

1998 SLOPE MAINTENANCE AUDIT REPORT ON HOUSING DEPARTMENT

Executive Summary

The first Slope Maintenance Audit (SMA) on Housing Department (HD) has been carried out by the Slope Maintenance Audit Section of the Geotechnical Engineering Office (GEO) during the period 1 June to 15 August 1998, in accordance with Works Branch Technical Circular No. 9/96.

The SMA was conducted in two main parts: (a) Adequacy Assessment of the Documented Slope Maintenance System, and (b) Compliance Assessment of the Implemented Slope Maintenance System. An overall grade (**GOOD, FAIR** or **POOR**) was given to each part based on the findings of the assessment.

The Departmental Plan for Slope Maintenance and Geotechnical Works for Management Division (HD, 1998) which documented HD's slope maintenance system was submitted to the GEO in June 1998 and was found to be **GOOD** in general, with reference to the requirements specified in Guide to Slope Maintenance (GEO, 1995), in the Adequacy Assessment.

Staff from the SMA Section visited the Geotechnical Engineering Section and seventeen District Management Offices of HD to assess the extent to which the submitted Departmental Plan is implemented and observed by HD. Thirty-four slopes/retaining walls maintained by HD were also inspected to assess their actual maintenance state. The results of the Compliance Assessment was found to be **FAIR**.

Findings of the SMA on the four main areas including management, inspections, works and other related activities are summarized in the table on the following pages. Recommendations to improve the present slope maintenance system of HD are also included in the table.

The percentages of the inspected slopes/retaining walls found to be in good, fair and poor maintenance conditions are 9%, 50% and 41% respectively. The poorly maintained areas were mainly surface drainage and slope protection.

Details of the SMA and its findings are contained in the **1998 Slope Maintenance Audit Report on Housing Department**.

Summary of Assessment Findings and Improvement Recommendations (Sheet 1 of 8)

Area	Achievement	Deficiency	Recommendation
Management	<p>(a) Various aspects of the slope maintenance system were accountable for by two responsible branches.</p> <p>(b) Most requirements stipulated by Works Bureau, including Geoguide 5 - Guide to Slope Maintenance (GEO, 1995), Code of Practice on Inspection & Maintenance of Water Carrying Services Affecting Slopes (WB, 1996b), were integrated into the in-house manuals.</p> <p>(c) Some in-house specifications were at a higher standard than stipulated by Works Bureau.</p> <p>(d) The examined records showed that most staff discharged their duties in accordance with the in-house manuals.</p> <p>(e) Most slopes/retaining walls within HD's boundaries were registered in their slope records.</p> <p>(f) Inventory of slope and other slope-related information were issued and distributed under quality assurance system.</p> <p>(g) Computer index system was used to assist in retrieving reports of engineer inspections for maintenance, stability assessments and maintenance manuals.</p>	<p>(a) Although Chief Geotechnical Engineer of the Geotechnical Engineering Section has been appointed as the Programme Manager for slope maintenance works, the two branches operated independently. No regular meetings were held among the responsible staff from the two branches to discuss their interactions as well as other important aspects of slope maintenance.</p> <p>(b) No or little joint reviews/follow-ups/feedbacks on the effectiveness of the inspections and works were conducted amongst various parties who carried out the inspections and works independently.</p> <p>(c) Some requirements stipulated in Geoguide 5 (GEO, 1995) were not clearly specified in the in-house manuals/consultancies.</p> <p>(d) Arrangement to update the stability assessment where significant modifications or deterioration occurred was not explicitly specified in the in-house manuals.</p> <p>(e) Preparation, review and updating, if needed, of maintenance manuals were not specified as one of the requirements in the consultancy for engineer inspection for maintenance.</p>	<p>(a) A steering committee comprising representatives of various divisions and offices involved in slope maintenance should be formed to oversee, advise, monitor and review the important aspects of slope maintenance.</p> <p>(b) Requirements specified in Geoguide 5 (GEO, 1995) should be fully adopted and integrated into the slope maintenance system to ensure that the scope of documentation, inspection and works related to slope maintenance is adequate.</p> <p>(c) Maintenance manuals and stability assessments should be prepared at the earliest possible time and then reviewed in every engineer inspection for maintenance to ensure that correct and up-to-date information is maintained.</p>

