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THE COMPARISON OF IMPLEMENTATION FIRE FIGHTING SYSTEM AT BLOCK MELATI 1, KOLEJ INDERA MULIA ANDBLOCK DAHLIA 1, KOLEJ CEMPAKA SARI AT UITM SERI ISKANDAR, PERAK

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ABSTRACT

The firefighting system is a vital part for any structure. Implementing a firefighting system at a student's college is important for protecting lives, minimising property damage, complying with guidelines, improving emergency preparedness, and keeping a positive image. There have been multiple incidents involving college students in Malaysia as a result of ignoring student complaints and causing a fire in a residential college. The purpose of this study is to analyse the implementation of a firefighting system by comparing two blocks of residential college and their level of a knowledge and awareness of the fire protection system. To achieve the objectives, a qualitative and quantitative method was applied, with a comparison checklist between two blocks prepared following the guidelines and a questionnaire survey distributed to students who staying at both residential colleges. The research findings help in collecting respondents' satisfaction and feedback regarding their college's firefighting system, as well as the appliances that need to be improved and installed for protecting students' lives. This research analyses how the installed firefighting system complies with safety requirements and standards to ensure that educational institutions have the appropriate equipment to protect their students and employees.

Keywords: *firefighting system, comparison, residential college, quantitative approach, satisfaction*

INTRODUCTION

A firefighting system is probably the most important of building services that aims to protect human life and property (What is Fire Protection System, 2019). Every building should be equipped with a safety system including in the residential college. The architects and engineers must keep in mind that Malaysia's fire safety rules based on international standards to preserve human life. Buildings and their contents, as well as firefighters, will be protected by some of the fire safety rules in the Uniform Building By-Laws 1984 and Fire Services Act 1988.

Residents of a residential college are at risk from fire situations. Residential college facilities are a shelter for students attending a university and are expected to provide an attractive environment, appropriate functionality that complies with codes or standards and adequate safety features (Hassanain, 1998). When a college catches fire, the damages can be devastating including loss of life, property and college operations. Installing a fire prevention system can help to prevent the spread of fires to adjacent areas.

The primary focus of this research is on the fire extinguishing systems implemented in student institutions and the comparisons between them. We can see which block has the best system in firefighting equipment by comparing the blocks. Furthermore, it may determine whether students are aware of the building's fire system, fire prevention, and fire protection system. This applies to an emergency evacuation planning.

BACKGROUND OF STUDY

The major focus of this study is on the fire extinguishing systems implemented in student colleges. An inspection and questionnaire survey were conducted to collect all of the information on firefighting systems along with the level of awareness of students. The purpose of this research is to compare systems based on fire safety guidelines, to assess the level of awareness and knowledge of respondents about the fire extinguishing system in their college.

There are 2 causes of fire which is nature and man-made. For nature, it can come in lightning struck and for man-made is cooking equipment, smoking, electrical appliances and candles (Trada, 2021). Usually, man-made incidents occur at residential colleges. In the data, there is a question asked to the respondents about potential fire hazards in their college. Colleges may significantly minimise the probability of fire incidents and create a safer environment for everyone on campus by implementing fire preventive measures and maintaining a strong fire safety policy.

There are two types of fire components: active and passive systems. Sprinklers, fire extinguishers, and fire alarms are examples of active fire protection components, while fire doors and fireproofing material sprayed are examples of passive fire protection components. Automatic sprinkler systems, fire extinguishers, and fire alarm systems are all important fire prevention systems at residential colleges (Trada, 2021).

In Malaysia, fire safety is governed by the Uniform Building By-Laws 1984 (UBBL) under the Streets, Drainage and Building Act 1974. According to the latest statistics in Malaysia as of 2019, there were 121 deaths from fire incidents. (Hanim, 2021). The researchers were used requirements on fire under Part VII and Part VIII in UBBL1984 as a guideline while collecting data.

