
Appendix 5.4A

**Noise Assessment for Main Stadium Fixed
Noise and Music, Singing and Instrument
Performing Activities**

Table 1 *Predicted noise level during a sporty event*

NSR	Height, mPD	Result, dB(A), Leq (30 min)	NSR	Height, mPD	Result, dB(A), Leq (30 min)
N1	10	23	PN4	30	28
N1	20	23	PN4	50	36
N2	10	23	PN4	70	41
N2	30	28	PN4	90	45
N2	50	34	PN5	10	28
N2	70	39	PN5	30	28
N2	90	43	PN5	50	41
N2	110	46	PN5	70	46
N2	130	48	PN5	90	48
N2	150	48	PN6	10	25
PN1	15	24	PN6	30	29
PN1	35	27	PN6	50	42
PN1	55	42	PN6	70	45
PN2A	30	30	PN6	90	51
PN2A	50	33	PN7	10	28
PN2A	70	46	PN7	30	36
PN2A	90	53	PN7	50	40
PN2A	110	55	PN7	70	44
PN2B	30	35	PN7	90	47
PN2B	50	39	PN7	110	50
PN2B	70	46	PN8	10	32
PN2B	90	52	PN8	30	38
PN2B	110	54	PN8	50	41
PN3	10	25	PN8	70	47
PN3	30	31	PN8	90	51
PN3	50	39	PN8	110	53
PN3	70	43	PN9	10	27
PN3	90	48	PN9	25	27
PN4	10	24	PN9	40	30

Table 2 *Predicted noise level for Concert Setting 1*

NSR	Height, mPD	Result, dB(A), Leq (15 min)	NSR	Height, mPD	Result, dB(A), Leq (15 min)
N1	10	36	PN4	30	40
N1	20	37	PN4	50	47
N2	10	43	PN4	70	51
N2	30	44	PN4	90	57
N2	50	45	PN5	10	36
N2	70	50	PN5	30	38
N2	90	55	PN5	50	53
N2	110	57	PN5	70	57
N2	130	58	PN5	90	59
N2	150	59	PN6	10	36
PN1	15	37	PN6	30	38
PN1	35	38	PN6	50	54
PN1	55	56	PN6	70	57
PN2A	30	41	PN6	90	62
PN2A	50	45	PN7	10	35
PN2A	70	57	PN7	30	49
PN2A	90	64	PN7	50	51
PN2A	110	66	PN7	70	55
PN2B	30	40	PN7	90	58
PN2B	50	49	PN7	110	60
PN2B	70	56	PN8	10	43
PN2B	90	63	PN8	30	50
PN2B	110	67	PN8	50	53
PN3	10	38	PN8	70	58
PN3	30	43	PN8	90	61
PN3	50	50	PN8	110	63
PN3	70	57	PN9	10	36
PN3	90	60	PN9	25	36
PN4	10	38	PN9	40	38

Table 3 *Predicted noise level for Concert Setting 2*

NSR	Height, mPD	Result, dB(A), Leq (15 min)	NSR	Height, mPD	Result, dB(A), Leq (15 min)
N1	10	33	PN4	30	38
N1	20	34	PN4	50	45
N2	10	37	PN4	70	50
N2	30	39	PN4	90	57
N2	50	43	PN5	10	35
N2	70	50	PN5	30	38
N2	90	55	PN5	50	53
N2	110	57	PN5	70	57
N2	130	58	PN5	90	58
N2	150	60	PN6	10	37
PN1	15	38	PN6	30	39
PN1	35	44	PN6	50	54
PN1	55	55	PN6	70	57
PN2A	30	41	PN6	90	62
PN2A	50	45	PN7	10	41
PN2A	70	56	PN7	30	52
PN2A	90	63	PN7	50	52
PN2A	110	66	PN7	70	55
PN2B	30	41	PN7	90	58
PN2B	50	49	PN7	110	60
PN2B	70	56	PN8	10	45
PN2B	90	63	PN8	30	51
PN2B	110	66	PN8	50	53
PN3	10	36	PN8	70	61
PN3	30	42	PN8	90	61
PN3	50	50	PN8	110	63
PN3	70	53	PN9	10	38
PN3	90	59	PN9	25	39
PN4	10	36	PN9	40	41

Table 4 *Sound Absorption Panel Specification*

Frequency, Hz	63	125	250	500	1000	2000	4000	8000
Absorption coefficient	0.25	0.25	0.65	0.85	0.83	0.75	0.55	0.55

A typical sound pressure spectrum for musical event can be found in the noise assessment for the Copper Box of Queen Elizabeth Olympic Park at London¹. On-site measurement of a rock and pop music event in Hong Kong was also performed in the Queen Elizabeth Stadium from 20:00 to 22:00 on 23 October 2015. The maximum Leq (15 mins) was 96.1 dB(A), which occurred between 20:45 and 21:00. Both sound pressure spectra are listed in **Table 5** below.

1: Noise assessment report for musical event held at the Copper Box
<http://planningregister.londonlegacy.co.uk/swift/MediaTemp/2705-41515.pdf>

Table 5 Music Event Sound Spectra

Frequency, Hz	63	125	250	500	1000	2000	4000	8000	A-weighted
Copper Box, in dB	105.0	97.0	97.0	94.0	89.0	85.0	81.0	78.0	95.5
Measurement in Hong Kong, in dB	95.9	101.9	100.0	94.7	87.3	86.2	79.8	71.2	96.1

The spectrum of the Copper Box is adopted as the sound power spectrum for musical event loudspeakers of the Main Stadium. The sound power levels (SWLs) of the loudspeakers are adjusted to give sufficient sound level at the audience area for both concert settings. In concert setting 1, the modelled sound pressure level ranges from 92.9 dB(A) to 110.1 dB(A) and the median is 98.6 dB(A); in concert setting 2, the modelled sound pressure level ranges from 92.1 dB(A) to 113.4 dB(A) and the median is 99.0 dB(A). The modelled loudspeaker spectra are listed in **Table 6**. A renowned local sound system expert has been consulted for the reasonableness of the system and the reply has been attached at the end of this Appendix.

Table 6 Modelled Loudspeaker Spectra

Frequency, Hz	63	125	250	500	1000	2000	4000	8000	A-weighted
Concert Setting 1 (P2-P6), dB	143.6	135.6	135.6	132.6	127.6	123.6	119.6	116.6	134.1
Concert Setting 1 (P7-P8), dB	140.6	132.6	132.6	129.6	124.6	120.6	116.6	113.6	131.1
Concert setting 2 (P2-P13), dB	140.1	132.1	132.1	129.1	124.1	120.1	116.1	113.1	130.6
PA system	90.4	98.9	99.5	99	98.3	98.4	95.1	91.6	104.2

Acoustic doors should be used for the entrances of the main stadium so that the noise insulation performance is not compromised. The dimensions of the doors on the inner and outer layers of the structure assumed are listed in **Table 7** below. Their locations are shown in **Figure 16**. A specification of the door is also attached in **Annex I**.

