



**PLANNING MALAYSIA:**

*Journal of the Malaysian Institute of Planners*

**VOLUME 20 ISSUE 3 (2022), Page 160 – 171**

**ASSESSING A CONDITION OF TIMBER DEFECT FOR PERAK TRADITIONAL MALAY'S ARCHITECTURE: AN INITIAL STEP TO CREATING ENTITY RELATIONSHIP (ER) MODEL IN DATABASES MANAGEMENT SYSTEM (DBMS)**

**Nur Fadhilah Bahardin<sup>1</sup>, Mohd Nurfaizal Baharuddin<sup>2</sup>, Muhammad Azrul Azwan Azman<sup>3</sup>, Mohamad Khairul Al Hafiz Bakhari<sup>4</sup>, Mohd Sabrizaa Abd Rashid<sup>5</sup>**

*<sup>1,3</sup>Faculty of Architecture, Planning & Surveying*

UNIVERSITI TEKNOLOGI MARA PERAK BRANCH, MALAYSIA

*<sup>2,5</sup>Knowledge Understanding Tropical Architecture & Interior (KUTAI)*

UNIVERSITI TEKNOLOGI MARA PERAK BRANCH, MALAYSIA

*<sup>4</sup>EK Build Sdn. Bhd.*

NO 60-2, JALAN 8/62A, BANDAR MANJALARA, 52200 KUALA LUMPUR

**Abstract**

The significance value of Traditional Malay's House is relying on its architecture and strength ability of timber building and reflect the cultural value to the society. The uniqueness of this house is on the use of timber material such as Meranti, Jati and Chengal which prominent as a robust, long lasting and not easy to deteriorate spontaneously. Numerous factor that affects to the timber material and make it deteriorate can possibly cause by external forces, biological agents, temperature and the poor standard of workmanship. An existing information is very crucial in a way to 'boost up' locality economy especially in the aspect of heritage tourism. Local authorities as an administrative agency can play an important role as an 'information provider' to the ministry in promoting the tourism sector if they have a comprehensive database. The primary issue of tourism data is no comprehensive information about the traditional Malay house at respective administrative area in terms of building performance as well as defect analysis as to ensure a sense of historical place is preserved successfully. The aim of this paper is to develop Databases Management System for Perak Traditional Malay's House based on defect pattern at eleventh (11) nos. of Perak which focusing on Rumah Limas Bumbung Perak. Based on that analysis, it can be summarized that defect which often attacked a timber building, especially in tropical country especially in Malaysia was mainly caused by moisture problems and biological attack. A continuous exposure to these environmental agents and pests without proper maintenance and care with preventive measures will speedily decayed the buildings materials especially timber. Therefore, this paper is intended to explore a possibility of building condition assessment activity towards a data creation for database management system by exploitation a benefit of geographical information system (GIS).

**Keywords:** Perak Traditional Malay's House; Condition Assessment; Timber Defects; Database Management System (DBMS); Entity Relationship; Geographical Information System (GIS)

<sup>1</sup> Senior Lecturer at MARA University of Technology. Email: nurfa644@uitm.edu.my



