

The Efforts to Increase the Awareness of the Danger of Fire by Using a Daily Assessment on the Safety Level of the Evacuation Route in Apartments (Vertical Housing)

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Abstract: *The building managers and the whole building users, including the tenants of apartments, need to have an awareness of the danger of fire. The increase of the awareness of the whole building users will automatically increase the safety level of the building on the danger of fire. The awareness might increase if there are good examples that the building users can follow or if there are strong penalties imposed by the building managers or the law enforcement for violations. A simple instrument to control the evacuation route in the apartment was developed to increase the awareness of the danger of fire and to assist the efforts to mitigate fire disaster. The instrument in the form of a daily assessment was created using a simple table checklist for an easy use. The number and the locations of the instrument may vary depending on the characteristics of each building. The daily assessment may be used in buildings with a high risk of fire and as a means of evaluation and reporting.*

Keywords: *daily assessment, safety behaviour, safety report,*

I. INTRODUCTION

Since the evacuation system is the main access to safety during fire, it should become the top priority for not only buildings with a high risk of fire[1-3], but also vertical housings such as apartments[4-6]. In many cases, the evacuation system does not receive the much-deserved attention from the apartment building owners[7]. This may lead to difficulty in evacuating the people trapped in the building during fire or may obstruct the fire fighters from reaching the fire hot spots.

To reduce loss due to fire, many topics were developed to combat fire hazards. one of them is the development of equipment for firefighting [8-10], as well as materials used [11]. other than that, the fire control in the form of fire assessment becomes a very interesting topic to discuss[12, 13]. One of the assessments done on fire control is the Ya-Yun WEI assessment which is done based on fuzzy mathematic algorithm and Support Vector Machine (SVM)[14, 15]. Aside from the passive and active fire prevention capability, the evacuation capability and the fire rescue capability are the crucial aspects of fire control[16].

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The fire evacuation needs to take into account the cultural habit of the people in the countries. Michael AP Taylor and Sally K Freeman[17] states that to reduce loss of materials and lives, the evacuation route plan needs to consider the environmental conditions in Australia. It also needs to consider the characteristics of the buildings and materials used in the building. After the identification of the environmental conditions, the separation and the classification of the fire risks can be made.

Fire risk assessment can be done with various methods. for example by Analytical hierarchy Method (AHP) as has been introduced by M. N. Ibrahim et.al[18] for heritage building. while the time range needed for assessment is influenced by the needs and management patterns applied[13]. The instrument in the form of a daily assessment to control the fire hazard was created to improve the safety of the building and to develop good habits for the tenants and the personnel directly responsible for the building management. as has been done by Yu-xi Guan et. al[19] for daily assessment for fire risk on cultural relic building can be done with ZigBee technology.

The daily assessment is a document which oversees the sterilization of the evacuation route starting from the assembly points to the evacuation routes and the supporting equipment. This type of assessment is the simplified form of the complete building assessment for fire. Generally, building managers rarely conduct the complete assessment for the prevention and mitigation of fire since the assessment is considered very costly and the people with the capacity to conduct the assessment are also very rare. Therefore, the schedule to conduct the complete assessment is very tight and not very flexible.

Although all tenants, which include the security guards and the cleaning service staff, need to be aware of the danger of fire, the fire fighters and the building managers are both responsible for reducing the risks of loss of property/materials and lives during fire. All parties need to begin looking out for little things, which are sometimes considered insignificant, but might be important to reduce the fire hazard. The daily assessment instrument is developed to increase the awareness and to reduce the loss caused by fire. Whereas for this study, daily assessment by using instrument that is easy to apply by involving all occupants of the building can be explained in the sub section below



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II. THE IMPLEMENTATION OF DAILY ASSESSMENT TO INCREASE AWARENESS OF FIRE HAZARD

In preparing the daily report instrument, building users, building security staff, and cleaning service staff are expected to take an active involvement in the effort to increase the awareness of fire hazard. Before the content of the daily assessment can be made, the characteristics of the building which are the determining factor for the fire hazard need to be identified. As an example, buildings which are used for offices have different characteristics than buildings which are used as residential buildings. These different characteristics are mostly caused by the different culture of the users. To develop the daily assessment, there are a few influential factors that need to be identified which can be seen in the flow chart below.

