



**Residential Estate
Callaghan Rd, Narangba**

Rail Noise Assessment Report



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1. Introduction

1.1. Background

TTM was engaged by Pointcorp to undertake a rail noise assessment for the residential estate located at Callaghan Rd, Narangba. This report covers Stages 1 -10 of the development.

The assessment is based on the following:

- a. Noise criteria contained in:
 - i. Transport and Main Roads (TMR) *Policy for Development on Land Affected by Environmental Emissions from Transport and Transport Infrastructure, Version 2.*
 - ii. Queensland Development Code *MP4.4 Buildings in a Transport Noise Corridor.*
- b. Development plan shown in Appendix A.
- c. Noise measurements, analysis and calculations conducted by TTM.

1.2. Scope

The assessment includes the following:

- i. Description of the development site and proposal;
- ii. Measurement of existing rail noise levels and statement of criteria for rail noise intrusion;
- iii. Prediction of rail noise on the development;
- iv. Analysis of measured and predicted noise levels;
- v. Details of recommendations to be incorporated to achieve predicted compliance.

2. Site Description

2.1. Site Location

The site is described by the following:

- Burpengary and Callaghan Roads, Narangba, Qld

The site locality is shown in Figure 1 below.

Figure 1: Site Locality



2.2. Current Conditions at the Site

The site is bound by Burpengary Road to the west and Callaghan Road to the north with privately owned property to the south and east. The rail corridor is located on the opposite side of Burpengary Road approximately 30 metres from the nearest boundary of Stage 10 and 9.

2.3. Acoustic Environment

The site is primarily affected by rail noise from the nearby rail line, which comprises both passenger and freight trains.

2.4. Proposed Development

The proposal is for the development of a residential subdivision comprising of approximately 470 lots. Access to the site is from Callaghan Road. The development plans are shown in Appendix A.

3. Measurements

3.1. Equipment

The following equipment was used to measure existing rail noise levels:

- Norsonic sound level meter Nor131 (SN# 1313158).
- Bruel & Kjaer Sound Calibrator type 4231 (SN# 3009814).

All equipment was calibrated by a NATA accredited laboratory and calibrated before and after the measurement session. No significant drift from the reference signal was recorded.

3.2. Attended Rail Noise Measurements

Attended noise measurements of train passes were conducted in proximity to the site on 11th July 2015. The SLM was positioned at a distance of approximately 15m from the rail line as shown in Figure 2.

Attended measurements were performed in proximity to the rail line to measure trains when they were dominant to eliminate other sources from the measurement. This eliminates the potential unknown maximum noise events which may result from long term unattended noise monitoring.

Noise measurements were conducted using “A”-weighting, “Fast” response, and 5 minute statistical intervals. Statistics recorded included L_{Amax} , SEL (LAE), and L_{Aeq} . The SEL or LAE is the sound exposure level. A parameter closely related to L_{Aeq} for assessment of train events that have similar characteristics but are of different duration. The LAE value contains the same amount of acoustic energy over a 'normalised' one second period as the actual noise event under consideration. Based on the measured LAE level, calculations can be conducted utilising the number of trains per day to determine predicted $L_{Aeq (period)}$ noise levels.

The measurements were conducted in accordance with Australian Standard *AS2377:2002 Acoustics – Methods for the Measurement of Railbound Vehicle Noise*. Weather conditions during the attended measurements were fine with light winds.

Figure 2: Attended Rail Measurement Location



3.3. Results of Measurements

3.3.1. Rail Noise Levels

Attended noise measurements of 14 train passes were obtained and these are considered representative of the rail noise environment at the site. Table 1 presents the measured free-field rail noise levels.

Table 1: Measured Rail Noise Levels

Train Type	Measurement Distance (m)	Measured Level L _{max} dB(A)	Instantaneous Noise Level LAE dB(A)
Electric	14	89	92
Electric	17	83	88
Diesel	14	90	93
Electric	17	86	91
Electric	17	79	87
Electric	14	82	89
Electric	17	86	90
Diesel	14	83	91
Electric	14	85	91
Electric	17	78	86
Diesel	17	91	97
Diesel	14	86	97
Electric	14	90	94
Electric	14	85	90
Single event maximum noise level		91	

The Queensland Rail *Code of Practice – Railway Noise Management* defines the single event maximum sound pressure level as the arithmetic average of maximum levels from the highest 15 single events over a 24-hour period. Based on rail noise modelling guidelines from DTMR, where attended noise measurements are used in calculating the single event maximum sound pressure level, the number of events used in the averaging should reflect the proportion of the total daily events. Therefore, based on 14 measurements of a total scheduled 175 trains per day the averaging is based on the highest single noise measurement, as detailed in Table 1 above.

4. Noise Criteria

4.1. Rail Noise

4.1.1. Department of Transport and Main Roads

The noise criteria for land affected by emissions from rail activities are contained in Module 1.1 of the *State Development Assessment Provisions (SDAP)* and TMR's *Policy for Development on Land Affected by Environmental Emissions from Transport and Transport Infrastructure, Version 2*. The criteria are reproduced in Table 2.

Table 2: Rail Noise Emission Criteria for New Sensitive Land Uses

Development Type	Location	Environmental Noise Criteria
Accommodation activities	External (All facades)	≤65 dB(A) Leq (24 hour) facade corrected ≤87 dB(A) (single event maximum sound pressure level) facade corrected.
	External (Recreation areas)	≤62 dB(A) Leq (24 hour) free field ≤84 dB(A) (single event maximum sound pressure level) free field.
	Internal (Habitable rooms all times)	≤45 dB(A) single event maximum sound pressure level.

4.1.2. Queensland Development Code MP4.4

The *Queensland Development Code Part MP 4.4 - 'Buildings in a Transport Noise Corridor'* August 2015 (QDC) specifies Noise Categories to ensure that habitable rooms of residential buildings are adequately protected from transport noise.

The Noise Categories specify the minimum acoustic R_w ratings for each building component (and provide examples of the relevant systems) to comply with the indoor sound levels as outlined in Australian Standard AS2107. Details regarding the noise categories and acceptable forms of construction can be found within Schedule 1 and 2 of the QDC document. The noise categories for rail noise impacts are summarised in Table 3.

Table 3: Rail Noise Category Levels – QDC MP4.4 (Schedule 3)

Noise Category	Single event maximum noise* L_{Amax} for railway land
Category 4	≥ 85 dB(A)
Category 3	80 – 84 dB(A)
Category 2	75 – 79 dB(A)
Category 1	70 – 74 dB(A)
Category 0	≤ 69 dB(A)

* Measured at 1 metre from the façade of the proposed or existing building.

5. Analysis – Rail Noise

5.1. Rail Volumes

Rail timetables of the North Coast line provided by Queensland Rail (QR) indicate that there is approximately 175 trains per day (highest day of the week) scheduled to pass the site. TTM was advised by QR that all services are subject to alteration, addition and cancellation which may vary the number of actual trains passing on a daily basis.

QR has previously advised TTM that due to confidentiality, QR is unable to provide details of any future plans to duplicate the rail lines or of the ultimate rail traffic volumes.

5.2. Noise Modelling Parameters

Rail noise predictions were conducted using 'SoundPLAN', with the following parameters:

Table 4: Rail Noise Modelling Parameters

Description	Value
Noise modelling program	SoundPLAN v7.4
Prediction methodology	Nordic Rail Prediction (Kilde Rep. 130)
Angle Increment	1°
Train frequency	175 trains per day
Train speed	60km/h (estimated)
Rail noise source height	3.0m above rail line. This source height represents the engine location of freight trains which are a train type on this line, while the source height would be conservative for passenger trains.
Ground heights	Natural and design contours provided by Pointcorp
Ground floor receiver height	1.8m above ground level
First floor receiver height	4.6m above ground level
Façade correction	+2.5 dB(A)

5.3. Noise Model Verification

The single event maximum noise level at the monitoring location was verified in the noise model prior to modelling noise impacts at the development. Table 5 presents the results of the rail noise model verification.

Table 5: Verification of the Rail Noise Model

SLM Location	Measured L _{Amax}	Predicted L _{Amax}	Required Correction
17m from the nearest rail line	91	91	0

The modelled levels are within an acceptable tolerance of the measured levels.

5.4. Predicted Rail Noise Levels - L_{Amax}

Predicted rail noise levels are presented in Figure 3 and Figure 4 at ground floor and first floor levels respectively, inclusive of acoustic barriers as recommended in Section 6.

