Summit Orchards West
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 Summit Orchards West development on the northwest corner of the intersection of Ward Road and Chipman Road in Lee's Summit, Missouri. 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. The site plan includes the naming convention used for the various site entrances.

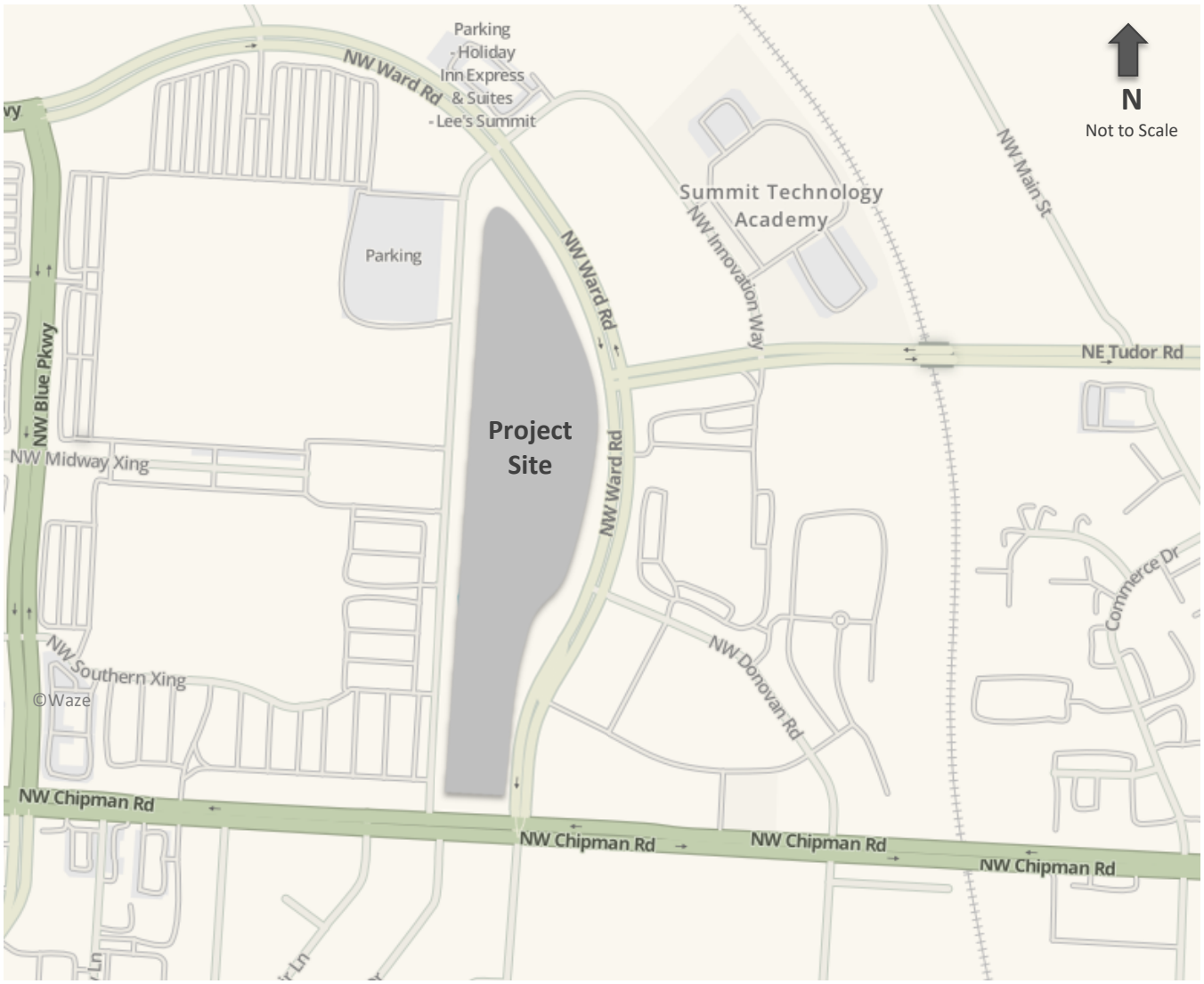

Figure 1 – Development Location

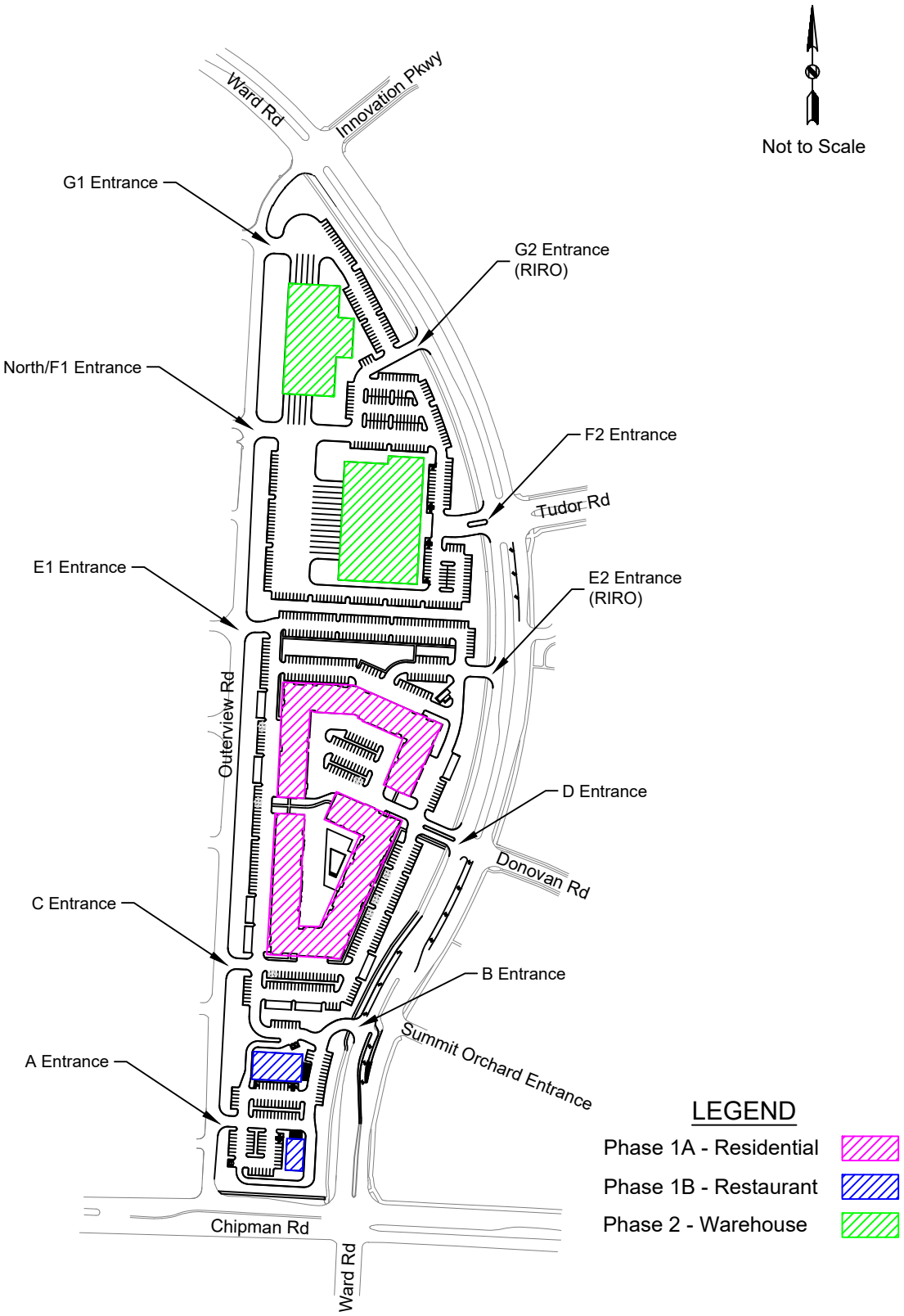

Figure 2 - Site Plan

EXISTING CONDITIONS

The site is in Lee's Summit, Missouri, in the northwest quadrant of the intersection of Chipman Road and Ward Road. The current land use of the planned development is undeveloped. The land use of the surrounding areas is undeveloped to the northeast, light industrial to the west, commercial/retail/multi-family housing to the east, and low density residential to the south.

Street Network and Traffic Control

The development is bordered on the west by Outerview Road and on the east by Ward Road. Chipman Road is located to the south of the site and provides access to Missouri Highway 50.

Chipman Road is a four-lane east-west median divided major arterial with a posted speed limit is 45 miles per hour (mph).

Ward Road is a four-lane north-south median divided major arterial roadway with a posted speed limit of 35 mph. The intersection of Chipman Road and Ward Road is signalized with left-turn lanes on all approaches (dual lefts southbound and eastbound), a southbound right-turn lane, and a westbound right-turn lane. The intersection of Chipman Road and Ward Road is approximately 2,700 feet west of MO 50.