There are many fires hazard that occurs in college such as from electrical appliances in the dorm, smoking and clutter. The college may be severely damaged, the risk of losing students records, damage for facilities in the building and might traumatized the students and staffs. To avoid the fire, all campus fire safety management systems must incorporate evacuation planning and safety drills in order to comply with the Regulatory Reform Order (RRO) (Deer, 2020).

According to (Fire Safety Management and Emergency Plan, 2022), A fire safety management plan outlines the responsibilities for implementing, controlling, monitoring, and reviewing fire safety standards and ensuring that they are upheld. The plan outlines the arrangements for managing fire safety properly in order to prevent fire from occurring and to safeguard persons and property in the event that it does. The plan should outline how the premises' fire safety provisions and measures will be planned, organized, controlled, monitored, and reviewed.

METHODOLOGY

To collect the data, I have used 2 method which is qualitative and quantitative method. For qualitative method, the observation has be made around Block Melati 1,Kolej Indera Mulia and Block Dahlia 1, Kolej Cempaka Sari. To collect the data, I have made an inspection checklist that use guideline from United Building By-Law 1984 to make a comparison of the firefighting appliances at both colleges. Next, for the quantitative method, the questionnaire has been distributed to the respondents who stayed at both colleges using Google Form. The questionnaire related to the question about implementation of firefighting system at their block. All the data will be used only for this research.

For sampling method, researcher referred to the Krejcie and Morgan 1970 table size to define how many people that need in this research.

Table 3.1

Table for Determining Sample Size of a Known Population

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	1000000	384

Note: N is Population Size; S is Sample Size *Source: Krejcie & Morgan, 1970*

Figure 1 : Krejcie and Morgan 1970 table size

Assume number of residents in 2 blocks:	160 student (80 each block)
Sample size that needed:	113 students

Student residents of Block Melati 1 and Block Dahlia 1 are the respondents for this study. Since there are many students in each block, researcher decided to use a Google Form to create a questionnaire that will ask respondents about their levels of understanding regarding firefighting systems and use a Qr Code to make the students are easy to answer. To collect info from all students, researcher will distribute this form to each WhatsApp group and Telegram block, respectively. Total respondents that researcher got is 112 students for 2 blocks.

QUALITATIVE DATA

CHECKLIST INSPECTION FOR FIRE PROTECTION SYSTEM – BLOCK MELATI 1, KOLEJ INDERA MULIA AND BLOCK DAHLIA 1, KOLEJ CEMPAKA SARI

No.	UBBL 1984	Block Melati 1		Block Dahlia 1		Remarks
		Provided	Not provided	Provided	Not provided	
	Part VII – FIRE REQUIREMENTS					
1	**162. Fire Doors in Compartment Walls and Separating Walls.**					
	-Fire doors of the appropriate FRP shall be provided	√		√		
2	**164. Door Closer for Fire Doors**					
	(1) All fire doors shall be fitted with automatic door closers of the hydraulically spring-operated type in the case of swing doors and of wire rope and weight type in the case of sliding doors.	√		√		
3	**168. Staircases**					
	(3) The required width of a staircase shall be the clear width between walls but handrails may be permitted to encroach on this width to a maximum of 75 millimeters	√		√		Width of a staircase: 72mm
	(5) Doors giving access to staircases shall be so positioned that their swing shall at no point encroach on the required width of the staircase or landing.	√		√		
4	**171. Horizontal Exits**					
	(2) Where horizontal exits are provided protected staircases and final exits need only be of a width to accommodate the occupancy load of the larger compartment or building discharging into it so long as the total number of exit widths provided is not reduced to less than half that would otherwise be required for the whole building.	√		√		
5	**172. Emergency Exit Signs**					
	(1) Story exits and access to such exits shall be marked by readily visible signs and shall not be obscured by any decorations, furnishings or other equipment.	√		√		Melati 1 : 4 x 3 level =12 emergency exit signs Dahlia 1: 4 x 4 level = 16 emergency exit signs
	(2) A sign reading "KELUAR" with an arrow indicating the direction shall be placed in every location where the direction of travel to reach the nearest exit is not immediately apparent.	√		√		

