

acoustic studio

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Dear Dane,

UTS CENTRAL PROJECT - ACOUSTIC ASSESSMENT FOR EXTENDED WORKING HOURS

The University of Technology Sydney (UTS) is currently redeveloping Building CB02 and extending the podium of CB01 within its Broadway Precinct of the UTS City Campus as part of the approved State Significant Development SSD 7382.

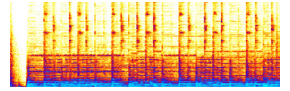
UTS proposes to facilitate acceleration of the construction phase through extended working hours and utilising hours outside of standard construction hours.

Acoustic Studio has been commissioned to carry out a construction noise and vibration impact assessment for proposed works conducted outside of standard construction hours, to accompany a State Significant Development Application (SSDA) modification for the proposal. We note that a previous construction noise and vibration assessment has been prepared by Acoustic Studio for activities undertaken within standard construction hours - *Acoustic Studio Report 20160915 UTS3035.0002.Rep. UTS Central Project - Construction Noise and Vibration Management Plan*.

This letter details the assessment that has been undertaken to review the potential operational impacts of the proposed extended working hours.

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1. Introduction

On 23 September 2016, the NSW Department of Planning and Environment granted development consent for SSD 7382 for the University of Technology Sydney (UTS) Central Precinct. The consent was granted for the construction and use of an education building.

The Broadway Precinct of the UTS City Campus is located entirely within the Sydney Local Government Area on the southern edge of the Sydney Central Business District.

The Broadway Precinct of the UTS City Campus has frontages to Broadway, Thomas, Wattle and Harris Streets, and the Ultimo Pedestrian Network. Jones Street and Harris Street intersect the precinct.

UTS proposes to facilitate acceleration of the construction phase of the UTS Central Project through extended working hours and utilising hours outside of standard construction hours.

Proposed amended construction hours are as follows:

- Between 7am to 7pm, Monday to Friday inclusive (currently this is 7am to 6pm).
- Between 7am to 5pm on Saturday (currently this is 7.30am to 3.30pm).
- No work on Sundays and public holidays (no change).
- Internal fit-out works between 7pm and 10.30pm Monday to Friday (building enclosed except at hoist location)

2. Noise Criteria

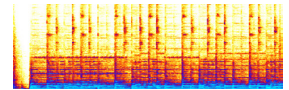
The relevant guideline applied for the assessment of the CNVMP is the Department of Environment and Climate Change (DECC) NSW, "*Interim Construction Noise Guideline (ICNG), 2009*". This guideline provides construction noise criteria for different sensitive receivers.

Section 4 of the ICNG provides recommendations for OOH construction activities and suggests construction noise management levels that aim to minimise the likelihood of annoyance caused to noise sensitive receivers.

Table 1 below outlines the methodology for determining construction noise criteria at nearby residential receivers surrounding the development site based on existing background noise levels.

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<i>Time of Day</i>	<i>Management Level</i> <i>L_{Aeq,15min}</i>	<i>How to Apply</i>
Outside recommended standard hours	Noise affected RBL + 5 dB	<ul style="list-style-type: none"> • A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see section 7.2.2 of the ICNG.

Table 1: Residential construction noise criteria for airborne noise (from the ICNG) during OOH works

The RBL is the overall single figure background level representing each assessment period (day/evening/night) over the whole assessment period. This is the level used for assessment purpose and is further described in the Environmental Protection Authority (EPA) “NSW Industrial Noise Policy, 2000”.

Based on the requirements detailed in Table 1 above and the measured data of existing conditions at the site, the RBL has been calculated over the proposed OOH periods and the corresponding project specific noise criteria levels for residential airborne noise have been determined. In addition the following includes the absolute noise level criteria as outlined in the ICNG for non residential noise sensitive receivers. These are detailed in Table 2 below.

