



**FACTUAL REPORT:**

**THE REVIEW ON THE GUIDELINES FOR**

**CONSTRUCTION ON PEAT AND ORGANIC**

**SOILS IN MALAYSIA**

**Kuching, 27 June 2018**



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## **1.0 INTRODUCTION**

This review examines the existing guidelines for construction on peat and organic soils in Malaysia. The review exercise includes formulation and distribution of questionnaires to professionals that are conversant with peat. The survey exercise took place within 2<sup>nd</sup> of March to 25<sup>th</sup> of April, 2018. A workshop is also organised to bring together the stakeholders who have reviewed the guidelines or put it to use for design or construction on peat and organic soils. The workshop was held on 25<sup>th</sup> of April, 2018 at Merdeka Palace Hotel Kuching, Sarawak. Through group discussion by the experienced stakeholders, the workshop creates a pool of knowledge that can be used to update the guidelines to a more effective and efficient report that can provide guidance and simplified methodology for construction on peat. The outcome of the group discussion was complemented by detailed analysis of inputs from questionnaire sent across to engineers and consultants dealing with peat. This report served as a compilation of the ideas and feedback on the improvements to enhance the guidelines.

## **2.0 OBJECTIVES**

Objectives of the industry roundtable workshop are: -

- a) To examine CREAM-CIDB existing guidelines for construction on peat soil;
- b) To collate feedback for the development of peat database;
- c) To gather up-to-date information on the construction practices and researches on peat
- d) To synthesize the feedback and recent information on the construction practices and researches on peat.

### 3.0 DEMOGRAPHIC INFORMATION

#### 3.1 Questionnaire Respondents

The 33 respondents (Table 1) represented different professionals, research students and organizations that have experience on peat as a geotechnical material.

**Table 1 Questionnaire Respondent Information**

NO.	NAME(OPTIONAL)	JOB TITLE	ORGANIZATION NAME	YEARS OF WORKING EXPERIENCE
1	Atiqah Zakari	Civil Engineer	Geocrete	3
2	Azrul b. Zulwali Kifli	Lecturer	UCTS	6
3	Cedric Kan	Manager		4
4	Dr Charles Bong HIn Joo	Engineer	Jurutera Adda	12
5	Dr Eddie Cheng Zhaguan	Chief Technical Officer		4
6	Dr Leonard	Lecturer	UNIMAS	9
7	Dr Mah Yau Seng	Lecturer	UNIMAS	10
8	Ir. Frydolin Siahaan	Civil Engineer	JKRS	36
9	Hisyammudin bin Maseri	Postgraduate Student	UNIMAS	0
10	Dato Sri Hj Abdul Aziz Hassan	Chairman	Geocrete	31
11	Ir Dr Ady KHO	Director	Jurutera Adda	18
12	Ir Dr Hii Ching Poon	Director	Jurutera Adda	18
13	Ir. Dr Low Tian Huat	Manager		24

14	Jacklyn Dominic Merican	Civil Engineer		15
15	Law Lee Fok	Manager	PPFSN	24
16	Law Sre Dina	Engineer		13
17	Lee Lin Jye	Engineer	JKRS	19
18	Leenna Bt. Roslan	Design Engineer	Perunding AJ Eksklusif Sdn Bhd	1
19	Leong Yun	Civil Engineer	JKR Sarawak	6
20	Malcolm Wee	Project Engineer/ Planner	Zafas Sdn. Bhd.	2
21	Ir. Roland Ling Koh Wen	Director		38
22	Sim Kwan Ben	Student		0
23	Ir. Simon Law	Engineer		18
24	Syahril b. Julaihi	Assistant Director	JKRS	13
25	Respondent	Research Manager		20
26	Respondent	Postgraduate Student	UNIMAS	0
27	Respondent	Associate Professor	Universiti Tunku Abdul Rahman	40
28	Respondent	Lecturer	UNIMAS	12
28	Respondent	Engineer		4
30	Respondent	Civil Engineer	JKRS	15
31	Respondent	Engineer		5
32	Respondent	Engineer		6
33	Respondent	Head Of Project		34

### 3.2 Workshop Participants

The workshop was well attended. The 28 workshop participants (Table 2) represented over 10 organizations, including construction, consultant, government agencies and university research experts.

