

**Railway Protection under Railways Ordinance,
Mass Transit Railway (Land Resumption and Related Provisions) Ordinance and
Area Number 3 of the Scheduled Areas in Schedule 5
to the Buildings Ordinance**

As a result of the merger of the Mass Transit Railway Corporation and the Kowloon-Canton Railway Corporation (KCRC) on 2 December 2007, the MTR Corporation Limited (MTRCL) becomes the operator of all the railway lines in the territory. The existing railway lines in operation are listed in Appendix A.

2. To safeguard the safety and stability of the railway structures and facilities¹, railway protection areas have been delineated and shown on relevant plans and a set of building/engineering guidelines has been specified. A copy of the plans showing the railway protection areas is available for viewing in MTRCL's office by appointment via email (RPNotify@mtr.com.hk). Relevant information are available at MTRCL's website².

3. As a general guide, the boundary of the railway protection areas is about 30 m outside the outer surface of the railway structures and facilities or the railway fence/wall, or from the nearest rail if there is no railway fence/wall, but it may encompass the whole of any lot where any part thereof lies within the 30 m distance. At the railway stations, the area enclosed by the boundary may be more extensive.

4. The railway protection areas of some of the railway lines are designated as Area Number 3 of the scheduled areas in Schedule 5 to the Buildings Ordinance (BO). Such protection areas are delineated and shown edged black on the plans as listed out in the Schedule, which will be updated from time to time as and when necessary. A copy of these plans has been deposited in the Land Registry and is available for viewing in the Building Information Centre of the Buildings Department (BD) or BD's website³ as detailed in Practice Note for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers (PNAP) APP-39.

/5. ...

¹ The common types of railway structures and facilities comprise station structures, viaducts, tunnels, platforms, ventilation shafts, overhead line masts, tracks, ancillary buildings, underground cooling water mains or other utilities, etc.

² https://www.mtr.com.hk/en/corporate/operations/protection_boundary.html

³ <https://www.bd.gov.hk/en/resources/codes-and-references/scheduled-areas/index.html>

5. The guidelines at Appendices B and C apply to all building works (including ground investigation works and underground drainage works) to be carried out in the railway protection areas. Ground investigation works and underground drainage works in Area Number 3 of the scheduled areas are subject to additional control as stated in paragraphs 13 and 14 below. While the guidelines are not applicable to the part of the lot that lies outside the railway protection areas, authorized persons (AP)/registered structural engineers (RSE)/registered geotechnical engineers (RGE) should ensure that building works outside the railway protection areas will not cause any adverse effects or damage to or render inadequate the factor of safety of any railway structures or facilities.

Building Works

6. Plans submitted to BD for proposed building works within the railway protection areas will be circulated to MTRCL for their comment under the centralised processing arrangements. Section 27 of the Railways Ordinance (RO) (Cap. 519) or section 15 of the Mass Transit Railway (Land Resumption and Related Provisions) Ordinance (MTR(LR&RP)O) (Cap. 276) will be invoked to require the incorporation of any necessary measures to protect the railway lines.

7. AP, RSE and RGE are required to monitor and assess the impact of any movement, vibration and/or other effects induced by the building works on the railway structures and facilities. A monitoring plan with particulars solely for monitoring the railway structures and facilities should be included in the plans submitted to the Building Authority (BA) for approval in respect of site formation works, foundation works, excavation and lateral support works and other types of building works which would cause ground movement/vibration affecting the railway structures and facilities. Apart from obtaining consent for commencement of works from the BA, AP, RSE and RGE are required to inform MTRCL directly the commencement of any building works within the railway protection areas, and send a copy of the monitoring records to MTRCL at bi-weekly intervals or at a frequency to be agreed by MTRCL during the whole process of the building works concerned. MTRCL will also plan an appropriate monitoring programme and will alert the parties concerned if any adverse situation of the railway structures and facilities becomes apparent.