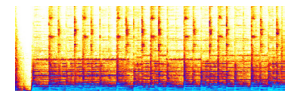
<i>Location</i>	<i>OOH Period</i>	<i>Rating Background Level RBL, dB(A)</i>	<i>Criteria L_{Aeq,15min}, dB(A)</i>	
Residential Receivers	Monday to Friday	6pm to 10pm	56	61
		10pm to 10.30pm	53	58
	Saturday	7am to 8am	55	60
		3.30pm to 5pm	56	61
	Sunday	NA	NA	NA
Retail and Commercial	When in use	NA	70	
Educational	When in use	NA	70*	

*External noise criteria for educational premises has been established considering a minimum sound transmission loss of 25 dB for fixed window and a target internal noise level of 45 dB(A) as per the ICNG requirements

Table 2: Project specific residential noise criteria for airborne noise during OOH works

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3. OOH Construction Noise Assessment

3.1 Proposed Works

Based on the proposed construction works, it is anticipated that the key construction activities to occur outside of standard construction hours are as follows:

Stage of Works	Activities	Typical Plant
Structure	Formwork	Tower crane / hand tools / jump form / hydraulic jacks
	Concrete place	Concrete trucks / concrete placing boom / concrete pump / concrete vibrator
Façade	Installation of glazing	Drill / mobile crane / tower crane
Fit-out	Services install	Hand tools / circular saw / angle grinder
	Masonry	Cement mixer / masonry saw
	Internal Linings and Joinery	Hand tools / circular saw / angle grinder
	Floor finishes and tiling	Cement mixer / angle grinder
External Works	In ground services	Demo saw / excavators
	Landscaping	Demo saw / excavators / hand tools / drills / angle grinders / hammer drill / mobile crane / tower crane

Table 3: Proposed Works. Items shaded in grey are works to be carried out internally within the building

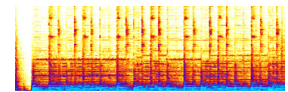
3.2 Construction Noise and Vibration Sources

The key construction noise sources for the works occurring during OOH construction periods and the associated equipment noise are listed in Table 4 below. These values are based on Acoustic Studio's database plus Australian and International Standards.

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<i>Equipment type</i>	<i>Item</i>	<i>Typical Power Noise Level L_{A10} PWL</i>	<i>Typical Noise Level $L_{A10,15min}$ at 7 m SPL</i>
<i>Heavy Vehicles</i>	Concrete trucks	112	84
	Tower Crane	108	80
	Mobile Crane	111	83
<i>Site Machinery</i>	Excavator	119	91
	Concrete Pump	113	85
	Cement Mixer	112	84
	Concrete Placing Boom	108	80
	Concrete Vibrator	107	79
	Jump Form	105	77
	Angle Grinder	104	76
<i>Hand Held Tools</i>	Drill	94	66
	Hammer Drill	107	79
	Hand Tools	102	74
	Circular Saw	115	87
	Demo Saw	122	94
	Masonry Saw	116	88

Table 4: Anticipated maximum airborne sound pressure levels for equipment/plant used during the different stages

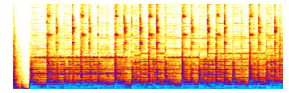
3.3 Sensitive Receivers

The nearest sensitive receivers to the UTS site that will be potentially affected by noise and vibration associated with the works are:

- *Residential:* apartment building Central Park (to the South) at 45 metres.
- *Retail and Commercial:* retail at building Central Park (to the South) at 45 metres.
- *Educational:* UTS buildings CB10 and CB11 across Jones Street (to the West) at 25 metres.

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3.4 Methodology

An assessment of the likely noise impacts of the proposed OOH activities on the nearest sensitive residential receiver has been carried out.

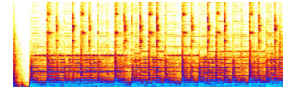
The assessment has considered the following:

- Typical construction activities considered in the noise impact assessment are detailed in Section 3.1.
- Project specific noise and vibration criteria at the nearest residential sensitive receiver location as outlined in Section 3.3.
- Noise level predictions are calculated using the noise data provided in Section 3.2.
- Noise level predictions account for:
 - Distance attenuation.
 - Attenuation from shielding from existing structures.
 - Ground and building reflections.
- Internal works are carried out progressively on a floor by floor basis only after the facade for that particular level is installed. The internal works noise predictions consider the transmission loss provided by the facade, except at the location in the facade where construction hoists are installed (where a reduced facade transmission loss is considered in the assessment). The hoist will be located to the northern section of the West facade of the proposed tower.
- L_{Aeq} noise levels are predicted for the operations of the nearest construction area on the site to the nearest residential sensitive receiver location.
- The predictions consider a range from individual tasks and associated equipment through to the cumulative noise contribution from all key activities and corresponding equipment, with plant running simultaneously for each phase and main task.
- The prediction assumes continuous operation of equipment/plant over the 15-minute assessment period, unless otherwise stated.

