The important factors of the safety system on fire hazard PD Pasar Jaya building for sustainable infrastructure in Jakarta

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Abstract. PD Pasar Jaya is the traditional market in Jakarta. It has different characteristics from other building. The research wants to evaluate the important factors. Direct observations in the field and assessment are conducted by competent experts in the field of fire safety. The criteria used as reference factors for the assessment of fire safety protection are derived from SNI 03-1736-2000 and for the assessment of fire prevention and prevention facilities are derived from minister of public work regulation No. 26/PRT/M/2008 and NFPA. Finding is the average 14 building of the safety system on fire hazard (73) with the value of intensity and the volume of buildings (79), facilities active protection (76), the infrastructure of life-saving facilities (75), facilities passive protection infrastructure including water potential and potential fire (72) are the four most important factors of the safety system on fire hazard PD Pasar Jaya Building for sustainable infrastructure.

1. Introduction
PD Pasar Jaya is one of the traditional market in Jakarta owned by DKI Jakarta province that has different characteristics from other building. The building is an asset that has to protect from disaster which include fire.

The Management safety system on fire hazard building is needed to minimize a risk from fire disaster. To know factors of the safety system on fire hazard building is preventing a risk from fire disaster for sustainable infrastructure.

There are many kiosk damage burnt for example Pasar Senen on Jakarta Pusat, 25/4/2014 in the morning. Over 2,000 kiosks burnt out after ten hours a fire could stop. The on Monday morning 28/4/2014 Pasar Rumput, Jakarta Selatan, then on 12/6/2017, Pasar Induk Kramat Jati, Jakarta Timur burnt over 90 kiosk damage.

This research is to find the factors on the safety system on fire hazard PD Pasar Jaya building in Jakarta for sustainable infrastructure. In this regard, it is necessary to make efforts to prevent fire hazards, namely efforts to find out the risks posed by fire hazards, how to deal with, elements of prevention and evacuation in PD Pasar Jaya Building in Jakarta. There must have check and maintenance activities carried out routinely and periodically on elements of fire hazard management.

2. The safety system on fire hazard of PD Pasar Jaya building
Building is built and/or placed in an environment partly or wholly on, above, or permanently in the land and/or waters that functions as a place for humans to carry out activities of residence, business, social
culture, and other activities. While public buildings are more intended for public activities and serve the needs of the general public, such as religion, education, recreation, sports, shopping [1].

PD Pasar Jaya is a BUMD with a percentage of 100% shares owned by DKI Jakarta Provincial Government, which is a regionally owned company or which manages the market in Jakarta.

The development of building construction in urban areas is increasingly complex in terms of intensity, technology, as well as the need for infrastructure and facilities. That the safety system of the community inside the building and its environment must be a primary consideration, especially against fire hazards, in order to carry out its activities, and improve its productivity and quality of life. For this reason, it is deemed necessary to issue regulation of the state minister of public works [2,3], stipulating the technical provisions for managing fire in the cities.

According to the state minister of public work regulation [4], management infrastructure of life-safety system on fire hazard that the sufficient water supply for overcome the danger of fire as well as transportation one’s support is its components very vital.

Fire can occur if the three elements of fire react with one another. Without any of these elements, fire cannot occur. There is a fourth element called the combustion reaction, because without a combustion reaction the fire will not be able to live continuously. These four elements of fire are called fire tetra hedron [5].

Therefore, the region must be planned in such a way so that it is available firefighting facilities active and passive protection such as fire stations, environmental fire hydrants, fire water reservoir making it easier for the department fire extinguisher for access and use it [6-8].

In traditional market has different characteristics from other building such as an intensity and the volume of buildings. There are mix it well traders who are in market area so comfort level as well market security is not maintained as it should be. On the other side, another building structure that is referred to related to minimum security requirements and safety in particular that market. The quality level of the structure and very building material vulnerable to danger Fire [9].