Outerview Road is a two-lane unmarked north-south private drive with no posted speed limit. The intersection of Outerview Road and Chipman Road is stop-controlled, with Outerview Road stopping; this intersection is right-in/right-out (RIRO) with a concrete median preventing left-turns on or off Chipman Road. The intersection of Outerview Road and Ward Road to the north is stop-controlled, with Outerview Road stopping and aligning with Innovation Parkway on the east side of Ward Road.

Donovan Road is a two-lane east-west collector roadway with a two-way left-turn lane and no posted speed limit. The intersection of Donovan Road and Ward Road is a stop-controlled T-intersection with Donovan Road stopping.

Tudor Road is a four-lane east-west median divided minor arterial roadway. There is a posted speed limit of 35 mph. The intersection of Tudor Road and Ward Road is a signalized T-intersection.

Traffic Volumes

Intersections counted for analysis in this study were:

- Chipman Road and Ward Road
- Chipman Road and Outerview Road
- Chipman Road and Donovan Road
- Ward Road and Summit Orchard Entrance
- Ward Road and Donovan Road
- Ward Road and Tudor Road
- Ward Road and Outerview Road
- Outerview Road and South Entrance (existing to the west)
- Outerview Road and North Entrance (existing to the west)

The turning movement traffic counts were completed on Tuesday, July 12th, 2022, and Wednesday, July 13th, 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 8:00 AM until 9:00 AM and the afternoon peak period was determined to be from 5:00 PM until 6:00 PM.

Trips from the July 2022 counts were compared to City supplied counts from April 19th, 2018, counts at the intersection of Chipman Road and Ward Road to determine what changes in traffic counts and distribution the current construction and detours on MO 50 might have on the intersection. On average, the July 2022 counts from the Chipman Road and Ward Road intersection were found to be between 10-55% lower than the April 2018 counts. The lower counts were expected due to the local construction and due to lower traffic volumes in general due to change in traffic patterns as a result of COVID.

For the Chipman and Ward intersection, the higher April 2018 traffic counts were used for the existing conditions traffic counts with an increase of 1% per year to account for nearby development since 2018. In addition, traffic generated from adjacent developments as part of the 2016 McClure TIS and the 2018 Olsson TIS were added to existing counts (McClure Engineering Co, *Summit Orchards Traffic Impact Study*, March 2016 and Olsson Engineers, *Tudor Road Development Traffic Impact Study*, July 2021).

July 2022 counts were used for the remaining study intersections and balanced with the April 2018 traffic counts.

The generated existing traffic volumes are shown on Figure 3. The April 2018 counts, July 2022 counts, and the previous study trip/generation counts are included in the Appendix.

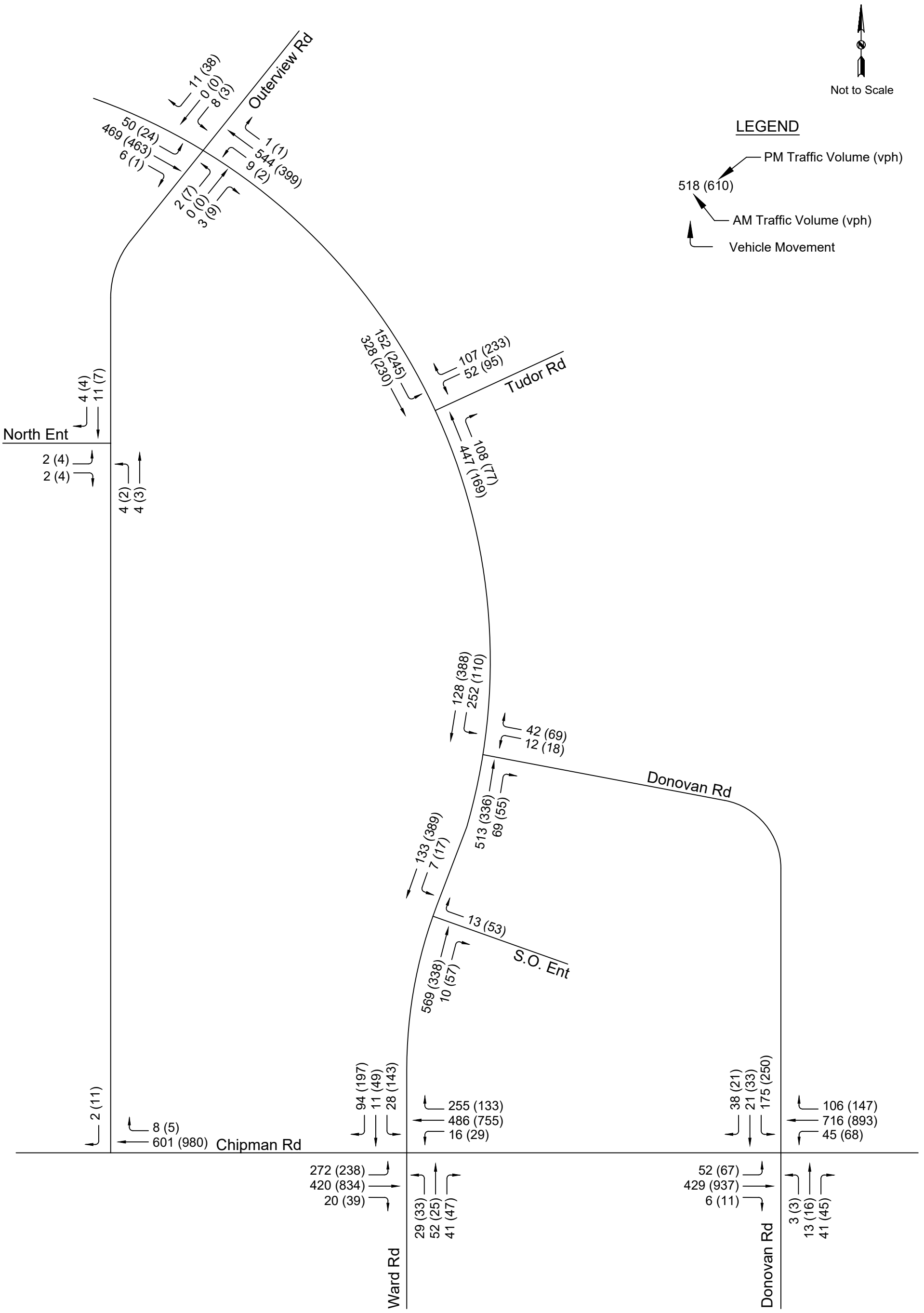

Figure 3 - Existing plus Approved Peak Hour Volumes

PROPOSED CONDITIONS

Summit Orchard West is expected to be constructed in two phases. The first phase will be on the south side of the development and will include two fast-food restaurants with drive-through windows and a residential multi-family housing complex with 323 units. The second phase will be on the north side of the development and will include two warehouse buildings totally 123,000 square feet.

Access Plan

The site will be accessed from the west (Outerview Road) via five entrances. There will be two entrances into each of the different land use areas—one of the two entrances for the restaurant and residential site will be a shared entrance accessing both the restaurant and residential sites and providing interconnectivity between them. There will be no interconnectivity between the residential and warehouse land uses. Where possible, these entrances will align with existing drives on the west side of Outerview Road. All entrances onto Outerview Road will be full access points and will be stop controlled.

The site will be accessed from Ward Road via five entrances. The southern entrance will be a three-quarter access into the restaurant portion of the site. Two entrances will access the residential portion of the site; one will be a full access aligned with Donovan Road and the second will be RIRO between Donovan Road and Tudor Road. The warehouse site will also be accessed in two locations, with the southern access being a full access aligning with Tudor Road and the northern access being a RIRO between Tudor Road and Outerview Road.

There will be no access into the site from Chipman Road.

Sight Distance

Sight distance was measured at the proposed accesses using the methodology recommending by the American Association of State Highway and Transportation Engineers (AASHTO) for the 35 mph speed limits on Ward Road and 25 mph on Outerview Road as City code states that a speed limit of 25 mph governs areas with no posted speed limit.

For 35 mph, AASHTO requires a minimum intersection sight distance of 390 feet and a stopping sight distance of 250 feet. The AASHTO required intersection site distance at 25 mph is 280 feet and 155 feet for stopping sight distance.

Ward Road and Summit Orchard Entrance/B Entrance
Based on field measurements, the available sight distance is approximately 420 feet and is adequate for the speed limit.

Ward Road and Donovan Road
No sight distance was measured as this is an existing intersection.

Ward Road and E2 (RIRO) Entrance
Based on field measurements, the available sight distance is greater than 400 feet and meets the AASHTO requirements.

Ward Road and Tudor Road
No sight distance was measured as this is an existing signalized intersection.

Ward Road and G2 (RIRO) Entrance
The available sight distance, based on field measurements, is greater than 400 feet and is adequate for the 35 mph speed limit.

Outerview Road and A Entrance
The measured sight distance is greater than 300 feet and meets the AASHTO requirements intersection and stopping sight distance requirements.

Outerview Road and C Entrance
Based on field measurements, the available sight distance is greater than 300 feet and meets the AASHTO requirements.

Outerview Road and E1 Entrance
The available sight distance, based on field measurements, is in excess of 300 feet and is adequate for the 25 mph speed limit.

