



**HEINRICH & KLEIN
ASSOCIATES, INC.**

TRAFFIC ENGINEERING & PLANNING
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MEMORANDUM

TO: Scott Risbon
Planebrook Partners, L.L.C.

FROM: Andreas Heinrich, P.E., P.T.O.E.

DATE: May 12, 2015

RE: Traffic Access Study
Celia Tract Townhouses
East Whiteland Township, Chester County, PA

In accordance with your request, please accept the results of this Traffic Access Study for the Celia Tract Townhouses proposed to be developed on an approximate 12.067 acre property situated between Planebrook Road and Frame Avenue in East Whiteland Township, Chester County, Pennsylvania. It is proposed to develop the property for 64 townhouses. Access to the site will be provided via a roadway that will intersect Frame Avenue at a point approximately 575 feet north of Lancaster Avenue (U.S. Route 30) and extend through the site to intersect the proposed new road for the Cockerham Tract Townhouse Development at a point approximately 1,000 feet west of Planebrook Road.

The purpose of this Traffic Access Study is to assess the potential traffic impact of new traffic generated by the proposed townhouses, and to comment on site access from the viewpoint of both traffic efficiency and safety. As such, our study has included:

- visits to the site to observe traffic conditions and to note existing physical characteristics of the adjacent highways;
- completion of Turning Movement Traffic Counts on a weekday from 7:00 AM to 9:00 AM and from 4:00 PM to 6:00 PM at the intersection of Lancaster Avenue (U.S. Route 30) and Frame Avenue and at intersection of Planebrook Road and Fairway Drive.
- estimation of the anticipated traffic generation characteristics and potential travel patterns of new traffic generated by the proposed new townhouses;
- completion of volume/capacity analyses of existing and future peak hour traffic after development of the proposed townhouses;

- completion of a Gap Study of through traffic along Planebrook Road at the site access location for the Cockerham Tract Townhouse Development;
- review of sight distances for site access including completion of a Speed Study in through traffic along Planebrook Road at the Cockerham Tract Townhouse Development site access location; and,
- review of the Preliminary Subdivision and Land Development Plan relative to the provision of safe and efficient access to the Celia Tract Townhouses.

Existing Transportation Setting

Lancaster Avenue (S.R. 0030) is a two-way, three-lane state highway in East Whiteland Township. Lancaster Avenue (U.S. Route 30) provides one travel lane 11 feet wide in each direction with a continuous center two-way left turn lane 12 feet wide with variable width paved shoulders along both sides of the highway. The posted speed limit along Lancaster Avenue (U.S. Route 30) is 35 miles per hour.

Frame Avenue is a two-way, two-lane, dead-end local road in East Whiteland Township. Frame Avenue generally provides one travel lane 10 feet wide in each direction, but widens out 24 to 29 feet through the commercially developed section within the approximate 450 foot section from the intersection with Lancaster Avenue (U.S. Route 30). Traffic on Frame Avenue is Stop-sign controlled at the intersection with Lancaster Avenue (U.S. Route 30). The posted speed limit along Frame Avenue is 25 miles per hour.

Planebrook Road is a two-way, two-lane local road in East Whiteland Township. Planebrook Road provides one travel lane 10 feet wide in each direction. The posted speed limit along Planebrook Road is 35 miles per hour.

Existing highway travel demand and traffic patterns in the vicinity of the site were determined from completion of Turning Movement Traffic Counts on a weekday from 7:00 AM to 9:00 AM and from 4:00 PM to 6:00 PM at the intersection of Lancaster Avenue (U.S. Route 30) and Frame Avenue and at the intersection of Planebrook Road and Fairway Drive. A copy of the Traffic Count Summary Data sheets is attached.

The four highest consecutive 15 minute periods during the weekday morning and afternoon peak periods constitute the peak hours for traffic traveling along the roadways in the vicinity of the site. The results of the traffic count reveal that Lancaster Avenue (U.S. Route 30) is currently carrying 1,717 vehicles per hour during the morning peak hour (7:45 AM to 8:45 AM) (61% eastbound and 39% westbound) and 1,781 vehicles per hour during the afternoon peak hour (4:45 PM to 5:45 PM) (53% westbound and 47% eastbound). The results of the traffic count reveal that Frame Avenue is currently carrying 25 vehicles per hour during the morning peak hour (7:45 AM to 8:45 AM) (52% northbound and 48% southbound) and 32 vehicles per hour during the afternoon peak hour (4:45 PM to 5:45 PM) (59% southbound and 41% northbound). It should be noted that the majority of this traffic is generated by the commercial development situated in close proximity to Lancaster Avenue (U.S. Route 30). The results of the traffic count reveal that Planebrook Road is

currently carrying 892 vehicles per hour during the morning peak hour (7:15 AM to 8:15 AM) (56% northbound and 44% southbound) and 882 vehicles per hour during the afternoon peak hour (4:30 PM to 5:30 PM) (54% southbound and 46% northbound). Existing peak hour traffic volumes are summarized in Figure 1.

Traffic Generation Characteristics

As described previously, the Celia Tract Townhouses are proposed to be developed on an approximate 12.067 acre property situated between Planebrook Road and Frame Avenue in East Whiteland Township, Chester County, Pennsylvania. It is proposed to develop the property for 64 townhouses. Development of the 64 townhouses will obviously add some traffic to the roads serving the site -- as would any development of the property.

Based on the number of dwelling units, an estimate of new traffic demand can be calculated for the proposed townhouses. The anticipated traffic generation of the proposed townhouses is estimated from trip generation data compiled by the Institute of Transportation Engineers and documented in the publication entitled Trip Generation Manual⁽¹⁾. Table 1 presents the calculated vehicular trip generation rates for the proposed townhouses. Application of these rates to the number of proposed townhouses produces the daily and peak hourly traffic volumes for the 51 townhouses presented in the bottom of Table 1.

As shown in Table 1, it is estimated that the proposed townhouses may generate a total of about 440 new trips per day (total inbound and outbound). It is also estimated that the proposed townhouses may generate a total of 36 new trips per hour during the weekday morning peak hour and 42 new trips per hour during the weekday afternoon peak hour.

It is anticipated that traffic generated by the proposed townhouses will approach and depart the site according to existing traffic patterns along Lancaster Avenue (U.S. Route 30) and along Planebrook Road. Based on review of existing peak hour trip generation, it is anticipated that about 53% of site generated traffic will be oriented to/from the east on Lancaster Avenue (U.S. Route 30) and south on Planebrook Road, about 28% of site generated traffic will be oriented to/from the west on Lancaster Avenue (U.S. Route 30), and about 19% of site generated traffic will be oriented to/from the north on Planebrook Road. The assignment of new trip generation for the Celia Tract Townhouses is presented in Figure 2.

Volume/Capacity Analysis

While traffic volumes provide a measure of activity on the area road system, it is also important to calculate the ability of the road system to adequately accommodate the traffic demand. This involves a comparison of peak hour traffic demand with available roadway or intersection capacity. Intersections and driveways are usually the critical points

(1) Trip Generation Manual, 9th Edition, Institute of Transportation Engineers, Washington DC, 2012.

