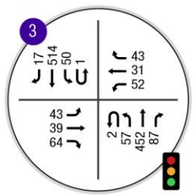
PEÑA BLVD (NB) AND
GREEN VALLEY RANCH BLVD



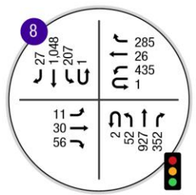
SALIDA ST AND
GREEN VALLEY RANCH BLVD



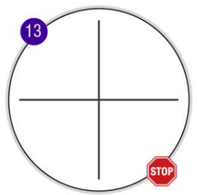
YAMPA ST AND
GREEN VALLEY RANCH BLVD



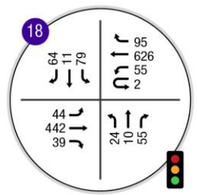
CHAMBERS RD AND 53RD AVE



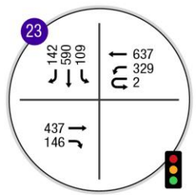
CHAMBERS RD AND 40TH AVE



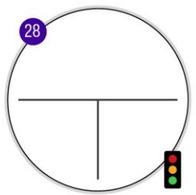
ANDREWS DR AND 40TH AVE



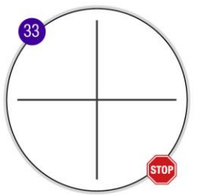
AIRPORT WAY AND 40TH AVE



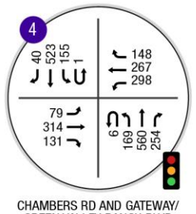
AIRPORT BLVD (SB) AND 40TH AVE



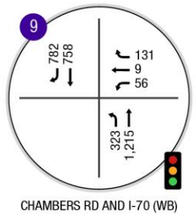
SALIDA ST AND 40TH AVE



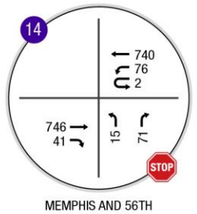
WALDEN ST AND 40TH AVE



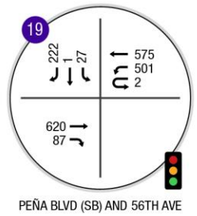
CHAMBERS RD AND GATEWAY/
GREEN VALLEY RANCH BLVD



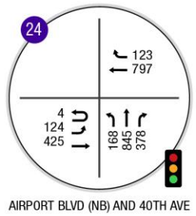
CHAMBERS RD AND I-70 (WB)



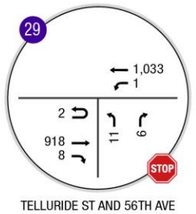
MEMPHIS AND 56TH



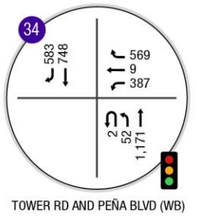
PEÑA BLVD (SB) AND 56TH AVE



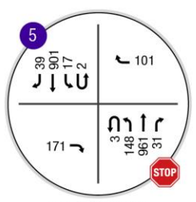
AIRPORT BLVD (NB) AND 40TH AVE



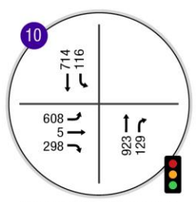
TELLURIDE ST AND 56TH AVE



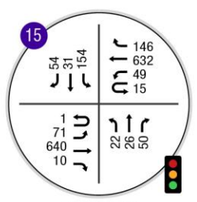
TOWER RD AND PEÑA BLVD (WB)



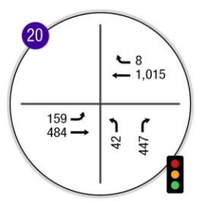
CHAMBERS RD AND
BOLLING DR



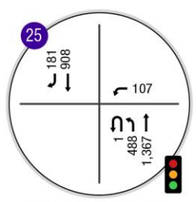
CHAMBERS RD AND I-70 (EB)



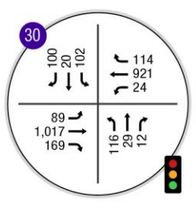
MEMPHIS AND
GREEN VALLEY RANCH BLVD



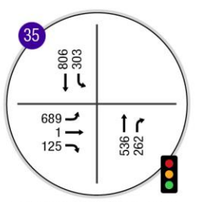
PEÑA BLVD (NB) AND 56TH



AIRPORT BLVD AND I-70 (WB)

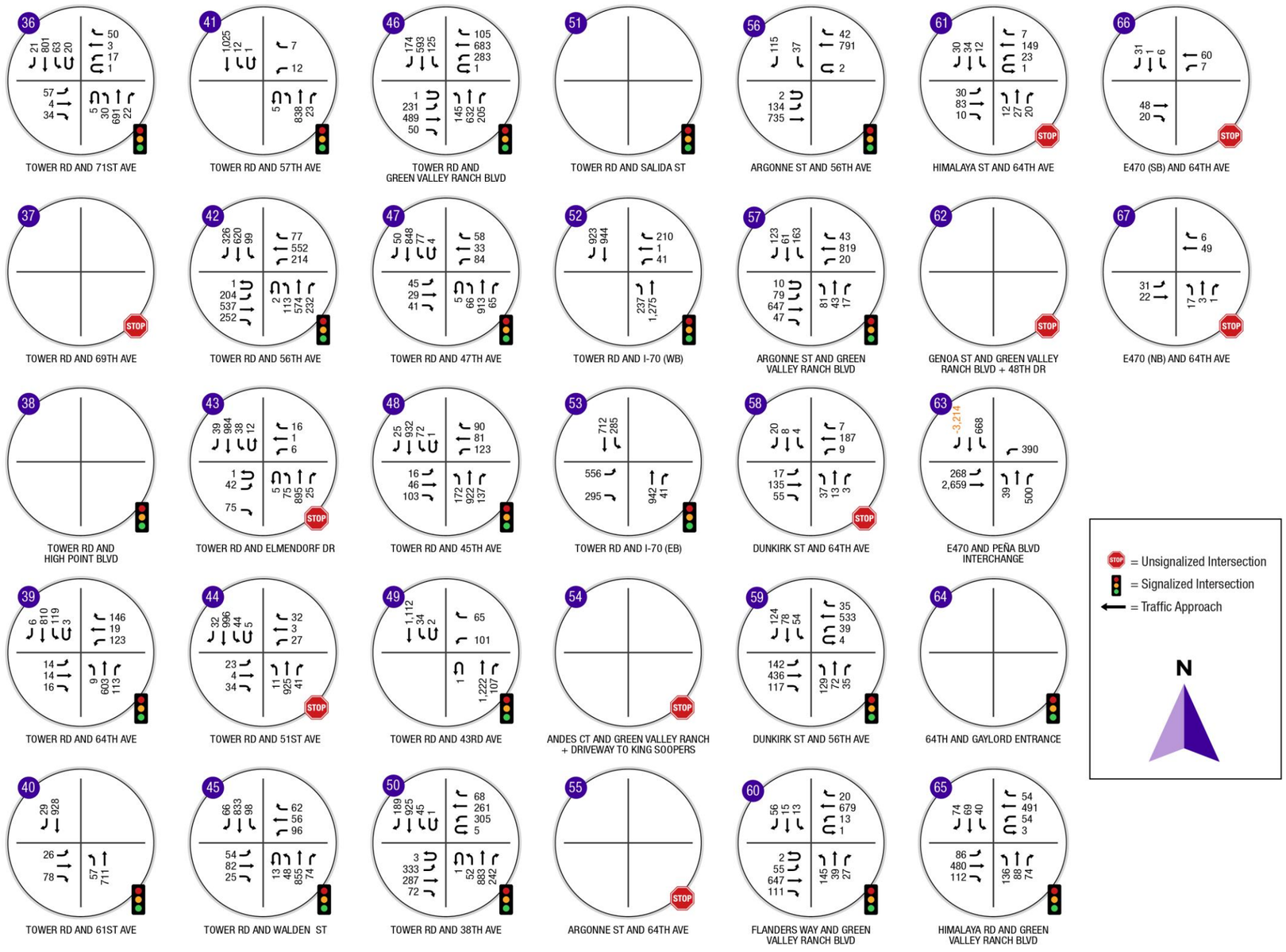


TELLURIDE ST AND
GREEN VALLEY RANCH BLVD



TOWER RD AND PEÑA BLVD (EB)

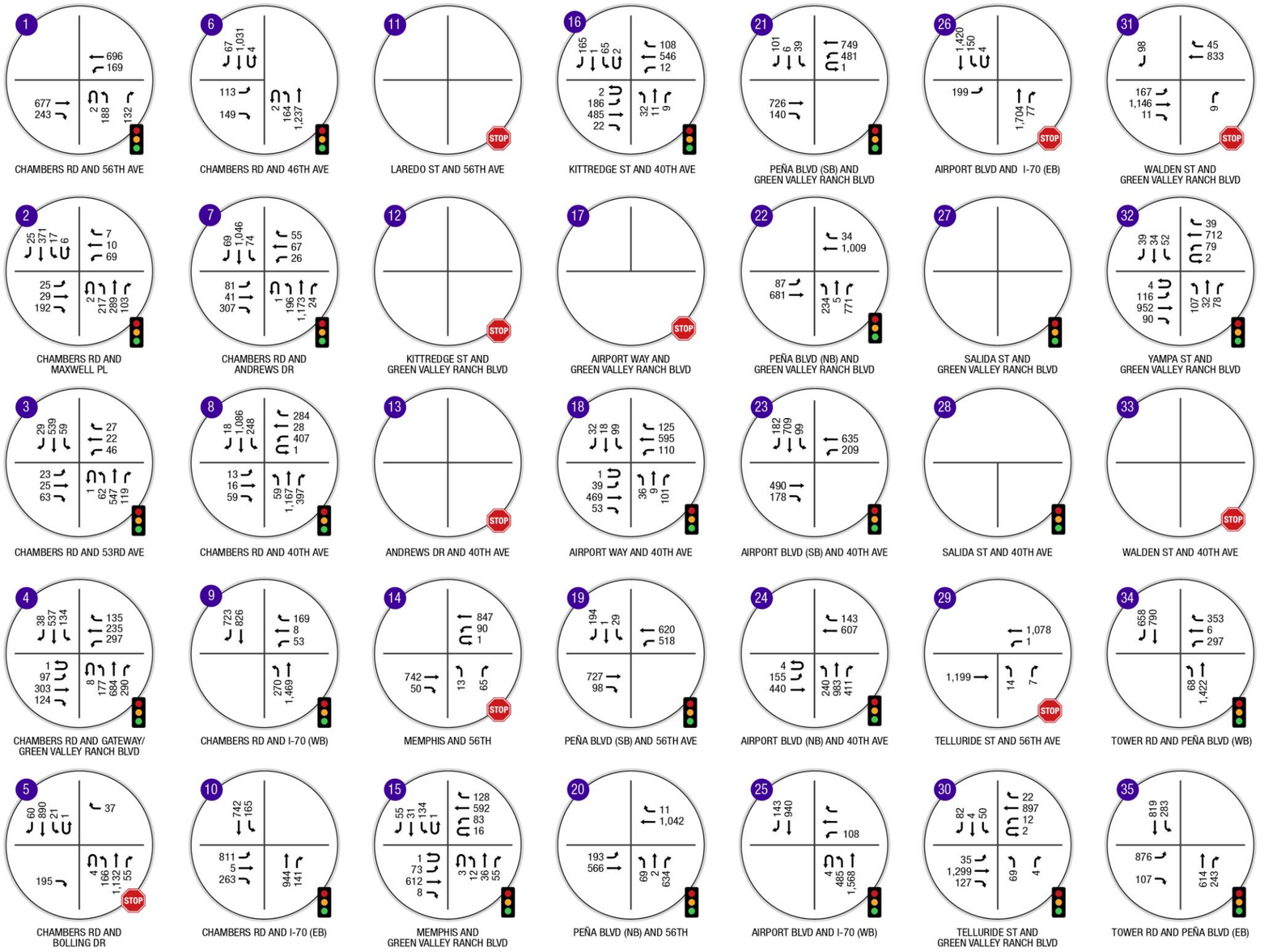
Unbalanced Volume TMCs: Mid-day Peak Period (Intersections 36–67)



