DEPARTMENT OF BUILDING

UNIVERSITI TEKNOLOGI MARA

(PERAK)

BUILDING FORENSIC INVESTIGATION OF COLLAPSE HALL AT CURE & CARE REHABILITATION CENTER (CCRC), PERLOP

PREPARED BY:

MUHAMMAD AIDIL QAYYUM BIN MOHAMMAD RUSLI

2019236012

DEPARTMENT OF BUILDING
FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING
UNIVERSITI TEKNOLOGI MARA
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FEBRUARY 2022

By:

MUHAMMAD AIDIL QAYYUM BIN MOHAMMAD RUSLI
2019236012

Practical Report

be accepted in partial fulfillment of requirement has obtaining Diploma in Building

Report Supervisor	:	_____ Dr. Hafizah Binti Mohd Latiff
Practical Training Coordinator	:	_____ Dr Nor Asma Hafizah Bt. Hadzaman
Program Coordinator	:	_____ Dr. Dzulkarnaen Bin Ismail

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STUDENT'S DECLARATION

I hereby declare that this report is my own work, except for extract and summaries for which the original references stated herein, prepared during a practical training session that I underwent at Public Work Department Kuala Kangsar (PWD) for duration of 20 weeks starting from 23 August 2021 and ended on 07 January 2022. It is submitted as one of the prerequisite requirements of BGN310 and accepted as a partial fulfillment of the requirements for obtaining the Diploma in Building.

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Name : Muhammad Aidil Qayyum Bin Mohammad Rusli

UiTM ID No : 2019236012

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At every beginning, I would like to express my deepest gratitude to almighty Allah for giving me the strength and the composure to complete my practical training and prepare this report within the scheduled time.

The practical training opportunity that I had with Public Work Department Kuala Kangsar (PWD) was a great chance for learning and professional development. Therefore, I consider myself as a very lucky individual as I was provided with an opportunity to be a part of it. I am also grateful for having a chance to meet so many wonderful people and professionals who led me though this practical training period.

Bearing in mind previous, I am using this opportunity to express my deepest gratitude and special thanks to the building engineer of Public Work Department Kuala Kangsar (PWD), lr. Hasni Bin Zainudin who in spite of being extraordinarily busy with his duties, took time out to hear, guide and keep me on the correct path and allowing me to carry out my project at their esteemed organization and extending during the training especially in construction project.

I am highly indebted to my academic supervisor, Dr. Hafizah Binti Mohd Latif (Ts) which helped a lot from us starting the practical training until the end like help student to get a intern's place and guide a report. In addition, she is always willing to give help and advice if there are any problems and issues related to practical training. Thanks to all parties involved because has been a part of my success completed this training well.

I perceive as this opportunity as a big milestone in my career development. I will strive to use gained skills and knowledge in the best possible way and I will continue to work on their improvement, in order to attain desired career objectives.

ABSTRACT

Industrial training is one of the conditions that has been made compulsory on every student according to some cost and faculty taken at UiTM. The objective of this industrial training is to provide initial exposure and experience to students before stepping into the real world of work. In this report describes the detail about the background of the company, scope of study, objectives for the project during the practical training and the projects I am involved during the practical training that is forensic engineering investigation. The objective of this report is to describe the method of forensic investigation of the collapse hall block, to identify the overview of the analysis after performing all inspection steps and to determine the recommendations and suggestions to the problems. This report will also describe the steps or information that need to be done to conduct building forensic investigation work. Hopefully every piece of information described will satisfy the reader as well as benefit myself and the organization itself. In addition, it can give me guidance and strength in facing all the problems that I will face when I am in the world of work later.

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CHAPTER 1: INTRODUCTION

Building forensic investigation is one of the tasks or scope of work available in the building department at the Public Works Department (PWD) Kuala Kangsar, Perak. Forensic definition is the application of knowledge to questions of civil and criminal law. Forensic engineering is the application of engineering principles and methodologies to answer questions of fact related to the failure of a building. The goal of such work is to positively identify the sequence of events that lead to ultimate failure. forensic investigation also constitutes an investigation into failures in materials, components, design and structure. Investigation is a scientific method of collecting, testing, investigating and evaluating current and historical situations to discover what lies beneath the surface of a structure.

In PWD Kuala Kangsar, the project or task of forensic investigation will be shouldered by the Works Inspector or assistant engineer, they will inspect the construction, maintenance and investigation related to the scope of their work (shrm, 2020). In this report will describe the forensic reporting activities on the collapse of the Cure & Care Rehabilitation Center (CCRC), Perlop hall building. Therefore, forensic scene investigators need to have a basic knowledge of science, engineering and medicine appropriate for legal or public argument (Moorthy, 2021). The purpose is for skilled civil and structural engineers to identify the cause of damage to buildings and structures and report it properly so that the final repair project of the investigation can determine the solution that needs to be done by the contractor (Moorthy, 2021). Based on the facts obtained during the inspection of the building and the knowledge of experts, conclusions can be drawn. Only an experienced forensic scene investigator can handle such cases and draw conclusions for presentation in the legal system (Moorthy, 2021).