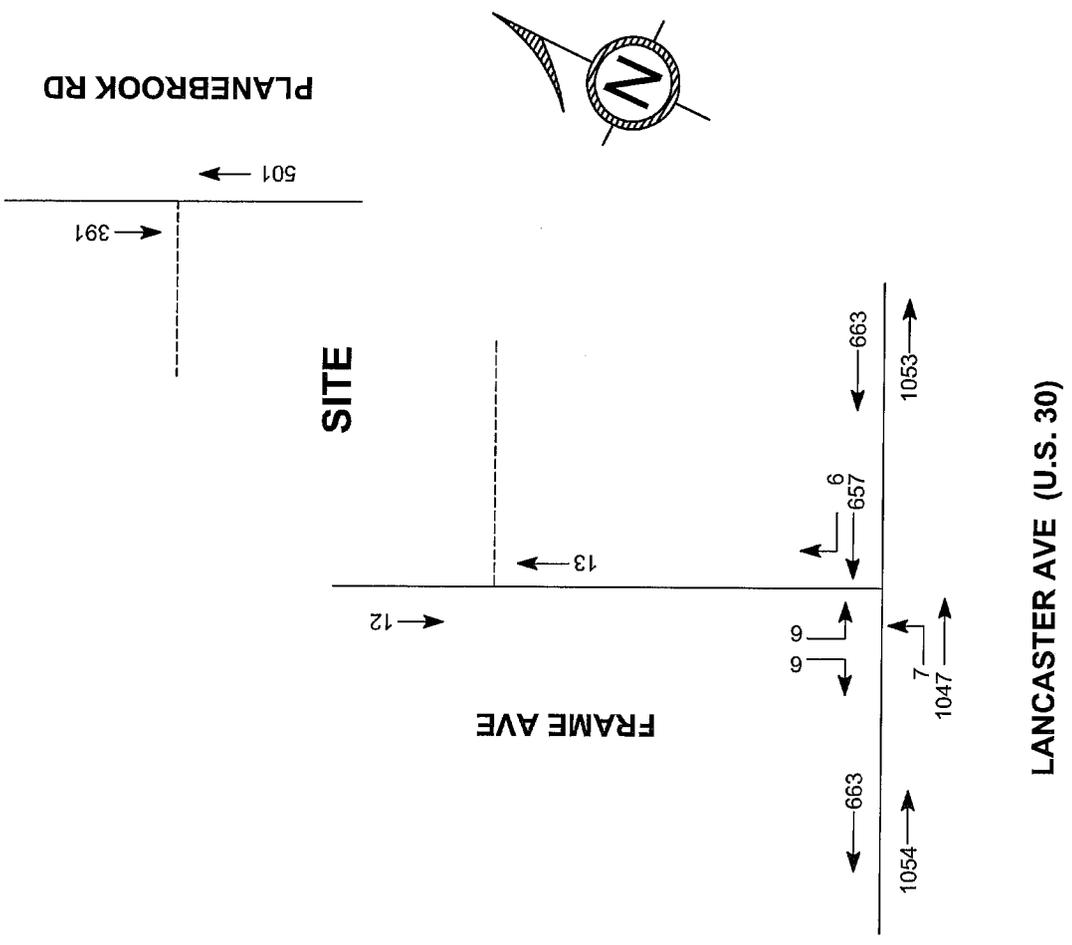
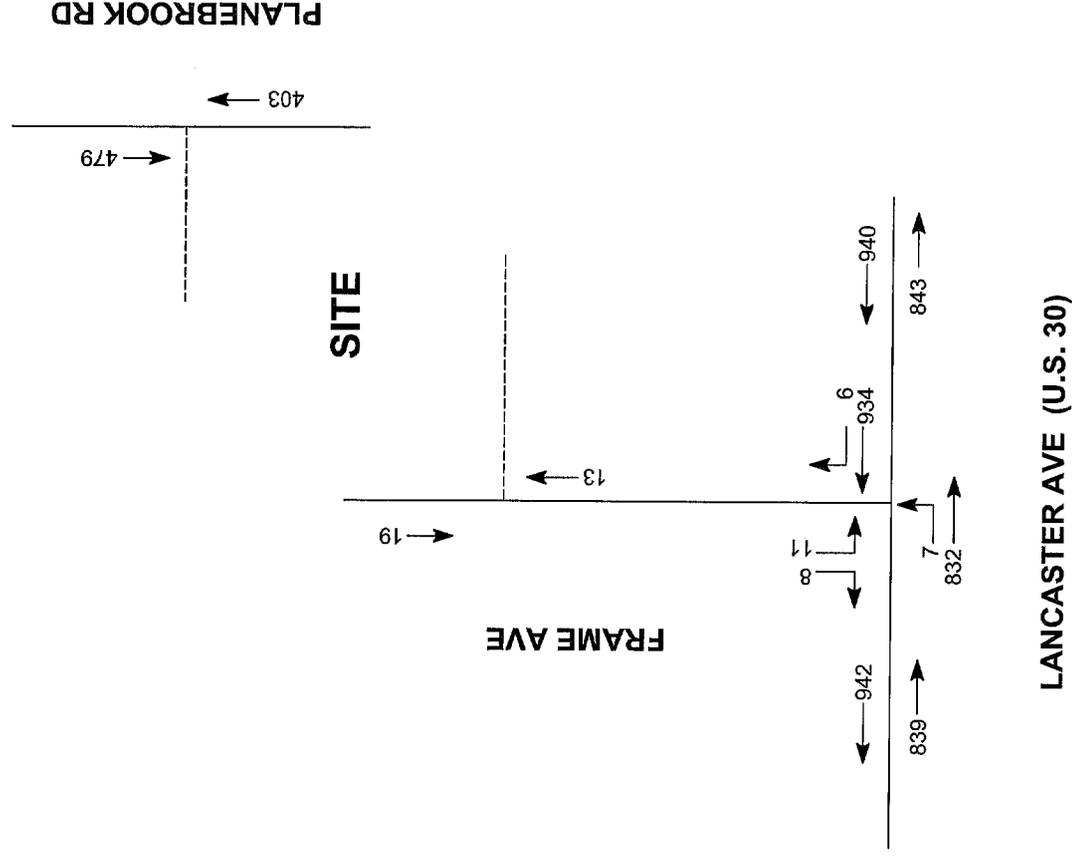
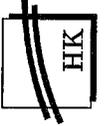


FIGURE 1
EXISTING PEAK HOUR TRAFFIC
(MAY 2015)

CELIA TRACT TOWNHOUSES
EAST WHITELAND TOWNSHIP, PA

TABLE 1

**TRAFFIC GENERATION CHARACTERISTICS
CELIA TRACT TOWNHOUSES
EAST WHITELAND TOWNSHIP, CHESTER COUNTY, PENNSYLVANIA**

TRIP RATES⁽¹⁾

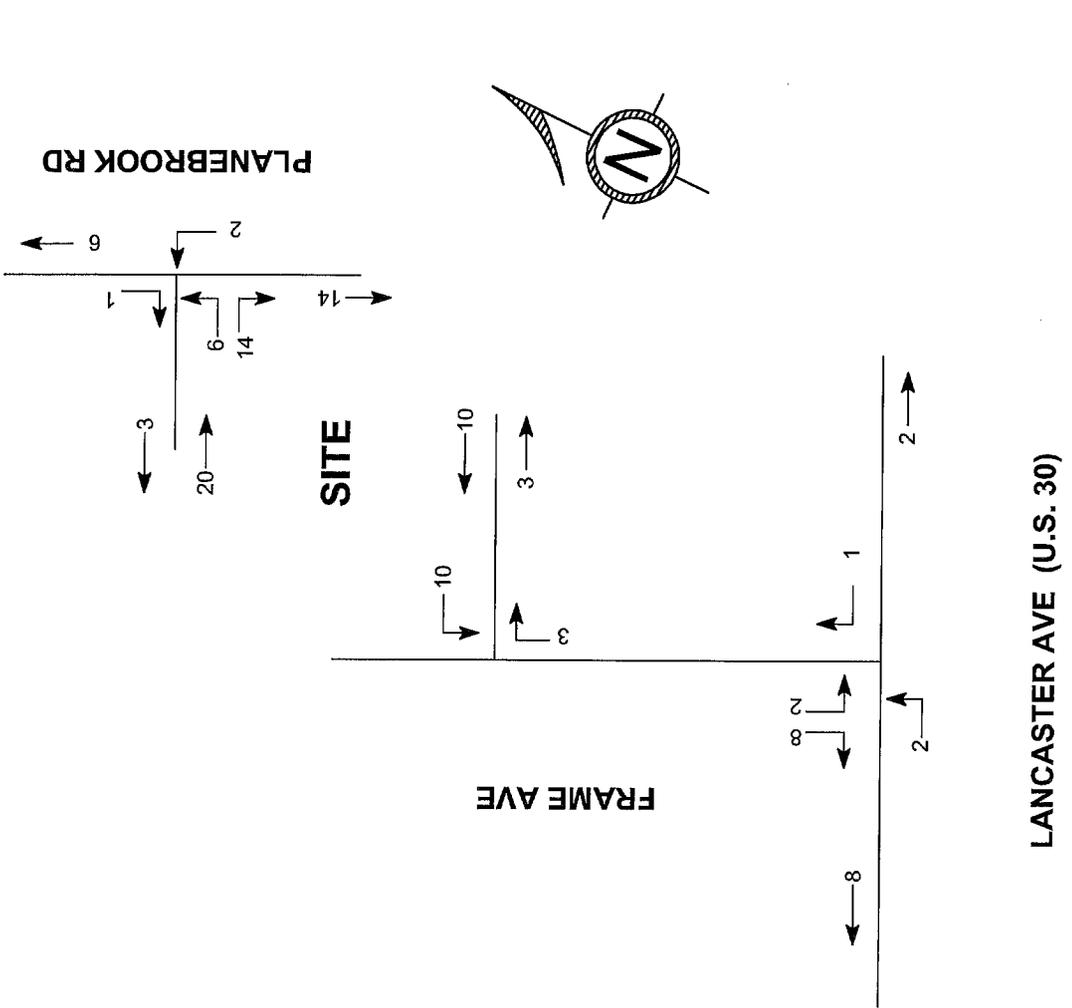
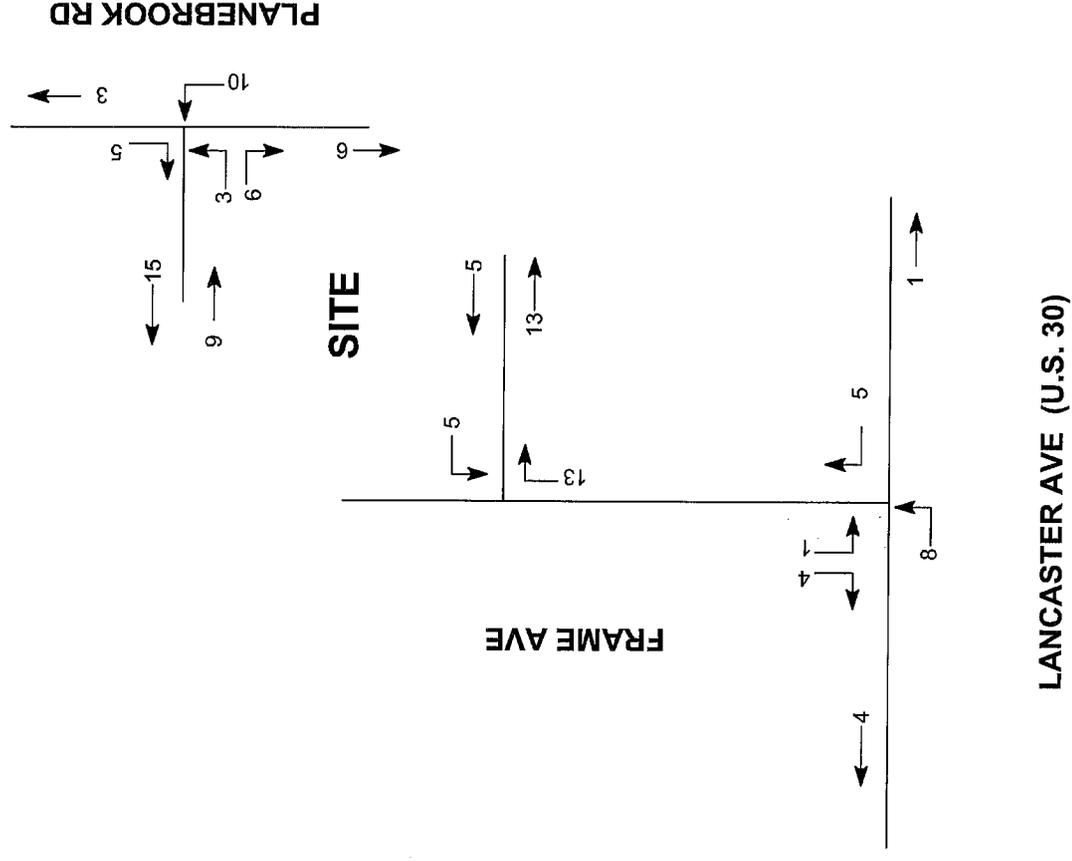
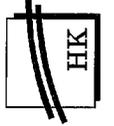
<u>Description</u>	<u>Daily</u>	<u>Morning Peak Hour</u>		<u>Afternoon Peak Hour</u>	
		<u>In</u>	<u>Out</u>	<u>In</u>	<u>Out</u>
Townhouses (64 DU) ⁽²⁾	6.82	0.10	0.46	0.44	0.21

