Kai Tak Sports Park Ltd.

Design, Construction and Operation of the Kai Tak Sports Park

Noise Mitigation Plan

OAP-GEN-SW-EN-00-EMT-NMP-00001

Rev. 01 | August 2019

Job number 266006-70

Home Affairs Bureau
The Government of the Hong Kong Special Administrative Region

MOTT MACDONALD

Environmental Permit No. EP- 544/2017

Kai Tak Sports Park – Investigation

Environmental Team Leader Certification

Reference Document /Plan

~~Document~~/Plan to be Certified:	Noise Mitigation Plan
Date of Report:	August 2019 (Rev. 1)
Date received by ETL:	30 August 2019

Reference EP Condition

Environmental Permit Condition: 2.19

The Permit Holder shall, no later than one month before the commencement of construction of the Project or otherwise approved by the Director, deposit with the Director three hard copies and one electronic copy of Noise Mitigation Plan(s) (the NMP). The NMP shall include details, implementation programme, maintenance and management schedules of the required noise mitigation measures for the Project.

ETL Certification

I hereby certify that the above reference plan complies with the above referenced condition of EP-544/2017.

Mr Sunny Chan
Environmental Team Leader Date: 2 September 2019

Home Affairs Bureau
The Government of the Hong Kong Special Administrative Region

ERM

Environmental Permit No. EP-544/2017

Kai Tak Sports Park - Investigation

Independent Environmental Checker Verification

Reference Document/Plan

~~Document~~/Plan to be ~~Certified~~/ Verified:	Noise Mitigation Plan
Date of Report:	August 2019 (Rev. 2)
Date received by IEC:	30 August 2019

Reference EP Condition

Environmental Permit Condition: 2.19 & 2.20

The Permit Holder shall, no later than one month before the commencement of construction of the Project or otherwise approved by the Director, deposit with the Director three hard copies and one electronic copy of Noise Mitigation Plan(s) (the NMP). The NMP shall include details, implementation programme, maintenance and management schedules of the required noise mitigation measures for the Project.

If there are any change(s) to the noise mitigation measures in the NMP, the Permit Holder shall, no later than one month before the implementation of such change(s), deposit with the Director three hard copies and one electronic copy of an update to the NMP (the Updated NMP). The Updated NMP shall show clearly the proposed change(s). Before submission to the Director, the NMP or any Updated NMP shall be certified by the ET Leader and verified by the IEC as conforming to the relevant information and recommendations on noise mitigation measures contained in the approved EIA report (Register No. AEIAR-204/2017), or otherwise approved by the Director. All noise mitigation measures recommended in the NMP or any Updated NMP shall be fully implemented. The Permit Holder shall make available additional copies of the NMP or any Updated NMP to the Director upon his request.

IEC Verification

I hereby verify that the above referenced ~~document~~/plan complies with the above referenced condition of EP-544/2017.

Ms Mandy To

Independent Environmental Checker

Date: 2 September 2019

Our ref: 0500384_IEC Verification Cert_KTSP_NMP_20190902.docx

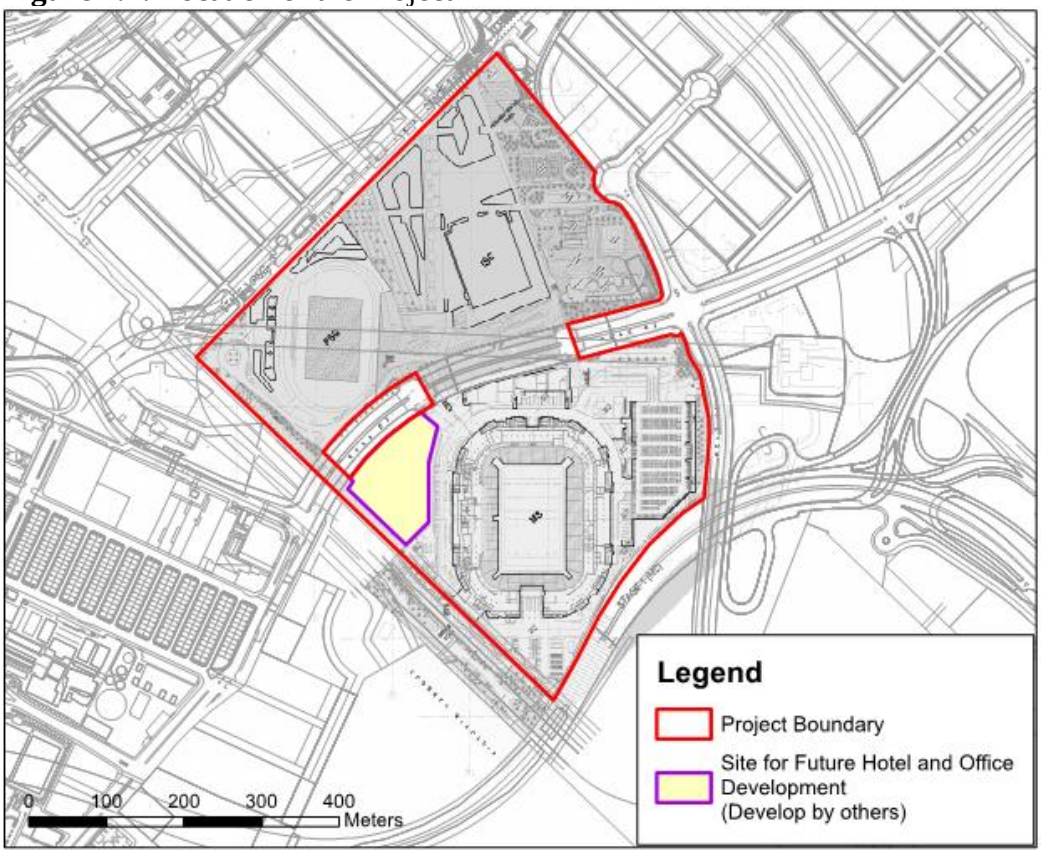
Contents

1 Introduction

1.1 Background

1.1.1.1 The Environmental Permit (EP) (i.e. EP-544/2017) for the approved Environmental Impact Assessment Report (EIA) for Kai Tak Multi-purpose Sports Complex (Former name of Kai Tak Sports Park) was issued on 8th September 2017. The location of the Project according to the EP is shown in **Figure 1.1**.

Figure 1.1: Location of the Project in EP



1.1.1.2 As stipulated in the Condition 2.19 of the EP, the Permit Holder shall, no later than one month before the commencement of construction of the Project or otherwise approved by Director of Environmental Protection (DEP), deposit with the DEP with three hard copies and one electronic copy of the Noise Mitigation Plan (NMP).

1.1.1.3 For the Kai Tak Sports Park project, Home Affairs Bureau is the Project Proponent and acts as Permit Holder. Kai Tak Sports Park Limited is nominated as the Contactor Party (CP). Hip Hing Engineering Co. Ltd. (HHE), as nominated first tier subcontractor under Kai Tak Sports Park Limited (KTSPL), will be responsible for carrying out construction works for whole development as well as associated environmental impact mitigation measures.

1.1.1.4 The first NMP was submitted on 8th March 2019 to outline the noise mitigation measures adopted. As the design develops, the adopted noise mitigation will be

more elaborated. This is an updated NMP submitted to update the design development of the following mitigation measures in accordance with EP-544/2017:

- Update design of Main Stadium; and
- Update design of Public Sports Ground.

1.2 Purpose of the updated NMP

1.2.1.1 The updated NMP is prepared to comply with Condition 2.19 and Condition 2.20 of the EP. This updated NMP contains details, implementation programme, maintenance and management schedules of the required noise mitigation measures for the Project.

1.3 Scale and Scope of Kai Tak Sports Park

1.3.1.1 The Project comprises the following elements which are considered as a Designated Project (DP) as per Schedule 2, Part I of the EIA Ordinance:

- O.6 – An open air concert venue with a capacity to accommodate more than 10,000 persons; and
- O.7. – An outdoor sporting facility with a capacity to accommodate more than 10,000 persons.

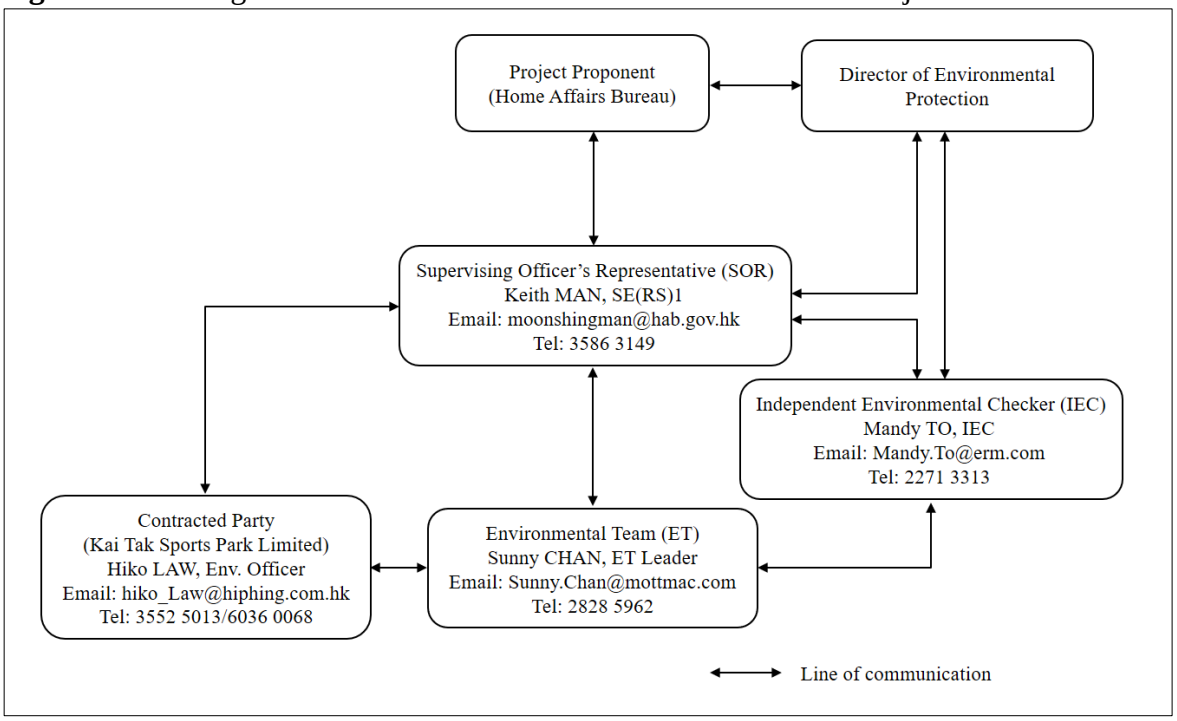
1.3.1.2 The Project comprises the construction and operation of the following key elements:

- A Main Stadium (MS);
- A Public Sports Ground (PSG);
- An Indoor Sports Centre (ISC); and
- Other ancillary/supporting facilities such as car parks, retail, food and beverage outlets; an office building and a hotel (provided by other).

1.4 Management Structure

1.4.1.1 The management structure for the environmental works of the Project is indicated in **Figure 1.2**.

Figure 1.2: Management structure for environmental works of the Project



1.5 Structure of Updated NMP

1.5.1.1 The structure of this updated NMP is as follows:

Chapter	Title	Aims
1	Introduction	Provides project background, purpose of the updated NMP, project scale and scope, management structure, and structure of this NMP.
2	Construction Phase	Presents the implementation details of mitigation measures during the construction phase.
3	Operational Phase	Presents the implementation details of mitigation measures during the operational phase.
4	Conclusion	Provides a summary of the updated NMP.

2 Construction Phase

2.1 Major Construction Activities

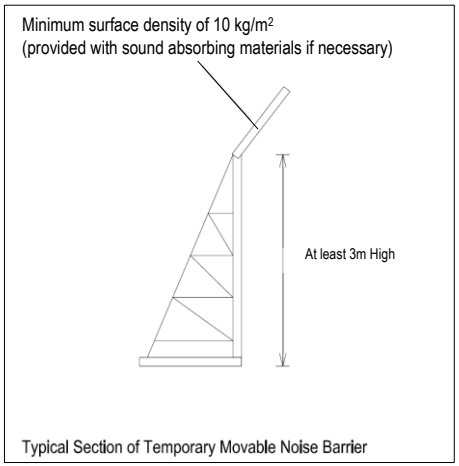
2.1.1.1 The Project will involve the following major construction activities which may induce noise impacts to nearby Noise Sensitive Receivers (NSRs):

- Piling works;
- Pile cap construction;
- Foundation works including excavations, site preparation and plants mobilizations;
- Superstructure including steel fixings, temporary formworks and scaffoldings;
- Builder works including materials transportation and interior works; and
- External works including loading/ unloading materials and road works.

