



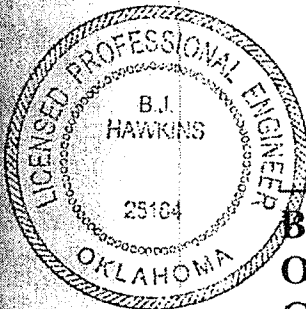
## TRAFFIC IMPACT STUDY

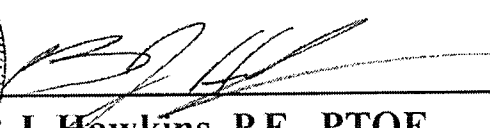
710 Asp Avenue  
Norman, Oklahoma

Prepared for:  
B3 Development Group

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Prepared by:  
Traffic Engineering Consultants, Inc.



  
B.J. Hawkins, P.E., PTOE  
Oklahoma P.E. #25164  
CA # 1160

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Date

## 1.0 INTRODUCTION

Traffic Engineering Consultants, Inc. (TEC) was retained by B3 Development Group to perform a traffic impact study for a proposed development to be located in Norman, Oklahoma. The study was requested to determine the effects the proposed development would have on the adjacent street system, to review the available access to the development, and to provide recommendations for improvements that may be necessary to accommodate the traffic expected to be generated by the development.

## 2.0 BACKGROUND

The site of the proposed development is located west of Asp Avenue and across from Duffy Street as shown in Figure 1. The development is proposed to include an apartment complex containing 200 units with a total of 240 bedrooms. The development will also include two retail spaces. The exact land uses for the spaces are unknown at this time, but for the purpose of this report it will be assumed to contain a specialty retail center and a high-turnover sit-down restaurant.

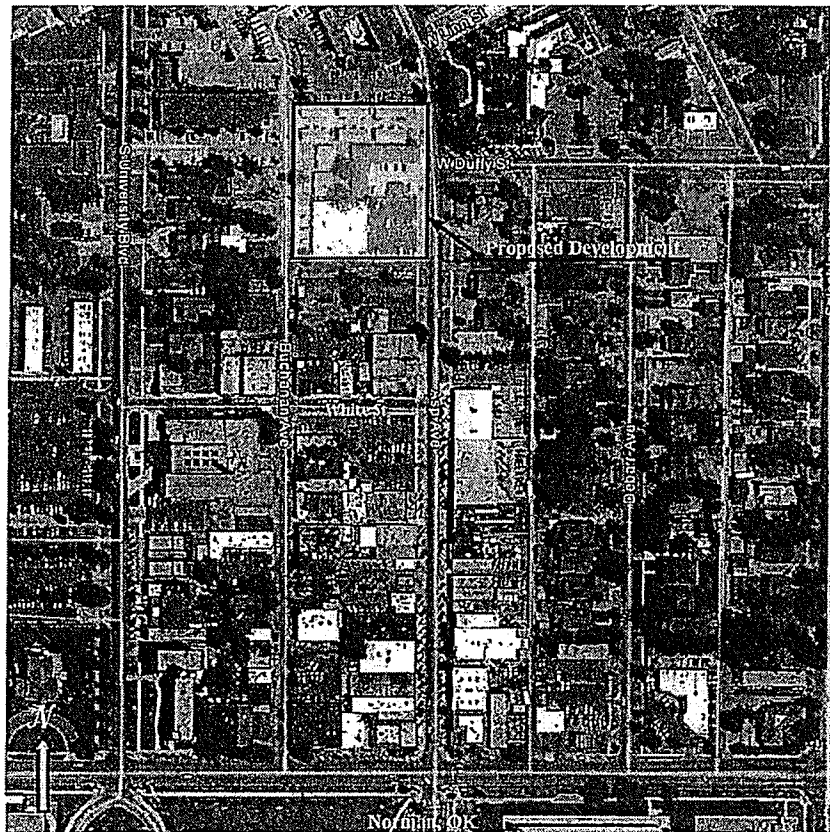


Figure 1 – General Location Map

Access to the new development, as shown in **Figure 2**, is proposed via one full-access drive on Asp Avenue. The drive will be located directly across from Duffy Street and will create an east/west stop controlled intersection. Asp Avenue is a two lane north/south collector street and it has a posted speed limit of 30 mph. Boyd Street is a four lane east/west major arterial and it has a posted speed limit of 30 mph.

### **3.0 TRAFFIC DATA COLLECTION**

Existing traffic volume data was collected adjacent to the proposed development in October of 2012. Peak hour turning movement volumes were collected at the intersections of Asp Avenue and Boyd Street, Asp Avenue and White Street, and Asp Avenue and Duffy Street. The data was collected during the a.m. (7:00 to 9:00) and p.m. (4:00 to 6:00) peak hour periods. The 2012 existing traffic data is summarized in **Figure 3** and detailed printouts of all the traffic count data are included in the appendix.

