CITY OF OVERLAND PARK

TRAFFIC IMPACT STUDY GUIDELINES

October 2020

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Acronyms:

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
ADT	Average Daily Traffic
DDHV	Directional Design Hourly Volume
HCM	Highway Capacity Manual
HCS	Highway Capacity Software
ITE	Institute of Transportation Engineers
KDOT	Kansas Department of Transportation
LOS	Level of Service
MUTCD	Manual on Uniform Traffic Control Devices
PE	Professional Engineer
PHF	Peak Hour Factor
PTOE	Professional Traffic Operations Engineer
Sq. Ft.	Square Feet
TIS	Traffic Impact Study
VPH	Vehicles Per Hour

Definitions:

Average Annual Daily Traffic (AADT): The total volume of vehicle traffic on a highway or road for a year divided by 365 days.

Average Daily Traffic (ADT): The volume of traffic passing a point or segment of a roadway, in both directions, during a period of time, divided by the number of days in the period and factored to represent an estimate of traffic volume for an average day of the year. For purposes of this document, this typically means the average daily volume during the Tuesday through Thursday weekday period.

Directional Design Hourly Volume (DDHV): The one-way volume in the predominant direction of travel in the design hour, expressed as a percentage of the two-way design hourly volume.

Level of Service (LOS): A quantitative stratification of a performance measure or measures that represent quality of service, measured on an A-F scale, with LOS A representing the best operating conditions from the traveler's perspective and LOS F the worst during a specific time period, typically 15 minutes.

Peak Hour: The hour of the day in which the maximum volume occurs. The typical analysis periods for a TIS include the AM peak and PM peak hours during a typical weekday. Typical weekday is defined as Tuesday, Wednesday, or Thursday. The typical weekday peak periods typically range from 7:00 A.M to 9:00 A.M. and 4:00 P.M to 6:00 P.M.

Peak Hour Factor (PHF): The hourly volume divided by the peak 15-minute flow rate within the peak hour. It is a measure of traffic demand fluctuations within the peak hour.

Traffic Impact Study: Primarily used to estimate the amount of vehicular traffic that would be expected

from the proposed development as compared to any previously approved plans or the land use identified on the Future Development Plan. Determines the potential impacts to the existing street network and predicts how roadway modifications could mitigate or improve the public street system.

Trip Generation: The process of forecasting the number of people generated by a proposed development based on the development size, number of employees, or dwelling units according to land use type.

TRAFFIC IMPACT STUDY GUIDELINES

1.0 Introduction

The City of Overland Park has developed the following guidelines to be used to complete Traffic Impact Studies (TIS) as part of the planning of proposed land development projects. The purpose of these guidelines is to establish uniform criteria to be used for the development of a TIS. These guidelines will help in the communication and coordination between all parties who conduct business with the City of Overland Park.

This document provides the following objectives:

- Identifies when TIS are required
- Establishes minimum qualifications to complete a TIS
- Standardizes traffic impact study procedures

If determined by City staff, TIS must be submitted concurrently with the development plan or plat application in conformance with the City's current Planning Commission submission schedule. Any effects to the street system should be identified and resolved prior to the Planning Commission major revisions deadline. Failure to meet these deadlines shall be cause for rejection of the submittal and/or the application may be rescheduled to a later Planning Commission meeting.

2.0 Development Conditions Warranting a Traffic Impact Study

The TIS Level will be defined by the amount of site-generated vehicular traffic. **Table 1** defines the different TIS levels.

A TIS will be required to be submitted with any preliminary development plan or preliminary plat submittal with the following exceptions:

- A single-family residential development that is not proposing a new access point to a collector or thoroughfare.
- Changes to a previously approved plan or plat with an increase in square footage that is less than 10%.
- A Revised Preliminary Development Plan that does not require a public hearing; however, if the plan includes a change in use that is expected to generate an increase in trips, at a minimum, a trip generation analysis will be required to document the change and evaluate the impact
- A reduction in square footage.
- In general, religious facilities will be exempt from providing a TIS; however, if there are multiple uses proposed on site (i.e. event center), a TIS may be required to evaluate the impact.

Applicants should consult with City staff prior to beginning a TIS to confirm the scope, assumptions, and schedule to avoid unnecessary delays.

3.0 Traffic Impact Study Level Thresholds

The level of analysis for a TIS is proportional to the vehicle trip generation from a given project and is shown in **Table 1**. Site-generated trips should be calculated using the latest edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual. The volume thresholds shown in **Table 1** represent the vehicles per hour (vph) estimated to be generated by the proposed net trips.

Table 1 – TIS Level Thresholds by Vehicles per Hour

Level of Study	Threshold (vph)
Level 1	0-20
Level 2	21-249
Level 3	250 – 499
Level 4	≥500 *

Table 2 provides a listing of example trip generation rates for a variety of land uses which would generate vehicle trips greater than 100 vehicles per hour (vph) or 500 vph. For land uses not listed in **Table 2**, trip generation rates should be developed by the Project's Traffic Engineer to estimate the level of effort required for the traffic impact study. In cases where the current version of the ITE Trip Generation Manual differs from **Table 2**, the most recent ITE Trip General Manual shall be used.

Table 2 – Example Trip Generation Rates by Land Use

ITE Code	Land Use	Units	Size to Generate 100 Trips	Size to Generate 500 Trips
110	Light Industry	Sq. Ft.	160,000	800,000
130	Industrial Park	Sq. Ft.	250,000	1,250,000
140	Manufacturing	Sq. Ft.	150,000	750,000
150	Warehouse	Sq. Ft.	600,000	4,000,000
210	Single Family	Units	100	525
220	Multi-Family (Townhomes/Condos)	Units	180	(A)
221	Multi-Family (Mid Rise - 3 to 10 Levels)	Units	250	1,250
254	Assisted Living	Beds	200	(A)
310	Hotel	Units	170	(A)
445	Multiplex Movie Theater	Screens	(D)	(D)
480	Soccer Complex	Units	(D)	(D)
495	Recreation Community Center	Sq. Ft.	30,000	250,000
560	Church	Sq. Ft.	(D)	(D)
565	Daycare	Sq. Ft.	9,000	(A)
710	General Office	Sq. Ft.	80,000	(A)
720	Medical Office	Sq. Ft.	30,000	(A)