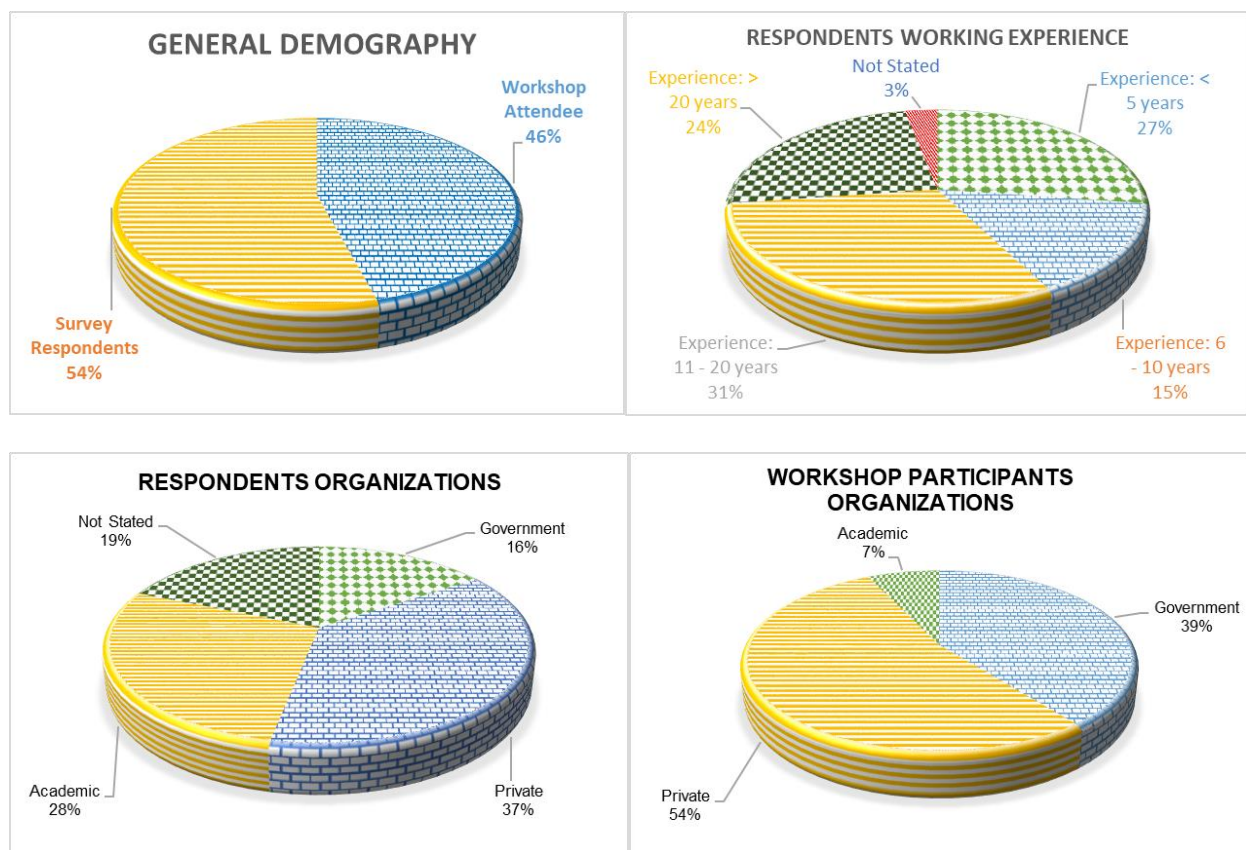
**Table 2. Workshop Participants**

NO.	NAME	ORGANIZATION
1	Mr Ron Aldrino Chan	UNIMAS Kota Samarahan
2	Ir. Dr Addy Kho Kai Tze	Jurutera Adda Sdn Bhd
3	Ir. Dr Hii Chiin Poon	
4	Dr Charles Bong	
5	Ir. Simon Law Kim Hul	Jurutera Perunding Geon Sdn.Bhd
6	Mr. Stanley Teo	
7	Mr. Lee Lam Seng	KTA (Sarawak) Sdn Bhd
8	Mr. Norman Chai	
9	Mr. Ting Cheong Fung	
10	Ir. Roland Ling	
11	Ir. Vincent Tang Chok Khing	Public Works Department Kuching
12	Ir. Fridolin Sia Haan	
13	Mr. Khairul Reza Mohamad	
14	Syahril Julaihi	
15	Jacklyn Anak Dominic Merican	Sarawak Energy Berhad
16	Mr Lee Lin Jye	JKR Central Material Laboratory Kuching
17	Mr Teo Khing Tnia	PPES Works (Sarawak) Sdn Bhd
18	Mr Law Lee Eik	
19	En Enggong Anak Aji	Jabatan Mineral Dan Geosains
20	Mr. Azrul Zulwali Kifli	UCTS Sibu Sarawak
21	Ir. Jonathan Law Sie Ding	Konsortium Malaysia
22	Mr Cedric Kon	Hoi Fu Group (M) Sdn Bhd
23	Mr Rio Fah	
24	Dr Benny Tan	

25	Mr. Eric Tan	Geocrete Specialist Sdn Bhd
26	Dato Dr. Philipson	
27	Ms. Atiqah Zakaria	
28	Dato Sri Abdul Aziz Hj. Hassan	

### 3.3 Summary of Questionnaires Respondents and Workshop Participants

Figure 1 gives detailed comparison between the survey respondent and workshop participants. The percentage of the contributors, organization and years of experience are all described with the chart.



**Figure 1. Information of the questionnaires respondents and workshop participants**

## 4.0 RESPONSE OF THE SURVEY AND INPUTS FROM STAKEHOLDERS

The survey responses and stakeholder's comments are discussed in nine different sections (A-I).

### A. Overview of the guidelines

Larger percentage of the survey participant are well informed about the guidelines for construction on peat and organic soils in Malaysia (Figure 2) They also agreed to the relevancy of such document for geotechnical practices. To a large extent, the content of the guidelines is adequate and the objective is achieved. The guidelines have served its purpose to be a reference document to practicing engineers.

