The following comments are provided in response to the issues raised by the RTA in their letter of 14 January 2008. This analysis relates to the 440 dwellings proposed. Recent changes to the Concept Plan have been proposed and are discussed on Page 8 of this document.

1. Traffic Data

Traffic counts were undertaken in 2007 on the approach roads to the site to confirm current levels of traffic generation and local road traffic volumes. Table 2 in the Arup Transport Assessment report provides a wide range of traffic volume data for the morning and afternoon peak periods on the road system surrounding the site. Table 1 below provides Annual Average Daily Traffic (AADT) data available for RTA count stations on the nearby main road system. Generally there appears to have been little growth between 1999 and 2005 on the Pacific Highway and Millwood Avenue. Lady Game Drive increased between 1999 and 2002 but dropped back again in 2005.

Table 1 AADT Values from Non-Permanent Stations around the Site

Location		**Classification**	**AADT**	**AADT**	**AADT**
			1999	**2002**	**2005**
Pacific Highway	South of Shirley Rd / Clanville Rd, Roseville	Arterial / Hwy	59,363	58,882	60,687
	South of Millwood Road	Arterial / Hwy	62,069	61,449	62,117
Millwood Avenue	East of Lady Game Drive	Sub-Arterial Rd	29,824	27,062	28,347
	West of Lady Game Drive	Sub-Arterial Rd	28,669	25,718	28,542
Lady Game Drive	North Of Millwood Avenue	Sub-Arterial Rd	10,817	15,192	10,352

Arup collected turning count data on Thursday 23 March 2006 for a Ku-ring-gai Council project and has been used for analysis of the intersection of Grosvenor Road and the Pacific Highway. A comparison of the 2006 data with the 2003 data for Grosvenor Road is provided in Table 2 below. It indicates that traffic volumes are variable but not significantly different. Traffic volumes on other local roads in the area providing local access are unlikely to have changed due to little change to development densities in the local residential area.

Table 2: Comparison of traffic data on Grosvenor Road between Austral Avenue and Pacific Highway

Year	**Morning Peak 8-9am**	**Afternoon Peak 5-6pm**
2003	799	783
2006	750	897

Arup did not rely on old traffic data for undertaking the analysis. From the discussion above on traffic volume data, it would appear that traffic volumes have remained at similar levels on the road system for a while.

2. Traffic Generation

The traffic generation rates were adopted and adjusted where appropriate from those provided in the RTA Guide to Traffic Generating Developments. The split of inbound to outbound trips adopted for each use in the peak hours are typical with residential traffic primarily departing and commercial traffic primarily arriving in the morning peak, with the reverse in the afternoon peak.

2.1 Residential

The standard RTA rates were adopted.

2.2 Commercial

The commercial component of the adaptive re-use has been assessed on the basis that it is predominantly occupied by high technology and computer based business and financial related services. This is typical of commercial developments in the area. The mix of uses used to assess traffic and parking implications are:

- 50 to 65% of the total floor area occupied by computer / high technology industry
- 5 to 7% of the total floor area occupied by health related industry
- 10 to 15% of the total floor area occupied by insurance related industry
- 10 to 15% of the total floor area occupied by accountancy / management related industry
- 10 to 13% of the total floor area occupied by legal related industry

The RTA guidelines specify that traffic conditions for office and commercial developments should be assessed at a base rate of 2 evening peak hour vehicle trips per 100 m² GFA. This is for sites with a mean peak hour mode split for cars of 0.62, a mean peak hour car occupancy of 1.19 (52 percent car drivers), 80 percent of employees leaving the site in the evening peak hour, and an employee density of 21.1 m² GFA per employee.
The RTA guidelines note that employee densities vary according to the type of commercial development proposed and that public sector offices often have higher densities than private sector offices. Typical densities specified by the RTA for commercial developments are contained in Table 3.

Table 3: Typical Employee Densities (Private Sector)

Industry Type	**Employee Density**	
	m² GLFA / employee	**m² GFA / employee**
Computers / High Tech	35.0	38.9
Health	29.0	32.2
Insurance	18.0	20.0
Accountancy, Management	17.0	18.9
Legal	16.0	17.8

Notes: From RTA Guide to Traffic Generating Development. GLFA is 90 percent of GFA.