8. In addition to the monitoring of railway structures and facilities, AP, RSE and RGE should maintain regular contact with MTRCL and keep MTRCL informed of the records of any necessary monitoring within and in the vicinity of the building site (e.g. monitoring of piezometric change, ground movement) as necessary.

9. The Director of Buildings may in writing, under the provisions of section 12 of the MTR(LR&RP)O authorise an employee of MTRCL to enter any building site within the railway protection areas for the purpose of monitoring the construction works. Alternatively, the Secretary for Transport and Logistics may issue such notice under the provisions of section 24 of the RO.

/Communication ...

Communication and Announcement Mechanism for Private Construction Works within Railway Protection Areas

10. BD, the Electrical and Mechanical Services Department (EMSD) and MTRCL have established a communication and announcement mechanism for private construction sites within railway protection areas.

11. During the construction of a private development project, if any monitoring checkpoint within railway protection areas records a reading reaching the pre-set limit for suspension of construction works set by BD or MTRCL, or in any other circumstances where BD, EMSD or MTRCL considers the safety of railway structures, facilities or operations has been so affected that warrants suspension of construction works⁴, the three parties will notify each other immediately. A joint press release by BD and EMSD will be issued within 48 hours upon the suspension of works requested by BD, EMSD or MTRCL, or voluntarily initiated by AP/RSE of the development project. MTRCL will also issue a separate press release.

12. For announcement of resumption of the suspended works, a joint press release by BD and EMSD will be issued within 48 hours after AP/RSE's application for resumption of suspended works⁵ has been agreed by BD, EMSD and MTRCL.

Ground Investigation Works and Underground Drainage Works

13. The practice of monitoring building works being carried out above railway structures has proved very effective and a number of potentially dangerous ground investigation operations have been identified. Particularly dangerous are ground investigation works where carelessness may result in the drill bit breaking through an underground railway tunnel with the possibility of striking a train.

14. Ground investigation works within Area Number 3 of the scheduled areas require prior approval and consent from the BA. Plans prescribed under regulation 8(1)(l) of the Building (Administration) Regulations should be submitted and the proposals should follow the guidelines at Appendix B. Application for concurrent processing of approval and consent in respect of ground investigation works should follow PNAP ADM-16. Apart from those underground drainage works which may be carried out under the simplified requirements of the Minor Works Control System (MWCS) as mentioned in paragraph 16 below, underground drainage works in any building to be carried out in Area Number 3 of the scheduled areas are not exempted from application for approval and consent to commence works and are subject to the full provisions of the BO.

15. Proposals for ground investigation works or underground drainage works in or for any existing buildings to be carried out within railway protection areas other than those designated as Area Number 3 of the scheduled areas should be forwarded to MTRCL for comment prior to commencement of the proposed works.

/Minor ...

⁴ In principle, all works that would induce adverse impact on the affected railway structures/facilities should be suspended once the pre-set "Action" limit is reached. The extent of works to be suspended may be predetermined and specified in the prescribed plans for the BA's approval.


⁵ Partial resumption of the suspended works may be allowed if there are sufficient justifications to ensure the safety of the railway structures, facilities and operations.

Minor Works

16. Upon receipt of minor works (MW) submission for notice of commencement of Class I and Class II MW involving spread footing, excavation or underground drainage works within Area Number 3 of the scheduled areas to be carried out under the simplified requirements of the MWCS, BD would forward a copy of the MW submission to MTRCL. MTRCL would then convey their comments to the prescribed building professionals (PBP)/prescribed registered contractors (PRC) directly. PBP/PRC should inform MTRCL and obtain their agreement before commencement of the MW. Section 27 of the RO or section 15 of the MTR(LR&RP)O will be invoked in case the proposed MW would be incompatible with any works for the construction, maintenance or improvement of the railway and facilities or with the operation thereof.