Forensic investigation has the importance of a building that needs to be done if the building has a collapse or accident. It is to figure out why something went wrong. This entails identifying the actions that lead to the failure and establishing a chain of causation that led to the accident. The data can be utilized to improve a component's performance and dependability. Structure failures and faults are a typical occurrence in the building business. Negative repercussions on the project's cost, length and

resources are possible. Failures and faults can lead to additional costs and delays (Shinde & Meshram, 2020). Furthermore, if this problem is not addressed and managed, it will result in more significant issues in future development projects. To reduce the lot of time and cost spent on a construction project, forensic studies are used to discover contributing reasons to building defects and failures (Shinde & Meshram, 2020).

The activities or steps that will be taken to conduct a forensic investigation on a building are gather information, investigate, visual inspection, document review, photographic documentation, analysis data, map actions of parties, develop opinions and conclusions, explain the reasoning behind the conclusion, prepare culpability worksheets and give a clear assessment of the risks involved with each issue. Among the important points in forensic investigation when conducting inspections, it is likely that structural flaws will take precedence. Structural faults are a result of the major reason of the building falling (Hamma-adama et al., 2020). Bad building materials, poor design and a lack of oversight could all be contributing factors. Before a structure collapses, structural flaws may be the last thing that is discovered (Hamma-adama et al., 2020).

Finally, the term forensic on building implies the formation of opinions through a disciplined approach and steps in conducting accurate investigations and not just speculation (Daniel, 2021). Inspection and quality management play an important role during construction projects (Wang et al., 2017). Thus, the diagnosis of detection and identification of the cause, effect and possible solution of the defect or failure of the building can all be determined from forensic investigation (Daniel, 2021).

1.1 Objective

The objective of this study is:

1. To describe the method of forensic investigation of the collapse hall block
2. To identify the overview of the analysis
3. To determine the recommendations and suggestions to the problems

1.2 Scope of Study

The scope of this study is the building forensic investigation at the construction site that identifies and do analysis about the collapse hall at the Cure & Care Rehabilitation Center (CCRC), Perlop, Sungai Siput, Perak. This study will try to how to conduct a forensic investigation on a building that has collapsed. The investigation usually carried out as a contractual responsibility performed by PWD to provide the contractor, client or third party an independent view of the construction works and their progress.

At the study site, there are several processes that have been taught and done such as how to record data, how to make inspections in each structure, how to use tools and how to make initial decisions based on the data obtained

1.3 Research methods

Research method are important because it was the strategies, procedures or techniques used to gather data or proof for evaluation to collect are information or generate a stronger knowledge of a subject. The research method adopted for this study are: -

1. Observation

   The inspection process is observed at the site, site visits to the construction site will be conducted when there is a complaint by any party of the building. There are many things to see and learn how an assistant engineer makes an inspection every time comes to the site such as looking at the tidiness and the way the contractor does the work, re -measuring and calculating the cost. If from the point of view of forensic work, all aspects, data or parts of the building need to be investigated and observed. That's where the way to learn and understand every time you see the way the assistant engineer works, especially the construction project inspection. All observations and information will be recorded in a notebook for reference. In addition, taking photos and videos using an iPhone brand smartphone all the procedures and activities in the inspection process as evidence and no how the thing is done.

2. Interview

   All questions and misunderstandings in a process or activity in conducting inspections will be asked to the assistant engineer or site supervisor. They will explain in detail how a process is implemented, why it needs to be done, its importance and the advantages and disadvantages when it is implemented. In addition, interviews were also conducted with contractors to better understand the opinions of both parties. By conducting an interview, all data, knowledge and information obtained will be recorded by writing brief notes into a notebook and smartphone.

3. Document review

   Architectural and structural drawings are the sorts of papers that have been referred to. A corporate profile is another document that describes the company's history. Progress reports were frequently referred to, as were progress images taken by the site supervisor using a smartphone camera. This is due to the need to recover lost progress. The assessment of documents will take place in the office. All pertinent information will be jotted down in a notebook, with papers including diagrams, such as architectural and structural drawings, being photographed using a smartphone camera.

CHAPTER 2: COMPANY BACKGROUND

Public Work Department Kuala Kangsar (PWD) is under the Perak state government district. it is located at Pejabat Jurutera Daerah, Jalan Raja Chulan, 33000 Kuala Kangsar, Perak. The Malaysian Public Works Department or Jabatan Kerja Raya Malaysia (JKR) is the federal government department in Malaysia under Ministry of Works Malaysia (MOW) which is responsible for construction and maintenance of public infrastructure in West Malaysia and Labuan. Public Works Department is engaged in planning, designing, construction and maintenance of government assets in the field of built environment and infrastructure development. The Perak Public Works Department is the largest government technical agency in the State of Perak Darul Ridzuan

Public Work Department Perak has been established since 1878 and serves as a technical company to the Perak Darul Ridzuan State Government. PWD Perak has the role of implementing infrastructure development and maintenance projects to various state departments and other government agencies. PWD Perak also strives to develop and maintain infrastructure and public facilities for the welfare of the people, especially the citizens of Perak Darul Ridzuan.

