Discovery Park
Traffic Impact Study
Lee's Summit, Missouri

July 24th, 2024

Prepared by:

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INTRODUCTION

The purpose of this traffic impact study is to update the 2023 Discover Park Traffic Impact Study (Olsson) and assess the potential impact on traffic based on the June 2024 site plan. This study is intended to be a supplement to the original study and not a standalone study. The site is located northwest of the intersection of I-470 and Douglas Street in Lee's Summit. The location of the development in relation to the street network is shown in Figure 1. The site plan for the development is shown in Figure 2. (Individual zone detailed site plans are included in the Appendix.)

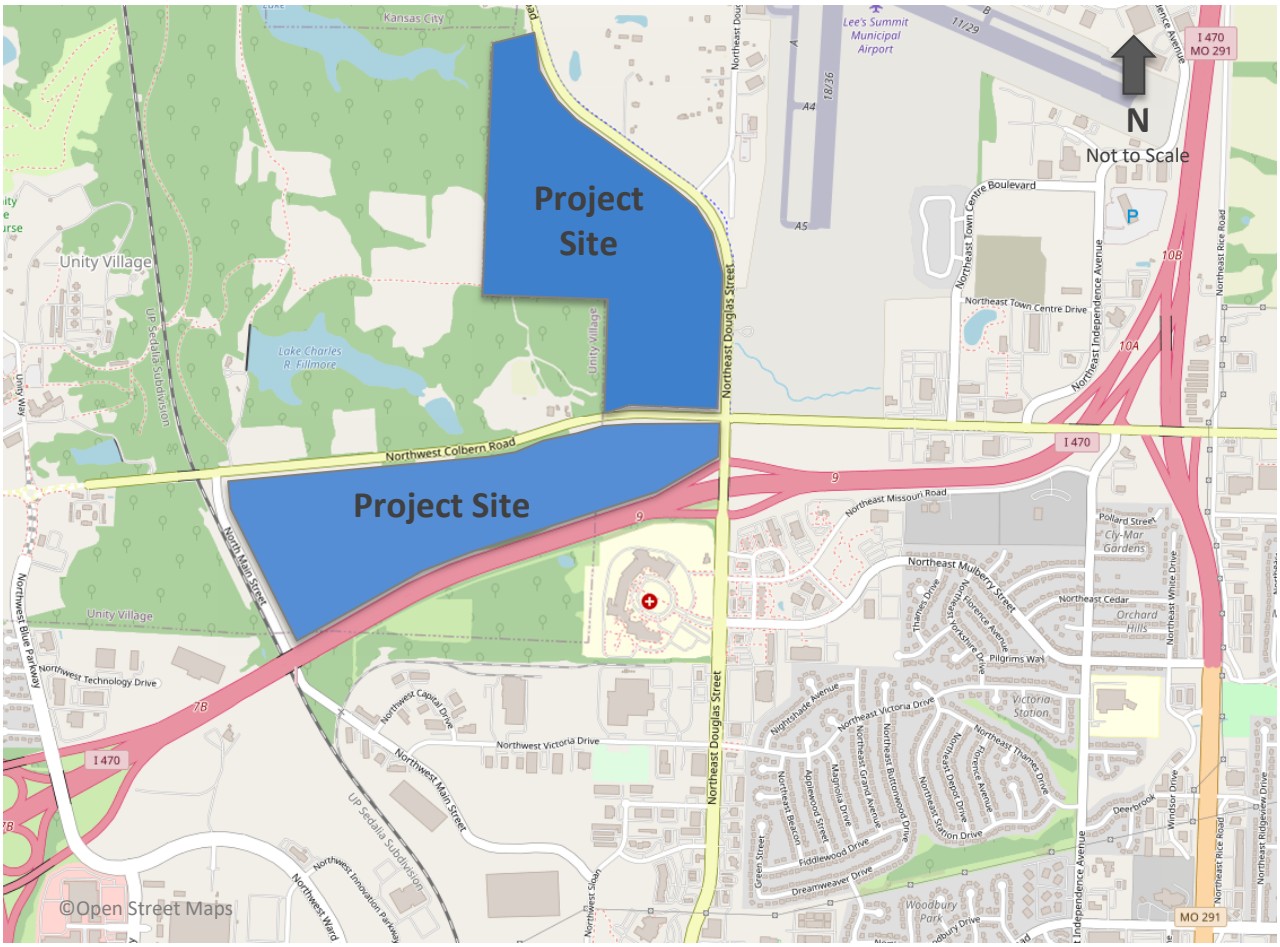

Figure 1 – Development Location

DISCOVERY PARK℠

lee's summit

Drive Access Points

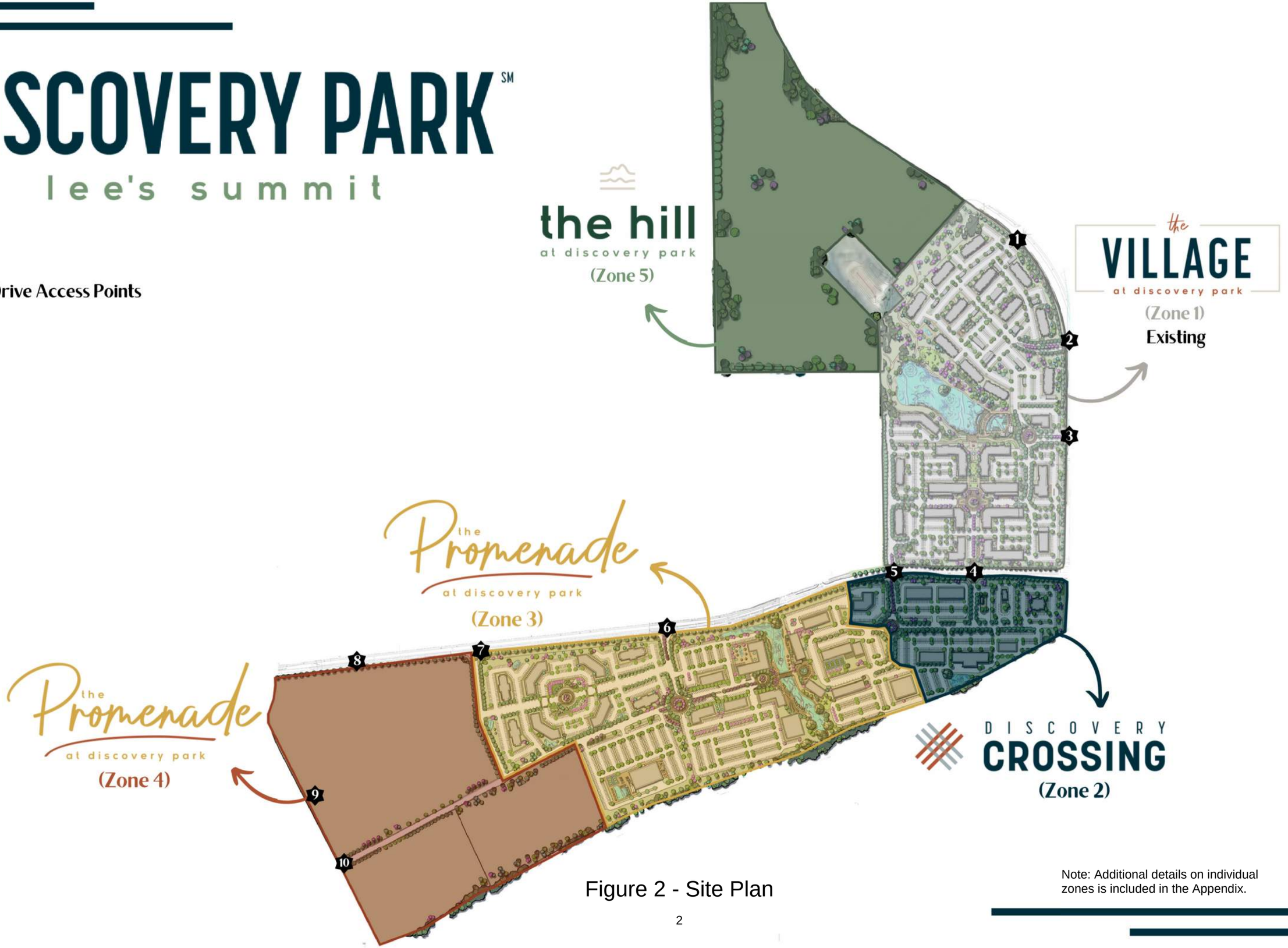

Figure 2 - Site Plan

Note: Additional details on individual zones is included in the Appendix.

EXISTING CONDITIONS

The site is in Lee's Summit, Missouri, in the northwest quadrant of the intersection I-470 and Colbern Road. The current land use of the planned development is undeveloped.

Street Network and Traffic Control

The development is generally bordered on the north by Colbern Road and Douglas St/Lee's Summit Road, on the west by Main Street, on the east by Douglas Street, and on the south by I-470.

Colbern Road is an east-west four-lane arterial roadway in the project vicinity with a posted speed limit of 45 miles per hour (mph). The roadway and lane configurations in the report and analysis are based on the 2022 reconstruction roadway plans.

Pryor Road is a north-south two-lane local roadway with a posted speed limit of 35 mph. The intersection of Colbern Road and Pryor Road is stop-controlled with Pryor Road stopping.

Missouri Highway 350 (M-350) is a grass median divided four-lane north-south state highway. The intersections of the M-350 northbound ramps and southbound ramps with Colbern Road are signalized.

Blue Parkway is a four-lane arterial with a 40 mph posted speed limit south of Colbern Road. North of Colbern Road, Blue Parkway serves as access to Unity Village. The intersection of Blue Parkway/Unity Drive and Colbern Road is a roundabout with through and shared through/right-turn lanes on the eastbound and northbound approaches. All other approaches are shared lanes.

I-470/M-291 is a four-lane divided interstate highway running north-south to the east of the project and east-west to the south of the project location. There are four northbound and southbound entrance and exit ramps intersecting Colbern Road—a signalized southbound off-ramp, a signalized northbound on-ramp/Independence Avenue, an unsignalized southbound on-ramp, and a signalized northbound on-ramp.

Douglas Street is a north-south arterial. North of Colbern Road, Douglas Street is a two-lane roadway with a two-way left-turn lane (TWLT) and a posted speed limit of 45 mph. Douglas Street becomes Lee's Summit Road at the intersection with the two-lane collector, Douglas Street, approximately half-a-mile north of Colbern Road. To the south of Colbern Road, Douglas Street is a four-lane median divided roadway. The intersection of Douglas Street/Lee's Summit Road (north-south) and Douglas Street (east-west) is a stop-controlled, T-intersection with Douglas Street stopping.

The intersection of Douglas Street and Colbern Road is signalized.

I-470 runs east-west parallel to Colbern Road south of the development. The east and westbound ramps and Douglas Street are signalized intersections.

Traffic Volumes

Intersections count data included the study analysis from the 2023 Olsson study include:

- Colbern Road and Main Street (count from 2019)
- Colbern Road and Blue Parkway/Unity Way (count from 2019)
- Douglas Street/Lee's Summit Road and Douglas Street (count from 2019)
- Colbern Road and Douglas Street (count from 2022)
- Douglas Street and I-470 Westbound Ramp (count from 2022)
- Douglas Street and I-470 Eastbound Ramp (count from 2022)
- Colbern Road and Pryor Road (count from 2022)
- Colbern Road and M-350 Northbound Ramp (count from 2022)
- Colbern Road and M-350 Southbound Ramp (count from 2022)

Trips from approved developments in the surrounding areas included in the existing conditions of the Olsson study were:

- Cable Dahmer KIA (December 2015)
- St. Michael Archangel Catholic High School (June 2016)
- Oakview Storage (March 2018)
- Aria/Summit Village North (April 2019)
- Automotive Detail Center (May 2020)
- Douglas Station Apartments (April 2021)
- Scannell LS (July 2021)
- Lot 1 Town Center (November 2021)

The expected site-generated traffic volumes of nearby approved developments were added to the existing morning peak hour and school/afternoon peak hour traffic scenarios in the 2023 Olsson study to create the existing plus site conditions for analysis as the sites were approved/under construction.

Additional traffic counts were collected to supplement the 2023 study at the following intersections:

- Colbern Road and I-470 Southbound Ramp
- Colbern Road and I-470 Northbound Ramp/Independence Ave
- Colbern Road and M-291 Southbound Ramp
- Colbern Road and M-291 Northbound Ramp

The turning movement traffic counts for the additional intersections were completed on Tuesday, April 16th, 2024, for the peak volume time periods. Morning traffic counts were conducted from 7:00 AM until 9:00 AM and afternoon traffic counts were from 4:00 PM until 6:00 PM. The morning peak period was determined to be from 7:15 AM until 8:15 AM and the afternoon peak period was determined to be from 4:30 PM until 5:30 PM.

An existing conditions scenario was created by balancing the peak hour traffic counts (2019, 2022, and 2024), the approved trips, and the Zone 1 trips (currently under construction) from the 2023 Olsson study. Traffic counts, an overview map, and site generated traffic volumes for the approved developments can be found in the Appendix.

The existing conditions traffic volumes are shown on Figure 3.

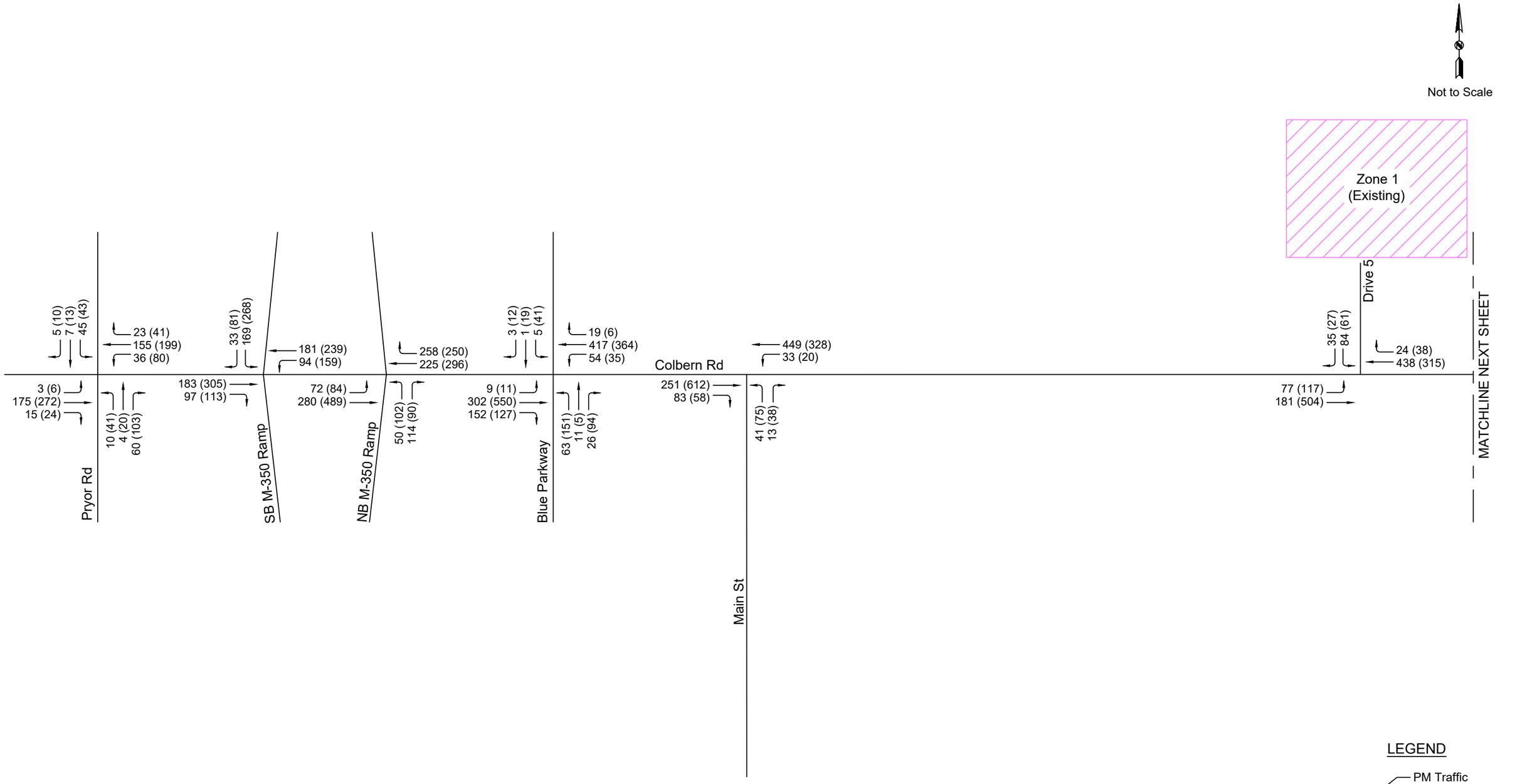

Figure 3 - Existing Conditions AM & PM Traffic Volumes (1 of 2)

PROPOSED CONDITIONS

The Discovery Park development is planned to consist of five zones with Zone 1 approved and currently under construction in the northwest quadrant of the intersection of Douglas Street and Colbern Road. Zones 2 through 4 will be a mix of residential, commercial, retail, and office space located south of Colbern Road. Zone 5 is planned as a mix of office, warehousing, and senior housing north of Zone 1. Zone 2 is planned for immediate construction, Zone 3 is for near-future construction, and Zones 4 and are planned for a later date.

A detailed breakdown of the number of units in each phase is included in the Trip Generation section of the report and in the site plan in the Appendix.

Access Plan

The site will be accessed via drives on Colbern Road, Douglas Street, and Main Street. There will be no access to the site from I-470.

Zone 1 will have three stop-controlled full-access drives on Douglas Street—Drive 1 (aligns with the existing east-west Douglas Street), Drive 2, and Drive 3. Zone 1 will have an additional two drives on Colbern Road—Drive 4 (a right-in/right-out (RIRO) access) and Drive 5 (a stop-controlled full access).

Zone 2 will be accessed by construction of a south leg of Drive 4 and Drive 5 on Colbern Road. Drive 4 will remain a RIRO access. There will be no access onto Douglas Street or I-470 from Zone 2.

Zone 3 access on Colbern Road will be from Drive 5, Drive 6 (full-access), and Drive 7 (¾-access). Zone 3 will have interconnectivity with Zone 2.

Zone 4 will be accessed via two stop-controlled drives on Main Street (Drive 9 and Drive 10) and two ¾-access on Colbern Road (Drive 7 and Drive 8). Zone 4 will connect and share internal streets with Zone 3.

Zone 5 will be accessed by two stop-controlled full-access drives (Drive 11 and Drive 12) from Douglas Street/Lee's Summit Road and will not have connectivity with Zone 1.

Sight Distance

Sight distance was not measured at the proposed accesses as part of this study as the roadway is currently under construction.

Trip Generation

The expected trip generation for the development was estimated using the 11th Edition of the Trip Generation Handbook published by the Institute of Transportation Engineers. The trip generation was based on Peak Hour of Adjacent Street Traffic, One Hour Between 7 and 9 AM along with Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 PM criteria. Trips for the retail, restaurant, office, entertainment, and restaurant land uses were generated using the ITE land use code for shopping plaza/center to account for the internal trip capture.

A detailed breakdown of the number of units, the phase, and locations of buildings are included in the trip generation and developer plan included in the Appendix. Estimates for the expected trips generated by the development are provided in Table 1.

Table 1 – Trip Generation

ITE Land Use Code	Weekday Trips (vpd)	A.M.		P.M.	
		Trips In (vph)	Trips Out (vph)	Trips In (vph)	Trips Out (vph)
821 – Shopping Plaza(40-150k) – 84,000 sq ft	7,877	184	113	364	395
Zone 2 Total	**7,877**	**184**	**113**	**364**	**395**
220 – Multifamily Housing – 350 dwelling units	2,319	31	100	108	63
820 – Shopping Center(>150k) – 527,040 sq ft	19,624	275	169	897	971
Zone 3 Total	**21,943**	**306**	**269**	**1,005**	**1,034**
Zone 3 Total with Multifamily Internal Capture	**n/a**	**275**	**242**	**905**	**931**
820 – Shopping Center(>150k) – 369,500 sq ft	15,511	218	134	694	752
Zone 4 Total	**15,511**	**218**	**134**	**694**	**752**
110 – General Light Industrial – 25,000 sq ft	**141**	**18**	**3**	**8**	**8**
220 – Multifamily Housing – 400 dwelling units	**2,639**	**35**	**112**	**122**	**71**
255 – Continuing Care Retirement – 290 dwelling units	**853**	**38**	**21**	**36**	**57**
Zone 5 Total	**3,636**	**91**	**136**	**166**	**136**
Total Zones 2 - 5	**49,134**	**728**	**609**	**2,103**	**2,180**

Trip Distribution

The trip distribution followed the trip distribution established in the 2023 Discovery Park TIS (Olsson) and updated based on the additional intersection counts. The detailed distribution patterns can be found in the Appendix.

Trip distribution during the morning peak period:

- 15% to/from the north
- 35% to/from the south
- 15% to/from the east
- 35% to/from the west

Trip distribution during the afternoon peak period:

- 15% to/from the north
- 35% to/from the south
- 15% to/from the east
- 35% to/from the west

Existing Plus Site Traffic Volumes

The expected development site-generated traffic volumes were added to the existing conditions morning peak hour and afternoon peak hour traffic scenarios for the four development zones (Zones 2, 3, 4, and 5) and are shown on Figures 4 through 11.