ITE Code	Land Use	Units	Size to Generate 100 Trips	Size to Generate 500 Trips
750	Office Park	Sq. Ft.	(B)	300,000
812	Bldg. Materials	Sq. Ft.	50,000	(A)
813	Discount Superstore	Sq. Ft.	(B)	115,000
816	Hardware Store	Sq. Ft.	38,000	(A)
820	Shopping Center	Sq. Ft.	(C)	90,000
840	Automobile Sales (New)	Sq. Ft.	44,000	(A)
850	Supermarket	Sq. Ft.	10,000	55,000
853	Convenience Market w/ Gas Pumps	Fuel Pos.	(B)	22
816	Hardware Store	Sq. Ft.	38,000	(A)
881	Pharmacy w/ Drive Thru	Sq. Ft.	10,000	(A)
912	Drive-In Bank	Sq. Ft.	5,000	(A)
931	Quality Restaurant	Sq. Ft.	13,000	(A)
932	High Turnover Sit Down Rest.	Sq. Ft.	10,000	(A)
934	Fast Food w/Drive Thru	Sq. Ft.	3,000	(A)
937	Coffee/Donut Shop w/ Drive Thru	Sq. Ft.	(B)	(A)
Institute of Transportation Engineers (ITE) *Trip Generation Manual*, 10th Edition				

(A) Land use typically does not generate more than 500 vph as standalone use.
(B) TIS required due to land generating more than 100 vph.
(C) Shopping Center land use applied to development with multiple commercial retail centers with shared parking.
(D) Peak generator times for land use typically occur during Friday or over the weekend. Engineering Services will determine the study analysis days and time periods to account for the weekend peak hour.

If a proposed development land use changes during the developer's design process the trip generation table shall be updated. If the cumulative changes in the trip generation results in more than an increase of 50 trips or 5% of the total development trip generation, whichever is greater, the entire TIS shall be updated. Both the final trip generation anticipated at the development and the trip generation used for the rest of the TIS shall be shown in the TIS if they differ.

4.0 Qualifications Required to Conduct Traffic Impact Study

It is the applicant's responsibility to prepare a qualified traffic impact study meeting the guidelines defined within this document. The TIS is required to be signed and sealed by a Professional Engineer (PE) in the State of Kansas with relevant TIS experience prior to submittal. It is recommended that the PE also have a PTOE to complete a Level 3 or Level 4 TIS. The Planning Director will make the final determination as to whether a particular engineer is qualified to complete a TIS for the Project.

5.0 TIS Scope of Service

Prior to conducting a TIS, the applicant or their representative should develop a scope of service in consultation with City staff to meet the TIS requirements for the Project. **Table 3** provides a summary of the typical scope items expected to be included within the TIS; however, additional detail may be requested by the City for certain tasks due to local knowledge of the area to address concerns

or meet other prior planning or engineering requirements. The scope of service should be determined with City staff prior to completing the study to ensure the technical requirements are met.

Table 3 – Traffic Impact Study – Example Scope of Service

Traffic Impact Study - Typical Requirements				
Traffic Impact Study Levels	Level 1	Level 2	Level 3	Level 4
Projected Peak Hour Site-Generated Automobile Trips by Project (Latest Edition ITE Trip Generation Manual)	0 - 20	21 - 249	250 - 499	> 500
Location Description	X	X	X	X
Land Use - Existing and Proposed	X	X	X	X
Trip Generation Estimate	X	X	X	X
Access Management Review	X	X	X	X
Adjacent Access Spacing - Upstream & Downstream	X	X	X	X
Intersection Sight Distance	X	X	X	X
Connectivity and Circulation Review		X	X	X
Existing Street Functional Classification		X	X	X
Posted Speed Limit		X	X	X
Existing ADT Volumes		X	X	X
Future ADT Volumes		X	X	X
Truck Volumes & Circulation (Existing and Proposed if Commercial or Industrial)		X	X	X
Summary of Existing Pedestrian & Bicycle Facilities and Connectivity		X	X	X
Current Intersection Turning Movement Peak Period Volumes			X	X
Existing Transit Routes			X	X
Crash History			X	X
Traffic Assignment Distribution Assumptions			X	X
Trip Generation Reduction Assumptions or Pass-By Trips (shall be documents if used on Level 1 or 2)			X	X
Traffic Operation Analysis Requirements			X	X

Traffic Impact Study - Typical Requirements				
Traffic Impact Study Levels	Level 1	Level 2	Level 3	Level 4
Projected Peak Hour Site-Generated Automobile Trips by Project (Latest Edition ITE Trip Generation Manual)	0 - 20	21 - 99	100 - 499	> 500
Traffic Operation Analysis Scenarios				
Existing Condition (no development)			X	X
Existing Conditions plus Previously Approved			X	X
Existing plus Site-Generated Traffic (full build only)			X	X
Existing plus Site-Generated Traffic (major phases to full build)				X
Existing plus Future Background Volumes (no build)			X	X
Existing plus Site-Generated and Future Background Volumes (full build)			X	X
Interrupted Flow Capacity Analysis (intersections)				
MUTCD Signal Warrant Analysis			X	X
Turn Lane Warrant Analysis			X	X
Proposed Transit Routes				X
Summary & Recommendations				
Intersection & Roadway Geometric Recommendations			X	X
Traffic Control Recommendations (stop sign, signal, roundabout)			X	X
Turn Lane Recommendations (including storage length)			X	X

6.0 Key Traffic Impact Study Parameters

Below are key traffic impact study parameters that should be defined prior to completing the TIS. The applicant or their representative should discuss the following parameters to help define the TIS scope of service in consultation with City staff.

6.1 **TIS Level of Effort:** The determination of TIS level is based on the above criteria.

6.2 **Study Area:** Defining the limits of the study area is very important for all levels of traffic impact studies. The Study area is dependent on a variety of variables – size of development, number of driveways, roadway classification, and influence the proposed access will have on the street segment or adjacent intersections. Final

determination of the study area will be determined by City staff.

