Building and Construction Authority

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In Collaboration With

ASSOCIATION OF CONSULTING ENGINEERS SINGAPORE

GeoSS

THE INSTITUTION OF ENGINEERS SINGAPORE

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Our Ref : APPBCA-2025-29

1 December 2025

Dear Sir/Madam

JOINT BCA / ACES / IES / GEOSS CIRCULAR 2025

GUIDELINE ON ENSURING INTEGRITY OF SHEET PILE WALL TO PREVENT GROUND LOSS

Objective

This circular informs the industry of the guidelines and risk-based measures to ensure the integrity of interlocked sheet pile walls for Earth Retaining or Stabilising Structures (ERSS). These measures aim to prevent ground loss incidents associated with gap in sheet piles, particularly in reclaimed or highly permeable soils. This guideline serves as good practices, except for **Section 4** which serves as requirements for geotechnical building works (GBW) with excavation depth greater than 6m.

Background

2 Recent ground loss incidents involving gap in sheet pile wall, particularly in reclaimed sand areas, have underscored the need for guidance and a risk-based approach to ensure integrity of sheet pile wall.

3 This circular has incorporated inputs from The Institution of Engineers, Singapore, Association of Consulting Engineers Singapore, and Geotechnical Society of Singapore. This circular applies to GBW projects except those that submitted their Planning Permission application to URA before **1 June 2026** and subsequently received Provisional Permission (PP) or Design Gateway (DG) clearance. For projects that do not require URA's Planning Permission, this circular applies if their first structural plan submission is on or after **1 June 2026.**

4 Developers are advised to engage QP(S) and Builders who are competent and have sufficient knowledge in ERSS design and construction when the proposed building works involve excavation in difficult ground condition.

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5 **Nothing contained in this circular is meant to replace or negate the need to comply with the provisions of the Building Control Act 1989 and the subsidiary building regulations in all aspects. QP(S) are to note that they have duties under the Building Control Act, amongst others, to take all reasonable steps and exercise due diligence to ensure that building works are designed in accordance with the provisions of the Building Control Act and the subsidiary building regulations.**

6 We would appreciate if you could disseminate the contents of this circular to your members. Please contact us at Tel 1800-3425222 or through the online feedback form (https://www.bca.gov.sg/feedbackform/) should you need any clarification. Thank you.

Yours faithfully

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Annex A

Guideline on Ensuring Integrity of Sheet Pile Wall to Prevent Ground Loss

Section 1. Introduction

1.1 As Singapore continues to expand its land area through reclamation projects, construction activities increasingly encounter difficult ground conditions characterised by reclaimed sand, highly permeable soils, and complex geological formations including the Kallang Group. Sheet pile wall is a common type of ERSS. For deep excavation, the toe of sheet pile wall is often designed to embed into hard soil to ensure stability. Uncontrolled hard driving of sheet piles into hard soil may result in separation between joints of sheet piles (declutched joint), creating a gap. If the gap occurs within highly permeable soil or soft soils, there is a risk of ground and water ingress through the declutched joint. This may eventually lead to ground instability and potential collapse, creating a sinkhole on the ground surface.

1.2 This guide focuses on preventing gaps in sheet pile wall arising from improper installation (e.g. uncontrolled hard driving described in the preceding paragraph), incorrect installation, and poor quality of sheet pile joint. For treatment of gaps between sheet pile and existing structure or utilities, refer to BCA Circular APPBCA-2024-23 titled “Requirements to Mitigate Risk Associated with Utility Gap Within ERSS”.

1.3 The integrity of sheet pile walls is paramount to preventing catastrophic ground loss incidents that can result in significant project delays, substantial remedial costs, and most critically, threats to workers and public safety.

1.4 This guide introduces a risk-based approach to ensure integrity of sheet pile walls by mitigating the risk of gaps in sheet pile walls, particularly in difficult ground conditions. The guide categorises risk levels based on ground type and soil permeability, providing targeted mitigation measures for low, medium, and high-risk scenarios.

1.5 **Section 2** provides the risk category for sheet pile installation. **Section 3** describes the risk-based mitigation measures. It also provides examples of good practices to achieve properly interlocked sheet pile wall. The Design QP [QP(D)] may consider good practices that are applicable to the case in hand to detect and overcome difficulties in sheet pile wall installation. **Section 4** provides the mandatory construction supervision and contingency measures to be specified in the ERSS plan during plan submission. **Section 5** serves as reminders of the key considerations when sheet pile wall is adopted for ERSS, including sufficient site investigation, relevant stability checks and instrumentation and monitoring.