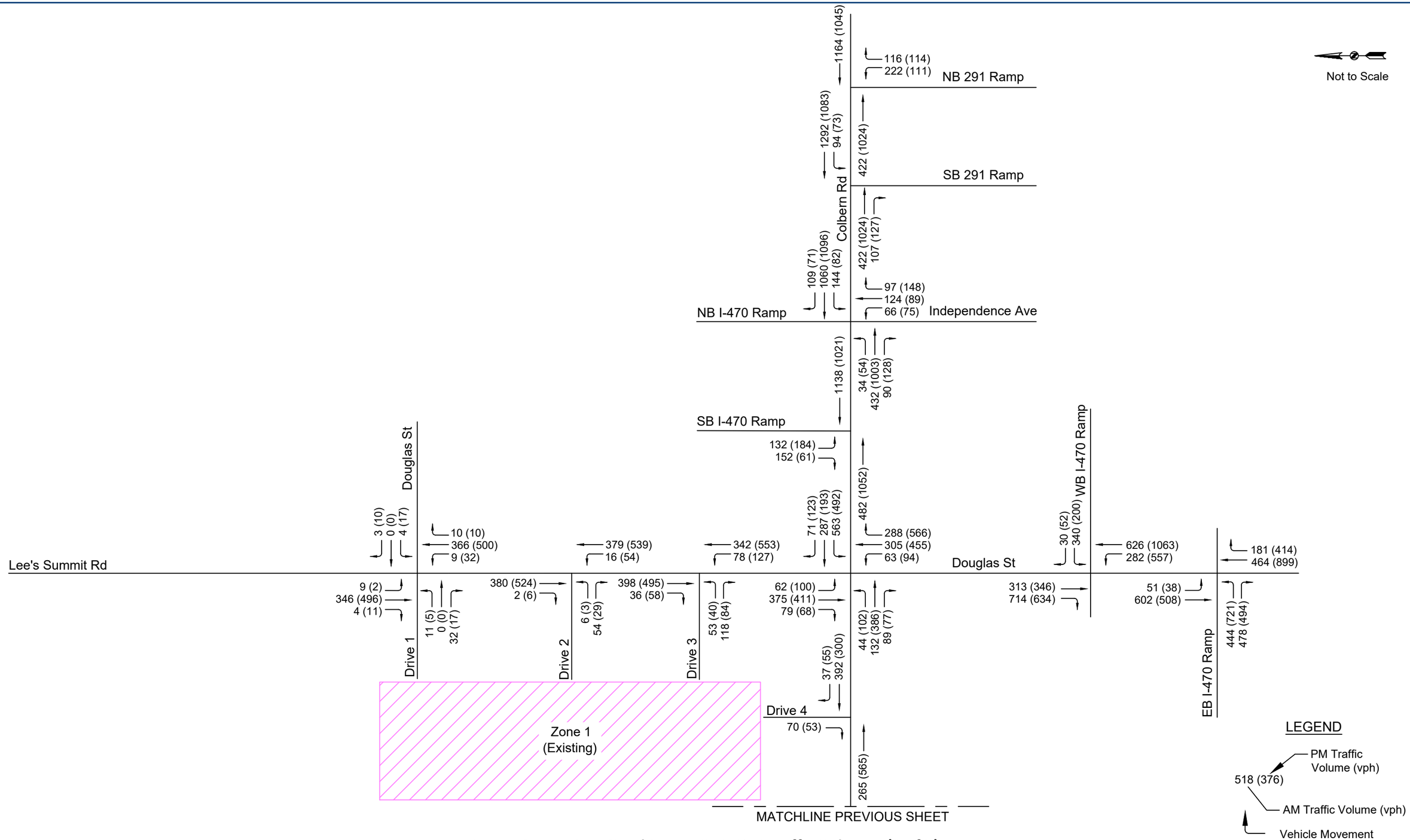

Figure 3 - Existing Conditions AM & PM Traffic Volumes (2 of 2)

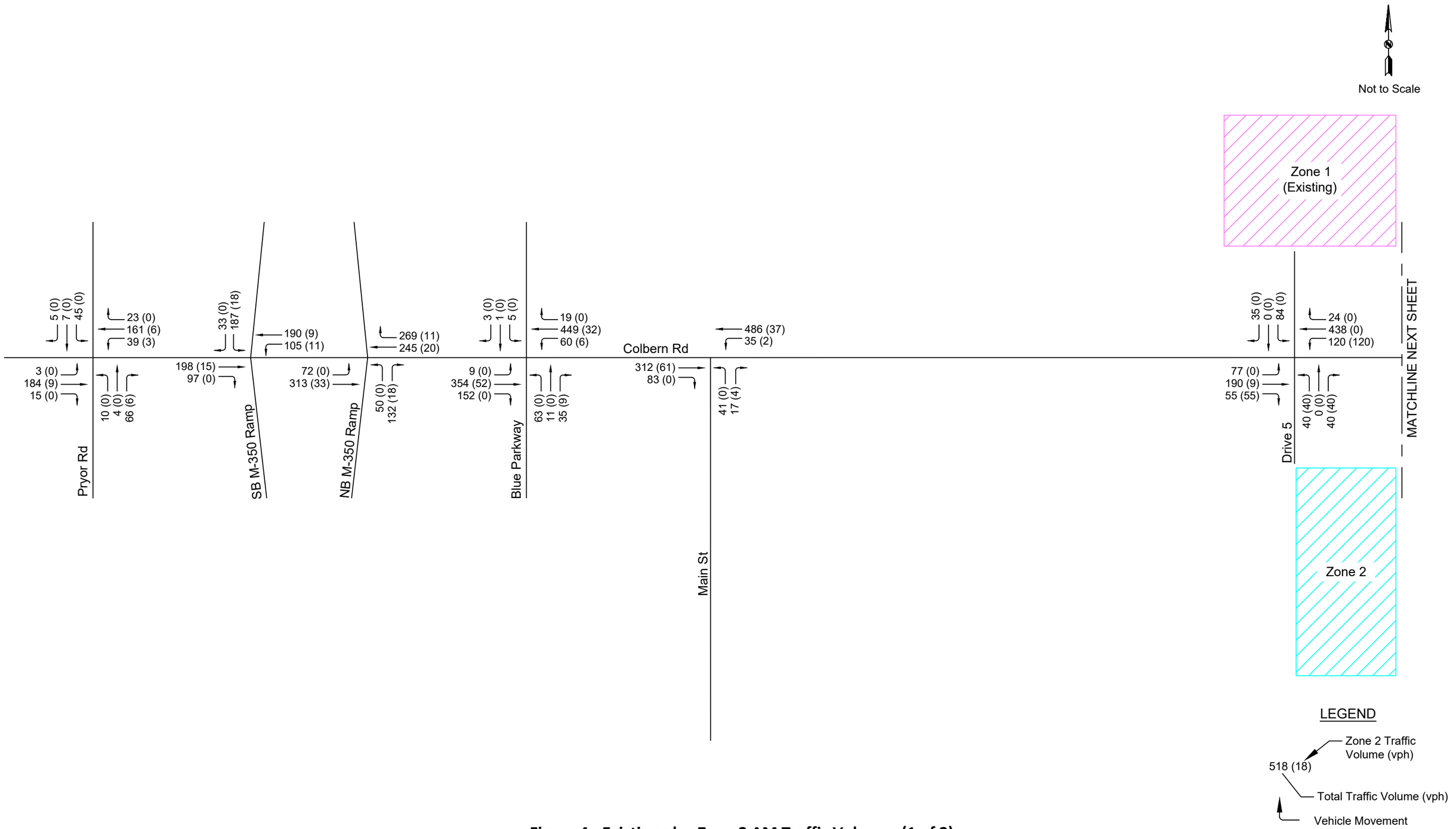

Figure 4 - Existing plus Zone 2 AM Traffic Volumes (1 of 2)

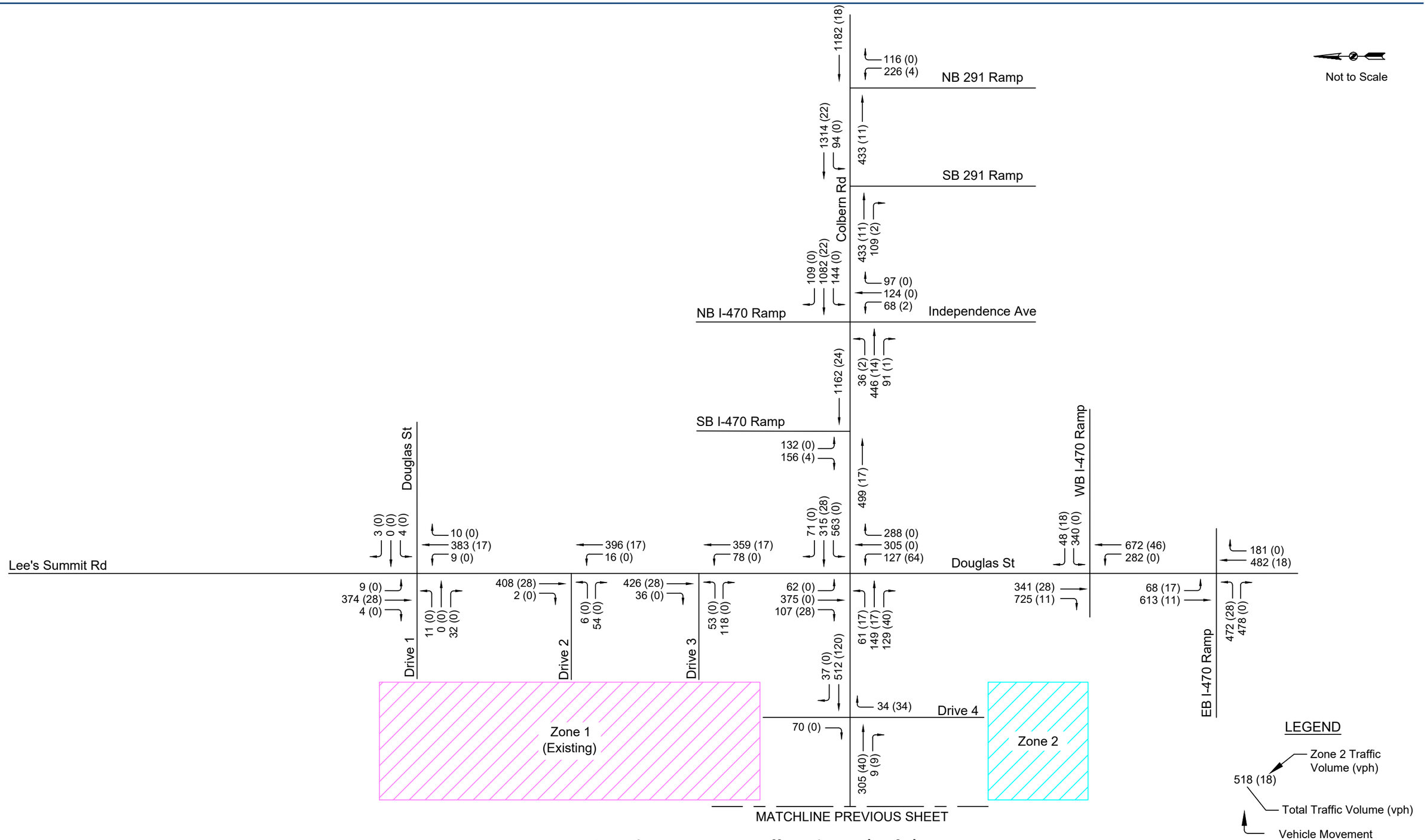

Figure 4 - Existing plus Zone 2 AM Traffic Volumes (2 of 2)

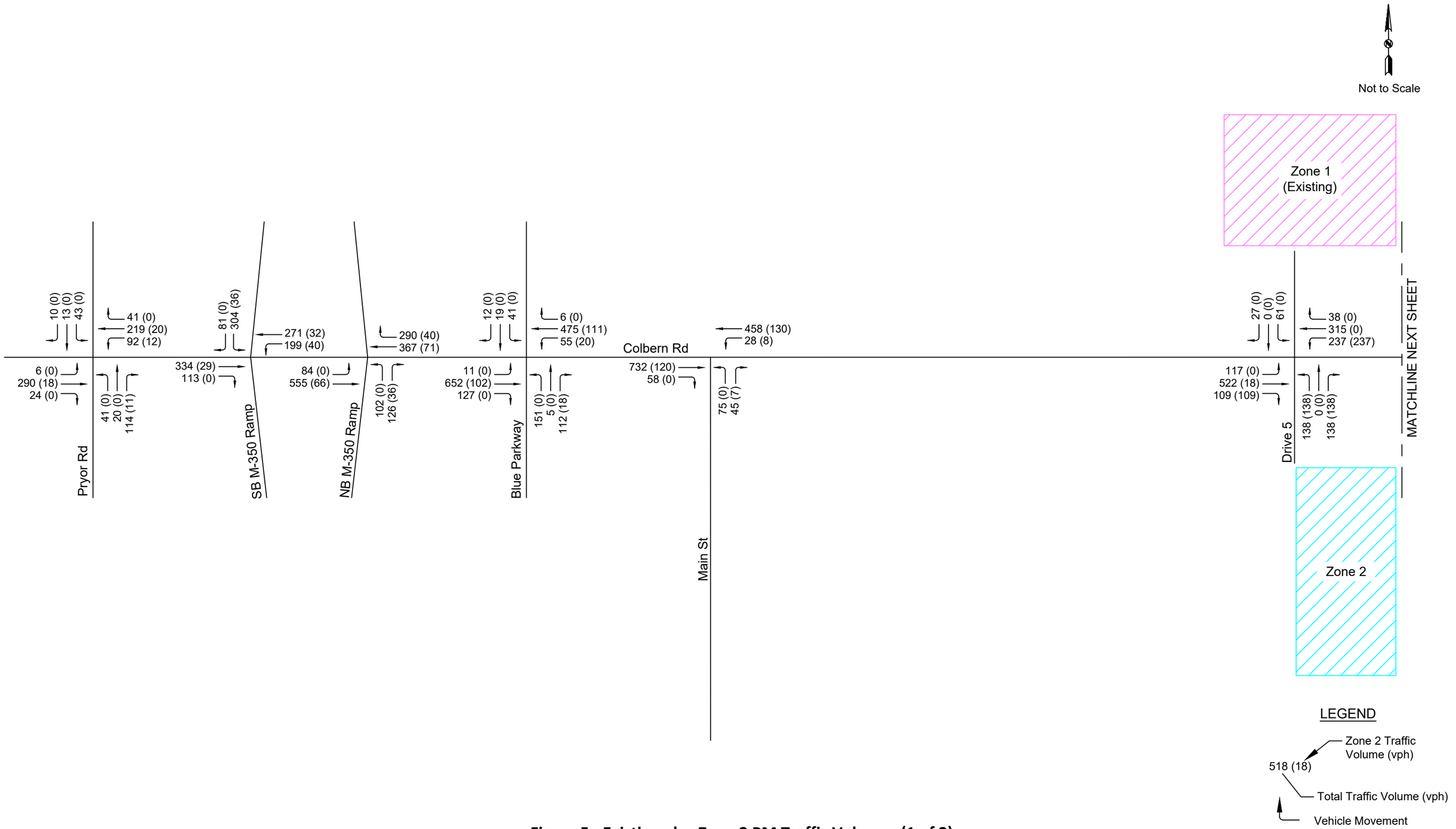

Figure 5 - Existing plus Zone 2 PM Traffic Volumes (1 of 2)

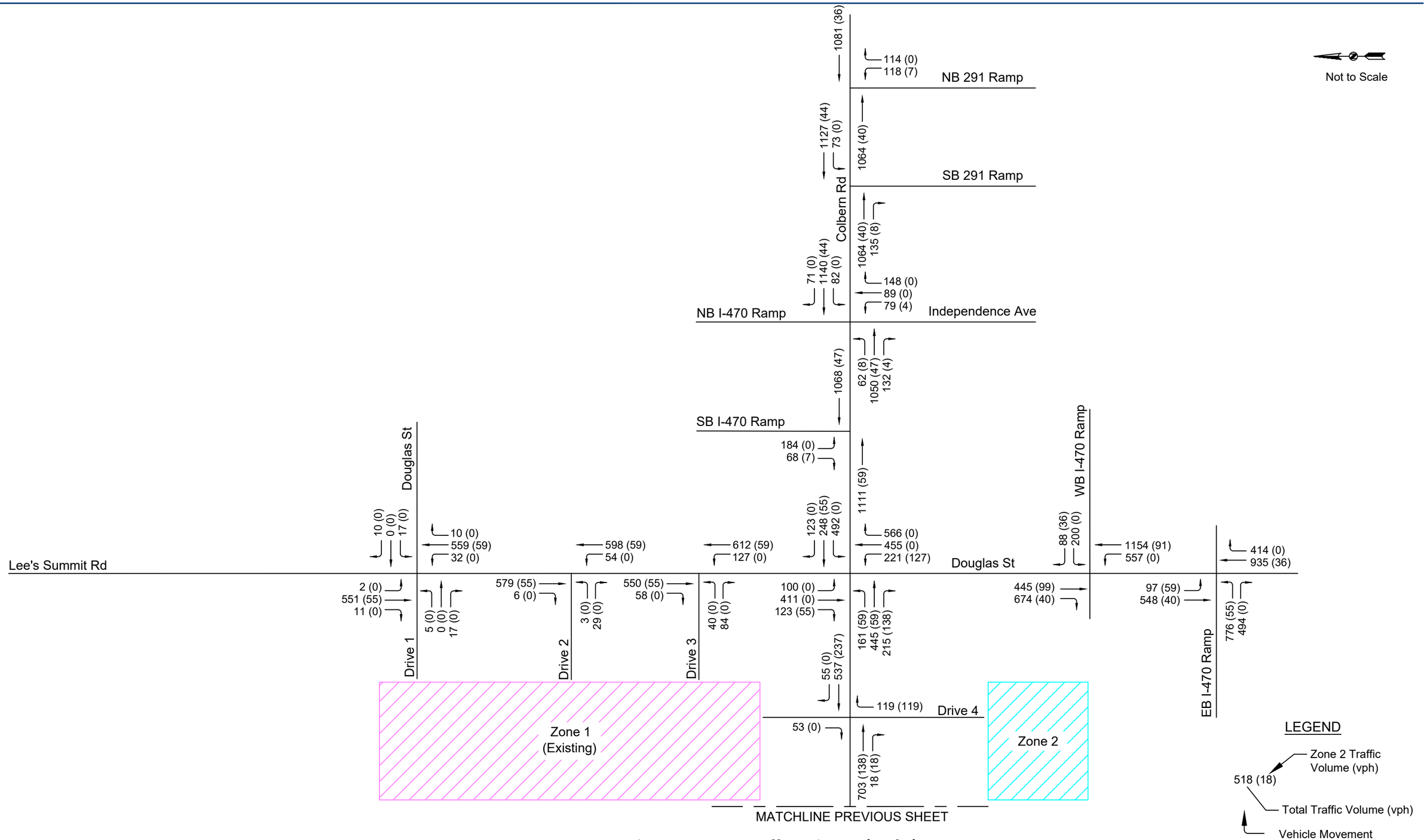

Figure 5 - Existing plus Zone 2 PM Traffic Volumes (2 of 2)

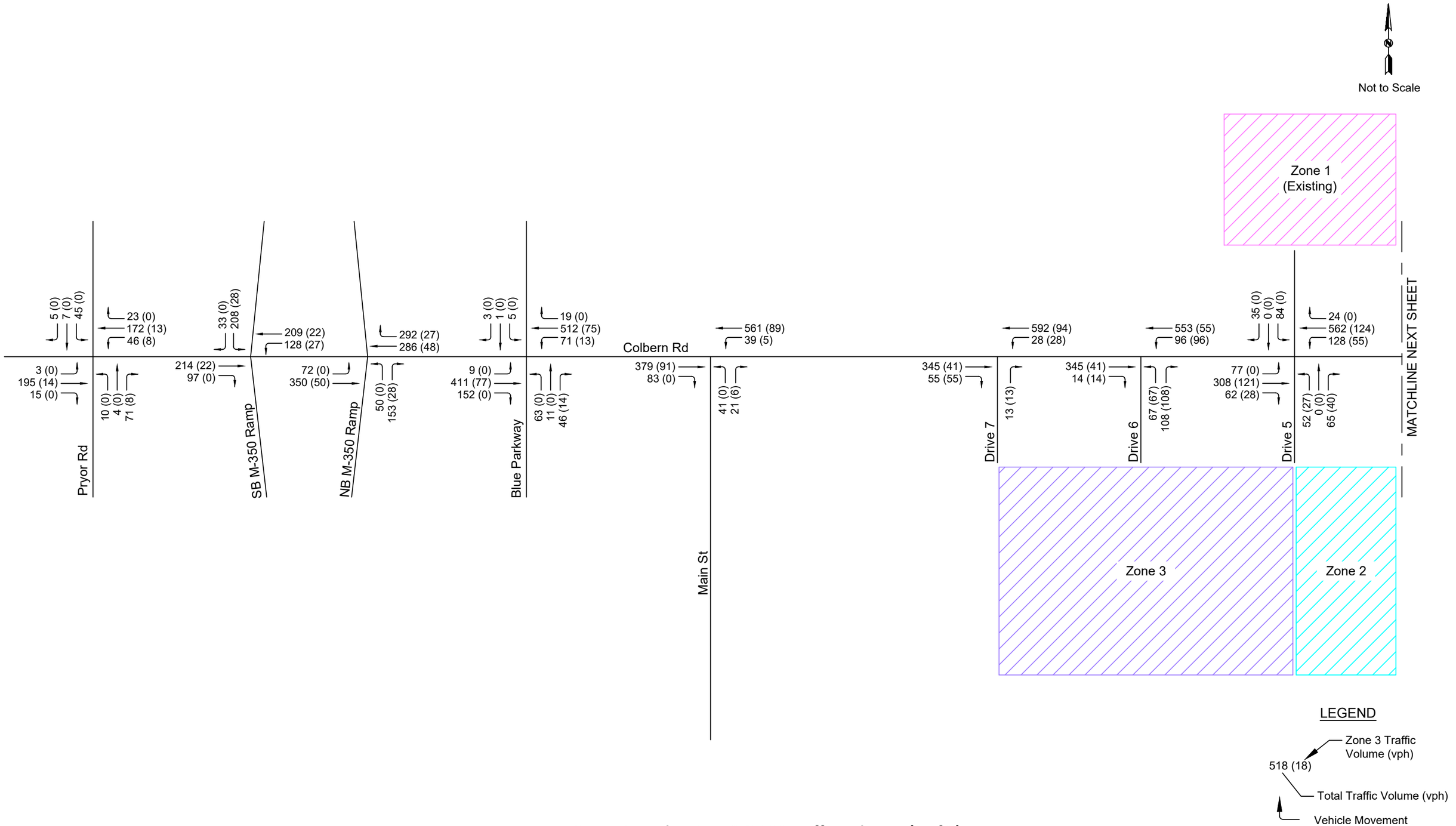

Figure 6 - Existing plus Zone 2-3 AM Traffic Volumes (1 of 2)

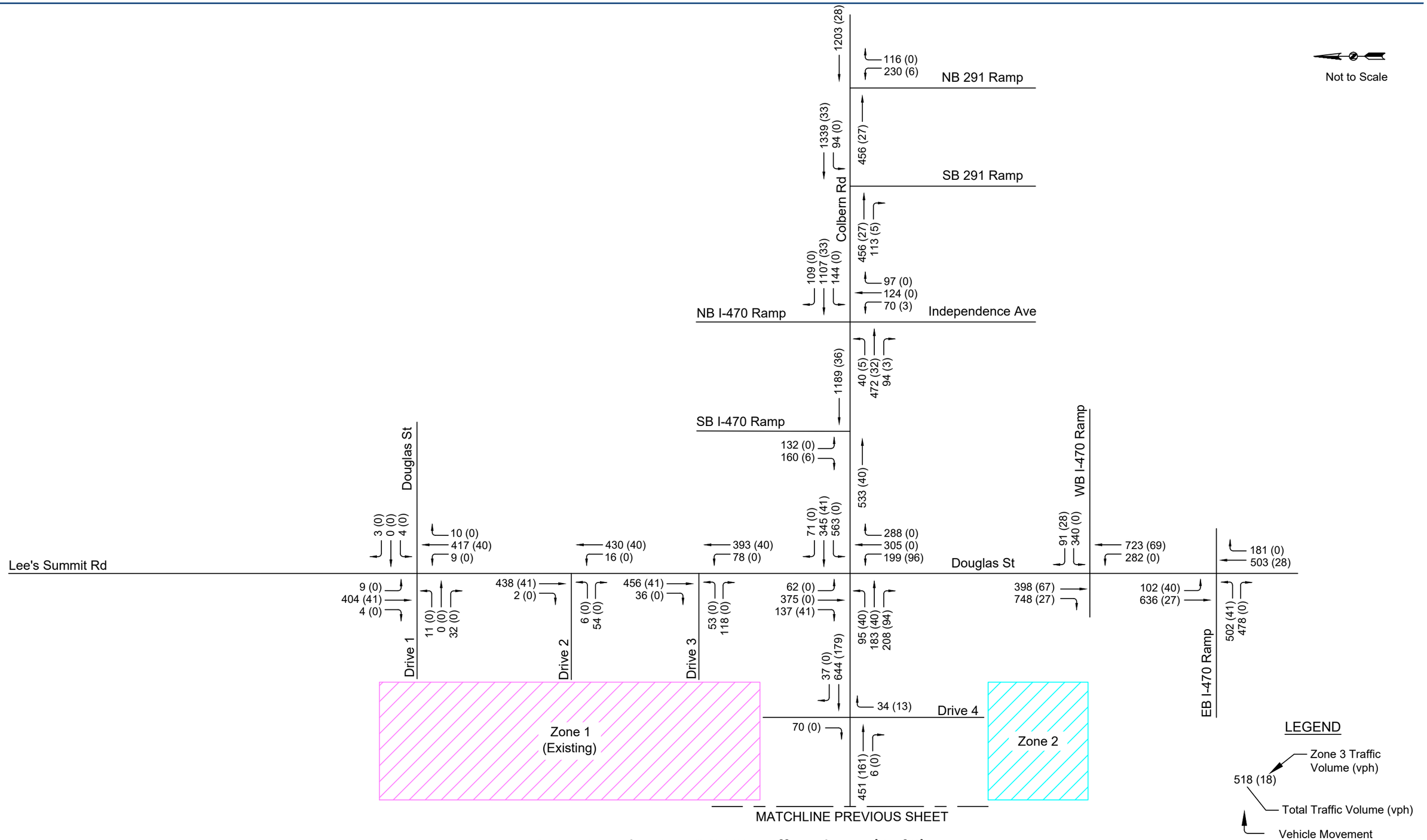

Figure 6 - Existing plus Zone 2-3 AM Traffic Volumes (2 of 2)