Figure 2: Checklist for part VII in UBBL 1984

	(5) Illuminated signs shall be provided with two electrics lamps of not less than fifteen watts each.	√		√		
6.	**173. Exit Doors**					
	(1) All exit doors shall be openable from the inside without the use of a key or any special knowledge or effort.	√		√		
	(2) Exit doors shall close automatically when released and all door devices including magnetic door holders, shall release the doors upon power failure or actuation of the fire alarm.	√		√		
7	**174. Arrangement of Story Exits**					
	(1) Where two or more story exits are required, they shall be spaced at not less than 5 meters apart measured between the nearest edges of the openings.	√		√		
	(2) Each exit shall give direct access to--- (a) a final exit; (b) a protected staircase leading to a final exit; or (c) an external route leading to a final exit.	√		√		
8	**177. Computing Number of Staircases and Staircase Width**					
	(a) except as provided in these By-laws, the minimum number of exits is two; (b) at least one of the staircases should be minimum of two units' width except that 900 millimeters may be allowed where total occupancy of all floors served by staircases are less than 50;	√		√		
9	**178. Exits for Institutional and Places of Assembly**					
	In buildings classified as institutional or places of assembly, exits to a street or large open space, together with staircases, corridors and passages leading to such exits shall be located, separated or protected as to avoid any undue danger to the occupants of the place of assembly from fire originating in the other occupancy or smoke therefrom	√		√		3 exits for each block

Figure 3: cont.'s Part VII in UBBL 1984

The analysis of Melati 1 and Dahlia 1 blocks reveals that both have adhered to UBBL 1984 guidelines for fire safety. They have installed fire doors with appropriate FRP as required by bylaw 162, equipped with automatic door closers. The staircases have the required width and permitted handrail measurements from bylaw 168, and both blocks have horizontal exits protecting the staircase and final exits. Emergency exit signs, following bylaw 172, are in place with 'KELUAR' signs and arrows indicating directions to the nearest exits. Melati 1 has 12 emergency exit signs across 3 levels, while Dahlia 1 has 16 across 4 levels, each with electric lamps not less than 15 watts. Both colleges have arranged 3 exits, spaced at least 5 meters apart as per bylaw 174, allowing students to exit directly to the assembly area. Overall, these measures ensure the fire safety compliance of both blocks and enhance the safety of their occupants.

PART VIII – FIRE ALARMS, FIRE DETECTION, FIRE EXTINGUISHMENT AND FIRE FIGHTING ACCESS						
1	**225. Detecting and Extinguishing Fire**					
	(1) Every building shall be provided with means of detecting and extinguishing fire and with alarms together with illuminated exit signs in accordance with the requirements as specified in the Tenth Schedule to these By-laws.	√		√		
	(2) Every building shall be served by at least one fire hydrant located not more than 91.5 meters from the nearest point of fire brigade access.	√		√		
2	**226. Automatic System for Hazardous Occupancy**					
	Where hazardous processes, storage or occupancy are of such character as to require automatic sprinklers or other automatic extinguishing system, it shall be of a type and standard appropriate to extinguish fires in the hazardous materials stored or handled or for the safety of the occupants.	√		√		
3.	**227. Portable Extinguishers**					
	Portable extinguisher shall be provided in accordance with the relevant codes of practice and shall be sited in prominent positions on exit routes to be visible from all direction and similar extinguishers in a building shall be of the same method of operation.	√		√		Date expired of fire extinguishers 03-08-2023
4.	**228. Sprinkler Valves**					
	(1) Sprinkler valves shall be located in a safe and enclosed position on the exterior wall and shall be readily accessible to the Fire Authority.			√		
	(2) All sprinkler systems shall be electricity connected to the nearest fire station to provide immediate and automatic relay of the alarm when activated.			√		
5	**237. Fire Alarms**					
	(1) Fire alarms shall be provided in accordance with the Tenth Schedule to these By-laws.	√		√		Melati 1 : 3 x 3 level =9 fire alarms Dahlia 1: 3 x 4 level = 12 fire alarms
6	**239. Voice Communication System**					
	There shall be two separate approved continuously electrically supervised voice communications systems, one a fire brigade communications system and the other a public address system between the central control station and the following areas: (a) lifts, lift lobbies, corridors and staircases;	√		√		
7	**244. Standard Required**					
	All firefighting installations and appliances shall conform edition of the following standards: (a) Fire Hydrants - BS 750:1977 and BS CP 402.101; 1952	√		√		Melati 1 : 3 x 3 level =9 fire extinguishers
	(b) Hydraulic Hose Reels - BS 5306 Part 1: 1976 (c) Portable Extinguishers - BS CP 402 Part 3: 1964 (d) Dry/Wet Rising Mains - BS 3980: 1966 BS 5306 Part 1: 1976 BS 750: 1964 (e) Foam Inlets - BS 3980: 1966 (f) Automatic Sprinklers - FOC Rules 29th Edition: 1973 Fire Alarm Systems - FOC Rules: 1973 BS CP 1019: 1972 BS 3116 Part 1: 1970 BS 3116 Part 4: 1974 BS 5446 Part 1: 1977					Dahlia 1: 3 x 4 level = 12 fire extinguisher
	To prepare a Fire and Emergency Action Plan and Evacuation Plan	√				

