Date 21/11/13

Our Ref: 13SYA0006 R02
Your Ref:

Attention: Robert Stark

JBA Planning
JBA

PO Box 375

North Sydney NSW 2059

Dear Robert,

RE: **Doncaster Avenue proposed light rail stabling yard acoustic assessment**

1. Introduction

As part of the proposed CBD and south East Light-Rail Extension (CSELR), Transport NSW has selected the old tram site in Randwick on Doncaster Avenue as their preferred location for a stabling yard.

A State Significant Infrastructure (SSI) application for the light-rail extension was lodged by the Department of Planning and Infrastructure in June 2013. The Environmental Impact Statement (EIS) was released for public review and comment in November 2013. Following consultation and approvals construction work is expected to commence in early 2015.

The network will initially run a fleet of 25 electrically powered light rail vehicles each 45m in length, with capacity to carry 100 seated and 200 standing passengers. Stabling and maintenance facilities are proposed at Rozelle and Randwick.

Normal hours of operation of the light rail system will be between 5am and 1am 365 days a year with amendments for special events.

A review of the EIS has been undertaken in relation to noise from the proposed stabling yard options proposed for Randwick.

This letter provides a high-level acoustic assessment high-lighting the potential noise impacts from a light rail stabling yard being located at Doncaster Avenue directly adjacent to existing and proposed residential developments.

2. Site Location and Noise Sensitive receivers

Two possible stabling-only yard options have been considered around Randwick Racecourse. These are:

- A stabling-only facility using a portion of land adjoining the Royal Randwick racecourse site, off Doncaster Avenue.
- A stabling-only facility using a portion of Royal Randwick Racecourse land to the west of Wansey Road, at the intersection of High Street and Wansey Road.

These two sites are shown in figure 1.

Figure 1: Two proposed stabling yards at Randwick racecourse

As stated in the EIS Section 4.5.1,

> *The stabling-only facility within racecourse land adjacent to Wansey Road would provide a key benefit over the Doncaster Avenue Site as this site is generally situated below the surface of Wansey Road residences, providing some screening for noise and visual impacts of stabling facilities. However, the site is slightly less optimal than the site at Doncaster Avenue as it is located further from both the Circular Quay and Kingsford stops, resulting in additional time to reach these termini for the commencement of daily light rail services.*

As a result of this thinking the EIS acoustic assessment has not considered the site at Wansey Road and has only undertaken an assessment for the Doncaster Avenue site.

Doncaster Avenue is a residential street with low rise housing on either side along its length. The dwellings to the east of Doncaster Avenue share their boundary with Randwick racecourse.

A Stage 2 Development Application (DA599/2010) was submitted to Council for residential development including the construction of 53 three storey town houses and a six storey building containing 29 dwellings, a community centre, public parks, associated site works, landscaping, utility services, car parking and vehicular access. This application was approved on the 25 November 2010.

This site, shown on Figure 2 occupies part of the proposed stabling yard at Doncaster Avenue and therefore, would be subject to compulsory acquisition should this site be finally selected.

The site was formerly owned by the State Government and used for tram and bus operations

Figure 2: Stabling yard and Residential Development Site location

3. Assessment Criteria

Construction noise will be assessed and managed by the provisions of the *NSW Interim Construction Noise Guidelines*.

Noise from the operation of stabling yards is assessed by the *NSW Industrial Noise Policy, 2000*.

Vibration for construction and operation will be assessed by the *NSW Assessing Vibration: A Technical Guideline, Feb 2006*.

4. Noise sources from light-rail stabling yards

The main difference between heavy or traditional rail systems and light-rail systems is that light-rail typically travels at lower speeds and carries less traffic or passengers per train. However, whereas this difference may result is lower noise levels whilst on the open rail system the noise sources associated with the stabling and maintenance yards for light and heavy rail are similar.

These noise sources are explained below:

a. Train/LRV Stabling and Preparation

There will be regular activity at the stabling facility 24 hours a day. The CSELR timetable runs between 5:00am and 01:00am, which means trains will arrive at the stabling yard as late as 02:00am and leave as early as 04:30am. When the LRV's come off the rail network at the end of their shift they come to a standstill on a siding where they are prepared and maintained for the next day. When this happens the brakes are applied. First the exhaust break is applied which lets out a short lived, but high noise intensity rush of air. Then the parking brake is applied.

