

**Environmental Impact Assessment Ordinance, Cap.499
Guidance Note**

**Preparation of Construction Noise Impact Assessment
Under the Environmental Impact Assessment Ordinance**

(This guidance note supersedes EIAO Guidance Notes No. 9/2004 and 9/2010 with immediate effect)

(Important Note :

The guidance note is intended for general reference only. You are advised to refer to and follow the requirements in the Environmental Impact Assessment Ordinance (Cap 499) and the Technical Memorandum on Environmental Impact Assessment (EIA) Process. Each case has to be considered on individual merits. This guidance note serves to provide some good practices on EIA and was developed in consultation with the EIA Ordinance Users Liaison Groups and the Advisory Council on the Environment. This guidance note may be subject to revision without prior notice. You are advised to make reference to the guidance note current to the date. Any enquiry on this guidance note should be directed to the EIA Ordinance Register Office of EPD on 27th Floor, Southorn Centre, 130 Hennessy Road, Wan Chai, Hong Kong. (Telephone: 2835-1835, Faxline: 2147-0894), or through the EIA Ordinance web site (www.epd.gov.hk/eia)

1. Purpose

- 1.1 This guidance note (GN) serves to provide some good practices to the practitioners on the preparation of Construction Noise Impact Assessment (CNIA) of Environmental Impact Assessment (EIA) studies for designated projects (DPs) under the Environmental Impact Assessment Ordinance (EIAO).
- 1.2 This GN is applicable to all EIA reports where CNIA is required unless otherwise specified in the EIA study brief. It is advisory in nature and is not intended to supersede the relevant Annexes of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM).
- 1.3 The considerations in identifying adverse environmental impacts, criteria for evaluating construction noise impact, contents of an EIA report, guidelines for CNIA, guidelines for the review of an EIA report, contents of Environmental Monitoring and Audit (EM&A) Programme are detailed in Annexes 3, 5, 11, 13, 20 and 21 of the EIAO-TM respectively.
- 1.4 This GN should not be considered as a prescriptive set of rules or an exhaustive manual of methods/techniques. It does not obviate the need for the compliance with all the requirements in the relevant Annexes of the EIAO-TM and the EIA study brief of the project.
- 1.5 The coverage of this GN includes those types of DP that may cause construction noise impacts. The level of information required for individual CNIA and hence the application of relevant parts of this GN is dependent on the type of DP and the surrounding situation in which the DP is located.
- 1.6 This GN is not intended for the assessment of construction noise during restricted hours [i.e. 1900 to 0700 hours on any day not being a general holiday AND at any time on a general holiday as defined under the Noise Control Ordinance (NCO) (Cap. 400)] and construction noise from percussive piling, which is controlled under section 6 of the NCO. For cases where the project proponent would like to evaluate the feasibility of construction

work during restricted hours in the context of construction works programming, a CNIA for the above should be carried out. Regardless of the results of the CNIA for restricted hours, the Noise Control Authority will consider an application under the NCO based on the prevailing condition / situations of adjoining land uses. The CNIA at EIA stage is meant to demonstrate that practical and feasible approaches can be found.

- 1.7 This GN is not intended for the assessment of structural / ground borne construction noise, i.e. noise generated by the construction work transmitted primarily through the ground and the structural elements of the building. In case there is likely structural/ ground borne noise affecting noise sensitive receivers (NSRs), the assessment methodology / model for structural / ground borne noise shall be agreed with the Director of Environmental Protection (the Director) prior to obtaining the empirical parameters required in the ground borne noise model or proceed with the assessment.

2. **Construction Noise Impact Assessment Methodology**

- 2.1 The CNIA should evaluate the construction noise impacts (excluding percussive piling) of a project during daytime, i.e. 0700 to 1900 hours on any day not being a Sunday or general holiday in accordance with the criteria and guidelines set out in Annexes 5 and 13 of the EIAO-TM, and the EIA study brief issued under the EIA Ordinance.

