



# Noise & Vibration Impact Assessment for the Redevelopment of the ex-Jerma Hotel Site

As per ERA requirements for PA/00437/23

## Report



Noise & Vibration Impact Assessment for the  
Redevelopment of the ex-Jerma Hotel Site

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## APPENDICES

### Appendix A – Glossary of Terms

# 1 INTRODUCTION

A noise impact assessment is presented in relation to the noise levels emitted from the construction and operation of the ex-Jerma Palace Hotel, as part of the Environmental Impact assessment (EIA).

The Scheme involves the comprehensive redevelopment of the former Jerma Palace Hotel site to create a mixed-use development comprising residential, tourism, retail and leisure use, together with associated parking, public open space, landscaping and coastal defence works.

The assessment has been required to provide a noise impact assessment from the construction and operation of the Scheme in conjunction with the requirements of the Environment and Resources Authority (ERA).

Following the submission of a formal method statement (MS) regarding the proposed methodology for the assessment to the ERA, this noise impact assessment considers:

- A quantitative assessment of the construction noise and vibration on human receptors; and
- A quantitative assessment of the operational noise from road traffic noise on human receptors.

With regard to the quantitative construction noise and vibration assessment, an assessment of construction noise and vibration was undertaken at the nearest noise-sensitive receptors to the site. Construction noise levels, which would include the demolition of the existing Jerma Hotel, are predicted using the guidance contained in British Standard 5228:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise* (BS 5228-1).

Construction vibration levels are predicted at the nearest receptors using the guidance contained in British Standard 5228:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration* (BS 5228-2).

With regard to the operational assessment from road traffic noise, the measured 3-hour  $L_{A10}$  noise levels were converted to the 18-hour  $L_{A10}$  using the calculations in CRTN in order to establish the existing baseline sound environment and assess the impacts from road traffic noise associated with the Scheme. The assessment includes the prediction of the traffic flows both with and without the Scheme in the first year of operation, using provided traffic flow data.

Baseline environmental sound levels have been measured at the nearest noise sensitive receptors to the Scheme.

Whilst reasonable effort has been made to ensure that this report is easy to understand, it is necessarily technical in nature. To assist the reader, a glossary of terminology is provided in **Appendix A**.

## 2 SITE DESCRIPTION

## 2.1 LOCATION

The geographical location of the Scheme lies in the south-eastern region of Malta, in Marsascala as shown in Figure 1 below.



FIGURE 1: SCHEME LOCATION

### 2.1.1 Current Site

Further to the above, the footprint of the Site associated with the Scheme is approximately 44,812m<sup>2</sup> (of which 17,570m<sup>2</sup> are proposed to be developed) and currently comprises the ex-Jerma Palace Hotel. Figure 2 shows the approximate developable area of the Site.



FIGURE 2: SITE RED LINE BOUNDARY

### 2.1.2 Surrounding Area

The Site is predominantly surrounded by Torri San Tumas and residential properties to the west, and the Mediterranean Sea to the north, east and south.

### 2.1.3 The Scheme in Greater Detail

The Scheme incorporates the demolition of the ex-Jerma Palace Hotel, excavation of the Site and construction of a mixed-use resort consisting of 146 residential units (Class 1), tourism accommodation (Class 3B) consisting of 342 serviced apartments and a 90-room 5-star hotel, retail (Class 4B) and food and beverage outlets (Class 4C and Class 4D), a below grade shopping mall (Class 4B), 330 public parking spaces, 191 garages accommodating 261 vehicles and 13,600sqm of open space available to the general public. The proposal consists of the construction of a two-storey basement below the landscaped public plaza and two eight storey blocks above the plaza, extensive landscaping works, repairs and changes to the existing coastal defences and the construction of a swimming pool on the existing concrete platform below the project.

To provide some context for this Chapter, the proposed Scheme layout for Level 0 is shown in Figure 3.

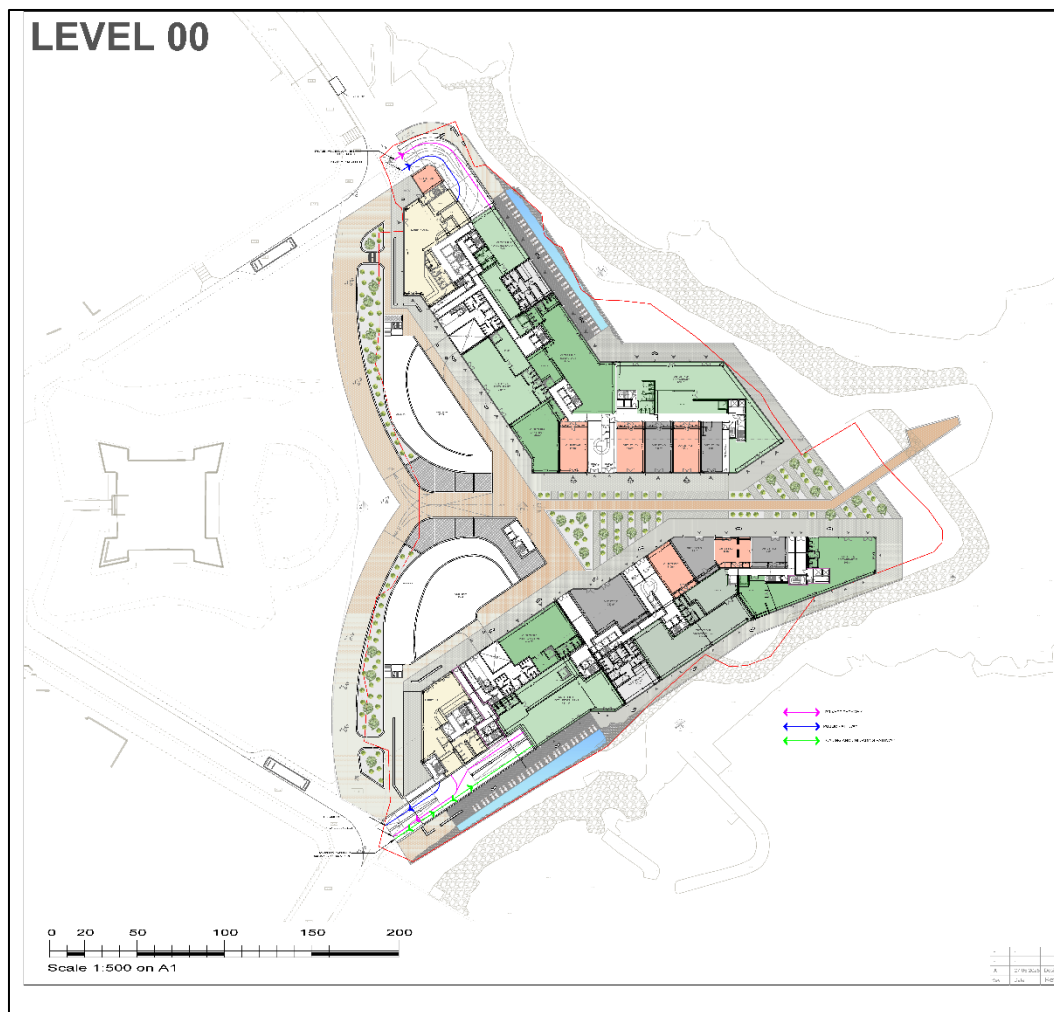


FIGURE 3: PROPOSED SCHEME LAYOUT

## 2.1.4 Nearest Sensitive Receptors

The nearest noise sensitive receptors (NSRs) to the Scheme are as follows.

- NSR01 – Residential properties located to the northwest of the Site along Triq is-Salini;
- NSR02 – Residential properties located to the southwest of the Site along Dawret it-Torri; and
- NSR03 – Residential properties located to the west of the Site along Triq il-Katakombi.

The NSRs described above are shown on Figure 4.



### 3 TERMS OF REFERENCE

The ERA issued the Draft Terms of Reference related to the study on land cover/uses and sea cover/uses for the EIA in May 2024. The ToRs relevant to noise and vibration are replicated hereunder.