6.3 **Analysis Periods:** Traffic impact study should be completed during the peak commuter periods. The peak periods are dependent on both the street network peak volume conditions as well as the peaking characteristic for the development type. Typical analysis periods include the peak AM and PM peak hours during a typical weekday. Typical weekday is defined as Tuesday, Wednesday, or Thursday. The typical weekday peak periods typically range from 7:00 A.M to 9:00 A.M. and 4:00 P.M to 6:00 P.M.

The proposed development type can define the traffic analysis periods. Certain land uses may require alternate analysis during off peak commuter periods or over specific weekend periods, including possible holiday weekends.

6.4 **Analysis Years:** The TIS will analyze the opening year of the development. Level 3 and 4 studies will analyze 20 years in the future. For significantly large or long duration build projects, additional development periods may be required to account for build years or phased projects.

6.5 **Future Volume Development Method:** Future year background traffic volumes should be developed using a growth rate approved by the City Traffic Engineer. Growth rate can be developed based on a review of available historic traffic volumes and comparing them to future volumes available in special study areas. In mature portions of the City, the growth rate may be minimal.

7.0 Data Collection

The applicant or their representative is responsible for obtaining the necessary data to complete a traffic study that meets these requirements. The following data should be assembled for each TIS.

7.1 Project Site Characteristics

The following descriptions of the existing and proposed land use for the development site should be included.

a. Existing Condition: Identify and document the existing land use and currently zoned land use per the City's current zoning map as well as the adopted Future Development Plan Map.

b. Proposed Plan (Project): A description of the proposed site plan should be provided. The description should include an exhibit of the proposed development that shows the number of access points, internal street network, and proposed land uses.

c. Surrounding Developments: Any pending or approved planned developments near the proposed project should be documented. The extent of surrounding developments will be located in close proximity to the proposed development commensurate with the size of the proposed development. Surrounding development extent must be approved by City staff.

d. Previously Approved Traffic Impact Studies: If a TIS was completed and approved for the development area, the study should be referenced, and the trip generation assumptions and recommendations should be reviewed and noted. If the previous TIS is not available, then site-generated traffic should be estimated based on the previous development plan for

comparison with the new development plan.

7.2 Transportation System

Include a description of the existing transportation network located adjacent to the project or within the study area. Data should include:

a. Functional classification of the roadway

b. Posted speed limit

c. Description of the roadway section (number of thru lanes, turn lanes, curb & gutter, rural ditch section, etc.)

d. Intersection control types (two-way stop control, roundabout, traffic signal, etc.)

e. Existing signal phasing, including left-turn phasing

f. Available sight distance at access points. New access points may require field measurements

g. Pedestrian and bicycle facilities (existing and planned)

h. Existing or proposed transit routes

i. Identify any planned improvements to adjacent street(s) or intersection(s)

7.3 Traffic Volumes

a. Daily Traffic Volumes: For Level 2 traffic impact studies, existing Average Daily Traffic (ADT) traffic volumes can frequently be obtained using City of Overland Park or KDOT traffic volume maps, available online. If not available, the Project's Traffic Engineer may be required to obtain current daily traffic counts adjacent to the Project area. Projected ADT volumes can be obtained from the City or KDOT. For Level 3 and 4 TIS, new traffic counts are required.

   Overland Park Traffic Volume Maps: www.opkansas.org
   KDOT Traffic Volume Maps: www.ksdot.org

b. Intersection Turning Movements: Level 3 and 4 traffic impact studies require new peak hour intersection turning movement counts which capture the demand flow rate for each movement. Intersection turning movement counts should be completed based on the anticipated peak hour for the Project. This is typically found on a weekday between the periods of 7:00 to 9:00 A.M. and 4:00 to 6:00 P.M. City staff may require other time periods based on the Project or proposed land use.

   Intersection turning movement counts shall be completed in 15-minute increments and should capture the heavy vehicle percentage along with any pedestrians or bicyclists. A minimum of 1.5 hours shall be counted in order to capture the peak hour prior. Queuing shall be included and accounted for during oversaturated conditions as per the Highway Capacity Manual. The calculated Peak Hour Factor (PHF) shall be provided for each intersection and used in the capacity analysis.

8.0 Background Traffic Volumes

Background traffic is defined as the traffic volumes obtained or recorded for the study intersection(s) prior to the development occurring. Balancing the traffic volumes between study intersection(s) will help with the traffic assignment process. Project generated trips will be assigned on top of the existing background volumes.

Future year background traffic growth should be developed using a growth rate developed based on review of historic traffic volumes or from available future year ADT volumes. The existing background volumes should be projected using the calculated growth rate. Project generated trips will be added to the future year background volumes.

9.0 Trip Generation

Anticipated traffic for the Project should be estimated using trip generation methods and procedures defined in the ITE Trip Generation Manual, 10th Edition or latest edition. The land use codes and trip generation volume examples provided in **Table 2** are from the ITE Trip Generation Manual, 10th Edition. The Trip Generation Manual should be used to determine the process for selecting the appropriate average rate or equation for each land use code. If the Trip Generation Manual recommends local data to be collected, prior approval from city staff is required to use any values other than locally collected data.

A table to summarize the trip generation for the Project should be included in the TIS report. The table should include the land use code, unit used (i.e. square feet, number of dwelling units, rooms, etc.), projected ADT, peak hour volumes including directionality, and summary of project phases for larger developments.

Trip generation shall be calculated for the development analysis periods. Trip generation tables for the peak hour of the adjacent street should typically be used. For conditions during non-typical peak periods, ITE Trip Generation Manual "Peak Hour of Generator" rates may be used for those conditions.

Trip generation for redevelopments, mixed-use development, larger developments, and certain types of land uses may choose to use some of these more advanced tools when determining the number of trips a site generates.

Net Trips: Redevelopment sites may determine the previously generated number of trips based on the ITE land use codes and subtract those from the proposed site development with approval from City staff. Depending on the intensity of the former development and the proposed development, this may result in the proposed development generating a net number of trips less than, approximately equal to, or more than, the existing site.

