

# Appendix 4.12 Calculation of Construction Ground-borne Noise Levels during Restricted Hours (Mitigated Scenario)

Ground-borne Noise (GBN) from TBM resulting from the construction of new middle third tunnel

NSR ID. : PHD  
 NSR Name : Planned Housing Development (NKIL6579)

$$L_p = L_{v,rms} + C_{dist} + C_{damping} + C_{building} + C_{floor} + C_{noise} + C_{multi} + C_{cum}$$

| Item                                      | Description   | Quantity        | Reference and Assumption  |
|---|---|-----------------|---|
| L <sub>v,rms</sub>                        | Vibration source term (Peak Particle Velocity (PPV)) at R <sub>0</sub> (from Graph1 DB320 Kwai Tsing Tunnel by Extrapolation) | 2.5 mm/s        | Ref: Kowloon Canton Railway Corporation Kowloon Southern Link Environmental Impact Assessment Report (KSL) EIA Appendix 7-2-3 PPV at 5.5m |
|   | rms velocity  | 0.625 mm/s      | L <sub>v,rms</sub> = PPV / Crest Factor, Crest Factor = 4   |
|   | L <sub>v, rms</sub>   | 115.92 VdB      |   |
| C <sub>dist</sub>                         | Distance Attenuation: -20*log (R/R <sub>0</sub> )   | -29.3 dB        | R = 160m; R <sub>0</sub> =5.5m  |
| C <sub>damping</sub>                      | Soil Damping  | 0 dB            | Assume no soil damping as the vibration would transmit through rock layer   |
| C <sub>building</sub>                     | Coupling Loss into Building Structures  | 0 dB            | For conservative approach, no correction is assumed   |
| C <sub>floor</sub>                        | Floor to Floor Attenuation  | 0 dB            | 1 dB/ floor is assumed  |
| C <sub>noise</sub>                        | Conversion from Floor Vibration to Noise Levels   | -27 dB          | Reference from KSL EIA Report Appendix 7.1  |
| C <sub>multi</sub>                        | Noise Level Increase due to Multiple Sources  | 0 dB            | Only 1 TBM will be operated   |
| C <sub>cum</sub>                          | Cumulative Effect due to Neighbouring Sites   | 0 dB            | No concurrent project identified within 300m from the NSR   |
| Vibration to Noise                        | Conversion to A-weighted Noise  | -20 dB          | From the "Transit Noise and Vibration Impact Assessment"  |
| <b>Predicted Ground-borne Noise Level</b> |   | <b>40 dB(A)</b> |   |

## Appendix 4.12 Calculation of Construction Ground-borne Noise Levels during Restricted Hours (Mitigated Scenario)

### Ground-borne Noise (GBN) from PME Operation

NSR ID : PHD  
NSR Name : Planned Housing Development (NKIL6579)

#### Construction of New Middle Third Tunnel

| Construction Activity                             | PME | No. of PME | GBN Level       |
|---|-----|------------|-----------------|
| Construction of New Middle Third Tunnel           | TBM | 1          | 40 dB(A)        |
| <b>Overall Predicted Ground-borne Noise Level</b> |     |            | <b>40 dB(A)</b> |
| <b>Evening Ground-borne Noise Criteria</b>        |     |            | <b>55 dB(A)</b> |
| <b>Compliance (Yes/No)</b>                        |     |            | <b>Yes</b>      |
| <b>Night-time Ground-borne Noise Criteria</b>     |     |            | <b>40 dB(A)</b> |
| <b>Compliance (Yes/No)</b>                        |     |            | <b>Yes</b>      |

#### Enlargement of Existing Kowloon bound Tunnel

PME: Hydraulic Breaker

| Item               | Description  |       |       |       |       |       |           | Reference and Assumption   |  |
|--------------------|--|-------|-------|-------|-------|-------|-----------|--|--|
|                    | Octave Band Frequency                                      | 16    | 31.5  | 63    | 125   | 250   | 500 Hz    |  |  |
| $L_{v,rms}$        | Source Vibration Velocity                                  | 0.06  | 0.07  | 0.06  | 0.05  | 0.06  | 0.12 mm/s | Reference from KSL EIA Appendix 7-1  |  |
|                    | Vibration Velocity, ref $10^{-6}$ mm/s                     | 96    | 97    | 96    | 94    | 96    | 102 dB    |  |  |
| $C_{dist}$         | Distance Attenuation: $-20 \cdot \log(R/R_0)$              | -37.7 | -37.7 | -37.7 | -37.7 | -37.7 | -37.7 dB  | R = 420m; $R_0 = 5.5m$   |  |
| $C_{damping}$      | Soil Damping   | 0     | 0     | 0     | 0     | 0     | 0 dB      | Assume no soil damping correction as vibration would transmit through rock layer |  |
| $C_{building}$     | Coupling Loss into Building Structures                     | 0     | 0     | 0     | 0     | 0     | 0 dB      | For conservative approach, no correction is assumed                              |  |
| $C_{floor}$        | Floor to Floor Attenuation                                 | 0     | 0     | 0     | 0     | 0     | 0 dB      | 1 dB/ floor is assumed   |  |
| $C_{noise}$        | Conversion from Floor Vibration to Noise Levels            | -27   | -27   | -27   | -27   | -27   | -27 dB    | Reference from KSL EIA Report Appendix 7.1                                       |  |
| $C_{multi}$        | Noise Level Increase due to Multiple Sources               | 0     | 0     | 0     | 0     | 0     | 0 dB      |  |  |
| $C_{cum}$          | Cumulative Effect due to Neighbouring Sites                | 0     | 0     | 0     | 0     | 0     | 0 dB      | No concurrent project identified within 300m from the NSR                        |  |
| Vibration to Noise | Conversion to A-weighted Noise                             | -56.7 | -39.4 | -26.2 | -16.1 | -8.6  | -3.2 dB   | Standard acoustical principles   |  |
|                    | Ground-borne Noise   | -26   | -7    | 5     | 13    | 23    | 34 dB(A)  |  |  |
|                    | Predicted Ground-borne Noise Level for 1 Hydraulic Breaker |       |       |       |       |       |           | 34.1 dB(A)   |  |

