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## MAPPING OF FIRE EXTINGUISHER: A CASE STUDY IN ISLAMIC BOARDING SCHOOL GONTOR 2 PONOROGO

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### Abstrak

Fire cases are one of the disasters that are increasing every year, one of the causes is the inadequate fire protection system and skills in using fire extinguishers. Gontor 2 Islamic Boarding School Ponorogo is a place that has 24-hour student activities with large electricity needs, continuous kitchen activities to provide dining facilities for students, as well as unsafe behavior and flammable materials that can be opportunities for fires. This study is to map the active fire protection system in the form of fire extinguishers and to map safety signs in the form of gathering points and evacuation routes. Method: This study is an analytical qualitative study, with a descriptive method supported by interview data and field surveys. Primary data comes from the results of field surveys and observations of active fire protection systems and safety signs using a checklist form that refers to the results of interviews with managers. The study found that it is still necessary to increase the distribution capacity of Fire Extinguishers owned, mapping safety signs in the form of evaluation routes and gathering points, and increasing the procurement of fire fighting facilities and infrastructure. Based on the mapping results, areas that have the potential for fire are the kitchen, cafeteria, residential areas of the caretakers of the boarding school, high-rise buildings, and there is still a need to increase the number of Fire Extinguishers by 30 units, evacuation routes by 22 units, gathering points by 2 units, and efforts to maintain fire protection equipment.

**Keywords:** Fire Extinguishers, Islamic Boarding School, Mapping

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### Introduction

Each region has a variety of potential disasters, ranging from natural disasters to floods, fires, earthquakes, and so on. One of these disasters occurs due to the geographical location of each region, then there are natural hazards and dangers caused by man-made hazards which according to the United Nations International Strategy for Disaster Reduction (UN-ISDR) can be grouped according to their classification, namely geological hazards, hydrometeorological hazards, hazards, biological hazards, technological hazards, as well as environmental degradation, high vulnerability of society, infrastructure and area elements which make the area an area with the potential for disasters to occur (1).

This is not in line with the mandate of law number 17 of 2023 concerning health, where in article 4 of the law it is written that every person has the right to live a healthy life physically,

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mentally and socially, to get a healthy environment, safe for achieving health status about balanced, responsible health, and getting safe, comfortable, quality and affordable health services in order to achieve maximum health status (2).

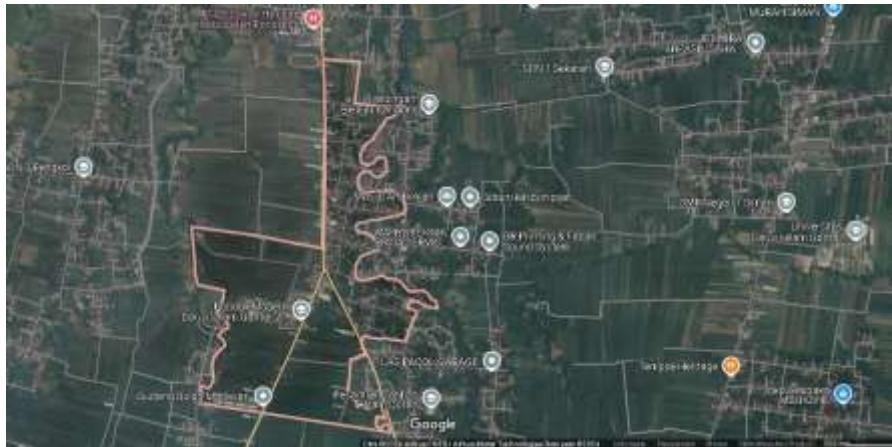
According to data from the Regional Disaster Management Agency in 2024, the island of Java is the region with the second highest number of disaster cases after Sumatra, namely reaching 239 disaster cases, which are listed in the statistical data of the Regional Disaster Management Agency. Data from the National Disaster Management Agency in 2024 shows that the island of Java ranks second in areas prone to disasters. Ponorogo Regency is one of the districts in East Java Province, which is approximately 193 km from Surabaya. Ponorogo is a district located at coordinates  $111^{\circ} 17' - 111^{\circ} 52'$  East Longitude and  $7^{\circ} 49' - 8^{\circ} 20'$  South Latitude with an altitude of around 92 to 2,563 meters above sea level, with an area of 1,371.78 km<sup>2</sup>. Due to its geographic location and topographic conditions in the lowlands and highlands, it has various potentials such as landslides, floods, earthquakes and fires (3).