2.2 Noise Mitigation Measures

2.2.1.1 All the associated noise mitigation measures as stated in the approved EIA report for Kai Tak Multi-purpose Sports Complex (AEIAR-204/2017) are adopted in the updated NMP unless otherwise stipulated as a result of design development. Mitigation measures with implementation programme, maintenance and management schedules are provided as follows.

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation Details	Implementation Agent	Implementation Programme[1]	Maintenance and Management Parties	Maintenance and Management Schedule
(a) Piling works							
5.9	N1	Adopt good site practice, such as throttle down or switch off equipment unused or intermittently used between works;	Noisy equipment, including cranes, trucks and excavators etc. will be shut down between work periods or will be throttled down to a minimum.	HHE	Q2/2019 – Q1/2020	KTSPL, HHE	As required
5.9	N2	Regular maintenance of equipment to prevent noise emission due to impair;	Maintenance checking will be conducted during the site inspection at least once a week. In case abnormal noise is generated by the PME, site personnel will stop using the equipment, carry out maintenance check and repair the PME item.	HHE	Q2/2019 – Q1/2020	KTSPL, HHE	As required
5.9	N5	Make good use of structures for noise screening;	Material stockpiles and site office can be placed as structures in between the NSRs and the PME item/noisy construction activities for noise screening.	HHE	Q2/2019 – Q1/2020	KTSPL, HHE	As required
5.9	N6	Use Quality Powered Mechanical Equipment (QPME) and quiet equipment which produces low noise level;	QPME will be used for construction works.	HHE	Q2/2019 – Q1/2020	KTSPL, HHE	As required

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation Details	Implementation Agent	Implementation Programme[1]	Maintenance and Management Parties	Maintenance and Management Schedule
5.9	N7	Erect movable noise barriers of 3m height to shed large plant equipment;	Movable noise barriers of at least 3m height will be provided at the site to shed noisy plant equipment and noisy activities. Movable noise barriers will be made of steel with a minimum surface density of 10 kg/m^2. They will be provided with absorbing materials and bend top if necessary. When fabricating the noise barrier, the length will be at least five times greater than its height, or as otherwise justifiable to achieve 5dB(A) noise reduction. A sketch of movable noise barrier is provided in **Figure 2.1**. **Figure 2.1**: Typical design of movable noise barrier  	HHE	Q2/2019 – Q1/2020	KTSPL, HHE	As required

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation Details	Implementation Agent	Implementation Programme[1]	Maintenance and Management Parties	Maintenance and Management Schedule
5.9	N3	Position mobile noisy equipment in locations away from NSRs and point the noise sources to direction away from NSRs;	For mobile noisy equipment, such as air compressors, generators and trucks etc., they will be sited away from NSRs as far as practicable. If the plant is known to emit noise strongly in one direction, they will, where possible, be oriented away from nearby NSRs. Otherwise, movable noise barriers will be provided to prevent the direct line of sight from the NSRs to the noise sources.	HHE	Q2/2019 – Q1/2020	KTSPL, HHE	As required
5.9	N4	Use of silencer or muffler for equipment;	Mufflers with sound absorbing materials will be used for noise reduction. In addition, regular inspection and maintenance would also be provided by the site personnel to ensure effective noise mitigation by mufflers.	HHE	Q2/2019 – Q1/2020	KTSPL, HHE	As required
5.9	N8	Carry out regular site inspection to audit the implementation of mitigation measures; and	Regular site inspection will be carried out by ET and HHE's representatives once a week to audit the implementation of mitigation measures. Site audit will be carried out by IEC at least once a month to verify the conditions.	HHE, ET, IEC	Q2/2019 – Q1/2020	HAB, SO, EPD	As required
5.9	N9	Carry out noise monitoring and audit throughout the construction period.	Noise monitoring will be carried out by ET once a week during the construction period according to EM&A manual, subject to further	ET, IEC	Q2/2019 – Q1/2020	HAB, SO, EPD	As required

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation Details	Implementation Agent	Implementation Programme[1]	Maintenance and Management Parties	Maintenance and Management Schedule
			agreement with IEC and EPD. Monitoring results will be verified by IEC.				
(b) Pile cap construction							
5.9	N1	Adopt good site practice, such as throttle down or switch off equipment unused or intermittently used between works;	Noisy equipment, including cranes, trucks, excavators and breakers etc. will be shut down between work periods or will be throttled down to a minimum.	HHE	Q4/2019 – Q4/2020	KTSPL, HHE	As required
5.9	N2	Regular maintenance of equipment to prevent noise emission due to impair;	Maintenance checking will be conducted during the site inspection at least once a week. In case abnormal noise is generated by the PME, site personnel will stop using the equipment, carry out maintenance check and repair the PME item.	HHE	Q4/2019 – Q4/2020	KTSPL, HHE	As required
5.9	N5	Make good use of structures for noise screening;	Material stockpiles and site office can be placed in between the NSRs and the PME item/noisy construction activities as structures for noise screening.	HHE	Q4/2019 – Q4/2020	KTSPL, HHE	As required

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation Details	Implementation Agent	Implementation Programme[1]	Maintenance and Management Parties	Maintenance and Management Schedule
5.9	N6	Use Quality Powered Mechanical Equipment (QPME) and quiet equipment which produces low noise level;	QPME will be used for construction works.	HHE	Q4/2019 – Q4/2020	KTSPL, HHE	As required
5.9	N7	Erect movable noise barriers of 3m height to shed large plant equipment;	Movable noise barriers of at least 3m height will be provided at the site to shed noisy plant equipment and noisy activities. Movable noise barriers will be made of steel with a minimum surface density of 10 kg/m^2. They will be provided with absorbing materials and bend top if necessary. When fabricating the noise barrier, the length will be at least five times greater than its height, or as otherwise justifiable to achieve 5dB(A) noise reduction. A sketch of movable noise barrier is provided in **Figure 2.1**.	HHE	Q4/2019 – Q4/2020	KTSPL, HHE	As required
5.9	N3	Position mobile noisy equipment in locations away from NSRs and point the noise sources to direction away from NSRs;	For mobile noisy equipment, such as air compressors, generators and trucks etc., they will be sited away from NSRs as far as practicable. If the plant is known to emit noise strongly in one direction, they will, where possible, be oriented away from nearby NSRs. Otherwise, movable noise barriers will be	HHE	Q4/2019 – Q4/2020	KTSPL, HHE	As required

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation Details	Implementation Agent	Implementation Programme[1]	Maintenance and Management Parties	Maintenance and Management Schedule
			provided to prevent the direct line of sight from the NSRs to the noise sources.				
5.9	N8	Carry out regular site inspection to audit the implementation of mitigation measures; and	Regular site inspection will be carried out by ET and HHE's representatives once a week to audit the implementation of mitigation measures. Site audit will be carried out by IEC at least once a month to verify the conditions.	HHE, ET, IEC	Q4/2019 – Q4/2020	HAB, SO, EPD	As required
5.9	N9	Carry out noise monitoring and audit throughout the construction period.	Noise monitoring will be carried out by ET once a week during the construction period according to EM&A manual, subject to further agreement with IEC and EPD. Monitoring results will be verified by IEC.	ET, IEC	Q4/2019 – Q4/2020	HAB, SO, EPD	As required
(c) Foundation works							
5.9	N1	Adopt good site practice, such as throttle down or switch off equipment unused or intermittently used between works;	Noisy equipment, including cranes, trucks and excavators etc. will be shut down between work periods or will be throttled down to a minimum.	HHE	Q2/2019 – Q2/2020	KTSPL, HHE	As required
5.9	N2	Regular maintenance of equipment to prevent noise emission due to impair;	Maintenance checking will be conducted during the site inspection at least once a week. In case abnormal noise is generated by the PME, site personnel will stop using the	HHE	Q2/2019 – Q2/2020	KTSPL, HHE	As required

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation Details	Implementation Agent	Implementation Programme[1]	Maintenance and Management Parties	Maintenance and Management Schedule
			equipment, carry out maintenance check and repair the PME item.				
5.9	N5	Make good use of structures for noise screening;	Material stockpiles and site office can be placed as structures in between the NSRs and the PME item/noisy construction activities for noise screening.	HHE	Q2/2019 – Q2/2020	KTSPL, HHE	As required
5.9	N6	Use Quality Powered Mechanical Equipment (QPME) and quiet equipment which produces low noise level;	QPME will be used for construction works.	HHE	Q2/2019 – Q2/2020	KTSPL, HHE	As required
5.9	N7	Erect movable noise barriers of 3m height to shed large plant equipment;	Movable noise barriers of at least 3m height will be provided at the site to shed noisy plant equipment and noisy activities. Movable noise barriers will be made of steel with a minimum surface density of 10 kg/m^2. They will be provided with absorbing materials and bend top if necessary. When fabricating the noise barrier, the length will be at least five times greater than its height, or as otherwise justifiable to achieve 5dB(A) noise reduction. A sketch of movable noise barrier is provided in **Figure 2.1**.	HHE	Q2/2019 – Q2/2020	KTSPL, HHE	As required

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation Details	Implementation Agent	Implementation Programme[1]	Maintenance and Management Parties	Maintenance and Management Schedule
5.9	N3	Position mobile noisy equipment in locations away from NSRs and point the noise sources to direction away from NSRs;	For mobile noisy equipment, such as generators, cranes, trucks and concrete pumps etc., they will be sited away from NSRs as far as practicable. If the plant is known to emit noise strongly in one direction, they will, where possible, be oriented away from nearby NSRs. Otherwise, movable noise barriers will be provided to prevent the direct line of sight from the NSRs to the noise sources.	HHE	Q2/2019 – Q2/2020	KTSPL, HHE	As required
5.9	N8	Carry out regular site inspection to audit the implementation of mitigation measures; and	Regular site inspection will be carried out by ET and HHE's representatives once a week to audit the implementation of mitigation measures. Site audit will be carried out by IEC at least once a month to verify the conditions.	HHE, ET, IEC	Q2/2019 – Q2/2020	HAB, SO, EPD	As required
5.9	N9	Carry out noise monitoring and audit throughout the construction period.	Noise monitoring will be carried out by ET once a week during the construction period according to EM&A manual, subject to further agreement with IEC and EPD. Monitoring results will be verified by IEC.	ET, IEC	Q2/2019 – Q2/2020	HAB, SO, EPD	As required

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation Details	Implementation Agent	Implementation Programme[1]	Maintenance and Management Parties	Maintenance and Management Schedule
(d) Superstructure							
5.9	N1	Adopt good site practice, such as throttle down or switch off equipment unused or intermittently used between works;	Noisy equipment, including cranes, trucks and excavators etc. will be shut down between work periods or will be throttled down to a minimum.	HHE	Q4/2019 – Q4/2022	KTSPL, HHE	As required
5.9	N2	Regular maintenance of equipment to prevent noise emission due to impair;	Maintenance checking will be conducted during the site inspection at least once a week. In case abnormal noise is generated by the PME, site personnel will stop using the equipment, carry out maintenance check and repair the PME item.	HHE	Q4/2019 – Q4/2022	KTSPL, HHE	As required
5.9	N6	Use Quality Powered Mechanical Equipment (QPME) and quiet equipment which produces low noise level;	QPME will be used for construction works.	HHE	Q4/2019 – Q4/2022	KTSPL, HHE	As required
5.9	N3	Position mobile noisy equipment in locations away from NSRs and point the noise sources to direction away from NSRs;	For mobile noisy equipment, such as air compressors, generators and saws etc., they will be sited away from NSRs as far as practicable. If the plant is known to emit noise strongly in one direction, they will, where	HHE	Q4/2019 – Q4/2022	KTSPL, HHE	As required

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation Details	Implementation Agent	Implementation Programme[1]	Maintenance and Management Parties	Maintenance and Management Schedule
			possible, be oriented away from nearby NSRs. Otherwise, movable noise barriers will be provided to prevent the direct line of sight from the NSRs to the noise sources.				
5.9	N8	Carry out regular site inspection to audit the implementation of mitigation measures; and	Regular site inspection will be carried out by ET and HHE's representatives once a week to audit the implementation of mitigation measures. Site audit will be carried out by IEC at least once a month to verify the conditions.	HHE, ET, IEC	Q4/2019 – Q4/2022	HAB, SO, EPD	As required
5.9	N9	Carry out noise monitoring and audit throughout the construction period.	Noise monitoring will be carried out by ET once a week during the construction period according to EM&A manual, subject to further agreement with IEC and EPD. Monitoring results will be verified by IEC.	ET, IEC	Q4/2019 – Q4/2022	HAB, SO, EPD	As required
(e) Builder works							
5.9	N1	Adopt good site practice, such as throttle down or switch off equipment unused or intermittently used between works;	Noisy equipment, including welders, drills/grinders and hoists etc. will be shut down between work periods or will be throttled down to a minimum.	HHE	Q1/2021 – Q4/2022	KTSPL, HHE	As required