Mode Split: Mode split is the estimated number of travelers anticipated to use transportation modes other than automobiles. Mode split would require typical trip generation rates to be modified when the influence of non-automobile transportation modes is demonstrated and documented. Approval must be received from City staff prior to implementing a trip generation reduction for Mode Split. Mode split should occur prior to applying pass-by trips.

Pass-by Trips: If pass-by trips are used for the TIS, the generation of the pass-by trips should be

documented and noted within the TIS report. Methods described in the ITE Trip Generation Handbook should be used to estimate pass-by trips. Pass-by trip rate should not exceed 10 percent of the adjacent street or 25 percent of the proposed development site-generation potential, whichever is less.

Mixed-Use Internal Capture: For mixed-use developments, internal site-generation capture procedures may be used. Methods defined in the Trip Generation Handbook for internal capture should be used. Approval must be received from City staff prior to implementing internal capture across collector or thoroughfare roads. The internal capture method should be clearly documented, and worksheets shall be provided with the TIS appendix.

10.0 Trip Distribution and Assignment

Trip distribution rates should be developed by reviewing the existing traffic patterns near the development and the respective location of the site within the City. The trip distribution percentages should be documented in a figure to visually represent the origins and destinations for the site-generated traffic.

Estimated vehicle-trips will be assigned to the existing and proposed street networking using the trip distribution rates. Traffic assignment should be completed using judgement for the best routes to/from the development site for the identified analysis periods (i.e. AM and PM peak hours). Site generated traffic volumes should be documented in a figure. The proposed development volume scenario figures should include the total traffic with the site-generated traffic included in a parenthesis. Resulting trip distribution and roadway assignment should be reviewed and approved by City staff prior to proceeding with analysis.

11.0 Traffic Signal Warrant Analysis

Project access points or existing unsignalized intersection(s) that have volumes anticipated to meet one or more traffic signal warrants will require a traffic signal warrant analysis to be completed. Traffic signal warrant analysis should be completed using Manual on Uniform Traffic Control Devices (MUTCD) methodologies to determine which signal warrants may be met, if any. Signal warrant analysis should be included in the TIS and a recommendation with justifications should be provided. Note that Warrant 3, Peak Hour Warrant, shall be applied only in unusual cases as described in the MUTCD. Meeting only Warrant 3 may be insufficient evidence to justify the installation of a signal. It is ultimately the decision of the City to determine if/when a signal will be constructed at any given location.

12.0 Turn Lane Analysis

The need to provide left and right turn lanes for a development project should include an evaluation of intersection capacity, individual movement capacity, driver expectations based upon the type of roadway, speed, turning volume, overall peak hour through volume, effects on pedestrian facilities and bicycle facilities, adjacent land use, intersection and stopping sight distance as appropriate, right of way and utility impacts, and long term maintenance considerations. The default position should be that additional left and right turn lanes shall not be constructed unless deemed necessary based on an evaluation of both vehicular desires and non vehicular effects. The final decision on whether such a facility should be required rests with the recommendation of the City Traffic Engineer. Appeals may be made to the Governing Body as part of the plan approval process. Each situation should weigh

these factors as appropriate for the proposed project. In order to provide a level of consistency in making decisions about providing left and right turn lanes shall be evaluated as follows.

12.1. Signalized Intersections

Determinations about whether to provide either left or right turn lanes for individual movements at signalized or future signalized intersections should be based an evaluation of level of service with goals to provide a level of service as shown in Section 13 above, or in cases where this is not feasible for existing intersections, to maintain an appropriate level of service.

12.2 Unsignalized Intersections - General Considerations

A recommendation for either a left or right turn lane at an unsignalized location requires evaluation of both vehicular and non vehicular impacts. For any given turning location, the designer should evaluate the vehicular traffic demand and when it can be demonstrated that vehicular operations may require a turn lane, an analysis of non-vehicular impacts shall be completed based on location specific factors. Non-vehicular factors that should be considered include include but are not be limited to:

- Potential negative impacts to usability of adjacent previously developed property.
- Utility relocations that may be required to accommodate the widened section and whether the cost and overall impact of such relocations outweigh the benefit of the turn lane.
- Impacts to adjacent sidewalks/trails. The designer should evaluate whether the roadway widening will negatively impact the safety of pedestrians and bicyclists due to potentially requiring the trail/sidewalk to be located closer to the street.
- A contextual analysis of the need for a turn lane should be completed. For example, a turn lane may be warranted in a suburban type environment involving lower density land uses where prior development in the area also provided turning lanes, while it may be inappropriate to recommend a turn lane in a denser urban type area prior development did not provide turn lanes.
- Existing or proposed on-street bike lanes where a right turn lane would create a weaving movement with more vulnerable roadway users.

12.3. Unsignalized Left Turns

Table 4 provides guidance on requirements for left turn lanes at unsignalized intersections on thoroughfares. For collector streets, the need for turn lanes should be evaluated in a similar manner. Generally on Collector streets, a left turn lane is required at the approach to thoroughfares and at heavy uses that have a primary access to a collector street. For intersections listed as requiring further evaluation, the designer should provide an analysis of the non vehicular traffic factors listed in Section 12.2 above along with a review of turning traffic shown in **Figures 1-3** below as part of a recommendation to provide left turn lanes.

Table 4: Left-Turn Lane Guidance for Access from a Thoroughfare Road - Unsignalized Intersections