Topographically and climatologically, Ponorogo Regency has lowlands with a tropical climate and experiences two dry seasons and a rainy season. In the Disaster Risk Study data compiled by the Regional Disaster Management Agency. Villages in Ponorogo Regency have several disaster threats that need to be addressed (4). Disaster events that occurred in Ponorogo Regency during 2023 were recorded as landslides, floods, fires, collapsed bamboo groves, forest and land fires, drought, collapsed land, broken embankments, fallen trees, moving land, strong winds, water accidents, well accidents, the house collapsed (5).

The Ponorogo Regency Regional Disaster Management Agency recorded that the Ponorogo Regency Disaster Risk Index in 2021 reached 112.48, while in 2022 the disaster risk reached 106.27 (6).

Siman District is one of the sub-districts in Ponorogo Regency which consists of Beton Village, Brahu Village, Demangan Village, Distance Village, Kepuhrubuh Village, Two Village, Manuk Village, Ngabar Village, Patihan Kidul Village, Pijeran Village, Ronosentanan Village, Sawuh Village, Sekaran Village, Siman Village, Tajug Village, Tranjang Village. The population in Siman District is approximately 47,320 people (3).

Two Village is one of the villages in Siman District, Ponorogo Regency, East Java, which borders Pengkol Village, Dengok Village, Wonoketro Village (Fig. 1). Two Village is a village area that has land with lots of dry trees, which has the potential for drought and fire (7). The following is a map of Two Village, Ponorogo, East Java :



**Figure 1.** Location of Two Village, Siman District, Ponorogo, East Java, Indonesia

Islamic Boarding School Gontor 2 Ponorogo is one of the branch boarding schools of Islamic Boarding School Modern Darussalam Gontor whose center is in Gontor Village in Mlarak District, Ponorogo Regency. Islamic Boarding School Gontor itself has several branches spread throughout Indonesia. Islamic Boarding School Gontor 2Ponorogo is located in Two Village, Ponorogo, East Jawa, Indonesia with a land area of approximately 10 ha surrounded by shady trees and rice fields (Fig. 1).

Since 2015, Islamic Boarding School Gontor 2 Ponorogo has been making efforts to prevent fires by providing fire protection facilities in the form of 2 fire extinguishers spread across two locations at the health center and the transportation department office, as an effort fire prevention in the cottage area (8). Apart from that, Islamic Boarding School Gontor 2 Ponorogo does not have a safety sign, does not have an evacuation route, does not have assembly point signs, and only has signs in the form of a smoking ban and signs related to mandatory Muslim dress in the area of Islamic Boarding School Gontor 2 Ponorogo.

However, potential dangers and emergencies can still occur at Islamic Boarding School Gontor 2 Ponorogo considering that the area in the cottage is an area with lots of trees, rice fields, and the climate of Ponorogo Regency which has a tropical climate, so the biggest potential is the danger of fire.

In accordance with the basic concept of disaster management, especially the concept of disaster mitigation, efforts to prevent disaster events aim to minimize the risk of disasters both small and large scale and prevent emergencies from occurring. This also refers to Law Number 24 of 2007 concerning Disaster Management, which states that disaster management can be done, one of the ways, is by carrying out mapping of disaster-prone areas according to the

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potential for disasters in each region (9). Moreover, data shows that cases of fires in cottages or dormitories are increasing every year. Fire cases are increasing in residential buildings due to short circuits, electrical short circuits, inadequate infrastructure in the form of fire extinguishers and hydrants, some cases are due to human factors, most of which occur in cottages or dormitories (10). Personal Protective Equipment (PPE), the fulfillment of infrastructure related to preventing fire and disasters is the main thing as a line of defense against the risk of disease and work accidents (11).