TRAFFIC VOLUMES

Townhouses (64 DU)	440	6	30	36	28	14	42
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(1) *Trip Generation, 9th Edition, Institute of Transportation Engineers, Washington, D.C., 2012 (ITE Land Use Code 230).*

(2) *Trips per dwelling unit (DU).*



MORNING PEAK HOUR

AFTERNOON PEAK HOUR

FIGURE 2

DEVELOPMENT GENERATED TRAFFIC

CELIA TRACT TOWNHOUSES
EAST WHITELAND TOWNSHIP, PA

in any road network. At intersections, conflicts occur between through, crossing and turning traffic. It is at intersections where congestion is most likely to occur.

A volume/capacity analysis was completed for the unsignalized intersections in the vicinity of the site based on the peak hour traffic volumes illustrated in Figure 1. The volume/capacity analysis was completed in accordance with the standard procedures contained in the "HCM 2010 Highway Capacity Manual"⁽²⁾. By definition, vehicle capacity represents "the maximum number of vehicles that can pass a given point during a specified period under prevailing roadway, traffic and control conditions". The level of functioning of an intersection or a uniform section of lane or roadway can be expressed in terms of levels of service. A level of service is a qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers. Such measures include speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience.

In calculating the capacity of an unsignalized intersection, it is assumed that the through movements on the major street and the right turns from the major street are unimpeded and have the right-of-way over all minor street traffic and left turns from the major street. All other movements in the intersection cross, merge with, or are affected by other flows. For each movement, all conflicting flows are summed and a "critical gap" is determined. The control delay of a critical movement includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay.

Since operation at capacity is usually unsatisfactory to most drivers, a descriptive mechanism has been developed which relates capacity with the expected traffic delay. This is known as Level of Service (LOS). Level of service for a two-way stop-controlled intersection is determined by the computed or measured control delay and is defined for each minor movement. Table 2 provides the correlation between levels of service and the average total delay at unsignalized intersections.

The resultant levels of service calculated from the volume/capacity analysis of existing peak hour traffic conditions are provided in Figure 3 and in the attached print-outs. The results of the analysis reveal that all critical movements at the unsignalized intersection of Lancaster Avenue (U.S. Route 30) and Frame Avenue are currently operating at an acceptable LOS C or better during both the morning and afternoon peak hours.

Future Traffic

Existing peak hour traffic was increased to account for background traffic growth and traffic generated by other new development in the vicinity of the site. Background traffic growth of 1.80% per year compounded for two years (i.e., 3.63%) was applied to

(2) "HCM 2010 Highway Capacity Manual", Transportation Research Board of the National Academies, Washington, D.C., 2010.

TABLE 2

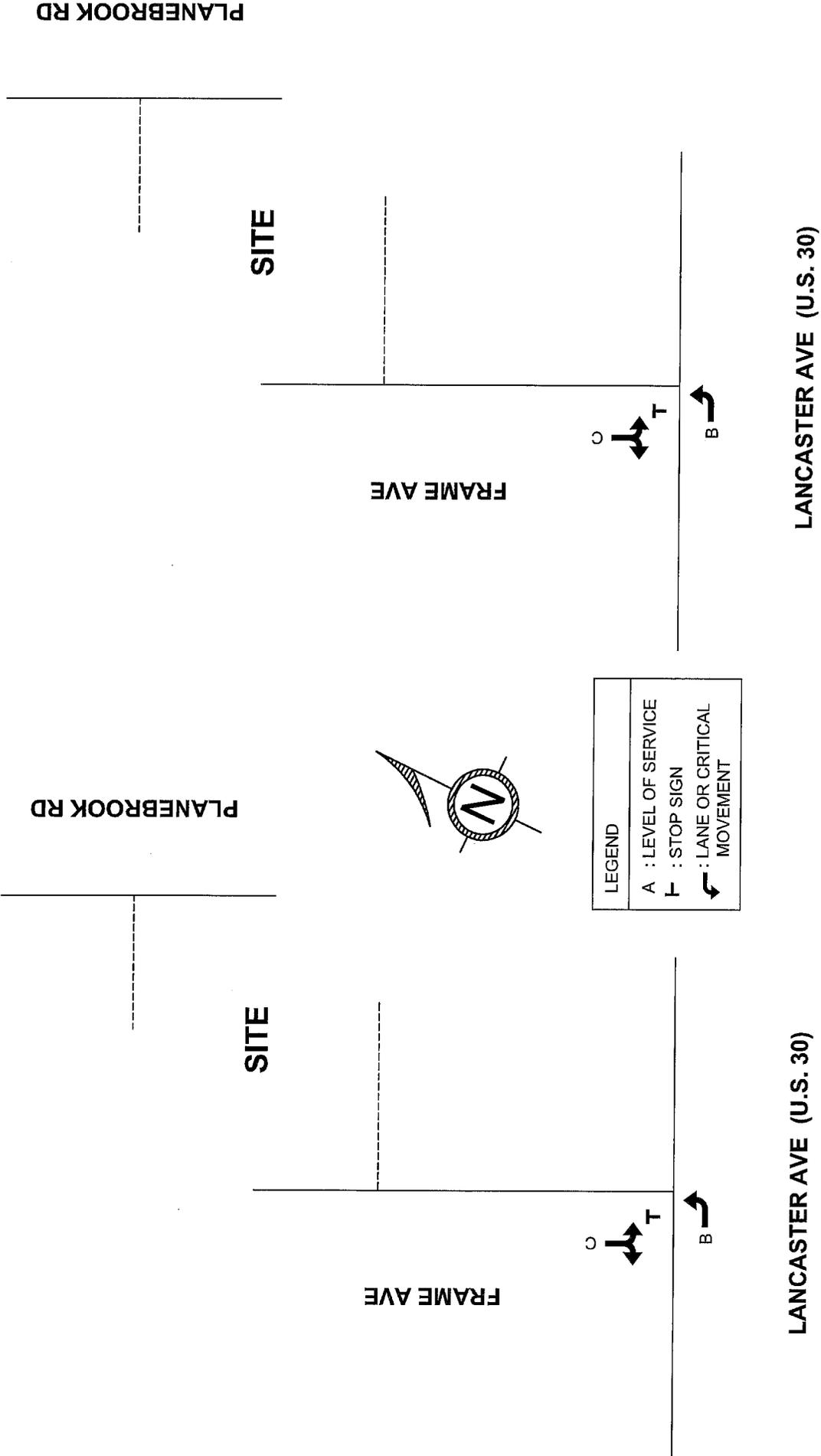
LEVEL OF SERVICE

UNSIGNALIZED INTERSECTIONS

At unsignalized intersections the criteria used to evaluate the quality of flow is the measure of the adequacy of the number of acceptable gaps in the through traffic stream for drivers facing a STOP or YIELD condition. Variables affecting the gaps are the distribution or arrival of vehicles in the through traffic stream, percentage of trucks, grades, and the amount of time it requires to enter the traffic stream from a stop position (critical gap size). The control delay of a critical movement includes the initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay.

