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## DISTRIBUTION OF FIRE INCIDENTS AND FIRE FIGHTING SERVICES IN DKI JAKARTA PROVINCE

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## DISTRIBUTION OF FIRE INCIDENTS AND FIRE FIGHTING SERVICES IN DKI JAKARTA PROVINCE

### Cover Page Footnote

thanks to the supervisor of this research and the geography department of the faculty of mathematics and natural sciences. University of Indonesia.

# Distribution of Fire Incidents and Fire Fighter Services in DKI Jakarta Province

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**Abstract.** *The rapid development of the city results in the risk of disasters, one of which is a fire disaster. Fire incidents have increased from time to time, this occurs in line with the continued increase in population and density of settlements. Fire can cause material loss or loss of life. Efforts to minimize fire disasters can be carried out by providing fire fighting service facilities whose numbers can reach all areas. The purpose of this study is to determine the distribution of fire incidents and to determine the distribution of fire services in DKI Jakarta Province. The type of research used in this research is ex-post facto research which then the results are analyzed by quantitative description. The location of this research is DKI Jakarta Province. The variables in this study are fire incidents and fire fighting services in the 2018-2020 range. The source of data in this study is data on fire incidents and fire fighting services obtained from related agencies, namely the DKI Jakarta Fire Department. Data analysis techniques are density analysis and service area analysis. The results showed that the distribution of fire incidents occurred in all areas of DKI Jakarta, with the highest distribution in the East Jakarta area. The spread of fires occurred in almost every residential or residential area. The distribution of fire services in DKI Jakarta is not available in every region, especially at the sub-district and urban village levels.*

**Keywords:** *fire fighter, fire sector, fire station, housing, settlement*

## 1. Introduction

The rapid development of the city results in a high potential for disaster in the region. As the capital city of Indonesia, DKI Jakarta is one of the provinces that has rapid urban development. This can be seen from the rampant construction of high-rise buildings, markets or shops and offices as well as the increasing number of densely populated settlements in Jakarta. In line with opinion (Kunu, PJ and Leloltery, H., 2010) which states that the increase in built-up area in DKI Jakarta Province is dominated by residential designations of 86.3% of the total area of 661.26 km<sup>2</sup>. Thus, it can be concluded that DKI Jakarta is an area with a high level of disaster potential.

Dense settlements in DKI Jakarta tend to be more vulnerable to disasters such as floods and fires. If the two are compared within the scope of dense settlements, fires are the most frequent occurrence in DKI Jakarta. (Paripurno, *et al.* 2012) revealed that residential fires are a disaster that poses a threat to DKI Jakarta province after the flood disaster. DKI Jakarta Province ranks second nationally as a province with the highest residential fire hazard index after South Kalimantan Province (Kurniawan, *et*

*al.*, 2011). It was further explained in the disaster management plan book published by the DKI Jakarta Regional Disaster Management Agency (BPBD) that Jakarta's vulnerability to fire disasters does not only occur in a special area, but evenly for all areas in DKI Jakarta. This is also reinforced by the publication of the national disaster management agency regarding Cities/Regencies that have the highest residential fire hazard index nationally, it is stated that all cities/regencies in the DKI Jakarta area occupy the top 10 nationally with details, the city of West Jakarta ranks 2nd nationally, Central Jakarta ranks 4th nationally, South Jakarta ranks 5th nationally, East Jakarta ranks 7th nationally and North Jakarta ranks 8th nationally (Kurniawan, *et al.*, 2011).

Based on the Central Agency, fire incidents in the DKI Jakarta area show an increasing number from time to time. In recent years, there have been an average of more than 200 fires per year in residential areas and houses and this figure has the potential to continue to increase both in terms of quantity and the amount of losses caused by the disaster. To overcome the problems mentioned above, the Provincial Government of DKI Jakarta as the responsible party needs to prevent and minimize the impact of these fires.

Fire has a potential hazard that is increasingly worrying if it is not immediately addressed and anticipated. One of the efforts that can be made for fire control is setting up fire fighting services. The closer the fire service is to the location of the fire, the faster the response time for firefighters will be, and the spread of an increasingly widespread fire can be stopped quickly so that the impact that arises can be minimized. Research on firefighting services is important to do with consideration of minimizing losses. One way of setting the location of fire services is to use spatial analysis to determine the appropriate land for the placement of fire services. The location of the fire service greatly affects the performance of the fire force. The location of fire fighter facilities must take into account the high risk of fire in an area and the accessibility or space for fire fighters to move in all directions as an effort to prevent and deal with fires. Thus, the placement of the location of facilities that are not appropriate will provide services that are slow, ineffective, and cause harm to the wider community. (Bagir and Buchori, 2019).

Based on this description, the problem that will be studied in this study is how is the distribution of fire incidents in DKI Jakarta Province? and How is the distribution of fire services in DKI Jakarta Province? Furthermore, the purpose of this research is to 1). find out the distribution of fire incidents in DKI Jakarta Province, 2). find out the distribution of fire services in DKI Jakarta Province.