#### **3.0 A DESCRIPTION OF THE SITE AND ITS SURROUNDINGS (I.E. ENVIRONMENTAL BASELINE)**

*The existing environmental features, characteristics and conditions, in and around the proposed development site as well as in all locations likely to be affected by the development or by ancillary interventions and operations, are to be identified and described in sufficient detail, with particular attention to the aspects elaborated further in the next sections.*

*The consultants should also identify (and justify) wherever relevant:*

- 1. The geographic area (e.g. viewshed or other area of influence) that needs to be covered by each study;*
- 2. The relevant sensitive receptors vis-à-vis the environmental parameter under consideration (e.g. residential communities, other users, natural ecosystems, specific populations of particular species, or individual physical features);*
- 3. The location of the reference points or stations (e.g. viewpoints, monitoring stations, or sampling points (including depth of multiple sampling points at a single sampling point in the case of water media and sediment, where applicable) to be used in the study; and*
- 4. Other methodological parameters of relevance, also noting that the assessment will normally require both desk-top studies and on-site investigations (including visual observations and sampling, as relevant).*

**Note:** *It is recommended that these details are discussed in advance with the ERA prior to commencement of the relevant parts of the studies, in order to pre-empt (as much as possible) later-stage issues.*

*Wherever relevant to the environmental aspects under discussion, reference to legislation, policies, plans (including programmes and strategies) standards and targets, should also be made, such that the compatibility (or otherwise) of the proposal therewith is also factored into the assessment required by Section 4 below. The discussion should cover the following aspects, in the appropriate level of detail:*

- 1. Supra-national (e.g. European Union; United Nations; or other international or regional) legislation, directives, policies, conventions, protocols, treaties, charters, plans and obligations;*
- 2. National legislation, policies and plans (e.g. Structure Plan; National Environment Policy); and*

3. *Sub-national legislation, policies and plans (e.g. local plans, site-specific regulations, action plans, management plans, and protective designations such as scheduling or Natura 2000).*

**Note:** *In addition to already in-force legislation, policies and plans, the discussion should also cover any foreseeable future updates (or new legislation, policies and plans) likely to be fulfilled, affected or compromised by the proposed project. Furthermore, it should be noted that some cross-cutting legal/policy instruments (e.g. Water Framework Directive and Marine Strategy Framework Directive) may need to be factored into more than one aspect of the discussion.*

### **3.9 Noise, Vibrations and Exterior Lighting**

*This study should provide sufficiently detailed information on representative background levels of noise, vibration and nocturnal lighting (as relevant), as a baseline for assessing the levels and effects expected to result from the development, including any short- and long-term changes, peaks and fluctuations as well as their acute or chronic impacts. The study should also take into account other relevant factors such as:*

- *Cumulation with other existing sources including traffic and with other predicted sources such as new developments;*
- *Additional effects of road traffic associated with operations on the site;*
- *Sensitive receptors (e.g. residents, recreational areas, fauna and avifauna, natural ecosystems); and*
- *The potential for attenuation or exacerbation by ‘environmental’ factors (e.g. topography, vegetation, physical barriers etc.), and for mitigation (e.g. shielding, muffling/soundproofing, reduced lighting, etc.).*

*Note 1: In the case of light pollution, the study needs to consider, among others, glare (e.g. the blinding light which is a danger to motorists/pedestrians and to fauna), light trespass (light straying into an area where it is not desired or required) and sky glow (‘wasted’ light directed upwards), together with any other relevant variables which are relevant to the determination of impact on the surrounding receptors.*

*The study results should include measurable noise parameters (e.g. noise indicators:  $L_{Aeq}$ ,  $L_{A90}$ ,  $L_{A10}$ ,  $L_{Amax}$ ) as relevant, and should be evaluated against appropriate reference values<sup>1</sup>. The measurement locations used should be approved by ERA prior to commencement of studies and, unless otherwise indicated, should be at ground level.*

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<sup>1</sup> Unless otherwise specifically indicated, it is recommended that: ISO 1996 and ISO 9613 (all series) standards are used for the noise assessment; BS6472 (relating to human exposure to vibration) and BS7385 (covering the effects on buildings) are used when studying vibration; BS 5228 is used for the assessment of construction noise; and BS 4142 is used vis-à-vis noise complaints.

*The methodology to be used should be submitted for ERA's evaluation prior to commencement of the studies. The Noise Assessment shall be conducted in accordance with the attached terms of reference in Appendix 3 and 4.*

#### **4.0 ASSESSMENT OF ENVIRONMENTAL IMPACTS AND ENVIRONMENTAL RISKS**

*All likely significant effects and risks posed by the proposed project on the environment during all relevant phases (including construction/ excavation/ demolition, operation and decommissioning) should be assessed in detail, taking into account the information emerging from Sections 1, 2 and 3 above. Apart from considering the project on its own merits (i.e. if taken in isolation), the assessment should also take into account the wider surrounding context and should consider the limitations and effects that the surrounding environmental constraints, features and dynamics may exert on the proposed development, thereby identifying any incompatibilities, conflicts, interferences or other relevant implications that may arise if the project is implemented.*

*In this regard, the assessment should address the following aspects, as applicable for any category of effects or for the overall evaluation of environmental impact, addressing the worst-case scenario wherever relevant:*

- 1. An exhaustive identification and description of the envisaged impacts;*
- 2. The magnitude, severity and significance of the impacts;*
- 3. The geographical extent/range and physical distribution of the impacts, in relation to: site coverage; the features located in the site surroundings; whether the impacts are short-, medium- or long-range; and any transboundary impacts (i.e. impacts affecting other countries);*
- 4. The timing and duration of the impacts (whether the impact is temporary or permanent; short-, medium- or long-term; and reasonable quantification of timeframes);*
- 5. Whether the impacts are reversible or irreversible (including the degree of reversibility in practice and a clear identification of any conditions, assumptions and pre-requisites for reversibility);*
- 6. A comprehensive coverage of direct, indirect, secondary and cumulative impacts, including:*
  - interactions (e.g. summative, synergistic, antagonistic, and vicious-cycle effects) between impacts;*
  - interactions or interference with natural or anthropogenic processes and dynamics;*
  - cumulation of the project and its effects with other past, present or reasonably foreseeable developments, activities and land uses and with other relevant baseline situations; and*
  - wider impacts and environmental implications arising from consequent demands, implications and commitments associated with the project (including: displacement of existing uses; new or increased pressures on the environment in the surroundings of the project, including pressures which may be exacerbated by the proposal but of*

*which effects may go beyond the area of influence; and impacts of any additional interventions likely to be triggered or necessitated by situations created, induced or exacerbated by the project);*

- 7. Whether the impacts are adverse, neutral or beneficial;*
- 8. The sensitivity and resilience of resources, environmental features and receptors vis-à-vis the impacts;*
- 9. Implications and conflicts vis-à-vis environmentally-relevant plans, policies and regulations;*
- 10. The probability of the impacts occurring; and*
- 11. The techniques, methods, calculations and assumptions used in the analyses and predictions, and the confidence level/limits and uncertainties vis-à-vis impact prediction.*

*The impacts that need to be addressed are detailed further in the sub-sections below.*

## **5.0 REQUIRED MEASURES, IDENTIFICATION OF RESIDUAL IMPACTS, AND MONITORING PROGRAMMES**

### **5.1 Mitigation Measures**

*A clear identification and explanation of the measures envisaged to prevent, eliminate, reduce or offset (as relevant) the identified significant adverse effects of the project during all relevant phases including construction, operation and decommissioning [see Section 1.2.3 above].*

*As a general rule, mitigation measures for construction-phase impacts should be packaged as a holistic Works Method Statement (WMS). Whilst the detailed workings of the WMS may need to be devised at a later stage (e.g. after the final design of the project has been approved and/or after a contractor has been appointed), the key parameters that the WMS must adhere to for proper mitigation need to be identified in the EIA. Broadly similar considerations also apply vis-à-vis operational-phase impacts [which may need to be mitigated through an operational permit] and decommissioning-phase impacts [see Section 5.4 below], where relevant.*

*Mitigation measures for accident/risk scenarios should be packaged as a holistic plan that includes the integration of failsafe systems into the project design as well as well-defined contingency measures.*

*The recommended measures should be feasible, realistically implementable to the required standards and in a timely manner, effective and reliable, and reasonably exhaustive. They should not be dependent on factors that are beyond the developer's and ERA's control or which would be difficult to monitor, implement or enforce. The actual scope for, and feasibility of, effective prevention or mitigation should also be clearly indicated, also identifying all potentially important pre-requisites, conditionalities and side-effects.*

### **5.2 Residual Impacts**

*Any residual impacts [i.e. impacts that cannot be effectively mitigated, or can only be partly mitigated, or which are expected to remain or recur again following exhaustive implementation of mitigation measures] should also be clearly identified.*

### **5.3 Additional Measures**

*Compensatory measures (i.e. measures intended to offset, in whole or in part, the residual impacts) should also be identified, as reasonably relevant. Such measures should be not considered as an acceptable substitute to impact avoidance or mitigation.*

*If the assessment also identifies beneficial impacts on the environment, measures to maximise the environmental benefit should also be identified.*

*In both instances, the same practical considerations as indicated vis-à-vis mitigation measures should also apply.*

### **5.4 Decommissioning Plan**

*A decommissioning plan (DP) should also be proposed to address the following circumstances, as relevant:*

- 1. Removal of any temporary or defined-lifetime development (or of any structures, infrastructure or land use required temporarily in connection with it) upon the expiry of their permitted duration; and*
- 2. Removal of the development (or of any secondary developments, infrastructure or land use ancillary to it) in the event of redundancy, cessation of operations, serious default from critical mitigation measures, or other overriding situations that may emerge in future.*

*The DP should also include, as relevant, a phasing-out plan, proposals for site remediation or decontamination, and methodological guidance on site reinstatement or appropriate after-use.*

### **5.5 Monitoring Programme**

*A realistic and enforceable programme for effective monitoring of those works envisaged to have an adverse or uncertain impact. The monitoring programme should include:*