Table 7 Modelled Acoustic Doors of Main Stadium

Door	Dimension		Door	Dimension	
	Height(m)	Width(m)		Height(m)	Width(m)
1	6.8	65.7	8	4.3	38.6
2	5.7	12.0	9	4.8	50.0
3	5.7	11.8	10	5.3	42.0
4	6.8	65.7	11	6.8	70.7
5	5.7	12.0	12	5.8	38.6
6	5.7	11.8	13	5.5	46.3
7	6.8	70.7	14	5.3	42.1

Figure 1 3D model of MPSC and its surroundings

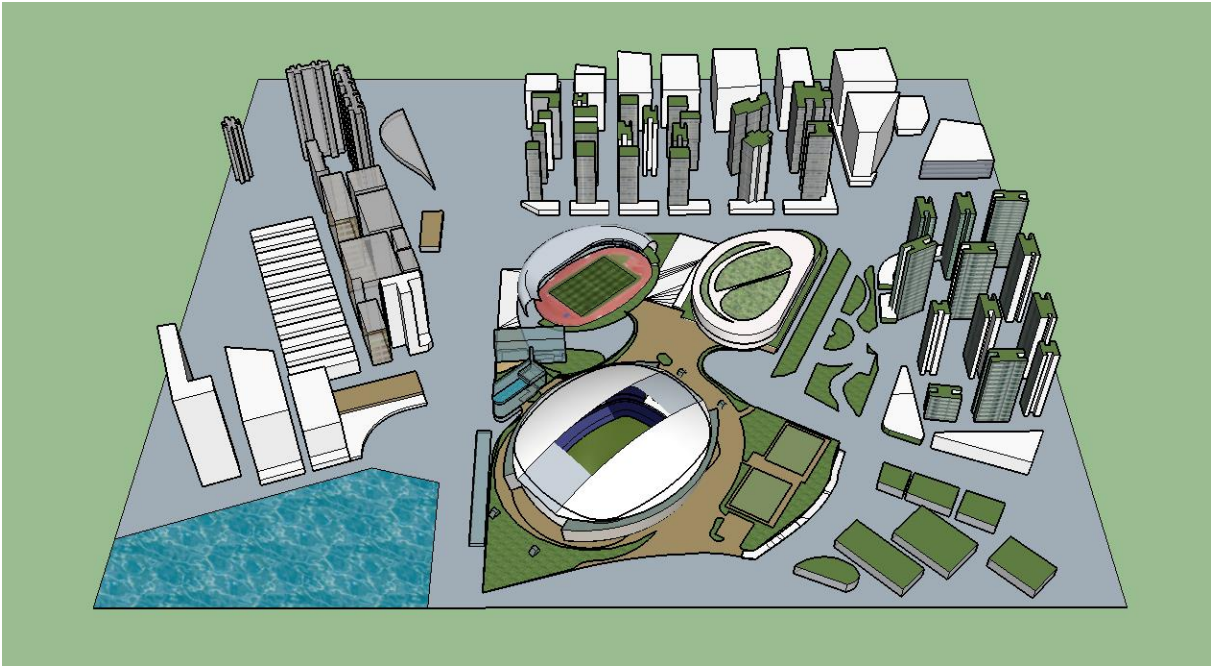


Figure 2 3D model of the Main Stadium

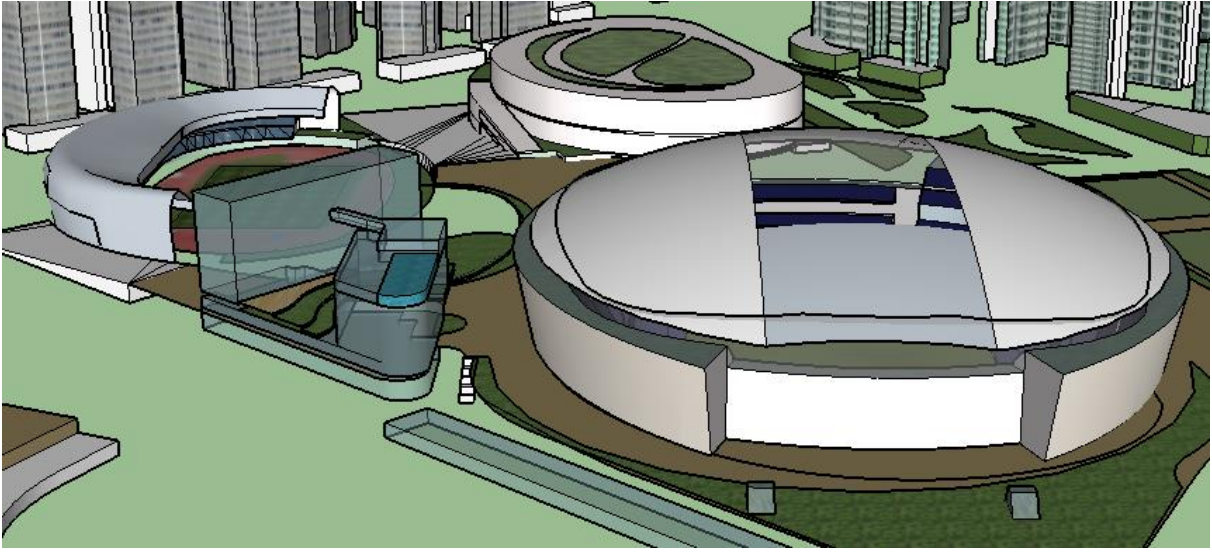


Figure 3 Frame view of noise model for MPSC and its surrounding

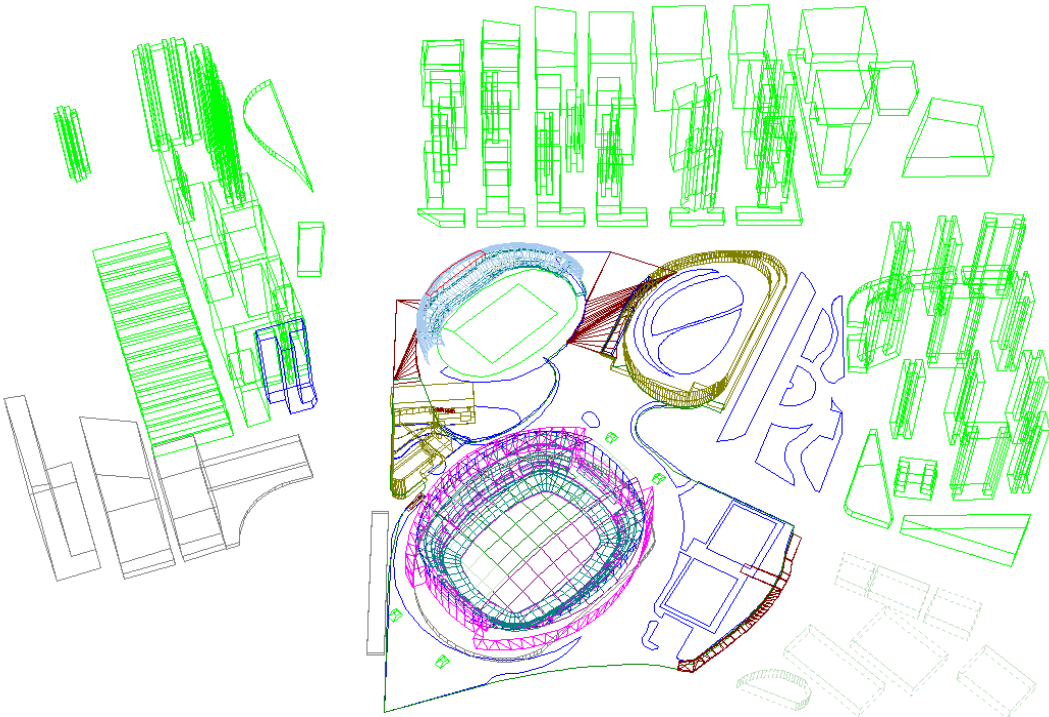


Figure 4 Frame view of noise model for Main Stadium

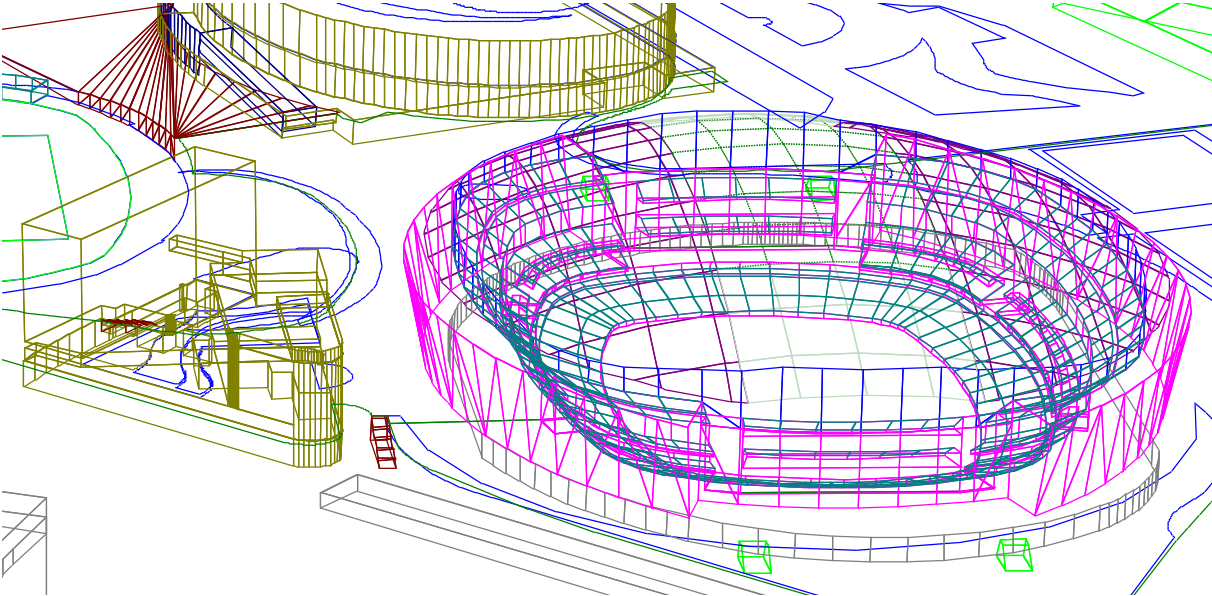


Figure 5 Retractable roof of Main Stadium (opened)

