NOTICE

This Guideline has been prepared for the proper planning and control of hillsite development activities in Penang. It is to be used by implementing agencies, developers, engineers, contractors, property owners and the public as a guide in planning, developing and maintaining hillsites and the surrounding areas.

This Guideline is applied by MPPP and MPSP in considering and evaluating for approval applications for planning permit submitted via the state One-Stop Centre (OSC).

The State’s planning policy at the material time shall take precedence.
Penang Island has an area of 285 sq km and of which about 40% are lands of Class 3 and Class 4 with slope gradient exceeding 25°. A significant portion of them is privately owned land and the rest belongs to the state government.

This Guideline aims to improve safety and the environment of hillsite developments. The State Government has appointed the Hillsite Development Advisory Panel Committee, which developed the Guideline after reviewing existing guidelines, lessons learnt from slope failures and landslides as well as studying good practices.

The Guideline will serve as the main reference in considerations of planning approval for hillsite development applications, and to be used by all the relevant agencies.

Penang Local Governments (MPPP & MPSP) are to strengthen their Geotechnical Unit, which processes and approves applications for hillsite developments, followed by strict enforcement.

A monitoring team will be established to ensure compliance in construction and monitoring performance of slopes. The unit will initially recruit contract staff with slope engineering expertise, and eventually has its own permanent experienced engineering staff.

An advisory panel of experts will be appointed to help the Geotechnical Unit. The Panel shall meet regularly to provide input and training to the staff of the unit and that of all stakeholders.

Due care and diligence of all the staff of the stakeholders are needed to use and implement the Guideline to mitigate landslides and prevent loss of lives from landslides while facilitating sustainable land use for the well-being of Penangites.

Penalty for non-compliance will be better stated for ease of enforcement.

Let us all work together towards a safe and green Penang.

YAB Tuan Lim Guan Eng
Chief Minister of Penang
Fig. 1: TERRAIN MAP OF PENANG ISLAND

Legend

<table>
<thead>
<tr>
<th>Angle Range</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0° - 15°</td>
<td>52%</td>
</tr>
<tr>
<td>&gt; 15° - 25°</td>
<td>9%</td>
</tr>
<tr>
<td>&gt; 25° - 35°</td>
<td>19%</td>
</tr>
<tr>
<td>&gt; 35°</td>
<td>20%</td>
</tr>
</tbody>
</table>
Fig. 2: TERRAIN MAP OF SEBERANG PERAI

Legend

- $0^\circ$ - $15^\circ$ = 90%
- $>15^\circ$ - $25^\circ$ = 5%
- $>25^\circ$ - $35^\circ$ = 3%
- $>35^\circ$ = 2%

[Map of Seberang Perai with legend and various locations marked]
Hillsite development has been tightened with guidelines from federal government agencies following the collapse of Block 1 of the Highland Towers in 1993, with the intention of improving safety for developments.

This new set of guidelines for hillsite development has been specifically formulated for Penang, and to be used by all stakeholders. The Advisory Panel, who developed the guideline, comprised slope engineering experts from Malaysia and local practising engineers from Penang.

Top state and federal government officers having experience dealing with approvals and control of hillsite developments also assisted the Panel.

The Guideline has gone through rigorous review processes including a public forum involving all stakeholders, both in the public and private sectors.

Thus, this Guideline for Hillsite Development can now provide clear and consistent application procedures together with transparent approving mechanisms and controls during construction.

The plinth areas for Class 3 and Class 4 lands have also been reduced by more than 5% for Class 3 and about 20% for Class 4. This is to enhance the safety of slopes and preserve more green areas.
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# ABBREVIATIONS

For easier understanding, the following are acronyms used in the Guideline:

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEM</td>
<td>Board of Engineers, Malaysia</td>
</tr>
<tr>
<td>CKC</td>
<td>Cawangan Kejuruteraan Cerun (Hillsite Engineering Division)</td>
</tr>
<tr>
<td>GE</td>
<td>Geotechnical Engineer</td>
</tr>
<tr>
<td>JAS</td>
<td>Jabatan Alam Sekitar (Department of Environment)</td>
</tr>
<tr>
<td>JKR</td>
<td>Jabatan Kerja Raya (Public Works Department)</td>
</tr>
<tr>
<td>JMG</td>
<td>Jabatan Mineral dan Geosains (Minerals and Geoscience Department)</td>
</tr>
<tr>
<td>JPBD</td>
<td>Jabatan Perancang Bandar dan Desa (Town and Country Planning Department)</td>
</tr>
<tr>
<td>JPS</td>
<td>Jabatan Pengairan dan Saliran (Department of Irrigation and Drainage)</td>
</tr>
<tr>
<td>MASMA</td>
<td>Manual Saliran Mesra Alam (Environmental Friendly Urban Drainage Manual)</td>
</tr>
<tr>
<td>MPPP</td>
<td>Majlis Perbandaran Pulau Pinang (Penang Island Municipal Council)</td>
</tr>
<tr>
<td>MPSP</td>
<td>Majlis Perbandaran Seberang Perai (Seberang Perai Municipal Council)</td>
</tr>
<tr>
<td>OSC</td>
<td>One Stop Centre</td>
</tr>
<tr>
<td>PBT</td>
<td>Pihak Berkuasa Tempatan (Local Authority)</td>
</tr>
<tr>
<td>PSP</td>
<td>Principal Submitting Person (Planner, Architect or Engineer)</td>
</tr>
<tr>
<td>SP</td>
<td>Submitting Person (Engineer – Civil &amp; Structural and/or Mechanical &amp; Electrical)</td>
</tr>
<tr>
<td>UBBL</td>
<td>Uniform Building By-laws</td>
</tr>
</tbody>
</table>
OBJECTIVES