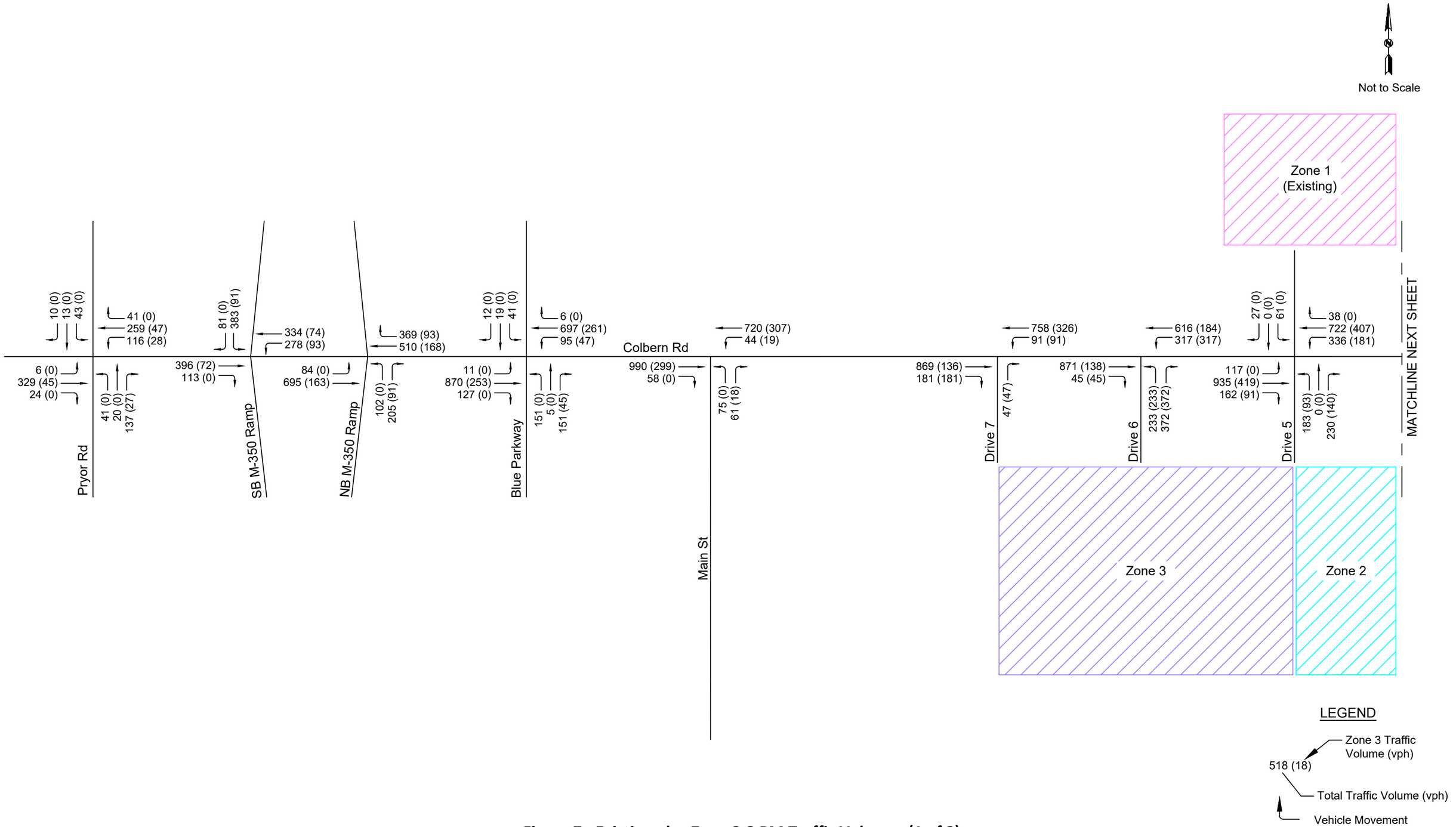

Figure 7 - Existing plus Zone 2-3 PM Traffic Volumes (1 of 2)

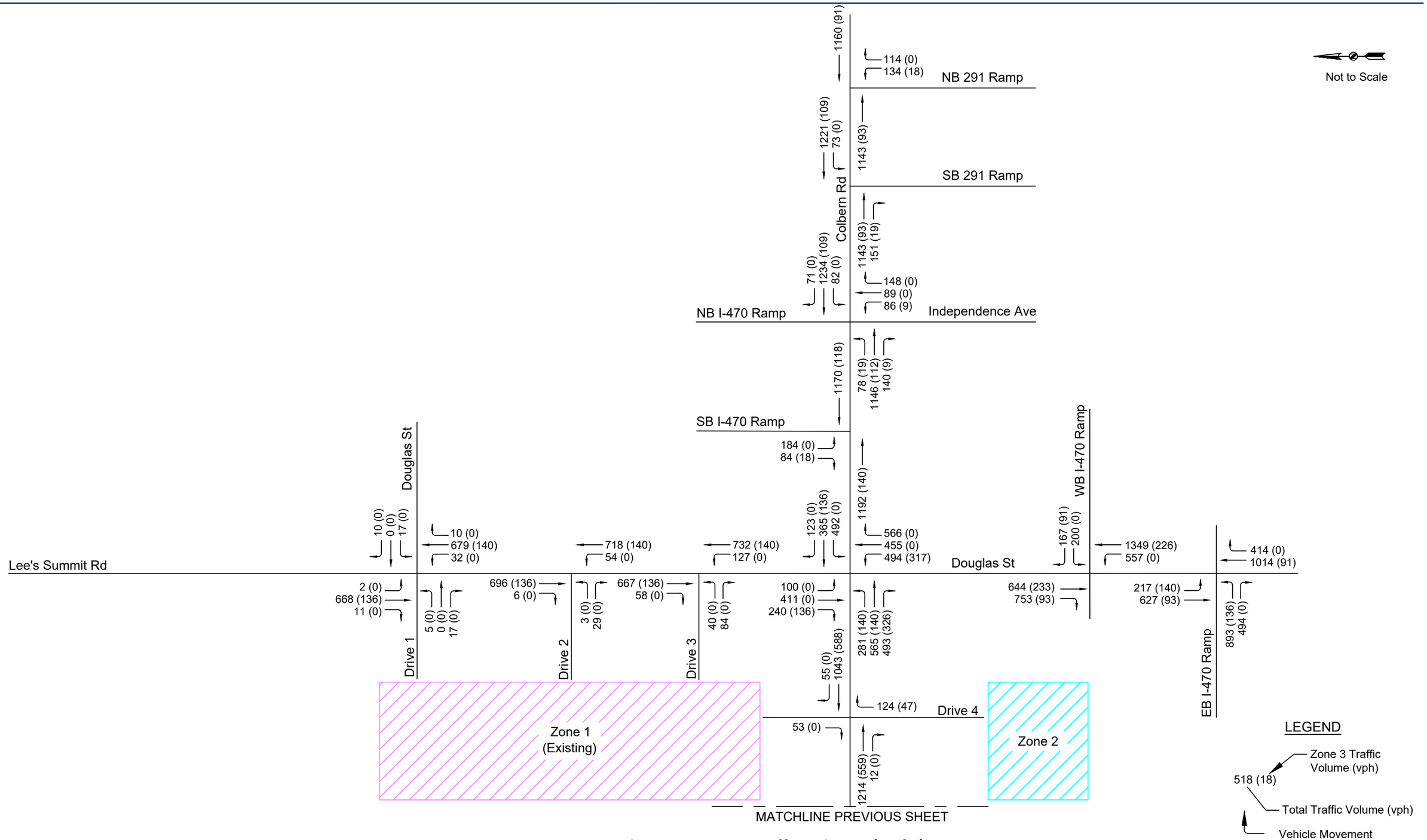

Figure 7 - Existing plus Zone 2-3 PM Traffic Volumes (2 of 2)

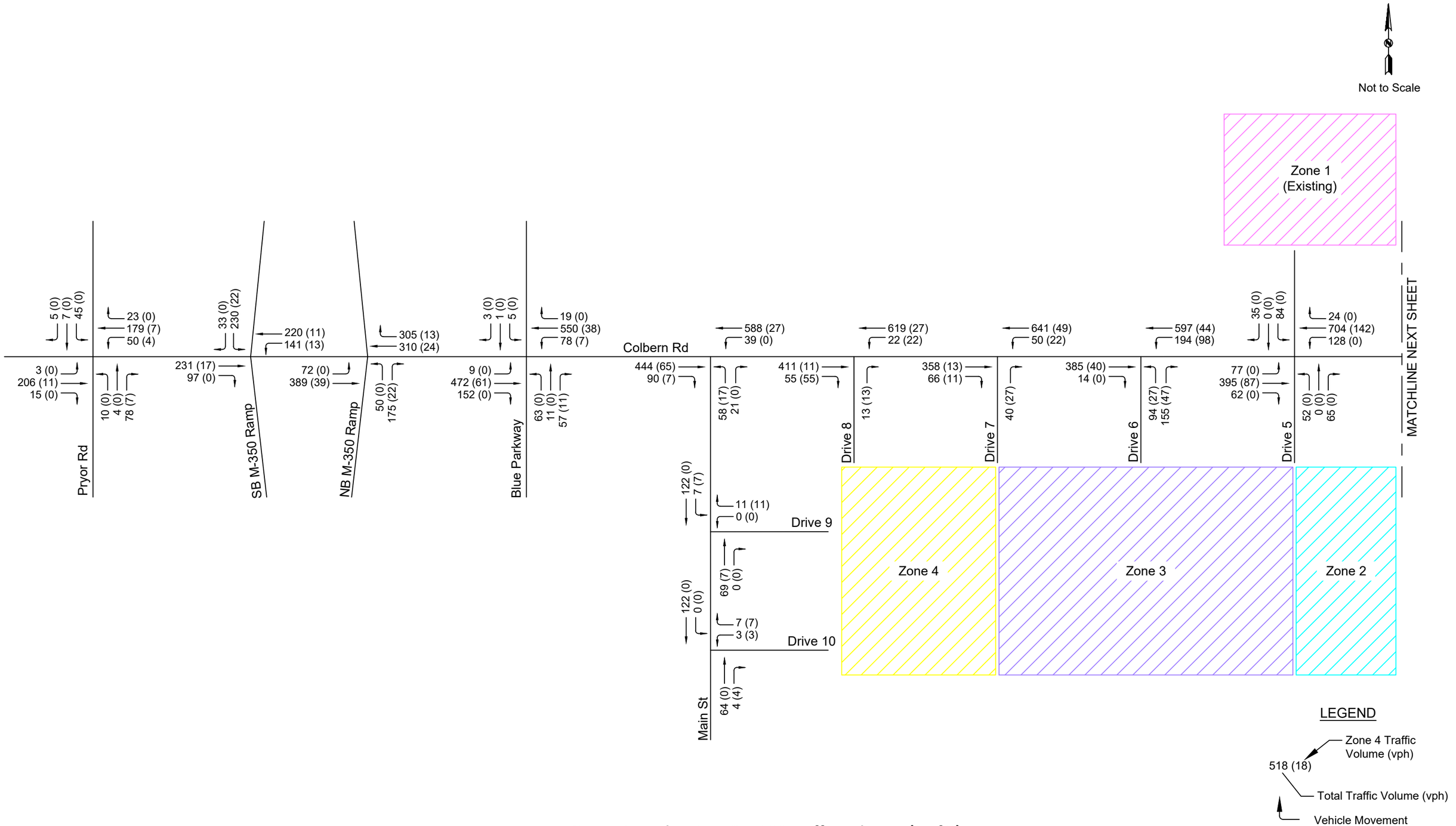

Figure 8 - Existing plus Zone 2-4 AM Traffic Volumes (1 of 2)

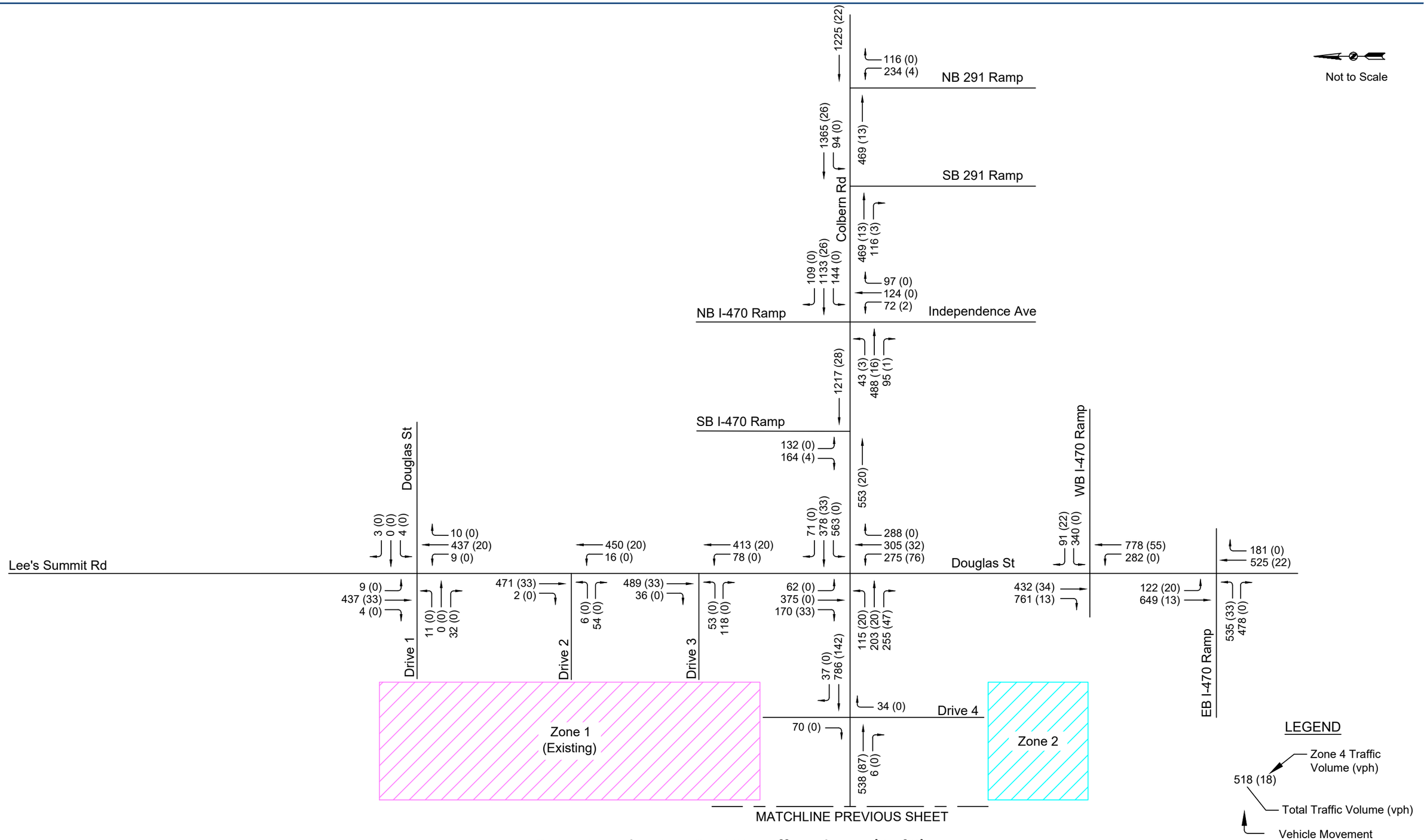

Figure 8 - Existing plus Zone 2-4 AM Traffic Volumes (2 of 2)

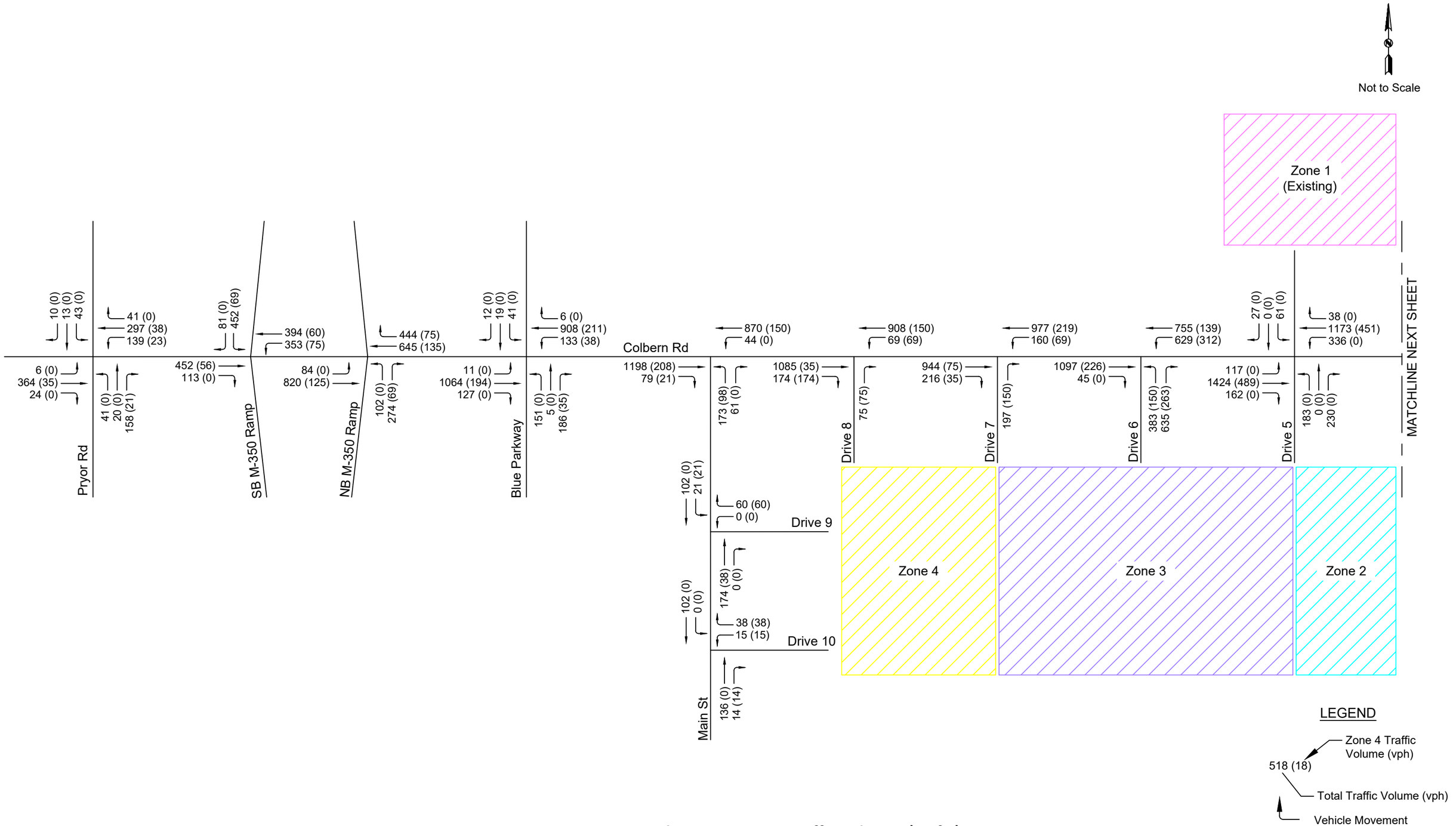

Figure 9 - Existing plus Zone 2-4 PM Traffic Volumes (1 of 2)

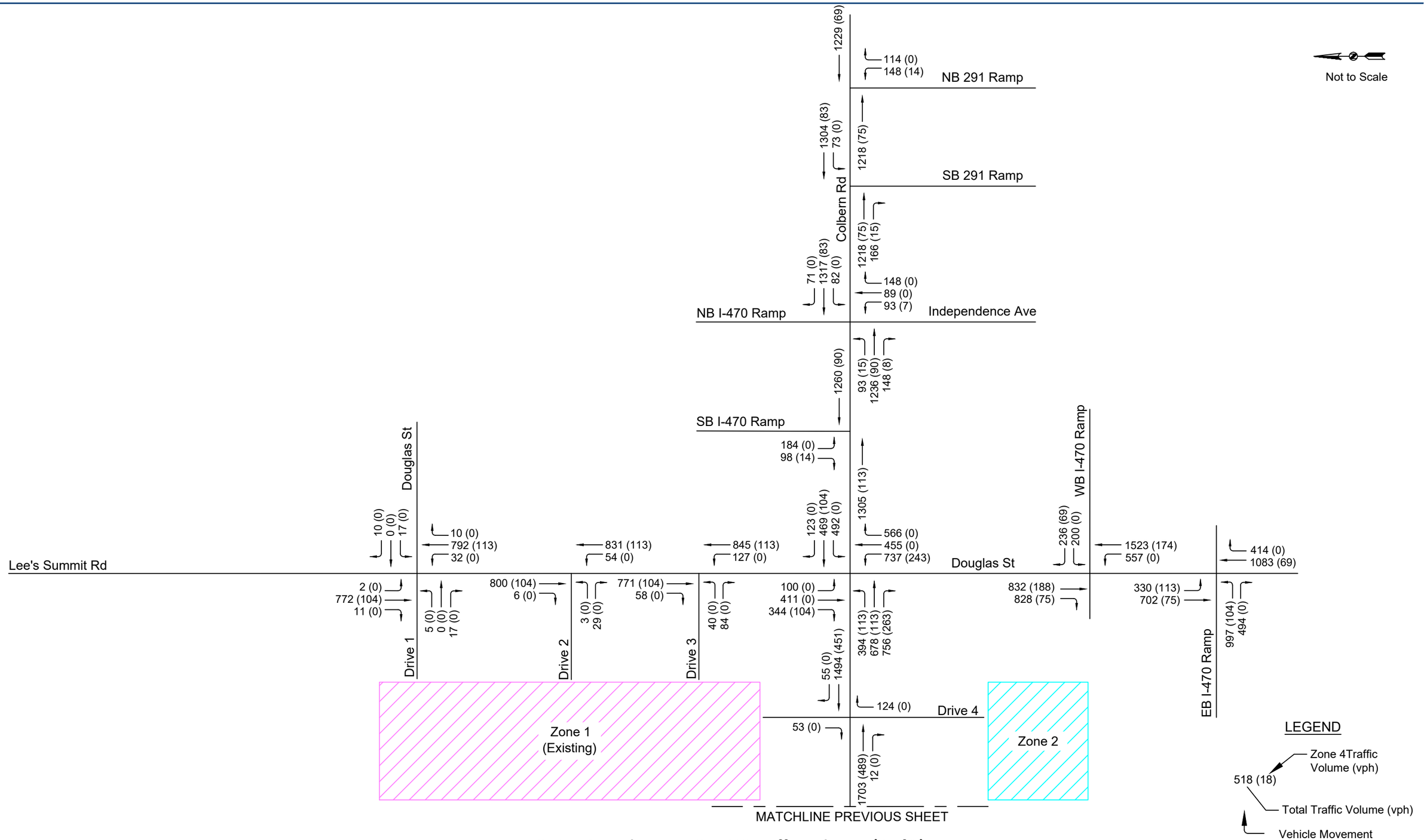

Figure 9 - Existing plus Zone 2-4 PM Traffic Volumes (2 of 2)