This law also stipulates that the response time for handling a fire incident is fifteen minutes from the time the information is received or from the time the fire is reported until arriving at the location (12). However, if you pay attention to the demands of existing regulations compared to the geographical and topographical conditions of Ponorogo Regency as well as the condition and facilities and infrastructure owned by Islamic Boarding School Modern Darussalam Gontor 2 Ponorogo, then the conditions need to be addressed and assistance needs to be carried out in disaster emergency response and identify fire risks.

In anticipation of this, through this research, the author examines the mapping of areas that have the potential for fire disasters at Islamic Boarding School Gontor 2 Ponorogo, which will be mapped in relation to existing conditions and real conditions at Islamic Boarding School Gontor 2 Ponorogo, including the capacity of Human Resources (HR). As well as the facilities and infrastructure owned by Islamic Boarding School Gontor 2 Ponorogo. In this way, disaster risk planning and mitigation will be able to be carried out, in terms of prevention and handling related to fire disasters, more effectively and efficiently in accordance with the mandate of the law and the regulatory mandate of the government of the Republic of Indonesia in terms of handling fire and disaster incidents as well as handling emergency situations when a disaster occurs.

## **Research Methods**

The method used in this research uses four main stages, namely preparation stage, data collection stage, data processing stage, data analysis stage, with the following explanation:

1. Preparation Stage: The preparation stage consists of activities to prepare work programs and prepare survey instruments, study literature related to capacity in mapping areas that have the potential for fires and efforts to handle fire disasters.
2. Data Collection Stage: At the stage of data collection in the field using the field survey method, field observations use observation sheets, which consist of primary data collection

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and secondary data collection, which are divided into three, namely document recording, field surveys and interviews. With details of the stages of data collection as follows, which consists of three stages:

First, the method of recording data and documents is intended to collect data about relevant policies, regulations, regulations. Second, the field survey method is used in collecting primary data, such as facility location data. infrastructure used in the context of mapping locations or areas that have the potential to catch fire and handle fire incidents. Field survey activities use a tool in the form of GPS which is intended to find out where the distribution of areas that have facilities and infrastructure owned by Islamic Boarding School Gontor 2 Ponorogo. Third, the interview method is used to obtain information from the Fire Department or several key informants who will provide information relating to the capacity of the Fire Department.

3. Data Processing Stage: Data processing is carried out through spatial analysis, which is a stage in processing spatial data into another form, using Google Earth Engine software to process the data that has been collected, including the overall location data for the cottage. The researcher processed the data in the form of a map as a whole at Islamic Boarding School Gontor 2 Ponorogo first, then made a design plan for further mapping. The presentation process in map form is facilitated using the software Turbo Floor Plan Home & Landscape Deluxe 2022 version
4. Data Analysis Stage: Data analysis was carried out descriptively qualitatively based on capacity data or in disaster management capacity is defined as the ability to deal with a disaster, which is possessed by Islamic Boarding School Gontor 2 Ponorogo in efforts to handle. This study is a mapping of health safety aspects, with variables of fire extinguishers, assembly points, evacuation routes, and was conducted in December 2024, at Pondok Modern Gontor 2 Ponorogo.

## **Result**

In this research, there were findings that the mapping of fire extinguishers was not evenly distributed, and they were only spread across 2 locations, namely the health center and the transportation department office, so that if a fire occurred outside this area it would be very difficult to handle, considering the location of the Islamic Boarding School Gontor 2 Ponorogo. Covering an area of more than 10 hectares. Another fire protection system that does not yet exist is a hydrant which is used if the fire from a fire has grown and spread, especially

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since there are several boarding houses which are multi-storey buildings with a student capacity of more than one hundred people which are dense residential areas which are required to provide fire extinguisher facilities. in every building, as well as hydrants in the area outside the building.

Apart from that, handling fire incidents requires the capacity of highly qualified Human Resources (HR), both in terms of skills in using fire protection equipment and the capacity of facilities and infrastructure that are adequate, suitable for use, and in accordance with needs.

