Macadoodle
Traffic Impact Study
Lee's Summit, Missouri

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INTRODUCTION

The purpose of this traffic impact study is to assess the potential impact on traffic with the Macadoodle liquor store development in the existing Southport Center. The shopping center is located on the northwest corner of the intersection of Route 291 and SW Market Street/SW 16th Street in Lee's Summit, Missouri. The location of the development in relation to the street network is shown in Figure 1.

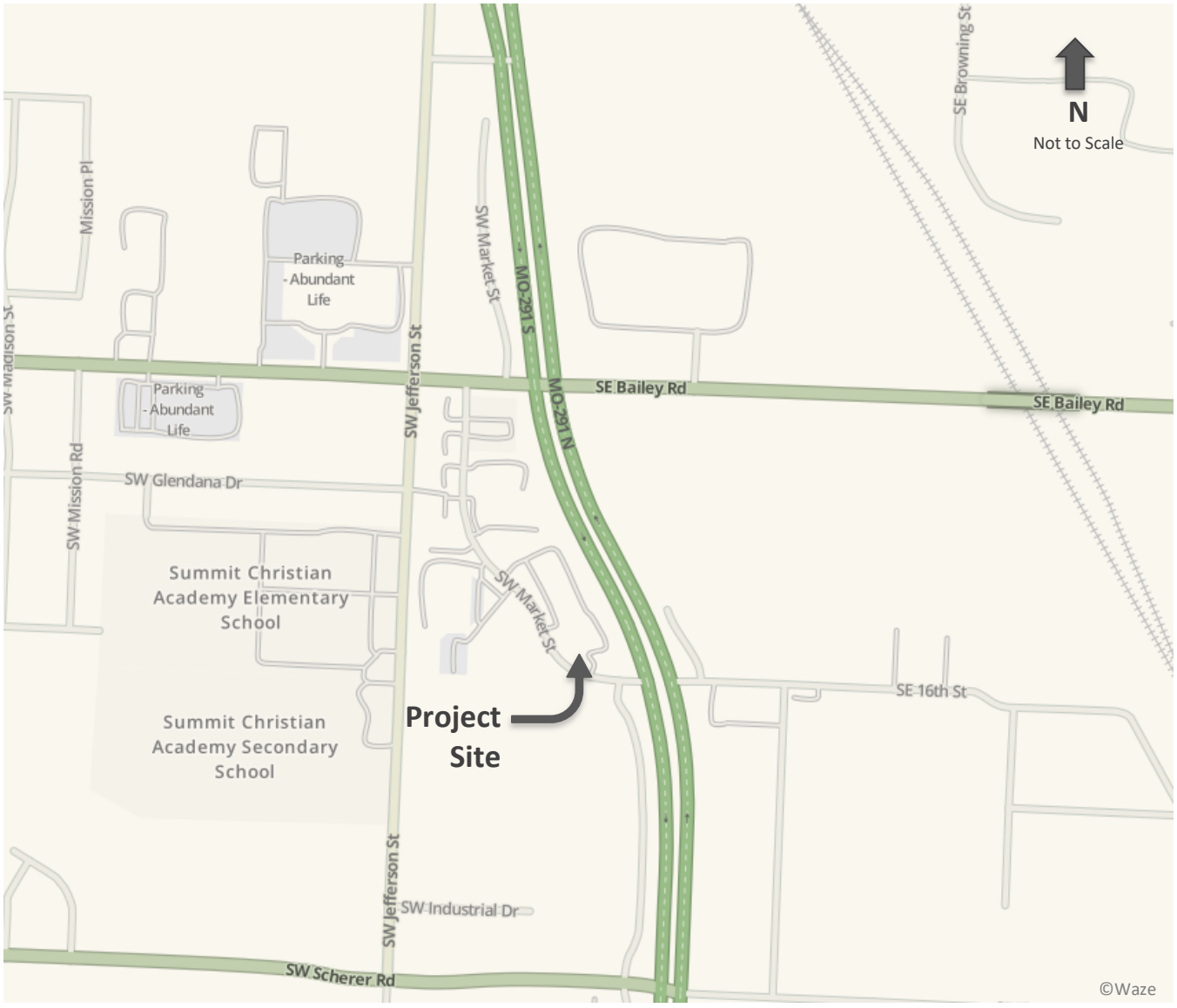

Figure 1–Development Location

EXISTING CONDITIONS

The site is located in Lee's Summit, Missouri, on the northwest corner of the intersection of MO 291 and SW Market Street/SW 16th Street. The Macadoodle liquor store will be going into the existing Summit Park Church location in the Southport Center. The shopping center currently has four vacant sites, two insurance agencies, a taekwondo studio, and a real estate office.

Street Network and Traffic Control

The development is accessed by SW Market Street running north-south at SW Persels Road and tee-ing into southbound MO 291, which is Right-In/Right-Out (RIRO). SW Market Street is a two-lane collector road with a double yellow centerline. There is no posted speed limit.

MO 291 is a north-south four-lane divided highway with a southbound right-turn lane. The posted speed limit is 45 miles per hour (mph). Traffic on SW Market Street is only able to turn right onto MO 291. The intersection of SW Market Street and MO291 is stop controlled with SW Market Street stopping.

SW Persels Road is a two-lane east-west arterial with a left-turn lane and a posted speed limit of 35 mph. The intersection of SW Market Street and SW Persels Road is stop controlled with SW Market Street stopping.

SW Jefferson Street is a two-lane north-south arterial with a two-way left-turn center lane and a posted speed limit of 35 mph. The intersection of SW Jefferson Street and SW Persels Road is signalized.

Traffic Volumes

Intersections included in the analysis for this study are:

- SW Market Street and SW Persels Road
- SW Market Street and SW Market Street/US 291
- SW Market Street and two existing access points
- SW Persels Road and SW Jefferson Street

The turning movement traffic counts were completed on Tuesday, February 8th, 2022, 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 4:00 PM until 5:00 PM.

Existing traffic volumes are shown on Figure 2. Traffic counts are included in the Appendix.