According to Republic of Indonesia Minister of Public Works Regulation No.26 / PRT / M / 2008 [10] in Pontan D and Maxsi A [11], the main goal in preventing fire risk is to put out or extinguish the fire before the fire gets bigger. Extinguish or turn off the fire, means to damage or break the heat triangle balance chain. This can be done in several ways, namely:

- Cooling out i.e. by cooling or lowering the temperature of the burning vapor or gas to below the flame temperature. If the heat is reduced, the material will not be flammable. Water spray at the point of fire will cause the air around the fire to cool. The heat will be absorbed by water which will then turn into water vapor which will cool the fire.
- Oxygen Restrictions, Fires can be stopped by eliminating or reducing oxygen supply. If oxygen supply is reduced, the combustion process can be extinguished.
- Fuel Removal, a fire can die by itself if the burning material is gone. Therefore, fire can be reduced by eliminating or reducing the amount of material burned. This method can be done by spraying the burning material with foam, so that the fuel supply is stopped or reduced, and the fire slowly dies.
- Breaking a Chain Reaction, namely by preventing chain reactions in the combustion process. By spraying chemicals that have the property of breaking the combustion chain. (CH4 + 2O2 → CO2 + 2H2O + E).

According to Ministry of Public Works regulation [12], buildings are classified according to the level of fire resistance of the main structure consisting of four classes, namely [13]:

- Class A buildings, are buildings whose main structural components must be resistant to fire for at least three hours, which include buildings: Hotels, Shops and bazaars, Offices, Hospitals and treatments, Industrial buildings, Entertainment venues, Museums, Buildings with multiple / mixed uses.
- Class B buildings, are buildings whose main structural components must be resistant to fire for at least two hours. Among others: multilevel housing, boarding, schools, places of worship
- Class C buildings, are buildings whose main structural components must be resistant to fire for at least half an hour, including buildings that are not terraced and simple.
- Class D buildings, are buildings that are not included in class A, B, C are not regulated in this provision, but are specifically regulated, for example: nuclear installations, buildings used as storage facilities for explosive materials.

Referring to RI Law [14], concerning Buildings in Article 17 regarding technical requirements:

- Safety requirements for buildings as referred to in Article 16 paragraph (1) include requirements for the ability of buildings to support load loads, as well as the ability of buildings to prevent and overcome fire and lightning hazards.
- Requirements for the ability of buildings to support their load as referred to in paragraph (1) are the ability of building structures that are stable and strong in supporting load loads.
- Requirements for the ability of buildings to prevent and cope with fire hazards as referred to in paragraph (1) shall be the ability of buildings to carry out security against fire hazards through passive protection systems and/or active protection.
- Requirements for the ability of buildings to prevent lightning hazards as referred to in paragraph (1) are the ability of buildings to carry out security against lightning hazards through the lightning protection system.

Fire protection means are equipment or infrastructure needed in a fire emergency situation such as a rescue device, first aid kit and adequate communication facilities that have the purpose to detect and extinguish fires as early as possible by using equipment that is moved manually or automatically [13].

Active protection system is a fire protection system that is implemented by using equipment that can work automatically or manually, used by residents or firefighters in carrying out fire operations. In addition, this system is used in carrying out fire prevention. While passive fire protection facilities can be defined as a fire protection system implemented by regulating building components from the architectural and structural aspects in such a way that they can protect occupants and objects from physical damage during a fire [4].

The intensity and the volume of buildings, facilities active protection, facilities passive protection and infrastructure including water potential and potential fire, the distance between regions and the location of availability water sources, environmental roads, yard hydrants, rescue facilities consist of exits, construction of exits, helicopter pad [15-17].

3. Experimental details
The research method that is a description of qualitative and quantitative analysis is equipped with means. Samples are taken randomly, from five regions in DKI Jakarta, assuming the samples taken represent representatives of markets in the DKI Jakarta area.