In Public Work Department Kuala Kangsar there are two parts namely Building department and Road Department. The PWD's Building Department is responsible for federal and state project of building and maintaining government buildings in Malaysia such as public government offices, schools, hospitals, police and army facilities, port and airports. It consists of general building works branch, health works branch, security works branch, education works branch and airport and maritime works branch. Then, The PWD's Roads Department is responsible for building and maintaining roads in Malaysia such as federal roads, state roads, bridges and interchange.

Lastly, the vision for Public Work Department Kuala Kangsar is to be a world -class service provider and center of excellence in the field of asset management, project management and engineering services for the development of national infrastructure through creative and innovative human capital and the latest technology. Next, among

the missions are assist customers in delivering policy and service outcomes through the collaboration of strategic partners and Standardization of processes and systems for consistent delivery of results.

2.1 Completed Projects

Public Work Department Kuala Kangsar has monitored many governments projects that have been completed under main contractors as shown in Table 1.

Table 1: Completed projects

Projects Name	Contractor's Grade	Price (RM)	Duration	Started	Finished
Build a New Mosque in Kampung Ulu Piol, Manong Perak.	Grade 4	1,792,857.36	3 years	18/11/2016	19/8/2019
Construction of Dormitory Building at Madrasah Idrisiah, Kuala Kangsar, Perak.	Grade 4	1,795,035.40	2 years	07/11/2017	15/01/2020
Rural Transformation Center (Rtc) Mini Project Kg. Orang Asli Bawong, Sg. Siput, Kuala Kangsar, Perak-phase 3 (Orang Asli One-stop Center)	Grade 7	25,667,532.81	3 years	18/04/2017	04/11/2020
Construction of New TNB Substation at Istana Iskandariah, Kuala Kangsar.	Grade 4	2.809,967.57	8 weeks	09/01/2020	05/03/2020

2.2 Ongoing Projects

Public Work Department Kuala Kangsar has monitoring ongoing government projects under main contractors as shown in Table 2.

Table 2: Ongoing projects

Projects Name	Contractor's Grade	Price (RM)	Duration	Started	Finished
Construction of Dormitory, Dining Hall, Surau & Other Facilities at Bawong National Secondary School, Sungai Siput, Perak	Grade 7	30,965,400.40	2 years	04/01/2021	06/11/2022
Slope Repair Project (Soil nailing) and Related Works at Kampung Nasib National School.	Grade 4	1,433,640.00	8 months	27/07/2021	28/03/2018
Kuala Kangsar Road Upgrading Project - Manong (A03)	Grade 7	38,903,844.28	3 years	28/02/2018	24/12/2021
Slope Repair Project (geogrid) at CRCC, Perlop	Grade 4	1,567,760.00	8 months	01/10/2021	01/05/2022
Reconstruction And Refurbishment Of Hall Building At CRCC, Perlop	Grade 4	1,200,000.00	1 year, 6 months	20/11/2021	23/05/2023

2.3 Organisation Chart

Public Work Department Kuala Kangsar have three departments were responsible for overall construction which is Building Department, Road Department and Administration Department. The Colonial Engineer's (as shown in Figure 1) was responsible in managing staff administration, in terms of the Service Scheme, benefits in and after the service as well as discipline. Furthermore, he planned and carried out road maintenance works, bridges, masonry and all road furniture under the jurisdiction of the Department (State and Federal). In addition, there took a responsible in planning and implementing maintenance works of government buildings (State and Federal).