Figure 3: Predicted Rail Noise Levels L_{Amax} – Ground Floor

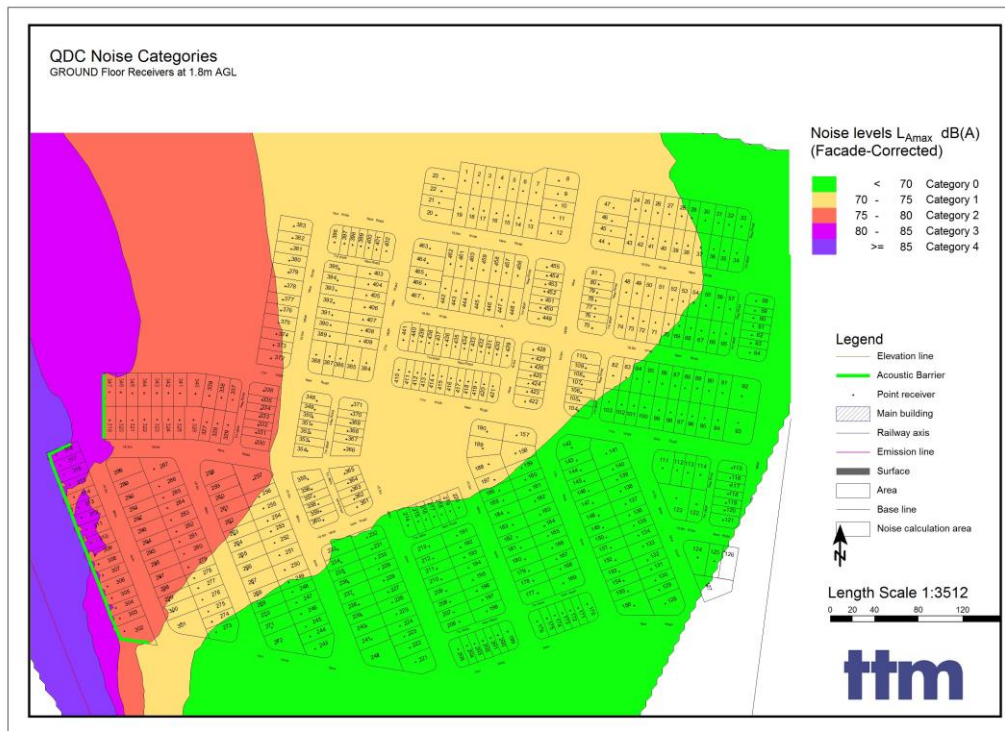
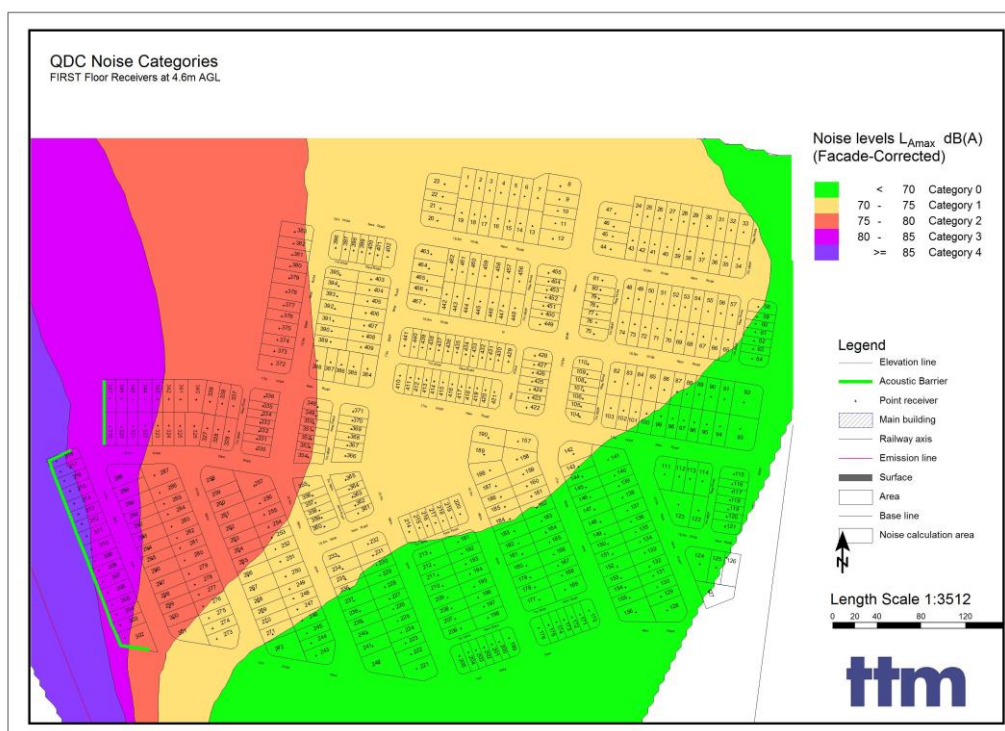


Figure 4: Predicted Rail Noise Levels L_{Amax} – First Floor



Rail noise levels are predicted to comply with the external L_{Amax} criteria for facades and private open space for all lots, with the inclusion of acoustic barriers as recommended in Section 6. Receiver point noise levels are provided in Appendix B.

Noise levels are however predicted to exceed QDC MP4.4 criteria (noise category 1 or higher) for many lots (as shown in Figure 3 and Figure 4). QDC noise affected lots are specified in Section 6 to ensure compliance with internal sound level criteria.

5.5. Predicted Rail Noise Levels - $L_{Aeq}(24\text{ hr})$

Based on the measured LAE levels, calculations were conducted in accordance with AS1055¹ utilising the number of trains per day to determine the $L_{Aeq}(24\text{ hr})$ noise impacts at the development. The predicted noise levels at the nearest receivers (lots 302 - 318) for external façade and private open space noise levels are presented in Table 6 and Table 7 respectively, with the inclusion of acoustic barriers as recommended in Section 6. If compliance is achieved at this location, then compliance is predicted to be achieved at all other locations.

Table 6: Predicted $L_{Aeq}(24\text{ hr})$ Noise Level at the Nearest Receiver – External Façade

Location	Distance from Rail Line (m)	Predicted $L_{Aeq}(24\text{ hr})$, dB(A) Façade Corrected	Criteria $L_{Aeq}(24\text{ hr})$, dB(A) Façade Corrected	Complies:
Lots 302 - 318	50	60	65	✓

Table 7: Predicted $L_{Aeq}(24\text{ hr})$ Noise Level at the Nearest Receiver – Private Open Space

Location	Distance from Rail Line (m)	Predicted $L_{Aeq}(24\text{ hr})$, dB(A) Free Field	Criteria $L_{Aeq}(24\text{ hr})$, dB(A) Free Field	Complies:
Lots 302 - 318	50	57	62	✓

Rail noise levels are predicted to comply with the external $L_{Aeq}(24\text{ hr})$ criteria for facades and private open space for all lots. Noise calculations are included in Appendix C.

¹ AS 1055.1-1997 Acoustics - Description and measurement of environmental noise

6. Recommendations

Compliance is predicted to be achieved provided the recommendations detailed below are incorporated into the development.

6.1. Acoustic Barrier

Acoustic barriers are recommended to improve the amenity for private open space areas and reduce the building treatment requirements where possible. The location and extent of the acoustic barriers are shown in Figure 5.

Barrier recommendations are as follows:

- a. The acoustic barriers should be the minimum height relative to the finished site boundary levels. The recommended minimum heights are specified in Figure 5.
- b. Noise barriers adjacent to a railway are required to be in accordance with Queensland Rail Civil Engineering Technical Requirement – CIVIL-SR-014 – Design of Noise Barriers Adjacent to Railways.
- c. The barrier shall be constructed of a material with a surface mass not less than 15kg/m^2 .
- d. Suitable materials may include earth mound, lapped timber palings, steel sheets, fibre cement sheeting, plywood, glass, masonry, or a combination of materials.
- e. No gaps or holes should be evident in the barrier construction.

Figure 5: Recommended Acoustic Barriers



6.2. Dwelling Treatments

The QDC MP4.4 requires that habitable rooms in residential buildings located in a transport noise corridor are adequately protected from transport noise to safeguard occupant's health and amenity.

In order to achieve the performance requirements of the QDC MP4.4, the external building envelope of habitable rooms must comply with the minimum R_w for each building component specified in Schedule 1 to achieve a minimum transport noise reduction level for the relevant noise category by either one of the following:

- Using materials specified in Schedule 2 of the QDC MP4.4;

OR

- b. Using materials with manufacturer's specifications that, in combination, achieve the minimum R_w value for the relevant building component and applicable noise category.

For application of Point (b), possible alternative constructions can be determined by the glazier (for glazing) and construction manuals such as 'The Red Book' by CSR (for walls and roof/ceiling).

Noise affected lots, with a QDC Noise Category 1 or higher, are presented in Table 8. All other lots are noise category 0. The QDC Noise Categories for noise affected lots are presented in Appendix B.

Table 8: Noise Affected Lots

Floor	Noise Affected Lots (QDC Noise Category 1 or higher)
Ground and First Floor	1-29, 37-54, 69-84, 102-110, 157-159, 186-190, 232, 233, 249-268, 273-467
First Floor only	30-36, 55-61, 65-68, 85-88, 100-101, 142, 143, 160-163, 183-185, 191, 214-220, 230, 231, 234-236, 246-248, 269-271,

QDC MP4.4 Schedule 1 & 2 which describe noise categories and associated building components are provided in Appendix D of this report.

Dwellings on noise affected lots may be constructed in accordance with the QDC Noise Category conservative construction requirements for the nominated lot, or alternatively, we recommend an individual acoustic assessment be conducted by a suitably qualified acoustic consultant, once building plans are available, to optimise acoustic treatments for quality and cost savings.

7. Conclusion

A rail noise assessment was conducted for the proposed residential estate located at Callaghan Rd, Narangba. Based on the implementation of the recommendations detailed in Section 6, the development is predicted to comply with the noise criteria outlined in Section 4.

