



# TUDOR ROAD DEVELOPMENT TRAFFIC IMPACT STUDY

Prepared for:  
Scannell Properties

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**olsson**



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Appendix F: Future Year 2041 plus Approved plus Full Build Development Conditions

# 1. INTRODUCTION

This report studies traffic impacts associated with a proposed warehouse development located in the northwest quadrant of Tudor Road and Sloan Road in Lee's Summit, Missouri.

This report will review the impacts of the proposed site on the existing roadway network and will recommend additional turn lanes, storage bays, and intersection control methods per the City of Lee's Summit *Access Management Code* for the following study intersections:

- Tudor Road and Ward Road
- Tudor Road and Main Street
- Tudor Road and Sloan Street
- Tudor Road and Douglas Street
- Douglas Street and Sycamore Street
- Proposed Site Driveways as appropriate

For this study, the following scenarios were analyzed for the AM and PM peak hour periods:

- Existing plus Approved Development Conditions
- Existing plus Approved plus Phase 1 Development Conditions
- Build Year 2026 plus Approved plus Full Build Development Conditions
- Future Year 2041 plus Approved plus Full Build Development Conditions

The approximate locations of the approved and proposed developments are shown on **Figure 1**.

# FIGURE 1




## Vicinity Map

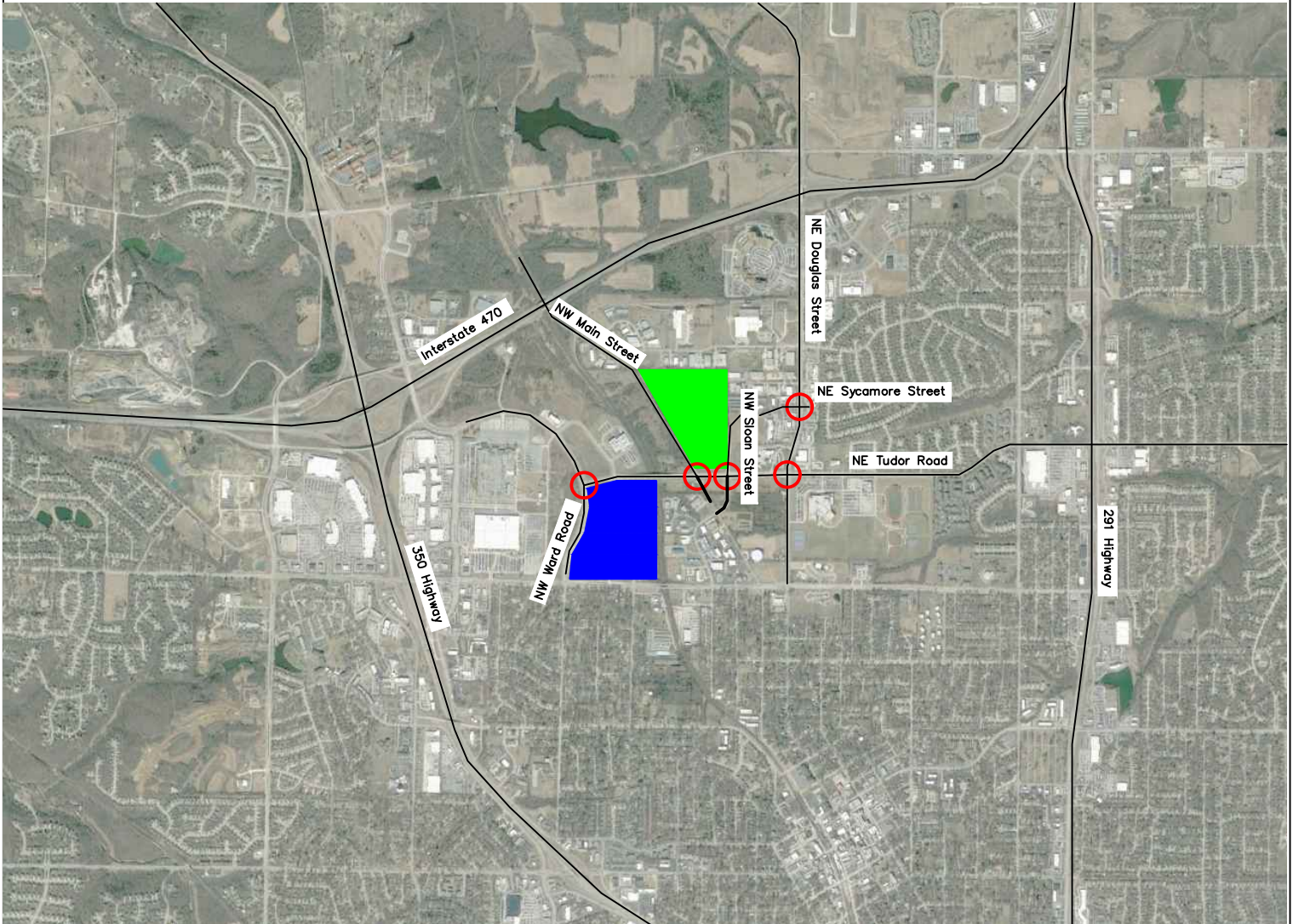
Tudor Road Development  
Lee's Summit, MO



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### LEGEND

-  Site Location
-  Approved Development
-  Proposed Study Intersections



Source: Google Earth

## 2. DATA COLLECTION

The data collection effort included acquiring traffic counts, approved development studies, signal timings, and documentation of current roadway geometrics.

Traffic counts were collected on Wednesday, June 2<sup>nd</sup>, 2021 at all study intersections with the exception of Douglas Street and Sycamore Street. Turning movement data available from a count conducted in 2019 was referenced for this intersection, with through volumes balanced from adjacent intersection counts. Turning movement traffic counts were conducted during the typical weekday AM and PM peak periods from 7:00-9:00 AM and 4:00-6:00 PM. The peak hour periods varied slightly between the study intersections. Due to the size of the study area, the peak hour of each intersection was utilized.

Data collection for this study occurred after school had been dismissed for the year. A high school is located in the southeast quadrant of the intersection of Douglas Street and Tudor Road, with additional school facilities located on the west side of the project study area. City staff requested that the existing traffic counts be reviewed and adjusted, if necessary, to accommodate increased volumes that may occur within the study area when school is in session. Data was available for the intersection of Douglas Street and Tudor Road from 2019, with counts conducted when school was in session. Count data from 2019 was compared to the 2021 count data. Individual movements were adjusted (increased) to better represent intersection volumes with school in session.

Existing signal timing information was provided by the City of Lee's Summit for the signalized intersection of Tudor Road and Ward Road. Existing signal timing information for intersections along Douglas Street were obtained from the Mid-America Regional Council's (MARC) Central Traffic Control System (TransSuite).

Traffic count and signal timing information is provided in **Appendix A**.

### 3. EXISTING CONDITIONS

The existing traffic conditions of the roadway network were evaluated to identify any existing deficiencies and to provide a baseline for comparative purposes. At the request of the City, a partially constructed approved development project was considered with the existing conditions. Approved development improvements recommended within this project study area have been constructed and are considered within the base scenario. The approved development will be presented further in **Section 4.0**.

#### 3.1. Network Characteristics

Six roadways within the study area were considered during analysis: Tudor Road, Ward Road, Main Street, Sloan Street, Douglas Street and Sycamore Street. The City of Lee's Summit *Thoroughfare Master Plan* was referenced to determine existing roadway classification. Current network characteristics are summarized in **Table 1**.

**Table 1. Existing Network Summary.**

Roadway	Functional Classification	Typical Section	Median Type	Posted Speed
Tudor Road	Minor Arterial	4-Lane	Divided	35 mph
Ward Road	Major Arterial	4-Lane	Divided	35 mph
Main Street	Commercial/ Industrial Collector	2-Lane	None	35 mph
Sloan Street	Local	2-Lane	None	25 mph
Douglas Street	Major Arterial	4-Lane	Divided north of Tudor Road	45 mph
Sycamore Street	Local	2-Lane	None	25mph*

\*No posted speed limit. Assumed speed limit of 25mph.

The Ward Road and Tudor Road intersection is signalized. A dedicated northbound right-turn lane and southbound left-turn lane is provided at the intersection. There is currently no west leg of the intersection, however a northbound turn lane is provided to accommodate U-turn movements. Pedestrian accommodations including marked crosswalks and pedestrian pushbuttons and signal heads are provided for all crossings.

The Main Street and Tudor Road intersection is unsignalized. No pedestrian accommodations are located at any crossings for the intersection. Reviewing the *Thoroughfare Master Plan* and based on discussions with City staff, Main Street is planned to be relocated to the east, intersecting Tudor Road at the current intersection of Sloan Street. Road re-alignment will be discussed later in this report.

The Sloan Street and Tudor Road intersection is unsignalized. Dedicated eastbound, westbound, and southbound left-turn lanes are provided. A dedicated westbound right-turn lane is provided. No pedestrian accommodations are located at any crossings for the intersection.

The Douglas Street and Tudor Road intersection is signalized. The signalized intersection is part of a coordinated signal system along Douglas Street. Dedicated left-turn lanes are provided for all approaches at the intersection. Eastbound and northbound right-turn lanes are provided. Pedestrian accommodations including marked crosswalks and pedestrian pushbuttons and signal heads are provided for all crossings.

The Douglas Street and Sycamore Street intersection is signalized. The signalized intersection is part of a coordinated signal system along Douglas Street. Dedicated eastbound, northbound and southbound left-turn lanes are provided. A dedicated northbound and southbound right-turn lane is provided. Pedestrian accommodations including marked crosswalks and pedestrian pushbuttons and signal heads are provided for all crossings.

*Exhibit 4 – Bicycle Transportation Plan* of the *City's Thoroughfare Master Plan* was reviewed to determine bicycle plans within the study area network. Tudor Road is illustrated as a planned route (path and street accommodation). Relocated Main Street is illustrated as a planned route (path).

The City of Lee's Summit has adopted an Unimproved Road Policy to provide guidance for development activity impacting roadways that are currently considered to meet unimproved/interim standards. Based on *Exhibit 6 – Existing Unimproved and Interim Roadways and Network Gaps* of the *Thoroughfare Master Plan*, Main Street is unimproved. Per the Unimproved Road Policy, Main Street should be improved to an urban standard. Main Street is proposed to be re-aligned and improved, consistent with guidance in the *Unimproved Road Policy*, within the boundaries of the project site.



## **4. EXISTING PLUS APPROVED DEVELOPMENT CONDITIONS**

Per the request of City staff, an approved development project located southwest of the proposed project was considered with the base condition analysis. The "*Summit Orchards Traffic Impact Study*" conducted by McClure Engineering Co, dated March 2016, was referenced for the purposes of this report. The approved development is a mixed-use project that has been partially constructed. Based on information provided by the City, the development is approximately 75% built, with the buildings adjacent to Chipman Road unbuilt. Trips associated with the built portion of the development were captured within the traffic counts. To represent trips associated with un-built approved development (along Chipman Road), the approved traffic impact study was referenced. The general location of the approved development is illustrated on the vicinity map (**Figure 1**). All geometric improvements associated with the approved development that impact the study area have been constructed.

### **4.1. Approved Trip Generation and Distribution**

The approved traffic impact study was referenced to develop trips associated with the un-built portion of the approved development. Applicable pages from the approved study are provided in **Appendix B**. Trips were distributed through the study area based on existing gravity at study intersections. The resulting existing plus approved development volumes are illustrated in **Figure 2**.