As a result, the following criteria has been established:

<u>Level of Service</u>	<u>Control Delay Range (sec./veh/)</u>
A	less than 10
B	10 to 15
C	15 to 25
D	25 to 35
E	35 to 50
F	more than 50 and/or volume-to- capacity ratio greater than 1.0



MORNING PEAK HOUR

AFTERNOON PEAK HOUR

FIGURE 3
 EXISTING PEAK HOUR LEVELS OF SERVICE
 (MAY 2015)

CELIA TRACT TOWNHOUSES
 EAST WHITELAND TOWNSHIP, PA

existing peak hour through traffic along Lancaster Avenue (U.S. Route 30) and along Planebrook Road. The growth rate is based on the most recent growth factors available from PennDOT for the period December 2014 to July 2015.

In addition, the specific traffic generation characteristics for the Cockerham Tract Townhouses – a 51 unit townhouse development with access via Planebrook Road – was included in the projected morning and afternoon peak hour traffic volumes. The assignment of trip generation for the Cockerham Tract Townhouses has been adjusted to reflect additional access available through the Celia Tract Townhouses to/from Frame Avenue and Lancaster Avenue (U.S. Route 30) to/from the west.

Development generated traffic, as illustrated in Figure 2, was then added to future peak hour traffic volumes without development adjusted as described above. Future peak hour traffic volume after development of the Celia Tract Townhouses is presented in Figure 4 for the future weekday morning and afternoon peak hours, respectively.

The resultant levels of service calculated from the volume/capacity analysis of future peak hour traffic conditions after development are provided in Figure 5 and in the attached print-outs. The results of the analysis reveal that all critical movements at the unsignalized intersection of Lancaster Avenue (U.S. Route 30) and Frame Avenue will continue to operate at an acceptable LOS C or better during both the morning and afternoon peak hours. All critical movements at the unsignalized intersection of Planebrook Road and the Cockerham Tract access roadway will operate at an acceptable LOS C or better during both the morning and afternoon peak hours. Finally, all critical movements at the unsignalized intersection of Frame Avenue and the site access roadway will operate at an acceptable LOS A during both the morning and afternoon peak hours.

Capacity for traffic turning into and out of the Cockerham Tract site access roadway to/from Planebrook Road was further evaluated based on the results of a Gap Study in traffic flow along Planebrook Road. The Gap Study was completed on Friday January 31, 2014 during the weekday morning peak hour and during the weekday afternoon peak hour.

The minimum critical gap size for left turn exiting traffic from a side street or driveway onto a highway is about 7 seconds with a follow-up gap time of about 4 seconds. The critical gap size for right turn egress and left turn entry from the major street under similar circumstances is about 6 seconds with a follow-up gap time of about 3 seconds.

The results of the gap study reveal a total of 718 gaps available during the morning peak hour and 612 gaps available during the afternoon peak hour to accommodate right turn exiting and left turn entering traffic into and out of the site access roadway to/from Planebrook Road. The results of the gap study reveal a total of 233 gaps available during the morning peak hour and 223 gaps available during the afternoon peak hour to accommodate left turn exiting traffic from site access roadway to/from Planebrook Road.

Comparison with projected peak hour traffic volume entering and exiting the site reveals that sufficient gaps are available to adequately accommodate all left and right turn

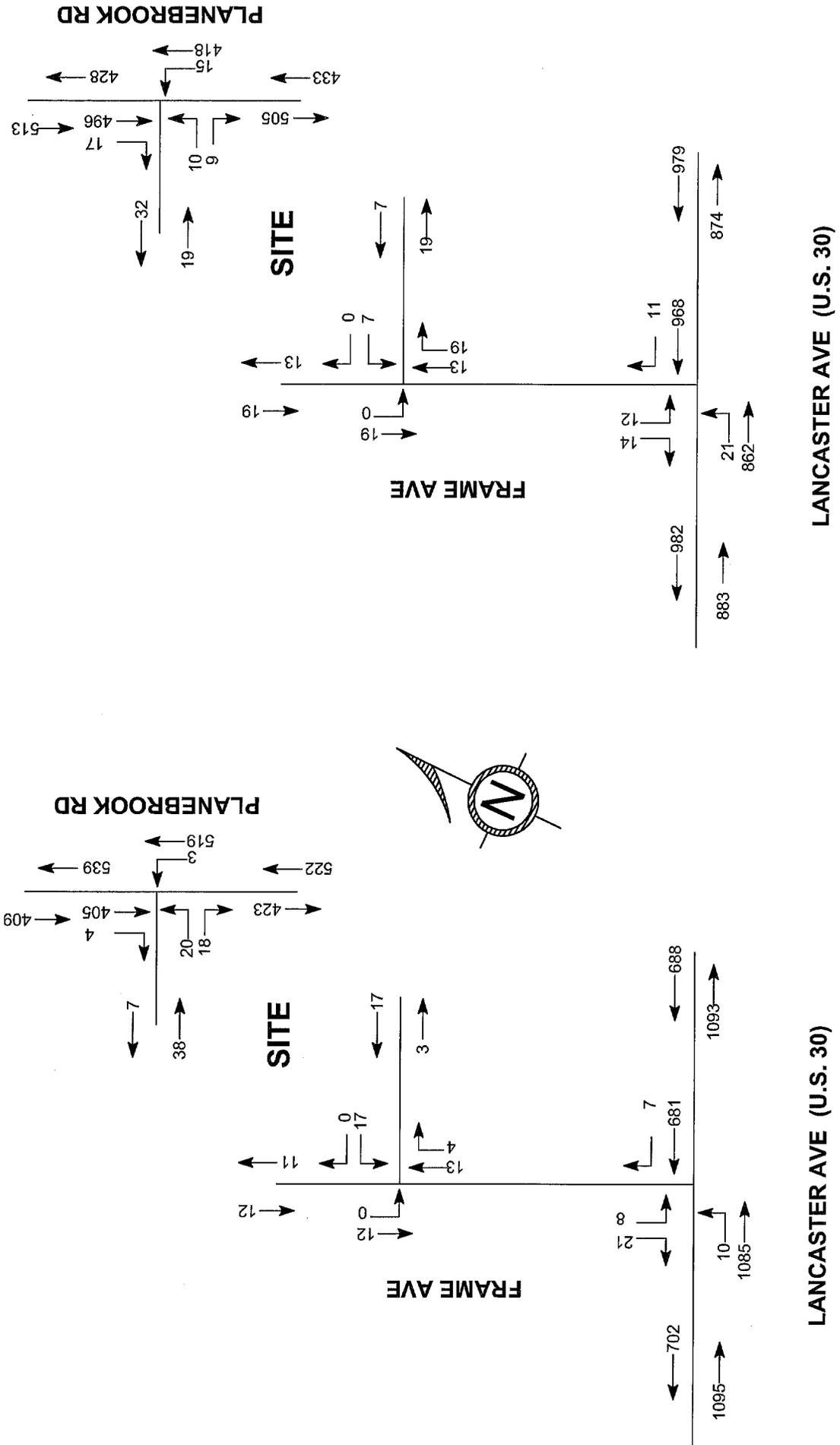
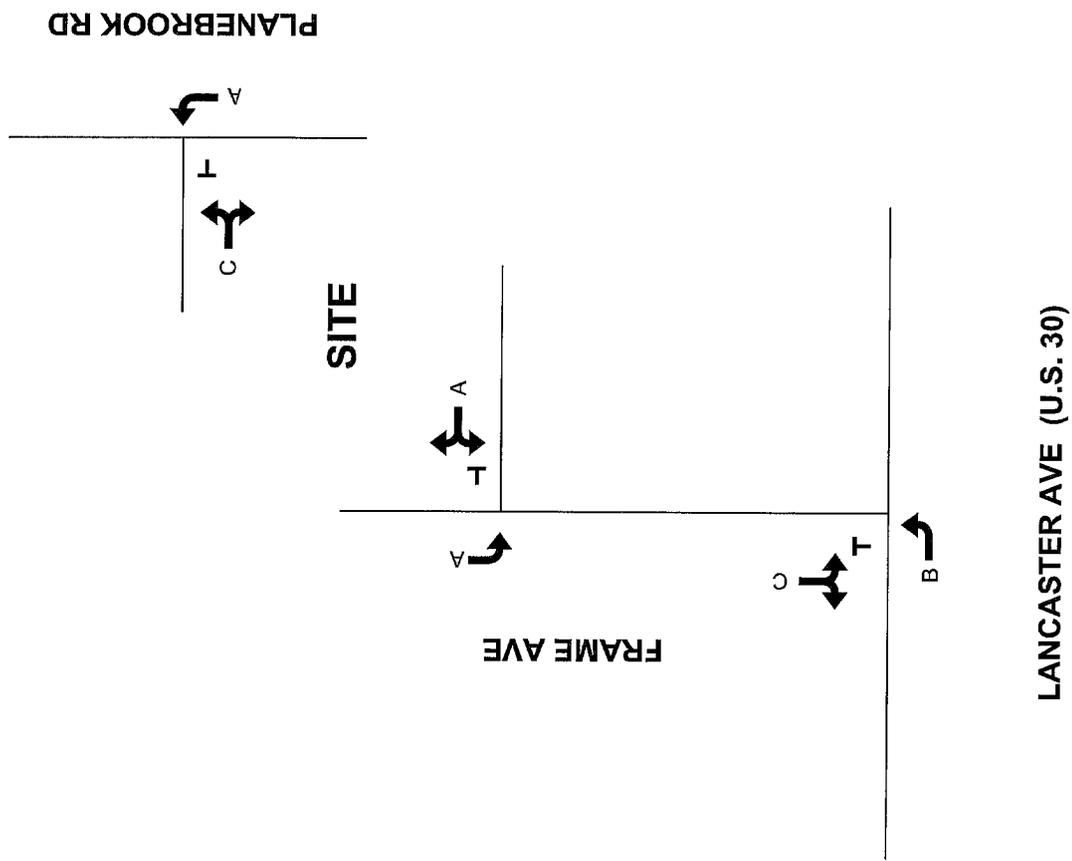


