Deben House
1 – 5 Lawrence House
Old Market
Bristol
BS5 0BY

CONDITION 17:
SOUND INSULATION
(Planning Ref: 20/04282/F)

Acoustics Report M2028/R02
30th April 2021

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1 Introduction

This acoustic report addresses Condition 17 (Planning Ref: 20/04282/F) for the permitted change of use of Deben House, 1- 5 Lawrence Hill, Bristol to 24 bed HMO (Sui Generis), Class E Commercial, Business and Service Unit (Ground Floor), Class F.1 Learning and Non-Residential Institutions Unit (Basement) and a Class E Commercial, Business and Service Unit (Basement).

The report is divided into the following sections:

- Section 2: Condition 17
- Appendix A: Calculations

2 Condition 17

No commencement of use shall take place until a scheme of noise insulation measures for floor/ceiling between the proposed Class E use and the flats above has been submitted to and approved in writing by the Local Planning Authority.

The scheme of noise insulation measures shall be prepared by a suitably qualified acoustic consultant/engineer and shall take into account the provisions of BS 8233: 2014 " Guidance on sound insulation and noise reduction for buildings".

The approved scheme shall be implemented prior to the commencement of the use and be permanently maintained thereafter.

Reason: To protect the living conditions of future occupiers.

2.1 Method of Compliance

In accordance with Part E of the Building Regulations, suitable sound level difference requirements have been developed between the Class E spaces and HMO units above, which take into account the expected noise generated by Class E use activities and the masking provided by the BS8233 environmental noise ingress limits.

In summary the required sound level differences are:

- D_w 45dB where the Class E noise level is not expected to exceed L_{Aeq} 70dB (e.g., busy open plan offices and café/restaurant/retail where music playback is not used)
- D_w 60dB where the Class E noise may be up to L_{Aeq} 80dB and contain impulsive and/or low frequency noise (e.g., gyms and café/restaurant/retail where music playback is used at a medium or greater amplitude)

The provisional uses of the two Class E spaces at Deben House are a gym at basement level and open plan office at ground floor, which would require sound level differences of D_w 60 and D_w 45dB respectively.

A suitable floor construction has been developed, which with the addition of an independent wall lining to the internal/external masonry walls in the case of the higher D_w 60dB requirement, has been demonstrated by BS EN 1235 flanking calculations to achieve the required sound level differences. Note that it will be acceptable to omit the wall lining in some instances as detailed in this report.

Once the end users of the Class E spaces have been confirmed, their expected activity noise levels and character should be considered; if their activity noise levels are likely to exceed L_{Aeq} 70dB and/or contain impulsive/low frequency elements, an independent wall lining as detailed in this report will need to be installed.