| Construction Activity                             | PME               | No. of PME | GBN Level       |
|---|-------------------|------------|-----------------|
| Enlargement of Existing Kowloon bound Tunnel      | Hydraulic Breaker | 4          | 40 dB(A)        |
| <b>Overall Predicted Ground-borne Noise Level</b> |                   |            | <b>40 dB(A)</b> |
| <b>Evening Ground-borne Noise Criteria</b>        |                   |            | <b>55 dB(A)</b> |
| <b>Compliance (Yes/No)</b>                        |                   |            | <b>Yes</b>      |
| <b>Night-time Ground-borne Noise Criteria</b>     |                   |            | <b>40 dB(A)</b> |
| <b>Compliance (Yes/No)</b>                        |                   |            | <b>Yes</b>      |

#### Rehabilitation of Existing Shatin Bound Tunnel

PME: Hydraulic Breaker

| Item               | Description  |       |       |       |       |       |           | Reference and Assumption   |  |
|--------------------|--|-------|-------|-------|-------|-------|-----------|--|--|
|                    | Octave Band Frequency                                      | 16    | 31.5  | 63    | 125   | 250   | 500 Hz    |  |  |
| $L_{v,rms}$        | Source Vibration Velocity                                  | 0.06  | 0.07  | 0.06  | 0.05  | 0.06  | 0.12 mm/s | Reference from KSL EIA Appendix 7-1  |  |
|                    | Vibration Velocity, ref $10^{-6}$ mm/s                     | 96    | 97    | 96    | 94    | 96    | 102 dB    |  |  |
| $C_{dist}$         | Distance Attenuation: $-20 \cdot \log(R/R_0)$              | -37.7 | -37.7 | -37.7 | -37.7 | -37.7 | -37.7 dB  | R = 420m; $R_0 = 5.5m$   |  |
| $C_{damping}$      | Soil Damping   | 0     | 0     | 0     | 0     | 0     | 0 dB      | Assume no soil damping correction as vibration would transmit through rock layer |  |
| $C_{building}$     | Coupling Loss into Building Structures                     | 0     | 0     | 0     | 0     | 0     | 0 dB      | For conservative approach, no correction is assumed                              |  |
| $C_{floor}$        | Floor to Floor Attenuation                                 | 0     | 0     | 0     | 0     | 0     | 0 dB      | 1 dB/ floor is assumed   |  |
| $C_{noise}$        | Conversion from Floor Vibration to Noise Levels            | -27   | -27   | -27   | -27   | -27   | -27 dB    | Reference from KSL EIA Report Appendix 7.1                                       |  |
| $C_{multi}$        | Noise Level Increase due to Multiple Sources               | 0     | 0     | 0     | 0     | 0     | 0 dB      |  |  |
| $C_{cum}$          | Cumulative Effect due to Neighbouring Sites                | 0     | 0     | 0     | 0     | 0     | 0 dB      | No concurrent project identified within 300m from the NSR                        |  |
| Vibration to Noise | Conversion to A-weighted Noise                             | -56.7 | -39.4 | -26.2 | -16.1 | -8.6  | -3.2 dB   | Standard acoustical principles   |  |
|                    | Ground-borne Noise   | -26   | -7    | 5     | 13    | 23    | 34 dB(A)  |  |  |
|                    | Predicted Ground-borne Noise Level for 1 Hydraulic Breaker |       |       |       |       |       |           | 34.1 dB(A)   |  |

PME: Drill Rig

|  |           |                     |
|--|-----------|---------------------|
| Using the calculated hydraulic breaker noise to correct to Drill Rig Noise | 5.1 dB(A) | 20 log(0.536/0.298) |
| Predicted Ground-borne Noise Level for 1 Drill Rig                         | 39 dB(A)  |                     |

| Construction Activity                             | PME               | No. of PME | GBN Level       |
|---|-------------------|------------|-----------------|
| Rehabilitation of Existing Shatin Bound Tunnel    | Hydraulic Breaker | 1          | 34 dB(A)        |
|   | Drill Rig         | 1          | 39 dB(A)        |
| <b>Overall Predicted Ground-borne Noise Level</b> |                   |            | <b>40 dB(A)</b> |
| <b>Evening Ground-borne Noise Criteria</b>        |                   |            | <b>55 dB(A)</b> |
| <b>Compliance (Yes/No)</b>                        |                   |            | <b>Yes</b>      |
| <b>Night-time Ground-borne Noise Criteria</b>     |                   |            | <b>40 dB(A)</b> |
| <b>Compliance (Yes/No)</b>                        |                   |            | <b>Yes</b>      |