9. Guide for the Noise impact assessment planning scheme policy

Brisbane City Plan 2014 (City Plan) has been developed by Brisbane City Council in consultation with the community and guides how land in Brisbane can be used and developed.

This guide explains how the Noise impact assessment planning scheme policy in City Plan applies to preparing a noise impact assessment report for a development application.

This guide provides an overview of the content and rationale of the Noise impact assessment planning scheme policy contained within City Plan. It also explains the key changes in relation to noise impact assessment from the previous *Brisbane City Plan 2000.*

Tools to help you understand the City Plan

Brisbane City Plan 2014 includes two online interactive planning tools: the ePlan (electronic version of *Brisbane City Plan 2014*) and the interactive mapping tool to make it easy for you to see what requirements may affect your development.

All of these tools can be found by visiting Council's website and searching for *Brisbane City Plan 2014.*

Council's interactive mapping tool allows you to view a property on a map to see the zone, zone precinct, overlays and neighbourhood plans that apply to the site. It can also generate a property report that will help you identify the rules that apply to a development and the criteria Council will use to assess an application.

The ePlan contains details of the planning scheme and hyperlinks to help you find the requirements that relate to a proposed development.

Understanding noise impacts

Understanding and assessing noise impacts is a complex technical area. Where noise is an issue it is highly recommended that a suitably experienced acoustic engineer or scientist is engaged to assist you. There are also many online sources of information that can assist you in your understanding of noise impacts.

Role of the Noise impact assessment planning scheme policy

The Noise impact assessment planning scheme policy contributes to achieving the strategic outcomes of *Brisbane City Plan 2014*, by:

- protecting the health and wellbeing of occupants of sensitive uses by reducing their level of noise exposure
- protecting existing lawful industrial uses from encroachment by incompatible sensitive uses.

The Noise impact assessment planning scheme policy contains guidance on assessment methods for preparing a noise impact assessment report. This includes methods for assessing noise exposure, background noise, low frequency noise and adjustments for noise characteristics.

The scope of the Noise impact assessment planning scheme policy covers the management of noise prediction from a nuisance and sleep disturbance perspective. It is not intended to be used for the evaluation or management of workplace health and safety.

This guideline and the Noise impact assessment planning scheme policy are planning tools only and not enforcement tools. For more general information on noise enforcement and regulation in Brisbane please visit Council's website and search for noise restrictions and complaints.

The assessment of aircraft, road and rail traffic noise is outside the scope of the Noise impact assessment planning scheme policy. The Airport environs overlay code provides for sensitive development within the vicinity of airports to be located and designed to adequately attenuate expected aircraft noise.

Where the development is covered by the transport noise corridor overlay this is managed by Queensland Development Code (QDC) MP4.4 Building in a Transport Noise Corridor. Appendix A in this guide explains the relationship between City Plan and the QDC.

Assessment of noise from amplified music venues in a Special entertainment area identified in a neighbourhood plan is outside the scope of the Noise impact assessment planning scheme policy. Appendix B of this guide provides technical guidance on the acoustic requirements for new development in these areas.

Changes from *Brisbane City Plan 2000*

A number of changes to the noise content of *Brisbane City Plan 2000* have been made. One of these key changes is to put the noise criteria in each code where it is appropriate for the type of development captured under that code. Table 1 below summarises the key changes relating to noise.

Table 1 – key changes made in *Brisbane City Plan 2014*

Brisbane City Plan 2000	*Brisbane City Plan 2014*
• Noise criteria are contained in the Noise impact assessment planning scheme policy.	• Noise criteria are contained in the code relevant to the development.
• Night time maximum criteria (L_{Amax}) levels are fixed values.	• Night time maximum criteria (L_{Amax}) are based on the night time ambient noise level.
• Noise criteria are independent of the zone where the noise emitter and/or receiver is located.	• Noise criteria are linked to the relevant zone where the emitter and/or receiver is located.
• Transport noise is assessed under the Noise impact assessment planning scheme policy for a sensitive use within 150 metres of a motorway, arterial road or sub-arterial road.	• Transport noise is assessed under Queensland Development Code MP 4.4 Buildings in a Transport Noise Corridor.

Related City Plan codes for noise and vibration

City Plan calls up the Noise impact assessment planning scheme policy in a number of codes. Each of these codes contains noise and/or vibration criteria relevant to the use covered by the code. Table 2 below lists these codes and the relevant assessments for each.

Note: Not all assessments are required for each code. For example, the Service station code does not require a vibration assessment. Only the relevant assessment benchmarks listed in the code need to be assessed.

Table 2 - relevant codes for noise assessment

Code	Intrusive noise and acoustic amenity assessment	Low frequency noise assessment	Night time noise assessment	Vibration assessment	Internal noise assessment	Other assessment
Airport environs overlay code						PO8 Airport environs overlay code
Animal keeping code						PO1 Animal keeping code
Caretakers accommodation code					✓	
Centre or mixed use code	✓	✓	✓			
Child care centre code						PO10 Child care centre code
Community facilities code	✓		✓			
Extractive industry code	✓	✓	✓	✓		
Extractive resources overlay code					✓	
Filling and excavation code				✓		
Home-based business code						PO3 Home based business code
Indoor sport and recreation code	✓		✓			
Industrial amenity overlay code					✓	
Industry code	✓	✓	✓			
Multiple dwelling code						PO41 Multiple dwelling code
Residential care facility code						PO3 Residential care facility code
Rooming accommodation code						PO8 Rooming accommodation code
Service station code	✓		✓			
Short term accommodation code						PO3 Short term accommodation code
Small-scale non-residential uses code						PO17 Small-scale non-residential uses

Code	Intrusive noise and acoustic amenity assessment	Low frequency noise assessment	Night time noise assessment	Vibration assessment	Internal noise assessment	Other assessment
						code
Special purpose code	✓	✓	✓			
Specialised centre code	✓	✓	✓			
Transport noise overlay code						Triggers QDC MP 4.4

The Noise impact assessment planning scheme policy does not specify detailed performance requirements or types of technology that should be used to control noise. The performance-based assessment requires the applicant to demonstrate that the development contains sufficient measures through separation, noise attenuation or shielding to meet the required criteria.

