Building and Construction Authority

An MND Statutory Board

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For enquiries, please contact:
Building Engineering Group (#12-01)
Tel: 1800 342 5222 (1800-DIAL-BCA)
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Dear Sir/Madam

REMINDER FOR DESIGN QUALIFIED PERSONS, SUPERVISING QUALIFIED PERSONS, DEVELOPERS AND BUILDERS TO CARRY OUT THEIR DUTIES TO ACHIEVE SAFE TUNNELLING WORKS

Objective

This circular is to remind the Qualified Persons appointed to prepare the plans of the building works ("**Design QP**"), the Qualified Persons appointed to supervise the carrying out of the building works ("**Supervising QP**"), Developers and Builders to carry out their duties to achieve safe tunnelling works, including pipe jacking works.

For tunnelling works which are classified as Geotechnical Building Works (GBW), the term "Design QP" refers to Design QP for structural works and Design QP (Geotechnical), and the term "Supervising QP" refers to Supervising QP for structural works and Supervising QP (Geotechnical).

Reminder

2 We wish to remind project parties of the following requirements.

3 The Specific Conditions of Permit for Projects Involving Bored Tunnelling Works are applicable for both GBW and non-GBW projects, including pipe jacking works. The Specific Conditions specify the requirements for various aspects of tunnelling works, including requirements for i) continuous monitoring of Key Performance Indicator (KPI) including face pressure and excavation volume during tunnelling and Cutter Head Intervention (CHI), ii) tunnelling within control zone, iii) over-excavation control measures, iv) no flushing, v) cutter head intervention, vi) emergency preparedness plan, and vii) incident reporting to the Commissioner of Building Control.

4 The Supervising QP(Geotechnical) and Design QP (Geotechnical) are reminded to carry out the duties listed under the Eighth Schedule of Building Control Regulations.

Key Points to Note

5 The Design QP, Supervising QP and Builder are expected to be familiar with design and construction of tunnel. Nevertheless, we wish to highlight some key points below.

(i) Adequate site investigation

Under Regulation 31 of the BC Regs, the Design QP shall carry out proper and adequate site investigation in accordance with relevant standards and codes of practice and ensure that all site investigation works must be carried out by an accredited inspection body for Site Investigation approved by the Singapore Accreditation Council. The relevant standards and codes of practice refer to the Eurocode 7 Code ("the Eurocode") and GeoSS Site Investigation Guide - "Guide on ground investigation and geotechnical characteristic values to EC7" (the "GeoSS Site Investigation Guide").

For tunnelling, there shall be adequate site investigation to identify the transition from hard to soft soils. The Design QP should review the need of more extensive site investigation such as geophysical surveys to identify challenging ground such as transition from hard to soft soils, presence of limestone, etc.

(ii) Risk of Tunnel Boring Machine (TBM) dipping while transitioning from hard to soft soil

When planning the tunnel alignment, the Developer should avoid, where possible, alignment which requires tunnelling in mixed face of hard and soft soils.

Tunnelling in mixed face, e.g. in the interface between soft soil and hard soil, is a well-known challenge in tunnelling. There is a risk of the TBM dipping into the soft soil when tunnelling through the transition from hard to soft soil. In addition to determining the appropriate face pressure, the Design QP should propose further measures to ensure smooth transitioning from hard to soft soil.

The Design QP shall assess the need of ground improvement. The location, extent and details of the ground improvement are to be specified in the structural plans.

For pipe jacking works, the dipping of the TBM into soft soil may lead to damage of the joints between the installed pipes. To mitigate this risk, the tunnel structure (i.e. the jacked-pipes) shall be designed with adequate rigidity, including: (i) design of the longitudinal joints between pipes, (ii) design of a structural connection between the first pipe and the TBM.

For bored tunnelling at the transition from hard to soft soil or tunnelling in mixed face, the Design QP is to design the structural connections between adjacent rings of the tunnel lining.

(iii) Risk of excessive wearing of tools due to long tunnel drive or inadequate maintenance

The Design QP, Supervising QP, Builder and Developer are to work together to provide adequate number of planned CHI along the tunnel drive to mitigate the risk of sinkhole due to

excessive wear of TBM cutter tools, and the risks associated with the use of unplanned CHI due to the inadequate provision of planned CHI. In addition, the contingency plans for unplanned CHI are also to be developed and specified in the structural plans.

In the event that the TBM is required to stop at an unplanned location due to unforeseen circumstances or emergency events, the Supervising QP in consultation with Design QP, and the Builder should assess the risk of such unplanned stoppage, and implement the appropriate contingency plan(s).

(iv) Risk during TBM launching or pipe jacking

(a) Appropriate face pressure during TBM launching - The Design QP and the Builder are to work together to develop a proper launching of TBM prior to leaving the ground improvement block, to ensure appropriate face pressure is applied, to provide effective entrance seal to prevent water ingress and to prevent over-pressure on the entrance wall.
(b) Risk of flooding - There have been cases where the shaft was flooded because the ground improvement block at the tunnel eye was not effective. In the structural plans, the Design QP to specify adequate ground improvement block and other measures to mitigate such risk.
(c) TBM thrust frame - The thrust frame for the TBM is part of tunnelling works. Where the tunnelling work is classified as GBW, the thrust frame is also GBW. Structural plans of the thrust frame including the design of its loadings transferred to the launching shaft ERSS are to be submitted to the Commissioner of Building Control for approval. Structural plans of the TBM thrust frame is to be submitted by the same Design QP, Design QP(Geotechnical), Accredited Checker and Specialist Accredited Checker who submit the plans of the tunnel Key Performance Indicators (KPI).

For Clarification

6 We would appreciate if you could bring to the attention of your members the contents of this circular. Should you need clarification on this matter, you may call our hotline at 1800 342 5222, or use our Online Feedback Form at: https://www.bca.gov.sg/feedbackform/.

Yours faithfully

ER. DR. POH TEOH YAW
BUILDING AND CONSTRUCTION AUTHORITY
for COMMISSIONER OF BUILDING CONTROL

Building and Construction Authority

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DISTRIBUTION (via e-mail):

PRESIDENT
INSTITUTION OF ENGINEERS, SINGAPORE (IES)
70, BUKIT TINGGI ROAD
SINGAPORE 289758

PRESIDENT
ASSOCIATION OF CONSULTING ENGINEERS, SINGAPORE (ACES)
18 SIN MING LANE
#06-01 MIDVIEW CITY
SINGAPORE 573960

PRESIDENT
GEOTECHNICAL SOCIETY OF SINGAPORE
C/O PROFESSIONAL ACTIVITIES CENTRE
NUS FACULTY OF ENGINEERING
9 ENGINEERING DRIVE 1
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PROFESSIONAL ENGINEERS BOARD, SINGAPORE (PEB)
1ST STOREY, TOWER BLOCK, MND COMPLEX
5 MAXWELL ROAD
SINGAPORE 069110

PRESIDENT
THE TUNNELLING AND UNDERGROUND
CONSTRUCTION SOCIETY SINGAPORE (TUCSS)
C/O CMA INTERNATIONAL CONSULTANTS PTE LTD
1 LIANG SEAH STREET
#02-12 LIANG SEAH PLACE
SINGAPORE 189022

PRESIDENT
SOCIETY OF ROCK MECHANICS AND ENGINEERING GEOLOGY
1 LIANG SEAH STREET
#02-12 LIANG SEAH PLACE
SINGAPORE 189022