Figure 4: Checklist for part VIII in UBBL 1984

In part VIII of the analysis, certain fire safety equipment and measures were found to be lacking in both Melati 1 and Dahlia 1 blocks. Notably, they did not comply with by law 225, 227, and 244 related to fire extinguishers, as some required equipment was missing. Both blocks have fire extinguishers located on each level near the staircase, but there were discrepancies in the number of extinguishers, with 9 in Melati 1 and 12 in Dahlia 1. By law 237 on fire alarms was followed, with 9 fire alarms in Melati 1 and 12 in Dahlia 1, along with voice communication systems. However, by law 226 concerning automatic sprinkler systems for hazardous occupancy was not implemented in Melati 1, while Dahlia 1 had sprinklers in each room.

It is important to install it since it is capable of offering accurate fire protection for a building and its people in the case of a fire (Why sprinklers should be considered as part of building desgin and construction, 2021). Lastly, Block Melati 1 provided evacuation plans at every level and hallway, meanwhile Block Dahlia 1 did not have any evacuation plans. Addressing these gaps is crucial to ensure comprehensive fire safety and evacuation preparedness in both blocks.

QUANTITATIVE DATA

The questionnaire was divided into 4 sections that has 18 questions. There are 112 students who responded this questionnaire that distributed in Google Form for two blocks. Section A contains demographic information data on respondents that required respondent's age, current level of study, college and period of staying in college. Level of awareness on fire safety is a Section B where there 8 questions given are related to the location of the firefighting system, safety policy and the level of satisfaction regarding the system in the college. Next is for Section C which is level of knowledge respondent on firefighting system that also provided 8 questions. Lastly is Section D which is open-ended question for respondents to about the satisfaction and recommendation.

- Question 1: Respondent's college

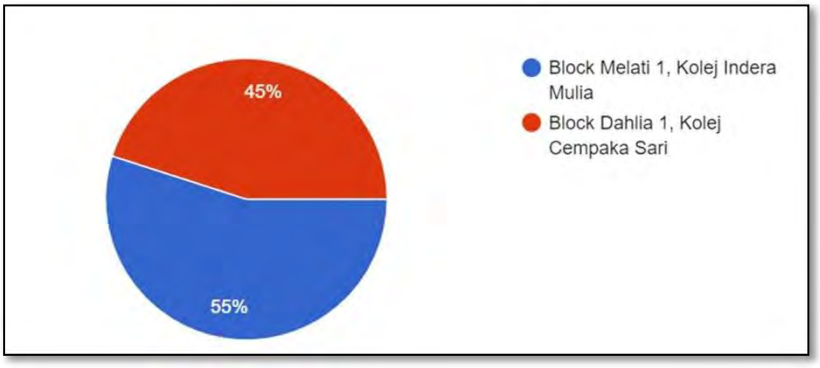

Figure 5: respondent's college

According to the figure 5, there are 2 blocks of respondents staying which is Block Melati 1 and Block Dahlia 1. Block Melati 1 was the highest respondents with a total of 62 persons or 55% meanwhile Block Dahlia 1 has 50 persons or 45% respond to this form. It shows students in Block Melati 1 have more information than Block Dahlia 1.