Guidelines for Registered Contractors

17. A similar practice note has been issued to registered contractors.



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List of Railway Lines in Operation

1. Airport Express
2. Disneyland Resort Line
3. East Rail Line
4. High Speed Rail
5. Island Line
6. Kwun Tong Line
7. Light Rail
8. South Island Line
9. Tseung Kwan O Line
10. Tsuen Wan Line
11. Tuen Ma Line
12. Tung Chung Line

**Guidelines on Carrying Out Building Works
Within Railway Protection Areas**

A. General

All proposals for building and engineering works including utilities works within the railway protection areas should be subject to special scrutiny of BD and other relevant government departments in consultation with MTRCL prior to giving approval to any plans and/or consent for the commencement and carrying out of such works. Every proposal should be assessed individually on its impact on existing railway and related structures and facilities including all plants and fixtures necessary for the safe operation of the railway and subject to satisfactory compliance with the following technical requirements.

B. Design, Planning and Construction of Building Works within Railway Protection Areas

(a) Ground investigation works

Ground investigation proposals should include the following:

- (i) Details of the exploration and locations of the proposed exploration holes, trial pits, trenches, field testing or instrumentations relative to any railway structures and facilities whether inside or outside the lot;
- (ii) Proposed depth of boreholes/drillholes, pits or trenches;
- (iii) A method statement for sinking boreholes/drillholes, excavating trial pits and trenches including back-filling, conducting field testing or installing instrumentation;
- (iv) A method statement for checking verticality of boreholes/drillholes located within a distance of 10 m on plan of any point of the underground railway structures and facilities, should boreholes/drillholes be sunk to a depth of 3 m from the highest point of the railway structures and facilities; and
- (v) A method statement for controlling the depth of boreholes/drillholes to be sunk within a distance of 3 m on plan of any point of the underground railway structures and facilities.

Each proposal will also be judged against the requirements as specified in item (b) below.

/(b) ...

(b) Site formation, foundation and excavation works

Where site formation, foundation or excavation works, etc. are proposed above, beneath or adjacent to railway structures and facilities, the following requirements should be complied with:

- (i) Unless prior special agreement of MTRCL has been obtained, no pile, foundation, borehole/drillhole, well, soil nail, horizontal drain, rock bolt/dowel or other geotechnical installation should be driven, constructed or installed within a distance of 3 m from any point of the underground railway structures and facilities;
- (ii) Unless prior special agreement of MTRCL has been obtained, piling works will not be permitted within 3 m on plan from the railway fence or wall along the railway structures and facilities, or 7 m on plan from the centreline of the nearest track when there is no railway fence or wall;
- (iii) Any part of an anchor, if allowed, should be more than 3 m away from any part of a railway structure/facility, and the centroid of the fixed length of the anchor should be more than twice the fixed length away from any railway structures and facilities; and
- (iv) The vertical or horizontal pressure change on any underground structures and facilities due to the works, including excavation, filling, ground improvement, dewatering and field testing (such as plate loading test, pressure-meter test and packer test), and due to the addition or reduction of loads transmitted from foundations (including any loads arising during construction), should not exceed 20 kPa¹.

(c) Demolition works

Where demolition and removal works for any structure which includes scaffolding, advertising signs, container offices and buildings are proposed above or adjacent to above-ground railway structures such as entrances, vent shafts, power distribution substations, traction substations, plant rooms, overhead railway structures and at-grade railway tracks, effective measures to protect the railway structures and facilities should be provided.

(d) Building openings adjacent to railway ventilation facilities

There are certain restraints on the design of and making alteration to properties in close proximity to railway ventilation facilities to minimise the possibility of contamination by fire or smoke. In this connection, AP/RSE are advised that any opening such as an openable or fixed window,

/doorway ...

¹ This 20kPa limit is set for avoiding any adverse effects on underground railway structures and facilities. This limit may be reviewed on a case-by-case basis, subject to MTRCL's and BD's acceptance when engineering approach is adopted.

doorway, building ventilation system intake or exhaust and the like in any building should be located not closer than 5 m to the ventilation opening of any railway ventilation facilities, irrespective of whether such ventilation facilities are free-standing or accommodated in a building. This distance may be reduced to 2.5 m, if the exhaust air from the railway ventilation facilities is directed away from and is not likely to affect the opening by natural convection.