# FIGURE 2

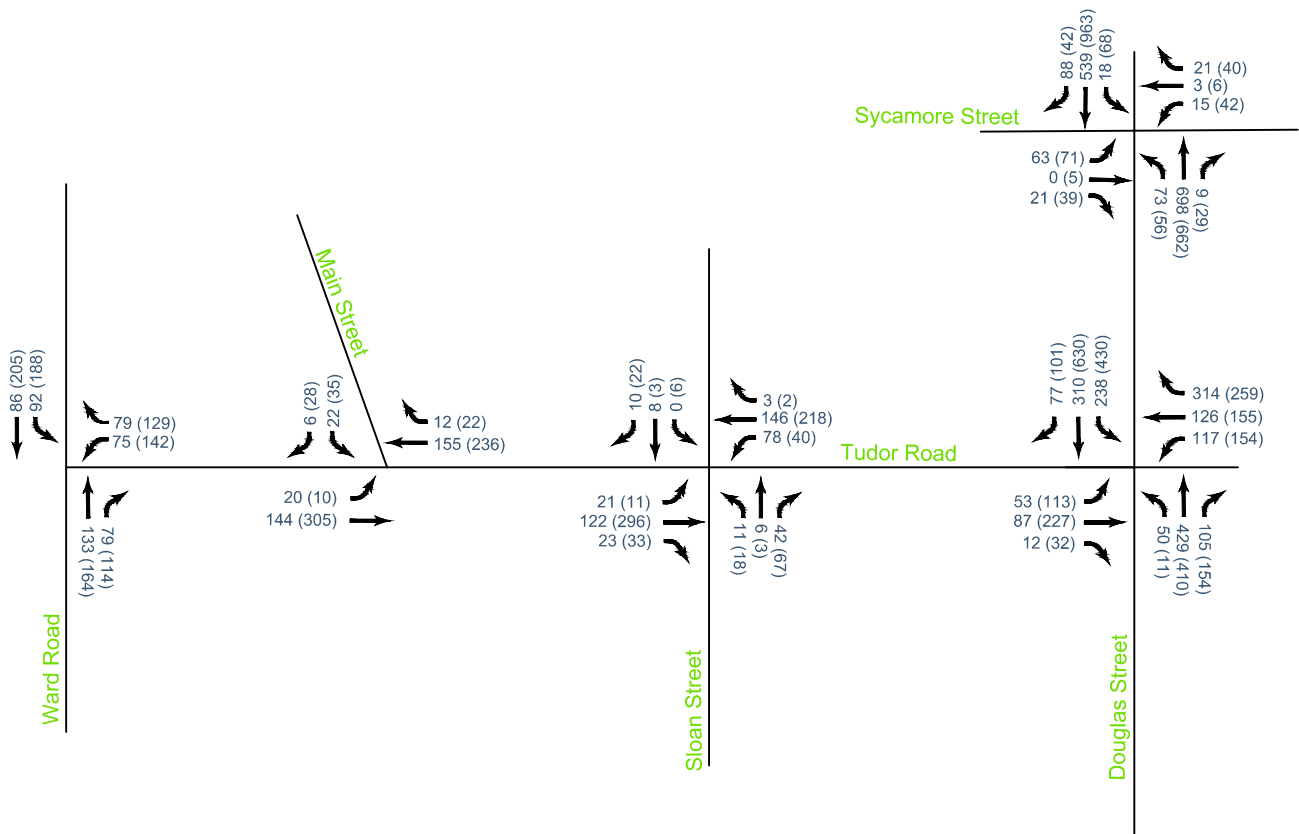
## Existing plus Approved Development Conditions Peak Hour Volumes

Tudor Road Development  
Lee's Summit, MO



### LEGEND

AM (PM) Peak Hour Volume



## 4.2. Existing plus Approved Development Warrant Analysis

### Signal Warrants

A traffic signal may be justified if traffic conditions meet any of the applicable nine signal warrants described in the 2009 Manual on Uniform Traffic Control Devices (MUTCD). The MUTCD provides criteria for conducting an engineering study to determine whether a traffic signal is appropriate at an intersection.

For this study, based on the data available, the Peak Hour Signal Warrant (Warrant 3) was reviewed under existing conditions to determine if alternative control measures are warranted for the currently unsignalized intersections of Tudor Road with Main Street and Sloan Street. Based on available data, traffic signals are currently not warranted based on warrant 3 at the reviewed intersections. Signal warrant analysis sheets are provided in **Appendix B**.

### Turn Lane Warrants

City of Lee's Summit Access Management Code (AMC) guidelines were reviewed for turn lanes at study intersections.

Left turn Lanes: Based on the Lee's Summit AMC, left-turn lanes shall be provided on all arterial streets at the intersection with another arterial and on non-residential connectors intersecting with minor arterial streets where the left turn volume is at least 20 vehicles per hour (vph). Left-turn lanes are also to be provided at all median openings on roadways with medians. An eastbound left-turn lane is currently not provided along Tudor Road and Main Street at the existing median break. Main Street is proposed to be re-aligned with the development of phase 1 of the proposed project, thus will be evaluated under the current lane geometrics.

Per the AMC, dual left-turn lanes should be planned for all approaches of an arterial/arterial intersection. The intersections of Douglas Street with Tudor Road and Ward Road with Tudor Road are currently serviced by single left-turn lanes for all approaches. The intersections will be evaluated under the current lane geometrics.

Per the AMC, the minimum length of a 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 following turn lanes do not meet the standard turn bay lengths.

- Southbound left-turn lane with reduced storage at Ward Road and Tudor Road
- Eastbound and westbound left-turn lanes with reduced storage at Tudor Road and Sloan Street
- Eastbound, westbound and northbound left-turn lanes with reduced storage at Douglas Street and Tudor Road

Operations will be evaluated considering the current turn bay storage lengths.

Right-turn Lanes: Based on the Lee's Summit AMC, right-turn lanes shall be provided on major arterial streets at all connections with a turning volume of at least 30 vph, and along minor arterial streets at all connections with a turning volume of at least 60 vph. Right-turn lanes are provided at locations meeting these characteristics except in the westbound and southbound directions at Douglas Street and Tudor Road.

Per the AMC, the minimum length of a right-turn lane should be 250 feet plus taper on a major arterial street intersecting another arterial street, and 200 feet plus taper on a minor arterial street intersecting another arterial street. The following turn lanes do not meet the standard turn bay lengths.

- Northbound right-turn lane with reduced storage at Ward Road and Tudor Road
- Westbound right-turn lane with reduced storage at Tudor Road and Sloan Street
- Eastbound and northbound right-turn lane with reduced storage at Tudor Road and Douglas Street

Capacity and queueing analysis is presented in **Section 4.3** to determine if additional left/right-turn lanes and/or increased storage length is recommended based on existing plus approved development operations. Existing plus approved development conditions lane configurations and traffic control for the study intersections are illustrated in **Figure 3**.

### **4.3. Existing plus Approved Development Capacity Analysis**

Capacity analysis was performed for the study intersections utilizing the existing lane configurations and traffic control. Analysis was conducted using Synchro, Version 11, based on the Highway Capacity Manual (HCM) delay methodologies. For simplicity, the amount of control delay is equated to a grade or Level of Service (LOS) based on thresholds of driver acceptance. The amount of delay is assigned a letter grade A through F, LOS A representing little or no delay and LOS F representing very high delay. **Table 2** shows the delays associated with each LOS grade for signalized and unsignalized intersections, respectively. Queueing analysis was also conducted using the 95<sup>th</sup>-percentile queue length. This represents the queue length that has a 5 percent probability of being exceeded during the peak hour period.

**Table 2. Intersection LOS Criteria.**

Level of Service	Average Control Delay (seconds)	
	Signalized	Unsignalized
A	< 10	< 10
B	> 10-20	> 10-15
C	> 20-35	> 15-25
D	> 35-55	> 25-35
E	> 55-80	> 35-50
F	> 80	> 50

Highway Capacity Manual (HCM 6<sup>th</sup> Edition)

The City of Lee's Summit references a Level of Service Policy to provide guidelines for acceptable traffic operations on its roadways. According to the policy, an overall LOS C is desirable at signalized intersections, and a LOS D may be acceptable under extraordinary circumstances. Based on discussions with City staff, individual signalized movements with a LOS D or E are typically considered acceptable. A LOS C is desirable at unsignalized intersections, and lower levels of service may be acceptable depending on the situation.

Results of the analysis indicate that the signalized intersections of Tudor Road with Ward Road and Douglas Street with Sycamore Street are expected to operate at an overall LOS A or better during both peak hour periods. All individual movements are expected to operate at LOS D or better.

The signalized intersection of Douglas Street and Tudor Road is expected to operate at a LOS E during the AM peak hour period and a LOS D during the PM peak hour period. During both peak periods, the westbound right-turn movement is expected to operate at a LOS F with all other movements at the intersection expected to operate at a LOS D or better. 95<sup>th</sup>-percentile queue lengths are expected to be accommodated within available storage. It is anticipated that the westbound movement is operating at a lower level of service due to signal progression favoring the north/south movements along Douglas Street and the heavy westbound right-turn movement. This movement is currently not serviced with a dedicated right-turn lane. As this is an existing condition, analysis for subsequent scenarios will consider the existing geometrics to represent the impact of the proposed development.

All movements at the unsignalized study intersections are expected to operate at LOS C or better with acceptable queues during the peak hour periods.

The existing plus approved conditions capacity analysis summary is illustrated in **Figure 4**. Detailed results are provided in **Appendix B**.




# FIGURE 3

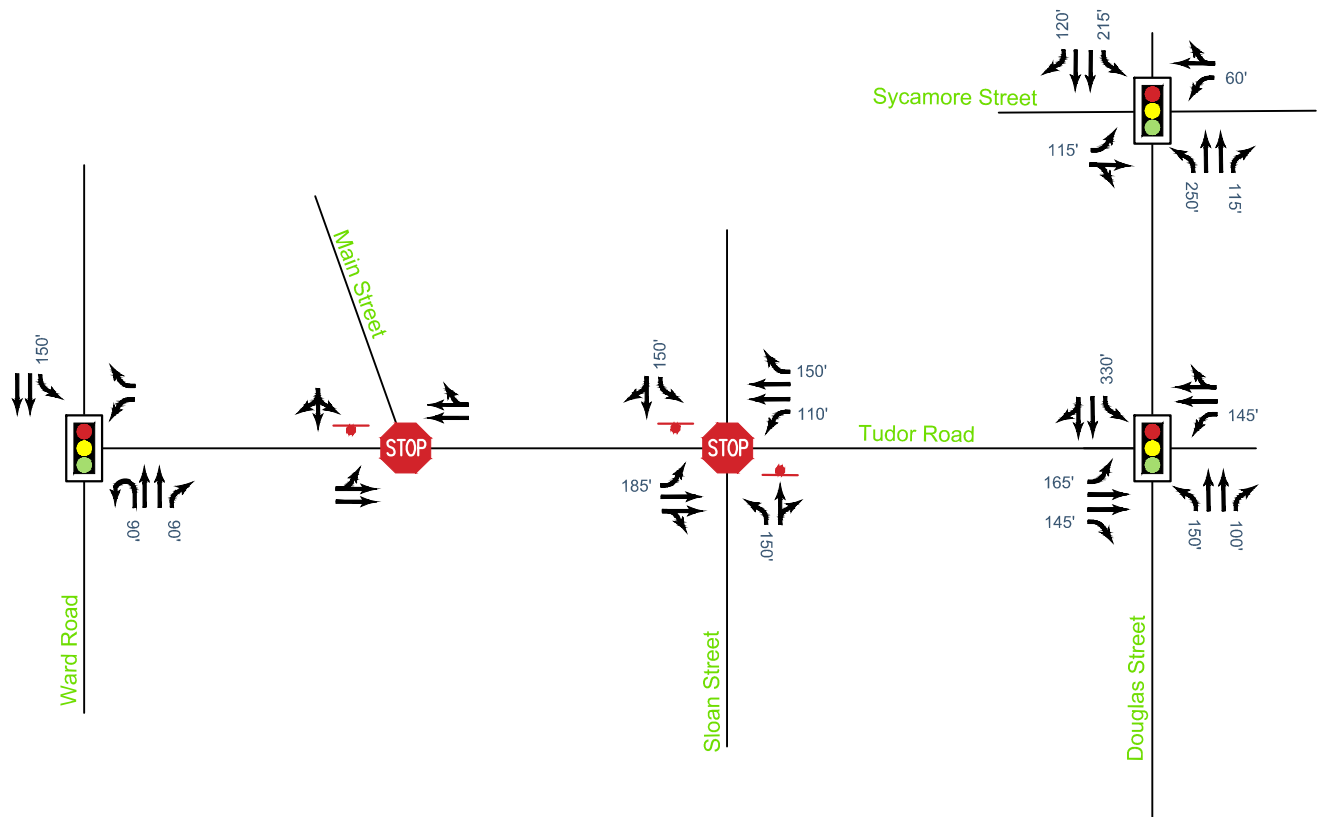
## Existing plus Approved Development Conditions Lane Configuration and Traffic Control

Tudor Road Development  
Lee's Summit, MO



### LEGEND

- xx' → Lane Configuration & Storage Length
-  Signalized Intersection
-  Stop Controlled Intersection
-  Stop Sign