- 2.2 Construction programme formulated during EIA stage is usually subject to significant changes in detailed design stage. Moreover, construction noise impacts can be significantly reduced by adopting quieter construction methods and equipment. Hence, it is considered more realistic and efficient to conduct quantitative CNIA at later stage of the project when project implementation details are available. To streamline the preparation of CNIA in EIA stage, the project proponent shall, unless otherwise agreed by the Director, conduct a qualitative assessment to demonstrate that no adverse construction noise impact would be associated with the project by committing to adopt quieter construction methods and equipment during all construction stages. In such case, the project proponent should demonstrate no adverse construction noise impact associated with the project by firstly identifying the major noise sources/activities, then propose the corresponding quieter construction methods (typical examples are provided in **Appendix A**), and commit to submit a Construction Noise Management Plan (CNMP) to the Director during pre-tender stage, if any, and before commencement of the project. The CNMP should include a quantitative CNIA, proposed adopted quieter construction methods and equipment, recommended noise mitigation measures and a proposed construction noise impact monitoring and audit programme for the project. It should be prepared with reference to the latest plant inventories and, in any case, to be submitted during pre-tender stage for inclusion in the tender document, if any, and before commencement of the project implementation. Any technical constraint that would hinder the use of these quieter construction methods and equipment should be evaluated and clearly recorded in the assessment. The submission of a CNMP during the pre-tender stage, if any, and before commencement of the project implementation will be imposed as a condition in the environmental permit.

- 2.3 Sections 5.3 and 5.4 of Annex 13 of the EIAO-TM stipulate the assessment methodology for construction noise impact. The assessment shall be based on standard acoustic principles. Reference could be made to the relevant technical memoranda issued under the NCO or international standards. Paragraphs 3 to 5 below provide a general reference on the considerations given in adopting construction noise mitigation measures and the

methodology for quantitative CNIA.

3 Identification of Construction Noise Impact

Identification of Assessment Area and Noise Sensitive Receivers (NSRs)

3.1 The assessment area is usually within 300 m from the project boundary. However, if warranted, impacts outside 300 m should also be considered (e.g. noisy rock breaking site formation activities affecting nearby school).

3.2 Regarding identification of NSRs in the CNIA, the approach would be specified in the EIA study brief of the project and examples of NSRs are given in Annex 13 of the EIAO-TM.

3.3 All NSRs, including existing and planned within the assessment area should be identified. Assessment points, representing all identified NSRs, shall be agreed with the Director prior to conducting the noise assessment. However, it may not be necessary to include planned/committed NSRs that will definitely not yet be ready for occupation before completion of the concerned construction work.

Inventory of Noise Sources

3.4 Construction noise impact mainly originates from the use of powered mechanical equipment (PME). The emission inventory of the noise source is a list of PME that would be used to carry out various construction activities for the project. It must be noted that different PME will be used during different stages of the construction work, e.g. site clearance, excavation, earthwork, road pavement, etc. Confirmation of the validity of the inventory shall be obtained from the client government work departments or the project proponent's construction professionals. Where necessary, the construction contractor should also be consulted.

3.5 The PME list must be realistic, practical and practicable in completing the works within the construction works schedule. It should not be artificially or arbitrarily developed to fit in with the noise criteria without any regard to the practicability. It is therefore important that the necessary number and types of PME is included in this list.

3.6 The project proponent should note and take into account of the following when preparing the PME list:-

- a hand held pneumatic drill/breaker (or a few of them) could not possibly handle large volume of rock excavation (e.g. site formation in rocky terrain). Large machine such as drilling rigs or excavator mounted breakers are more commonly used;
- while large diameter bore piling is usually quieter than percussive piling, it may also involve noisy rock breaking activities when encountering rock boulders or rock strata. Chisel or even rock drills may be required;
- for many construction works, concreting would be required, hence, concrete lorry mixer, vibratory poker and crane are usually included in the PME list;
- if work sites are isolated and scattered in small clusters, lorry or even dump truck would be required to deliver construction materials;
- dump truck instead of lorry would be required for disposal of excavated materials offsite, delivery of filling materials or asphalt concrete; and
- filling materials will require compaction, thus relevant PME such as compactor and roller need to be included.

4 Prediction and Evaluation of Construction Noise Impact

Phases of Construction

- 4.1 The project proponent should identify representative phases of construction that would have noticeable varying construction noise impact on existing NSRs within the assessment area for agreement of the Director before commencing the CNIA.

Scenarios

- 4.2 The project proponent shall, unless otherwise agreed by the Director, conduct a qualitative assessment to demonstrate that no adverse construction noise impact would be associated with the project by committing to adopt quieter construction methods and equipment during all construction phases (typical examples are attached in **Appendix A**). Alternatively, if a detailed quantitative CNIA is to be carried out in the EIA study, the project proponent should assess the construction noise impact of unmitigated scenario and mitigated scenario at different phases of construction of the project with respect to criteria set out in Annex 5 of the EIAO-TM.