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3.5 Noise Assessment

The following section presents the results of the construction noise assessment carried out for external and internal OOH construction works scheduled.

This construction noise assessment determines the potential noise impact of activities and associated equipment / plant at the nearest sensitive receiver.

Tables 5 and 6 below present the predicted construction noise levels with comparison against the relevant criteria at the nearest sensitive receivers.

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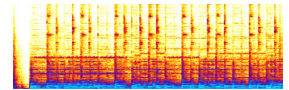
Nearest Residential Sensitive Receivers

Location and Construction Activity	Predicted equipment noise level $L_{Aeq,15min}$, dB(A)			
	Monday to Friday 6pm to 7pm	Monday to Friday 7pm to 10.30pm	Saturday 7am to 8am	Saturday 3.30pm to 5pm
	Criteria $L_{Aeq,15min}$, dB(A)			
	61	58	60	61
Structural - Formwork	58 to 70	n/a	58 to 70	58 to 70
Structural - Concrete place	63 to 72	n/a	63 to 72	63 to 72
Façade - Installation of glazing	62 to 69	n/a	62 to 69	62 to 69
Fit-out - Services install	33 to 54	33 to 54	33 to 54	33 to 54
Fit-out - Masonry	43 to 48	43 to 48	43 to 48	43 to 48
Fit-out - Internal linings and Joinery	33 to 46	33 to 46	33 to 46	33 to 46
Fit-out - Floor finishes and tiling	34 to 44	34 to 44	34 to 44	34 to 44
External Works - In ground services	64 to 69	n/a	64 to 69	64 to 69
External works - Landscaping	50 to 72	n/a	50 to 72	50 to 72

Table 5: Predicted equipment/plant noise levels at the nearest residential sensitive receiver - Levels predicted to exceed the worst-case criteria are in **red**. Items shaded in grey are works to be carried out internally within the building

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Nearest Commercial and Educational Sensitive Receivers

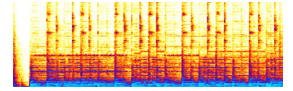
Location and Construction Activity	Predicted equipment noise level $L_{Aeq,15min}$, dB(A)	
	Commercial Monday to Saturday - when in use	Educational Monday to Saturday - when in use
	Criteria $L_{Aeq,15min}$, dB(A)	
	70	70
<i>Structural - Formwork</i>	58 to 70	63 to 75
<i>Structural - Concrete place</i>	63 to 72	68 to 78
<i>Façade - Installation of glazing</i>	62 to 69	68 to 75
<i>Fit-out - Services install</i>	33 to 54	48 to 69
<i>Fit-out - Masonry</i>	43 to 48	58 to 63
<i>Fit-out - Internal linings and Joinery</i>	33 to 46	48 to 61
<i>Fit-out - Floor finishes and tiling</i>	34 to 44	50 to 59
<i>External Works - In ground services</i>	64 to 69	69 to 74
<i>External works - Landscaping</i>	50 to 72	55 to 78

Table 6: Predicted equipment/plant noise levels at the nearest commercial and educational sensitive receiver - Levels predicted to exceed the worst-case criteria are in **red**. Items shaded in grey are works to be carried out internally within the building

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3.5 Vibration Assessment

With regard to construction vibration, we make the following comments:

- There is no change in vibration criteria for OOH works from previous assessments.
- Demolition is the most vibration intensive stage of any construction project. These works are already complete and will not be included as part of the OOH works.

Acoustic Studio has previously assessed construction vibration impacts and with consideration of the above comments, there are no adverse vibration impacts expected at surrounding receivers around the project site during OOH works.