Outerview Road and North Entrance/F1 Entrance
No sight distance was measured as this is an existing intersection.

Outerview Road and G1 Entrance
The measured intersection sight distance is in excess of 300 feet and the stopping sight distance is in excess of 160 feet and is adequate.

Crash Analysis

Crashes at the study intersections were analyzed over a five-year period (2017-2021) from City of Lee's Summit Police Department data to identify existing crash patterns. There were a total of 18 crashes reported during the crash study time period, and no fatal crashes within the study area.

The Chipman Road and Outerview Road, Ward Road and Summit Orchard Entrance, Ward Road and Donovan Road, and Outerview Road and North Entrance intersections had no crashes reported during the study period.

Chipman Road and Ward Road

There were 39 reported crashes at the intersection during the study period—averaging approximately eight crashes a year.

Based on the analysis of the 39 crashes, there were two run off-road/lost control crashes, one sideswipe crash, six right-angle crashes, and the remaining were rear-end crashes. Of the right-angle crashes, one resulted in injuries while the other five were property damage only—four of the crashes were inattentive drivers running red lights and two occurred when the intersection was stop controlled due to a vehicle hitting the signal pole. The remaining rear-end crashes were primarily due to inattentive drivers.

Chipman Road and Donovan Road

There were 11 total crashes over the five-year study period at the Chipman Road and Donovan Road intersection. Based on the analysis of the eleven crashes, there were five right-angle crashes (one prior to the signal being installed), two rear-end crashes, three lost control crashes (one was a DUI), and two rear-end crashes due to inattentive drivers.

Ward Road and Tudor Road

There were seven reported crashes at the intersection during the study period—four lost control crashes, two right-angle crashes, and one rear-end crash. The rear-end crash and two of the lost control crashes occurred during icy conditions.

Ward Road and Outerview Road

The one reported crash, during the study time period, was a lost control crash when a moped without headlights had to stop suddenly to avoid crashing into a police vehicle turning onto Ward Road. The moped driver was not injured.

No correctable crash patterns emerged as a result of the study and no recommendations are made to alter the study intersections based on crash data.

Detailed crash summaries are included in the Appendix.

Throat Length Analysis

The throat lengths for the proposed entrances into the site from Ward Road and were compared to City of Lee's Summit *Access Management Code*, March 2018 requirements for drives adjacent to arterial roadways based on vehicles per hour. As Outerview Road is a private roadway, there is no specific guidance provided for throat lengths however, all drives will have at least a 50-foot throat which exceeds the expected queue.

Throat lengths for entrances onto Ward Road are provided in Table 1.

Table 1 – Ward Road Driveway Throat Depths		
Intersection	**Recommended Throat Length (feet)**	**Site Plan Measured Throat Length (feet)**
Ward Road and Summit Orchard/B Entrance	125	125
Ward Road and Donovan Road	125	100
Ward Road and E2 (RIRO) Entrance	75	75
Ward Road and Tudor Road	75	110
Ward Road and G2 (RIRO) Entrance	75	75

While the Donovan Road access onto Ward Road is less than the required length, the longest expected queue length for eastbound traffic is 30 feet, so the storage provided by a 100-foot throat will be sufficient to prevent vehicles interfering with circulation or parking areas within the site. All other access onto Ward Road meet or exceed the recommended throat lengths.

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.

Estimates for the expected trips generated by the development are provided in Table 2.

Table 2 – Trip Generation					
ITE Land Use Code	**Units**	**A.M.**		**P.M.**	
		Trips In (vph)	**Trips Out (vph)**	**Trips In (vph)**	**Trips Out (vph)**
220- Multifamily Housing (Low-Rise)	323 dwelling units	30	93	100	59
934- Fast Food Restaurant with Drive-Through Window	12,300 sq ft	280	269	211	195
Phase I Total		**310**	**362**	**311**	**254**
150- Warehousing	123,000 sq ft	29	9	11	30
Full Build Out Total		**339**	**371**	**322**	**284**

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, location of nearby schools, 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:

- 15% to/from the north
- 5% to/from the south
- 35% to/40% from the east (Chipman Road)
- 5% to/from the east (Chipman Road)
- 40% to/35% from the west

Trip distribution during the afternoon peak period:

- 15% to/from the north
- 5% to/from the south
- 40% to/35% from the east (Chipman Road)
- 5% to/from the east (Chipman Road)
- 35% to/40% from the west

Existing Plus Site Traffic Volumes

The expected development site-generated traffic volumes were added to the existing plus approved traffic scenario. The volumes are shown on Figures 4, 5, 6, and 7.

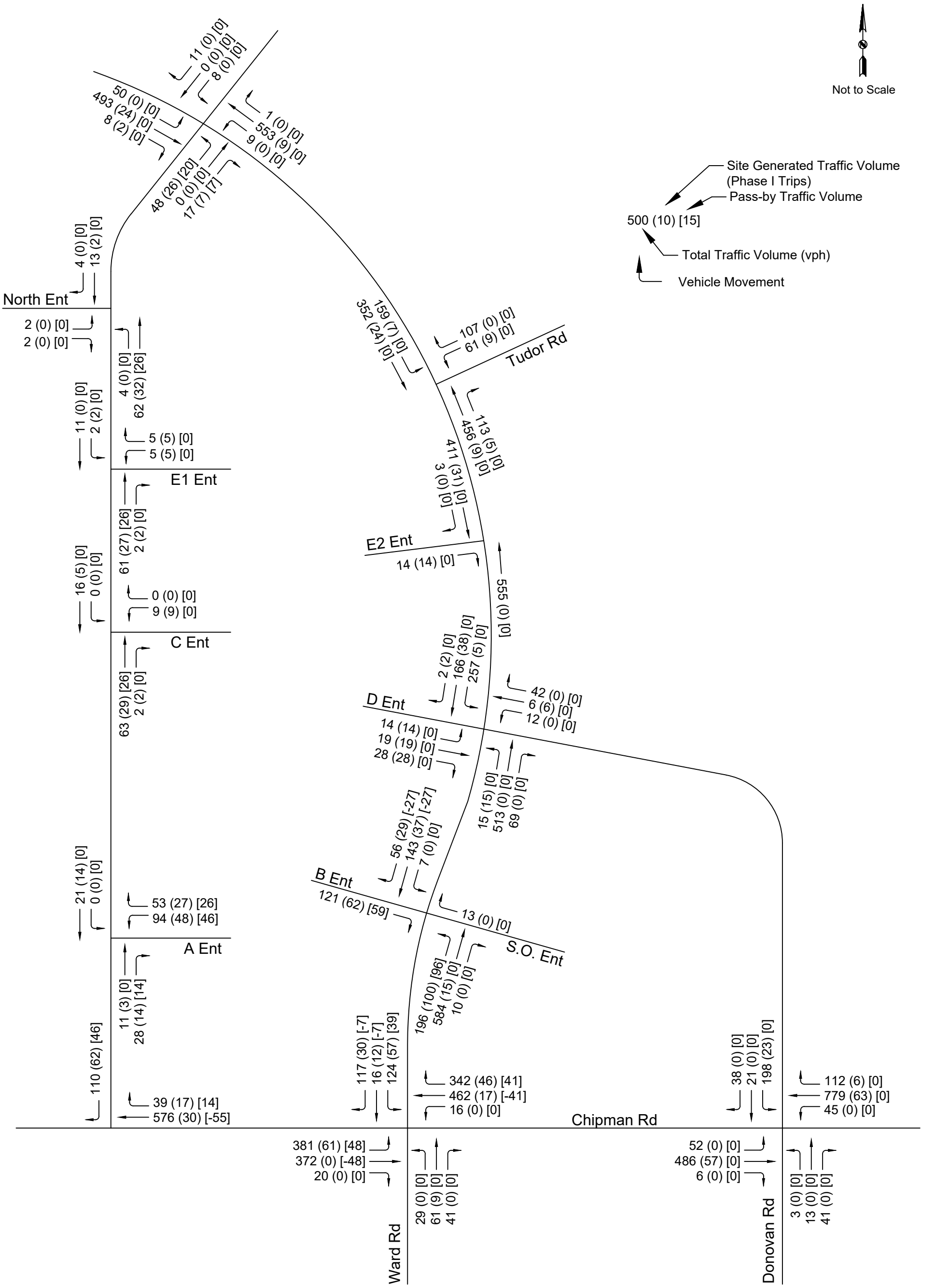

Figure 4 - Existing plus Phase I Site AM Peak Hour Volumes (Restaurant & Residential)