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation Details	Implementation Agent	Implementation Programme[1]	Maintenance and Management Parties	Maintenance and Management Schedule
5.9	N2	Regular maintenance of equipment to prevent noise emission due to impair;	Maintenance checking will be conducted during the site inspection at least once a week. In case abnormal noise is generated by the PME, site personnel will stop using the equipment, carry out maintenance check and repair the PME item.	HHE	Q1/2021 – Q4/2022	KTSPL, HHE	As required
5.9	N8	Carry out regular site inspection to audit the implementation of mitigation measures; and	Regular site inspection will be carried out by ET and HHE's representatives once a week to audit the implementation of mitigation measures. Site audit will be carried out by IEC at least once a month to verify the conditions.	HHE, ET, IEC	Q1/2021 – Q4/2022	HAB, SO, EPD	As required
5.9	N9	Carry out noise monitoring and audit throughout the construction period.	Noise monitoring will be carried out by ET once a week during the construction period according to EM&A manual, subject to further agreement with IEC and EPD. Monitoring results will be verified by IEC.	ET, IEC	Q1/2021 – Q4/2022	HAB, SO, EPD	As required
(f) External works							
5.9	N1	Adopt good site practice, such as throttle down or switch off equipment unused or intermittently used between works;	Noisy equipment, including welders, drills/grinders and hoists etc. will be shut down between work periods or will be throttled down to a minimum.	HHE	Q2/2020 – Q1/2023	KTSPL, HHE	As required

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation Details	Implementation Agent	Implementation Programme[1]	Maintenance and Management Parties	Maintenance and Management Schedule
5.9	N2	Regular maintenance of equipment to prevent noise emission due to impair;	Maintenance checking will be conducted during the site inspection at least once a week. In case abnormal noise is generated by the PME, site personnel will stop using the equipment, carry out maintenance check and repair the PME item.	HHE	Q2/2020 – Q1/2023	KTSPL, HHE	As required
5.9	N8	Carry out regular site inspection to audit the implementation of mitigation measures; and	Regular site inspection will be carried out by ET and HHE's representatives once a week to audit the implementation of mitigation measures. Site audit will be carried out by IEC at least once a month to verify the conditions.	HHE, ET, IEC	Q2/2020 – Q1/2023	HAB, SO, EPD	As required
5.9	N9	Carry out noise monitoring and audit throughout the construction period.	Noise monitoring will be carried out by ET once a week during the construction period according to EM&A manual, subject to further agreement with IEC and EPD. Monitoring results will be verified by IEC.	ET, IEC	Q2/2020 – Q1/2023	HAB, SO, EPD	As required

Note:
[1] Construction works will be carried out between Q2 2019 and Q1 2023.

3 Operational Phase

3.1 Overview

3.1.1.1 All the associated noise mitigation measures as stated in the approved EIA report for Kai Tak Multi-purpose Sports Complex (AEIAR-204/2017) are adopted in the updated NMP unless otherwise stipulated as a result of design development.

3.2 Road Traffic Noise

3.2.1.1 No mitigation measures for road traffic noise are required by the Contracted Party within the Project Boundary according to the approved EIA and EP.

3.3 Noise from Sports Events

3.3.1.1 For the Main Stadium (MS), the following design updates will be adopted:

- The structure still comprises multiple layers of concrete walls, corridors and function rooms surrounding the stadium field, except for a glazed South Façade to connect with the harbour view.
- The loudspeakers of public address system are suspended in two rows of line array formats over the MS and directed towards the spectator stands.
- Acoustic absorption panels will be provided underneath the fixed and retractable roofs of the Main Stadium to control reverberation.
- While a retractable roof system will be provided, the noise assessment is prepared for the updated design scheme with open roof. The noise assessment of the updated design scheme is detailed in **Appendix A**. Adverse noise impact on the representative NSRs is not anticipated.

3.3.1.2 For the Public Sports Ground (PSG), the following design updates will be adopted:

- The structure still comprises multiple layers of concrete walls, corridors and function rooms behind the seating area, except for glazing façade at the two back ends.
- The extent of the roof is updated to reflect the latest design.
- The loudspeakers of public address system are ceiling mounted on the underside of grandstand roof in two rows and directed towards the spectators.
- With a distributed loudspeakers system replacing the array speakers along the roof canopy front edge, the barrier screen dropped down from the roof canopy front edge is omitted.
- Acoustic absorption panels will be provided on the underside of the roof of the spectator stand.
- The noise assessment of the updated design is detailed in **Appendix B**. Adverse noise impact on the representative NSRs is not anticipated.

3.3.1.3 The above design updates for the MS and PSG would be adopted to comply with the EP conditions.

3.3.1.4 During the operational phase, there would be no major separately organised events to be held concurrently in the MS and the PSG. If an organized event is being held at the Main Stadium, community activities such as jogging, training, amateur ball games, and activities supporting the organized event in the Main Stadium such as warm up, hospitality, etc. may be held at the Public Sports Ground.

3.4 Fixed Plant Noise

3.4.1.1 The noise impact for fixed plant will be determined by cumulative assessment with noise from sports events.

3.4.1.2 According to "Good Practices on Ventilation System Noise Control" issued by EPD, noisy equipment would be placed, wherever practicable, at a greater distance from receivers and behind some large enough obstruction (e.g. a building or a barrier) to avoid any direct line of sight between the receivers and noisy equipment. Silencers will be used to reduce noises from the air intakes and exhausts, whilst major fixed noise plants will be adequately screened or housed in plant rooms to comply with the noise criteria. The noise assessment of the updated design scheme is detailed in **Appendix A** and **B** for Main Stadium and Public Sports Ground respectively. Adverse noise impact on the representative NSRs is not anticipated.

3.5 Noise from Music, Singing and Instrument Performance Activities

3.5.1.1 Similarly, the structure of the MS will be soundproofing and completed with multiple layers of concrete walls, corridors and functional rooms surrounding the stadium field, except for the glazed South Façade to connect with the harbour view. The noise assessment of the updated design scheme is detailed in **Appendix A**. Adverse noise impact on the representative NSRs is not anticipated.

3.5.1.2 Noise monitoring will be provided by the event organisers for music, singing and instrument performance activities. The event organisers will appoint appropriate persons to monitor the noise level during the activities.

3.5.1.3 Real-time noise monitoring at selected locations will be conducted for any musical event held in the MS during daytime or evening time periods for the first 3 years of operation. After the 3-year monitoring period, a review of the findings of the monitoring will be conducted to determine whether further monitoring will be required. The corresponding actions will follow the Event and Action Plan in the Environmental Monitoring and Audit (EM&A) Manual.

3.5.1.4 In addition, the operator will provide a manned complaint hotline to respond to any complaints by the nearby NSRs. The complaint hotline will be operated during major organised events with advance notice displayed on the KTSP website.

3.6 Night time Crowd Dispersion

3.6.1.1 Crowd management measures would be adopted by the operator for major events with more than 20,000 participants finished at or later than 2230 hours. The operator would arrange staff members to marshal the dispersion of crowds in an orderly manner from the MS all the way to the future Kai Tak Station and Sung Wong Toi Station. Placards will be used to advise attendees of the events to keep the noise down. No loudspeakers will be used. If any attendees are found to raise the voice or make any noise beyond control even after verbal advice by the marshalling staff, the Police will be called in to restore the situation.

3.7 Noise Mitigation Measures

3.7.1.1 All the associated noise mitigation measures as stated in the approved EIA report for Kai Tak Multi-purpose Sports Complex (AEIAR-204/2017) are adopted in the updated NMP unless otherwise stipulated as a result of design development. Mitigation measures with implementation programme, maintenance and management schedules are provided as follows.

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation Details	Implementation Agent	Implementation Stage
5.7	N10	No organized events should be held concurrently in the Main Stadium and the Public Sports Ground.	During the operational phase, there would be no major separately organised events to be held concurrently in the MS and the PSG. If an organized event is being held at the Main Stadium, community activities such as jogging, training, amateur ball games, and activities supporting the organized event in the Main Stadium such as warm up, hospitality, etc. may be held at the Public Sports Ground.	CP	Operation
5.6.1-5.6.4 and 5.9	N11	<u>Operational Fixed Noise from Main Stadium</u> • The structure of the stadium shall be soundproofing and complete. The entrances of the stadium shall have special acoustic design (e.g. double acoustic door) such that the soundproofing performance of the structure is not compromised. • There should be no air-gap between the base structure of the stadium and the fixed roof to avoid noise leakage. A retractable roof, which forms part of the design of the Main Stadium, will be closed when needed. Rubber bearing or other devices with similar function shall be used to avoid the noise leakage between the fixed roof and the retractable roof. • A distributed public address system shall be adopted with the loudspeakers directed towards spectator stand.	The structure still comprises multiple layers of concrete walls, corridors and function rooms surrounding the stadium field, except for a glazed South Façade to connect with the harbour view. The loudspeakers of public address system are suspended in two rows of line array formats over the MS and directed towards the spectator stands. Acoustic absorption panels will be provided underneath the fixed and retractable roofs of the Main Stadium to control reverberation.	CP	Design

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation Details	Implementation Agent	Implementation Stage
		• Acoustic panels shall be attached underneath the fixed roof of the main stadium.			
5.9	N12	<u>Operational Fixed Noise from Public Sports Ground</u> • A cover shall be built over the spectator stand. • Sound absorption panels shall be attached underneath the entire cover.	The structure still comprises multiple layers of concrete walls, corridors and function rooms behind the seating area, except for glazing façade at the two back ends. The extent of the roof is updated to reflect the latest design. The loudspeakers of public address system are ceiling mounted on the underside of grandstand roof in two rows and directed towards the spectators. With a distributed loudspeakers system replacing the array speakers along the roof canopy front edge, the barrier screen dropped down from the roof canopy front edge is omitted. Acoustic absorption panels will be provided on the underside of the roof of the spectator stand.	CP	Design
5.9	N13	<u>Operation Noise from Fixed Plants</u> • Partial enclosures and silencers should be installed at the building services and ventilation systems.	The noise impact for fixed plant will be determined by cumulative assessment with noise from sports events.	CP	Design

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation Details	Implementation Agent	Implementation Stage
			According to "Good Practices on Ventilation System Noise Control" issued by EPD, noisy equipment would be placed, wherever practicable, at a greater distance from receivers and behind some large enough obstruction (e.g. a building or a barrier) to avoid any direct line of sight between the receivers and noisy equipment. Silencers will be used to reduce noises from the air intakes and exhausts, whilst major fixed noise plants will be adequately screened or housed in plant rooms to comply with the noise criteria.		
5.9	N14	<u>Crowd Noise from Dispersion</u> • Crowd management measures should be adopted for major events (i.e. more than 20,000 persons) which finish at or later than 2230 hours. • Crowd shall be managed and confined to pre-determined routes, which lead the crowd towards the future Kai Tak Station & To Kwa Wan Station. For the crowd moving toward the Kai Tak Station, people will be directed to leave through or along the ISCB. For the dispersal routes toward To Kwa Wan Station, the exit from the Project site is designed near the Sung Wong Toi Park.	Crowd management measures would be adopted by the operator for major events with more than 20,000 participants finished at or later than 2230 hours. The operator would arrange staff members to marshal the dispersion of crowds in an orderly manner from the MS all the way to the future Kai Tak Station and Sung Wong Toi Station. Placards will be used to advise attendees of the events to keep the noise down. No loudspeakers will be used. If any attendees are found to raise the voice or make any noise beyond control even after verbal advice by the marshalling staff, the Police will be called in to restore the situation.	CP	Operation

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation Details	Implementation Agent	Implementation Stage
		• The operator should arrange staff members to marshal the dispersion of crowds in an orderly manner from the Main Stadium all the way to the future Kai Tak Station & To Kwa Wan Station. Placards should be used to advise attendees of the events to keep the noise down. No loudspeakers should be used. If any attendees are found to raise the voice or make any noise beyond control even after verbal advice by the marshalling staff, the Police should be called in to restore the situation.			
5.11	N15	<u>Operational Noise Monitoring</u> • The operator should appoint an appropriate person to monitor the noise situation during the activities. • The organiser should provide a manned complaint hotline to respond to complaints from nearby NSRs immediately. • Real time noise monitoring at selected locations shall be conducted for any music event held in the Main Stadium during daytime or evening time periods for the first 3 years of operation. After the 3-year monitoring period, a review of the findings of the monitoring will be conducted to determine whether further monitoring will be required. The corresponding actions shall follow the Event and Action Plan in the EM&A Manual.	Noise monitoring will be provided by the event organisers for music, singing and instrument performance activities. The event organisers will appoint appropriate persons to monitor the noise level during the activities. Real-time noise monitoring at selected locations will be conducted for any musical event held in the MS during daytime or evening time periods for the first 3 years of operation. After the 3-year monitoring period, a review of the findings of the monitoring will be conducted to determine whether further monitoring will be required. The corresponding actions will follow the Event and Action Plan in the Environmental Monitoring and Audit (EM&A) Manual.	CP	Operation

EIA Ref.	EM&A Log Ref.	Mitigation Measures	Implementation Details	Implementation Agent	Implementation Stage
			In addition, the operator will provide a manned complaint hotline to respond to any complaints by the nearby NSRs. The complaint hotline will be operated during major organised events with advance notice displayed on the KTSP website.		