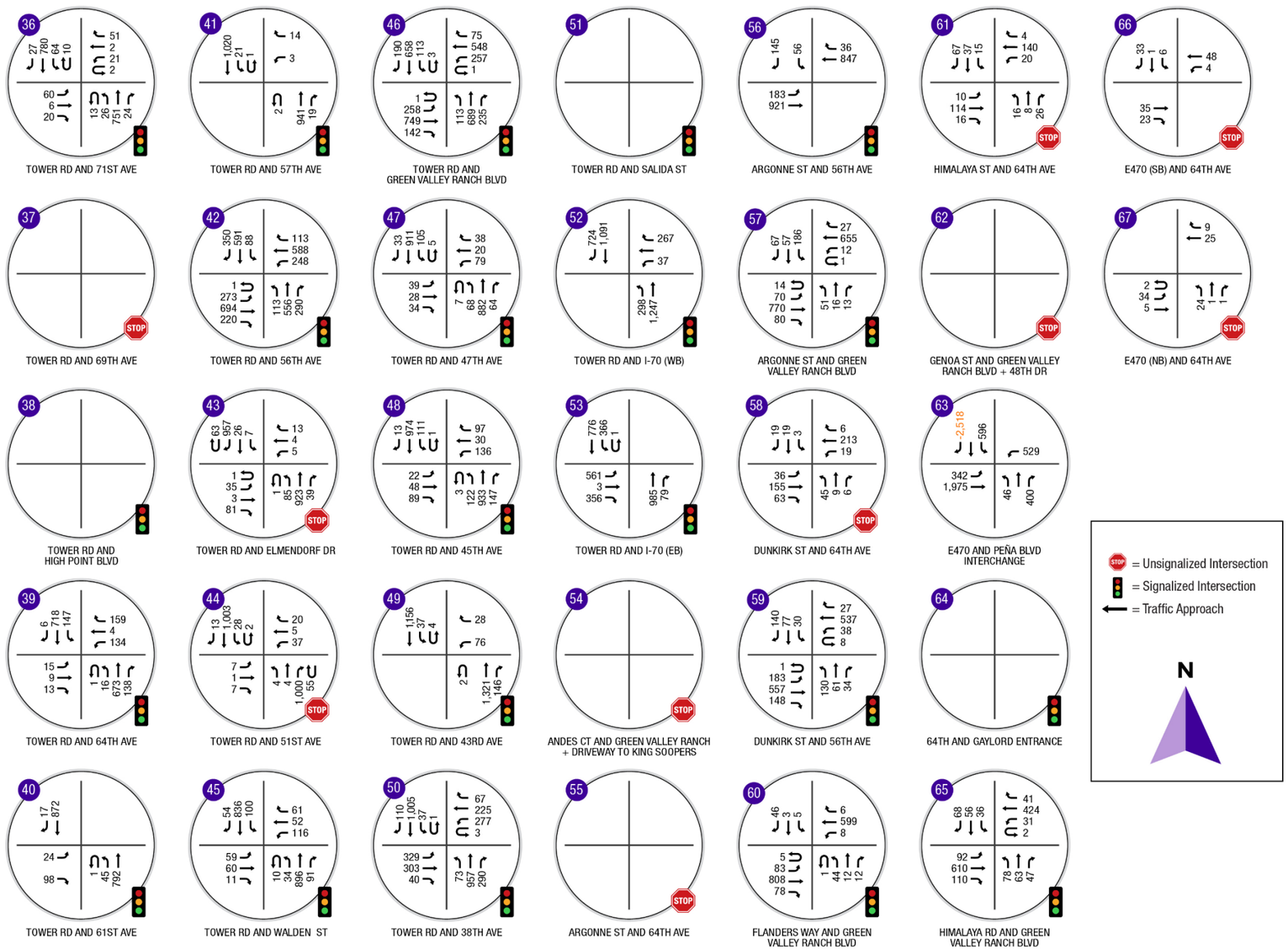
Unbalanced Volume TMCs: PM Peak Period (Intersections 1–35)

= Unsignalized Intersection
= Signalized Intersection
= Traffic Approach

N



Unbalanced Volume TMCs: PM Peak Period (Intersections 36–67)

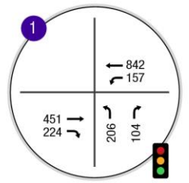


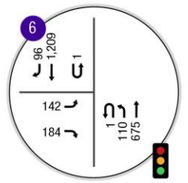
Appendix B. Balanced Existing Conditions TMCs

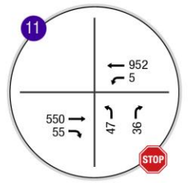
Balanced Volume TMCs: AM Peak Period (Intersections 1–35)

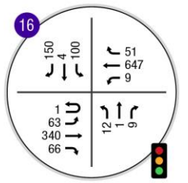
= Unsignalized Intersection
= Signalized Intersection
= Traffic Approach

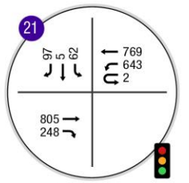
N

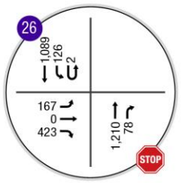

1
842
157
451
224
206
104
CHAMBERS RD AND 56TH AVE

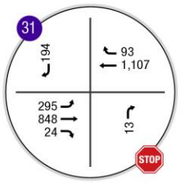

6
96
1,209
1
142
184
1
110
675
CHAMBERS RD AND 46TH AVE

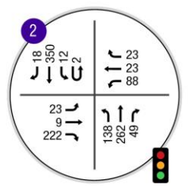

11
952
5
550
55
47
36
STOP
LAREDO ST AND 56TH AVE

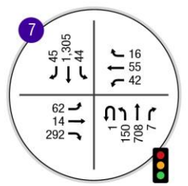

16
150
4
100
51
647
9
1
63
340
66
12
1
9
KITTREDGE ST AND 40TH AVE

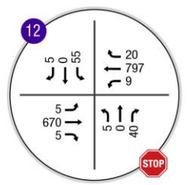

21
97
5
62
769
643
2
805
248
PEÑA BLVD (SB) AND
GREEN VALLEY RANCH BLVD

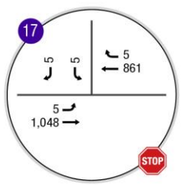

26
1,089
126
2
167
0
423
1,210
78
STOP
AIRPORT BLVD AND I-70 (EB)

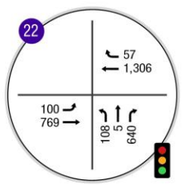

31
194
93
1,107
295
848
24
13
STOP
WALDEN ST AND
GREEN VALLEY RANCH BLVD

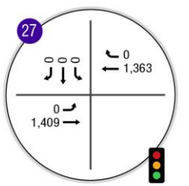

2
18
350
12
2
23
23
88
23
9
222
138
262
49
CHAMBERS RD AND
MAXWELL PL

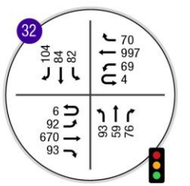

7
45
1,305
44
16
55
42
62
14
292
1
150
708
7
CHAMBERS RD AND
ANDREWS DR

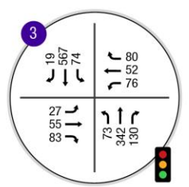

12
5
0
55
20
797
9
5
670
5
5
0
40
STOP
KITTREDGE ST AND
GREEN VALLEY RANCH BLVD

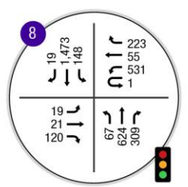

17
5
5
5
861
5
1,048
STOP
AIRPORT WAY AND
GREEN VALLEY RANCH BLVD

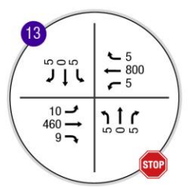

22
57
1,306
100
769
108
5
640
PEÑA BLVD (NB) AND
GREEN VALLEY RANCH BLVD

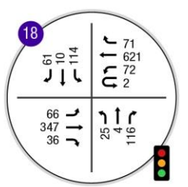

27
0
0
0
0
1,363
0
1,409
SALIDA ST AND
GREEN VALLEY RANCH BLVD

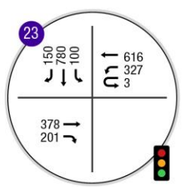

32
104
84
82
70
997
69
4
6
92
670
93
93
58
76
YAMPA ST AND
GREEN VALLEY RANCH BLVD

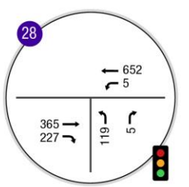

3
19
567
74
80
52
76
27
55
83
73
342
130
CHAMBERS RD AND 53RD AVE

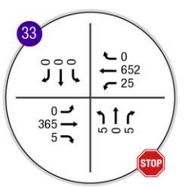

8
19
1,473
148
223
55
531
1
19
21
120
67
624
309
CHAMBERS RD AND 40TH AVE

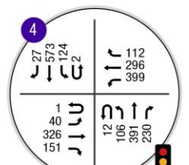

13
5
0
5
5
800
5
10
460
9
5
0
5
STOP
ANDREWS DR AND 40TH AVE

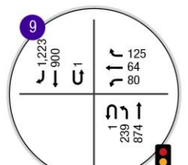

18
61
10
114
71
621
72
2
66
347
36
25
4
116
AIRPORT WAY AND 40TH AVE

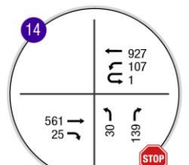

23
150
780
100
616
327
3
378
201
AIRPORT BLVD (SB) AND 40TH AVE

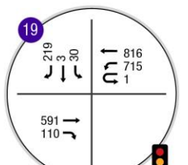

28
652
5
365
227
119
5
SALIDA ST AND 40TH AVE

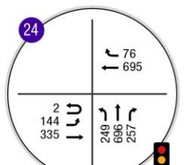

33
0
0
0
0
652
25
0
365
5
5
0
5
STOP
WALDEN ST AND 40TH AVE

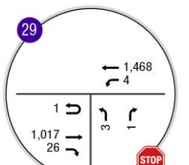

4
27
573
124
2
112
296
399
1
40
326
151
12
106
391
230
CHAMBERS RD AND GATEWAY/
GREEN VALLEY RANCH BLVD

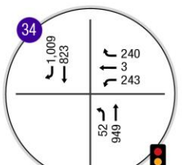

9
1,223
900
1
125
64
80
1
239
874
CHAMBERS RD AND I-70 (WB)

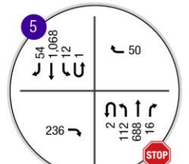

14
927
107
1
561
25
30
139
STOP
MEMPHIS AND 56TH

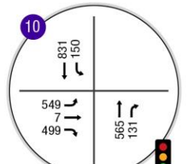

19
219
3
30
816
715
1
591
110
PEÑA BLVD (SB) AND 56TH AVE

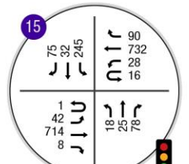

24
76
695
2
144
335
249
696
257
AIRPORT BLVD (NB) AND 40TH AVE

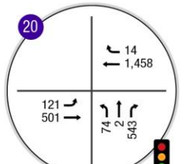

29
1,468
4
1
1,017
26
3
1
STOP
TELLURIDE ST AND 56TH AVE

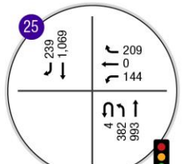

34
1,009
823
240
3
243
52
949
TOWER RD AND PEÑA BLVD (WB)

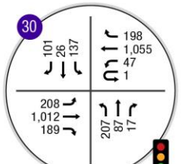

5
54
1,068
12
1
50
236
2
112
688
16
STOP
CHAMBERS RD AND
BOLLING DR

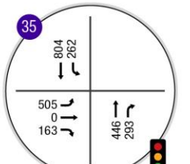

10
831
150
549
7
499
565
131
CHAMBERS RD AND I-70 (EB)