The above densities are based on surveys in North Sydney. Densities for the site at the UTS campus would be lower as it is not located within a CBD. The standard traffic generation of rate of 2 evening peak hour vehicle trips per 100 m² GFA needs to be adjusted for the densities associated with the potential uses within the existing buildings.

Table 4 presents the calculation of the adjustment factor based on the likely mix of uses.

Table 4: Calculation of Traffic Generation Adjustment Factor

	Employee Density		**% Breakdown for Proposed Development**	
	m2 GLFA / employee	**M2 GFA / employee**	**Upper Bound**	**Lower Bound**
RTA Standard Employee Density	19.0	21.1	NA	NA
RTA Employee Density by Industry Type				
Computers / High Tech	35.0	38.9	50%	65%
Health	29.0	32.2	7%	5%
Insurance	18.0	20.0	15%	10%
Accountancy, Management	17.0	18.9	15%	10%
Legal	16.0	17.8	13%	10%
Total	**NA**	**NA**	**100%**	**100%**
Weighted m2 GFA / employee			**29.8**	**32.6**
Adjustment Required to RTA Standard Rates			**-29%**	**-35%**

From Table 4 it can be seen that for the range of likely commercial uses and over the upper to lower range considered, the base RTA traffic generation rate should be adjusted down by between 29 and 35 percent to allow for the mix of uses associated with the proposed development. The resultant traffic generation rate ranges from 1.30 to 1.41 trips per 100 m2 GFA in peak hours.

2.3 Educational

Rate based on existing educational use site generation

2.4 Remainder of the adaptive reuse components of the main building

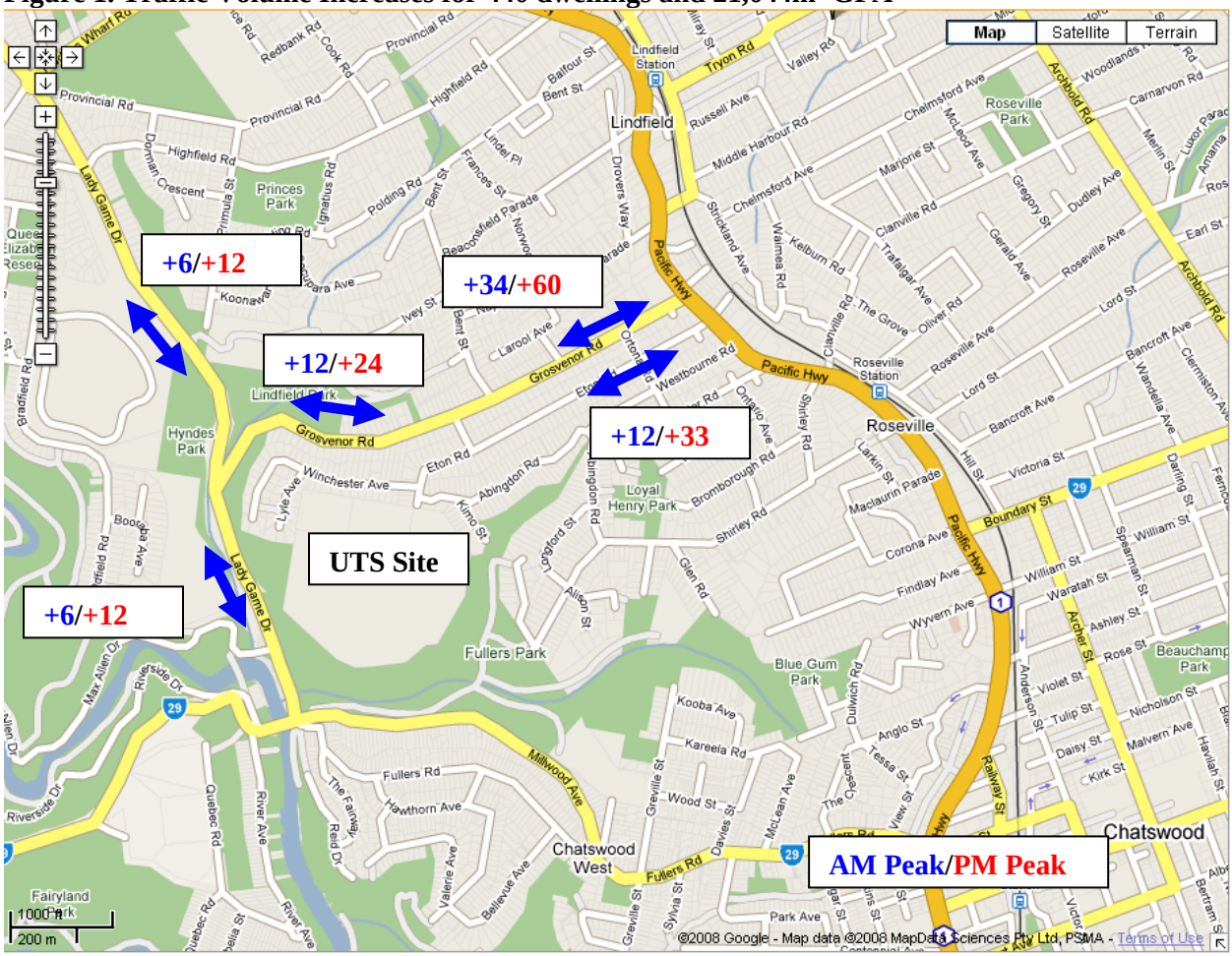
Rates have been adopted that are considered to represent the likely traffic generation in the combined peak hour and take into account shared use and use by residents of the site. These uses make up about 25% of the sites traffic generation.