## **2. Research Methodology**

The type of research used in this research is ex-post facto. Where in this study is the variable has occurred and researchers are not trying to manipulate or control it. This study attempts to trace back events from existing events to identify a series of causal variables (Sukardi, 2005)

This research was conducted in DKI Jakarta Province in accordance with the research objectives. The determination of the research location is determined by the researcher himself. The basis for choosing the location of this research is because the area is the capital city of Indonesia, as well as a province with a high population density that allows for a high fire hazard as well.

The variables of this study are fire incidents and fire fighter services in DKI Jakarta Province during the 2018-2020 period. The indicators used in the fire incident variable are the coordinates of the fire incident. Furthermore, the indicators used in the fire service variable are the coordinates of the fire service location.

Source of data obtained from secondary sources. Data on fire incidents and fire fighter services were obtained from the relevant agencies, namely the DKI Jakarta Fire Department for 2018-2020. This data was obtained from an official source for the DKI Jakarta Fire Department.

The data analysis technique used in the first problem formulation is density analysis using point density. The data analysis technique used for the second problem formulation is service area analysis.

### 3. Results and Discussion

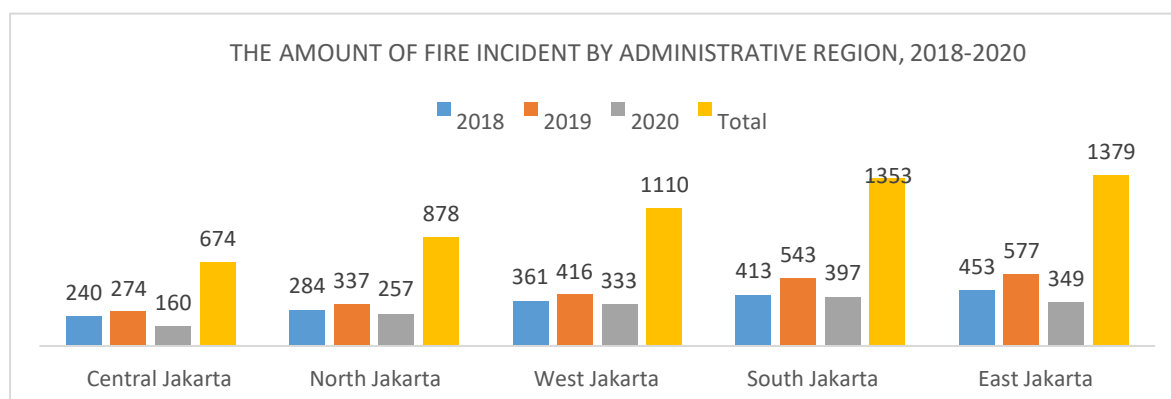
#### 3.1. Condition of Research Area

Astronomically, DKI Jakarta is located at 5°10'00" LS - 6°22'21.5" LS and 106°41'12.5" E - 106°58'24.5" E. Administratively, the DKI Jakarta area is located at an altitude of 79 meters above sea level. DKI Jakarta is surrounded by Depok City and West Java Province to the south, and to the east is surrounded by Bekasi Regency and Bekasi City, as well as West Java Province. Furthermore, to the west it is surrounded by Tangerang Regency and Tangerang City, as well as Banten Province. And finally, in the north it is surrounded by the Java Sea. Thus, regionally, DKI Jakarta is surrounded by West Java, Banten, and the Java Sea.

DKI Jakarta has an area of 661.5 km<sup>2</sup> divided into 5 Cities, 44 Districts, 267 Sub-Districts, 2,741 Community Units, and 30,470 Neighborhood Units. The population of DKI Jakarta Province is 9.041 million people with a population density of 13,667.01 people per km<sup>2</sup>. The population density of DKI Jakarta is based on population density people/km<sup>2</sup> where Central Jakarta is the area with the densest population density, namely 22,034, then West Jakarta 20,654, then areas with medium and lower density levels such as in DKI Jakarta such as East Jakarta 17,703, South Jakarta 15,350 and North Jakarta 13,176.