Noise impact assessment reports

A noise impact assessment report is used to demonstrate that development complies with the criteria stated in the noise performance outcomes of the codes listed in Table 2.

Section 2 of the Noise impact assessment planning scheme policy identifies the matters a noise impact assessment report needs to address and the information it needs to contain. As this section needs to cover an extensive range of possible noise assessments it is not expected that all parts of this section will be relevant to all development proposals. You should only present information that is deemed relevant to the development.

A noise impact assessment report helps Council verify the details of the proposed development and evaluate:

- whether the impacts of noise have been properly assessed
- whether the relevant criteria can be achieved
- the nature, scale and significance of the impact where the relevant criteria cannot be met.

There are two assessment scenarios that may require a noise impact assessment report to be prepared.

1. Where the development emits noise, the noise impact assessment report needs to describe the impact of the noise emissions by the development.
2. Where the development is a sensitive use exposed to noise, the noise impact assessment report needs to describe the impact of noise on the development.

Where the development is being assessed for noise emission, the noise assessment should be a comprehensive record of the:

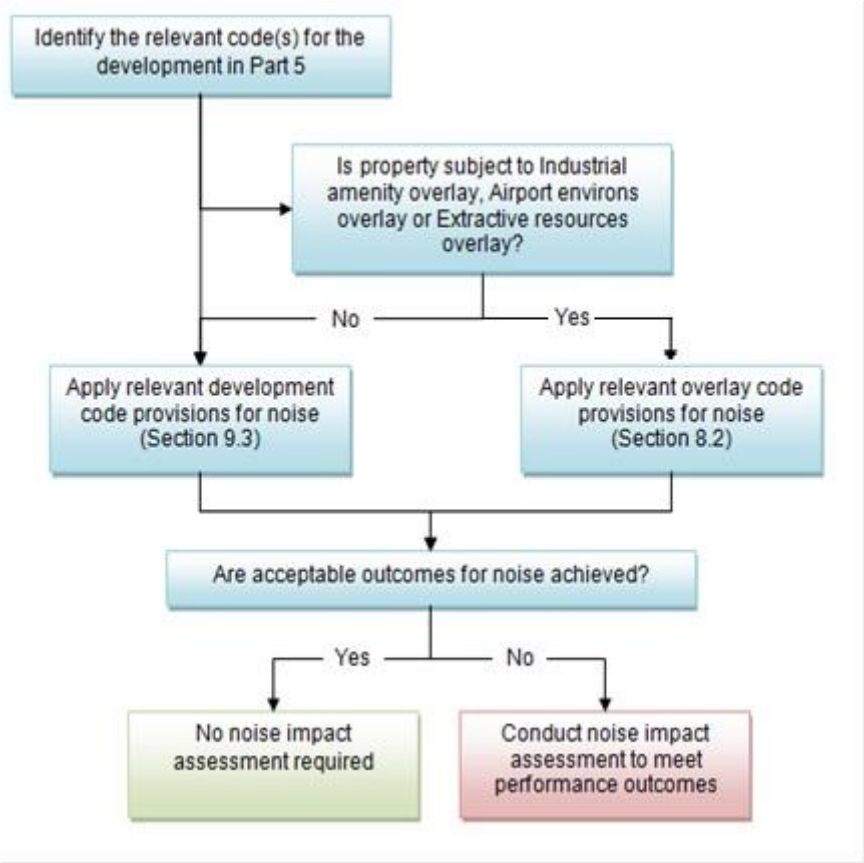
- noise sources relevant to the development
- assessment methodology used
- justification for the selection of models and input data
- results of the assessment.

Where the development is for a sensitive use within the Industrial amenity overlay, Extractive resource overlay or Airport environs overlay, the noise assessment needs to include an evaluation of the building design necessary to achieve the internal criteria specified in the relevant code.

It is recommended that a suitably experienced acoustical engineer or scientist conduct the noise impact assessment to ensure that the input data, assessment methodologies and interpretation of results are properly appraised.

The flowing flowchart in Figure 1 identifies where a noise impact assessment would be required for noise emission or for development of a sensitive use.

Figure 1 - requirement for a noise impact assessment report for noise emission or for development of a sensitive use



Inventory of noise emission sources

Section 2.1 of the Noise impact assessment planning scheme policy requires you to list all noise sources (relevant to the development) that are being assessed for noise emission. A table should be presented that names the noise source and details its sound power/pressure level, characteristics, frequency of use and duration of use.

Noise impact control measures

Section 4 of the Noise impact assessment planning scheme policy relates to noise impact control measures. A noise impact assessment report should detail all noise control measures that apply to the development. The noise attenuation performance of each measure should be clearly described and justified through modelling assumptions, input data, sample calculations and noise mapping where relevant.

There may be situations where City Plan noise criteria cannot be achieved, even when all reasonable and practical measures are implemented.

This is discussed in a following section, titled Managing situations where noise is forecast to exceed criteria.

Acoustic fences

Acoustic fences are a common noise impact control measure. As City Plan seeks integrated outcomes, acoustic fences need to balance the need for noise reduction against a number of other planning values, including:

- visual character of the area
- light and overshadowing
- the need for visual surveillance and safety
- drainage and stormwater considerations
- community division
- wildlife movement.