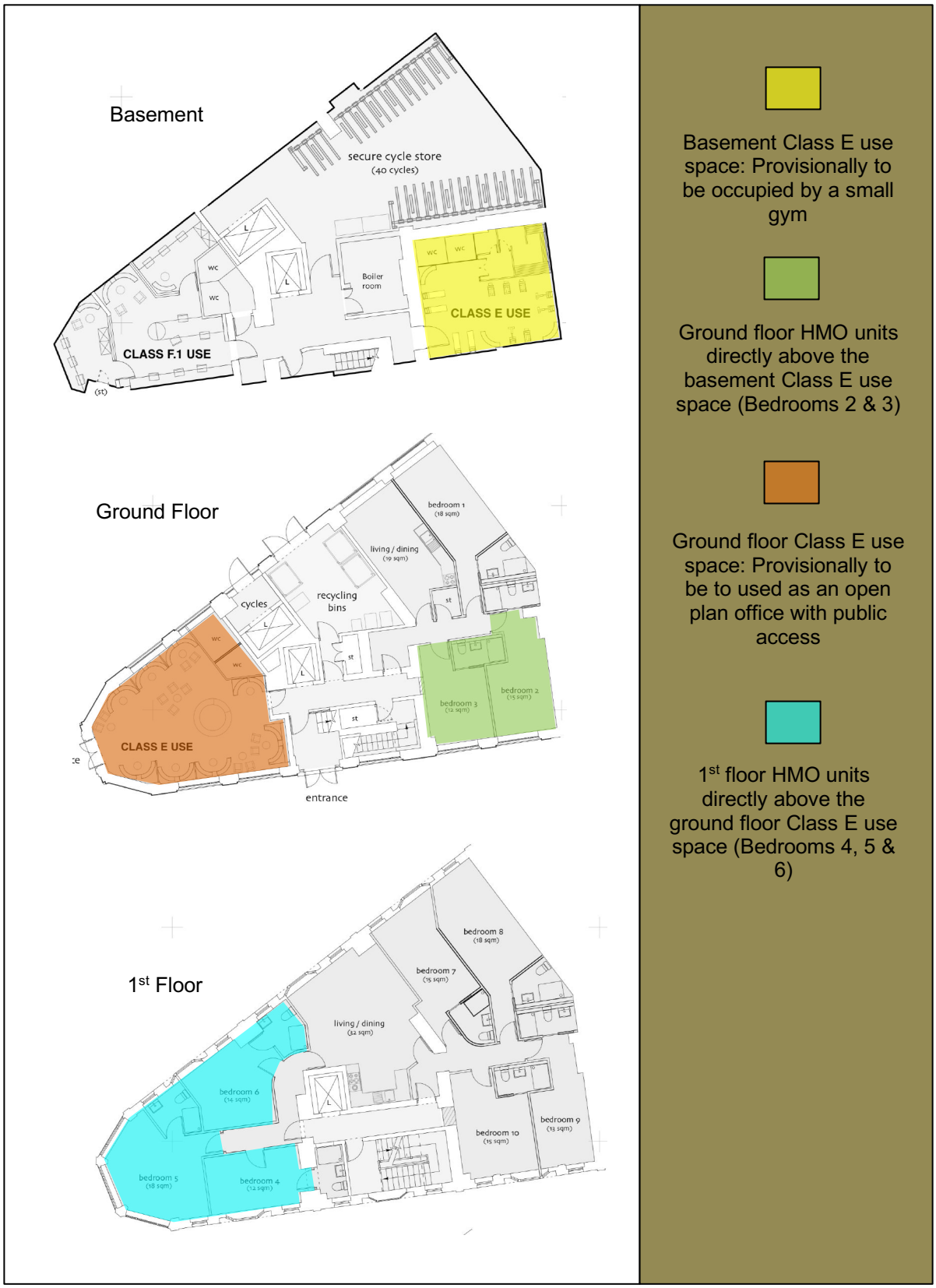

Figure 1. Basement, ground and 1st floor plans with Class E use spaces and HMO units directly above identified

2.2 Class E Spaces

There two Class E spaces in the development, located at basement and ground floors levels. In both case there will be HMO units directly above the Class E spaces.

Figure 1 provides basement, ground and 1st floor plans with the Class E spaces and HMO units directly above identified.

2.3 Sound Insulation Requirement

BS8233:2014 provides noise ingress limits for habitable rooms, namely:

- Living Room: $L_{Aeq,16hr}$ 35dB (07:00 – 23:00hrs)
- Dining Room/Area: $L_{Aeq,16hr}$ 40dB (07:00 – 23:00hrs)
- Bedroom: $L_{Aeq,16hr}$ 35dB (07:00 – 23:00hrs) and $L_{Aeq,8hr}$ 30dB (23:00 – 07:00hrs)

The above noise limits are for steady external noise source such as road traffic and continually operating plant; they therefore do not inform on the acceptability of noise transmission between Class E and residential spaces.

Part E of the Building Regulations (ADE) provides minimum airborne sound reduction requirements between residential spaces, which for conversions is $D_{nT,w}$ + C_{tr} 43dB.

Where a dwelling is adjacent to a non-domestic space, ADE states that a higher standard of sound insulation maybe required. ADE provides no assessment methodology or guidance to determine the required sound level difference between a dwelling and non-domestic space other than that the appropriate level of sound insulation will depend on the noise generated in the non-domestic space.

Our interpretation of ADEs requirement in the case of the proposed development is that the sound level difference provided between the Class E use spaces and the HMO units:

- Must meet the minimum sound level difference for 'dwellings formed by material change of use': $D_{nT,w}$ + C_{tr} 43dB
- Impact sound insulation requirement is not applicable i.e., the commercial spaces are not sensitive to impact noise from the apartment
- Provide sufficient attenuation of the Class E activity noise transmission to the floor apartment so as to avoid annoyance to the occupier.