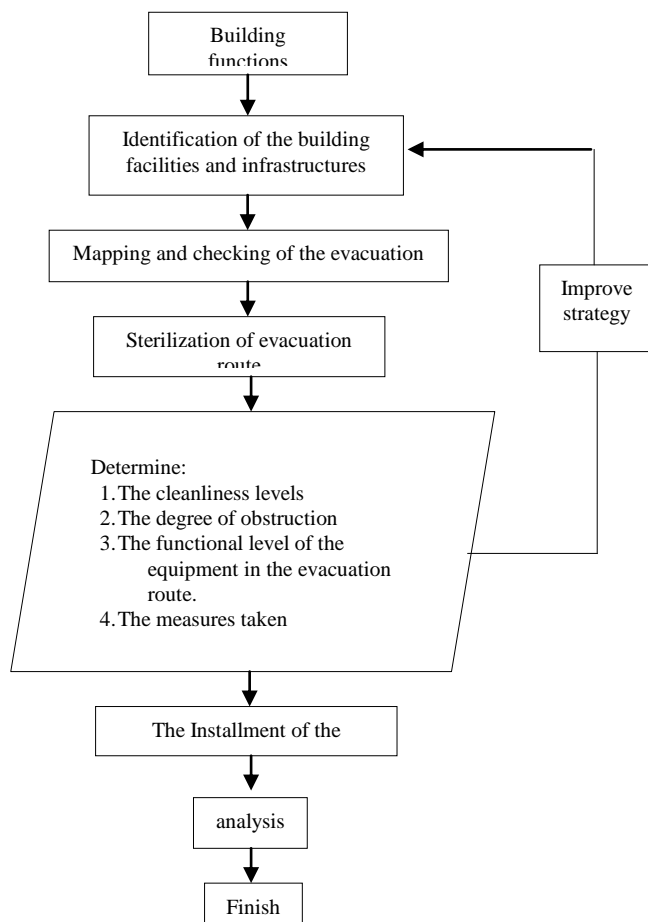


Fig. 1. flow chart of the research

The flow chart above shows how the functions of the high-rise building are used to determine the characteristics of the building structure and the building content while the building utility is used to determine the map of the evacuation route during fire. The information on the utility (for example, the locations of the genset, pump rooms, fire hydrants, sprinkler, and the fire evacuation route) needs to be disseminated and socialized to the whole building users. Generally, this information can only be found in the drawings of the building plan made by the contractor and therefore, the access to this information is limited since it is stored in the engineering room of the building. If this information cannot be accessed, the building users will not be aware it and the building users will care less about the building safety.

III. INSTRUMENT OF DAILY ASSESSMENT

The information on building structure and characteristics must be known by the whole building users. Generally, building materials are divided into the following 5 categories which can be seen Table 1:

Table 1.categories of building materials

Level	Classification	Notes
M1	Non-Combustible	Materials which pass both the combustibility test and the surface test for non-combustion materials.
M 2	Semi Non-Combustible	Materials which pass at least the surface test for non-combustible materials.
M 3	Fire Retardant	Materials which pass at least the surface test for fire retardant materials;
M 4	Semi Fire Retardant	Materials which pass at least the surface test for semi fire retardant materials;
M 5	Combustible	Materials which do not pass the combustibility nor the surface test;

By learning the characteristics of the building, the building managers and users, as well as the security and cleaning staff, will become aware of the fire hazard level of the building they live and work in. The lack of knowledge with the ways and procedures to sterilize the evacuation route may lead to panic and a lack of coordination among the building users during fire. Generally, the maximum time allowed to reach the emergency exits during evacuation can be seen in the Table 2 below:

Table 2.classification of evacuation times

Class	Level of Fire Hazard	Maximum evacuation time
A	Residential buildings with a small risk of fire	2 minutes
B	Residential buildings with a mediocre risk of fire	2.5 minutes
C	Residential buildings with a high risk of fire	3 minutes

The basic evacuation facilities available in the buildings and apartments are normally evacuation route directions, emergency exit doors, emergency stairs, emergency lights along the routes, alternative sources of electricity, and the assembly points. Each facility and infrastructure must function well to guarantee safety for the building users. However, cultural factors also affect the success of the evacuation process during fire.

One factor that may contribute the lack of success during the evacuation process are the lack of control from the building management and the personnel who are related to the safety of the building.



Figure 2. shows one example of obstructions that can often be found in the evacuation route.



Fig 2. An example of obstructions in the evacuation route.

It can be clearly seen in the Figure 2 above that a tenant with the lack of awareness on the danger and the risk of fire stores building materials in the evacuation route. Added with lights which are not functional, this spot becomes an obstacle during fire. The spot will soon become crowded with people trying to

Run into safety and slows down the evacuation process. Meanwhile, the obstacle that can normally be found in the assembly point can be seen in the figure 3.



Fig 3. An example of unsterilized assembly point.

