Bahagian 3 : Penjelasan Mengenai TOR

Term Of Reference – The Forensic Engineering Services (Slopes & Slopes Related Structures) And The KISB Services



PK 2.2 Lampiran G

LAMPIRAN G Terms Of Reference

TERMS OF REFERENCE THE FORENSIC ENGINEERING SERVICES (SLOPES & SLOPES RELATED OF STRUCTURES) AND THE KISB SERVICES



1.0 INTRODUCTION

- * 1.2.1 Technical Definitions
- * a) 'Forensic Engineering & Failures' has the meaning which include, without limitation:-
- i. Forensic Engineering means the engineering investigation of the causes of failures (materials, products, workmanships and design) of slopes and structures. The investigation will benchmark against existing codes, standards, statutory/regulatory requirements and best practices in the construction industry; and
- ii. Failure means the ultimate manifestation of distress, resulting in an unacceptable difference between expected and observed performance.
 Failure can also mean the termination of the ability of a component or system to perform an intended or required function. Not all failures are catastrophic; most involve components that simply do not perform as expected.



1.1. THE SCOPE OF SERVICES

- * 1.1.1. The Forensic Engineering Services (Slopes & Slope Related Structures), including Site Supervision of Construction Works as follows:
 - i. Slopes;
 - ii. Slope related (associated and affected) structures; and
 - iii. Related services inclusive of field & laboratory testing which are needed solely for the Forensic Engineering Services (Slopes & Slope Related Structures).
- * 1.1.2. Any physical works (construction) are outside the scope of this Agreement.



* 1.2.1 Technical Definitions

* b) 'Slope Associated Structures' means any or all structural components which form(s) an integral part of the Slope and contribute(s) towards(s) its stability including but without limitation to soil nail, retaining wall, reinforced earth wall, rubble wall, etc; and

* c) 'Slope Affected Structures' means any or all structures located in the vicinity of the Slope and is/ are affected by the Failure.



DEFINITION OF SLOPES



Anatomy Of A Slope MAR Canally S. H. L. Land Partially Saturated Soil >15° H > 3m**Saturated Soil** Water Table





Unipark Suria Agensi : IKRAM



MRSM Bentong Agensi : MARA

Basket Ball & Sepak Takraw Court

estet Ball Court

Thick Overburden (Silty Material)



H = 50m

RATI

 $\alpha = 70$



SLOPES ASSOCIATED STRUCTURES



RC Wall Failure





RE Wall Failure





SOIL NAIL FAILURE



SLOPES AFFECTED STRUCTURES



EiMAS, Bangi (2012)





Loji Rawatan Air





Pulau Banding





RELATED SERVICES



SITE INVESTIGATION







TOPOGRAPHY SURVEY





1.2 AREAS NOT COVERED BY THE SCOPE

- * 1.2.1 The Services provided by KISB shall cover all slopes failure throughout Malaysia except:
 - * (a) All Federal roads in Malaysia. In any event that the Public Works Department do not have the capacity to carry out the services, the ROFR to KISB applies;
 - * (b) All forensic engineering services that are currently being undertaken and pending completion by the Government/Agency either on its own or through its appointed consultants/contractors; and
 - * (c) All roads that are currently under privatized concession agreement (toll roads).



KM 65 FT 185 AGENSIF JKR MALAYSIA KATEGORI TJALAN PERSEKUTUAN



ROAD UNDER CONSTRUCTIO





TOLL HIGHWAYS







4.0 EMERGENCY CASES



Highland Tower 1993



Landslide brings house down

reporting for duty at Affin Bank chairman Jen (R) Tan Sri Ismail Omar's bungalow at Taman 2328. Taman Hillview in ing out of the room, he saw his

2002

KUALA LUMPUR: It was a landslide, trapping all the 13 4.30am, and two guards were occupants yesterday.

Intan Jasmin, Ismail, Mohamad Shazwan, Shamir Izat and Illva Syamira survived the tragedy.

However, eight perished, including Puan Sri Azizah who Downstairs in the master was the last to be pulled out of the pile of debris at 10.40pm. The dead were Ismail's son Ahmad Hijaz, 39, daughter-in-

law Zaradina Zaini 29 grandchildren Zureen Aishah Ahmad Hijaz, five, Johan Ariff, 18-months, and his sonin-law Shamsul Azhar Ahmad Shafie, 35. Two of his Indonesian maids, identified as Tini and Su, both in their

two Indonesian maids running towards him. His first thought 20s, also died. was that there was another While rescuers were busy robbery, following the one that digging into the rubble in took place last month. Before search of the last victim at he could react further, the about 9.30pm, rescuers were also keeping an eye on four units of three-storey bungalow At the same time upstairs his son-in-law, Shamsul Azhar houses as they have been Ahmad Shafie had also woken found to be tilting. up and left the bedroom to

Police have asked the occupants to vacate their homes. However at press time, they had not done so.