Often the pantographs are left up to maintain power throughout the night. This results in compressors cycling on and off to replenish air lost through leaks. In addition the air conditioning and lighting still operates for cleaning and maintenance. Continuous and intermittent noise is created by the alternators and the compressors respectively. However, some trains and potentially the light-rail rolling stock will have a 'stabled mode' which will avoid some of this noise. Nevertheless, the trains will still be required to be powered down and then up again which, will also create noise similar to the sources discussed above.

With residences adjacent to the stabling yard this noise is likely to be clearly audible at night creating a high risk of sleep disturbance.

b. Horn/Warning Bell Noise

The LRV's will be required to have horns/warning bells for safety requirements and usually horns are required to be tested before the train leaves the stabling yard in the early morning. However, the EIS says that warning bells would not be tested in the stabling yard. Nevertheless, should they ever be used the high intensity, tonal and directional nature of the horns/bells, necessary for warning and direction location will

standout against the broad spectrum and lower ambient night time noise environment. This will increase the risk of annoyance and sleep disturbance.

Train horns/bells routinely have a sound power level significantly in excess of 100 decibels. Even with directional characteristics reducing off-axis sound, horns/bells still represent a significant source of noise likely to give rise to complaints from residents and cause sleep disturbance, should they be used in or close to the stabling yard.

c. Cleaning

The cleaning of trains during the night represents a lower risk of disturbance to the community especially when they are being cleaned on the inside, where the typical activities are mopping and vacuuming. However, the cleaning of the outside will likely use high-pressured water jets, powered by compressors which will result in additional noise produced by the stabling yard. This will take place in the wash area.

d. Maintenance

Maintenance of the trains can be split into major and minor repairs. Major maintenance is not proposed for the stabling yard at Doncaster Avenue, although minor maintenance will likely take place.

Minor repairs such as, fixing loose panels, windscreens and seat repairs would likely use hand held power tools, compressors and possibly generators. All of these sources are generators of noise and represent a risk of annoyance and sleep disturbance to residents in close proximity, during the lower ambient noise levels at night.

e. Wheel Squeal

LRV movements within the stabling yard would occur at low speeds, however, there is still a risk of wheel squeal and other rail/wheel noise at crossovers, turnouts and around tight corners.

Wheel squeal is perhaps the most annoying and difficult to control noise source in the stabling yard. It is produced by lateral slip of the wheel across the rail. This is most likely to occur at certain train speeds travelling through bends, particularly tight radius.

Wheel squeal can often significantly exceed 100 dB(A) at a distance of 15m depending on the speed, radius or bend and condition of the rail and wheels. In addition to the high level of noise produced it is also high-pitched, which means it will stand out against the broad spectrum ambient noise environment dominated by traffic noise from Alison Road.

Although the trains are likely to be travelling slowly whilst in the stabling yard, wheal squeal, should it occur represents a significant risk of annoyance and sleep disturbance to residents living in close proximity to the stabling yard.

5. Sleep disturbance

The overriding adverse noise impact from stabling yards close to residential areas is that they are most active during the night time and early morning when the trains are not running on the network. However, they are still in use during the daytime. The night time operations are at the same time that residents are sleeping and at their most sensitive to noise. In addition the ambient noise levels are lowest during the night time, which means that any extraneous noise can be more noticeable due to the lack of masking by the ambient noise.

The proposed normal operating hours for the CBD and Southeast light-rail system are between 5am and 1am 365 days a year with amendments for special events. This means that sleep disturbance is the primary acoustic risk, with LVR's returning to and leaving the stabling yard at 02:00am and 04:30am respectively.

There have been many studies of sleep disturbance that have shown the high variability of response due to noise levels and number of noise events. People do not have to be awoken by the noise to have their sleep cycles interrupted, which leads to fatigue and consequently safety risks the following day.

The World Health Organisation (WHO) in their publication, *Community Noise 1992* suggest an equivalent continuous internal noise level of **35 dB L_{Aeq}** and a maximum noise level of **45 dB L_{Amax}** should not be exceeded in order to minimise the risk of sleep disturbance.