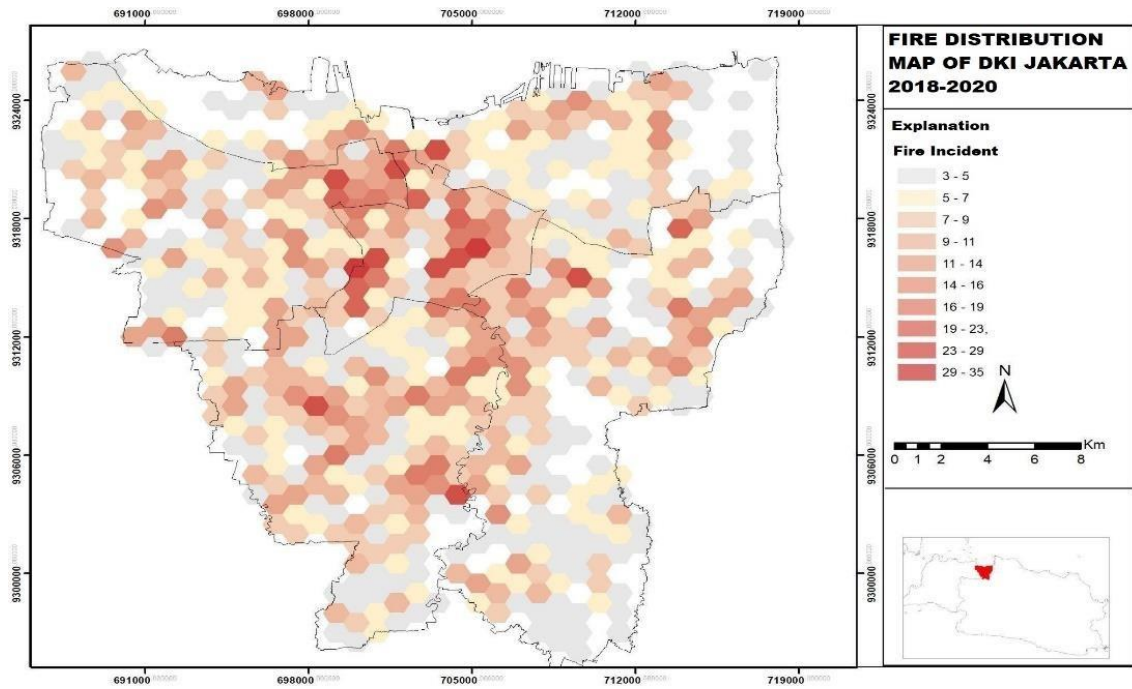
#### 3.2. Distribution of Fire Incidents in DKI Jakarta Province

Fire incidents in DKI Jakarta Province in 2018-2020 according to the recapitulation from DKI Jakarta Fire Service data were 5,439 cases. When viewed from the region, the most fire incidents in the 2018-2020 range were in the South Jakarta area with 1,353 cases. Next, followed by East Jakarta with 1,379 cases, West Jakarta with 1,110 cases, North Jakarta with 878 cases, and Central Jakarta with 674 cases. More details can be seen in (Figure 1).



**Figure 1.** Graph of Fire Incidents by Region

The distribution map in this study is the distribution of fire incidents on the topographic map of DKI Jakarta Province which has been processed using a computer program ArcView. A map of the distribution of fire incidents in DKI Jakarta for 2018-2020 is presented in (Figure 2).



**Figure 2.** Map of DKI Jakarta Fire Incident Distribution in 2018-2020

The distribution map shows in detail the number of fire incidents in each area in DKI Jakarta. The deep red color on the distribution map shows the number of fires in the area of 29-35 cases. In the Central Jakarta area and the border area between Central Jakarta and West Jakarta, it can be seen that many places have a high number of fire cases. This can be seen from the red color which is quite a lot in the Central Jakarta and West Jakarta areas.

The distribution map shows that the Central Jakarta and West Jakarta areas have a high density of fire incidents in 2018-2020. Thus, in this study further analysis was carried out, namely spatial analysis of the area. Spatial analysis aims to obtain further information on an area with a high concentration of fire incidents. This information relates to strong indications that an area has environmental characteristics and patterns that support the occurrence of fires.

