Stanton Dahl Architects

Charlton Christian College, Fassifern

Master Plan Acoustic Assessment for the Proposed Facilities Upgrade

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PREPARED FOR:	**PREPARED BY:**
Stanton Dahl Architects	Vipac Engineers & Scientists Ltd
P O Box 833	2 Sirius Rd
Epping NSW 1710	Lane Cove NSW 2066
	AUSTRALIA
Contact: Habib Hayek	**e**: Sydney@vipac.com.au
Phone: +61 2 9868 4955	**t**: +61 2 9422 4222
Fax : +61 2 9868 2624	**f**: +61 2 9420 5911

AUTHOR:	J. J. Ameli	
	Jimmy Ameli	Date: 02-04-2013
	Acoustic Engineer	
REVIEWED BY:		
	Sean Matthews	Date: 02-04-2013
	Project Engineer, Acoustics	
ISSUED BY:		
	Fu Siong Hie	Date: 02-04-2013
	Senior Acoustic Consultant	

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EXECUTIVE SUMMARY

Vipac Engineers & Scientists Ltd. (VIPAC) has been commissioned by Stanton Dahl Architects to provide a report on the acoustic issues related to the Master Plan for the proposed upgrade of Charlton Christian College, Fassifern.

A noise survey was conducted to measure the ambient and traffic noise. Limiting noise criteria for mechanical plant/equipment and school activities have been determined based on the NSW Industrial Noise Policy (see Section 6.4).

Noise issues related to the school upgrade have been considered. Areas where noise emissions could impact the surrounding neighbours have been identified. Issues related to noise intrusion into the external & internal spaces have been identified and discussed (see Section 7).

In conclusion, our calculations indicate that the acoustic design of the internal spaces and associated mechanical services would not create major noise impacts upon the surroundings provided the given recommendations are implemented.

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1 INTRODUCTION

Vipac Engineers & Scientists Ltd. (VIPAC) has been commissioned by Stanton Dahl Architects to provide an acoustic assessment for the Master Plan of the proposed upgrade at Charlton Christian College, Fassifern. The school intends to extend/upgrade the facilities and to increase the number of students from 615 to 900.

The school will typically operate between 8 am and 5 pm Monday to Friday. It will also have occasional evening activities such as meetings or teacher-parent interviews, which will end by 10 pm.

The following standards will be used in the assessment.

- NSW School Facilities Standard;
- NSW OEH Industrial Noise Policy;
- AS/NZ 2107:2000- Recommended design sound levels and reverberation times for building interiors;
- NSW OEH Road Noise Policy.

2 SITE DESCRIPTION

The site is bound by Fassifern Road to the east and north-east, Narara Street to the south, and bushland vegetation to the west and north-west. The site plan is shown in Figure 1.

Figure 1: Site plan and measurement location

The noise sensitive receivers adjacent to the school will be the residential buildings across Fassifern Road and those across Narara Street.

3 PROPOSED UPGRADE

The master plan drawing showing the existing layout and the proposed extensions and upgrades is shown in Figure 2.

Figure 2: Master plan drawing

The revised masterplan upgrade involves:

- Addition of 3 GLA buildings and admin/staff building.
- Expansion of library area.
- Addition of a trade training centre used for technology training and manual arts.
- Specialist GLAs eg for music or visual art.
- Outdoor play areas including PE court.
- Addition of mechanical services for the above buildings.
- Extension of the existing carpark (carpark 2) and addition of a carpark on the north (carpark 1).

4 NOISE ISSUES FOR CONSIDERATION

In our opinion the following noise issues should be considered in the assessment:

- Noise emissions from the school new buildings and the carpark.
- Noise impact issues upon the surrounding related to student number increase from 615 to approximately 900.
- Mechanical services noise impact on the surroundings and on the internal spaces.
- Traffic noise intrusion into the school.
- Construction noise emissions.

5 CRITERIA

5.1 MECHANICAL SERVICES NOISE

A search was conducted on Lake Macquarie Council DCPs to find the noise limit for mechanical noise. As this is not defined by the council, NSW OEH Industrial Noise Policy was used.

