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17 July 2014

John Holland Pty Ltd
Level 3, 65 Pirrama Road
Pyrmont NSW 2009

Attention: Dominic Begley

Dear Dominic,

ABERCROMBIE PRECINCT REDEVELOPMENT - CONSTRUCTION NOISE & VIBRATION MANAGEMENT PLAN FOR EXTENDED CONSTRUCTION HOURS

Construction associated with the Abercrombie Precinct redevelopment is currently underway. The Project Approval stipulates that construction must take place between 0700-1800hrs Monday to Friday and between 0800-1500hrs on Saturdays. John Holland Pty Ltd (John Holland) is seeking to extend the construction hours to 1800-0000hrs Monday to Friday and 1500-2200hrs Saturdays for considerably less noisy construction activities. Marshall Day Acoustics (MDA) have been engaged to prepare a noise and vibration management plan to address the out of hours construction activity.

This letter report is issued as an addendum to the construction noise and vibration management plan issued for the construction phase of the Abercrombie project (refer *Rp001 R00 2013244SY JH-B834-PLN-EMP-NVECP-012-A*) and should be read in conjunction with this report.

OBJECTIVE

In order to complete construction associated with this project on or by 31 January 2015 and meet project deadlines, John Holland propose to schedule less noisy construction activities outside of standard construction hours. The purpose of this plan is to provide strategies to minimise the disruption at the nearest affected receivers from the construction work that is proposed to take place outside of standard construction hours.

NOISE AFFECTED RECEIVERS

The nearest noise sensitive receivers have been identified in Table 1 of our report (*Rp001 R00 2013244SY JH-B834-PLN-EMP-NVECP-012-A*) and are reproduced here for reference.

Table 1: Representative receivers

Receiver	Location	Description
A	109 Darlington Road	Two storey residential dwelling
B	415 Abercrombie Street	Darlington Public School
C	405 Abercrombie Street	Boundary Lane Childcare Centre
D	391 Abercrombie Street	The Shepherd Centre
E	385 Abercrombie Street	Mandelbaum House

Of these receivers, the Shepherd Centre and the Boundary Lane Child Care centre will both be demolished prior to the commencement of out of hours construction works. Therefore they have been excluded from this assessment. Furthermore, the Darlington Public School is not expected to operate during the proposed extended construction hours and therefore it has also been excluded from this assessment.

Figure 1 indicates the location of the nearest affected receivers in relation to the construction site.

Figure 1: Location of the subject construction site and representative receivers

NOISE AND VIBRATION CRITERIA

Construction noise criteria

Construction noise criteria for this development have been derived based on the requirements of the *Interim Construction Noise Guideline* (CNG). Background noise levels identified in the Noise Impact Assessment report prepared by MDA (refer *Rp001 R06 201009de Noise Impact Assessment*) have been used to derive appropriate criteria applicable to construction activities proposed outside of approved construction hours. Table 2 below presents a summary of the criteria with a full derivation set out in Appendix B.

Table 2: Construction noise management levels

Receiver	Type	RBL, dB L_{A90}[1]	Management level, dB $L_{Aeq, 15mins}$
A	Residential	43	48
E	Residential	43	48

1: Based on the evening time period RBL

Construction vibration criteria

The German Standard DIN 4150-3 *Structural vibration - Part 3: Effects of vibration on structures* (DIN 4150)provides vibration limits below which there is unlikely to be any cosmetic damage to buildings. The vibration limits for short-term vibration are detailed in Table 3 below.

Table 3: Guideline values for vibration velocity to evaluate the effects of short-term vibration on structures

Line	Type of structure	Guideline values for velocity, in mm/s			
		Vibration at the foundation at a frequency of			Vibration at horizontal plane of higher floor at all frequencies
		1-10Hz	10-50Hz	50-100Hz*	
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and area of great intrinsic values (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8

*At frequencies above 100 Hz, the values given in this column may be used as minimum values.

Source: DIN 4150-3 Table 1

CONSTRUCTION NOISE AND VIBRATION IMPACT ASSESSMENT

Construction activities taking place outside standard construction hours will be restricted to non-structural works. The following trades are expected to be employed outside of standard construction hours:

- Floor lining and carpet laying
- Plastering
- Tiling
- Joinery installation
- Services fit out including electrical and communications wiring
- Painting

In general these activities are not expected to be excessively noisy and the tools used for these activities are mostly small and battery operated. Furthermore, it is proposed that all construction work taking place outside of standard construction hours will take place within the building envelope and work will not commence until the glass facade has been installed to the floor under consideration. This has been further detailed in the management plan.