(e) Scaffolding, advertising signs and projections

Erection of scaffolding, working platforms, advertising signs or any projections at a level above the railway tracks should not be allowed within a distance of 6 m on plan of any point of the railway tracks, without the agreement of MTRCL. When such works are permitted to be carried out within the 6 m limit, effective measures to protect the railway structures and facilities should be provided. According to individual circumstances, it may be necessary for such works to be conducted outside the railway operation hours. All protective works should comply with the relevant ordinances and their subsidiary regulations.

(f) Vertical greening systems

Any vertical greening systems should be located not closer than 5 m to the ventilation opening of any railway ventilation facilities.

(g) Protection of open section railways from fallen objects

During the carrying out of the construction works, proper protection of the railway tracks from fallen objects must be provided at all times by the erection and maintenance of suitable hoardings, covered walkways and gantry, and catch platform. Reference should be made to PNAP APP-102. AP/RSE should take into consideration the risk of falling objects on the railway track and adopt mitigation measures as appropriate.

(h) Flood protection

For a building that adjoins or is integrated with the railway structures and facilities, its drainage system should be designed to prevent any possible flooding arising from blockage of drains, bursting of water pipe, etc. from entering the railway structures and facilities.

For construction sites adjacent to and/or adjoining railway structures and facilities, an effective site drainage system should be provided to prevent any foul and/or storm water from entering the railway structures and facilities. Such flood protection measures should be agreed with MTRCL.

/(i) ...

(i) Marine works

Any reclamation, dredging, laying of submarine pipes or other engineering works to be carried out in proximity to the railway immersed tunnel and marine structures should be submitted for approval in consultation with MTRCL.

(j) Sinking of wells

Sinking of wells within railway protection areas is building works subject to the control of the BO including section 14(1) thereof. Before the carrying out of the works, the approval of plans and consent for the commencement of such works should be obtained from the BA.

C. Requirements for Monitoring the Effects on Railway Structures and Facilities Arising from Building Works within Railway Protection Areas

AP/RSE/RGE may use one of the following approaches to monitor the effects on railway structures and facilities arising from the proposed building works of a specific site. AP/RSE/RGE should take into full consideration not only the affected railway structures and facilities, but also the proposed building works, construction sequence, site conditions, geological profiles, precautionary measures and other related factors in choosing which approach to be adopted. In addition, AP/RSE/RGE should carefully predict the “Alert, Alarm, Action” levels in order to minimise further changes during the construction stage which might bring about unnecessary public concerns and construction hindrance.

(a) Empirical approach

Different railway structures and facilities will have different tolerance in accommodating movements, vibration and/or other effects. In the absence of an engineering analysis agreed by MTRCL, the effect of building works on railway structures and facilities should not exceed the following empirical limits²:

- (i) Differential movement resulting from the works should not produce angular distortion in any railway structures and facilities including the plinth or track in excess of 1 in 1 000 in any plane or a total movement in any railway structures and facilities including the plinth or track exceeding 20 mm in any plane;
- (ii) The induced level difference between rails of a track in perpendicular plane resulting from the works should not exceed 5 mm;

/(iii) ...

² A set of more stringent values may need to be adopted if the empirical limits are considered insufficient to ensure the structural integrity, stability, serviceability and/or functionality of the railway structures and facilities as well as the operational safety of railway (e.g. railway structures with previous settlement records).