# FIGURE 4

## Existing plus Approved Development Conditions Capacity Analysis

Tudor Road Development  
Lee's Summit, MO



### LEGEND

AM (PM) {AM (PM)} Movement LOS & {95th Percentile Queue}

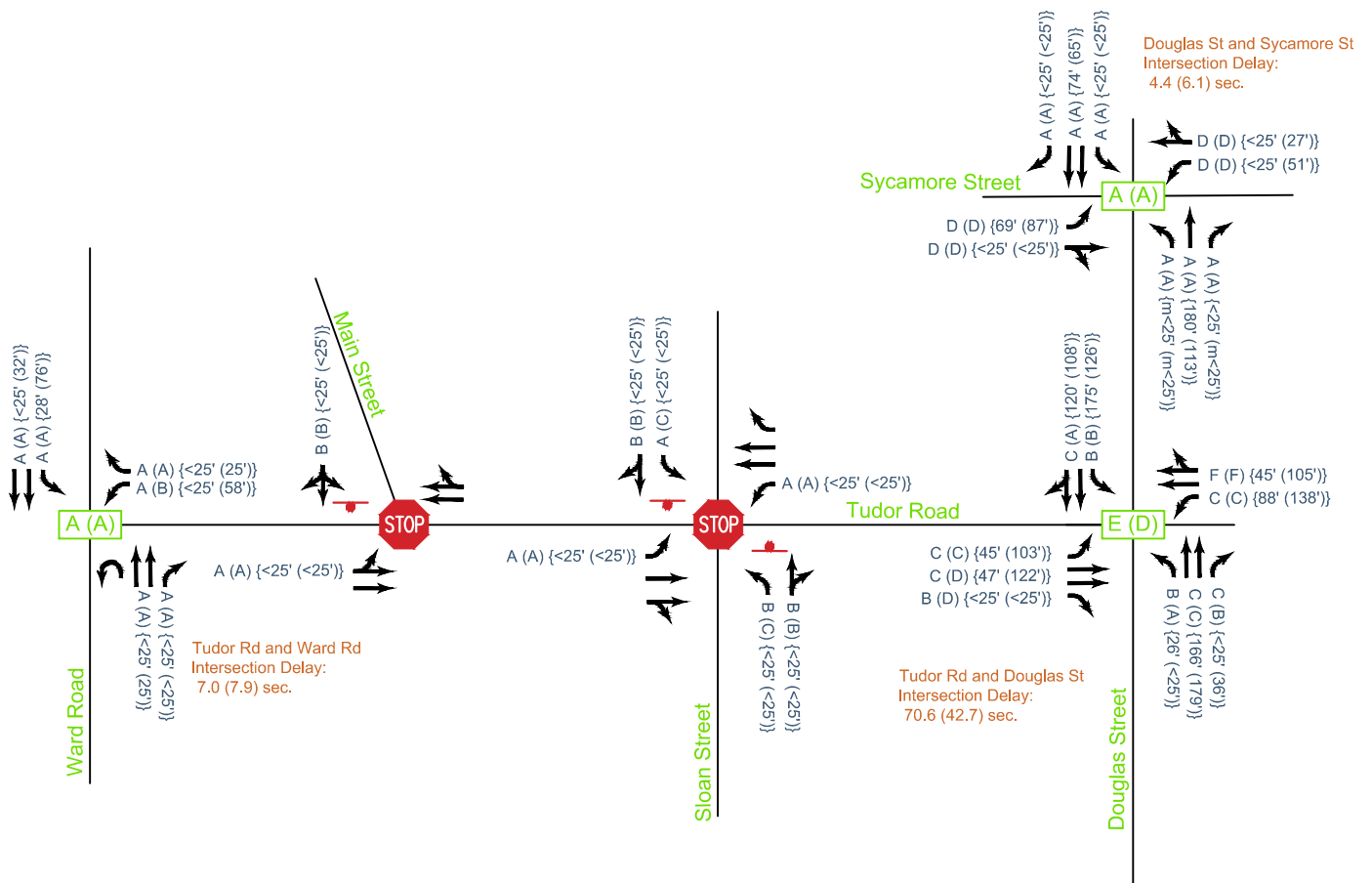
AM (PM) Signalized Intersection LOS

→ Lane Geometry

<sub>m</sub> Volume for 95th percentile queue is metered by upstream signal

STOP Stop Controlled Intersection

Stop Sign



## 5. PROPOSED DEVELOPMENT

The proposed development is located in the northwest quadrant of Tudor Road and Sloan Street. The proposed development is classified as an industrial park with expected warehouse and manufacturing uses. The total square footage for the development is 795,960 square feet encompassed in three buildings. The development is expected to be constructed over a five-year period. For the purposes of this study, phase 1 will consider construction of one building. Full build analysis will consider year 2026 conditions (five-year build period). The proposed site plan is illustrated in **Figure 5**.

With the development of the proposed property, Main Street is proposed to be reconstructed as a two-lane roadway north of Tudor Road to align with the planned road network presented in the City of Lee's Summit *Thoroughfare Master Plan*. The realignment and improvement of Main Street is consistent with the *Unimproved Road Policy*. Main Street will be relocated to intersect Tudor Road and the existing Sloan Street intersection. Main Street will continue to be the major road north of Tudor Road, with Sloan Street re-aligning as a T-intersection with Main Street. Sloan Street is proposed to intersect Main Street approximately 930 feet north of Tudor Road. Stop control should be provided for Sloan Street at the intersection with Main Street.

With the relocation of Main Street, the current Main Street intersection with Tudor Road will be removed and the existing median break closed. The proposed re-alignment of Main Street and Sloan Street is illustrated on the site plan. These modifications to the roadway network will be considered under phase 1 development conditions.

### 5.1. Trip Generation and Distribution

To determine the impact of potential site traffic, expected trips associated with the proposed development were generated and applied to the study network. The Institute of Transportation Engineers (ITE) provides methods for estimating traffic volumes of common land uses in the Trip Generation Manual (10<sup>th</sup> Edition). The land use that most closely resembles the proposed school is Land Use Code 130 (Industrial Park). The industrial park land use represents a mix of warehouse, service and manufacturing facilities.

Trip generation characteristics expected for the site are shown in **Table 3**. Detailed ITE and expected trip generation information is provided in **Appendix C**.



**Table 3. Trip Generation.**

Development Phase	Land Use	Size	Average Weekday	AM Peak Hour			PM Peak Hour		
				Total	Enter	Exit	Total	Enter	Exit
Phase 1	Industrial Park	431,460 SF	2,762	173	140	33	173	36	137
Phase 2	Industrial Park	113,400 SF		46	37	9	46	10	36
Phase 2	Industrial Park	251,100 SF		101	82	19	101	21	80
<b>Total</b>		<b>795,960 SF</b>	<b>2,762</b>	<b>320</b>	<b>259</b>	<b>61</b>	<b>320</b>	<b>67</b>	<b>253</b>

The expected trips generated by the site were categorized by vehicle type, accounting for both passenger cars and trucks. Referencing the *Trip Generation Handbook* (3<sup>rd</sup> Edition), truck percentages for industrial park land uses range from 1 to 31%. A 20 percent truck trip percentage is provided for the warehouse land use, which corresponds to data collected at one location. ITE published a document discussing vehicle trip generation for “high-cube” warehouses and provides average truck trip percentages considering over one hundred sites. Most of these sites – which included short-term, transload, and cold storage facilities – had an average truck trip percentage between approximately 20-30 percent. While the proposed development is expected to be warehousing and manufacturing land uses (not high-cube), a truck trip percentage of 30 percent was utilized for this study based on information available and to provide a conservative analysis. An excerpt from the recent ITE publication is provided in **Appendix C**.

Trips were distributed through the network based on existing gravity, discussions with City staff, and the surrounding roadway network and land uses. A different distribution was utilized for passenger cars and for trucks. Passenger cars are anticipated to utilize all local roadways adjacent to the site to travel regionally, while truck traffic is expected to travel primarily to/from the interstate system. Directional trip distribution percentages expected for the site are illustrated in **Table 4**.

**Table 4. Trip Distribution.**

Direction	Passenger Vehicles	Trucks
Ward Road (North)	20%	70%
Ward Road (South)	10%	-
Main Street (North)	5%	-
Sloan Street (South)	5%	-
Douglas Street (North)	25%	30%
Douglas Street (South)	20%	-
Tudor Road (East)	15%	-
<b>TOTAL</b>	<b>100%</b>	<b>100%</b>

Truck trip distribution was developed considering the primary travel to/from the interstate system, specifically I-470 located north of the study area. Both Ward Road and Douglas Street provide interchange access to I-470. A higher percentage of truck traffic was distributed to Ward Road for the purposes of this study. This distribution is based on consideration of the number of signals along the roadways, density of development, and volume of traffic. Douglas Street is a highly trafficked commercial corridor with dense development located along both sides of the corridor, thus a higher percentage of truck traffic was distributed to Ward Road. Trip distribution for Phase 1 and Full Build development conditions is presented in **Sections 6 and 7** (respectively) of this report.

## 5.2. Access Characteristics

Access to the site is proposed via five full access drives located along Main Street. Drive 1 is proposed approximately 400 feet north of Tudor Road. Drive 2 is proposed approximately 360 feet west of the T-intersection of Ward Road and Sloan Street. Drive 3 is proposed approximately 960 feet west of Drive 2. Drives 1, 2 and 3 will service phase 1 development only and will be a T-intersection with Main Street. These drives are expected to service both passenger vehicle and truck traffic associated with phase 1 development.

Drive 4 is proposed approximately 330 feet north of Drive 3. The drive will extend east and west of Main Street servicing buildings 2 and 3. Drive 4 is expected to service both passenger vehicle and truck traffic for building 2 (located along the west side of Main Street). Drive 4 is expected to service primarily passenger vehicle traffic only for building 3 (located along the east side of Main Street).

Drive 5 is proposed approximately 360 feet north of Drive 4 and 480 feet south of the intersection of Main Street and Victoria Drive. The drive will extend east and west of Main Street servicing buildings 2 and 3. Drive 5 is expected to service both passenger vehicle and truck traffic for building 2. Drive 5 is expected to service primarily truck traffic for building 3.

Access Spacing

Access is proposed along the relocated Main Street, which is expected to be a City maintained roadway. Thus, Section 15 (Connection Spacing) of the City's AMC was reviewed. Per the AMC, connections shall have a minimum spacing of 300 feet along industrial/commercial collectors, such as Main Street, and be located outside any intersection influence area and turn lanes. All proposed access points meet the minimum spacing requirement.

The posted speed limit of Main Street is expected to remain 35 mph with the relocation of the roadway. Per the AMC, the upstream intersection influence area along a 35-mph road is 370 feet (270 feet if limiting conditions) excluding storage, and the downstream influence area is 250 feet. Reviewing expected 95<sup>th</sup>-percentile queuing through all phases of development, adequate spacing is proposed considering the limiting condition for intersection influence area.

Access Geometrics

City standards outlined in the AMC and Design & Construction Manual were reviewed for drive width and throat characteristics. Section 18.1.D (Driveway Width) of the AMC provides standards for commercial/industrial driveways. **Table 5** summarizes proposed access geometrics for the proposed site drives.

**Table 5. Access Characteristics**

Proposed Access	Public Roadway Intersected	Access Type	Proposed Throat Length	Proposed Pavement Width	Median Divided
Drive 1	Main Street	Full Access	220 feet	30 feet	No
Drive 2	Main Street	Full Access	100 feet	30 feet	No
Drive 3	Main Street	Full Access	220 feet	30 feet	No
Drive 4	West of Main Street	Full Access	50 feet	30 feet	No
	East of Main Street	Full Access	110 feet	30 feet	No
Drive 5	West of Main Street	Full Access	325 feet	30 feet	No
	East of Main Street	Full Access	240 feet	30 feet	No

Referencing *Table 18-1* of the AMC, driveways servicing less than 150 vph during the peak hour period should have a driveway width from back-of-curb between 28 feet (striped for 2 lanes) and 42 feet (striped for 3 lanes) for two-way access. Considering the trip generation for the full build

of the site, all proposed drives are expected to service less than 150 vph during the peak hour periods.

Throat length standards are based on projected peak hour volumes, per the City of Lee's Summit AMC. Referencing *Table 18-2* of the AMC, driveways servicing between 10 – 50 vph during the peak hour period shall have a minimum throat length of 50 feet adjacent to a collector roadway. Drive 3, Drive 4 (west leg) and Drive 5 (west and east legs) are expected to service fewer than 50 vph during the peak hour periods and meet minimum throat length requirements.

Driveways servicing between 50 – 100 vph during the peak hour period shall have a minimum throat length of 75 feet adjacent to a collected roadway. Drive 1, Drive 2, and Drive 4 (east leg) are expected to service between 50 – 100 vph during the peak hour periods and meet minimum throat length requirements.