The collapse is believed to have been caused by downpour over the past few

Soveral security guards TURN TO PAGE SIX



NATURE'S FURY ... rescuers working to clear the debristo get to the victims of the collapsed bungalow at Taman Hillvlew In Ampang yesterday. The Highland Towers loom in the background.

King, VIPs visit Ismail at KL Hospital

which had befallen him and

Ismail were the Yang di-

Pertuan Agong Tuanku Syed

Sirajuddin Syed Putra

Jamalullail, Foreign Minister

Datuk Seri Syed Hamid Albar and Minister in the Prime Minister's Department Brig-

Jen (R) Datuk Abdul Hamid

Zainal Abidin and Affin Bank

Bhd president and chief exec-

utive officer Raja Datuk Scri

Syed Hamid and Abdul

Among the VIPs who visited

his family.

Aman Ahmad



Hamid, who worked with Ismail when he was Defence ROYAL CONCERN ... the King and Queen being Forces chief, said Ismail's milbriefed on the tragedy

KUALA LUMPUR: Affin Bank itary background had greatly chairman Tan Sri Ismail Omar assisted him in confronting put on a brave face for his visthe shock and sadness over the itors at the Kuala Lumpur tragedy Hospital despite the tragedy

"Ismail had wanted to move to Scremban but his children asked him to stay with them." said Syed Hamid, who was Defence Minister when Ismail was the Defence Forces chief. Abdul Hamid said Ismail was fine except for some slight injuries to his leg.

"Ismail had woken up at 4.30am to join his family for sahur downstairs. He told me that the landslide occurred so fast that he and his family members could not react in time." he added.

"Ismail suffered wounds to his left leg. He is still in shock and has been asking how the incident happened," he added.





HOW IT HAPPENED ... a member of the rescue team showing Dr Mahathir, Najib and Ong the direction where the landslide came from.

Ampang, about 150m from the site of the Highland Towers. bedroom of the double-storey bungalow, Ismail had just woken to join his family for soluir downstaars, his wire Puon Sri Azizinh Abdul Aziz, Mise proparing the meal in the kitchen. As the SJ-year-old formor define forces chief was comdefence forces chief was com-

house collapsed.

wake up his two children who were sleeping in another room

as his wife Intan Jasmin was

feeding their nine-month-old

Shamir Izat, six, and Illya

Syamira, eight, the bungalow

ame crashing down following

son Mohamad Shazwan. But as he was waking up

Kampung Pasir, Ulu Klang (2006)

ULU KLANG was struck by landslide again, the fifth major tragedy since 1993.

Two women died and two toddlers were listed missing yesterday when thousands of tonnes of earth flattened an Indonesian settlement of 160 homes near Taman Zooview, less than 2km from Highland Towers. Sixteen Taman Zooview houses atop the slope that gave way have been deemed dangerous and the residents told to move out.

Stories and pictures in Pages 4, 35, 36 & 37





BUKIT ANTARABANGSA 2008





3.0 TOR FOR FORENSIC ENGINEERING

- 3.1 Serve as a guiding reference to the implementation of the steps in the Forensic Engineering Services aimed to :
 - * (a) Determine the cause(s) of the failure:
 - * (i) Identify failure or potential failure of the assets
 - * (ii) Understand the key failure mechanisms in order to avoid them in the future
 - * (b) Provide short and long term preventive solutions:
 - * (i) Propose immediate remedial measures to ensure safety to the public
 - * (ii) Provide conceptual remedial design options for remedial works

3.0 TOR FOR FORENSIC ENGINEERING (CONT'D)

- * (c) Recommend solution to prevent the recurrence of the landslides :
 - * (i) Provide detailed design inclusive of Bill of Quantities, Specifications and Drawings for the purpose of tendering for remedial works
 - * (ii) Propose systematic routine maintenance to ensure the stability of the rehabilitated slope
- * (d) Identify person/parties responsible, whenever applicable.
- * (e) Control the quality of remedial works through supervision and QAQC of remedial construction works.