4 Conclusion

4.1.1.1 According to Condition 2.19 and Condition 2.20 of EP-544/2017, the first NMP including details, implementation programme, maintenance and management schedules of the required mitigation measures for the Project has been submitted no later than one month before the commencement of construction.

4.1.1.2 This updated NMP submission has been prepared to provide updated noise assessment of Main Stadium and PSG based on the latest design for DEP approval. The noise assessment has included sports and musical events of open roof Main Stadium operations and sports events of PSG operations in the day /evening time period. Adverse noise impact to the identified NSRs is not anticipated.

4.1.1.3 Pursuant to Condition 2.20 of the EP-544/2017, if there are further change(s) to the NMP, the Permit Holder shall, at no later than one month before implementation of such change(s), deposit with the DEP three hard copies and one electronic copy of an update to the NMP.

Appendix A

Noise Assessment for Main Stadium

A1 Introduction

In the approved EIA study for Kai Tak Sports Park (KTSP, formerly Kai Tak Multi-purpose Sports Complex) (AEIAR-204/2017), the Main Stadium (MS) design was assumed with multiple layers of concrete walls, corridors and functional rooms surrounding the stadium field of play as the basis of noise mitigation for compliance with the noise criteria.

In the updated design scheme of MS changes are made to:

- Glazing façade at the south stand to connect with the Victoria Harbour View as shown in **Figure A1.1** and **A1.2**;

Figure A1.1: Locations of glazed South Façade and NSR locations

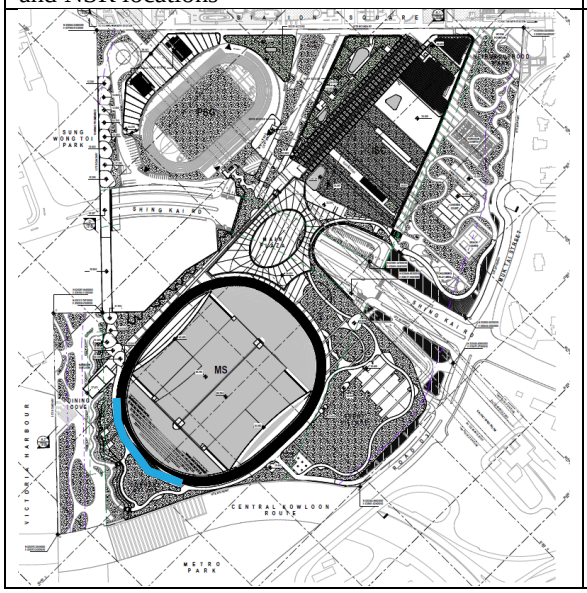
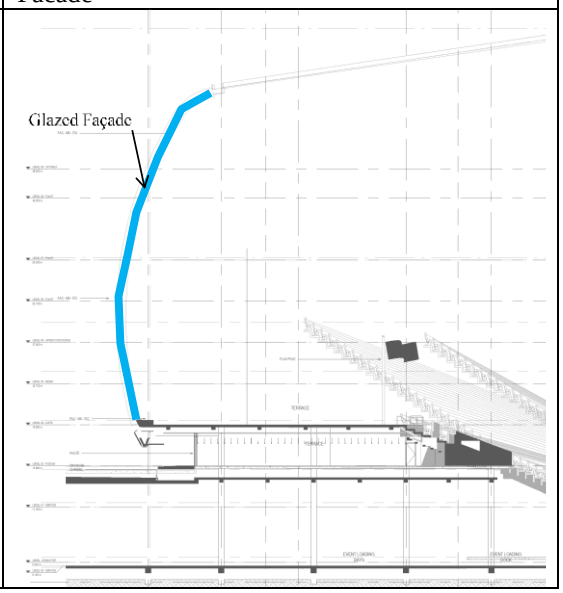


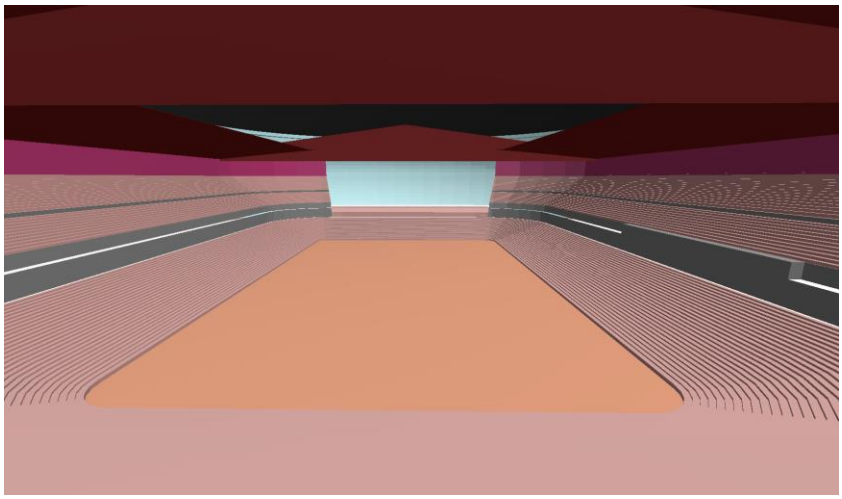
Figure A1.2: Section drawing of glazed South Facade



- Array loudspeakers instead of distributed speaker for the PA system according to the Employer Requirement (ER); and
- The internal finishes of MS are also updated as follows:

Location	Finishes	Colour Code in Figure A1.3
Fixed Roof Underside	Minimum 100mm fibreglass material	Brown
Southern Façade	Glazing	Light blue
Seating Bowl	Audiences on Plastic Chair	Pink
Upper Tier Partition	Acoustic wall panel	Purple
Pitch	Turf	Light coral
Opening to Circulation	50% opening absorption	Grey

Figure A1.3: 3D Odeon model for the MS



Section View

This noise assessment is undertaken for sports and music events to demonstrate that the proposed changes would not cause adverse noise impact to nearby noise sensitive receivers (NSRs).

A2 Assessment Methodology

A2.1 Overview

Odeon model as used in the approved EIA study is adopted for the MS noise modelling of the updated design scheme. The 3D model images are shown in **Figure A2.1** to **Figure A2.4.**

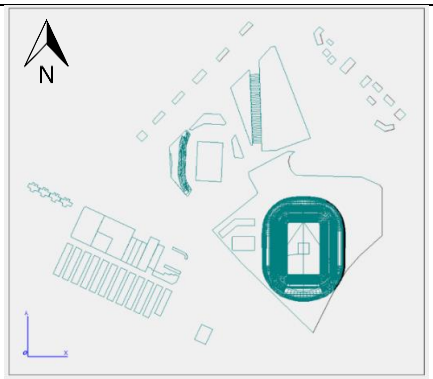
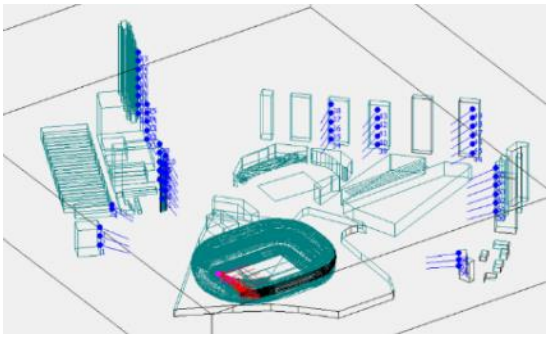
Figure A2.1: Overview of Odeon Model	**Figure A2.2**: NSRs and noise sources (blue dots indicate the locations of NSRs)
	

Figure A2.3: 3D view of noise model

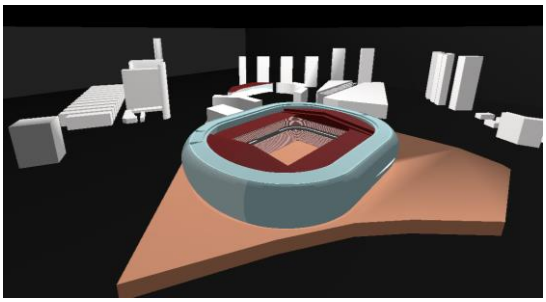
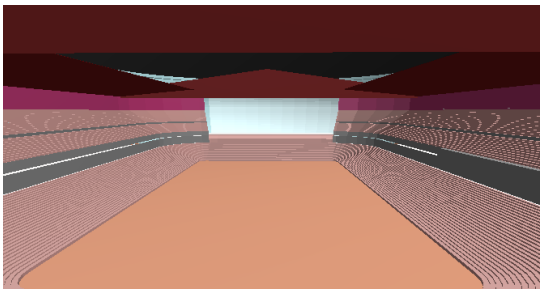


Figure A2.4: 3D view of MS from the pitch



A2.2 Sound Transmission Losses and Absorption

Sound transmission losses of envelope structures including wall, fixed roof and South Façade glazing for noise modelling are summarised in **Table A2.1**.

Table A2.1: Sound transmission losses of envelope structures

Frequency, Hz	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**
Wall	49.3	52.5	57.4	59.1	63.8	66.5	73.1	75.8	78.4	80.7
Fixed roof	35.7	38.8	44.3	46.0	47.2	48.0	52.4	56.4	58.0	60.3
South Façade Glazing (13.52mm + AS12 + 13.52mm)	28.0	30.0	25.0	26.0	31.0	33.0	35.0	37.0	38.0	39.0
Frequency, Hz	**800**	**1000**	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**
Wall	83.6	84.4	84.3	84.1	86.6	86.4	86.9	82.9	82.7	80.5
Fixed roof	62.7	64.7	66.2	65.7	67.2	69.2	73.0	76.2	80.1	81.0
South Façade Glazing (13.52mm + AS12 + 13.52mm)	39.0	40.0	41.0	42.0	43.0	43.0	44.0	45.0	46.0	46.0

Sound absorption of the acoustic panels underneath the fixed roofs of the Main Stadium is summarised in **Table A2.2**.

