"Gardens on Lindfield" Retirement Community - Traffic Noise Impact Assessment – Case Study

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Abstract

Gold Coast, the fastest growing city in Australia, is experiencing an unprecedented development boom. A major growth corridor is established along the recently completed Pacific Motorway (M1). Currently, M1 carries as much as 100,000 vehicles per day (Annual Average Daily Traffic - AADT). Within a planning horizon of 10 years (year 2014), the AADT is expected to be close to 180,000 vehicles. Major noise amelioration measures are becoming a necessity for establishment of noise sensitive developments along M1. Recently, a major earthmound along the M1 at Helensvale has been designed to protect the noise amenity of a newly established retirement community – *"Gardens on Lindfield"*. The recommended noise amelioration measures are presented. The earthmound was designed to bridge a gully along M1 that was a major conveyor of traffic noise. The results showed high efficiency in noise attenuation, ensuring compliance with the relevant road traffic noise criterion of 63dB(A) $L_{10(18\ Hour)}$ within a 10 year planning horizon.

Introduction

Gold Coast, the fastest growing city in Australia, is experiencing an unprecedented development boom. A major growth corridor is established along the recently completed Pacific Motorway (M1). Currently, M1 carries as much as 100,000 vehicles per day (Annual Average Daily Traffic - AADT). Within a planning horizon of 10 years (year 2014), the AADT is expected to be close to 180,000 vehicles. Major noise amelioration measures are becoming necessity for establishment of noise sensitive developments along M1.

belleng Pty Ltd was engaged by Cater Corporation Pty Ltd (the developer of the site) to provide noise amelioration measures to ensure that the noise amenity at the retirement community – *"Gardens on Lindfield"* is protected. The subject site is at the Gold Coast suburb of Helensvale at the junction of the Pacific Motorway (M1) and the Gold Coast Highway (Figure 1). Road traffic noise was recognised as a major constraint on the site. The project brief was to ensure that the noise amelioration measures are efficient, cost effective and acceptable by the Department of Main Roads (DMR) and the Gold Coast City Council (GCCC).

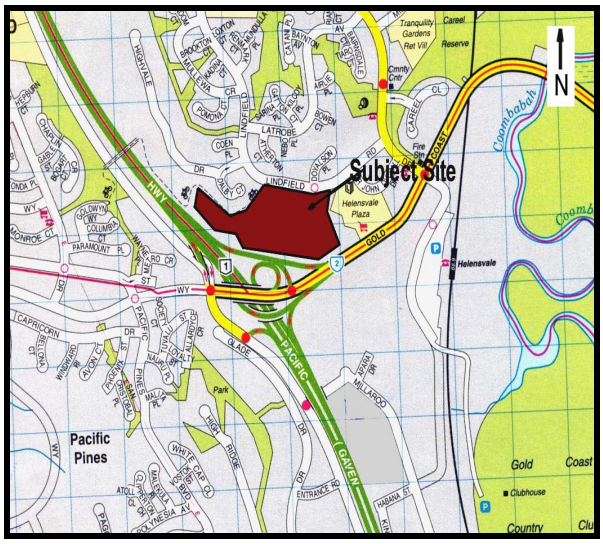

Figure 1. Locality Plan

"Gardens on Lindfield" is a staged development with the most recent stages (Stages 10, 11A and 12) currently under development. The development layout is presented in Figure 2.