Summary of Assessment Findings and Improvement Recommendations (Sheet 2 of 8)

Area	Achievement	Deficiency	Recommendation
Management (Cont'd)	<p>(h) About 27% of the slopes/retaining walls were ordered for preparation of stability assessment reports.</p> <p>(i) About 6% of the slopes/retaining walls were ordered for preparation of maintenance manuals.</p> <p>(j) Programme for erecting slope registration plates were being planned.</p> <p>(k) Appropriate controls of records of slope maintenance inspections and works were established under quality assurance system.</p>	<p>(f) No maintenance manuals and stability assessment reports were to be prepared for slopes/retaining walls in cottage areas/temporary housing areas/redevelopment estates which amounted to more than 20% of the total slopes/retaining walls.</p> <p>(g) Some maintenance manuals did not include all the information stipulated in Geoguide 5 (GEO, 1995), e.g. layout plans of water-carrying services, recommended frequency for regular checks of buried water-carrying services, outline of the basis of design and/or findings of stability assessment and as-built plans and record photographs.</p> <p>(h) Requirements of erecting slope registration plates stipulated in Works Bureau Technical Circular No. 20/97 (WB. 1997) were not yet incorporated in the in-house manuals.</p> <p>(i) Not all slopes within the HD's boundaries were registered in its inventory of slopes. Thus no slope maintenance inspections were carried out for these slopes/retaining walls.</p> <p>(j) A number of the GEO slope reference nos. in HD's conversion table were incorrect.</p>	<p>(d) Correct, consistent and up-to-date information (such as GEO ref. nos., slope records and maintenance manuals) of all slopes/retaining walls should be appropriately distributed to and maintained by the concerned parties to ensure that all slopes/retaining walls are properly documented, inspected and maintained. The use of GEO slope ref. nos. together with the maintenance boundaries specified in Systematic Identification of the Maintenance Responsibility of Slopes in the Territory (SIMAR) would facilitate communication with other departments on slope issues.</p> <p>(e) Technical checks and reviews should be established in slope maintenance system to ensure that all slope maintenance activities are properly carried out.</p>

Summary of Assessment Findings and Improvement Recommendations (Sheet 3 of 8)

Area	Achievement	Deficiency	Recommendation
Management (Cont'd)		<p>(k) For some slopes, inconsistent boundaries were used by various parties including consultants for engineer inspections for maintenance, district management office and Geotechnical Engineering Section staff.</p> <p>(l) Some staff did not perform their duties in accordance with the in-house manuals.</p> <p>(m) Maintenance manuals were not kept by staff of district management offices who were responsible for routine maintenance inspections.</p> <p>(n) The frequencies of the EIs and RMIs specified in maintenance manuals were not followed during the actual slope maintenance inspections.</p> <p>(o) Records of routine maintenance works were kept by various parties at various locations. Checking the proper completion of all works after inspections was thus difficult.</p> <p>(p) Master lists of available records especially slope maintenance inspections were not available.</p>	<p>(f) The needs for preparation of reference documents such as maintenance manuals and stability assessment for slopes/retaining walls in cottage areas/temporary housing area/redevelopment estates should be reviewed taken into consideration the re-housing programmes to ensure that adequate interim measures such as preventive maintenance measures are provided to these slopes/retaining walls as appropriate. Use of prescriptive measures (GEO, 1996) as preventive maintenance works should also be promoted in the in-house manuals and contracts for those slopes/retaining walls which upgrading works are not carried out in short time.</p> <p>(g) Slope registration plates should be erected at the earliest possible time to facilitate identification of slopes/retaining walls on site.</p> <p>(h) Records of slope maintenance inspections and works should be centralized to facilitate follow-ups of recommended works, periodic technical reviews and easy retrieval of records.</p>