- 1. Details regarding type and frequency of monitoring and reporting, including spot checks;*
- 2. The parameters that will be monitored, their units of measurement, the monitoring indicators to be used; and standard analytical methods in line with relevant EU policy;*
- 3. An effective indication of the required action to address any exceedances, risks, mitigation failures or non-compliances for each monitoring parameter;*

4. *An evaluation of forecasts, predictions and measures identified in the EIA; and*
5. *An indication of the nature and extent of any additional investigations (including EIAs or ad hoc detailed investigations, if relevant) that may be required in the event of any contingencies, unanticipated impacts, or impacts of larger magnitude or extent than predicted.*

*The programme should address all relevant stages, as follows:*

- a. *Where relevant, monitoring of preliminary on-site investigations that may entail significant disturbance or damage to site features (e.g. archaeological excavations, geological sampling, or any works that require prior site clearance or any significant destructive sampling); [Note: Official written consent from the competent authorities (e.g. Superintendence of Cultural Heritage) may also be required for such interventions.]*
- b. *Monitoring of the construction phase, including the situation before initiation of works (including site clearance), during appropriate stages of progress, and after completion of works;*
- c. *Monitoring of the operational phase, except where otherwise directed by ERA (e.g. where monitoring would be more appropriately integrated into an operating permit); and*
- d. *Where relevant, monitoring of the decommissioning phase, including the situation before initiation of works, during appropriate stages of progress, and after completion of works.*

#### **5.6 Identification of required authorisations**

*The assessment should also identify all environmentally-relevant permits, licences, clearances and authorisations (other than the development permit to which this EIA is ancillary) which must be obtained by the applicant in order to effectively implement the project if development permission is granted. Any uncertainty, as to whether any of these pre-requisites is applicable to the project, should be clearly stated.*

#### **Note on Sections 5.1 to 5.6 above:**

*The expected effects, the proposed measures, the residual impacts, the proposed monitoring etc. should also be summarised in a user-friendly itemised table that enables the reader to easily relate the various aspects to each other.*

Further to the paragraph above an indicative specimen impact table is attached in Appendix 5.

## 4 CONSULTATION AND METHODOLOGY, GUIDANCE AND STANDARDS

### 4.1 CONSULTATION AND METHODOLOGY

A summary of the agreed assessment methodology is provided below.

- Baseline sound levels were measured at the NSRs identified in Figure 4. For the construction assessment, four x 15-minute non-consecutive measurements at each location during the daytime; and two x 15-minute non-consecutive measurements at each location during the night-time were measured.
- For the operational road traffic assessment, three 1-hour consecutive measurements at each location during the daytime between the hours of 10:00-17:00 were measured.
- A quantitative construction noise assessment was undertaken, with reference to BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*.
- Noise levels from the construction of the Scheme were predicted at the nearest human receptors using the proprietary software-based noise model, CadnaA®, and the calculation algorithms contained in ISO9613-2 Acoustics – *Attenuation of sound during propagation outdoors – Part 2 General method of calculation*.
- Vibration levels from the construction of the Scheme was assessed in accordance with Table E.1 of BS5228-2:2009+A1:2014 Part 2 Vibration. The predicted vibration levels would be then assessed in accordance with the criteria contained within the guidance.
- Operational road traffic noise assessment utilised measured 3-hour  $L_{A10}$  noise levels which were converted to the 18-hour  $L_{A10}$  using the calculations in the Calculation of Road Traffic Noise 1988 (CRTN).

The results of the assessment indicate whether any noise mitigation measures would be required to reduce any identified impacts, which would be included as part of the assessment if deemed necessary.

A summary of the standards and guidance referenced above is provided below.

### 4.2 GUIDANCE AND STANDARDS

#### 4.2.1 British Standard 5228-1:2009+A1:2014 (BS 5228)

Construction noise levels have been calculated in accordance with BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise* (BS 5228-1). This standard sets out a methodology for predicting noise levels arising from a wide variety of open site activities and contains tables of sound power levels generated by a wide variety of mobile and fixed plant equipment.

Noise levels generated by open site construction operations and experienced at local receptors will depend upon a number of variables, the most significant of which are likely to be:

The amount of noise generated by plant and equipment being used during the construction phases, generally expressed as a sound power level:

- The periods of operation of the plant, known as the “on-time”;
- The distance between the noise source and the receptor, known as the “stand-off”;
- The attenuation due to ground absorption or barrier screening effects;
- Reflections of noise due to the presence of hard vertical faces such as walls.

BS 5228-1 gives several examples of acceptable noise limits for construction or demolition noise. For this assessment, as baseline noise data is available, it is proposed that the ABC method will be used to determine the threshold value at the NSR locations.

Under the ABC method, a threshold value noise level is determined by establishing the existing ambient noise level at each location. This measured ambient noise level is then rounded to the nearest whole 5dB(A), and the threshold noise value for each receptor is then established from Table E.1 of BS 5228-1. This threshold value is the  $L_{Aeq,T}$  noise level that should not be exceeded at the receptor location by operations at the site. Accordance with this method, the threshold noise levels for a potentially significant effect are as detailed in Table 1 below.

TABLE 1: CONSTRUCTION NOISE RESIDENTIAL RECEPTORS – EXAMPLE THRESHOLD VALUES

| ASSESSMENT CATEGORY AND THRESHOLD VALUE PERIOD    | THRESHOLD VALUE IN DECIBELS (dB) |                  |                  |
|---------------------------------------------------|----------------------------------|------------------|------------------|
|                                                   | CATEGORY A<br>A)                 | CATEGORY B<br>B) | CATEGORY C<br>C) |
| Night-time (23:00 – 07:00)                        | 45                               | 50               | 55               |
| Evenings and weekends <sup>D)</sup>               | 55                               | 60               | 65               |
| Daytime (07:00-19:00) and Saturdays (07:00-13:00) | 65                               | 70               | 75               |

<sup>A)</sup> Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.

<sup>B)</sup> Category B: threshold values to use when the ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.

| ASSESSMENT CATEGORY AND THRESHOLD<br>VALUE PERIOD | THRESHOLD VALUE IN DECIBELS (dB) |                  |                          |
|---------------------------------------------------|----------------------------------|------------------|--------------------------|
|                                                   | CATEGORY A<br>A)                 | CATEGORY B<br>B) | CATEGORY C <sup>C)</sup> |

<sup>C)</sup> Category C: threshold values to use when the ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.

<sup>D)</sup> 19:00-23:00 weekdays, 13:00-23:00 Saturdays and 07:00-23:00 Sundays.

Construction vibrations were assessed in accordance with BS5228-2:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites - Part 2: Vibration* (BS 5228-2). This standard gives recommendations for basic methods of vibration control relating to construction and open sites where work activities/operations generate significant vibration levels.

BS 5228-2 provides guidance on the effects of vibration as shown in Table 2.

TABLE 2: CONSTRUCTION VIBRATION RESIDENTIAL RECEPTORS – EXAMPLE THRESHOLD VALUES

| VIBRATION LEVEL, $\text{MMS}^{-1}$ | EFFECT                                                                                                                                                                                          |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.14                               | Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration. |
| 0.30                               | Vibration might be just perceptible in residential environments.                                                                                                                                |
| 1.00                               | It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.                   |
| 10.00                              | Vibration is likely to be intolerable for any more than a very brief exposure to this level.                                                                                                    |

#### 4.2.2 Road Traffic Noise Guidance

The CRTN 1988 is a technical memorandum that sets out standard methods and procedures to measure and predict road traffic noise. Road traffic noise is predicted and measured in terms of a statistical measure, equivalent to the 10th percentile. Termed the  $L_{10}$ , this measure of noise is equivalent to the sound level exceeded for 10% of the reference period.

Relevant to this assessment, CRTN contains a Shortened Measurement Procedure for determining the  $L_{A10,18hr}$  sound level. To calculate the  $L_{A10,18hr}$  sound level, road traffic

noise levels are first measured over a three-hour continuous period between 10:00 and 17:00 to determine the  $L_{A10,3hr}$ . 1 dB is then subtracted from the measured  $L_{A10,3hr}$  to give the  $L_{A10,18hr}$  sound level.

Using the  $L_{A10,18hr}$  sound level, daytime  $L_{Aeq,16hr}$  and night-time  $L_{Aeq,8hr}$  levels can then be calculated using formulae contained within the '*Method for Converting the UK Road Traffic Noise Index  $L_{A10,18hr}$  to the EU Noise Indices for Road Noise Mapping*' (2006) and shown in Table 3

TABLE 3:  $L_{A10,18hr}$  CONVERSION FORMULAE

| TIME PERIOD   | NON- MOTORWAY CONVERSION                                                                      |
|---------------|-----------------------------------------------------------------------------------------------|
| 07:00 – 21:00 | $L_{day} = 0.95 \times L_{A10,18hr} + 1.44$                                                   |
| 21:00 – 23:00 | $L_{evening} = 0.97 \times L_{A10,18hr} - 2.87$                                               |
| 23:00 – 08:00 | $L_{night} = 0.90 \times L_{A10,18hr} - 3.77$                                                 |
| 07:00 – 23:00 | $L_{Aeq,16hr} = 10 \log_{10} ((12 \times 10(L_{day}/10) + 4 \times 10(L_{evening}/10)) / 16)$ |

To assess potential changes in road traffic noise arising from development-related traffic, the  $L_{A10,18hr}$  noise level at 10m from the carriageway edge (referred to as the 'Basic Noise Level' (BNL)) has been calculated for each relevant road link identified by the Transport Consultant. The calculations have been undertaken in accordance with the principles set out in CRTN for the 2030 and 2035 'Do Nothing' and 'Do Something' scenarios. The assessment includes base and committed development traffic flows in the Do Nothing scenarios and also incorporates proposed Scheme flows in the Do Something scenarios.