15
75
32
245
90
732
28
16
1
42
714
8
18
25
78
MEMPHIS AND
GREEN VALLEY RANCH BLVD

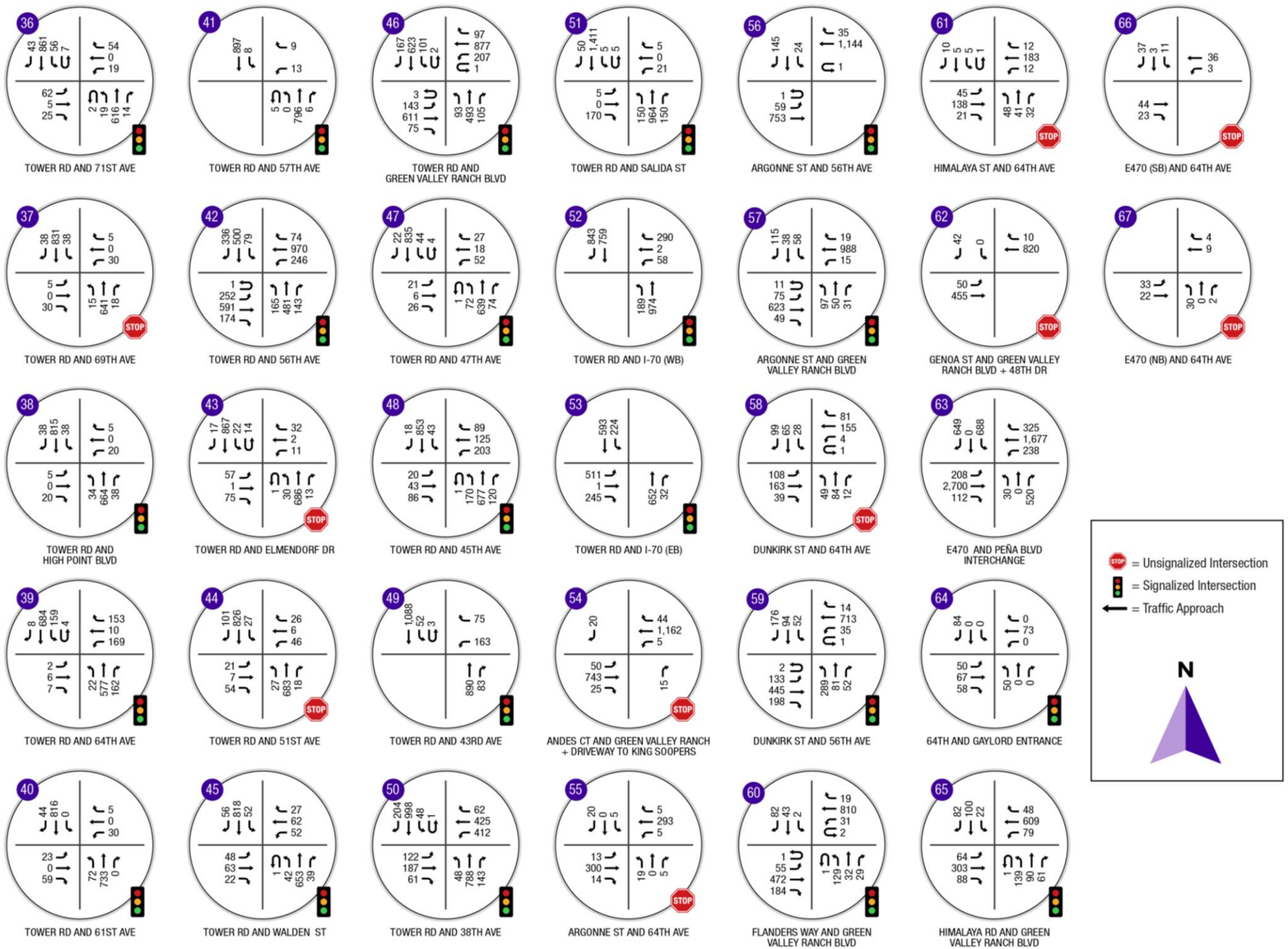

20
14
1,458
121
501
74
2
543
PEÑA BLVD (NB) AND 56TH


25
239
1,069
209
0
144
4
382
993
AIRPORT BLVD AND I-70 (WB)


30
101
26
137
198
1,055
47
1
208
1,012
189
207
87
17
TELLURIDE ST AND
GREEN VALLEY RANCH BLVD


35
804
262
505
0
163
446
293
TOWER RD AND PEÑA BLVD (EB)

Balanced Volume TMCs: AM Peak Period (Intersections 36–67)

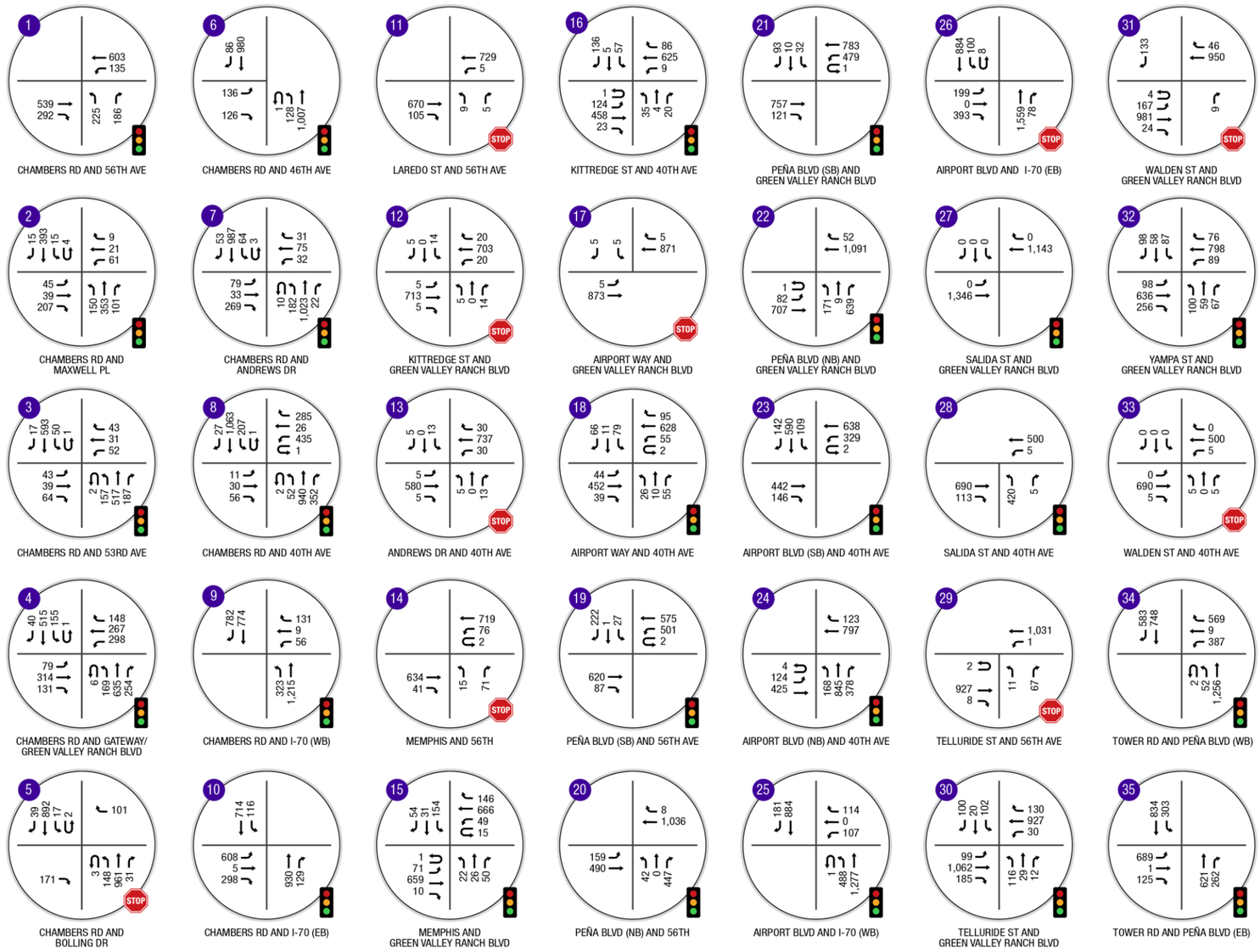


DEN

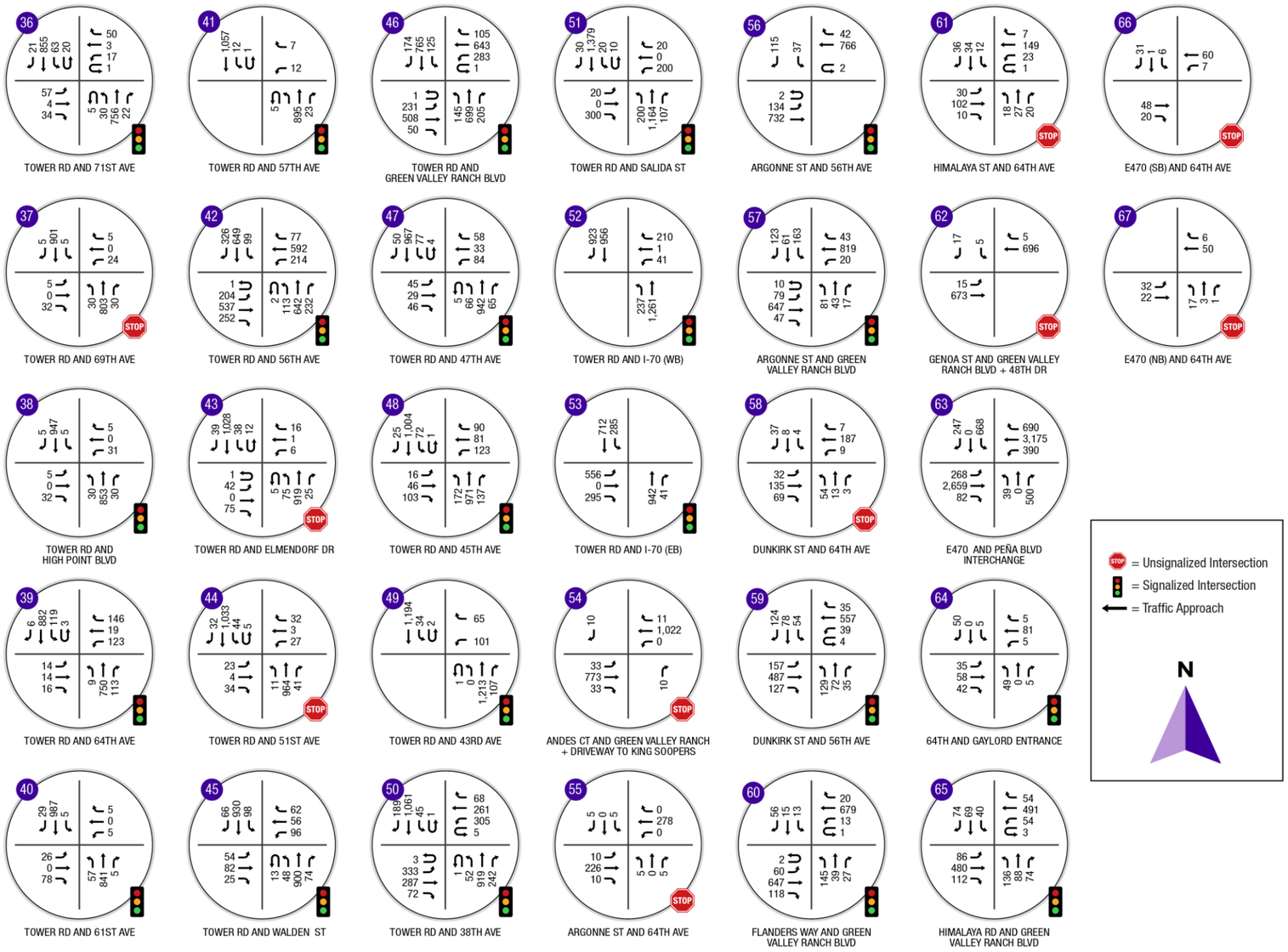
Balanced Volume TMCs: Mid-day Peak Period (Intersections 1–35)