In some situations, large acoustic fences may not be suitable noise impact control measures.

Table 1 of the Noise impact assessment planning scheme policy provides a guide to acoustic fence heights. This only applies to acoustic fences on shared lot boundaries with a sensitive use, where it is needed to reduce industrial or commercial noise into the sensitive use. It does not apply to industrial or commercial uses that do not share a boundary with a sensitive use.

The fence heights do not apply to road traffic noise barriers.

Note: The 2.4 metre height shown on row 6 of Table 1 of the Noise impact assessment planning scheme policy only applies along major roads and commercial or industrial uses for the purpose of reducing industrial or commercial noise.

Assessment of the existing acoustic environment

Clearly describing the existing acoustic environment is important to understand how a development will integrate with the existing soundscape. Qualitative and quantitative methods should be utilised. You are encouraged to use clearly labelled site plans, aerial photos, site photos, attended noise measurements, unattended noise logging data and weather data to achieve this.

Types of assessments used in City Plan

Section 6 of the Noise impact assessment planning scheme policy outlines the methods to be used for assessing noise against the relevant criteria.

A noise impact assessment involves a predicted forecast of the future noise environment. The assessment should demonstrate compliance with the relevant criteria in a clear and transparent manner. The assessment should present clear assumptions, data and methodology in sufficient detail to enable replication of noise predictions by Council or other third parties.

Note: This guideline and the Noise impact assessment planning scheme policy are to be used in a noise prediction context, not a noise measurement or enforcement context.

The different types of noise/vibration assessment are listed below:

1. Intrusive noise and acoustic amenity assessment
2. Night time noise assessment
3. Low frequency noise assessment
4. Internal noise assessment
5. Vibration assessment

Intrusive noise and acoustic amenity assessment

Intrusive noise and acoustic amenity assessment is used to assess the emission of noise. It consists of two criteria – the intrusive noise criterion and the acoustic amenity criterion (for an example, refer to Table 9.3.12.3.E).

As the intrusive noise criterion and acoustic amenity criterion are intended for general environmental noise, the A-weighted sound pressure level is used.

Intrusive noise criterion and the Rating Background Level (RBL)

The **intrusive noise criterion** is an L_{Aeq} based on achieving a limited noise level above the Rating Background Level (RBL) for each of the relevant day, evening and night periods.

These three periods are defined below.

- Day: 7am-6pm, assessed with an 11 hour L_{Aeq}
- Evening: 6-10pm, assessed with a four hour L_{Aeq}
- Night: 10pm-7am, assessed with a nine hour L_{Aeq}

Section 5.1 of the Noise impact assessment planning scheme policy describes the methodology for determining the RBL.

Ambient noise levels vary throughout the day depending on factors such as traffic, weather and opening and closing times of various facilities. The intrusive noise criterion is intended to limit noise from the development to a level where it generally mixes into the ambient noise environment, without becoming intrusive.

Noise sources are to be added over the period being assessed to determine the relevant total 11 hour, four hour or nine hour $L_{Aeq.}$

The RBL is effectively the lowest 10^{th} percentile background noise level during the day, evening or night period.

Acoustic amenity criterion

The **acoustic amenity criterion** provides an upper limit to the L_{Aeq} of the noise source(s) during the relevant day, evening and night periods.

This is intended to prevent background and ambient noise levels increasing without limit.

Night time noise assessment

This involves assessing the emission of short duration maximum noise events, based on the L_{Amax} level during the night period.

The intent of the night time maximum level is to reduce sleep disturbance for occupants of sensitive uses. Intermittent noise events occurring during sleeping hours have been linked to sleep disturbance effects. There is a correlation that exists between the L_{Amax} noise level at night, the number of noise events and sleep disturbance.

A number of codes (see Table 2 of this guide) contain night time criteria to minimise sleep disturbance at relevant sensitive uses. The L_{Amax} criterion ranges from 50dB(A) to 65dB(A) and depends on the night time ambient noise level at the sensitive use. For this

range of L_{Amax} values, the sleep disturbance criterion is obtained by adding 5dB to the night time ambient level.

As L_{Amax} levels from multiple events can be variable, both of the following L_{Amax} criteria need to be achieved.

1. The arithmetic average of maximum levels from up to the highest 15 single events over a given night time period is not to exceed the existing L_{Aeq}, 9hr (10pm-7am) by more than 5dB(A).
2. The absolute highest single L_{Amax} event is not to exceed the existing $L_{Aeq,}$ 9hr (10pm-7am) by more than 10dB(A).

Although L_{Amax} is assessed for the night time period only, data may be obtained at any time during the day, evening or night when predicting the forecast L_{Amax}. This is provided that the data obtained is equivalent to the night time events forecast to be used in the prediction.

Low frequency noise assessment

This involves assessing the emission of low frequency noise. This criteria uses a C-weighted sound pressure level for day, evening and night.

Low frequency noise can cause more annoyance than would be expected based on an A-weighted sound pressure level. While most environmental noise sources can be reasonably assessed with an A-weighted sound pressure level, some sources have been identified where low frequency noise is often an important consideration. The following sources should be assessed for low frequency noise in addition to an A-weighted assessment:

- gas turbines
- boilers
- forced draft and induced draft fans
- shakers on hoppers
- vibratory screens
- wind farms
- power stations, generators
- amplified music.

Using a C-weighted level provides a simple method of assessing low frequency noise. Outdoor and indoor low frequency outcomes are presented in the codes identified in Table 2 of this guide.

Internal noise assessment

This involves assessing internal noise within the habitable room of a proposed noise sensitive development. The assessment is based on the L_{Aeq} during day, evening and night and the night time maximum internal $L_{Amax.}$

The Industrial amenity overlay code and the Extractive resources overlay code identify areas of the city that are exposed to noise levels that are potentially higher than found in most residential areas.