The 'annoyance' criterion is subjective, depending on the nature and level of the noise source and the sensitivity of the occupier.

Typically, non-domestic noise ingress is considered acceptable in dwellings provided it is 10dB below the environmental noise ingress. However, for noise sources that contain a strong low frequency element or are impulsive or tonal we advise that a noise ingress limit of 15dB below the BS822 noise ingress limit should be designed for.

Using BS8233:2014's day environmental noise ingress limit for bedrooms and living rooms of L_{Aeq} 35dB as a baseline (we understand that the Class E spaces will only be open during the day), we advise that a sufficient sound level difference will be provided if the activity noise ingress is typically not greater than L_{Aeq} 25dB in the HMO units (L_{Aeq} 20dB if the Class E noise source includes impulsive or low frequency noise).

The end user of the Class E spaces have yet to be confirmed. However, provisionally they are to be used as a small gym (basement) and open-plan office with public access (ground floor).

The noise levels and corresponding sound level difference requirements for the provisional uses are:

- Gym use: The noise level within a gym depends on the types of activities proposed. Some gym activities such as weight lifting can contain an impulsive element. There is also potential for a strong low frequency content if music playback is used. Other uses however can be very quiet, such as yoga classes. To take account of the uncertainty of the noise sources, a relatively high noise level of L_{Aeq} 80dB has been assumed. On the basis that there may be impulsive noises and/or noise with a low frequency content, a sound level difference between the basement floor Class E and ground floor HMO units would therefore need to be D_w 60dB minimum.
- Open-plan office: The noise levels within a busy open-plan office can be up to L_{Aeq} 70dB, with the main noise being people talking (no music playback systems are expected). A sound level difference between the ground floor Class E and 1st floor HMO units would therefore need to be D_w 45dB minimum.

Class E encompasses other uses such as retail, café/restaurants and creches. The noise levels generated by these uses will primarily be dependent on their use of music playback systems. Without music playback (or with music playback at low levels) the noise levels generated are not expected to be typically higher than L_{Aeq} 70dB (requiring D_w 45dB sound level difference). If a music playback system is to be used at a medium or greater amplitude, the overall activity noise will potentially be higher and may contain a low frequency content; for this scenario we advise the higher D_w 60dB sound level difference should be designed for.

2.4 Proposed Construction

Figure 2 provides the proposed separating floor build-up between the Class E spaces and HMO units, which achieves an Insul calculated sound reduction of R_w 63dB.

Note that, depending on the direction of the joists and feasibility of ensuring there is separation at the junction of the floor and the two leaves of the twin stud partitions between the HMO units, an additional floating floor maybe required to control flanking between the apartments. As this layer is not required to control noise transmission vertically between the Class E and HMO units, the potential floating floor layer has not been included in the proposed floor build-up detailed in Figure 2.