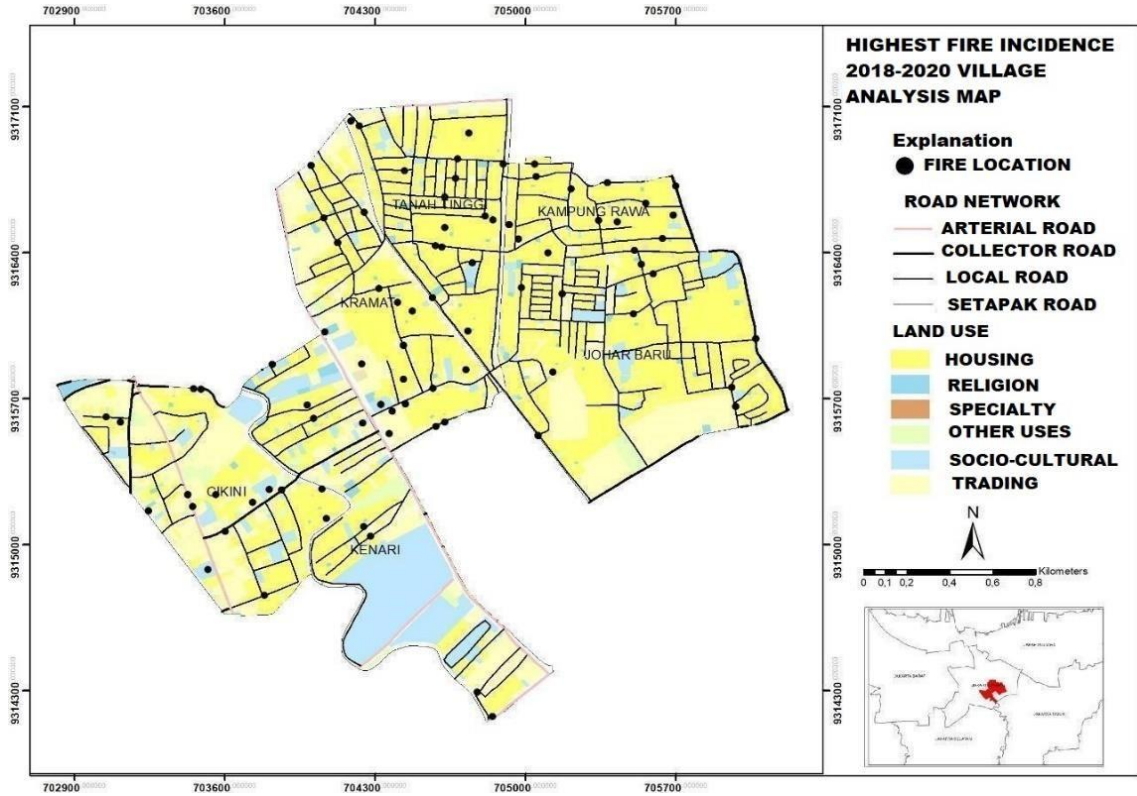


Figure 3. Map of Urban Village Analysis for the Central Jakarta Region

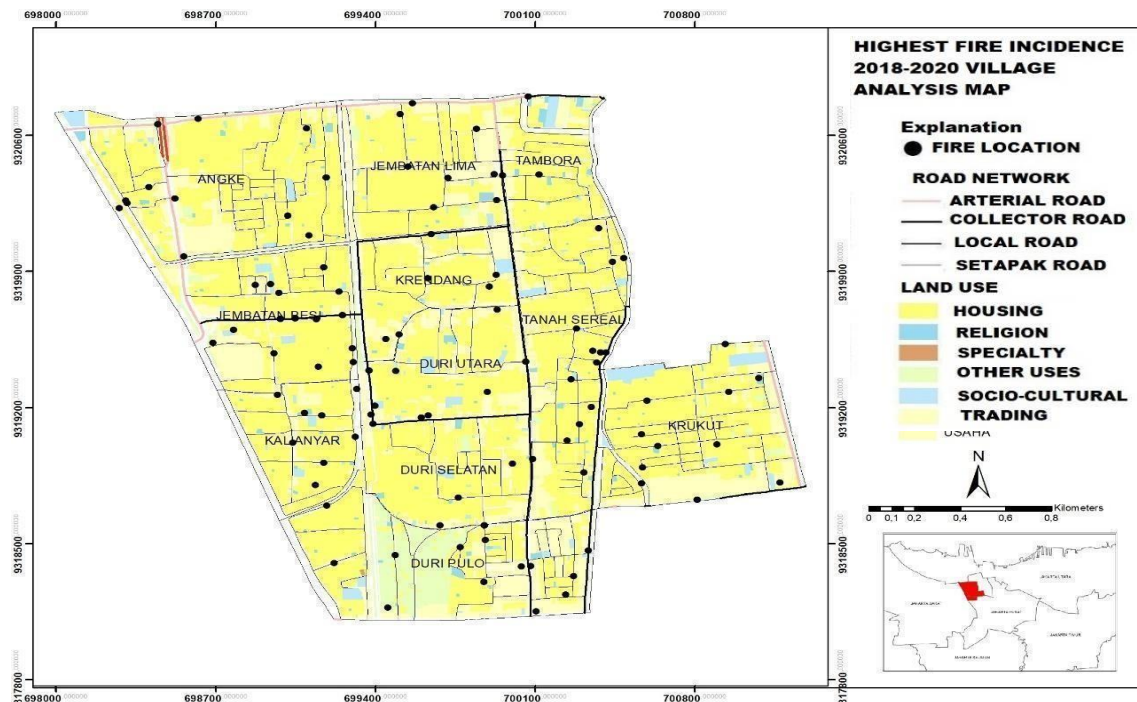


Figure 4. Map of Urban Village Analysis for the West Jakarta Region

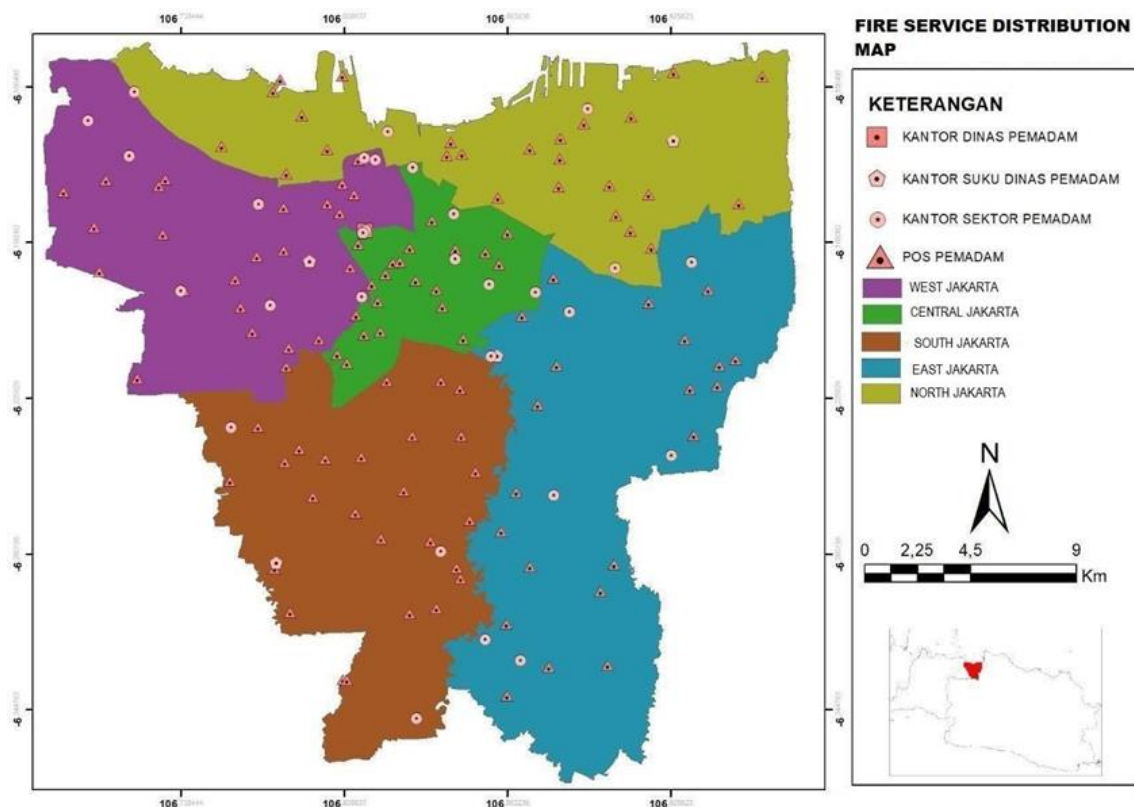
Based on (Figure 3) and (Figure 4), it can be seen that the most used land use is residential. By associating with local and collector road networks, these settlements are included in dense settlements where the problem in dense settlements is access barriers, such as roadside parking. The analysis map shows that residential areas have high cases of fire.

DKI Jakarta as the capital city of Indonesia is the center of human activity, from working to living. In the 2018-2020 vulnerable year, the distribution of fire incidents was 5,439 objects. Most of the fire incidents were in residential areas with a total of 1,573 residential buildings. Outside installations of buildings totaled 1,416 objects, then public trade buildings totaled 852 objects.