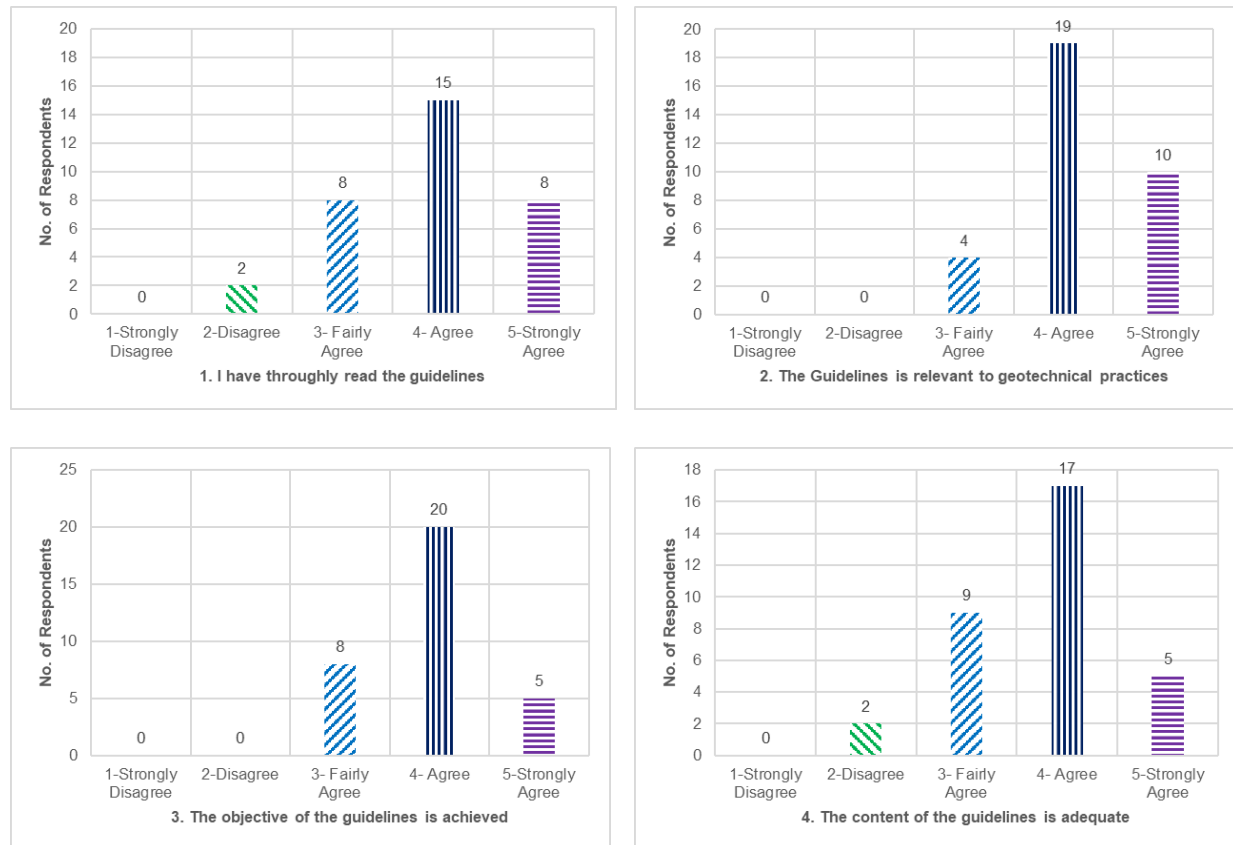


Figure 2. Responses on overview of the guidelines



## Comments from stakeholders

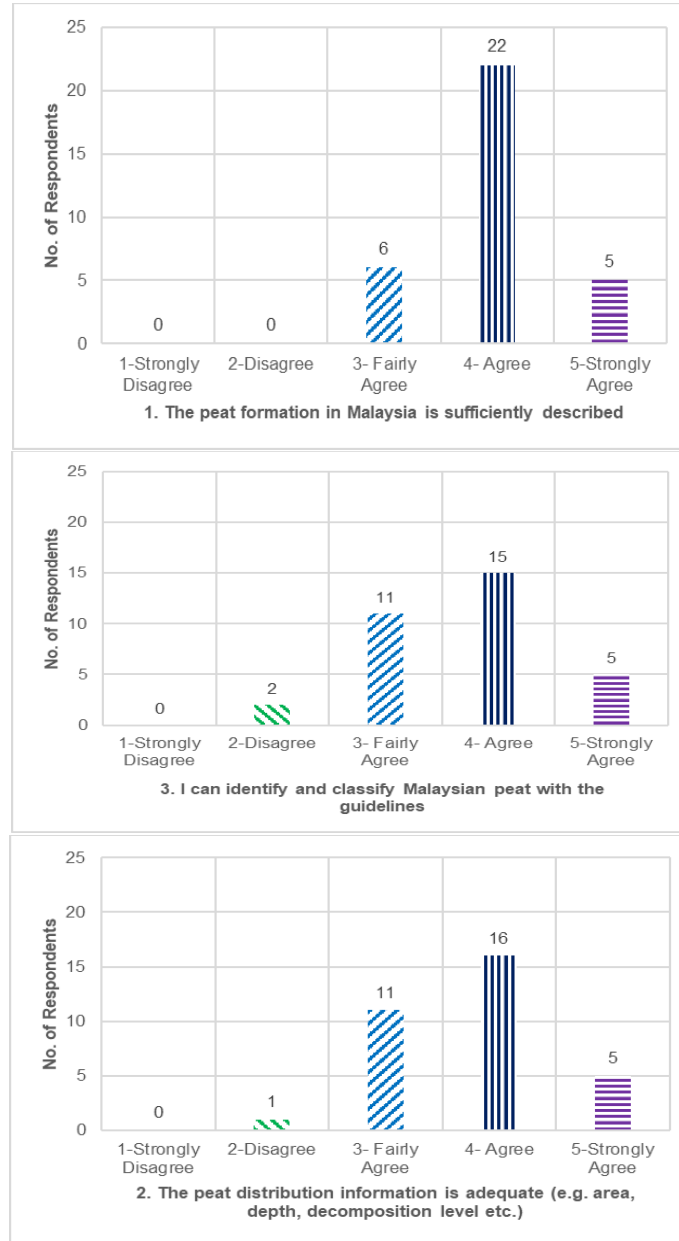
- Very informative and interesting
- The content should be strongly guidelines-oriented. Irrelevant information/sections as far as guidelines are concerned **should be omitted** where applicable.
- Some content **lacks technicalities** for a manual/guidelines
- The **formatting should be reviewed again** as there is inconsistency of figure size, table etc. provide case study sample calculations for guidance of design.
- It may need further development
- Further improvement
- **Useful for general understanding of peat**
- **Suggestion to have more practical classifications of peat based on region.** e.g. we have London clay. Therefore, we can have sibu upper lanang peat, Sg Bidut peat, Bawang Asan peat Bintulu peat etc. we should have photos of each samples in a glass container (jars measuring 0.3m diameter by 0.5 m high).

## Remarks

Generally, the respondents appreciate the initiative of the guidelines for construction on peat and organic soils in Malaysia as an informative and useful tool for solving the problem of construction on peat. A more significant percentage of the commentators concluded that the guidelines should be improved by sieving out of the irrelevant content, formatting the whole document professionally and making it more technical for practical use.

## B. Chapter 1&2 - Formation and distribution of peat lands, and peat classification scheme

Majority of the survey participant acknowledged the rich description of the peat formation and distribution in Malaysia (Figure 3). The description in the guidelines can be valuable for identifying peatlands in Malaysia.



**Figure 3. Responses on formation and distribution of peat lands, and peat classification scheme**

## Comments from stakeholders

- **Clear representation** of tables and soil classification
- The content giving information on i) peat formation areas and ii) identification and classification **should be precise and concise** preferably convey via, say, maps, pictures, diagrams & tables etc.
- **To include** the classifications published on papers for reference as it may be more practical for design engineers
- **Update the contents**, maps etc. get information from local authorities. less wording
- **Adequate. improvement** on the mapping for standardized format
- The guidelines should include flow charts and examples
- **Provide definitions** of distribution and status of peat swamp to avoid cross reference and elaborate limitations in details
- To provide **more data on peat depth**
- **Requires more information** on peat distribution
- Noted that this classification is more of agriculture department. we **should use** MC, degree of decomposition, water level, in-situ condition and some empirical strength and settlement characteristics

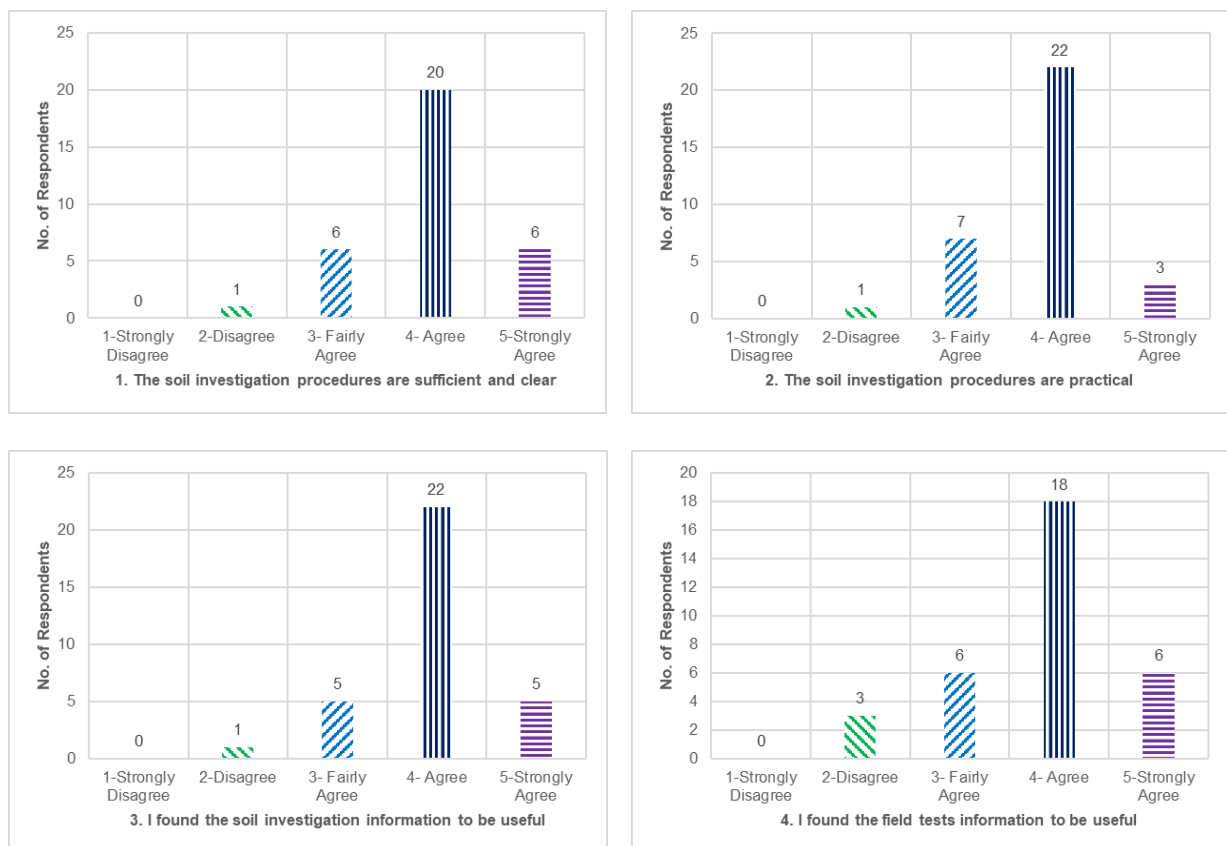
## Remarks

The formation and distribution information is agreed upon to be adequate. However, it requires latest updates and the precise classification based on specific locations. The information in the guidelines should include data of peat depth and types. The classification should be based on engineering properties such as moisture content and degree of humification. However, the