## **INTRODUCTION**

A Traditional Malay's House has a lot of significance value especially on its architecture and strength ability of the timber building which brings the significance cultural value to the civilisation. According to Baharuddin et al (2020), the traditional Malay house is fully construct using the timber material which is from many kinds of timber types such as Meranti, Jati and Chengal which classified as a vigorous material and does not deteriorate spontaneously compared to other material. Timber would only deteriorate if it was attacked by the certain external forces. Therefore, Bakri (2014) in his study revealed that timber will provide excellent and lasting performance under a certain condition. However, it also faces several potential threats to service life, including fungal activity and insect damage which can be avoided in numerous ways. He added, timber is a hygroscopic material, which means it naturally absorbs and releases water to balance its internal moisture content with the surrounding environment. It was agreed by Reyers & John (2001), that a key important factor to controlling decay is to control moisture. Normally, a moisture content of timber is measured by the weight of water as a percentage of the oven-dry weight of the timber fibre. A minimum moisture content for decay to propagate is 22 to 24%, so building experts recommend 19% as the maximum safe moisture content for untreated wood in service. Water by itself does not harm the wood, but rather, wood with consistent high moisture content enables fungal organisms to grow. According to Harun (2020), National Heritage Department Malaysia (NHDM) has outlined the process to investigate historic buildings which namely architectural research, documentation on measured drawings, and dilapidation survey or building condition assessment with laboratory analysis. Therefore, this paper is intended to explore a possibility of building condition assessment activity towards a data creation for database management system by exploitation a benefit of geographical information system (GIS). By using this method, it can help ministries and local authorities standardize tourism information data as well as facilitate them to monitor and update the latest data regarding tourist attractions, tourism activities and other important information as to re-boost tourism industry in Malaysia after COVID-19 pandemic. (Soffian et al., 2021).

## **RESEARCH BACKGROUND**

According to Baharuddin et-al (2020), most of the vernacular architecture style are classified in the form of old Malay palaces, traditional houses and mosques, schools, offices, rest houses and hospital which located along the Sungai Perak. Rashid (2018) in his book entitled "*Rumah Kutai: Documentation of Memories*" that Perak Traditional Malay's Architecture styles can be divided into two (2) main categories:

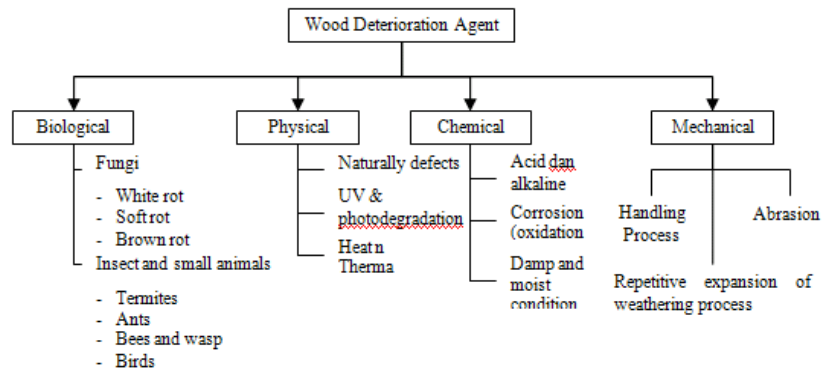
**Table 1:** Rumah Kutai (a) and Rumah Limas (b)

	<p><b>a.Rumah Bumbung Melayu or Rumah Kutai</b></p> <p>Based on the architectural view, Rumah Kutai can be refers as traditional Perak Malay house in where the house is defined by 'Rumah Ibu using Bumbung Panjang' or 'Bumbung Melayu' criteria.</p>
	<p><b>b.Rumah Limas Bumbung Perak or Potong Belanda</b></p> <p>It was believed that it is imitation the Dutch style during the colonial era. The design of roof of 'Rumah Limas Potong Perak' is well known on the west coast of the peninsula Malaysia.</p>

Source: M. N Baharuddin et-al (2020)

### **Timber Defect on Traditional Malay's House**

Based on study by Baharuddin et-al (2020), timber strength in Malaysia was classified into two (2) categories which it is naturally durable based on the types of timber while the other group was identified as timber that required treatment as to strengthen its properties. However, timber defect and damages still can affect the timber performance. According to study by Bakri (2014), defects can be referred to fault on something that detract from perfection, while building damage can be seen when any structure, material, equipment, and element of the building was not fully functional as to acceptable standard and function. He also further explains, defects are noticeable within the structure, fabric, services and other facilities of the flawed building. Most of the typical defects found in tropical climate in Malaysia are rotten timber, a slumped roof, damaged or deteriorated block walls, and slumped ceilings. He also added, timber properties are very flexible material for building structure, can deteriorate easily if no preventive action is taken to protect and avoid it from worsening. It was agreed by Johar et al (2013), which claimed that the presences of defects in timber houses are becoming more common because of biological agents, temperature and the poor standard of workmanship. Referring to the figure below, it was recognized four (4) major group for timber deterioration agents, where; biological, physical, mechanical and chemical agents (Johar et al, 2013).