The Penang Safety Guideline For Hillsite Development 2012 is to streamline both the existing federal and state guidelines for all hillsite developments with the aim to improve slope safety and enhance the environment.

This Guideline will no doubt mitigate the risk of landslides when used and implemented diligently by all the stakeholders.

The Hillsite Development Advisory Panel Committee, appointed by the Penang Government, has reviewed the existing guidelines and lessons learnt from slope failures and landslides as well as current good and safe practices.

The Guideline, among others:

• Has made clearer classification of slopes for ease of implementation at planning stage.

• Has stated the duties and responsibilities of Engineers and Independent Checkers during design and construction stages.

• Requires Independent Checkers to visit project sites during constructions and report any non-compliance directly to the local authority for prompt enforcement.

• Has defined better the qualification and experience of key personnel (geotechnical engineer and independent checkers) to ensure quality of works for hillsite developments during the design and construction stages.

• Has made it mandatory for developers to engage qualified engineers and independent checkers - having the required expertise and experience on hillsite developments and sufficient capacity to design and supervise the constructions.

• Requires contractors to comply with the design drawings and specifications for the slope works.

• Has reduced the requirement for plinth area (maximum allowable hard surface footprint) for buildings on Class 3 and Class 4 hillside lands, with the intention of preserving more natural green areas.

• Requires engineered slopes including earth retaining systems to incorporate green features to enhance Penang’s natural environment.
The Guideline addresses and upgrades existing safety measures and outlines better project implementation procedures and effective enforcement. It strives to inculcate good slope design, construction and maintenance culture. With its proper implementation, the Guideline will inspire confidence in the safety of hillsite developments in Penang.

The advisory panel which drew up the Guideline will continue to assist the authorities to effectively implement and enforce it. This is to ensure that developers, engineers, contractors and property owners in hillsite areas comply with good engineering practices relating to the stability of hill slopes.

Still lingering in the Malaysian public’s consciousness are the many hill land failures which caused tragedies over the past 20 years.

The major causes of slope failures can be summarized as follows:

1. **Design** – inadequate ground investigation, lack of understanding of engineering analysis and design.

2. **Construction** – lack of quality assurance and quality control by contractors and lack of proper site supervision by engineers.

3. **Maintenance** – lack of slope maintenance culture is prevalent in both the public and private sectors.

4. **Communication** – lack of communication amongst various parties involved in construction.

The resulting loss of lives, destruction to public and private properties as well as the ensuing legal tangles that may be still ongoing have triggered various reactions; there had been conferences, seminars, dialogues, more stringent rules and regulations and better practices for hillsite development.

The Guideline makes a concerted attempt to incorporate all the lessons learnt.
Numerous guidelines for hillsite developments from various agencies have been produced after the collapse of Block 1 of Highland Towers in 1993. This Guideline aims to simplify existing procedures and to improve the safety of hillsite developments.

To further improve the safety of slopes and earth retaining systems, this Guideline has some major considerations that include:

1. Slope classification for planning approval has been simplified for clarity and consistency.

2. Design requirements of slope have been strengthened through clearer definitions.

3. The required qualifications of engineers including geotechnical engineers needed for different terrain classification of slopes are established.

4. The requirement and need for independent checkers is now better defined and the input is extended beyond design to include inspection during construction.

5. Maintenance of slope needs proper input by the Engineers which includes the need to produce maintenance manuals so that owners know their responsibilities and what entails in the maintenance of slopes.

6. The maximum allowable hard surface footprint has been intentionally reduced by more than 5% for Class 3A & 3B and about 20% for Class 4A & 4B slopes. This will improve safety and enhance the preservation of the green environment.
Major considerations (cont’d)

7. Geotechnical engineer shall provide solution for localised Class 3 and 4 slopes within the proposed development.

8. Proposed development on flat land adjacent to potentially unstable slope, as shown in fig. 3, which could not be strengthened for any reason including its inaccessibility due to trespass and/or land issues, will require a suitable buffer zone. The width of the buffer zone should be at least the height of the slope.

9. Proposed development on potentially unstable slope as shown in fig. 4, which could not be strengthened due to inaccessibility and/or land issues, shall not be allowed.
Slopes are classified according to slope gradient and type.