These predictions consider the relative change in noise level that is likely to result from the Scheme at a notional roadside receptor for each assessed road link. Representative traffic speeds and a constant HGV proportion of 0% have been assumed consistently across all scenarios. As the assessment is based on the change between scenarios, rather than the prediction of absolute noise levels, these assumptions do not materially influence the predicted noise changes. It is noted that, the assumption of 0% HGV is considered conservative, as existing HGV traffic is likely to reduce the relative influence of development-generated light vehicle traffic on overall road traffic noise levels

The likely changes in road traffic noise levels attributable to the Scheme has been determined for each road link by comparing the predicted BNLs for the Do Nothing and Do Something scenarios.

The noise impact upon existing NSRs of Scheme-related road traffic, reference has been made to guidance contained within The Design Manual for Roads and Bridges (DMRB) LA 111 Noise and Vibration. DMRB LA111 sets out the requirements for

assessing and reporting the effects of highways noise and vibration from construction, operation and maintenance projects.

DMRB LA 111 presents a significance matrix for assessing the magnitude of changes in BNLS in the short-term. Within the DMRB LA111 significance framework, noise changes below 3 dB are typically considered not perceptible, whereas changes at or above 3 dB may contribute to a perceptible effect and therefore may influence the assessment of significance depending on context, receptor sensitivity, and baseline sound levels.

#### 4.2.3 ISO 9613-2: 2024

The levels of sound generated by the operation of the Scheme has been predicted in accordance with the prediction framework within ISO 9613-2:2024 *Acoustics – Attenuation of Sound during Propagation Outdoors– Part 2: General Method of Calculation*. This method of calculation takes into account the distance between the sound sources and the closest receptors, and the amount of attenuation due to atmospheric absorption. The methodology also assumes downwind propagation, i.e. a wind direction that assists the propagation of sound from the source to the receiver.

## 5 ASSESSMENT CRITERIA

In this section the sensitivity criteria, impact magnitude and the level of effect have been described. A summary of the significance of impact will be put forward in terms of whether the impact is considered not significant, of minor significance, of moderate significance, or of major significance.

### 5.1 RECEPTOR SENSITIVITY

The level of significance is determined in relation to the magnitude of impact together with the sensitivity of the receptor. Different NSRs can be classified in levels of sensitivity: High, Medium, Low and Negligible as described in Table 4.

TABLE 4: LEVEL OF SENSITIVITY ASSOCIATED WITH NSRs

| SENSITIVITY | DESCRIPTION OF NSRs                                                                                            |
|-------------|----------------------------------------------------------------------------------------------------------------|
| High        | Residential properties (night-time), Schools and healthcare building (daytime)                                 |
| Medium      | Residential properties (daytime), Ecological Sites i.e., SAC, SPA, SSSI (or similar areas of special interest) |
| Low         | Offices and other non-noise producing employment areas                                                         |
| Negligible  | Industrial areas                                                                                               |

### 5.2 CONSTRUCTION NOISE AND VIBRATION IMPACT MAGNITUDE

The impact of construction noise upon existing residential receptors will be determined with reference to the ABC method presented in BS 5228-1. The impact of construction noise upon existing residential receptors is as detailed in Table 5.

TABLE 5: CONSTRUCTION NOISE IMPACT MAGNITUDE

| MAGNITUDE  | DESCRIPTION                                        |
|------------|----------------------------------------------------|
| High       | Threshold limit value exceeded by more than 5dB    |
| Medium     | Threshold limit value exceeded by a maximum of 4dB |
| Low        | Threshold limit value exceeded by a maximum of 2dB |
| Negligible | Threshold value not exceeded                       |

The impact of construction vibration upon existing residential receptors will be determined with reference to the BS 5228-2. The impact of construction vibration upon existing residential receptors is as detailed in Table 6 below.

TABLE 6: CONSTRUCTION VIBRATION IMPACT MAGNITUDE

| MAGNITUDE  | DESCRIPTION                                                    |
|------------|----------------------------------------------------------------|
| High       | Threshold value exceeded by $10.0\text{mms}^{-1}$ or more      |
| Medium     | Threshold value exceeded between $1.0$ to $9.9\text{mms}^{-1}$ |
| Low        | Threshold value exceeded between $0.3$ to $0.9\text{mms}^{-1}$ |
| Negligible | Threshold value of $0.3\text{ mms}^{-1}$ not exceeded          |

### 5.3 OPERATIONAL NOISE IMPACT MAGNITUDE

The impact of operational noise from the Scheme upon existing residential receptors from road traffic noise will be determined with reference to Table 3.54a of DMRB LA111. The impacts of Scheme-related traffic upon existing receptors in the short-term are detailed in Table 7.

TABLE 7: OPERATIONAL ROAD TRAFFIC NOISE IMPACT MAGNITUDE – RESIDENTIAL RECEPTORS

| MAGNITUDE  | NOISE CHANGE $L_{A10,18\text{HR}}$ DB |
|------------|---------------------------------------|
| High       | 5.0 +                                 |
| Medium     | 3.0 – 4.9                             |
| Low        | 1.0 – 2.9                             |
| Negligible | 0.1– 0.9                              |

### 5.4 LEVEL OF EFFECT

Where an adverse impact is identified, the following generic relationship between noise impact and noise effect will be referred to:

- **Major**– environmental significance is associated with the impacts where mitigation is not practical or would be ineffective and could influence the decision whether or not to proceed with the project;
- **Moderate** – environmental significance is associated with the effects that are important considerations, which could result in adverse effects if they are not mitigated;

- **Minor**– environmental significance could have an influence on the decision unless it is mitigated; and
- **Not Significant** – environmental significance will not have an influence on the decision or require modification on the project design or alternative mitigation and noise need not be considered as a determining factor in the decision process.

The significance of the noise effect will depend on the receptor type and its sensitivity to the noise impact, (see Table 4). The sensitivity of the receptor, together with the magnitude of the noise impact, defines the level of the noise effect, as shown in Table 8 below.

TABLE 8: LEVEL OF NOISE EFFECTS

|           |            | SENSITIVITY |          |                 |                 |
|-----------|------------|-------------|----------|-----------------|-----------------|
|           |            | HIGH        | MEDIUM   | LOW             | NEGLIGIBLE      |
| MAGNITUDE | High       | Major       | Major    | Moderate        | Minor           |
|           | Medium     | Major       | Moderate | Minor           | Minor           |
|           | Low        | Moderate    | Minor    | Minor           | Not Significant |
|           | Negligible | Minor       | Minor    | Not Significant | Not Significant |

Where an effect is classified as Major or Moderate, this may be considered to represent a ‘significant effect’ but should always be subject to professional judgement and interpretation, particularly where the sensitivity or impact magnitude levels are not clear, or are borderline between categories, or the impact is temporary or intermittent.

The Level of Noise Effects matrix provided within Table 8 therefore provides a guide to decision making but is not a substitute for professional judgement.

## 6 BASELINE CONDITIONS

### 6.1 BASELINE SOUND SURVEY

A baseline sound survey has been undertaken at the closest NSRs during September and October 2025.

- Baseline sound measurements were undertaken during both daytime and night-time periods at three locations as indicated in **NSR01** – Residential properties located to the northwest of the Site along Triq is-Salini;
- **NSR02** – Residential properties located to the southwest of the Site along Dawret it-Torri; and
- **NSR03** – Residential properties located to the west of the Site along Triq il-Katakombi

- **NSR01** – Residential properties located to the northwest of the Site along Triq is-Salini;
- **NSR02** – Residential properties located to the southwest of the Site along Dawret it-Torri; and
- **NSR03** – Residential properties located to the west of the Site along Triq il-Katakombi



FIGURE 5: BASELINE SOUND MONITORING LOCATIONS

### 6.1.1 Critical Listening and Weather Observations

Observations of the acoustic environment were made during the baseline sound survey periods for the monitoring locations and are included in Table 9.