### Sight Distance

Main Street is expected to be constructed with horizontal roadway curvature along the re-aligned section. During design, sight distance requirements should be reviewed such that minimum sight distance requirements are met at all proposed public roadway and private drive intersections.

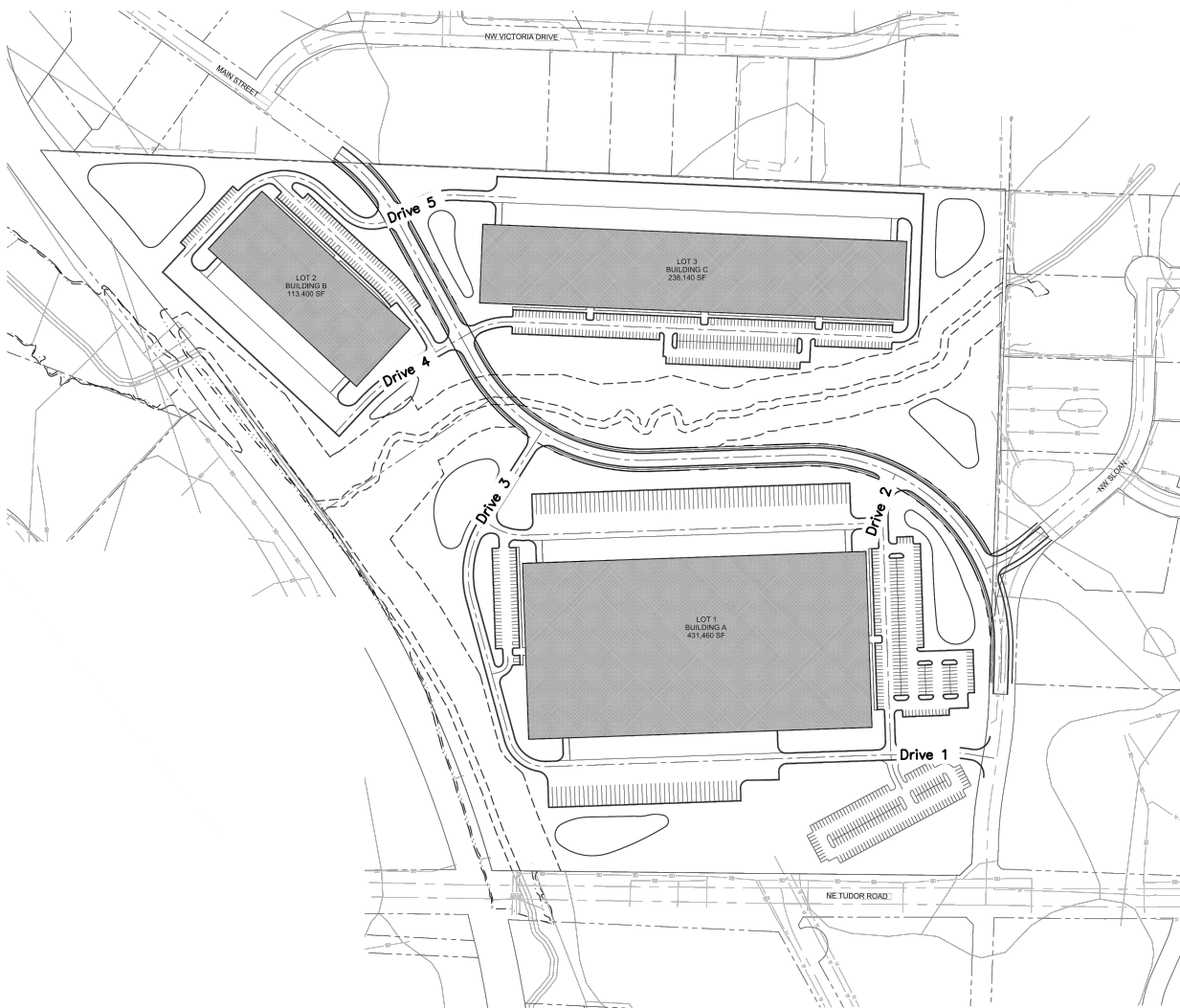
# FIGURE 5

## Site Plan

Tudor Road Development  
Lee's Summit, MO



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## **6. EXISTING PLUS APPROVED PLUS PHASE 1 DEVELOPMENT CONDITIONS**

This section presents expected operations with the construction of phase 1 of the proposed development. Phase 1 considers the construction of one building with a total development square footage of 431,460 square feet. With phase 1 development, Drives 1, 2 and 3 are proposed to be constructed along relocated Main Street.

### **6.1. Existing Plus Approved plus Phase 1 Development Trip Distribution**

Trip generation and distribution for the proposed site was presented in **Section 5.1**. The expected trip distribution for phase 1 development of the site is shown in **Figure 6**. The resulting existing plus approved plus phase 1 development volumes are illustrated in **Figure 7**.

# FIGURE 6

Phase 1  
Trip Distribution  
Tudor Road Development  
Lee's Summit, MO



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## LEGEND

AM (PM) Peak Hour Vehicle Trips (Car)

[AM (PM)] Peak Hour Vehicle Trips (Truck)

(XX%) AM/PM Car Trip Distribution Percentages

(XX%) AM/PM Truck Trip Distribution Percentages



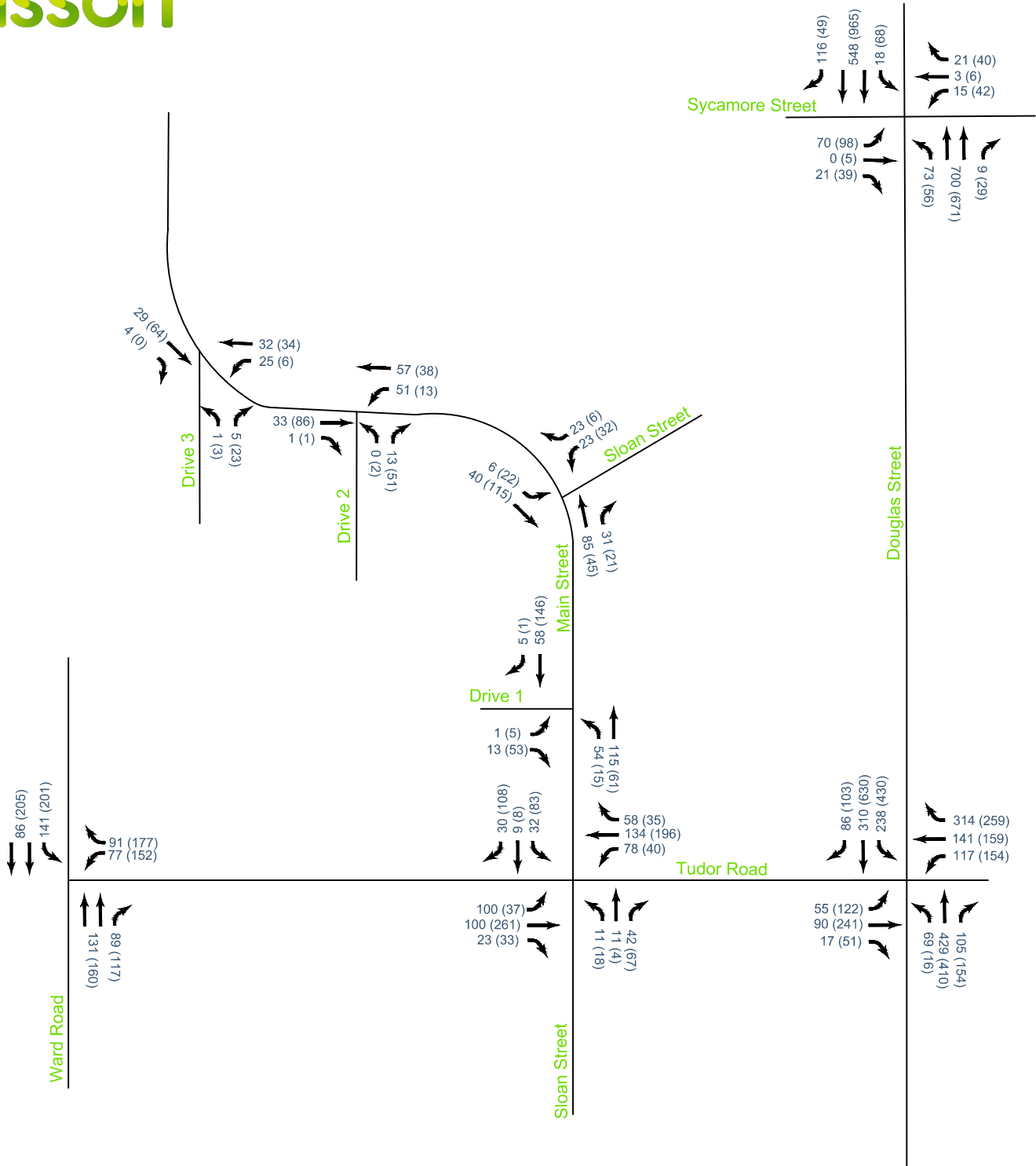
# FIGURE 7

Existing plus Approved plus Phase 1 Development Conditions  
 Peak Hour Volumes  
 Tudor Road Development  
 Lee's Summit, MO



## LEGEND

AM (PM) Peak Hour Volume





## 6.2. Existing Plus Approved plus Phase 1 Development Warrant Analysis

Warrant analysis was conducted using the same methodology described in **Section 4.2**.

### Signal Warrants

The peak hour signal warrant (warrant 3) was reviewed for public street intersections. Due to proposed access spacing and expected low side street volumes, signal warrants were not reviewed for proposed drive locations.

Considering existing plus approved plus phase 1 development volumes, signals are not warranted at the unsignalized intersections of Tudor Road with Main Street and Main Street with Sloan Street. Signal warrant analysis sheets are provided in **Appendix D**.

### Turn Lane Warrants

Existing turn lane deficiencies are unchanged for this scenario and were presented in **Section 4.2**.

Left turn Lanes: Based on the Lee's Summit AMC, left-turn lanes shall be provided on collector streets at the intersection with a connector servicing non-residential development when the left turn lane volume is at least 30 vehicles in any hour. Reviewing expected traffic volumes, a northbound left-turn lane should be provided at Drive 1. A westbound left-turn lane should be provided at Drive 2. The left-turn lanes are recommended with a length of 150 feet plus taper. Operations will be reviewed (**Section 6.3**) to confirm the recommended turn bay storage is adequate to accommodate development traffic.

Right-turn Lanes: Based on the Lee's Summit AMC, right-turn lanes shall be provided on collector streets in non-residential areas at the intersection with any street or driveway when the right turn volume on the collector street is project to be at least 100 vph in an hour. Reviewing expected traffic volumes, the southbound right- turn lane volume at the intersection of Tudor Road and Main Street slightly exceeds 100 vehicles during the PM peak hour period. Currently, the right-turn movement is proposed to share a lane with through traffic, which is expected to have a low volume. Operations will be reviewed (**Section 6.3**) to determine if a southbound right-turn lane is recommended.

Capacity and queueing analysis were also reviewed (see **Section 6.3**) to determine if additional turn lanes and/or storage length is recommended based on expected operations. Existing plus approved plus phase 1 development lane configurations and traffic control for the study network are illustrated in **Figure 8**.

### **6.3. Existing Plus Approved plus Phase 1 Development Capacity Analysis**

Capacity analysis was performed under existing plus approved plus phase 1 development conditions using the methodologies described in **Section 4.3**. The peak hour factors observed under existing conditions were utilized for this scenario except for movements at new drive locations. At these locations, the peak hour factors were conservatively adjusted considering the Synchro suggested values and expected traffic conditions after development. Truck percentages were updated for relevant movements to represent development traffic. Signal timings from the previous analysis scenario were maintained.

Results of the analysis indicate that the signalized intersections are expected to continue operating similar to the existing plus approved development conditions.

All movements at the unsignalized study intersections are expected to operate at LOS D or better with acceptable queues during the peak hour periods.

Several existing turn lane deficiencies were noted in **Section 4.2**. Additionally, a southbound right-turn lane slightly exceeds the warrant criteria during one peak hour period at the intersection of Tudor Road and Main Street. Reviewing operations, with the exception of the westbound movement at the intersection of Douglas Street and Tudor Road, all movements are operating at an acceptable LOS under current geometrics. Current turn bay lengths are adequate to support existing plus approved as well as phase 1 development conditions. Thus, additional turn lane improvements are not recommended with phase 1 development.

The existing operations for the westbound movement at Douglas Street and Tudor Road are poor, with the proposed development expected to have a minimal impact on operations. Improvements to address the existing deficiency are not proposed.