When planning a noise sensitive development impacted by these overlays, an internal noise assessment needs to be conducted.

Generally, this results in a night time criterion that is within a reasonable range of existing ambient night time L_{Amax} events.

Vibration assessment

This involves assessing vibration emission. Assessment is based on the following standards.

- AS 2187.2 - *Explosives - Storage Transport and Use, Part 2 Use of Explosives*.
- BS 6472-1992 *Guide to evaluation of human exposure to vibration in buildings (1Hz to 80Hz).*

The descriptors used to define vibration are not the same as those used to describe sound. Vibration can generally be described in terms of acceleration, velocity or displacement. A vibration dose value (VDV) can also be determined, which has been shown to have correlation to community response.

Section 6.4 of the Noise impact assessment planning scheme policy provides details of the types of vibration to be assessed. These are described in Table 3 on the next page.

Table 3 – vibration assessment

Type of vibration assessment	Application examples and relevant standard
Intermittent vibration levels for cosmetic damage	Use of explosives over a short term period. Criteria are based on AS 2187.2 *Explosives - Storage Transport and Use, Part 2 Use of Explosives.*
Blasting vibration levels for human comfort	Use of explosives over a long period. Criteria are based on AS 2187.2 - *Explosives - Storage Transport and Use, Part 2 Use of Explosives*
Continuous and impulsive vibration for human comfort	Machinery, continuous construction activity (such as tunnel boring), dropping of heavy equipment, occasional loading and unloading. Criteria are based on BS 6472-1992 *Guide to evaluation of human exposure to vibration in buildings* (1Hz to 80Hz).
Intermittent vibration for human comfort	Intermittent construction activity, forging machines, impact pile driving and jack hammers. Criteria are based on BS 6472-1992 *Guide to evaluation of human exposure to vibration in buildings* (1Hz to 80Hz).

Modifying factor adjustments

Table 4 of the Noise impact assessment planning scheme policy identifies four types of noise characteristics that require a modifying factor adjustment. These characteristics are:

- tonal noise (applies to the L_{Aeq})
- impulsive noise (applies to the L_{Aeq})
- modulating noise (applies to the L_{Aeq})
- fluctuating low-frequency noise (applies to the L_{Ceq}).

These characteristics result in a noise that has a subjectively more annoying effect and therefore the modifying factor attempts to account for this effect. These characteristics are discussed below.

Tonal noise

Tonal noise contains energy within a small frequency band(s). Subjectively it can be described as tonal if it contains a noticeable note. This includes noises such as beeps, rings, buzzes and hums. Alarms, beepers, sirens, bells and music are all known to have tonal characteristics and are to be adjusted. In addition, some mechanical and electrical equipment will exhibit tonal characteristics and need to be considered on a case-specific basis.

The tonal adjustment is added to the relevant one-third octave band (it is not added directly to the total L_{Aeq}).

Example one

An electrical device is being assessed. The device is not known to be tonal, but one-third octave data shows a 25dB(A) tone at 50Hz. The overall noise level predicted from the device is 45dB(A).

In this case, applying a 5dB(A) adjustment to the 50Hz band results in 30dB(A) at 50Hz. This adjustment does not have any effect on the overall level, i.e. overall the level is still 45dB(A) as the non-tonal component of the noise is dominant.

Example two

A warning alarm is being assessed. The device is known to emit a tonal sound. The manufacturer's data predicts a 65dB(A) tone at 2000Hz. The overall noise level from the device is 65dB(A).

In this case, the 5dB adjustment results in the total level being adjusted to 70dB(A).

Impulsive noise

Impulse noise consists of short bursts of noise, with a duration of shorter than one second. Impulse noise contains rapid sound pressure transients.

Subjectively impulse noise is often described as a bang, pop or click. Examples of clearly impulsive noise include blasting, firearms and fireworks. Other sources that may contain moderate impulsive character include door slamming, hammering and other impacts, and should be assessed on a case-specific basis.

Modulating noise

Modulating noise varies in amplitude at a regular interval. Subjectively this can be described as a beat. The bass drum in electronic music clearly has a modulating characteristic. Some mechanical equipment, such as a printing press, can have a modulating component.

Fluctuating low frequency noise

Fluctuations in low frequency noise can make the noise more annoying. The criteria applied for low frequency noise (discussed further in the low frequency noise section) assumes a steady state noise. Therefore, if the noise is fluctuating +/- 5dB then a 5dB adjustment applies.

Note, it is not necessary to assess adjustments for tonality, impulsiveness and modulation when conducting a low frequency noise assessment.

Applying modifying factor adjustments to the total noise level

Only the relevant component of noise containing the characteristic needs to be adjusted.

Example

During the day period there are 10 hours of general steady plant noise predicted at 30dB(A) with no adjustments and one hour of electronic beepers predicted at 40dB(A) with a 5dB tonal adjustment to become 45dB(A). Only the one hour tonal period is adjusted before determining the total 11 hour day time L_{Aeq}.

Managing situations where noise is forecast to exceed criteria

Section 7 of the Noise impact assessment planning scheme policy deals with situations where it is forecast that the noise criteria will be exceeded, despite implementing all reasonable and practical noise impact control measures.

Noise is only one of the many factors that Council must consider when assessing the appropriateness of a development. The performance outcomes used throughout City Plan provide guidance towards achieving the overall purpose statement described in the relevant development codes and zone codes. However, even when best available noise control measures are implemented it may not be reasonable or practical to achieve the relevant noise criteria.

In situations where noise criteria are forecast to be exceeded, you should provide additional information to help describe the nature, scale and significance of the noise impact on the community. This will help Council to assess the net benefit of the development in terms of social, environmental and economic outcomes.