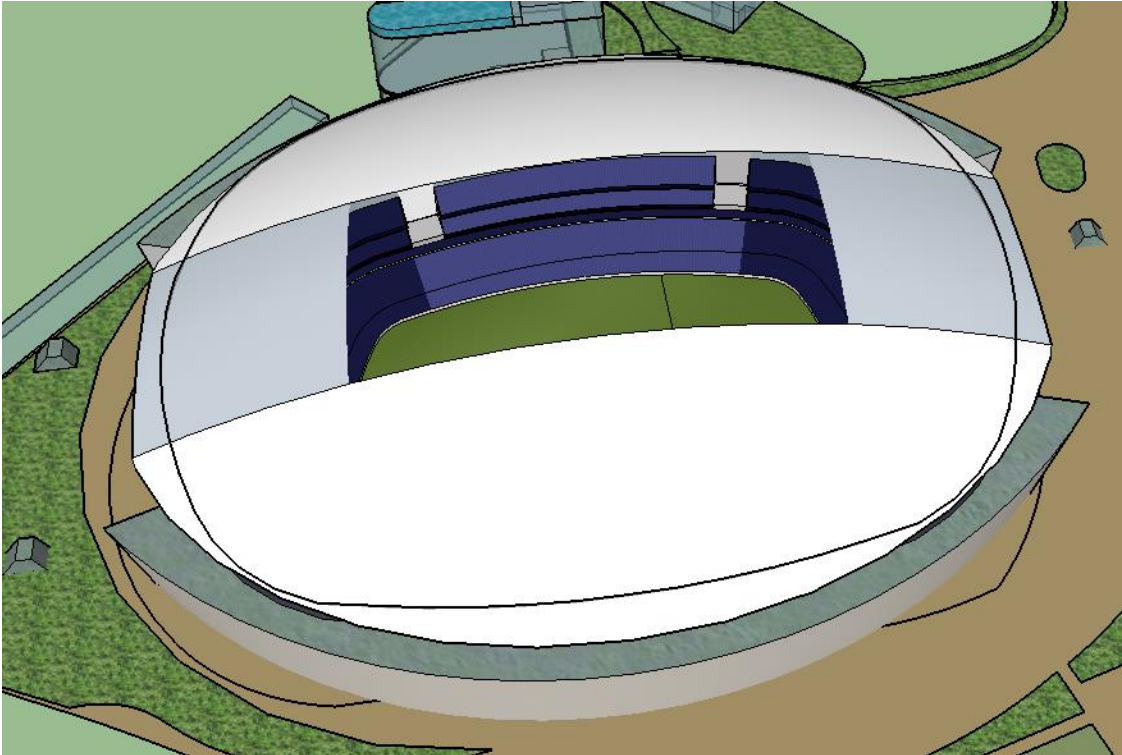


Figure 6 Retractable roof of Main Stadium (closed)

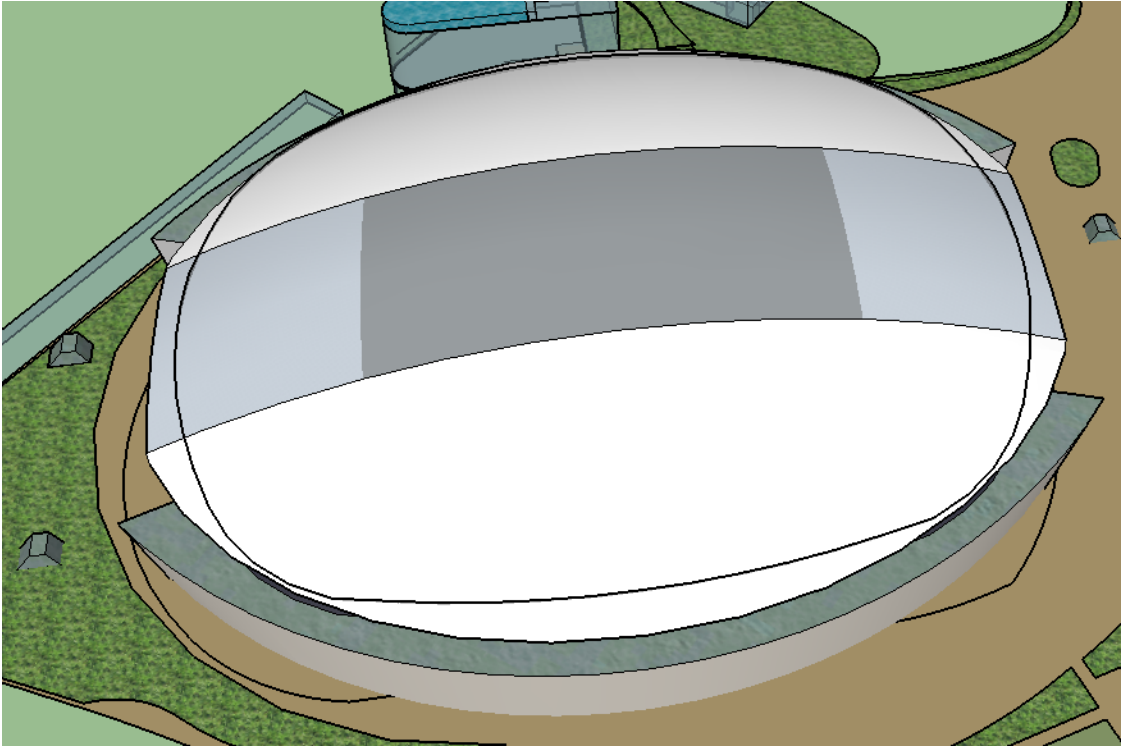


Figure 7 Positions and orientations of sporty event spectators
(red points indicate the location of the sources that represent spectators)

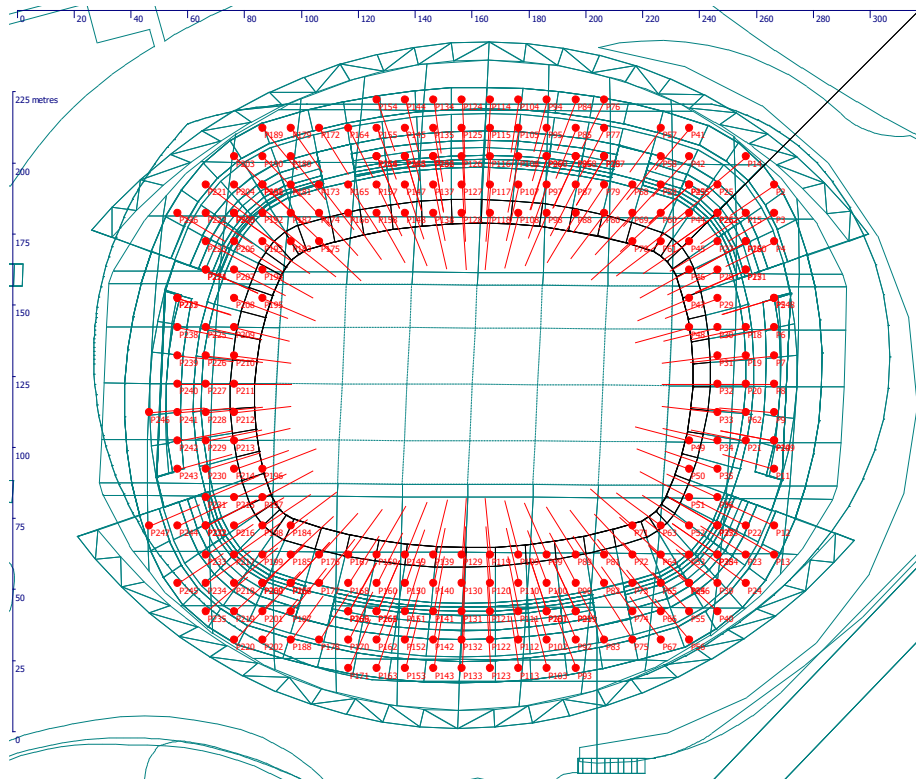


Figure 8 Positions and orientations of sporty event public address system loudspeakers
(red points indicate the location of the loudspeakers)

