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EVALUATION OF PASSIVE FIRE PROTECTION SYSTEM IN HIGH DENSITY SETTLEMENT IN MEDAN CITY (STUDYCASE IN SEI PUTIH TIMUR II)

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Abstract

Density settlements are areas that are not balanced between building land and the people who live there. Density settlements are synonymous with fires that can quicklyspread to mass fires. So it is necessary to have a passive fire protection system. Qualitative research methods will obtain data from observations, interviews, and related literature studies. It was choosing a location Lingkungan III in Sei Putih Timur II as the researchlocation is seen as having problems according to the topic. The study conducted anassessment of the conformity of the components of environmental roads, water supplies, buildings, and rescue facilities with existing regulations. It was found that the Sei PutihTimur II has a passive fire protection system component, but it is not under the standard.

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Key Words

Disaster, Fire, Passive protection, Settlement, Density settlement.

Abstrak

Permukiman padat penduduk adalah daerah yang tidak seimbang antara lahan bangunan dan jumlah penduduk. Permukiman padat penduduk identik dengan kebakaran yang dapat dengan cepat menyebar menjadi kebakaran besar. Oleh karena itu, diperlukan sistem proteksi kebakaran pasif. Metode penelitian kualitatif akan memperoleh data dari observasi, wawancara, dan studi literatur terkait. Lokasi Lingkungan III di Sei Putih Timur II dipilih sebagai lokasi penelitian karena dianggap memiliki masalah sesuai dengan topik penelitian. Penelitian ini melakukan penilaian kesesuaian komponen lingkungan jalan, pasokan air, bangunan, dan fasilitas penyelamatan dengan peraturan yang ada. Ditemukan bahwa Sei Putih Timur II memiliki komponen sistem proteksi kebakaran pasif, tetapi belum memenuhi standar.

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Kata Kunci

Bencana, Kebakaran, Perlindungan pasif, Permukiman, Kepadatan permukiman.

Introduction

Fire often occurs in a settlement. Generally, the fires that occur are single fires, but in cases that arise in highly populated areas, they can turn into mass fires. There are two types of fireprotection systems: active fire protection systems and passive fire protection systems [1]. Thedynamic fire protection system plays a role during the fire fighting process. In contrast, passive protection acts as fire prevention, or it can be said that the fire prevention process occurs first in the passive protection system and then in the active protection system. Medanis a city with a high population density and population growth. The results of the Medan City Population Census in 2020 show that the population in MedanCity reached a value of 2.44 million people with a population density of 9.186,16 people/sqkm

Medan is a city that has 21 districts with 151 villages. The official website of the FirePrevention Service (P2K) in Medan City from 2020 to 2021 shows that there have been 485fires, which are generally caused by human negligence. One of them was dozens of houses burned in the Sei Putih Timur II area. A fire occurred on Punak Street on June 10, 2020, causingten places to catch fire but no casualties [3]. Then on July 24, 2021, there was a fire on JalanNangka Baru, which caused four houses to burn but did not cause any casualties [4]. Therefore, it is necessary to research "Evaluation of Passive Environmental Fire Protection

SysteminDense Settlement in Medan City" to see the environmental fire passive protection systeminSei Putih Timur II in Medan City.

Literatur Review

A residential area is an area that functions as a place for people to live in a room. Settlements are man-made and can also be made naturally by having facilities that operate as places of residence that are occupied temporarily or for a longer time. High population density is an areathat is not balanced between land and houses or buildings in the room with the people who livethere. The need for facilities and housing is not following the city's growth, resultinginlagging development as a result of the unequal abilities of the population [5] . Thecentralization of community activities in the form of social, economic, government, and other activities in government areas can result in high average population growth each year [6] . Density settlements have characteristics, namely (1) houses/buildings are built unevenly, (2) there is no yard in each house, (3) environmental roads are narrow and cannot be passed by4-wheeled vehicles, winding, waste, and waterlogged (4) poor public facilities, (5) housing is inpoor condition, (6) poor environmental sanitation, and (7) prone to mass fires caused by the absence of distance between buildings [7]. Fire can harm humans. Fire can be defined as a fire that cannot be controlled and is beyond human desire. Fire is not formed by itself but through a chemical process. In the fire triangle theory, three elements make up the fire: (1) oxygen,(2) heat, and (3) fuel [8]. Combining these elements produces afire that can cause fire, heat, smoke, and gases. The merging of these three elements is a disaster for humans, buildings, and their contents [9] . In addition to the fire triangle theory, there is an advanced theory called the tetrahedron of fire. The fire tetrahedron theory explains that a normal combustion process will produce substances resulting from combustion, namely, (1) CO2, (2) CO, (3) SO2, (4) gas, and (5) smoke [10]. Fires can occur due to several factors, (1) natural events, (2) human negligence, (3) igniting by itself, and (4) intentional. Fire protection aims to control and extinguish a fire in the event of a fire by destroying the heat balance [11]. Fire prevention must be carried out by each individual and work unit so that number of fire events, causes of fire and the number of accidents can be reduced as small as possible through good planning [12].