TABLE 9: CRITICAL LISTENING OBSERVATIONS

| LOCATION | DATE       | TIME STAMP    | CRITICAL LISTENING OBSERVATIONS                                                                                                                                          |
|----------|------------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NSR01    | 29/09/2025 | 07:37 - 07:54 | Quiet residential area, noise includes cars passing, pedestrians and waves. Between 08:40-08:58 there was occasional noise from construction work in a nearby residence. |
|          |            | 08.40 - 08:58 |                                                                                                                                                                          |
|          |            | 09:38 -09:55  |                                                                                                                                                                          |
|          |            | 10.17 - 10.33 |                                                                                                                                                                          |
|          |            | 05:50 -06:10  | Quiet residential area, noise includes occasional car passes, crickets, waves and occasional sounds from pedestrians.                                                    |
|          |            | 06:39 - 06:55 |                                                                                                                                                                          |

| LOCATION | DATE       | TIME STAMP    | CRITICAL LISTENING OBSERVATIONS                                                                                                      |
|----------|------------|---------------|--------------------------------------------------------------------------------------------------------------------------------------|
|          | 30/09/2025 | 10:02 – 13:38 | Quiet residential area, soundscape includes sound from waves, vehicles, pedestrians and cyclists.                                    |
| NSR02    | 29/09/2025 | 07:00-07:15   | Quiet residential area, noise includes cars passing and pedestrians.                                                                 |
|          |            | 07:59-08:16   |                                                                                                                                      |
|          |            | 09:01-09:17   |                                                                                                                                      |
|          |            | 09:57-10:14   |                                                                                                                                      |
|          |            | 05:31 – 05:50 | Quiet residential area, noise includes crickets, waves and occasional sounds from pedestrians.                                       |
|          | 30/09/2025 | 03:48 – 04:03 | Quiet residential area, noise includes birds and waves.                                                                              |
|          |            | 13:50 – 16:50 | Quiet residential area, soundscape includes sound from waves, vehicles, pedestrians and cyclists.                                    |
| NSR03    | 29/09/2025 | 07:18-07:33   | Residential area, high pitch noise from unknown source constant during monitoring, occasional car passes and noise from pedestrians. |
|          |            | 08:20-08:37   |                                                                                                                                      |
|          |            | 09:20-09:37   |                                                                                                                                      |
|          |            | 10:35-10:52   |                                                                                                                                      |
|          |            | 06:19 – 06:35 | Quiet residential area, noise includes crickets, occasional car passes and some noise from pedestrians.                              |
|          | 30/09/2025 | 04:38 – 04:53 | Quiet residential area, noise includes occasional car passes and constant beeping from an unknown source.                            |
|          | 14/10/2025 | 13:22 – 16:22 | Quiet residential area, soundscape included sound from generator and occasional drilling.                                            |

Observations of the weather conditions were made during the baseline sound survey periods for both monitoring locations and are included in Table 10 below. Windspeeds were below 5 ms<sup>-1</sup> and there was an absence of precipitation, meaning that weather conditions were conducive to noise monitoring.

TABLE 10: WEATHER OBSERVATIONS

| LOCATION | DATE       | TIME<br>STAMP | TEMP<br>(°C) | HUMIDITY<br>(%) | WIND<br>SPEED<br>(MS <sup>-1</sup> ) | CLOUD<br>COVER<br>(%) | PRECIPITATION |
|----------|------------|---------------|--------------|-----------------|--------------------------------------|-----------------------|---------------|
| NSR01    | 29/09/2025 | 07:37-07:54   | 23.0         | 63              | 3.0                                  | 10                    | No            |
|          |            | 08:40-08:58   | 23.0         | 63              | 3.0                                  | 10                    | No            |
|          |            | 09:38-09:55   | 25.0         | 55              | 4.5                                  | 60                    | No            |
|          |            | 10:17-10:33   | 25.0         | 55              | 4.5                                  | 60                    | No            |
|          |            | 05:50-06:10   | 21.0         | 68              | 4.0                                  | 0                     | No            |
|          |            | 06:39-06:55   | 21.0         | 70              | 3.5                                  | 0                     | No            |
|          | 30/09/2025 | 10:02-13:38   | 23.0         | 74              | 1.0                                  | 1                     | No            |
| NSR02    | 29/09/2025 | 07:00-07:15   | 23.0         | 63              | 3.0                                  | 0                     | No            |
|          |            | 07:59-08:16   | 23.0         | 63              | 3.0                                  | 15                    | No            |
|          |            | 09:01-09:17   | 23.0         | 63              | 3.0                                  | 20                    | No            |
|          |            | 09:57-10:14   | 25.0         | 55              | 4.5                                  | 60                    | No            |
|          |            | 05:31-05:50   | 21.0         | 68              | 4.0                                  | 0                     | No            |
|          | 30/09/2025 | 03:48-04:03   | 20.0         | 80              | 2.5                                  | 0                     | No            |
|          |            | 13:50-16:50   | 26.0         | 59              | 3.0                                  | 25                    | No            |
| NSR03    | 29/09/2025 | 07:18-07:33   | 23.0         | 63              | 3.0                                  | 5                     | No            |
|          |            | 08:20-08:37   | 23.0         | 63              | 3.0                                  | 15                    | No            |

| LOCATION | DATE       | TIME<br>STAMP | TEMP<br>(°C) | HUMIDITY<br>(%) | WIND<br>SPEED<br>(MS <sup>-1</sup> ) | CLOUD<br>COVER<br>(%) | PRECIPITATION |
|----------|------------|---------------|--------------|-----------------|--------------------------------------|-----------------------|---------------|
|          |            | 09:20-09:37   | 23.0         | 63              | 3.0                                  | 50                    | No            |
|          |            | 10:35-10:52   | 25.0         | 55              | 4.5                                  | 60                    | No            |
|          |            | 06:19-06:35   | 21.0         | 70              | 3.5                                  | 5                     | No            |
|          | 30/09/2025 | 04:38-04:53   | 20.0         | 83              | 2.0                                  | 0                     | No            |
|          | 14/10/2025 | 13:22-16:22   | 23.0         | 69              | 1.8                                  | 5                     | No            |

### 6.1.2 Survey Protocol

Baseline sound measurements were undertaken during both daytime and night-time periods at each of the three monitoring locations. For the construction assessment, four x 15-minute non-consecutive measurements at each location during the daytime; and two x 15-minute non-consecutive measurements at each location during the night-time were measured. For the operational road traffic assessment, three 1-hour consecutive measurements at each location during the daytime between the hours of 10:00-17:00 were measured.

The following monitoring protocol is proposed for each receptor:

- NSR01 – Residential: A fully attended 3-hour consecutive measurement, with noise levels being logged every 15-minute during the daytime, four 15-minute non-consecutive readings during daytime and two 15-minute non-consecutive readings during the night-time;
- NSR02 – Residential: A fully attended 3-hour consecutive measurement, with noise levels being logged every 15-minute during the daytime, four 15-minute non-consecutive readings during daytime and two 15-minute non-consecutive readings during the night-time; and
- NSR03 – Residential: A fully attended 3-hour consecutive measurement, with noise levels being logged every 15-minute during the daytime, four 15-minute non-consecutive readings during daytime and two 15-minute non-consecutive readings during the night-time.

Measurements at the survey locations were made at 1.5m above the ground in free-field conditions, i.e. at least 3.5m from the closest vertical reflecting surface.

The measurements were attended at all times with a record of all noise observations made. The following noise indices were recorded:

- $L_{Aeq,T}$ : The A-weighted equivalent continuous noise level over the measurement period T;
- $L_{A90}$ : the A-weighted noise level exceeded for 90% of the measurement period. This parameter is often used to describe background noise;
- $L_{A10}$ : The A-weighted noise level exceeded for 10% of the measurement period. This parameter is often used to describe road traffic noise; and
- $L_{Amax}$ : the maximum A-weighted noise level during the measurement period.

### 6.1.3 Survey Results

The results of the sound survey are summarised in Table 11 including the background sound level ( $L_{A90}$ ),  $L_{A10}$ , ambient noise level ( $L_{Aeq}$ ) and the highest  $L_{Amax}$  values. The daytime period is taken between 07:00 and 23:00 hours and the night-time between 23:00 and 07:00 hours.