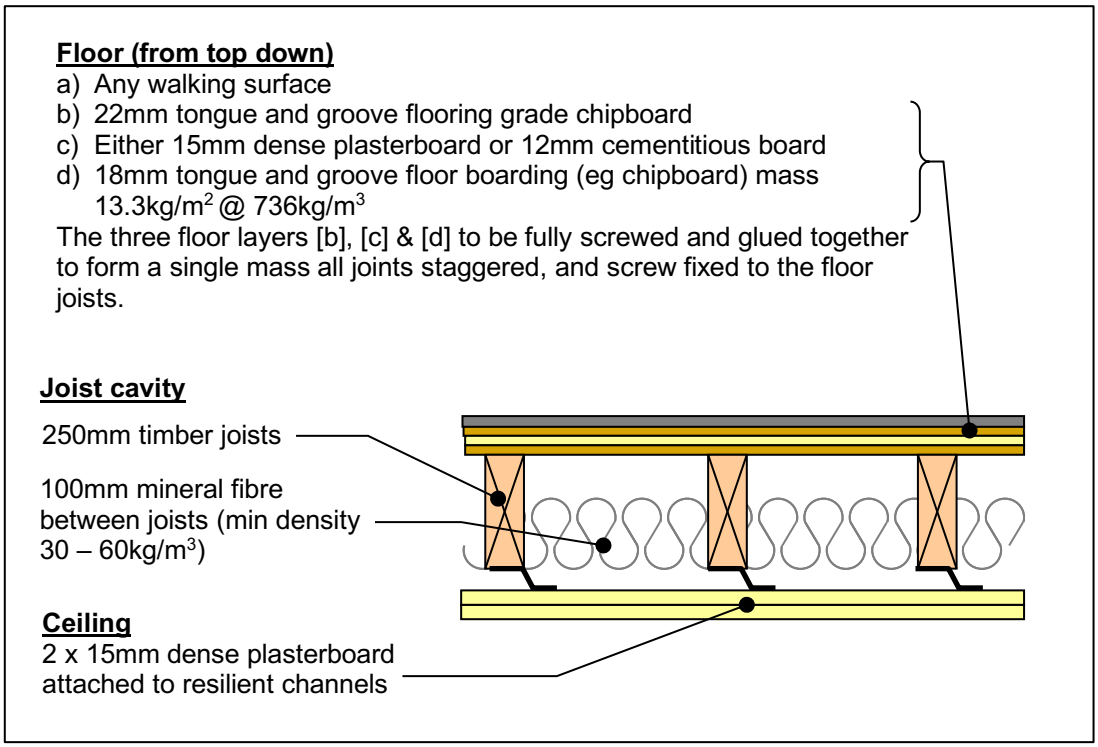

Figure 2. separating floor between Class E and HMO units

Calculations conducted in accordance with BS EN 1235, which take into account flanking via the common masonry external and internal walls, demonstrate that with the proposed floor construction detailed in Figure 2 both ADE's requirement for residential conversions ($D_{nT,w}$ + C_{tr} 43dB) and our suggested minimum D_w 45dB performance requirement with regard to the proposed ground floor office use will be met.

To achieve our suggested higher D_w 60dB requirement with regard to the basement Class E space gym use (or potentially other Class E uses that employ moderate volume music playback systems) independent wall linings will be required to control flanking noise via the external and internal masonry walls; Figure 3.

The independent wall lining should consist of 12.5mm plasterboard on a timber or metal stud frame (which must not touch the wall), with 40mm dense mineral fibre contained within the cavity.

Note that for instances where there are other spaces against the masonry wall, such as ancillary rooms, full height built-in cupboards or rooms where higher activity noise levels will not be generated, the wall lining can be omitted i.e., these spaces act as a wall lining in themselves.

Example flanking calculations are provided in Appendix A.