FIGURE 4

FUTURE (2017) PEAK HOUR TRAFFIC
 AFTER DEVELOPMENT
 CELIA TRACT TOWNHOUSES
 EAST WHITELAND TOWNSHIP, PA



LANCASTER AVE (U.S. 30)

MORNING PEAK HOUR

LANCASTER AVE (U.S. 30)

AFTERNOON PEAK HOUR

FIGURE 5
FUTURE (2017) PEAK HOUR LEVELS OF SERVICE
AFTER DEVELOPMENT

CELIA TRACT TOWNHOUSES
EAST WHITELAND TOWNSHIP, PA

entering and exiting traffic at the unsignalized access roadway to/from Planebrook Road. These comparisons are quantified in the table presented below:

**GAP STUDY
 SITE ACCESS AT PLANEBROOK ROAD
 EAST WHITELAND TOWNSHIP, CHESTER COUNTY, PA**

<u>Access Movement</u>	<u>Morning Peak Hour</u>		<u>Afternoon Peak Hour</u>	
	<u>Turning Volume</u>	<u>Available Gaps</u>	<u>Turning Volume</u>	<u>Available Gaps</u>
Left Turn Exit	20	233	10	223
Right Turn Exit	18	718	9	612
Left Turn Entry	3	718	15	612

Left turn exiting traffic from the site onto Planebrook Road is the most critical movement requiring the longest gap, with a gap required simultaneously in both directions along Planebrook Road. As indicated in the table above, it is obvious that sufficient capacity is available for turning traffic into and out of the site access roadway to/from Planebrook Road.

Site Access

As described previously, access to the site will be provided via a roadway that will intersect Frame Avenue at a point approximately 575 feet north of Lancaster Avenue (U.S. Route 30) and extend through the site to intersect the proposed new road for the Cockerham Tract Townhouse Development at a point approximately 1,000 feet west of Planebrook Road. Based on the anticipated trip generation characteristics for the combined development of the Celia Tract Townhouses and the Cockerham Tract Townhouses, the proposed Celia Tract site access roadway that will intersect Frame Avenue and the Cockerham Tract site access roadway that will intersect Planebrook Road would be classified as a “low volume driveway” in accordance with PennDOT Regulations Governing Access To and Occupancy of Highways By Driveways and Local Roads. It is proposed to construct both site access roadways to provide one entry lane and one exit lane within a width of 24 feet with corner radii of 35 feet. The right turn corner radius onto Frame Avenue will be limited to only 20 feet but it should be noted that little, if any traffic will be right exiting from the site access roadway onto Frame Avenue.

Based on the posted speed limit of 35 miles per hour along Planebrook Road, it is desirable to provide 440 feet of safe sight distance to left of the access roadway and 350 feet of safe sight distance to the right of the access roadway for traffic exiting the access roadway; and, it is desirable to provide 300 feet of safe sight distance to the left of the site access roadway for left turn entering traffic. Observations reveal that available sight distance along Planebrook Road exceeds 500 feet in both directions for both exiting and

entering traffic. Accordingly adequate safe sight distance is available in both directions along Planebrook Road based on the posted speed limit.

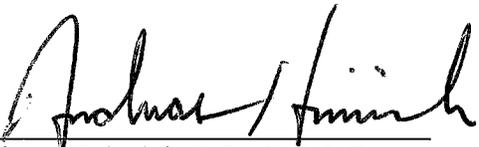
A Spot Speed Study was completed to measure the 85th% vehicle operating speed along Planebrook Road in the vicinity of the proposed site access roadway. The results of the study (tabulation sheets attached) reveal the 85th% vehicle operating speeds to be 42 miles per hour in the northbound direction and 43 miles per hour in the southbound direction. Based on the measured 85th% vehicle operating speeds, and approach grades of about -1.0% in the northbound direction and about 2.0% in the southbound direction, the minimum Safe Stopping Sight Distance (SSSD) for traffic exiting the site access roadway is calculated to be 351 feet from the left (north) and 358 feet from the right (south). The SSSD to the north for left turn entering traffic is calculated to be 351 feet and the SSSD for a northbound following vehicle behind a left turning vehicle is 358 feet.

Based on the findings of the sight distance analysis, adequate safe sight distance is available in both directions along Planebrook Road for all entering and exiting movements at the proposed site access location based on the posted speed limit and the 85th% vehicle operating speeds along Planebrook Road.

The results of a turn lane warrant analysis for site access reveal that, based on the measured 85th% vehicle operating speeds along Planebrook Road, a separate left turn lane is not warranted along northbound Planebrook Road. The results of the turn lane warrant analysis for site access also reveal that, based on the measured 85th% vehicle operating speeds along Planebrook Road, a separate right turn deceleration lane is not warranted along southbound Planebrook Road. Nomographs indicating the results of the turn lane warrant analysis are attached.

Conclusions

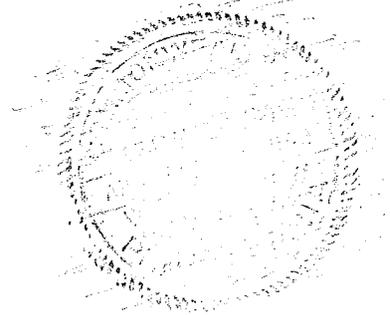
The foregoing Traffic Access Study for the Celia Tract Townhouses proposed to be developed on an approximate 12.067 acre property situated between Planebrook Road and Frame Avenue in East Whiteland Township, Chester County, Pennsylvania, clearly demonstrates that there will be little traffic impact due to new traffic generated by the proposed development; and, safe and efficient access will be provided for the Celia Tract Townhouses.



Andreas Heinrich, P.E., P.T.O.E.
Principal

AH:rh

cc: Victor Kelly, Jr., P.E.





HEINRICH & KLEIN
ASSOCIATES, INC.
TRAFFIC ENGINEERING & PLANNING

TRAFFIC VOLUME SUMMARY

MUNICIPALITY East Whiteland Twp, PA

LOCATION Lancaster Ave (US 30) & Frame Ave

HOURS 7:00 AM - 5:45 PM

COUNT MADE BY: AMK

REMARKS

DATE 5/5/15

WEATHER Cloudy

From East

From North

From West

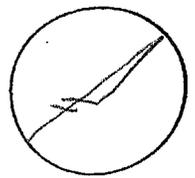
on US 30

Frame Ave

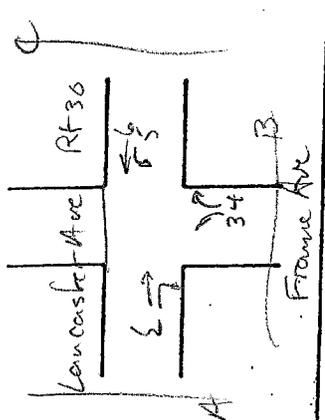
on US 30

PEDESTRIANS

TIME	From East			From North			From West			PEDESTRIANS				Total
	L	S	R	L	S	R	L	S	R	L	S	R	Total	
7:00-7:15		104	5	0	0	0	1	245	9	0	0	0	0	352
7:15-7:30		133	5	1	1	2	1	278	18	0	0	0	0	418
7:30-7:45		158	0	2	2	0	0	267	17	0	0	0	0	429
7:45-8:00		165	2	0	1	0	0	265	9	0	0	0	0	433
8:00-8:15		153	2	2	2	0	4	265	13	0	0	0	0	438
8:15-8:30		168	1	1	2	0	1	261	13	0	0	0	0	434
8:30-8:45		171	1	5	1	4	2	256	16	0	0	0	0	434
8:45-9:00		189	2	1	3	1	2	235	15	0	0	0	0	432
AM		657	6	6	6	1	7	1047	51	0	0	0	0	1729
Peak Hour														
7:45-8:45														
4:00-4:15		212	1	0	4	0	5	162	9	0	0	0	0	382
4:15-4:30		233	0	0	0	0	3	194	9	0	0	0	0	430
4:30-4:45		243	0	3	0	0	0	174	4	0	0	0	0	420
4:45-5:00		218	1	2	3	0	3	206	4	0	0	0	0	433
5:00-5:15		244	2	5	2	1	5	208	0	0	0	0	0	463
5:15-5:30		239	1	2	3	0	1	219	5	0	0	0	0	465
5:30-5:45		233	2	3	0	0	0	199	5	0	0	0	0	437
5:45-6:00		232	1	0	0	0	3	183	3	0	0	0	0	419
PM														
Peak Hour														
4:45-5:45		934	6	11	9	1	7	932	22	0	0	0	0	1798
TOTAL														