The following summarizes improvements recommended with phase 1 development.

- Reconstruct Main Street to intersection Tudor Road and the current Sloan Street intersection. Sloan Street should become a 'T'-intersection with Main Street. Sloan Street should be stop controlled. The current geometrics at the intersection of Tudor Road and Sloan Street should remain with the re-alignment of Main Street.
- The existing median opening at Tudor Road and the current Main Street intersection should be closed.
- Provide a 150-foot plus taper northbound left-turn lane along Main Street at Drive 1.
- Provide a 150-foot plus taper westbound left-turn lane along Main Street at Drive 2.

The existing plus approved plus phase 1 conditions capacity analysis summary is illustrated in **Figure 9**. Detailed results are provided in **Appendix D**.

# FIGURE 8

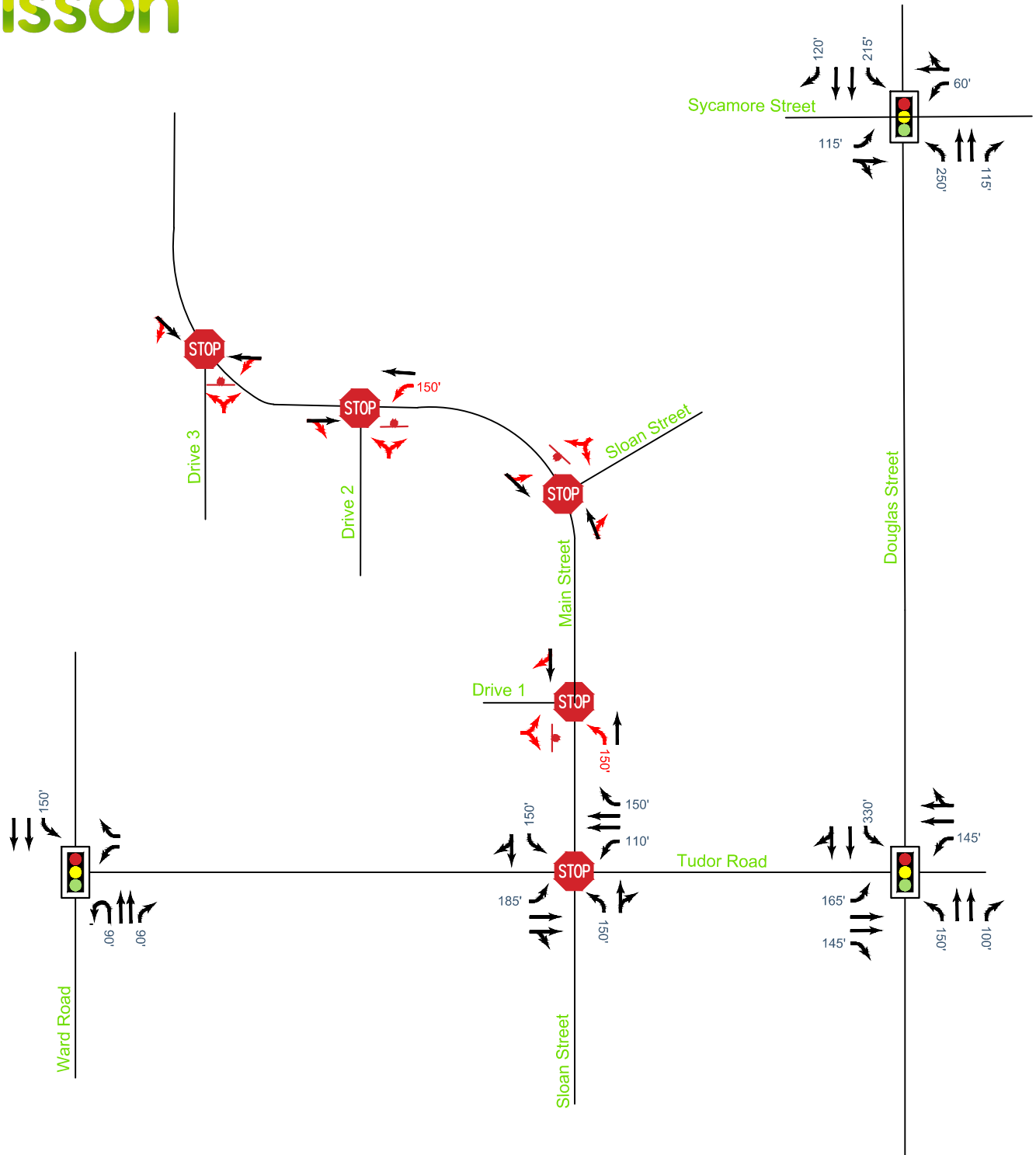
## Existing plus Approved plus Phase 1 Development Conditions Lane Configuration and Traffic Control

Tudor Road Development  
Lee's Summit, MO



### LEGEND

- xx' → Lane Configuration & Storage Length
- xx' → Recommended Lane Configuration & Storage Length
- Signalized Intersection
- STOP Stop Controlled Intersection
- Stop Sign



# FIGURE 9

## Existing plus Approved plus Phase 1 Development Conditions Capacity Analysis

Tudor Road Development  
Lee's Summit, MO



### LEGEND

AM (PM) {AM (PM)} Movement LOS & {95th Percentile Queue}

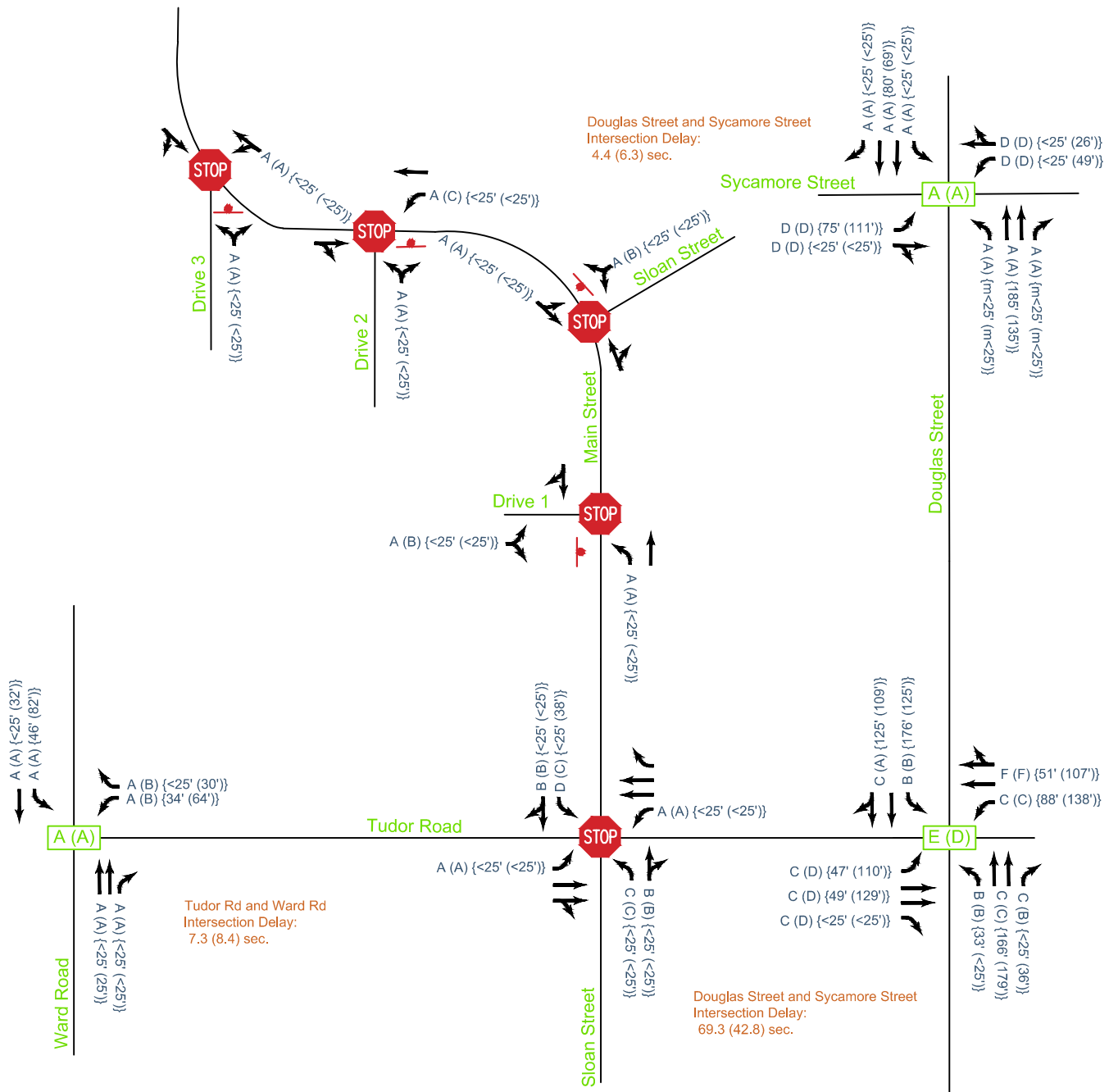
AM (PM) Signalized Intersection LOS

→ Lane Geometry

m Volume for 95th percentile queue is metered by upstream signal

Stop Controlled Intersection

Stop Sign



## **7. BUILD YEAR 2026 PLUS APPROVED PLUS FULL BUILD DEVELOPMENT CONDITIONS**

The proposed development is expected to be constructed over a five-year period. This scenario evaluates the full build conditions in build year 2026. Existing plus approved traffic volumes were grown at a rate of 2% per year to represent background traffic growth. The growth rate was reviewed with City staff. The growth rate was applied to through traffic volumes along Ward Road, Tudor Road, and Douglas Street and to turning volumes, as appropriate, at major intersections. Background traffic growth was not applied to Main Street or Sloan Street as future growth of traffic along these roadways is expected to be dependent on development.

Full build of the development will consist of the construction of approximately 364,500 square feet of additional development, resulting in the total development square footage of approximately 795,960 square feet. With full build development, Drives 4 and 5 are proposed to be constructed along relocated Main Street. For the purposes of this report, the additional 364,500 square feet of development will be referenced as phase 2 development.

### **7.1. Trip Generation and Distribution**

Trip generation and distribution for the proposed site was presented in **Section 5.1**. The expected trip distribution for phase 2 development of the site is shown in **Figure 10**. Phase 1 and phase 2 development trips represent the full build development condition. The resulting build year 2026 plus approved plus full build development volumes are illustrated on **Figure 11**.

