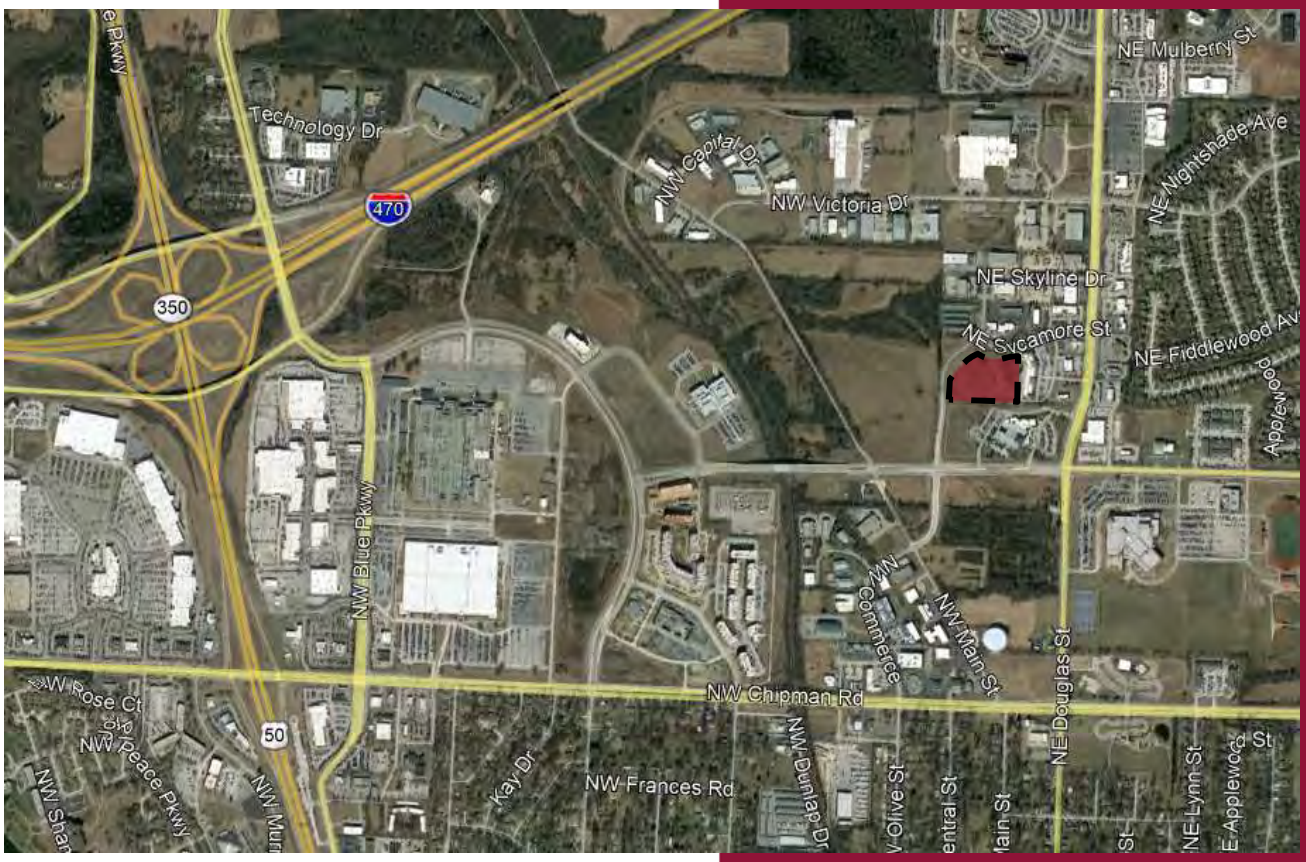
Douglas Station Traffic Impact Study

Sycamore Street and Sloan Street
Lee's Summit, Missouri



STATE OF MISSOURI
JEFFREY J WILKE
NUMBER PE-2007032448
PROFESSIONAL ENGINEER
4/30/21

TranSystems
EXPERIENCE | Transportation

Prepared for:
Cave State Companies

Prepared by TranSystems
April 2021

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April 30, 2021

Mr. Jacob Engle
Cave State Companies
569 Melville Ave., Suite 208
St. Louis, Missouri 63130

RE: Douglas Station Traffic Impact Study
Sycamore Street and Sloan Street
Lee's Summit, Missouri

Dear Mr. Engle:

In response to your request and authorization, TranSystems has completed a traffic impact study for the proposed multifamily residential development generally located in the southeast corner of Sycamore Street and Sloan Street in Lee's Summit, Missouri. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system.