= Unsignalized Intersection
= Signalized Intersection
= Traffic Approach

N



Balanced Volume TMCs: Mid-day Peak Period (Intersections 36–67)

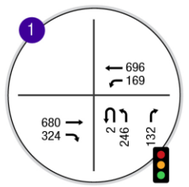


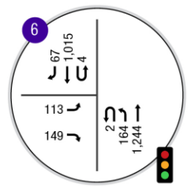
DEN

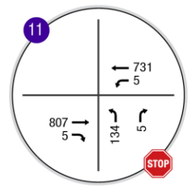
Balanced Volume TMCs: PM Peak Period (Intersections 1–35)

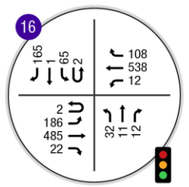
= Unsignalized Intersection
= Signalized Intersection
= Traffic Approach

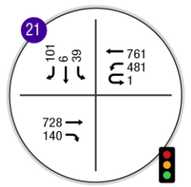
N

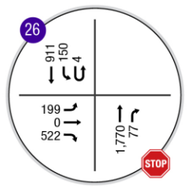


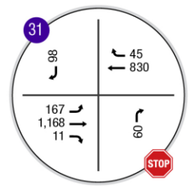


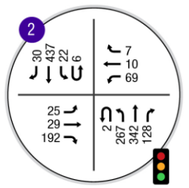


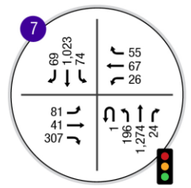


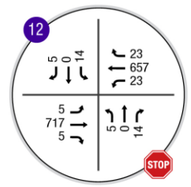


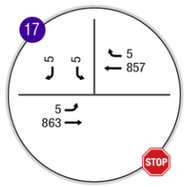


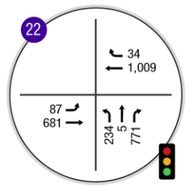


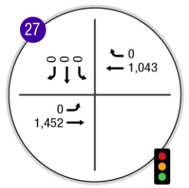


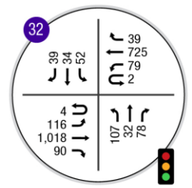


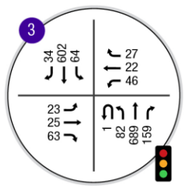


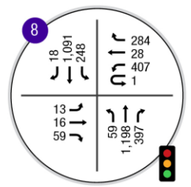


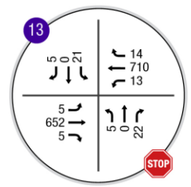


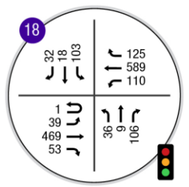


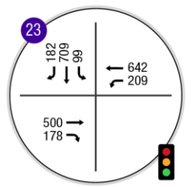


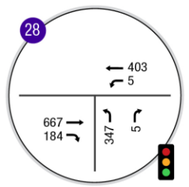


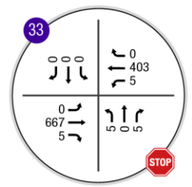


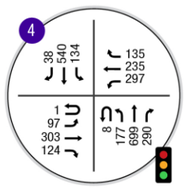


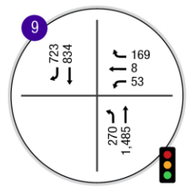


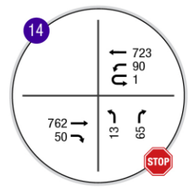


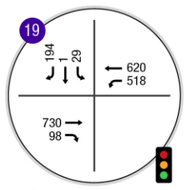


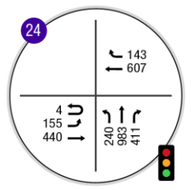


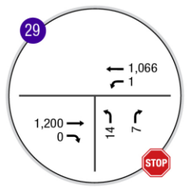


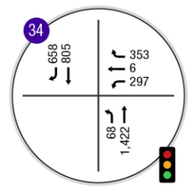


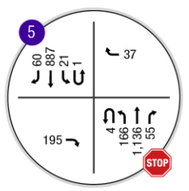


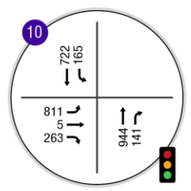


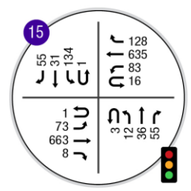


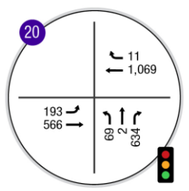


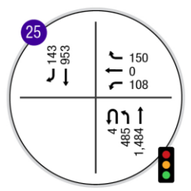


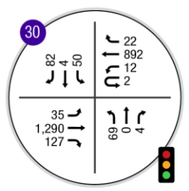


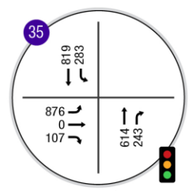












Balanced Volume TMCs: PM Peak Period (Intersections 36–67)

Appendix C. Microsimulation Model Calibration Results

Appendix C. Microsimulation Model Calibration Results

			AM Peak Period					Mid-day Peak Period					PM Peak Period				
Street	**Direction**	**Location**	**Field Value**	**Microsimulation**	**Difference**	**% Difference**	**Target Met?**	**Field Value**	**Microsimulation**	**Difference**	**% Difference**	**Target Met?**	**Field Value**	**Microsimulation**	**Difference**	**% Difference**	**Target Met?**
Pena Boulevard	**Inbound (NB/ EB)**	East of I-70 EB	3340	3270	-70	-2%	Yes	3164	3139	-25	-1%	Yes	3096	3027	-69	-2%	Yes
		Between 40th on-ramp and GVR off-ramp	4256	4132	-124	-3%	Yes	4256	4195	-61	-1%	Yes	4377	4259	-118	-3%	Yes
		Between GVR off-ramp and on-ramp	3503	3380	-123	-4%	Yes	3437	3381	-56	-2%	Yes	3367	3277	-90	-3%	Yes
		Between GVR on-ramp and 56th off-ramp	3665	3520	-145	-4%	Yes	3580	3523	-57	-2%	Yes	3493	3396	-97	-3%	Yes
		Between 56th off-ramp and on-ramp	3046	2921	-125	-4%	Yes	3091	3034	-57	-2%	Yes	2788	2702	-86	-3%	Yes
		Between 56th on-ramp and Tower off-ramp	3183	3022	-161	-5%	Yes	3258	3192	-66	-2%	Yes	2994	2903	-91	-3%	Yes
		Between Tower off-ramp and on-ramp	2465	2314	-151	-6%	Yes	2443	2388	-55	-2%	Yes	2011	1949	-62	-3%	Yes
		Between Tower on-ramp and E-470 off-ramp	3020	2848	-172	-6%	Yes	3009	2960	-49	-2%	Yes	2537	2425	-112	-4%	Yes
		Between E-470 off-ramp and on-ramp	2700	2543	-157	-6%	Yes	2659	2612	-47	-2%	Yes	1975	1894	-81	-4%	Yes
		Between E-470 on-ramp and gun club road off-ramp	3908	3646	-262	-7%	Yes	3827	3717	-110	-3%	Yes	2971	2779	-192	-6%	Yes
	Outbound (SB/ WB)	Between E-470 off-ramp and gun club road on-ramp	2240	2245	5	0%	Yes	4255	4239	-16	0%	Yes	3672	3691	19	1%	Yes
		Between E-470 clover on-ramp and off-ramp	1945	1937	-8	0%	Yes	3604	3585	-19	-1%	Yes	3047	3054	7	0%	Yes
		Between Tower off-ramp and E-470 on-ramp	2356	2244	-112	-5%	Yes	3461	3421	-40	-1%	Yes	2931	2848	-83	-3%	Yes
		Between Tower off-ramp and on-ramp	1870	1768	-102	-5%	Yes	2496	2454	-42	-2%	Yes	2275	2228	-47	-2%	Yes
		Between 56th off-ramp and Tower on-ramp	2934	2853	-81	-3%	Yes	3140	3116	-24	-1%	Yes	3007	2987	-20	-1%	Yes
		Between 56th off-ramp and on-ramp	2682	2600	-82	-3%	Yes	2890	2848	-42	-1%	Yes	2783	2846	63	2%	Yes
		Between GVR off-ramp and 56th on-ramp	3510	3362	-148	-4%	Yes	3479	3427	-52	-2%	Yes	3400	3471	71	2%	Yes
		Between GVR off-ramp and on-ramp	3346	3163	-183	-5%	Yes	3344	3284	-60	-2%	Yes	3254	3355	101	3%	Yes
		Between 40th off-ramp and GVR on-ramp	4242	3978	-264	-6%	Yes	3954	3868	-86	-2%	Yes	3881	3950	69	2%	Yes
		East of I-70 WB	3212	2918	-294	-9%	Yes	3113	2940	-173	-6%	Yes	2891	3024	133	5%	Yes
Chambers Road	**NB**	South of I-70	696	715	19	3%	Yes	1059	1166	107	10%	Yes	1085	1049	-36	-3%	Yes
		South of 40th (Partial)	1000	898	-102	-10%	Yes	1346	1288	-58	-4%	Yes	1654	1482	-172	-10%	Yes
		South of GVR	739	649	-90	-12%	Yes	1064	968	-96	-9%	Yes	1174	998	-176	-15%	No
		South of 56th	310	309	-1	0%	Yes	411	413	2	0%	Yes	380	349	-31	-8%	Yes
	SB	South of 56th	382	381	-1	0%	Yes	427	448	21	5%	Yes	495	479	-16	-3%	Yes
		North of Green Valley Ranch	726	727	1	0%	Yes	711	747	36	5%	Yes	712	694	-18	-3%	Yes
		North of 40th	1640	1620	-20	-1%	Yes	1298	1347	49	4%	Yes	1357	1285	-72	-5%	Yes
		North of I-70 (Partial)	2124	1713	-411	-19%	No	1556	1358	-198	-13%	Yes	1557	1270	-287	-18%	No
		South of I-70	1330	1225	-105	-8%	Yes	1012	984	-28	-3%	Yes	985	876	-109	-11%	Yes
Tower Road	**NB**	South of I-70	684	684	0	0%	Yes	983	1043	60	6%	Yes	1078	1033	-45	-4%	Yes
		South of 40th	979	954	-25	-3%	Yes	1214	1255	41	3%	Yes	1360	1333	-27	-2%	Yes
		South of GVR	691	646	-45	-6%	Yes	1049	1043	-6	-1%	Yes	1069	1025	-44	-4%	Yes
		South of 56th	789	762	-27	-3%	Yes	989	1017	28	3%	Yes	938	919	-19	-2%	Yes
		South of 64th	761	727	-34	-5%	Yes	872	890	18	2%	Yes	893	878	-15	-2%	Yes
		South of Pena	739	720	-19	-3%	Yes	883	903	20	2%	Yes	857	850	-7	-1%	Yes
		North of Pena	1189	1127	-62	-5%	Yes	1825	1817	-8	0%	Yes	1775	1735	-40	-2%	Yes
	SB	North of Pena	1832	1838	6	0%	Yes	1331	1336	5	0%	Yes	1463	1267	-196	-13%	Yes
		South of Pena	967	973	6	1%	Yes	959	971	12	1%	Yes	926	846	-80	-9%	Yes
		North of 64th	855	871	16	2%	Yes	1010	1048	38	4%	Yes	957	879	-78	-8%	Yes
		North of 56th	915	766	-149	-16%	No	1074	997	-77	-7%	Yes	1017	821	-196	-19%	No
		North of GVR	893	727	-166	-19%	No	1064	963	-101	-9%	Yes	1026	867	-159	-16%	No
		North of 40th	1251	1156	-95	-8%	Yes	1296	1284	-12	-1%	Yes	1236	1126	-110	-9%	Yes
		North of I-70	1602	1520	-82	-5%	Yes	1879	1940	61	3%	Yes	1830	1715	-115	-6%	Yes
		South of I-70	838	802	-36	-4%	Yes	1007	1020	13	1%	Yes	1132	1079	-53	-5%	Yes
64th Avenue	**EB**	West of Tower	15	15	0	2%	Yes	44	47	3	6%	Yes	37	37	0	-1%	Yes
		West of Himalaya	204	190	-14	-7%	Yes	142	138	-4	-3%	Yes	164	157	-7	-4%	Yes
	WB	East of Himalaya	207	224	17	8%	Yes	180	217	37	20%	Yes	164	156	-8	-5%	Yes
		East of Tower	332	351	19	6%	Yes	288	324	36	12%	Yes	297	285	-12	-4%	Yes
56th Avenue	**EB**	West of Chambers	675	692	17	3%	Yes	831	893	62	7%	Yes	1004	962	-42	-4%	Yes
		West of Pena	701	660	-41	-6%	Yes	707	697	-10	-1%	Yes	828	787	-41	-5%	Yes
		East of Pena	1044	977	-67	-6%	Yes	937	918	-19	-2%	Yes	1200	1167	-33	-3%	Yes
		West of Tower	1018	954	-64	-6%	Yes	994	985	-9	-1%	Yes	1207	1177	-30	-2%	Yes
	WB	East of Tower	1290	1272	-18	-1%	Yes	883	937	54	6%	Yes	964	930	-34	-3%	Yes
		East of Pena	1472	1452	-20	-1%	Yes	1044	1091	47	4%	Yes	1080	1031	-49	-5%	Yes
		West of Pena	1035	1018	-17	-2%	Yes	797	826	29	4%	Yes	814	806	-8	-1%	Yes
		East of Chambers	999	983	-16	-2%	Yes	738	770	32	4%	Yes	865	853	-12	-1%	Yes
Green Valley Ranch Boulevard	**EB**	West of Chambers	518	519	1	0%	Yes	524	529	5	1%	Yes	525	460	-65	-12%	Yes
		West of Pena	1053	986	-67	-6%	Yes	878	851	-27	-3%	Yes	868	779	-89	-10%	Yes
		East of Pena	1409	1282	-127	-9%	Yes	1346	1271	-75	-6%	Yes	1452	1330	-122	-8%	Yes
		West of Tower	832	787	-45	-5%	Yes	790	783	-7	-1%	Yes	1150	1069	-81	-7%	Yes
		EB GVR west of Himalaya	455	507	52	11%	Yes	678	707	29	4%	Yes	855	835	-20	-2%	Yes
	WB	WB GVR east of Himalaya	736	754	18	2%	Yes	602	644	42	7%	Yes	498	476	-22	-4%	Yes
		WB GVR east of Tower	1182	1216	34	3%	Yes	1032	1110	78	8%	Yes	874	827	-47	-5%	Yes
		WB GVR east of Pena	1363	1366	3	0%	Yes	1143	1195	52	5%	Yes	1043	977	-66	-6%	Yes
		WB GVR west of Pena	866	860	-6	-1%	Yes	876	903	27	3%	Yes	862	832	-30	-4%	Yes
		WB GVR east of Chambers (partial)	807	773	-34	-4%	Yes	713	718	5	1%	Yes	667	629	-38	-6%	Yes
40th/38th Avenue	**EB**	West of Chambers	160	170	10	6%	Yes	97	106	9	9%	Yes	88	82	-6	-7%	Yes
		West of Pena	579	546	-33	-6%	Yes	588	589	1	0%	Yes	678	626	-52	-8%	Yes
		East of Pena	592	571	-21	-4%	Yes	803	804	1	0%	Yes	851	763	-88	-10%	Yes
		West of Tower	370	354	-16	-4%	Yes	695	706	11	2%	Yes	672	616	-56	-8%	Yes
	WB	East of Tower	899	916	17	2%	Yes	639	689	50	8%	Yes	572	540	-32	-6%	Yes
		East of Pena	771	737	-34	-4%	Yes	920	948	28	3%	Yes	750	694	-56	-7%	Yes
		West of Pena	766	724	-42	-5%	Yes	780	794	14	2%	Yes	824	753	-71	-9%	Yes
		East of Chambers	810	789	-21	-3%	Yes	747	773	26	3%	Yes	720	685	-35	-5%	Yes
I-70	**EB**	West of Chambers	6250	6187	-63	-1%	Yes	6239	6201	-38	-1%	Yes	7020	6801	-219	-3%	Yes
		West of Pena	5195	5103	-92	-2%	Yes	5328	5286	-42	-1%	Yes	5941	5719	-222	-4%	Yes
		West of Airport	2143	2094	-49	-2%	Yes	2414	2425	11	0%	Yes	3156	3036	-120	-4%	Yes
		West of Tower	1757	1707	-50	-3%	Yes	2000	2007	7	0%	Yes	2662	2581	-81	-3%	Yes
	WB	East of Tower	2457	2436	-21	-1%	Yes	1904	1915	11	1%	Yes	1802	1812	10	1%	Yes
		East of Airport	3141	3066	-75	-2%	Yes	2813	2851	38	1%	Yes	2520	2477	-43	-2%	Yes
		East of Pena	3140	3047	-93	-3%	Yes	3065	3086	21	1%	Yes	2660	2712	52	2%	Yes
		West of I-225	6352	5821	-531	-8%	No	6178	5873	-305	-5%	Yes	5551	5804	253	5%	Yes