We envisage that a combination of the following equipment/tools will be used during the out of hours construction works:

Table 4: Anticipated activities and equipment schedule

Activity	Equipment
Floor lining including carpet laying	Hand-held tools (knife)
Plastering	Electric mixer Screw gun
Tiling	Electric mixer
Joinery Installation	Screw gun
Services fit out including electrical and communications wiring	Screw gun Oxy-acetylene
Painting	Compressor motor for spray gun
Ceiling fixing	Screw gun
General construction	Electric lights in building

Construction noise

Noise levels from proposed construction activities during the extended construction hours have been calculated at the nearest noise sensitive receivers.

For the purpose of our calculations we have calculated the noise level from each activity that is proposed to take place outside of standard construction hours. The calculations assume, as a worst-case scenario, each activity will take place simultaneously on up to four levels of the building once the facade has been made watertight

Details of the building facade construction have been provided by John Holland. It is understood the facade will primarily be constructed of a double glazed unit made up as follows:

- 6mm glass / 12mm air gap / 11.52mm laminated glass

This glazing system is expected to achieve a sound insulation rating of R_w 42. The glazing will be the weakest element of the facade, with the remainder of the facade being of lightweight construction with a sound insulation performance greater than R_w 45. Facade construction details are provided in Appendix D.

We have presented data below for "worst-case" situations where noise sources will be closest to the noise sensitive receivers and also for the "average" situation, with noise sources located towards the centre of the site. The latter is likely to be representative of the long-term noise emissions. The noise levels presented below are external noise levels calculated at the facade of the worst affected floor of the affected receiver.

Table 5: Calculated noise levels from proposed construction activities

Receiver	Management level, dB $L_{Aeq, 15min}$	Assessment scenario	Plastering	Services Fitout	Tiling	Ceiling Fixing	Joinery Installation	Painting
A	48	Worst case	37	37	25	36	36	38
		Average	33	33	21	33	33	34
E	48	Worst case	45	45	31	45	45	45
		Average	36	37	24	36	36	37

Note: Carpet laying has not been considered in the above assessment as the tools associated with it are not expected to generate significant noise.

The calculated noise levels indicate that the average noise levels associated with the construction activities proposed outside of standard construction hours will comply with the construction noise management levels.

Construction equipment should be chosen so as to minimise the noise impact on the nearest impacted receivers. Its use in the vicinity of impacted receivers should be scheduled earlier in the evening time period as far as practicable. Furthermore, tile cutting should be restricted to not take place during the extended construction hours.

Construction vibration

No high vibration generating activities are proposed during the extended construction hours. Therefore, we do not expected the nearest receivers to experience vibration impacts.

NOISE AND VIBRATION MANAGEMENT PLAN FOR CONSTRUCTION OUTSIDE STANDARD HOURS

In addition to the management practices and noise and vibration control techniques provided in the construction noise and vibration management plan for the project (refer *Rp001 R00 2013244SY),* the following controls will be employed to minimise the potential noise impacts from activities taking place outside of standard construction hours:

- Consultation with the community will need to be carried out as per the recommendations made in the construction noise and vibration management plan for the project
- Out of hours construction will only commence on each level of the building once the facade has been made watertight. This in itself will prove to be the most effective mitigation strategy as it endeavours to contain construction noise within the building
- Noisier construction activities taking place within the building will be scheduled to take place away from receivers during the later hours of the evening as far as practicable
- Tiling activity will be restricted to the installation of tiles and tile cutting will not take place during the extended construction hours
- Deliveries to the site will not occur outside of standard construction hours
- Scaffolding erection associated with painting activities will not take place outside of standard construction hours
- Workers working within the building will be encouraged to keep voice levels to a minimum
- All sub-contractors will be encouraged to car pool or use public transport
- Parking will be made available for all staff in the underground car park (once completed) to minimise impact on the surrounding streets and limit noise when staff leave the site at night
- In addition to implementing the complaint-handling procedure detailed in the construction noise management plant, if any tools/equipment related to out of hours construction work are found to give rise to complaints from affected receivers, then these activities will be rescheduled to only occur during the standard construction hours.

We trust this information is satisfactory. If you have any further questions please do not hesitate to contact us.

Yours faithfully

MARSHALL DAY ACOUSTICS LTD

Anjali Chandhok

Consultant

APPENDIX A ACOUSTIC TERMINOLOGY

Ambient — The ambient noise level is the noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.

SPL or L_P — Sound Pressure Level
A logarithmic ratio of a sound pressure measured at distance, relative to the threshold of hearing (20 µPa RMS) and expressed in decibels.