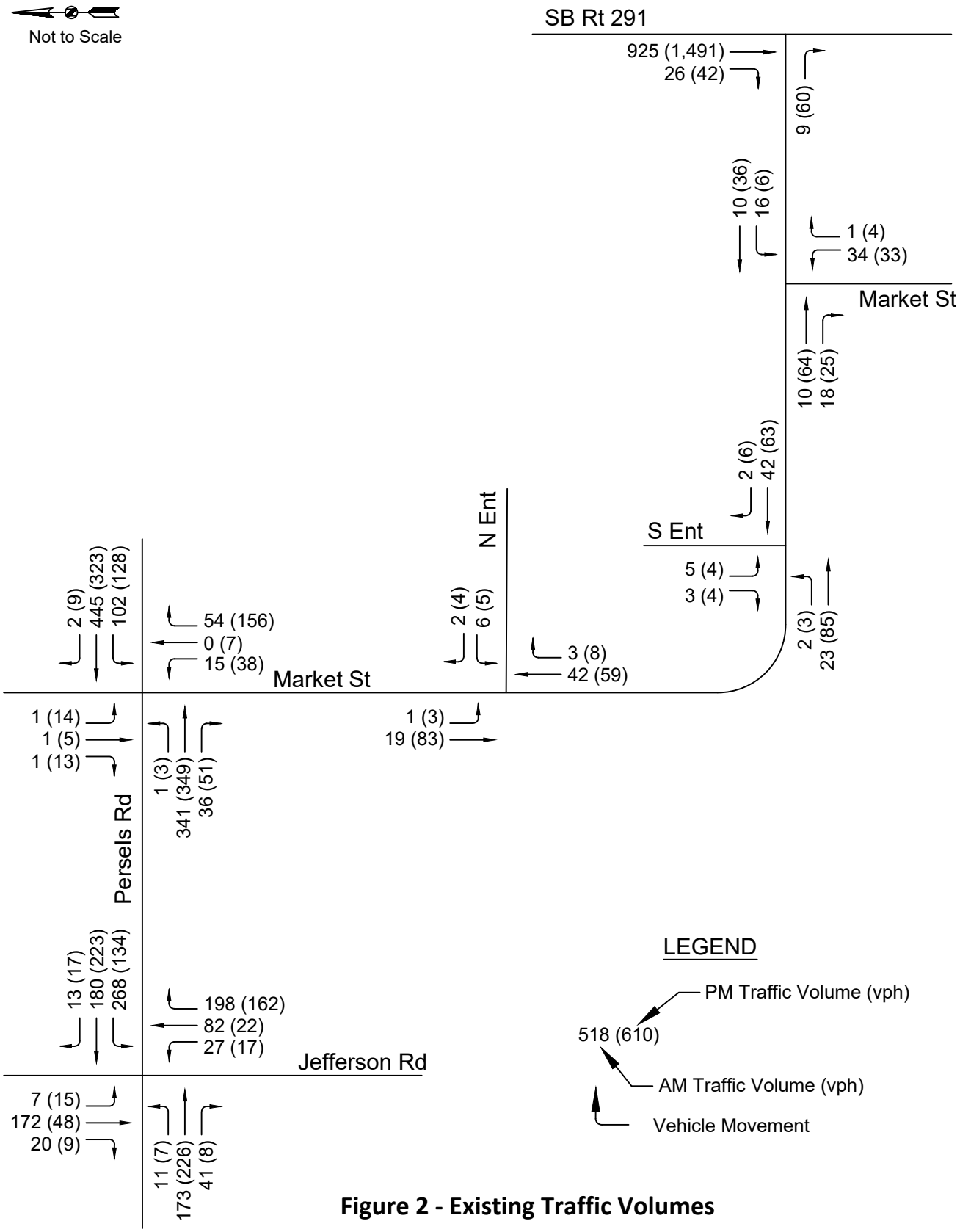

Figure 2 - Existing Traffic Volumes

PROPOSED CONDITIONS

The Macadoodle development is a planned 12,000 square foot liquor store.

Access Plan

The site will be accessed via two access existing points off SW Market Street. There is a third access point into the development, however, based on the location and design that will primarily be for truck traffic.

Sight Distance

Sight distance was measured at the north and south entrances into the site using the methodology recommending by the American Association of State Highway and Transportation Engineers (AASHTO). City code states that a speed limit of 25 mph governs areas with no posted speed limit. For 25 mph, AASHTO requires a minimum intersection sight distance of 280 feet. AASHTO requires a stopping sight distance of 155 feet for a roadway with a speed limit of 25 mph.

Based on field measurements at the north entrance, the available sight distance will be in excess of 280 feet and is adequate. The measured stopping sight distance is in excess of 155 feet and is adequate.

The south entrance has an available sight distance to the intersection with MO 291 to the east. To the west, the stopping sight distance is adequate. However, the intersection sight distance was only 180 feet and is less than the AASHTO required 280 feet.

Crash Analysis

Crash data was not analyzed as part of this study.

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 AM Peak Hour of Generator along with Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 PM criteria for Liquor Store.

Estimates for the expected trips generated by the development are provided in Table 1.

Table 1 – Trip Generation					
ITE Land Use Code	Units	AM		PM	
		Trips In (vph)	Trips Out (vph)	Trips In (vph)	Trips Out (vph)
899 – Liquor Store	12,000 Sq Ft	28	26	80	80

Trip Distribution

The trip distribution pattern was determined for the site based on the existing directional traffic pattern of the peak period and based on a general analysis of the surrounding area. The detailed distribution patterns can be found in the appendix. Based on the existing traffic patterns, the type of development, and the metropolitan population centers, the new trips were assigned onto the roadway network, as shown below for the morning and afternoon periods.