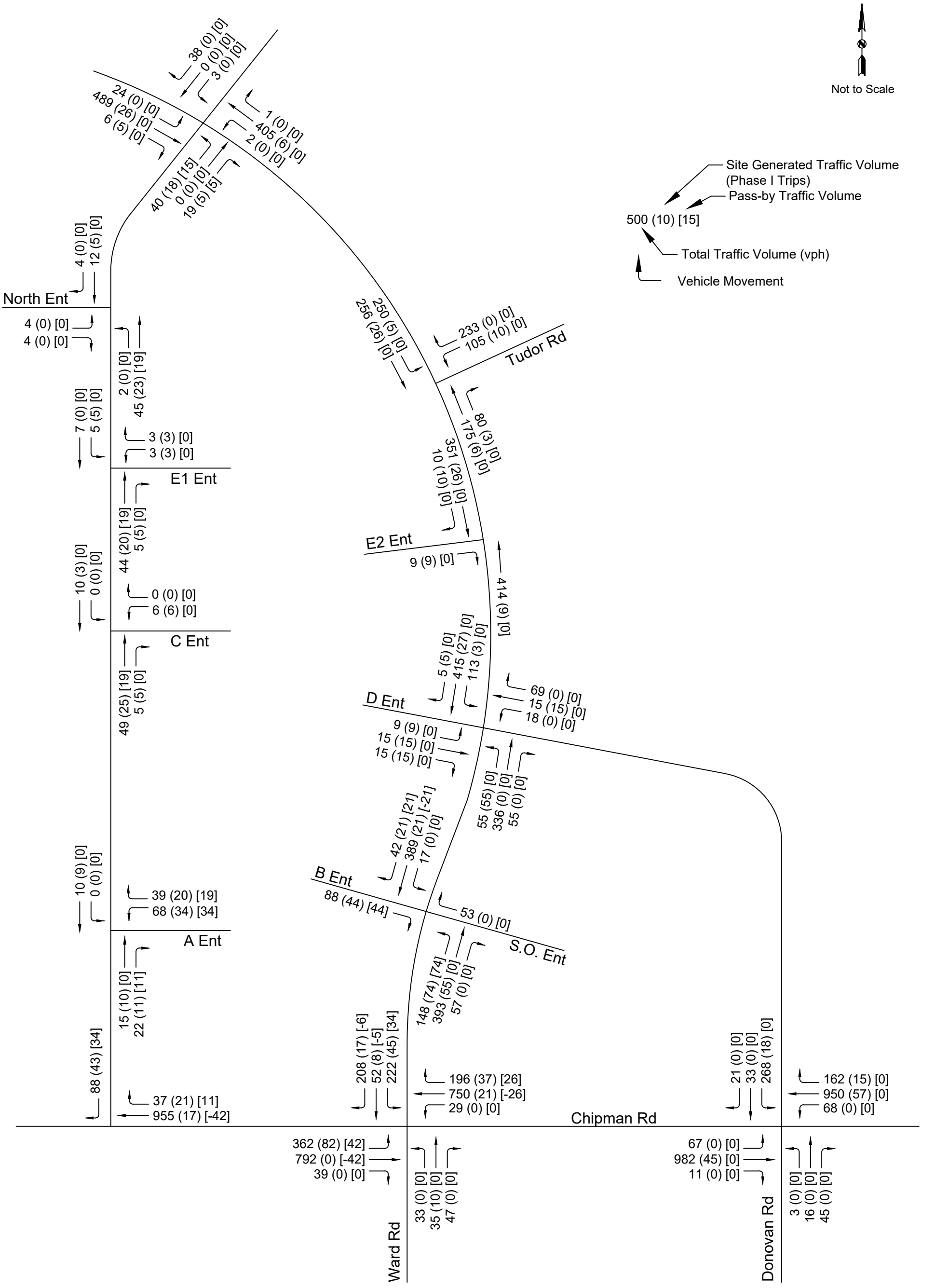

Figure 5 - Existing plus Phase I Site PM Peak Hour Volumes (Restaurant & Residential)

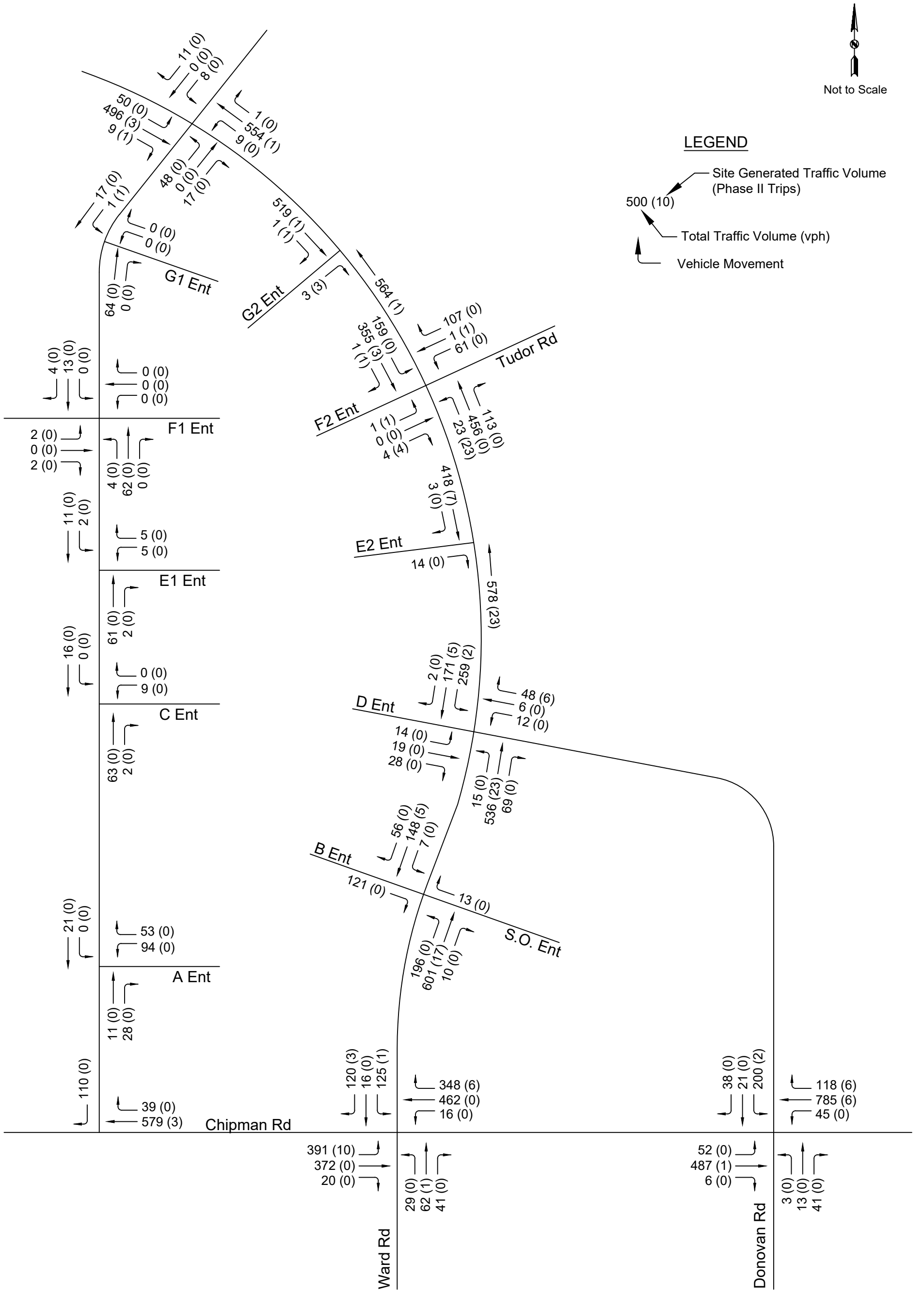

Figure 6 - Existing plus Phase I&II Site AM Peak Hour Volumes (Full Build-Out)