3.6 Discussion of Results

Based on the results above, it is likely that unrestricted construction activities will, at times, exceed the stated criteria at the nearest sensitive receivers. These times are indicated by **red** values in Tables 5 and 6.

It is noted that these predictions are based on a typical worst case with a general consideration of works being carried out at a position on the construction site nearest to the potentially affected receiver and activities generally being carried out continuously.

It is noted that Central Park (the nearest residential, retail and commercial receivers) are affected by high levels of construction noise and also has a direct line of site to noise exposure from current construction sites that are separate from the UTS project site. Therefore, the likelihood of construction noise complaints are less likely than would be the case if the UTS construction site is the only noise source affecting Central Park.

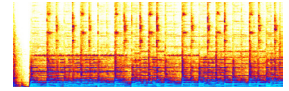
With respect to noise impacts at the nearest commercial and educational receivers, it is noted that the criteria does not change during OOH works as the criteria applies "when in use". Therefore there is no additional impact from OOH works when compared to standard hours at these receivers.

For each of the construction activities assessed and assuming that, in fact, these activities are found to exceed the noise criteria, then the noise control measures and construction best practices presented in Section 4 shall be considered and implemented wherever reasonable and feasible. For OOH works, work scheduling and on site management is considered the most effective and practical measures that can be implemented to minimise the impact on noise sensitive receivers.

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4. Control Elements

As a general rule, prevention should be applied as universal work practice at any time of day, but especially for the occasional construction works to be undertaken at critical times outside normal daytime/weekday periods.

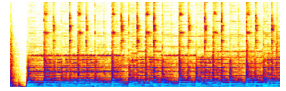
It is noted that the reduction of noise at the source and the control of the transmission path between the construction site and the receiver(s) are the preferred options for noise minimisation. Providing treatments at the affected residences or other sensitive land uses should only be considered as a last resort. Construction noise shall be managed by implementing the strategies listed below:

- *Plant and equipment.* In terms of both cost and results, controlling noise and vibration at the sources is one of the most effective methods of minimising the impacts from any work site activities. Work practices that will reduce noise and vibration at the source include:
 - Employing quieter techniques for all high noise activities such as rock- breaking, concrete sawing, and using power and pneumatic tools.
 - Use quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks.
 - Selecting plant and equipment with low vibration generation characteristics.
 - Operate plant in a quietest and most effective manner.
 - Where appropriate, limit the operating noise of equipment.
 - Regularly inspecting and maintain plant and equipment to minimise noise and vibration level increases, to ensure that all noise and vibration reduction devices are operating effectively.
 - Where appropriate, obtain acoustic test certificates for equipment.
- *On site noise management.* Practices that will reduce noise from the site include:
 - Maximising the distance between noise activities and noise sensitive receivers. Strategically locate equipment and plant.
 - Undertaking noisy fabrication work off-site where possible.
 - Avoid the use of reversing beeping alarms or provide for alternative systems, such as broadband reversing alarms, particularly during night or out-of-hours works.
- *Work scheduling.* Scheduling work during periods when people are least affected is an important way of reducing adverse impacts. The following scheduling aspects may reduce impacts:

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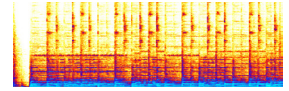
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- Restricting very noisy activities to daytime, restricting the number of nights that after-hours work is conducted near residences, or by determining any specific requirements, particularly those needed for noise sensitive receivers such as teaching, study or research spaces.
 - Scheduling activities to minimise impacts by undertaking all possible work during hours that will least adversely affect sensitive receivers and by avoiding conflicts with other scheduled events (i.e. University exam periods).
 - Scheduling work to coincide with non-sensitive periods (i.e. work near education facilities during weekends or school holidays).
 - Scheduling noisy activities to coincide with high levels of neighbourhood noise (such as traffic noise from Broadway affecting Central Park) so that noise from the activities is partially masked and not as intrusive.
 - Planning deliveries and access to the site to occur quietly and efficiently and organising parking only within designated areas located away from sensitive receivers.
 - Optimising the number of deliveries to the site by amalgamating loads where possible and scheduling arrivals within designated hours.
 - Designating, designing and maintaining access routes to the site to minimise impacts.
 - Including contract conditions that include penalties for non-compliance with reasonable instructions by the principal to minimise noise or arrange suitable scheduling.
- *Consultation, notification and complaints handling.*
 - Provide information to neighbours before and during construction.
 - Maintain good communication between the community and Project staff.
 - Have a documented complaints process and keep register of any complaints.
 - Give complaints a fair hearing and provide for a quick response.
 - Implement all feasible and reasonable measures to address the source of complaint.