4.0 EMERGENCY RESPONSE

4.1 Response Time

- In the event of failure where the situation is in the state of emergency, the first critical step is to prevent further damage or loss of life and response time has become critical. KISB shall respond to the reported failure situation upon directive of authority in the following manner:
- If the failure location is within 50 km from its nearest branch office the response time shall be within 3 hours.
- * 2. If the failure location is more than 50 km from its nearest branch office the response time shall be within 24 hours. In the case where the failure occurs in the remote area or location, the response time shall be within 48 hours. For the purpose of this clause, the phrase "remote" shall mean any area or location with no/difficult accessibility by proper road.



IKRAM UTARA



IKRAM UTARA



IKRAM UTARA





Figure 4.3 : Ipoh Branch





 KISB will assign a response team to the site of failure and determine the safety and stability of the slopes and slope related structures





- * 4.3.1 KISB will provide an initial report to the relevant authorities pertaining to the background of the slope failures and its consequences within 3 hours of arrival.
- * Key to the initial report will also include technical advices pertaining to safety issues as well as other information subject to the directive of the authority.
- * The initial report which will serve as "talking point", amongst others, will cover:
- * (i) Location and time of slope failure;
- (ii) The nature & probable cause/s of the slope failure;
- * (iii) The measures taken and will be taken to ensure safety of the public;
- * (iv) Reminders to the public especially pertaining to safety; and
- (v) Relevant photographs.



5.0 THE STEPS IN FORENSIC ENGINEERING INVESTIGATION (SLOPES & SLOPE RELATED STRUCTURES)

- * 5.2 STEPS IN FORENSIC
 ENGINEERING INVESTIGATION
 (SLOPES & SLOPE RELATED
 STRUCTURES)
- The generic steps in the Forensic
 Engineering Investigation (Slopes
 & Slope Related Structures).



Figure 5.2 :Generic Steps in the Forensic Engineering Investigation (Slopes & Slope Related Structures)



5.2.1 Step1 : Desk Study & Site Survey

- 5.2.1.1 Preliminary site survey will be required to identify the study location and establish study objective and scope.
- 5.2.1.2 Types of information that are typically sought in this step specifically for slopes include:
- * A. Assessment of the historical records (if available)
 - * a. Geotechnical Report
 - b. Soil investigation records
 - c Instrumentation monitoring records
 - d. Layout plan & Slope design reports
 - e. Development layout plan
- * B. Preparation of Site Geology Map
- * C. Compilation of rainfall records
- * D. Preparation of basic thematic maps but not limited to :
 - * a. Orthophotos
 - * b. Satellite images
 - c. Digital terrain model
 - d. Slope angle
 - e. Slope drainage
 - f. Boundary lot
 - * g. Road network
 - * h. Other related thematic maps



5.2.2 Step 2 : Site Forensic Study

5.2.2.2 Steps in the Investigation

- * 1. Site Surface Investigation
 - * a. Site reconnaissance survey
 - * b. Site technical issues evaluation
 - * c. Detailed Engineering survey
 - * d. Slope cross section preparation
 - * e. Terrestrial laser scanning
 - * f. Site surface and subsurface utility survey
 - * g. Geomorphological mapping
 - * h. Slope sketches
- * 2. Subsurface Investigation
 - a. Soil investigation
 - b. Mackintosh probings
 - c. Geophysical survey including seismic refraction survey and/or electrical resistivity survey
- * 3. Instrumentation
 - * a. Slope / site surface instrumentations
 - * b. Inclinometer for slope movement
 - * c. Piezometer for underground water pressure monitoring





5.2.3 Step 3 : Laboratory Testing

- 5.2.3.1 Laboratory analysis is to determine the actual soil / material properties. These would include the strength tests for the soils / materials as appropriate. The purpose of the tests is to determine actual soils / material properties at the time of failure as opposed to code-required minimum values. These tests should help to identify any time or environment dependent changes in soil / material properties.
- Typical soil / rock / material tests include, but not limited to the following:

*

- * 1. Soil / rock classification tests on collected samples
- * 2. Soil / rock strength and compressibility tests
- Soil general engineering properties tests such as porosity, erosivity and other hydraulic properties



5.2.4 Step 4 : Engineering Analysis

- 5.2.4.1 Engineering analysis shall be carried out to determine the prevalent soil / material properties at failure of the slopes.
- 5.2.4.2 The steps to be undertaken during this step for slope failure shall include:
 - * a. Slope stability back analyses on the failed slope
 - b. Slope stability analyses for remedial works
- * 5.2.4.3 Remedial Design for Failed Slope



SECTION AT CH 30.00



5.2.5 Step 5 : Preparation of Final Report

- * 5.2.5.1 Typical flow to be undertaken under this step shall include:
- Preparation of draft final report on Forensic Engineering investigation
- * 2. Modifications on draft final report
- Finalisation of the Forensic
 Engineering investigation report
- 4. Submission of Final Report:
 - (a) Soft and hard copy to the respective Agency; and
 - * (b) Soft copy of the Documents to JKR (editable data).