Included in this study is a discussion of the anticipated impact of the proposed development on the adjacent street network and identified improvements to mitigate deficiencies for the following scenarios:

- Existing Conditions
- Existing plus Development Conditions

We trust that the enclosed information proves beneficial to you and the City of Lee's Summit in this phase of the development process. We appreciate the opportunity to be of service to you and will be available to review this study at your convenience.

Sincerely,
TRANSYSTEMS

By: _____ By: _____

Jeffrey J. Wilke, PE, PTOE Emma H Martin, EIT

JJW:EHM/ehm/P101210128
Enclosure

Introduction

TranSystems has completed a traffic impact study for the proposed multifamily residential development generally located in the southeast corner of the Sycamore Street and Sloan Street intersection in Lee's Summit, Missouri. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system.

The location of the development site relative to the major streets in the area is shown on ***Figure A-1*** in ***Appendix A***. This study also contains a description of the proposed development and the surrounding transportation infrastructure along with trip generation estimates, trip distribution estimates, capacity analyses, and a summary of the findings.

Proposed Development Plan

The proposed development consists of seven, three-story apartment buildings. Each building will have 24 units, which totals 168 overall units at the development. Surface parking will be provided surrounding each of the buildings. The proposed development plan is included on ***Figure A-2*** in ***Appendix A*** for reference.

Access to the proposed development will be provided from two proposed intersections. Site Drive 1 will be along Sycamore Street, approximately 300 feet east of Sloan Street. This driveway will align with an existing driveway along the north side of Sycamore Street. The second driveway (Site Drive 2) will be along Sloan Street, approximately 575 feet south of Sycamore Street. Both intersections will allow full access.

Study Area

To assess the impacts of the proposed development, the intersections listed below were identified for study during the A.M. and P.M. peak periods.

- Tudor Road and Sloan Street
- Sycamore Street and Douglas Street
- Site Driveways

Surrounding Street Network and Land Uses

The development site is located on approximately 6 acres of undeveloped land. The north side of the site is bounded by Sycamore Street. There are several commercial buildings to the north along Sycamore Street, including medical offices, auto service businesses, and restaurants. Farther to the northwest along Sloan Street there are business park type land uses. The west side of the site is bounded by Sloan Street, and the land is generally undeveloped to the west of Sloan Street. The east side of the site is bounded by the rear parking lot of the Douglas Station retail shopping center. The Lee's Summit Police Department and Municipal Court are located to the south of the development site.

Tudor Road is a four-lane divided street with a raised median. According to the Lee's Summit Thoroughfare Master Plan, it is classified as a minor arterial. There is curb and gutter, along with sidewalks on both sides of the road. The posted speed limit is 35 mph. The street widens for left- and right-turn

lanes at the intersection with Sloan Street. Sloan Street is stop sign controlled at the intersection and Tudor Road is uncontrolled, allowing uninterrupted flow.

Douglas Street is a four-lane divided street with a raised median. It is classified as a major arterial. There is curb and gutter along with a sidewalk on both sides of the street. The posted speed limit is 45 mph. The street widens for left- and right-turn lanes at the signalized intersection with Sycamore Street.

Sycamore Street is a two-lane local street. The roadway is generally 32-feet wide and has curb and gutter. There is sidewalk along the entire north side of the road, and along the south side to the east of the proposed development site. The posted speed limit is 25 mph.

Adjacent to the development site, Sloan Street is classified as a local street. It has curbs and gutters, but no sidewalk adjacent to the development site. The posted speed limit is 25 mph. There is a horizontal curve in the roadway adjacent to the proposed development site. Just south of the site, Sloan widens to 36 feet and is classified as a commercial collector. There is sidewalk adjacent to this segment of the street. South of Tudor Road, Sloan Street becomes Commerce Drive.