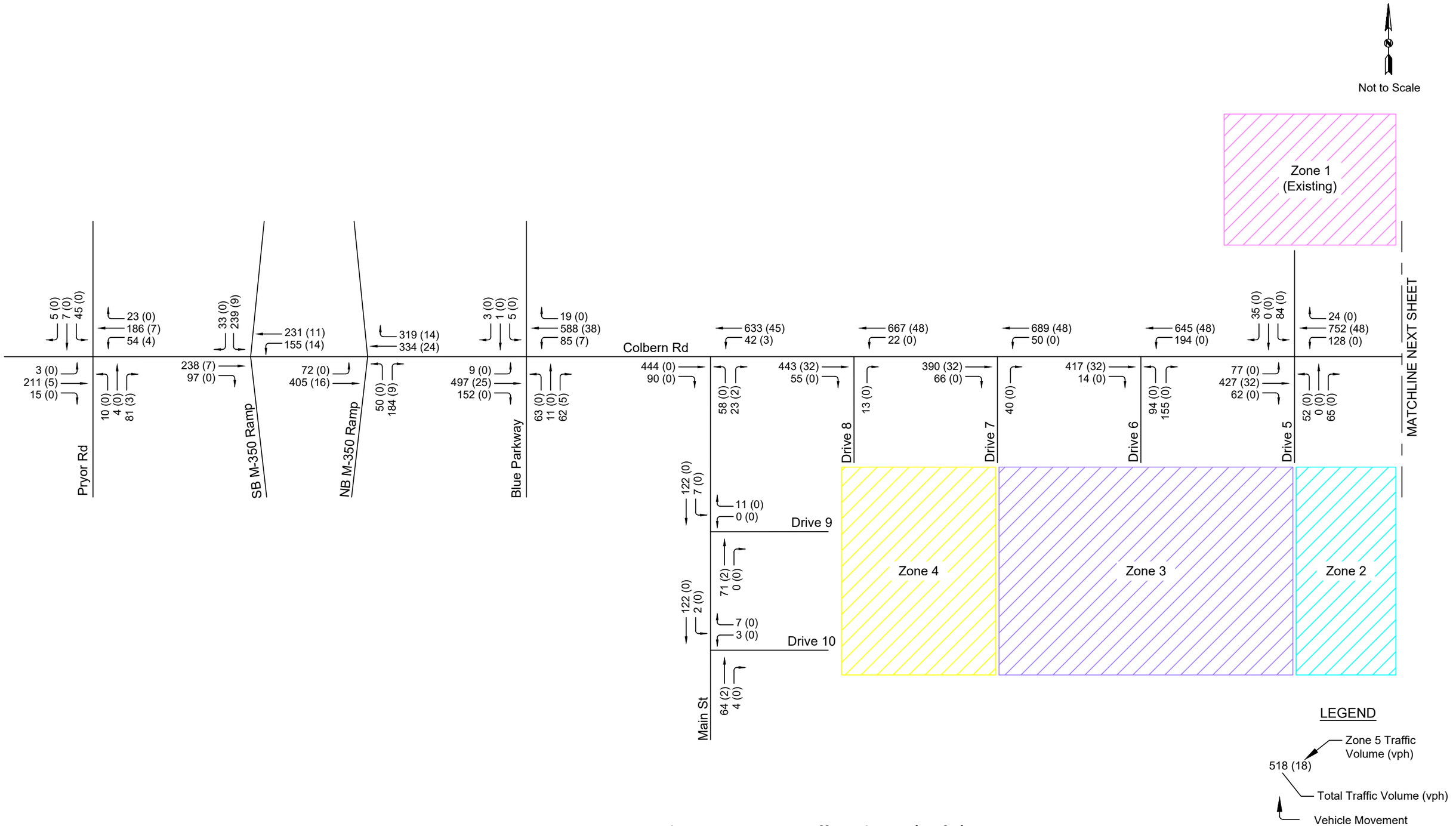

Figure 10 - Existing plus Zone 2-5 AM Traffic Volumes (1 of 2)

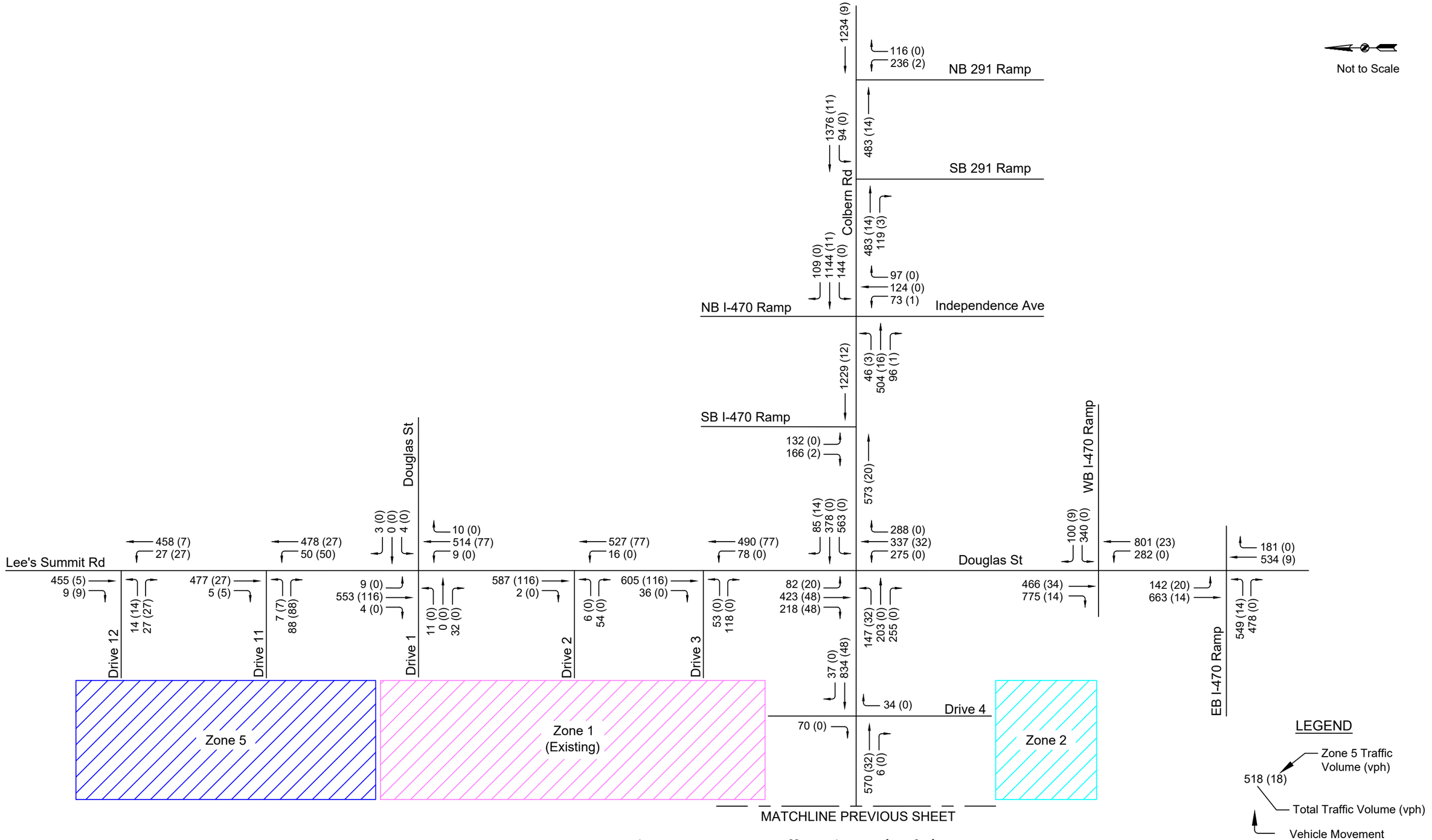

Figure 10 - Existing plus Zone 2-5 AM Traffic Volumes (2 of 2)

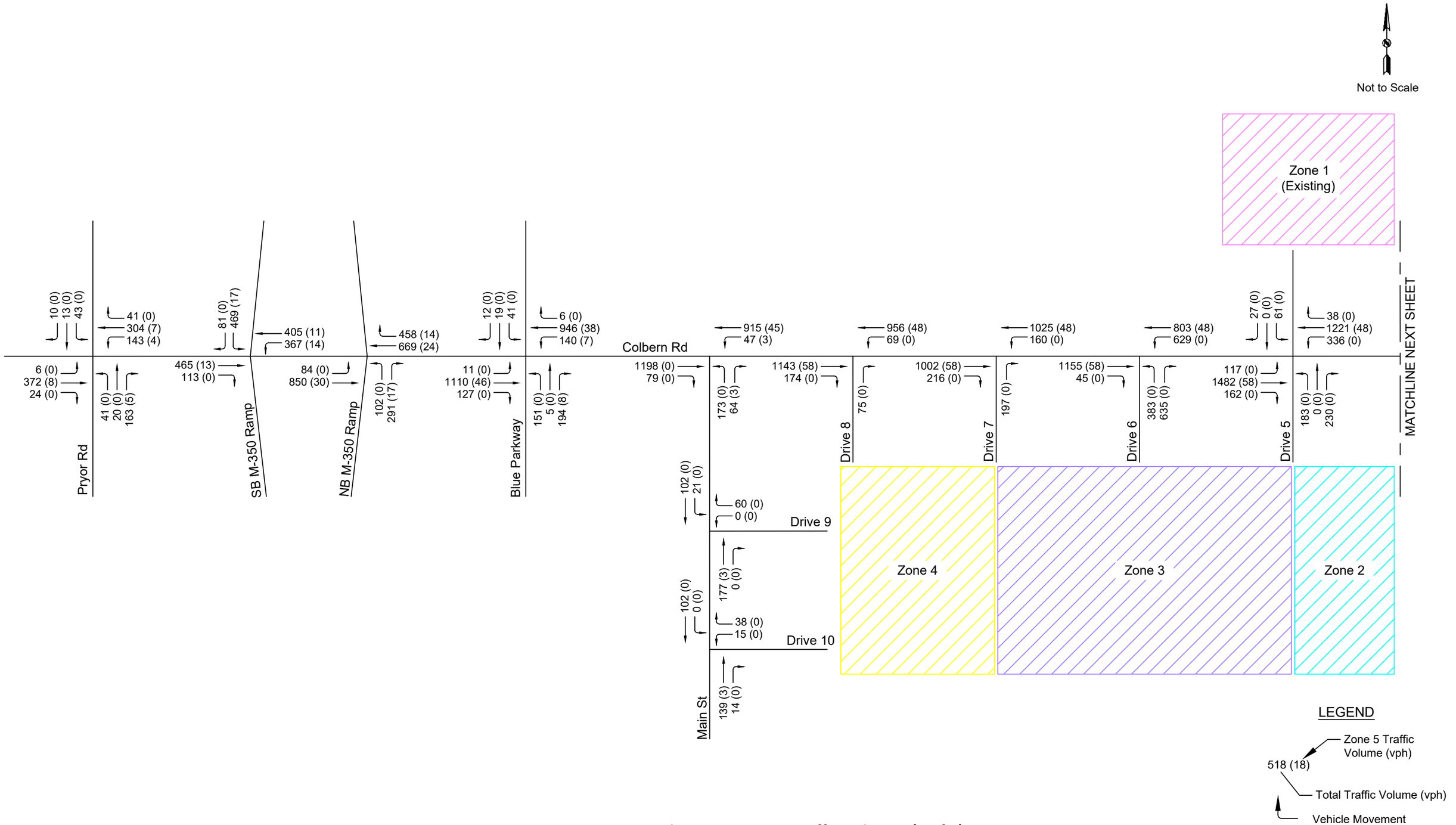

Figure 11 - Existing plus Zone 2-5 PM Traffic Volumes (1 of 2)

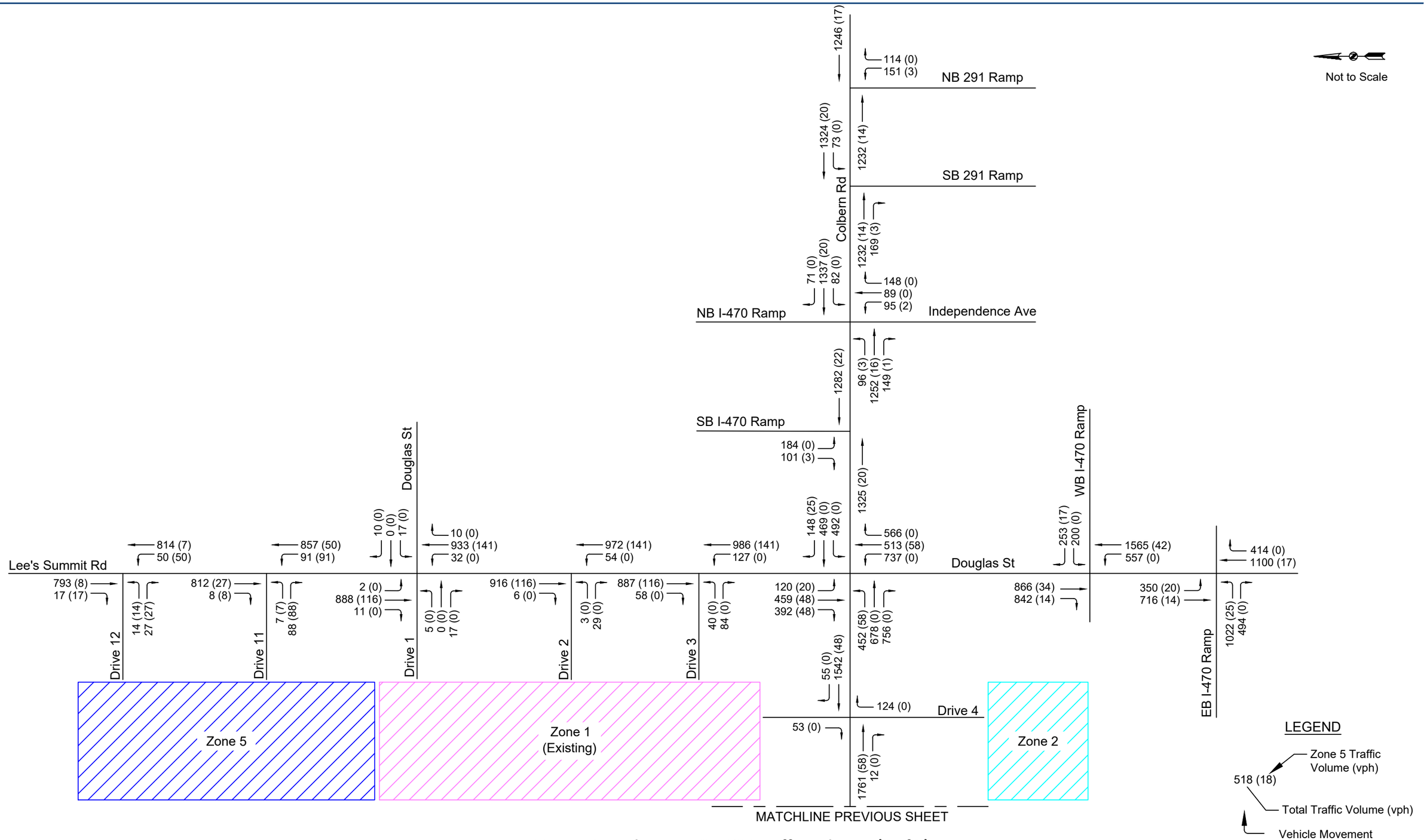

Figure 11 - Existing plus Zone 2-5 PM Traffic Volumes (2 of 2)

Signal Warrant Study

It may be considered justified to install a traffic signal at a location if one or more of the traffic signal warrants listed in the 2023 MUTCD are met. The traffic signal warrants are:

Warrant 1: Eight-Hour Vehicular Volume
Warrant 2: Four-Hour Vehicular Volume
Warrant 3: Peak Hour
Warrant 4: Pedestrian Volume
Warrant 5: School Crossing
Warrant 6: Coordinated Signal System
Warrant 7: Crash Experience
Warrant 8: Roadway Network
Warrant 9: Intersection Near at Grade Crossing

Warrant 3 was evaluated at the analysis intersections as part of this study.

Warrant 3: Peak Hour

The peak hour warrant is satisfied if either of the two following conditions are met:

A: This condition is satisfied if any of the following conditions are met for a period of one hour during an average day:

1. The total stopped time delay experience by the traffic on one minor-street approach (one direction only) controlled by a stop sign equals or exceeds: 4 vehicles-hours for a one-lane approach or five vehicle hours for a two-land approach and

2. The volume on the same minor-street approach (one directions only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes and

3. The total entering volume serviced during the hour equals or exceeds 650 vehicles per hour for intersections with three approaches or 800 vehicles per hour for intersections with four or more approaches.

(Condition A is not being examined in this study)

B: The peak hour warrant is satisfied if the vehicles per hour on both approaches of the major street and the vehicles on the higher volume approach of the minor street for one hour fall above the 2009 MUTCD Warrant 3 curve.

Warrant Analysis

Table 2 summarizes the results of the traffic signal warrant analysis. The raw data and graphs from the 2009 MUTCD are included in the Appendix.

Table 2 – Traffic Signal Warrant Analysis (Warrant 3: Peak Hour)					
Intersection	**Existing Conditions**	**Existing plus Zone 2**	**Existing plus Zone 2-3**	**Existing plus Zone 2-4**	**Existing plus Zone 2-5**
Colbern Road and Drive 4	No	No	No	No	No
Colbern Road and Drive 5	No	**Yes—PM peak hour**	n/a	n/a	n/a
Colbern Road and Drive 6	No	No	**Yes—AM & PM peak**	n/a	n/a
Colbern Road and Drive 7	No	No	No	No	No
Colbern Road and Drive 8	No	No	No	No	No
Colbern Road and Main Street	No	No	**Yes—AM & PM peak**	n/a	n/a
Colbern Road and Pryor Road	No	No	No	**Yes- PM peak hour**	n/a
Main Street and Drive 9	No	No	No	No	No
Main Street and Drive 10	No	No	No	No	No
Lee's Summit Road and Drive 11	No	No	No	No	No
Lee's Summit Road and Drive 12	No	No	No	No	No

Traffic signals should not be installed based on Warrant 3: Peak Hour criteria alone, but this data can be used to act as a trigger for a traffic signal warrant analysis once construction is completed for the various zones.

The raw data and graphs from the 2023 MUTCD are included in the Appendix.

CAPACITY

The capacity analysis for the study intersections was completed using the methodology outlined in the Highway Capacity Manual, 6th Edition. The volume and capacity analysis was completed using Trafficware SYNCHRO software (latest version) and SIDRA software (latest version) for the following scenarios:

- Existing Conditions (peak hour counts, approved trips, and Zone 1 trips)
- Existing plus Zone 2
- Existing plus Zone 3
- Existing plus Zone 4
- Existing plus Zone 5

Level of Service (LOS) is defined as the measure of the quality of traffic flow and is graded from A to F where A is the best situation, F is the worst situation, and D is generally the minimum acceptable level of service. The criteria for determining level of service for signalized and unsignalized study intersections and access points are based on the average vehicle delay and is outlined in Table 3.

Table 3 – Intersection Level of Service

Level of Service (LOS)	Average Control Delay (sec/veh)	
	Unsignalized	Signalized
A	< 10	< 10
B	< 15	< 20
C	< 25	< 35
D	< 35	< 55
E	< 50	< 80
F	≥ 50	≥ 80

Existing Conditions

Analysis was completed for existing conditions (peak hour counts, approved trips, and Zone 1 trips) using approved lane configurations from previous studies and Colbern Road design plans.

Colbern Road and Pryor Road

The through movements of Colbern Road are not stop-controlled and are therefore operating in a free-flow condition. Pryor Road lanes operate at a LOS C or better for the morning and afternoon peak periods and have sufficient capacity for queuing vehicles.

Colbern Road and M-350 Southbound Ramp

All approaches operate at a LOS B or above for the morning and afternoon peak periods and the intersection has sufficient capacity for queuing vehicles. The overall LOS for the intersection is a LOS A during the morning peak period and a LOS B during the afternoon peak period.

Colbern Road and M-350 Northbound Ramp

All approaches operate at a LOS A for the morning and afternoon peak periods and the intersection has sufficient capacity for queuing vehicles. The overall LOS for the signal is a LOS A during the morning and afternoon peak periods.

Colbern Road and Blue Parkway/Unity Way

The overall LOS for the roundabout is a LOS A with all approaches operating at a LOS A. There is sufficient capacity for queuing vehicles.

Colbern Road and Main Street

The through movements of Colbern Road are not stop-controlled and are therefore operating in a free-flow condition. The northbound lanes operate at a LOS C or better and have sufficient capacity for queuing vehicles.

Douglas Street/Lee's Summit Road and Douglas Street/Drive 1

The through movements of Douglas Street/Lee's Summit Road are not stop-controlled and are therefore operating in a free-flow condition. All other movements operate at a LOS C or better and have sufficient capacity for queuing vehicles.

Douglas Street and Drive 2

The through movements of Douglas Street are not stop-controlled and are therefore operating in a free-flow condition. All other movements operate at a LOS B or better and have sufficient capacity for queuing vehicles.

Douglas Street and Drive 3

The through movements of Douglas Street are not stop-controlled and are therefore operating in a free-flow condition. All other movements operate at a LOS C or better and have sufficient capacity for queuing vehicles.

Colbern Road and Drive 4 (RIRO)

The through movements of Colbern Road are not stop-controlled and are therefore operating in a free-flow condition. All other movements operate at a LOS B or better and have sufficient capacity for queuing vehicles.

Colbern Road and Drive 5

The through movements of Colbern Road are not stop-controlled and are therefore operating in a free-flow condition. The southbound left-turn lane operates at a LOS C and all other movements operate at a LOS B or better for the morning and afternoon peak periods. The intersection has sufficient capacity for queuing vehicles.

Colbern Road and Douglas Street

All approaches operate at a LOS C or above for the morning and afternoon peak periods and the intersection has sufficient capacity for queuing vehicles. The overall LOS for the signal is a LOS B during the morning peak hours and a LOS C during the afternoon peak periods.

Colbern Road and I-470 Southbound Off-Ramp

All approaches operate at a LOS B or above for the morning and afternoon peak periods and the intersection has sufficient capacity for queuing vehicles. The overall LOS for the signal is a LOS B during the morning and afternoon peak periods.

Colbern Road and I-470/M-291 Northbound On-Ramp/Independence Ave

All approaches operate at a LOS C or above for the morning and afternoon peak periods and the intersection has sufficient capacity for queuing vehicles. The overall LOS for the signal is a LOS B during the morning and afternoon peak periods.

Colbern Road and M-291 Southbound Ramp

The through movements of Colbern Road are not stop-controlled and are therefore operating in a free-flow condition. All movements operate at a LOS A for the morning and afternoon peak periods.