The procedures detailed in OEH Industrial Noise Policy has two requirements that must be met, namely:

- that the noise source not be 'intrusive'; and also
- that the 'amenity' of the nearby land be preserved.

This policy sets out two separate noise criteria designed to ensure developments meet environmental noise objectives. The first criterion accounts for intrusive noise and the second criterion applies to protection of amenity of particular land uses. The new development is assessed by applying both the amenity and intrusiveness criteria to the situation and adopting the more stringent of the two. This becomes the project specific noise levels. Applying the most stringent requirement as the Project Specific Noise Levels ensures that both intrusive noise is limited and the amenity is protected.

5.2 BUILDING ACOUSTIC DESIGN CRITERIA

5.2.1 Internal Noise Level Design criteria

To ensure that the building envelope protects against external noise intrusion such as traffic and mechanical services noise, the internal noise levels should be assessed in accordance with the NSW School Facilities Standard and Australian Standard *AS/NZS 2107: 2000 Acoustics – Recommended Design Sound Levels and Reverberation times for Building Interiors (Table 1).*

The following Table 1 presents the recommended values by AS 2107 and by the School Facilities Standard.

Table 1: Recommended design sound levels for building interiors, educational buildings

Type of occupancy/activity	AS2107 Recommended design sound level, L_{Aeq}, dB(A)		SFS Recommended design sound level
	Satisfactory	Maximum	
Communal Hall (as learning space, seminar, assembly halls)	30	40	Not specified
Manual art workshop	40	45	-
Teaching spaces	35	45	-
Gymnasium	45	55	NR 30
Movement studio (as music practice rooms)	40	45	45

5.3 OEH NSW ROAD NOISE POLICY

Table 2 presents the OEH's road traffic noise assessment criteria for land use developments with potential to create additional traffic on existing roads. The external criteria are assessed at 1 metre from the affected residential building façades and at a height of 1.5 metres from the floor.

Table 2: Road traffic noise assessment for Residential Land Use.

Road Category	Type of project / land use	Assessment criteria, dB(A)	
		Day (7am - 10pm)	Night (10pm-7am)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq, (1\ hour)}$ 55 (external)	$L_{Aeq, (1\ hour)}$ 50 (external)

Note: In cases where noise exceeds the above criteria:

1. The OEH recommends that "where feasible, existing noise levels should be mitigated to meet the noise criteria. In this regard the RNP states that for existing roads there is limited potential for noise control as the development is not linked to road improvements. It does however advise that applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments."
2. For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.

5.4 GUIDELINES FOR CONSTRUCTION NOISE

The following guidelines for The Interim Construction Noise Guideline was developed by the NSW Office of Environment & Heritage.

The Guideline presents two ways of assessing construction noise impacts – the quantitative method, which is generally suited to longer-term construction, and the qualitative method, which is generally suited to short-term works such as infrastructure maintenance. Using a quantitative as described in the guideline the noise criteria as presented in Table 3 would be adopted.

Table 3: Noise at Residences Using Quantitative Assessment

Time of day	Management level, $L_{Aeq(15min)}$	How to apply
Recommended standard hours Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays and Public Holidays	Noise affected RBL+10dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended hours	Noise affected RBL+5dB	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 guideline.

6 NOISE SURVEY

6.1 OBSERVATIONS

VIPAC engineers visited the school site on 5th June for a site study and environmental noise survey. From our observations on site, the acoustic environment is dominated by the general ambient noise of the area and the traffic on Fassifern Road. Fassifern Road, which bounds the eastern boundary of the school is a sub-arterial road handling low-medium traffic volumes. The traffic peaks generally around 8 am and around 3 pm due to traffic associated with the school start and finish times.

The existing rail line, located approximately 145 m behind the school is the main line between Sydney and Newcastle and carries both passenger and freight trains. Rail link timetable indicates there are at least 1-2 trains that pass daily through Fassifern station each hour between 8 am- 3 pm. In our opinion, the train line will not have a noticeable noise impact as the train passbys are infrequent and the noise is considerably attenuated due to distance.