**Figure 1:** Typical Defects on Timber Building  
 Source: Johar et-al (2013)

Thus, determination of these condition is vital and can be conducted via observation to the area of the building by using visual inspection to identify and diagnose a building defect (Baharuddin et-al, 2020).

***Geographical Information System Capabilities in Perak Malay’s Traditional House***

As a component of Spatial Data Management, the Geographical Information System (GIS), may locate, document, and model geo-referenced spatial information. Recognizing the significance, most planning institutions are aggressively incorporating technology (mainly GIS, simulation, and modelling) into their courses (transport, urban growth, and environmental) (Evans-Cowley, 2010). GIS is a generic idea that allows data to be captured, stored, manipulated, and analysed on the earth's surface to aid decision making that affects spatial organisation. (Sun and Li 2016). Apart of the application of the GIS system, namely Data Based Management System (DBMS), it can facilitate a process in building inspection process in terms of storage a data after visual condition survey been execute on site. DBMS in the assessment of timber defect pattern in Perak Traditional Malay’s Architecture indirectly benefits the assessor in confirming the data and information of the timber defects in Malay’s traditional architecture house by including the exact location for each type of defect in respectively house.

## RESEARCH METHODOLOGY

The aim of this paper is to establish a Timber Defect Pattern of Perak Traditional Malay's House which focusing on 'Rumah Kutai' Perak as well as creating an initial step of Database Management System (DBMS) towards integrated information regarding a building performance. Towards attaining this aim, a qualitative research approach is used to achieve a main objective which to analyse the development of Timber Defect Pattern at the eleventh (11) nos. of Perak Traditional Malay's House located at Perak Tengah District. The critical stage in this research is to assess the existing condition of the building through building condition survey. A pro-forma survey was established as a checklist and being used to identify the types of timber building defect, the possible causes and the location of defects. The inspection is carried out by using Visual Inspection or Condition Survey Protocol 1 as to diagnosing a building defect for the traditional house before transferring the information to the DBMS in GIS approach. A few observations and procedures need to be followed such as top to down approach, which start the inspection from the highest level of the house i.e roof space. Then, the survey will be move from the internal building to the external façade with reasonable care. A several valuable information such as building background which is the property belongs to whom, year of built and completed, global positioning station (GPS) location, timber types, any maintenance information regarding the property and any related information were gathered during that inspection. At the time of survey, a weather condition is sunny day.

Furthermore, the analysis was made based on element by element; the column, beams, walls, floors, windows, doors, roof, plinth and stairs, diagnosing the building defect and defect possible causes.

## FINDINGS AND DISCUSSION

In order to achieve the objective No. 3, eleventh (11) nos. of Perak Traditional Malay's House located at Perak Tengah District was selected as a case study as follows:

**Table 3:** Case Study Information


No	Perak Traditional Malay's House (PTMH)	Building Age	Types	Timber Material	Location / Coordinate	Photo
1	PTMH 1	200 years	<i>Kutai Anjung Beranda</i>	Chengal	Parit / 4° 28' 14" N / 100° 54' 20" E	