- (iii) The maximum peak particle velocities (ppv) induced to any railway structures resulting from blasting (where permitted) and from driving or withdrawing of piles or any similar operation which can induce prolonged vibration should not exceed 25 mm/sec and 15 mm/sec respectively, when measured with a vibrograph;
- (iv) Vibration measured on the overhead power line mast, or signalling and telecommunication furniture of railway should not exceed the ppv of 10 mm/sec and the vibration amplitudes should not exceed 80 μ m; and
- (v) While the requirements for controlling vibrations and settlements as specified in PNAP APP-137 should be followed, the “Alert”, “Alarm” and “Action” levels should be taken as approximately 50%, 75% and 100% respectively for movement, and 60%, 80% and 100% respectively for vibration of such empirical limits. Hence, the levels to be adopted should be as follows:

Criterion		Alert	Alarm	Action
Angular distortion in any plane		1:2 000	1:1 350	1:1 000
Total movement in any plane		10 mm	15 mm	20 mm
Level difference between rails of a track in perpendicular plane		2.5 mm	3.8 mm	5 mm
ppv induced to any railway structures	blasting	15 mm/sec	20 mm/sec	25 mm/sec
	prolonged vibration	9 mm/sec	12 mm/sec	15 mm/sec
Vibration measured on the overhead power line mast, or signalling and telecommunication furniture of railway	ppv	6 mm/sec	8 mm/sec	10 mm/sec
	vibration amplitude	48 μ m	64 μ m	80 μ m

(b) Engineering approach

RSE/RGE may adopt engineering approach to establish a set of site-specific limits³. RSE/RGE should include in the submission of plans a proposal of preventive and mitigation measures to be implemented prior to and during the works, and a detailed and comprehensive assessment on the effects of the proposed works with respect to the integrity, stability, serviceability and functionality of the railway structures and facilities, as well as the

/operational ...

³ Subject to MTRCL’s and BD’s acceptance on a case-by-case basis, the engineering approach may also be adopted for the assessment of any adverse effect on railway structures and facilities.

operational safety of the railway. Guidelines on the engineering approach are given in Appendix C of this PNAP.

To facilitate early clearance of the basic design principles for adopting the engineering approach before formal submission of plans, RSE/RGE should make use of the pre-submission enquiry service for obtaining BD's determination on the matters. BD may hold pre-submission conferences with AP/RSE/RGE and invite representatives of government departments and MTRCL to discuss and examine the issues and principles involved.

D. Other Requirements

(a) Maintenance of road lamp standards

When road lighting tower maintenance vehicles are to be used to service road lamp standards adjacent to railway tracks, the working equipment should not be positioned closer to the railway tracks than the nearest part of the road lamp standard where the height of the lamp standard is greater than the height of the tracks. If the working equipment is to be operated at a level higher than 1 m above railway tracks and closer than 6 m from the railway tracks, effective measures subject to the agreement of MTRCL should be provided. According to individual circumstances, it may be necessary for such works to be conducted outside the railway operation hours.

(b) Fire services/police vehicles

The operation of fire services/police vehicles adjacent to the railway tracks or vent shafts under emergency situations should be in accordance with the emergency procedure agreed between MTRCL and the respective organisation.

(c) Tree planting works

For tree planting works within railway protection areas, the respective planting proposal should be sent to MTRCL for comment. The tree planting proposal should provide an estimation of the sizes (including height and spread width at maturity) of the proposed trees where possible. The tree planting locations should be agreed by MTRCL such that collapse of tree trunk or branches would not affect the railway operation, including the supporting facilities (e.g. power supply, signalling system). In addition, trees should not be planted at a distance less than 2 m away from the nearest rail of the unfenced railway section.

/(d) ...

(d) Operation of stationary lifting appliance and working equipment

- (i) Where stationary lifting appliance (e.g. tower crane, hoist) are erected adjacent to railway tracks and/or above ground structures and facilities; or mobile plant/lifting appliance (e.g. excavator, mobile crane, piling rigs) operating within 6 m on plan of railway structures and facilities with any part of the appliance higher than the railway track level; effective measures to protect the railway structures and facilities should be provided. All protective works should be subject to agreement of MTRCL. MTRCL may impose conditions on the operation and positioning of the appliance and equipment if it is considered that such operation and positioning may endanger the safe operation of the railway.
- (ii) The arc in which the jib of lifting appliance swings should not encroach within 6 m of the railway tracks and/or above ground structures and facilities on plan except with the agreement of MTRCL. According to individual circumstances, it may be necessary for such works to be conducted outside the railway operation hours.