TABLE 11: SOUND SURVEY SUMMARY

| LOCATION     | DATE/ TIME PERIOD | TIME        | $L_{Aeq,T}$ | $L_{A90}$ | $L_{A10}$ | $L_{Amax}$ |
|--------------|-------------------|-------------|-------------|-----------|-----------|------------|
| <b>NSR01</b> | 29/09/2025        | 07:37-07:54 | 52.7        | 44.0      | 55.4      | 70.1       |
|              |                   | 08:40-08:58 | 53.3        | 43.0      | 55.3      | 75.3       |
|              |                   | 09:38-09:55 | 49.8        | 40.7      | 52.8      | 65.3       |
|              |                   | 10:17-10:33 | 54.3        | 41.9      | 57.6      | 75.4       |
|              | 30/09/2025        | 05:50-06:10 | 50.1        | 45.3      | 49.4      | 71.2       |
|              |                   | 06:39-06:55 | 52.2        | 42.7      | 55.8      | 70.2       |
|              | 30/09/2025        | 10:02-13:38 | 56.7        | 37.3      | 60.0      | 87.2       |
| <b>NSR02</b> | 29/09/2025        | 07:00-07:15 | 49.6        | 41.5      | 52.9      | 63.0       |
|              |                   | 07:59-08:16 | 52.4        | 42.7      | 56.0      | 69.7       |
|              |                   | 09:01-09:17 | 52.0        | 39.9      | 56.8      | 65.9       |
|              |                   | 09:57-10:14 | 55.0        | 41.2      | 58.7      | 74.4       |
|              | 30/09/2025        | 05:31-05:50 | 44.7        | 41.3      | 44.9      | 62.5       |

| LOCATION | DATE/ TIME PERIOD | TIME        | $L_{Aeq,T}$ | $L_{A90}$ | $L_{A10}$ | $L_{AFMAX}$ |
|----------|-------------------|-------------|-------------|-----------|-----------|-------------|
|          |                   | 03:48-04:03 | 38.8        | 35.8      | 41.2      | 52.6        |
|          | 30/09/2025        | 13:50-16:50 | 52.4        | 36.7      | 55.0      | 77.4        |
| NSR03    | 29/09/2025        | 07:18-07:33 | 50.1        | 40.6      | 48.7      | 72.9        |
|          |                   | 08:20-08:37 | 51.0        | 41.4      | 52.3      | 69.7        |
|          |                   | 09:20-09:37 | 47.7        | 39.1      | 50.5      | 64.6        |
|          |                   | 10:35-10:52 | 50.7        | 46.7      | 51.0      | 69.9        |
|          | 30/09/2025        | 06:19-06:35 | 48.4        | 39.9      | 50.1      | 66.8        |
|          |                   | 04:38-04:53 | 52.4        | 36.0      | 56.6      | 58.0        |
|          | 14/10/2025        | 13:22-16:22 | 51.3        | 38.4      | 48.6      | 79.1        |

For assessment purposes, the daytime  $L_{A10,T}$  sound levels measured on the 30<sup>th</sup> September 2025 (NSR01 and NSR02) and the 14<sup>th</sup> October 2025 (NSR03) have been converted to daytime  $L_{Aeq,16hr}$  and night-time  $L_{Aeq,8hr}$  equivalent continuous sound levels using the formulae presented in Table 3. The results are shown in Table 12.

It is acknowledged that this method assumes all sound was from road traffic on the adjacent road links and it is considered that, based on the critical listening observations (Table 9), in all likelihood this presents an overestimation of road traffic noise.

TABLE 12: 2025 BASE  $L_{A10,18HR}$  CONVERSION TO  $L_{Aeq,T}$  SOUND LEVELS

| LOCATION | PARAMETER/PERIOD           | $L_{A10,3HR}$ | $L_{A10,18HR}$ | CALCULATED<br>$L_{Aeq,T, DB}$ |
|----------|----------------------------|---------------|----------------|-------------------------------|
| NSR01    | $L_{Aeq,16hr}$ (daytime)   | 60            | 59             | 57                            |
|          | $L_{Aeq,8hr}$ (night-time) |               |                | 49                            |
| NSR02    | $L_{Aeq,16hr}$ (daytime)   | 55            | 54             | 52                            |
|          | $L_{Aeq,8hr}$ (night-time) |               |                | 45                            |

| LOCATION | PARAMETER/PERIOD           | $L_{A10,3HR}$ | $L_{A10,18HR}$ | <i>CALCULATED</i><br>$L_{Aeq,T, DB}$ |
|----------|----------------------------|---------------|----------------|--------------------------------------|
| NSR03    | $L_{Aeq,16hr}$ (daytime)   | 49            | 48             | 46                                   |
|          | $L_{Aeq,8hr}$ (night-time) |               |                | 39                                   |

## 7 IMPACT ASSESSMENT

### 7.1 CONSTRUCTION PHASE NOISE AND VIBRATION EFFECTS

A quantitative assessment of construction noise has been undertaken with reference to BS 5228-1, as an applicable working methodology to assess construction noise.

The BS 5228 calculation methods allow  $L_{Aeq,T}$  noise levels to be determined for various site activities. The value of any such prediction is necessarily limited by the number of assumptions that must be made regarding the number and type of plant to be utilised, their location and detailed operating arrangements. Some of this information will be clarified as the project design progresses, but other information (such as exactly where the plant operates and for how long) will remain uncertain, even after works have commenced.

Based on similar projects of this nature, the worst-case (loudest) construction phase from a noise perspective is the initial Site Preparation Phase which involves soil stripping, soil excavation, grading of material and construction of Site compounds and fences.

Again, based on previous experience, the combined sound power level for all plant associated with Site preparation operations, taking into account associated on-times is approximately 120dB(A).

#### 7.1.1 Predicted Construction Noise Levels

Based on the above, high level noise predictions for worst-case construction works were undertaken within the CadnaA® modelling software, based on the following.

- Predictions were based on the calculation algorithms contained in BS 5228:2014.
- The combined sound power level from all construction plant (120dB(A)) was modelled as an area source covering the entire area within the red line boundary at a height of 2m above ground level.
- A ground absorption factor of 0.5 (mixed ground).
- Downwind propagation between the source and receptors.
- A daytime receiver height of 1.5m above ground level.
- The predictions took into account the local topography and any intervening structures.

Based on the above, the predicted noise levels at each of the NSRs are shown in Table 13 (rounded to the nearest decibel).

TABLE 13: PREDICTED CONSTRUCTION NOISE LEVELS, dB

| NOISE SENSITIVE RECEPTOR                             | PREDICTED NOISE LEVEL, dB $L_{Aeq, 1-HOUR}$ |
|------------------------------------------------------|---------------------------------------------|
| NSR01 - Residential Property to the west of the Site | 69.2                                        |
| NSR02 - Residential Property to the west of the Site | 70.2                                        |
| NSR03 - Residential Property to the west of the Site | 56.2                                        |

### 7.1.2 Construction Noise Assessment - Human Receptors

It has been assumed that construction operations would take place during normal daytime hours. Measured daytime  $L_{Aeq,t}$  levels were below 65 dB (see Table 11). The predicted construction noise levels have therefore been compared to the BS 5228-1 Category A daytime noise threshold limit of  $L_{Aeq,t}$  65 dB (see Table 1) and assessed in conjunction with the construction noise impact magnitude detailed in Table 5. As construction activities are expected to place during the daytime, receptor sensitivity has been defined as 'medium' (see Table 4).

The construction noise assessment is shown in Table 14 below.

TABLE 14: PREDICTED CONSTRUCTION NOISE LEVELS AND ASSESSMENT

| LOCATION | CONSTRUCTION PHASE | PREDICTED NOISE LEVEL, dB $L_{Aeq,T}$ | DAYTIME CATEGORY A THRESHOLD LIMIT, dB $L_{Aeq,T}$ | DIFFERENCE, dB | IMPACT MAGNITUDE |
|----------|--------------------|---------------------------------------|----------------------------------------------------|----------------|------------------|
| NSR01    | Site Preparation   | 69                                    | 65                                                 | 4              | Medium           |
| NSR02    |                    | 70                                    |                                                    | 5              | High             |
| NSR03    |                    | 56                                    |                                                    | -9             | Negligible       |

With reference to Table 14, the initial assessment of impacts and effects is as follows:

- At NSR01 the impact magnitude is predicted to be Medium adverse, with Moderate adverse effects.
- At NSR02 the impact magnitude is predicted to be High adverse, with Major adverse effects.

- At NSR03 the impact magnitude is predicted to be Negligible, with Minor adverse effects.

While predicted construction noise levels may give rise to effects assessed as Moderate or Major adverse, these do not necessarily equate to significant effects. Significance is determined not solely by the magnitude of impact, but by a holistic consideration of context, duration, frequency, and the effectiveness of mitigation.

Construction activities will be temporary and phased, with noisy operations confined to defined daytime periods, thereby limiting prolonged exposure and avoiding the most sensitive periods.

Appropriate mitigation will be implemented during the construction phases to minimise noise impacts on existing and future NSRs. As construction will be temporary, effects would not be permanent in nature.

It is therefore considered that effects will not be significant.

Mitigation and residual impacts are considered further in Section 8.

## 7.2 CONSTRUCTION PHASE VIBRATION EFFECTS

Desktop predictions of vibratory compaction (steady state), vibratory compaction (start up and run-down) and vibratory piling, have been completed in accordance with Table E.1 of BS25228-2.

With reference to the methodology detailed, the predicted vibration levels at the identified NSRs are shown in Table 15.

For the purpose of the calculation the following parameter values have been assumed:

- Maximum amplitude of drum vibration = 2.38mm (the middle value of the accepted range).
- Vibrating roller drum width = 1.48m (the middle value of the accepted range).
- Number of vibrating drums = 1 (the lowest value of the accepted range).