3. Intersection Analysis

The intersection of Grosvenor Road and the Pacific Highway has been analysed for the peak periods using turning count data collected for Arup on Thursday 23 March 2006 overlayed with the additional site traffic.

The intersection of Millwood Avenue/ Lady Game Drive/Fullers Road has not been analysed because only minor traffic increases are predicted on Lady Game Drive. The increase in traffic on Grosvenor Road west of Austral Avenue as indicated in Table 9 of the Arup report is 12 vehicles in the morning peak hour and 24 vehicles in the afternoon peak hour. These are further split north and south on Lady Game Drive as shown in Figure 1. In the evening peak there are some 1000 vehicles per hour using Lady Game Drive and it is predicted that there would be an increase of some 12 vehicles in the PM peak hour. This represents only a 1.2% increase which is well within normal daily traffic fluctuations.

Figure 1. Traffic Volume Increases for 440 dwellings and 21,044m² GFA



Background
The Pacific Highway / Grosvenor Road intersection is approaching capacity in both the AM and PM peaks. Due to the current signal timings, the main source of delay is to traffic on Grosvenor Road and it is unlikely the RTA would allocate more green time to this approach. The presence of Burleigh Street, which is offset from Grosvenor Road necessitating a dedicated phase, also impacts on the operation of the intersection due to the high intergreen + green time required to accommodate relatively low traffic flows.

Existing Volumes and Phasing
The traffic survey undertaken on Thursday 23 March 2006 revealed that 13 vph exited Burleigh Street in the AM peak hour and 4 vph in the PM peak hour. The Burleigh Street phase is an optional phase that is only called-up if a vehicle arrives at the Burleigh Street approach and triggers the in-ground loop detectors. The signals are set so that this phase can only be called up every second cycle at the most. It was observed that the Burleigh Street phase was called-up approximately every second cycle in the AM peak and approximately only every 15 minutes in the PM peak.

Intersection Capacity Modelling using the Sidra software package
The Burleigh Street phase was included as the fourth phase in the Sidra modelling for the AM peak and excluded from the modelling for the PM peak. It was believed that this was the most satisfactory way to simulate existing conditions.

Results of the intersection analysis are summarised in Table 5. In both the morning and evening peak hours, the intersection overall experiences no noticeable change from existing operations. The Grosvenor Road approach operates as a separate phase from the Burleigh Street approach due to the offset nature of the intersection approaches. This means that the inter-green time is long due to the offset nature of the intersection as shown in Figure 2. In the morning peak, the Grosvenor Road approach to the Pacific Highway is anticipated to experience an increased queue length with the level of service going down from D to E for that approach. In the afternoon peak the Grosvenor Road approach remains relatively unchanged.