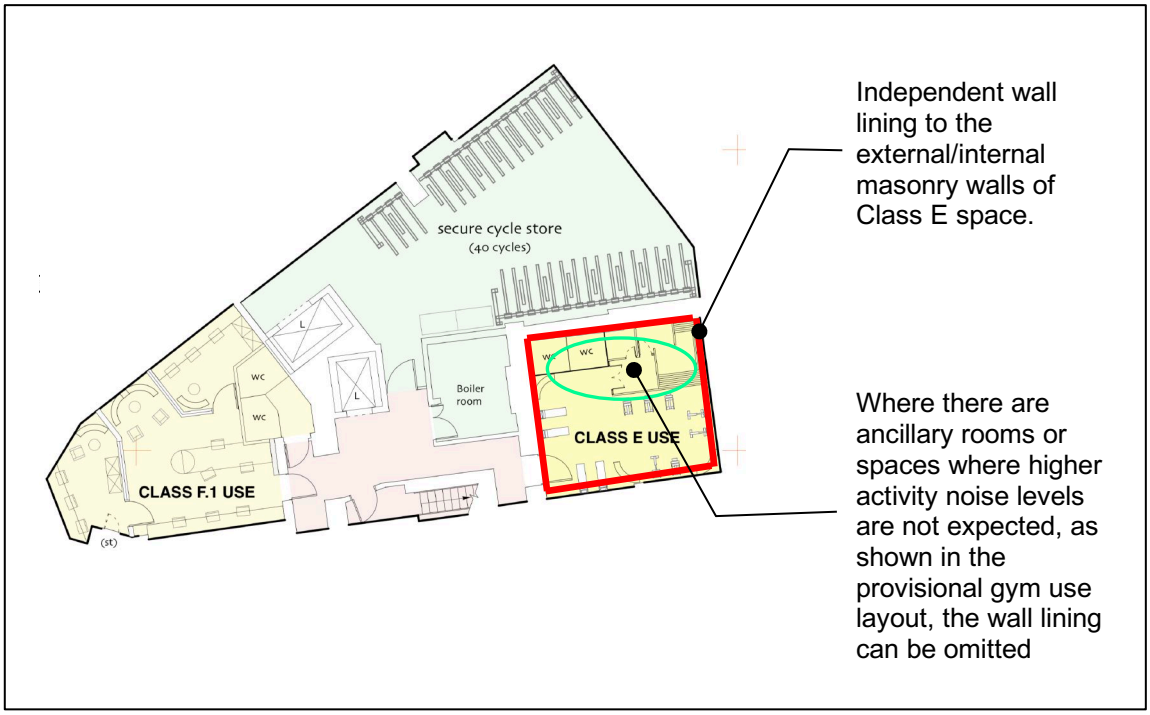

Figure 3. Basement floor plans with location for the independent wall linings on the external and internal masonry wall as required to achieve the higher D_w 60dB sound level difference

Table A1. BS EN 1235 flanking calculation 1

Source Room: Basement Class E space
Receiver Room: Bedroom 2, Ground Floor
Receiver Room Volume: 60 m^3

					Octave Band Centre Frequency, Hz							Rw		
					63	125	250	500	1000	2000	4000			
BS EN 12354 Calculation														
INPUT DATA														
	element	area	length	mass										
S	Floor	15		66	36.0	48.0	55.0	64.0	64.0	64.0	71.0	64.0		
F1	Ext Wall (300mm solid brick)		3	480	43.0	41.0	49.0	56.0	62.0	67.0	72.0	59.0		
F2	Int Wall (500mm solid brick)		6	800	45.0	50.0	58.0	64.0	69.0	73.0	78.0	67.0		
F3	Int Wall (500mm solid brick)		1.6	18	16.0	14.0	29.0	40.0	47.0	49.0	44.0	38.0		
F4	Int Partition		7	18	16.0	14.0	29.0	40.0	47.0	49.0	44.0	38.0		
JUNCTION ATTENUATION														
K11	Jnct of lgt dbl leaf wall & homg elemt				-4.9	-4.9	-4.9	-4.9	-4.9	-4.9	-4.9			
K1d					15.6	16.6	17.6	18.6	19.6	20.6	21.6			
KD1					15.6	16.6	17.6	18.6	19.6	20.6	21.6			
K22	Jnct of lgt dbl leaf wall & homg elemt				-5.6	-5.6	-5.6	-5.6	-5.6	-5.6	-5.6			
K2d					17.9	18.8	19.8	20.8	21.8	22.8	23.8			
KD2					17.9	18.8	19.8	20.8	21.8	22.8	23.8			
K33	Jnct of lgt dbl leaf wall & homg elemt				24.3	23.3	22.3	21.3	20.3	19.3	18.3			
K3d					12.7	13.7	14.6	15.6	16.6	17.6	18.6			
KD3					12.7	13.7	14.6	15.6	16.6	17.6	18.6			
KD4	Jnct of lgt coupled dbl leaf walls				18.6	17.6	16.6	15.6	14.6	13.7	12.7			
ADDITIONAL LAYERS														
+S														
+s														
+F1	12.5mm plasterboard, 40mm mineral wool, metal studs				0.0	6.0	12.0	14.0	14.0	14.0	14.0			
+f1														
+F2	12.5mm plasterboard, 40mm mineral wool, metal studs				0.0	6.0	12.0	14.0	14.0	14.0	14.0			
+f2														
+F3	12.5mm plasterboard, 40mm mineral wool, metal studs				0.0	6.0	12.0	14.0	14.0	14.0	14.0			
+f3														
+F4														
+f4														
RESULTS														
				RDd	36.0	48.0	55.0	64.0	64.0	64.0	71.0			
				R11	45.1	49.1	63.1	72.1	78.1	83.1	88.1			
				R1d	62.1	74.1	88.6	99.6	103.6	107.1	114.1			
				RD1	62.1	68.1	76.6	85.6	89.6	93.1	100.1			
				R22	43.4	54.4	68.4	76.4	81.4	85.4	90.4			
				R2d	62.3	77.8	92.3	102.8	106.3	109.3	116.3			
				RD2	62.3	71.8	80.3	88.8	92.3	95.3	102.3			
				R33	50.0	53.0	73.0	85.0	91.0	92.0	86.0			
				R3d	48.4	60.4	78.4	91.4	95.9	97.8	99.8			
				RD3	48.4	54.4	66.4	77.4	81.9	83.8	85.8			
				RD4	47.9	51.9	61.9	71.0	73.5	73.5	73.5			
				R'	**34.1**	**43.2**	**53.2**	**62.3**	**63.2**	**63.4**	**68.8**			
Calculation tolerance					3.0	3.0	3.0	3.0	3.0	3.0	3.0	DnTw	Ctr	Dntw + Ctr
D_{nT} = R' + 10 x Log(0.32 x V/S) + Tolerance					32.2	41.3	51.3	60.4	61.3	61.5	66.9	60	-6	54.0