Appendix A Development Plans

Appendix B SoundPLAN Noise Modelling Results

Callaghan Rd, Narangba Assessed receiver levels 16BRA0130 Verification 2015	2
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Receiver	FI	Lmax dB(A)	
Norsonic - 91dBA	G	91.0	

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	TTM Consulting (Qld) Pty Ltd Level 1 - 129 Logan Rd Woolloongabba, QLD 4102	1
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SoundPLAN 7.4

Callaghan Rd, Narangba
Assessed Receiver Levels
16BRA0130 Rail Noise 2026
with Acoustic Barrier

SoundPLAN
v7.4

Receiver	Floor	LAmaz Free field dB(A)	LAmaz Façade Corrected dB(A)	Recreation Criteria < 84 dB(A) (free field)	External Façade Criteria < 87 dB(A) (façade corrected)	QDC Noise Category
Lot 001	G	70	72.5	ok	ok	1
	F2	70.8	73.3	ok	ok	1
Lot 002	G	70.1	72.6	ok	ok	1
	F2	70.8	73.3	ok	ok	1
Lot 003	G	70.1	72.6	ok	ok	1
	F2	70.9	73.4	ok	ok	1
Lot 004	G	70.2	72.7	ok	ok	1
	F2	71	73.5	ok	ok	1
Lot 005	G	70.2	72.7	ok	ok	1
	F2	71	73.5	ok	ok	1
Lot 006	G	70.3	72.8	ok	ok	1
	F2	71	73.5	ok	ok	1
Lot 007	G	70.5	73	ok	ok	1
	F2	70.9	73.4	ok	ok	1
Lot 008	G	70.5	73	ok	ok	1
	F2	70.9	73.4	ok	ok	1
Lot 009	G	70.5	73	ok	ok	1
	F2	70.8	73.3	ok	ok	1
Lot 010	G	70.4	72.9	ok	ok	1
	F2	70.8	73.3	ok	ok	1
Lot 011	G	70.4	72.9	ok	ok	1
	F2	70.7	73.2	ok	ok	1
Lot 012	G	70.4	72.9	ok	ok	1
	F2	70.7	73.2	ok	ok	1
Lot 013	G	70.2	72.7	ok	ok	1
	F2	70.9	73.4	ok	ok	1
Lot 014	G	70.2	72.7	ok	ok	1
	F2	70.9	73.4	ok	ok	1
Lot 015	G	70.2	72.7	ok	ok	1
	F2	71	73.5	ok	ok	1

Lot 016	G	70.1	72.6	ok	ok	1
	F2	70.9	73.4	ok	ok	1
Lot 017	G	70.1	72.6	ok	ok	1
	F2	70.9	73.4	ok	ok	1
Lot 018	G	70	72.5	ok	ok	1
	F2	70.8	73.3	ok	ok	1
Lot 019	G	70	72.5	ok	ok	1
	F2	70.8	73.3	ok	ok	1
Lot 020	G	70.2	72.7	ok	ok	1
	F2	71	73.5	ok	ok	1
Lot 021	G	70.2	72.7	ok	ok	1
	F2	70.9	73.4	ok	ok	1
Lot 022	G	70.1	72.6	ok	ok	1
	F2	70.8	73.3	ok	ok	1
Lot 023	G	70.1	72.6	ok	ok	1
	F2	70.9	73.4	ok	ok	1
Lot 024	G	69.5	72	ok	ok	1
	F2	69.9	72.4	ok	ok	1
Lot 025	G	69.3	71.8	ok	ok	1
	F2	69.7	72.2	ok	ok	1
Lot 026	G	69.1	71.6	ok	ok	1
	F2	69.4	71.9	ok	ok	1
Lot 027	G	68.8	71.3	ok	ok	1
	F2	69.2	71.7	ok	ok	1
Lot 028	G	68.2	70.7	ok	ok	1
	F2	69	71.5	ok	ok	1
Lot 029	G	67.5	70	ok	ok	1
	F2	68.9	71.4	ok	ok	1
Lot 030	G	66.7	69.2	ok	ok	0
	F2	68.7	71.2	ok	ok	1
Lot 031	G	65.9	68.4	ok	ok	0
	F2	68.5	71	ok	ok	1
Lot 032	G	65.6	68.1	ok	ok	0
	F2	68.3	70.8	ok	ok	1
Lot 033	G	65	67.5	ok	ok	0
	F2	68.1	70.6	ok	ok	1
Lot 034	G	65.5	68	ok	ok	0
	F2	68.2	70.7	ok	ok	1
Lot 035	G	66.3	68.8	ok	ok	0
	F2	68.4	70.9	ok	ok	1
Lot 036	G	66.8	69.3	ok	ok	0
	F2	68.5	71	ok	ok	1
Lot 037	G	67.6	70.1	ok	ok	1
	F2	68.7	71.2	ok	ok	1

Lot 038	G	68.1	70.6	ok	ok	1
	F2	68.9	71.4	ok	ok	1
Lot 039	G	68.6	71.1	ok	ok	1
	F2	69.1	71.6	ok	ok	1
Lot 040	G	68.9	71.4	ok	ok	1
	F2	69.2	71.7	ok	ok	1
Lot 041	G	69.1	71.6	ok	ok	1
	F2	69.6	72.1	ok	ok	1
Lot 042	G	69.3	71.8	ok	ok	1
	F2	69.7	72.2	ok	ok	1
Lot 043	G	69.4	71.9	ok	ok	1
	F2	69.9	72.4	ok	ok	1
Lot 044	G	69.8	72.3	ok	ok	1
	F2	70.2	72.7	ok	ok	1
Lot 045	G	69.8	72.3	ok	ok	1
	F2	70.2	72.7	ok	ok	1
Lot 046	G	69.8	72.3	ok	ok	1
	F2	70.2	72.7	ok	ok	1
Lot 047	G	69.8	72.3	ok	ok	1
	F2	70.2	72.7	ok	ok	1
Lot 048	G	69.2	71.7	ok	ok	1
	F2	69.7	72.2	ok	ok	1
Lot 049	G	69	71.5	ok	ok	1
	F2	69.6	72.1	ok	ok	1
Lot 050	G	68.8	71.3	ok	ok	1
	F2	69.4	71.9	ok	ok	1
Lot 051	G	68.6	71.1	ok	ok	1
	F2	69	71.5	ok	ok	1
Lot 052	G	68.3	70.8	ok	ok	1
	F2	68.9	71.4	ok	ok	1
Lot 053	G	68.1	70.6	ok	ok	1
	F2	68.7	71.2	ok	ok	1
Lot 054	G	67.2	69.7	ok	ok	1
	F2	68.6	71.1	ok	ok	1
Lot 055	G	66.8	69.3	ok	ok	0
	F2	68.4	70.9	ok	ok	1
Lot 056	G	66.1	68.6	ok	ok	0
	F2	68.2	70.7	ok	ok	1
Lot 057	G	65.4	67.9	ok	ok	0
	F2	68	70.5	ok	ok	1
Lot 058	G	64.2	66.7	ok	ok	0
	F2	67.5	70	ok	ok	1
Lot 059	G	64.3	66.8	ok	ok	0
	F2	67.4	69.9	ok	ok	1

Lot 060	G	64.3	66.8	ok	ok	0
	F2	67.4	69.9	ok	ok	1
Lot 061	G	63.8	66.3	ok	ok	0
	F2	67.2	69.7	ok	ok	1
Lot 062	G	63.4	65.9	ok	ok	0
	F2	66.5	69	ok	ok	0
Lot 063	G	62.9	65.4	ok	ok	0
	F2	66.4	68.9	ok	ok	0
Lot 064	G	62.3	64.8	ok	ok	0
	F2	66	68.5	ok	ok	0
Lot 065	G	64.3	66.8	ok	ok	0
	F2	67.7	70.2	ok	ok	1
Lot 066	G	65.1	67.6	ok	ok	0
	F2	68	70.5	ok	ok	1
Lot 067	G	66.1	68.6	ok	ok	0
	F2	68.2	70.7	ok	ok	1
Lot 068	G	66.7	69.2	ok	ok	0
	F2	68.4	70.9	ok	ok	1
Lot 069	G	67.2	69.7	ok	ok	1
	F2	68.6	71.1	ok	ok	1
Lot 070	G	67.8	70.3	ok	ok	1
	F2	68.7	71.2	ok	ok	1
Lot 071	G	68.3	70.8	ok	ok	1
	F2	68.9	71.4	ok	ok	1
Lot 072	G	68.6	71.1	ok	ok	1
	F2	69.1	71.6	ok	ok	1
Lot 073	G	68.9	71.4	ok	ok	1
	F2	69.3	71.8	ok	ok	1
Lot 074	G	69.2	71.7	ok	ok	1
	F2	69.7	72.2	ok	ok	1
Lot 075	G	69.4	71.9	ok	ok	1
	F2	69.9	72.4	ok	ok	1
Lot 076	G	69.5	72	ok	ok	1
	F2	70	72.5	ok	ok	1
Lot 077	G	69.5	72	ok	ok	1
	F2	70	72.5	ok	ok	1
Lot 078	G	69.6	72.1	ok	ok	1
	F2	70.1	72.6	ok	ok	1
Lot 079	G	69.6	72.1	ok	ok	1
	F2	70.1	72.6	ok	ok	1
Lot 080	G	69.6	72.1	ok	ok	1
	F2	70.1	72.6	ok	ok	1
Lot 081	G	69.7	72.2	ok	ok	1
	F2	70.1	72.6	ok	ok	1