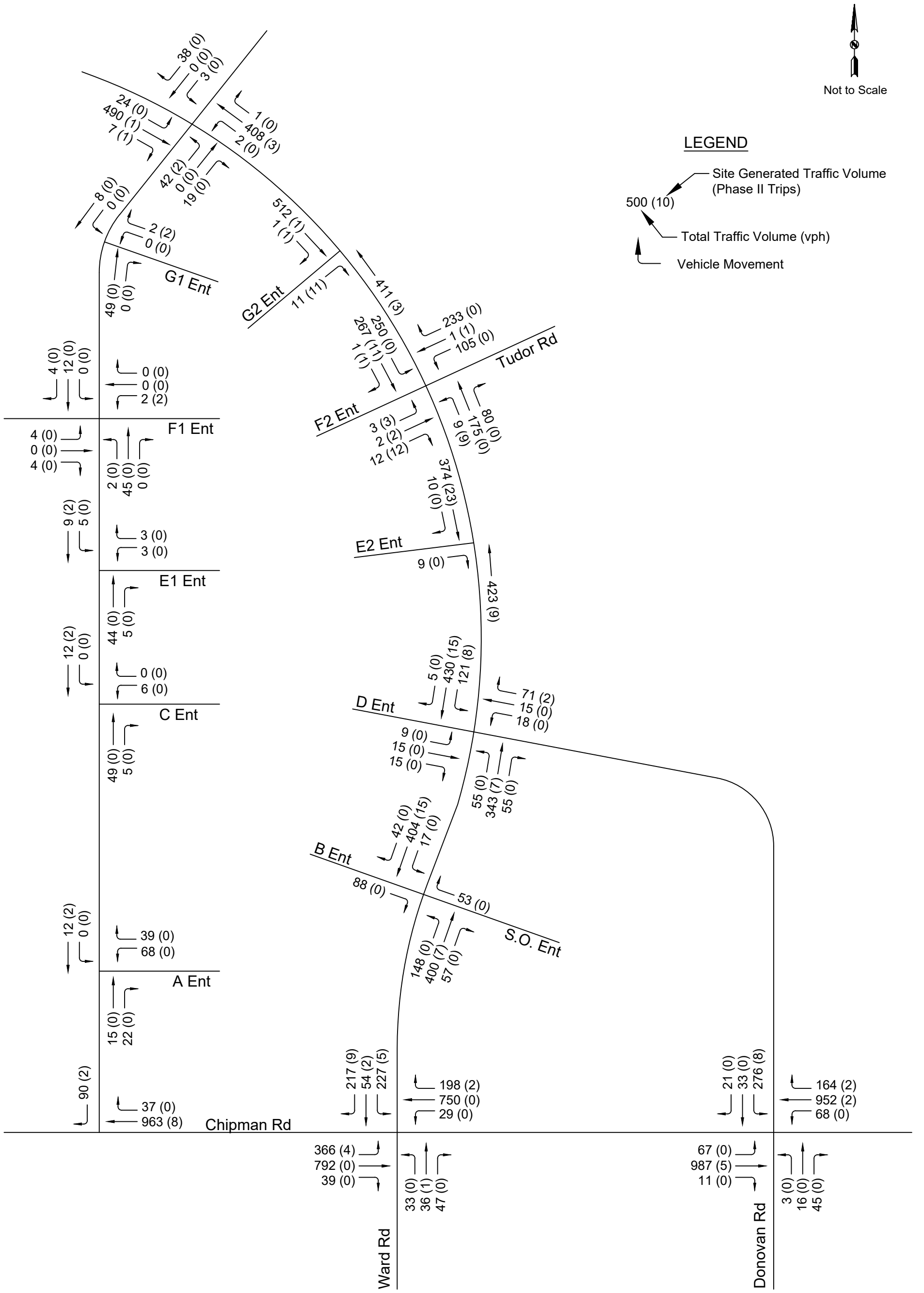

Figure 7 - Existing plus Phase I&II Site PM Peak Hour Volumes (Full Build-Out)

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 Ward Road and Outerview Road and at Ward Road and Donovan Road 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 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 are not expected to warrant a traffic signal at the Ward Road and Outerview Road or at Ward Road and Donovan Road intersections. The raw data and curves from the 2009 MUTCD are included in the Appendix.

Right-Turn and Left-Turn Lane Warrants

The need for right and left-turn lanes into the site entrances was evaluated using the City of Lee's Summit *Access Management Code*, March 2018 turning lane guidelines as part of this study for the existing plus site (Phase I & II) condition.

Left-Turn Warrant

Left-turn lane guidelines per City of Lee's Summit *Access Management Code*:

> 16.1.E. Left-turn lanes shall be provided at all median openings on roadways with medians.
>
> 16.1.H. The minimum length of left-turn lane should be 250 feet plus taper on an arterial street intersecting another arterial street and 200 feet plus taper on an arterial street at other locations. The minimum length of left-turn lane on collectors should be 150 feet plus taper. The minimum length of left-turn lane on connectors should meet the driveway throat length requirements.

Left-turn lanes will be required northbound on Ward Road at the Summit Orchard/B Entrance, Donovan Road intersection, and Tudor Road intersection, as Ward Road is a median divided arterial roadway.

Right-Turn Warrant

Right-turn lane guidelines per City of Lee's Summit *Access Management Code*:

> 16.2.A. Required on arterial streets at each intersecting street or driveway where the right-turn volume on the major arterial street is or is projected to be at least 30 vehicles in any hour, or the right-turn volume on the minor arterial street is or is projected to be at least 60 vehicles in any hour. Minimum length should be 250 feet plus the taper on a major arterial at the intersection of another arterial street or 200 feet plus the taper on a minor arterial at the intersection with another arterial street or on a major arterial at the intersection of a collector and 150 feet plus the taper at other locations along arterial streets.

The traffic volumes are expected to meet the right-turning volume criteria southbound at the Ward Road and Summit Orchard/B Entrance.

The raw analysis data is 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 3 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 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

Chipman Road and Ward 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. The overall LOS for the intersection is a LOS C during the morning peak period and a LOS D during the afternoon peak period.

Chipman Road and Outerview Road

The through movements of Chipman Road are not stop-controlled and are therefore operating in a free-flow condition. The southbound right-turn lane operates at a LOS B and has sufficient capacity for queuing vehicles.

Chipman Road and Donovan Road

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 C during the morning and afternoon peak periods.

Ward Road and Summit Orchard Entrance

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

Ward Road and Donovan Road

The through movements (northbound and southbound) of Ward Road are not stop-controlled and are therefore operating in a free-flow condition. The southbound left-turn lane operates at a LOS B or better and has sufficient capacity for queuing vehicles.

The westbound left-turn lane operates at a LOS E during the morning peak period due to the traffic volumes on Ward Road.

Ward Road and Tudor 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. The overall LOS for the signal is a LOS B during the morning and afternoon peak periods.

Ward Road and Outerview Road

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

Outerview Road and North Entrance

All approaches operate at a LOS A for the morning and afternoon peak periods 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 8 and 9.

