Re: Site Development – SP #

Subject: Preliminary Parking Management and Garage Plan Sample Queuing Analysis

Date:

INTRODUCTION

This memorandum presents the results of a queuing analysis for the inbound traffic at the garage access of the approved academic/office building as part of Site Plan #.
The purpose of this assessment is to respond to a request from Arlington County for an evaluation of the queuing from inbound traffic at the proposed academic/office building garage entrance, to ensure that queues will remain within the subject property without extending on to the public roadway network.

ANALYSIS

The following assumptions and calculations were made to perform the queuing analysis:

1. The number of inbound lanes at the academic/office building garage entrance was two (2) during the AM peak hour, and one (1) during the PM peak hour.
2. Office employees and students were assumed to use a proximity card for entry into the garage; "transient"/retail users and visitors were assumed to use a pay-on-foot system for entry into the garage.
3. Peak hour forecasts for the academic/office building garage entrance were

obtained from the traffic impact analysis.

For purposes of this analysis, "monthly" users were considered to include office and academic uses, and "transient" users were considered to include retail uses.

AM Peak Hour Inbound Monthly Users Volume (V_m) = 257 vehicles/hour
PM Peak Hour Inbound Monthly Users Volume (V_m) = 111 vehicles/hour

AM Peak Hour Inbound Transient Users Volume (V_t) = 3 vehicles/hour
PM Peak Hour Inbound Transient Users Volume (V_t) = 4 vehicles/hour

Total AM Peak Hour Inbound Monthly Users Volume (V_m) = 260 vehicles/hour
Total PM Peak Hour Inbound Monthly Users Volume (V_m) = 115 vehicles/hour

Lane processing rates for each of the uses were derived from PARC service rates established in the Parking Structures, Third Edition manual. A blended processing rate was then derived.

Monthly Users (Office and Academic) Processing Rate (μ_m)= 600 vphpl (or 6 sec/vehicle)
Transient Users (Retail) Processing Rate (μ_t) = 400 vphpl (or 9 sec/vehicle)

$$\mu = \frac{V_m + V_t}{V_m/\mu_m + V_t/\mu_t}$$

$$\mu_{AM} = \frac{257\text{ vph} + 3\text{ vph}}{257\text{ vph}/(600\text{ vph}) + (3\text{ vph})/(400\text{ vph})}$$

$$= 597\text{ vph (or 6.03 sec/vehicle)}$$

$$\mu_{PM} = \frac{111\text{ vph} + 4\text{ vph}}{111\text{ vph}/(600\text{ vph}) + (4\text{ vph})/(400\text{ vph})}$$

$$= 590\text{ vph (or 6.10 sec/vehicle)}$$

For a more conservative analysis, a turn factor was added into the lane processing rates to account for the time required for vehicles to turn into the gate area. A turn factor of approximately 1 seconds/vehicle was applied.

The total service rate (μ) for the gate is as follows:

Total Service Rate (μAM) = *2 lanes * 3600/(6.03 sec/vehicle + 1 sec/vehicle)*
= *1,024 vehicles/hour*

Total Service Rate (μPM) = *1 lane * 3600/(6.10 sec/vehicle + 1 sec/vehicle)*
= *507 vehicles/hour*

The traffic intensity (λ) is generally $\lambda = V/\mu$

Thus, the traffic intensity for each gate is as follows:

AM Peak Hour Traffic Intensity (λ_{am}) = *260/1,024*
= *0.254*

PM Peak Hour Traffic Intensity (λ_{pm}) = *115/507*
= *0.227*

Attachment I shows the Parking Structures, Third Edition design queue curve as a function of traffic intensity. It is inferred from the graph that the 90% probability queue for the entrance, as a two-lane gate, would be zero (0) vehicles in the reservoir during the AM peak hour and zero (0) vehicles in the reservoir during the PM peak hour.

CONCLUSION

As shown in the analysis elaborated above, allowing for two inbound lanes during the AM peak hour and one inbound lane during the PM peak hour would minimize queuing at the academic/office building entrance.