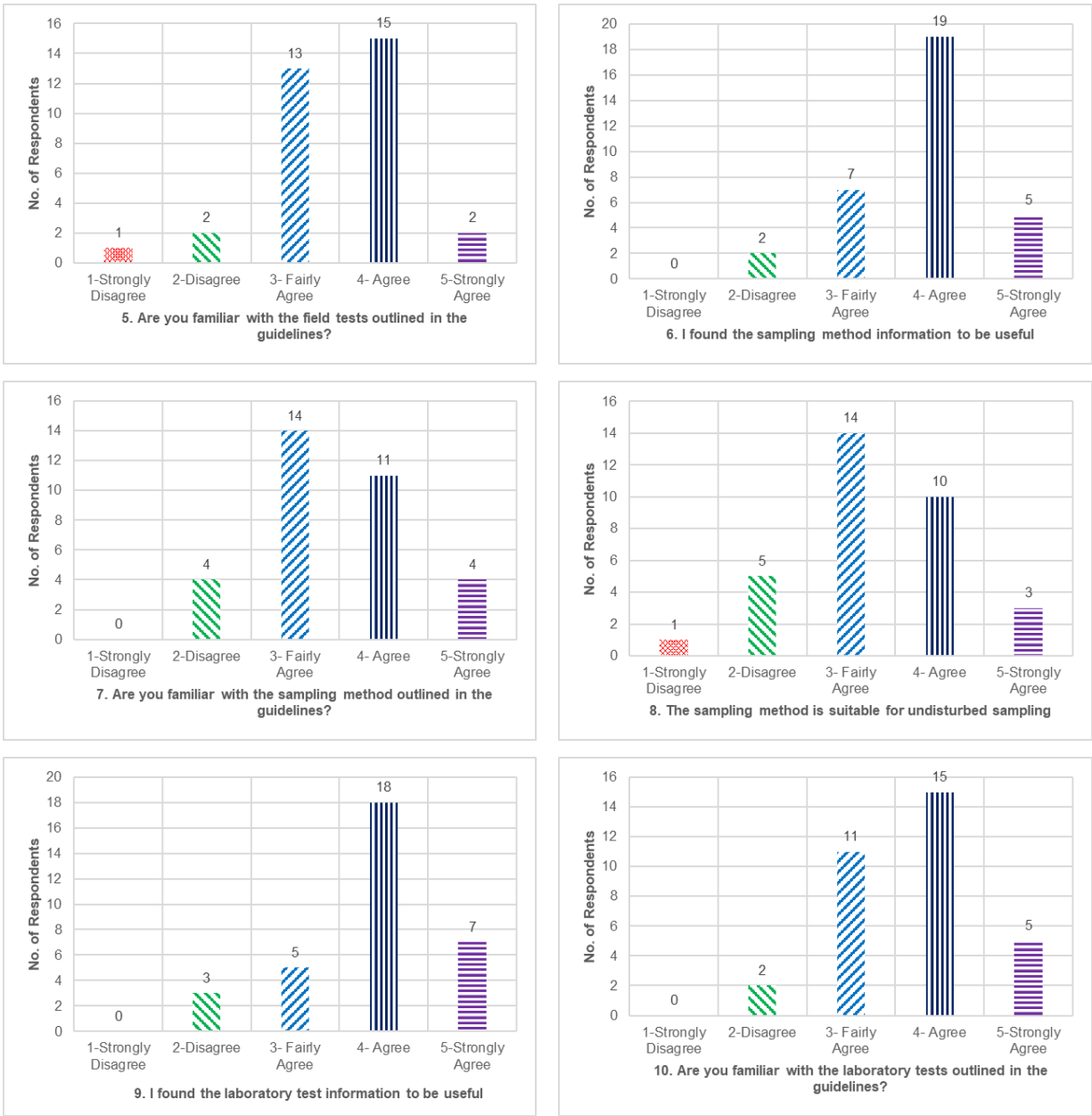
guidelines have proven to be useful to industry practitioners grasp the formation and distribution of peat in Malaysia.

### C. Chapter 3 - Soil investigation and peat testing

Majority of the survey participant acknowledged that the soil investigation procedure is clear, sufficient and applicable to peat (Figure 4). However, most of the participants are yet to be familiar with the field testing and sampling methods presented in the guidelines. Also a large percentage of the participants do not agree that the sampling method could be used for undisturbed sampling.



**Figure 4. Responses on soil investigation and peat testing**



**Figure 4 Responses on soil investigation and peat testing (Con't)**

In the survey, respondents are required to share their common practices

Table 3. The field tests that are commonly used as specified by the participants for item C4

Tools	Mackintosh Probe	SPT	Peat auger	Vane shear	Moisture Content	Visual inspection	Ash content	Degree of decomposition
No. of respondents	7	4	4	3	1	1	1	1

#### Comments from respondent on item C4

- I found that there isn't a so-called 'usually use field test' method but will change according to the type of construction to be built upon it, the site conditions and the budget allocation factor etc.

Table 4. The unfamiliar field tests as specified by the participants for item C5

Tools	T-bar/ball penetrometer	Geophysical survey	Wetness, fibres & woodiness	Undisturbed peat sampling
No. of respondents	5	1	1	1

Table 5. The common sampling methods as specified by the participants for item C6

Sampler	Peat/Russian sampler
No. of respondents	7

Table 6. The unfamiliar Sampling methods as specified by the participants for item C7

Sampler	Tube sampler	Block sampler	Peat/Russian sampler
No. of respondents	5	5	1

Table 7. The laboratory tests that are commonly used as specified by the participants for item C9

Laboratory test	Organic content	MC	Atterberg Limit	Direct shear	Specific gravity	Consolidation	PH	Permeability
No. of respondents	6	5	3	3	2	2	1	1

Table 8. The unfamiliar laboratory tests as specified by the participants for item C10

Laboratory test	Ring shear	Oedometer	Chemical
No. of respondents	6	3	3

## Comments from stakeholders

- The sampling method information can be rendered more useful if their methods can be **presented in step-by-step format** for clarity and ready comprehension purposes. The sampling methods usually used are those related to disturbed soil samples involving the use of sampling tubes attached to boring machines as well as the auger method
- The sampling method proposed **might have limitations** for deep peat sampling. provide the range of strength value for different decomposition of peat based on existing literature
- The laboratory tests are **opined to be of little use**, if any. This is because what is the point is to construct structures upon peat where its design is based supposedly based on properties (especially mechanical strength) but the decay would decompose away and become non-existent. As such what is the meaning of taking great effort to determine soil data for design and yet the **peat itself disappeared due to decomposition**. The question would be can we design a structure sit on the peat based on its strength properties determined but later simply become non-existent?
- Laboratory tests to **obtain fiber content**. provide test parameters that is governing design. provide correlations/equations for bearing capacity. give the merits and demerits of various tests
- So far, **no other method** can be used, as at this knowledge
- At the moment, **we do not consider peat strength**. we either remove the peat or improve the peat or transfer the loads to other layers by piled embankment, geotextiles, surcharge etc.
- **Peat is not soil**, therefore CIDB should look into methods of investigating, sampling and testing peat. instead of following BS 1377

- It will be more appropriate to **tabulate the comparison of sampling method** to give strength, weakness and limitations of different types.