Colbern Road and M-291 Northbound Ramp

All approaches operate at a LOS B or better for the morning and afternoon peak periods and the intersection has sufficient capacity for queuing vehicles. The overall LOS for the signal is a LOS B during the morning and afternoon peak periods.

Douglas Street and I-470 Westbound Ramp

All approaches at this intersection operate at a LOS D or better and there is sufficient capacity for queuing vehicles. Overall, the signal operates at a LOS B for the morning and afternoon peak periods.

Douglas Street and I-470 Eastbound Ramp

All approaches operate at a LOS D or better for the peak periods, with an overall LOS B for the morning peak period and a LOS C for the afternoon peak period. There is sufficient capacity for queuing vehicles.

The results of the existing conditions analysis are shown for the morning and afternoon peak hours along with lane configuration and queue lengths on Figures 12 and 13.

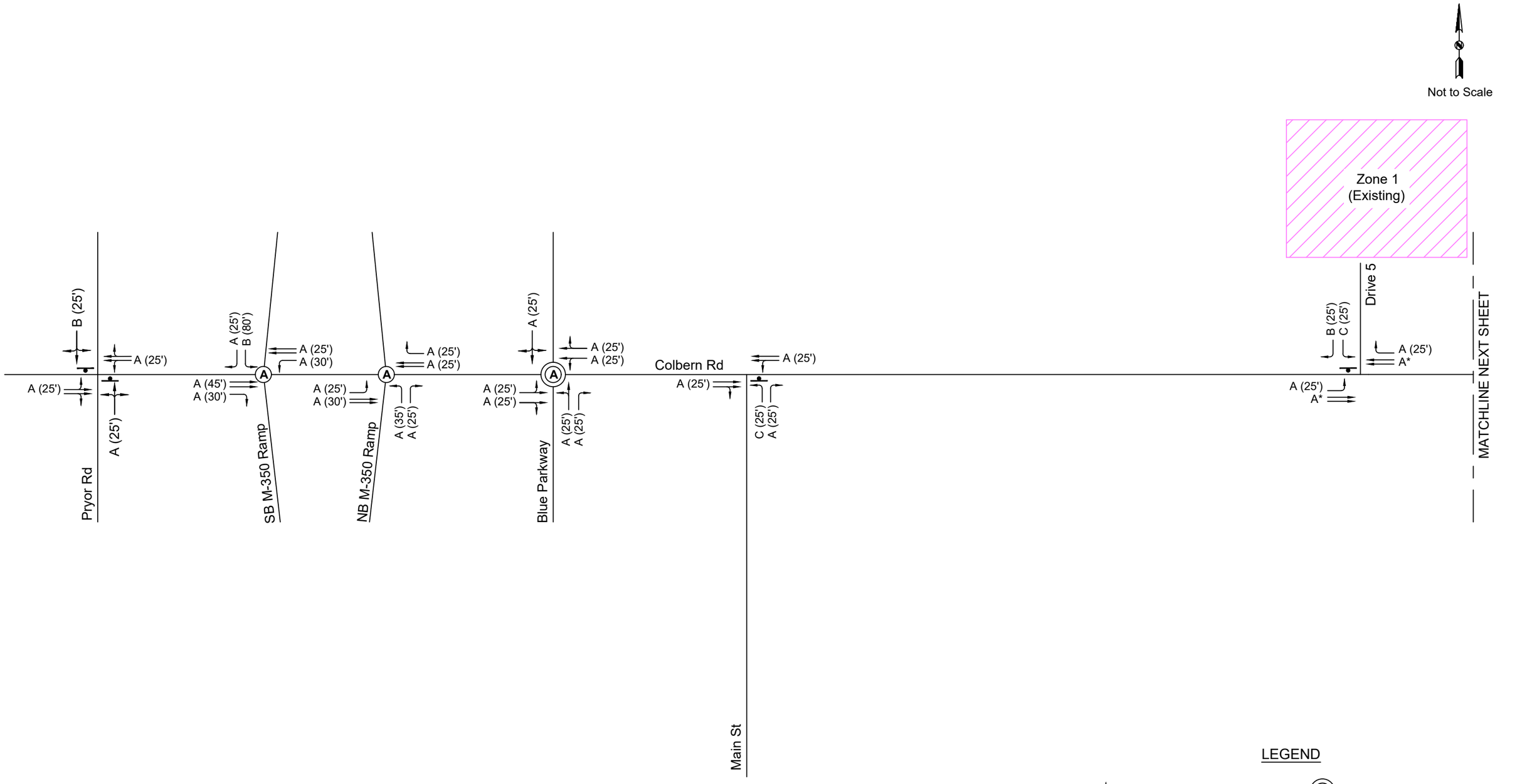

Figure 12 - Existing AM LOS (1 of 2)

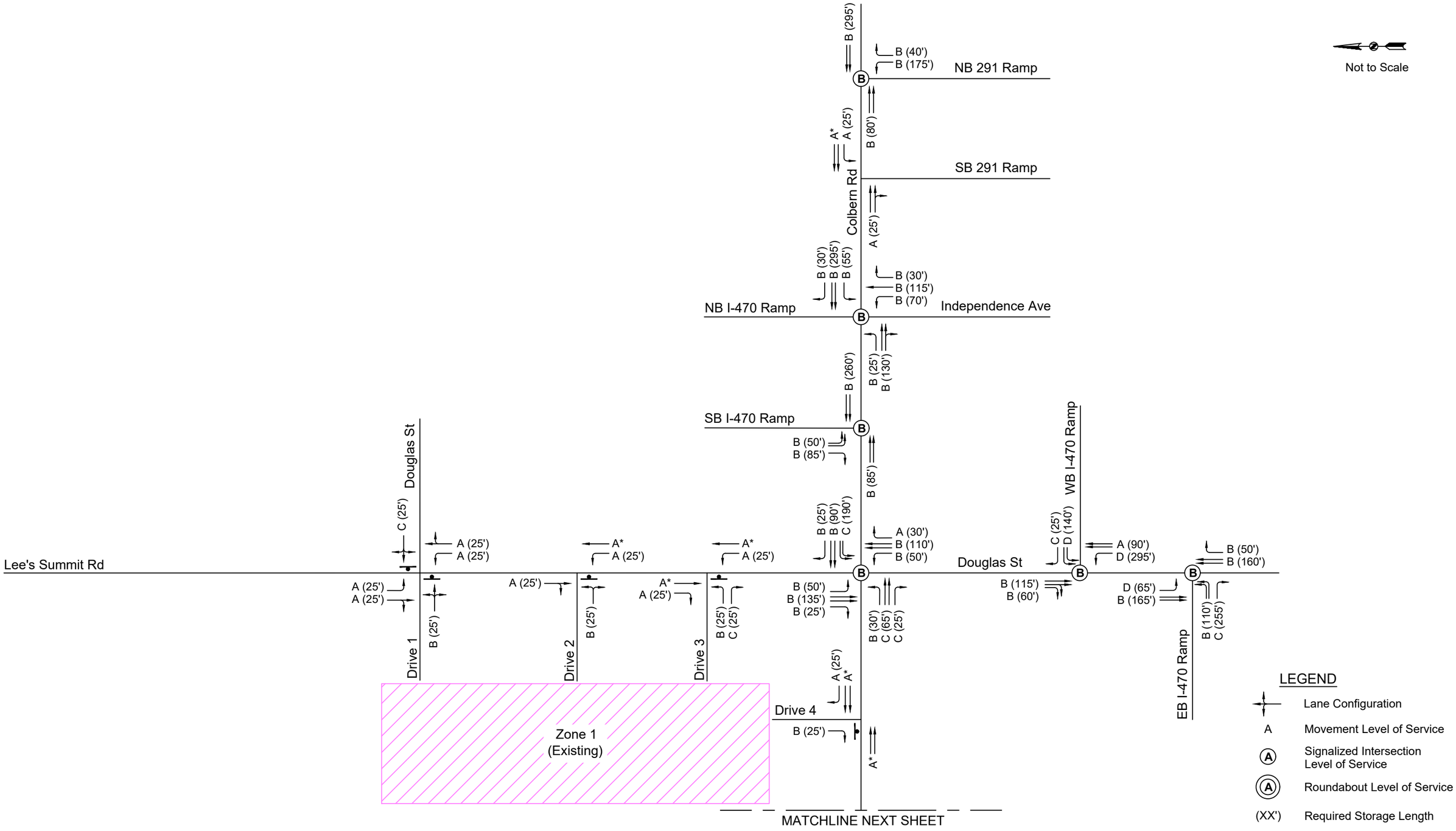

Figure 12 - Existing AM LOS (2 of 2)

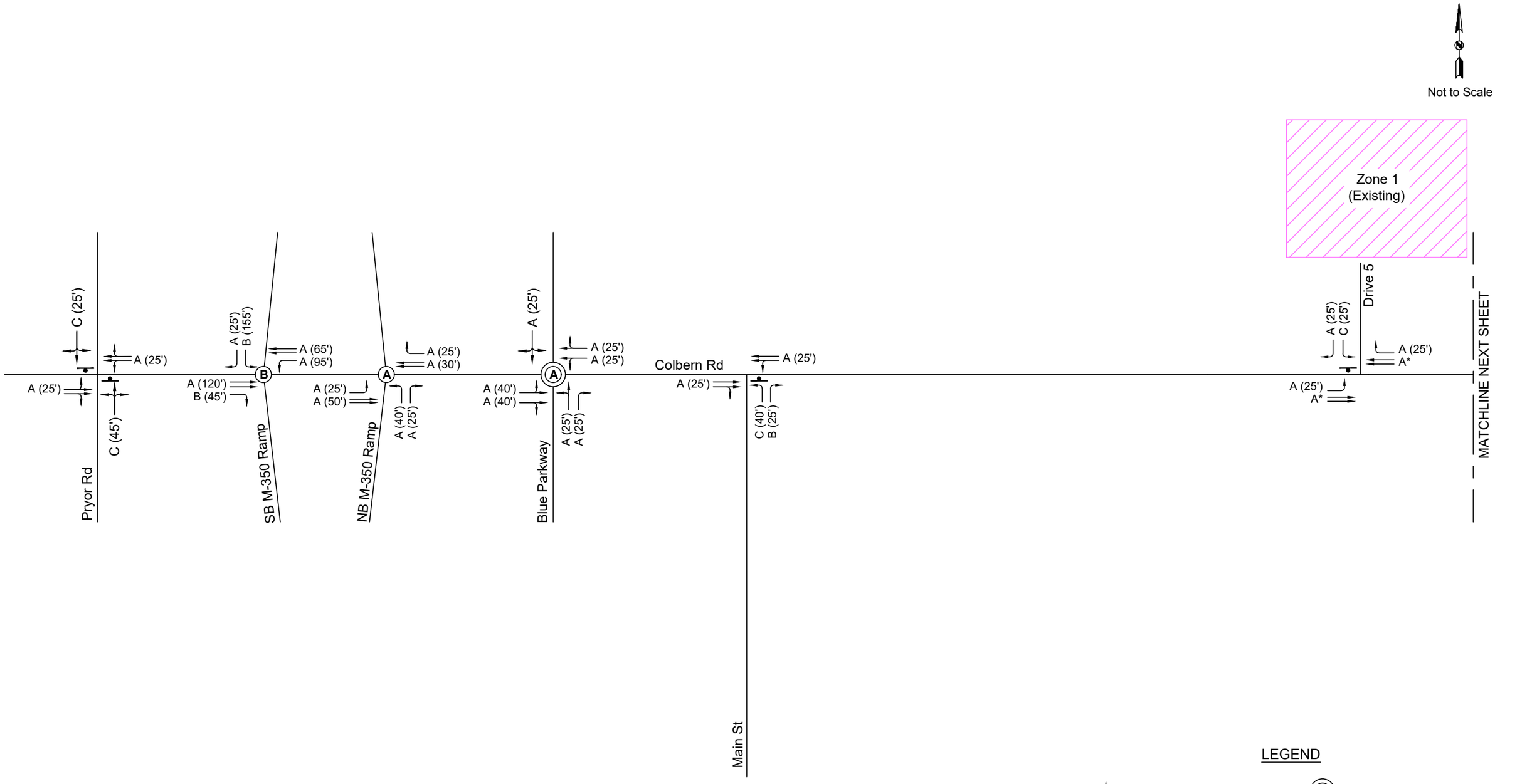

Figure 13 - Existing PM LOS (1 of 2)

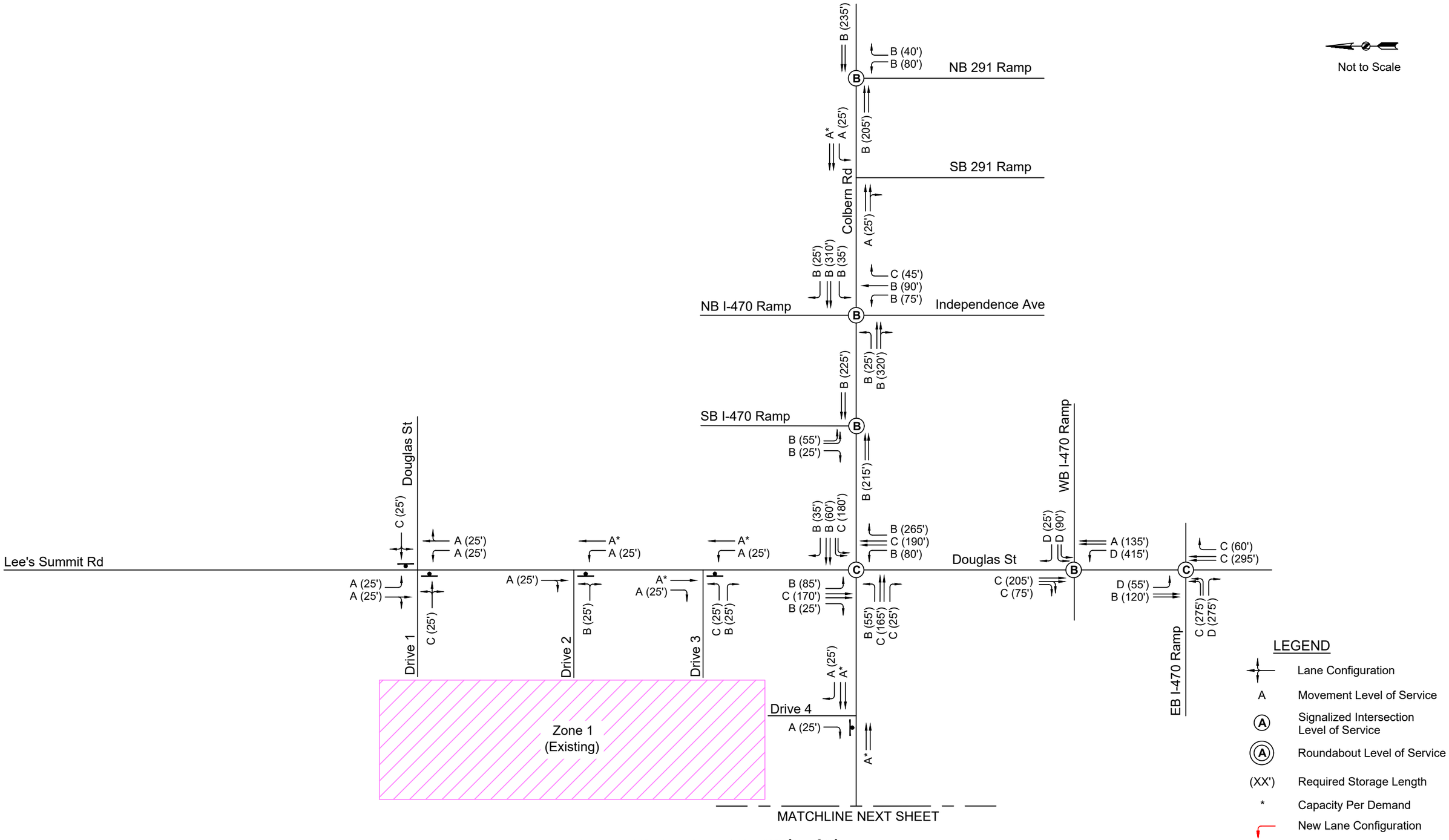

Figure 13 - Existing PM LOS (2 of 2)

Existing Plus Zone 2 Conditions

Signal timings were optimized to account for the additional traffic. Unless noted, existing roadway and lane configurations were used in intersection analysis.

The additional traffic caused minimal changes to the individual lane movement LOS, the overall LOS, or intersection queueing. The following intersections remained at a LOS C or better for all movements and continued to have sufficient capacity for queueing vehicles:

- Colbern Road and Pryor Road
- Colbern Road and M-350 Southbound Ramp
- Colbern Road and M-350 Northbound Ramp
- Colbern Road and Blue Parkway/Unity Way
- Douglas Street/Lee's Summit Road and Douglas Street/Drive 1
- Douglas Street and Drive 2
- Douglas Street and Drive 3
- Colbern Road and I-470 Southbound Off-Ramp
- Colbern Road and I-470 Northbound On-Ramp/Independence Ave
- Colbern Road and M-291 Southbound Ramp
- Colbern Road and M-291 Northbound Ramp

Colbern Road and Main Street

The through movements of Colbern Road are not stop-controlled and continue operating in a free-flow condition. The additional development traffic causes the northbound left-turn lane to operate at a LOS E for the afternoon peak period and the expected delay is 39 seconds. The average control delay drops from a LOS D to LOS E at 35 seconds, so the LOS E is just outside the LOS D criteria by an additional 4 second delay. All other movements continue to operate at a LOS C or better and have sufficient capacity for queuing vehicles.

Colbern Road and Drive 4 (RIRO)

This intersection was analyzed with the south leg of the intersection as a stop-controlled RIRO intersection with a 250-foot eastbound right-turn lane and a 200-ft northbound right-turn only lane.

All movements operate at a LOS B or better and have sufficient capacity for queuing vehicles.

Colbern Road and Drive 5

The intersection was analyzed as a signalized intersection with the addition of a 250-foot eastbound right-turn lane, a 200-foot westbound left-turn lane, a 200-foot northbound left-turn lane, and a shared through/right-turn lane.

All approaches operate at a LOS C or better for the morning and afternoon peak periods and the intersection has sufficient capacity for queuing vehicles. The overall LOS for the signal is a LOS B.

Colbern Road and Douglas Street

There is no significant change in the operations of this intersection from the existing conditions. The additional traffic causes northbound and southbound traffic movements to drop to a LOS D during the afternoon peak period. The LOS D is still within the acceptable criteria and the intersection has sufficient capacity for queuing vehicles for the morning and afternoon peak periods.

Douglas Street and I-470 Westbound Ramp

There is no significant change in the operations of this intersection from the existing conditions. All approaches continue to operate at a LOS D or better; however, the northbound left-turn queue is approaching capacity during the afternoon peak period.

Douglas Street and I-470 Eastbound Ramp

The additional traffic causes the eastbound movement to drop to a LOS E during the afternoon peak period. The intersection has sufficient capacity for queuing vehicles for the morning and afternoon peak periods.

The results of the existing plus Zone 2 analysis for the morning and afternoon peak hour conditions along with lane configuration and queue lengths are shown on Figures 14 and 15.

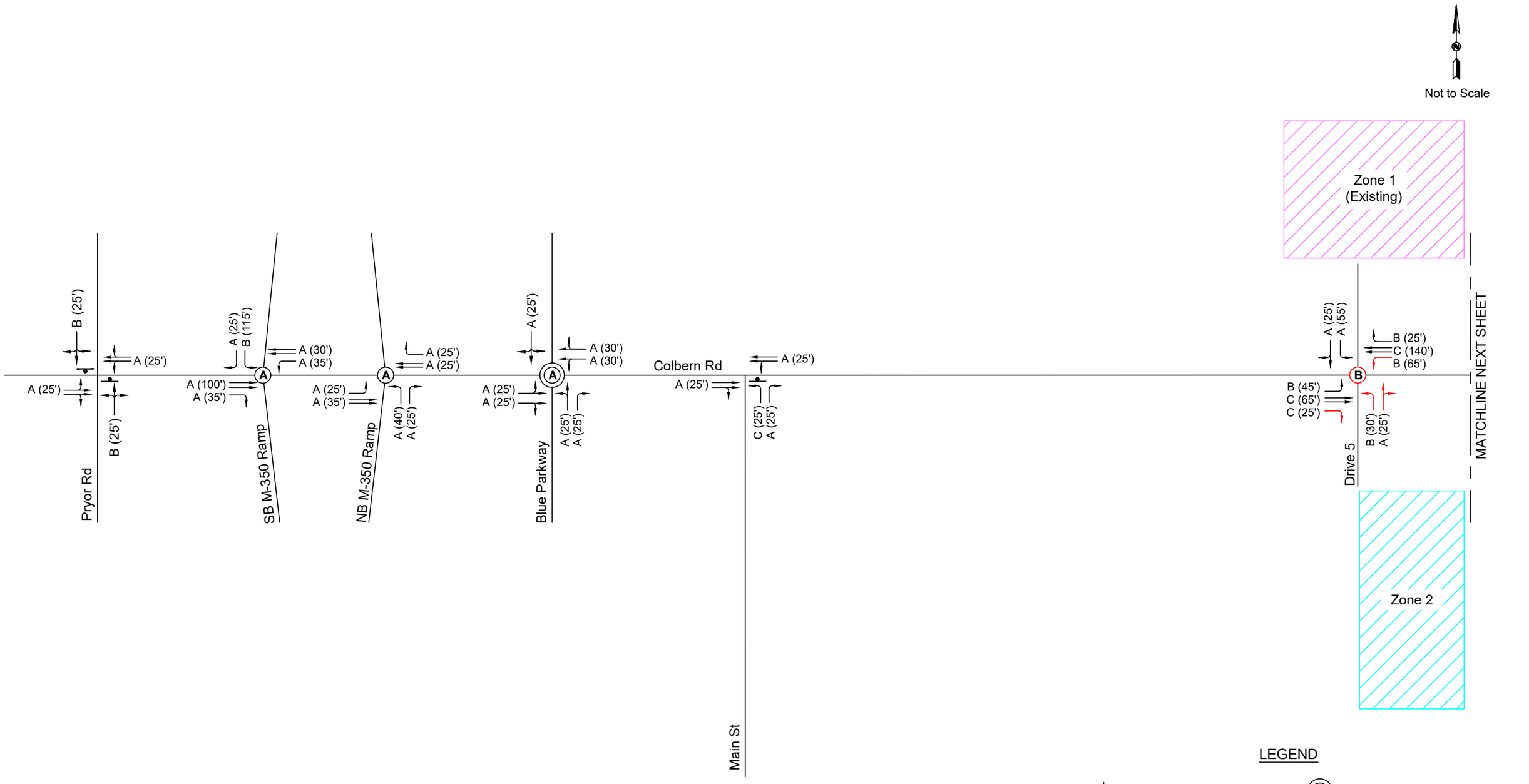

Figure 14 - Existing plus Zone 2 AM LOS (1 of 2)