(e) Storage of materials

No materials, dangerous goods or other inflammable, containers, huts, etc. should be stored/placed/erected within 6 m on plan of the railway structures/tracks and ventilation openings without agreement of MTRCL. Storage of dangerous goods or other inflammable materials should comply with the relevant ordinances and their subsidiary regulations.

(f) Utility works

- (i) Utility trenches/pits which require excavation within the railway protection areas should not be carried out without the approval of the relevant government departments in consultation with MTRCL.
- (ii) When cables, ducts and pipes, etc. are to cross above or below railway overhead structures and facilities, the utility undertaking should submit to MTRCL details of the cables, ducts, pipes and the method of construction and seek agreement of MTRCL prior to the commencement of works. When utility works are to be carried out across the at-grade railway tracks, agreement from MTRCL has to be sought before commencement of works.

**Guidelines¹ on Engineering Approach for Movement Control and
Assessment of the Effects on Railway Structures/Facilities and Operations**

Objective

1. To control the effects induced to existing railway structures and facilities due to the proposed building works to within a set of control limits determined by engineering assessment and analysis.

Information Required for Adoption of Engineering Approach

2. The following information is required for conducting the engineering assessment and analysis:
 - (a) The existing ground and groundwater conditions, soil/rock parameters, etc.;
 - (b) As-built information, design assumptions and calculations of the affected railway structures and facilities;
 - (c) Historical movement records of the affected railway structures/facilities obtained from MTRCL, if available;
 - (d) Details of the proposed preventive and mitigation measures (e.g. ground improvement works, temporary supporting works) together with a discussion on their effectiveness, method of verification and limitations; and
 - (e) A structural appraisal report on the existing conditions of the affected railway structures and facilities.

Precautionary and Preventive Measures

3. The engineering approach should be formulated to explore a combination of different feasible precautionary and preventive measures to arrive at an optimal design of the proposed building works for the most effective control of movements of the railway structures and facilities. Examples include the following:
 - (a) Re-planning of the proposed building works (e.g. alternative foundation scheme, setback of foundations and/or excavation works);

/(b) ...

¹ The guidelines apply to ground/building movements. RSE/RGE may follow the same principles for assessment of any adverse effect on railway structures and facilities and devise the necessary monitoring system.

- (b) Ground improvement works (e.g. pre-grouting, post-grouting);
- (c) Enhanced construction methods and sequence (e.g. pre-boring, pre-grouting, use of permanent casings for replacement type piles, limiting the number of drilling/piling rigs operating concurrently in close proximity, site specific control of air flushing pressure and drilling rate and time during piling operations);
- (d) Enhanced excavation and lateral support system (e.g. pre-loading, additional layers of strut/waling, carrying out excavation and de-propping works zone by zone);
- (e) Providing sufficient observation and re-charge wells for monitoring and maintaining the groundwater level; or
- (f) Provisions for enhancing water cut-off (e.g. vertical piled wall found at deeper level, toe grouting).

Ground Movement Analysis

4. A detailed ground movement analysis² for each type and stage of the proposed works with justifications of soil parameters and design assumptions adopted should be submitted together with the prescribed plans.

Structural Assessment on Railway Structures and Facilities

5. As different railway structures/facilities have different tolerance limits in accommodating movements, the acceptable level of movements may be different for individual railway structures/facilities and the assessment should be considered on a case-by-case basis.
6. The structural integrity, stability and functionality of railway structures/facilities affected should be assessed for each critical stage of the proposed building works based on the estimated values of ground movements and the ultimate and serviceability limits of the affected railway structures/facilities in accordance with recognised engineering principles and/or by making reference to item C(a)(v) of Appendix B if applicable.