The slope gradient, in degrees, is measured from the horizontal plane. Sufficient survey points shall be obtained to produce accurate contour lines at 5m intervals. More survey points shall be obtained at localized areas such as existing slip, man-made slopes/structures, etc. The extent of survey shall include an area beyond the land boundary not less than 20 metres.

The type of slopes is divided into natural or man-made slope. Man-made slope is further divided into cut or fill slope. Higher risk is associated with fill slope.

Table 1 shows the Slope Classification for Design Purposes. The table also shows the associated risk and the maximum allowable hard surface footprint. The maximum allowable hard surface footprints for Class 3A, 3B, 4A and 4B are reduced in this guideline as compared to the previous guidelines. This is to preserve the green area and to allow easy maintenance and strengthening of slopes.

The maximum allowable hard surface in Table 1 below is applicable to all allowable developments. Nonetheless, the state’s planning policy at the material time shall take precedence.

Table 1: Slope Classification for Design Purposes

<table>
<thead>
<tr>
<th>CLASS</th>
<th>SLOPE GRADIENT</th>
<th>ASSOCIATED RISK</th>
<th>MAXIMUM ALLOWABLE HARD SURFACE FOOTPRINT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>NATURAL SLOPE</td>
<td>MAN-MADE SLOPE¹</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>1</td>
<td>0° - 15°</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td>&gt; 15° - 25°</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>3A</td>
<td>&gt; 25° - 35°</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>3B</td>
<td>&gt; 25° - 35°</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>4A</td>
<td>&gt; 35°</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>4B</td>
<td>&gt; 35°</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

Notes:
1. For man-made slope within a proposed development area, which is formed previously prior to the current application for development.
2. Hard Surface is an impervious surface as defined in MASMA.
Classification Of Slopes (cont’d)

Table 2 shows the submission requirements for all the classes of slopes by submission engineers. The qualifications of the submission engineers are stated in Table 3. Table 4 states the responsible party for the appointment of Geotechnical Design Engineer and Independent Checkers.

Please take note of the following:

i) The Civil Engineer and Geotechnical Engineer for a particular project can be the same or different engineer.

ii) The Geotechnical Engineer and Independent Checker for a particular project must be different engineers. They must also not be from the same firm.

Table 2: Submission Requirements

<table>
<thead>
<tr>
<th>CLASS</th>
<th>SUBMISSION REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Low Risk)</td>
<td>Slope Stabilization Analysis by Civil Engineer</td>
</tr>
<tr>
<td>2 (Low Risk)</td>
<td>Geotechnical Report by Geotechnical Engineer</td>
</tr>
<tr>
<td>3A (Medium Risk),</td>
<td>Geotechnical Report by Geotechnical Engineer</td>
</tr>
<tr>
<td>3B, 4A (High Risk)</td>
<td>and</td>
</tr>
<tr>
<td>4B (Very High Risk)</td>
<td>Geotechnical Review Report by Independent Checker</td>
</tr>
</tbody>
</table>
## Classification Of Slopes (cont’d)

### Table 3: Qualifications of Engineers³

<table>
<thead>
<tr>
<th>SUBMISSION ENGINEER</th>
<th>QUALIFICATIONS</th>
</tr>
</thead>
</table>
| Civil Engineer       | 1. Meets relevant Local Authority’s requirements.  
                        2. Registered Professional Engineers with Board of Engineers, Malaysia (BEM). |
| Geotechnical Engineer³ | 1. Meets relevant Local Authority’s requirements.  
                        2. Registered Professional Engineers with BEM with minimum three years practical geotechnical experience and one year gained in Malaysia. |
| Independent Checker³ | 1. Meets relevant Local Authority’s requirements.  
                        2. Registered Professional Engineers with BEM with:  
                           - At least 10 years relevant practical experience in the design or construction of buildings and, during the period 7 years immediately preceding the current appointment, has been engaged in geotechnical design after registration as a professional engineer with at least one year of such practical experience gained in Malaysia.  
                           - At least 3 years relevant practical experience in slope engineering with at least one year of such practical experience gained in Malaysia.  
                           OR  
                        Registered Accredited Checkers (Geotechnical) with BEM |

**Note:**
³ Qualifications of Geotechnical Engineer and Independent Checker shall be clearly specified to ensure only competent geotechnical engineers with relevant experience undertakes the design and checking works.

---

![Classification of Slopes](image.png)
Table 4: Appointment of Geotechnical Engineer and Independent Checker

<table>
<thead>
<tr>
<th>CLASS</th>
<th>APPOINTMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Low Risk)</td>
<td>Geotechnical Engineer is not required.</td>
</tr>
<tr>
<td>2 (Low Risk)</td>
<td>Appointment of Geotechnical Engineer by Developer.</td>
</tr>
<tr>
<td>3A (Medium Risk),</td>
<td>Appointment of Geotechnical Engineer and Independent Checker by Developer.</td>
</tr>
<tr>
<td>3B, 4A (High Risk)</td>
<td></td>
</tr>
<tr>
<td>4B (Very High Risk)</td>
<td>Appointment of Geotechnical Engineer and Independent Checker by Developer and</td>
</tr>
<tr>
<td></td>
<td>concurred by Local Authority.</td>
</tr>
</tbody>
</table>

During construction, proper and adequate supervision are important. Table 5 states the construction supervision requirement.