Lot 082	G	68.1	70.6	ok	ok	1
	F2	69.1	71.6	ok	ok	1
Lot 083	G	67.5	70	ok	ok	1
	F2	68.9	71.4	ok	ok	1
Lot 084	G	67.1	69.6	ok	ok	1
	F2	68.6	71.1	ok	ok	1
Lot 085	G	65.2	67.7	ok	ok	0
	F2	68.2	70.7	ok	ok	1
Lot 086	G	64.7	67.2	ok	ok	0
	F2	68	70.5	ok	ok	1
Lot 087	G	64.2	66.7	ok	ok	0
	F2	67.7	70.2	ok	ok	1
Lot 088	G	63.4	65.9	ok	ok	0
	F2	67.3	69.8	ok	ok	1
Lot 089	G	62.7	65.2	ok	ok	0
	F2	66.5	69	ok	ok	0
Lot 090	G	61.8	64.3	ok	ok	0
	F2	65.9	68.4	ok	ok	0
Lot 091	G	61.1	63.6	ok	ok	0
	F2	64.9	67.4	ok	ok	0
Lot 092	G	60.1	62.6	ok	ok	0
	F2	64.1	66.6	ok	ok	0
Lot 093	G	59.1	61.6	ok	ok	0
	F2	62.5	65	ok	ok	0
Lot 094	G	59.8	62.3	ok	ok	0
	F2	64.1	66.6	ok	ok	0
Lot 095	G	60.6	63.1	ok	ok	0
	F2	64.2	66.7	ok	ok	0
Lot 096	G	61.4	63.9	ok	ok	0
	F2	65.2	67.7	ok	ok	0
Lot 097	G	62	64.5	ok	ok	0
	F2	66	68.5	ok	ok	0
Lot 098	G	62.5	65	ok	ok	0
	F2	66.5	69	ok	ok	0
Lot 099	G	63	65.5	ok	ok	0
	F2	66.8	69.3	ok	ok	0
Lot 100	G	64.4	66.9	ok	ok	0
	F2	67.7	70.2	ok	ok	1
Lot 101	G	66.6	69.1	ok	ok	0
	F2	68.4	70.9	ok	ok	1
Lot 102	G	67.2	69.7	ok	ok	1
	F2	68.6	71.1	ok	ok	1
Lot 103	G	67.3	69.8	ok	ok	1
	F2	68.8	71.3	ok	ok	1

Lot 104	G	67.5	70	ok	ok	1
	F2	69	71.5	ok	ok	1
Lot 105	G	68.2	70.7	ok	ok	1
	F2	69.2	71.7	ok	ok	1
Lot 106	G	68.5	71	ok	ok	1
	F2	69.3	71.8	ok	ok	1
Lot 107	G	68.7	71.2	ok	ok	1
	F2	69.4	71.9	ok	ok	1
Lot 108	G	68.8	71.3	ok	ok	1
	F2	69.5	72	ok	ok	1
Lot 109	G	69	71.5	ok	ok	1
	F2	69.5	72	ok	ok	1
Lot 110	G	69.1	71.6	ok	ok	1
	F2	69.8	72.3	ok	ok	1
Lot 111	G	59.9	62.4	ok	ok	0
	F2	61.6	64.1	ok	ok	0
Lot 112	G	59.6	62.1	ok	ok	0
	F2	61	63.5	ok	ok	0
Lot 113	G	59.4	61.9	ok	ok	0
	F2	60.7	63.2	ok	ok	0
Lot 114	G	59.3	61.8	ok	ok	0
	F2	60.4	62.9	ok	ok	0
Lot 115	G	59.1	61.6	ok	ok	0
	F2	60	62.5	ok	ok	0
Lot 116	G	58.8	61.3	ok	ok	0
	F2	59.7	62.2	ok	ok	0
Lot 117	G	58.8	61.3	ok	ok	0
	F2	59.5	62	ok	ok	0
Lot 118	G	58.7	61.2	ok	ok	0
	F2	59.5	62	ok	ok	0
Lot 119	G	58.6	61.1	ok	ok	0
	F2	59.3	61.8	ok	ok	0
Lot 120	G	58.5	61	ok	ok	0
	F2	59.2	61.7	ok	ok	0
Lot 121	G	58.4	60.9	ok	ok	0
	F2	59	61.5	ok	ok	0
Lot 122	G	58.8	61.3	ok	ok	0
	F2	59.7	62.2	ok	ok	0
Lot 123	G	59	61.5	ok	ok	0
	F2	59.9	62.4	ok	ok	0
Lot 124	G	58.3	60.8	ok	ok	0
	F2	58.9	61.4	ok	ok	0
Lot 125	G	58.1	60.6	ok	ok	0
	F2	58.7	61.2	ok	ok	0

Lot 126	G	58.1	60.6	ok	ok	0
	F2	58.7	61.2	ok	ok	0
Lot 127	G	58	60.5	ok	ok	0
	F2	59.6	62.1	ok	ok	0
Lot 128	G	58.2	60.7	ok	ok	0
	F2	59.5	62	ok	ok	0
Lot 129	G	58.4	60.9	ok	ok	0
	F2	59	61.5	ok	ok	0
Lot 130	G	58.5	61	ok	ok	0
	F2	59.1	61.6	ok	ok	0
Lot 131	G	58.7	61.2	ok	ok	0
	F2	59.3	61.8	ok	ok	0
Lot 132	G	58.8	61.3	ok	ok	0
	F2	59.5	62	ok	ok	0
Lot 133	G	58.9	61.4	ok	ok	0
	F2	59.6	62.1	ok	ok	0
Lot 134	G	58.9	61.4	ok	ok	0
	F2	59.8	62.3	ok	ok	0
Lot 135	G	59.1	61.6	ok	ok	0
	F2	60.1	62.6	ok	ok	0
Lot 136	G	59.3	61.8	ok	ok	0
	F2	60.4	62.9	ok	ok	0
Lot 137	G	59.6	62.1	ok	ok	0
	F2	60.8	63.3	ok	ok	0
Lot 138	G	60.1	62.6	ok	ok	0
	F2	61.9	64.4	ok	ok	0
Lot 139	G	60.6	63.1	ok	ok	0
	F2	63	65.5	ok	ok	0
Lot 140	G	60.7	63.2	ok	ok	0
	F2	64.3	66.8	ok	ok	0
Lot 141	G	61.2	63.7	ok	ok	0
	F2	65.8	68.3	ok	ok	0
Lot 142	G	65.3	67.8	ok	ok	0
	F2	68.3	70.8	ok	ok	1
Lot 143	G	63.2	65.7	ok	ok	0
	F2	67.7	70.2	ok	ok	1
Lot 144	G	62.1	64.6	ok	ok	0
	F2	66.6	69.1	ok	ok	0
Lot 145	G	61.1	63.6	ok	ok	0
	F2	65.5	68	ok	ok	0
Lot 146	G	60.6	63.1	ok	ok	0
	F2	64.6	67.1	ok	ok	0
Lot 147	G	60.9	63.4	ok	ok	0
	F2	63.3	65.8	ok	ok	0

Lot 148	G	60.3	62.8	ok	ok	0
	F2	61.9	64.4	ok	ok	0
Lot 149	G	59.8	62.3	ok	ok	0
	F2	61.2	63.7	ok	ok	0
Lot 150	G	59.6	62.1	ok	ok	0
	F2	60.7	63.2	ok	ok	0
Lot 151	G	59.3	61.8	ok	ok	0
	F2	60.3	62.8	ok	ok	0
Lot 152	G	59.1	61.6	ok	ok	0
	F2	59.9	62.4	ok	ok	0
Lot 153	G	59	61.5	ok	ok	0
	F2	59.8	62.3	ok	ok	0
Lot 154	G	58.9	61.4	ok	ok	0
	F2	59.6	62.1	ok	ok	0
Lot 155	G	58.8	61.3	ok	ok	0
	F2	59.4	61.9	ok	ok	0
Lot 156	G	58.5	61	ok	ok	0
	F2	59.6	62.1	ok	ok	0
Lot 157	G	68.8	71.3	ok	ok	1
	F2	69.6	72.1	ok	ok	1
Lot 158	G	68.4	70.9	ok	ok	1
	F2	69.1	71.6	ok	ok	1
Lot 159	G	67.2	69.7	ok	ok	1
	F2	68.7	71.2	ok	ok	1
Lot 160	G	66.1	68.6	ok	ok	0
	F2	68.3	70.8	ok	ok	1
Lot 161	G	65.3	67.8	ok	ok	0
	F2	67.9	70.4	ok	ok	1
Lot 162	G	64	66.5	ok	ok	0
	F2	67.5	70	ok	ok	1
Lot 163	G	63.5	66	ok	ok	0
	F2	67.2	69.7	ok	ok	1
Lot 164	G	61.8	64.3	ok	ok	0
	F2	65.4	67.9	ok	ok	0
Lot 165	G	61.1	63.6	ok	ok	0
	F2	64.4	66.9	ok	ok	0
Lot 166	G	60.6	63.1	ok	ok	0
	F2	63.8	66.3	ok	ok	0
Lot 167	G	61	63.5	ok	ok	0
	F2	62.7	65.2	ok	ok	0
Lot 168	G	60.6	63.1	ok	ok	0
	F2	62	64.5	ok	ok	0
Lot 169	G	60.2	62.7	ok	ok	0
	F2	61.3	63.8	ok	ok	0

Lot 170	G	59.3	61.8	ok	ok	0
	F2	60.3	62.8	ok	ok	0
Lot 171	G	59.3	61.8	ok	ok	0
	F2	60.4	62.9	ok	ok	0
Lot 172	G	59.3	61.8	ok	ok	0
	F2	60.5	63	ok	ok	0
Lot 173	G	59.4	61.9	ok	ok	0
	F2	60.5	63	ok	ok	0
Lot 174	G	59.4	61.9	ok	ok	0
	F2	60.5	63	ok	ok	0
Lot 175	G	59.4	61.9	ok	ok	0
	F2	60.6	63.1	ok	ok	0
Lot 176	G	59.5	62	ok	ok	0
	F2	60.6	63.1	ok	ok	0
Lot 177	G	60.4	62.9	ok	ok	0
	F2	61.5	64	ok	ok	0
Lot 178	G	60.9	63.4	ok	ok	0
	F2	62.4	64.9	ok	ok	0
Lot 179	G	60.9	63.4	ok	ok	0
	F2	63.1	65.6	ok	ok	0
Lot 180	G	60.8	63.3	ok	ok	0
	F2	64.2	66.7	ok	ok	0
Lot 181	G	61.6	64.1	ok	ok	0
	F2	64.8	67.3	ok	ok	0
Lot 182	G	62.3	64.8	ok	ok	0
	F2	66.1	68.6	ok	ok	0
Lot 183	G	63.9	66.4	ok	ok	0
	F2	67.2	69.7	ok	ok	1
Lot 184	G	64.7	67.2	ok	ok	0
	F2	67.5	70	ok	ok	1
Lot 185	G	65.9	68.4	ok	ok	0
	F2	68.1	70.6	ok	ok	1
Lot 186	G	67	69.5	ok	ok	1
	F2	68.5	71	ok	ok	1
Lot 187	G	67.7	70.2	ok	ok	1
	F2	68.9	71.4	ok	ok	1
Lot 188	G	68.5	71	ok	ok	1
	F2	69.4	71.9	ok	ok	1
Lot 189	G	69	71.5	ok	ok	1
	F2	69.9	72.4	ok	ok	1
Lot 190	G	69.2	71.7	ok	ok	1
	F2	70.1	72.6	ok	ok	1
Lot 191	G	64.2	66.7	ok	ok	0
	F2	67.3	69.8	ok	ok	1