Traffic Counts

The turning-movement traffic volume counts were collected at the study intersections on Tuesday, April 6, 2021. The turning movement counts were collected from 7:00 to 9:00 A.M. and from 4:00 to 6:00 P.M. The A.M. peak hour occurred between 7:00 and 8:00 A.M at both intersections. The P.M. peak hour occurred between 4:30 and 5:30 P.M at the intersection of Sycamore Street and Douglas Street and between 4:45 and 5:45 P.M. at the intersection of Tudor Road and Sloan Street. The existing lane configurations, traffic control devices, and peak hour volumes used for this study are illustrated in ***Figure A-3***.

Analysis

The scope of analysis for the assessment of the proposed development's impact on the surrounding transportation system is based in large part on the recommended practices of the Institute of Transportation Engineers (ITE), as outlined in their Traffic Engineering Handbook. ITE is a nationally-recognized organization of transportation professionals with members from both private and public sectors. The analysis of the proposed development's impact included development of trip generation and trip distribution estimates as well as a traffic operations assessment for each study scenario. Each of the analysis methodologies and findings are described in the subsequent sections.

Trip Generation

Trip generation estimates were prepared using the Institute of Transportation Engineer's Trip Generation, 10th Edition. ***Table 1*** on the following page shows the expected trips to be generated by the proposed development. Additional information related to trip generation is included in ***Appendix B***.

Table 1
Trip Generation

Land Use	Intensity	ITE Code	Average Weekday	A.M. Peak Hour			P.M. Peak Hour		
				Total	In	Out	Total	In	Out
Multifamily Housing (Mid-Rise)	168 units	221	914	57	15	42	73	45	28
Total Full Development Trips			***914***	***57***	***15***	***42***	***73***	***45***	***28***

Trip Distribution

The estimated trips generated by the proposed development were distributed onto the surrounding street network based on the trip distributions summarized in ***Table 2***. These distributions are based on existing travel patterns, the surrounding street network, and engineering judgment. Detailed distributions through the study intersections is included in ***Appendix B***.

Table 2
Trip Distribution

Direction To/From	Percentage
North on Douglas Street	25%
South on Douglas Street	20%
East on Tudor Road	25%
West on Tudor Road	30%
Total	**100%**

Sight Distances

Sight distances and methods for measurement are provided in A Policy on Geometric Design of Highways and Streets (7th Edition), also referred to as the AASHTO Green Book published by the American Association of State Highway and Transportation Officials (AASHTO). Intersection sight distance is provided at intersections to allow the drivers of stopped vehicles to depart from their approach and enter or cross the uncontrolled street. These distances are generous, allowing enough distance for the stopped driver to complete their turning or crossing maneuver without requiring through traffic on the uncontrolled street to reduce their speed.

Sight distances were measured in the field at each proposed site driveway intersection. The measurements and AASHTO recommended sight distances for each direction of travel are shown on the next page in ***Table 3***.

Table 3
Intersection Sight Distances

Intersection	Direction Looking	Intersection Sight Distance, feet	
		Field Measured	Recommended
Sycamore Street & Site Drive 1	East	565	280
	West	300	240
Sloan Street & Site Drive 2	North	280	280
	South	475	240

The field measurements indicate that sight distances are adequate for the posted speed limit at each of the proposed site driveway intersections. Although these sight lines are adequate, one of the proposed buildings will limit a driver's line of sight when looking to the north from Site Drive 2 in the horizontal curve of Sloan Street. There should be no obstructions north of this driveway to ensure adequate sight lines are provided. No trees, bushes, signage, or retaining walls shall be located within the yellow shaded area to maintain adequate sight lines, as shown in ***Figure 1***.