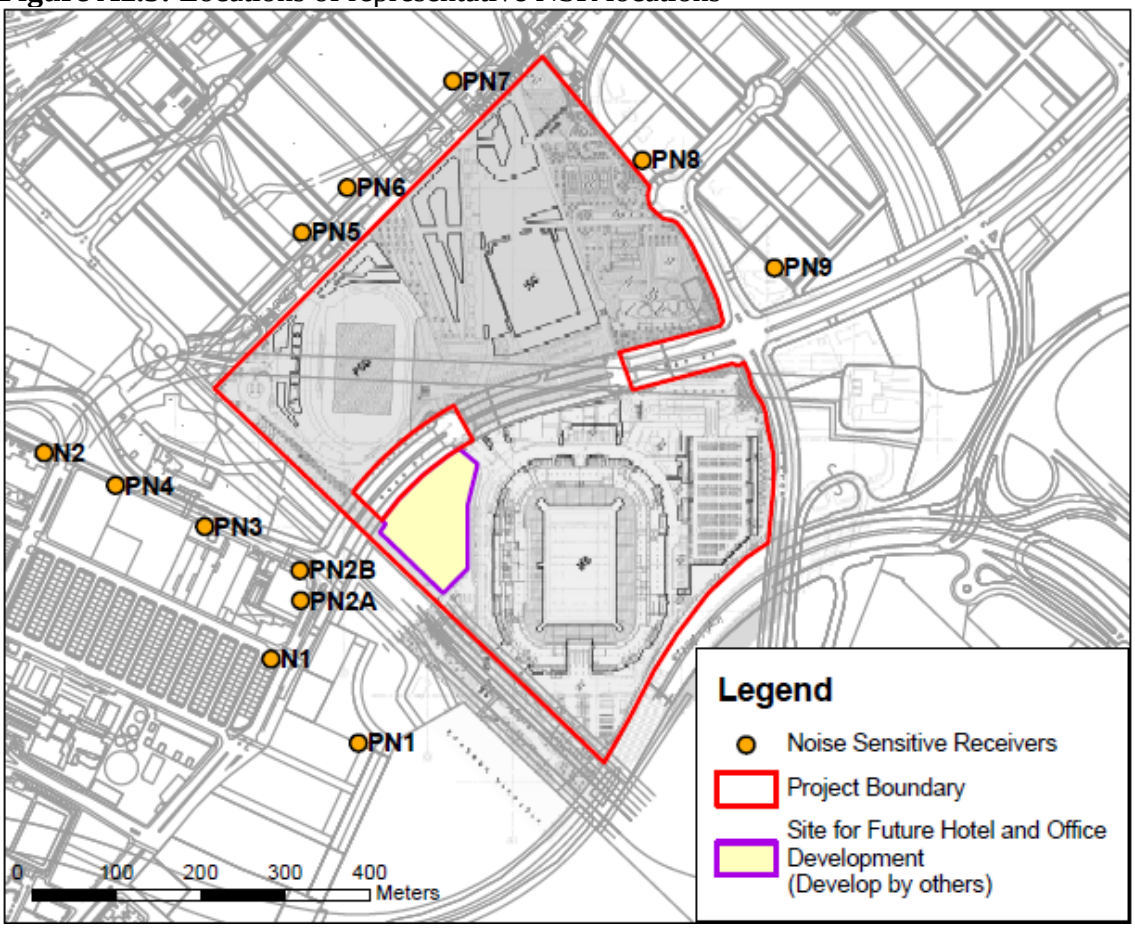
Table A2.2: Sound absorption of acoustic panels

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

A2.3 NSRs and Assessment Criteria

Representative NSRs identified in the approved EIA study are included in the assessment. NSR locations are shown in **Figure A2.5**.

Figure A2.5: Locations of representative NSR locations



EIA assessment criteria and results at NSRs for music and sports events combined with noise in the EIA study are shown in **Table A2.3** and **Table A2.4** respectively.

Table A2.3: Assessment criteria for music events

NSR ID	Assessment Criteria for Music Noise, Leq (15 mins), dB(A)		EIA Result (Daytime and Evening), dB(A)	
	Daytime and Evening (0700 to 2300)	Night time (2300 to 0700)	Concert Setting 1	Concert Setting 2
N1	75	Not Audible	36 – 37	33 – 34
N2	77		43 – 59	37 – 60
PN1	75		37 – 56	38 – 55
PN2A	75		41 – 66	41 – 66
PN2B	75		40 – 67	41 – 66
PN3	77		38 – 60	36 – 59
PN4	77		38 – 57	36 – 57
PN5	73		36 – 59	35 – 58
PN6	73		36 – 62	37 – 62
PN7	73		35 – 60	41 – 60
PN8	73		43 – 63	45 – 61
PN9	73		36 – 38	38 – 41

Table A2.4: Assessment criteria for sports event and fixed noise

NSR ID	Assessment Criteria for Sports event and fixed noise, Leq (30 mins), dB(A)	EIA Result (Daytime and Evening), dB(A)
	Daytime and Evening (0700 to 2300)	Sports event and fixed noise
N1	60	47
N2	65	51
PN1	60	48
PN2A	60	56
PN2B	60	
PN3	65	51
PN4	65	49
PN5	60	49
PN6	60	51
PN7	60	50
PN8	60	54
PN9	60	44

A2.4 Noise Sources

Major noise sources in sports event are the spectator crowd noise and the operation of public-address (PA) system. In music events, the noise activities are dominated by the on-stage loudspeakers. Spectra of on-stage loudspeakers for music events and PA system are referenced from the EIA report and given in **Table A2.5**.

Table A2.5: Loudspeaker spectra for noise modelling

Frequency, Hz	63	125	250	500	1000	2000	4000	8000	A-weighted
Sports Event									
Arrays with 10 speakers	93.2	101.9	102.4	99.1	94.2	90.1	84.2	79.2	100.4
Arrays with 8 speakers	91.3	100.0	100.4	97.1	91.8	88	83.4	79.4	98.4
Concert Setting 1 – End Stage									
Loudspeakers (Higher power)	143.6	135.6	135.6	132.6	127.6	123.6	119.6	116.6	134.1
Loudspeakers (Lower power)	140.6	132.6	132.6	129.6	124.6	120.6	116.6	113.6	131.1
Concert Setting 2 – Centre Stage									
Loudspeakers	140.1	132.1	132.1	129.1	124.1	120.1	116.1	113.1	130.6

A2.4.1 Sports Events at Main Stadium

Noise from the spectators and public address system were assessed. The spectators were modelled as 272 point sources located on the spectator stands. They represented a full-house event of 50,000 persons in total. The sound power level per person was 85.4 dB(A) as per the EIA assessment.

In accordance with the requirement of ER, array loudspeakers design was adopted for the public-address system. It consists of 23 arrays with 10 loudspeakers plus 13 arrays with 8 loudspeakers in 2 rows directed towards the spectator stands. The sound power levels of these arrays are tuned as shown in **Table A2.5** to produce a sound level of 70-75 dB(A) at the spectator stands. Comparison of the sports event mode for the updated design and

that in EIA is given in **Table A2.6**. The settings are shown in **Figure A2.6** to **Figure A2.9** to illustrate the layout arrangement.

Table A2.6: Comparison of EIA and the updated design scheme for sports event

Parameters	EIA	The updated design scheme
No. of Loudspeakers	60 distributed speakers	26 arrays with total 334 speakers
Sound Power Level per Loudspeaker	104.2 dB(A)	100.4 dB(A) for arrays with 10 speakers 98.4 dB(A) for arrays with 8 speakers
Sound Level at Spectator Stand	70 – 75 dB(A)	
No. of spectator	50,000	
No. of modelling source	272	
Sound power level per person	85.4 dB(A)	

Figure A2.6: Array Speaker layout for in the updated design scheme

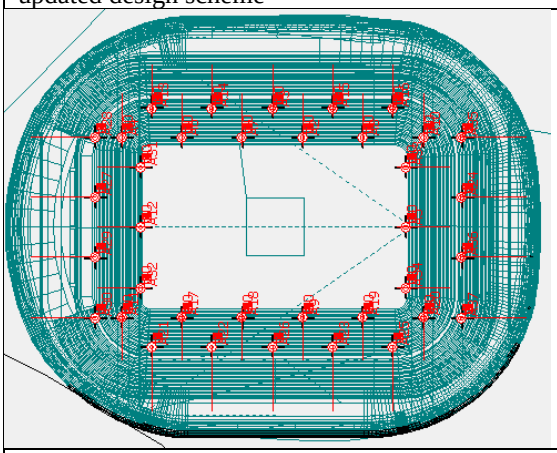


Figure A2.7: Audience Setting in the updated design scheme

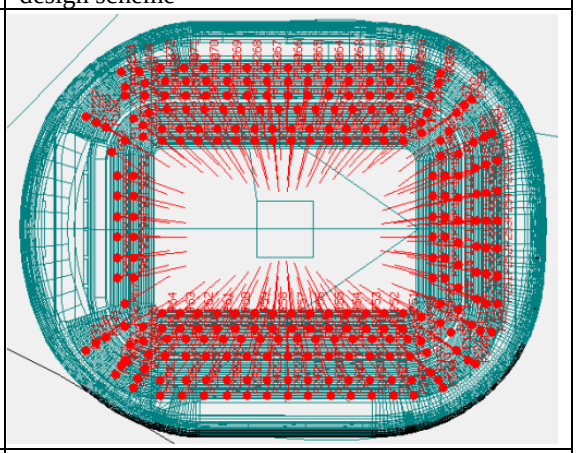


Figure A2.8: Speaker layout in EIA

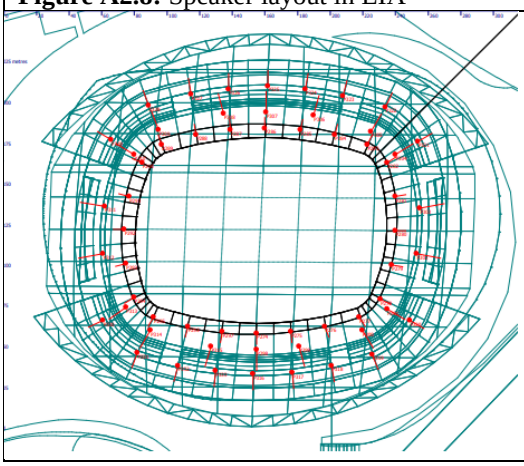
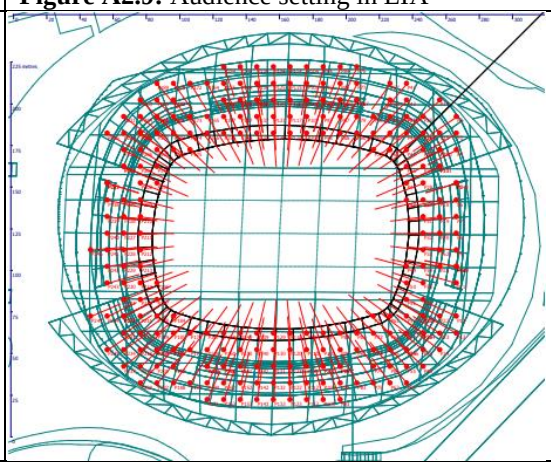


Figure A2.9: Audience setting in EIA



A2.4.2 Music Events at Main Stadium

Music events may be held in 2 different settings. In Concert Setting 1 (End Stage), a 3-sided stage is located at the southern end of the stadium field. In Concert Setting 2 (Centre Stage), a 4-sided stage is set up at the centre of the field. Noise assessments for both settings have been carried out for the updated design scheme.

Noise from the loudspeakers and the audience were assessed. The audience was modelled as 272 point sources distributed on the seating area according to the 2 different concert

settings, as shown in **Figure A2.10** to **2.13** and **Figure A2.14** to **2.17**. Audience sizes are 50,000 persons in both setting in accordance with EIA report. The sound power frequency spectra of the specified concert setting were adopted to operate at 93dB(A) or above at the spectator stands.

The parameters of music event loudspeakers for the 2 concert settings in the Main Stadium are summarized in **Table A2.7**.

Table A2.7: Comparison of EIA and the updated design scheme for sports event

Parameters	EIA	The updated design scheme
No. of Loudspeakers	Refer to **Table A2.5**	
Sound Power Level per Loudspeaker	Refer to **Table A2.5**	
Sound Level at Spectator Stand	Concert Setting 1: 93 – 110 Concert Setting 2: 92 – 113	Concert Setting 1: 95 – 110 Concert Setting 2: 93 – 115
No. of spectator	50,000	
No. of modelling source	272	
Sound power level per person	85.4 dB(A)	

Figure A2.10: Speaker layout for Concert Setting 1 in the updated design scheme

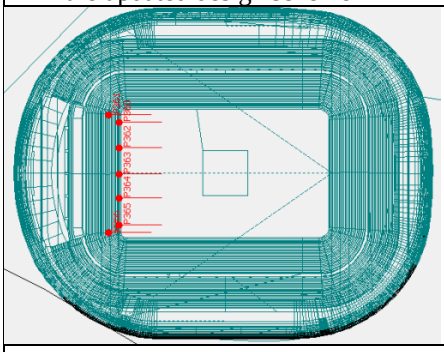


Figure A2.11: Speaker layout for Concert Setting 2 in the updated design scheme

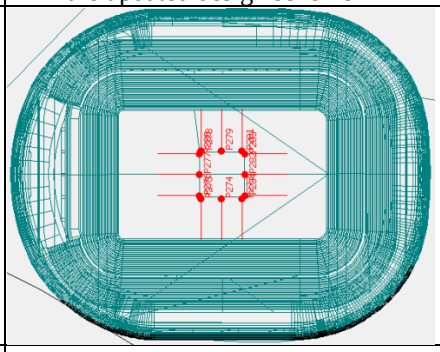


Figure A2.12: Audience setting for Concert Setting 1 in the updated design scheme