In this study, the focus is more on discussing passive protection systems. A passive protection system is a system that works through the quality of building materials, control, building infrastructure, and the provision of rescue support facilities [13] . The following are thecomponents of passive protection, (1) An environmental road is a road that is in an environment that has pavement and can be accessed by fire fighting vehicles; (2) Water supply is a water source capable of supplying water for fire protection; (3) Buildings are components consist of the distance between buildings and the construction of building materials; (4) Rescue facility, are facilities provided for use by the public and firefighters to save lives and property [1].

Method

This study used qualitative research methods. This study was used to examine the sample byusing qualitative data collection and analysis. This study will discuss the evaluation of a passiveenvironmental fire protection system in dense settlements in the Sei Putih Timur II. This evaluation is implemented by considering the feasibility level of the passive protection systemagainst existing regulations. The sample of this research is Lingkungan III which is locatedinSei Putih Timur II. This kind of evaluation is carried out by evaluating the suitability of thepassive fire protection system. This evaluation is divided into four levels of the score.

Table 1. Level of The Score

Theory	Scores
There are No. components of a passive fire protection system	1
There are several components of a passive fire protection system, but they are not up to standard	2
There are several component of a passive fire protection system, and they comply with the standard	3
There are a passive fire protection system components that eet the standard	4

Result and Discussion

The research location is in a high population desensity area of Medan City. The research was conducted in Sei Putih Timur II with an area of ±34 ha, where there are 24.63 people per km 2. The research location in Lingkungan III includes several roads, (1) Makmur Alley, (2) Meranti streets, (3) Nangka Baru Alley, (4) Sederhana Alley, (5) Sepakat Alley, (6) Berisik Alley, (7) Sukses Alley, (8) Setia Alley, (9) Bahagia Alley, (10) Sentosa Alley, (11) GBH Alley, (12) Dewi Alley, (13) Pasundan Baru Alley

1. Environmental Road

There are no access points at the research site that can be passed and do not meet the requirements. The results of the environmental road analysis in Sei Putih Timur II are as follows:

Table 2. Environmental Road

Research Result		
Theory		Scores
Environmental road access using the pavement.	The access point has pavement.	3
The minimum width of the pavement is 6 m, and the driveway is 4 m.	Wide vehicle roads on environment II range from 1.5 – 3 m.	2
The pavement layer must be free of obstacles.	There are abstacles	1

Figure 1. Environmental Road

The environmental road at the location is already using the pavement. Environmental roads have road widths that are not up to standard. Only a few road vehicles conform to the standard. The road at the research location is not free of obstacles where there are obstacles in the form of piles of garbage, motor vehicles, and selling carts parked on the road. The evaluation value of environmental roads is 2. There are several components of a passive fire protection system, but they are not up to standard.

2. Water Supply

Water supply is obtained from PDAM, which is used for daily activities. The following are the results of the analysis of the water supply in Sei Putih Timur II:

Table 3. Environmental Road

Theory	Research Result	Scores
The water supply must be able to provide the required water for fire protection	No. water source can supply water needs	2
Water source distance	The distance of water supply to environment II is approximately 450 m.	2
The condition of the path that is passed when it reaches the water source	Available and have standard access	3
The closeness of the distance affects the blackout time	The distance between the Fire Service Office sis nt too far, which is about 1.7 km from the research location.	3
Avarage Score		2,5

Figure 2. Water Supply

Based on the results of observational data obtained on the research object, the water supply in the research location comes from PDAM Tirtanadi. Still, it cannot supply water for fire protection. There is another alternative water supply, namely the Deliriver, along the research location's north side. But it cannot supply water in the event of a fire. The value of the evaluation of Water Sources is 2.5, meaning that there are components of a passive fire protection system, but some are not in accordance with the standard.