- Question 2: Respondent's familiar with the firefighting system at college

Figure 6: Familiar with the firefighting system at college

Figure 6 shows the data from the respondents that 72 student or 64.3% voted that they were familiar with the firefighting system in college. Followed by 40 students or 35.7% were voted for not familiar with the system in college. This indicates that student from Block Melati 1 is more knowledgeable of firefighting equipment in their college than student from Block Dahlia 1. Fire alarms, fire alarm monitoring, fire extinguishers, fire sprinkler systems, fire hose reels, emergency lighting, evacuation plans and signs, and fire safety training are among the systems used at the student's college. (What you need to know about fire prevention and preparedness on college campuses, 2020).

- Question 3: Life Safety Facilities in college

Figure 7: Life Safety Facilities in College

Table 1: result from respondents that alert with the location of fire safety facilities

Location of life safety facilities in college	Result of respondent			
	Yes	Maybe	No	Total respondent
Exit signage	94	17	1	112
Emergency lighting	68	24	20	112
Fire evacuation plan	70	23	19	112
Fire emergency notice	67	28	17	112
Emergency stair	84	23	5	112
Fire exit door	78	27	7	112

Based on the table 1, voting for 'Yes' for all location have the highest respondent especially in Exit signage, meanwhile for 'Maybe' was the second highest for recognize of fire emergency notice. Lastly voting for 'No' was the lowest respondent. It shows most students are already aware with the location of these facilities in their college and also there are numerous students who are unsure with the locations such as emergency lighting, fire evacuation plan and fire notice.

- Question 4: Overall Rating for fire safety preparedness in college

Figure 8: overall rating for fire safety preparedness in college

Table 2: Likert's scale for overall rating for fire safety preparedness

Rating by each block	Frequencies for Likert's Scale						Mean score
	1	2	3	4	5	Total	
Block Melati 1	0	3	23	23	13		
Block Dahlia 1	0	2	17	22	9		
Total	0	5	40	45	22	112	3.75

$$\text{Mean score} = \frac{(1 \times 0) + (2 \times 5) + (3 \times 40) + (4 \times 45) + (5 \times 22)}{0+5+40+45+22}$$

$$= 420/112$$

$$= 3.75$$

Based on the chart 2 and table 2, majority respondent voting for 'Satisfied' is 40.2% and 35.7% voted 'Enough Satisfied'. Meanwhile 19.6% voting for 'Extremely Dissatisfied' and 4.5% student voting for 'Dissatisfied' with overall of fire safety preparedness in their college. The mean score for this rating is 3.75 where student is likely satisfied enough with the fire safety preparedness in the college.

- Question 5: Involvement in fire drills

Figure 9: result from respondent for involvement in fire drills

73.2% respondents were voted for 'Yes' as they have previously participated in fire drill as shown in figure 7. The remaining respondents voted 'No' which is 26.8%. student should be involved in fire drills to familiarize them with the steps to take in the event of fire. It also can raise students' awareness and provide a calm response and in compliance with the established procedures.

- Question 6: Knowledge about the proper procedure to follow when fire happened.