TABLE 15: PREDICTED CONSTRUCTION VIBRATION LEVELS, dB

| NSR   | DISTANCE<br>FROM SITE | OPERATION               | PREDICTED*<br>VIBRATION<br>LEVEL, $\text{MMS}^{-1}$ | IMPACT<br>MAGNITUDE | EFFECT   |
|-------|-----------------------|-------------------------|-----------------------------------------------------|---------------------|----------|
| NSR01 | (30m)                 | Vibratory<br>compaction | 4.39                                                | Medium              | Moderate |

| NSR      DISTANCE<br>FROM SITE | OPERATION                                        | PREDICTED*<br>VIBRATION<br>LEVEL, $\text{MMS}^{-1}$ | IMPACT<br>MAGNITUDE | EFFECT   |
|--------------------------------|--------------------------------------------------|-----------------------------------------------------|---------------------|----------|
|                                | (startup/<br>rundown)                            |                                                     |                     |          |
|                                | Vibratory<br>compaction<br>(steady state)        | 2.97                                                | Medium              | Moderate |
|                                | Vibratory piling                                 | 1.51                                                | Medium              | Moderate |
| NSR02 (30m)                    | Vibratory<br>compaction<br>(startup/<br>rundown) | 4.39                                                | Medium              | Moderate |
|                                | Vibratory<br>compaction<br>(steady state)        | 2.97                                                | Medium              | Moderate |
|                                | Vibratory piling                                 | 1.51                                                | Medium              | Moderate |
| NSR03 (140m)                   | Vibratory<br>compaction<br>(startup/<br>rundown) | 0.62                                                | Low                 | Minor    |
|                                | Vibratory<br>compaction<br>(steady state)        | 0.31                                                | Low                 | Minor    |
|                                | Vibratory piling                                 | 0.20                                                | Negligible          | Minor    |

\* Probability of predicted value being exceeded 33%

With reference to Table 15 and the definitions in Table 8, the initial assessment of impacts and effects is as follows:

- At NSR01 and NSR02 the impact magnitude is predicted to be Medium adverse, with Moderate adverse effects.
- At NSR03 the impact magnitude for vibratory piling is predicted to be Negligible with Minor adverse effects. The impact magnitude for vibratory compaction is predicted to be Low with Minor adverse effects.

It is therefore considered that effects from construction vibration at NSR01 and NSR02 have the potential to be significant.

Mitigation and residual impacts are considered further in Section 8.0.

### 7.3 OPERATIONAL PHASE NOISE EFFECTS - ROAD TRAFFIC NOISE

Road traffic arising from operation of the Scheme may alter noise levels at receptors near to the road network. Assessment has been undertaken to include the following road links for which traffic flow data has been provided:

- Triq Sant Antnin
- Triq is-Salini
- Triq il-Qaliet (upper)
- Triq il-Qaliet (lower)
- Triq tal-Gardiel

For each road link the BNL has been established for the 'Do Nothing' and 'Do Something' scenarios for the future years of 2030 and 2035, and assessment undertaken following the procedures described in Section 4.2.2 above. The BNL is the  $L_{A10,18hr}$  dB noise level at 10m from the kerb of the road assessed. The results of the assessment are provided in Table 16 and

Table 17 below.

TABLE 16:2030 OPERATIONAL ROAD TRAFFIC ASSESSMENT

|                           | 2030 DO NOTHING |                           |      | 2030 DO SOMETHING |                           |      | CHANGE IN<br>BNL | IMPACT     | EFFECT             |
|---------------------------|-----------------|---------------------------|------|-------------------|---------------------------|------|------------------|------------|--------------------|
|                           | AAWT            | ASSUMED<br>SPEED<br>KM/HR | BNL  | AAWT              | ASSUMED<br>SPEED<br>KM/HR | BNL  |                  |            |                    |
| Triq Sant Antnin          | 23730           | 48                        | 70.0 | 25829             | 48                        | 70.2 | 0.2              | Negligible | Minor              |
| Triq is-Salini            | 1534            | 32                        | 54.4 | 2563              | 32                        | 58.0 | 3.6              | Medium     | Moderate/<br>Major |
| Triq il-Qaliet<br>(Upper) | 9074            | 48                        | 65.8 | 9613              | 48                        | 65.9 | 0.1              | Negligible | Minor              |
| Triq il-Qaliet<br>(Lower) | 9074            | 48                        | 65.8 | 10394             | 48                        | 66.2 | 0.4              | Negligible | Minor              |
| Triq Sant Antnin          | 23730           | 32                        | 62.3 | 7090              | 32                        | 62.9 | 0.6              | Negligible | Minor              |

TABLE 17:2035 OPERATIONAL TRAFFIC ASSESSMENT

|                           | 2035 DO NOTHING |                           |      | 2035 DO SOMETHING |                           |      | CHANGE IN<br>BNL | IMPACT     | EFFECT                                              |
|---------------------------|-----------------|---------------------------|------|-------------------|---------------------------|------|------------------|------------|-----------------------------------------------------|
|                           | AAWT            | ASSUMED<br>SPEED<br>KM/HR | BNL  | AAWT              | ASSUMED<br>SPEED<br>KM/HR | BNL  |                  |            |                                                     |
| Triq Sant Antnin          | 25953           | 48                        | 70.2 | 27089             | 48                        | 70.4 | 0.2              | Negligible | Minor                                               |
| Triq is-Salini            | 1678            | 32                        | 54.8 | 2644              | 32                        | 58.2 | 3.4              | Medium     | Moderate<br>(daytime)/<br>Major<br>(night-<br>time) |
| Triq il-Qaliet<br>(Upper) | 9924            | 48                        | 66.0 | 10094             | 48                        | 66.1 | 0.1              | Negligible | Minor                                               |
| Triq il-Qaliet<br>(Lower) | 9924            | 48                        | 66.0 | 10875             | 48                        | 66.4 | 0.4              | Negligible | Minor                                               |
| Triq Sant Antnin          | 6452            | 32                        | 62.5 | 7403              | 32                        | 63.1 | 0.6              | Negligible | Minor                                               |

As shown in Table 16, initial assessment indicates that increases in operational road traffic would result in a Negligible impact with Minor adverse effects at NSRs adjacent all assessed road links, except Triq is-Salini.

At Triq is-Salini, increases in operational road traffic are shown to result in a Medium adverse impact with Moderate/ Major adverse effects, which could be significant. It is noted that Moderate adverse effects are predicted in the daytime period as receptor sensitivity is 'medium' and Major adverse effects are predicted in the night-time period as receptor sensitivity is 'high' (see Table 4).

Whilst the assessment identifies a Moderate/Major adverse effect at receptors adjacent to Triq is-Salini, this outcome has been considered in the context of the existing acoustic environment and the nature of the affected road link. Triq is-Salini is currently a lightly trafficked road, such that relatively small increases in traffic flow can result in a proportionally larger increase in the calculated BNLs for the 'Do Something' scenarios. With reference to DMRB LA111 guidance, the maximum predicted increase is only marginally above the level generally regarded as just perceptible to residents.

Notwithstanding the calculated changes, the calculated 2025 Base  $L_{Aeq,16hr}$  and night-time  $L_{Aeq,8hr}$  sound levels at NSR01 and NSR02 indicate that existing ambient levels are relatively moderate, with daytime  $L_{Aeq,16hr}$  levels between 52 and 57 dB and night-time  $L_{Aeq,T}$  levels between 45 and 49 dB. It is considered that the resulting increases in operational sound levels would remain within a range that is typical of residential environments influenced by local road traffic.

Furthermore, the predicted increase is primarily associated with traffic using the site access road and would be localised to receptors immediately adjoining Triq is-Salini. The effect would diminish rapidly with increasing distance from the road and is not representative of the wider study area, where increases in road traffic noise are predicted to result in only Negligible impacts and Minor adverse effects.

Within the context of the significance matrix, moderate/major adverse effects may be significant or not depending on the specific circumstances with professional judgement applied. The assessment methodology is intentionally precautionary, being based on changes in traffic noise indices rather than direct assessment of resulting absolute noise levels at façade locations. Consequently, whilst a Moderate/Major adverse effect has been identified in accordance with the adopted significance criteria, the increase represents a localised change on a lightly trafficked access road and is not considered likely to result in a substantial deterioration in overall residential amenity. Taking into account the above and the modest scale of the increase, the impact is considered to be Low with Low adverse effects and is judged to be not significant.

Mitigation of operational road traffic noise upon existing NSRs is therefore not considered necessary.

## 8 MITIGATION MEASURES

### 8.1 CONSTRUCTION NOISE AND VIBRATION

The noise impact from construction activities has been initially assessed as potentially significant. The impact magnitude, in the worst-case, is High with calculation assumptions tending towards a worst-case. To reduce the potential for adverse noise impacts, the following construction mitigation measures are provided as recommended good practice, to be incorporated within the Works Method Statement (WMS) and implemented where appropriate. The adoption of Best Practicable Means is usually the most effective means of controlling noise from construction sites and a number of generic measures are available. Examples are below:

- Consideration will be given to noise emissions when selecting plant and equipment to be used on site;
- All equipment should be maintained in good working order and fitted with the appropriate silencers, mufflers or acoustic covers where applicable;
- Stationary noise sources will be sited as far away as reasonably possible from noise-sensitive receptors and where necessary and appropriate, acoustic barriers will be used to screen them;
- The movement of vehicles to and from the site will be controlled and employees will be instructed to ensure compliance with any noise control measures adopted;
- The contractor's site induction programme and site rules must include good working practice instructions for site staff/managers and contractors to help minimise noise and vibration whilst working on the site.
- Good public relations, including good lines of communication, giving advance notice of noisy activities and the implementation of a complaints action plan, enabling complaints to be reported, recorded, investigated and actioned where necessary.