Table 5: Construction supervision requirements

<table>
<thead>
<tr>
<th>CLASS</th>
<th>SUPERVISION REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &amp; 2 (Low Risk)</td>
<td>No changes to existing requirements as stipulated in UBBL Sections 5 and 7.</td>
</tr>
<tr>
<td>3A (Medium Risk),</td>
<td>Additional audit via site visits shall be carried out by Independent Checker.</td>
</tr>
<tr>
<td>3B, 4A (High Risk)</td>
<td>Minimum frequency of site visits shall be once a month.</td>
</tr>
<tr>
<td>4B (Very High Risk)</td>
<td>Additional audit via site visits shall be carried out by Independent Checker.</td>
</tr>
<tr>
<td></td>
<td>Minimum frequency of site visits shall be once every fortnightly.</td>
</tr>
<tr>
<td></td>
<td>Instrumentation monitoring shall be carried out to monitor conditions of slopes.</td>
</tr>
</tbody>
</table>
SUBMISSION REQUIREMENTS

Pre-Submission Consultation

Submitting Person (SP) – be it the Planner, Architect, Engineer, Geotechnical Engineer or Surveyor – shall engage in pre-submission consultation with the relevant departments prior to submission of Layout Plan and Geotechnical Report for all hillsite development projects.

The submitting person shall compile or make available some basic documents and/or information for discussion during the pre-submission consultation with the relevant authorities. For example land classification, land suitability, preliminary proposed Layout Plan, Land Survey Plan and Terrain Mapping.

Preparation of final Layout Plan & Geotechnical Report

The SP shall ensure that there will be no more changes made to the Layout Plan and shall order the Final Geotechnical Report to be prepared for concurrent submission to OSC.

Changes made during the delivery process may result in re-submission of Layout Plan and Geotechnical Report for approval.

The table below shows the colours to use in preparing terrain map.

Table 6: Colour Code for Terrain Mapping

<table>
<thead>
<tr>
<th>Slope Classification</th>
<th>Colour</th>
<th>Decimal RGB Codes</th>
<th>Equivalent AutoCAD Colour Index #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>Light Green</td>
<td>212 255 170</td>
<td>71</td>
</tr>
<tr>
<td>Class 2</td>
<td>Beige</td>
<td>255 255 170</td>
<td>51</td>
</tr>
<tr>
<td>Class 3A</td>
<td>Brown</td>
<td>255 234 170</td>
<td>41</td>
</tr>
<tr>
<td>Class 3B</td>
<td>Orange</td>
<td>255 170 170</td>
<td>11</td>
</tr>
<tr>
<td>Class 4A</td>
<td>Light Red</td>
<td>255 63 0</td>
<td>20</td>
</tr>
<tr>
<td>Class 4B</td>
<td>Red</td>
<td>255 0 0</td>
<td>1</td>
</tr>
</tbody>
</table>

Notes:
Decimal RGB codes for the 256 Colors in equivalent with AutoCAD Color Index (numbers 0-255).
Equivalent AutoCAD colour Index is provided for comparison and reference purposes only.
Fig. 5: Hillsite Development Plan Submission Flow Chart:
(Concurrent Submission of Planning Permission (Layout Plan) and Geotechnical Report)

Application (PSP/SP/GE)
Pre-submission Consultation

OSC
2 days

Technical Departments
Check and Comment on Submitted Plan

Technical Departments
Check/Comment on Submitted Plan
[Chairman, MPPP, MPSP, JMG, JAS, JPS, JPBD, CKC/JKR]

21 days

J KR P. Pinang
Risky Land Development Committee Secretariat
Distribution of reports to Technical Departments

2 days

Applicant (PSP/SP/GE)
Compliance of Requirements
Presentation to Risky Land Development Committee

40 days

PBT (Planning Dept.)
Confirmation of Plan Recommendation of Plans for approval

37 days

JKR P. Pinang
Risky Land Development Committee Secretariat
Approval of Geotechnical Report

7 days

Applicant (PSP/SP)
Compliance of Requirements including requirements from GE

14 days

Total Time = 70 days

Total Time = 108 days
Notes to the Submission Flow Chart

1. Pre-Submission Consultation
   Submitting Person, be it Planner, Architect, Consulting Engineer, Geotechnical Engineer and Surveyor shall engage in pre-submission consultation with the relevant Departments prior to submission of layout plan and geotechnical report for all project located in hillsite.