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Implementation of all reasonable and feasible mitigation measures for all works will ensure that any adverse noise impacts to surrounding receivers are minimised when noise goals cannot be met due to safety or space constraints



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4.1 Noise Monitoring

The Contractor should consider implementing environmental noise monitoring at the boundary of the construction site at the nearest residential sensitive receiver, particularly for OOH activities.

An allowance of 1.5 days per week, at least, should be dedicated to monitoring of noise for the first 4 weeks of OOH works. Further monitoring should be reviewed after this time or sooner should it be deemed necessary by the Acoustic Consultant and the Project Manager. This should take place mainly at the above locations although other locations and plant and equipment monitoring should take place as and when necessary.

The Contractor should prepare a noise monitoring report each month of OOH works for review by the Project Manager. The reports should summarise and interpret the results of the noise monitoring carried out during the past month.

4.2 Communication and Complaints

The Contractor should establish a communications register for recording incoming complaints. The registration of a particular item will remain open until the complaint has been appropriately dealt with.

In addition, the following procedures are an example of the procedures that should be specifically adopted for complaints relating to noise.

Upon receipt of a complaint The Contractor should:

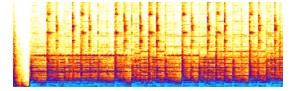
- Try to ascertain from the complaint which appliance is causing the problem i.e. inside or outside the site and in what position.
- Establish from the monitoring equipment if the allowable noise levels have been complied with.
- Establish if the appliance positioning has previously been highlighted as a problem area. If not and the noise levels are above the allowable limit, then the equipment and its position shall be noted.
- Move machinery if the allowable levels have been exceeded or take other acoustic remedial action.

If the activity is occurring outside normal working hours, the activity should be immediately stopped. Where stopping the activity would create a safety issue the activity may be permitted to continue only as long as is necessary to make the area safe. The activity should then cease.

Any activity which is directed to cease due to excessive noise should not recommence until the Project Manager is satisfied that the noise and vibration limits requirements can be met and has given permission to recommence the activity.

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The Site Supervisor should ensure that a report of any incident is provided to the Project Manager.

The Project Manager should provide a report on the incident to the relevant stakeholders.

The Contractor should provide a 24-hour telephone contact number and this number should be prominently displayed on the site.

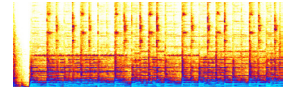
4.3 Non-compliances

Non-compliance reports can be used as appropriate to deal with failures to meet the construction noise management and control requirements.

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5. Summary and Conclusions

A construction noise and vibration assessment report has been produced for proposed OOH activities to facilitate the construction phase of the acceleration of the UTS Central Project development.

Appropriate criteria for OOH construction noise levels have been established based on relevant guidelines and standards.

Based on the results above, it is likely that unrestricted construction activities will, at times, exceed the stated criteria at the nearest sensitive receivers. These times are indicated by **red** values in Tables 5 and 6.

For each of the construction activities assessed and assuming that, in fact, these activities are found to exceed the noise criteria, then the noise control measures and construction best practices presented in Section 4 shall be considered and implemented wherever reasonable and feasible. For OOH works, work scheduling and on site management is considered the most effective and practical measures that can be implemented to minimise the impact on noise sensitive receivers.

We trust that this information is valuable to you. If you have any questions or comments, please do not hesitate to contact us.

Yours sincerely,

Jorge Reverter

Acoustic Engineer,
Acoustic Studio Pty Ltd

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