INDICATE NORTH
BY ARROW



TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	AUH			Intersection	Lancaster Ave. & Frame Ave.			
Agency/Co.	H&K			Jurisdiction	East Whiteland Township, PA			
Date Performed	5/8/2015			Analysis Year	Existing Conditions			
Analysis Time Period	AM Peak							
Project Description <i>Celia Tract Townhouses</i>								
East/West Street: <i>Lancaster Avenue</i>				North/South Street: <i>Frame Avenue</i>				
Intersection Orientation: <i>East-West</i>				Study Period (hrs): <i>0.25</i>				
Vehicle Volumes and Adjustments								
Major Street	Eastbound			Westbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)	7	1047			657	6		
Peak-Hour Factor, PHF	0.99	0.99	1.00	1.00	0.99	0.99		
Hourly Flow Rate, HFR (veh/h)	7	1057	0	0	663	6		
Percent Heavy Vehicles	14	--	--	0	--	--		
Median Type	Two Way Left Turn Lane							
RT Channelized			0			0		
Lanes	1	1	0	0	1	0		
Configuration	L	T				TR		
Upstream Signal		0			0			
Minor Street	Northbound			Southbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)				6		6		
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.99	1.00	0.99		
Hourly Flow Rate, HFR (veh/h)	0	0	0	6	0	6		
Percent Heavy Vehicles	0	0	0	17	0	0		
Percent Grade (%)		0			5			
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0			0		
Lanes	0	0	0	0	0	0		
Configuration					LR			
Delay, Queue Length, and Level of Service								
Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L						LR	
v (veh/h)	7						12	
C (m) (veh/h)	665						314	
v/c	0.01						0.04	
95% queue length	0.03						0.12	
Control Delay (s/veh)	10.5						16.9	
LOS	B						C	
Approach Delay (s/veh)	--	--					16.9	
Approach LOS	--	--					C	

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	AUH			Intersection	Lancaster Ave. & Frame Ave.			
Agency/Co.	H&K			Jurisdiction	East Whiteland Township, PA			
Date Performed	5/8/2015			Analysis Year	Existing Conditions			
Analysis Time Period	PM Peak							
Project Description <i>Celia Tract Townhouses</i>								
East/West Street: <i>Lancaster Avenue</i>				North/South Street: <i>Frame Avenue</i>				
Intersection Orientation: <i>East-West</i>				Study Period (hrs): <i>0.25</i>				
Vehicle Volumes and Adjustments								
Major Street	Eastbound			Westbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)	7	832			934	6		
Peak-Hour Factor, PHF	0.97	0.97	1.00	1.00	0.97	0.97		
Hourly Flow Rate, HFR (veh/h)	7	857	0	0	962	6		
Percent Heavy Vehicles	14	--	--	0	--	--		
Median Type	Two Way Left Turn Lane							
RT Channelized			0			0		
Lanes	1	1	0	0	1	0		
Configuration	L	T				TR		
Upstream Signal		0			0			
Minor Street	Northbound			Southbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)				11		8		
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.97	1.00	0.97		
Hourly Flow Rate, HFR (veh/h)	0	0	0	11	0	8		
Percent Heavy Vehicles	0	0	0	9	0	0		
Percent Grade (%)		0			5			
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0			0		
Lanes	0	0	0	0	0	0		
Configuration					LR			
Delay, Queue Length, and Level of Service								
Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L						LR	
v (veh/h)	7						19	
C (m) (veh/h)	516						286	
v/c	0.01						0.07	
95% queue length	0.04						0.21	
Control Delay (s/veh)	12.1						18.5	
LOS	B						C	
Approach Delay (s/veh)	--	--					18.5	
Approach LOS	--	--					C	

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	AUH			Intersection	Lancaster Ave. & Frame Ave.		
Agency/Co.	H&K			Jurisdiction	East Whiteland Township, PA		
Date Performed	5/8/2015			Analysis Year	After Development		
Analysis Time Period	AM Peak						
Project Description <i>Celia Tract Townhouses</i>							
East/West Street: <i>Lancaster Avenue</i>				North/South Street: <i>Frame Avenue</i>			
Intersection Orientation: <i>East-West</i>				Study Period (hrs): <i>0.25</i>			
Vehicle Volumes and Adjustments							
Major Street	Eastbound			Westbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)	10	1085			681	7	
Peak-Hour Factor, PHF	0.99	0.99	1.00	1.00	0.99	0.99	
Hourly Flow Rate, HFR (veh/h)	10	1095	0	0	687	7	
Percent Heavy Vehicles	14	--	--	0	--	--	
Median Type	Two Way Left Turn Lane						
RT Channelized			0				0
Lanes	1	1	0	0	1		0
Configuration	L	T					TR
Upstream Signal		0			0		
Minor Street	Northbound			Southbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				8		21	
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.99	1.00	0.99	
Hourly Flow Rate, HFR (veh/h)	0	0	0	8	0	21	
Percent Heavy Vehicles	0	0	0	17	0	0	
Percent Grade (%)		0			5		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0				0
Lanes	0	0	0	0	0	0	
Configuration					LR		
Delay, Queue Length, and Level of Service							
Approach	Eastbound	Westbound	Northbound			Southbound	
Movement	1	4	7	8	9	10	11
Lane Configuration	L						LR
v (veh/h)	10						29
C (m) (veh/h)	651						344
v/c	0.02						0.08
95% queue length	0.05						0.27
Control Delay (s/veh)	10.6						16.4
LOS	B						C
Approach Delay (s/veh)	--	--					16.4
Approach LOS	--	--					C

TWO-WAY STOP CONTROL SUMMARY								
General Information			Site Information					
Analyst	AUH		Intersection	Lancaster Ave. & Frame Ave.				
Agency/Co.	H&K		Jurisdiction	East Whiteland Township, PA				
Date Performed	5/8/2015		Analysis Year	After Development				
Analysis Time Period	PM Peak							
Project Description <i>Celia Tract Townhouses</i>								
East/West Street: <i>Lancaster Avenue</i>			North/South Street: <i>Frame Avenue</i>					
Intersection Orientation: <i>East-West</i>			Study Period (hrs): <i>0.25</i>					
Vehicle Volumes and Adjustments								
Major Street	Eastbound			Westbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)	21	862			968	11		
Peak-Hour Factor, PHF	0.97	0.97	1.00	1.00	0.97	0.97		
Hourly Flow Rate, HFR (veh/h)	21	888	0	0	997	11		
Percent Heavy Vehicles	14	--	--	0	--	--		
Median Type	<i>Two Way Left Turn Lane</i>							
RT Channelized			0			0		
Lanes	1	1	0	0	1	0		
Configuration	L	T				TR		
Upstream Signal		0			0			
Minor Street	Northbound			Southbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)				12		14		
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.97	1.00	0.97		
Hourly Flow Rate, HFR (veh/h)	0	0	0	12	0	14		
Percent Heavy Vehicles	0	0	0	9	0	0		
Percent Grade (%)		0			5			
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0			0		
Lanes	0	0	0	0	0	0		
Configuration					LR			
Delay, Queue Length, and Level of Service								
Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L						LR	
v (veh/h)	21						26	
C (m) (veh/h)	499						268	
v/c	0.04						0.10	
95% queue length	0.13						0.32	
Control Delay (s/veh)	12.5						19.9	
LOS	B						C	
Approach Delay (s/veh)	--	--					19.9	
Approach LOS	--	--					C	