Human Resources (HR) whose skills in using fire protection equipment need to be increased in accordance with Minister of Home Affairs Regulation Number 64 of 2013 concerning Village Development Guidelines which explains that the response time for handling fire incidents or the duration and time span is calculated from the receipt of the report fire incident until arriving at the location ready to provide service is only fifteen minutes, so that the effects of the fire do not spread to various areas (Minister of Home Affairs Regulation, 2013). This must be balanced with the capabilities of skilled and qualified Human Resources (HR) as well as the infrastructure owned by the Islamic Boarding School Gontor 2 Ponorogo.

The results of observations on the capacity of the Islamic Boarding School Gontor 2 Ponorogo carried out through qualitative analysis combined with the results of interviews with several parties found the fact that there were aspects of disaster mitigation that had not been fulfilled. Islamic Boarding School Gontor 2 Ponorogo, consists of several buildings, namely the auditorium, classroom building, lecturer's quarters, Jami' cottage mosque, cafeteria, kitchen, dormitory, kiosk, business unit, health hall, transportation office, toilets, care department office, administration, Kulliyatul Mu'allimin al-Islamiyah (KMI) room, kitchen.

Some of these buildings are type C fire-resistant construction, such as: multi-storey dormitories, classrooms, there are also rooms that involve intense fire activities, for example kitchens, lecturer housing, and cafeterias that are in areas that have the potential for fire. Type C fire-resistant construction is construction where the building's structural components are made from combustible materials and are not designed to be structurally resistant to fire (Indonesian National Standards, 2000).

Fires that occur can be made worse by the presence of electrical short circuits, flammable household materials, materials that produce toxic smoke, poisons, flammable buildings whose components are wood. This active fire protection system can detect and control fires as early

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as possible through mapping. On-site observations and interviews with management leaders were carried out to strengthen information and facts with the following results:

**Table 1.** Data related to the Active Fire Protection System at Islamic Boarding School Gontor 2 Ponorogo

Aspects of The Interview	Information
The Fire Management Commitment	Management is open to suggestions and willing to provide active fire protection. Management understands the importance of an active fire protection system and supports the fulfillment of an active fire protection system and supports the fulfillment of an active fire protection system
Fire Emergency Response Team	Not available but willing to provide
Routine Maintenance of Standard Operating Procedure and Document	There is a Standard Operational Procedure, but it is not routinely maintained
Knowledge and Skill about Using the Existing Active Fire Protection	Management has only held training a few times so knowledge and skills are still lacking
Top Management Perception	Top management understands the importance of an active fire protection system, and supports the fulfillment of an active fire protection system
Safety Sign (Evacuation Route, Assembly Point)	Not available but willing to provide
Fire Extinguisher	There are only 2 fire extinguisher evenly distributed

In (Table.1) is an illustration of the capacity of the Islamic Boarding School Gontor 2 Ponorogo as well as the condition of the existing capacity both in terms of facilities and infrastructure and human resources at the Gontor 2 Islamic Boarding School, namely as follows:

## 1. The Fire Management Commitment

Management is open to suggestions and willing to provide active fire protection, management understands the importance of an active fire protection system, and supports the fulfillment of an active fire protection system. Overall, the human resources at Islamic Boarding School Gontor 2 Ponorogo number more than one hundred people, with details of grade 6 students along with teachers and Islamic Boarding School administrators. This means that there is a need for fire protection and efforts to minimize if a disaster occurs in accordance with the mandate of Minister of Public Works Regulation Number 26 of 2008 concerning Technical Requirements for Fire Protection Systems in Buildings and the Environment which states that buildings that have a residential capacity of 100 people or more, must be equipped with a fire protection system installation and every multi-storey building must be equipped with life-saving facilities.

Islamic Boarding School Gontor 2 Ponorogo has committed to working towards fire protection and trying to minimize disasters, this is in accordance with research which states

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that if management's commitment to the level of fire risk is low it will affect disaster prevention efforts (14).