   For hillsite project, submitting person shall compile or make available some basic documents and/or information for discussion during the pre-submission consultation with the relevant authorities. (e.g. Land Classification, Land Suitability, Preliminary Proposed Layout plan, Land Survey plan, Terrain Mapping and etc.)

2. Preparation of final Layout Plan and Geotechnical Report for Submission
   Submitting person to ensure that there shall be no more changes made to the layout plan and order the Final Geotechnical Report to be prepared for concurrent submission to OSC. Changes made during the delivery process may result in re-submission of layout plan and Geotechnical Report for approval.

3. Submission to OSC
   Upon receipt of Layout Plan and 8 copies of Geotechnical Report, OSC will forward the plan and Geotechnical Report to the relevant Departments.
   Time frame : 2 days

4. Submission of Geotechnical Report to JKR
   Upon receipt of Geotechnical Report from OSC, JKR (Risky Land Development Committee Secretariat) will then distribute it to the relevant Departments for Comments/Clearance.
   Time frame : 2 days

5. Comments and Requirements from All Technical Departments
   Comments, requirements and/or recommendations from various technical departments shall be submitted to JKR (Risky Land Development Committee Secretariat) within 21 days and shall be forwarded immediately to the SP/Geotechnical Engineer for immediate compliance.
   Time frame : 21 days

6. Compliance of Requirements by Geotechnical Engineer
   Upon receipt of comments, requirements and/or recommendations from various technical departments, Geotechnical Engineer shall notify the Architect/Planner of any changes, which may affect the layout or building design. Upon compliance of all requirements imposed by authorities, and synchronization of the drawing and design with Architect/Planner, Geotechnical Engineer shall re-submit report to JKR.

   Geotechnical briefing and presentation to the Risky Land Development Committee by the Geotechnical Engineer shall be accomplished within 40 days.
   Time frame : 40 days

7. Approval of Geotechnical Report
   Geotechnical Report shall be approved after satisfactory deliberation in the Risky Land Development Committee meeting. Copy of approval will be forwarded to OSC to synchronize with the approval process of layout plan.
   Time frame : 7 days

Note : Durations quoted are in calendar days.
The method of selecting engineers by ability shall be as follows:

a) Technical Competence  
b) Managerial Ability  
c) Availability of Resources  
d) Professional Independence & Integrity  
e) Fairness of Fee  
f) Quality Assurance System

These are very important criteria to be considered in selecting a competent engineer *(see appendix 3 for detailed explanation & examples).*

The other considerations are the engineer’s personal attributes such as having good commitment towards project, communication skills and engineering judgement, and these should be well augmented with his experience in the industry.
### Table 7: Criteria for Selecting a Competent Engineer

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technical Competence</strong> (Max. 30pts)</td>
<td></td>
</tr>
<tr>
<td>- Competency, experience and qualifications of key personnel</td>
<td></td>
</tr>
<tr>
<td>- Knowledge management system</td>
<td></td>
</tr>
<tr>
<td>- Methodology of technical approach to be utilized</td>
<td></td>
</tr>
<tr>
<td>- List of similar projects</td>
<td></td>
</tr>
<tr>
<td>- Comments from previous clients</td>
<td></td>
</tr>
<tr>
<td><strong>Managerial Ability and Availability of Resources</strong> (Max. 30pts)</td>
<td></td>
</tr>
<tr>
<td>- Adequate experienced staff for the project</td>
<td></td>
</tr>
<tr>
<td>- Similar experience in handling the scale of project</td>
<td></td>
</tr>
<tr>
<td>- Record of project achievements and success of previous projects</td>
<td></td>
</tr>
<tr>
<td>- Engineer’s technical manual, check-lists or procedures to ensure quality output</td>
<td></td>
</tr>
<tr>
<td>- Evidence of value-engineering</td>
<td></td>
</tr>
<tr>
<td><strong>Professional Independence and Integrity</strong> (Max. 5pts)</td>
<td></td>
</tr>
<tr>
<td>- Reputation of the engineer</td>
<td></td>
</tr>
<tr>
<td>- List of clients</td>
<td></td>
</tr>
<tr>
<td><strong>Fairness of Fee</strong> (Max. 25pts)</td>
<td></td>
</tr>
<tr>
<td>- Value-for-money service in relation to the detailed scope of work</td>
<td></td>
</tr>
<tr>
<td><strong>Quality Assurance System</strong> (Max. 10pts)</td>
<td></td>
</tr>
<tr>
<td>- Examine documentation of a project particularly on the:</td>
<td></td>
</tr>
<tr>
<td>- Check &amp; review</td>
<td></td>
</tr>
<tr>
<td>- Traceability ex. meeting notes, etc</td>
<td></td>
</tr>
<tr>
<td>- ISO9001:2000 certified is encouraged</td>
<td></td>
</tr>
<tr>
<td><strong>Total Score</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Selection Procedure

The Selection procedure shall have the following key components:

1. Terms of reference
2. Pre-qualification
3. Short-listing
4. Request for technical and fees proposals
5. Assessment of proposals
MAINTENANCE - INSPECTION

The maintenance of slopes and earth retaining walls should generally follow the guidelines given in the Public Works Department’s publication “Guidelines on Slope Maintenance in Malaysia, JKR 21503-0001-06, Slope Engineering Branch, Public Works Department Malaysia, August 2006.”