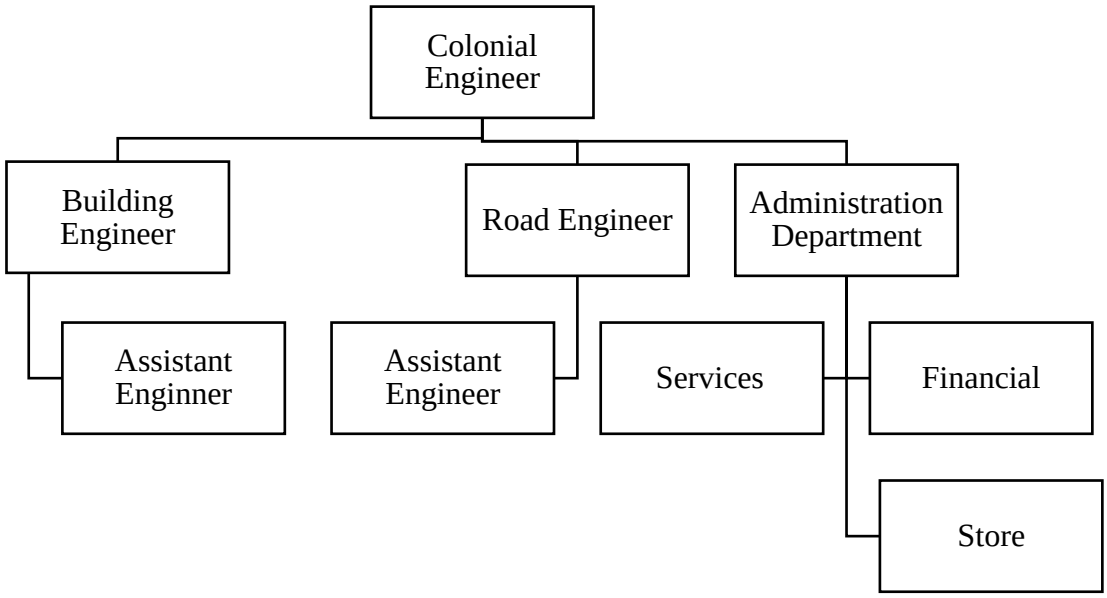

Figure 1: Public Work Department in Kuala Kangsar chart

2.3.1 Organisation Chart for Building Department

Building Department is responsible for building and maintaining government buildings in Malaysia such as public government offices, schools, hospitals, police and army facilities, port and airports. They also responsible to maintain state and federal buildings, plan and supervise the work of the state and federal building design and appoint a contractor to execute the project through a quotation and tender. Besides, they responsible to carry out the duties of the Administration Contract to educational projects, general buildingand state and federal government security. The people who worked in the Building Department is as shown in Figure 2.

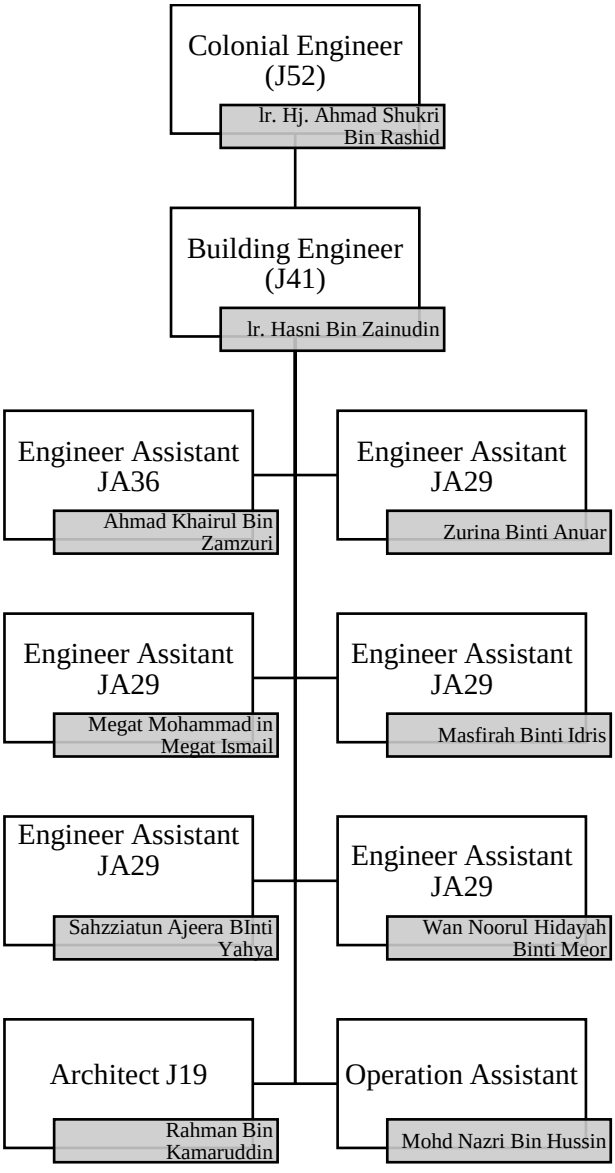

Figure 2: Department of building organisation chart

2.3.2 Organisation Chart for Road Department

Public Work Department Kuala Kangsar Roads Branch is responsible for building and maintaining roads in Malaysia such as federal roads, state roads, bridges and interchange. Besides, responsible for the road they have been assigned to them. They needed to maintain the road, widening or make sure that the road has followed the specification as being planned. The people who worked in the Road Department is as shown in Figure 3.