Summary of Assessment Findings and Improvement Recommendations (Sheet 4 of 8)

Area	Achievement	Deficiency	Recommendation
<p>Slope Maintenance Inspections</p>	<p>(a) Most of the requirements such as scope, personnel, frequency stipulated in Geoguide 5 were incorporated in the in-house manuals.</p> <p>(b) Responsibilities and procedures for conducting slope maintenance inspections were documented in the in-house manuals.</p> <p>(c) More frequent routine maintenance inspections and engineer inspections for maintenance were specified in the in-house manuals, in comparison with that stipulated in Geoguide 5 (GEO, 1995).</p> <p>(d) The examined reports of engineer inspections for maintenance and regular monitoring of special measures showed that most of the engineer inspections for maintenance were conducted in accordance with the in-house manuals.</p> <p>(e) About 20% of the slopes/retaining walls had the first leakage assessment reports.</p> <p>(f) About 88% and 82% of the inspected slopes/retaining walls with adequate maintenance access to the crest and to the toe respectively.</p>	<p>(a) The following scopes stipulated in Geoguide 5 (GEO, 1995) were not included in the consultancy for engineer inspection for maintenance:</p> <p>(i) determination of whether stability assessment has previously been carried out;</p> <p>(ii) assessment of the adequacy of RMWs; and</p> <p>(iii) Preparation/updating the maintenance manual, where necessary, after each engineer inspection.</p> <p>(b) Procedures to ensure compliance of the frequencies of leakage checks with those stipulated in Code of Practice on Inspection & Maintenance of Water Carrying Services Affecting Slopes (WB, 1996b) were not included in the in-house manuals.</p> <p>(c) No leakage assessments were to be carried out for slopes/retaining walls in cottage areas/temporary housing areas/redevelopment estates which amounted to more than 20%.</p> <p>(d) Works carried out by term contractor of estate management offices were neither checked nor reviewed by geotechnical engineers to confirm their effectiveness.</p>	<p>(a) Requirements specified in Geoguide 5 (GEO, 1995) should be fully adopted and integrated into the slope maintenance system to ensure that the scope of documentation, inspection and works related to slope maintenance is adequate.</p> <p>(b) First leakage assessment report should be prepared at the earliest possible time and regular checks should then be continued to ensure that slope maintenance inspections and works are properly carried out.</p> <p>(c) Correct, consistent and up-to-date information (such as GEO ref. nos., slope records and maintenance manuals) of all slopes/retaining walls should be appropriately distributed to and maintained by the concerned parties, especially those responsible for slope maintenance inspections and works, to ensure that all slopes are properly documented, inspected and maintained.</p>

Summary of Assessment Findings and Improvement Recommendations (Sheet 5 of 8)

Area	Achievement	Deficiency	Recommendation
Slope Maintenance Inspections (Cont'd)		<p>(e) Information (such as slope boundaries, coordinates, buried water-carrying services etc.) on the basic data sheets in some reports of engineer inspections for maintenance were either incorrect or outdated.</p> <p>(f) Up-to-date information such as slope records and maintenance manuals were not kept by the district management office staff for their routine maintenance inspections. This resulted in missing and/or improper routine maintenance inspections.</p> <p>(g) The examined records showed that about 52% of the selected slopes/retaining walls had their routine maintenance inspections not carried out at the frequency specified in the in-house manuals.</p> <p>(h) The examined records showed that no routine maintenance works were recommended in most routine maintenance inspections. In contrast, lots of routine maintenance works were recommended in the engineer inspections for maintenance and maintenance condition of 41% of the inspected slopes/retaining walls was graded as poor. Many of these poorly maintained items such as serious blockage of surface channels by vegetation and rubbish for a long time should have been observed in the frequent routine maintenance inspections.</p>	<p>(d) Technical checks and reviews should be established in slope maintenance system to ensure that all slope maintenance activities are properly carried out.</p> <p>(e) Adequate and safe access for maintenance should be provided to ensure that the slope maintenance inspections and works are properly carried out.</p>