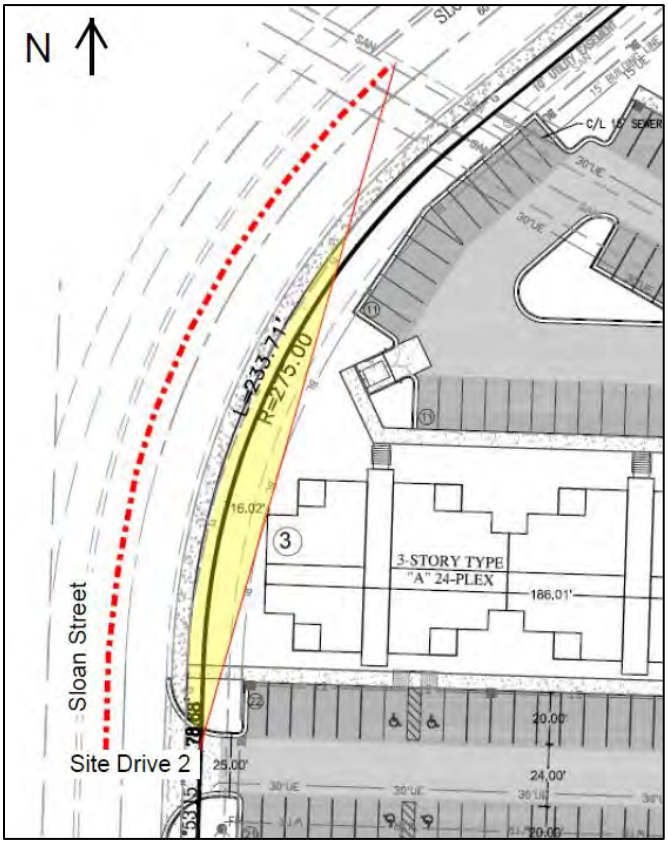

Figure 1: Driver's Line of Sight Looking North from Site Drive 2

Access Management

Lee's Summit Access Management Code (AMC) provides guidance on turn lane requirements, throat lengths, and spacing of intersections and driveways. The proposed site plan was reviewed for compliance with the AMC. No turn lanes are required at the site driveway intersections, as the driveways are located along local streets and low traffic volumes are projected. The two site driveway locations are adequately spaced from adjacent access points. Site Drive 1 has an adequate throat length, exceeding the 50 foot requirement based on the AMC. There is an adequate length before the first major turn at Site Drive 2, however there are several parking stalls within the throat that are less than 50 feet from Sloan Street.

Traffic Operation Assessment

An assessment of traffic operations was made for the scenarios listed below.

- Existing Conditions
- Existing plus Proposed Development Conditions

The study intersections were evaluated using the Synchro traffic analysis software package. Calculations were performed based on the methodologies outlined in the Highway Capacity Manual (HCM), 6th Edition, which is published by the Transportation Research Board. The operating conditions at an intersection are graded by the "level of service" experienced by drivers. Level of service (LOS) describes the quality of traffic operating conditions and is rated from "A" to "F". LOS A represents the least congested condition with free-flow movement of traffic and minimal delays. LOS F generally indicates severely congested conditions with excessive delays to motorists. Intermediate grades of B, C, D, and E reflect incremental increases in the average delay per stopped vehicle. Delay is measured in seconds per vehicle. ***Table 4*** shows the upper limit of delay associated with each level of service for signalized and unsignalized intersections.

Table 4
Intersection Level of Service Delay Thresholds

Level of Service (LOS)	Signalized	Unsignalized
A	≤ 10 Seconds	≤ 10 Seconds
B	≤ 20 Seconds	≤ 15 Seconds
C	≤ 35 Seconds	≤ 25 Seconds
D	≤ 55 Seconds	≤ 35 Seconds
E	≤ 80 Seconds	≤ 50 Seconds
F	> 80 Seconds	> 50 Seconds

While LOS measurements apply to both signalized and unsignalized intersections, there are significant differences between how these intersections operate and how they are evaluated. LOS for signalized intersections reflects the operation of the intersection as a whole.

Unsignalized intersections, in contrast, are evaluated based on the movement groupings which are required to yield to other traffic. Typically, these are the left turns off of the major street and the side-

street approaches for two-way stop-controlled intersections. At unsignalized intersections lower LOS ratings (D, E and F) do not, in themselves, indicate the need for additional improvements. Many times there are convenient alternative routes to avoid the longer delays. Other times the volumes on the unsignalized approaches are relatively minor when compared to the major street traffic, and improvements such as a traffic signal installation may increase the average delay to all users of the intersection.

The decision to install a traffic signal, which is often considered when lower LOS ratings are projected, should be based on engineering studies and the warrants for traffic signal installation as outlined in the Federal Highway Administration's Manual on Uniform Traffic Control Devices (MUTCD). Signals are typically not recommended in locations where there are convenient alternative paths, or if the installation of a traffic signal would have negative impacts on the surrounding transportation system.

The LOS rating deemed acceptable varies by community, facility type and traffic control device. In Lee's Summit, LOS C has been identified as the minimum desirable goal for signalized intersections. However, at unsignalized intersections LOS D, E, or even F may be considered acceptable for low to moderate traffic volumes where the installation of a traffic signal is not warranted by the conditions at the intersection, or the location has been deemed undesirable for signalization.