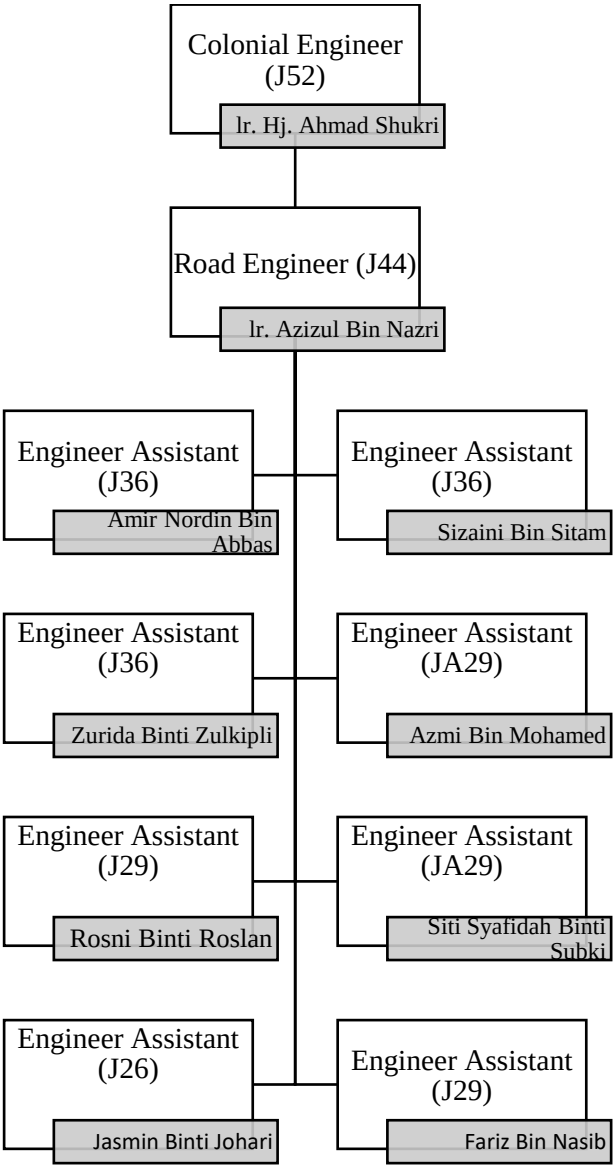

Figure 3: Department of road organisation chart

2.2.3 Organisation Chart for Administration Department

The administration department has a responsible to manage all the works that relate to administration such as administration staffs and finances. For administration staffs they needed to manage the staff's salary, their holiday, their attitude and about correspondence. for finances they needed to handle all the things that related to finances affair such as manage the receipt and expenditure, distribution of allocations to each division or sign all payment vouchers of each section. The people who worked in the Administration Department is as shown in Figure 4.