Lot 192	G	62.8	65.3	ok	ok	0
	F2	66.1	68.6	ok	ok	0
Lot 193	G	62.4	64.9	ok	ok	0
	F2	65.1	67.6	ok	ok	0
Lot 194	G	61.6	64.1	ok	ok	0
	F2	64.4	66.9	ok	ok	0
Lot 195	G	61.3	63.8	ok	ok	0
	F2	63.1	65.6	ok	ok	0
Lot 196	G	60.9	63.4	ok	ok	0
	F2	62.3	64.8	ok	ok	0
Lot 197	G	60.6	63.1	ok	ok	0
	F2	61.7	64.2	ok	ok	0
Lot 198	G	60.2	62.7	ok	ok	0
	F2	61.5	64	ok	ok	0
Lot 199	G	59.3	61.8	ok	ok	0
	F2	60.6	63.1	ok	ok	0
Lot 200	G	59.4	61.9	ok	ok	0
	F2	60.8	63.3	ok	ok	0
Lot 201	G	59.4	61.9	ok	ok	0
	F2	60.9	63.4	ok	ok	0
Lot 202	G	59.4	61.9	ok	ok	0
	F2	60.9	63.4	ok	ok	0
Lot 203	G	59.4	61.9	ok	ok	0
	F2	60.8	63.3	ok	ok	0
Lot 204	G	59.3	61.8	ok	ok	0
	F2	60.8	63.3	ok	ok	0
Lot 205	G	59.4	61.9	ok	ok	0
	F2	60.8	63.3	ok	ok	0
Lot 206	G	60	62.5	ok	ok	0
	F2	61.2	63.7	ok	ok	0
Lot 207	G	60.3	62.8	ok	ok	0
	F2	61.6	64.1	ok	ok	0
Lot 208	G	60.7	63.2	ok	ok	0
	F2	61.9	64.4	ok	ok	0
Lot 209	G	61.1	63.6	ok	ok	0
	F2	62.6	65.1	ok	ok	0
Lot 210	G	62	64.5	ok	ok	0
	F2	64.3	66.8	ok	ok	0
Lot 210	G	61.6	64.1	ok	ok	0
	F2	63.3	65.8	ok	ok	0
Lot 212	G	62.3	64.8	ok	ok	0
	F2	65	67.5	ok	ok	0
Lot 213	G	62.9	65.4	ok	ok	0
	F2	66.4	68.9	ok	ok	0

Lot 214	G	65.4	67.9	ok	ok	0
	F2	68.4	70.9	ok	ok	1
Lot 215	G	65.8	68.3	ok	ok	0
	F2	68.4	70.9	ok	ok	1
Lot 216	G	66.1	68.6	ok	ok	0
	F2	68.4	70.9	ok	ok	1
Lot 217	G	66.3	68.8	ok	ok	0
	F2	68.5	71	ok	ok	1
Lot 218	G	66.3	68.8	ok	ok	0
	F2	68.5	71	ok	ok	1
Lot 219	G	66.6	69.1	ok	ok	0
	F2	68.5	71	ok	ok	1
Lot 220	G	66.8	69.3	ok	ok	0
	F2	68.5	71	ok	ok	1
Lot 221	G	60	62.5	ok	ok	0
	F2	61.5	64	ok	ok	0
Lot 222	G	60.5	63	ok	ok	0
	F2	62.1	64.6	ok	ok	0
Lot 223	G	60.8	63.3	ok	ok	0
	F2	62.6	65.1	ok	ok	0
Lot 224	G	61.2	63.7	ok	ok	0
	F2	62.6	65.1	ok	ok	0
Lot 225	G	61.4	63.9	ok	ok	0
	F2	62.8	65.3	ok	ok	0
Lot 226	G	61.8	64.3	ok	ok	0
	F2	63.3	65.8	ok	ok	0
Lot 227	G	62.2	64.7	ok	ok	0
	F2	63.8	66.3	ok	ok	0
Lot 228	G	62.6	65.1	ok	ok	0
	F2	64.8	67.3	ok	ok	0
Lot 229	G	63.3	65.8	ok	ok	0
	F2	66.1	68.6	ok	ok	0
Lot 230	G	64	66.5	ok	ok	0
	F2	67.4	69.9	ok	ok	1
Lot 231	G	65.2	67.7	ok	ok	0
	F2	68.5	71	ok	ok	1
Lot 232	G	67.1	69.6	ok	ok	1
	F2	69.6	72.1	ok	ok	1
Lot 233	G	67.2	69.7	ok	ok	1
	F2	69.9	72.4	ok	ok	1
Lot 234	G	65.7	68.2	ok	ok	0
	F2	69.1	71.6	ok	ok	1
Lot 235	G	64.6	67.1	ok	ok	0
	F2	68.4	70.9	ok	ok	1

Lot 236	G	63.8	66.3	ok	ok	0
	F2	67.5	70	ok	ok	1
Lot 237	G	63.7	66.2	ok	ok	0
	F2	66	68.5	ok	ok	0
Lot 238	G	63.1	65.6	ok	ok	0
	F2	65	67.5	ok	ok	0
Lot 239	G	62.7	65.2	ok	ok	0
	F2	64.4	66.9	ok	ok	0
Lot 240	G	62.2	64.7	ok	ok	0
	F2	63.6	66.1	ok	ok	0
Lot 241	G	61.8	64.3	ok	ok	0
	F2	63.1	65.6	ok	ok	0
Lot 242	G	61.4	63.9	ok	ok	0
	F2	62.7	65.2	ok	ok	0
Lot 243	G	63.4	65.9	ok	ok	0
	F2	64.6	67.1	ok	ok	0
Lot 244	G	64.2	66.7	ok	ok	0
	F2	65.7	68.2	ok	ok	0
Lot 245	G	64.4	66.9	ok	ok	0
	F2	66.6	69.1	ok	ok	0
Lot 246	G	64.8	67.3	ok	ok	0
	F2	67.4	69.9	ok	ok	1
Lot 247	G	65.2	67.7	ok	ok	0
	F2	68.4	70.9	ok	ok	1
Lot 248	G	66.2	68.7	ok	ok	0
	F2	69.4	71.9	ok	ok	1
Lot 249	G	67.3	69.8	ok	ok	1
	F2	70.3	72.8	ok	ok	1
Lot 250	G	69.1	71.6	ok	ok	1
	F2	71.3	73.8	ok	ok	1
Lot 251	G	70.4	72.9	ok	ok	1
	F2	71.9	74.4	ok	ok	1
Lot 252	G	70.9	73.4	ok	ok	1
	F2	72.2	74.7	ok	ok	2
Lot 253	G	71.2	73.7	ok	ok	1
	F2	72.5	75	ok	ok	2
Lot 254	G	71.6	74.1	ok	ok	1
	F2	72.7	75.2	ok	ok	2
Lot 255	G	72	74.5	ok	ok	2
	F2	73.1	75.6	ok	ok	2
Lot 256	G	72.4	74.9	ok	ok	2
	F2	73.4	75.9	ok	ok	2
Lot 257	G	72.7	75.2	ok	ok	2
	F2	73.8	76.3	ok	ok	2

Lot 258	G	74.2	76.7	ok	ok	2
	F2	74.9	77.4	ok	ok	2
Lot 260	G	73.5	76	ok	ok	2
	F2	74.3	76.8	ok	ok	2
Lot 261	G	73.1	75.6	ok	ok	2
	F2	74	76.5	ok	ok	2
Lot 262	G	72.7	75.2	ok	ok	2
	F2	73.7	76.2	ok	ok	2
Lot 263	G	72.3	74.8	ok	ok	2
	F2	73.2	75.7	ok	ok	2
Lot 264	G	71.8	74.3	ok	ok	1
	F2	73	75.5	ok	ok	2
Lot 265	G	71.3	73.8	ok	ok	1
	F2	72.7	75.2	ok	ok	2
Lot 266	G	70.2	72.7	ok	ok	1
	F2	72.2	74.7	ok	ok	2
Lot 267	G	69.2	71.7	ok	ok	1
	F2	71.6	74.1	ok	ok	1
Lot 268	G	67.9	70.4	ok	ok	1
	F2	70.7	73.2	ok	ok	1
Lot 269	G	66.8	69.3	ok	ok	0
	F2	69.8	72.3	ok	ok	1
Lot 270	G	65.8	68.3	ok	ok	0
	F2	68.9	71.4	ok	ok	1
Lot 271	G	65.3	67.8	ok	ok	0
	F2	67.8	70.3	ok	ok	1
Lot 272	G	64.9	67.4	ok	ok	0
	F2	66.6	69.1	ok	ok	0
Lot 273	G	67.1	69.6	ok	ok	1
	F2	69.9	72.4	ok	ok	1
Lot 274	G	68	70.5	ok	ok	1
	F2	71	73.5	ok	ok	1
Lot 275	G	69.1	71.6	ok	ok	1
	F2	71.9	74.4	ok	ok	1
Lot 276	G	70.1	72.6	ok	ok	1
	F2	72.6	75.1	ok	ok	2
Lot 277	G	71.1	73.6	ok	ok	1
	F2	73.2	75.7	ok	ok	2
Lot 278	G	72.1	74.6	ok	ok	2
	F2	73.7	76.2	ok	ok	2
Lot 279	G	73	75.5	ok	ok	2
	F2	74.2	76.7	ok	ok	2
Lot 280	G	73.4	75.9	ok	ok	2
	F2	74.7	77.2	ok	ok	2