Table 5: Pacific Highway / Grosvenor Road Intersection Analysis

Intersection	Control	Peak Hour	DS	AVD	Intersection LOS	Grosvenor Rd Approach LOS	HMD
AM Peak Hour	Signals	Existing	0.87	30	C	D	65
		Future	0.84	31	C	E	65
		Future Modified (retains 110 sec cycle time)	0.75	22	B	D	62
PM Peak Hour	Signals	Existing	0.92	26	C	E	99
		Future	0.94	31	C	E	97

Terms
DS Degree of Saturation
AVD Average Delay (seconds)
LOS Level of Service
HMD Highest Movement Delay (seconds) - Highest average delay for any movement at an intersection

LOS for signals and roundabouts is based on average overall delay, and based on highest movement delay for priority intersections

Improvement Options

1. Remove the Burleigh Street exit to the Pacific Hwy from the signal operation.

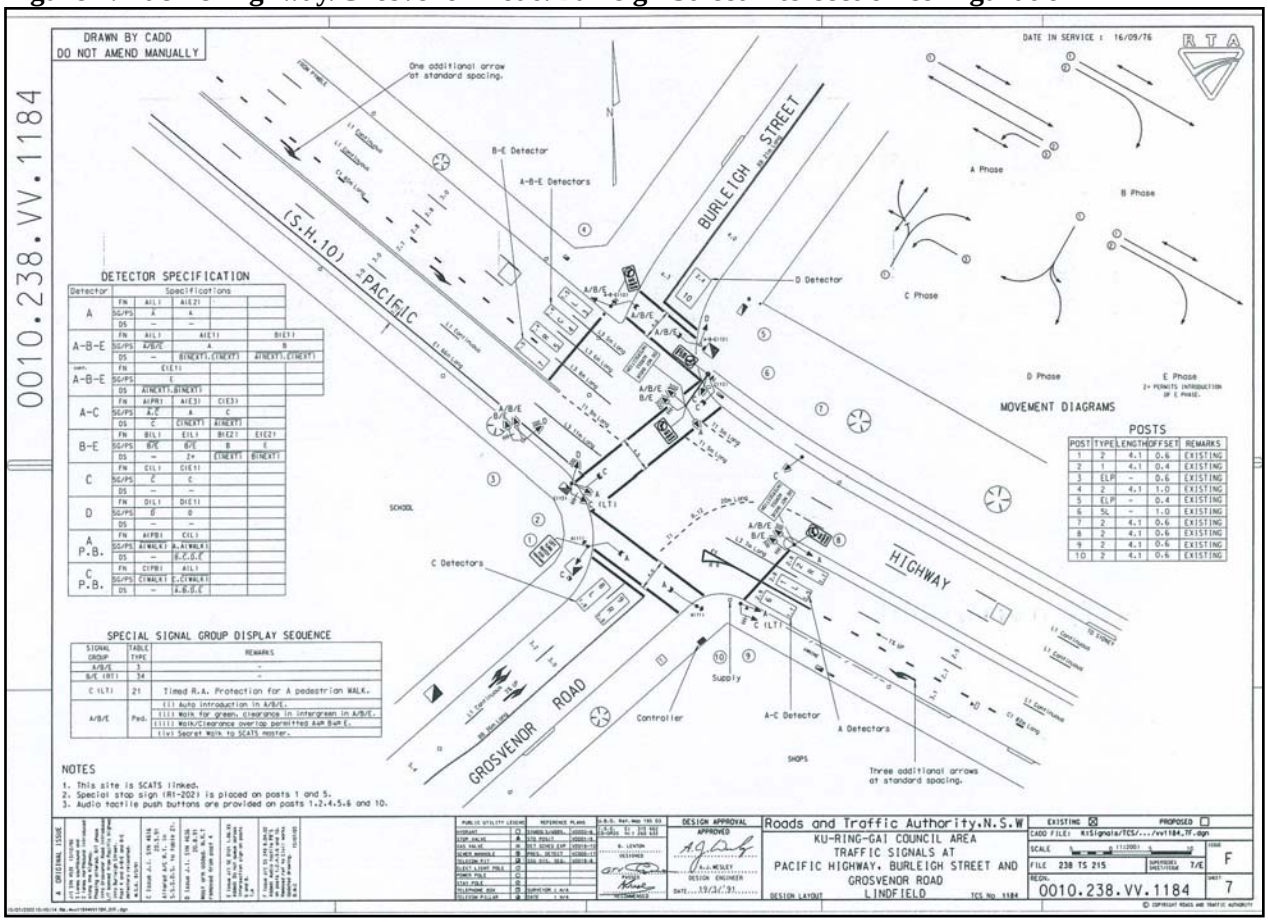
This would mainly improve operation of the intersection in the AM peak but have less impact in the PM peak. Table 5 shows the improvement for the AM Future Modified with an overall intersection LoS B and the Grosvenor Road approach being at Los D. It is likely that Ku-ring-gai Council would not support this traffic management measure due to reduced accessibility for local traffic. Vehicles formally exiting Burleigh Street to turn right would be forced to turn left out of Llewellyn Street onto the Pacific Hwy and then perform a right turn at some point along the highway.