6.2 NOISE MEASUREMENTS

Unattended noise monitoring was conducted on site for a period of six days between the 5th and 12th June 2012. The monitor was located near the Fassifern Road boundary at the end of the existing carpark. This represents the ambient noise for the residential buildings across Fassifern Road. This location was chosen as the carpark extension is the most likely source which may have a noise impact upon the surroundings.

The monitor internal software calculated and stored the L_n percentile noise levels for each 15 minute sampling period. Measurements were made of L_{Amin}, L_{Amax}, L_{A90}, L_{A10}, and L_{Aeq}, the results were stored in an internal memory and were later retrieved for detailed analysis.

Attended noise measurements were conducted to obtain data for traffic noise. Traffic noise was measured at the boundary of Fassifern Road during afternoon peak. Measurement locations are shown in Figure 1.

6.3 INSTRUMENTATION

Measurements were conducted using the following equipment:

- Larson Davis Sound Level Meter LD812, Serial Number 0381.
- Bruel & Kjaer 2250 Sound Level analyser, Serial Number 2590541.
- Cirrus CRL 511E Sound Level Calibrator, Serial Number 21578.

The instruments were checked for calibration immediately before and after the measurements and there was no adverse deviation between the two. The instruments carry traceable calibration certificates. The sound analysers are Type 1 and comply with the Australian standard AS1259.2: 1990.

6.4 MEASURED NOISE LEVELS

For assessment purposes, the survey results were analysed in accordance with the OEH Industrial Noise Policy where the time periods are defined as:

- Day: 7am – 6pm.
- Evening: 6pm – 10pm.
- Night: 10pm – 7am.

Using the unattended noise monitor data the ambient noise levels have been established. The data for those periods where adverse weather conditions prevailed was disregarded. Table 4 presents a summary of ambient and background noise and Project Specific Levels for this site.

Table 4: Amenity Criteria, Intrusiveness Criteria and Project Specific Noise Levels at Noise Sensitive Receiver

All Values in dBA

Receiver Type	Period	L_{Aeq}	RBL	Recommended Acceptable L_{Aeq}[1]	Amenity Criteria	Intrusiveness Criteria	Project Specific Levels
Residential	Day	55	46	55	55	51	51
	Evening	54	44	45	45	49	45
	Night	50	35	40	40	40	40

Hence noise from mechanical plant and equipment and the operational noise from the school should not exceed the Project Specific Noise Levels specified above.

Attended traffic noise measurements were taken on Fassifern Road boundary during peak afternoon traffic. Traffic noise values obtained are presented in the following Table 5. Values have been rounded to the nearest 0.5 dB.

Table 5: Summary of Traffic Noise measurement Levels.

Day/Time	Traffic Noise level, $L_{eq\ -\ 15\ mins}$, dBA
5Th June 2012/2:30 pm- 2:45 pm	63.5
5Th June 2012/3:00 pm - 3:15 pm	64.0

[1] Recommended Acceptable L_{Aeq} noise level for residence in suburban areas from Table 2.1 in EPA Industrial Noise Policy

7 ASSESSMENT

7.1 INCREASE IN THE NUMBER OF STUDENTS

The school is making an application to increase the number of students from 615 to approximately 900 and will have a number of new learning spaces (3 GLA buildings & a technology teaching area, visual arts) built to accommodate the increase in number, therefore the increase in number is not expected to increase the noise emissions from the existing or the new buildings.

The school sports matches will be held at a sports field at a location remote from the school. The school oval will be used for PE sessions and training purposes. The oval does not have grandstands and will not have many spectators, therefore the increase in number of students will not result in an increase to the exiting noise level emissions from the oval.

7.2 GENERAL LEARNING AREAS (GLA)

The locations of the GLAs and other new buildings are shown in the master plan drawing in Figure 2. In general most new buildings are not noise generating and due to large setback from the road they will not cause a noise impact upon the surrounding, nor will have a noise impact from the road.

The nearest GLA will have a set back of 50 m from Fassifern Road. Traffic noise on Fassifern Road boundary was measured at Leq 64 dBA during afternoon peak. This noise will have a level of 53 dBA at the façade of the nearest GLA.

