

**Control of Trenchless Works by Non-government Proponents
to Avoid Subsidence and Damage to Public Roads
(March 2019)**

1 Basis of the Requirements in these Guidelines

- 1.1 Further to the issue of the Block Licence/Lease Conditions to the non-government proponent by the Lands Department (LandsD) setting out conditions that require proponent to take or cause to be taken all proper and adequate care, skill and precautions at all times to avoid doing any damage to any government or other existing works and services, and to submit proposals for dealing with the works and services in writing to the appropriate authority for approval, these guidelines on the control of trenchless works by non-government proponents (“Guidelines”) set out the requirements that the non-government proponent shall comply with in order to satisfy those conditions in the Block Licence/Lease Conditions that are relevant to the Highways Department (HyD).
- 1.2 In case of non-compliance of the non-government proponent with requirements stipulated in these Guidelines, the HyD shall report the cases to the LandsD for taking necessary action under the Block Licence/Lease Conditions.

2 Scope

- 2.1 These Guidelines apply to non-government underground works (hereafter referred to as “Trenchless Works”) involving tunnels, pipes, crossings, conduits, etc. that:
 - are constructed by trenchless excavation methods within unallocated government land and affecting public roads, under public roads, or within a horizontal distance from public roads equal to the existing ground cover of the works;
 - are proposed by non-government proponents; and
 - have the diameter of the excavation for the tunnel, pipe, crossing, or conduit etc. more than 1 metre.
- 2.2 The requirements specified in these Guidelines are to avoid subsidence and damage to public roads and features maintained by the HyD due to Trenchless Works only. For other aspects of the Trenchless Works, including but not limited to construction site safety of works and impact to existing facilities, the non-government proponent responsible for the Trenchless Works (“Project Proponent”) shall satisfy the requirements of all other relevant government departments and utility undertakers.

3 Liability of the Project Proponents, its Designer, Contractor and Independent Checking Engineer (ICE)

- 3.1 No work carried out and no submission made by the Project Proponent, its Designer, Contractor and ICE (specified below) in connection to the requirements stipulated in these Guidelines shall absolve the Project Proponent, its Designer, Contractor and ICE from their liability on the Trenchless Works. The HyD will not be responsible for any deficiency in the work or submissions of the Project Proponent, its Designer, Contractor and ICE according to the requirements in

these Guidelines in connection to the Trenchless Works, nor any works carried out thereof.

- 3.2 It is the solely obligation of the Project Proponent to timely notify the Labour Department (LD), all other relevant government departments and utility undertakers in writing the details of its Trenchless Works, including but not limited to the location, commencement and completion dates of the proposed Trenchless Works, and to satisfy their requirements, including those stipulated in the “Guidance Notes on Safety and Health of Hand-dug Tunnelling Work” issued by the LD. The written notification to the LD shall be copied to the HyD for record purpose.

4 The Requirements of the Highways Department

4.1 General Requirements

- 4.1.1 The Project Proponent shall employ a professionally qualified and experienced consultant as the designer (“Designer”) to undertake the ground investigation (GI), ground water monitoring, design and supervision of the proposed Trenchless Works. At least one of the staff of the consultant responsible for the work shall be registered with the Engineers Registration Board in the Geotechnical or Civil discipline (and also in the Structural discipline if structural works are required), with a minimum of 5 years of experience in GI, planning, design and construction supervision of Trenchless Works. The Designer shall be independent from the Contractor and the ICE.
- 4.1.2 The Project Proponent shall also employ a professionally qualified and experienced engineer as the ICE to independently check and certify the GI and design including subsequent design amendments and independently audit the construction supervision of the Designer for the Trenchless Works. The ICE shall be registered with the Engineers Registration Board in the Geotechnical or Civil discipline (and also in the Structural discipline if structural works are required), with a minimum of 5 years of experience in GI, planning, design and construction supervision of Trenchless Works. The ICE shall be independent from the Contractor and Designer.
- 4.1.3 The Project Proponent shall employ also a suitably experienced and competent contractor (“Contractor”) with sufficient resources to carry out the Trenchless Works.
- 4.1.4 The Project Proponent shall require its Designer, Contractor and ICE to strictly follow the procedures set out in these Guidelines for the planning, investigation, design, construction and supervision of its Trenchless Works. The Project Proponent, its Designer, Contractor and the ICE shall be fully responsible for the adequacy and appropriateness of all matters and all submissions in connection to the Trenchless Works.
- 4.1.5 The Project Proponent shall submit details of its Designer, Contractor, and ICE, and the curriculum vitae of the engineers of its Designer responsible for the Trenchless Works, to the HyD for record purpose. The submissions shall include engagement confirmation of the Project Proponent with the Designer, the Contractor and the ICE, and the employment of the engineers responsible for the Trenchless Works issued by the Designer. The above

submissions may pass to other relevant government departments for their specific use.