SLR in their noise assessment of the stabling yard at Doncaster Avenue has used the guidance given in the *Industrial Noise Policy* application notes, which in turn refers to the, *NSW Road Noise Policy (RNP)*. The RNP suggest that, internal noise levels below **50 dB L_{Amax}** to **55 dB L_{Amax}** are unlikely to awaken people from sleep and one or two events per night of **65 dB L_{Amax}** to **70 dB L_{Amax}** are not likely to affect health and wellbeing significantly.

Whilst acknowledging that sleep disturbance due to noise is not well understood, the RNP sleep disturbance criteria are in excess of that suggested by WHO.

6. EIS Acoustic Outcomes

The EIS has only considered in detail the acoustic impact of the stabling facility at Doncaster Avenue as this is the overall preferred location for Randwick Racecourse, whilst acknowledging that there is a key noise and light pollution benefit in using the site at Wansey road, due to the natural shielding provided by the lower ground level of the proposed stabling yard.

The noise predictions for the Doncaster Avenue site has assumed three potential stabled locations of LRV's. These are;

1. Along the western boundary of the site closest to the residences on Doncaster avenue.
2. Stabled south with LRV's on adjacent roads except for one residential receiver, which is the closest receiver of all.
3. At the northeast corner as far from the residences on Doncaster Avenue as possible.

With no noise mitigation the noise predictions exceed the noise criteria significantly under all scenarios.

The noise predictions using a 6m high barrier along the western boundary of the site extending from the north to south corner, show a significant reduction in noise impact to the site. However, there are still 33 properties that exceed the criteria at upper floor levels (Level 2) at night. Predicted maximum noise levels do nevertheless meet the background + 15 dB criterion.

A second option for noise mitigation predicted was the construction of an acoustic shed enclosed along the western boundary and roof over the stabling facility. This resulted in the elimination of daytime and evening time exceedances of the criteria, but exceedances of the night time criterion still persist with eleven properties being affected.

7. Discussion

The land along Doncaster Avenue and around Randwick Racecourse where the stabling yard is proposed is prime high value residential land. The presence and operation of a light rail stabling yard at Doncaster Avenue would result in an unacceptable risk of a serious loss of acoustic amenity for residents living in close proximity. The other proposed site at Wansey Road would be more suited than Doncaster Avenue to stabling and minor maintenance of trains given the natural acoustic shielding provided by the lower ground level of the Racecourse land where the stabling facility would be located.

The suggested noise mitigation measure of a 6m high barrier along the western boundary or a partial enclosure of the whole site will be either impractical or ineffective. Noise barriers regardless of height (within reason) can only achieve a practical maximum noise attenuation of approximately 20 dB(A). This may benefit single or two story houses, but will not benefit apartments at higher levels that will have direct line of sight into the stabling yard. The predictions still show 33 properties exceeding the night time noise criterion on Level 2. Furthermore, the currently vacant site at 66A Doncaster Avenue, which already has Development Approval under Development Application (DA599/2010) for residential development including; the construction of 53 three storey town houses and a six storey building containing 29 dwellings, would further exceed the day, evening and nigh time criteria as there would be no benefit provided by the barrier for the higher levels.

A 6m high noise barrier would also likely receive complaint on visual grounds in addition to being very expensive, due to the significant structural requirements to make it stand up and resist wind loading pressures. A barrier along Wansey road would not need to be as high, reducing cost, visual and structural impacts.

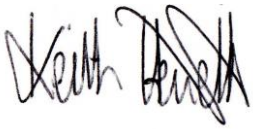
An acoustic enclosed shed would be the best performing acoustic and most expensive solution. SLR have suggested in the EIS that the sound insulation performance of the wall would need to be upgraded from a standard shed construction of this scale. However, five properties are still exceeding the night time noise criterion.

Furthermore, with the potential for horn/warning bell noise and wheel squeal to have sound powers far in excess of 100 dB(A) a noise barrier or enclosure will likely not provide the necessary attenuation to avoid loss of acoustic amenity and sleep disturbance. The presence of residences and sites with residential Development Consents sharing boundaries with the stabling yard is expected to result in a significant loss

of acoustic amenity, which will likely result in complaints and loss of land value in Doncaster Avenue and other surrounding streets.

In terms of acoustic amenity for residents the potential stabling yard at Wansey Road would be preferred.

Yours faithfully,



Keith Hewett
Principal Consultant - Acoustics
soundmatters