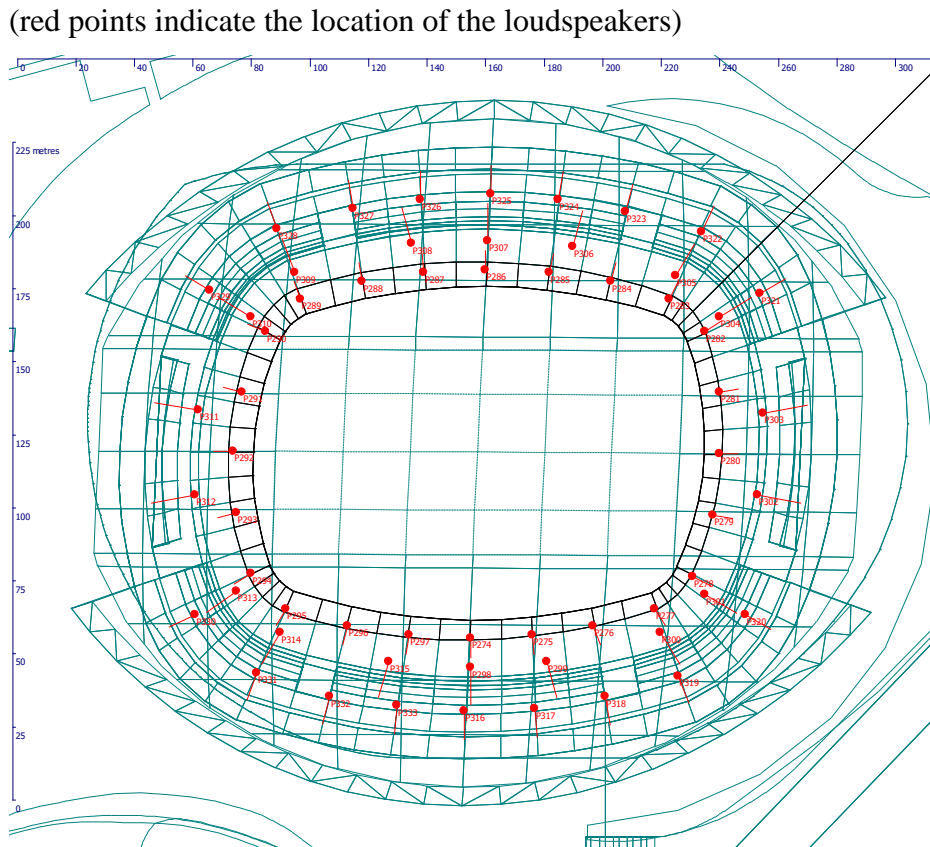


Figure 9 Location and height of the receivers in the noise model

(blue points indicate the location of the modelled receivers)

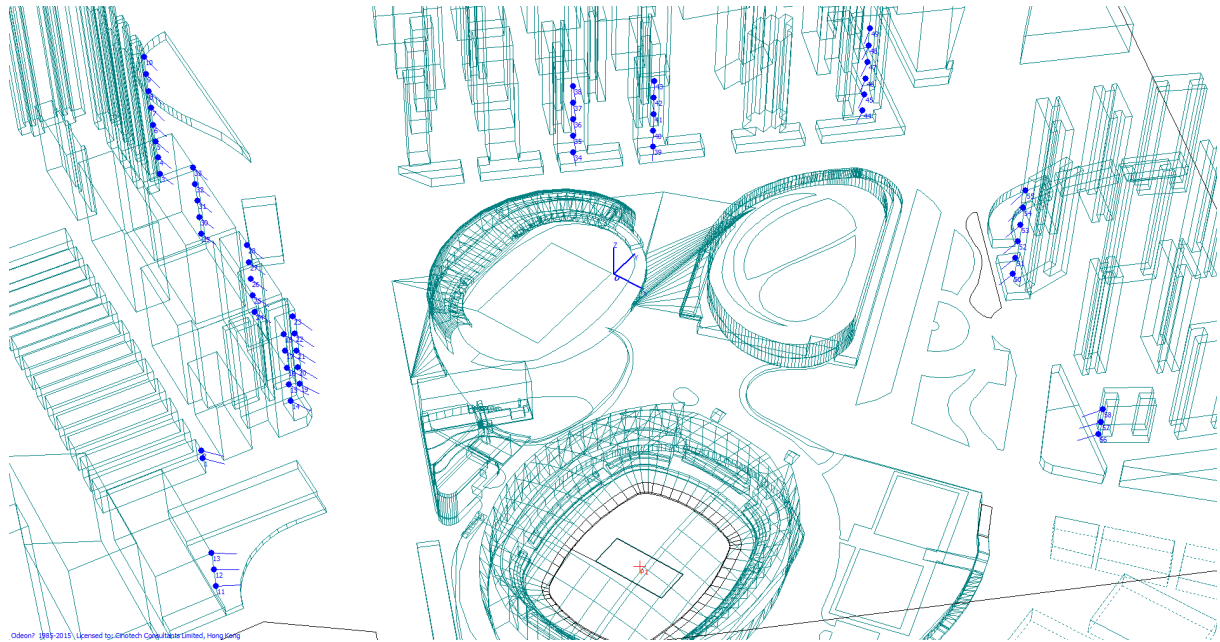


Figure 10 Positions and orientations of audiences in Concert Setting 1

(red points indicate the location of the sources that represent audiences)