The 2012 existing traffic data was utilized to determine the background traffic for 2015. The 2015 design period was selected as the year the development is projected to be completed. The background traffic was determined for the 2015 design year by applying an average annual growth rate of 1% to the 2012 existing traffic. The 1% annual growth rate was provided by the City of Norman and represents the typical annual growth in the area. The 2015 projected background traffic is summarized in **Figure 4**. This data is the base or background traffic to which the new development traffic was added for conducting the reviews and analyses.

### **4.0 PROJECTED TRAFFIC**

#### **4.1 Site Generated Traffic**

To determine the effects a new development will have on an existing street system, the new or additional traffic must be projected. The latest edition of the *Trip Generation Report*, published by the Institute of Transportation Engineers, was used to determine the amount of traffic the development is expected to generate. The report is a nationally accepted reference which provides trip rates for determining the traffic expected to be generated by different land use types.

Available information was utilized regarding the anticipated land uses to determine the site generated traffic. The *Specialty Retail Center* (Land Use Code 826) and *High-Turnover Sit-Down Restaurant* (Land Use Code 932) categories were selected to determine the trip generation for the retail spaces. Due to the close proximity of the development to the University of Oklahoma, the *apartment* land use category does not accurately reflect the expected development traffic and therefore other data must be used.

The new apartment development is proposed to provide residential dwellings primarily for students attending the University of Oklahoma. Due to the proximity of the development, it is believed that many of the residents will not drive to and from campus, but either walk or bike. TEC collected traffic volumes into and out of two nearby apartment complexes (Campus Station Apartments and Key West Apartments). Both of the sampled apartment complexes are similar in size and location to the proposed development. Based on the traffic volumes collected at these apartment complexes, the trip rate for a similar land use was determined to be 0.17 vehicles per hour per dwelling unit during the a.m. peak hour and 0.37 vehicles per hour per dwelling unit during the p.m. peak hour. These trip rates were approved by the City of Norman for this traffic study. The resulting traffic volumes projected to be generated by the site once it is fully developed are indicated in Table 1.

**TABLE 1.**  
PROJECTED SITE GENERATED TRAFFIC VOLUMES

Building Type  ( Land Use )	Land Use Code	Approx. Gross Floor Area or Other	Average Weekday Vehicle Trip Ends			Average AM Peak Hour Directional Distribution		Average AM Peak Hour Directional Volume		Average PM Peak Hour Directional Distribution		Average PM Peak Hour Directional Volume	
			PER DAY	Per Peak Hour of Adjacent Street Traffic									
				One Hour Between 7am & 9am (vph)	One Hour Between 4pm & 6pm (vph)								
				(vpd)			IN	OUT	IN	OUT	IN	OUT	IN
Trip Rate** Mid-Rise Apartment	---	(dwelling units)	---	0.17	0.37	0.31	0.69	11	23	0.58	0.42	43	31
	200	---	34	74									
Trip Rate* Specialty Retail Center	826	(sf)	49.06	---	5.98	---	---	---	---	0.44	0.56	16	20
	6,000	294	---	36									
Trip Rate* High-Turnover Sit-Down Restaurant	932	(sf)	127.15	10.81	9.85	0.55	0.45	21	17	0.60	0.40	20	14
	3,500	445	38	34									
TOTAL			739	72	144			32	40			79	65

\* Trip rates from "TRIP GENERATION", 9th Ed., Vol. 3 of 3, Institute of Transportation Engineers, 2012.

\*\* Trip rate determined from data collected at Campus Station Apartments in Norman, Oklahoma.

#### 4.2 Trip Distribution

The traffic expected to be generated by the proposed development was then distributed among the surrounding street system as well as the point of access for the a.m. and p.m. peak hours. The distribution of the site generated traffic was based on traffic patterns in the area and the assumed destination of future residents and is summarized in **Figure 5**. The directional distribution of the site generated traffic for the proposed development is expected to be:

- 35% from Boyd Street west of the development
- 30% from Boyd Street east of the development
- 20% from Asp Avenue north of the development
- 12% from Duffy Street east of the development
- 03% from White Street west of the development

The projected site generated traffic was then added to the background traffic for the 2015 design year. The 2015 projected combined traffic volumes (2015 projected background traffic + site generated traffic) for the access point to the proposed development, as well as the surrounding street system, are summarized in **Figure 6**.

#### 5.0 CAPACITY ANALYSIS

The capacity analyses were conducted using *Synchro 7.0*, which is a software package for modeling and optimizing traffic signal timings at signalized intersections and analyzing unsignalized intersections in accordance with the methodology of the latest edition of the *Highway Capacity Manual*. The *Highway Capacity Manual* is published by the Transportation Research Board of the National Research Council, Washington, D.C. The information has been widely accepted throughout the U.S. as a guide for defining and solving transportation challenges. The information is approved and distributed by the U.S. Department of Transportation, Federal Highway Administration.

The capacity analysis provides a measure of the amount of traffic that a given facility can accommodate. Traffic facilities generally operate poorly at or near capacity. The analysis is intended to estimate the maximum amount of traffic that can be accommodated by a facility while maintaining prescribed operational qualities. The definition of operational criteria is accomplished using levels-of-service. The concept of levels-of-service is defined as a qualitative measure and describes operational conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and

convenience, and safety. Six levels-of-service are defined for each type of facility for which analysis procedures are available. They are given letter designations, from "A" to "F", with level-of-service "A" representing the best operating conditions and level-of-service "F" the worst.