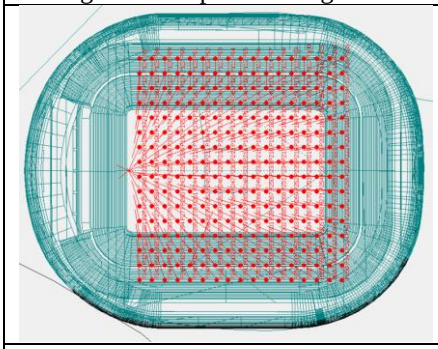


Figure A2.13: Audience setting for Concert Setting 2 in the updated design scheme

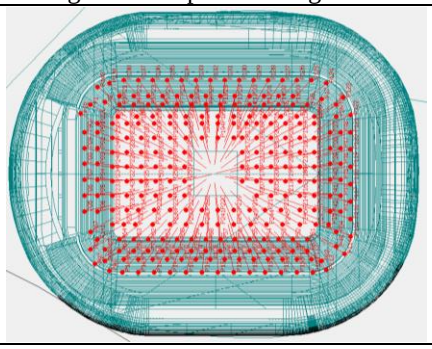


Figure A2.14: Speaker layout for Concert Setting 1 in EIA

Figure A2.15: Speaker layout for Concert Setting 2 in EIA

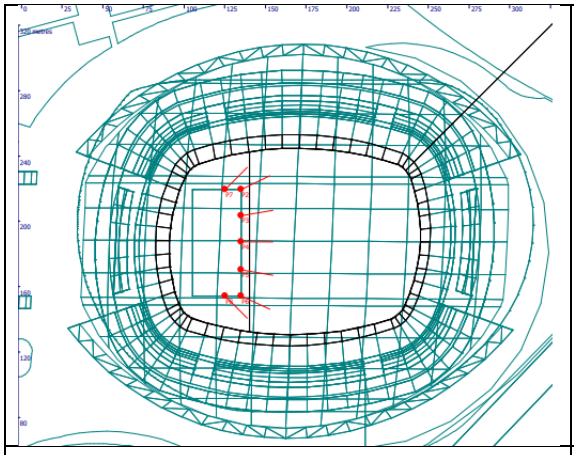


Figure A2.16: Audience setting for Concert Setting 1 in EIA

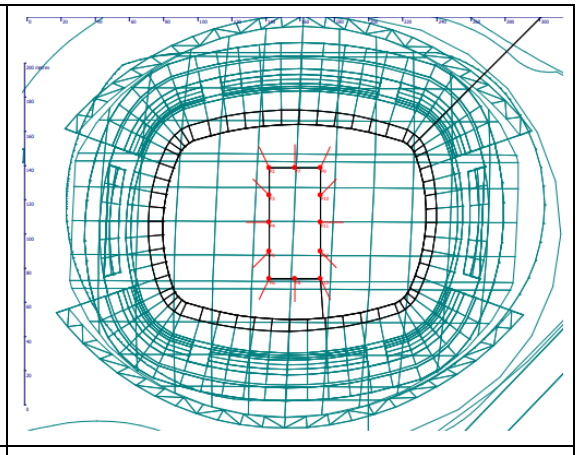
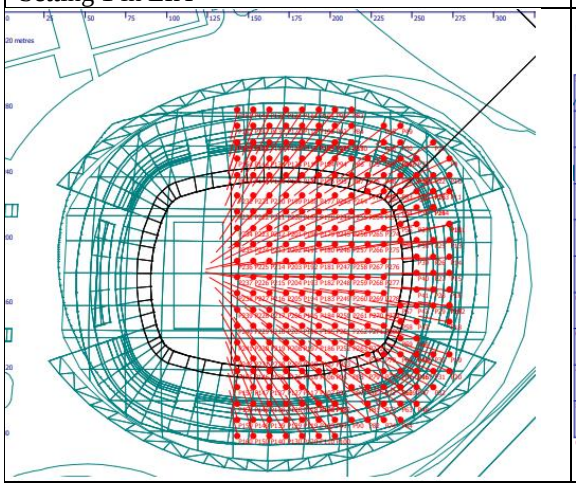
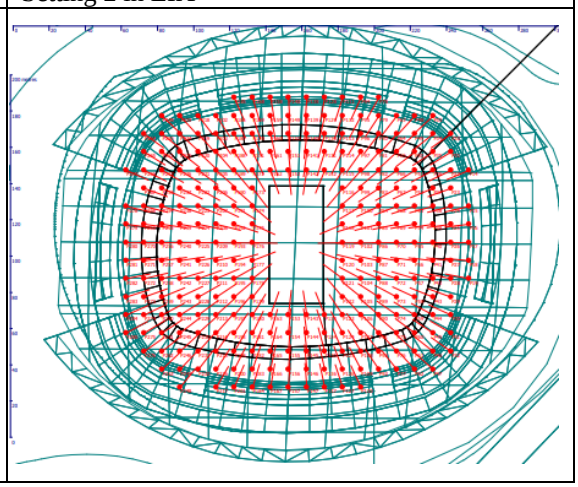


Figure A2.17: Audience setting for Concert Setting 2 in EIA





A3 Assessment Scenario

Day and evening open roof scenario has been adopted for the sports and music event assessment in accordance with the EIA assumptions.

As the updated design scheme is in variation with the reference design in the EIA report, there will be changes in the noise levels predicted at some of the NSRs as shown in **Figure A2.5**.

A4 Results

The predicted noise levels at the representative NSRs for sports events and music events are presented in **Table A4.1** and **Table A4.2** respectively. Detailed results are shown in **Annex A**.

Table A4.1: Predicted noise levels for sports event and fixed noise

NSR ID	Assessment Criteria, dB(A)	EIA Result, dB(A)	Model Result of Updated Design Scheme, dB(A)		
	Sports event and fixed noise	Sports event and fixed noise	Sports event and fixed noise		
			Sports Event	M&E Noise Design Level	Max. cumulative
N1	60	47	24	47	47

NSR ID	Assessment Criteria, dB(A)	EIA Result, dB(A)	Model Result of Updated Design Scheme, dB(A)		
	Sports event and fixed noise	Sports event and fixed noise	Sports event and fixed noise		
			Sports Event	M&E Noise Design Level	Max. cumulative
N2	65	51	19 – 52	41	52
PN1	60	48	28 – 33	48	48
PN2A	60	56	35 – 59	46	60
PN2B	60		23 – 60		
PN3	65	51	22 – 43	50	51
PN4	65	49	18 – 28	49	49
PN5	60	49	22 – 35	49	49
PN6	60	51	21 – 33	51	51
PN7	60	50	19 – 35	50	50
PN8	60	54	18 – 43	54	54
PN9	60	44	21 – 23	44	44

The predicted results at N2 and PN2 are slightly higher than that of the EIA high level assessment points. This is due to the noise transmission via the open roof, from which a more realistic assumption of the internal finishes has resulted in higher levels of sound reflections.

Table A4.2: Predicted noise levels for music events

NSR ID	Assessment Criteria, dB(A)	EIA Result, dB(A)		Model Result, dB(A)	
	Music Noise	Concert Setting 1	Concert Setting 2	Concert Setting 1	Concert Setting 2
N1	75	36 – 37	33 – 34	39 – 40	39 – 40
N2	77	43 – 59	37 – 60	33 – 56	35 – 60
PN1	75	37 – 56	38 – 55	40 – 42	41 – 43
PN2A	75	41 – 66	41 – 66	42 – 66	44 – 67
PN2B	75	40 – 67	41 – 66	39 – 65	37 – 68
PN3	77	38 – 60	36 – 59	39 – 53	37 – 56
PN4	77	38 – 57	36 – 57	35 – 39	34 – 40
PN5	73	36 – 59	35 – 58	28 – 43	30 – 42
PN6	73	36 – 62	37 – 62	29 – 41	30 – 41
PN7	73	35 – 60	41 – 60	30 – 42	33 – 47
PN8	73	43 – 63	45 – 61	33 – 58	33 – 54
PN9	73	36 – 38	38 – 41	36 – 37	36 – 37

The predicted results at PN4 – PN9 are generally lower than that of the EIA. This is due to a better combination of sound insulation of the structure elements of the Main Stadium envelope.

The predicted results at N1 and PN2 are slightly higher than that of the EIA high level assessment points. This is due to the noise transmission via the open roof from which a more realistic assumption of the internal finishes has resulted in higher levels of sound reflections.

The results show that the noise levels of the updated design scheme are comparable with EIA assessment results except at higher level assessment point of NSRs as result of

adopting a more realistic assumption of the internal finishes. Overall, the predicted noise levels are in compliance with the EIA assessment criteria and no adverse noise impact to NSRs.

Annex A

Detailed Noise Assessment Results for Sports

NSR ID	Level, mPD	Criterion for Sports Event, dB(A)	Predicted Noise Level, dB(A)	Comply [Y/N]
N1	10	60	24	Y
N1	20	60	24	Y
N2	10	65	19	Y
N2	30	65	20	Y
N2	50	65	22	Y
N2	70	65	25	Y
N2	90	65	29	Y
N2	110	65	36	Y
N2	130	65	46	Y
N2	150	65	52	Y
PN1	15	60	28	Y
PN1	35	60	33	Y
PN1	55	60	29	Y
PN2A	30	60	35	Y
PN2A	50	60	42	Y
PN2A	70	60	43	Y
PN2A	90	60	55	Y
PN2A	110	60	59	Y
PN2B	30	60	23	Y
PN2B	50	60	26	Y
PN2B	70	60	37	Y
PN2B	90	60	49	Y
PN2B	110	60	60	Y
PN3	10	65	22	Y
PN3	30	65	24	Y
PN3	50	65	25	Y
PN3	70	65	34	Y
PN3	90	65	43	Y
PN4	10	65	18	Y
PN4	30	65	19	Y
PN4	50	65	19	Y
PN4	70	65	25	Y
PN4	90	65	28	Y
PN5	10	60	22	Y
PN5	30	60	28	Y

NSR ID	Level, mPD	Criterion for Sports Event, dB(A)	Predicted Noise Level, dB(A)	Comply [Y/N]
PN5	50	60	32	Y
PN5	70	60	28	Y
PN5	90	60	35	Y
PN6	10	60	21	Y
PN6	30	60	24	Y
PN6	50	60	24	Y
PN6	70	60	27	Y
PN6	90	60	33	Y
PN7	10	60	19	Y
PN7	30	60	23	Y
PN7	50	60	24	Y
PN7	70	60	26	Y
PN7	90	60	31	Y
PN7	110	60	35	Y
PN8	10	60	18	Y
PN8	30	60	21	Y
PN8	50	60	21	Y
PN8	70	60	26	Y
PN8	90	60	35	Y
PN8	110	60	43	Y
PN9	10	60	22	Y
PN9	25	60	23	Y
PN9	40	60	21	Y

Detailed Noise Assessment Results for Concert

NSR ID	Level, mPD	Criterion for Music Events, dB(A)	Predicted Noise Level, dB(A)		Comply [Y/N]
			Concert Setting 1	Concert Setting 2	
N1	10	75	40	39	Y
N1	20	75	39	40	Y
N2	10	77	33	35	Y
N2	30	77	34	35	Y
N2	50	77	35	37	Y
N2	70	77	36	40	Y
N2	90	77	40	45	Y
N2	110	77	49	53	Y
N2	130	77	51	56	Y
N2	150	77	56	60	Y
PN1	15	75	40	41	Y
PN1	35	75	42	43	Y
PN1	55	75	42	43	Y
PN2A	30	75	42	44	Y
PN2A	50	75	45	44	Y
PN2A	70	75	56	47	Y
PN2A	90	75	60	64	Y
PN2A	110	75	66	67	Y
PN2B	30	75	39	37	Y
PN2B	50	75	40	40	Y
PN2B	70	75	45	47	Y
PN2B	90	75	62	60	Y
PN2B	110	75	65	68	Y
PN3	10	77	39	37	Y
PN3	30	77	40	39	Y
PN3	50	77	42	40	Y
PN3	70	77	44	45	Y
PN3	90	77	53	56	Y
PN4	10	77	35	34	Y
PN4	30	77	35	34	Y
PN4	50	77	35	34	Y
PN4	70	77	37	39	Y
PN4	90	77	39	40	Y
PN5	10	73	28	30	Y
PN5	30	73	32	33	Y

NSR ID	Level, mPD	Criterion for Music Events, dB(A)	Predicted Noise Level, dB(A)		Comply [Y/N]
			Concert Setting 1	Concert Setting 2	
PN5	50	73	35	34	Y
PN5	70	73	38	38	Y
PN5	90	73	43	42	Y
PN6	10	73	30	30	Y
PN6	30	73	33	33	Y
PN6	50	73	34	34	Y
PN6	70	73	39	38	Y
PN6	90	73	41	41	Y
PN7	10	73	30	33	Y
PN7	30	73	34	41	Y
PN7	50	73	35	36	Y
PN7	70	73	38	39	Y
PN7	90	73	40	47	Y
PN7	110	73	42	43	Y
PN8	10	73	33	33	Y
PN8	30	73	35	36	Y
PN8	50	73	35	37	Y
PN8	70	73	58	39	Y
PN8	90	73	45	43	Y
PN8	110	73	50	54	Y
PN9	10	73	36	37	Y
PN9	25	73	37	36	Y
PN9	40	73	37	36	Y

Appendix B

Noise Assessment for Public Sports Ground

B1 Introduction

In the approved EIA study for Kai Tak Sports Park (KTSP, formerly Kai Tak Multi-purpose Sports Complex) (AEIAR-204/2017), the Public Sports Ground (PSG) design was assumed with multiple layers of internal walls, corridors and function rooms at the back of the grandstand as the basis of noise mitigation for compliance with the noise criteria.