Those responsible for the slope design shall prepare recommendations for regular inspections and maintenance that are essential to be followed. Regular inspections and maintenance are essential for the continued stability of well-designed and well-constructed slopes.

Routine maintenance inspection, engineer inspection for maintenance, regular checks of buried water carrying services and regular monitoring of special measures are four major categories of maintenance inspection.
The typical inspection procedure is set out as above.

**Maintenance manual**

A maintenance manual shall be prepared by the Engineer, and the maintenance programme includes monitoring of the installed instruments if they are specifically needed in the design.

The proposed actions shall clearly be specified at various threshold readings or profiles of the monitoring results.

All stakeholders are to accord maintenance effort to slopes and retaining structures with respect to their consequences. It must be noted that safe and efficient access is important for maintenance works.

Refer to Appendix 4 for a Checklist for Maintenance Manual.
This Guideline needs the commitment of all the stakeholders to improve safety of hillsite development and enhance the environment. To succeed, it demands:

(i) Developers must engage competent engineers and contractors with capability and capacity.

(ii) Engineers must exercise due skill and care when performing their duties in planning, analysis, design and supervision, and must complement these duties with a regiment of quality checking and review. Their service must include the preparation of maintenance manuals and the duty of adequate post-construction inspections.

(iii) Contractors must have trained personnel and proper and adequate plant and equipment to meet the design and specification requirements of the Works. The importance of implementing temporary works for safety, site control and erosion protection must be instilled in the workers and implemented at the construction site.

(iv) Approving authorities must have experienced engineers in their geotechnical units to facilitate and enforce compliance with the Guideline.

When hard surfaces such as earth retaining systems and reinforced slopes have to be constructed to enhance or achieve safety, all stakeholders must be committed to the green initiative to incorporate planting provisions on these facilities to achieve a friendlier environment.
APPENDICES
APPENDIX 1

PROPOSED FORMAT FOR GEOTECHNICAL REPORT

EXECUTIVE SUMMARY

BODY OF REPORT

1. Project Information
   1.1 Project Title
   1.2 Name and contact details of developer
   1.3 Name and contact details of architect
   1.4 Name and contact details of C & S Engineer
   1.5 Name and contact details of submitting geotechnical engineer
   1.6 Curriculum vitae of submitting geotechnical engineer
   1.7 Approving authorities
   1.8 PM No.

2. Scope of Geotechnical Report
   2.1 General scope
   2.2 Limitations

3. Background of Development
   3.1 Location and land size
   3.2 Information on proposed development
   3.3 Information on surrounding developments

4. Area Geology and Terrain Classification
   4.1 Regional geology
   4.2 General site geology and general structural geology highlighting the presence of observable discontinuities e.g. rockslopes, cliffs, etc. Need Requirements for geologist input (if necessary).
   4.3 Terrain classification (terrain map) - terrain classification map to be plotted and prepared based on the approved colour codes.
   4.4 Terrain geological component
   4.5 Construction suitability map
5. Site Investigation

5.1 Topographical survey
   5.1.1 Topographical survey plans
   5.1.2 Aerial photographs

5.2 Site reconnaissance and desk study
   5.2.1 Site photographs
   5.2.2 General observations and description of the site (nature of terrain, surface boulders, etc)
   5.2.3 Observable evidence of potential slope instability, water marks or slip scars

5.3 Sub-surface soil investigation
   5.3.1 Types of investigation (boreholes, mackintosh probes, etc)
   5.3.2 Weather conditions before and during the soil investigation
   5.3.3 Subsoil profiles derived from soil investigation to be plotted and superimposed over the cross sections. Cross-sections should be perpendicular to ground contours and cross-sections need not be in a straight line.
   5.3.4 Field testing and results
   5.3.5 Laboratory testing and results
   5.3.6 Groundwater table level measurements and records
   5.3.7 Selected soil parameters for design – total and effective strength parameters

5.4 Geophysical survey (if applicable)
   5.4.1 Need requirements for geophysical survey
   5.4.2 Type and method of geophysical survey
   5.4.3 Results of geophysical survey

6. Geotechnical Design

6.1 Geotechnical design considerations
   6.1.1 Geotechnical issues associated with the project
   6.1.2 Design concepts and considerations
Appendix 1 (cont’d)

6. Geotechnical Design (cont’d)

6.2 Slopes
6.2.1 Proposed cut slope
6.2.2 Proposed fill slope
6.2.3 Proposed rock cut slope
6.2.4 Natural slope profiles
6.2.5 Determination of worst probable groundwater table levels and/or presence of perched groundwater table conditions
6.2.6 Slope stability analyses (total or effective stress conditions, types/methods of analysis and computer programs used)
6.2.7 Stability analyzes and considerations of natural and man-made slopes in neighbouring developments, which may affect the stability of the current project and vice versa
6.2.8 Recommended slope stabilization/strengthening measures
6.2.9 Recommended testing on the adequacy, safety and performance of slope stabilization works