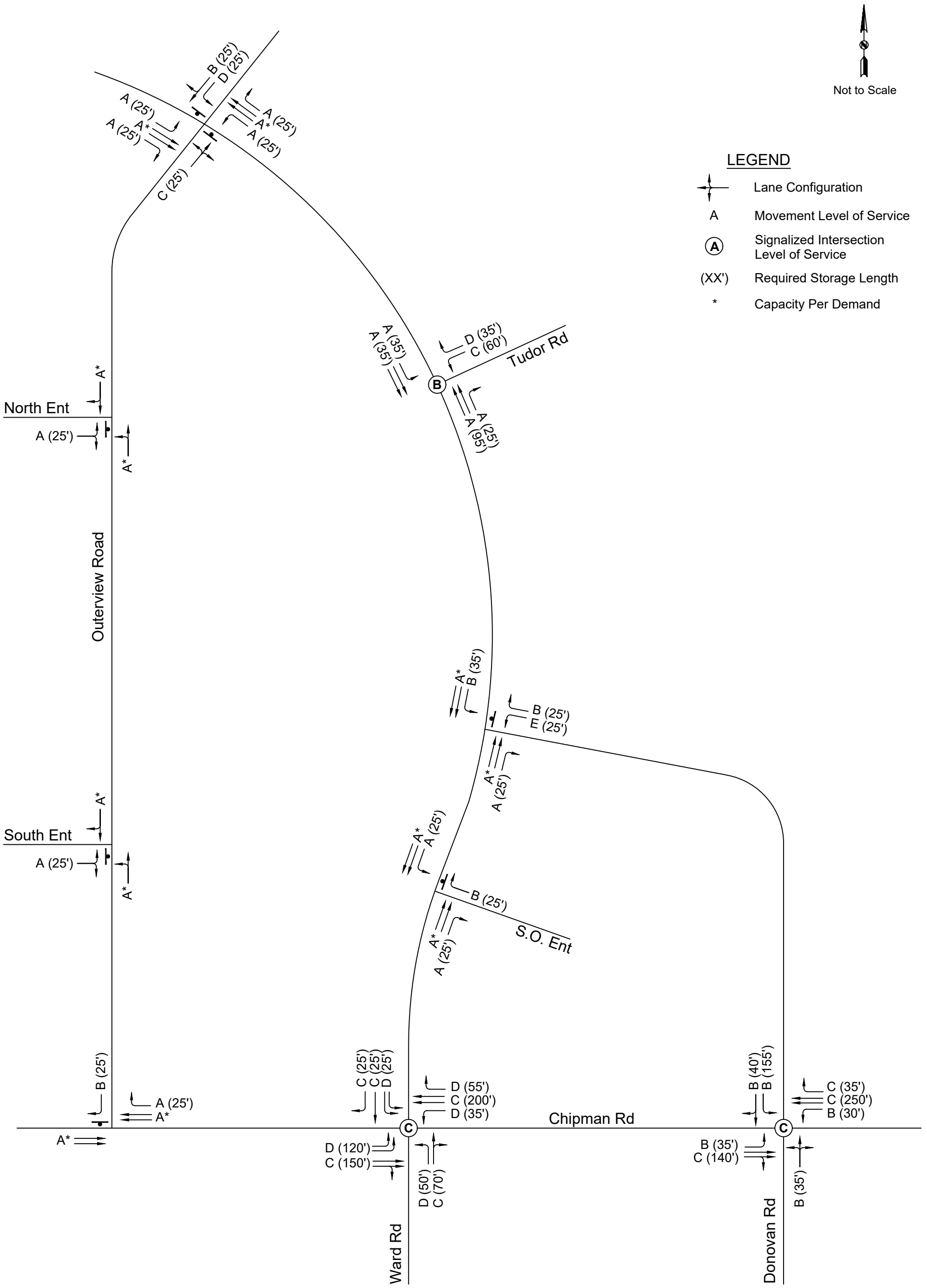

Figure 8 - Existing AM Level of Service

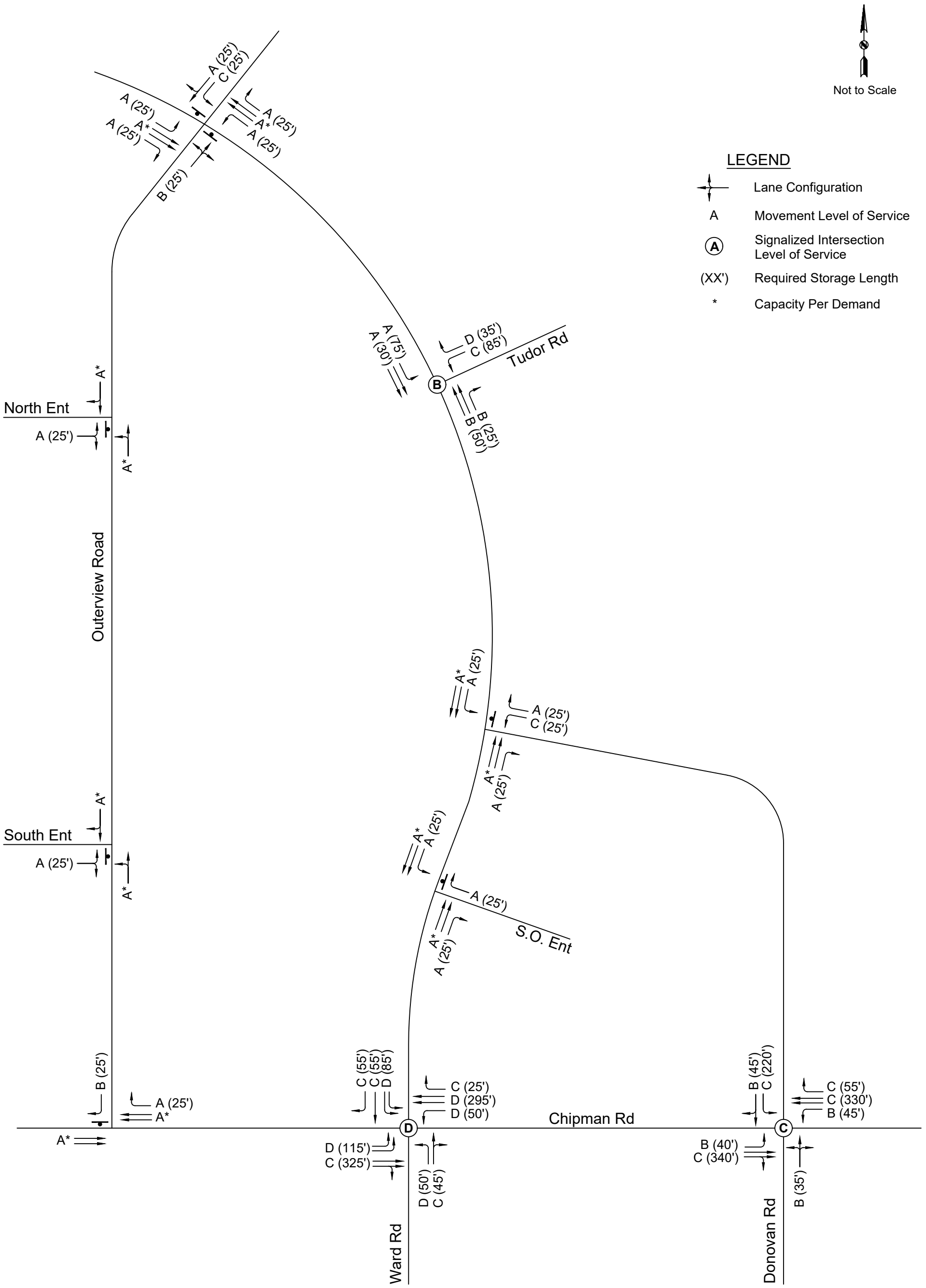

Figure 9 - Existing PM Level of Service

Existing Plus Phase I Site Conditions

Signal timings were optimized to account for the additional traffic.

Chipman Road and Ward Road

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 for the morning and afternoon peak periods and the intersection has sufficient capacity for queuing vehicles.

Chipman Road and Outerview Road

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

Chipman Road and Donovan Road

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

Ward Road and Summit Orchard/B Entrance

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

The proposed access for the northbound left-turn lane at this location does not fall within the spacing criteria of the City's *Access Management Guidelines*, therefore requires a formal waiver for a nonconforming situation based on existing conditions.

Per the City of Lee's Summit *Access Management Code*:

> 5.3. Waiver for Nonconforming Situations
>
> Where the existing configuration of properties and driveways in the vicinity of the subject site precludes spacing of an access point in accordance with the spacing standards of this policy, the City Lee's Summit Access Management Code 15 March 2018 Traffic Engineer, in consultation with appropriate City departments, shall be authorized to waive the spacing requirement if all of the following conditions have been met:
>
> 5.3.A. No other reasonable access to the property is available.
>
> 5.3.B. The connection does not create a potential safety or operational problem as reasonably determined by the City Traffic Engineer based on a review of a transportation impact study prepared by the applicant's professional engineer.

5.3.C. The access connection along the property line farthest from the intersection may be allowed. The construction of a median may be required on the street to restrict movements to right-in/right-out and only one drive shall be permitted along the roadway having the higher functional classification.

5.3.D. Joint access shall be considered with the property adjacent to the farthest property line. In these cases:

- A joint-use driveway with cross-access easements will be established to serve two abutting building sites,
- The building site is designed to provide cross access and unified circulation with abutting sites; and
- The property owner agrees to close any pre-existing curb cuts after the construction of both sides of the joint use driveway.

The northbound left-turn lane at the Summit Orchard/B Entrance will be the primary access into the restaurant site. The drive will be located off Ward Road, which is an arterial roadway, and has significantly higher existing traffic volumes and capacity than the private roadway referred to as Outerview Road. The additional Outerview Road access and shared access with the residential development to the north are designed to be secondary accesses. As fast-food restaurant sites have a high number of pass-by trips, it is essential for the businesses to have clear and direct access—without direct access, patrons will consider the development too difficult to access and the businesses will fail.

The Summit Orchard/B Entrance will be designed as a ¾ access and will mirror the existing southbound left-turn lane into the Summit Orchard development. The restaurant access is located as far north on the site as geometrically possible (five feet south of the property line) and will be the only access to the restaurant site from Ward Road.

Results of the Synchro analysis for queuing show the proposed northbound left-turn lane into the site will have sufficient queuing with 130 feet of storage (max expected northbound left-turn queue length is 25 feet). The southbound dual left-turn lane at Chipman Road is expected to need a maximum of 120 feet of storage and the proposed site plan will provide 170 feet of storage for the inner lane and 190 feet for the outer lane. The queues for the new northbound left-turn lane into the restaurant site will be substantially less than the storage provided and will not back onto Ward Road or into the Chipman Road intersection.

Joint access with the residential site to the north is provided at the secondary access at Outerview Road.

Ward Road and Donovan Road

During this phase the additional traffic on Ward Road and from the site will cause the westbound left-turn lane to drop to a LOS F from a LOS E, and the eastbound left-turn lane will operate at a LOS E during the morning peak period due to the traffic volumes on Ward Road. The volumes experiencing this unacceptable level of delay are less than 15 for each movement and there are alternative routes available during the peak periods—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 morning peak period.

As a signal is not expected to be warranted at this intersection; the installation of one to help with delays is not recommended.

Ward Road and E2 (RIRO) Entrance

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

Ward Road and Tudor Road

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

Ward Road and Outerview Road

During the morning peak period, the northeast movement drops from a LOS C 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 northeast movement is 38.2 seconds and the limit for LOS D is 35 seconds, so the movement is 3.2 seconds outside the LOS D criteria.

As a signal is not expected to be warranted at this intersection and, the installation of a signal to help with delays is not recommended.

Outerview Road and A Entrance

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

Outerview Road and C Entrance

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

Outerview Road and E1 Entrance

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

Outerview Road and North Entrance/F1 Entrance

There is no significant change in the operations of this intersection from the existing conditions. All approaches operate at a LOS A for the morning and afternoon peak periods and the intersection has sufficient capacity for queuing vehicles.

The results of the capacity analysis for the existing plus phase I morning and afternoon peak hour conditions along with lane configuration and queue lengths are shown on Figures 10 and 11.