Trip distribution during the morning peak period:

- 20% to/25% from SW Jefferson St
- 65% to/30% from SE Bailey Rd/MO 291
- 10% to/40% from MO 291 RIRO
- 5% to/from SW Market St (to the south)

Trip distribution during the afternoon peak period:

- 25% to/30% from SW Jefferson St
- 60% to/25% from SE Bailey Rd/MO291
- 10% to/40% from MO291 RIRO
- 5% to/from SW Market St (to the south)

Existing Plus Site Traffic Volumes

The expected development site-generated traffic volumes were added to the existing traffic. The volumes are shown on Figures 3 and 4.

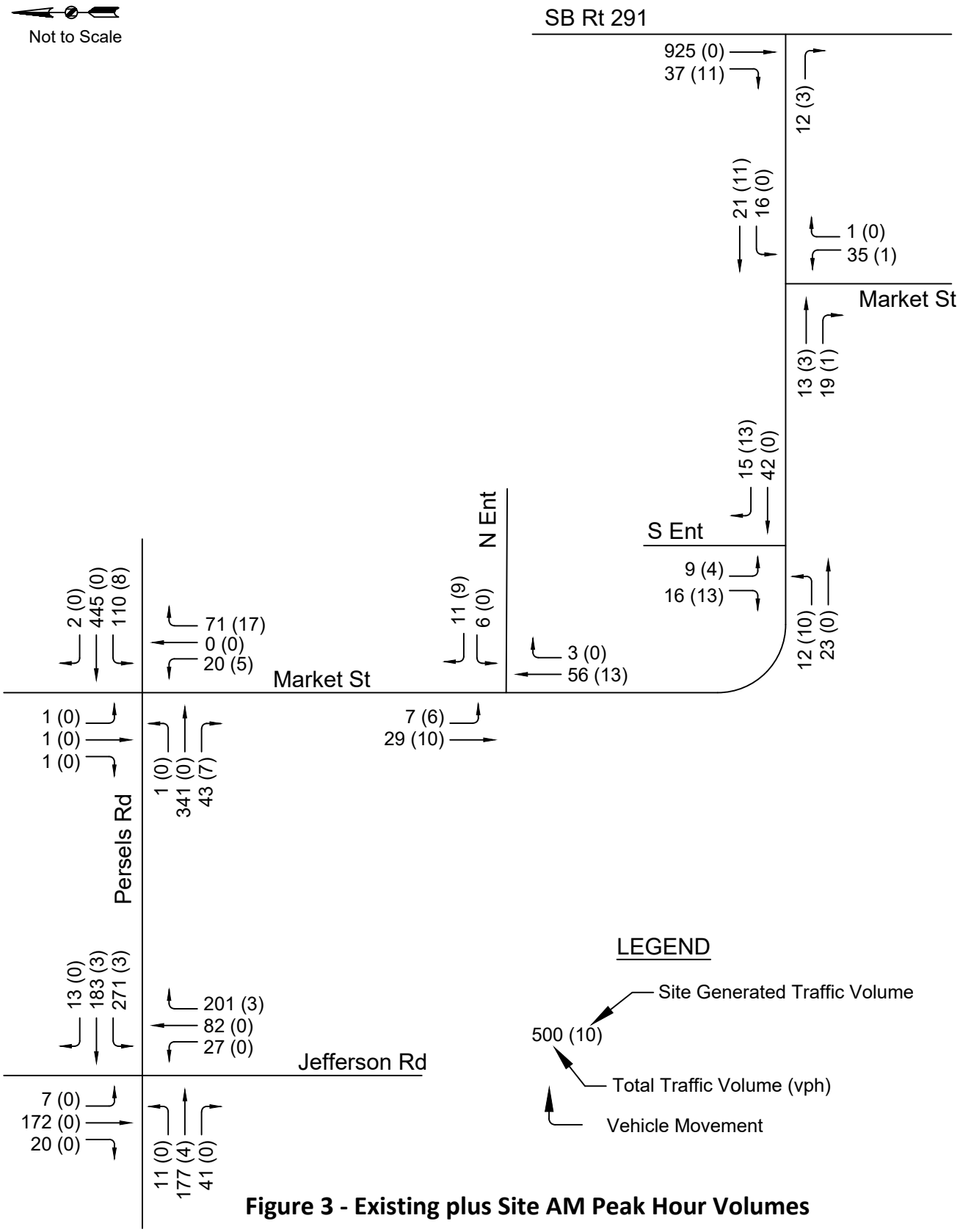

Figure 3 - Existing plus Site AM Peak Hour Volumes

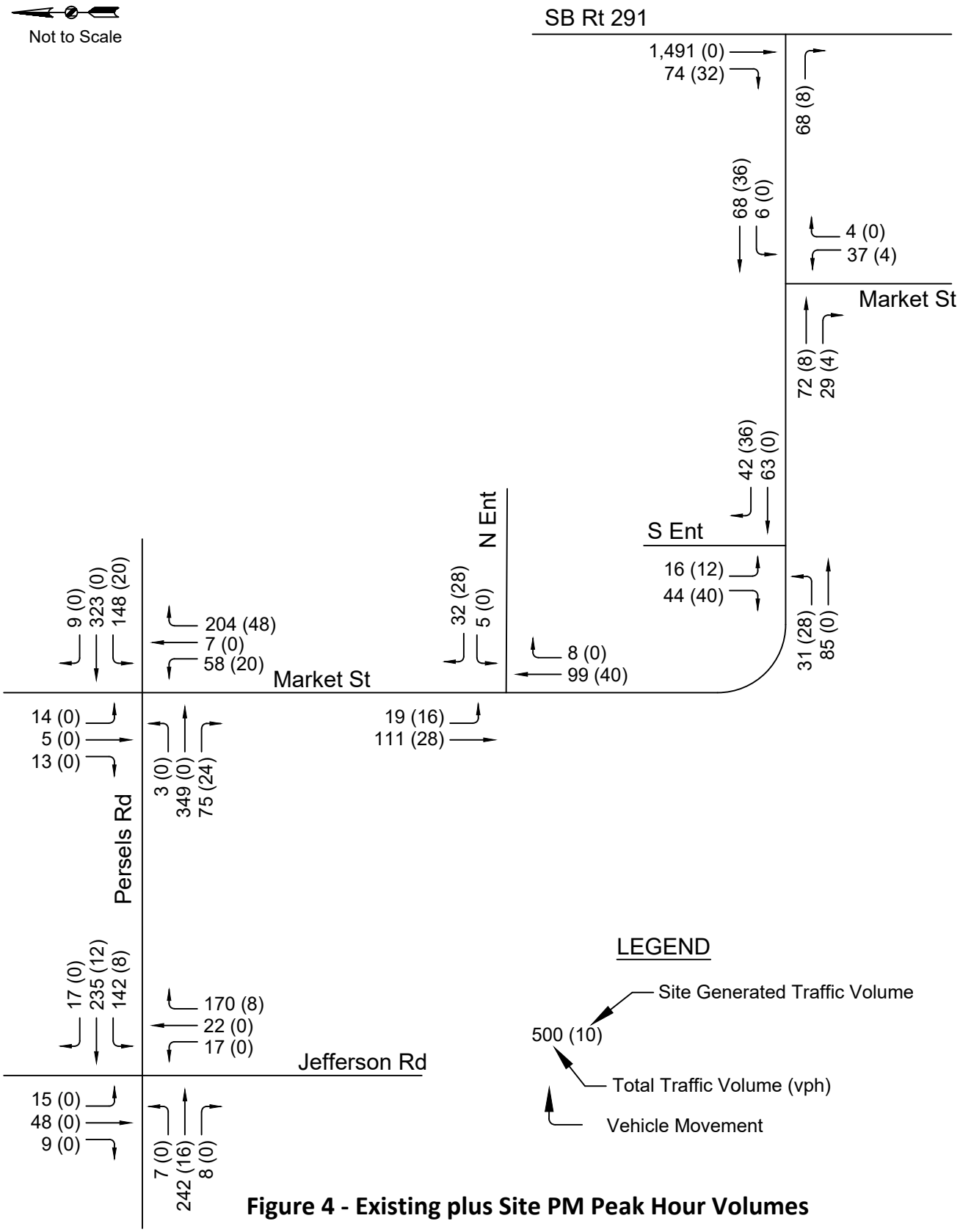

Figure 4 - Existing plus Site PM Peak Hour Volumes

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 2009 MUTCD is 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 SW Market Street and SW Persels Road as part of this study for the existing and existing plus site conditions.