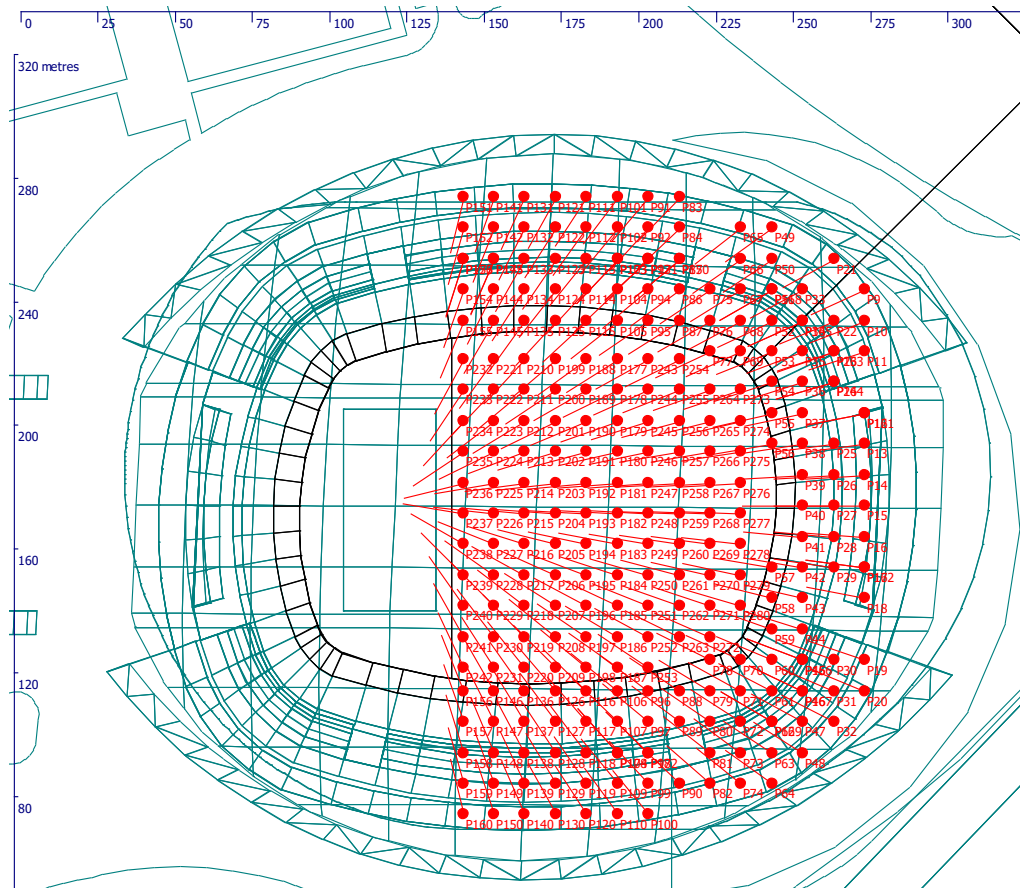


Figure 11 Positions and orientations of audiences in Concert Setting 2

(red points indicate the location of the sources that represent audiences)

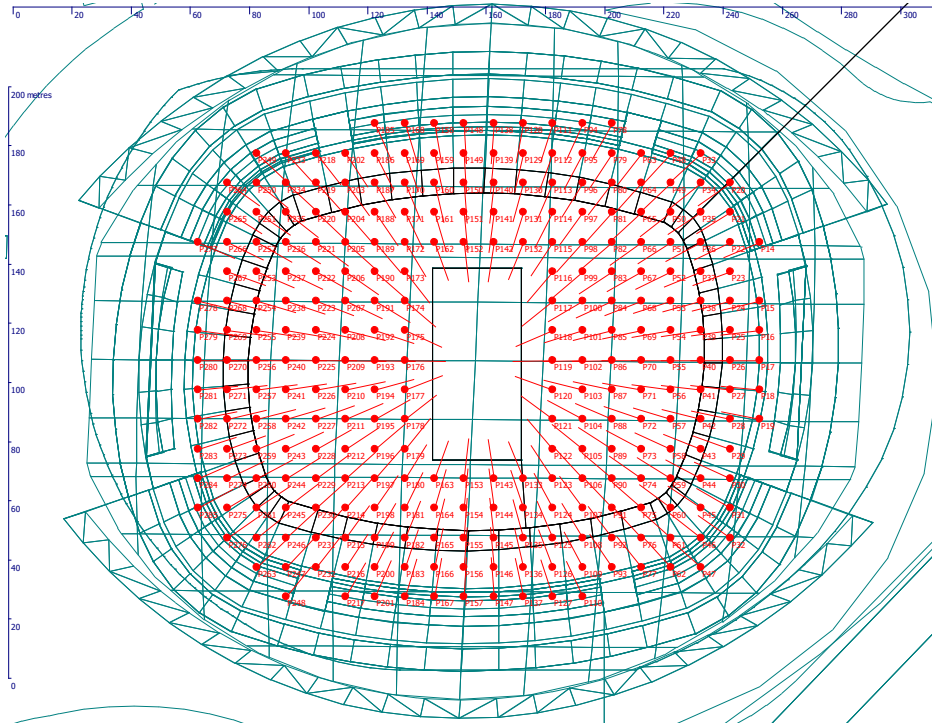


Figure 12 Positions of loudspeakers in Concert Setting 1

(red points indicate the location of loudspeakers)

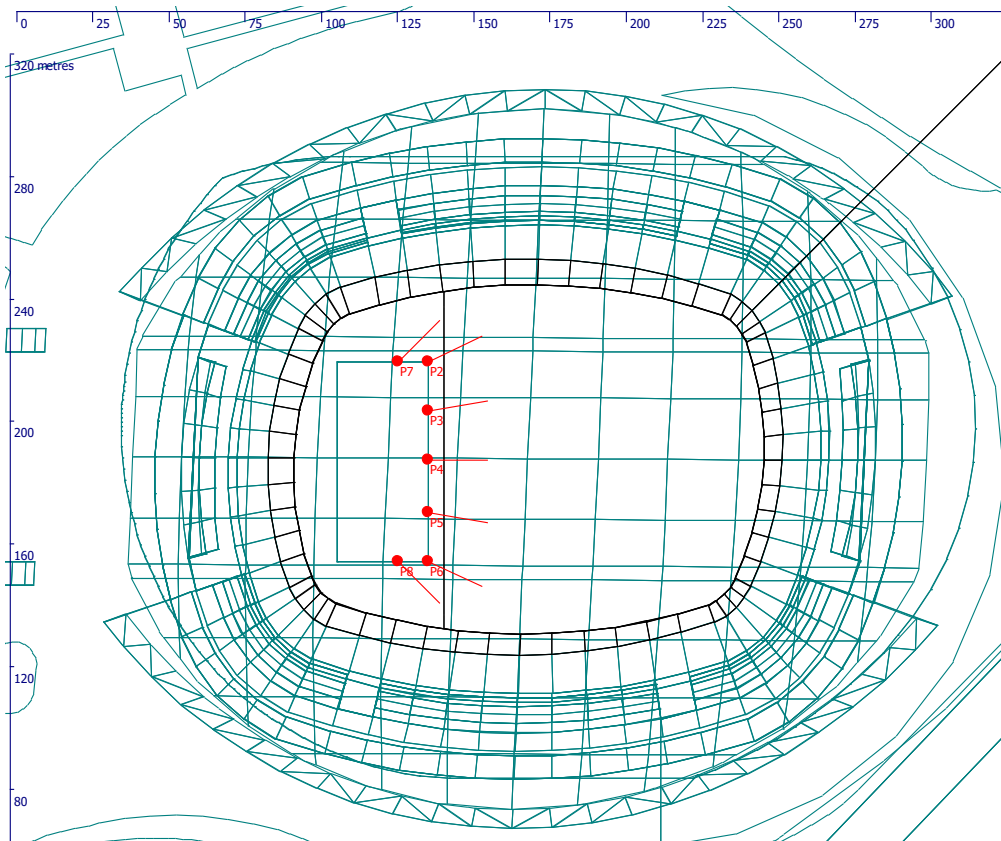


Figure 13 Positions of loudspeakers in Concert Setting 2
 (red points indicate the location of loudspeakers)

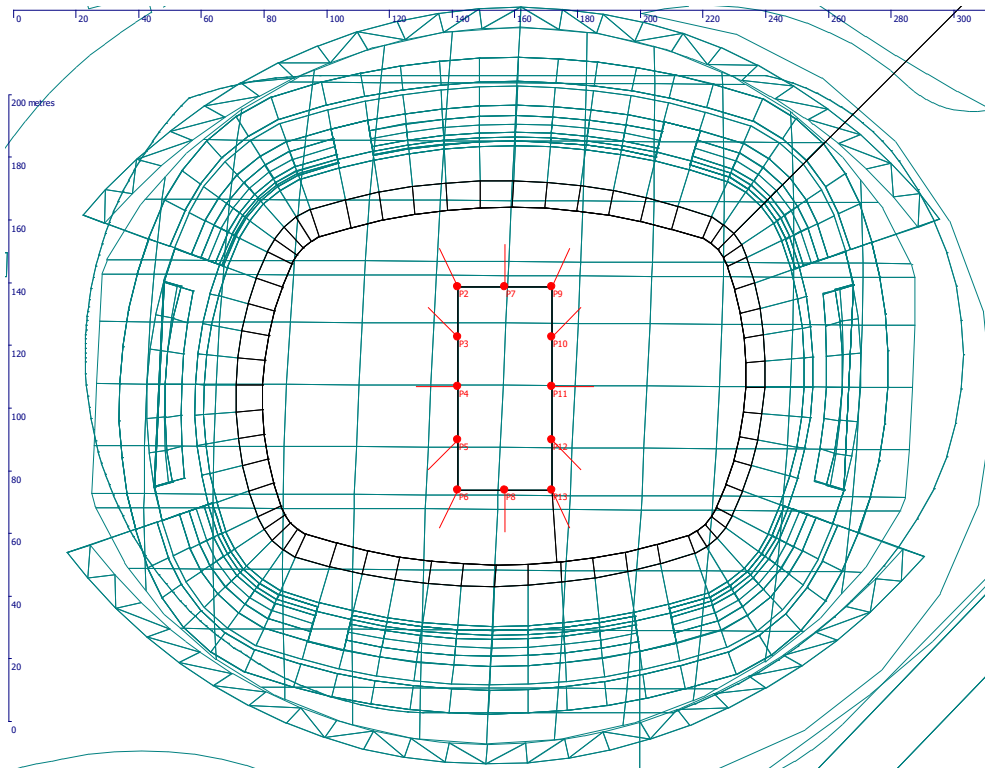


Figure 14 Unweighted Sound Pressure Level measured inside Queen Elizabeth Stadium for Pop/Rock Musical Event