The average control delay for signalized intersections is estimated for each lane group and aggregated for each approach and for the intersection as a whole. The level-of-service for this type of traffic control is directly related to the control delay value. The level-of-service criteria for signalized intersections are indicated below.

### SIGNALIZED INTERSECTIONS

Level-of-Service	Control Delay per Vehicle (s/veh)
A	0-10
B	> 10-20
C	> 20-35
D	> 35-55
E	> 55-80
F	> 80

The criteria for stop controlled or unsignalized intersections have different threshold values than do those for signalized intersections. A higher level of control delay has been determined to be acceptable at a signalized intersection for the same level-of-service. The level-of-service criteria for unsignalized intersections are indicated below.

### UNSIGNALIZED INTERSECTIONS

Level-of-Service	Control Delay per Vehicle (s/veh)
A	0-10
B	> 10-15
C	> 15-25
D	> 25-35
E	> 35-50
F	> 50

Capacity analyses were conducted for the a.m. and p.m. peak hours for the access point to the proposed development as well as the intersections of Asp Avenue and Boyd Street and Asp Avenue and White Street. The intersections were analyzed and reviewed under the 2012 existing traffic, 2015 projected background traffic, and 2015 projected combined traffic. For purposes of this report, an overall intersection level-of-service "D" or better and a critical movement (movement with the lowest level-of-service) level-of-service "E" or better was considered an acceptable level-of-service. The results of the capacity analyses conducted are summarized in Table 2 and the raw data sheets have been included in the appendix.

**TABLE 2**  
Capacity Analysis Summary

Intersection	Type of Traffic Control	AM Peak Hour					PM Peak Hour				
		Critical Movement			Intersection		Critical Movement			Intersection	
		Movement	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Movement	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
2012 Existing Traffic											
Asp Avenue & Boyd Street	Signalized	SB	36.0	D	7.6	A	SB	65.9	E	19.0	B
Asp Avenue & White Street	Unsignalized	EB	9.0	A	1.1	A	EB	10.6	B	2.8	A
Asp Avenue & Duffy Street	Unsignalized	EB	10.1	B	4.8	A	WB	12.2	B	5.2	A
2015 Projected Background Traffic											
Asp Avenue & Boyd Street	Signalized	SB	36.0	D	7.7	A	SB	67.8	E	19.6	B
Asp Avenue & White Street	Unsignalized	EB	9.0	A	1.1	A	EB	10.8	B	2.8	A
Asp Avenue & Duffy Street	Unsignalized	EB	10.2	B	4.8	A	WB	12.4	B	5.2	A
2015 Projected Background Traffic + Site Traffic											
Asp Avenue & Boyd Street	Signalized	SB	38.6	D	8.9	A	SB	77.5	E	23.5	C
Asp Avenue & White Street	Unsignalized	EB	9.2	A	0.9	A	EB	11.5	B	2.6	A
Asp Avenue & Duffy Street/Drive #1	Unsignalized	WB	10.3	B	5.7	A	WB	16.0	C	7.1	A

The analyses conducted under the 2012 existing traffic conditions indicated that each intersection currently operates at acceptable levels-of-service during the a.m. and p.m. peak hours. Under the 2015 projected background traffic, the intersections would continue to operate at acceptable levels-of-service. Once the site generated traffic was added to the 2015 projected background traffic, each intersection would be expected to continue operating at acceptable levels-of-service. The intersection of Asp Avenue and Boyd Street currently experiences high vehicle delay on the side streets during the peak hours. Due to right-of-way constraints, widening improvements to this intersection are not feasible. By slightly adjusting the signal timing plans to provide more green time for Asp Avenue, vehicle delay would be improved on the side street. The site generated traffic was analyzed entering the development from the existing thru lanes on Asp Avenue and the construction of exclusive left and right turn lanes are not recommended.

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

TEC was requested to conduct a traffic impact study on a proposed development in Norman, Oklahoma. Existing traffic volume data was collected adjacent to the proposed development in October of 2012. The existing traffic was utilized to determine the background traffic for 2015 by applying an average annual growth rate of 1% for three years. The 2015 design period was selected as the year the development is projected to be completed. The traffic expected to be generated by the new development was determined and distributed among the point of access to the development, as well as the adjacent street intersections. The proposed development traffic was added to the 2015 projected background traffic for conducting the reviews and analyses.

Each intersection analyzed under the 2012 existing traffic and 2015 projected background traffic operates within acceptable levels-of-service. Once the site generated traffic was applied to the 2015 projected background traffic, the intersections continue to operate within acceptable levels-of-service. Based on the results of the analyses conducted, no geometric roadway improvements are necessary for traffic to operate at an acceptable level-of-service. Slight signal timing plan modifications could be made at Asp Avenue and Boyd Street to improve side street vehicle delay. It is important to make sure that the proposed development drive (Drive #1) lines up with Duffy Street to avoid any potential conflicting left-turn movements.