SWL or L_W — Sound Power Level
A logarithmic ratio of the acoustic power output of a source relative to 10^{-12} watts and expressed in decibels. Sound power level is calculated from measured sound pressure levels and represents the level of total sound power radiated by a sound source.

dB — Decibel
The unit of sound level.

Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of Pr=20 µPa i.e. dB = 20 x log(P/Pr)

dBA — The unit of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.

A-weighting — The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.

$L_{Aeq\ (t)}$ — The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level.

The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.

L_{A90} — The A-weighted noise level equalled or exceeded for 90% of the measurement period. This is commonly referred to as the background noise level.

L_{Amax} — The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.

Vibration

When an object vibrates, it moves rapidly up and down or from side to side. The magnitude of the sensation when feeling a vibrating object is related to the vibration velocity.

Vibration can occur in any direction. When vibration velocities are described, it can be either the total vibration velocity, which includes all directions, or it can be separated into the vertical direction (up and down vibration), the horizontal transverse direction (side to side) and the horizontal longitudinal direction (front to back).

PPV

Peak Particle Velocity

For Peak Particle Velocity (PPV) is the measure of the vibration aptitude, zero to maximum. Used for building structural damage assessment.

VDV

Vibration Dose Value

Vibration Dose Value is based on British Standard BS 6472:1992 Guide to Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz) and provides guidelines for the evaluation of whole body exposure to intermittent vibration.

VDV can be used to take into account the weighted measured RMS vibration from many vibration sources including rail vehicles, construction equipment such as jackhammers and industry. VDV takes into account the duration of each event and the number of events per day, either at present or in the foreseeable future and calculates a single value index.

APPENDIX B CONSTRUCTION NOISE CRITERIA

The NSW EPA Interim Construction Noise Guideline (CNG) provides guidance for assessing noise associated with construction activities. The CNG sets out management levels above which there may be community reaction to construction noise.

The noise management levels for residential receivers affected by construction noise are derived from the Rating Background Level detailed in the Environmental Assessment prepared by MDA (refer *Rp001 R06 2010009de Noise Impact Assessment*) and adding 5dB for construction outside of the recommended hours set out in the CNG.

The construction noise management level for residential receivers that will be impacted by the extended construction hours are provided in Table B1 below.

Table B1: Construction noise management levels

Receiver	Type	RBL, dB L_{A90}	Management level, dB $L_{Aeq,\ 15mins}$
Darlington Road Residential	Residential	43	48
Mandelbaum House Residential	Residential	43	48

In applying the management level, the CNG requires that all feasible and reasonable work practices are employed. Where the management level is exceeded, all potentially impacted receivers should be informed.

APPENDIX C CONSTRUCTION NOISE SOURCES

A variety of construction plant will be used for this project. Table C1 provides a schedule of construction equipment that is anticipated to be used on this site and their noise levels as taken from:

- BS5228:1-2009 *Code of practice for noise and vibration control on construction and open sites - Part 1: Noise*
- AS 2436-2010: *Guide to noise and vibration control on construction, demolition and maintenance sites*.

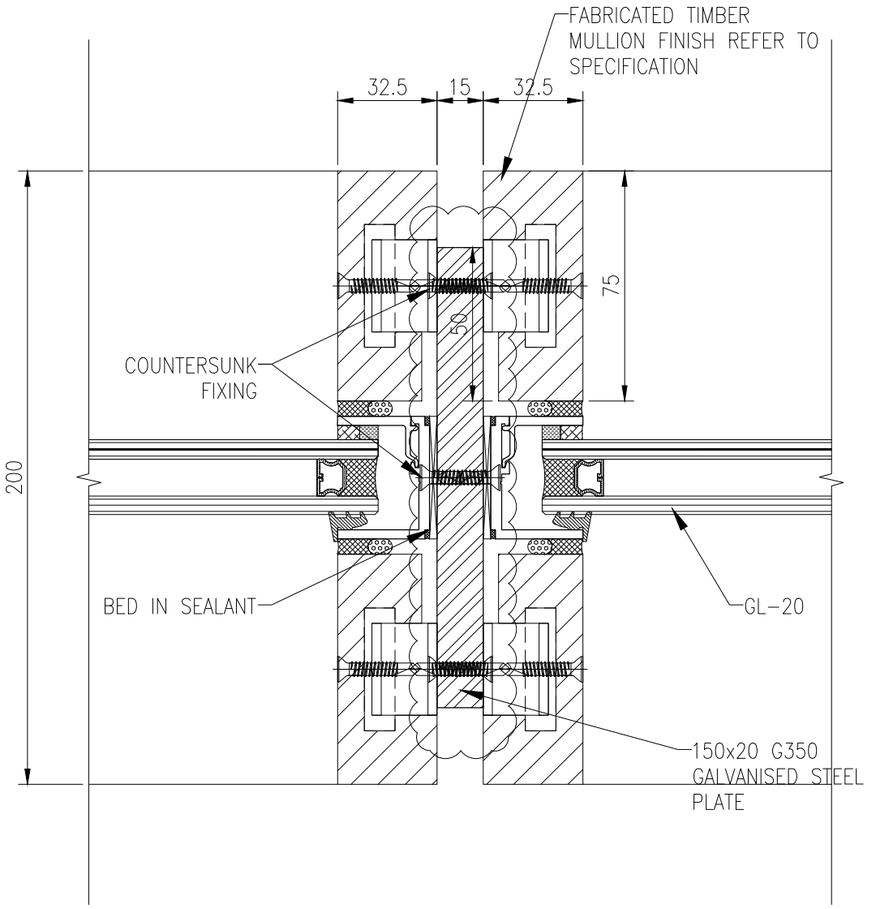
Table C1: Construction noise source sound power levels (L_{WA}), dB re 10^{-12} W