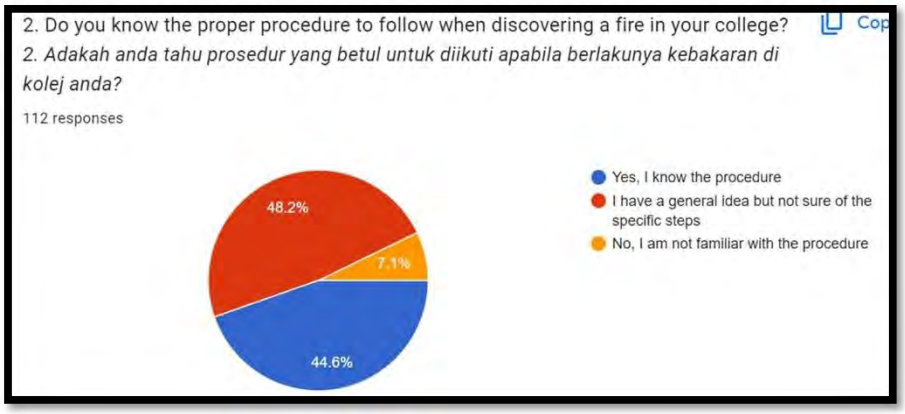

Figure 10: shows the data from the respondent about are they know the proper procedure to follow when discovering a fire in the college.

Based on the figure 8, it shows the data from the respondent about the proper procedure to follow when discovering a fire in the college. The highest percentage for this question is 48.2% who answer 'I have a general idea but not sure of the specific steps. Meanwhile there are 44.6% answer 'Yes, I know the procedure' and lastly followed by 7.1% that voted 'No, I am not familiar with the procedure'. It is important for knowing the right procedure to follow when a fire is discovered on campus. Taking quick and appropriate action can assist minimize dangers and

secure their own safety. Students are advised to become familiar with the college's fire safety guidelines and evacuation routes.

- Question 7: Agreement from respondent about fire drills should be provided in college.

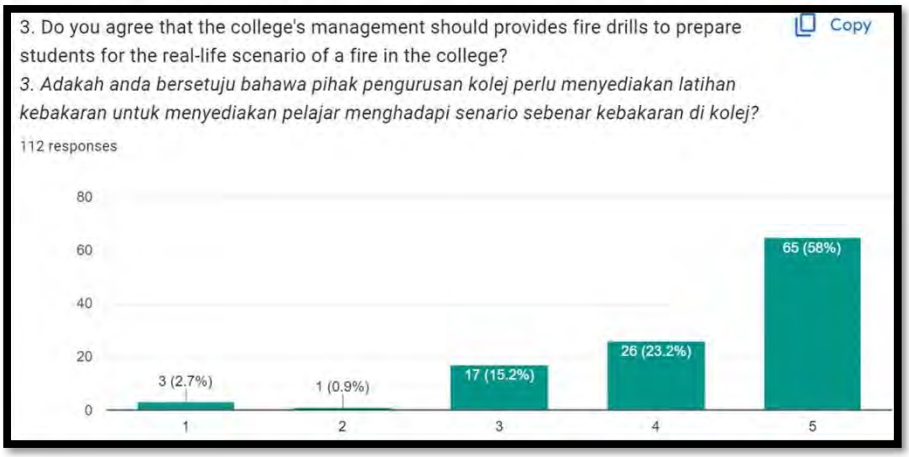

Figure 11: Agreement from respondent about fire drills should be provided in college.

Table 3: Likert's scale for agreement from respondent about fire drills should be provided in college.

Rating by each block	Frequencies for Likert's Scale						Mean score
	1	2	3	4	5	Total	
Block Melati 1	2	1	13	7	39		
Block Dahlia 1	1	0	4	19	26		
Total	3	1	17	26	65	112	4.43

Table 3: total frequencies for Likert's scale

$$\text{Mean score} = \frac{(1 \times 3) + (2 \times 1) + (3 \times 17) + (4 \times 26) + (5 \times 65)}{3+1+17+26+65}$$

$$= 485/112$$

$$= 4.33$$

Based on the column chart 3, it shows the result of respondent about the management should provide a fire drill for student. There are 58% voted for 'Strongly Agree' that the management should do a fire drill to prepare students for the real-life scenario of a fire in the college. Next, they are 23.2% are voted 'Agree' with the question. However, there are 15.2% are 'Slightly Agreeing' for management to do a fire drills. The rest of respondent are voted for 'Strongly Disagree' and 'Disagree' is 3 and 1 students. The mean score for management should provide fire drills is 4.33.

the student strongly agree that the college management should provide a fire drill for students. It required for improving preparedness, awareness, and protecting the safety of students and staff in the case of a fire. The college's management should organize fire drills to enable students and staff become familiar with the actions to take in the event of a fire.