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Section 2. Risk Category for Sheet Pile Wall

2.1 BCA Approved Document provides risk-based requirements for ERSS. This guideline complements the risk-based requirements by providing specific guidance for sheet pile installation.

2.2 The risk for sheet pile wall in ERSS is categorized into “Low”, “Medium” and “High” risk based on the ground condition, as given in **Table 2.1** and illustrated in **Figure 2.2** and **Figure 2.3** below.

Table 2.1: Classification of Risk Categories for the Use of Interlocked Sheet Pile in ERSS

	No presence of Kallang Group or high-permeability soil	**Presence of Kallang Group other than Fluvial sand**	**Presence of high permeability soil such as reclaimed sand or Fluvial sand**
Risk Category	Low	Medium	High

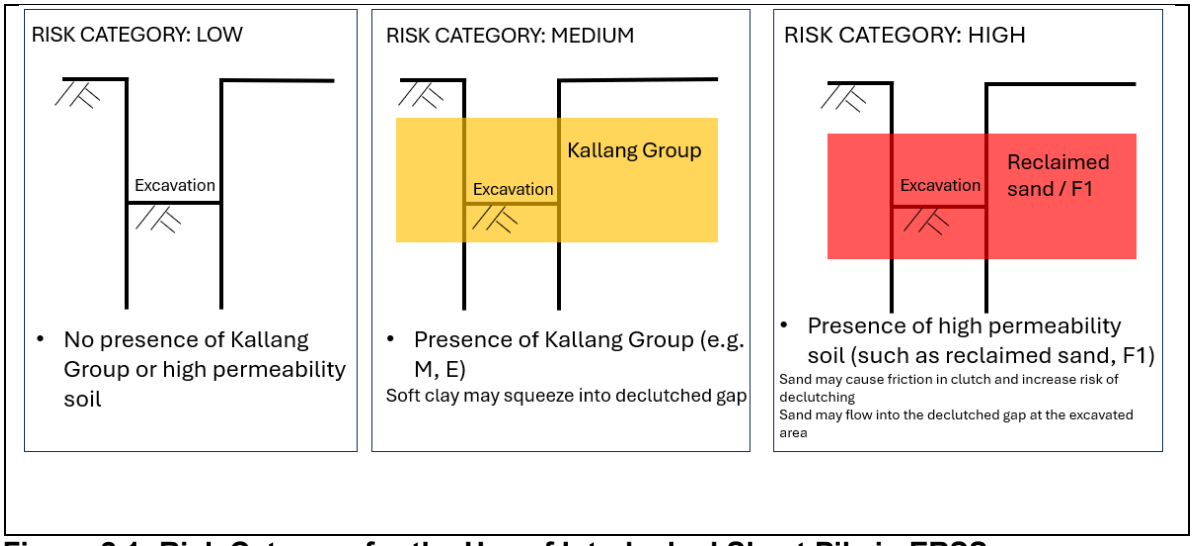

Figure 2.1: Risk Category for the Use of Interlocked Sheet Pile in ERSS

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Section 3. Risk Mitigation Measures and Good Practices

3.1 **Table 3.1** provides risk mitigation measures for each risk category.

Table 3.1: Risk Mitigation Measures for Various Risk Categories

<table>
<tr><th rowspan="2">Risk Category</th><th>Design Stage</th><th colspan="3">Construction Stage</th></tr>
<tr><th>Sheet pile type, installation method</th><th>Grouting <u>before</u> excavation</th><th>Special measures</th><th rowspan="4">Mandatory measures if gap is observed <u>during</u> excavation (as described in Section 4)</th></tr>
<tr><td>LOW</td><td>QP(D) to specify</td><td>QP(S) to assess</td><td>Nil</td></tr>
<tr><td>MEDIUM</td><td>For ERSS in Zone 1: New or reused sheet pile with clutches in good condition, complying with Class 1 steel material in BC1.</td><td>Yes, at location of suspected improper interlocking#</td><td>Nil</td></tr>
<tr><td>HIGH</td><td>Same as MEDIUM, and Press-in method / equivalent*.
For ERSS in Zone 1: installation with continuous recording.</td><td>Yes, at location of suspected improper interlocking#</td><td>Start excavation from the wall alignment, observe sheet pile.
If proper interlock is verified, proceed with the rest.</td></tr>
<tr><td colspan="5">For all risk categories:
a) Installation by crush piler or pre-augering before installation, for hard soil (SPT-N>30).
b) Installation by press-in method for ERSS within 1m from boundary wall / neighbouring property.
c) Adopt silent piler or an equivalent low-impact method for sheet pile installation in residential area
d) Adopt low-vibration method for hacking works near the installed sheet pile</td></tr>
<tr><td colspan="5">Notes:
* To adopt installation method which allows more precise installation, such as press-in method, or vibro with guide frame.
# QP(D) is to define “suspected improper interlocking” in approved plans. QP(S) is to review and approve method statements of sheet pile installation and grouting.
Refer to BCA Advisory Note 01/09 for definition of Zone 1.</td></tr>
</table>