Traffic queues were also evaluated as part of the analyses. Long traffic queues which extend beyond the amount of storage available, either between intersections or within turn lanes, can have significant impacts on operations. The projected vehicular queues were analyzed to ensure the analyses are reflective of the physical constraints of the study intersections and to identify if additional storage is needed for turn lanes.

Existing Conditions

The results of the Existing Conditions intersection analyses are summarized in ***Table 5***. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on ***Figures A-3*** through ***A-5***. The Synchro output files are included in ***Appendix C***. The 95th percentile queues at the study intersections are shown in ***Figure A-6***.

Table 5
Intersection Operational Analysis
Existing Conditions

Intersection	A.M. Peak Hour		P.M. Peak Hour	
Movement	LOS[1]	Delay[2]	LOS[1]	Delay[2]
Douglas Street and Sycamore Street				
Traffic Signal	*A*	*8.5*	*B*	*10.3*
Sloan Street and Tudor Road				
Northbound	*B*	*11.4*	*B*	*11.5*
Southbound Left-Turn	*A*	*0.0*	*B*	*14.7*
Southbound Through/Right-Turn	*A*	*9.7*	*B*	*10.4*
Eastbound Left-Turn	*A*	*7.7*	*A*	*7.7*
Westbound Left-Turn	*A*	*7.8*	*A*	*8.0*

1 – Level of Service
2 – Delay in seconds per vehicle

The results in ***Table 5*** indicate that both study intersections currently operate within acceptable levels of service during the peak hours. All 95th percentile queues are minimal and contained within their respective turn lanes.

Existing plus Proposed Development Conditions

The results of the Existing plus Proposed Development Conditions intersection analyses are summarized in ***Table 6***. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on ***Figures A-7*** through ***A-9***. The Synchro output files are included in ***Appendix C***. The projected 95th percentile queues at the study intersections are shown in ***Figure A-10***.

Table 6
Intersection Operational Analysis
Existing plus Proposed DevelopmentConditions

Intersection	A.M. Peak Hour		P.M. Peak Hour	
Movement	LOS[1]	Delay[2]	LOS[1]	Delay[2]
Douglas Street and Sycamore Street				
Traffic Signal	*A*	*9.0*	*B*	*10.7*
Site Drive 1 and Sycamore Street				
Northbound	*A*	*9.0*	*A*	*9.0*
Westbound Left-Turn	*A*	*7.4*	*A*	*7.5*
Sloan Street and Site Drive 2				
Westbound	*A*	*8.8*	*A*	*8.9*
Southbound Left-Turn	*A*	*7.3*	*A*	*7.3*
Sloan Street and Tudor Road				
Northbound	*B*	*11.6*	*B*	*11.7*
Southbound Left-Turn	*B*	*14.4*	*C*	*15.5*
Southbound Through/Right-Turn	*A*	*9.5*	*B*	*10.1*
Eastbound Left-Turn	*A*	*7.8*	*A*	*7.8*
Westbound Left-Turn	*A*	*7.8*	*A*	*8.0*

1 – Level of Service
2 – Delay in seconds per vehicle

The results in the table indicate that the study intersections are projected to continue operating at good levels of service. The analysis indicates that the effect on queue lengths will be nominal. The addition of development traffic is projected to have a minimal impact on the study intersections.

Summary

TranSystems has completed a traffic impact study for the proposed multifamily residential development generally located in the southeast corner of the Sycamore Street and Sloan Street intersection in Lee's Summit, Missouri. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system.

The proposed development plan includes two new site driveways. Site Drive 1 will be aligned with an existing driveway along Sycamore Street, approximately 300 feet east of Sloan Street. Site Drive 2 will be

along Sloan Street, approximately 575 feet south of Sycamore Street. Sight distance is adequate at both site driveways. One of the proposed buildings will limit sight lines when looking to the north from Site Drive 2, therefore obstructions should be located in the area to the north of the driveway.

The proposed development is projected to generate 57 trips during the A.M. peak hour and 73 trips during the P.M. peak hour. This equates to approximately one additional vehicle per minute. No capacity improvements are identified to mitigate the addition of development traffic to the street network. All intersections are projected to continue operating at good levels of service with the addition of development traffic.