# FIGURE 10

Phase 2  
 Trip Distribution  
 Tudor Road Development  
 Lee's Summit, MO



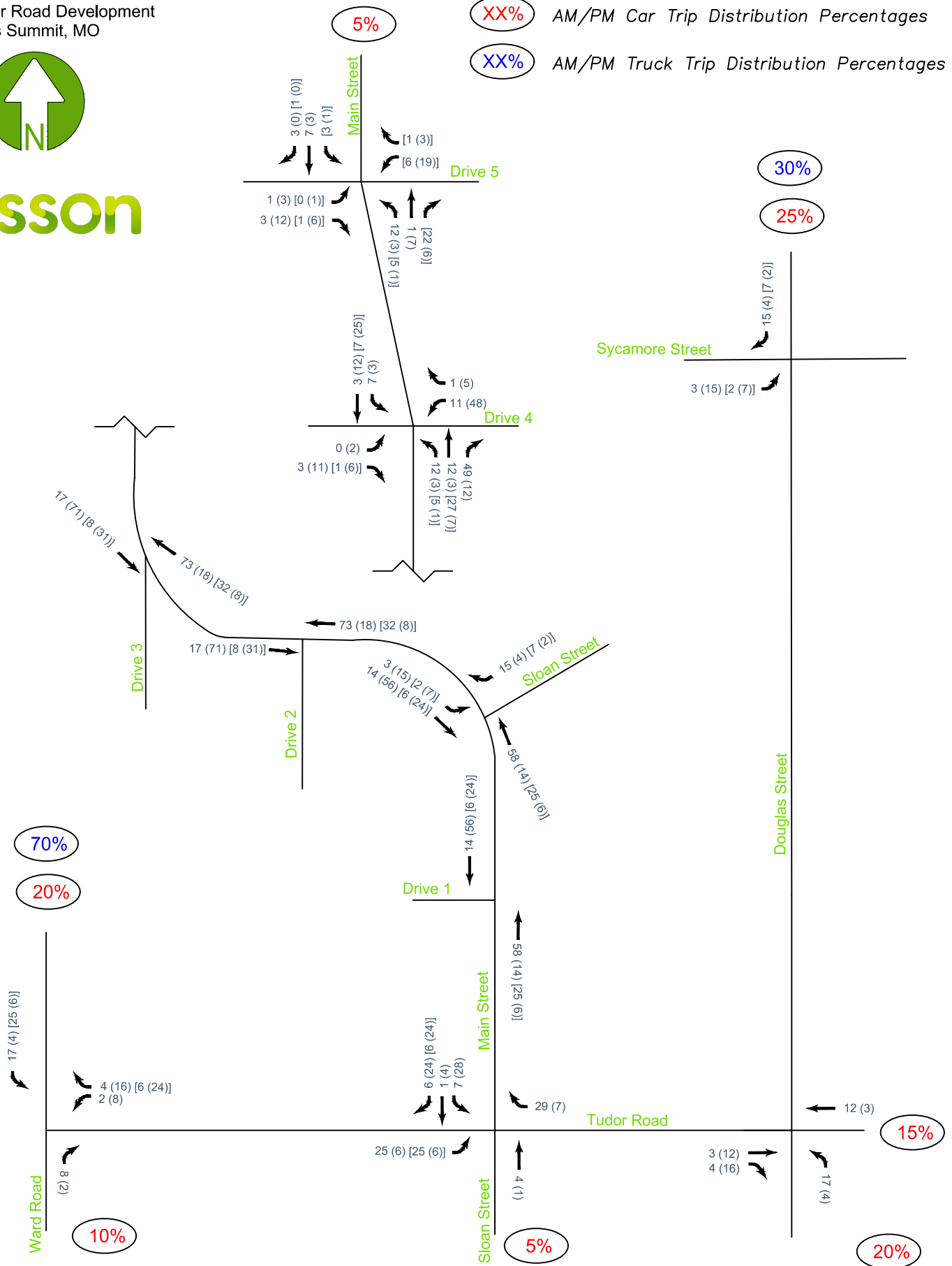
## LEGEND

AM (PM) AM (PM) Peak Hour Car Trips

[AM (PM)] AM (PM) Peak Hour Truck Trips

**XX%** AM/PM Car Trip Distribution Percentages

**XX%** AM/PM Truck Trip Distribution Percentages



# FIGURE 11

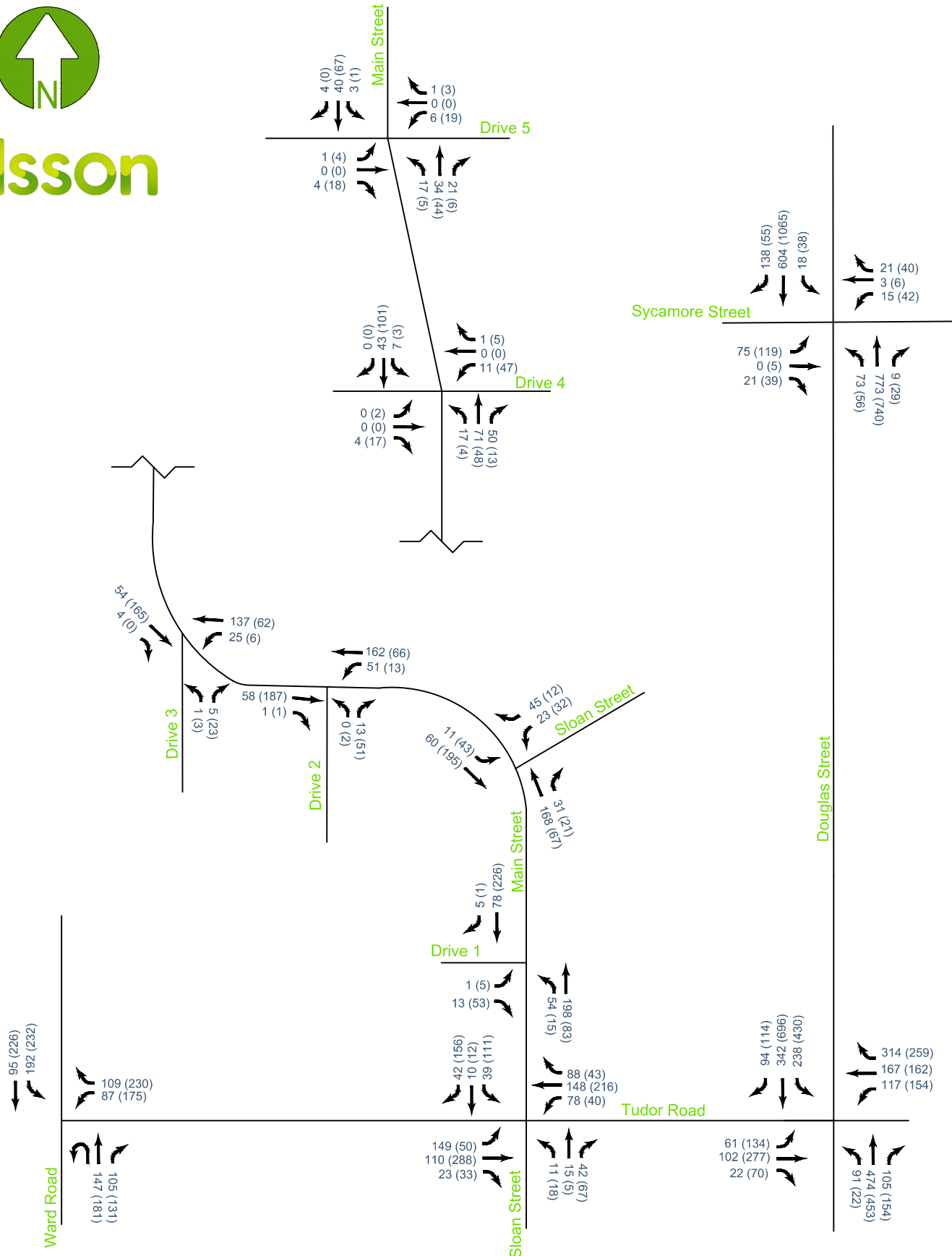
Build Year 2026 plus Approved plus Full Build Development  
Peak Hour Volumes

Tudor Road Development  
Lee's Summit, MO



## LEGEND

AM (PM) Peak Hour Volume



## 7.2. Build Year 2026 plus Approved plus Full Build Development Warrant Analysis

Warrant analysis was conducted using the same methodology described in **Section 4.2**.

### Signal Warrants

The peak hour signal warrant (warrant 3) was reviewed for public street intersections. Due to proposed access spacing and expected low side street volumes, signal warrants were not reviewed for proposed drive locations.

Considering build year 2026 plus approved plus full build development volumes, signals are not warranted at the unsignalized intersections of Tudor Road with Main Street and Main Street with Sloan Street. Signal warrant analysis sheets are provided in **Appendix E**.

### Turn Lane Warrants

Existing turn lane deficiencies are unchanged for this scenario and were presented in **Section 4.2**.

Left turn Lanes: Based on the Lee's Summit AMC, left-turn lanes shall be provided on collector streets at the intersection with a connector servicing non-residential development when the left turn lane volume is at least 30 vehicles in any hour. Reviewing expected traffic volumes, a southbound left-turn lane should be provided at the intersection of Main Street and Sloan Street based on expected PM Peak hour volumes. The turn lane should be provided with a minimum storage length of 150 feet plus taper.

Under phase 1 development, left-turn lanes were recommended at Drives 1 and 2 along Main Street. With a left-turn lane recommended at the intersection of Main Street and Sloan Street, a three-lane road section with two-way left turn lane could be provided along Main Street from Tudor Road to Drive 2 in lieu of separate left-turn lanes along the roadway segment.

Right-turn Lanes: Based on the Lee's Summit AMC, right-turn lanes shall be provided on collector streets in non-residential areas at the intersection with any street or driveway when the right turn volume on the collector street is project to be at least 100 vph in an hour. Under full build development, the southbound right turn volume at the intersection of Tudor Road and Main Street exceeds 100 vehicles during the PM peak hour period. A southbound right-turn lane with a minimum storage length of 150 feet plus taper should be provided.

Capacity and queueing analysis were also reviewed (see **Section 6.3**) to determine if additional turn lanes and/or storage length is recommended based on expected operations. Build year 2026 plus approved plus full build development lane configurations and traffic control for the study network are illustrated in **Figure 12**.



### **7.3. Build Year 2026 plus Approved plus Full Build Development Capacity Analysis**

Capacity analysis was performed under build year 2026 plus approved plus full build development conditions using the methodologies described in **Section 4.3**. The peak hour factors observed under previous conditions were utilized for this scenario except for movements at new drive locations. At these locations, the peak hour factors were conservatively adjusted considering the Synchro suggested values and expected traffic conditions after development. Truck percentages were updated for relevant movements to represent development traffic. Signal timings from the previous analysis scenario were maintained.

Results of the analysis indicate that the signalized intersections are expected to continue operating similar to the previous scenarios.

All movements at the unsignalized study intersections are expected to operate at LOS D or better with acceptable queues during the peak hour periods with the exception of the southbound left turn movement at the intersection of Tudor Road and Main Street. The southbound left turn movement is expected to operate at a LOS E during the AM and PM peak hour periods with a 95<sup>th</sup>-percentile queue length of approximately 75 feet (3 vehicles) during the PM peak hour period. The provided turn lane is expected to accommodate the expected 95<sup>th</sup>-percentile queue.

Several existing turn lane deficiencies were noted in **Section 4.2**. Reviewing operations, with the exception of the westbound movement at the intersection of Douglas Street and Tudor Road, all movements are operating at an acceptable LOS under current geometrics. Current turn bay lengths are adequate to support build year plus approved plus full build development conditions. Thus, additional turn lane improvements are not recommended with full build development.

The existing operations for the westbound movement at Douglas Street and Tudor Road are poor, with the proposed development expected to have a minimal impact on operations. Improvements to address the existing deficiency are not proposed.

The following summarizes improvements recommended with phase 2 (full build) development.

- Provide a 150-foot plus taper southbound left turn lane along Main Street at Sloan Street.
- Provide a 150-foot plus taper southbound right turn lane along Main Street and Tudor Road.

The build year 2026 plus approved plus full build development conditions capacity analysis summary is illustrated in **Figure 13**. Detailed results are provided in **Appendix E**.

# FIGURE 12

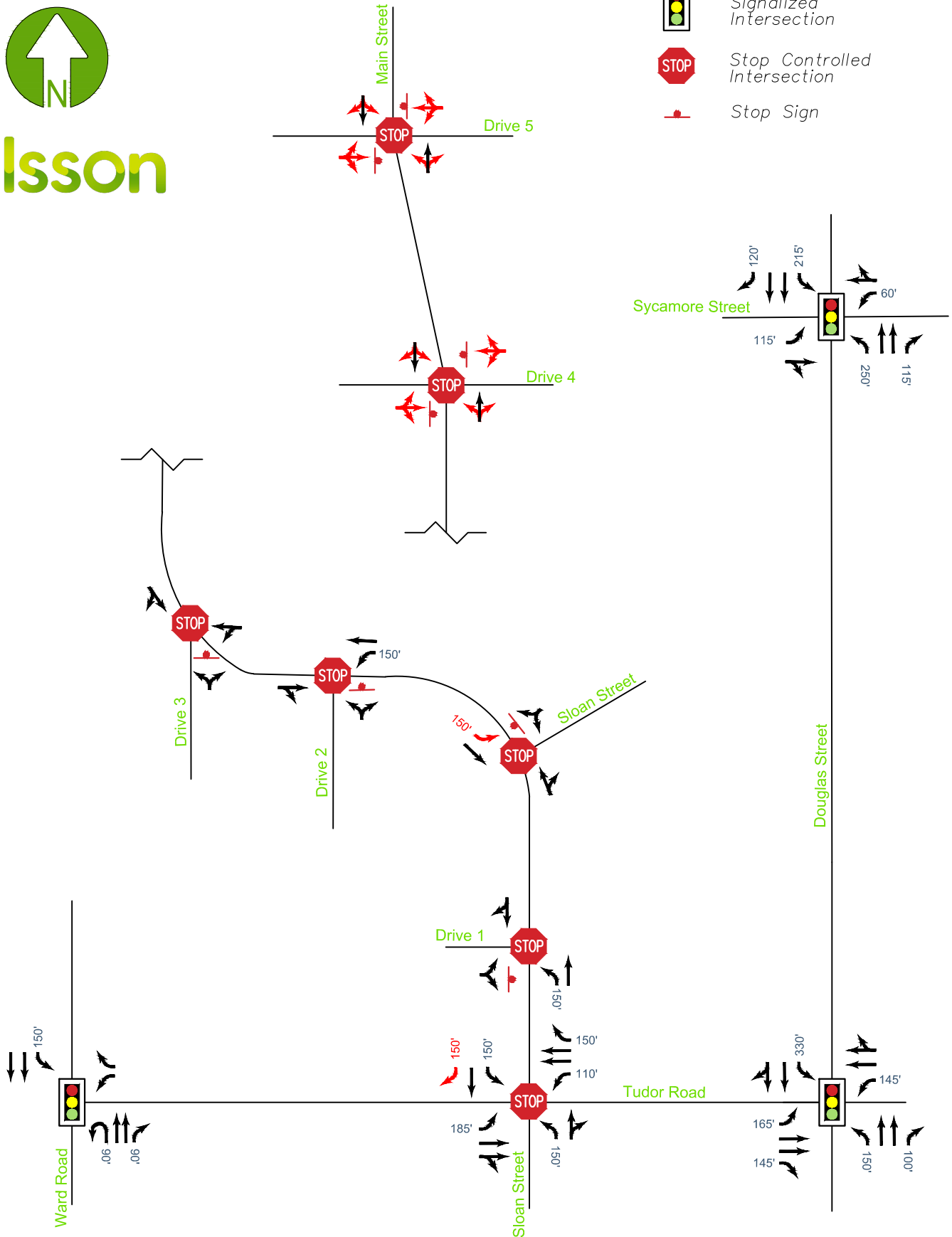
## Build Year 2026 plus Approved plus Full Build Development Lane Configuration and Traffic Control