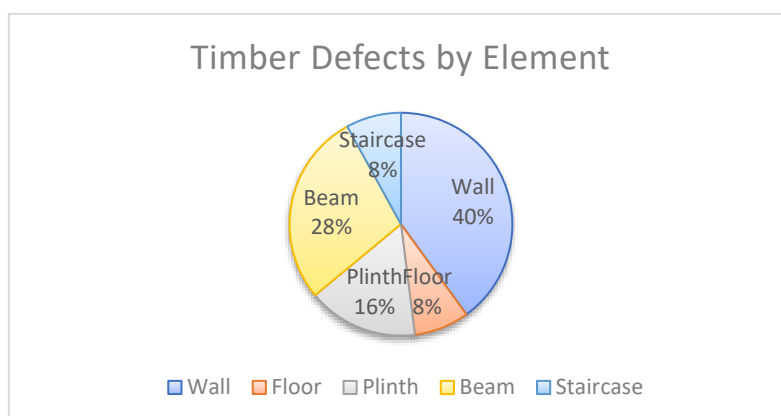
Figure 2: PTMH 1

2	PTMH 2	150 years	<i>Kutai Anjung Beranda</i>	Chengal	Parit / 4° 28' 11" N / 100° 54' 21" E		Figure 3: PTMH 2
3	PTMH 3	100 years	<i>Kutai Anjung Beranda</i>	Chengal	Parit / 4° 27' 02" N / 100° 54' 25" E		Figure 4: PTMH 3
4	PTMH 4	100 years	<i>Kutai Anjung Beranda</i>	Chengal	Bota Kanan / 4° 24' 37" N / 100° 53' 33" E		Figure 5: PTMH 4
5	PTMH 5	100 years	<i>Kutai Anjung Beranda</i>	Chengal	Bota Kanan / 4° 20' 30" N / 100° 53' 17" E		Figure 6: PTMH 5
6	PTMH 6	100 years	<i>Kutai Anjung Beranda</i>	Chengal	Bota Kanan / 4° 20' 47" N / 100° 53' 05" E		Figure 7: PTMH 6
7	PTMH 7	175 years	<i>Kutai Anjung Beranda</i>	Chengal	Bota Kanan / 4° 19' 27" N / 100° 54' 28" E		Figure 8: PTMH 7
8	PTMH 8	100 years	<i>Kutai Anjung Beranda</i>	Chengal	Bota Kanan / 4° 19' 28" N / 100° 54' 28" E		Figure 9: PTMH 8
9	PTMH 9	100 years	<i>Kutai Anjung Beranda</i>	Chengal	Bota Kiri / 4° 21' 47" N / 100° 53' 35" E		Figure 10: PTMH 9
10	PTMH 10	100 years	<i>Kutai Anjung Beranda</i>	Chengal	Bota Kiri / 4° 21' 53" N / 100° 53' 36" E		Figure 11: PTMH10
11	PTMH 11	100 years	<i>Kutai Anjung Beranda</i>	Chengal	Bota Kiri / 4° 21' 57" N / 100° 53' 45" E		Figure 12: PTMH11

*Source: Author (2022)*

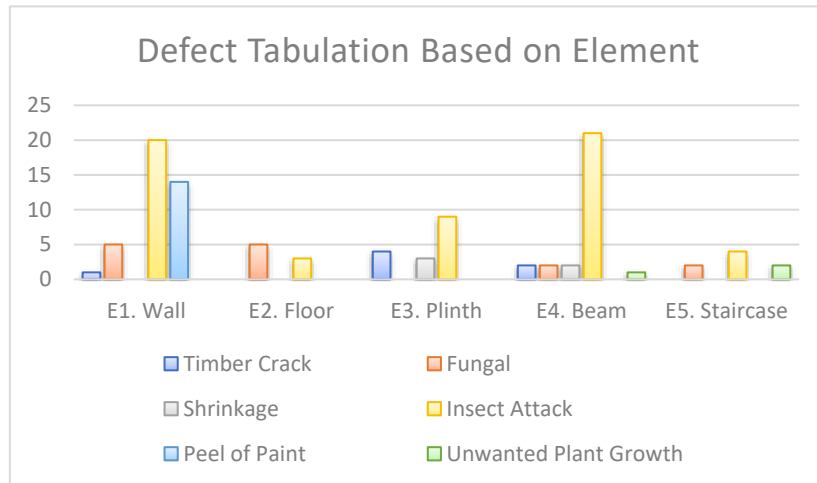
### **Defects Tabulation at Perak Traditional Malay's House**

Figure below shows a tabulation of defect for eleventh (11) nos. of Perak Malay's Traditional House. There are five (5) major elements were counted in this study, whereas six (6) category of building defects were set up as a common typical defect occurred at timber building (Baharuddin, 2020).