3.2 For reuse of sheet piles, before installation, the site supervisor should inspect that the sheet piles delivered on site are in good conditions and meet the traceability and reusability criteria as detailed in Section 6 of BC1: 2023. The supplier/fabricator shall have in their possession a valid certificate of assessment for these reused materials as proof of conformance to the quality system. As required in Section 6.3 of BC1: 2023, this certificate shall be issued by an inspection body accredited by Singapore Accreditation Council (SAC).

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3.3 **Table 3.2** provides good practices during design and construction stage, applicable to all risk categories.

Table 3.2: Good Practices for All Risk Categories

Design Stage
1. Map the actual dimension of sheet pile on the excavation layout to ensure proper interlocking at corners. Adopt prefabricated corner panels or panel connectors to achieve proper interlock.

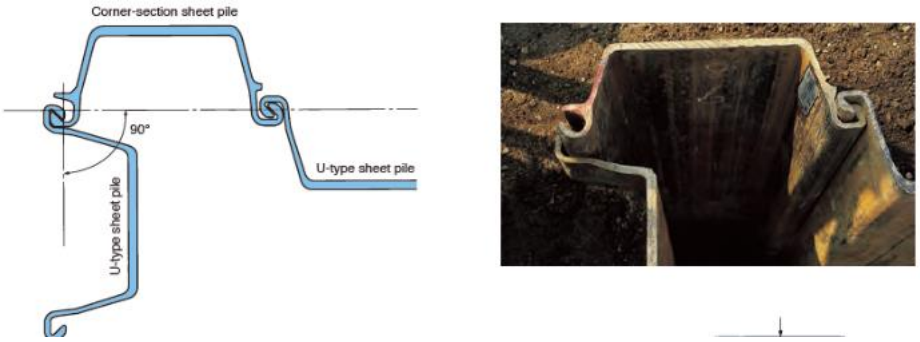

Figure 3.1: Example of prefabricated corner panels

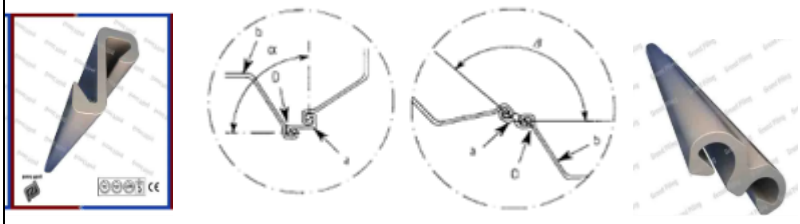

Figure 3.2: Example of prefabricated panel connector

Construction Stage
2. QPS to establish criteria to identify suspected improper interlocking and specify the criteria in the site supervision plan. Examples of criteria for suspected improper interlocking: • installation time required for 1m length of sheet pile penetration more than 2 times of normal operation or • re-driving more than 2 times of normal operation or • verticality of sheet pile panel during installation exceeds the allowable limit Operators are to be competent and trained to identify improper interlocking and report to QPS.
3. Sheet pile installation record should include the press-in force (where applicable), penetration time taken for per metre length of sheet pile and the number of re-driving. These records must be reviewed by the QPS prior to excavation to confirm the integrity of the wall and to determine whether any mitigation measures are required.

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4. Before allowing excavation to proceed, QPS to review the installation record and determine whether there is potential improper interlocking and whether mitigation measures are required.