In the updated design scheme of PSG changes are made to:

- Glazing façades at 2 back ends as shown in **Figure B1.1** and **1.2**;

Figure B1.1: Locations of glazed façade

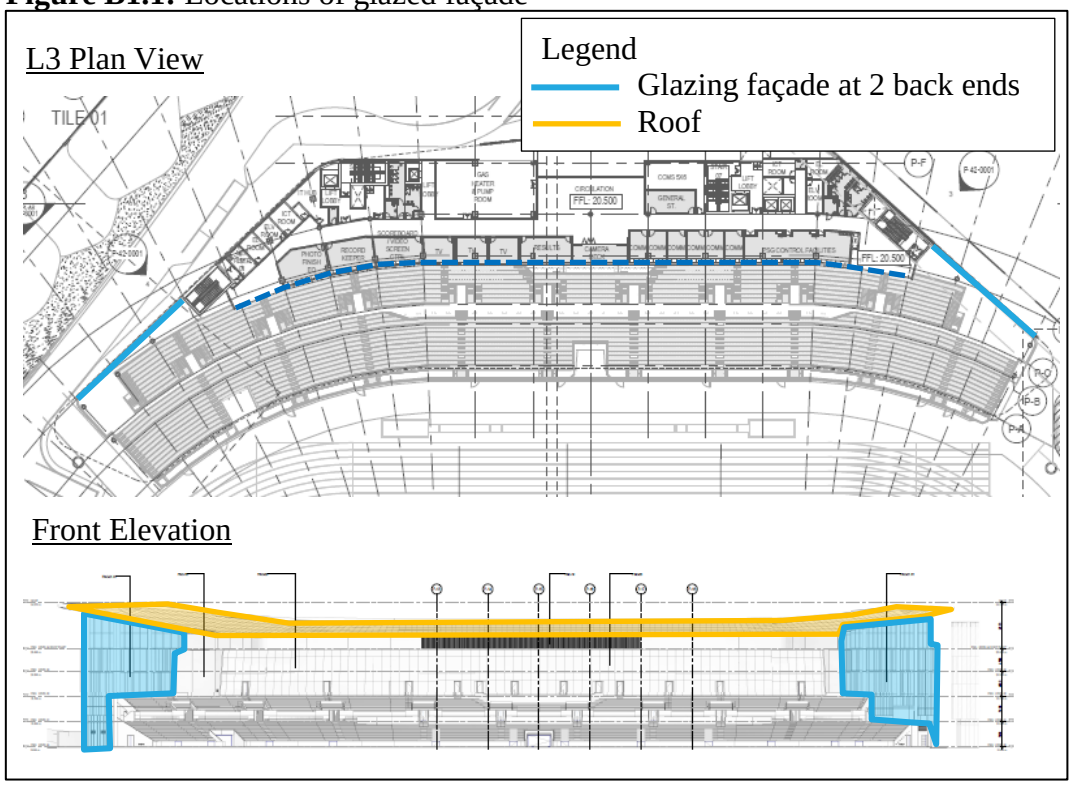
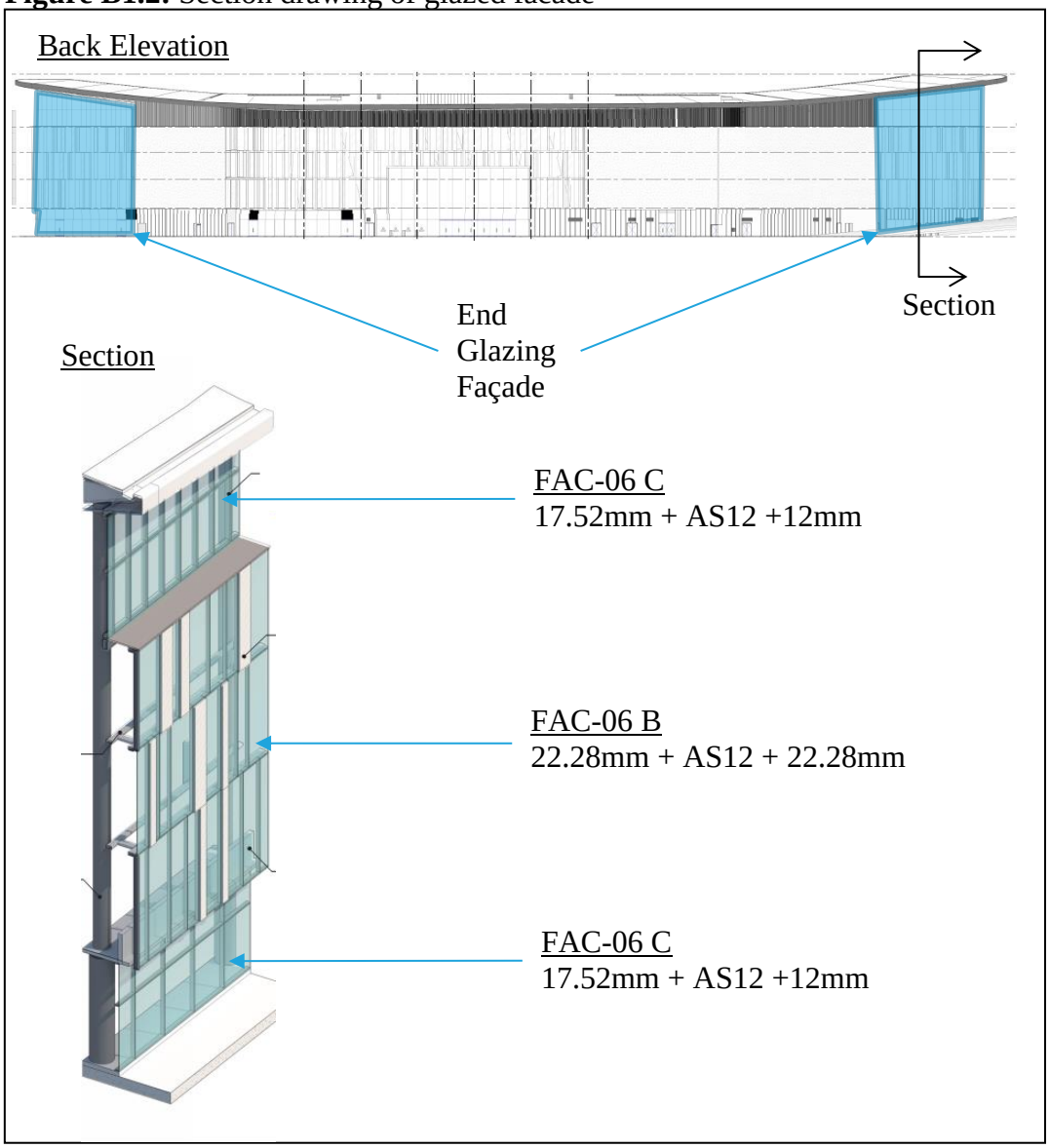


Figure B1.2: Section drawing of glazed facade



- The loudspeakers of public address system are ceiling mounted on the underside of grandstand roof in two rows and directed towards the spectators; and
- With a distributed loudspeakers system replacing the array speakers along the roof canopy front edge, the barrier screen dropped down from the roof canopy front edge is omitted.

This noise assessment is undertaken for sports events to demonstrate that the proposed changes would not cause adverse noise impact to nearby noise sensitive receivers (NSRs).

B2 Assessment Methodology

B2.1 Overview

Odeon model as used in the approved EIA study is adopted for the PSG noise modelling of the updated design scheme. The 3D model images are shown in **Figure B2.1** to **Figure B2.4**.

Figure B2.1: Overview of Odeon Model

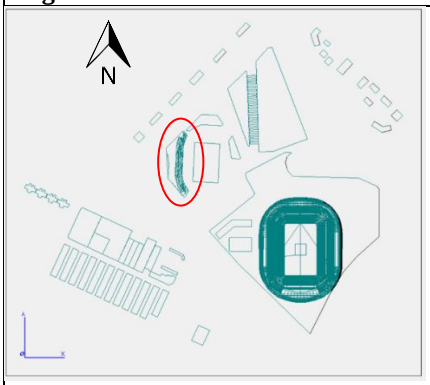


Figure B2.2: Overview of PSG

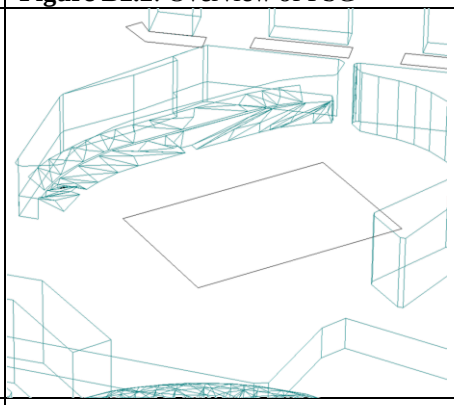


Figure B2.3: Frame view of noise model for MPSC and its surrounding

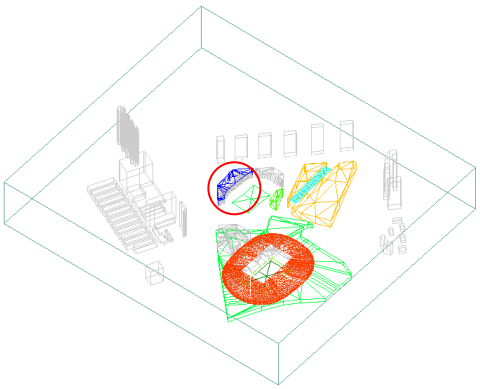
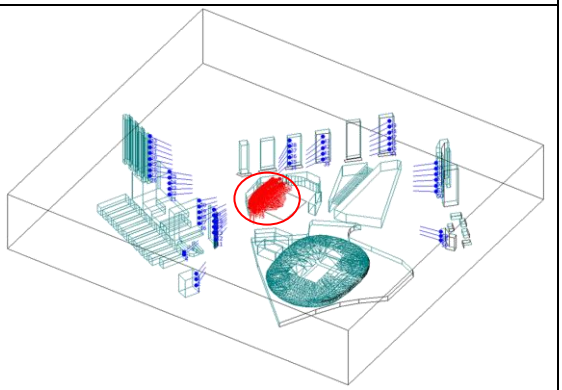


Figure B2.4: NSRs and Modelling Sources



B2.2 Sound Transmission Losses and Absorption

Sound transmission losses of wall and roof for noise modelling are summarised in **Table B2.1**.

Table B2.1: Sound transmission losses of structures

Frequency, Hz	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**
Structure	49.3	52.5	57.4	59.1	63.8	66.5	73.1	75.8	78.4	80.7
Glazing façade at 2 back ends	28	30	25	26	31	33	35	37	38	39
Roof	35.7	38.8	44.3	46.0	47.2	48.0	52.4	56.4	58.0	60.3
Frequency, Hz	**800**	**1000**	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**
Structure	83.6	84.4	84.3	84.1	86.6	86.4	86.9	82.9	82.7	80.5
Glazing façade at 2 back ends	39	40	41	42	43	43	44	45	46	46
Roof	62.7	64.7	66.2	65.7	67.2	69.2	73.0	76.2	80.1	81.0

Sound absorption of the acoustic panels underneath the roofs of PSG is summarised in **Table B2.2**.