**Figure 13:** Defect Tabulation Based on Building Element  
*Source: Author (2022)*

Figure 13 shows a breakdown of defects in each element found in the eleventh (11) nos. of case study. Overall, based on survey, hundred (100) numbers of defect were recorded as a common failure and shortcoming during this exercise. The highest percentage of defect occurred at the building element is wall (40%), beam (28%), plinth (16%), followed by staircase and floor were recorded 8% respectively. Generally, the defects happened will absolutely decrease a timber building performance in terms of aesthetic point of view (Johar et-al, 2013).



**Figure 14:** Defect Tabulation Based on Building Element  
 Source: Author (2022)

Figure 14 shows a breakdown of defects in each element found in the eleventh (11) nos. of case study. The highest percentage of defect caused by insect attack due to biological agent where it can be affected by insect attack consisting of Termites/ Wet Rot/ Dry Rot/ Beetles. According to survey, the building element focusing on beam (21 nos.) and wall (20 nos.) as well as plinth (9 nos.) recorded a higher number of defects occurred rather than floor (0 nos.) and staircase (0 nos.). Based on the analysis, it can be summarizing that most of the external facades recorded the highest percentage of defects due to external factors of biological attack and environmental agents. Continuous exposing to the environmental factor such as extreme weather condition contributes as a main factor of this findings. Meanwhile, for wall elements which considered as building fabric that concealed a building space internally and externally, was recorded the second highest percentage due to the fungal attack of dry and wet rot. Plinth and decorative elements similarly experienced the building defects since most of the decorative elements or ornamentation are being design based on normal 'timber' grade as to easy the carpenter to carving the timber materials with certain design and motifs (Baharuddin et al, 2020). Few defects were identified in the floor and staircase inspection. Those presents are the result of biological factors, physical and mechanical factors. Fungal attack, insect attack due to termites/ wet rot/ dry rot/ beetles are the commonly occurred for the floor and staircase element while unwanted plant growth is complemented for a small number of defects for staircase (Nawi, 2020). To conclude, this assessment is intent to establish the similarity and pattern of Perak Traditional Malay's House



focusing on 'Rumah Kutai' gives an overview of the existing condition, particularly those made from timber building element. The importance of this study where it can be used to creating a comprehensive Database Management System (DBMS) for Perak Malay's Traditional House, then followed by formulating a framework or guidance of proper remedial measures in terms of maintenance planning which focusing on timber building elements as to conserve a heritage identity at this area. Unlike with other property, most of the building in this study was left unoccupied since the owner died and the custodian of this building was inherited to their relatives. Subsequently, it was used only during festive season such as hari raya festival, resulting a development of termites' colony attack was rapidly growth (Bakri, 2014). Furthermore, a main factor due to the lack of maintenance and care of the building contribute the major causes of defects throughout the buildings. Therefore, a holistic prevention measures need to be taken in a way to overcome these issues. A comprehensive database management for Perak Traditional Malay's House is crucial and thus its preventive measures will minimize the risk of extinction of heritage significance element at certain places or district.