Prediction of Noise Impact

- 4.3
- (a) The assessment should cover the cumulative construction noise impact resulting from the construction works of the project and other concurrent projects identified during the course of the EIA study on existing NSRs within the assessment area.
 - (b) The potential construction noise impact under different phases of construction shall be assessed by estimating the total number of dwellings, classrooms and other NSRs that will be exposed to noise impact exceeding the criteria set out in Annex 5 of the EIAO-TM.
 - (c) The project proponent should, as far as practicable, formulate a reasonable construction programme so that no work will be required in restricted hours as defined under the NCO.

5 Mitigation of Construction Noise Impact

Direct Mitigation Measures

- 5.1 The project proponent should consider and evaluate the possible application of all direct mitigation measures including but not limited to, quieter alternative methods (e.g. use of non-explosive chemical expansion agent, non-percussive construction method, etc.) and equipment (e.g. use of bored piles, and press-in piler for sheet piles, to replace percussive piling), movable barriers, enclosures, re-scheduling, restricting hours of operation of noisy tasks, etc. The feasibility, practicability, programming and effectiveness of the recommended mitigation measures shall be assessed. Any direct mitigation measures recommended should be well documented in the CNIA. Specific reasons for not adopting certain direct mitigation measures should be clearly substantiated and documented in the CNIA.

- 5.2 Some commonly used and quantifiable direct mitigation measures are listed below:

- use of quieter PME;
- use of quieter alternative construction method; and
- use of noise barriers / enclosure.

- 5.3 It must be noted that reduction of percentage on-time is not a viable mitigation measure for PME. In particular, it should not be considered as a direct way to mitigate the construction noise after the assessment found exceedance in the unmitigated construction noise levels. Nonetheless, for some PME which only operate for a short period of time in 30 minutes (e.g. concrete lorry mixer in case of concreting and dump truck in case of disposal of excavated materials in roadside), a reasonable reduction in percentage of operating-time within a given period (i.e. percentage on-time) to reflect the actual situation could be accepted as a basic assumption for the assessment when involving these PME.
- 5.4 In the EIA study brief, there would be a requirement to identify, assess and minimize any side effects and resolve potential constraints arising from the inclusion of any recommended direct mitigation measures. For example, secondary impact such as safety, firefighting and obstruction in relation to temporary noise barrier should not be ignored.
- 5.5 Quieter PME refer to those PME which could deliver the same output but having a sound power level lower than that stipulated in the Technical Memorandum on Noise from Construction Work other than Percussive Piling (GW-TM). The common source of such information could be found in EPD's Quality Powered Mechanical Equipment System, EPD's list of "Sound power levels of other commonly used PME", or international standard / certification, e.g. EC directives on outdoors equipment or Germany's Blue Angel Label. However, the consultants should also confirm that the quoted PME are readily available for use in the local construction market.
- 5.6 As stated in paragraph 3.4 above, the project proponent's construction professionals and if necessary the construction contractor should be consulted in the preparation of the PME list. Sometimes, consultants would propose alternate PME, which are not necessarily viable, to replace those noisier counterparts, for example:-
- a lorry to replace dump truck (dump truck has a tilting bin but a lorry does not);
 - an air compressor with a lower air flow rate to replace the one with higher flow rate (this could be viable only when the nature and requirement of works do not need higher air flow);
 - a breaker with lower sound power level to replace a noisier one [the hand held pneumatic percussive breaker commonly used in the local construction industry is the one of 37 kg (CNP 026) and pneumatic breaker, hydraulic breaker and electric breaker lighter in weight and quieter may not perform the same duty]; and
 - a hand held pneumatic rock drill cannot replace the output of a hydraulic crawler mounted rock drill.
- 5.7 Use of noise barriers is a possible solution to mitigate construction noise. In general, a 5 dB(A) reduction for movable PME, 10 dB(A) for stationary PME and about 15 dB(A) for enclosed PME can be assumed depending on the actual design. The viability of using barriers depends on whether there is sufficient space available. Another concern is safety. A temporary barrier might not be suitable for erecting along a lane closure in highway as the barrier might be knocked down by vehicles. It might also be not possible to enclose large and moving PME, e.g. excavator & dump truck, etc. If there is only one nearby NSR, the consultant could explore the possibility of locating the barrier near the NSR to optimize the mitigation package.
- 5.8 It must be noted that reduction in number of PME is not a viable mitigation measure for

construction noise impact arising from PME. This should never be considered as a direct way to mitigate the construction noise and there will also be practical problem in the implementation. Nonetheless, some PME for different activities need not be assessed together, as in reality they would not be operated at the same time, e.g. road milling and road paving at the same location. They can be assessed separately by grouping.