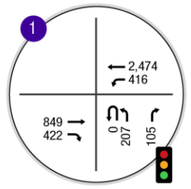
Appendix D. Balanced 2050 No Build TMCs

DEN

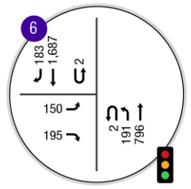
Balanced Volume TMCs: 2050 No Action: AM Peak Period (Intersections 1–35)

= Unsignalized Intersection
= Signalized Intersection
= Traffic Approach

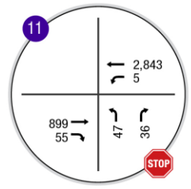
N



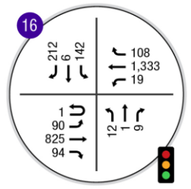
CHAMBERS RD AND 56TH AVE



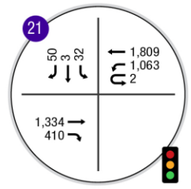
CHAMBERS RD AND 46TH AVE



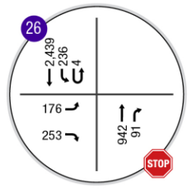
LAREDO ST AND 56TH AVE



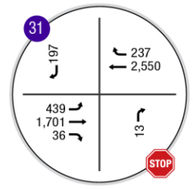
KITTREDGE ST AND 40TH AVE



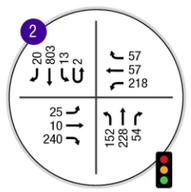
PEÑA BLVD (SB) AND
GREEN VALLEY RANCH BLVD



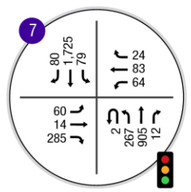
AIRPORT BLVD AND I-70 (EB)



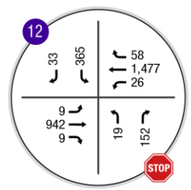
WALDEN ST AND
GREEN VALLEY RANCH BLVD



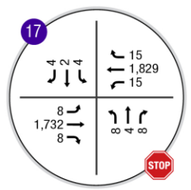
CHAMBERS RD AND
MAXWELL PL



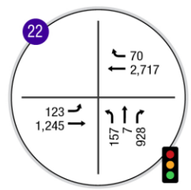
CHAMBERS RD AND
ANDREWS DR



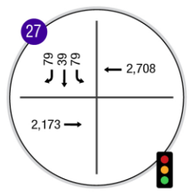
KITTREDGE ST AND
GREEN VALLEY RANCH BLVD



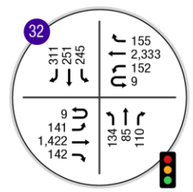
AIRPORT WAY AND
GREEN VALLEY RANCH BLVD



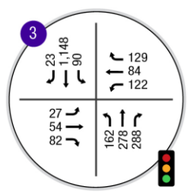
PEÑA BLVD (NB) AND
GREEN VALLEY RANCH BLVD



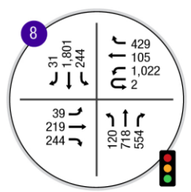
SALIDA ST AND
GREEN VALLEY RANCH BLVD



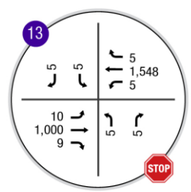
YAMPA ST AND
GREEN VALLEY RANCH BLVD



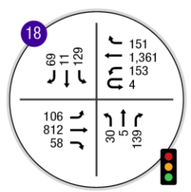
CHAMBERS RD AND 53RD AVE



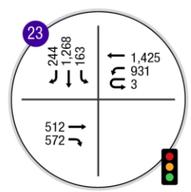
CHAMBERS RD AND 40TH AVE



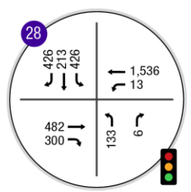
ANDREWS DR AND 40TH AVE



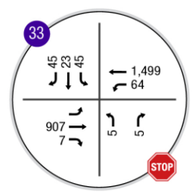
AIRPORT WAY AND 40TH AVE



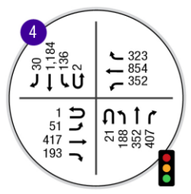
AIRPORT BLVD (SB) AND 40TH AVE



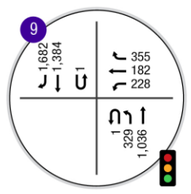
SALIDA ST AND 40TH AVE



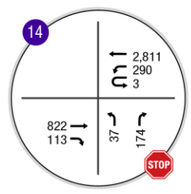
WALDEN ST AND 40TH AVE



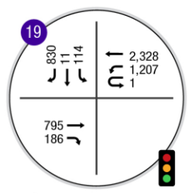
CHAMBERS RD AND GATEWAY/
GREEN VALLEY RANCH BLVD



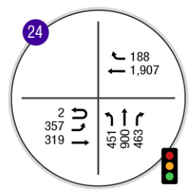
CHAMBERS RD AND I-70 (WB)



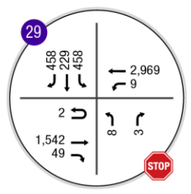
MEMPHIS AND 56TH



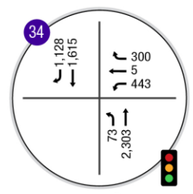
PEÑA BLVD (SB) AND 56TH AVE



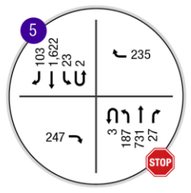
AIRPORT BLVD (NB) AND 40TH AVE



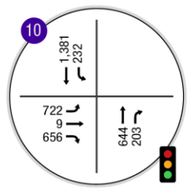
TELLURIDE ST AND 56TH AVE



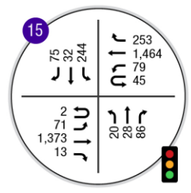
TOWER RD AND PEÑA BLVD (WB)



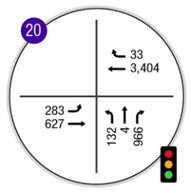
CHAMBERS RD AND
BOLLING DR



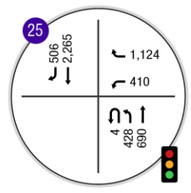
CHAMBERS RD AND I-70 (EB)



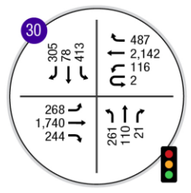
MEMPHIS AND
GREEN VALLEY RANCH BLVD



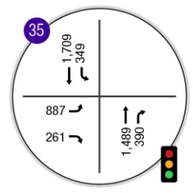
PEÑA BLVD (NB) AND 56TH



AIRPORT BLVD AND I-70 (WB)

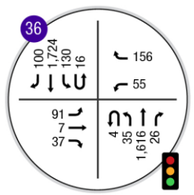


TELLURIDE ST AND
GREEN VALLEY RANCH BLVD

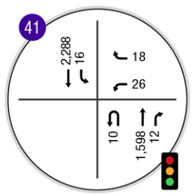


TOWER RD AND PEÑA BLVD (EB)