#### ***Creating of Entity Relationship (ER) in Databased Management System (DBMS)***

Generally, DBMS can help in store the data systematically and can show the detail analysis through the supporting map view. The data and analysis can be easily monitor and also can be identify virtually to help in any of decision making based on the issues and problems occurred from the defect data collection (Wilson, 2009). Then, the ER Diagram method by Chen (1976) is used in this study to form a Databased Management System (DBMS) for Timber Defect Pattern in Perak Traditional Malay's Architecture variables that have three main mechanisms which are entities, attributes and relationship. The database in this study covers 5 main building elements of Perak Traditional Malay House which is wall, floor, beam, plinth and staircase and the specifics of the components will be utilised as variables of each building element's defect such as:

- i. Entities: The components of entities are grouped according to the division of building elements that had been listed in this study.
- ii. Attributes: Defect diagnosis variables of the Perak Traditional Malay House is the data that had been collected from the inventory from each unit of the house such as timber crack, shrinkage, insect attacks, peel of paints, unwanted plant growth, and fungal.
- iii. Relationship: Relationship meaning is that of a verb that links two nouns (entities). Sharing on defect Databased and Management in Perak

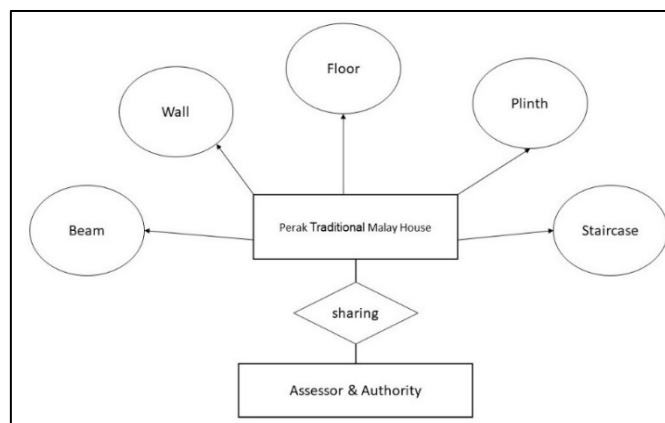
Traditional Malay House in this study is important in giving a comprehensive view to the assessor and also to the Authority to look at the details on the defect and will lead to the suitable method in maintaining and solve the problems by using the right materials and precise procedure.

The following table shows the details with respect to the attribute component for which building elements and types of defects on each of the elements in Perak Traditional Malay House.

**Table 4:** Attribute for ER development

<b>Attribute</b>	<p>Perak Traditional Malay House Number Building Elements</p> <p>Defect Diagnosis</p>	<p>Each Perak Traditional Malay house will be code with a number for easy identification on the types of defects based on the building element’s defects inventory</p> <p>There are 5 Building elements that had been listed in this study which is reflect to the different function and important elements in Perak Traditional Malay House.</p> <p>Based on the listed Building element’s, each of it will be assess trough the types of defect diagnosis which had been categorized to 6 parts with different causes and factor. This is the key element in this study which can be as a prove in making a decision on rehabilitation and others process in future.</p>
------------------	---	---

*Source: Author (2022)*


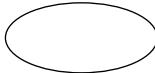
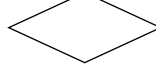


**Figure 15:** ER diagram symbols

*Source: Author (2022)*

The key entities and their inter-relationships are represented by symbols and connections in the ER Diagram. The following graphic was created by Chen (2002) to depict the basic components:

**Table 5: ER Diagram of Perak Traditional Malay House Database**

COMPONENTS	SYMBOLS	
Entity	Rectangle	
Attributes	Circle	
Relationship	Diamond	

*Source: Author (2022)*

## CONCLUSION

In a nutshell, based on the analysis, it can be concluded that both owner or caretaker for each Perak Traditional Malay House and respective local authority should have a decent synergy between others as to ensure a cultural significance element at certain element should be protected and conserved. As a policy maker as well as government agency, a proper database management for traditional Malay house is crucial for local authority as to monitor its performance in providing as much as information for heritage tourism such as 'heritage trails' of Perak Tengah District. At the same time, owner or caretaker of the building must emphasis on the maintenance aspect of the timber house since it was recorded as a main factor of timber decay in the building. A reasonable care of timber elements, such as the routine maintenance works is being conducted by the owner as to avoid the peel off paint defect, the painting works must be done in very five years which using the old method which is using the oil-based paint which eventually proven as a good solution of timber decay in the context to prevent environmental factors. Therefore, with a good synergy between both parties, it is believed that a 'pearl' of Perak Tengah District which is significance heritage values for traditional Malay house will be continuously preserve with a proper maintenance strategy throughout digitalization strategy.