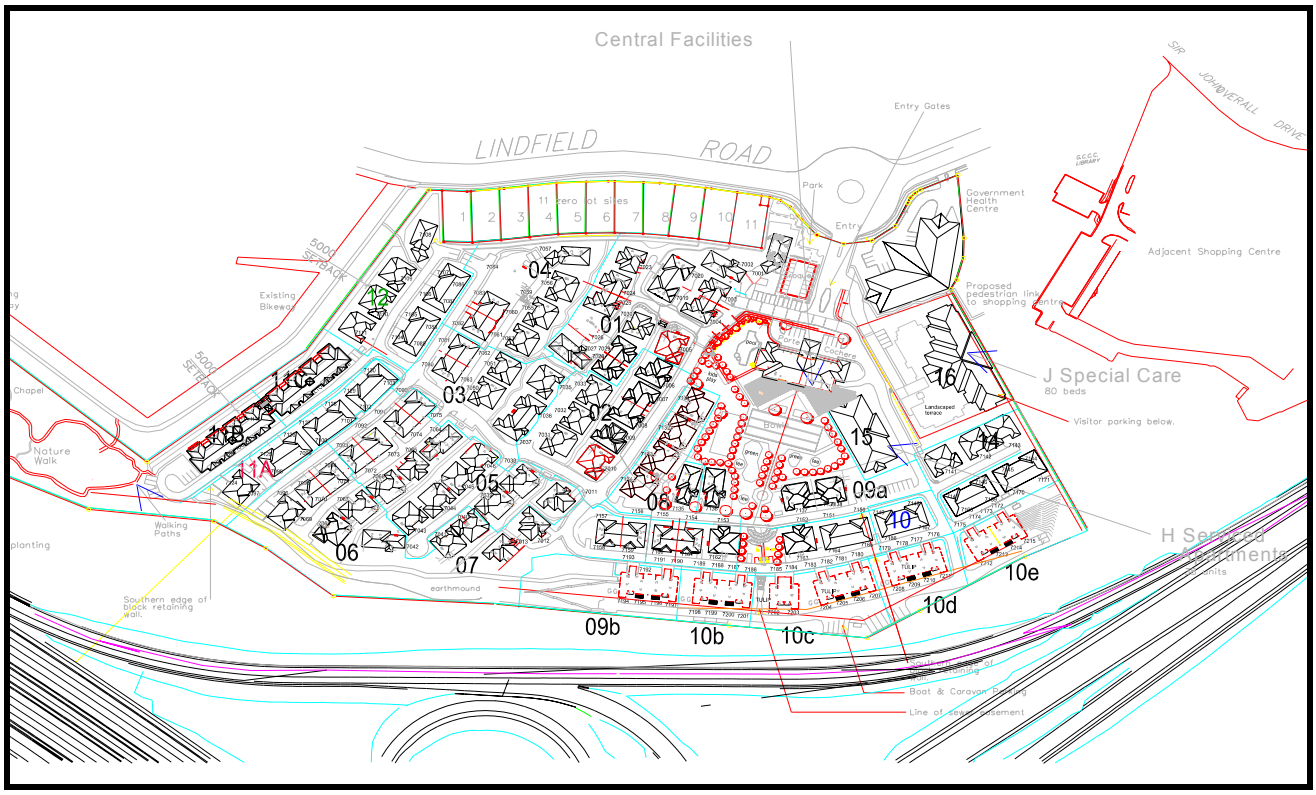

Figure 2. "*Gardens on Lindfield"* – Stages 10, 11A and 12

Traffic Noise Impact Assessment

Existing Noise Amenity

Site specific noise measurements were carried out to obtain traffic noise data for the verification of the TNOISE road traffic noise calculation model developed by Main Roads Western Australia.[1] The locations of the noise measurements are presented in Figure 3.

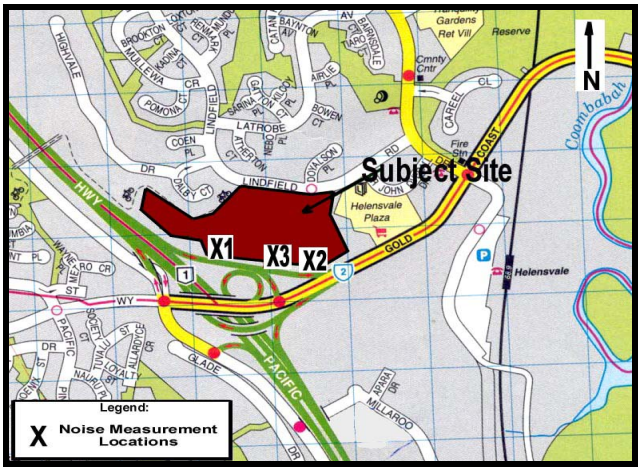

Figure 3. Noise Measurement Locations

Noise levels were measured using calibrated noise loggers - EL 315. The results of the traffic noise $L_{10(18\ hour)}$ measurements are presented in Table 1.

Table 1. Traffic Noise Measurement Results

Location 1	Location 2	Location 3
$L_{10(18\ Hour)}$ (Free field) dB(A)	$L_{10(18\ Hour)}$ (Free field) dB(A)	$L_{10(18\ Hour)}$ (Free field) dB(A)
69	63	60

External Traffic Noise Criteria

The external traffic noise criteria were derived as per the requirements of Section B6 of DMR's document *Road Traffic Noise Management: Code of Practice (January 2000)*[2], as presented in Table 2.

Table 2. Traffic Noise Criteria

Residential	Balconies and Open Space	Parks
$L_{10(18\ Hour)}$ (Façade Adjusted) dB(A)	$L_{10(18\ Hour)}$ (Façade Adjusted) dB(A)	$L_{10(12\ Hour)}$ (Free field) dB(A)
63	63	N/A

Internal Criteria

Based on AS/NZS 2107:2000 (*Acoustics – Recommended design sound levels and reverberation times for building interiors*)[3], the internal criteria are presented in Table 3.