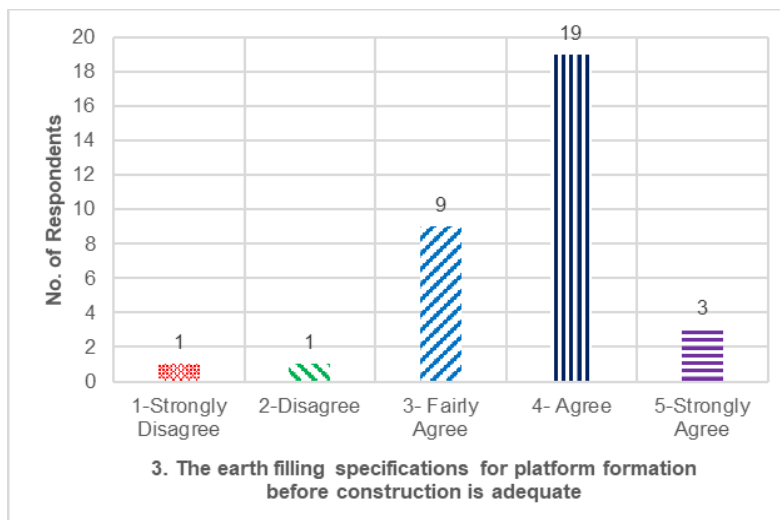
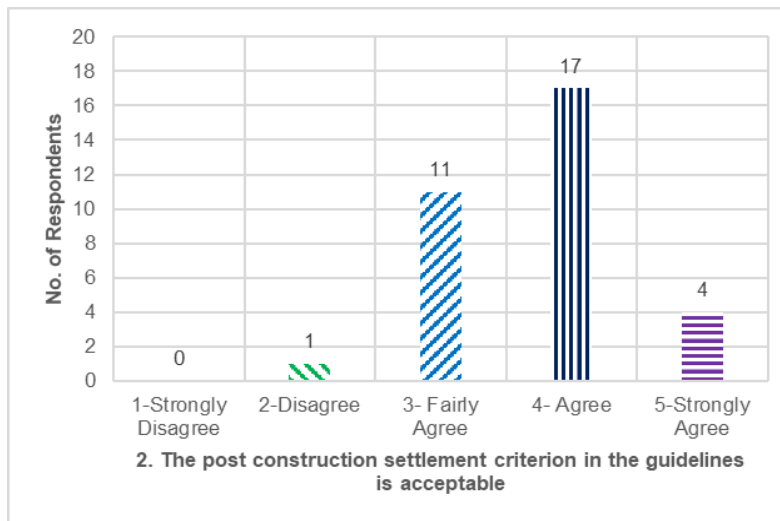
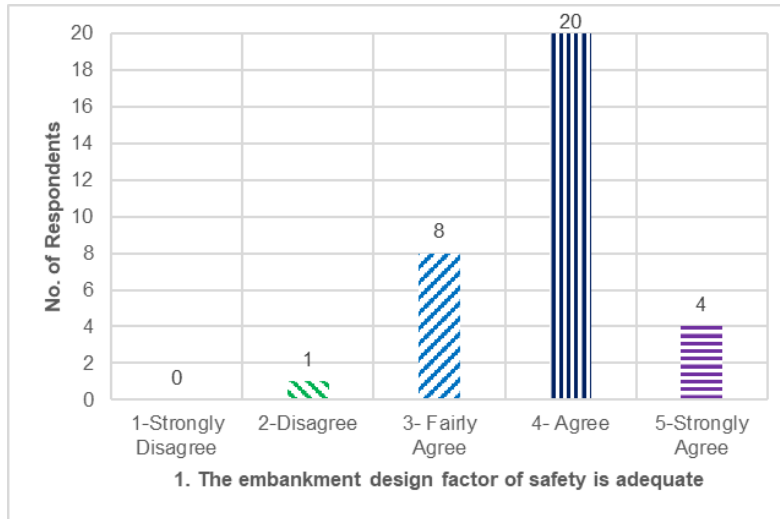
### **Remarks**

The soil investigation and field testing section show that respondents are very much aware of the conventional testing methods and most of them are used to conducting the simple and more economical ones for their site investigations. However, they are mostly aware of the limitations connected to the conventional methods while they are yet to be familiar with some specified new techniques such as the T-bar and ball penetrometers. Most of the respondents are not familiar with the sampling methods presented in the guidelines. They need to be guided on how to obtain an undisturbed sample of peat. The respondents requested that more details about the new peat sampling and testing methods should be explained in the guidelines.

### **D. Chapter 4 - Methodology and criteria for design**

The embankment design factor of safety is accepted to be adequate by most of the respondent, so is the earth filling specifications for platform formation before construction. Many of the respondents are not in full agreement with the post construction settlement criterion as depicted in the guidelines (Figure 5).





**Figure 5. Responses on methodology and criteria for design**

Table 9. The factor of safety commonly used by the participants for item C10

<b>Factor of safety</b>	2.0	1.5	1.3	1.2
<b>No. of respondents</b>	2	2	3	1

### Comments from stakeholders

- **Give flexibility** for road design on peat of more than 5m. it should cover for other constructions e.g. piling and pipelines on peat
- The information is **very useful**
- Provide **specific guidelines for designers**. Any assumptions?
- Filling materials ok
- **Peat treatment must be done** and settlement values need to be reviewed
- Please note that the **300-500 mm thickness is too thick**
- **Thickness provided is too much**. normally ranging from 50-100mm
- **Needs expert knowledge** which is not available to design as advised. it is important that these criteria are applicable for deep peat grounds where it is not practicable to replace the peat
- How about **tertiary settlement due to peat deterioration**.

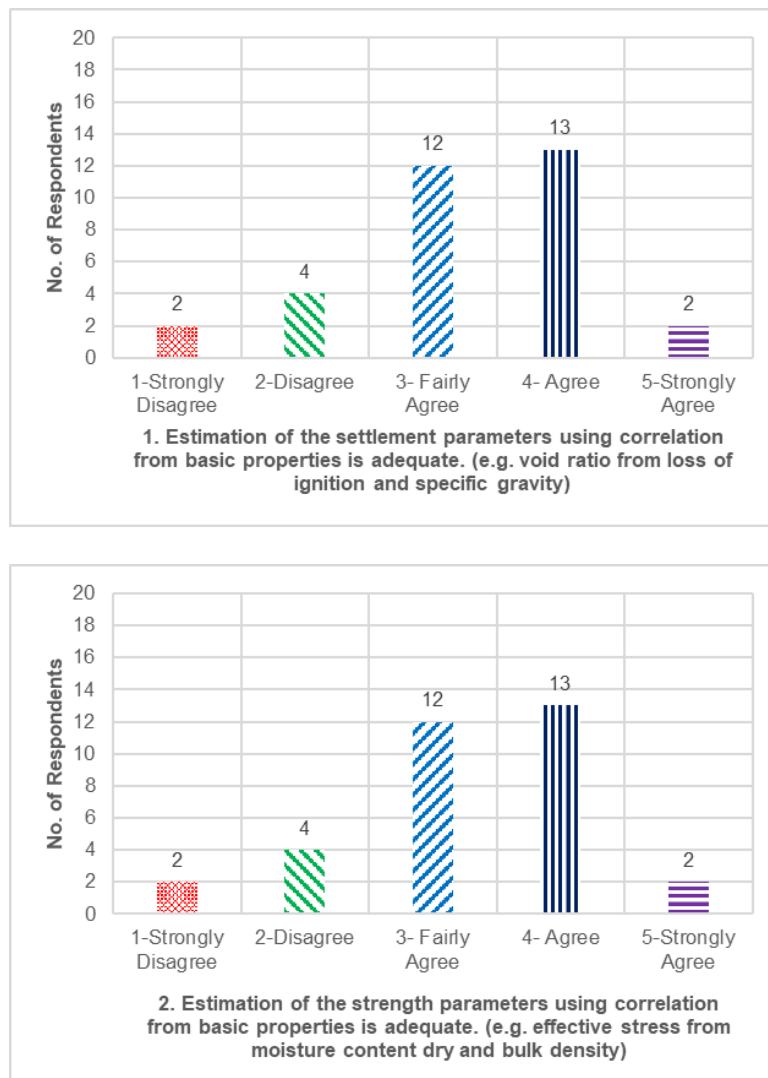
### Remarks

The methodology and criteria for design are well known to the respondents, and they have been making use of it. The factor of safety and earth filling specifications are agreed to adequate by most of the respondents. The post-construction settlement criterion, however, got a significant objection. There is a need for a review of the settlement criteria for construction on peat. The long

term changes in peat properties is a matter of concern by practitioners. There is a need to conduct a lateral research on performance of road or any infrastructure on peat several years after completion.