Carry out surveys assessing the safety system on fire hazard of the traditional market building of 14 buildings PD Pasar Jaya, using the checklist building safety system on fire hazard, then the results were analyzed with means [9,11].

Secondary data, surveys the literature using journals and previous research, books, laws and government regulations on building safety system on fire hazard,

and then explore the data and information management required from the relevant part is the field of care management building safety system on fire hazard PD Pasar Jaya [9,11].

The research design used in this study was a descriptive qualitative research method with a comparative quantitative approach through field observation and evaluation. Collecting primary data with a check list to get an overview of the building active protection devices, and passive protection devices for fire hazard management system needs. Secondary data obtained through reference books, regulation, research reports, related literature [9,11].
The unit under this research includes the site's completeness components namely water sources, yard hydrants. Active protection facility components which include detectors, alarms, sprinklers, building hydrants, fire extinguishers. Components of passive protection include the fire resistance of building structures. Components of life-saving facilities, such as escape facilities, directional signs, emergency exits, emergency lighting, meeting places. As well as fire management system, including fire emergency response organizations, emergency response procedures, and fire drills found at PD Pasar Jaya.

4. Results and discussion
The PD Pasar Jaya building classification is based on minister of man power and transmigration regulation No. Per-04/ MEN/ 1980 is a class A building, a building with a risk of fire from non-metal solid fuels, and class C buildings whose main cause of fire can be caused by installation electricity [11,16,17].

The building classification of PD Pasar Jaya Building based on Ministry of Public Works Decree No. 02 / KPTS / 1985 according to the level of resistance of the main structure to fire is a class A building, that is a building similar to shops and a bazaar whose main structure must be resistant to fire for at least 3 hours. The PD Pasar Jaya building classification is based on Permen PU [5], according to the building division or building part according to the type of designation or its use is a class 6 building, that is, a market building used for trade purposes.

The level of reliability of market fires hazard management system in 14 PD Pasar Jaya buildings in Jakarta is calculated by first filling in a checklist form that has been prepared based on several requirements, guidelines / regulations, and applicable SNI or NFPA [2,3,10].

The value of the level of reliability according to these requirements is categorized into three score, namely "Good" with minimum value of 80, "Fair Enough" with minimum value of 70, and "Less" with a value of 60 or below. Furthermore, the evaluation result of the six factors is carried out as follows:

![Figure 1. Evaluation the importance factors of the safety system on fire hazard PD Pasar Jaya building.](image)

According figure 1, show that the average value of intensity and the volume of buildings is 79 (Fair enough), facilities active protection is 76 (Fair enough), the infrastructure of life-saving facilities is 75 (Fair enough), facilities passive protection infrastructure including water potential and potential fire is 72 (Fair enough), the distance between regions and the location of water sources is 71 (Fair enough). The average value management safety system on fire hazard building is 67 (Less to Fair enough).

Over all the average value 14 building of the safety system on fire hazard is 73 (Fair enough). But there are several findings of observations in some PD Pasar Jaya building, such as: there is not fire...
detection system equipment, there is not equipped with fire control rooms, there is not socialize to visitors and market kiosk tenants about evacuation signs and procedure.

5. Conclusion
The conclusion is the average 14 building of the safety system on fire hazard 73 (fair enough) with the value of intensity and the volume of buildings (79), facilities active protection (76), infrastructure of life-saving facilities (75), facilities passive protection infrastructure including water potential and potential fire (72), the distance between regions and the location of water sources (71) are the most important factors of the safety system on fire hazard PD Pasar Jaya Building for sustainable infrastructure in Jakarta. Other factor is the management safety system on fire hazard building (67).

Some PD Pasar Jaya building need for awareness of the fulfillment of the detection system equipment, provision of fire control rooms, installation of evacuation signs and socialization.