With the alleged causes that the electricity was the most, namely 3,198 and burned as much as 754 garbage. The alleged causes that have occurred can be interpreted as the cause of fires originating from human activities and basic human needs in urban areas. It can be interpreted that the distribution of fire incident locations is in residential and business areas which are the objects that burn the most because of the causes of their occurrence.

### 3.3. Distribution of Fire Service in DKI Jakarta Province

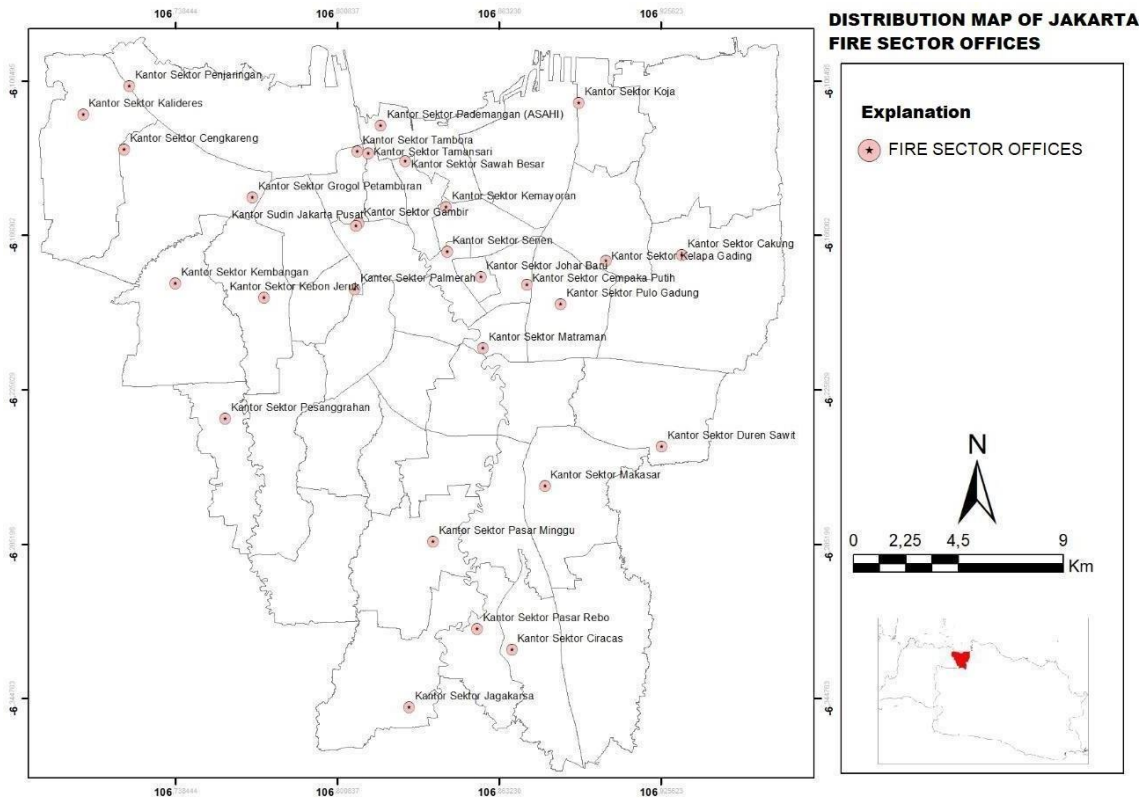
In the event of a fire, the role of the fire service becomes very important. Thus, in addition to the distribution of fire incidents, this study also presents the distribution of fire services in DKI Jakarta Province. (Figure 5) shows the distribution map of DKI Jakarta fire services.