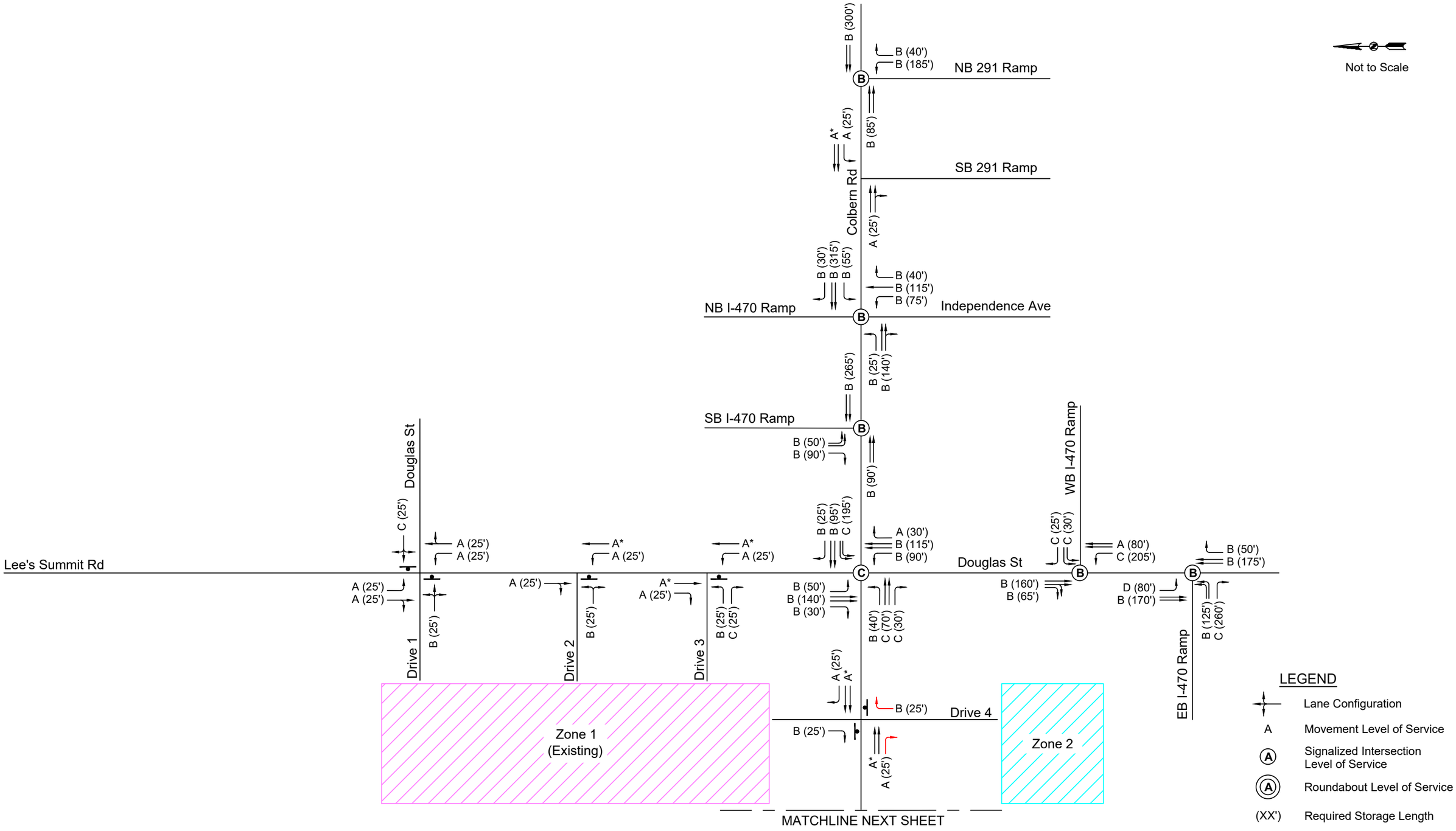

Figure 14 - Existing plus Zone 2 AM LOS (2 of 2)

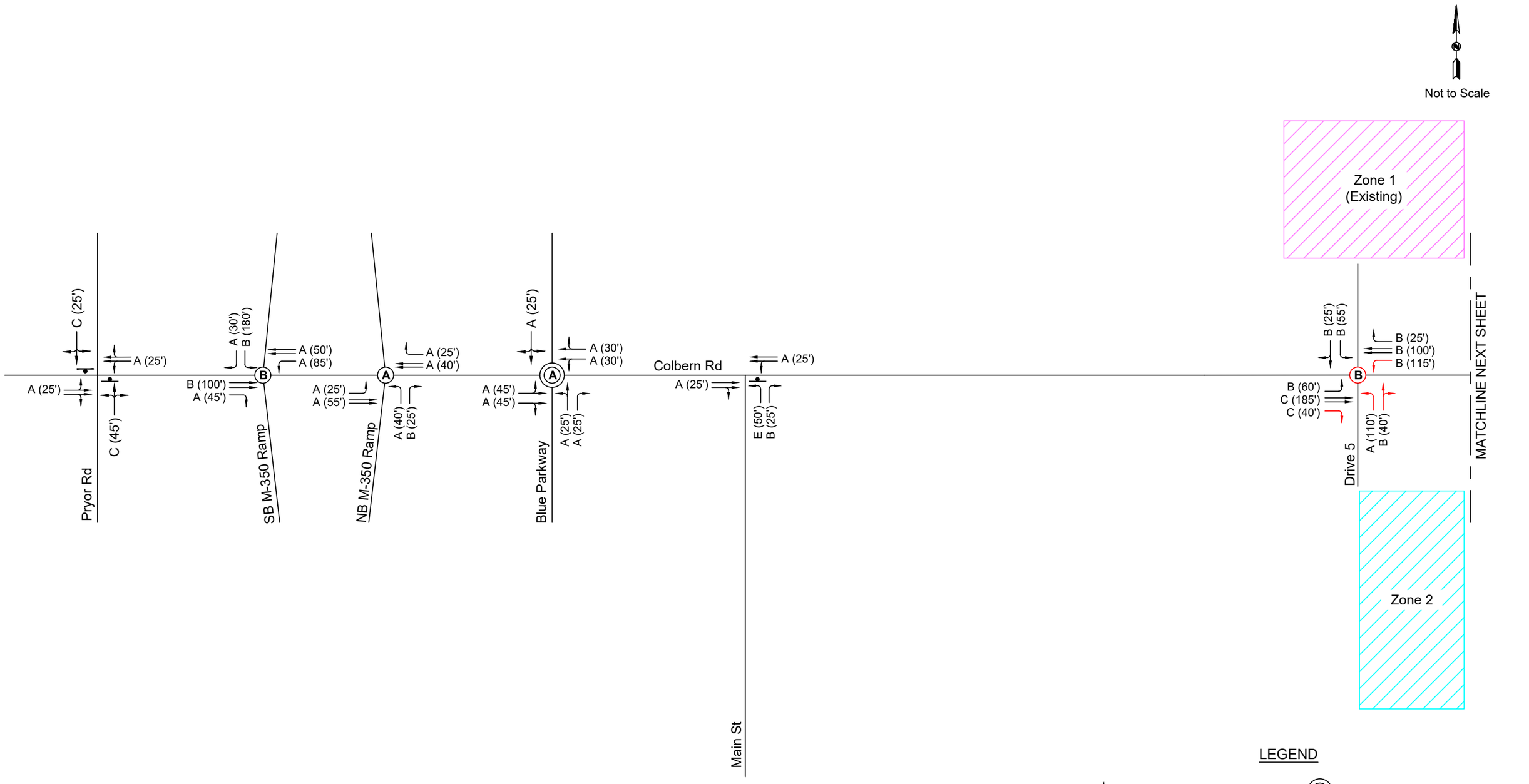

Figure 15 - Existing plus Zone 2 PM LOS (1 of 2)

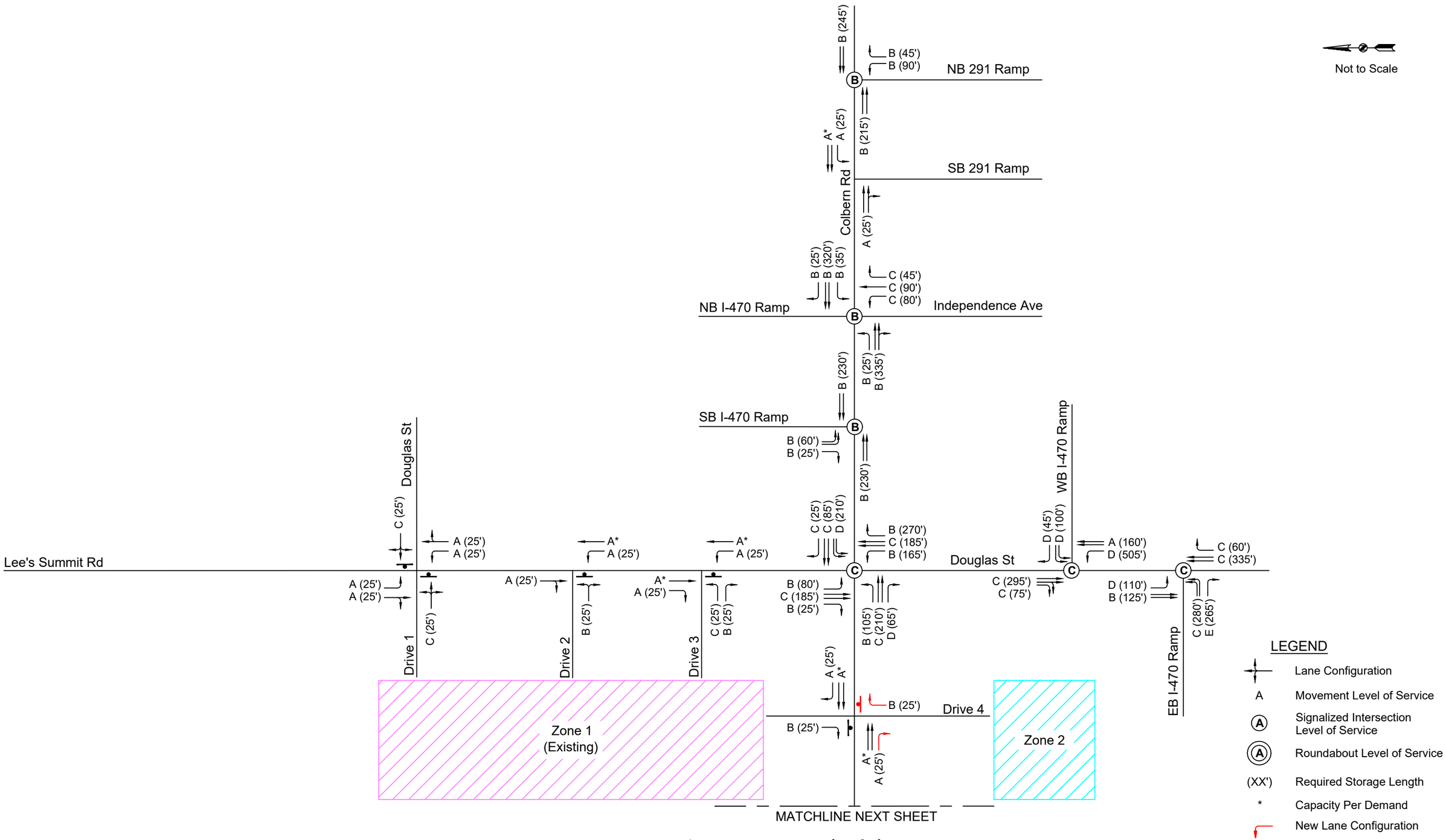

Figure 15 - Existing plus Zone 2 PM LOS (2 of 2)

Existing Plus Zone 2-3 Conditions

Signal timings were optimized to account for the additional traffic. Unless noted, roadway and lane configurations from the previous phase were used in intersection analysis.

The additional traffic caused minimal changes to the individual lane movement LOS, the overall LOS, or intersection queueing. The following intersections remained at a LOS C or better for all movements and continued to have sufficient capacity for queueing vehicles:

- Colbern Road and M-350 Southbound Ramp
- Colbern Road and M-350 Northbound Ramp
- Colbern Road and Blue Parkway/Unity Way
- Douglas Street/Lee's Summit Road and Douglas Street/Drive 1
- Douglas Street and Drive 2
- Douglas Street and Drive 3
- Douglas Street and Drive 4 (RIRO)
- Douglas Street and Drive 5
- Colbern Road and I-470 Southbound Off-Ramp
- Colbern Road and I-470 Northbound On-Ramp/Independence Ave
- Colbern Road and M-291 Southbound Ramp
- Colbern Road and M-291 Northbound Ramp

Colbern Road and Pryor Road

There is no significant change in the operations of this intersection from the existing conditions. The additional traffic causes the southbound lane to drop to a LOS D; however, this is still within the acceptable criteria and the intersection has sufficient capacity for queuing vehicles for the morning and afternoon peak periods.

Colbern Road and Main Street

This intersection was analyzed as signalized as it is expected to be warranted with this phase of development. All approaches at this intersection operate at a LOS B or above and the intersection has sufficient capacity for queuing vehicles.

Colbern Road and Drive 6

The intersection was analyzed as a signalized intersection with the addition of a 250-foot eastbound right-turn lane, a 200-foot westbound left-turn lane, a 200-foot northbound left-turn lane, and a right-turn lane.

All approaches operate at a LOS C or better for the morning and afternoon peak periods and the intersection has sufficient capacity for queuing vehicles. The overall LOS for the signal is a LOS B.

Colbern Road and Drive 7 (3/4 access)

The intersection was analyzed as a ¾ access with a 250-foot eastbound right-turn lane, a 200-foot westbound left-turn lane, and a 200-ft northbound right-turn only lane.

All movements operate at a LOS B or better and have sufficient capacity for queuing vehicles.

Colbern Road and Douglas Street

The additional traffic causes the westbound dual-left turn to drop to a LOS E during the afternoon peak period. Various movements are approaching queuing capacity for the morning and afternoon peak periods.

Douglas Street and I-470 Westbound Ramp

There is no significant change in the operations of this intersection from the existing conditions. All approaches continue to operate at a LOS D or better; however, the northbound left-turn queue is approach capacity during the afternoon peak period.

Douglas Street and I-470 Eastbound Ramp

The additional traffic causes the eastbound movement to drop to a LOS F and the southbound left-turns to a LOS E during the afternoon peak period. Some intersection queues are approaching capacity.

The results of the existing plus Zone 2-3 analysis for the morning and afternoon peak hour conditions along with lane configuration and queue lengths are shown on Figures 16 and 17.

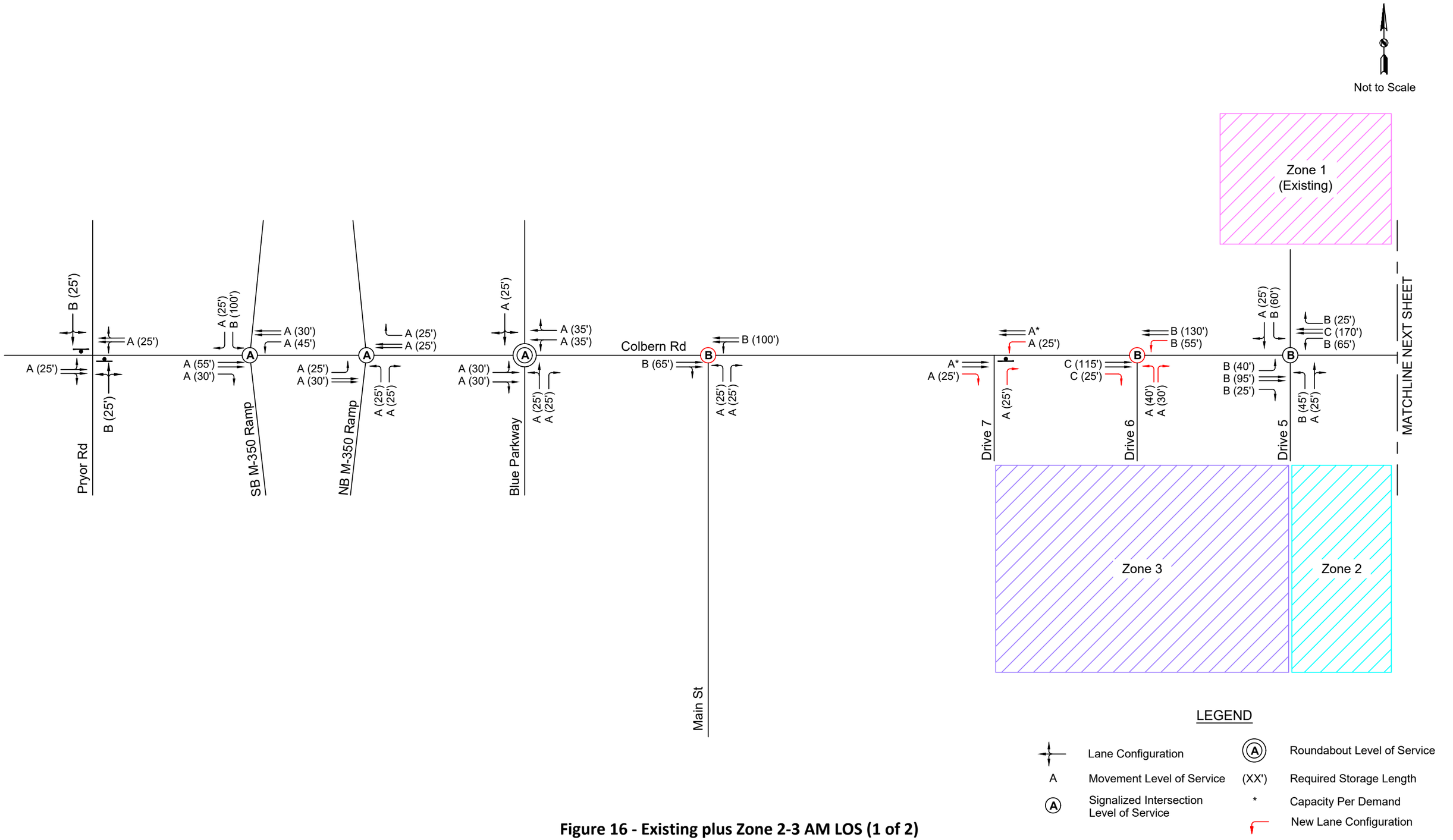

Figure 16 - Existing plus Zone 2-3 AM LOS (1 of 2)

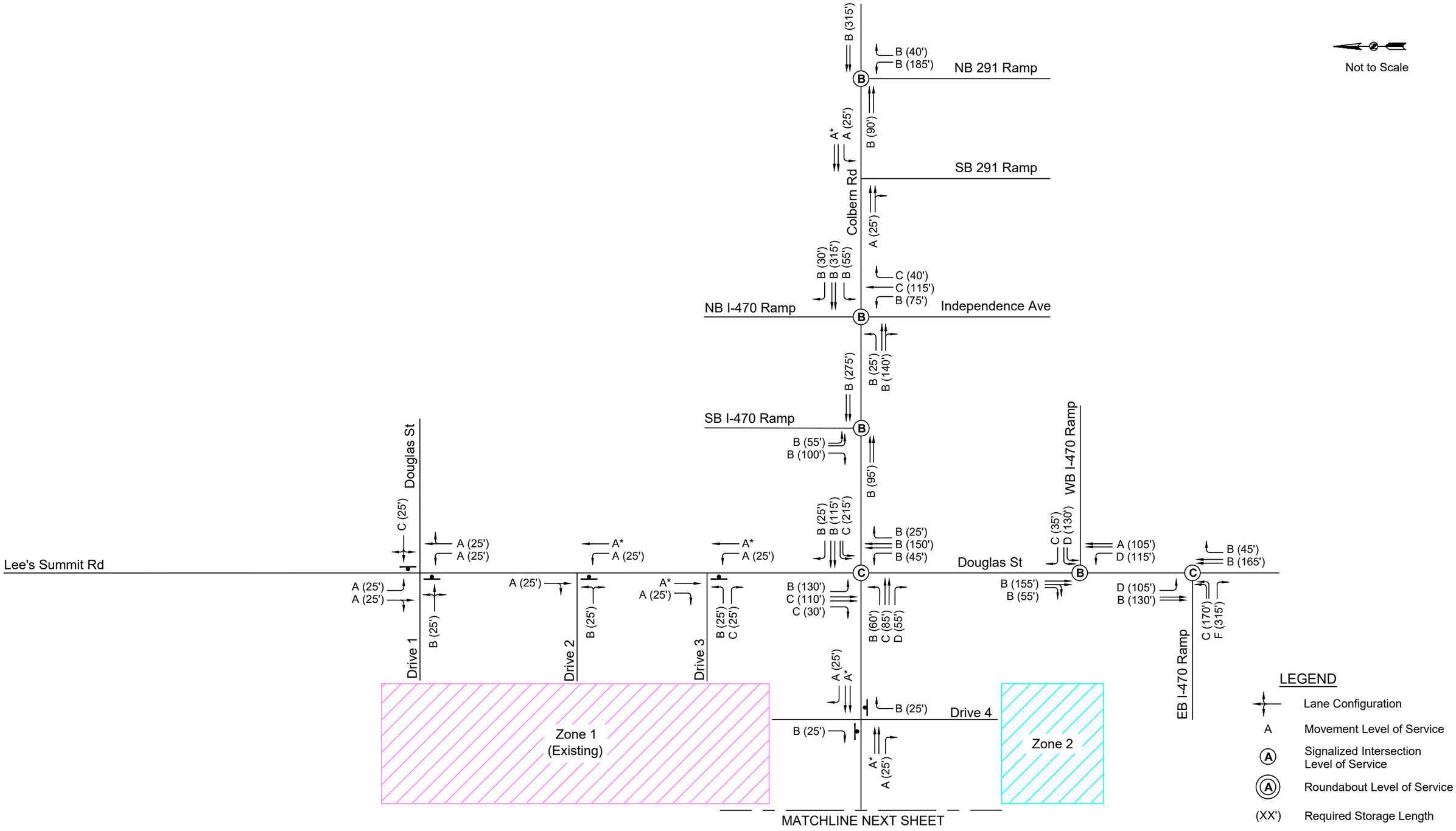

Figure 16 - Existing plus Zone 2-3 AM LOS (2 of 2)

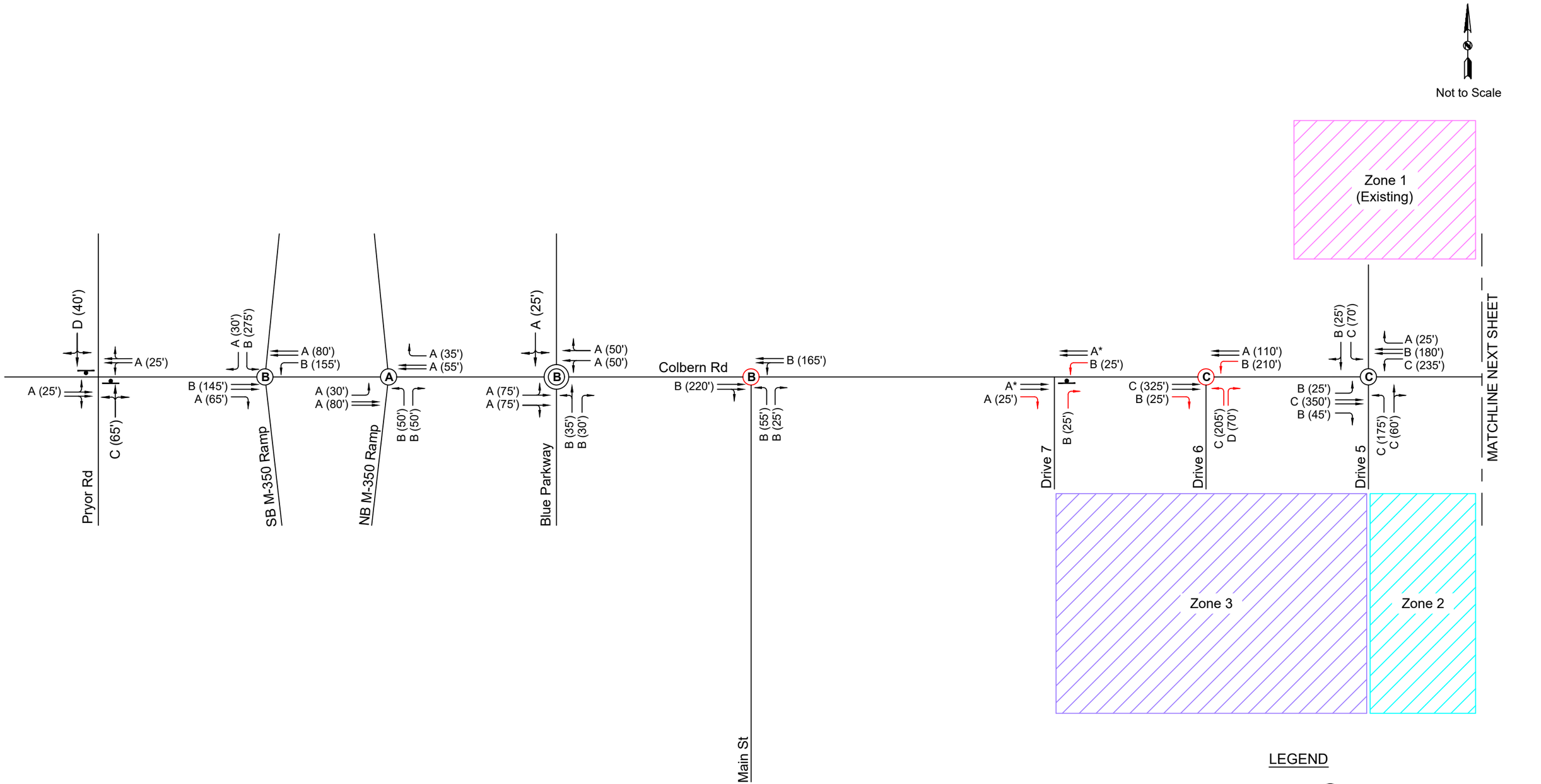

Figure 17 - Existing plus Zone 2-3 PM LOS (1 of 2)