TWO-WAY STOP CONTROL SUMMARY

General Information			Site Information				
Analyst	AUH		Intersection	Frame Avenue & Site Access			
Agency/Co.	H&K		Jurisdiction	East Whiteland Township, PA			
Date Performed	5/10/2015		Analysis Year	After Development			
Analysis Time Period	AM Peak						
Project Description <i>Celia Tract Townhouses</i>							
East/West Street: <i>Site Access</i>			North/South Street: <i>Frame Avenue</i>				
Intersection Orientation: <i>North-South</i>			Study Period (hrs): <i>0.25</i>				
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		13	4	0	12		
Peak-Hour Factor, PHF	1.00	0.63	0.63	0.63	0.63	1.00	
Hourly Flow Rate, HFR (veh/h)	0	20	6	0	19	0	
Percent Heavy Vehicles	0	--	--	0	--	--	
Median Type	<i>Undivided</i>						
RT Channelized			0			0	
Lanes	0	1	0	0	1	0	
Configuration			TR	LT			
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				17		0	
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.63	1.00	0.63	
Hourly Flow Rate, HFR (veh/h)	0	0	0	26	0	0	
Percent Heavy Vehicles	0	0	0	0	0	0	
Percent Grade (%)		0			1		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0			0	
Lanes	0	0	0	0	0	0	
Configuration					LR		
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		LT		LR			
v (veh/h)		0		26			
C (m) (veh/h)		1176		1131			
v/c		0.00		0.02			
95% queue length		0.00		0.07			
Control Delay (s/veh)		8.1		8.3			
LOS		A		A			
Approach Delay (s/veh)	--	--		8.3			
Approach LOS	--	--		A			

TWO-WAY STOP CONTROL SUMMARY							
General Information			Site Information				
Analyst	AUH		Intersection	Frame Avenue & Site Access			
Agency/Co.	H&K		Jurisdiction	East Whiteland Township, PA			
Date Performed	5/10/2015		Analysis Year	After Development			
Analysis Time Period	PM Peak						
Project Description <i>Celia Tract Townhouses</i>							
East/West Street: <i>Site Access</i>			North/South Street: <i>Frame Avenue</i>				
Intersection Orientation: <i>North-South</i>			Study Period (hrs): <i>0.25</i>				
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		13	19	0	19		
Peak-Hour Factor, PHF	1.00	0.73	0.73	0.73	0.73	1.00	
Hourly Flow Rate, HFR (veh/h)	0	17	26	0	26	0	
Percent Heavy Vehicles	0	--	--	0	--	--	
Median Type	<i>Undivided</i>						
RT Channelized			0			0	
Lanes	0	1	0	0	1	0	
Configuration			TR	LT			
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				7		0	
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.73	1.00	0.73	
Hourly Flow Rate, HFR (veh/h)	0	0	0	9	0	0	
Percent Heavy Vehicles	0	0	0	0	0	0	
Percent Grade (%)		0			1		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0			0	
Lanes	0	0	0	0	0	0	
Configuration					LR		
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		LT		LR			
v (veh/h)		0		9			
C (m) (veh/h)		1160		1108			
v/c		0.00		0.01			
95% queue length		0.00		0.02			
Control Delay (s/veh)		8.1		8.3			
LOS		A		A			
Approach Delay (s/veh)	--	--		8.3			
Approach LOS	--	--		A			

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	AUH	Intersection	Planebrook Road & Site Access
Agency/Co.	H&K	Jurisdiction	East Whiteland Township, PA
Date Performed	5/10/2015	Analysis Year	After Development
Analysis Time Period	AM Peak		

Project Description <i>Cockerham Tract Townhouses</i>	
East/West Street: <i>Site Access</i>	North/South Street: <i>Planebrook Road</i>
Intersection Orientation: <i>North-South</i>	Study Period (hrs): <i>0.25</i>

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	3	519			405	4
Peak-Hour Factor, PHF	0.92	0.92	1.00	1.00	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	3	564	0	0	440	4
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	<i>Undivided</i>					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	<i>LT</i>					<i>TR</i>
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	20		18			
Peak-Hour Factor, PHF	0.92	1.00	0.92	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	21	0	19	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		-3			0	
Flared Approach		<i>N</i>			<i>N</i>	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		<i>LR</i>				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	<i>LT</i>						<i>LR</i>	
v (veh/h)	3						40	
C (m) (veh/h)	845						452	
v/c	0.00						0.09	
95% queue length	0.01						0.29	
Control Delay (s/veh)	9.3						13.7	
LOS	<i>A</i>						<i>B</i>	
Approach Delay (s/veh)	--	--					13.7	
Approach LOS	--	--					<i>B</i>	

TWO-WAY STOP CONTROL SUMMARY								
General Information			Site Information					
Analyst	AUH		Intersection	Planebrook Road & Site Access				
Agency/Co.	H&K		Jurisdiction	East Whiteland Township, PA				
Date Performed	5/10/2015		Analysis Year	After Development				
Analysis Time Period	PM Peak							
Project Description Cockerham Tract Townhouses								
East/West Street: Site Access			North/South Street: Planebrook Road					
Intersection Orientation: North-South			Study Period (hrs): 0.25					
Vehicle Volumes and Adjustments								
Major Street	Northbound			Southbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)	15	418			496	17		
Peak-Hour Factor, PHF	0.88	0.88	1.00	1.00	0.88	0.88		
Hourly Flow Rate, HFR (veh/h)	17	475	0	0	563	19		
Percent Heavy Vehicles	0	--	--	0	--	--		
Median Type	Undivided							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration	LT					TR		
Upstream Signal		0			0			
Minor Street	Eastbound			Westbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)	10		9					
Peak-Hour Factor, PHF	0.88	1.00	0.88	1.00	1.00	1.00		
Hourly Flow Rate, HFR (veh/h)	11	0	10	0	0	0		
Percent Heavy Vehicles	0	0	0	0	0	0		
Percent Grade (%)		-3			0			
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0			0		
Lanes	0	0	0	0	0	0		
Configuration		LR						
Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	17						21	
C (m) (veh/h)	756						399	
v/c	0.02						0.05	
95% queue length	0.07						0.17	
Control Delay (s/veh)	9.9						14.5	
LOS	A						B	
Approach Delay (s/veh)	--	--					14.5	
Approach LOS	--	--					B	

SPOT SPEED STUDY FIELD SHEET

Date 1/30/14 Location PLANE BROOK ROAD Direction NB
 Time 9:00 AM Weather CLEAR Road Surface Condition DRY

SECONDS	mph for 88 ft.	mph for 176 ft.	MPH	PASSENGER VEHICLES		BUSES		TRUCKS		TOTAL	
					No. Veh.		No. Veh.		No. Veh.		
1	60.0	120.0	60								
1-1/5	50.0	100.0	59								
1-2/5	42.8	85.7	58								
1-3/5	37.5	75.5	57								
1-4/5	33.3	66.6	56								
2	30.0	60.0	55								
2-1/5	27.2	54.5	54								
2-2/5	25.0	50.0	53								
2-3/5	23.0	46.1	52								
2-4/5	21.4	42.8	51								
3	20.0	40.0	50								
3-1/5	18.7	37.5	49								
3-2/5	17.6	35.2	48								
3-3/5	16.6	33.3	47							2	
3-4/5	15.7	31.5	46							1	
4	15.0	30.0	45							3	
4-1/5	14.2	28.9	44							2	
4-2/5	13.6	27.2	43							2	
4-3/5	13.0	26.1	42							4	
4-4/5	12.5	25.0	41							4	
5	12.0	24.0	40							4	
5-1/5	11.5	23.0	39							4	
5-2/5	11.1	22.2	38							4	
5-3/5	10.7	21.4	37							4	
5-4/5	10.3	20.6	36							4	
6	10.0	20.0	35							4	
6-1/5	9.6	19.3	34							4	
6-2/5	9.3	18.7	33							4	
6-3/5	9.0	18.1	32							4	
6-4/5	8.7	17.6	31							4	
7	8.5	17.1	30							4	
7-1/5	8.3	16.6	29							1	
7-2/5	8.1	16.2	28							1	
7-3/5	7.8	15.7	27							1	
7-4/5	7.6	15.3	26								
8	7.5	15.0	25								
8-1/2	7.0	14.1									
9	6.6	13.3									
9-1/2	6.3	12.6									
10	6.0	12.0									
11	5.4	10.9									
12	5.0	10.0									
13	4.6	9.2									
14	4.2	8.5									
15	4.0	8.0									
TOTAL VEHICLES											100

85/100

SPOT SPEED STUDY FIELD SHEET

Date 1/30/14 Location PLANE BROOK ROAD Direction SB
 Time 9:00 AM Weather CLEAR Road Surface Condition DRY