/Formulation ...

² The detailed ground movement analysis which also considers the effects on railway structures and facilities can be carried out using mathematics models and computer methods for estimation and assessment purposes. If the ground movement induced by the site work cannot be predicted by using well recognised mathematics models or computer methods, AP/RSE/RGE can estimate the ground movement by experience based on similar nature of ground conditions and/or proposed construction methods, or by using conventional techniques (e.g. trial installation on site) to estimate a certain degree of ground movement which will then be submitted to MTRCL and BD for acceptance.

Formulation of “Alert, Alarm, Action (AAA)” Trigger Values for Ground/Building Movement

7. The combined effects of ground/building movement due to different types of the construction works to be carried out concurrently within a construction site (e.g. piling and excavation works being carried out concurrently) and the cumulative effects at different critical stages of the construction works (e.g. vertical piled wall installation, staged excavation and strutting installation in basement construction) should be assessed. For effective monitoring and control of movements and/or any other effects during the works, the construction process should be divided into a number of critical stages taking due consideration of the construction sequence and procedures such that the estimated movement in each critical stage should not be less than 10% or more than 50% of the estimated total movement of the particular construction works.

In addition, the AAA trigger values for each critical stage of works should be set according to the criteria below based on the results of ground movement analysis and structural assessment:

- “Alert” – 50% of the estimated movement for a particular critical stage of works plus the total estimated movement for the previous critical stage(s)
- “Alarm” – Except the last critical stage of works, 100% of the estimated movement for a particular critical stage of works plus the total estimated movement for the previous critical stage(s). For the last critical stage of works, it should be taken as the mean value of the “Alert” and “Action” levels
- “Action” – 100% of the estimated total movement upon completion of all building works concerned

8. A breakdown of the AAA trigger values for each critical stage of the proposed building works (typical example for movement as shown in the table below) should be shown on the monitoring plan included in the prescribed plans submitted to the BA for approval under the BO and agreement by MTRCL.

Critical Stage	Type of Works	Estimated Movement [^]	Alert	Alarm	Action
1	Grouting	a	0.5(a+b)	a+b	a+b+c+d+e+f
	Sheet Piling	b			
2	Foundation (Zone 1)	c	a+b+0.5c	a+b+c	
3	Foundation (Zone 2)	d	a+b+c+0.5d	a+b+c+d	
4	ELS (Stages 1-3)	e	a+b+c+d+0.5e	a+b+c+d+e	
5	ELS (Stages 4-6)	f	a+b+c+d+e+0.5f	a+b+c+d+e+0.75f	

[^] Each estimated movement should be not less than 10% and not more than 50% of the estimated total movement upon completion of all building works concerned.

Monitoring and Evaluation

9. The initial readings of all monitoring checkpoints should be measured by an independent qualified survey team. A report with photographs showing the installation of these monitoring checkpoints with a summary of the initial readings should be submitted to BD and MTRCL prior to the commencement of the building works concerned. The movement readings should be verified by the independent qualified survey team and submitted to BD and MTRCL according to the requirements and intervals as specified in BD's approval letter upon approval of plans.
10. The assessment on railway structures and facilities should be regularly reviewed to take into consideration of the actual movements recorded and, if necessary, an updated analysis should be conducted. Consent to the commencement of the building works concerned may be given by the BA on a stage-by-stage basis subject to satisfactory review results. RSE/RGE should conduct the necessary review promptly to facilitate timely consent application such that the staged consents would be obtained from the BA without impeding site progress.

Engineering Appraisal of Railway Equipment

11. AP/RSE/RGE should submit to MTRCL for agreement an engineering appraisal report to assess the anticipated impact on all existing railway equipment (e.g. track works, power supply equipment, signalling equipment) within the affected zone to ensure the safe operation of the railway.

(12/2022)