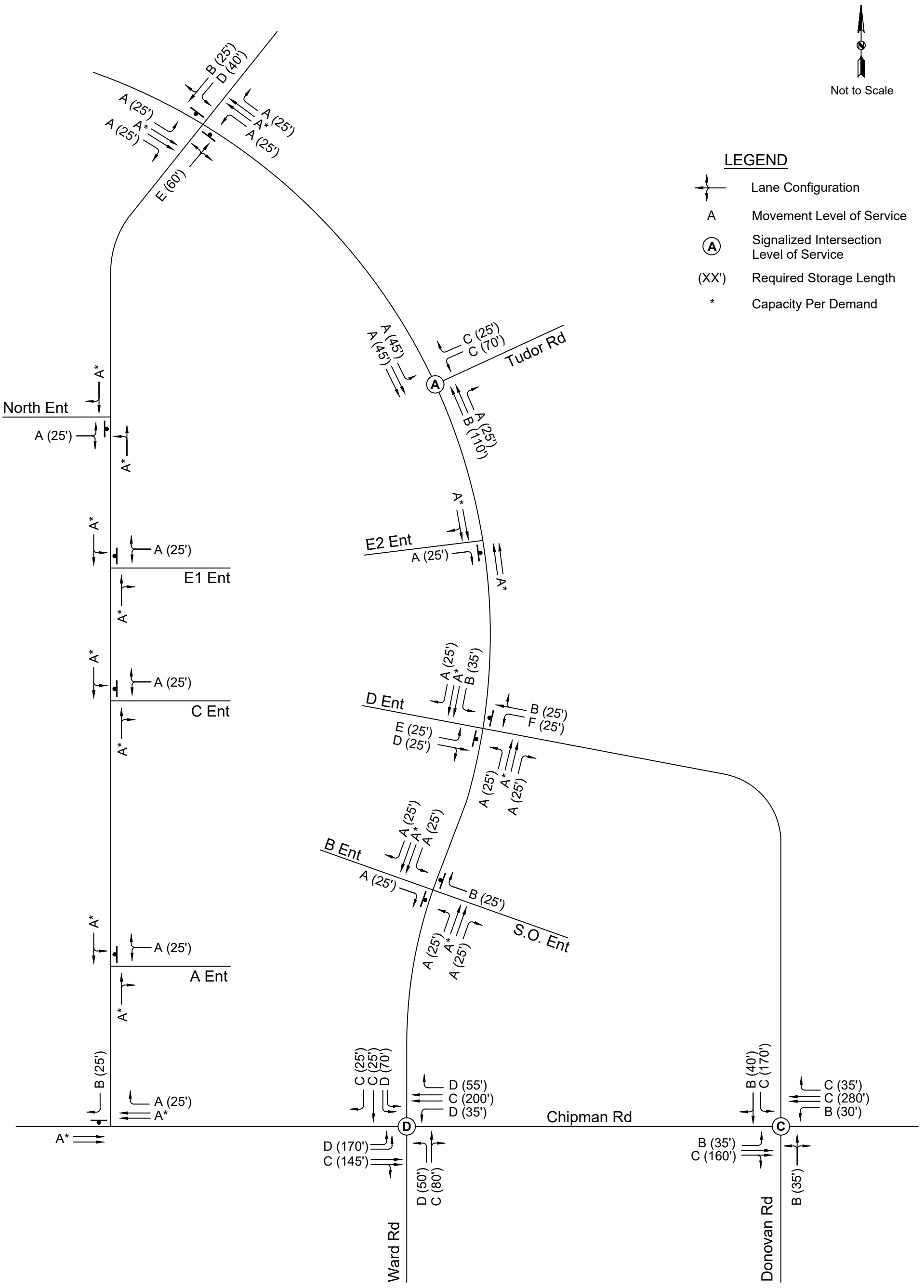

Figure 10 - Existing plus Phase I Site AM Level of Service (Restaurant & Residential)

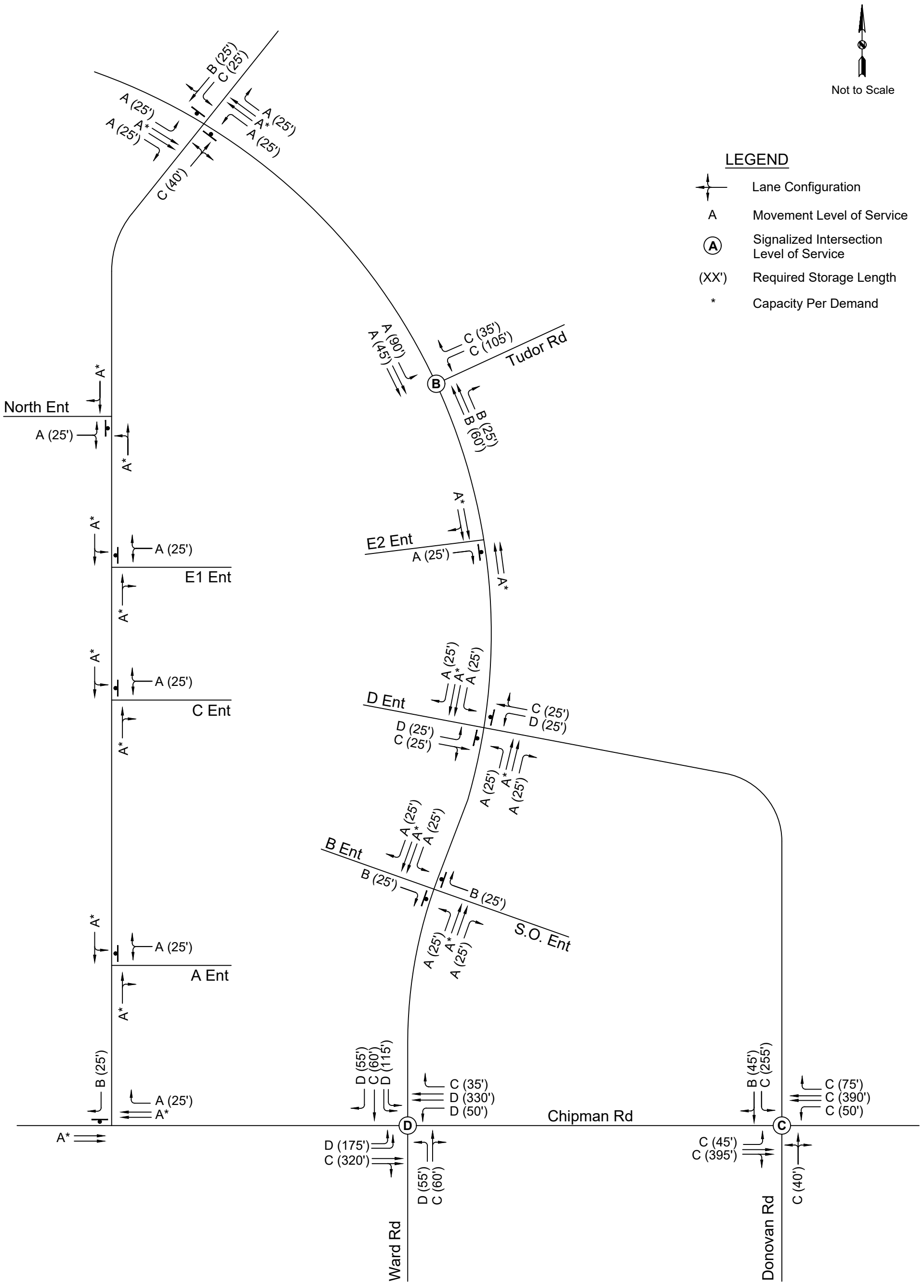

Figure 11 - Existing plus Phase I Site PM Level of Service (Restaurant & Residential)

Existing Plus Phase I & II Site Conditions

Signal timings were optimized to account for the additional traffic.

Chipman Road and Ward Road

There is no significant change in the operations of this intersection from the phase I 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.

Chipman Road and Outerview Road

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

Chipman Road and Donovan Road

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

Ward Road and Summit Orchard Entrance/B Entrance

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

The northbound left-turn lane into the site will continue to have sufficient queuing with 130 feet of storage.

Ward Road and Donovan Road

There is no significant change in the operation of this intersection from the phase I conditions. The westbound left-turn lane continues to operate at a LOS F and the eastbound left-turn lane at a LOS E.

Ward Road and E2 (RIRO) Entrance

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

Ward Road and Tudor Road

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

Ward Road and G2 (RIRO) Entrance

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

Ward Road and Outerview Road

The northeast movement continues to operate at a LOS E. All other movements continue to operate at a LOS D or better and have sufficient capacity for queuing vehicles.

Outerview Road and A Entrance

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

Outerview Road and C Entrance

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

Outerview Road and E1 Entrance

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

Outerview Road and North Entrance/F1 Entrance

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

Outerview Road and G1 Entrance

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

The results of the capacity analysis for the existing plus phase I & II morning and afternoon peak hour conditions along with lane configuration and queue lengths are shown on Figures 12 and 13.