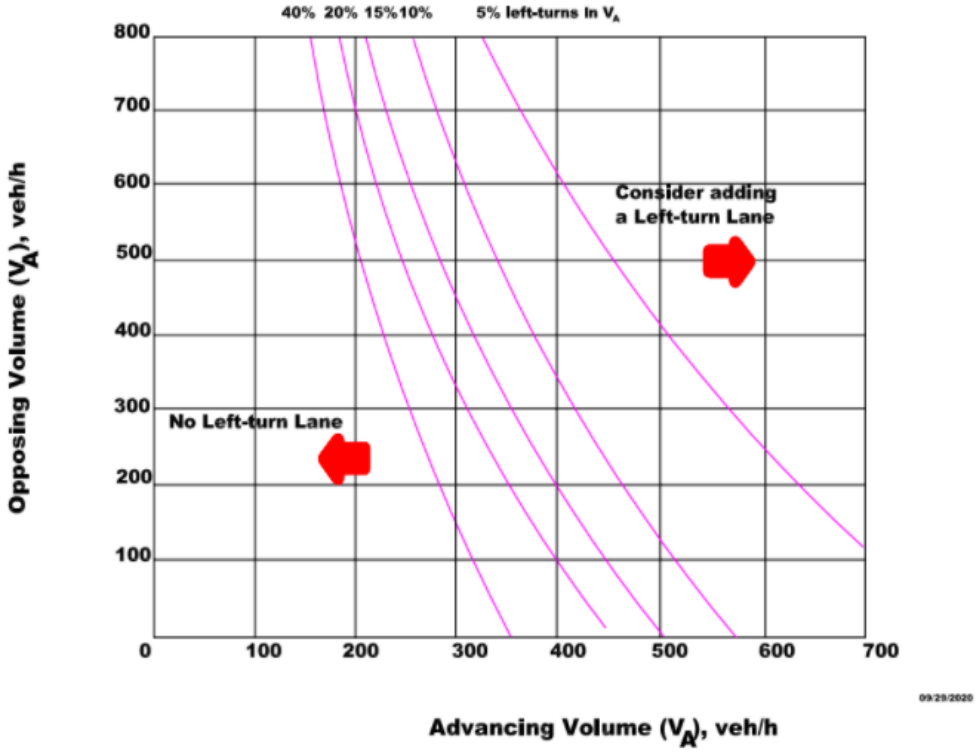
Intersecting Street Primary Land Use	Intersecting Street or Drive	Thoroughfare Section				
		2 lane undivided	2 lane divided	4 lane undivided	4 lane divided	6 lane divided
Residential**	Driveway	Not Required*	Not Required*	Not Required*	Not Applicable	Not Applicable
Residential**	Local Street	Not Required*	Not Required*	Not Required*	Required	Required
Residential**	Collector Street	Evaluate ***	Required	Required	Required	Required
Non Residential	Driveway	Evaluate ***	Evaluate ***	Evaluate ***	Required	Required
Non Residential	Local Street	Evaluate ***	Evaluate ***	Evaluate ***	Required	Required
Non Residential	Collector Street	Evaluate ***	Required	Required	Required	Required
	Thoroughfare	Evaluate ***	Required	Required	Required	Required

** Not required except in cases where stopping sight distance is insufficient for advancing vehicles behind a stopped left turning vehicle.*

*** Residential defined as "low density residential in the comprehensive plan*

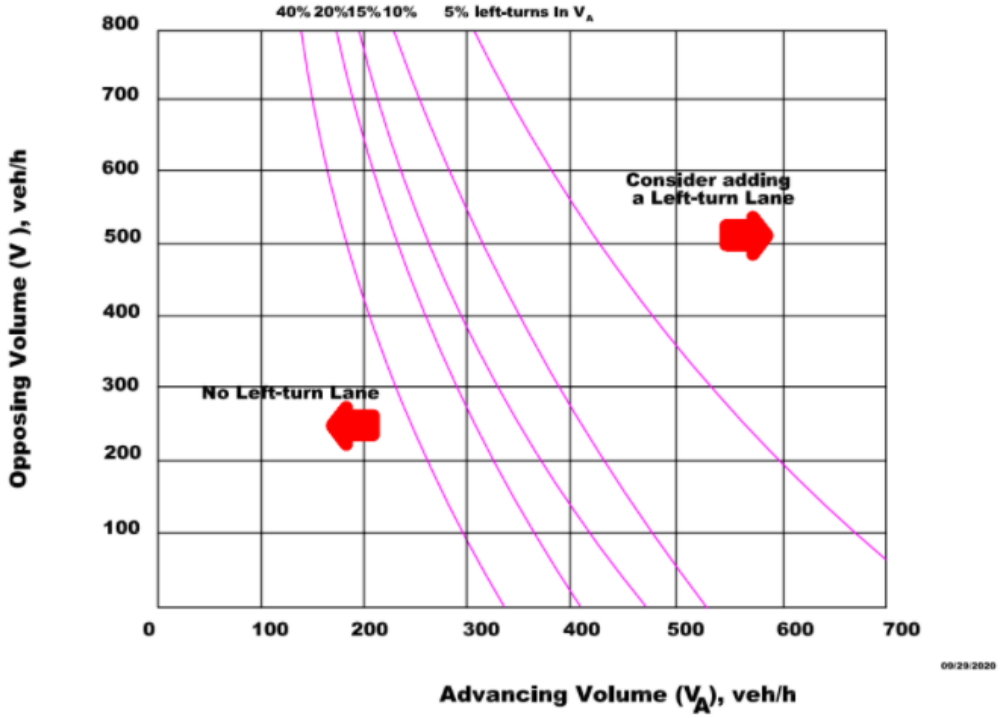
**** Evaluate peak hour turning movement and directional peak hour through volume according to Figure 1-3 below. Also evaluate impacts to pedestrian/bicycle facilities and other factors listed in Section 12.C above.*

Figure 1 -
Left Turn Lane Guidelines for Two-Lane Roadway Less Than or Equal to 40 mph *