5.2.6 Step 6 : Preparation of Detailed Design including Drawings, Bill of Quantities and Specifications

- * 5.2.6.2 This step shall include the followings:
 - * 1. Preparation of detailed design on the selected option
 - Preparation of detailed
 costing on the selected option
 - * 3. Preparation of specifications and bill of quantities
 - * 4. Preparation of tender document

ITEM	DESCRIPTION	UNIT	QUANTITY	RATE (RM)	AMOUNT (RM)
	ALL QUANTITIES ARE PROVISIONAL				
1	Soil Nailing				
1.1	Mobilisation and demobilisation including shifting from one site to another.	L.Sum			80,000.00
1.2	Supply and install 12m long, 100mm diameter soil nail, reinforced by one end treded Y25 tendon bar with single corrosion protection inclusive drilling, rebar installation, grouting and nail head preparation.	No.	560	2,388.00	1,337,280.00
1.3	Extraover for drilling into rock and anchoring of 1.5m into the rock if enclunter within the 12m length.		Rate Only	380.00	
1.4	Carry out Proof Test to 1.26 times working load on working hail as per specification of all necessary equipment, setting out, taking results and prepare reports.	No.	4	3,500.00	14,000.00
1.5	Allow for preparation and submission of soil nail records installed.	L.Sum			

SOU MAILING



KERAJAAN MALAYSIA KEMENTERIAN PELAJARAN MALAYSIA

DOKUMEN TENDER

UNTUK

PROJEK

CADANGAN KERJA-KERJA PEMBAIKAN STRUKTUR BANGUNAN DAN MENDAPAN TANAH DI SMK KIDURONG DAN SK KIDURONG II, BINTULU, SARAWAK



BAILAGIAN PEROLEBAN DAN PENGURUSAN ASET KEMENTERIAN PELAJARAN MALAYSIA, ARAB SILOK ESILOK KOMPLEKS E, PUSAT PENTADBIRAN KERAJAAN PERSEKUTUAN, GEOG PUTRAJAYA.

5.2.7 Step 7 : Construction Site Supervision

- During the construction of remedial works, KISB shall:
 - 1. Act as Superintending Officer's representative
 - * 2. Ensure complete preparation of construction works documents
 - 8. Rationalise the bill of quantities
 - 4. Ensure that all contract documents are completed within the stipulated time
 - 5. Coordinate the remedial works so that work programs are adhered to
 - 6. Institute cost control to avoid unnecessary cost escalation
 - 7. Certify that all claims are according to work done
 - 8. Enforce a proper construction quality control such as construction material testing, slope reinforcement system testing etc.
 - 9. Supervise the construction to ensure strict adherence to the intended design option
 - * 10. Maintain the contractor's optimum works quality
 - * 11. Report the construction progress to the client





5.2.8 Step 8 : Maintenance Advisory and Preventive Measures

- * 5.2.8.1 KISB's responsibility shall be to:
 - * 1. Prepare routine and periodic maintenance program on the remedied slopes;
 - Prepare suitable budget and manpower requirement for slope management program;
 - * 3. Prepare maintenance works program chart for proper implementation;
 - * 4. Prepare slope monitoring program (if necessary).





4.0 NON EMERGENCY CASES

a. PREVENTIVE b. NORMAL CONSULTANCY SERVICE



5.0 THE STEPS IN FORENSIC ENGINEERING INVESTIGATION (SLOPES & SLOPE RELATED STRUCTURES)

* 5.1 METHODOLOGY

 For non - emergency events, the methodology for the implementation of Forensic
 Engineering Investigation (Slopes & Slope Related Structures) shall be undertaken in the following flow chart.