Additional methodologies can be used in a noise impact assessment report to better describe potential community impact. These include:

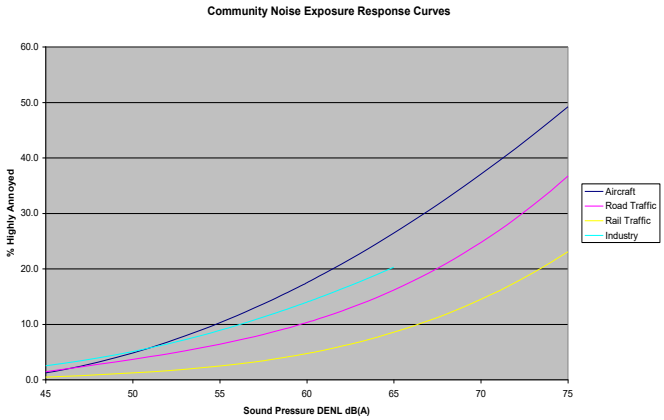
- relationships between community annoyance and noise metrics curves for aircraft, road traffic, rail traffic and industrial noise
- relationship between sleep awakenings and internal night time noise levels.

Community annoyance response to sources of noise emission

Studies of community response to noise have resulted in the development of dose response relationships for noise from different sources. These dose response formulas can be used to give context to a forecast change in noise exposure, e.g. from a proposed new noise source.

The community annoyance from the existing acoustic environment (from industry, aircraft, road and rail noise) can be compared to the forecast community annoyance from the development. Formulae to determine the percentage of the community highly annoyed are given on the following page.

Figure 2 - Community noise exposure response curves



Aircraft

$\%HA = -9.199 \times 10^{-5} (DENL - 42)^3 + 3.932 \times 10^{-2} (DENL-42)^2 + 0.2939 (DENL - 42)$

Road traffic

$\%HA = 9.868 \times 10^{-4} (DENL - 42)^3 - 1.436 \times 10^{-2} (DENL-42)^2 + 0.5118 (DENL - 42)$

Railways

$\%HA = 7.239 \times 10^{-4} (DENL - 42)^3 - 7.851 \times 10^{-3} (DENL-42)^2 + 0.1695 (DENL - 42)$

Industry

$\%HA = 36.307 - 1.886\ DENL + 0.02523\ DENL^2$

$DENL = 10 \log [(12/24) \times 10^{LD/10} + (4/24) \times 10^{(LE+5)/10} + (8/24) \times 10^{(LN+10)/10}]$

Here LD, LE, and LN are the A-weighted long-term L_{Aeq} for day (7am-7pm), evening (7-11pm), and night (11pm-7am) determined over the year at the most exposed façade of the sensitive use.

Note, the day, evening and night time periods for this descriptor are based on the European Union (EU) metric, which is different from the day, evening and night time periods used throughout City Plan and generally in Queensland. So it will be necessary to recalculate the day, evening and night noise predictions for these time periods if it is desired to use these formulae.

Application of community response formulas

Where a code requires the assessment of noise criteria, all reasonable and practical noise attenuation measures need to be considered and implemented in order to achieve the relevant criteria. There may be situations where, despite all reasonable and practical measures being taken, there is still a minor exceedance forecast. Some examples where presenting the community annoyance percentage may be useful are given below.

- The forecast community response is not significant. For example, where a forecast industry DENL is less than 45dB(A) (a very low annoyance is predicted at this level). The result is below the useful range of the formula.
- The estimated community response is minimal in comparison to another existing source of exposure. For example, new industrial noise sources estimated to result in 4% annoyance, while the existing environment is already dominated by road traffic noise with an estimate of 15% annoyance from road traffic. That is, greater than 10% more annoyance is forecast from the existing environment compared to the proposed noise source(s) scenario.

Sleep awakening

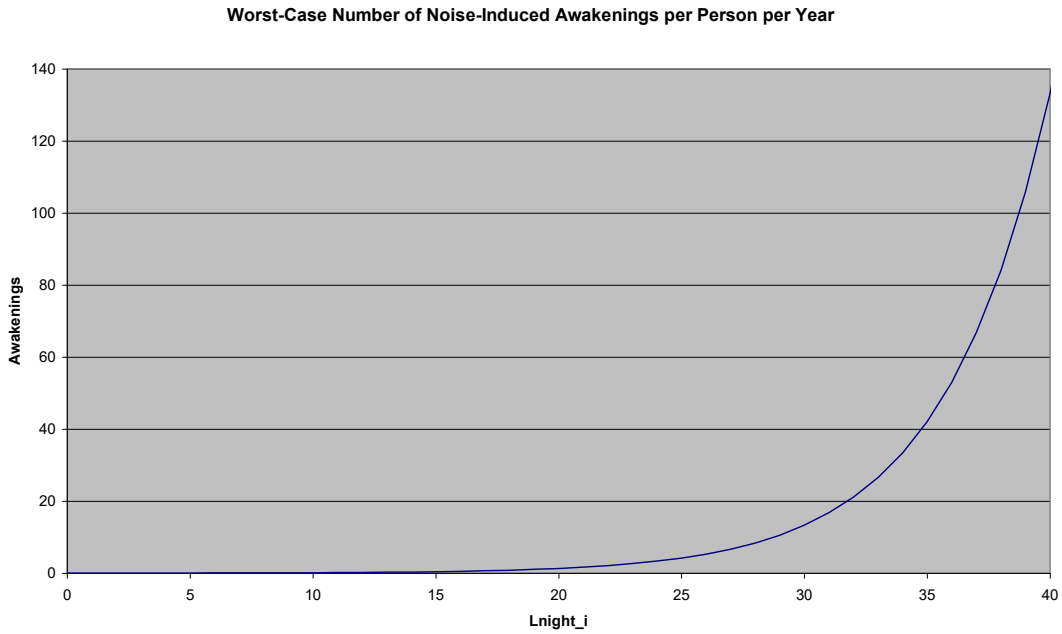
For the purpose of assessing a façade design for a sleeping area, sleep awakenings can be estimated with the following formula:

worst case number of noise-induced awakenings per person per year

$$\#Awakenings = 365 \times 0.96 \times 10^{\frac{(Lnight\_i - 44.2)}{10}}$$

where L_{night_1} (internal night noise indicator) is the internal L_{Aeq} measured over the night period 11pm-7am averaged over one year.