Appendix A - Figures

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TranSystems	LOCATION MAP	Douglas Station Traffic Impact Study Lee's Summit, Missouri	April 2021 No Scale	Figure A-1

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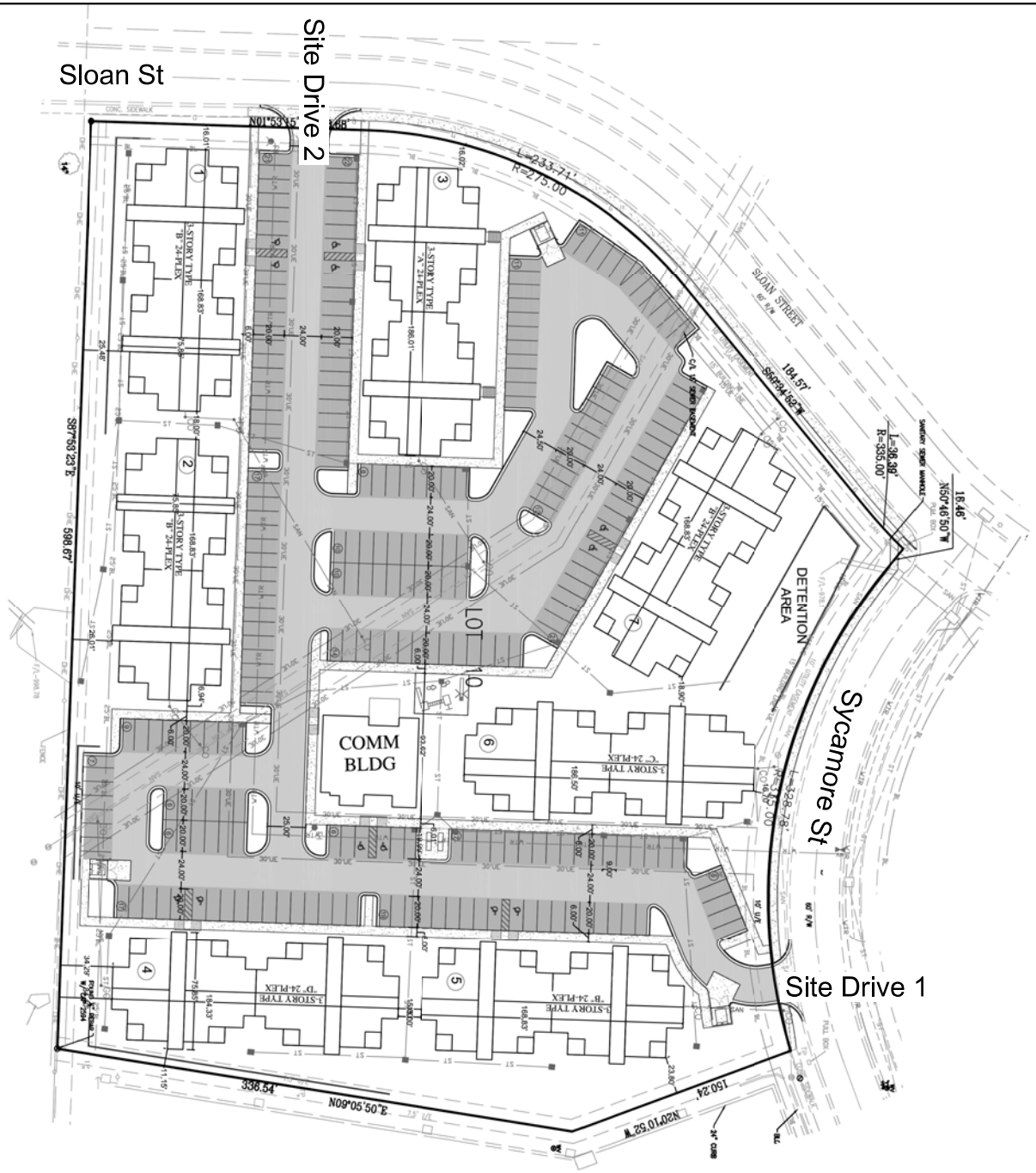

NORTH

TranSystems	SITE PLAN	Douglas Station Traffic Impact Study Lee's Summit, Missouri	April 2021 No Scale	Figure A-2