## **2. Fire Emergency Response**

Regarding fire emergency response, the team is not available but willing to provide, thus management has committed to making efforts to create a fire emergency response by creating an Occupational Safety and Health Advisory Committee within the scope of the Islamic Boarding School Gontor 2 Ponorogo, which has been written and has a legal basis, namely a Ministerial Regulation Regarding the work safety advisory committee and procedures for appointing occupational safety experts, it is stated that every residence or workplace that employs one hundred or more workers and every place with the potential for great danger is obliged to form an occupational health and safety advisory committee, apart from that, the implementation of the Occupational Safety and Health Advisory Committee is very important for the creation of zero accidents and can be a forum for management to consider the safety and health of the environment, both indoors and workplaces (16).

## **3. Routine Maintenance of Standard Operational Procedure and Document**

There is a Standard Operational Procedure, but it is not regularly maintained, so fire protection equipment such as fire extinguishers still need routine maintenance, checking and recharging. Therefore, it is necessary to have an inspection by a competent technician to ensure that fire protection equipment is working optimally. This is fully supported by the management of Islamic Boarding School Gontor 2 Ponorogo.

Standard Operational Procedure (SOP) is a description of work steps related to systems, mechanisms and internal work, which are required in carrying out a task to achieve goals. Standard Operational Procedure (SOP) in the field of fire fighting and rescue is a reference in implementing service activities in the field of fire prevention and control (17).

Management policy regarding building maintenance aims to create comfortable and safe environmental conditions for its users. Without building commitment, the maintenance program will not run smoothly. In relation to policy, the next stage is to develop a framework for maintenance programs, designing maintenance programs and maintenance programs for buildings and the environment to create safe and comfortable conditions (18).

#### 4. Knowledge and Skill about Using the Existing Active Fire Protection

Management has only held training a few times so knowledge and skills are still lacking. Fire extinguishers are used by people who have skills and know how to use them, good knowledge, this is reinforced when they are in the field, can minimize the occurrence of fires and fires that are getting bigger (19). In addition, research shows that there is a significant relationship between knowledge and skills in the use of active fire protection equipment and fire emergency response. This means that the better the knowledge regarding the use of active fire protection equipment and fire emergency response, the better the security guard's skills in implementing it. fire emergency response (20).

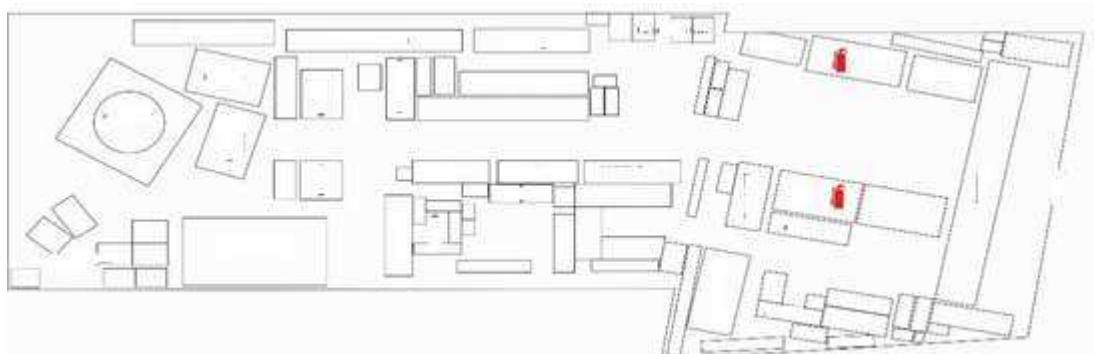
#### 5. Safety Sign: Evacuation Route, Assembly Point

Not available but willing to provide. Safety signs are equipment and safety signs found in the work environment to protect and increase workers' preparedness for potential dangers in the work environment. (21). To increase awareness of the dangers of fire and as an emergency disaster response effort, safety signs are needed according to the dangers (22).

#### 6. Fire Extinguisher

There are fire extinguishers, but only two so they are not evenly distributed. A fire extinguisher is a tool that is easy to use by one person with the aim of extinguishing a fire at the start of a fire (19). Fire Extinguisher is a tool to prevent and minimize the impact of fires and as an initial step in disaster management and efforts to anticipate fires (23).