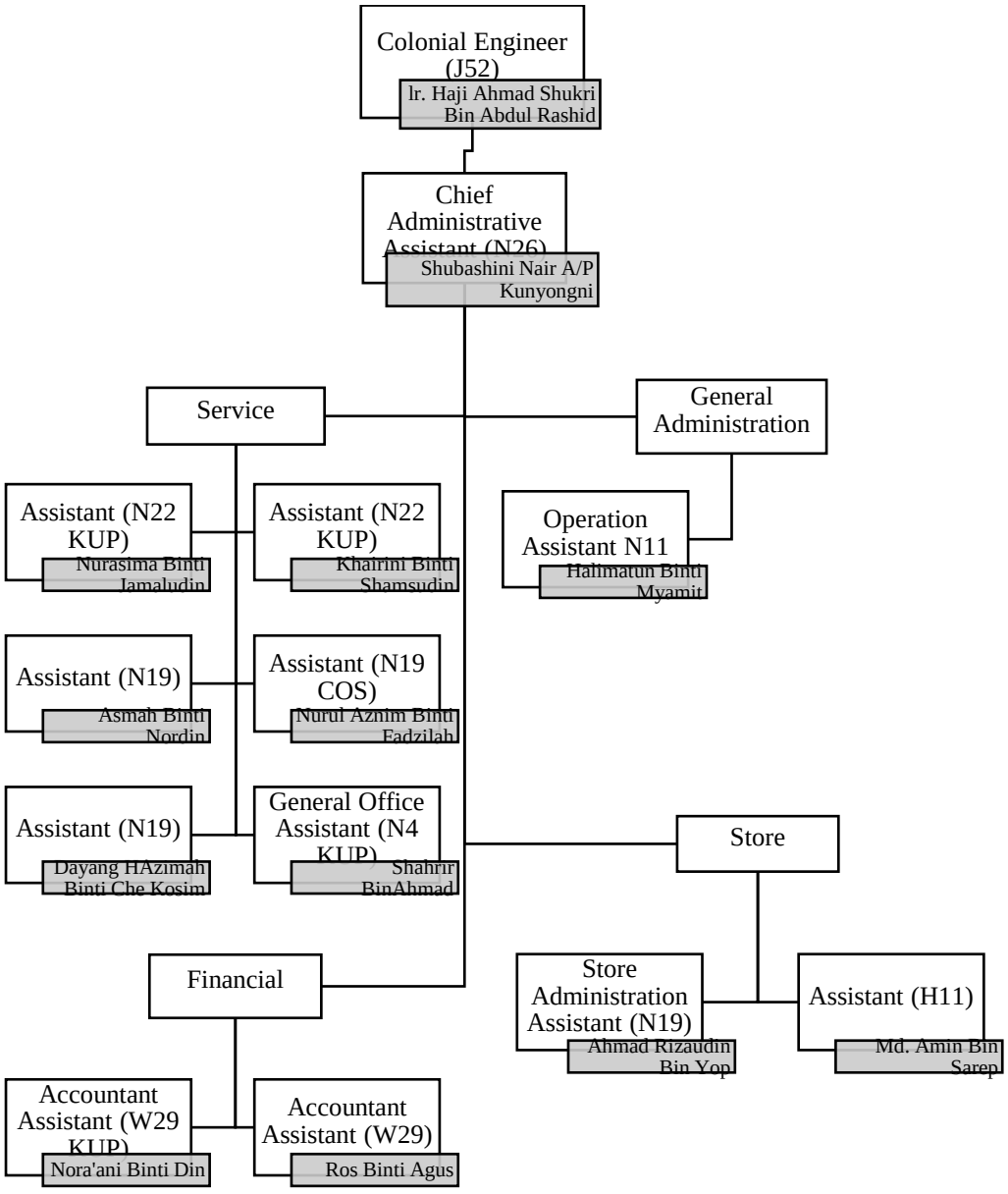

Figure 4:Department of administration organisation chart

CHAPTER 3: CASE STUDY

The case study of this report is a forensic investigation work on a hall building project at a Cure and Care Rehabilitation Centre (CCRC) or Pusat Pemulihan Narkotik (PUSPEN) located at Perlop, Sungai Siput, Perak Darul Ridzuan. The key plan and location plan, Figure 5 and 6 respectively, show the proposed sites.

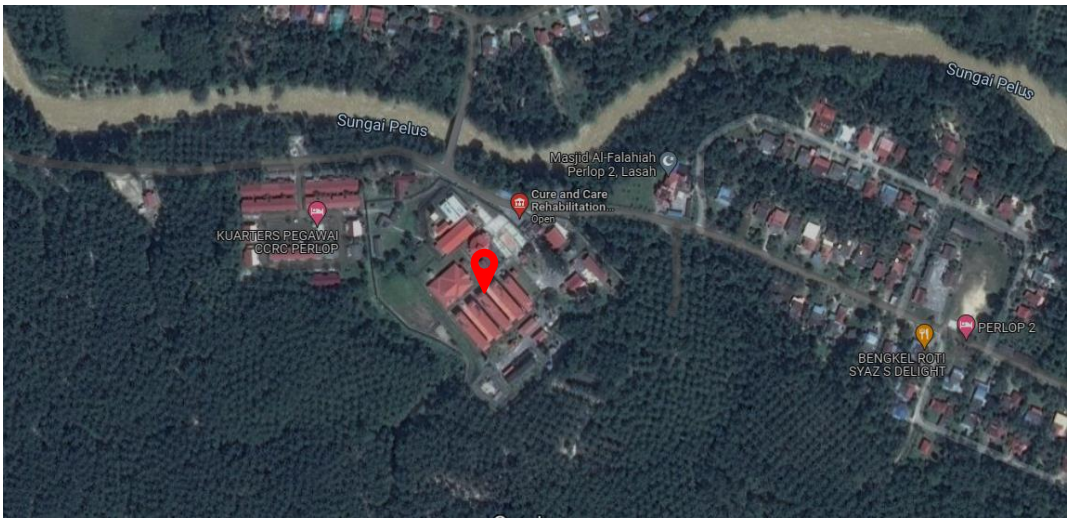

Figure 5: The location plan of CCRC Perlop

Figure 6: The key plan of Hall Building in CCRC Perlop

Initially, PWD Kuala Kangsar had two projects in CCRC Perlop, namely the project to make a slope and the project to replace the roof reinforcement or trusses for the hall building in the area. On 10 November 2021 had received a report where the walls of the hall had collapsed. Representatives of PWD Kuala Kangsar (Forensic Unit) were present at CCRC Perlop after being informed of the incident where the wall of the Hall Block collapsed the day before. The visit took place on 11 November 2021, Thursday. The preliminary inspection was conducted by the Building Engineer, Ir Hasni B Zainudin and assisted by the Assistant Engineer of PWD Kuala Kangsar from the building department.

Figure 7 The overall view from the top of the collapsed hall building

CCRC Perlop located in Kampung Perlop Dua was built near Jalan Negeri A19 and A 155 in Mukim Pulau Kemiri Dun Lintang. Most of the existing blocks were built around 1983 and are 38 years old.

The objective of conducting a forensic investigation on this building is to identify and investigate the cause of building damage. This is very important and is the main thing and needs to be done carefully and thoroughly. Besides, to determine the level of security and integrity of the structure. In additional, assess and review the level of safety and risk to occupants and movable assets of the building.

3.1 Forensic investigation methodology of the collapsed hall

1. Visual Inspection

   The inspection methodology used in this project is to conduct a ‘visual inspection’ of damage to the entire building components, both structural and non -structural (as shown as figure 8 and 9). Engineers assess the individual and related impact of building materials, site, exposure, architecture and maintenance history through visual inspection and consultation of acceptable documentation. This process is done primarily when informed by information about the site of the building, it can identify targets for more in -depth or possibly invasive inspections and tests in cases where known problems are unclear or where investigators are open to discovering less obvious but important contributors to building failures or environmental complaints.