6.3 Earth Retaining Structures
6.3.1 Types of earth retaining structures for the project
6.3.2 Overturning stability, sliding stability and bearing capacity checks
6.3.3 Global stability checks

6.4 Foundation Design
6.4.1 General considerations
6.4.2 Preliminary foundation design information/calculations
6.4.3 Effect of slopes on foundations and vice versa
6.4.4 Recommendations

6.5 Filled Platforms and Embankments
6.5.1 Settlement analyses
6.5.2 Stability analyses

6.6 Rockfall Analysis (if applicable)
6.6.1 Methods of analysis
6.6.2 Recommended measures to prevent and/or control rockfall and/or recommended land buffer requirements

6.7 Earthwork Quantities
6.7.1 Estimated cut quantity
6.7.2 Estimated fill quantity
6.7.3 Estimated rock excavation quantity

6.8 Surface and Sub-surface Water Problems (if applicable)
6.8.1 Presence and/or evidence of surface/sub-surface water conditions affecting the stability of slopes, retaining structures or foundations
6.8.2 Recommended rectification and/or controlling measures
Appendix 1 (cont’d)

6. Geotechnical Design (cont’d)

6.9 Temporary and permanent slope protection and surface drainage provisions

6.10 Instrumentation and Monitoring
   6.10.1 Need requirements for instrumentation and monitoring
   6.10.2 Type, location and quantity of instrumentation
   6.10.3 Recommended instrumentation monitoring programme

7. Earthworks Construction

7.1 Temporary works
7.2 Construction control and safety provisions
7.3 Construction method statement
7.4 Erosion and sediment control plan
7.5 Controlled rock blasting requirements (if applicable)

8. Post-construction Slope and Site Maintenance

8.1 Maintenance of slopes and related facilities
8.2 Frequency of slope maintenance inspections
8.3 Responsibility for slope maintenance
8.4 Slope maintenance manual

9. Conclusions And Recommendations

10. Engineer’s Declaration

11. References

12. Attachments

12.1 Planning Layout (Extracted Copy)
12.2 Survey Plan and Terrain Map
12.3 Slope Stability Analysis Results
12.4 Preliminary Design Calculations
12.5 Erosion Sediment Control Plan
12.6 Soil Investigation Reports
12.7 Slope Maintenance Manual
12.8 Independent Checker’s Report
APPENDIX 2

INDEPENDENT CHECKER REPORT FORMAT

CURRICULUM VITAE OF INDEPENDENT CHECKER

EXECUTIVE SUMMARY

BODY OF REPORT

1. Introduction
2. Limitations
3. Development description and location
4. Area geology and terrain classification
5. Site investigation
   5.1 Description of site
   5.2 Sub-surface soil investigation
      5.2.1 Subsoil profile
      5.2.2 Field test results
      5.2.3 Laboratory test results
      5.2.4 Underground water table
   5.3 Design soil parameters
   5.4 Geophysical survey
6. Geotechnical design
   6.1 Geotechnical design consideration
   6.2 Slopes
      6.2.1 Proposed cut slope
      6.2.2 Proposed fill slope
      6.2.3 Proposed rock slope
      6.2.4 Natural slope profile
      6.2.5 Slope stability analysis
      6.2.6 Slope stabilization measures
      6.2.7 Type of test for slope stabilization measures
   6.3 Retaining structures
   6.4 Foundation design considerations
   6.5 Slope protection and surface drainage provisions
   6.6 Instrumentation
7. Construction
8. Maintenance
9. Conclusion and Recommendations
10. Independent Checker’s declaration

REFERENCE

ATTACHMENT
CRITERIA FOR A RELEVANT EXPERIENCED ENGINEER

1. **Technical Competence**
   a) Engineer should provide technical approach and methods for the project (e.g. types of foundation system, what are the pros & cons, cost effectiveness, long-term maintenance and serviceability).

   b) Obtain a list of similar projects carried out by the firm. (e.g. projects of similar technical nature and subsoil condition, constructed and handed over)

   c) The competency, experiences and qualifications of personnel including peer recognition. (e.g. technical papers published in seminar, conferences, etc.),

   d) Check whether Engineer carry out knowledge management including Research and Development (R&D) to improve their services. (e.g. evidence of in-house engineering manuals, check-lists etc.). This is to ensure Clients get value designs which are safe, cost effective and construction friendly.

   e) Discuss with owners/clients of previous projects that involved the Engineer.