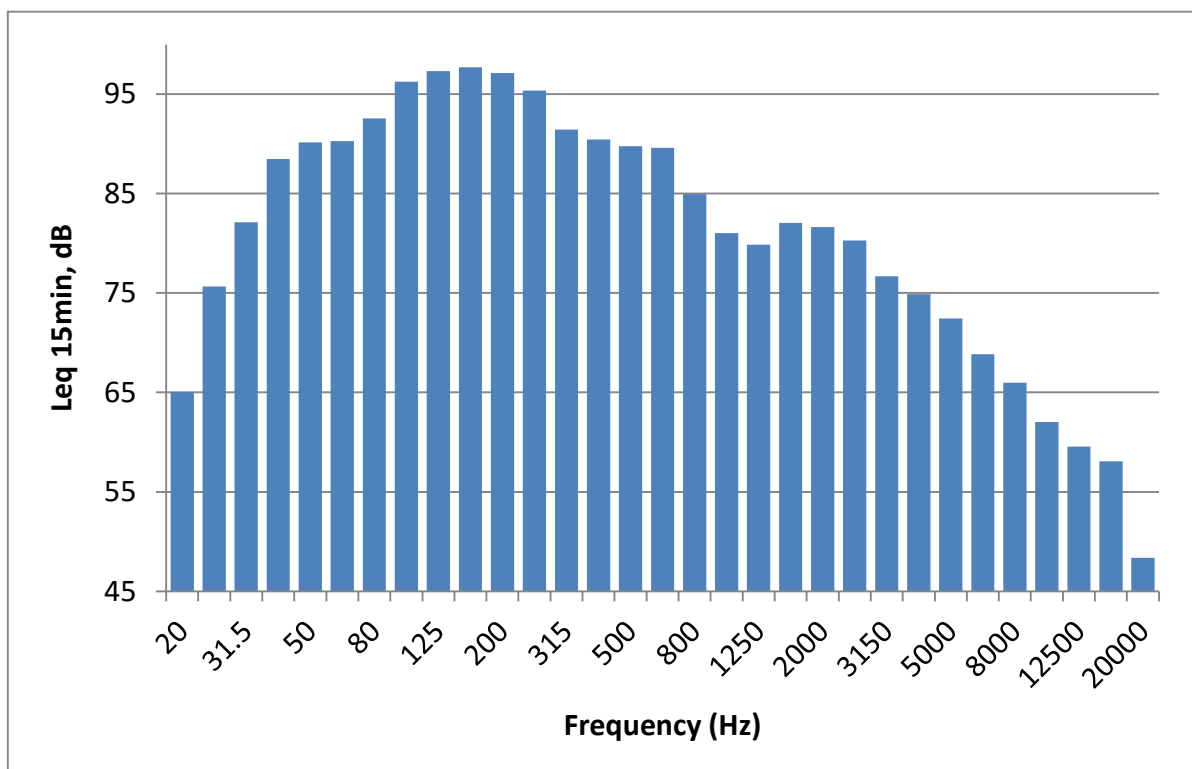


Figure 15 A-weighted Sound Pressure Level measured inside stadium for Pop/Rock Musical Event