Table 3. Recommended Design Sound Levels (L_{Aeq} dB(A)

	Satisfactory LaeqdB(A)	Maximum LaeqdB(A)
Living Areas	35	45
Sleeping Areas	30	40
Work Areas	35	45
Apartment common areas	45	55

Traffic Noise Level Prediction Methodology

The traffic noise levels, within an ultimate planning horizon of 10 years from the establishment of Stage 10, 11A and 12 (year 2014), were predicted using the noise prediction model TNOISE. The relevant segments used in the road traffic noise calculations are presented in Figure 4.

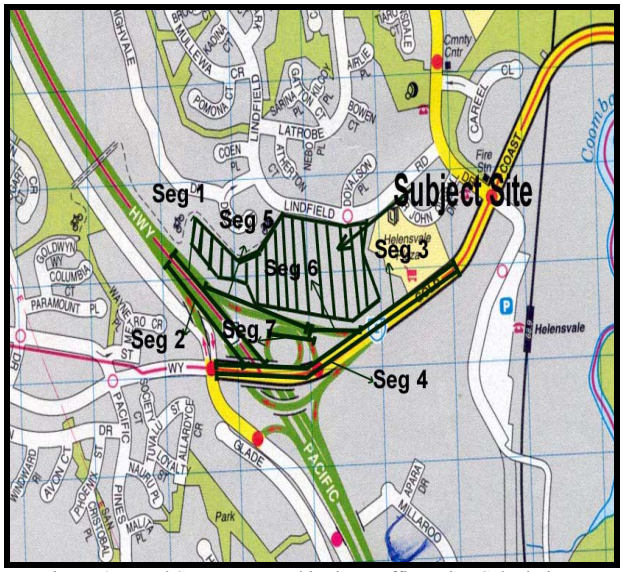

Figure 4. Road Segments Used in the Traffic Noise Calculations

The model was verified to be within the acceptable tolerance of ±2dB(A).

Significant effects that were considered in the prediction of the road traffic noise levels within a planning horizon of 10 years at Stage 11A and 12 are presented in Table 4.

Table 4. TNOISE Input Data

Input Parameters →	AADT* Traffic Flow	Heavy Vehicles	Angle of View	Distance	Propagation Height	Gradient	Speed (Zone)	Road Surface
Road Segment	Veh/Day	%	nº	m	m	%	Km/h	
1 Pacific Highway Southbound	89,839	10	63	136	1 to 2.5	1	110	Concrete
2 Pacific Highway Northbound	91,604	10	63	165	1 to 2.5	1	110	Concrete
3 Gold Coast Highway Eastbound	20,895	10	110	258	2.35 to 3.7	0	80	DGA
4 Gold Coast Highway Westbound	11,883	10	110	265	2.35 to 3.7	2	80	DGA
5 The Pacific Highway Helensvale exit off – ramp 1	11,243	10	50	105	3.5 to 5	0	80	DGA
6 The Pacific Highway Helensvale exit off – ramp 2	8,560	10	110	253	4.5 to 6	1	80	DGA
7 Gaven exit off/on ramp	6,545	10	47	220	0.7 to 2.2	7	80	DGA

**95 %ile of the road traffic forecast data for the Pacific Motorway and the Gold Coast Highway overpass provided by the Brisbane Office of DMR based on the traffic census carried out in August/September 2001.*

The predicted road traffic noise levels within a planning horizon of 10 years (2014) at the proposed dwelling within Stages 11A and 12 were between 60 and 62dB(A)$L_{10\ (18\text{-hour})}$ (façade adjusted) for lowset dwellings and between 62 and 63dB(A)$L_{10\ (18\text{-hour})}$ (façade adjusted) for highset dwellings.

The predicted noise levels took into account noise attenuation by an earth mound and a noise barrier fence combination that extends along the western boundary of the development with an ultimate height of between 25m AHD at the commencing point and at an elevation of 41.5m AHD at the termination point. The height of the acoustic barrier (earth mound noise fence combination) exceeds 9m at the north-western section.

The noise barrier fence, to be constructed on top of the earth mound), will be not more than 3.0metres high.

The overall cost of the earthmound and noise barrier combination is estimated to be approximately $250,000.00. The coast of construction of the earthmound is approximately $30,000.00. The estimated cost for the construction of the timber noise barrier fence is $220,000.00.

The predicted road traffic noise levels within Stage 10 of the development, only partially screened by the acoustic barrier, were between 68 and 70dB(A)$L_{10\ (18\text{-hour})}$ (façade adjusted) for lowset dwellings and between 70 and 71dB(A)$L_{10\ (18\text{-hour})}$ (façade adjusted) for highset dwellings.

The proposed dwellings at Stage 10 were designed and are currently under construction with building components that comply with AS 3671 – 1989[4] to meet internal criteria as per AS/NZS 2107:2000.

The alignment of the acoustic barrier is presented in Figures 4 and 5.