**Figure 5.** Distribution Map of DKI Jakarta Fire Services

The map above explains the pattern of distribution of the presence of fire services in DKI Jakarta. There is 1 fire department office in DKI Jakarta, then there is 1 fire department office in each administrative area in DKI Jakarta. The distribution of fire sector offices in Central Jakarta is 5 sectors, North Jakarta is 4 sectors, West Jakarta is 8 sectors, South Jakarta is 4 sectors, and East Jakarta is 6 sectors. Furthermore, if seen from the distribution of fire extinguishers, there are 21 posts in Central Jakarta, 27 posts in North Jakarta, 27 posts in West Jakarta, 31 posts in South Jakarta, and 30 posts in East Jakarta.





**Figure 6.** Distribution Map of DKI Jakarta Fire Department Offices

There are 28 fire department offices in DKI Jakarta. (Figure 6) The fire sector office is a fire service at the sub-district level. In addition, the duties of the sector office are also a fire disaster mitigation unit with community activities related to fire disasters. The work area of the sector office regionally is in charge of sub-district administration according to the location of the sector office. The sector office is in charge of handling fire incidents in the task area, but sector offices can also handle fire incidents in other areas if necessary.

Fire fighters post are the smallest unit in the hierarchy of firefighter duties. The fire station is a form of work area in one sub-district which is expected to provide full service to the sub-district where the post is located. The fire station is the front guard for the initial handling of fire incidents, this is due to its close position to the incident. Thus, it is expected to minimize the blaze. The map of the distribution of DKI Jakarta fire stations is presented in (Figure 7).