Tudor Road Development  
Lee's Summit, MO



### LEGEND

- xx' → Lane Configuration & Storage Length
- xx' → Recommended Lane Configuration & Storage Length
- Signalized Intersection
- Stop Controlled Intersection
- Stop Sign



# FIGURE 13

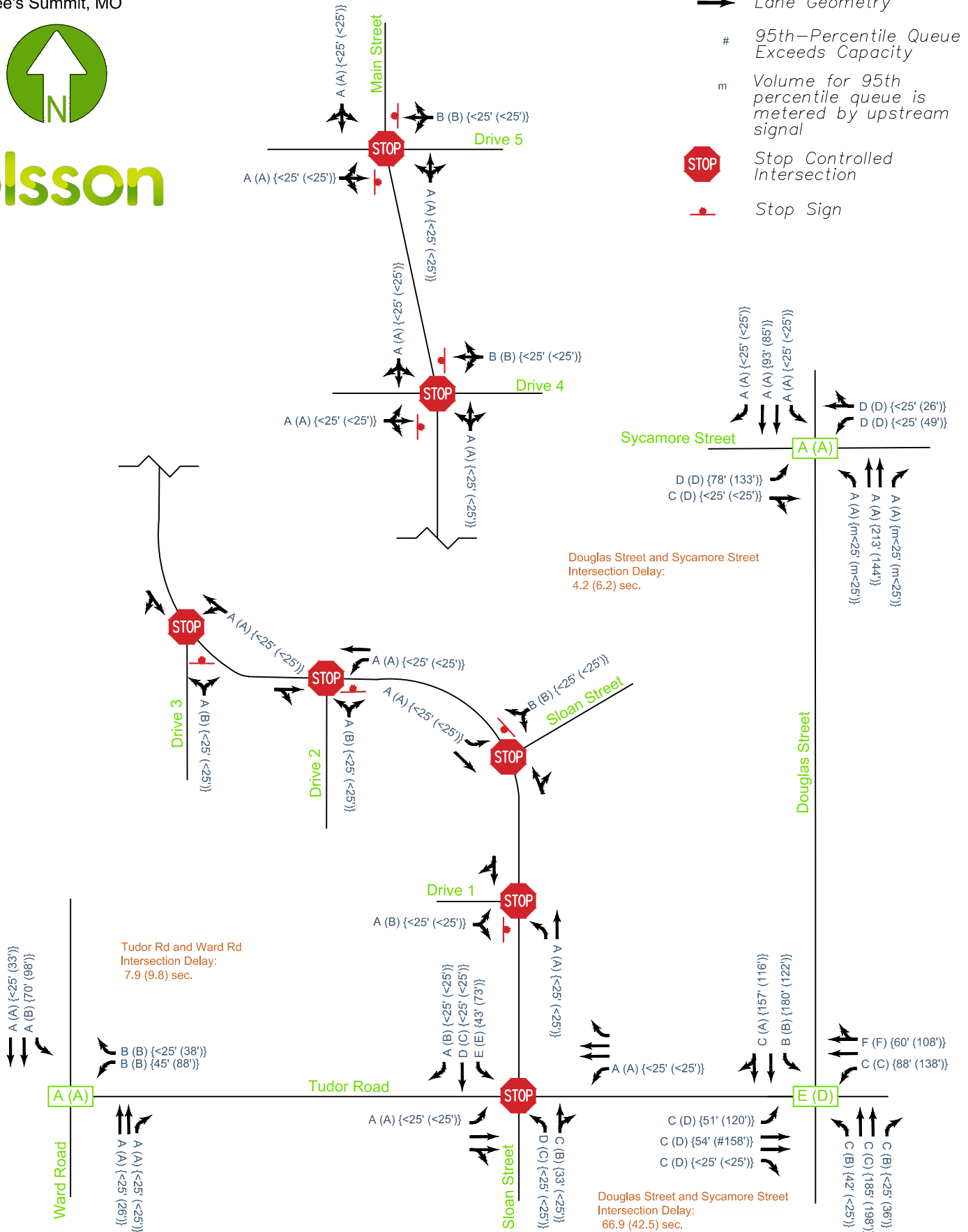
## Build Year 2026 plus Approved plus Full Build Development Capacity Analysis

Tudor Road Development  
Lee's Summit, MO



### LEGEND

- AM (PM) {AM (PM)} Movement LOS & {95th Percentile Queue}
- AM (PM) Signalized Intersection LOS
- Lane Geometry
- # 95th-Percentile Queue Exceeds Capacity
- m Volume for 95th percentile queue is metered by upstream signal
- Stop Controlled Intersection
- Stop Sign



## **8. FUTURE YEAR 2041 PLUS APPROVED PLUS FULL BUILD DEVELOPMENT CONDITIONS**

This scenario evaluates the full build development conditions in the future year 2041. Similar to the build year scenario, existing plus approved traffic volumes were grown at a rate of 2% per year to represent background traffic growth for the year 2041. The resulting future year 2041 plus approved plus full build development volumes are illustrated on **Figure 4**. Future volume development worksheets are provided in **Appendix F**.

# FIGURE 14

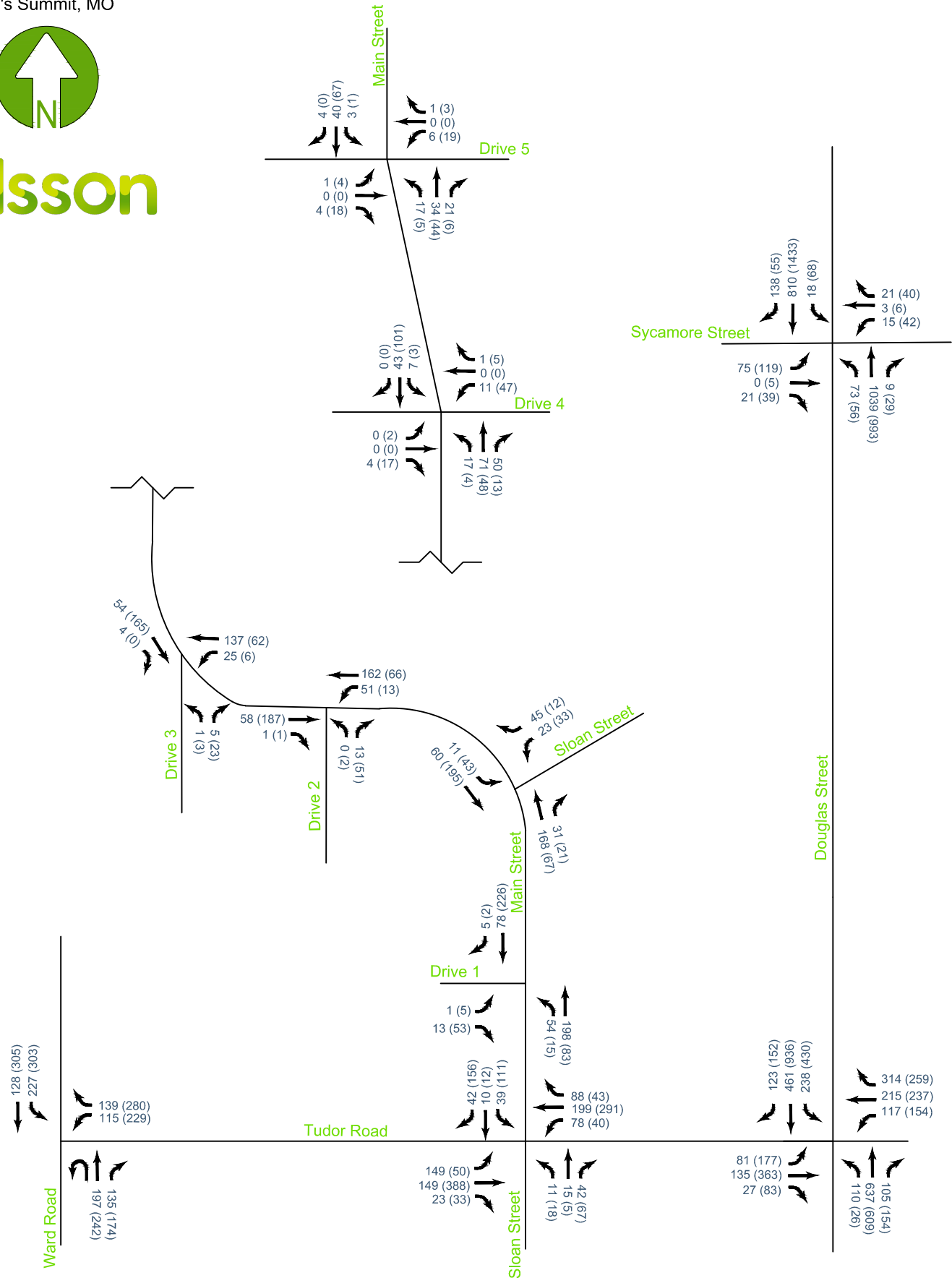
Future Year 2041 plus Approved plus Full Build Development  
Peak Hour Volumes

Tudor Road Development  
Lee's Summit, MO



## LEGEND

AM (PM) Peak Hour Volume



## 8.1. Future Year 2041 plus Approved plus Full Build Development Warrant Analysis

Warrant analysis was conducted using the same methodology described in **Section 4.2**.

### Signal Warrants

The peak hour signal warrant (warrant 3) was reviewed for public street intersections. Due to proposed access spacing and expected low side street volumes, signal warrants were not reviewed for proposed drive locations.

Considering future year 2041 plus approved plus full build development volumes, signals are not warranted at the unsignalized intersections of Tudor Road with Main Street and Main Street with Sloan Street. Signal warrant analysis sheets are provided in **Appendix F**.

### Turn Lane Warrants

Existing turn lane deficiencies are unchanged for this scenario and were presented in **Section 4.2**.

Left turn Lanes: No additional turn lanes are warranted based on future year 2041 plus approved plus full build development conditions.

Right-turn Lanes: No additional turn lanes are warranted based on future year 2041 plus approved plus full build development conditions.

Capacity and queueing analysis were also reviewed (see **Section 6.3**) to determine if additional turn lanes and/or storage length is recommended based on expected operations. Future year 2041 plus approved plus full build development lane configurations and traffic control for the study network are illustrated in **Figure 15**.

## 8.2. Future Year 2041 plus Approved plus Full Build Development Capacity Analysis

Capacity analysis was performed under future year 2041 plus approved plus full build development conditions using the methodologies described in **Section 4.3**. The peak hour factors observed under the previous condition was utilized for this scenario. Signal timings from the previous analysis scenario were maintained.

Results of the analysis indicate that the signalized intersections are expected to continue operating similar to the previous scenarios. The study intersection of Douglas Street with Sycamore Street is expected to continue to operate at a LOS A during both peak hour periods, with individual movements expected to continue operating at LOS D or better. Longer north/south through queues can be expected, associated with background traffic growth.

The study intersection of Ward Road and Tudor Road is expected to operate at a LOS A during the AM peak hour period and LOS B during the PM peak hour period. Individual movements are expected to continue operating at LOS D or better. If future year volumes develop, the southbound left turn 95<sup>th</sup>-percentile queue may exceed available storage.