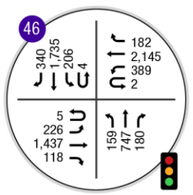
Balanced Volume TMCs: 2050 No Action: AM Peak Period (Intersections 36–73)



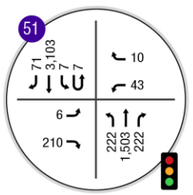
TOWER RD AND 71ST AVE



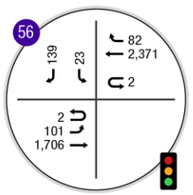
TOWER RD AND 57TH AVE



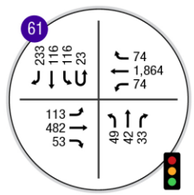
TOWER RD AND
GREEN VALLEY RANCH BLVD



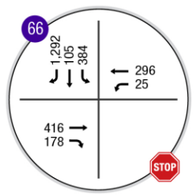
TOWER RD AND SALIDA ST



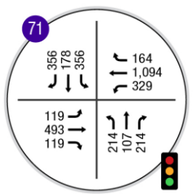
ARGONNE ST AND 56TH AVE



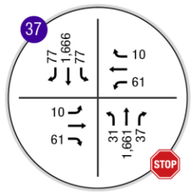
HIMALAYA ST AND 64TH AVE



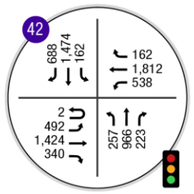
E470 (SB) AND 64TH AVE



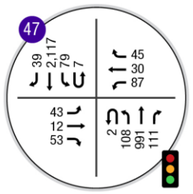
PICADILLY ST AND 64TH AVE



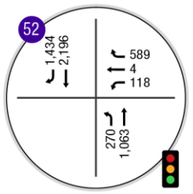
TOWER RD AND 69TH AVE



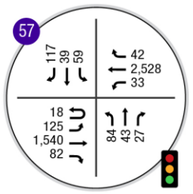
TOWER RD AND 56TH AVE



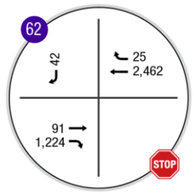
TOWER RD AND 47TH AVE



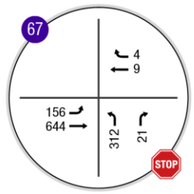
TOWER RD AND I-70 (WB)



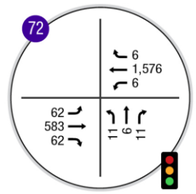
ARGONNE ST AND GREEN
VALLEY RANCH BLVD



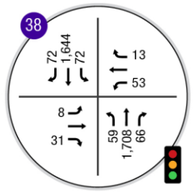
GENOA ST AND GREEN VALLEY
RANCH BLVD + 48TH DR



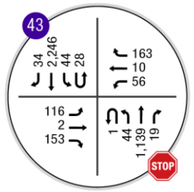
E470 (NB) AND 64TH AVE



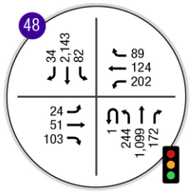
TIBET ST AND 64TH AVE



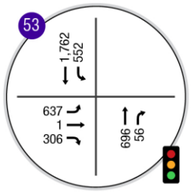
TOWER RD AND
HIGH POINT BLVD



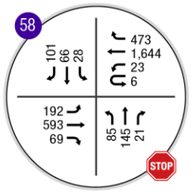
TOWER RD AND ELMENDORF DR



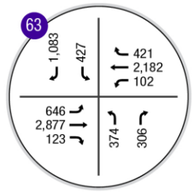
TOWER RD AND 45TH AVE



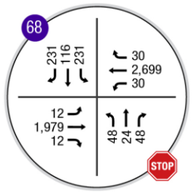
TOWER RD AND I-70 (EB)



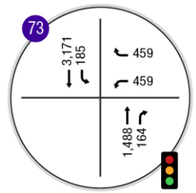
DUNKIRK ST AND 64TH AVE



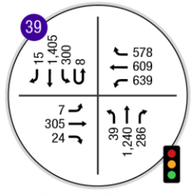
E470 AND PEÑA BLVD
INTERCHANGE



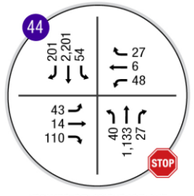
YAMPA ST AND 56TH AVE



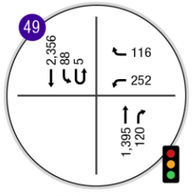
TOWER RD AND 32ND AVE



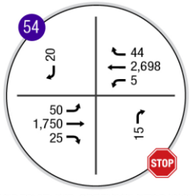
TOWER RD AND 64TH AVE



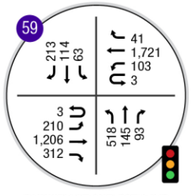
TOWER RD AND 51ST AVE



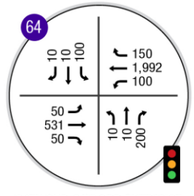
TOWER RD AND 43RD AVE



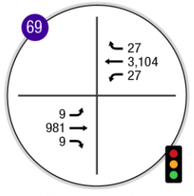
ANDES CT AND GREEN VALLEY RANCH
+ DRIVEWAY TO KING SOOPERS



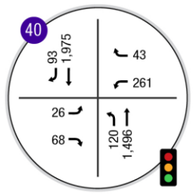
DUNKIRK ST AND 56TH AVE



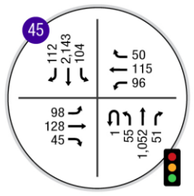
64TH AND GAYLORD ENTRANCE



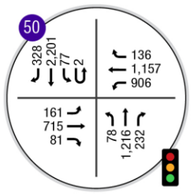
AIRPORT WAY AND 56TH AVE



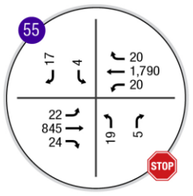
TOWER RD AND 61ST AVE



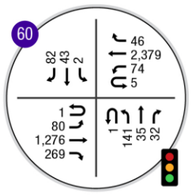
TOWER RD AND WALDEN ST



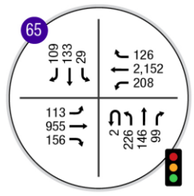
TOWER RD AND 38TH AVE



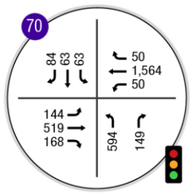
ARGONNE ST AND 64TH AVE



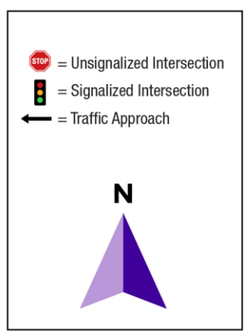
FLANDERS WAY AND GREEN
VALLEY RANCH BLVD



HIMALAYA RD AND GREEN
VALLEY RANCH BLVD



LISBON ST AND 64TH AVE

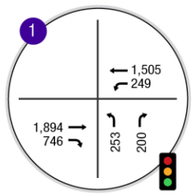


DEN

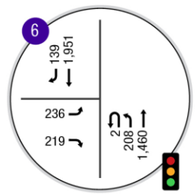
Balanced Volume TMCs: 2050 No Action: Mid-day Peak Period (Intersections 1–35)

= Unsignalized Intersection
= Signalized Intersection
= Traffic Approach

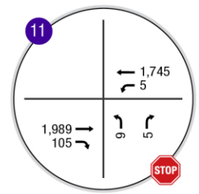
N



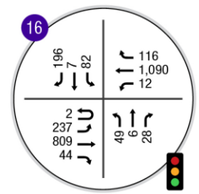
CHAMBERS RD AND 56TH AVE



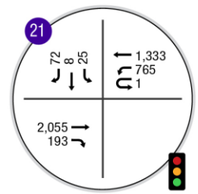
CHAMBERS RD AND 46TH AVE



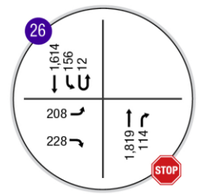
LAREDO ST AND 56TH AVE



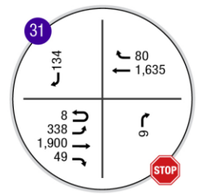
KITTREDGE ST AND 40TH AVE



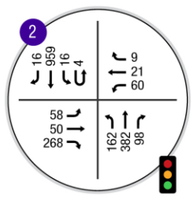
PEÑA BLVD (SB) AND
GREEN VALLEY RANCH BLVD



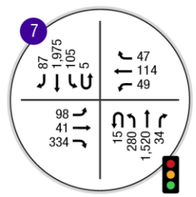
AIRPORT BLVD AND I-70 (EB)



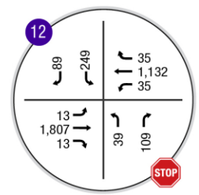
WALDEN ST AND
GREEN VALLEY RANCH BLVD



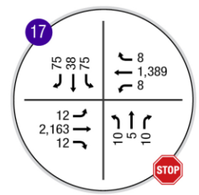
CHAMBERS RD AND
MAXWELL PL



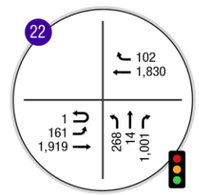
CHAMBERS RD AND
ANDREWS DR



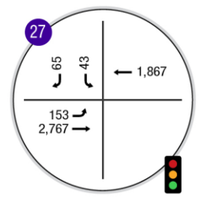
KITTREDGE ST AND
GREEN VALLEY RANCH BLVD



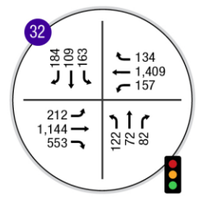
AIRPORT WAY AND
GREEN VALLEY RANCH BLVD



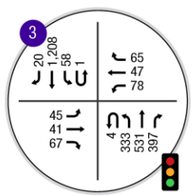
PEÑA BLVD (NB) AND
GREEN VALLEY RANCH BLVD



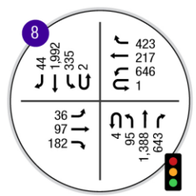
SALIDA ST AND
GREEN VALLEY RANCH BLVD



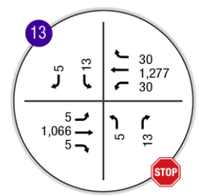
YAMPA ST AND
GREEN VALLEY RANCH BLVD



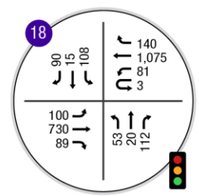
CHAMBERS RD AND 53RD AVE



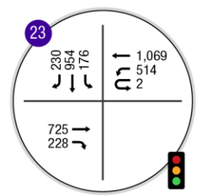
CHAMBERS RD AND 40TH AVE



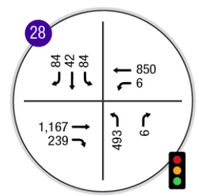
ANDREWS DR AND 40TH AVE



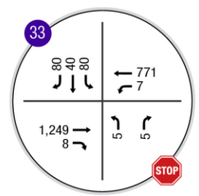
AIRPORT WAY AND 40TH AVE



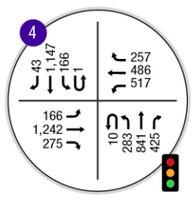
AIRPORT BLVD (SB) AND 40TH AVE



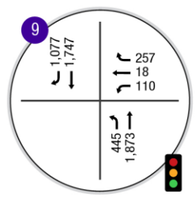
SALIDA ST AND 40TH AVE



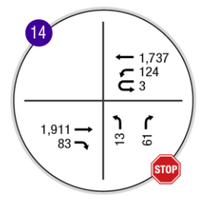
WALDEN ST AND 40TH AVE



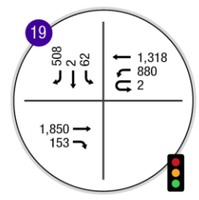
CHAMBERS RD AND GATEWAY/
GREEN VALLEY RANCH BLVD