Figure 8 Inspection activities of the hall that have fallen and collapsed

Figure 9 The condition of the fallen wall

2. Gather and taking all the data or information

   The second way entails gathering all relevant data as well as damage information for the hall structure as shown as table 3. Physical measurements and testing of the building and surroundings as needed, such as tests of materials, contents or samples to find contaminants or analyze material failures. However, relying just on blind testing without the other stages would almost always result in incorrect results.

Table 3 Table of all collection data of the collapsed hall

No.	Picture	Description
1	 *Figure 10 Trusses replacement work*	The roof has been dated in advance for trusses replacement work to be carried out by the contractor
2	 *Figure 11 The condition of collapse hall*	There are some parts of the wall that do not collapse which is. at the front of the hall
3	 *Figure 12 Sloping wall condition*	The condition of the wall that began to collapse on the left side of the hall

No.	Picture	Description
4	 *Figure 13 Wooden column size*	The size of the wooden column used for this building is 125mm
5	 *Figure 14 Placed of wooden column*	Wooden columns are placed only on top of the beam foundation
6	 *Figure 15 Rafter's size*	The size of the rafters was found to be larger than the size of the joists which was 170mm
7	 *Figure 16 Roof truss cladding's size*	The size of the roof truss cladding over the brick wall ties is 78mm

No.	Picture	Description
8	 *Figure 16 Electrical wiring system*	Electrical wiring systems that are damaged due to wall collapse
9	 *Figure 17 The condition of the floor and beam foundation*	Excavated the floor and found the floor surface to be cement and a bond of beam foundation bricks made on it
10	 *Figure 18 The size of nails*	The size of the nails used as fasteners between columns and brick ties as well as fasteners for roof trusses
11	 *Figure 19 Fragment of cement*	A mixture of cement and sand on the bottom layer of the bond used as the base beam layer

No.	Picture	Description
12	 *Figure 20 The condition of roof trusses*	The original roof truss suffered damage and collapse as a whole
13	 *Figure 21 The condition of the new roof trusses*	New trusses where supposed roof truss fabrication work should be done by the contractor

3. Discussion from initial observations

Discussions with parties or representatives from the premises about the history, events before and after the damage occurred (as shown as figure 22). Based on all of the information gathered, the forensic investigator constructs, tests, documents and then provides a reasoned explanation of the cause, effect and possibly the recommended remedy for the building or building environment concern under investigation.

Figure 22 Discussion between PWD Engineer and CCRC Owners

3.2 The overview of the analysis of forensic engineering of the collapsed hall

Obtaining the causes of construction failure is not easy. The source of failure itself is often an accumulation of various factors. The aim of investigator is to find out the cause of collapse and failure in a particular material, component, product or structure. The present study is after a scene investigation, where is the hall collapsed. The analysis or research was conducted by the Public Works Department Kuala Kangsar because the research supporting data is closely related to this agency. In addition, the results of the Hall Block collapse investigation were recorded at this agency after taking all the data at the site. The supporting data for this case study is broadly taken from secondary data. The data were obtained from other parties or related agencies. In other words, this research uses the existing data which is the results of forensic investigation from the owner of CCRC, Perlop and the Public.Work Department.

Based on the investigation of the collapse of the hall that is damage to the roof components, the structure of the walls and columns can be summarized into several things or aspects. Firstly, the wall as one of the load-receiving parts of the roof component becomes weak when the roof truss fastener nails that are the strength holders to the left and right walls have been opened. An important aspect of the construction of any building is the connection between the roof and the walls. Trusses or rafters may be attached to walls. The roofing system is called the roof support structure, which is the basis for overcoming the impact and stability of the walls.

NAIL TYPE	MAXIMUM UPLIFT RESISTANCE CAPACITY (LBS.) FOR THREE TOENAILS
16d Common	178
16d Box	149
12d Common	149
16d Gun Nail	144
12d Sinker	144
16d Sinker	139
10d Common	139
The Following do not meet required resistance.	
12d Box	130
12d Gun Nail	120
10d Box	120
10d Gun Nail	110
10d Sinker	106

Figure 23 Adjoining table

Secondly, the cause or aspect of the collapse of the hall is about the load borne by the wall. Prior to the collapse of the hall walls, the ongoing project was to repair the roof of the hall building. the contractor has found that the load borne by the wall panels through the upper components has long been detected when the joists have sagged before the roof repair work was carried out. Subsequent observations during the incident of the wall collapse are all the truss wood is wet.

A joist is a structural member that spans horizontally between the foundations of a building or between walls or structural beams (as shown as figure 24). In combination with other joist, it provides support for a ceiling. In effect, a joist is a type of beam

composed of solid wood that often spans very short lengths. Small-scale building is frequently connected with joists. They can, however, be formed of composite materials such as engineered wood I-joists, metal web joists and so on and utilised in longer-spanning constructions.