3. Building

The components of the building variable consist of the distance between buildings and the construction of building materials [1]. To protect buildings, the distance between buildings is to prevent fire from spreading around the main building [14]. In contrast, building materials construction forms a building whose structure is fire resistant and structurally able to withstand loads. The following are the results of the analysis of the building in Sei Putih Timur II:

Table 4. Building

Theory	Research Result	Scores
Building height up to 8m, the distance between building is 3 m. Building heught> 8 to 14 m, the distace between building>3 to 6 m. Building height >14 to 40 m, the ditance between building > 6 to 8 m. Building height > 40 m, the distance between building > 8 m.	There is No. distance between building and other buildings. But there is a distance between the buildig and the building in front. There is environmental road as the distance between buildings	2
The level of the fire resistance of materials, according to the theory od fire resistance classification in building, is devided into type A, B, and C	The object od research includes the resistance level of C	1
Avarage Score		2,5

Figure 3. Building

Based on the results of observational data obtained from the object of research, the building does not have a distance between one building and the building next to it but has a distance from the opposite building. The distance between the buildings comes from the environmental road as the distance between opposite buildings. The materials used in the buildings in Sei Putih Timur II do not have a level of fire resistance that is resistant to fire when a fire occurs. The value of the building evaluation results is 1.5, meaning there are no passive fire protection system components.

4. Rescue Facilities

Rescue facilities are media provided to be used by the community and firefighters to save lives and property [1]. This safe place must be protected from the threat of fire and can be indoors or outdoors. The open space where the evacuation should be located must be in the same environment.

Table 5. Recue Facilities

Theory	Research Result	Scores
Adequate means of evacuation are available when a fire occurs	The is a means of evacuation room	3
Exit access is free from obstractions for evacuation and fire fighting	There are obstacles in the evacuation access route	2
Avarage Score		2,5

Figure 4. Rescue Facilities

There are several rescue facilities in Sei Putih Timur II. Rescue facilities can be in the form of public facilities such as schools, sub-district offices, mosques, and monasteries that can function as an evacuation areas. Accessibility to rescue facilities has several obstacles, such as motorbikes parked and people selling on the road, which can interfere with the ongoing evacuation process. The evaluation value of infrastructure is 2.5, which means that there are several components of a passive fire protection system, but they are not up to standard

Conclusion

Based on the observations and assessments of the passive environmental fire protection system in dense settlements in Sei Putih Timur II Village. The results of the conformity of the passive protection system to existing regulations are obtained, namely:

The Environmental Road variable got a value of 2. It means that there are components of a passive fire protection system, but some are not in accordance with the standard. An environment road on the location already uses pavement street that has a non-standard road width. Only a few road vehicles comply with the standard. The road at the research location is not free of obstacles where there are obstacles in the form of piles of garbage, motorized vehicles, and sales carts parked on the road.

The Water Supply Variable got a value of 2.5. This means that there are components of a passive fire protection system, but some are not in accordance with the standard. The water sources in the research location come from PDAM Tirtanadi and Deli River, which are in the west of the research location but cannot be used as water suppliers for fire protection.

The Building variable gets a value of 1.5. This means that there are components of a passive fire protection system but some are not in accordance with the standard. The materials used in the buildings in Sei Putih Timur II Village do not have a level of fire resistance that is resistant to fire when a fire occurs. There are still many buildings that still use combustible materials such as wood. Accessibility to evacuation facilities has several obstacles, such as motorbikes parked and people selling on the road

The Rescue Means variable gets a value of 2.5. This means that there are components of a passive fire protection system, but some are not in accordance with the standard. At the research location, there are several public facilities such as schools, village offices, mosques, and monasteries that can function as evacuation facilities if a fire occurs.

Then the overall value of the passive environmental fire protection system in Sei Putih Timur II Village is a value of 2.125. This means that there are components of a passive fire protection system, but some are not in accordance with the standards at the research site. In the previous study, by taking housing in urban areas as the research location. These housings include Graha Tanjung Sari housing, Johor Indah Permai 1 Housing and Stella Residence Housing. Obtaining the overall final score, namely Graha Tanjung Sari Housing, received a score of 0.675, Johor Indah Permai housing 0.934, and Stella Residence housing 0.726. Which means that the three case studies received poor scores, because there are still many environmental facilities and infrastructure needed to deal with fire disasters but are not yet available in each case study location [15].

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