2. Grosvenor Road parking

Minor capacity improvements could be achieved by extending parking restrictions on Grosvenor Road, particularly in the PM peak, to enable two continuous approach lanes.

Parking restrictions could be enforced from 4.30pm to 6.30pm, to avoid impacting on pickup/ drop-off activities associated with Lindfield Public School. These improvements would have only a marginal improvement on the overall intersection level of service but would reduce the length of queues on Grosvenor Road.

Figure 2: Pacific Highway/Grosvenor Road/Burleigh Street intersection configuration



Millwood Avenue/ Lady Game Drive/Fullers Road Improvement Options
Although not analysed, there are a number of improvements that could be implemented at the Millwood Avenue/ Lady Game Drive/Fullers Road intersection:

- A right turn phase from Lady Game Drive into Millwood Avenue west would increase the capacity of this movement and remove capacity from the Fullers Road approach. The Fullers Road approach is heavily utilised by short cutting traffic which is using this route rather than Millwood Avenue from the east to approach Lady Game Drive from the south. This is due to the right turn from Millwood Avenue being oversaturated. This change would provide a better balance to main road traffic although the intersection would still be operating at a poor level of operation.
- Widening the Lady Game Drive approach would improve the utilisation of lanes at the intersection but this would require bridge works.

4. Sustainable Transport and Public Transport

Shorelink Route (565) provides regular bus services between the site and the train service. Pedestrian footpaths are provided on at least one side of all streets providing access to the site with the exception of Austral Avenue. These footpaths allow people to walk to the Pacific Highway and to the rail stations is desired. Cycling conditions have been assessed as suitable as on-road local street cycling. Traffic management devices including pedestrian refuge islands are installed on local streets and no further need has been identified to install additional devices. The Transport Behavioural Program is a practical measure that will encourage alternative travel modes to be considered by residents and users of the site.

5. Traffic and Transport Improvements

The traffic and transport improvements and sustainable transport initiatives would be identified at the project application stage and would be included in the approval conditions for the development. Some of the issues to be addressed are:

- Condition of the footpaths, drop kerbs, etc
- Availability and condition of bicycle parking in racks and lockers at the rail station
- Directional signage for pedestrians and cyclists

Change in the Proposed Concept Plan

The revised concept plan for UTS Kuring-gai includes the removal of one apartment block and the retention of active open space with the provision of one full sized adult soccer field with 30 associated parking spaces. The retention of the soccer field and the provision of GFA for child care facilities, in the ground floor of one apartment building, have resulted in the reduction of dwelling numbers to 382. The dwelling mix will be 10 traditional lots, 25 integrated lots and 347 apartments.

Traffic Analysis

The reduction in residential dwellings results in a reduction of 28 vehicles in the morning peak from 445 veh/hr to 417 veh/hr and 27 vehicles in the afternoon peak from 501 veh/hr to 474 veh/hr.

The traffic analysis undertaken for the operation of the Grosvenor Road intersection at the Pacific Highway assumed a worst case with all traffic assigned to Grosvenor on exit, however in the busy morning peak some left turn traffic at the highway may choose to use Eton Road instead which would reduce the traffic at Grosvenor Road.

We have re-assessed the operation of the Grosvenor Road intersection at the Pacific Highway assuming 30% of left turn traffic uses Eton Road and applying the overall reduction of 28 vehicle movements. The analysis shows that the future operations would be close to retaining a Level of Service D for the Grosvenor Road approach in the AM peak with an acceptable overall intersection operation of Level Of Service C.

Car Parking

The number of car parking spaces required for the residential component of the development reduces from 685 spaces to 590 spaces.

With the provision of a full playing field, Council has advised that 30 car spaces are required. This is considered appropriate to meet normal daytime parking demand when the remainder of spaces on the site are utilised. In the evenings and at weekends when there is the potential for competitive sporting events and training to be occurring, additional car parking spaces will be available associated with the commercial uses on the site.