4.2 Pre-construction Requirements

- 4.2.1 The design of the Trenchless Works, including GI and associated temporary works, shall be undertaken by the Designer.
- 4.2.2 The design shall comply with all relevant geotechnical standards listed in GEO TGN 1 and recognised structural and safety standards. The design and construction method shall ensure that the Trenchless Works will not cause excessive road settlement.
- 4.2.3 The Designer shall recommend the road settlement limit with due consideration of the recommendations given in Appendix B to Practice Note for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers (PNAP) APP-137 published by Buildings Department. If the Designer considers this road settlement limit not applicable to the particular conditions of the Trenchless Works and/or concerned road, the Designer shall carry out an analysis to review and justify any revised settlement limit so required.
- 4.2.4 The Designer shall make design submission to the ICE for checking and certification. The submission shall include:
 - (a) plans showing existing nature of the site, including accurate survey plan with ground level contours, road levels, geological conditions, groundwater conditions and surface water conditions, and details of streets, structures, foundations, public utilities and other services;
 - (b) plans showing all proposed works, including any excavation, ground support, ground treatment and groundwater control, incorporating the findings, recommendations and requirements in the report specified in paragraph 4.2.4 (j) below;
 - (c) a schedule of geotechnical design assumptions and verification requirement of these assumptions in the design review (“Design Review”) which includes verifying and reviewing, during construction, the geotechnical assumptions made;
 - (d) sequence of the proposed works and the methods to be adopted, highlighting the critical stages of the Trenchless Works;
 - (e) an assessment of the magnitude and extent of ground settlement/heave/lateral movement, including estimates of the maximum allowable water inflow rates/groundwater pressure changes to be specified for the control of ground deformation, as well as their effects;
 - (f) particulars of monitoring to be carried out for sensitive receivers, ground and sub-surface movements and vibrations, variations in piezometric levels, the period of the monitoring to be carried out and the mitigation measures for settlement/subsidence of road pavement reaching Alert, Alarm and Action (AAA) levels;

- (g) a site supervision plan (SSP) which shall include details of the Category A supervisor and Category B supervisor who are appointed by the Designer specified below to carry out site supervision:

Category A supervisor is an engineer who shall be registered with the Engineers Registration Board in the Geotechnical or Civil discipline (and also in the Structural discipline if structural works are required), with a minimum of 5 years of experience in GI, planning, design and construction supervision of Trenchless Works.

Category B supervisor acceptable for site supervision shall possess a minimum of a higher certificate/diploma in civil/structural/geotechnical engineering and 2 years relevant site experience in trenchless works.

- (h) a report containing the results of a study including topography, geology, groundwater, surface water, site history, public utilities, other services and geotechnical records;
- (i) a report containing the results of ground investigation and laboratory testing;
- (j) a report on critical examination and interpretation of the reports specified in paragraphs 4.2.4 (h) and (i) above. The report shall also contain:
 - (i) a schedule of the geotechnical assumptions;
 - (ii) discussion of anticipated geotechnical problems;
 - (iii) an outline of possible variations of the works; and
 - (iv) geotechnical requirements for the design and construction of the works including inspection, monitoring and testing requirements.
- (k) design calculations for the proposed works, calculations of the effects of the works on groundwater conditions, the site and any structure, street, land or service, and calculations for and consideration of all other relevant geotechnical matters.
- (l) construction procedures to be adopted if, during the carrying out of the works, a geotechnical design assumption is revealed to be erroneous so that there is an unacceptable level of risk to public life and property due to damage/subsidence of public road; and
- (m) the schedule for submitting all the above to the ICE for checking and certification.

4.2.5 The ICE shall be fully responsible to ensure and certify that the GI, design, construction method statements and procedures, performance, risk control limits and measures, monitoring and SSP and all the details submitted under Paragraph 4.2.4 are satisfactory and meet all required standards for the proposed Trenchless Works.

4.2.6 Prior to commencement of construction, the Project Proponent shall submit to the HyD the Design Checking Certificate from the ICE confirming that the requirements stipulated in Paragraphs 4.2.5 are satisfactorily completed.

- 4.2.7 The ICE shall keep a copy of the design submission with details stipulated in Paragraphs 4.2.4 that ICE certified and agreed. This copy of the design submission shall be made available for checking by any parties when requested by the HyD or other Government Departments.
- 4.2.8 The Project Proponent is required to submit the following information to the HyD for record purpose at least two months before commencement of works:
- (a) brief account of the design assumptions and construction method;
 - (b) layout plan and longitudinal profile of the proposed works with existing structures and utilities;
 - (c) typical cross-section;
 - (d) the estimated values of settlement/subsidence;
 - (e) the AAA levels of settlement to be adopted;
 - (f) the mitigation measures for settlement/subsidence of road pavement reaching AAA levels;
 - (g) particulars of monitoring to be carried out for ground and sub-surface movements and variations in piezometric levels;
 - (h) baseline measurement including contour of existing road level, water table level and ground level of the settlement markers, etc;
 - (i) the curriculum vitae of Category A and Category B supervisors; and
 - (j) the written notification to the LD with details stipulated in Paragraph 3.2.
- 4.2.9 The Project Proponent is required to notify the HyD at least one week in advance of the commencement date of the works.