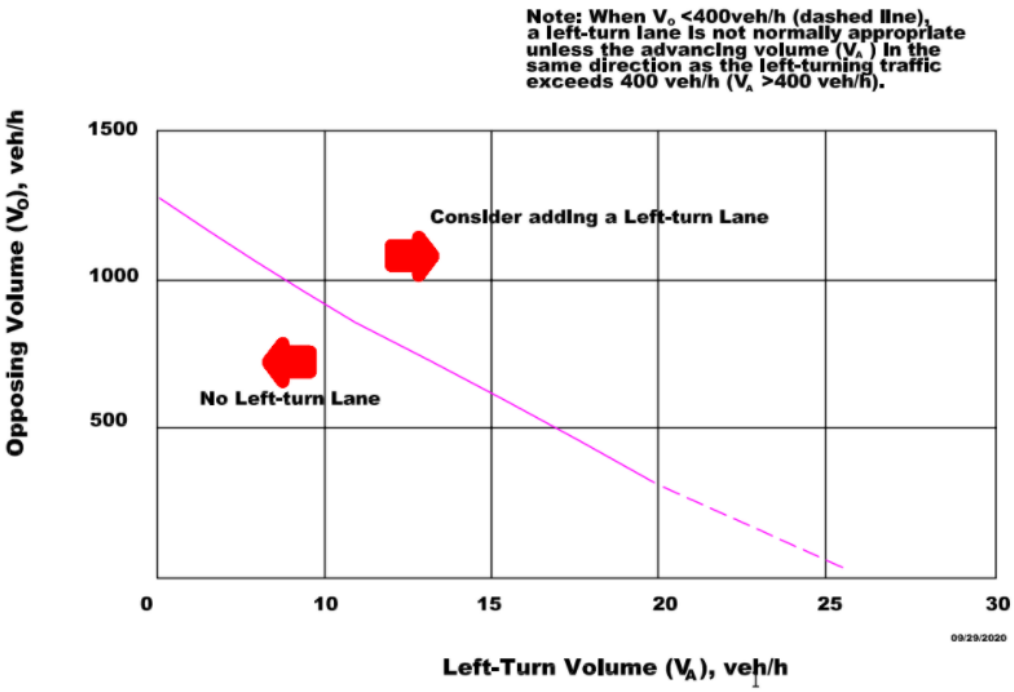
* Adapted from MODOT Engineering Policy Guide, Section 940-Access Management, April 2020 Update

Figure 2 -
Left Turn Lane Guidelines for Two-Lane Roads, 45 MPH *



* Adapted from MODOT Engineering Policy Guide, Section 940-Access Management, April 2020 Update

Figure 3 -
Left Turn Lane Guidelines for Four-Lane Roads. *



*** Adapted from MODOT Engineering Policy Guide, Section 940-Access Management, April 2020 Update**

Left Turn Geometric Considerations:

- Left turn lanes shall be 200 feet plus the taper at the intersection with another arterial street and 150 feet plus the taper at other locations.
- Dedicated left-turn lanes are required on side streets or driveways intersecting arterial streets at full median breaks. Minimum distance shall be 150 feet plus the taper.
- The length of the left-turn lane shall be increased as necessary to accommodate estimated queue length. The minimum length shall be exceeded based on the estimated 95th percentile queue length determined for future traffic volume projections. The queue length shall be estimated using analysis procedures outlined in the latest edition of the Highway Capacity Manual published by the Transportation Research Board. Where the analysis is based on traffic signal control, existing cycle lengths shall be used when available, otherwise a 120 second cycle length should be used in the analysis.
- Unless otherwise approved by the City Traffic Engineer, left-turn lane lengths shall cover the full-width segment between the taper and the end of the lane at an intersection with a public street or driveway. The end of the lane at the intersection shall be determined as the point of curvature for the turning radius used for design of the particular intersection. Turning radius shall meet City of Overland Park design standards.

12.4. Unsignalized Right Turns Lanes

Table 5 below provides guidance on requirements for right turn lanes at unsignalized intersections on thoroughfares. For intersections listed as requiring further evaluation, the

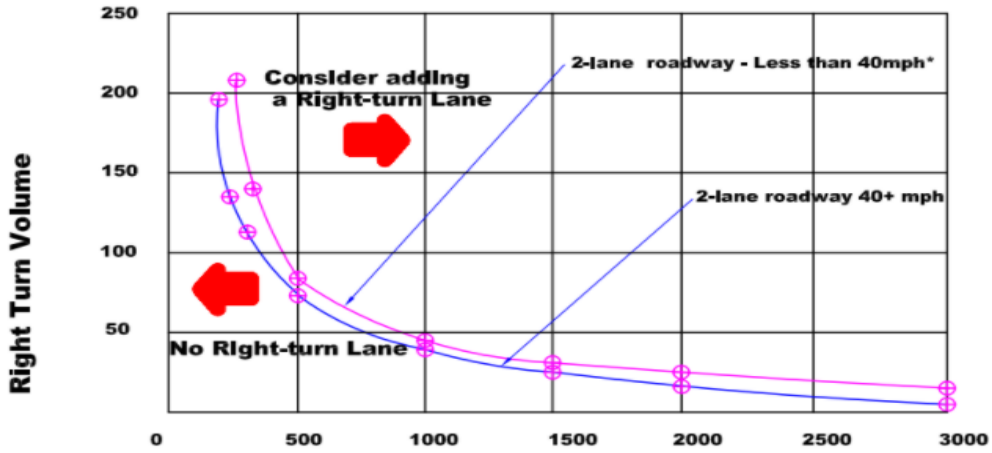
designer should provide an analysis of the non vehicular traffic factors listed in Section 12.2 above along with a review of turning traffic shown in **Figures 4 and 5** below as part of a recommendation to provide left turn lanes.

Table 5: Right Turn Lane Guidance on Thoroughfare Roads - Unsignalized Intersections

Intersecting Street/Drive Land Use	Intersecting Street or Drive	Thoroughfare Section				
		2 lane undivided	2 lane divided	4 lane undivided	4 lane divided	6 lane divided
Residential**	Driveway	Not Required	Not Required	Not Required	Not Required	Not Required
Residential**	Local Street	Not Required	Not Required	Not Required	Not Required	Not Required
Residential**	Collector Street	Evaluate*	Evaluate*	Evaluate*	Evaluate*	Not Required
Non Residential	Driveway	Evaluate*	Evaluate*	Evaluate*	Evaluate*	Not Required
Non Residential	Local Street	Evaluate*	Evaluate*	Evaluate*	Evaluate*	Not Required
Non Residential	Collector Street	Evaluate*	Evaluate*	Evaluate*	Evaluate*	Evaluate *
Not Applicable	Thoroughfare	Evaluate*	Evaluate*	Evaluate*	Evaluate*	Evaluate *

** Evaluate peak hour turning movement and directional peak hour through volume according to Figure 4 and 5 below. Also evaluate impacts to pedestrian/bicycle facilities and other factors listed in Section 12.C above.*
*** Residential defined as low density residential in the Comprehensive Plan*