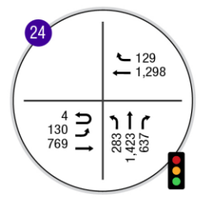
CHAMBERS RD AND I-70 (WB)



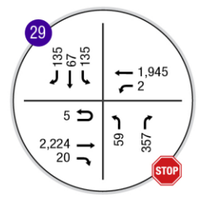
MEMPHIS AND 56TH



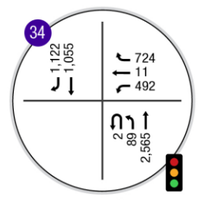
PEÑA BLVD (SB) AND 56TH AVE



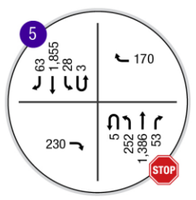
AIRPORT BLVD (NB) AND 40TH AVE



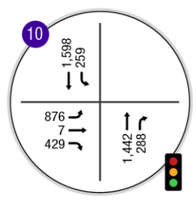
TELLURIDE ST AND 56TH AVE



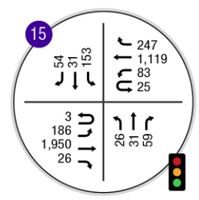
TOWER RD AND PEÑA BLVD (WB)



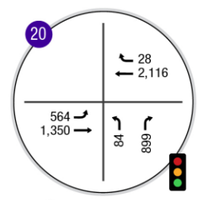
CHAMBERS RD AND
BOLLING DR



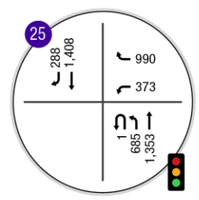
CHAMBERS RD AND I-70 (EB)



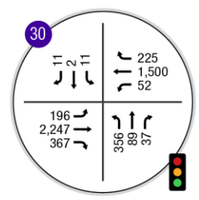
MEMPHIS AND
GREEN VALLEY RANCH BLVD



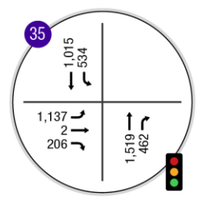
PEÑA BLVD (NB) AND 56TH



AIRPORT BLVD AND I-70 (WB)



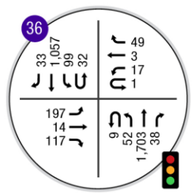
TELLURIDE ST AND
GREEN VALLEY RANCH BLVD



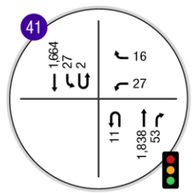
TOWER RD AND PEÑA BLVD (EB)

DEN

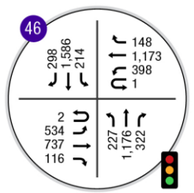
Balanced Volume TMCs: 2050 No Action: Mid-day Peak Period (Intersections 36–73)



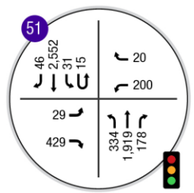
TOWER RD AND 71ST AVE



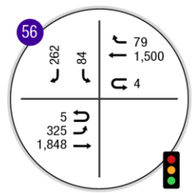
TOWER RD AND 57TH AVE



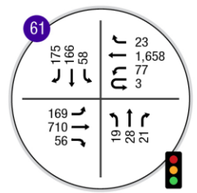
TOWER RD AND
GREEN VALLEY RANCH BLVD



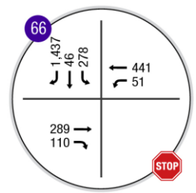
TOWER RD AND SALIDA ST



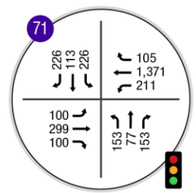
ARGONNE ST AND 56TH AVE



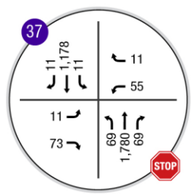
HIMALAYA ST AND 64TH AVE



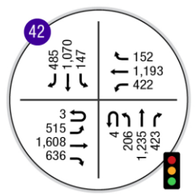
E470 (SB) AND 64TH AVE



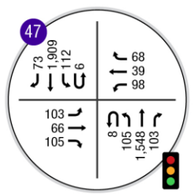
PICADILLY ST AND 64TH AVE



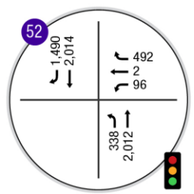
TOWER RD AND 69TH AVE



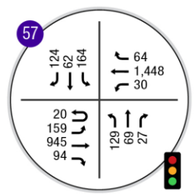
TOWER RD AND 56TH AVE



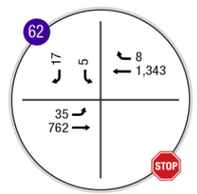
TOWER RD AND 47TH AVE



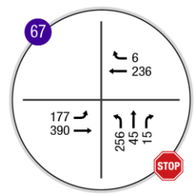
TOWER RD AND I-70 (WB)



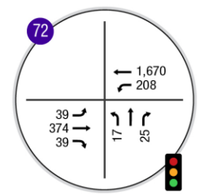
ARGONNE ST AND GREEN
VALLEY RANCH BLVD



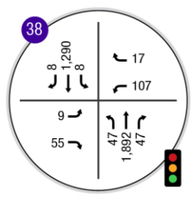
GENOA ST AND GREEN VALLEY
RANCH BLVD + 48TH DR



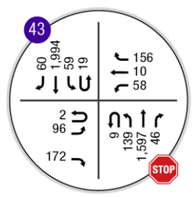
E470 (NB) AND 64TH AVE



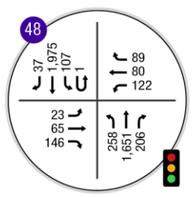
TIBET ST AND 64TH AVE



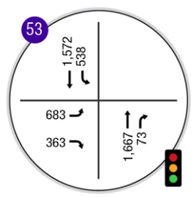
TOWER RD AND
HIGH POINT BLVD



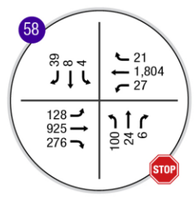
TOWER RD AND ELMENDORF DR



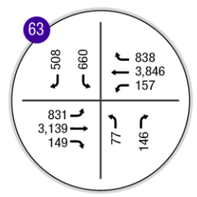
TOWER RD AND 45TH AVE



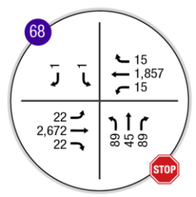
TOWER RD AND I-70 (EB)



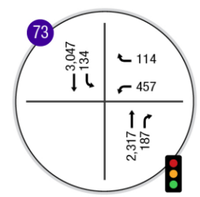
DUNKIRK ST AND 64TH AVE



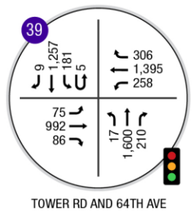
E470 AND PEÑA BLVD
INTERCHANGE



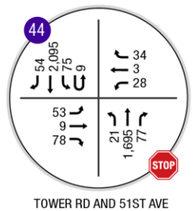
YAMPA ST AND 56TH AVE



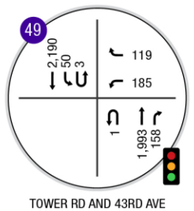
TOWER RD AND 32ND AVE



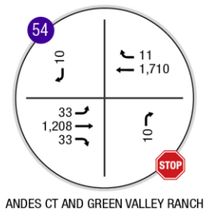
TOWER RD AND 64TH AVE



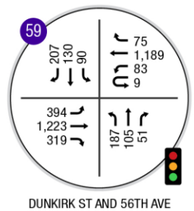
TOWER RD AND 51ST AVE



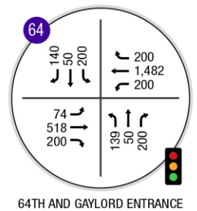
TOWER RD AND 43RD AVE



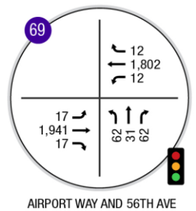
ANDES CT AND GREEN VALLEY RANCH
+ DRIVEWAY TO KING SOOPERS



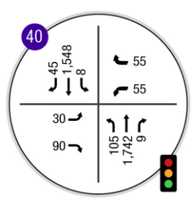
DUNKIRK ST AND 56TH AVE



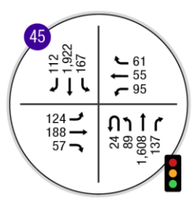
64TH AND GAYLORD ENTRANCE



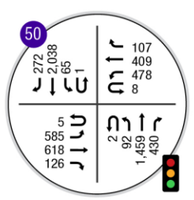
AIRPORT WAY AND 56TH AVE



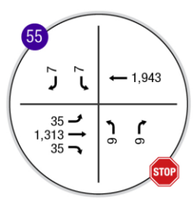
TOWER RD AND 61ST AVE



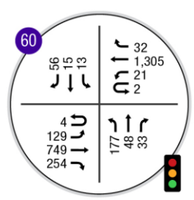
TOWER RD AND WALDEN ST



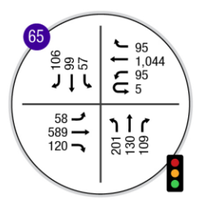
TOWER RD AND 38TH AVE



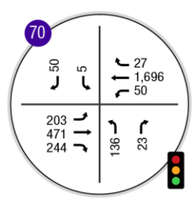
ARGONNE ST AND 64TH AVE



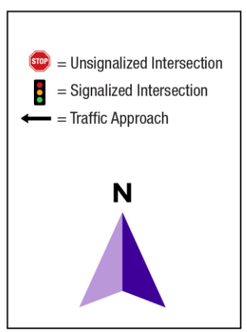
FLANDERS WAY AND GREEN
VALLEY RANCH BLVD



HIMALAYA RD AND GREEN
VALLEY RANCH BLVD



LISBON ST AND 64TH AVE

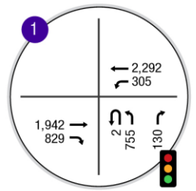


DEN

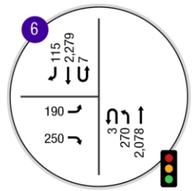
Balanced Volume TMCs: 2050 No Action: PM Peak Period (Intersections 1–35)

= Unsignalized Intersection
= Signalized Intersection
= Traffic Approach

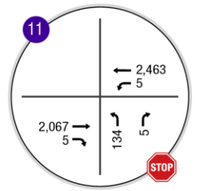
N



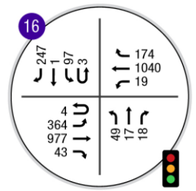
CHAMBERS RD AND 56TH AVE



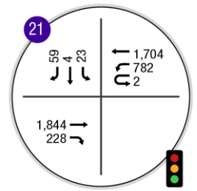
CHAMBERS RD AND 46TH AVE



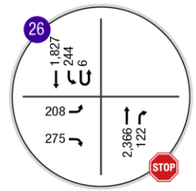
LAREDO ST AND 56TH AVE



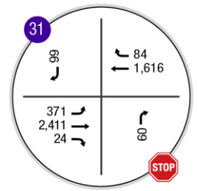
KITTREDGE ST AND 40TH AVE



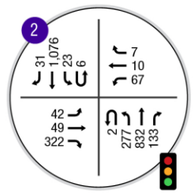
PEÑA BLVD (SB) AND
GREEN VALLEY RANCH BLVD



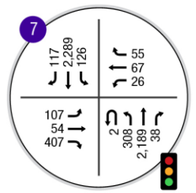
AIRPORT BLVD AND I-70 (EB)



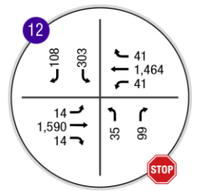
WALDEN ST AND
GREEN VALLEY RANCH BLVD



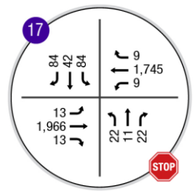
CHAMBERS RD AND
MAXWELL PL



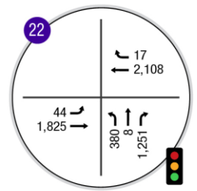
CHAMBERS RD AND
ANDREWS DR



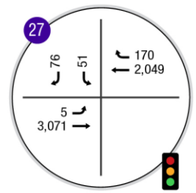
KITTREDGE ST AND
GREEN VALLEY RANCH BLVD