Figure 3 – worst-case number of noise-induced awakensing per person per year



When using this method for the purpose of façade design for new sensitive uses, windows can be assumed to be closed.

Application of the sleep awakenings formula

The best reasonable and practical glazing solution for a sleeping area generally consists of laminated glazing with upgraded thickness (e.g. 10.38mm), installed with acoustically rated seals. Even when this type of solution is applied, there may still be a forecast exceedance of the night time amenity criteria (e.g. 45dB(A) L_{Amax} in the Industry amenity overlay code or Extractive resources overlay code). The benefit of further upgrading a façade should be balanced against the economic cost of the construction material. In this case, it may be useful to present a comparison of forecast sleep awakenings for various façade design options.

It may also be useful to present a forecast number of sleep awakenings when a proposed sensitive use is exposed to a low number of short-term events that are not forecast to result in a significant number of sleep awakenings in a year.

Airport environs overlay code

Performance outcome PO8 in the Airport environs overlay code refers to internal noise criteria to reduce community annoyance. The criteria can be assessed in accordance with the methodology in AS 2021-2000 Acoustics - Aircraft noise intrusion - Building siting and construction.

The acceptable solutions in AO8.1 and AO8.2 provide weighted sound reduction index (R_w) values that can be used as an alternative to the more detailed AS2021 assessment.

R_w values for many building materials can be found from their manufacturer's technical data sheets. An example of a configuration that achieves the acceptable outcomes is provided in Table 4 on the following page.

Table 4 – Examples of construction materials for AO8.1 and AO8.2

Component	Construction material
Walls	Double brick cavity.
Roof	Pitched, minimum 25 degree slope, masonry tiles or metal sheet with acoustically sealed sarking (impervious membrane) over rafters.
Ceiling	Plasterboard (10mm minimum thickness) with ceiling joists separate from roof structure, i.e. not attached to rafters or roof trusses.
Insulation	Fibrous thermal insulation (R2.5 or greater) between ceiling joists.
Windows	Laminated glass (6.38mm or greater) with acoustic or resilient flap weather seals to frames.
Doors	Solid core (40mm or greater) with acoustic or resilient flap weather seals to frames. Doors with glass panels are to match the standard for windows above.

More information

For more information about City Plan visit www.brisbane.qld.gov.au and search for '*Brisbane City Plan 2014*', or phone Council on (07) 3403 8888.

Disclaimer: The content of this information sheet is a summary and has been prepared to assist the reader to understand City Plan. Please refer to the full City Plan document, entitled Brisbane City Plan 2014, on Council's website for further detail.

Appendix A

Using the Transport noise corridor overlay code

The Transport noise corridor overlay is used to determine whether assessment under the Transport noise corridor overlay code is required (see Levels of assessment for Transport noise corridor overlay). Where assessment is required, development needs to be designed and built in accordance with Queensland Development Code *MP 4.4 – Buildings in a Transport Noise Corridor (QDC MP 4.4).* The five noise categories from zero to four, from the lowest exposed to transport noise to the highest exposed, are only applicable to the QDC provisions.

Appendix B

Residential design in the Fortitude Valley Special entertainment area

Purpose

To provide technical guidance regarding the acoustic requirements for façade design in a Special entertainment area (SEA) identified in the *Fortitude Valley Neighbourhood Plan.*

Note: An SEA is taken to be a special entertainment precinct for the purposes of the *Local Government Act 2009.*