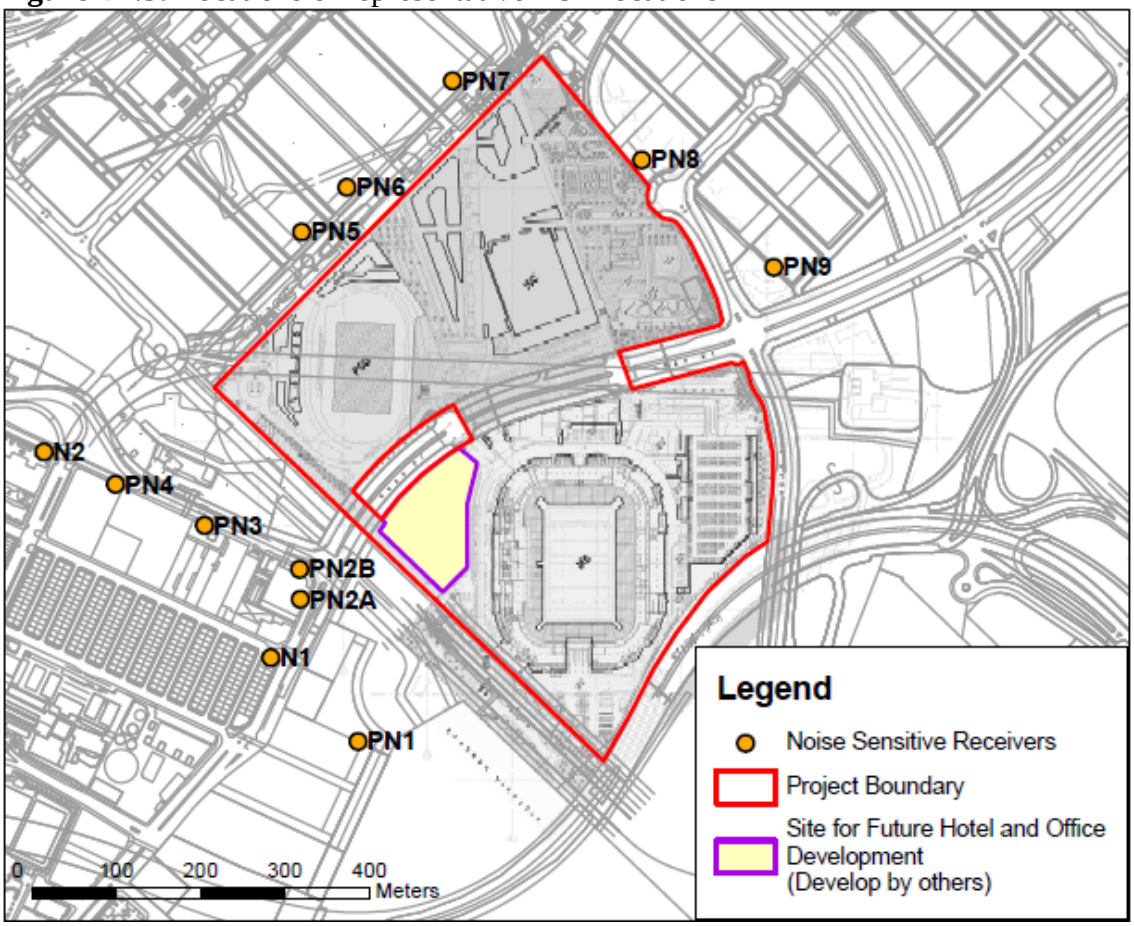
Table B2.2: Sound absorption of acoustic panels

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

B2.3 NSRs and Assessment Criteria

Representative NSRs identified in the approved EIA study are included in the assessment. NSR locations are shown in **Figure B2.5**.

Figure B2.5: Locations of representative NSR locations



Assessment criteria adopted for sports event combined with fixed noise in the EIA study are shown in **Table B2.3**.

Table B2.3: Assessment criteria for sports event and fixed noise

NSR ID	Assessment Criteria for sports event and fixed noise, Leq (30 mins), dB(A)	EIA Result, dB(A)
	Daytime and Evening (0700 to 2300)	Sports event and fixed noise
N1	60	52
N2	65	56
PN1	60	54
PN2A	60	60
PN2B	60	
PN3	65	58

NSR ID	Assessment Criteria for sports event and fixed noise, Leq (30 mins), dB(A)	EIA Result, dB(A)
	Daytime and Evening (0700 to 2300)	Sports event and fixed noise
PN4	65	56
PN5	60	59
PN6	60	60
PN7	60	57
PN8	60	59
PN9	60	52

B2.4 Noise Sources

The 5,000 spectators were modelled as 42 point sources located in the spectator stand. In line with the EIA report, a sound power level per person of 85.4dB(A) is adopted and shown in **Table B2.4**.

Distributed loudspeakers are adopted for the public-address system. It consists of 30 loudspeakers which are ceiling mounted on the underside of grandstand roof in two rows and directed towards the spectators. The sound power levels of these ceiling mounted loudspeakers are tuned as are shown in **Table B2.4** in order to produce a sound level of 70-75 dB(A) at the spectator stands. Comparison of the sports event mode for the updated design and that in EIA is given in **Table B2.5**. The settings are shown in **Figure B2.6** to **Figure B2.9** to illustrate the layout arrangement.

Table B2.4: Loudspeaker spectra for noise modelling

Frequency, Hz	63	125	250	500	1000	2000	4000	8000	A-weighted
SWL adopted for spectator	70.4	73.4	78.4	81.4	81.4	76.4	77.4	-	85.4
SWL adopted for loudspeaker	-	104	102	100	98	97	96	96	104.5

Table B2.5: Comparison of calculation parameter in EIA and current design development

Item	EIA	Updated design scheme
No. of Loudspeakers	10	30
No. of Spectators	7,500	5,000
Sound Power Level of Each Loudspeakers, dB(A)	104.2	104.5
Sound Level at Spectator Stand	70 – 75 dB(A)	80 – 85 dB(A) [1]
Sound Power Level of Each Spectators, dB(A)	85.4	85.4

Note:
[1] The sound level at spectator stand in updated design scheme is higher than that of EIA. A conservative assessments is adopted.

Figure B2.6: Speaker layout for in the updated design scheme

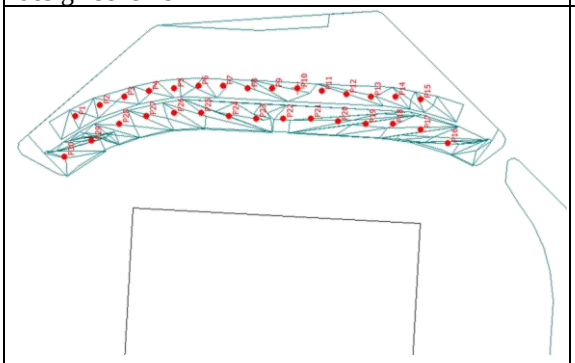


Figure B2.7: Audience Setting in the updated design scheme

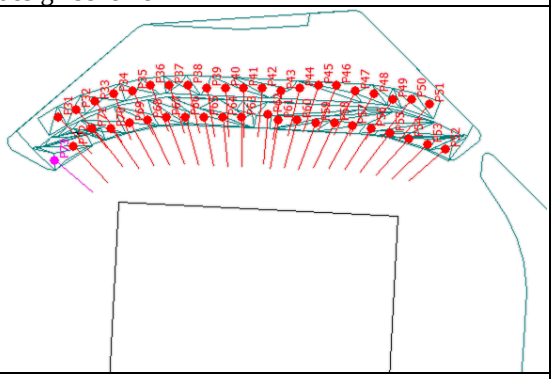


Figure B2.8: Speaker layout in EIA

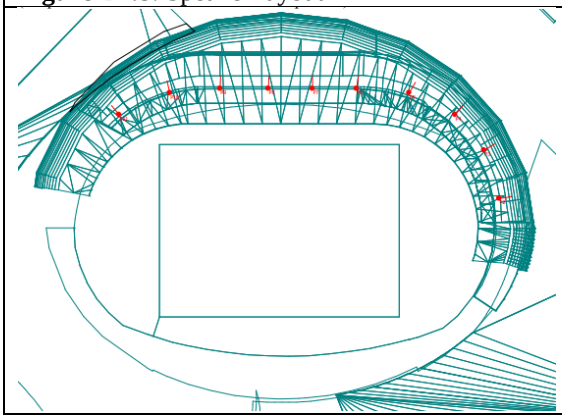
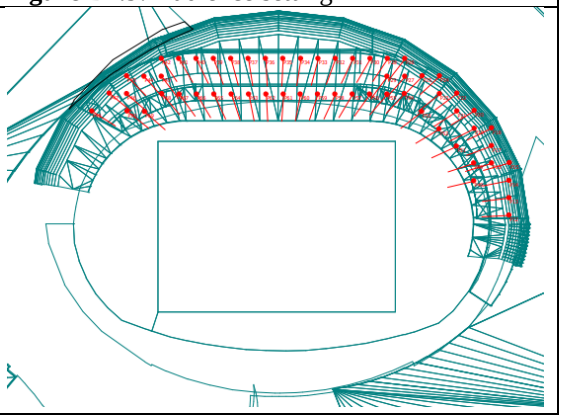


Figure B2.9: Audience setting in EIA



B3 Assessment Scenario

Day and evening scenario has been adopted for sports events the spectator stands in accordance with the EIA assumption except those as given in **Table B2.5**.

As the updated design scheme is in variation with the reference design for EIA report, there will be changes in the noise levels predicted at the NSRs in **Figure B2.5**.

B4 Results

The predicted noise levels at the representative NSRs for sports events combined with fixed noise are presented in **Table B4.1**. Detailed results are shown in **Annex B**.

Table B4.1: Predicted noise levels for sports event and fixed noise

NSR ID	Assessment Criteria, dB(A)	EIA Result, dB(A)	Model Result, dB(A)		
	Sports event and fixed noise	Sports event and fixed noise	Sports event and fixed noise		
			Sports Event	M&E Noise Design Level	Max. cumulative
N1	60	52	< 40	52	52
N2	65	56	<40	56	56
PN1	60	54	51– 53	44	54
PN2A	60	60	53 – 54	57	60
PN2B	60		52 – 54		

NSR ID	Assessment Criteria, dB(A)	EIA Result, dB(A)	Model Result, dB(A)		
	Sports event and fixed noise	Sports event and fixed noise	Sports event and fixed noise		
			Sports Event	M&E Noise Design Level	Max. cumulative
PN3	65	58	46 – 50	57	58
PN4	65	56	< 40 – 40	56	56
PN5	60	59	48 – 58	49	59
PN6	60	60	59 – 60	50	60
PN7	60	57	47 – 54	53	57
PN8	60	59	<40 – 53	56	59
PN9	60	52	46 – 48	49	52

Overall, the predicted noise levels are in compliance with the EIA assessment criteria and no adverse noise impact to NSRs.

Annex B Detailed Noise Assessment Results

NSR ID	Level, mPD	Criterion, dB(A)	Predicted Noise Level, dB(A)	Comply [Y/N]
N1	10	60	<40	Y
N1	20	60	<40	Y
N2	10	65	<40	Y
N2	30	65	<40	Y
N2	50	65	<40	Y
N2	70	65	<40	Y
N2	90	65	<40	Y
N2	110	65	<40	Y
N2	130	65	<40	Y
N2	150	65	<40	Y
PN1	15	60	51	Y
PN1	35	60	52	Y
PN1	55	60	53	Y
PN2A	30	60	53	Y
PN2A	50	60	54	Y
PN2A	70	60	53	Y
PN2A	90	60	53	Y
PN2A	110	60	53	Y
PN2B	30	60	52	Y
PN2B	50	60	54	Y
PN2B	70	60	54	Y
PN2B	90	60	54	Y
PN2B	110	60	54	Y
PN3	10	65	46	Y
PN3	30	65	44	Y
PN3	50	65	45	Y
PN3	70	65	50	Y
PN3	90	65	49	Y
PN4	10	65	<40	Y
PN4	30	65	<40	Y
PN4	50	65	<40	Y
PN4	70	65	40	Y
PN4	90	65	40	Y
PN5	10	60	48	Y
PN5	30	60	56	Y
PN5	50	60	58	Y
PN5	70	60	56	Y
PN5	90	60	55	Y
PN6	10	60	59	Y
PN6	30	60	60	Y

NSR ID	Level, mPD	Criterion, dB(A)	Predicted Noise Level, dB(A)	Comply [Y/N]
PN6	50	60	60	Y
PN6	70	60	59	Y
PN6	90	60	59	Y
PN7	10	60	47	Y
PN7	30	60	47	Y
PN7	50	60	49	Y
PN7	70	60	52	Y
PN7	90	60	54	Y
PN7	110	60	54	Y
PN8	10	60	<40	Y
PN8	30	60	<40	Y
PN8	50	60	45	Y
PN8	70	60	50	Y
PN8	90	60	53	Y
PN8	110	60	53	Y
PN9	10	60	46	Y
PN9	25	60	48	Y
PN9	40	60	48	Y