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 experienced 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

The traffic volumes at SW Market Street and SW Persels Road are not expected to warrant a signal for the existing or existing plus site conditions. The raw data and curves from the 2009 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). The criteria for determining Level of Service (LOS) for signalized and unsignalized study intersections and access points are based on the average vehicle delay and is outlined in Table 2 below. Level of Service is defined as the measure of the quality of traffic flow and is graded from "A" to "F"—with "A" being the best situation and "F" being the worst.

Table 2 – 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

SW Persels Road and SW Jefferson Street

All approaches operate at a LOS D 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 C during the morning peak period and a LOS B during the afternoon peak period.

SW Market Street and SW Persels Road

All approaches operate at a LOS D or above for the morning and afternoon peak periods and the intersection has sufficient capacity for queuing vehicles.

SW Market Street and SW Market Street/MO 291

The through movements of MO291 at the intersection of SW Market Street is not stop controlled and therefore operates in a free-flow condition. The only allowed turning movements are a right turn onto SW Market Street or a right turn from SW Market Street onto MO291. The southbound right turn operates at a LOS A for both morning and afternoon peak periods. The eastbound right turn operates at a LOS C or better and has sufficient capacity for queuing vehicles.

SW Market Street and North Entrance

All approaches operate at a LOS A and the intersection has sufficient capacity for queuing vehicles.

SW Market Street and South Entrance

All approaches operate at a LOS A and the intersection has sufficient capacity for queuing vehicles.

The results of the capacity analysis for the existing morning and afternoon peak hour conditions along with lane configuration and queue lengths are shown on Figures 5 and 6.