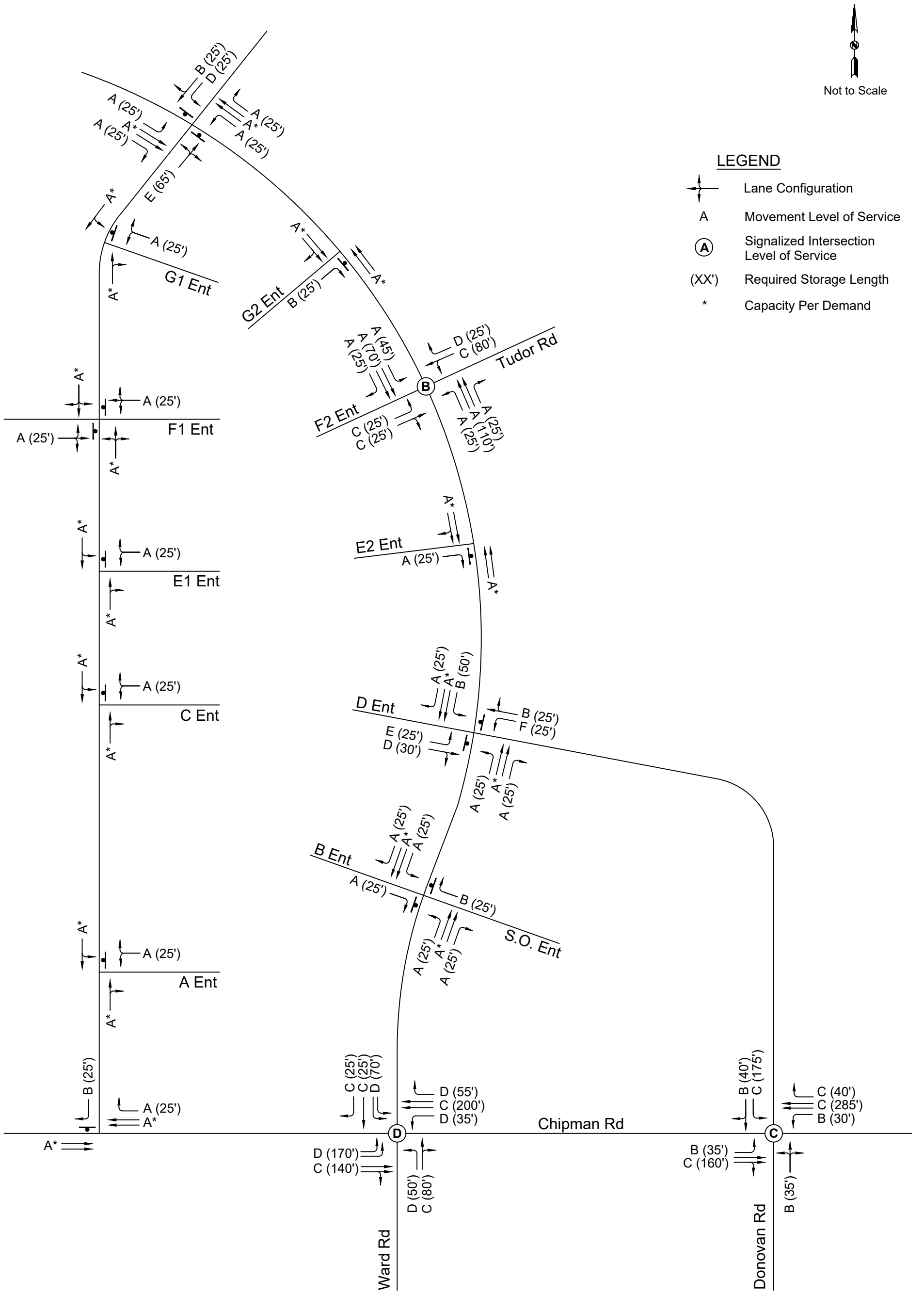

Figure 12 - Existing plus Phase I&II Site AM Level of Service (Full Build-Out)

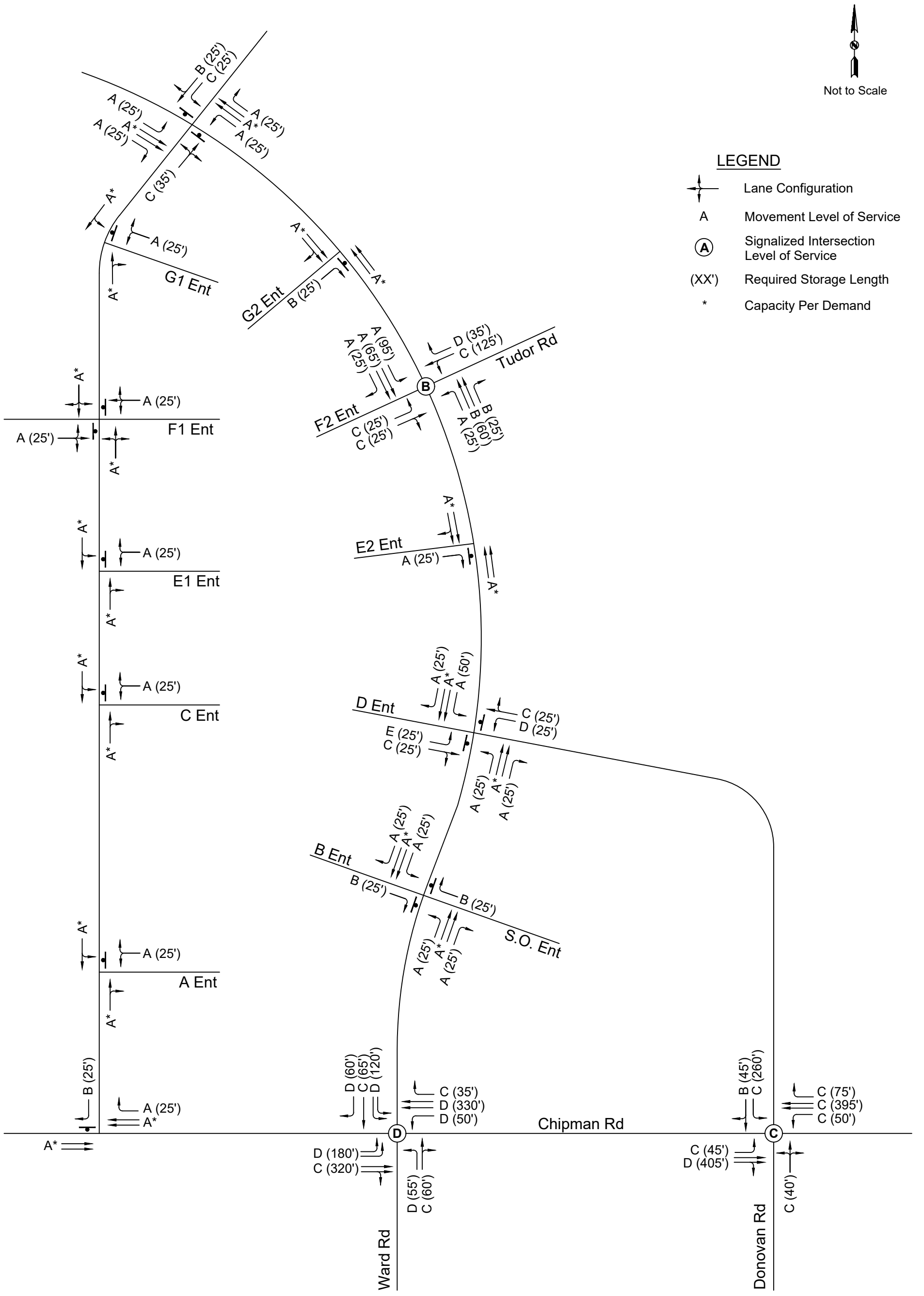

Figure 13- Existing plus Phase I&II Site PM Level of Service (Full Build-Out)

RECOMMENDATIONS

This study documents the findings of the traffic analysis of the expected traffic for the Summit Orchards West development in Lee's Summit, Missouri. The study includes an analysis of the existing conditions, existing plus Phase I site conditions, and existing plus Phase I & II site conditions.

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

When the Phase 1A residential development (center lot) is constructed:

- Install northbound left-turn lane (200 feet plus taper) at the intersection of Ward Road and Donovan Road.

When the Phase 1B restaurant development (south lot) is constructed:

- Restripe the southbound lanes at Ward Road and Chipman Road to a right-turn lane, a through lane, and dual left-turn lanes (minimum 170 feet of storage for the inner lane and 190 feet for the outer lane plus taper). Install signing per MUTCD recommendations for the right-turn lane-drop. Optimize/adjust signal timings as necessary for the Ward Road and Chipman Road signal.
- Install a northbound left-turn lane (minimum 130 feet of storage plus taper) at the intersection of Ward Road and Summit Orchard/B Entrance with modifications to median.
- Install a southbound right-turn lane (200 feet plus taper) at the intersection of Ward Road and Summit Orchard/B Entrance.
- Construct an internal site connection between the residential and restaurant development near A Entrance and Outerview Road.

When the Phase 2 warehouse development (north lot) is constructed:

- Reconstruct the northbound u-turn lane at Ward Road and Tudor Road to a left-turn lane (200 feet plus taper). Restripe the westbound lanes to consist of a right-turn lane and a through/left-turn lane. Construct the eastbound signal mast arm and pole with pedestrian equipment and optimize/adjust signal timings as necessary.
- The need for future roadway improvements should be reevaluated as additional development occurs.