SECONDS	mph for 88 ft.	mph for 176 ft.	MAT	PASSENGER VEHICLES		BUSES		TRUCKS		TOTAL
					No. Veh.		No. Veh.		No. Veh.	
1	60.0	120.0	60							
1-1/5	50.0	100.0	59							
1-2/5	42.8	85.7	58							
1-3/5	37.5	75.5	57							
1-4/5	33.3	66.6	56							
2	30.0	60.0	55							
2-1/5	27.2	54.5	54							
2-2/5	25.0	50.0	53							
2-3/5	23.0	46.1	52							
2-4/5	21.4	42.8	51							
3	20.0	40.0	50							
3-1/5	18.7	37.5	49							1
3-2/5	17.6	35.2	48							
3-3/5	16.6	33.3	47							
3-4/5	15.7	31.5	46							3
4	15.0	30.0	45							3
4-1/5	14.2	28.9	44							5
4-2/5	13.6	27.2	43							5
4-3/5	13.0	26.1	42							6
4-4/5	12.5	25.0	41							9
5	12.0	24.0	40							8
5-1/5	11.5	23.0	39							8
5-2/5	11.1	22.2	38							11
5-3/5	10.7	21.4	37							9
5-4/5	10.3	20.6	36							6
6	10.0	20.0	35							6
6-1/5	9.6	19.3	34							6
6-2/5	9.3	18.7	33							2
6-3/5	9.0	18.1	32							2
6-4/5	8.7	17.6	31							5
7	8.5	17.1	30							2
7-1/5	8.3	16.6	29							2
7-2/5	8.1	16.2	28							
7-3/5	7.8	15.7	27							1
7-4/5	7.6	15.3	26							
8	7.5	15.0	25							1
8-1/2	7.0	14.1								
9	6.6	13.3								
9-1/2	6.3	12.6								
10	6.0	12.0								
11	5.4	10.9								
12	5.0	10.0								
13	4.6	9.2								
14	4.2	8.5								
15	4.0	8.0								
TOTAL VEHICLES										100

85th

Figure 10. Warrant for right turn lanes on two-lane roadways (45 mph or greater speeds, unsignalized and signalized intersections)

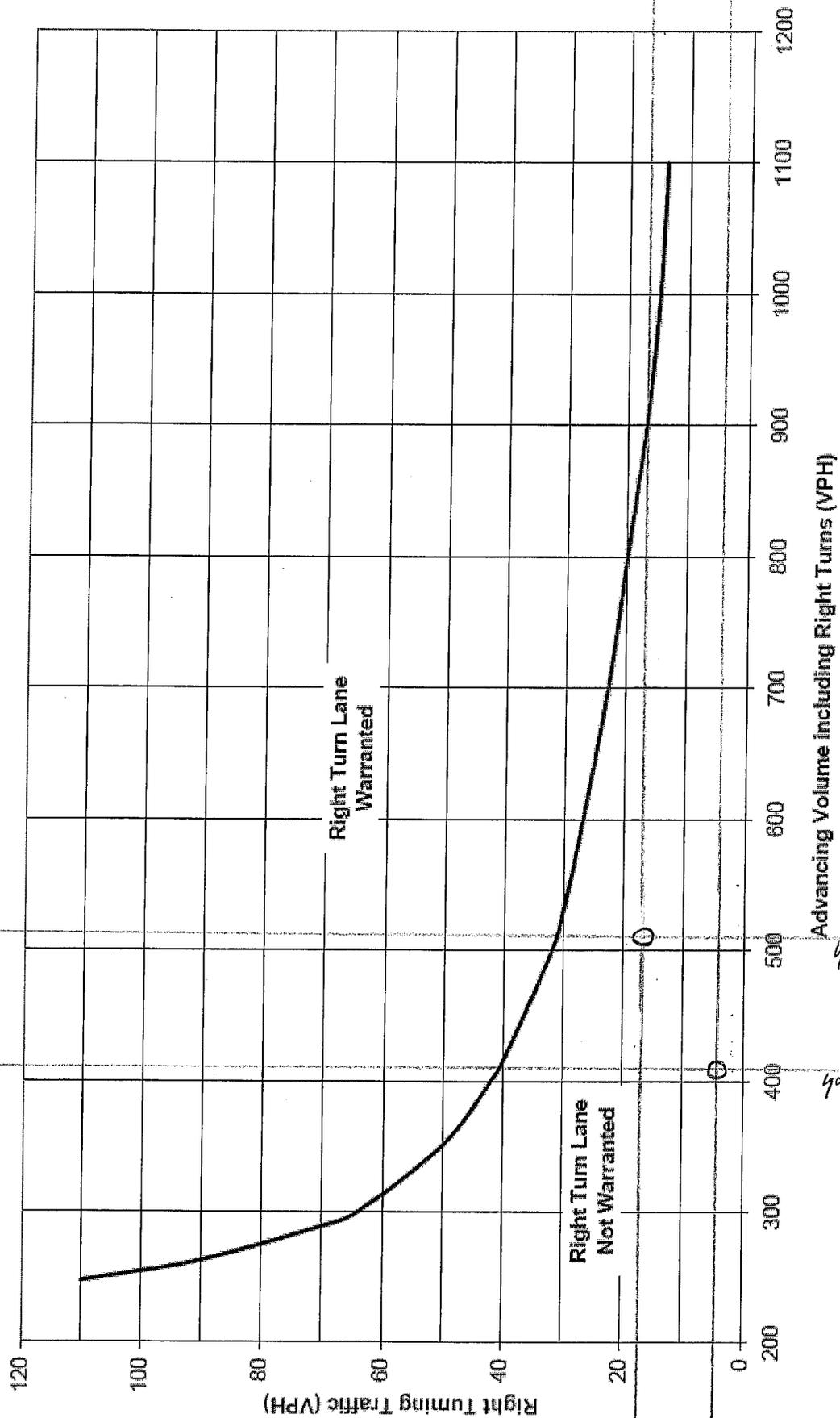
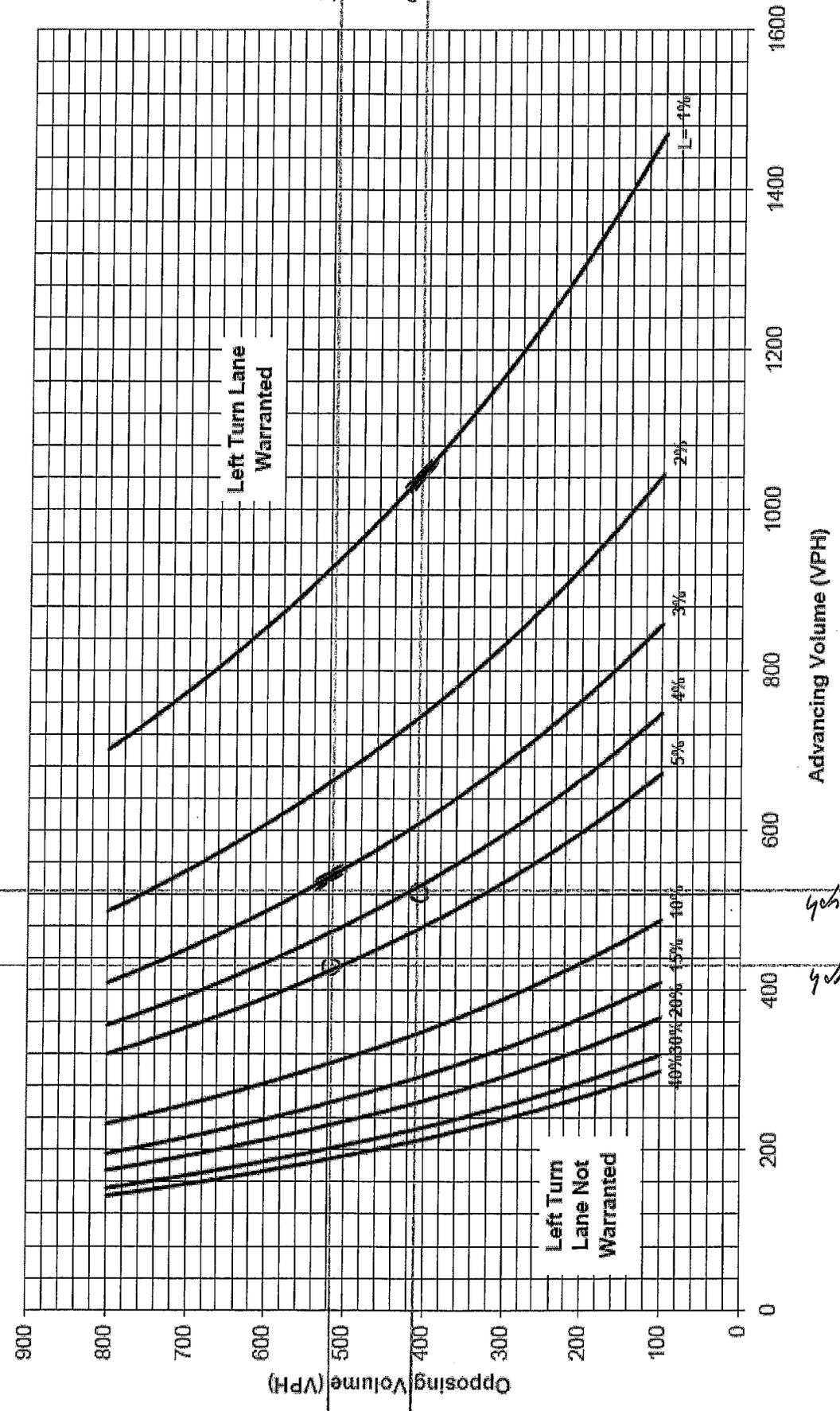


Figure 3. Warrant for left turn lanes on two-lane highways (45 mph speed, unsignalized and signalized intersections)
(L = % Left Turns in Advancing Volume)



513 vph
409 vph

433 vph
522 vph