DISCUSSION AND ANALYSIS

For qualitative data analysis of Block Melati 1 and Block Dahlia 1, it indicates that both have adhered to UBBL 1984 guidelines for fire safety, with proper installation of fire doors, staircases, horizontal exits, and emergency exit signs. They have also arranged multiple exits to ensure efficient evacuation. However, some shortcomings were found in both blocks regarding fire safety equipment and measures. Specifically, they did not fully comply with regulations related to fire extinguishers, fire alarms, and automatic sprinkler systems. Additionally, Dahlia 1 lacked evacuation plans. Addressing these gaps is crucial to enhance comprehensive fire safety and evacuation preparedness in both blocks, ensuring the safety of their occupants.

The research's qualitative data analysis gives helpful information into the respondents' demographics, awareness and understanding of the firefighting system, and recommendations for enhancing fire safety at their institution. Most respondents were between the ages of 21 and 23, were pursuing a bachelor's degree, and lived in Block Melati 1. While most respondents claimed to be familiar with the firefighting system, there were varying levels of awareness about specific fire safety facilities and equipment. Respondents were generally confident in their abilities to operate firefighting equipment; however, some were unsure about specific fire prevention methods.

Despite overall satisfaction with the firefighting system, recommendations included upgrading and installing firefighting systems, conducting fire drills, making awareness posters, and doing spot inspections in rooms to address possible fire threats. It is critical that college administration utilise these recommendations to improve fire safety measures and conduct education and awareness programmes, such as regular assessments and training sessions, to improve students' knowledge and preparation in dealing with fire issues.

CONCLUSION

For the firefighting system in two blocks regarding on this research, both blocks show their compliance with UBBL 1984 guidelines for fire safety with a proper installations of fire doors, stairs, horizontal exits and emergency exit signs. However, it also did not fully meet regulation with UBBL 1984 where they not install automatic sprinkler system at Block Melati 1. Block Dahlia 1 also lacked of evacuation plans that was an important item in the building. Addressing these gaps is crucial to enhance fire safety and evacuation preparedness for the safety of occupants. Majority of students are aware with the firefighting system in their college in age 21- 23 years old which is 60.7% from them. Most of them are in studying degree that stay Block Melati 1 which staying in the college for less than 1 years. This shows that they are more aware to the fire system around them. The college management also should take an action to upgrading the system in college such as college policy and prepared some fire drills in the college.

RECOMMENDATION

This section contains the research's recommendations, which are based on the three objectives of the study. The study must develop an improvement proposal based on the objective, as well as their findings and analysis.

1. Form a firefighting squad for college.

   A fire management team for a college is a group of people who are in charge of fire safety, prevention, and emergency response on college grounds. A fire safety officer, emergency management coordinator, facilities manager, and residential life coordination are all part of the team.

2. Conduct a site inspection.

   The college management needs to evaluate the presence of firefighting systems in two blocks. Block Dahlia 1 requires an emergency evacuation plan and flowchart for students during fire incidents, while Block Melati 1 needs installation of sprinklers and heat detectors in all rooms. Additionally, every college building should have a reliable and integrated fire alarm system. Regular inspections and maintenance of the fire safety system are necessary to ensure all equipment functions properly, with prompt repairs of any identified issues. (Carter, 2021)

3. Improve college fire safety training and policy administration.

   Fire drills and training are required twice a year at the college, with particular potential hazards for each area and activity prioritised. Participating in these drills will assist students and faculty in getting familiar with fire prevention practises, evacuation guidelines, and proper handling of firefighting equipment. It is recommended to collaborate with local fire departments for specialised training sessions (Ferrara, 2019). Furthermore, college administration should develop and distribute to students a clear and up-to-date policy statement that includes fire safety protocols, evacuation procedures, assembly areas during emergencies, and the 'Emergency Contact List,' which includes essential contacts for reporting emergencies, such as the local fire department, medical emergency services, a resident life, and the local police department.

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