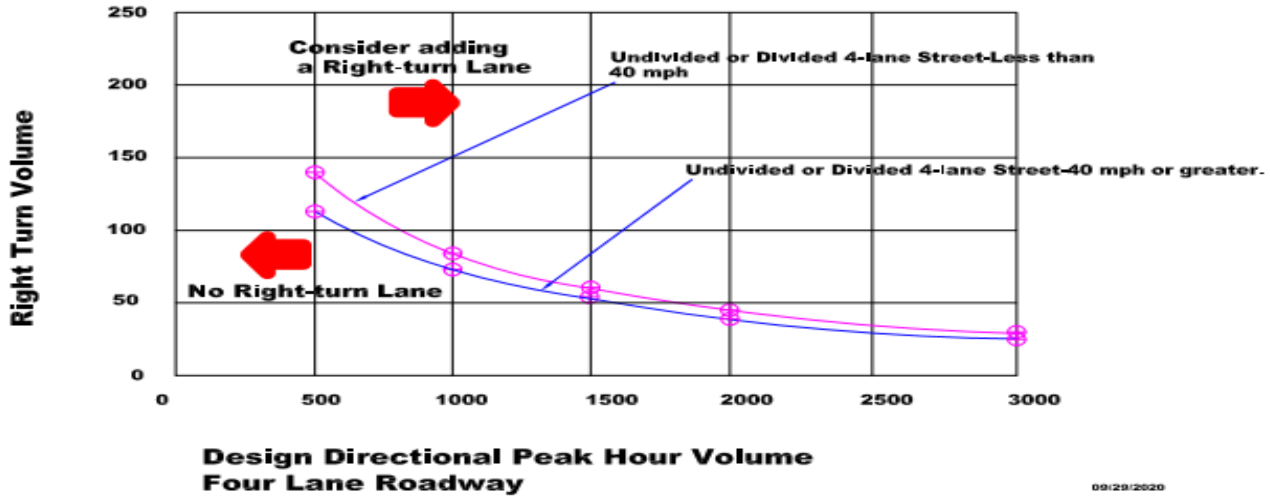
Figure 4-
Minimum Peak Hour Turning Volume to Warrant a Right Turn Lane - 2 Lane Streets **



*roadway with speeds directional peak hour volume of less than 200 and speed less than 40 mph, will not warrant a turn lane.

** Adapted from "Warrants for Right Turn Lanes/Treatments - July 2008 by the Minnesota Department of Transportation."

Figure 5-
Minimum Peak Hour Turning Volume to Warrant a Right Turn Lane - 4 Lane Streets. **



*roadway with directional volume <500 will not require a turn lane.

** Adapted from "Warrants for Right Turn Lanes/Treatments - July 2008 by the Minnesota Department of Transportation."

13.0 Capacity Analysis

Capacity analysis shall be performed for each study intersection using methodologies described in the Highway Capacity Manual (HCM), 6th edition, or latest edition. All capacity analysis should be performed using city-approved software programs. The capacity analysis results should be reported using HCM methodologies.

13.1 Capacity Analysis Criteria

The capacity analysis will be completed using the criteria defined below:

Level of Service (motorized): TIS should include computation of motorized LOS for the study intersection(s) using the methods described in the HCM. The traffic analysis should be completed using approved traffic engineering software.

Multi-modal Level of Service: Where there are pedestrian crosswalks, bike lanes, or transit stops adjacent to the development, the TIS should include a qualitative analysis of the development to determine the effect on the different modes of transportation.

Approved Traffic Engineering Software:
Synchro/Sim Traffic Suite, version 10 or latest edition
Highway Capacity Software (HCS), version 7 or latest edition

City Planning staff can request additional analysis and/or access to electronic files for specialized software for more complicated traffic studies. Example software may include, but limited to, PTV Vissim, PTV Vistro, or SIDRA software.
LOS should be reported for each movement (or lane group) at the intersection.

Traffic simulation should be conducted for closely spaced intersections, or complex traffic conditions. All traffic analysis files should be submitted electronically to the City as part of the TIS submittal.

Impact thresholds for overall intersection LOS are:
LOS D – is typically acceptable on all arterials and collectors
LOS C – is typically acceptable on all other roadways (the highest class of road defines an intersection)

Individual turning movements should operate with LOS E or better for all intersections. For locations with LOS F, additional information or explanation should be provided (i.e. vehicle queue length, signal warrant and geometric or traffic control recommendations should be included in the TIS. A TIS that results in LOS F for individual intersections or movements may not preclude acceptance of the TIS and the development by the City.

Vehicle Queuing: TIS should provide 95th percentile queue length for the individual turning movements. This information is beneficial in determining appropriate turn lane lengths or issues of driveways/streets being blocked by the traffic queue from an adjacent study intersection.

13.2 Intersection Analysis

a. Unsignalized Intersections: HCM results should be reported for unsignalized capacity analysis. Analysis should include the following information:

   1. Existing and proposed lane configurations and traffic control.

   2. Existing volume data should be included in the analysis. These factors included PHF, heavy vehicle percentage, and approach grades.

   3. The results of the capacity analysis should be summarized in a figure showing the lane configurations and individual movement level of service.

   4. Vehicle queue lengths can be reported to the nearest 5-foot intervals with the minimum queue assumed to be 25 feet for queues reported between 0.0 and 1.0 vehicles. HCM output results should be converted from number of vehicles in queue to vehicle queue length (1 vehicle = 25 feet). Vehicle queue information should be provided in the TIS to note when vehicle queues from intersections block left-turn lane(s) and/or other nearby intersection(s). Vehicle queue information should be obtained from a traffic analysis program.

   5. The vehicle queue information should be noted if the queue lengths extend beyond the available turn lane storage. Vehicle queues for the Project access point(s) or side street(s) should not extend into the circulatory roadway within the development. Internal development intersections should not spill back onto the public street system.

b. Signalized Intersections: Capacity analysis should include the following items:

   1. Basic Inputs: Existing traffic volume data – PHF, heavy vehicle percentage, number of lanes, lane widths, approach grades, location to nearest traffic signal, and other inputs (i.e. on-street parking, storage bay lengths, number of pedestrians, etc.)