Figure 24 The condition of the joist and trusses that have fallen

Thirdly, the cause or aspect of the collapse of the hall is the material for the beam foundation is a brick bond and there is just a mixture of cement and sand below it placed on the surface of the cement floor (as shown as figure 25). Fourth, the wooden poles are placed on a brick bond which is used as the beam foundation without planting even a small part of it. The strength of this loose wooden pole handle contributes to the collapsed wall because the brick bond that rests on it is not fastened with iron from the pole even when exmet application is applied.

Figure 25: Beam foundation condition

Lastly, analysis that can be inferred is the structure is made of bricks. Solid clay bricks are used as building blocks in stone walls. The building's top and partial side walls collapsed completely. The entire roof area collapsed and plummeted, according to a detailed investigation at the scene. It is a brick construction and the walls are made by meticulously placing bricks in mortar. Mortar acts as a glue that holds the entire construction together. The mortar in several collapsed regions was found to be easily fragile when physically tested. The compressive strength of the brick and mortar employed determines the strength of the brick. Bricks are mostly utilized to support vertical loads as load-bearing walls.

3.3 Diagnosis and recommendation

Based on all of the information gathered, the forensic investigator constructs, tests, documents and then provides a reasoned explanation of the cause, effect and possibly the recommended remedy for the building or building environment concern under investigation. After making a study and analysis related to all the data and get the result that have been taken, the Public Work Department Kuala Kangsar has made some recommendations and suggestions in overcoming the damage.

To overcome the increasingly critical damage to related components, priority repairs should immediately be carried out by dismantling, demolishing and removing as well as rebuilding the entire hall block. Firstly, dismantle or demolish the entire building and bring out of the site existing construction waste. It is because all components and parts of the hall can no longer be worn or replaced because they have been damaged such as beam foundation, columns, doors, windows, trusses, roof and so on.

Secondly, the proposed preparation of the new building cannot be changed from the original size as the roof trusses work has been completed on site, however the owner of the premises can propose to change the height of this hall block if necessary for other activities. This is because they do not want to interfere with the costs and losses that need to be incurred if they want to remake a roof truss with a new measurement or dimension. Next, the reconstruction work of the hall building should take into account civil, electrical as well as mechanical works. The building that has completely

collapsed needs to be repaired in all aspects, systems and components. Lastly, for the replacement of the roof and roof trusses need not be taken.

CHAPTER 4: CONCLUSION

In conclusion, forensic investigation on buildings plays an important role in educating the construction industry about the possibility of failure and provides practical ways to prevent these failures as a result of highly specialized knowledge. Forensic investigation work can help improve construction codes and standards. As a result, investigation and inspection of the cause of the collapse of the hall at CCRC, Perlop can be investigated the cause. To our knowledge, forensic structural engineering is becoming more widely recognized as a subject of professional engineering practice. Almost every engineering business, at some point, performs forensic engineering work as part of their profession or as a one-time service to clients of their choosing. As a consequence of this investigation, we also discovered that poor building material quality is the most common cause of damage and building failure. Contractors' poor job outcomes, incompetent contractors, faulty construction, developers' or contractors' non-compliance with specifications or regulations, structural defects, designs, or damaged structures are all prevalent issues in the construction industry. The construction sector is also threatened by poor risk management, budget surplus, poor communication management, schedule delays, poor budgeting practices, cost flow challenges, design inconsistencies, inadequate project structure and lack of collaboration.

Finally, it can be concluded that failures in structures occur due to various reasons during construction & they are responsible for such failures. According to studies, soil, sand and concrete tests are required when constructing structures. This study will offer a forensic report of existing structural structure and identify design mistakes; based on sample test results, this study will determine the reason of failure and structure strength; and this study will also provide failure prevention. As a result, the PWD Kuala Kangsar has successfully identified the variables contributing to building damage and failure that frequently occur in construction projects in order to reduce the time and expense required.

REFERENCES

Daniel, F. (2021). Forensic Building Investigation definitions, education, supplies: Forensic Investigation Tools & Methods: Forensic engineering, forensic microscopy & photography aid in building & environmental investigation & diagnostic procedures. https://inspectapedia.com/Building_Damage/Forensic-Investigation.php

Hamma-adama, M., Iheukwumere, O., & Kouider, T. (2020). Analysis of Causes of Building Collapse: System Thinking Approach. Jordan Journal of Civil Engineering, 14, 188–197.

Moorthy, T. N. (2021). Forensic Engineering Investigation on a Collapsed School Building Involved Multiple Deaths: A Real Case Report. 3.

Shinde, R., & Meshram, K. (2020). Investigation Of Building Failure Using Structural Forensic Engineering. 9(04), 3.

shrm. (2020, February 28). Public Works Inspector. SHRM. https://www.shrm.org/resourcesandtools/tools-and-samples/job-descriptions/pages/public-works-inspector.aspx

Wang, C., Wood, L. C., Lim, A. D., & Abdul-Rahman, H. (2017). Bee colony optimised mass rapid transit routing prototype. Proceedings of the Institution of Civil Engineers - Municipal Engineer, 170(3), 135–150. https://doi.org/10.1680/jmuen.15.00026