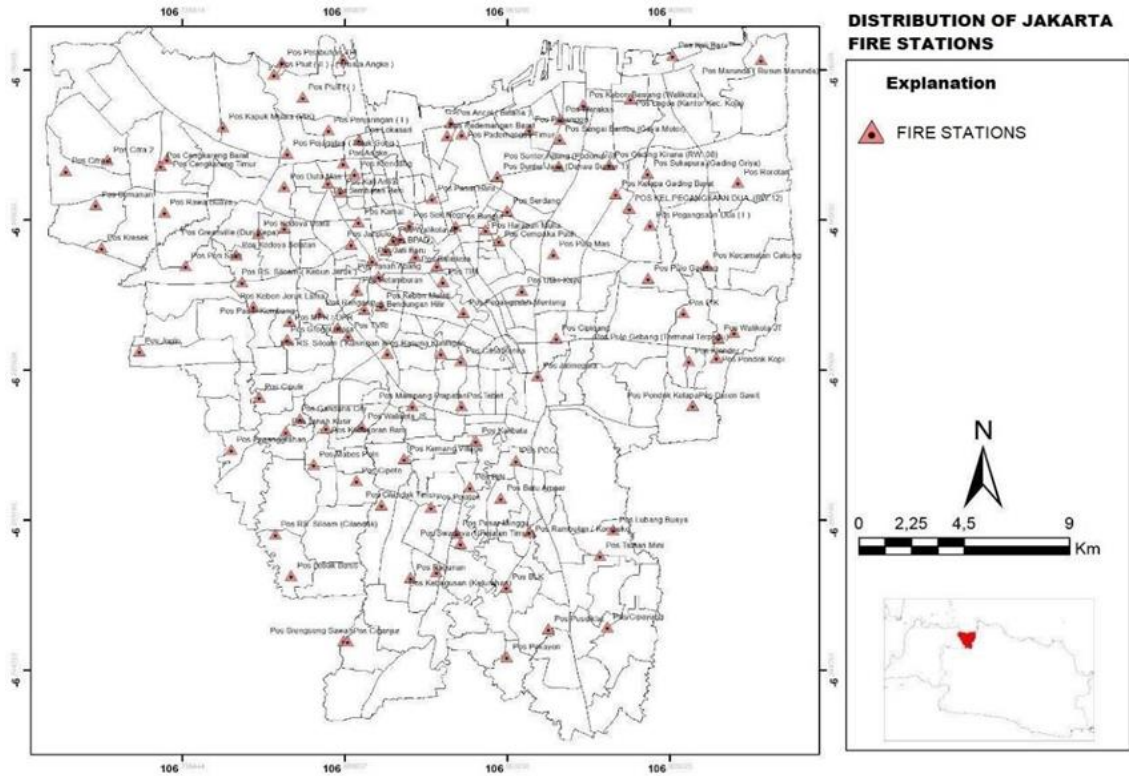


Figure 7. Map of the Distribution of DKI Jakarta Fire Stations

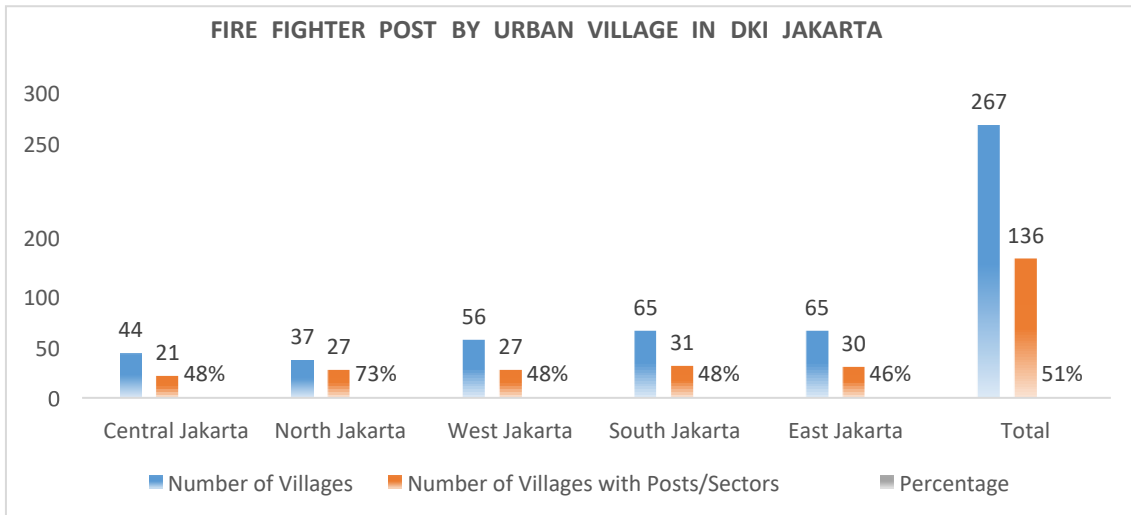


Figure 8. Graph of Fire Fighter Post in Urban Village DKI Jakarta

Based on the (Figure 8) graph of firefighter posts in DKI Jakarta urban villages above, there are 267 urban villages and 136 firefighter posts. In the Central Jakarta area, there are 44 sub-districts with 21 sub-districts having fire stations. In the North Jakarta area, there are 37 urban villages with 27 urban villages having fire stations. West Jakarta has 56 sub-districts with 27 sub-districts having fire stations. South Jakarta has 65 sub-districts with 31 sub-districts having fire stations. Furthermore, in the South Jakarta area there are 65 sub-districts with 30 sub-districts having fire stations.

On a percentage basis, 51% of urban villages in DKI Jakarta already have fire stations and the remaining 49% of urban villages are not yet equipped with fire stations. each-Each area in Central

Jakarta, West Jakarta and South Jakarta has a percentage of 48% of sub-districts that already have fire stations. Furthermore, North Jakarta has the highest percentage, namely 73% of urban villages that are equipped with fire extinguishers. And the lowest is in the East Jakarta area with a percentage of 46% of sub-districts that already have fire stations.

### 3.4. Discussion

In relation to the results of the study, the distribution of fire incidents occurred in every area in DKI Jakarta Province, with the highest distribution in the East Jakarta area. The second highest distribution of fire incidents was in the South Jakarta area, followed by West Jakarta. North Jakarta occupies the fourth position with the highest distribution of fire incidents. And finally, Central Jakarta is the area with the lowest distribution of fire incidents in DKI Jakarta.

Based on the Central Bureau of Statistics (2020), the population in DKI Jakarta Province when viewed from its area is as follows. The total population in the East Jakarta area is 3,037,140, then the population in South Jakarta is 2,226,810. The total population in the West Jakarta area is 2,434,510, in the North Jakarta area is 1,778,980, and the Central Jakarta area has a population of 1,056,900.

East Jakarta, as the area with the highest population, also has the highest distribution of fire incidents. Furthermore, Central Jakarta, as the area with the lowest population, also has the lowest distribution of fire incidents. Thus, it can be concluded that there is a relationship between population and the distribution of fire incidents.

If an area has a high population density, then the area also has a vulnerability to fire. Population density is related to the number of people who occupy the area. The number of people affects the potential for fire in an area. This is in accordance with the opinion (Bastinas, *et al.*, 2013) stated that the number of human populations affects the number of fire incidents in the region.