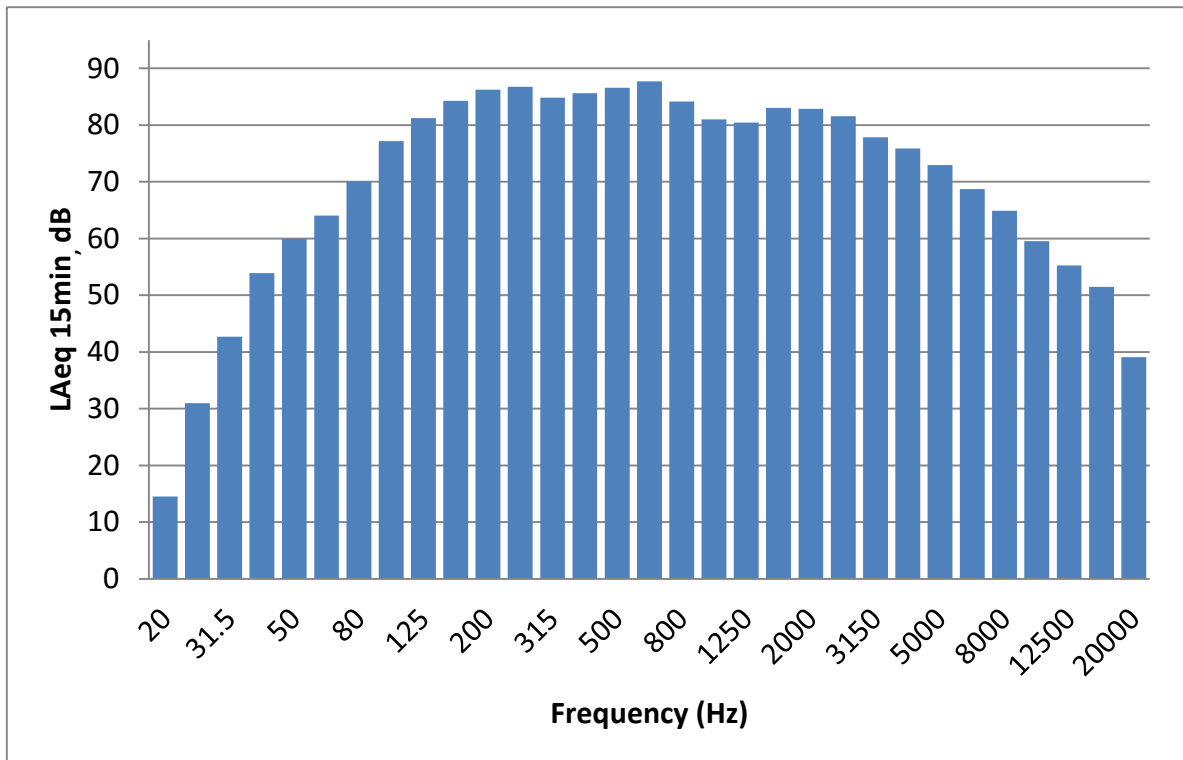
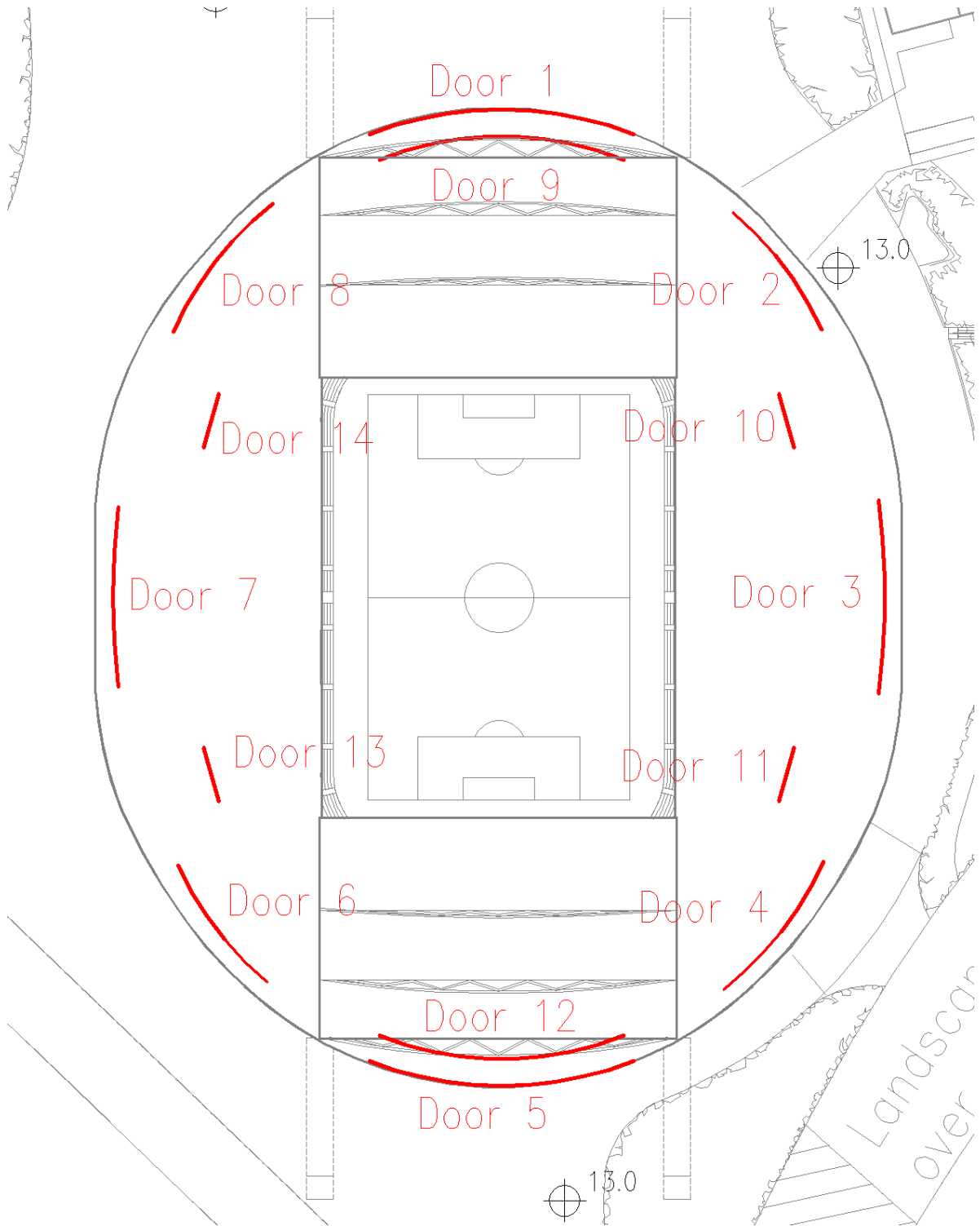
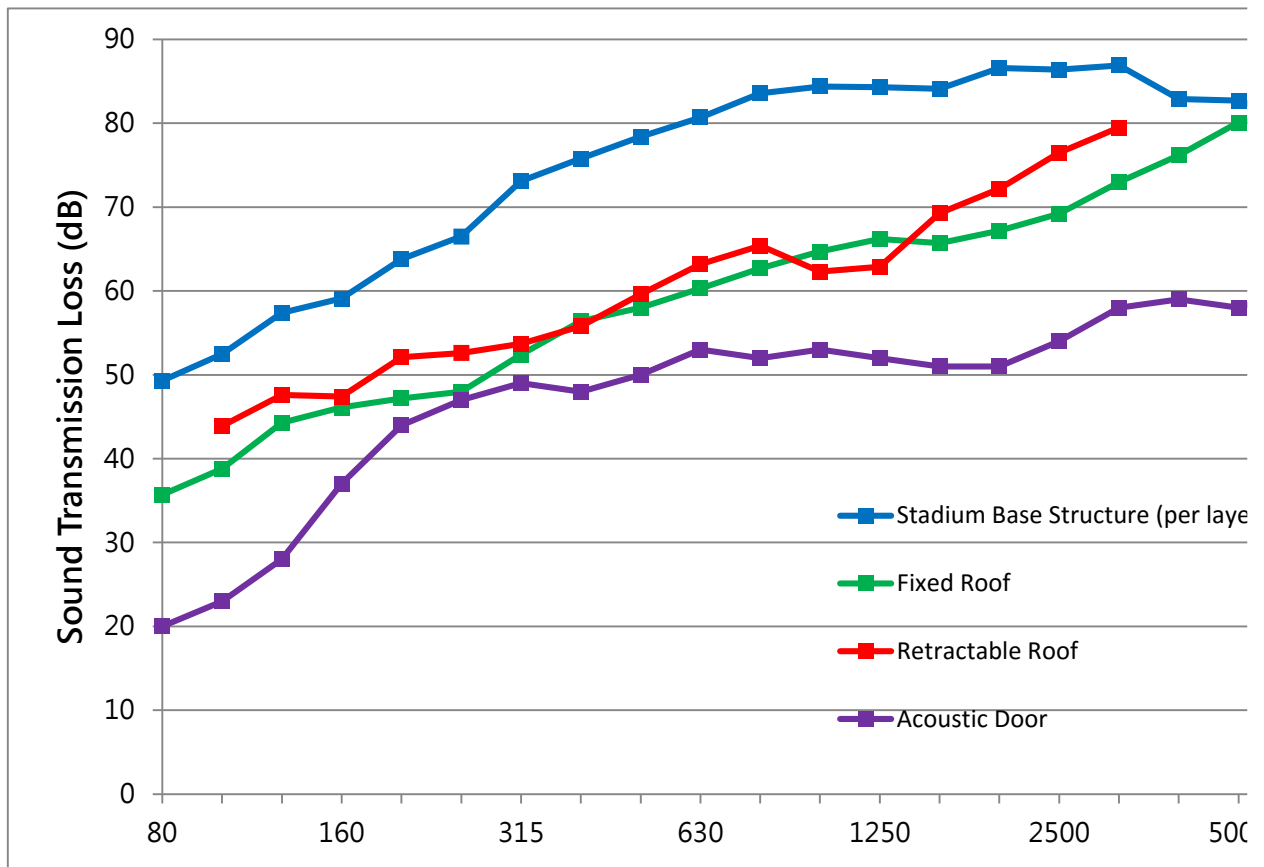


Figure 16 Location of Acoustic Doors of the Main Stadium



Annex I Specifications of sound transmission loss (in dB)



Frequency, Hz	80	100	125	160	200	250	315
Structure	49.3	52.5	57.4	59.1	63.8	66.5	73.1
Fixed Roof	35.7	38.8	44.3	46.1	47.2	48	52.4
Retractable Roof	-	43.9	47.6	47.4	52.1	52.6	53.7
Acoustic Door	20	23	28	37	44	47	49

Frequency, Hz	400	500	630	800	1000	1250	1600
Structure	75.8	78.4	80.7	83.6	84.4	84.3	84.1
Fixed Roof	56.4	58	60.3	62.7	64.7	66.2	65.7
Retractable Roof	55.8	59.6	63.2	65.4	62.3	62.9	69.3
Acoustic Door	48	50	53	52	53	52	51

Frequency, Hz	2000	2500	3150	4000	5000	6300
Structure	86.6	86.4	86.9	82.9	82.7	80.5
Fixed Roof	67.2	69.2	73	76.2	80.1	81
Retractable Roof	72.2	76.5	79.5	-	-	-
Acoustic Door	51	54	58	59	58	50