Background

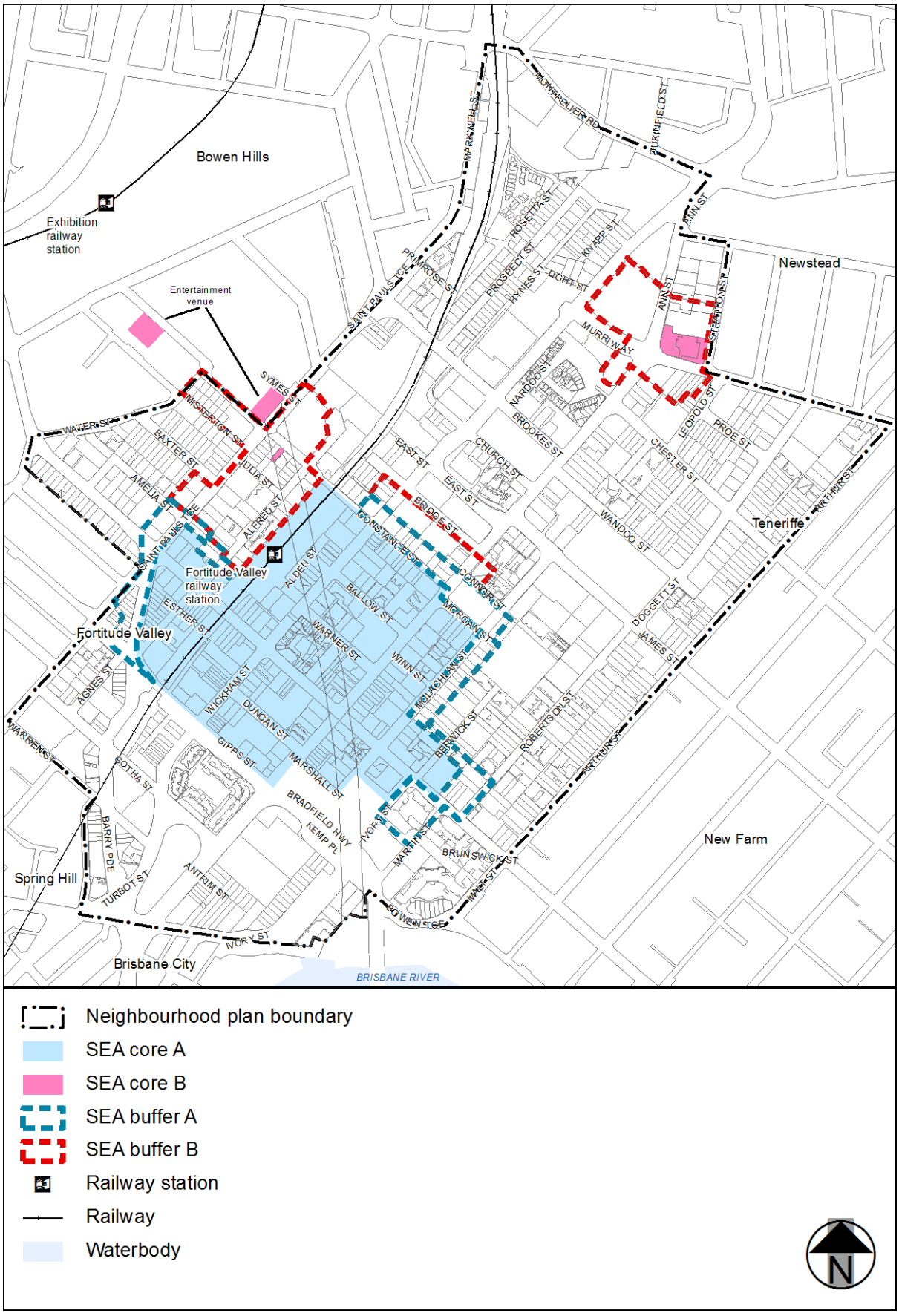
Fortitude Valley (the Valley) is Brisbane's most popular and dynamic entertainment hub. The Valley's night time economy is an important sector of Brisbane's economy. Around 50,000 people head to Fortitude Valley's clubs, pubs and restaurants each weekend night.

Council started developing a *Valley Music Harmony Plan* in July 2002 with the aim of managing the impacts of music noise on residents and businesses without compromising the viability of the entertainment industry in Fortitude Valley.

Since the implementation of the *Valley Music Harmony Plan*, the Valley SEA has been described in planning literature as "the envy of the nation", (Burke & Schmidt 2013, '*How should we plan and regulate live music in Australian cities?*' Australian Planner, Vol.50(1), pp.68-78) and its methodologies have been duplicated in other entertainment precincts throughout Australia.

The intent of the SEA is to allow amplified music venues to operate at typical levels. As a result, the lawful level of entertainment noise permitted in the precinct is significantly higher than that allowed in any other part of the city. This presents specific challenges when designing a residential development for a site within the SEA. It is expected that residential development in the SEA will include noise reduction measures that go beyond that of a typical residential building.

Figure 1. Fortitude Valley Special entertainment area (SEA)



The Valley SEA is shown in Figure 1. It consists of the following four areas:

- **Core A -** this area has a specific focus on entertainment venues. These venues are regulated under the *Amplified Music Venues (AMV) Local Law 2006* and are permitted to emit high levels of noise. The design of new residential development needs to account for potentially high levels of noise exposure.
- **Buffer A** - these areas are closely exposed to the Core A. The design of new residential development needs to account for potentially high levels of noise exposure.
- **Core B -** this area identifies key music venues outside of Core A. These venues are regulated under the *AMV Local Law 2006* and are permitted to emit high levels of noise.
- **Buffer B** - these areas are closely exposed to Core B. The design of new residential development needs to account for potentially high levels of noise exposure.

When designing sensitive uses in these areas, high levels of noise reduction are required. The criteria is given in City Plan under: *7.2.6.4 Fortitude Valley neighbourhood plan code*

Achieving these criteria requires a detailed, professional acoustic assessment. Typically, the controlling factor in the façade design is the glazing. Some indicative designs that can achieve these noise reduction levels are shown below.

Indicative glazing solutions

Table 1 - indicative glazing to achieve a noise reduction of LLeq,T 25dB at 63Hz in SEA's Core A and Buffer A

Double glazing design	• 12.38mm laminated glass, 200mm air gap, 10.76mm laminated glass • 10.38mm laminated glass, 400mm air gap, 6.76mm laminated glass
Enclosed balcony design (Wintergarden)	• 6mm laminated glass, 1000mm air gap, 6.76mm laminated glass

Table 2 - indicative glazing to achieve a noise reduction of LLeq,T 20dB at 63Hz in SEA's Core B and Buffer B

Double glazing design	• 10.38mm laminated glass, 200mm air gap, 8.38mm laminated glass
Enclosed balcony design (Wintergarden)	• 6.38mm laminated glass, 1000mm air gap, 6.38mm laminated glass

Table 3 - indicative glazing to achieve a noise reduction of LLeq,T 18dB at 63Hz for short-term accommodation in an SEA core area or buffer area.

Double glazing design	• 8.38mm laminated glass, 200mm air gap, 8.38mm laminated glass • 12.38mm laminated glass, 12mm air gap, 12.38mm laminated glass

All operable glazing systems are to include acoustically rated seals and a closing mechanism that is acoustically effective.