## ACKNOWLEDGEMENTS

We would like to acknowledge and extend heartfelt gratitude to the Ministry of Higher Education and Universiti Teknologi MARA (UiTM) for funding this study under the Fundamental Research Grant Scheme (FRGS) – (Ref: FRGS/1/2021/SSI02/UITM/02/10). A special thanks to the Centre for Knowledge &

Understanding of Tropical Architecture & Interior (KUTAI) for sponsoring 50% of the PMJ Special Edition 2022 publication fees. May this effort encourage more scholars to publish in Index Journal in the future.

## REFERENCES

- Baharuddin M. N, M. S A. Rashid, M.K A. Bakhari, N. F. Bahardin, K. Alaudin.(2020). Expanding the Longevity of Traditional Malay's Architecture Identity: *International Journal of Solid State Technology*, ISSN: 0038-111X, Vol. 63, No. 3.
- Bakri N. N. O & M. A. O. Mydin (2014). General Building Defects: Causes, Symptoms and Remedial Work. *European Journal of Technology and Design*, 2014, Vol.(3), No. 1
- Chen, P.P.S. (1976). The entity-relationship model: toward a unified view of data, *ACM Transactions on Database Systems*, Volume 1, Issue 1 Special issue: papers from the international conference on very large data bases: September 22–24, 1975, Framingham, MA
- Evans-Cowley, J. (2010). Planning in the Real-Time City: The Future of Mobile Technology. *Journal of Planning Literature*, 25(2), 136–149. <https://doi.org/10.1177/0885412210394100>
- Harun S. N, N. A Karim, A. Muhammad & S. M Saod (2020). Assessment of the Historic Interior of CarcosaHeritage Building, Kuala Lumpur for Building Conservation *Journal of the Malaysian Institute of Planners*, Volume 18 Issue 2 (2020), Page 1 – 11
- Hisham, N. A. A., & Hassan, H. (2015). Problems in heritage building conservation. *Advances in Environmental Biology*, 63-67
- Johar S., A. I. Che-Ani, N. M. Tawil, M. Surat, S. N. Kamaruzzaman (2013), Preliminary Survey and Defects Analysis of Traditional Timber Mosques in Malaysia: *WSEAS TRANSACTIONS on ENVIRONMENT and DEVELOPMENT*; Issue 1, Volume 9, January 2013, E-ISSN: 2224-3496
- Nawi N. H. M., R. C Haron & Z. Kamaruddin. (2020). Risk Cost Analysis in Malay Heritage Conservation Project. *Journal of the Malaysian Institute of Planners*, Volume 18 Issue 2 (2020), Page 59–72
- Rashid M. S. A (2017), *Rumah Kutai: Documentation of Memories*, Institut Darul Ridzuan, Ipoh, Malaysia
- Reyers John, & John, M. (2001). The assessment of risk in conservation refurbishment projects. *Structural Survey*, 19(Number 5), 238-244.
- Sun, Y., & Li, S. (2016). Real-time collaborative GIS: A technological review. *ISPRS Journal of Photogrammetry and Remote Sensing*, 115, 143–152. <https://doi.org/10.1016/j.isprsjprs.2015.09.011>
- Soffian, N. S. M., Rosli, N. M., Azman, M. A. A., & Muhamad, A. K. (2021). Development of Tourism Database Management System: Creating ER Model. *International Journal of Academic Research in Business and Social Sciences*, 11(2), 1307-1314.

Received: 30<sup>th</sup> June 2022. Accepted: 12<sup>th</sup> September 2022