Fire is a fire event that occurs under conditions where there is no intentional element of daily activities, for example cooking and carrying out other activities (Fema, 2013). In general, fire incidents are caused by cooking activities, electrical short circuits, damaged cables, improper handling of flammable materials, such as candles and their fuels. Thus, the biggest factor in fires is human negligence.

(Xiong, Bruck, and Ball, 2016) stated that 60% of the causes of fires are human errors or negligence. Negligence is characterized by activities that are not in accordance with security procedures. This negligence occurs when humans do not check equipment that can cause a fire.

(Sanderson, *et al.*, 2022; Venevsky, Thonicke, Sitch, and Cramer, 2002) stated that humans are the most important factor in the occurrence of fires. Fires can be caused by various things related to humans. For example, the low knowledge of the population about the things they face, low concern for the environment, and dense settlements. This is in line with the opinion of (Jonathan, Renee, and Garry, 2016), fires are influenced by the level of the environment, dense settlements, low home ownership, high levels of unemployment, low education, low income, and socio-cultural elements of society.

The results showed that the highest distribution of fire incidents was in residential areas or settlements. (Setiawan, 2020) revealed that residential areas are areas with a high risk of fire. This is consistent with previous findings that high incidence of fires occurs in areas with high population density. If an area is full of dwellings, then the number of people is also high, the population density is also high.

Study described areas with the highest concentration of fire incidents as having dense residential

characteristics, but accessibility was not developed (Twigg and Haworth, 2017). This causes settlements with great attractiveness to be unable to function flexibly in all conditions. Plus the problem of portals in residential areas is of course an obstacle to access, because you have to increase the distance and travel time to get to the location. Furthermore, the most common problems encountered in dense residential areas with narrow land are obstacles caused by parking of residents' vehicles, there are permanent buildings such as gates, flower pots in front of people's houses, and during the wetting process, the result is that the local residents are difficult to control, so it is difficult to carry out the extinguishing process.

According to (Ramli, 2010), residential areas that have a high distribution of fires have the following characteristics.

1. Settlements with solid building materials, such as wood, cloth, and paper (class A).
2. This type of open fire, as a result of the rapid spread of cancer, due to the distance from the building, the burning material increases the intensity of the flames.
3. Difficult access to fire prevention, for example access for four-wheeled vehicles.
4. Residents vary in age, education, physical condition, and behavior, which will complicate the firefighting and rescue efforts.
5. Limited extinguishing media, especially from adequate water.

Fire incidents often occur unexpectedly and can occur at any time. Fires can cause a lot of material loss, loss of life and environmental damage. In addition, the fires that occur are often difficult to overcome so that the losses increase. Therefore, a fire service is needed that can prevent and minimize losses.

In the event of a fire, the fire service is very important and vital. The form of responsibility of the DKI Jakarta Provincial Government to overcome the danger of fire disasters in the DKI Jakarta area is to provide fire fighter services that can reach every area. The fire service is divided into 4, namely the fire department office, the fire department sub-department office, the fire department sector office, and the fire department post.

The fire sector office is a fire service at the sub-district level. Based on the results of the study, the distribution of fire department offices does not meet the needs. This can be seen from the amount. There are only 28 fire department offices in DKI Jakarta. Meanwhile, based on the Central Statistics Agency (2020), there are 44 sub-districts in DKI Jakarta. Thus, there are 16 urban villages that do not yet have a fire department office.

The fire station is a fire service at the sub-district level. The fire station is the front guard for the initial handling of fire incidents, this is due to its close position to the incident. Thus, it is expected to minimize the blaze. The results of the study show that the distribution of DKI Jakarta fire stations does not meet the needs. This can be seen from the number of fire department posts, which are only 136 posts. Meanwhile, based on the (Central Statistics Agency, 2020), there are 267 urban villages in DKI Jakarta. Thus, there are 131 urban villages that do not yet have fire stations.

Based on the results of the research, the Provincial Government of DKI Jakarta needs to review firefighting services, especially in the fire department and fire department posts. The number of fire department offices will be better if it is adjusted to the number of sub-districts in an area (Sutaryo and Suryadi, 2019).

Implementation of services and problems are forms that cannot be separated to describe the implementation of the fire service where there are a number of posts in each urban village. This can be an embodiment of the optimal implementation of services to reduce visit time during a disaster. For more effective fire management, it would be better if the number of firefighters was adjusted to the number of sub-districts in an area (Amelia and Mendrofa, 2020).

#### 4. Conclusions

- 4.1. The distribution of fire incidents occurred in every area in DKI Jakarta Province in the 2018- 2020 range, with the highest distribution of fire incidents in the East Jakarta area. Furthermore, the spread of fire incidents occurred in almost every residential or residential area.
- 4.2. The distribution of fire services in DKI Jakarta Province in the 2018-2020 range is not available in every region. This can be seen in the distribution of fire services that are not available in every village and sub-district.

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