## E. Chapter 5 - Design Parameters from Basic Properties

Majority of the survey participant do not agree with the estimation of settlement and strength parameters using correlation from basic properties of peat (Figure 6).



**Figure 6. Responses on design parameters from basic properties**

## Comments from stakeholders

- **Very useful** graphs, formulation and references.
- Being organic **peat is subjected to decomposition** where it would eventually become non-existent. Thus, the total deformation observed is partly contributed initially by settlement and later due to decomposition, i.e. total deflection = settlement (initial) + decomposition drop (subsequent). Thus, how can settlement be correlated to so-called basic properties of peat which became null and void once the peat itself no longer exist? The same argument is also applied when one attempt to correlate the strength of peat with its so-called properties when the material decomposed and became non-existent.
- **Provide examples.** QA/QC.
- For high degree of MC, the design concept should change to hydraulic. **Decomposition of peat should be considered.**
- As an industrial guideline, the literature should single out **which correlations best suit Malaysian peat** and also provide more instructive approach so that there will be less ambiguity during design. sensitive study should also be provided to caution users of these correlations and to ensure that they are able to take conservative approach during the design stage.
- **Add more locally sourced data**
- **Correlation of peat on local peats**
- the provided friction angle is based on fibrous peat and appear better than compacted sand.
- A young engineer is not advised to use this parameters, it can lead to gross error. **peat is highly variable** and testing is susceptible to inaccuracy. unless for experts
- Provide correlations for different types of peats

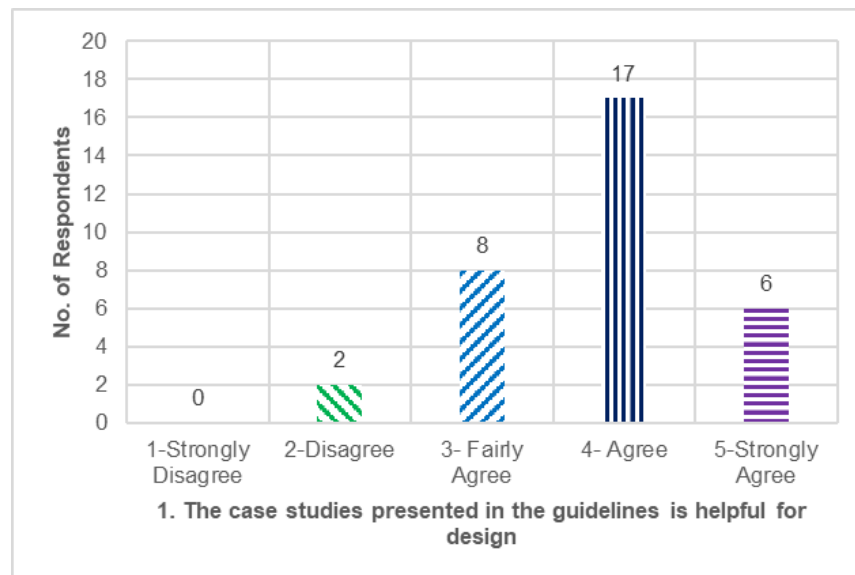
- **More research is needed on tropical peat.** most of the design references are from overseas (temperate countries)

## Remarks

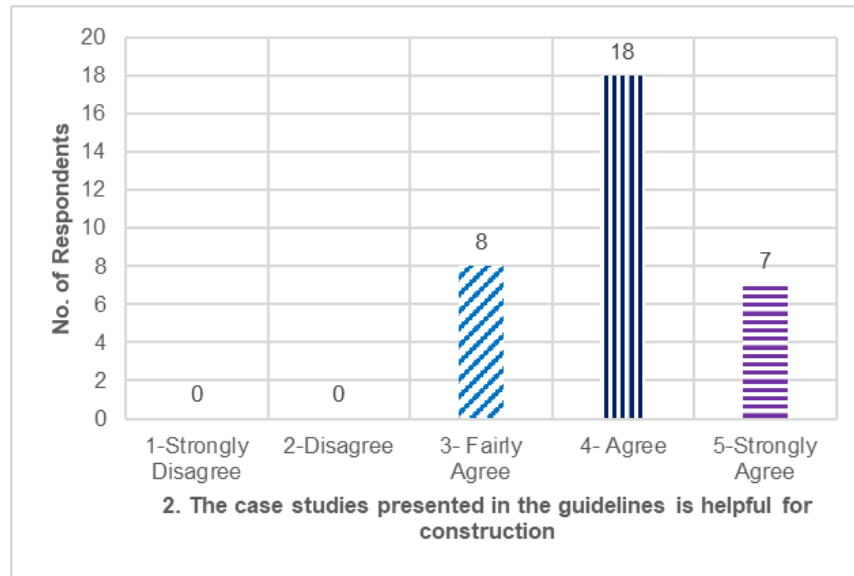
Many respondents reasonably disagree with the formulations presented in the guidelines for estimation of settlement and strength parameters from basic peat properties. Their reason is that peat exist at different degree decomposition and heterogeneous properties. Most of the comments requested a region-specific formulation based on data that are locally sourced. Most of the data available are from temperate countries which is not the same with tropical region.

## F. Chapter 6 - Case Histories of Construction on Peat

Majority of the survey participant find the case studies presented in the guidelines to be helpful for design and construction (Figure 7).



**Figure 7. Responses on case histories of construction on peat**



**Figure 7. Responses on case histories of construction on peat (Con't)**

Case histories suggested by the participants for item F1

- Stage Construction of a High Geotextile Reinforced Embankment in Sylhet, Bangladesh

#### **Comments from stakeholders**

- To the best of my knowledge, **quite a number of structures being constructed successfully** on soft to very clay (sometimes a mixture of organic and inorganic natures) and in each case a method of design is provided and all these can be provided upon request.
- The chapter overview is **more like conference paper**. consider other examples. update on lesson learned.
- Elaborate **analysis of the use of geotextile and bamboo is required**. e.g. the laboratory and in-situ tests soil parameters used for the analysis and special consideration, if any.
- State advantages and disadvantages **during construction and post construction**.
- **To include "lesson learned"** more recent cases in Malaysia peat environment.