Summary of Assessment Findings and Improvement Recommendations (Sheet 6 of 8)

Area	Achievement	Deficiency	Recommendation
Slope Maintenance Inspections (Cont'd)		(i) Instead of assessing the adequacy of routine maintenance works done, the reports only recorded what was informed by staff of the district management offices. (j) Only 46% of the inspected slopes/retaining walls had adequate access to the berms for maintenance. Furthermore, about 29% of the inspected slopes/retaining walls which had channels across the slope surface did not have berms for maintenance.	
Slope Maintenance Works	(a) Discharge of slope maintenance works after inspections were documented in the in-house manuals and contracts. (b) Records of routine maintenance works were kept in the offices of resident engineer, district management offices and estate management offices. (c) Preventive maintenance works were carried out as recommended by consultants. (d) Preventive maintenance works adopting prescriptive measures approach were carried out in cottage areas.	(a) Demarcation of responsibilities and administration procedures/arrangement on conducting various types of routine maintenance works (such as cleansing works and non-cleansing works) among various parties were not clearly documented in the in-house manuals. (b) No or little checking/reviews/follow-ups were carried out by the initiating offices (i.e. Geotechnical Engineering Section or District Management Offices) who recommended the works to ensure that the works are properly carried out.	(a) Technical checks and reviews should be established in slope maintenance system to ensure that all slope maintenance activities are properly carried out. (b) Use of prescriptive measures (GEO, 1996) as preventive maintenance works should be promoted in the in-house manuals and contracts for those slopes/retaining walls which upgrading works are not carried out in short time.

Summary of Assessment Findings and Improvement Recommendations (Sheet 7 of 8)

Area	Achievement	Deficiency	Recommendation
Slope Maintenance Works (Cont'd)	(e) Initiation and procedures for conducting emergency repair works were documented in the in-house manuals and contracts.	<p>(c) Encouragement to use prescriptive measures (GEO, 1996) as preventive maintenance works was not mentioned in the in-house manuals, consultancies and contracts.</p> <p>(d) No/little control on time frame for commencement and completion of slope maintenance works after inspections was available to avoid unnecessary delay.</p> <p>(e) Lag time for commencement of routine maintenance works after engineer inspections for maintenance was long. (75% of the examined records was between 3 and 6 months while 25% was longer than 6 months.)</p> <p>(f) Routine maintenance works recommended in the slope maintenance inspections were carried out by various responsible parties including term contractor of Geotechnical Engineering Section, term contractors of district management offices and term contractors of estate management offices. Records of these works were kept in various offices by different staff.</p> <p>(g) Records of follow-up works recommended in emergency inspection were kept by various parties.</p>	<p>(c) Control of work progress should be tightened for slope maintenance works to avoid unnecessary delay.</p> <p>(d) Records of slope maintenance inspections and works should be centralized to facilitate follow-ups of recommended works, periodic technical reviews and easy retrieval of records.</p>

Summary of Assessment Findings and Improvement Recommendations (Sheet 8 of 8)

Area	Achievement	Deficiency	Recommendation
Other Related Slope Maintenance Activities	<p>(a) General technical training and quality assurance audit was provided and conducted under quality assurance system.</p> <p>(b) The examined records showed that a few courses on slope maintenance organized by external institutions were attended by staff.</p>	<p>(a) Training and technical audit on slope maintenance were not specifically addressed.</p> <p>(b) No in-house training and technical audit on slope maintenance was performed.</p>	<p>A steering committee comprising representatives of various divisions and offices involved in slope maintenance should be formed to oversee, advise, monitor and review the important aspects of slope maintenance.</p>
<p>Note:</p> <p>1. For full titles of the references, please refer Section 7 of the Report</p>			