- 5.9 Site formation or rock excavation by means of non-percussive quieter construction methods such as chemical expansion agent or pulse plasma rock fragmentation shall be considered as far as practicable, and use of excavator-mounted breaker or blasting with explosives shall be kept in minimum. Any technical constraint that would hinder the use of these quieter construction methods shall be evaluated and clearly documented in the assessment. In case it is unavoidable to carry out rock blasting with explosive means, it shall be carried out, as far as practicable, during daytime, i.e. 0700 to 1900 hours on any day not being a Sunday or general holiday, and with implementation of the best practicable noise mitigation measures. In addition to quieter construction methods for site formation, to minimize the construction noise impact, alternative non-percussive piling construction methods (such as bored piles, and press-in piler for sheet piles, to replace percussive piling) shall be proposed as far as practicable.
- 5.10 Other mitigation measures, such as good site practice, etc. which are not quantifiable should not be taken into account in working out the mitigated noise levels.
- 5.11 Common mitigation measures for alleviating construction noise impacts have been briefly discussed above. Some examples of projects which had successfully adopted quieter measures are listed below for reference:-
- tunnel boring machine replace "cut and cover" for tunneling, e.g. Shatin Central Link project, which had greatly reduced the number of NSRs being affected;
 - use of concrete crushers instead of excavator mounted breakers in the demolition of Yau Ma Tei Carpark Building of the Central Kowloon Route project;
 - adaptation of pulse plasma rock fragmentation technology instead of dill and break method using excavator-mounted breaker for rock breaking in Lam Tei Quarry;
 - chemical agent (non-explosive blasting) to replace rock drilling/breaking, e.g. in a North Point residential site;
 - hydraulic press-in method to replace drop/ vibrating hammer for construction of the temporary retaining wall for Tai Wai Station;
 - "cut and lift method" for demolishing bridge structures in lieu of traditional "breaking up" method, e.g. a footbridge over Tuen Mun Road near Sham Tseng, where the main span of the footbridge was cut and lifted off in short sections for disposal off-site. This will reduce the duration of on-site works;
 - acoustic doors at tunnel portals to prevent noise outbreak, e.g. South Island Line, Tseung Kwan O - Lam Tin Tunnel;
 - use of water as blast ballast in the excavation of the construction adit of the West Island Line; and
 - acoustic enclosure to enclose the vertical shaft at King George V Memorial Park for the construction of West Island Line project and at the Ho Man Tin Ventilation Shaft for the Central Kowloon Route project.
- 5.12 The above list is not exhaustive and it should be considered on a case-by-case basis. The project proponent should also make reference to other methods listed on Quieter Construction Methods EPD's website

https://www.epd.gov.hk/epd/misc/construction_noise/contents/index.php/en/home2/quiet-construction-methods.html).

- 5.13 Should the works involve the work processes (e.g. concrete removal, demolition, foundation works, general building works, road works, tunneling and pipe installation) as mentioned on the above website, or the use of conventional PME for which quieter options are available (e.g. excavator/loader, bulldozer, excavator mounted breaker, piling machines), the project proponent should evaluate the practicability of adopting the quieter alternative as given on the website. Any technical constraint that would hinder the use of these quieter alternatives should be evaluated and clearly recorded in the CNIA.
- 5.14 The project proponent should involve the construction professionals at an early stage and encourage development and implementation of innovative noise mitigation measures. In general, these more noise innovative mitigation measures should be considered when:
- there are residual impacts after implementation of noise mitigation measures;
 - the work site is close to NSRs;
 - there are NSRs on all sides of the site; or
 - same noisy construction activities would continue at the same location for a long period of time.