Noise source	A-weighted sound power level, dB L_{WA}	Source
Nail gun	101[1]	BS5228:1-2009
Small mixer	90[1]	BS5228:1-2009
Hand-held gas cutter	93[1]	BS5228:1-2009
Compressor (silenced)	101	AS2436-2010

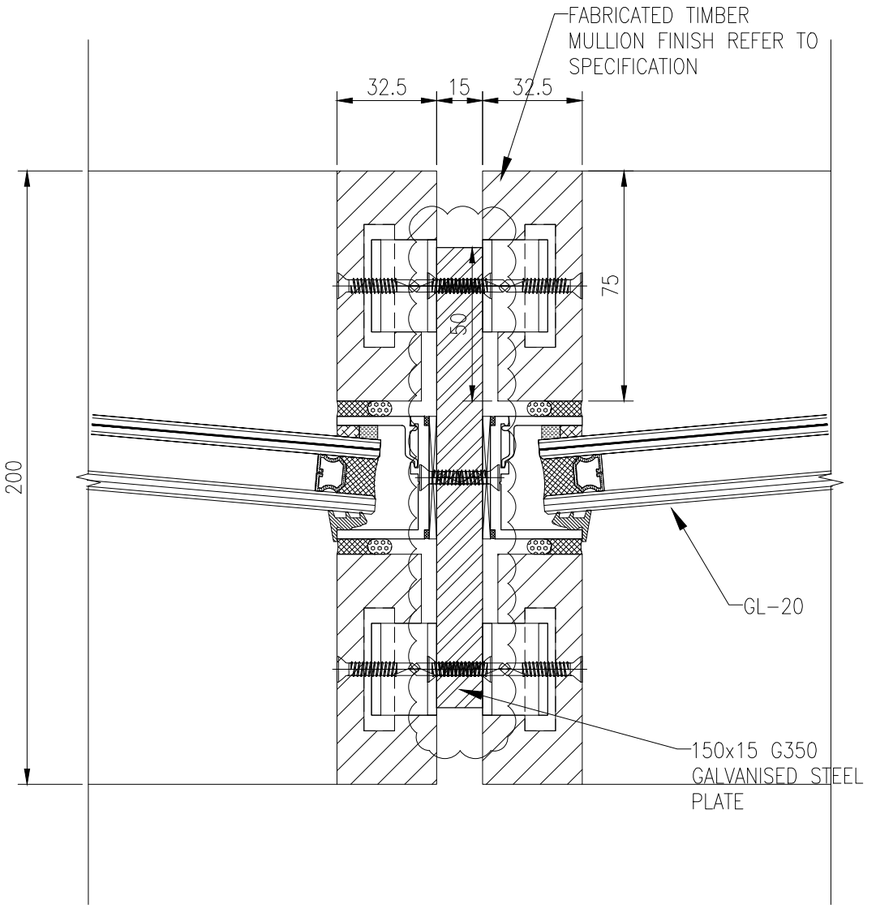
Note 1: Sound power level calculated based on the sound pressure level provided in BS5228:1-2009

APPENDIX D FACADE DETAILS

REFER TO THE FOLLOWING :
- SD FACADE SPECIFICATION (LATEST REVISION)
- GENERAL NOTES PAGE SK-FT-000
- ARCHITECTURAL DRAWING FOR SETTING OUT



01 TIMBER MULLION VISION HORIZONTAL SECTION



02 TIMBER FACETED MULLION HORIZONTAL SECTION

INFORMATION
NOT FOR CONSTRUCTION

Rev	Date	Revision Details	Drn	Ver.	App.
C	28.11.13	ISSUED FOR TENDER	SW		
B	25.10.13	ISSUED FOR TENDER	SW		
A	13.09.13	ISSUED FOR TENDER	GMc		