While these systems are calculated to achieve the required noise reduction, the performance of the systems is indicative only and details should be confirmed on a case-by-case basis. Manufacturers' test data should be obtained if possible, though if manufacturers' test data is not available, the acoustic assessment should include a description of the methodology used to forecast the performance of the glazing system.

Applying an alternative design

There may be some locations in the Valley SEA where these requirements may be reduced; for example where the location is on the boundary of an entertainment area and the façade is facing away from any potential music noise source. In these situations it can be useful to determine the potential noise exposure by using a noise model. The methodology for modelling these scenarios is given in the following sections.

Modelling music emission in the Valley Special entertainment area

A key focus of the Valley SEA is for the development of music venues. Venues in the Valley SEA are allowed a particularly generous level of noise emission in comparison with other parts of Brisbane. As music venues have the potential to be developed anywhere in the Valley SEA core areas, this potential needs to be accounted for when modelling noise emission.

The AMV Local Law permits a music venue to emit 90dB(C) at 1 metre external to the premises in Core Area A and 88dB(C) in Core Area B. There are no details for the emission spectrum at this level in the local law. A venue can lawfully play music that is dominant in any 1/3rd octave band provided that the C-weighted overall level does not exceed the local law criteria.

To assist with producing a noise model to represent a typical music emission spectrum, data used to develop the entertainment precinct is provided:

A level of 88dB at 63Hz in Core Area A and 86dB at 63Hz in Core Area B can be used as the venue emission 1 metre from the premises.

This is a typical music spectrum in the entertainment precinct that results in the local law criteria being met.

As any site in the entertainment precinct can be used as a potential music venue, all lots in the vicinity of the proposed development should be modelled with the emission levels specified above. All parts of a building can emit this level, including the roof. As there are a number of multi-story entertainment venues with rooftop bars in the precinct, four storeys can be used to represent a typical rooftop emission scenario.

The resulting noise levels can be forecast at the façades of the proposed sensitive building(s) and based on the forecasts, the required noise reduction is can be determined on the following page in Table 4 (see over page).

Summary of façade design criteria

Table 4 – noise reduction requirements where noise levels have been forecast through noise modelling

Sensitive use location	Noise reduction requirement
Special entertainment area Core Area A or Buffer Area A	• Noise reduction of L_{LeqT} 25dB at 63Hz where forecast entertainment noise at the relevant façade is ≥ 68dB at 63Hz for a bedroom or ≥ 70dB at 63Hz for a living room. • Noise reduction to achieve an amplified music level of L_{LeqT} 43dB at 63Hz in a bedroom, where forecast entertainment noise at the relevant façade is < 68dB at 63Hz. • Noise reduction to achieve an amplified music level of L_{LeqT} 45dB at 63Hz in a living room, where forecast entertainment noise at the relevant façade is < 70dB at 63Hz.
Special entertainment area Core Area B or Buffer Area B	• Noise reduction of L_{LeqT} 20dB at 63Hz where forecast entertainment noise at the relevant façade is ≥ 63dB at 63Hz for a bedroom or ≥ 65dB at 63Hz for a living room. • Noise reduction to achieve an amplified music level of L_{LeqT} 43dB at 63Hz in a bedroom, where forecast entertainment noise at the relevant façade is < 63dB at 63Hz. • Noise reduction to achieve an amplified music level of L_{LeqT} 45dB at 63Hz in a living room, where forecast entertainment noise at the relevant façade is < 65dB at 63Hz.
Short-term accommodation where a backpackers hostel is located in a Special entertainment area Core Area or Buffer Area	• Noise reduction of L_{LeqT} 18dB at 63Hz where forecast entertainment noise at the relevant façade is ≥ 61dB at 63Hz for a bedroom or ≥ 63dB at 63Hz for a living room. • Noise reduction to achieve an amplified music level of L_{LeqT} 43dB at 63Hz in a bedroom, where forecast entertainment noise at the relevant façade is < 61dB at 63Hz. • Noise reduction to achieve an amplified music level of L_{LeqT} 45dB at 63Hz in a living room, where forecast entertainment noise at the relevant façade is < 63dB at 63Hz.

As the noise reduction from outside to inside will depend on the overall transmission loss of the façade, as well as the characteristics of the room (dimensions, volume, surface finishes etc.), the acoustic assessment should clarify how the noise reduction has been determined. For typical residential designs, noise reduction at 63Hz may be assumed to be 6dB less than the overall façade transmission loss at 63Hz. Alternatively, the assessment should provide details of the methodology, assumptions and provide sample calculations to demonstrate how the noise reduction has been determined.

Summary for entertainment noise modelling and façade design

Performance outcome PO24 in 7.2.6.4 of the Fortitude Valley neighbourhood plan code is the default criteria for sensitive development exposed to the Valley SEA core areas. There may be situations where building siting, orientation and/or shielding results in lower noise exposure. If this is the case, a detailed noise model and façade design may be of value. Where this method is applied, the following factors need to be accounted for:

- all surrounding buildings in the Valley SEA core areas are to be modelled as potential entertainment venues
- venues in Core Area A are to be modelled as emitting 88dB at 63Hz at 1 metre from all parts of the building
- venues in Core Area B are to be modelled as emitting 86dB at 63Hz at 1 metre from all parts of the building noise levels at the façades of the proposed building are to be determined from the noise model; the noise reduction required is then determined from Table 4.
- for typical apartment design, noise reduction is assumed to be 6dB less than the façade transmission loss at 63Hz; otherwise provide details of the methodology, assumptions and sample calculations to demonstrate how the noise reduction has been determined.