6 Requirement of CNMP

- 6.1 The submission of a CNMP can be imposed under the EP, particularly for the EIA studies only having undergone qualitative assessment as mentioned in paragraph 2.2 of this GN. The CNMP shall typically include the following information:
- Detailed CNIA
 - Construction works programme and construction methodology;
 - PME list for the construction work;
 - Construction noise impact assessment; and
 - List of noise mitigation measures to be adopted.
 - The conditions to be incorporated in the tender document (if any) include the recommended mitigation measures and the relevant requirement for the submission of an updated CNMP, should there be any change to the construction noise mitigation measures and/or plant inventory recommended in the submitted CNMP.
- 6.2 Under the EP, the CNMP usually needs to be submitted to the Director no later than 2 months before the issuance of the tender of the project, if any, and before commencement of the project implementation. If there is any change to the construction noise mitigation measures and/or plant inventory recommended in the submitted CNMP, an updated CNMP should be submitted to the Director, no later than one month before the implementation of any of such change.
- 6.3 The CNMP / updated CNMP shall include an implementation schedule clearly listing out the mitigation measures, the implementation party, location and timing of implementation. The CNMP / updated CNMP shall be prepared and checked by Certified Noise Modelling Professional as recognized by the Hong Kong Institute of Qualified Environmental Professionals Limited or equivalent as meeting the requirements given in this GN. The

CNMP / updated CNMP shall then be certified by the Environmental Team (ET) Leader, verified by the Independent Environmental Checker (IEC) as conforming to the relevant information and recommendations of the approved EIA report. All mitigation measures recommended and requirements specified in the CNMP / updated CNMP shall be fully implemented.

- 6.4 The CNIA contained in the CNMP / updated CNMP shall follow the principles mentioned in paragraph 4 of this GN. In proposing the mitigation measures, the project proponent shall make reference to the principles given in paragraph 5 of this GN, and include the quieter construction methods identified in the EIA process.
- 6.5 During the course of preparation of the CNMP / updated CNMP, the project proponent should involve the construction professionals as early as possible. For large scale projects, the project proponent is encouraged to prepare the CNMP as early as possible so as to avoid causing any delay on the tendering process, if any, and project implementation as mentioned in paragraph 6.2 above.

7 **Conclusion**

- 7.1 This document attempts to provide good practices for general reference in preparing a CNIA. Though it is expected that the guidelines could be followed for most of the situations, one should always exercise sound professional judgment on the appropriateness, practicability, feasibility and acceptability of the proposals and recommendations made in the CNIA.

Environmental Protection Department

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Typical Quieter Construction Methods / Equipment

Processes	Conventional Practices	Alternative Quieter Construction Methods / Equipment
Tunneling (large scale)	Cut and cover method using excavator-mounted breaker	Use of tunnel boring machine
Laying or replacement of large diameter pipe	Cut and cover method using excavator-mounted breaker	Pipe jacking using micro tunnel boring machine
Rehabilitation of underground pipe	Cut and cover method using excavator-mounted breaker	Quiet pipe rehabilitation methods (e.g. Cured-in-place-pipe lining, Ribline spiral wound method)
Site formation (concrete or rock breaking)	Drill and break method using excavator-mounted breaker	<ul style="list-style-type: none"> - Use of hydraulic splitter, hydraulic crusher/ quieter type saw (e.g diamond wire saw, noise reducing diamond blade saw) - Non-explosive chemical expansion agent (soundless chemical demolition agent) - Pulse plasma rock fragmentation technology
Piling (sheet pile / H-beam pile)	Percussive piling (e.g. percussive hammer, vibration hammer)	Use of silent piling such as hydraulic press-in method
Piling for foundation works	Percussive piling	Large diameter bored piling
Building / structure demolition (Large scale)	Excavator-mounted breaker	<ul style="list-style-type: none"> - Use of hydraulic crusher - Non-explosive chemical expansion agent (soundless chemical demolition agent) - Use of quieter type saw (e.g diamond wire saw, noise reducing diamond blade saw)
Building / structure modification works	Excavator-mounted breaker	<ul style="list-style-type: none"> - Use of quieter type saw (e.g diamond wire saw, diamond blade saw) - Robot-type hydraulic crusher or handheld concrete crusher

Processes	Conventional Practices	Alternative Quieter Construction Methods / Equipment
Road works (Concrete compacting)	Vibratory Poker	Self-compacting Concrete or Rubber Head Poker Vibrator
Building works (Superstructure)	In-situ construction	Use of pre-casting and prefabrication technology
Formwork Installation	Timber formwork by hammer and drilling	Modular lightweight formwork

Purpose-built Noise Enclosure

The project proponent could evaluate the practicability to provide the best mitigation measures in the form of purpose-built noise enclosure to cover the equipment as fully as possible. The noise enclosure should also be internally lined with sound absorbing materials such as mineral wool. Any opening or gap in the enclosure will tend to compromise the noise reduction effect and should therefore be minimized. Where access and forced ventilation is required for the enclosure, proper acoustic door and suitably designed silencers fitted with the air intake and outlet should be installed.