Lot 281	G	73.7	76.2	ok	ok	2
	F2	75	77.5	ok	ok	2
Lot 282	G	74.2	76.7	ok	ok	2
	F2	75.4	77.9	ok	ok	2
Lot 283	G	74.6	77.1	ok	ok	2
	F2	75.8	78.3	ok	ok	2
Lot 284	G	74.7	77.2	ok	ok	2
	F2	76	78.5	ok	ok	2
Lot 285	G	75	77.5	ok	ok	2
	F2	76.2	78.7	ok	ok	2
Lot 286	G	75.5	78	ok	ok	2
	F2	76.4	78.9	ok	ok	2
Lot 287	G	75.9	78.4	ok	ok	2
	F2	76.8	79.3	ok	ok	2
Lot 288	G	77	79.5	ok	ok	3
	F2	78.5	81	ok	ok	3
Lot 289	G	76.5	79	ok	ok	2
	F2	78.2	80.7	ok	ok	3
Lot 290	G	76.2	78.7	ok	ok	2
	F2	77.8	80.3	ok	ok	3
Lot 291	G	75.8	78.3	ok	ok	2
	F2	77.7	80.2	ok	ok	3
Lot 292	G	75.7	78.2	ok	ok	2
	F2	77.5	80	ok	ok	3
Lot 293	G	75.4	77.9	ok	ok	2
	F2	77.4	79.9	ok	ok	3
Lot 294	G	75	77.5	ok	ok	2
	F2	76.9	79.4	ok	ok	2
Lot 295	G	74.7	77.2	ok	ok	2
	F2	76.6	79.1	ok	ok	2
Lot 296	G	74.2	76.7	ok	ok	2
	F2	76	78.5	ok	ok	2
Lot 297	G	73.8	76.3	ok	ok	2
	F2	75.5	78	ok	ok	2
Lot 298	G	73.3	75.8	ok	ok	2
	F2	75	77.5	ok	ok	2
Lot 299	G	72.5	75	ok	ok	2
	F2	74.3	76.8	ok	ok	2
Lot 300	G	71.8	74.3	ok	ok	1
	F2	73.6	76.1	ok	ok	2
Lot 301	G	70	72.5	ok	ok	1
	F2	72.7	75.2	ok	ok	2
Lot 302	G	74	76.5	ok	ok	2
	F2	78	80.5	ok	ok	3

Lot 303	G	74.8	77.3	ok	ok	2
	F2	78.9	81.4	ok	ok	3
Lot 304	G	76.4	78.9	ok	ok	2
	F2	79.8	82.3	ok	ok	3
Lot 305	G	76.4	78.9	ok	ok	2
	F2	80.1	82.6	ok	ok	3
Lot 306	G	76.8	79.3	ok	ok	2
	F2	80.7	83.2	ok	ok	3
Lot 307	G	77.1	79.6	ok	ok	3
	F2	81.3	83.8	ok	ok	3
Lot 308	G	77.4	79.9	ok	ok	3
	F2	81.7	84.2	ok	ok	3
Lot 309	G	77.4	79.9	ok	ok	3
	F2	82.1	84.6	ok	ok	4
Lot 310	G	78.1	80.6	ok	ok	3
	F2	82.5	85	ok	ok	4
Lot 311	G	77.9	80.4	ok	ok	3
	F2	82.9	85.4	ok	ok	4
Lot 312	G	78.5	81	ok	ok	3
	F2	83.2	85.7	ok	ok	4
Lot 313	G	78	80.5	ok	ok	3
	F2	83.3	85.8	ok	ok	4
Lot 314	G	77	79.5	ok	ok	3
	F2	83.5	86	ok	ok	4
Lot 315	G	77.8	80.3	ok	ok	3
	F2	83.7	86.2	ok	ok	4
Lot 316	G	78.7	81.2	ok	ok	3
	F2	84	86.5	ok	ok	4
Lot 317	G	79.9	82.4	ok	ok	3
	F2	84.2	86.7	ok	ok	4
Lot 318	G	78.4	80.9	ok	ok	3
	F2	84	86.5	ok	ok	4
Lot 319	G	76.2	78.7	ok	ok	2
	F2	79.3	81.8	ok	ok	3
Lot 320	G	76.6	79.1	ok	ok	2
	F2	78.7	81.2	ok	ok	3
Lot 321	G	76.7	79.2	ok	ok	2
	F2	78.3	80.8	ok	ok	3
Lot 322	G	76.5	79	ok	ok	2
	F2	77.8	80.3	ok	ok	3
Lot 323	G	76.2	78.7	ok	ok	2
	F2	77.4	79.9	ok	ok	3
Lot 324	G	75.9	78.4	ok	ok	2
	F2	76.9	79.4	ok	ok	2

Lot 325	G	75.5	78	ok	ok	2
	F2	76.6	79.1	ok	ok	2
Lot 326	G	75	77.5	ok	ok	2
	F2	76.1	78.6	ok	ok	2
Lot 327	G	74.6	77.1	ok	ok	2
	F2	75.6	78.1	ok	ok	2
Lot 328	G	74.2	76.7	ok	ok	2
	F2	75.2	77.7	ok	ok	2
Lot 329	G	73.9	76.4	ok	ok	2
	F2	74.9	77.4	ok	ok	2
Lot 330	G	72.9	75.4	ok	ok	2
	F2	74.1	76.6	ok	ok	2
Lot 331	G	73.1	75.6	ok	ok	2
	F2	74	76.5	ok	ok	2
Lot 332	G	72.9	75.4	ok	ok	2
	F2	74	76.5	ok	ok	2
Lot 333	G	72.9	75.4	ok	ok	2
	F2	74	76.5	ok	ok	2
Lot 334	G	73	75.5	ok	ok	2
	F2	74	76.5	ok	ok	2
Lot 335	G	73.1	75.6	ok	ok	2
	F2	74	76.5	ok	ok	2
Lot 336	G	73	75.5	ok	ok	2
	F2	74	76.5	ok	ok	2
Lot 337	G	73.9	76.4	ok	ok	2
	F2	74.9	77.4	ok	ok	2
Lot 338	G	74.3	76.8	ok	ok	2
	F2	75.2	77.7	ok	ok	2
Lot 339	G	74.9	77.4	ok	ok	2
	F2	75.8	78.3	ok	ok	2
Lot 340	G	75.4	77.9	ok	ok	2
	F2	76.3	78.8	ok	ok	2
Lot 341	G	75.8	78.3	ok	ok	2
	F2	76.9	79.4	ok	ok	2
Lot 342	G	76.2	78.7	ok	ok	2
	F2	77.3	79.8	ok	ok	3
Lot 343	G	76.5	79	ok	ok	2
	F2	77.6	80.1	ok	ok	3
Lot 344	G	76.9	79.4	ok	ok	2
	F2	78.1	80.6	ok	ok	3
Lot 345	G	77.1	79.6	ok	ok	3
	F2	78.5	81	ok	ok	3
Lot 346	G	77.1	79.6	ok	ok	3
	F2	79.1	81.6	ok	ok	3

Lot 347	G	76.1	78.6	ok	ok	2
	F2	79.6	82.1	ok	ok	3
Lot 348	G	71.3	73.8	ok	ok	1
	F2	72.3	74.8	ok	ok	2
Lot 349	G	71.5	74	ok	ok	1
	F2	72.5	75	ok	ok	2
Lot 350	G	71.5	74	ok	ok	1
	F2	72.6	75.1	ok	ok	2
Lot 351	G	71.5	74	ok	ok	1
	F2	72.5	75	ok	ok	2
Lot 352	G	71.5	74	ok	ok	1
	F2	72.6	75.1	ok	ok	2
Lot 353	G	71.6	74.1	ok	ok	1
	F2	72.6	75.1	ok	ok	2
Lot 354	G	71.6	74.1	ok	ok	1
	F2	72.6	75.1	ok	ok	2
Lot 355	G	71.3	73.8	ok	ok	1
	F2	72.4	74.9	ok	ok	2
Lot 356	G	71.1	73.6	ok	ok	1
	F2	72.1	74.6	ok	ok	2
Lot 357	G	70.6	73.1	ok	ok	1
	F2	71.9	74.4	ok	ok	1
Lot 358	G	70.1	72.6	ok	ok	1
	F2	71.5	74	ok	ok	1
Lot 359	G	70.1	72.6	ok	ok	1
	F2	71.5	74	ok	ok	1
Lot 360	G	70.2	72.7	ok	ok	1
	F2	71.5	74	ok	ok	1
Lot 361	G	69.1	71.6	ok	ok	1
	F2	70.5	73	ok	ok	1
Lot 362	G	69.6	72.1	ok	ok	1
	F2	70.9	73.4	ok	ok	1
Lot 363	G	69.9	72.4	ok	ok	1
	F2	71.2	73.7	ok	ok	1
Lot 364	G	70	72.5	ok	ok	1
	F2	71.3	73.8	ok	ok	1
Lot 365	G	70.2	72.7	ok	ok	1
	F2	71.4	73.9	ok	ok	1
Lot 366	G	70.6	73.1	ok	ok	1
	F2	71.7	74.2	ok	ok	1
Lot 367	G	70.6	73.1	ok	ok	1
	F2	71.7	74.2	ok	ok	1
Lot 368	G	70.6	73.1	ok	ok	1
	F2	71.7	74.2	ok	ok	1