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ARCHITECT :

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ABERCROMBIE PRECINCT REDEVELOPMENT

ABERCROMBIE PRECINCT, DARLINGTON, NSW 2008

Drawing Title:

TYPICAL TIMBER MULLION VISION

FACADE TYPE WD-01

Drawn	Signed	Date	Verified	Signed	Date
SW					
Designed	Signed	Date	Approved	Signed	Date
GMc			BMD		

Project No.	Scale:	Sheet Size
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Drawing No.	Revision:	
SK-WD01-001	C	

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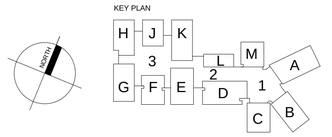
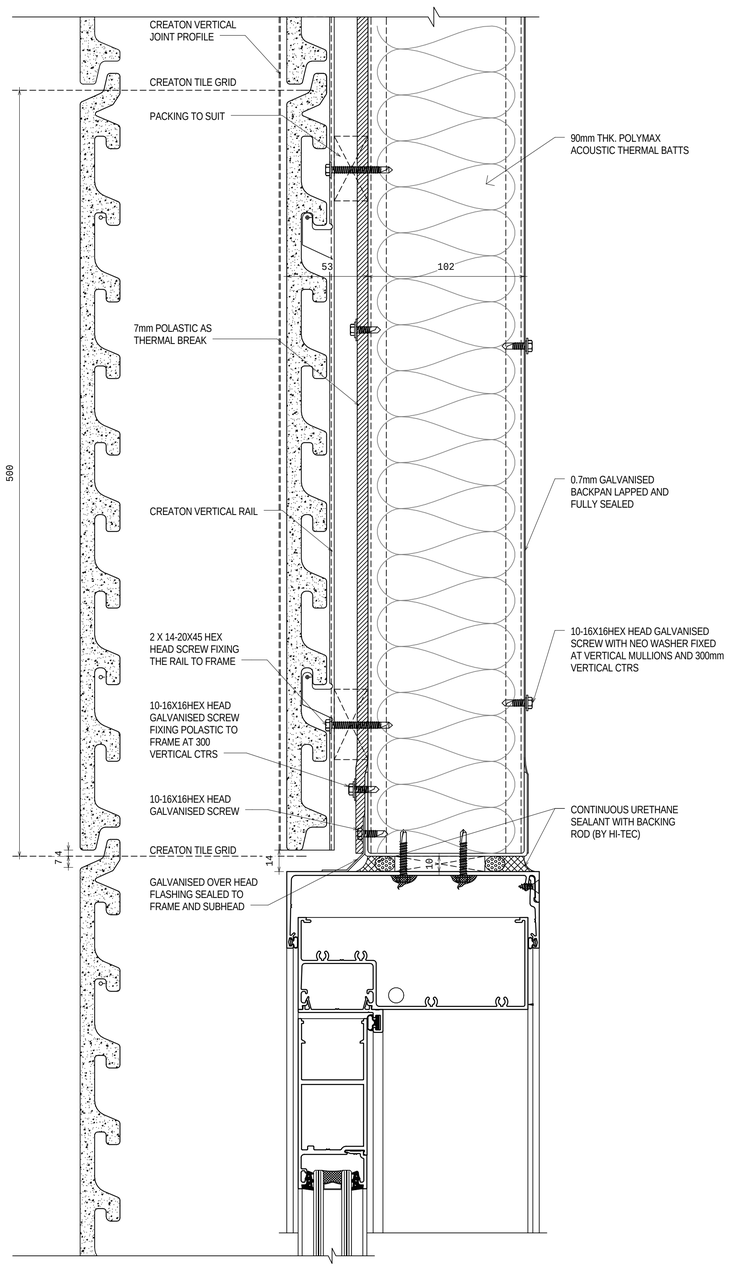
KEY PLAN





Rev.	Date	Amendment
2	26/06/2014	FOR APPROVAL
1	13/06/2014	FOR INFORMATION

Principal :

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UNIVERSITY OF SYDNEY

SCHOOL OF BUSINESS

ABERCROMBIE PRECINCT DARLINGTON NSW, 2008

Drawing:

TYPICAL INTERFACE OF TILE AND WINDOW HEAD

Drawing No:
STN-BUS-FAC-SHD-552

Scale:
1 : 2 @ A1 sheet size

Project No:
146

27/06/2014 2:56:40 AM :Plot Date