Attachment I

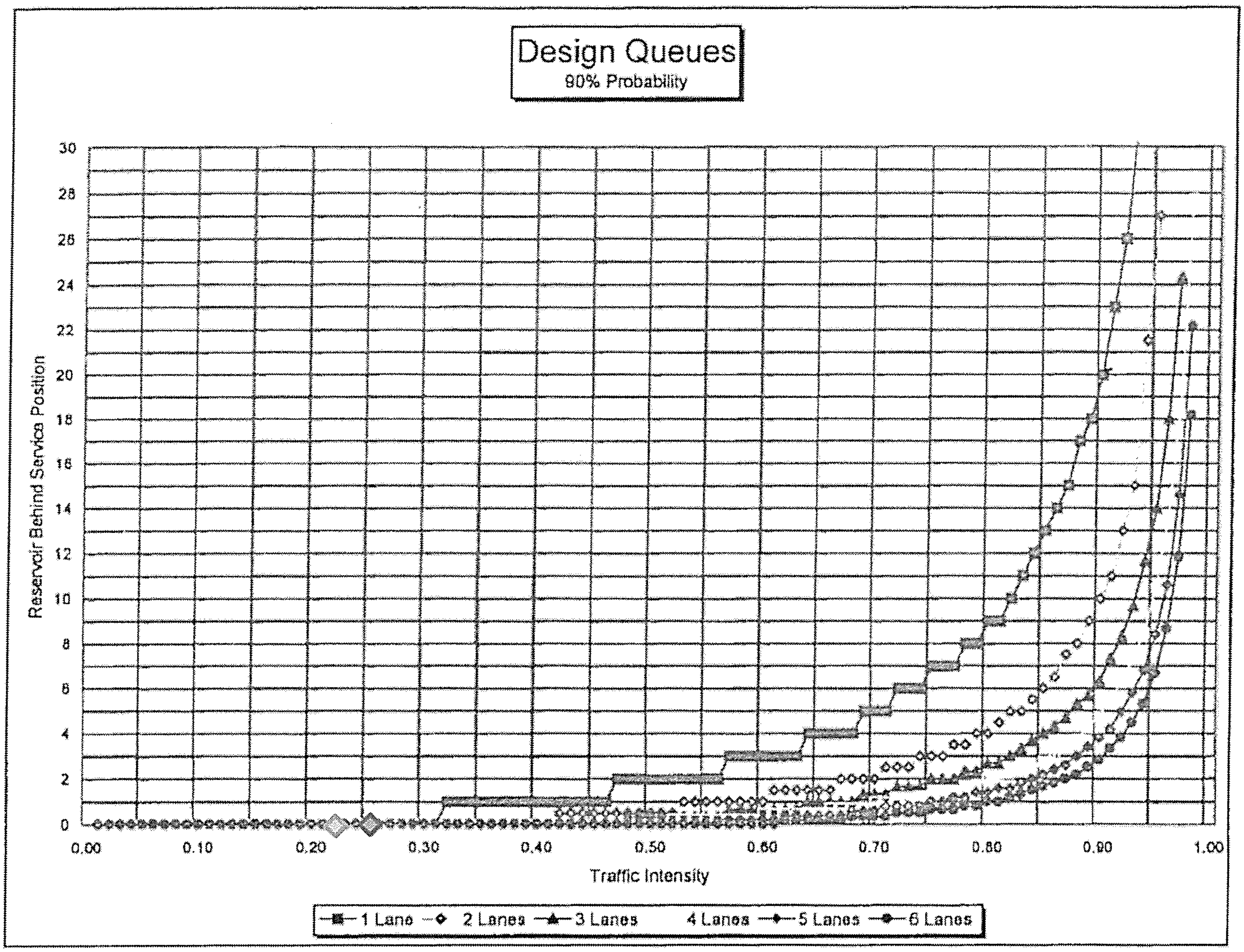

Figure 4-12. Design queue curves

: Entrance AM Traffic Intensity of 0.254 along "2 Lanes" curve
90% Probability Queue (Reservoir Behind Service Position) =0 Vehicles

: Entrance PM Traffic Intensity of 0.227 along "2 Lanes" curve
90% Probability Queue (Reservoir Behind Service Position) =0 Vehicles

Site Plan Development - SP #

Site Trip Generation Summary (1)

Development	ITE Land Use Code	Quantity	Units	AM Peak Hour			PM Peak Hour			ADT
				In	Out	Total	In	Out	Total	Total
Existing Uses										
Academic (2)(3)	-	70,000	Square Feet	126	19	145	63	50	113	1130
Proposed Uses										
Building One										
Residential	220	272	Dwelling Units	27	110	137	109	58	167	1772
Non-Auto Mode Share Reduction		*50%*		*14*	*55*	*69*	*55*	*29*	*84*	*886*
Residential Subtotal				13	55	68	54	29	83	886
Building Two										
Office	710	55,000	Square Feet	105	14	119	24	116	140	833
Non-Auto Mode Share Reduction		*35%*		*37*	*5*	*42*	*8*	*41*	*49*	*292*
Office Subtotal				68	9	77	16	75	91	541
Retail (4)	826	5,000	Square Feet	16	18	34	15	18	33	222
Non-Auto Mode Share Reduction		*80%*		*13*	*14*	*27*	*11*	*15*	*26*	*178*
Retail Subtotal				3	4	7	4	3	7	44
Academic (3)(5)	-	105,000	Square Feet	189	29	218	95	75	170	1700
Total Proposed				273	97	370	169	182	351	3171
Net-New Trips				147	78	225	106	132	238	2041

Notes:

(1) Trip generation calculations based on Institute of Transportation Engineers (ITE) Trip Generation, Ninth Edition.

(2) Existing trip generation for academic uses based on existing driveway counts for the peak hour of the adjacent street at the intersection of N. Fairfax Drive and N. Glebe Road.

(3) Average daily trips generated for academic uses estimated as ten (10) times the observed PM peak hour traffic.

(4) For the AM peak hour, a peak hour of the generator rate was used due to the lack of ITE data for peak hour of the adjacent street.

(5) Trip generation of proposed academic uses estimated based on the square footage ratio of the existing trip generation (see note 2.) The ratio of 105,000 S.F. to 70,000 S.F. is 1.5. Therefore, this ratio of 1.5 was multiplied with the existing trip generation to derive the proposed trip generation.