Figure 4. The Earth mound
(Viewed from the Northwestern Corner)

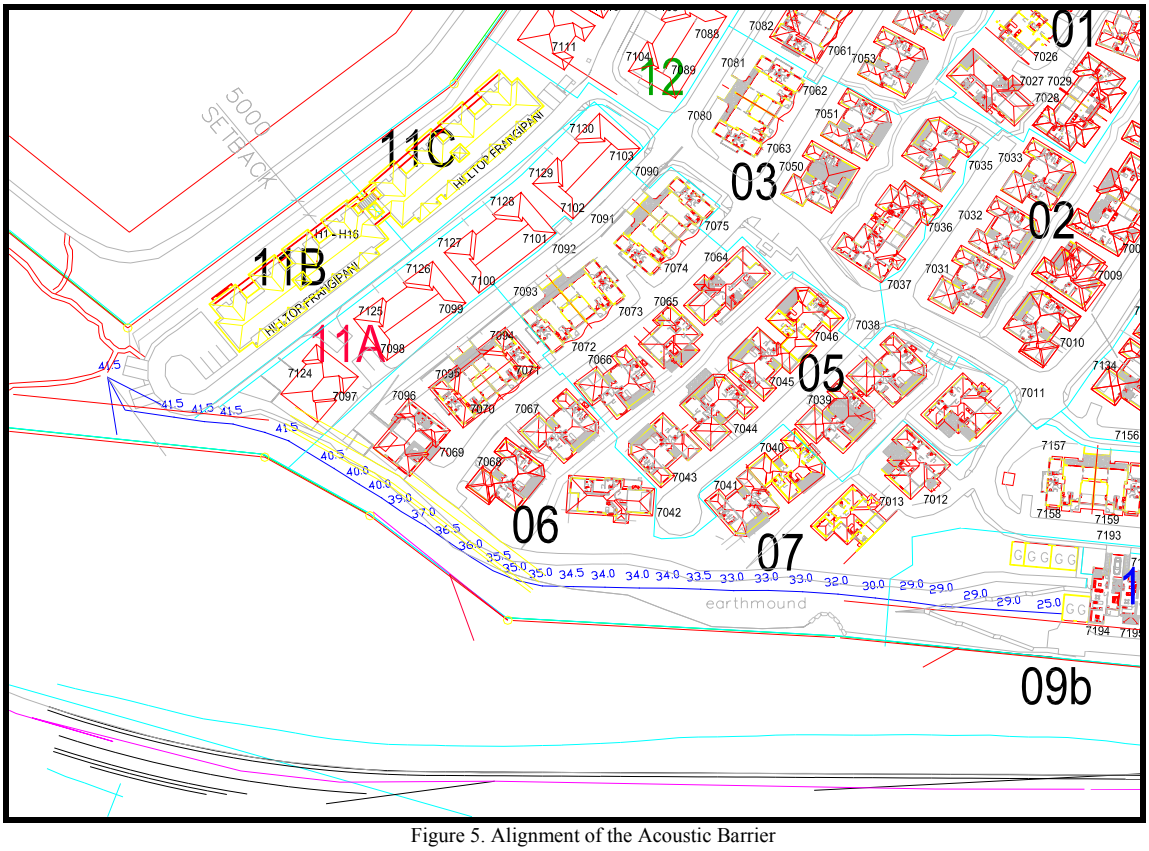

Figure 5. Alignment of the Acoustic Barrier

Conclusions

The recommended acoustic barrier (earth mound and noise barrier fence combination) is predicted to provide sufficient noise attenuation to ensure that the relevant criterion of 63dB(A)$L_{10\ (18\text{-hour})}$ (façade adjusted) is met at the most exposed sections of the *"Gardens on Lindfield"* development (Stages 11A and 12).

The acoustic barrier provides partial screening for the dwellings within Stage 10, but does not provide sufficient noise attenuation to ensure compliance with the external traffic noise criteria. The proposed dwellings at Stage 10 were designed and are currently under construction with building components that comply with AS 3671 – 1989 to meet internal criteria as per AS/NZS 2107:2000.

The brief given by the proponent of the development was achieved as the recommended noise amelioration measures were accepted by the DMR and GCCC. At an overall cost of $250,000.00 the recommended noise amelioration measures were considered cost effective.

References

[1] Main Roads Western Australia, 1992, TNOISE Computer Programme for Calculating Traffic Noise (based on procedures developed by UK Department of Transport, Welsh Office, 1988, Calculation of Road Traffic Noise)
[2] Department Of Main Roads, January 2000, Road Traffic Noise Management: Code of Practice
[3] Australian Standard AS/NZS 2107:2000 (Acoustics – Recommended design sound levels and reverberation times for building interiors)
[4] Australian Standard AS 3671 - 1989 (Acoustics – Road Traffic Noise Intrusion – Building siting and construction)