References
[1] Direktorat Jendral Cipta Karya Departemen Pekerjaan Umum 2008 Pedoman Pemeliharaan dan Perawatan Bangunan Gedung, Peraturan Menteri Pekerjaan Umum Nomor : 24/PRT/M/2008 Tanggal 30 Desember 2008 (Direktorat Jendral Cipta Karya Departemen Pekerjaan Umum)
[2] Indonesia National Standard SNI 03-1736–2000 2000 Tata Cara Perencanaan Sistem Proteksi Pasif Untuk Pencegahan Bahaya Kebakaran pada Bangunan Rumah dan Gedung (Jakarta)
[3] Direktorat Pekerjaan Umum PD–T–11-2005 2005 Tentang Pemeriksaan Keselamatan Kebakaran Bangunan Gedung (Jakarta: Pekerjaan Umum)
[4] Peraturan Menteri Pekerjaan Umum RI No.26/PRT/M/2008 2008 Persyaratan Teknis Sistem Proteksi Kebakaran Pada Bangunan Gedung dan Lingkungan (Jakarta)
[5] Ramli S 2010 Petunjuk Praktis Manajemen Kebakaran (Fire Management) (Jakarta: Dian Rakyat)
[6] National Fire Protection Association 10 2002 Standard for Portable Fire Extinguishers, (One Battery Park, Quincy, Massachusetts)
[7] National Fire Protection Association 13 2002 Standard for Installation of Sprinkler Systems (One Battery Park, Quincy, Massachusetts)
[8] National Fire Protection Association 72 2002 National Fire Alarm Code (One Battery Park, Quincy, Massachusetts)
[9] Pontan D 2018 Effect of the building maintenance and resource management through user satisfaction of maintenance International Journal of Engineering & Technology
[10] Pusat Penelitian dan Pengembangan PU 2006 Konsep Pedoman Teknis Pemeriksaan Keselamatan Kebakaran Pada Bangunan Gedung (Bandung: Puslitbang PU)
[11] Pontan D and Maxsi A 2017 Identifikasi Tingkat Keandalan Elemen-elemen Penanggulangan Bencana Kebakaran Gedung PD Pasar Jaya di DKI Jakarta Seminar Nasional Cendikiawan ke 3, Jakarta
[12] Keputusan Menteri Pekerjaan Umum RI No.02/KPTS/1985 1985 Ketentuan Pencegahan dan Penanggulangan Kebakaran Pada Bangunan Gedung (Jakarta)
[13] Iskandar R 2008 Evaluasi Alat Proteksi Kebakaran Aktif dan Gambaran Pengetahuan Pekerja Mengenai Penggunaan Alat Proteksi Kebakaran Aktif di Gedung Wet Paint Production PT International Paint Indonesia Tahun 2008 (Jakarta: Universitas Indonesia)
[14] Peraturan Pemerintah Republik Indonesia nomor 36 tahun 2005 Tentang Peraturan Pelaksanaan UU nomor 28 tahun 2002 Bangunan Gedung. 2005 Kementerian Pekerjaan Umum, Peraturan Menteri Pekerjaan Umum nomor 24/PRT/M/2008 tanggal 30 Desember 2008 tentang Pedoman Pemeliharaan dan Perawatan Bangunan Gedung
[15] Ambar K 2012 Evaluasi Sistem Manajemen Kebakaran Gedung Rektorat universitas Brawijaya (Lt. 1 s.d. 4), Program Pasca Sarjana PSLP Universitas Brawijaya ERUDIO I(1)
[16] Aribowo A B and Agustina J 2012 Kajian Perencanaan Akses Bangunan dan Akses Lingkungan Gedung C Universitas Trisakti Untuk Pencegahan Kebakaran (Jakarta: Universitas Trisakti)
[17] Sekarsari J, Pontan D, Winoto S and Agustina J 2014 Pencegahan Risiko Kebakaran Gedung Elemen-Elemen Penanggulangan Bencana Kebakaran Pada Gedung C, Kampus A, Universitas Trisakti (Jakarta: Universitas Trisakti)