There are many strategies to reduce construction noise by the limitation of activities that would result in predicted noise levels being reduced. Any such measures should be considered adequate, and the mitigation adopted should not be limited to the measures above.

Experience has shown that by implementing these measures, typical noise levels from construction activities could be reduced by 5dB or more.

Regarding vibration during construction, effects without mitigation have been judged to be potentially significant. With reference to Table 2, where vibration levels are between 1 and 10mm/s<sup>2</sup> it is likely that vibration of this level will cause complaint but can be tolerated if prior warning and explanation has been given to residents.

It is therefore recommended that residents are notified before any vibratory compaction of piling is carried out. Furthermore, where reasonably practicable, plant or work that may lead to significant levels of vibration at sensitive premises should be replaced by other less intrusive plant and/or methods of working. Alternatively, equipment should be relocated or isolated using resilient mounting.

## 8.2 OPERATIONAL NOISE

It has not been considered necessary to apply specific mitigation measures to reduce operational road traffic noise. The green travel proposed in the TIA should help to reduce trip generation to the site and consequently reduce road traffic noise.

## 8.3 RESIDUAL IMPACTS

### 8.3.1 Construction Noise

Based on the BS 5228-1 assessment, construction activities associated with the Scheme have the potential to result in significant adverse noise impacts at the nearest NSRs, in the absence of mitigation. However, construction activities will be temporary in nature, undertaken in phases and confined to daytime working hours. As a result, exposure to elevated noise levels will be limited in duration and avoid the most sensitive periods.

While construction noise mitigation has not been considered qualitatively within this assessment, the WMS will incorporate a range of standard best-practice noise control measures. Such measures can typically provide reductions of several decibels at nearby receptors and, importantly, reduce the frequency and duration of the highest noise events. Furthermore, compliance with the applicable Maltese legislative and regulatory framework, together with any conditions imposed by the relevant competent authorities, will ensure that construction activities are undertaken in accordance with recognised good practice.

Taking into account the temporary and intermittent nature of the construction works, together with the likely reduction in sound levels and improved management of noise-generating activities resulting from the implementation of mitigation measures, the residual impact significance is considered to reduce from Moderate to Low, corresponding to a Minor adverse effect. The residual effect is therefore considered to be not significant.

### 8.3.2 Construction Vibration

With the adoption of appropriate mitigation measures such as suitable plant selection and methods to control vibration, vibration levels can typically be substantially reduced, and it is considered reasonable that levels associated with activities such as vibratory compaction could be reduced from around 4 mm/s PPV to below 1 mm/s PPV at NSRs.

This reduction in vibration levels is expected to reduce the impact of construction vibration to Negligible with Negligible effects. The residual effect is therefore considered to be not significant.

### 8.3.3 Operational Noise Road Traffic Noise

No significant adverse effects were identified and therefore no additional mitigation is required and the residual effects remain as presented above.

## 9 CUMULATIVE ASSESSMENT

### 9.1.1 Cumulative Construction Noise Assessment

There are no identified developments within 300 m of the proposed Scheme. Therefore, no additional cumulative construction noise effects are predicted.

### 9.1.2 Cumulative Operational Noise Assessment

Cumulative schemes have been embedded within the future baseline traffic flow data used for the noise assessment, where relevant. The future baseline reflects the anticipated conditions in the absence of the Development and is represented within the assessment results.

## 10 CONCLUSIONS

This chapter has assessed the likely effects of the proposed Scheme with respect to noise and vibration. The assessments have been undertaken with reference to relevant standards and guidelines, including BS5228:2009+A1:2014, CRTN and DMRB LA111. The significance of these effects has been determined with reference to the ToR; relating to noise and vibration.

With respect to noise and vibration associated with construction activities within the application site, the assessment has referenced the guidance of BS5228:2009+A1:2014.

The quantitative assessment of construction noise has shown that the derived daytime criterion has the potential to be exceeded at the closest receptors. Mitigation measures in line with Best Practicable Means have been recommended and with the implementation of suitable measures it is judged that construction a noise would result in no significant residual effects.

The quantitative assessment of construction vibration has shown that the criterion has the potential to be exceeded at the closest sensitive receptors. Mitigation measures in line with Best Practicable Means have been recommended and with the implementation of suitable measures it is judged that construction vibration would result in no significant residual effects.

Operational sound levels associated with off-site road traffic noise from the proposed Scheme have been determined. The assessment has shown that, for the closest residential receptors, operational road traffic on Triq is- Salini will lead to an increase in sound levels. Initial assessment has indicated that this increase has the potential to lead to significant effects, however taking into account context, it is judged that operational road traffic would result in no significant residual effects.

Overall, it can be concluded that noise should not pose a significant constraint to the construction and operation of the proposed Scheme.

With reference to the conclusions above, Table 18 provides a summary of the impacts.

11 SUMMARY OF IMPACT TABLE

TABLE 18: SUMMARY OF IMPACTS

| Impact Type and Source |                                         |               | Impact Receptor             |                            | Effect & Scale               |                     |          |                                        |                           |                                                  |                                                            | Impact Occurring                                      | Overall Impact Significance | Proposed Mitigation Measures                                | Residual Impact Significance | Other Requirements (Monitoring, Authorisations, etc) |
|------------------------|-----------------------------------------|---------------|-----------------------------|----------------------------|------------------------------|---------------------|----------|----------------------------------------|---------------------------|--------------------------------------------------|------------------------------------------------------------|-------------------------------------------------------|-----------------------------|-------------------------------------------------------------|------------------------------|------------------------------------------------------|
| Impact Type            | Specific Intervention Leading to Impact | Project Phase | Receptor Type               | Sensitivity Towards Impact | Direct/ Indirect/ Cumulative | Beneficial/ Adverse | Severity | Physical / Geographic Extent of Impact | Short-/Medium-/ Long-term | Temporary (Indicate Duration) / Permanent        | Reversible (Indicate Ease of Reversibility) / Irreversible | (Inevitable, Likely, Unlikely, Remote, Uncertain)     |                             |                                                             |                              |                                                      |
| Noise                  | Site preparation                        | Construction  | Residential (day)           | Medium                     | Direct                       | Adverse             | High     | Local                                  | Short-term                | Temporary (for duration of construction)         | Reversible with suitable mitigation                        | Likely                                                | Major Adverse               | Best practicable means in line with standard best practice  | Minor Adverse                | None                                                 |
| Vibration              | Vibratory compaction and piling         | Construction  | Residential (day)           | Medium                     | Direct                       | Adverse             | Moderate | Local                                  | Short-term                | Temporary (for duration of vibratory activities) | Reversible with suitable mitigation                        | Unlikely (dependent on required construction methods) | Moderate Adverse            | Alternative equipment/methods of working, notify residents. | Negligible                   | None                                                 |
| Noise                  | Operational Road Traffic Noise          | Operation     | Residential (day and night) | Medium/High                | Direct                       | Adverse             | Medium   | Local                                  | Long-term                 | Permanent                                        | No                                                         | Remote                                                | Moderate / Major Adverse    | None identified                                             | Low adverse                  | None                                                 |

# **Appendix A**

## **Glossary of Terminology**

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0dB (the threshold of hearing) to over 120dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

TABLE A-01  
SOUND LEVELS COMMONLY FOUND IN THE ENVIRONMENT

| Sound Level     | Location                   |
|-----------------|----------------------------|
| 0dB(A)          | Threshold of hearing       |
| 20 to 30dB(A)   | Quiet bedroom at night     |
| 30 to 40dB(A)   | Living room during the day |
| 40 to 50dB(A)   | Typical office             |
| 50 to 60dB(A)   | Inside a car               |
| 60 to 70dB(A)   | Typical high street        |
| 70 to 90dB(A)   | Inside factory             |
| 100 to 110dB(A) | Burglar alarm at 1m away   |
| 110 to 130dB(A) | Jet aircraft on take off   |
| 140dB(A)        | Threshold of Pain          |

### Acoustic Terminology

**dB (decibel)** The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure ( $2 \times 10^{-5}$  Pa).

**dB(A)** A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

**L<sub>Aeq</sub>** L<sub>Aeq</sub> is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.

**L<sub>10</sub> & L<sub>90</sub>** If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L<sub>n</sub> indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L<sub>10</sub> is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L<sub>90</sub> is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L<sub>10</sub> index to describe traffic noise.

**L<sub>AFmax</sub>** This is the maximum A-weighted sound pressure level recorded over the period stated. L<sub>Amax</sub> is sometimes used in assessing environmental noise where

occasional loud noises occur, which may have little effect on the overall  $L_{eq}$  noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.