5. Adopt one-directional driving instead of driving the sheet pile wall from multiple directions.

6. Provide guide frame for sheet pile installed using vibro-hammer method.

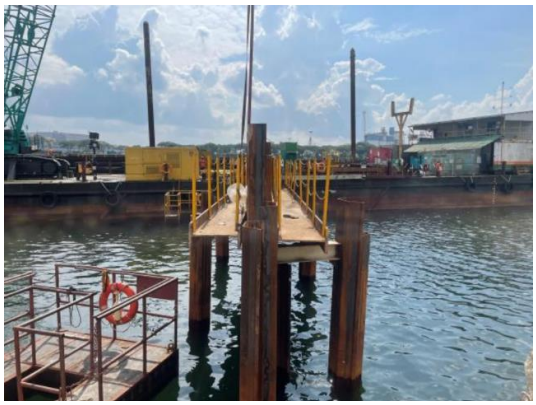

Figure 3.3: Example of guide frame for sheet pile installation

7. Provide declutching detector sensor if applicable.

8. For sheet pile in reclaimed sand / sandy soils, when the sheet pile cannot reach the required design length, provide grouting up to the impermeable layer below the sandy layer.

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Section 4. Requirements for Geotechnical Building Works with Excavation Depth > 6m

In the ERSS structural plans, QP(D) is to specify construction supervision and contingency measures to be implemented if a gap / improper interlocking is observed during excavation. **Table 4.1** provides the requirements that QP(D) shall specify in the structural plans.

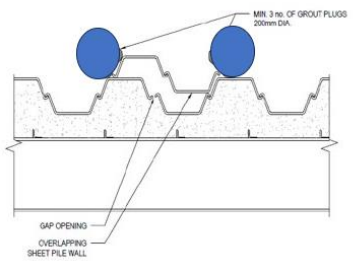
Table 4.1: Construction Supervision and Contingency Measures (Mandatory to be Included in Approved Plans)

To specify in the approved plans:

(a) Builder and site supervisors are to inspect the exposed sheet pile during excavation and verify that the joints are properly interlocked. If a gap is observed in the sheet pile wall, site supervisors are to report to QP(S).

(b) If a gap is observed in the sheet pile wall, Builder and QP(S) are to carry out contingency measures as specified by QP(D). The measures below shall apply if no contingency measures are specified by QP(D):

- To stop excavation in the affected area.
- To backfill to the previous excavation layer (for High-risk category).
- QP(S) to assess the need to backfill to the previous excavation layer (for Low and Medium-risk categories). If QP(S) assesses that the ERSS can remain stable without backfilling, Builder to immediately seal the gap. For Low-risk category, welding steel plates across gaps is an example of contingency measures.
- For cases which require backfilling, to do grouting behind the wall. For High-risk category, to also provide additional 2 pieces of sheet pile and grouting at the improper interlocking location (see the diagram below for illustration)



4.2 During excavation, if any soil ingress and/or water gushed-in is observed, site supervisors shall inform the QP(S). Builder and QP(S) are to stop the excavation and implement contingency measures. QP(S) is to include this in site supervision plan and brief the site supervisors.

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Section 5. Reminder for Design of Sheet Pile ERSS

The QP(D), QP(S) and Builder are expected to be familiar with design and construction of ERSS. Some of the key points pertinent to sheet pile ERSS are included in this section.

Site Investigation

5.1 Adequate site investigation along the ERSS alignment is essential. The site investigation must comply with GeoSS2015 guidelines which recommend one borehole every 10 to 30m spacing for ERSS > 6m depth. QP should plan the site investigation so that the boreholes and testing can provide reliable data for profiling ground and groundwater conditions, ensuring an accurate understanding of site-specific risks.

Stability check

5.2 Geotechnical design shall be carried out in accordance with SS EN 1997-1: 2010 Eurocode 7: Geotechnical design – Part 1: General rules, in conjunction with the Singapore National Annex to Eurocode 7, NA to SS EN 1997-1: 2010. The design code requires, among others, that the EQU, STR, GEO ultimate limit states (ULS) be satisfied for all excavations. For excavations in sand or highly permeable soils, piping checks in accordance with Eurocode Clause 2.4.7 are to be carried out to verify that the ERSS wall toe embedment is adequate for basal heave stability, hydraulic stability and resistance to piping.

Instrumentation and monitoring

5.3 Instrumentation and monitoring are crucial in ensuring the safety of the excavation and adjacent ground, buildings and structures. A cluster of inclinometer, piezometer/ water standpipe shall be installed at intervals of 30 to 40 metres along the ERSS wall. Inclinometer(s) are to be provided at every potential weak point (e.g. utility gap) and higher risk location (e.g. near existing building).

5.4 Adequate rod-type ground settlement markers shall be provided around the ERSS. In high-risk category, deep settlement markers must be placed at closer interval to provide early warning of improper sheet pile interlocking or ground movement. Builders and supervisors must be vigilant in monitoring these instruments throughout excavation works. QP and Builder are to stop excavation and take remedial measures if the critical instruments exceed the design limit.

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