Considering the internal design noise levels specified in Table 1, a standard 4 mm monolithic glass will be adequate for the windows/doors to prevent any noise intrusion into the GLAs.

The GLAs are used for normal teaching therefore do not have any noise generating activities. The GLAs are not expected to have any noise emissions to the surrounding area.

It should be noted that a partially open window provides 10 dBA attenuation from outside to the inside. This indicates that the above noise within the GLAs and the technology teaching spaces will have a level of 43 dBA. This is within the criteria therefore natural ventilation mode may be used if required.

7.3 TRADE TRAINING CENTRE

The trade training centre will have 65 m setback from Fassifern Road. The corresponding peak traffic noise level outside this area will be 52 dBA. Considering the internal design noise levels specified in Table 1, a standard 4 mm monolithic glass will be adequate for the windows/doors to prevent any noise intrusion into the this space.

The trade training centre will be used as a manual art class and may be used for various activities such as painting and woodwork which involves the use of equipment. Noise associated with equipment such as electric saw, grinder, router may be present in this

building. However the building envelope and the large setback from Fassifern Road and Narara Street will provide adequate attenuation to the surrounding residential dwellings.

The internal noise level with the windows open will be 42 dBA which is within the design noise level specified in Table 1, therefore natural ventilation mode can be used if required.

7.4 NOISE EMISSIONS FROM THE CAR PARKS

Typical noise events associated with car movements will include:

- Vehicle movement (engine noise, tyre scuff, braking, etc)
- Engine starts
- Engine revving
- Car door slams

Drawings indicate that the existing carpark (carpark 2) has 74 car spaces. As a result of school upgrade, the parking spaces will be increased to 124.

Noise impact from the use of carpark 2 has been calculated to the residential boundary across Fassifern Road. It was assumed that all vehicles arrive within 1 hour prior to start time of the school in the morning. It has been assumed that the carpark is two thirds full. The attenuation effects of distance & directivity have been considered in the calculations.

Calculations indicate that the use of the carpark will result in a noise level of $L_{eq(1\ hr)}$ 45 dBA at the boundary of residential receivers across Fassifern Road. This complies with the day and evening criteria, therefore no further acoustic treatment will be required.

As carpark 1 has a larger setback from the road and from residential receivers, the noise levels will be lower than the above, hence it does not require any acoustic treatment.

7.5 NOISE FROM GENERATED TRAFFIC

Traffic data provided by the traffic consultant (Traffic Engineers Services report dated January 2013) was used to assess the noise increase levels due to the generated traffic. The traffic report has conducted an assessment and provides data for traffic volumes on the existing surrounding local roads and the generated traffic.

Fig 3 of the traffic report provides traffic volume figures for the existing traffic. The data is related to the morning and afternoon peak hours. The figures indicate that the total number of vehicles in the north direction during the am peak is 685 vehicles per hour (vph). For the south direction the figure is 662 vph. As the figures are close we have chosen to analyse the noise impact on Fassifern Road to the north of school entrance.

Section 6 of the traffic report states that the additional number of vehicles due to school upgrade (due to increase in the number of students) will be 30 vph. Calculations have been made to predict the vehicular noise increase due to school upgrade/increase in number of students. A summary of noise levels is presented in the following Table 6.

Table 6: Summary of generated traffic noise levels, AM peak

Location	Existing traffic (vph)	Generated traffic (vph)	Increase in noise level, dBA	Permitted noise increase dBA	Complies (Yes/No)
Fassifern Road- (North)	685	30	0.2	2.0	Yes

The noise level increase from the generated traffic on Fassifern Road will be within the allowable 2 dBA increase, therefore will comply with the requirements of the Road Noise Policy.

7.6 MECHANICAL SERVICES NOISE

Noise impact assessments should be conducted as soon as the mechanical plant and locations are finalised. The mechanical plant noise impact should be considered as follows :

7.6.1 External noise impact

At this preliminary stage, the design and selection of the mechanical plant has not been finalised therefore a noise impact assessment for mechanical equipment is not possible. A noise assessment should be conducted once the mechanical plant is finalised.

Noise emissions from air conditioning systems and mechanical plant such as exhaust, ventilation and supply air fans must be controlled to acceptable noise levels as shown in Table 4.