HAZARD MAP PSMZA





HAZARD MAP PSMZA



RECOMMENDATION

	Geological Hazard	Geotechnical Assessment		
Zone / Method	SAS B	Present Factor safety	Factor safety after mitigation	Remarks
ZONE A	Low hazard (CH 00-B – CH 200-B)– High Hazard (CH 200-B – CH 550- B)	Sec .15 1.19 Sec. 16 1.39 Sec.17 1.40	1.75 1.62	Installed Horizontal drain Continue monitoring
ZONE B	Low hazard (CH 450 -A– CH 550-A) - High Hazard (CH 700 -A– CH 900-A)	Sec. 1 1.19	1.14	Installed Horizontal drain
ZONE C	Low hazard (Middle to top hill) – High Hazard (Outcrop and boulders)	Sec.10 3.48 Sec.11 1.47 Sec.12 1.45	4.06 2.06 1.75	Rock slope stable Horizontal drain to enhance stability Horizontal drain to enhance stability





Kicking things off: Ahmad Phesal (middle) launching Kuala Lumpur Slope Information System (KuLSIS) at Institut Latihan DBKL. With him are (left) Real Estate and Housing Developers Association Malaysia past president Datuk Seri Michael Yam and (right) DBKL deputy director-general (Planning) Datuk Mahadi Che Ngah.

A A

DEVELOPERS can soon access comprehensive information on hill slopes for any future high-rise projects in Kuala Lumpur.

The Kuala Lumpur Slope Information System (KuLSIS) provides a 360 degree 3D view of the capital's topography.

Kuala Lumpur mayor Datuk Seri Ahmad Phesal Talib said they were in the midst of determining the charges for developers to use the system.

"We will discuss this with the Real Estate and Housing Developers' Association (Rehda) and other relevant parties," he said after launching KuLSIS at Institut Latihan DBKL yesterday.

At the moment, he said developers can visit Kuala Lumpur City Hall's headquarters to get more information on KuLSIS .

"The system can be used in every proposed plan sent to DBKL.

- a. KuLSIS Kuala Lumpur
 Slope Information
 System Hazard and
 Risk Map
- b. Hazard and Risk map for Ipoh, Cameron Highland by JMG
- c. Hazard and Risk map for Ampang and Penang



4.0 NORMAL CONSULTANCY SERVICES



CADANGAN TEKNIKAL DAN KEWANGAN

5.1 Proposed Remedial Work

No.	Slope	Proposal Remedial	Estimated Cost	Ref.	
			(RM)	Figure	
1	KM 40 (Seksyen 687.40)	Sheet Pile Wall & New Culvert crossing	1,100.000.00	Fig. 3	
2	KM 46	Gabion Wall & New Culvert crossing	850,000.00	Fig. 2	
3	KM 45	LHS Gabion Wall RHS Sheet Pile Wall	1,250.000.00	Fig. 1	
4	KM 48	Sheet Pile Wall & Soil Nail	1,885.000.00	Fig. 3	
5	KM 51	Gabion Wall & New Culvert crossing	939,000.00	Fig. 5	
6	KM 52	Gabion Wall & New Culvert crossing	550,000.00	Fig. 6	
7	KM 53	Gabion Wall & New Culvert crossing	895,000.00	Fig. 5	
8	KM 54 (Seksyen 670.5)	Reconstruct using Reinforced Geotextile	1,050.000.00	Fig. 4	
9	KM 50	Reconstruct using Reinforced Geotextile	1,480.000.00	Fig. 4	
Pre	reliminaries 799,920.00				
Co	nsultancy Elem	ent			
a)	Consultancy F	ee & Supervision	450,000.00		
b)	Soil Investigati	ion (SI)	250.000.00		
c)	Topographic S	urvey	150,000.00		
Tot	al Cost		11,648,920.00		





3 OPTIONS

OPTION	DESCRIPTION	FOS	TOTAL COST		
1	REINFORCED GEOTEXTILE PEC 100 & ROCK FILL	1.517	RM 4,577,562.50		
2	REINFORCED GEOTEXTILE PEC 100 & PEC 150	1.589	RM 4,783,250.00		
3	RC WALL & ROCK FILL	1.460	RM 4,848,166.67		



B19 SG LALANG SEMENYIH AGENSI : JKR SELANGOR KATEGORI : JALAN NEGERI







COMPARISON OF VARIOUS OPTIONS

Options	Description	Performance	Machinery Requirements	Cost	Duration
<u>1</u> Bridge	Installation of pile	Very Good	Неаvy	Very High	Long
<u>2</u> Rebuilt-Back Slope	Remove all failure debris, install reinforcement geotextile, replace with 6"~12" size rock fills and armour rock	Good	Medium	Reasonable	Long
<u>3</u> Realignment	Implementation of slope strengthening measure on the existing slope	Good	Heavy	High	Long
				🖌 ік	RAM

COMPLETED PROJECT









THANK YOU