The following is a floor plan of the Islamic Boarding School Gontor 2 Ponorogo before the active fire protection mapping analysis was carried out throughout the Gontor 2 Islamic Boarding School area (Fig. 4)



**Figure 4.** Islamic Boarding School Gontor 2 Map Before Analysis was Conducted

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Based on the observation results (Figure 4), there are two fire extinguishers placed in different rooms, at a close distance so that they are collected in one place. So the number of fire extinguishers is still inadequate and their distribution is not yet comprehensive in the Islamic Boarding School area and there are no hydrants. Islamic Boarding School Gontor 2 Ponorogo only has two fire extinguishers installed in the front room of the Islamic Boarding School, so fire extinguishers are collected in one area, while other areas have not installed fire extinguishers. So after carrying out the analysis, it was found that there was a need for 30 units of fire extinguishing equipment for areas that had not been installed. Research conducted by Jevtić states that the most important thing in optimizing an active fire protection function is the correct number and position of installation and in accordance with applicable procedures (24).

In multi-storey buildings such as dormitories and classrooms, there are no portable fire extinguishers, which based on the mapping results should be 30 units. Safety signs such as Evacuation Routes which based on the mapping results should be 22 units and Assembly Points which based on the mapping results should be 2 units, so that guests from outside the Islamic Boarding School who come do not know where the evacuation route is in the event of a fire or emergency. And there is no Assembly Point to accommodate people who gather when a fire or emergency occurs.

The placement of fire extinguishers is regulated in government regulations (25) namely: a) each one or group of fire extinguishers must be placed in a position that is easy to see clearly, easy to reach and take and equipped with installation markings, b) the height of the installation markings is 125 cm from the bottom of the floor directly above one or a group of fire extinguishers are concerned, c) the installation and placement of fire extinguishers must be in accordance with the type and classification of fire, d) the placement of one fire extinguisher with another or one group with another must not exceed 15 meters, unless otherwise determined by a supervisory employee or work safety expert, e) all fire extinguisher cylinders should be red. Thus, researchers provide recommendations for installing fire extinguishers, installing safety signs, assembly points and evacuation routes as follows (Fig. 5):



**Figure 5.** Mapping Recommendation for Islamic Boarding School Gontor 2 Ponorogo  
After Analysis was Conducted

Based on observations, the multi-storey building and rooms at the Islamic Boarding School Gontor 2 Ponorogo have 2 fire extinguishers placed in the front room at a distance of about 30 meters, but do not have and have not yet installed safety signs and assembly points. This is not based on the Regulation of the Minister of Manpower and Transmigration of the Republic of Indonesia Number 4 of 1980 concerning Installation and Maintenance Requirements for Fire Extinguishers which states that the standard distance for fire extinguishers is 15 m.

If calculated correctly on a building size of 75 x 30 meters with an area of approximately 10 ha but minus the futsal field and area, then 30 units of fire extinguishers are needed on each floor and in each room. This is also supported by the results of Lufyana's research in industry which states that workers have difficulty putting out fires if the fire is more than 15 meters away (26).

According to research by Juan M. Corchado the mapping of fire extinguishers must be visible, accessible, and a minimum number of fire extinguishers must be available depending on the area of the building. It is necessary to periodically check the effectiveness of the function of fire extinguishers by a special operator. Apart from that, it can also save economically because fire extinguishers work optimally (27).

## Conclusion

It was concluded that the leadership of Gontor 2 Ponorogo Islamic Boarding School has been fully committed to implementing the safety of the residents of the Islamic Boarding School, by providing two APARs in 2015, but maintenance is still lacking. The mapping results still require an additional 30 units of fire extinguishers to meet the provisions of the

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law, the addition of 2 assembly point signs, the addition of 22 evacuation route signs, and installation in each recommended area.

## **Suggestion**

Best to provide a fire extinguisher that is in accordance with the results of the mapping and implementation of Occupational Safety and Health in Islamic Boarding Schools.

## **Acknowledgement**

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