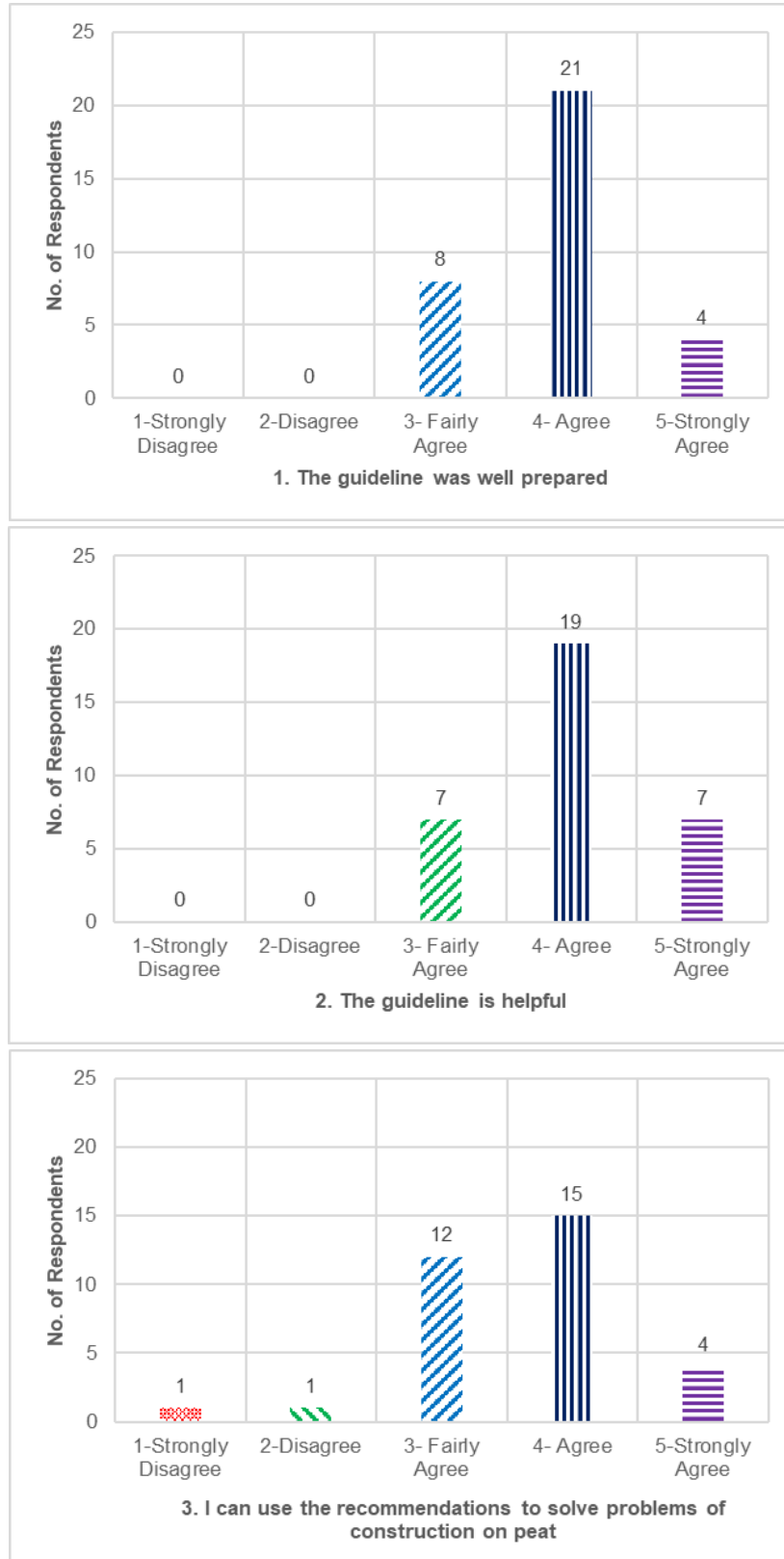
- **More case histories with follow up results of settlement and performance** will be useful. fund researchers to collate the existing data in Sarawak on peat depth and distribution. get information from practitioners and consultants on how they deal with peat
- Preloading
- Stage Construction of a High Geotextile Reinforced Embankment in Sylhet, Bangladesh
- Same answer as for previous question
- Allow **more case history** on other types of constructions
- Messy. difficult to understand
- Bamboo and Geotextile

## **Remarks**

Most of the respondents agree with the importance of case histories for improving construction on peat. However, commentators' states that the guidelines should give details of the merits, demerits and lesson learned for professional use. The procedures, methods, materials and management from each case histories should be outlined. The case histories should include follow up results of settlements and long term performance of the structure to ascertain the method used.

## **G. Guideline outcome**

Majority of the survey participant agreed that the guidelines is helpful, however, many of them do not give strong backing to using the recommendations in the guidelines for solving construction problems (Figure 8).



**Figure 8. Responses on guidelines outcome**



## Comments from stakeholders

- The case studies were **interesting and informative**.
- **Good reference** especially in for construction projects in Sarawak
- As a reader of the guidelines produced, it is felt that some improvements are thought useful in order to render it much **more realistic and practical-oriented** that it would become a very popular handbook giving the very practical guidelines for successful construction on peat. To achieve this whatever method proposed it must substantiate many successful case histories **containing the salient information of each case**. In addition, where possible to reduce those unnecessary theoretical content contained in the current edition of guidelines book. It is strongly believed that as any other book on guidelines it is generally emphasize greatly, if not solely, on its related practical aspect only. Just a little opinion.
- **Too wordy**
- From the consultant point of view, the guidelines need to be more instructive.
- **Include example calculations and more technical guidelines**
- **Need more study on other methods** of solving peat construction problems
- It is a very good start. hopefully **it will be improved to become a "bible" for peat solutions**
- **Still need further improvement**

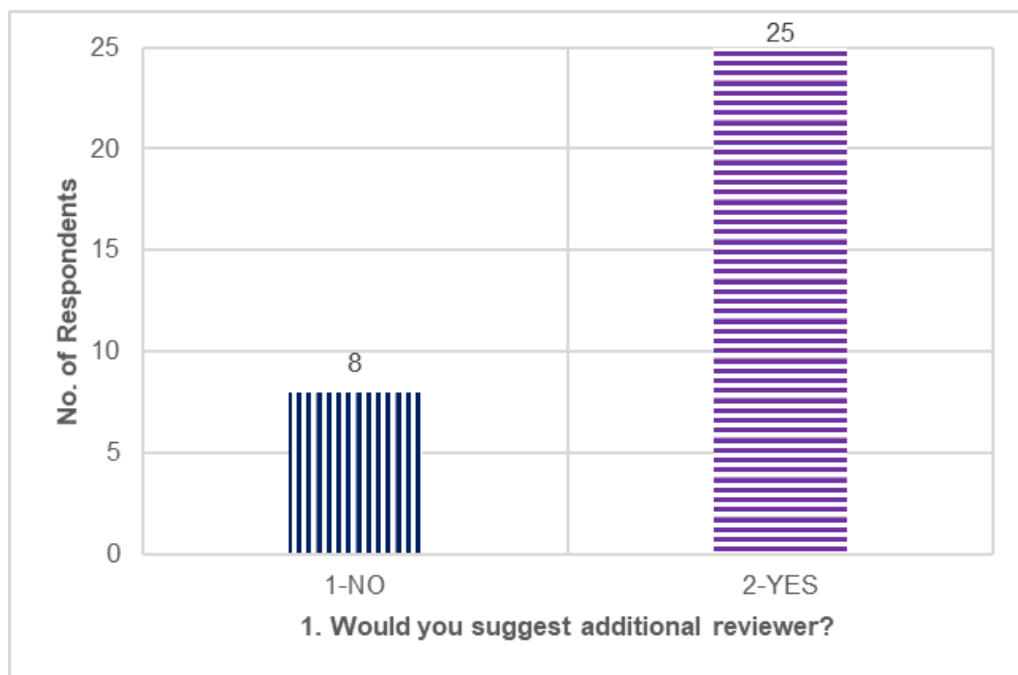
## Remarks

Generally, the guideline is helpful, and it is an excellent start to solving the challenges of construction on peat in Malaysia. The guidelines can be improved to be more technical and instructive for engineers to make use of it. The guidelines need to be more exhaustive with

appropriate field data if it were to be used as design reference for practitioners. Sample calculation should be added, and the case histories should contain salient information that can easily be adopted. The improvement can be achieved by increasing and updating the content with the help of additional reviewers.