2. **Managerial ability**
   a) Ensure Engineer have adequate manpower resources and maintain schedules. (e.g. size of company and resources committed to be mobilized for the project)

   b) Ensure Engineer have similar experience in handling the **scale** of project.

   c) Examine Engineer’s record of project achievement and success on previous projects (e.g. awards won, peer recognition, etc.). However, it is important to **check whether the personnel involved in the previous successful projects are still with the company** and will be involved in the project to be awarded.

   d) Examine Engineer’s manual, check-lists or procedures of engineering that he follows in order to perform his services (e.g. to submit the list of design manual, check-lists etc. for review by Client).

3. **Availability of Resources**
   Ensure Engineer has sufficient staff available to carry out the works & to obtain the list of staff to be involved in the project.

4. **Professional Independence & Integrity**
   Ensure the Engineer is registered with BEM. Also consult industry players on the reputation of the Engineer (e.g. on his reputation, integrity, competency, etc.)
Appendix 3 (cont’d)

5. Fairness of Fee
Engineers need to be adequately paid to ensure that they are able to give a high quality service with proper attention to detail, alternative designs, material and method of construction.

a) Therefore, the Engineer shall be employed based on “Value for Money” rather than “Lowest Price”. This is because the engineer’s fees only contribute a very small percentage to the project cost. If ineffective or non-economic designs were produced by the engineer and used, the cost of remedial and unnecessary wastage of materials and workmanship will be SIGNIFICANTLY more than the fees paid. In addition, ineffective design may also cause DELAY in the project.

b) Alternatively if bidding process is still necessary to ensure competitiveness is observed, only Pre-Qualified Engineers shall be invited to participate.

6. Quality Assurance System
Quality of the project is often the most important measure of the services received. Without quality assurance system, the product and design may have high risk of not achieving its intended purpose.

a) It is encouraged that the Engineering Firm is ISO9001:2000 certified (e.g. either by SIRIM Berhad or other accrediting bodies).

b) The Engineer shall have proper procedures (written in black and white) and followed by the Engineers and staff to ensure all designs are checked. This shall include having the necessary forms to record checking (examine evidence of checking and recording). The Client shall request the Engineer to submit their procedures and forms for verification.

c) The Engineer shall have proper filing and re-tractable procedures in place. (e.g. project filing and identification and traceability, which allows documents to be traced and submitted within a short period (e.g. less than 1 day).

d) All design (calculations, specifications, drawings, etc.) shall be properly checked and reviewed by different person of relevant experiences within the company. The process shall have proper forms for evidence and record purposes.

e) The client has the right to engage another consulting firm with specialist to carry out independent review if needed.
**APPENDIX 4**

**CHECKLIST FOR MAINTENANCE MANUAL**

<table>
<thead>
<tr>
<th>Man-made Item</th>
<th>Check For</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface drainage channels, catchpits and sand traps</td>
<td>Debris, undesirable vegetation and other obstructions.</td>
</tr>
<tr>
<td></td>
<td>Cracks.</td>
</tr>
<tr>
<td></td>
<td>Missing or deteriorated joint fillers and sealant.</td>
</tr>
<tr>
<td>Weepholes and drainage pipes</td>
<td>Obstructions (e.g. weeds and debris) in weepholes at pipe ends.</td>
</tr>
<tr>
<td></td>
<td>Undesirable vegetation growth.</td>
</tr>
<tr>
<td>Impermeable surface cover (e.g. gunite and shotcrete)</td>
<td>Cracks or spalling.</td>
</tr>
<tr>
<td></td>
<td>Erosion.</td>
</tr>
<tr>
<td></td>
<td>Surface cover that has separated from underlying soil.</td>
</tr>
<tr>
<td></td>
<td>Missing or deteriorated joint fillers and sealant.</td>
</tr>
<tr>
<td></td>
<td>Dead, decaying or unstable trees.</td>
</tr>
<tr>
<td>Vegetated surface cover</td>
<td>Erosion</td>
</tr>
<tr>
<td></td>
<td>Dead vegetation surface</td>
</tr>
<tr>
<td></td>
<td>Overgrown vegetation.</td>
</tr>
<tr>
<td></td>
<td>Dead, decaying or unstable trees.</td>
</tr>
<tr>
<td>Rock slopes and boulders</td>
<td>Cracked or spalled concrete surface and support.</td>
</tr>
<tr>
<td></td>
<td>Loose rock debris.</td>
</tr>
<tr>
<td></td>
<td>Undesirable vegetation.</td>
</tr>
<tr>
<td>Facing</td>
<td>Deteriorated mortar joints on masonry face.</td>
</tr>
<tr>
<td></td>
<td>Cracked or spalled concrete surface and replace missing or deteriorated joint fillers and sealant.</td>
</tr>
<tr>
<td>Slope furniture instrumentations: inclinometers, settlement markers, tilt</td>
<td>Rust.</td>
</tr>
<tr>
<td>meters etc. installed on slopes and retaining structures.</td>
<td>Reading (within acceptable range).</td>
</tr>
<tr>
<td></td>
<td>Movement on slope or retaining structure.</td>
</tr>
</tbody>
</table>
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