4.3 Requirements during Construction

- 4.3.1 The Category A supervisor shall conduct inspections at least twice a week and shall critically inspect the Trenchless Works including but not limited to the excavated ground, the tunnel faces and the support system.
- 4.3.2 The Category B supervisor shall conduct full time site supervision, to inspect and check the compliance of the works with drawings and specifications, and working procedures are followed properly.
- 4.3.3 During the critical stages of the works, or when irregularities are reported by site personnel on ground movement, seepages and changes of soil conditions during excavation, the Category A supervisor shall conduct inspections more frequently as necessary, and shall be available at all time to deal with any emergency incidents that arise from the works. The Designer shall review its design including geotechnical design assumptions made, and submit the design amendment to the ICE for checking and certification if amendments are made.
- 4.3.4 During construction, the ICE shall ensure that the Designer, through the Project Proponent, submits to him the Category A supervisor's reports on the works at the times specified. The reports shall document the site

inspection observations, Design Review and design amendments made, and a review of the ground investigation, groundwater condition, inspection, monitoring and test data obtained during construction. Relevant data and site records should be included in the reports. The ICE shall carry out audit inspections, including the excavated ground, tunnel faces, and support system, to confirm the adequacy of the Design Review and risk control action taken, at least once a week or more frequently if necessary during the critical stages of the works and if irregularities are identified and reported by the Designer. The ICE shall be available at all time to deal with any emergency incident that arises from the works.

4.3.5 The ICE shall keep copies of the Category A supervisor's reports together with his own inspection report for inspection by any parties upon request by the HyD.

4.3.6 The ICE should submit a summary list bi-weekly to the HyD upon commencement and until completion of Trenchless Works with the following information:

- (a) The results of monitoring of ground and sub-surface movements and variations in piezometric levels;
- (b) Confirmation on the adequacy of the Design Review and risk control action taken;
- (c) The dates of site inspection conducted by the ICE and Category A supervisor;
- (d) The amendments of the works and construction procedures which should be adopted if, during the carrying out the works, a geotechnical design assumption is revealed to be erroneous so that there is an unacceptable level of risk to public life and property due to damage/subsidence of public road; and
- (e) Mitigation measures taken if the AAA levels reached or any emergency incidents arisen from the works.

4.3.7 The Designer shall ensure that the Trenchless Works will not cause road settlement affecting the safe use of the roads. The Designer shall notify the HyD immediately if any of the AAA levels is reached or any emergency incident that arises from the works. Where the ground settlement reaches or exceeds the Alert level given in the AAA plan, the Designer shall conduct more frequent monitoring measurements and/or install additional monitoring points. Where the ground settlement reaches or exceeds the Alarm level given in the AAA plan, the Designer shall take necessary action to carry out Design Review and implement necessary remedial/emergency measures with the agreement and certification of the ICE. Where the ground settlement reaches or exceeds the Action level given in the AAA plan, the Trenchless Works shall suspend immediately. The Trenchless Works shall not resume without the agreement of the ICE. The Project Proponent shall notify the HyD before resuming works.

4.4 Requirements upon Completion of Construction

4.4.1 Upon completion of the Trenchless Works, the ICE shall carry out a site inspection, if necessary, recommend remedial works that need to be carried out to restore the site to a satisfactory condition and ensure the remedial

works are completed accordingly, before certifying completion of his checking of the works. The ICE shall confirm, in writing, to the Project Proponent and the HyD, that his checking of the site works has been completed and the site has been restored to a satisfactory condition, and submit copies of all his own inspection report and Category A supervisor's reports to the Project Proponent and the HyD for record at the same time.

5 Notification and Auditing

- 5.1 The Regions of the HyD shall notify LandsD to take appropriate follow up action under the Block Licence/Lease Conditions in the event that the Trenchless Works result in subsidence/damages of public road which causes damage to property or injury to members of the public.
- 5.2 The Regions of the HyD together with the Geotechnical Engineering Office of Civil Engineering and Development Department may carry out site audits of the Trenchless Works in the event that the works result in damage to property or injury to members of the public due to subsidence/damages of public road and or any emergency incidents arisen by the works. The Project Proponent shall make all necessary arrangements and provide all necessary assistance to facilitate these audits swiftly once it is required by the HyD.