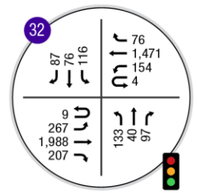
AIRPORT WAY AND
GREEN VALLEY RANCH BLVD



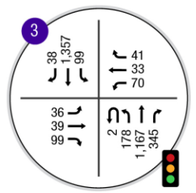
PEÑA BLVD (NB) AND
GREEN VALLEY RANCH BLVD



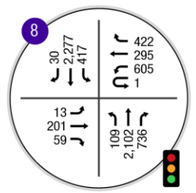
SALIDA ST AND
GREEN VALLEY RANCH BLVD



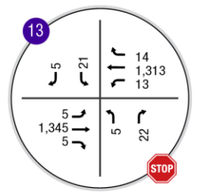
YAMPA ST AND
GREEN VALLEY RANCH BLVD



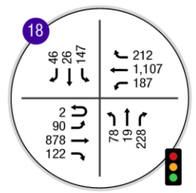
CHAMBERS RD AND 53RD AVE



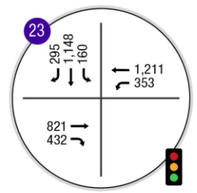
CHAMBERS RD AND 40TH AVE



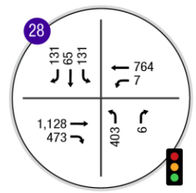
ANDREWS DR AND 40TH AVE



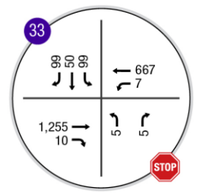
AIRPORT WAY AND 40TH AVE



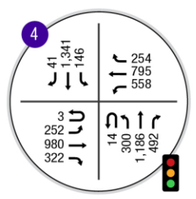
AIRPORT BLVD (SB) AND 40TH AVE



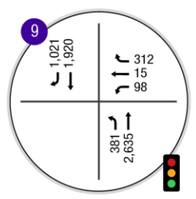
SALIDA ST AND 40TH AVE



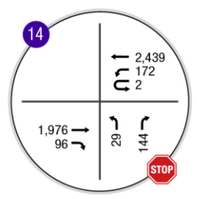
WALDEN ST AND 40TH AVE



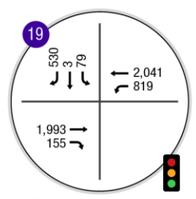
CHAMBERS RD AND GATEWAY/
GREEN VALLEY RANCH BLVD



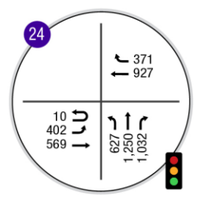
CHAMBERS RD AND I-70 (WB)



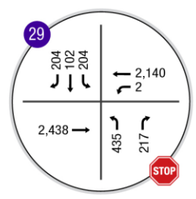
MEMPHIS AND 56TH



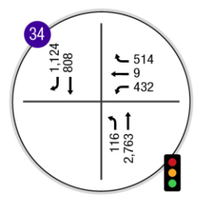
PEÑA BLVD (SB) AND 56TH AVE



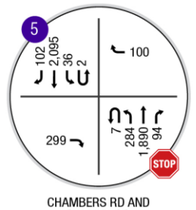
AIRPORT BLVD (NB) AND 40TH AVE



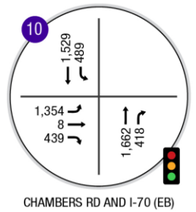
TELLURIDE ST AND 56TH AVE



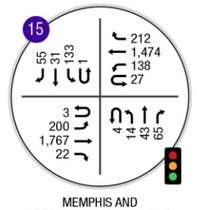
TOWER RD AND PEÑA BLVD (WB)



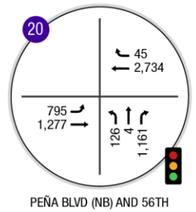
CHAMBERS RD AND
BOLLING DR



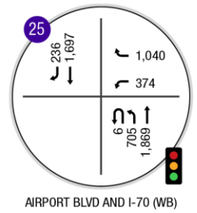
CHAMBERS RD AND I-70 (EB)



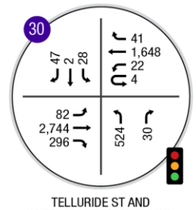
MEMPHIS AND
GREEN VALLEY RANCH BLVD



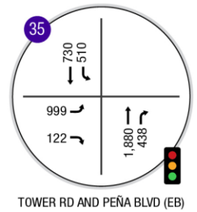
PEÑA BLVD (NB) AND 56TH



AIRPORT BLVD AND I-70 (WB)

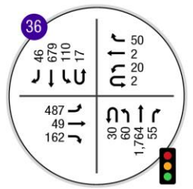


TELLURIDE ST AND
GREEN VALLEY RANCH BLVD

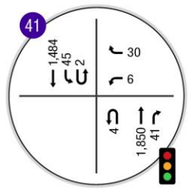


TOWER RD AND PEÑA BLVD (EB)

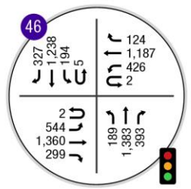
Balanced Volume TMCs: 2050 No Action: PM Peak Period (Intersections 36–73)



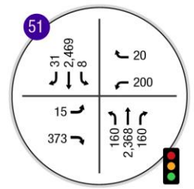
TOWER RD AND 71ST AVE



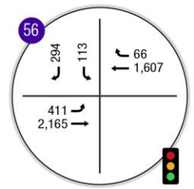
TOWER RD AND 57TH AVE



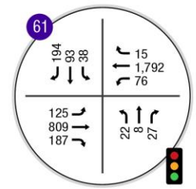
TOWER RD AND
GREEN VALLEY RANCH BLVD



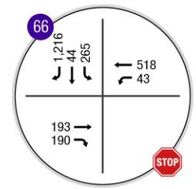
TOWER RD AND SALIDA ST



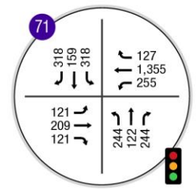
ARGONNE ST AND 56TH AVE



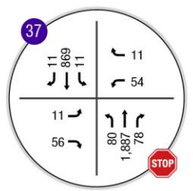
HIMALAYA ST AND 64TH AVE



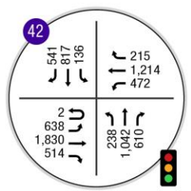
E470 (SB) AND 64TH AVE



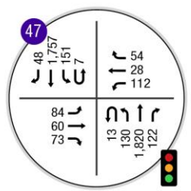
PICADILLY ST AND 64TH AVE



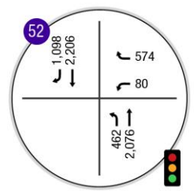
TOWER RD AND 69TH AVE



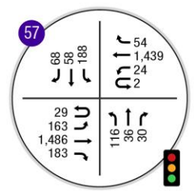
TOWER RD AND 56TH AVE



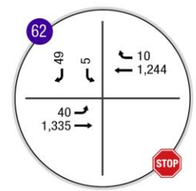
TOWER RD AND 47TH AVE



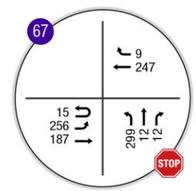
TOWER RD AND I-70 (WB)



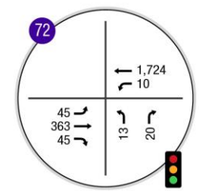
ARGONNE ST AND GREEN
VALLEY RANCH BLVD



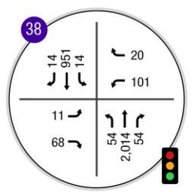
GENOA ST AND GREEN VALLEY
RANCH BLVD + 48TH DR



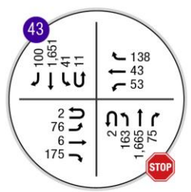
E470 (NB) AND 64TH AVE



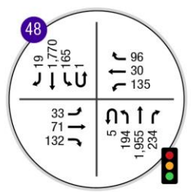
TIBET ST AND 64TH AVE



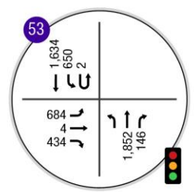
TOWER RD AND
HIGH POINT BLVD



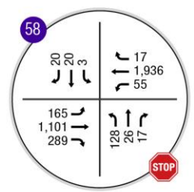
TOWER RD AND ELMENDORF DR



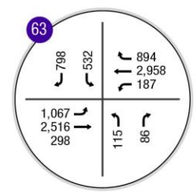
TOWER RD AND 45TH AVE



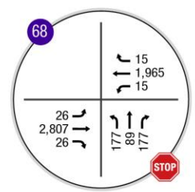
TOWER RD AND I-70 (EB)



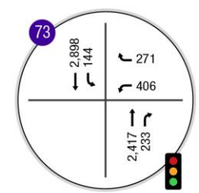
DUNKIRK ST AND 64TH AVE



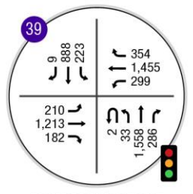
E470 AND PEÑA BLVD
INTERCHANGE



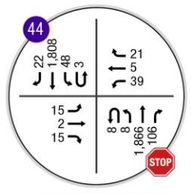
YAMPA ST AND 56TH AVE



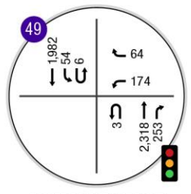
TOWER RD AND 32ND AVE



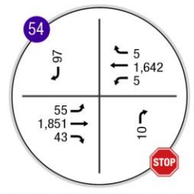
TOWER RD AND 64TH AVE



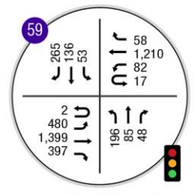
TOWER RD AND 51ST AVE



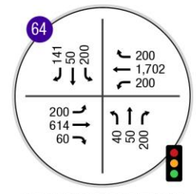
TOWER RD AND 43RD AVE



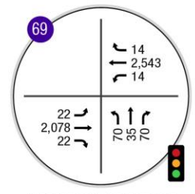
ANDES CT AND GREEN VALLEY RANCH
+ DRIVEWAY TO KING SOOPERS



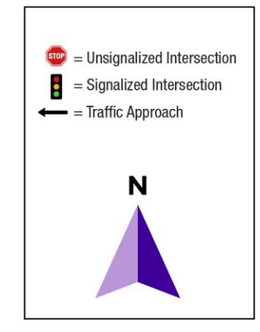
DUNKIRK ST AND 56TH AVE

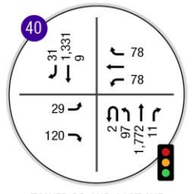


64TH AND GAYLORD ENTRANCE

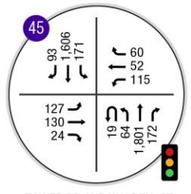


AIRPORT WAY AND 56TH AVE

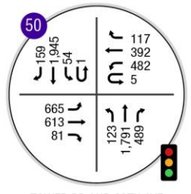




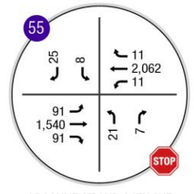
TOWER RD AND 61ST AVE



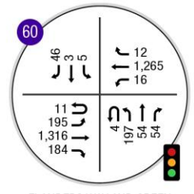
TOWER RD AND WALDEN ST



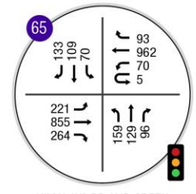
TOWER RD AND 38TH AVE



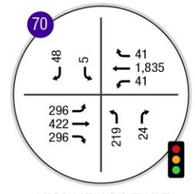
ARGONNE ST AND 64TH AVE



FLANDERS WAY AND GREEN
VALLEY RANCH BLVD



HIMALAYA RD AND GREEN
VALLEY RANCH BLVD



LISBON ST AND 64TH AVE