The signalized intersection of Douglas Street and Tudor Road is expected to continue operating similar to the previous scenarios with the same overall LOS. During both peak periods, the westbound through/right-turn movement is expected to continue operating at a LOS F. The eastbound through and right-turn movements are expected to operate at a LOS E during the PM peak hour period. All other movements are expected to operate at LOS D or better. If future year volumes develop, longer 95<sup>th</sup>-percentile queuing could be experienced at the intersection.

Signal timings were not updated for the purposes of this study. Adjustment of signal timings at study intersections to accommodate future year volumes may result in improved LOS or reduced 95<sup>th</sup>-percentile queuing. At the intersection of Douglas Street and Tudor Road, geometric improvements (specifically consideration of a westbound right-turn lane) may be needed in the future year to accommodate traffic volumes.

All movements at the unsignalized study intersections are expected to operate at LOS D or better with acceptable queues during the peak hour periods with the exception of the southbound left turn movement at the intersection of Tudor Road and Main Street. The southbound left turn movement is expected to operate at a LOS F during the AM and PM peak hour periods with a 95<sup>th</sup>-percentile queue length of approximately 125 feet (5 vehicles) during the PM peak hour period. The provided turn lane is expected to accommodate the expected 95<sup>th</sup>-percentile queue.

Several existing turn lane deficiencies were noted in **Section 4.2**. If future year traffic volumes develop, increasing existing storage lengths or providing additional turn lanes may improve operations. Future year improvements should be based on actual traffic volumes.

The existing operations for the westbound movement at Douglas Street and Tudor Road are poor, with the proposed development expected to have a minimal impact on operations. Improvements to address the existing deficiency are not proposed.

The future year 2041 plus approved plus full build development conditions capacity analysis summary is illustrated in **Figure 16**. Detailed results are provided in **Appendix F**.

# FIGURE 15

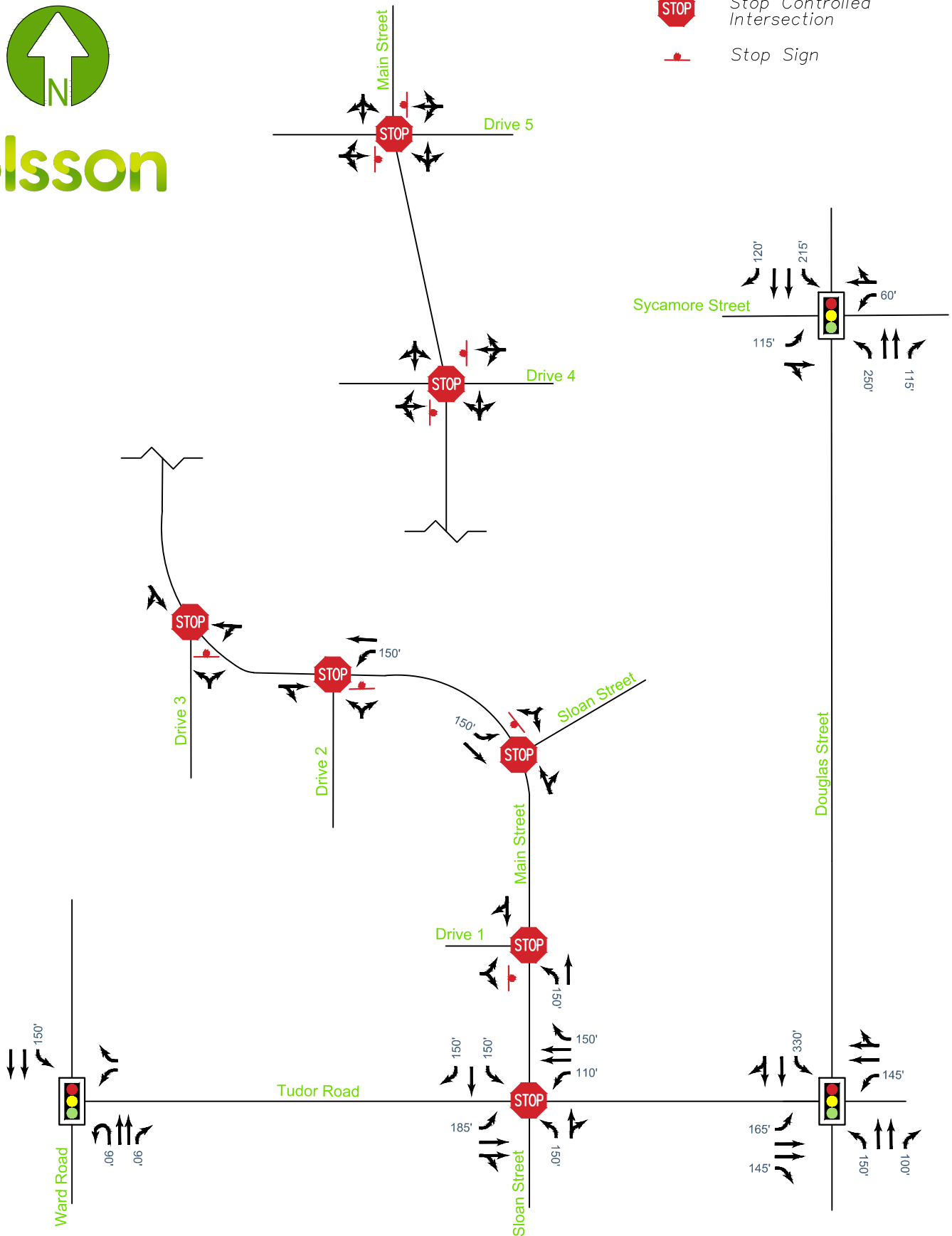
## Future Year 2041 plus Approved plus Full Build Development Lane Configuration and Traffic Control

Tudor Road Development  
Lee's Summit, MO



### LEGEND

- xx' → Lane Configuration & Storage Length
- Signalized Intersection
- Stop Controlled Intersection
- Stop Sign





# FIGURE 16

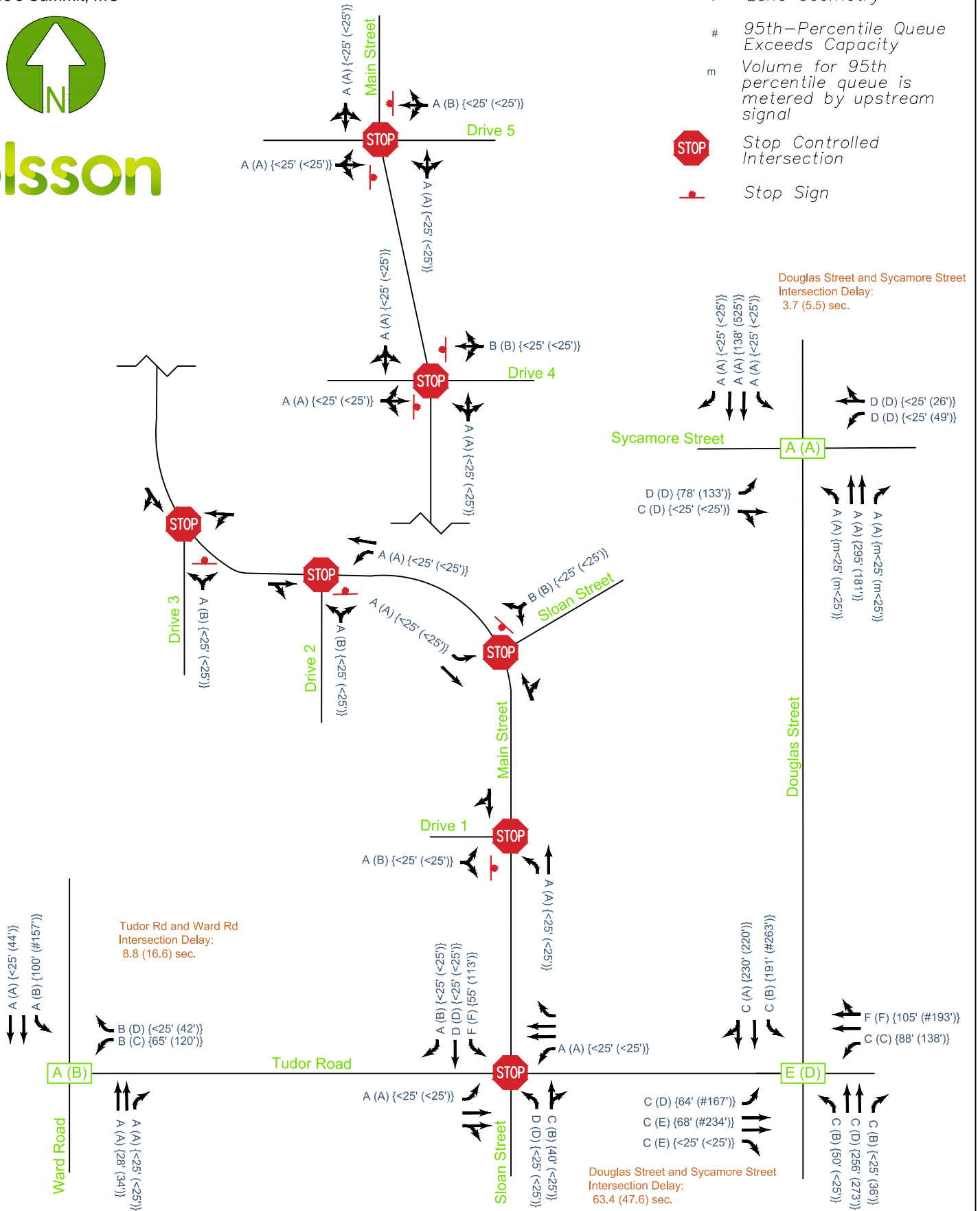
## Future Year 2041 plus Approved plus Full Build Development Capacity Analysis

Tudor Road Development  
Lee's Summit, MO



### LEGEND

- AM (PM) {AM (PM)} Movement LOS & {95th Percentile Queue}
- AM (PM) Signalized Intersection LOS
- Lane Geometry
- # 95th-Percentile Queue Exceeds Capacity
- m Volume for 95th percentile queue is metered by upstream signal
- Stop Controlled Intersection
- Stop Sign



## 9. SUMMARY

The purpose of this study was to summarize traffic impacts regarding a proposed industrial development located in the northwest quadrant of Tudor Road and Sloan Street in Lee's Summit, Missouri.

### 9.1. Conclusions

The general findings of note for the traffic impact study include:

1. In addition to the proposed development, the analysis scenarios considered a partially built approved development located in the southeast quadrant of Tudor Road and Ward Road.
2. The proposed development is expected to be constructed over a five-year period. The first phase of development considers the construction of one building. The remaining facilities (three buildings total) are expected to be constructed by the build year 2026. Analysis was conducted considering an existing year scenario as well as the five-year build year scenario.
3. Several existing lane deficiencies were noted, specifically related to provided storage length. Analysis was conducted considering existing geometrics of the roadway network.
4. Main Street is proposed to be re-aligned and improved within the boundaries of the project site, consistent with the *Thoroughfare Master Plan* and the *Unimproved Road Policy*.
5. The proposed development is expected to have a minimal impact to operations within the study area network.

### 9.2. Recommendations

Based on review and analysis of the study area, the following action items are recommended:

#### Existing plus Approved plus Phase 1 Development Conditions

- Reconstruct Main Street to intersect Tudor Road and the current Sloan Street intersection. Sloan Street should become a 'T'-intersection with Main Street. Sloan Street should be stop controlled. The current geometrics at the intersection of Tudor Road and Sloan Street should remain with the re-alignment of Main Street.
- The existing median opening at Tudor Road and the current Main Street intersection should be closed.
- Provide a 150-foot plus taper northbound left-turn lane along Main Street at Drive 1.
- Provide a 150-foot plus taper westbound left-turn lane along Main Street at Drive 2.

- In lieu of dedicated left-turn lanes along Main Street between Tudor Road and Drive 2, consideration could be given to construction of a three-lane section with two-way left turn lane to support full build development conditions.

Build Year 2026 plus Approved plus Full Build Development Conditions

- Provide a 150-foot plus taper southbound left-turn lane along Main Street at Sloan Street.
- Provide a 150-foot plus taper southbound right-turn lane along Main Street and Tudor Road.

Future Year 2041 plus Approved plus Full Build Development Conditions

- If future year volumes develop, signal timing modifications at signalized intersections, increased turn lane storage, or other geometric improvements may be considered to address operations associated with future year conditions.