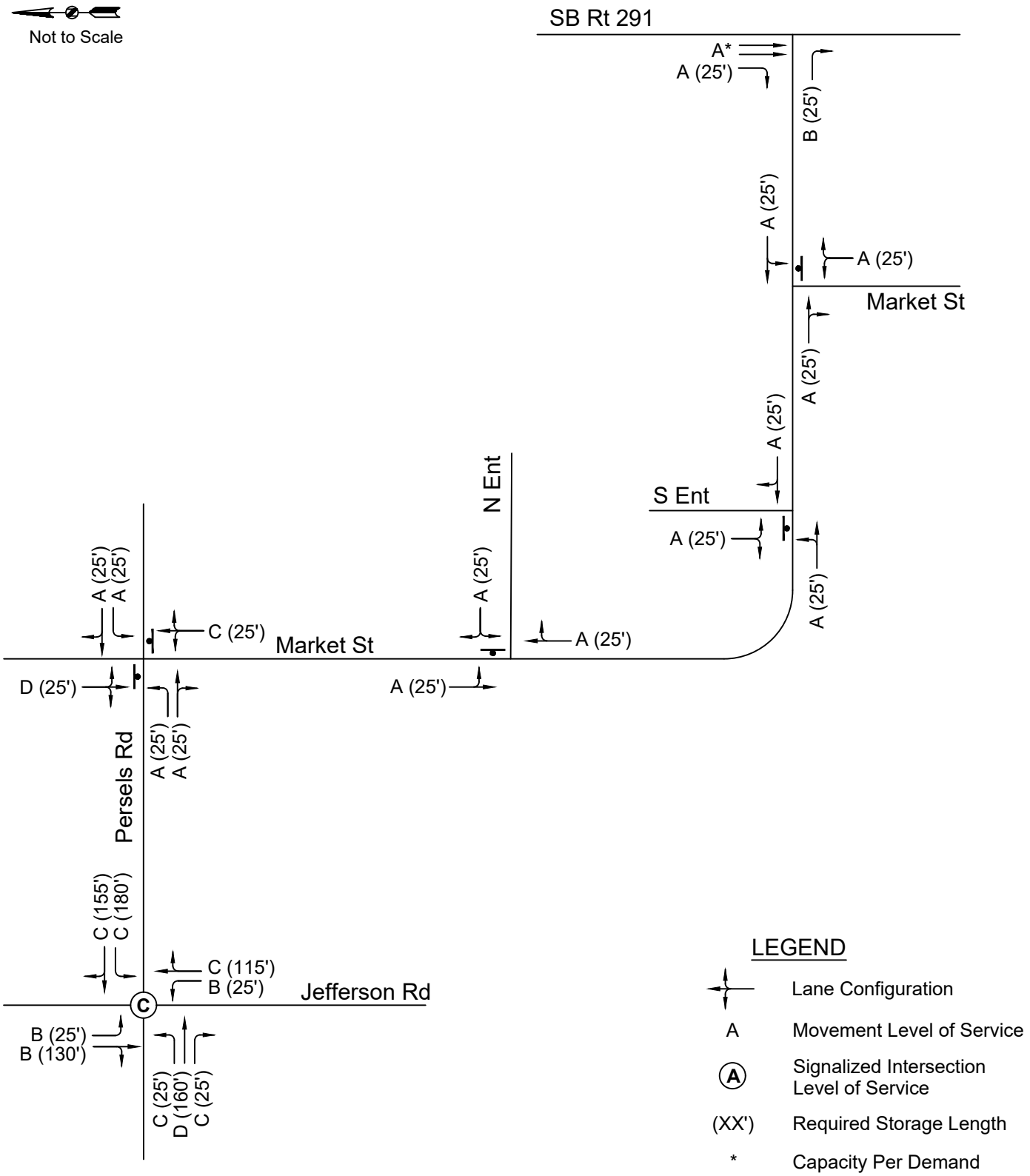

Figure 5 - Existing AM Level of Service

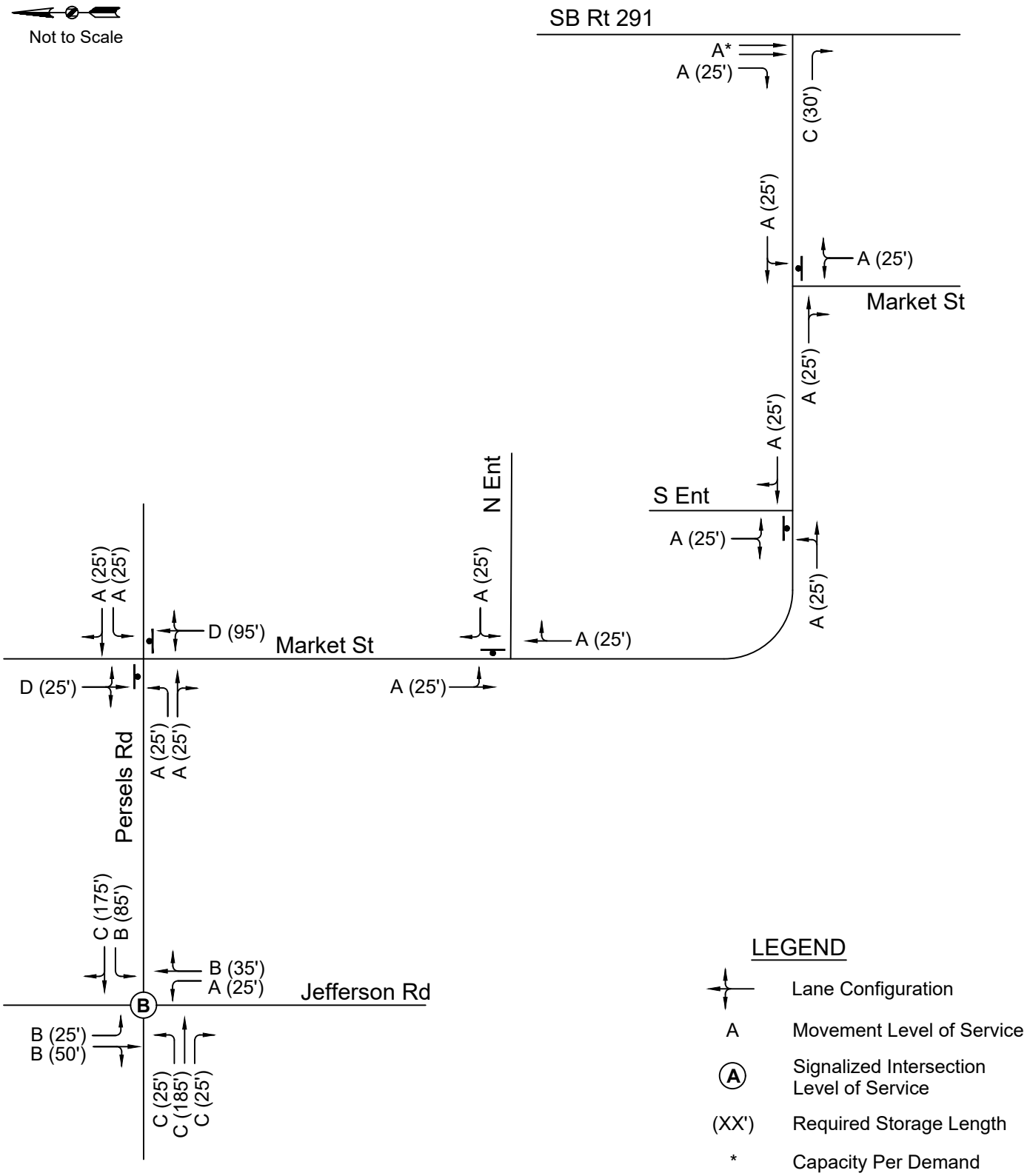

Figure 6 - Existing PM Level of Service

Existing Plus Site Conditions

SW Persels Road and SW Jefferson Street

Analysis for this intersection was completed with signal timings optimized to account for the additional development traffic. There is no significant change in operations of this intersection from the Existing Conditions. All approaches continue to operate at a LOS D or above for the morning and afternoon peak periods and the intersection has sufficient capacity for queuing vehicles.

SW Market Street and SW Persels Road

During the afternoon peak period, the northbound movement drops to a LOS F and southbound movement drops to a LOS E. The storage length is adequate for this movement and the expected delay during the afternoon peak is 59.3 seconds for the northbound movement and 40.3 seconds for the southbound movement. The LOS for the average control delay drops from a LOS D to LOS E at 35 seconds and from LOS E to LOS F at 50 seconds. The northbound queue length is expected to be 215 feet. The intersection does not warrant a signal at this time.

There is sufficient roadway width to re-stripe the northbound lanes for a left turn lane and a shared through/right lane. This lane configuration would decrease the northbound queue lengths to 60 feet. The northbound left lane would still operate at a LOS F however, the northbound shared through/right lane would operate at a LOS C. The northbound delay with the modified lane configuration would drop to 51 seconds which is only one second outside the LOS E criteria.

SW Market Street and SW Market Street/MO 291

The through movements of MO291 at the intersection of SW Market Street are not stop controlled and therefore operates in a free-flow condition. The only allowed turning movements are a right turn onto SW Market Street or a right turn from SW Market Street onto Route 291. The southbound right turn operates at a LOS A for both morning and afternoon peak periods. The eastbound right turn operates at a LOS C or better and has sufficient capacity for queuing vehicles.

SW Market Street and North Entrance

All approaches continue to operate at a LOS A with the additional site traffic and the intersection has sufficient capacity for queuing vehicles.

SW Market Street and South Entrance

All approaches continue to operate at a LOS A with the additional site traffic and the intersection has sufficient capacity for queuing vehicles.

The results of the analysis are shown for the morning and afternoon peak hour conditions along with lane configuration and queue lengths in Figures 7 and 8.