   2. Existing signal timings, if available. If no timings are available, the analysis should be completed with a 120 second cycle length.

   3. Existing left-turn signal phasing should be documented and used in the analysis (i.e. protected left-turn, permissive left-turn, protected/permissive left-turn, etc. Overland Park typically uses leading protected-permissive left turns when needed.).

   4. For signals located within a corridor, the same cycle length should be used. Half cycle lengths can only be used if approved by City staff.

   5. Existing clearance intervals should be used when available. If clearance intervals are not available, a clearance interval ranging from 5 to 6 seconds should be used. Typical clearance intervals for modeling purposes are 2 seconds all-red with 4 seconds yellow. Actual clearance intervals can be calculated using ITE Signal Timing Methodologies.

   6. Signalized capacity analysis results should be summarized on figures to illustrate the number of lanes, individual movement Level of Service, 95th percentile vehicle queue length, and overall intersection Level of Service.

   7. Lane utilization factors can be adjusted to help replicate the existing conditions for lane unbalance. Adjustments such as these should be documented in the appendix.

This condition typically occurs near major intersections or near interchanges.

8. Traffic simulation results are typically the best way to document the vehicle queue behavior and interaction between multiple intersections. For a study corridor, a minimum of 10 traffic simulation runs should be completed to provide the vehicle queue information.

9. Vehicle queue information should be provided in the TIS to note when vehicle queues from intersections block left-turn lane(s) and/or other nearby intersection(s).

10. All capacity analysis results should be analyzed using HCM methodologies and reports should be included in the TIS appendix.

c. Roundabout: HCS should be used to analyze any existing or proposed roundabouts. Existing and proposed site-generated traffic volume data should be included in the analysis. These factors include PHF, heavy vehicle percentage, approach grades, and other required inputs. Vehicle queue information should be included in the analysis results. Planning staff can request additional analysis using SIDRA or VISSIM software for more complicated TIS.

d. Non-Standard Interchange or Intersection Concepts: Should a non-standard interchange or intersection concept be proposed, the capacity analysis should be completed using VISSIM or other approved method to adequately evaluate the traffic operation.

14.0 Site Circulation

TIS should include a review of the on-site circulation. This would include an assessment of the proposed access points onto the existing street network. The review should evaluate driveway throat lengths, vehicle turn radii, sight distance, internal driveway distance from the internal street network and connection points to the external system.

Vehicle turn radii assessment may require a review of truck access. Truck access should be evaluated to document the design vehicle that can enter and exit the development without causing impacts outside the proposed street network. Autoturn or other approved methods shall be used to assess the truck circulation. The design vehicle should be approved by City staff. At minimum, any non-residential development shall be able to accomodate an SU-40 design vehicle in areas outside of the downtown Form District and SU-30 in the Downtown Form District. The City Bus design vehicle should be used if a Ride KC bus is anticipated to enter the site based on the proposed route.

In addition to the above analysis, the TIS should include a review of the pedestrian and bicycle circulation within a development. Increasingly, pedestrian connections and bicycle facilities are included as development amenities, so it is important to consider the interaction between pedestrians, bicyclists, and automobile drivers. The site design should consider all modes of transportation and should minimize conflicts between the various modes.

APPENDIX

TRAFFIC IMPACT STUDY OUTLINE

The Traffic Impact Study (TIS) should be prepared according to generally acceptable professional practice and should address the study elements listed below. Overland Park City staff must approve all major assumptions. The TIS should provide sufficient text, maps, graphics, and tables to describe the study findings, recommendations, and appendices.

a. **Introduction and Study Scope:** This section should explain the context of the TIS and the scope of the work.

b. **Existing Conditions:** The TIS should document existing transportation conditions covering infrastructure/service inventory, existing demand/usage, safety issues, and operational performance.

c. **Development Project Description:** This section should provide the following information:

- Proposed site location, layout, access (motorized and non-motorized), land uses, and development phasing
- Existing site access (motorized and non-motorized), land uses (types, intensities, building arrangement), and parking
- Information on nearby parcel access and land use, and their relationship to the proposed development project
- Trip generation using the latest ITE Trip Generation Manual and ITE Trip Generation Handbook procedures
- Traffic assignment and distribution should be summarized and illustrated onto figures

d. **Traffic Operational Analysis Sections:** The traffic operational analysis should be summarized for each of the traffic volume scenarios. Discussion should include individual motorized Levels of Service (LOS) by movement and vehicle queueing along with the overall intersection LOS, if applicable. This section should include traffic signal warrant analysis and any turn lane recommendations.

1. **Existing Conditions (No Development):** The TIS should present the background transportation conditions on the assumed opening day. This includes any changes in transportation infrastructure, service, demand, safety, or operational performance anticipated to take place between the existing conditions and opening day. If opening day is within one year of existing conditions, and no substantial changes are expected during that time-frame, existing conditions can be used for opening day.

2. **Existing Conditions plus Site Generated Traffic (Full Build Only):** This section should present the opening day conditions with the proposed development project added. If the Project will cause traffic operation issues to the existing street network, mitigation measures should be identified, and their effect on the performance of the relevant mode should be identified. Acceptable levels of service are defined in Section 11.

3. **Existing Conditions plus Site Generated Traffic (Major Phases to Full Build):** A Project with trip generation levels that meet Level 4 will require additional traffic operation analysis

scenarios. Depending on the number phases, additional phased conditions may need to be developed for the TIS. Operations not meeting the acceptable levels of service will need to be mitigated.

4. **Future Year Background Traffic (No Build):** This analysis scenario is to provide a base scenario to compare against "Full Build Project" conditions.
5. **Future Year Background Traffic plus Site Generated Traffic(Full Build):** This analysis scenario is to determine the ultimate impact the Project will have on the street network for the future year scenario. Operations not meeting the acceptable levels of service will need to be mitigated.

e. **Summary and Recommendations:** This section should provide a summary of the study process and geometric improvement recommendations.

f. **Appendix:** All trip generation assumptions, internal capture rates, and traffic analysis reports should be provided in an appendix with sufficient detail to recreate the process and assumptions at a later date