Table A2. BS EN 1235 flanking calculation 2

Source Room: Ground Floor Class E space
Receiver Room: Bedroom 4, 1st Floor
Receiver Room Volume: 34 m^3

					Octave Band Centre Frequency, Hz							Rw		
					63	125	250	500	1000	2000	4000			
BS EN 12354 Calculation														
INPUT DATA														
	element	area	length	mass										
S	Floor	12		66	36.0	48.0	55.0	64.0	64.0	64.0	71.0	64.0		
F1	Ext Wall		4.9	480	43.0	41.0	49.0	56.0	62.0	67.0	72.0	59.0		
F2	Ext Wall		2.7	480	43.0	41.0	49.0	56.0	62.0	67.0	72.0	59.0		
F3	Int Partition		4.4	18	16.0	14.0	29.0	40.0	47.0	49.0	44.0	38.0		
F4	Ext Partition		2.7	18	16.0	14.0	29.0	40.0	47.0	49.0	44.0	38.0		
JUNCTION ATTENUATION														
K11	Jnct of lgt dbl leaf wall & homg elemt				-4.9	-4.9	-4.9	-4.9	-4.9	-4.9	-4.9			
K1d					15.6	16.6	17.6	18.6	19.6	20.6	21.6			
KD1					15.6	16.6	17.6	18.6	19.6	20.6	21.6			
K22	Jnct of lgt dbl leaf wall & homg elemt				-4.9	-4.9	-4.9	-4.9	-4.9	-4.9	-4.9			
K2d					15.6	16.6	17.6	18.6	19.6	20.6	21.6			
KD2					15.6	16.6	17.6	18.6	19.6	20.6	21.6			
KD3	Jnct of lgt coupled dbl leaf walls				18.6	17.6	16.6	15.6	14.6	13.7	12.7			
KD4	Jnct of lgt coupled dbl leaf walls				18.6	17.6	16.6	15.6	14.6	13.7	12.7			
ADDITIONAL LAYERS														
+S														
+s														
+F1														
+f1														
+F2														
+f2														
+F3														
+f3														
+F4														
+f4														
RESULTS														
				RDd	36.0	48.0	55.0	64.0	64.0	64.0	71.0			
				R11	42.0	40.0	48.0	55.0	61.0	66.0	71.0			
				R1d	59.0	65.0	73.5	82.5	86.5	90.0	97.0			
				RD1	59.0	65.0	73.5	82.5	86.5	90.0	97.0			
				R22	44.6	42.6	50.6	57.6	63.6	68.6	73.6			
				R2d	61.6	67.6	76.1	85.1	89.1	92.6	99.6			
				RD2	61.6	67.6	76.1	85.1	89.1	92.6	99.6			
				RD3	49.0	53.0	63.0	72.0	74.5	74.5	74.5			
				RD4	51.1	55.1	65.1	74.1	76.6	76.6	76.6			
				R'	**34.3**	**37.4**	**45.4**	**52.6**	**57.7**	**60.7**	**65.8**			
Calculation tolerance					3.0	3.0	3.0	3.0	3.0	3.0	3.0	DnTw	Ctr	Dntw + Ctr
D_{nT} = R' + 10 x Log(0.32 x V/S) + Tolerance					30.9	34.0	42.0	49.2	54.3	57.3	62.4	52	-6	46.0