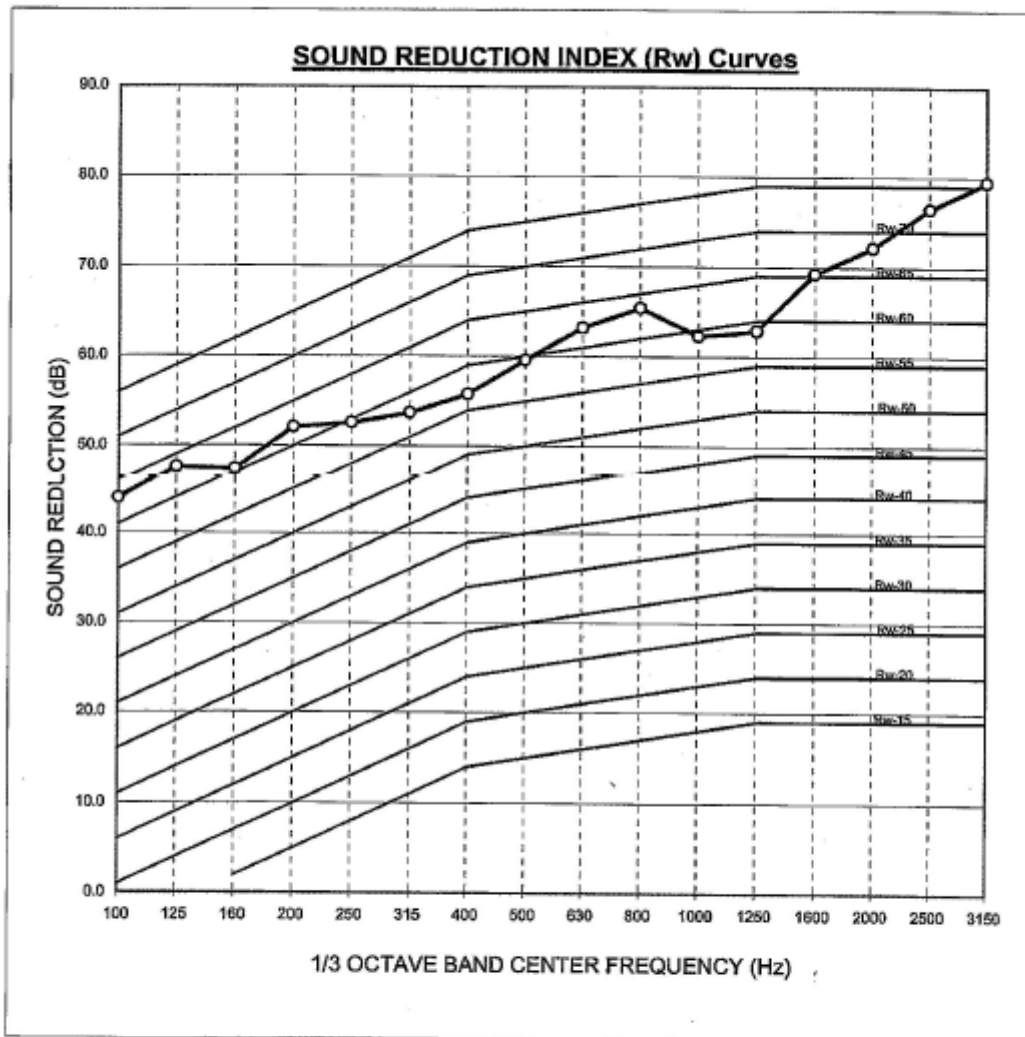
The catalogue of the adopted retractable roof and acoustic door sound reduction is provided in the following pages.

The specification of fixed roof can be found as ID TL-88-474 of the following publication.

<http://nparc.cisti-icist.nrc-cnrc.gc.ca/npsi/ctrl?action=shwart&index=an&req=20358477>

Catalogue of sound transmission loss of retractable roof adopted

TITLE: Transmission Loss Test of Wall Cladding System (Test Unit 4)
 DATE OF TEST: 9/6/2004



Freq.	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150
Rw (Input)	43.9	47.6	47.4	52.1	52.6	53.7	55.8	59.6	63.2	65.4	62.3	62.9	69.3	72.2	76.5	79.5
Rating:		Rw 63														
Summation:		29 dB														
Max. deviation:		8 dB														



Catalogue of sound transmission loss of acoustic door adopted

UK-P4-D00-0136-201507-03

Acoustic Door Specification Noise-Lock® D-50 Steel Acoustic Door

IAC Acoustics
 IAC House, Moorside Road, Winchester
 Hampshire, SO23 7US, United Kingdom
 T: +44 (0) 1962 873 000
 www.iac-acoustics.com

Construction

- Door Structure** Each leaf shall be 64mm thick, fabricated from 2.0mm thick steel sheet filled with sound absorbing and damping elements. Leaf shall be internally reinforced to accept hardware.
- Frame** Architectural split frame shall be fabricated from 2.0mm thick steel sheets, channels and plates and to be filled with sound absorbing and damping elements. Additional structural elements incorporated into the builders' wall may be required to support the door assembly, please refer to IAC Acoustics for more information.
- Acoustic Seals** Side and head of door and frame shall each receive two sets of acoustic seals. An acoustic labyrinth shall be created when door is in closed position. Bottom of door leaf shall contain continuous gravity-activated seal which shall compress against steel threshold as door is closed.
- Pre-hung** Assembly and adjustment of door leaf, frame, acoustic seals and hinges shall take place at factory to ensure ease of installation, reliable operation and maintenance of acoustic performance. The entire doorset shall be shipped to job site ready to install and operate.
- Hinges** Shall be by IAC, CAM lift design, painted to match the door.
- Preparation** Door leaf and frame shall be predrilled and tapped in accordance with manufacturer's templates to accept specified hardware.

Vision Panel (if applicable)

Double glazed window unit comprising two panes of laminated safety glass (Thickness dependant on vision panel size) sealed within 2mm steel frames to suit leaf thickness of 64mm. Acoustic absorptive material fitted between the panes. Steel frames to be RAL polyester powder coated to match the door finish.

Colour / Finishes

Leaf and frame to be polyester powder coated to standard RAL colours.

Furniture

To be confirmed - factory fit and assembly.

Acoustic Rating

Rw (C; Ctr) 50 [-3; -9] dB to achieve minimum R'w45dB once installed (subject to flanking).
 STC-51(dB) to achieve minimum NIC 46 once installed (subject to flanking).
 Certified laboratory performance in single leaf arrangement as follows:

Frequency (Hz)	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k
1/3 Octave Sound Transmission Loss (dB)	25	24	20	23	28	37	44	47	49	48	50	53	52	53	52	51	51	54	58	59	58	50	48	54
Frequency (Hz)	63			125			250			500			1k			2k			4k			8k		
Full Octave Sound Transmission Loss (dB)	22			26			46			50			52			52			58			50		

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RE: MPSC EIA - Final Draft Chapter 5 Noise Impact Assessment - Assumptions for assessment of noise from music or sports events (URGENT)

ignacio.diez@leighorange.com

to:

moonshingman@hab.gov.hk

05/08/2016 15:11

Cc:

mpsc@smwhk.com, 15112-LO@leighorange.com

Hide Details

From: "Diez Aguirre, Ignacio" <ignacio.diez@leighorange.com>

To: "moonshingman@hab.gov.hk" <moonshingman@hab.gov.hk>,

Cc: SMW MPSC Team <mpsc@smwhk.com>, 15112-KaiTak_SportComplex <15112-LO@leighorange.com>

Dear Keith,

Kindly find response from SMW highlighted in yellow below in regards the assumptions on the locations and characteristics of the loudspeakers.

Best Regards,

Ignacio Diez Aguirre

Associate

Direct Line: +852 2899 9544



Integrity | Humanity | Creativity | Sustainability

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From: Roy Poon [<mailto:rpoon@smwhk.com>]

Sent: Friday, August 05, 2016 3:03 PM

To: Diez Aguirre, Ignacio

Cc: SMW MPSC Team; 15112-KaiTak_SportComplex

Subject: RE: MPSC EIA - Final Draft Chapter 5 Noise Impact Assessment - Assumptions for assessment of noise from music or sports events (URGENT)

Dear Ignacio,

We had reviewed the assumption of the speaker systems in the EIA report.

The location of the speakers is similar to what we discussed and the parameters are reasonable.

A minor comment that in page 2 Table A and Table B, the term "Noise Level at Spectator Stand", in our opinion, it should be "Sound Level at Spectator Stand".

Regards,

Roy

From: moonshingman@hab.gov.hk [<mailto:moonshingman@hab.gov.hk>]

Sent: Friday, August 05, 2016 12:38 PM

To: Diez Aguirre, Ignacio

Cc: 15112-KaiTak_SportComplex; moonshingman@hab.gov.hk; mpsc@smwhk.com

Subject: RE: MPSC EIA - Final Draft Chapter 5 Noise Impact Assessment - Assumptions for assessment of noise from