Lot 369	G	70.5	73	ok	ok	1
	F2	71.6	74.1	ok	ok	1
Lot 370	G	70.6	73.1	ok	ok	1
	F2	71.7	74.2	ok	ok	1
Lot 371	G	70.5	73	ok	ok	1
	F2	71.5	74	ok	ok	1
Lot 372	G	72.9	75.4	ok	ok	2
	F2	73.8	76.3	ok	ok	2
Lot 373	G	72.7	75.2	ok	ok	2
	F2	73.7	76.2	ok	ok	2
Lot 374	G	72.6	75.1	ok	ok	2
	F2	73.7	76.2	ok	ok	2
Lot 375	G	72.6	75.1	ok	ok	2
	F2	73.6	76.1	ok	ok	2
Lot 376	G	72.4	74.9	ok	ok	2
	F2	73.5	76	ok	ok	2
Lot 377	G	72.2	74.7	ok	ok	2
	F2	73.4	75.9	ok	ok	2
Lot 378	G	72.2	74.7	ok	ok	2
	F2	73.3	75.8	ok	ok	2
Lot 379	G	71.9	74.4	ok	ok	1
	F2	73	75.5	ok	ok	2
Lot 380	G	71.8	74.3	ok	ok	1
	F2	72.9	75.4	ok	ok	2
Lot 381	G	71.6	74.1	ok	ok	1
	F2	72.9	75.4	ok	ok	2
Lot 382	G	71.5	74	ok	ok	1
	F2	72.9	75.4	ok	ok	2
Lot 383	G	71.6	74.1	ok	ok	1
	F2	72.8	75.3	ok	ok	2
Lot 384	G	69.7	72.2	ok	ok	1
	F2	70.9	73.4	ok	ok	1
Lot 385	G	69.9	72.4	ok	ok	1
	F2	71.2	73.7	ok	ok	1
Lot 386	G	70.3	72.8	ok	ok	1
	F2	71.5	74	ok	ok	1
Lot 387	G	70.9	73.4	ok	ok	1
	F2	72	74.5	ok	ok	2
Lot 388	G	71.4	73.9	ok	ok	1
	F2	72.4	74.9	ok	ok	2
Lot 389	G	70.8	73.3	ok	ok	1
	F2	71.9	74.4	ok	ok	1
Lot 390	G	70.7	73.2	ok	ok	1
	F2	71.9	74.4	ok	ok	1

Lot 391	G	70.5	73	ok	ok	1
	F2	71.9	74.4	ok	ok	1
Lot 392	G	70.5	73	ok	ok	1
	F2	71.8	74.3	ok	ok	1
Lot 393	G	70.4	72.9	ok	ok	1
	F2	71.8	74.3	ok	ok	1
Lot 394	G	70.3	72.8	ok	ok	1
	F2	71.7	74.2	ok	ok	1
Lot 395	G	70.3	72.8	ok	ok	1
	F2	71.6	74.1	ok	ok	1
Lot 396	G	70.5	73	ok	ok	1
	F2	71.7	74.2	ok	ok	1
Lot 397	G	70.3	72.8	ok	ok	1
	F2	71.5	74	ok	ok	1
Lot 398	G	70.2	72.7	ok	ok	1
	F2	71.4	73.9	ok	ok	1
Lot 399	G	70.1	72.6	ok	ok	1
	F2	71.2	73.7	ok	ok	1
Lot 400	G	70	72.5	ok	ok	1
	F2	71.1	73.6	ok	ok	1
Lot 401	G	69.9	72.4	ok	ok	1
	F2	71.1	73.6	ok	ok	1
Lot 402	G	70	72.5	ok	ok	1
	F2	70.9	73.4	ok	ok	1
Lot 403	G	69.9	72.4	ok	ok	1
	F2	71.1	73.6	ok	ok	1
Lot 404	G	70	72.5	ok	ok	1
	F2	71	73.5	ok	ok	1
Lot 405	G	70	72.5	ok	ok	1
	F2	71	73.5	ok	ok	1
Lot 406	G	70.1	72.6	ok	ok	1
	F2	71.1	73.6	ok	ok	1
Lot 407	G	69.9	72.4	ok	ok	1
	F2	71	73.5	ok	ok	1
Lot 408	G	69.7	72.2	ok	ok	1
	F2	71	73.5	ok	ok	1
Lot 409	G	69.6	72.1	ok	ok	1
	F2	71	73.5	ok	ok	1
Lot 410	G	69.5	72	ok	ok	1
	F2	70.6	73.1	ok	ok	1
Lot 411	G	69.7	72.2	ok	ok	1
	F2	70.6	73.1	ok	ok	1
Lot 412	G	69.8	72.3	ok	ok	1
	F2	70.5	73	ok	ok	1

Lot 413	G	69.7	72.2	ok	ok	1
	F2	70.5	73	ok	ok	1
Lot 414	G	69.7	72.2	ok	ok	1
	F2	70.6	73.1	ok	ok	1
Lot 415	G	69.8	72.3	ok	ok	1
	F2	70.7	73.2	ok	ok	1
Lot 416	G	69.8	72.3	ok	ok	1
	F2	70.7	73.2	ok	ok	1
Lot 417	G	69.8	72.3	ok	ok	1
	F2	70.6	73.1	ok	ok	1
Lot 418	G	69.9	72.4	ok	ok	1
	F2	70.7	73.2	ok	ok	1
Lot 419	G	69.9	72.4	ok	ok	1
	F2	70.6	73.1	ok	ok	1
Lot 420	G	69.9	72.4	ok	ok	1
	F2	70.7	73.2	ok	ok	1
Lot 421	G	69.8	72.3	ok	ok	1
	F2	70.6	73.1	ok	ok	1
Lot 422	G	69.3	71.8	ok	ok	1
	F2	70.1	72.6	ok	ok	1
Lot 423	G	69.4	71.9	ok	ok	1
	F2	70.2	72.7	ok	ok	1
Lot 424	G	69.4	71.9	ok	ok	1
	F2	70.3	72.8	ok	ok	1
Lot 425	G	69.5	72	ok	ok	1
	F2	70.3	72.8	ok	ok	1
Lot 426	G	69.6	72.1	ok	ok	1
	F2	70.3	72.8	ok	ok	1
Lot 427	G	69.9	72.4	ok	ok	1
	F2	70.4	72.9	ok	ok	1
Lot 428	G	70	72.5	ok	ok	1
	F2	70.5	73	ok	ok	1
Lot 429	G	69.9	72.4	ok	ok	1
	F2	70.7	73.2	ok	ok	1
Lot 430	G	70	72.5	ok	ok	1
	F2	70.8	73.3	ok	ok	1
Lot 431	G	70.1	72.6	ok	ok	1
	F2	70.9	73.4	ok	ok	1
Lot 432	G	70.1	72.6	ok	ok	1
	F2	70.8	73.3	ok	ok	1
Lot 433	G	69.9	72.4	ok	ok	1
	F2	70.7	73.2	ok	ok	1
Lot 434	G	69.9	72.4	ok	ok	1
	F2	70.7	73.2	ok	ok	1

Lot 435	G	70	72.5	ok	ok	1
	F2	70.8	73.3	ok	ok	1
Lot 436	G	70	72.5	ok	ok	1
	F2	70.9	73.4	ok	ok	1
Lot 437	G	70.1	72.6	ok	ok	1
	F2	71	73.5	ok	ok	1
Lot 438	G	69.8	72.3	ok	ok	1
	F2	70.7	73.2	ok	ok	1
Lot 439	G	69.9	72.4	ok	ok	1
	F2	70.7	73.2	ok	ok	1
Lot 440	G	69.8	72.3	ok	ok	1
	F2	70.7	73.2	ok	ok	1
Lot 441	G	69.6	72.1	ok	ok	1
	F2	70.7	73.2	ok	ok	1
Lot 442	G	70.2	72.7	ok	ok	1
	F2	71	73.5	ok	ok	1
Lot 443	G	70.3	72.8	ok	ok	1
	F2	71.1	73.6	ok	ok	1
Lot 444	G	70.3	72.8	ok	ok	1
	F2	71.1	73.6	ok	ok	1
Lot 445	G	70.2	72.7	ok	ok	1
	F2	71.1	73.6	ok	ok	1
Lot 446	G	70.3	72.8	ok	ok	1
	F2	71.1	73.6	ok	ok	1
Lot 447	G	70.2	72.7	ok	ok	1
	F2	71	73.5	ok	ok	1
Lot 448	G	70.4	72.9	ok	ok	1
	F2	70.9	73.4	ok	ok	1
Lot 449	G	70.1	72.6	ok	ok	1
	F2	70.6	73.1	ok	ok	1
Lot 450	G	70.2	72.7	ok	ok	1
	F2	70.7	73.2	ok	ok	1
Lot 451	G	70.2	72.7	ok	ok	1
	F2	70.7	73.2	ok	ok	1
Lot 452	G	70.2	72.7	ok	ok	1
	F2	70.7	73.2	ok	ok	1
Lot 453	G	70.2	72.7	ok	ok	1
	F2	70.7	73.2	ok	ok	1
Lot 454	G	70.2	72.7	ok	ok	1
	F2	70.7	73.2	ok	ok	1
Lot 455	G	70.3	72.8	ok	ok	1
	F2	70.7	73.2	ok	ok	1
Lot 456	G	70.2	72.7	ok	ok	1
	F2	70.9	73.4	ok	ok	1