It is likely that the mechanical plant of each new building will be located close to that building, therefore due to large distances to the residential receivers, the possibility of noise impacts are minimal.

Typical amelioration measures are outlined below (not necessarily limited to):

- Construction of acoustic enclosures for plant equipment and acoustic louvers at ventilation openings.
- Location of plant equipment away from noise sensitive receivers.
- The extraction systems to be constructed such that the outlet is either shielded from the noise sensitive premises and/or is pointing in a direction at least 90 degrees away from the nearest residences.
- Achieving no direct 'line of sight' path between the nearest residences and all the major plant equipment, extraction and air conditioning systems.

7.6.2 Internal noise impact

The mechanical plant will have the potential for noise impact upon the closeby internal spaces. These could be sensitive areas such as classrooms where the internal noise levels are important. A full assessment should be conducted once the mechanical plant details

including the locations have been finalised. If exceedances occur acoustic treatments should be provided.

8 CONCLUSION

A noise survey was conducted to measure the ambient and traffic noise. Limiting noise criteria for mechanical plant/equipment and school activities have been determined based on NSW Industrial Noise Policy (see Section 6.4).

Noise issues related to the school upgrade have been considered. Areas where noise emissions could impact the surrounding neighbours have been identified. Issues related to noise intrusion into the internal spaces have been identified and discussed (see Section 7).

In conclusion, our calculations indicate that the acoustic design of the internal spaces and associated mechanical services would not create major noise impacts upon the surroundings provided the given recommendations are implemented.

APPENDIX A - ARCHITECTURAL DRAWINGS

The acoustic assessment carried out in this report was based on the following drawings supplied by Stanton Dahl Architects.

Drwg No.	Issue /Date	Description
A01/P4	05-02-2013	College master plan

APPENDIX B- GLOSSARY OF ACOUSTIC TERMS

Decibel, dB:

Unit of acoustic measurement. Measurements of power, pressure and intensity. Expressed in dB relative to standard reference levels.

dB(A):

Unit of acoustic measurement weighted to approximate the sensitivity of human hearing to sound frequency.

Sound Pressure Level, L_P (dB), of a sound:

20 times the logarithm to the base 10 of the ratio of the r.m.s. sound pressure to the reference sound pressure of 20 micro Pascals. Sound pressure level is measured using a microphone and a sound level meter, and varies with distance from the source and the environment.

Sound Power Level, L_W (dB), of a source:

10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 Pico Watt. Sound power level cannot be directly measured using a microphone. Sound power level does not change with distance. The sound power level of a machine may vary depending on the actual operating load.

Ambient Sound:

Of an environment: the all-encompassing sound associated with that environment, being a composite of sounds from many sources, near and far.

Percentile Level - L_{90}, L_{10}, etc:

A statistical measurement giving the sound pressure level which is exceeded for the given percentile of an observation period, e.g. L_{90} is the level which is exceeded for 90% of a measurement period. L_{90} is commonly referred to as the **"background"** sound level.

$L_{AEQ,T}$:

Equivalent continuous A-weighted sound pressure level. The value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval T, has the same A-weighted sound energy as the actual time-varying sound.

R_w – Weighted Sound Reduction Index:

A new single number quantity for airborne sound insulation rating which replaces STC. STC has been traditionally used for the classification of partitions and to define acoustical requirements in the Building Code of Australia.

For majority of partitions, the value for R_w will be similar to the value for STC. Partitions with particularly poor performance at 100Hz may have lower values for R_w than for STC. Conversely, partitions with poor performance at 4kHz may have higher values for R_w than for STC.

STC - Sound Transmission Class:

Of a partition separating two enclosed spaces: a single number evaluation of its ability to attenuate sound passing between the two spaces. STC takes into account the sound transmission loss in each band of a specified set of one-third octave bands.

Reverberation time (RT60)

Defined as the time required, in seconds, for the average sound in a room to decrease by 60 decibels after a source stops generating sound.

T_{mf}

Is the arithmatic average of reverberation times in the 500Hz, 1kHz and 2kHz octave bands.