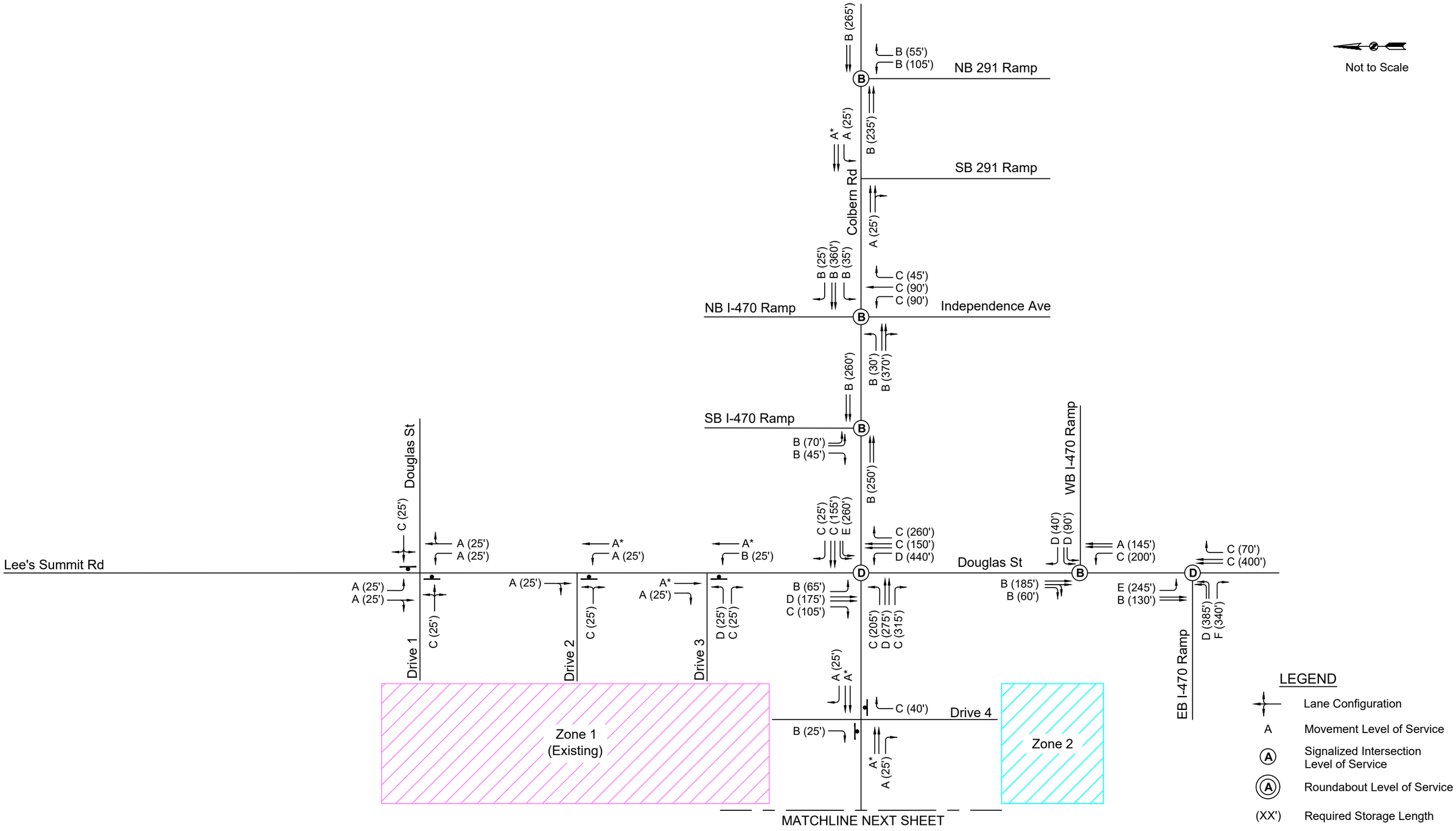

Figure 17 - Existing plus Zone 2-3 PM LOS (2 of 2)

Existing Plus Zone 2-4 Conditions

Signal timings were optimized to account for the additional traffic. Unless noted, the previous phase roadway and lane configurations were used in intersection analysis.

The additional traffic caused minimal changes to the individual lane movement LOS, the overall LOS, or intersection queueing. The following intersections remained at a LOS C or better for all movements and continued to have sufficient capacity for queueing vehicles:

- Colbern Road and M-350 Southbound Ramp
- Colbern Road and M-350 Northbound Ramp
- Colbern Road and Blue Parkway/Unity Way
- Colbern Road and Main Street
- Douglas Street and Drive 2
- Douglas Street and Drive 3
- Colbern Road and Drive 7 (3/4 access)
- Colbern Road and I-470 Southbound Off-Ramp
- Colbern Road and I-470 Northbound On-Ramp/Independence Ave
- Colbern Road and M-291 Southbound Ramp
- Colbern Road and M-291 Northbound Ramp

Colbern Road and Pryor Road

During this phase the additional traffic on Colbern Road will cause the southbound lane to drop to a LOS E. All other movements continue to operate at a LOS D or better and have sufficient capacity for queuing vehicles. The expected delay for the southbound movement is 38.2 seconds. The maximum delay for LOS D is 35 seconds, so the movement is 3.2 seconds outside the LOS D criteria.

Installing a traffic signal to alleviate vehicle delay at the intersection is not recommended as the intersection traffic volumes are not likely to meet warrant criteria.

Douglas Street/Lee's Summit Road and Douglas Street/Drive 1

There is no significant change in the operations of this intersection from the existing conditions. The additional traffic causes the westbound lane to drop to a LOS D; however, this is still within the acceptable criteria and the intersection has sufficient capacity for queuing vehicles for the morning and afternoon peak periods.

Colbern Road and Drive 5

This intersection was analyzed with an additional westbound left-turn lane.

All movements operate at a LOS D or better and the intersection has sufficient capacity for queuing vehicles.

Colbern Road and Drive 6

This intersection was analyzed with an additional westbound left-turn lane, northbound left-turn lane, and northbound right turn-lane.

All movements are expected to operate at a LOS C or better and the intersection has sufficient capacity for queuing vehicles.

Colbern Road and Drive 8 (3/4 access)

The intersection was analyzed as a ¾ access with a 250-foot eastbound right-turn lane, a 200-foot westbound left-turn lane, and a 200-ft northbound right-turn only lane.

All movements operate at a LOS B or better and have sufficient capacity for queuing vehicles.

Main Street and Drive 9

This intersection was analyzed as a full access intersection with a westbound shared left/right-turn lane.

All movements operate at a LOS B or better and have sufficient capacity for queuing vehicles.

Main Street and Drive 10

This intersection was analyzed as a full access intersection with a westbound shared left/right-turn lane.

All movements operate at a LOS B or better and have sufficient capacity for queuing vehicles.

Colbern Road and Douglas Street

The intersection was analyzed with an additional northbound right-turn lane and left-turn lane and an additional eastbound right-turn lane and left-turn lane.

During the afternoon peak period the southbound left-turn and westbound left-turn lanes operate at a LOS E. All other movements during the morning and afternoon peak period operate at a LOS D or above and there is sufficient capacity for queueing vehicles.

Douglas Street and I-470 Ramps

The additional traffic causes multiple movements to drop below an acceptable LOS threshold and vehicle queue lengths exceed their available storage. A future study of this intersection with large scale improvements should be coordinated.

The results of the existing plus Zone 2-4 analysis for the morning and afternoon peak hour conditions along with lane configuration and queue lengths are shown on Figures 18 and 19.

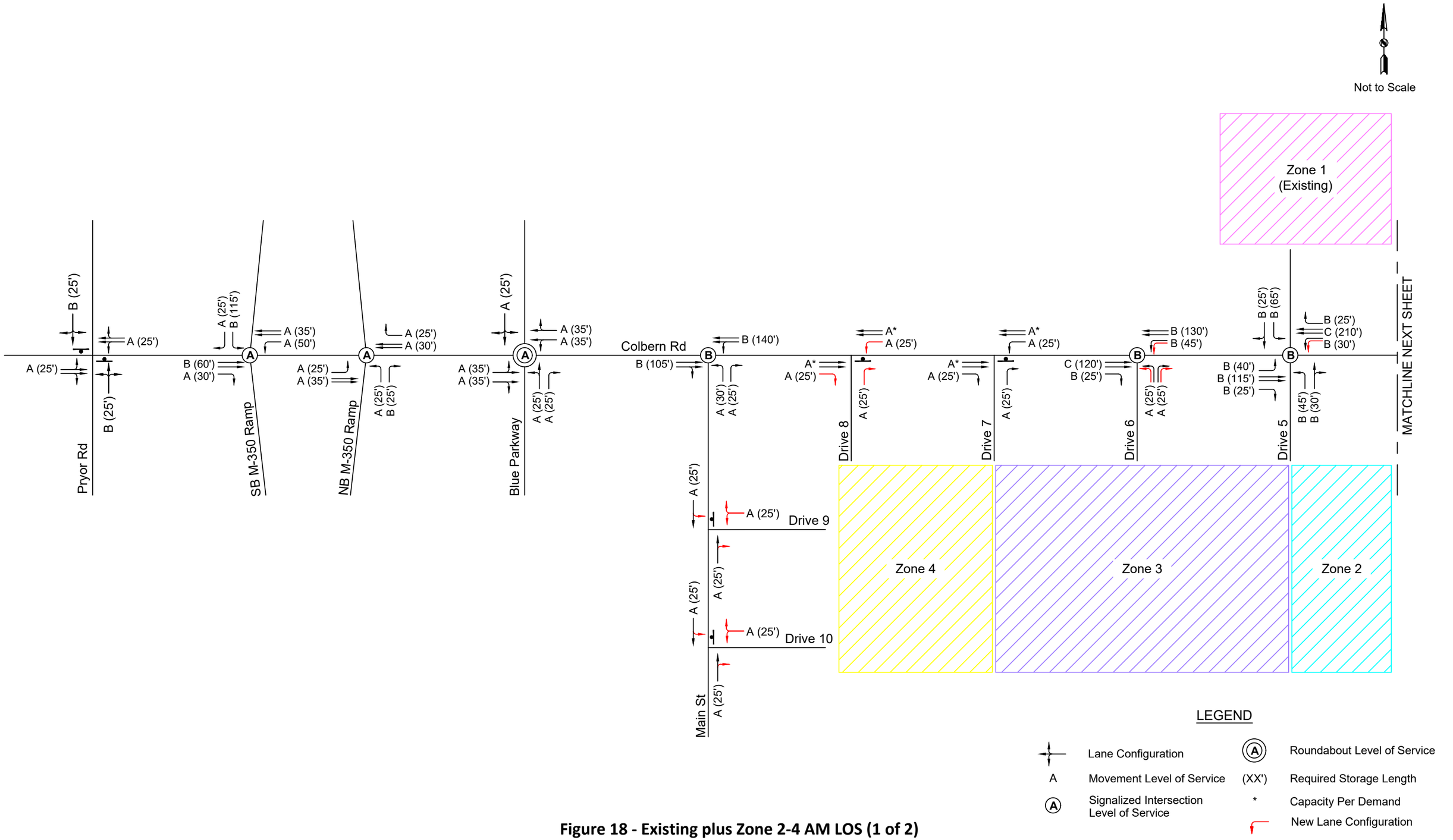

Figure 18 - Existing plus Zone 2-4 AM LOS (1 of 2)

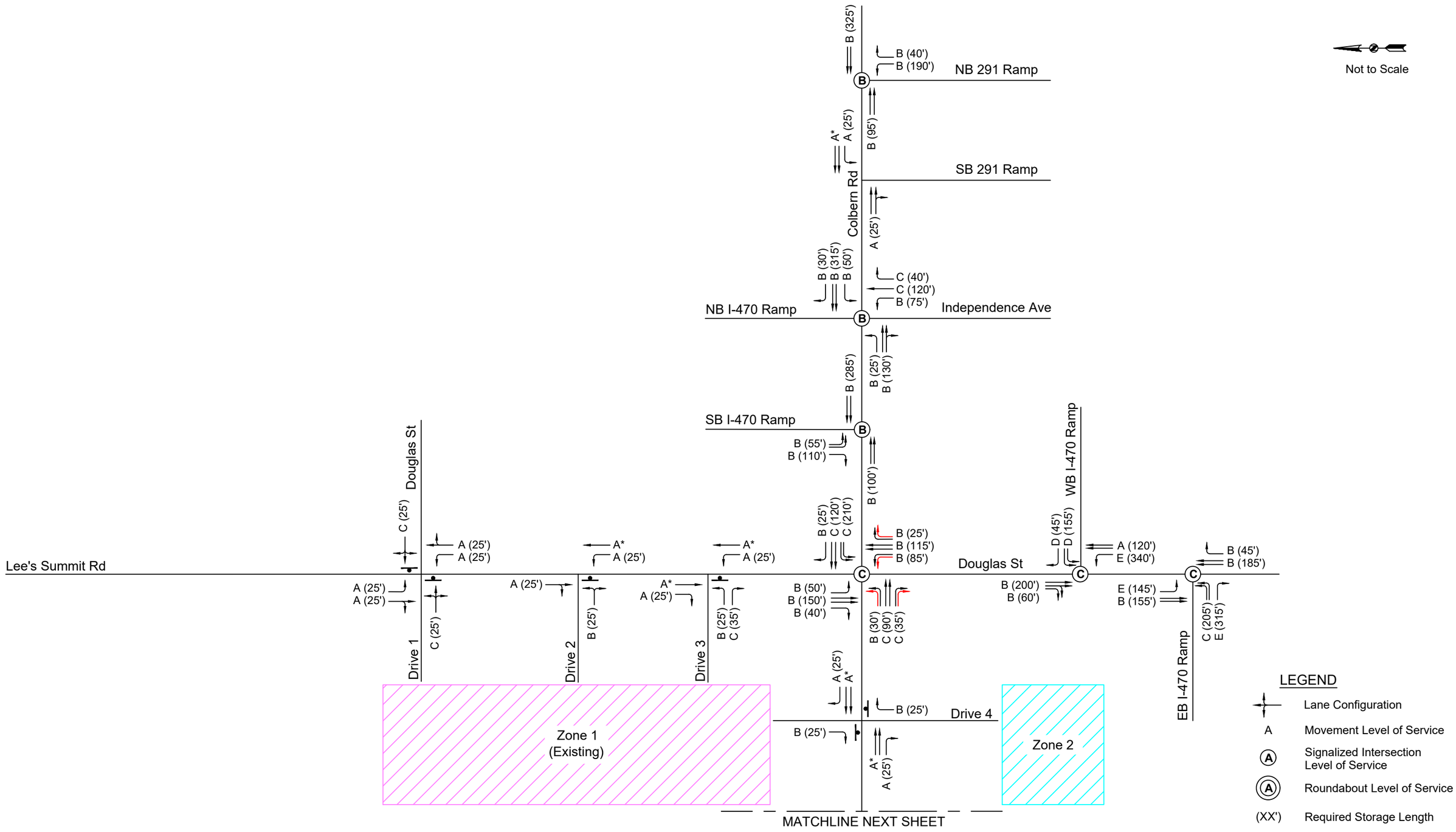

Figure 18 - Existing plus Zone 2-4 AM LOS (2 of 2)

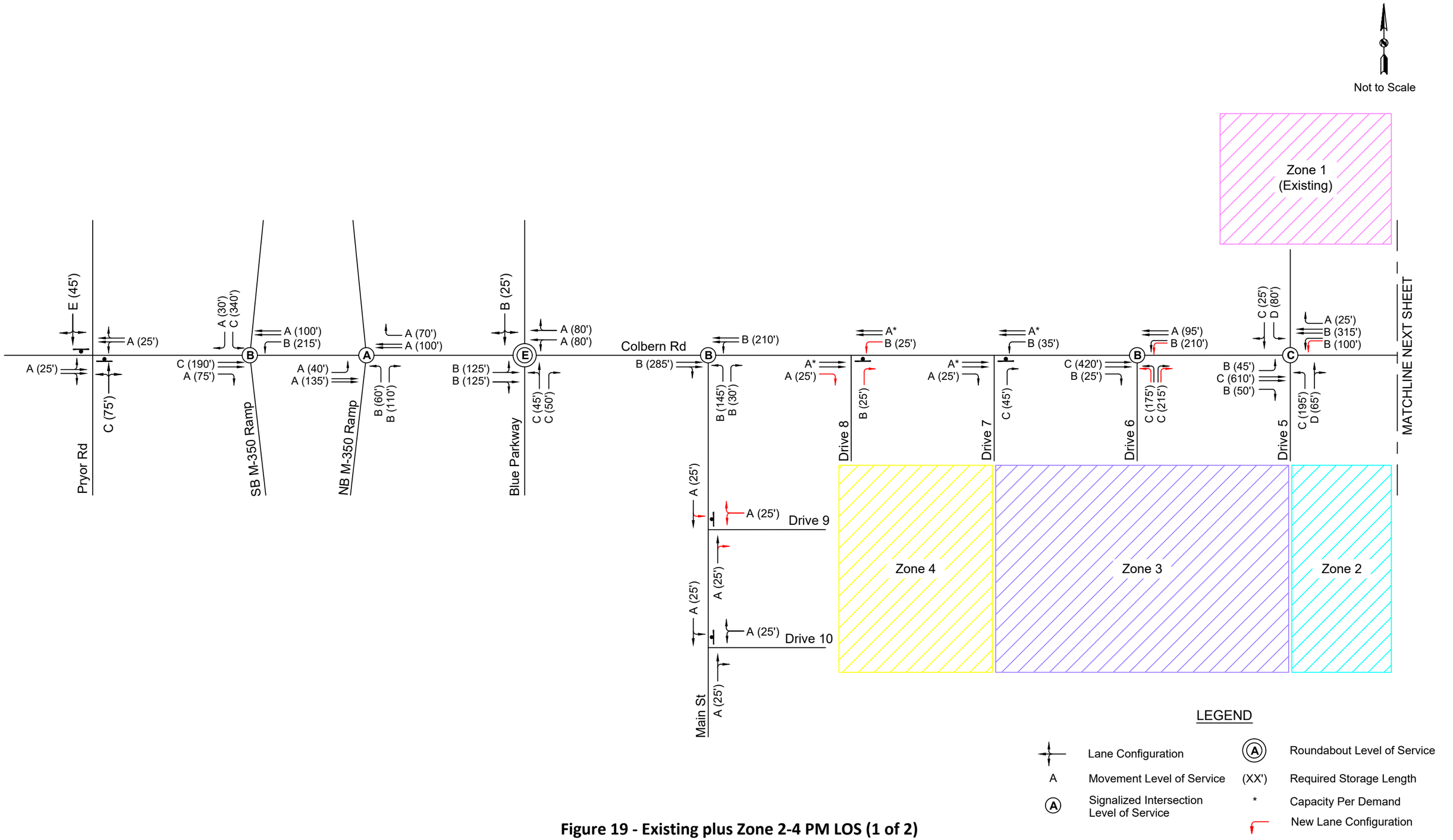

Figure 19 - Existing plus Zone 2-4 PM LOS (1 of 2)

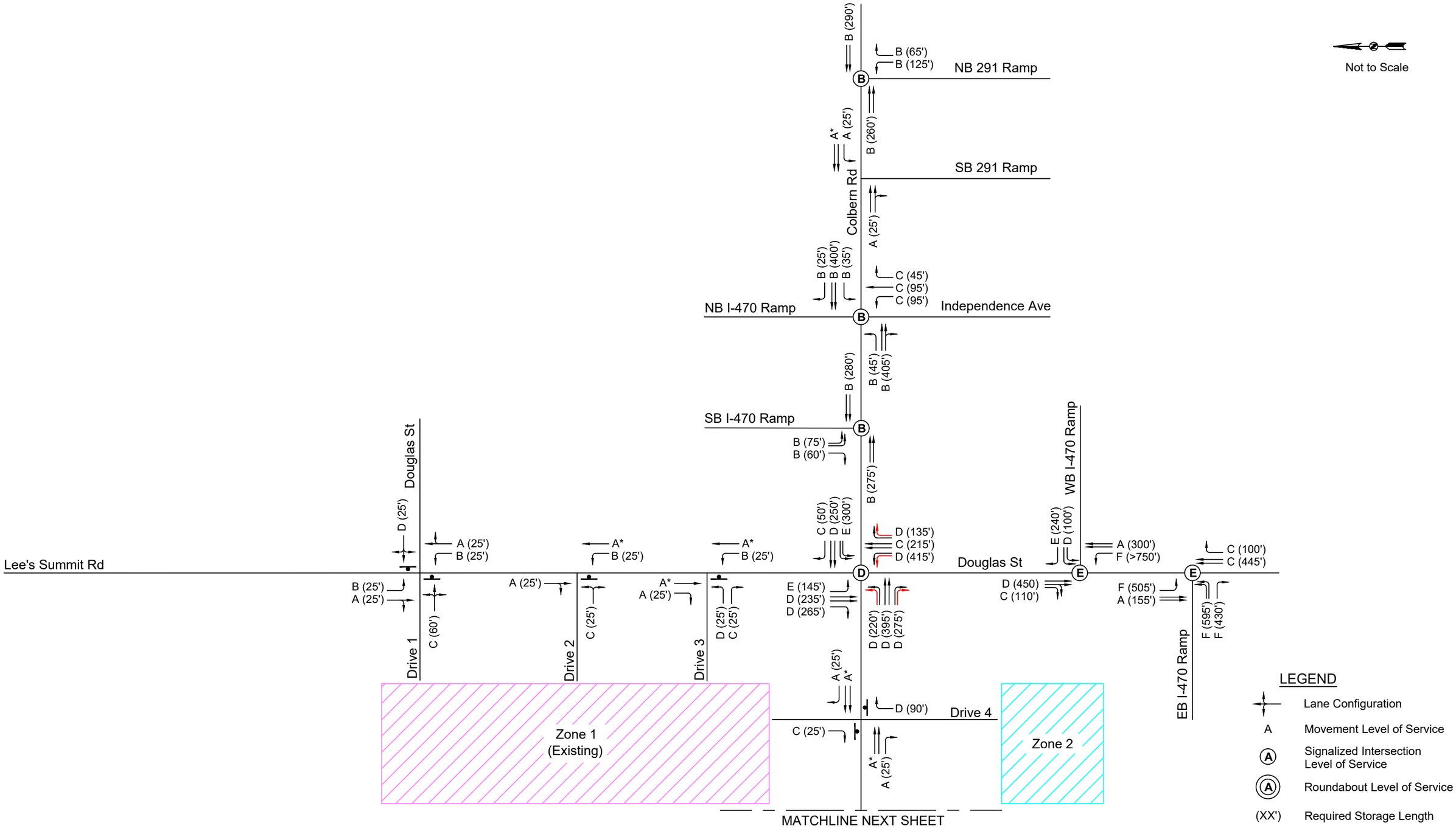

Figure 19 - Existing plus Zone 2-4 PM LOS (2 of 2)

Existing Plus Zone 2-5 Conditions

Zone 5 is intended to provide a high-level overview of trips and provide recommendations for reserving right-of-way for future expansion as there are not definite land uses for Zone 5 yet. Signal timings were optimized to account for the additional traffic. Unless noted, the previous phase roadway and lane configurations were used in intersection analysis.

