VARGA TRAFFIC PLANNING Pty Ltd
Transport, Traffic and Parking Consultants

ACN 071 762 537 ABN 88 071 762 537

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Ref 19583

Woollahra Council
P.O. Box 61
DOUBLE BAY NSW 1360

Attn: Ms Ever Fang
ever.fang@woollahra.nsw.gov.au

Dear Ever,

LAND & ENVIRONMENT COURT PROCEEDINGS NO. 2021/38192
PROPOSED ALTS & ADDS TO AN APPROVED RESIDENTIAL DEVELOPMENT
23 WOLSELEY RD (AKA 2 WENTWORTH ST), POINT PIPER
QUEUING ANALYSIS

I refer to the recent *Without Prejudice* meeting held on the 25th May 2021, relating to the abovementioned LEC appeal. Discussions between yourself and myself during the meeting were productive and I trust I addressed your concerns. Notwithstanding, you requested a queuing analysis be undertaken to demonstrate that there will not be any queuing outside of the site boundaries and across the public footpath. The following advice is therefore provided in respect of the queuing analysis requested by Council.

Key parameters of a queueing analysis include car lift speed, car lift door opening/closing times, time required for the car to enter/exit the lift and the traffic generation of the development.

The table below provides a breakdown of the timing of the lift for each specific task, and is based on two scenarios; one whereby a car arrives at street (basement) level and is transferred to the mezzanine level however returns to street level *empty*. The second scenario is based on the assumption that the lift returns to street level *with* another vehicle ready to exit the site.

Lift Sequence (Returning Empty)		**Travel Duration Key Data**		**Lift Sequence (Returning Occupied)**	
Action	**Duration (sec)**			**Action**	**Duration (sec)**
Door Open	10	Travel Distance Basement-Mezz	2.75m	Door Open	10
Car IN	10			Car IN	10
Door Close	10	Lift Speed	0.15m/s	Door Close	10
Door Lock	2	Travel Time	18 sec	Door Lock	2
Lift Travel	18			Lift Travel	18
Door Unlock	2			Door Unlock	2
Door Open	10			Door Open	10
Car OUT	5			Car OUT	5
Car IN	-			Car IN	10
Door Close	10			Door Close	10
Door Lock	2			Door Lock	2
Lift Travel	18			Lift Travel	18
Door Unlock	-			Door Unlock	2
Door Open	-			Door Open	10
Car OUT	-			Car OUT	5
TOTAL	97			TOTAL	126
Service Rate (s)	**3600/97 = 37.1**			**Service Rate (s)**	**2 (3600/126) = 57.1**

With respect to the traffic generation potential of the proposed development, reference to the RMS *Guidelines* indicates that 3-bedroom residential apartments in a medium density development will generate in the order of *0.65 peak trips per dwelling.*

Application of the above rate to the proposed provision of 7 x 3-bedroom apartments yields a traffic generation potential of 4.6 trips during the weekday AM and PM peak periods (vph) – IN & OUT, combined.

It is also pertinent to note that only 46% of the total parking is required to use the car lift (i.e. only 6 of 13 car spaces are located on the mezzanine parking level). In theory therefore, the traffic using the car lift and mezzanine parking level is 46% of 4.6 vph = 2.1 vph.

Notwithstanding, in order to provide a more rigorous queuing analysis assessment, it has been assumed that *all* of the 4.6 vph will be required to use the car lift.

In summary, the timing analysis confirms that the proposed system has a capacity of *37.1 cars per hour*, assuming the lift returns to street level *empty*, or a capacity of *57.1 cars per hour*, assuming the lift returns with another vehicle.

Accordingly, the queuing analysis in the scenario where the lift returns to street level *empty*, is detailed below.

In this scenario, r = 3.7 vph, which is based on the busier weekday afternoon *arrival* period (i.e. when the majority of associated traffic is arriving home, representing approximately 80% of the total traffic generation potential of 4.6 vph), and s = 37.1 vph (based on the timing analysis). Accordingly, $\boldsymbol{\rho = 3.7/37.1 = 0.100}$.

The probability of "n" vehicles in the system is given by the following equation:

$$P_n = (1-\rho)\,\rho^n$$
$$P_0 = (1-0.100) \times 0.100^0 = 0.900 \text{ or } 90.0\%$$
$$P_1 = (1-0.100) \times 0.100^1 = 0.090 \text{ or } 9.0\%$$
$$\mathbf{P_2 = (1-0.100) \times 0.100^2 = 0.009 \text{ or } 0.9\%}$$

Furthermore, the queuing analysis in the scenario where the lift returns to street level *with an exiting car*, is detailed below.

In this scenario, r = 4.6 vph (i.e. the *total* peak traffic generation of the proposed development), and s = 57.1 vph (based on the timing analysis). Accordingly, $\boldsymbol{\rho = 4.6/57.1 = 0.081}$.

Again, the probability of "n" vehicles in the system is given by the following equation:

$$P_n = (1-\rho)\,\rho^n$$
$$P_0 = (1-0.081) \times 0.081^0 = 0.919 \text{ or } 91.9\%$$
$$P_1 = (1-0.081) \times 0.081^1 = 0.074 \text{ or } 7.4\%$$
$$\mathbf{P_2 = (1-0.081) \times 0.081^2 = 0.006 \text{ or } 0.6\%}$$

Accordingly, based on the *Austroads* equations it can be seen that the probability of the car lift being completely empty during peak periods ranges between 90% and 91.9%, whilst the probability of one car in the lift and no car waiting to enter ranges between 7.4% and 9%. Lastly, and critically, the probability of one car in the lift and one car waiting to enter ranges between just 0.6% and 0.9%.

Where traffic flow at the site entrance is restricted to a single lane and/or a garage door (effectively a control point), *AS2890.1:2004* requires the *98th percentile queue* to be accommodated on-site. That is, no waiting bay is required where the probability of a vehicle waiting is *less than* 2%.

As noted above, the probability of 2 vehicles being present in the system will range between 0.6% and 0.9% and therefore the provision of an on-site waiting/passing bay is *not* required, nor will there be any queuing of vehicles outside the site boundary and across the public footpath.

I trust the above queuing analysis addresses your concerns. Please do not hesitate to contact me on telephone 9904 3224 should you have any enquiries.

Yours sincerely

Chris Palmer
Executive Engineer B.Eng (Civil)
Varga Traffic Planning Pty Ltd