Lot 457	G	70.3	72.8	ok	ok	1
	F2	71	73.5	ok	ok	1
Lot 458	G	70.3	72.8	ok	ok	1
	F2	71.1	73.6	ok	ok	1
Lot 459	G	70.3	72.8	ok	ok	1
	F2	71.2	73.7	ok	ok	1
Lot 460	G	70.4	72.9	ok	ok	1
	F2	71.1	73.6	ok	ok	1
Lot 461	G	70.4	72.9	ok	ok	1
	F2	71.2	73.7	ok	ok	1
Lot 462	G	70.3	72.8	ok	ok	1
	F2	71.1	73.6	ok	ok	1
Lot 463	G	70.4	72.9	ok	ok	1
	F2	71.1	73.6	ok	ok	1
Lot 464	G	70.3	72.8	ok	ok	1
	F2	71.1	73.6	ok	ok	1
Lot 465	G	70.3	72.8	ok	ok	1
	F2	71	73.5	ok	ok	1
Lot 466	G	70.3	72.8	ok	ok	1
	F2	71	73.5	ok	ok	1
Lot 467	G	70.1	72.6	ok	ok	1
	F2	70.9	73.4	ok	ok	1

Appendix C Sample Calculations

Appendix D Extract from QDC MP4.4

Schedule 1

Noise category	Minimum transport noise reduction (dB (A)) required for habitable rooms	Component of building's external envelope	Minimum R_w required for each component
Category 4	40	Glazing	43
		External walls	52
		Roof	45
		Floors	51
		Entry doors	35
Category 3	35	Glazing	38 (where total area of glazing for a <i>habitable room</i> is greater than 1.8m ²)
			35 (where total area of glazing for a <i>habitable room</i> is less than or equal to 1.8m ²)
		External walls	47
		Roof	41
		Floors	45
		Entry doors	33

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Noise category	Minimum transport noise reduction (dB (A)) required for habitable rooms	Component of building's external envelope	Minimum R_w required for each component
Category 2	30	Glazing	35 (where total area of glazing for a <i>habitable room</i> is greater than 1.8m ²)
			32 (where total area of glazing for a <i>habitable room</i> is less than or equal to 1.8m ²)
		External walls	41
		Roof	38
		Floors	45
Category 1	25	Glazing	27 (where total area of glazing for a <i>habitable room</i> is greater than 1.8m ²)
			24 (where total area of glazing for a <i>habitable room</i> is less than or equal to 1.8m ²)
		External walls	35
		Roof	35
		Entry Doors	28
Category 0	No additional acoustic treatment required – standard building assessment provisions apply.		

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Schedule 2

Component of building's external envelope	Minimum R_w	Acceptable forms of construction
Glazing	43	Double glazing consisting of two panes of minimum 5mm thick glass with at least 100mm air gap and full perimeter <i>acoustically rated seals</i> .
	38	Minimum 14.38mm thick laminated glass, with full perimeter <i>acoustically rated seals</i> ; OR Double glazing consisting of one pane of minimum 5mm thick glass and one pane of minimum 6mm thick glass with at least 44mm air gap, and full perimeter <i>acoustically rated seals</i>
	35	Minimum 10.38mm thick laminated glass, with full perimeter <i>acoustically rated seals</i> .
	32	Minimum 6.38mm thick laminated glass with full perimeter <i>acoustically rated seals</i> .
	27	Minimum 4mm thick glass with full perimeter <i>acoustically rated seals</i>
	24	Minimum 4mm thick glass with standard weather seals

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Component of building's external envelope	Minimum R_w	Acceptable forms of construction
External walls	52	Two leaves of clay brick masonry, at least 270mm in total, with subfloor vents fitted with noise attenuators.
	47	Two leaves of clay brick masonry at least 110mm thick with: (i) cavity not less than 50mm between leaves; and (ii) 50mm thick mineral insulation or 50mm thick glass wool insulation with a density of 11kg/m ³ or 50mm thick polyester insulation with a density of 20kg/m ³ in the cavity. OR Two leaves of clay brick masonry at least 110mm thick with: (i) cavity not less than 50mm between leaves; and (ii) at least 13mm thick cement render on each face OR Single leaf of clay brick masonry at least 110mm thick with: (i) a row of at least 70mm x 35mm timber studs or 64mm steel studs at 600mm centres, spaced at least 20mm from the masonry wall; and (ii) Mineral insulation or glass wool insulation at least 50mm thick with a density of at least 11 kg/m ³ positioned between studs; and (iii) One layer of plasterboard at least 13mm thick fixed to outside face of studs. OR Single leaf of minimum 150mm thick masonry of hollow, dense concrete blocks, with mortar joints laid to prevent moisture bridging.

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Component of building's external envelope	Minimum R_w	Acceptable forms of construction
	41	<p>Two leaves of clay brick masonry at least 110mm thick with cavity not less than 50mm between leaves</p> <p>OR</p> <p>Single leaf of clay brick masonry at least 110mm thick with:</p> <ul style="list-style-type: none"> (i) a row of at least 70mm x 35mm timber studs or 64mm steel studs at 600mm centres, spaced at least 20mm from the masonry wall; and (ii) mineral insulation or glass wool insulation at least 50mm thick with a density of at least 11 kg/m³ positioned between studs; and (iii) One layer of plasterboard at least 10mm thick fixed to outside face of studs <p>OR</p> <p>Single leaf of brick masonry at least 110mm thick with at least 13mm thick render on each face</p> <p>OR</p> <p>Concrete brickwork at least 110mm thick</p> <p>OR</p> <p>In-situ concrete at least 100mm thick</p> <p>OR</p> <p>Precast concrete at least 100mm thick and without joints.</p>

Component of building's external envelope	Minimum R_w	Acceptable forms of construction
	35	<p>Single leaf of clay brick masonry at least 110mm thick with:</p> <ul style="list-style-type: none"> (i) a row of at least 70mm x 35mm timber studs or 64mm steel studs at 600mm centres, spaced at least 20mm from the masonry wall; and (ii) One layer of plasterboard at least 10mm thick fixed to outside face of studs <p>OR</p> <p>Minimum 6mm thick fibre cement sheeting or weatherboards or plank cladding externally, minimum 90mm deep timber stud or 92mm metal stud, standard plasterboard at least 13mm thick internally.</p>
Roof	45	<p>Concrete or terracotta tile or sheet metal roof with sarking, <i>acoustically rated plasterboard</i> ceiling at least 13mm thick fixed to ceiling joists, cellulose fibre insulation at least 100mm thick with a density of at least 45kg/m³ in the cavity.</p> <p>OR</p> <p>Concrete or terracotta tile or sheet metal roof with sarking, 2 layers of <i>acoustically rated plasterboard</i> at least 16mm thick fixed to ceiling joists, glass wool insulation at least 50mm thick with a density of at least 11kg/m³ or polyester insulation at least 50mm thick with a density of at least 20kg/m³ in the cavity.</p>
	41	<p>Concrete or terracotta tile or metal sheet roof with sarking, plasterboard ceiling at least 10mm thick fixed to ceiling joists, glass wool insulation at least 50mm thick with a density of at least 11kg/m³ or polyester insulation at least 50mm thick with a density of at least 20kg/m³ in the cavity.</p> <p>OR</p> <p>Concrete suspended slab at least 100mm thick.</p>
	38	<p>Concrete or terracotta tile or metal sheet roof with sarking, plasterboard ceiling at least 10mm thick fixed to ceiling cavity, mineral insulation or glass wool insulation at least 50mm thick with a density of at least 11 kg/m³.</p>

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	35	Concrete or terracotta tile or metal sheet roof with sarking, plasterboard ceiling at least 10mm thick fixed to ceiling cavity.
Floors	51	Concrete slab at least 150mm thick.
	45	Concrete slab at least 100mm thick OR Tongued and grooved boards at least 19mm thick with: (i) timber joists not less than 175mm x 50mm; and (ii) mineral insulation or glass wool insulation at least 75mm thick with a density of at least 11kg/m ³ positioned between joists and laid on plasterboard at least 10mm thick fixed to underside of joists; and (iii) mineral insulation or glass wool insulation at least 25mm thick with a density of at least 11kg/m ³ laid over entire floor, including tops of joists before flooring is laid; and (iv) secured to battens at least 75mm x 50mm; and (v) the assembled flooring laid over the joists, but not fixed to them, with battens lying between the joists.
Entry Doors	35	Solid core timber not less than 45mm thick, fixed so as to overlap the frame or rebate of the frame by not less than 10mm, with full perimeter <i>acoustically rated seals</i> .
	33	Fixed so as to overlap the frame or rebate of the frame by not less than 10mm, fitted with full perimeter <i>acoustically rated seals</i> and constructed of - (i) solid core, wood, particleboard or blockboard not less than 45mm thick; and/or (ii) acoustically laminated glass not less than 10.38mm thick.

Component of building's external envelope	Minimum R_w	Acceptable forms of construction
	28	Fixed so as to overlap the frame or rebate of the frame, constructed of - (i) Wood, particleboard or blockboard not less than 33mm thick; or (ii) Compressed fibre reinforced sheeting not less than 9mm thick; or (iii) Other suitable material with a mass per unit area not less than 24.4kg/m ² ; or (iv) Solid core timber door not less than 35mm thick fitted with full perimeter <i>acoustically rated seals</i> .