The additional traffic caused minimal changes to the individual lane movement LOS, the overall LOS, or intersection queueing. The following intersections remained at a LOS C or better for all movements and continued to have sufficient capacity for queueing vehicles:

- Colbern Road and M-350 Southbound Ramp
- Colbern Road and M-350 Northbound Ramp
- Colbern Road and Blue Parkway/Unity Way
- Colbern Road and Main Street
- Douglas Street and Drive 2
- Colbern Road and Drive 4 (RIRO)
- Colbern Road and Drive 6
- Colbern Road and Drive 7 (3/4 access)
- Colbern Road and Drive 8 (3/4 access)
- Main Street and Drive 9
- Main Street and Drive 10
- Colbern Road and I-470 Southbound Off-Ramp
- Colbern Road and I-470 Northbound On-Ramp/Independence Ave
- Colbern Road and M-291 Southbound Ramp
- Colbern Road and M-291 Northbound Ramp

Colbern Road and Pryor Road

There is no significant change in the operations of this intersection from the previous conditions. The southbound lane is a LOS E during the afternoon peak period. All other movements continue to operate at a LOS D or better and the intersection has sufficient capacity for queuing vehicles.

Douglas Street/Lee's Summit Road and Douglas Street/Drive 1

There is no significant change in the operations of this intersection from the previous conditions. All approaches continue to operate at a LOS D or better for the morning and afternoon peak periods and the intersection has sufficient capacity for queuing vehicles.

Douglas Street and Drive 3

The additional through traffic on Douglas Street eastbound left-turn lane causes a drop to LOS E during the afternoon peak period. As this drive accesses the residential section of the development most of these trips would be vehicles that are familiar with peak hour characteristics and know to take an alternative route during the afternoon peak period. All other movements operate at a LOS D or better for the morning and afternoon peak periods and there is sufficient capacity for queuing vehicles.

Installing a traffic signal to alleviate vehicle delay at the intersection is not recommended as the intersection traffic volumes are not likely to meet warrant criteria.

Colbern Road and Drive 5

There is no significant change in the operations of this intersection from the previous conditions. All movements continue to operate at a LOS D or better and the intersection has sufficient capacity for queuing vehicles.

Douglas Street/Lee's Summit Road and Drive 11

This intersection was analyzed as a full access intersection with the northbound TWLT lane restriped for a left-turn lane and an eastbound shared left/right-turn lane.

All movements operate at a LOS C or better and have sufficient capacity for queuing vehicles.

Douglas Street/Lee's Summit Road and Drive 12

This intersection was analyzed as a full access intersection with the northbound TWLT lane restriped for a left-turn lane and an eastbound shared left/right-turn lane.

All movements operate at a LOS C or better and have sufficient capacity for queuing vehicles.

Colbern Road and Douglas Street

Multiple movements operate at a LOS E; however, there is expected to be sufficient capacity for queueing vehicles.

Douglas Street and I-470 Ramps

The overall and individual movements continue to decline with the additional traffic.

The results of the existing plus Zone 2-5 analysis for the morning and afternoon peak hour conditions along with lane configuration and queue lengths are shown on Figures 20 and 21.

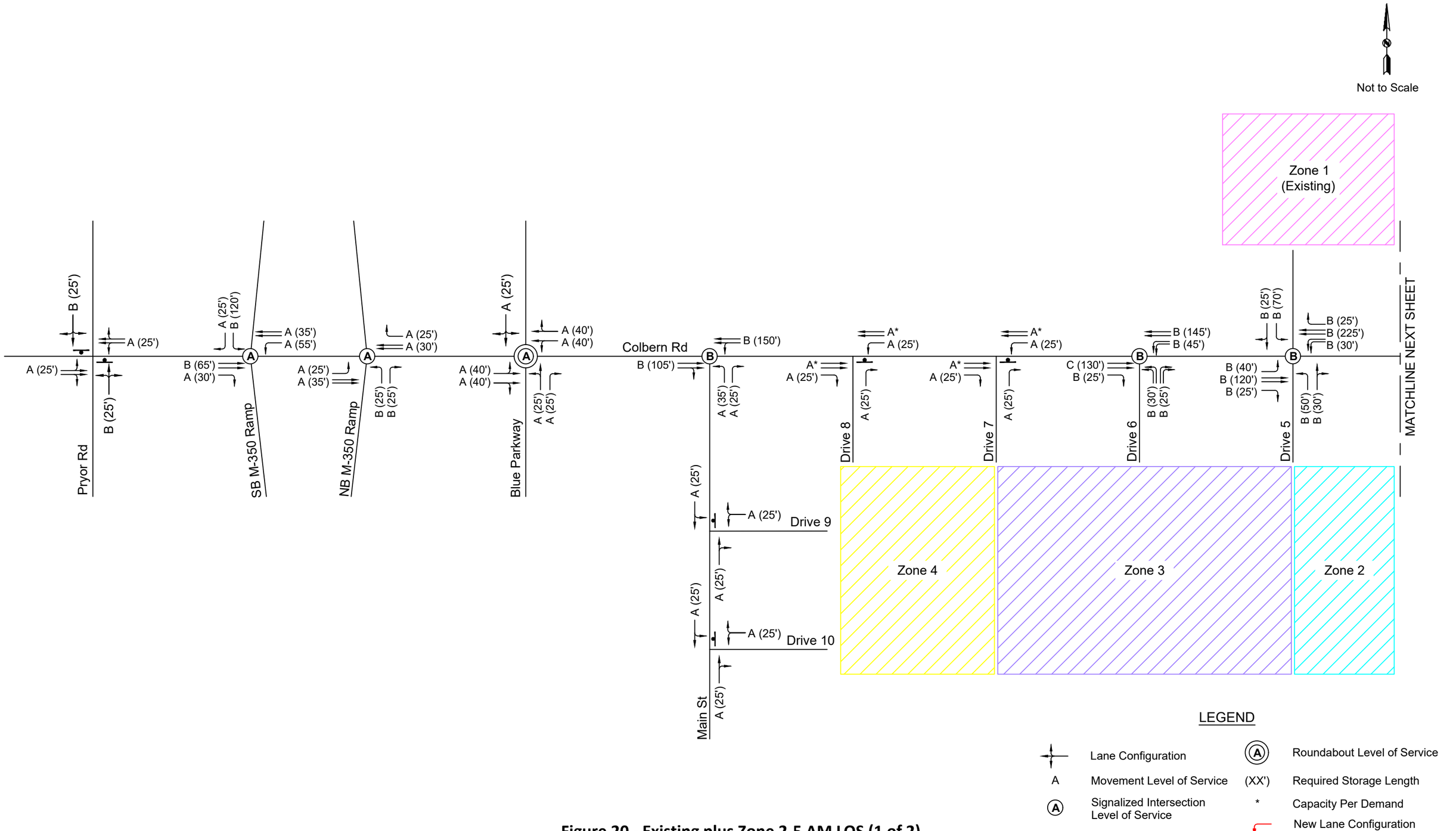

Figure 20 - Existing plus Zone 2-5 AM LOS (1 of 2)

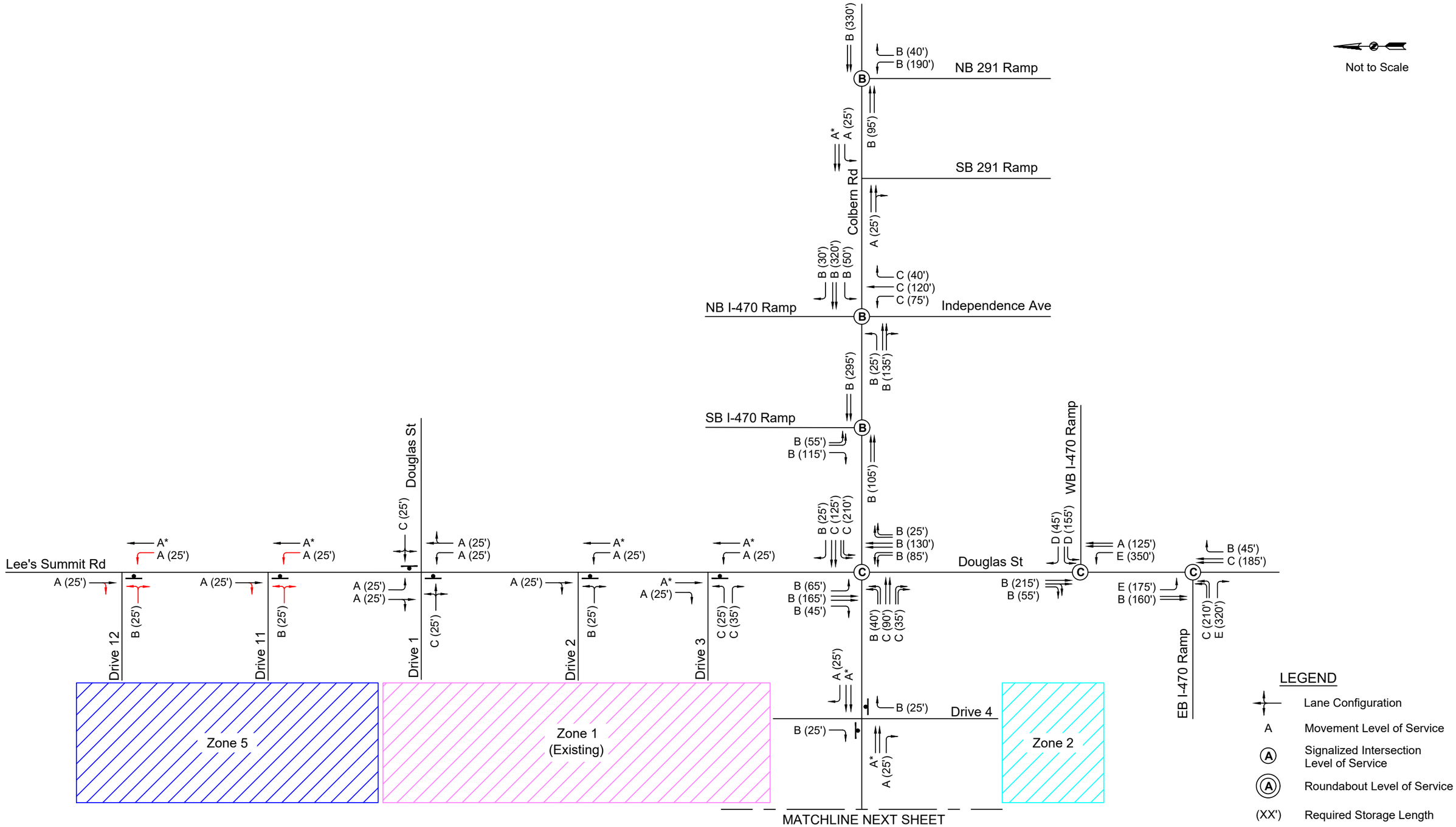

Figure 20 - Existing plus Zone 2-5 AM LOS (2 of 2)

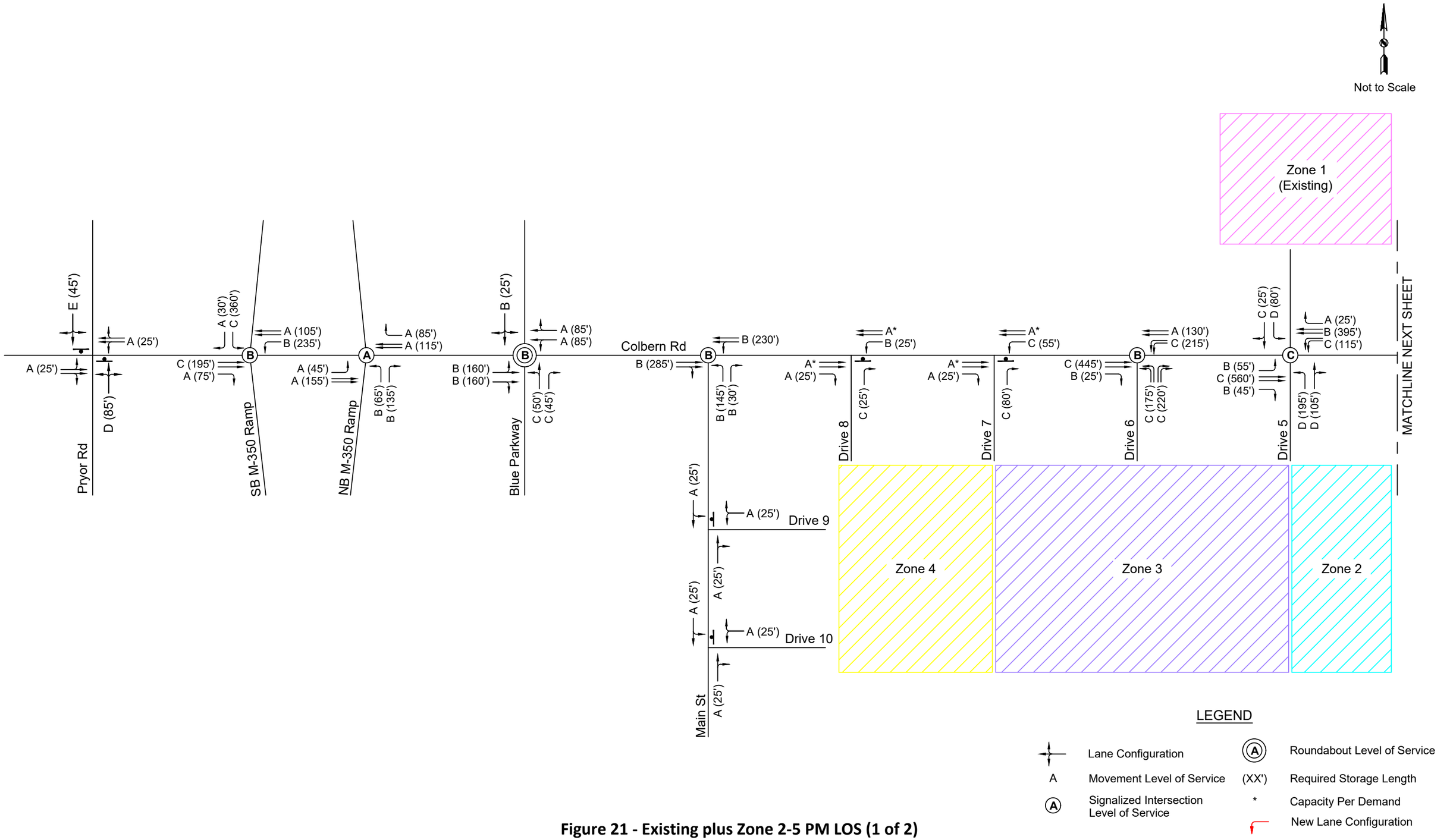

Figure 21 - Existing plus Zone 2-5 PM LOS (1 of 2)

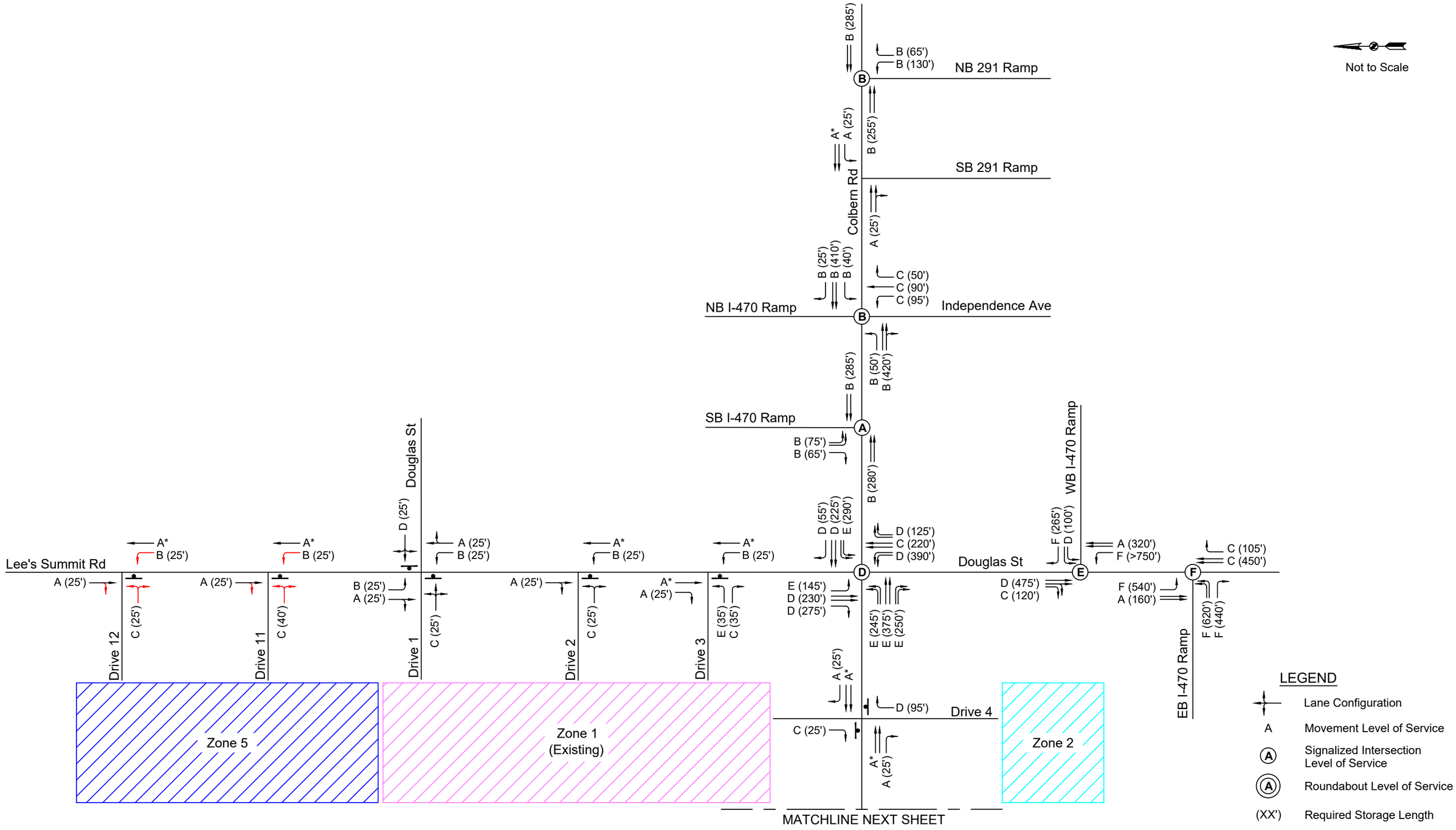

Figure 21 - Existing plus Zone 2-5 PM LOS (2 of 2)

RECOMMENDATIONS

This study documents the findings of the traffic analysis of the expected traffic for the Discovery Park Update development in Lee's Summit, Missouri. The study includes an analysis of:

- Existing Conditions (peak hour counts, approved trips, and Zone 1 trips)
- Existing plus Zone 2
- Existing plus Zone 3
- Existing plus Zone 4
- Existing plus Zone 5

Based on the results of the SYNCHRO analysis, SIDRA analysis, observations from the field, and engineering judgment, the following recommendations are made:

Zone 2 recommendations:

- *General:* Update traffic signal timings as necessary and reserve right-of-way for future roadway widening.
- *Colbern Road and Drive 4:* Construct an eastbound right-turn lane (250 feet of storage) and a northbound approach with a right-turn only lane (200 feet minimum of throat length). The northbound approach should be stop-controlled.
- *Colbern Road and Drive 5:* Signalize intersection. Construct an eastbound right-turn lane (250 feet of storage), a westbound left-turn lane (250 feet of storage), and a northbound approach with a left-turn lane (200 feet of storage) and a shared through/right-turn lane.

Zone 3 recommendations:

- *Colbern Road and Main Street:* Monitor traffic increase and signalize the intersection when Warrant 1: Eight-Hour Vehicular Volume or Warrant 2: Four-Hour Vehicular Volume is met.
- *Colbern Road and Drive 6:* Construct a signalized intersection with an eastbound right-turn lane (250 feet of storage), a westbound left-turn lane (250 feet of storage), and a northbound approach with a left-turn lane (200 feet of storage) and a right-turn lane.
- *Colbern Road and Drive 7:* Construct a stop-controlled intersection with an eastbound right-turn lane (250 feet of storage), a westbound left-turn lane (250 feet of storage), and a northbound approach with a right-turn only lane. The northbound approach should be stop-controlled.
- *Colbern Road and Drive 8:* Construct a stop-controlled intersection with an eastbound right-turn lane (250 feet of storage), a westbound left-turn lane (250 feet of storage), and a northbound approach with a right-turn only lane. The northbound approach should be stop-controlled.

Zone 4 recommendations:

- *Colbern Road and Drive 5:* Construct an additional westbound left-turn lane.
- *Colbern Road and Drive 6:* Construct an additional northbound left-turn lane and right-turn lane.
- *Colbern Road and Drive 8:* Construct a stop-controlled intersection with an eastbound right-turn lane (250 feet of storage), a westbound left-turn lane (250 feet of storage), and a northbound approach with a right-turn only lane. The northbound approach should be stop-controlled.
- *Main Street and Drive 9:* Construct a stop-controlled intersection with a westbound approach consisting of a shared left/right-turn lane. The westbound approach should be stop-controlled.
- *Main Street and Drive 10:* Construct a stop-controlled intersection with a westbound approach consisting of a shared left/right-turn lane. The westbound approach should be stop-controlled.
- *Colbern Road and Douglas Street:* Construct an additional left and right-turn lane northbound. Construct an additional left and right-turn lane eastbound. Modify signal as necessary.

Zone 5 recommendations:

- *Douglas Street and Drive 11:* Construct a stop-controlled intersection with an eastbound approach consisting of a shared left/right-turn lane. Restripe the TWLT northbound into a left-turn lane.
- *Douglas Street and Drive 12:* Construct a stop-controlled intersection with an eastbound approach consisting of a shared left/right-turn lane. Restripe the TWLT northbound for a left-turn lane.

The need for future roadway improvements should be reevaluated as additional development in the area occurs including conducting signal warrant studies before signalization. Right-of-way should be reserved throughout the design process for future roadway and intersection improvements.