#### **H. Would you suggest additional reviewer?**

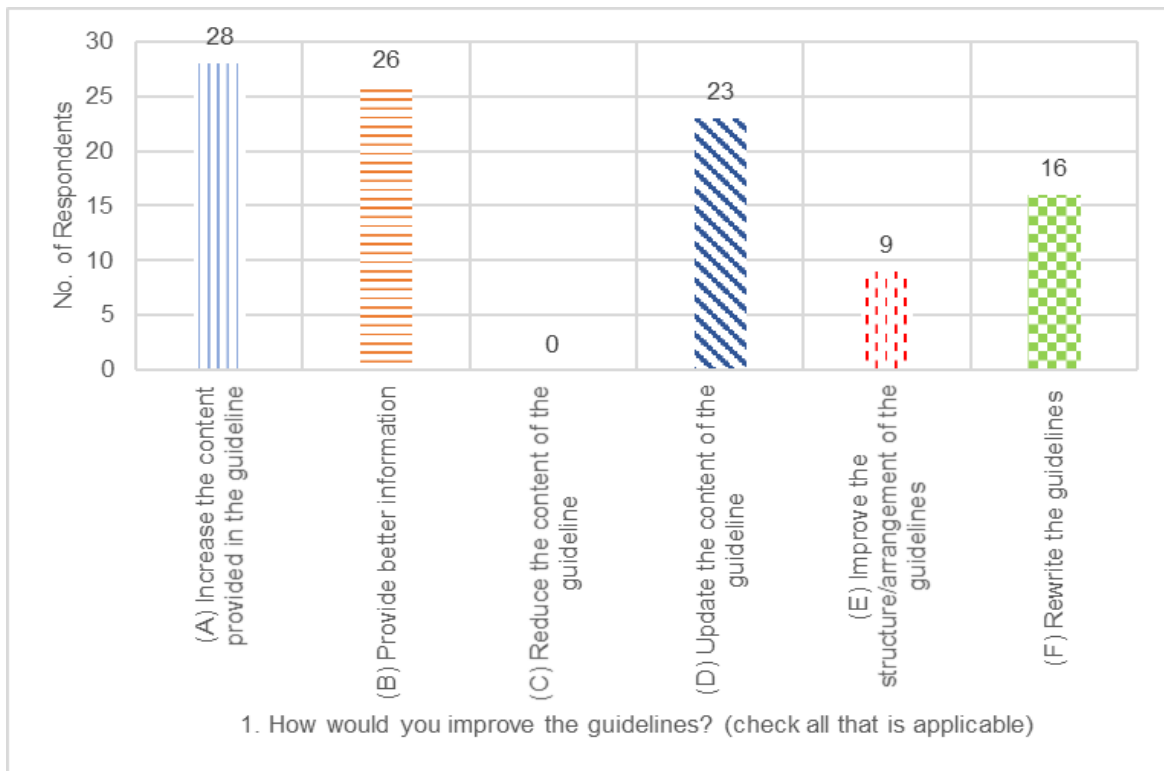
Majority of the survey participant agreed to suggest additional reviewers to improve the guidelines.



**Figure 9. Responses on additional reviewer**

## I. General comment

How would you improve the guidelines? (check all that is applicable)



**Figure 10. Responses on general comment**

## J. General comments from stakeholders

- **More Case Studies** would be appropriate.
- Update the guidelines on a yearly basis with newer techniques.
- The guidelines can be improved by updating the content from time to time.

(a) & (c): Not so much a case of increase or reduce the content of the content of the current guidelines but to amend a few sections which at the end by result in an increase or reduction of the content. That is it is not the amount of content but whether it is relevant or irrelevant, useful or not useful that matter. (b), (d), (e) & (f) To update the content or even rewrite the

present guidelines by provide better information via an improving to the structure/arrangement of the present guidelines. Following the issuance of the present guidelines and experiencing what the industry really need is a comprehensive guidelines that enable the construction of 1) building platform for building/housing development, 2)a building platform to support highway/railway with or without embankment, and 3)other structures etc. which is written in plain language easily be comprehend by construction industry of all levels seems helpful and would be sought after considerably. Where possible, step by step approach to give clarity is preferable and where possible each step be illustrated with picture(s), diagram(s), table(s) etc would be desirable.

- **Make the content more technical** and specify requirements where appropriate.
- To **include QA/QC**. SI recommendation during design and construction. eg numbers of boreholes to be used for SI.
- Compile **electronic project data base**.
- It should **tell the users** what to consider and do during the design stage. need more information regarding the design process, sensitivity studies.
- **Provide flow charts** to identify peat locations and some examples to be useful for non-experienced engineers.
- **Provide more local case studies**.
- **Findings from contractors and consultants** should be included in the guidelines.
- get a professional writer to edit. more case studies from different consultants.
- Some of the **laboratory procedure not suitable**.
- To provide **more examples & evident to sustain the content of the guideline** and to follow up the case studies with update data and information.

## **5.0 RECOMMENDATIONS**

- a) The guidelines should be reviewed for enhancement and to suit the needs of the engineering practitioners.
- b) Chapter 5 and 6 strongly attracted the attentions of the participants and stakeholders, hence, it should be comprehensively updated for easy use.
- c) All the information should be updated to the current practices.
- d) The updated guidelines should be reviewed by external professionals.

## 6.0 COMMITTEE MEMBERS

The list below contains information of the team that participated in the review process

**Table 10. List of Committee Members and Job Descriptions**

Job Title	Person In-Charge	Job Description
Advisor	Ir. Dr Hj Zuhairi Abd Hamid, CREAM Prof Ir. Dr Al-Khalid Othman	
Workshop Producer	Assoc. Prof. Ir. Dr Siti Noor Linda Taib	
Master of Ceremony	Ir. Dr Leonard Lim Lik Pueh	Opening Ceremony
Registration Team	Ir. Dr Abdul Razak Abdul Karim Ir. Dr Norazzlina M.Sa'don Hjh Fatimah Hj Tenain	Invitation, registration, attendance, certificate, venue
Technical Team	En Ahmad Kamal Abdul Aziz Dr Mah Yau Seng Hj Affandi Othman En Akeem Amuda	Compilation of papers and note printing
Rapporteur and Reporting Team	Assoc. Prof. Ir Dr Siti Noor Linda Taib Assoc. Prof. Dr Mohammad Ibrahim Safawi Ir. Dr Norazzlina M.Sa'don Ir. Dr Abdul Razak Abdul Karim Ir. Dr Leonard Lim Lik Pueh Dr Alsidqi Hasan Dr Mah Yau Seng En Ahmad Kamal Abdul Aziz En Akeem Amuda	Reporting
Audio Visual Team	En Denny Pon En Saiful Edi	PA System
Program Protocol Team	Pn. Angela Robert	Protocol during opening, program printing, signage
Moderator/Facilitator	Assoc. Prof. Dr Mohammad Ibrahim Safawi	
CREAM Team	Mohd Khairolden Ghani En Mohd Jumain Maplatti	Invitation

## APPENDIX: WORKSHOP PHOTOGRAPHS