The assembly point should be a safe and sterilized area without anything on it. Aside from becoming a place where people gather during the evacuation process, the place is also used to assist to collect data on the survivors during fire.

However, the above examples are only temporary arrangements which can still be prevented. Simple and routine identifications can be done to prevent these from happening and to increase the awareness of fire hazard. The following are the table which can be used as the instrument for daily observation of the evacuation system in the apartment (see table 3, below).

Table 3. Identification of problems (disruption, obstructions, or waste)

No	Aspects	Month.... Week							Notes
		Mon	Tue	Wed	Thu	Fri	Sat	Sun	
1	Evacuation routes (directions)	√	√	√	-	-	-	-	damaged or missing
2	Emergency exit/fire doors	√	√	√	-	-	-	-	Locked or unlocked
3	Emergency lights	-	-	-	√	√	-	-	switched off or ready
4	Other sources of electricity	-	-	√	√	-	-	-	Available or not
5	Emergency stairs	-	-	-	-	√	√	-	Sterile or not
6	Other supporting equipment	-	-	-	-	-	√	√	Oxygen analyser, exhaust fan
7	Assembly points	-	-	-	-	-	-	-	Sterile or not
Person-in-charge: mr P									

Note (√): field checks (identification of problems/issues)
(-): no problem/issues found

From the table above, direct observation and early identification of obstructions in the evacuation route are done every day at certain times and certain personnel are assigned for the task. The number of the personnel assigned may depend on the personnel and the capacity available for the task. As an example, a building with a limited number of personnel may assign the security staff or cleaning service staff to assist the safety check and observation. They may help observing the cleanliness of the emergency stairs and the

evacuation routes, checking obstructions in the emergency exit doors and making sure that the fire doors are not locked.

Each daily assessment table is placed not only in the engineering staff room or in the fire control room, but also in each of the aspect controlled. This is done so that any building users may help detect any disruption, any obstruction, or any safety issue. It can be placed in each assembly point,



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emergency exit door, and emergency stair.

From the daily assessment (table 4), a weekly assessment can be prepared which can be used as the maintenance report

and the improvement for the following months. Table 4 below is the example of a monthly report for identification of issues.

Table 4. Daily assessment which can be used as the monthly evaluation on the evacuation routes.

Aspects	Month												Notes	
	1	2	3	4	5	6	7	8	9	10	11	12		
Evacuation routes	-	-	-	√	-	-	-	-	-	-	-	-	-	Replacement of direction signs
Emergency exits/doors	-	-	-	-	√	-	-	-	-	-	-	-	-	Replacement of keys
Emergency lights	-	-	-	-	-	-	√	-	-	-	-	-	-	Need to be Replaced
The cleanliness of the emergency stairs	-	-	√	-	√	-	√	-	-	√	-	√	-	cleaning
Assembly point	-	-	-	√	-	√	-	-	-	-	√	-	-	cleaning

Note (√): field checks (actions/ problems/issues)
(-): no problem/issues found

Table 5. The personnel assigned to conduct daily observation in the evacuation routes.

No	Aspect	Month.... Week							Note
		Mon	Tue	Wed	Thu	Fri	Sat	Sun	
1	Mr P	√	-	-	-	-	-	-	Replacement of direction signs
2	Mr Q	-	-	-	√	-	-	-	cleaning
3	Mr R	-	√	-	-	-	-	-	cleaning
4	Mr S	-	-	√	-	-	-	-	cleaning
5	Mr T	-	-	-	-	-	-	√	Replacement of keys
6	Mr U	-	-	-	-	√	-	-	cleaning
7	Other Person								
Chief engineer					Mr O				

Note (√): field checks (actions/ problems/issues)
(-): no problem/issues found

By using the instrument above, the whole building users and the building managers may easily identify the fire hazard and be involved in the evaluation.

hazard, the involvement of the building users to sterilize the evacuation routes and to maintain/use the daily control instrument will increase the awareness of the fire hazard

IV. THE RESULT OF EVALUATION

As the result of the daily instrument development, the instruments are not only placed in the engineering room, but also in places where the security and the cleaning staff can access so that they can also observe and record the conditions of the evacuation routes. Specially for the security staff, the observation can be done during shift changes so that it does not disrupt their main task which is to secure the building. The Table 5, shows an example of table which includes the names of the personnel which are assigned to conduct daily direct observation in the evacuation routes.

By using the above Table, the personnel many easily assess the existing obstructions. Broken equipment and damaged components can be repaired or replaced immediately after identification. The building users indirectly act as the objects of observation, for example, when a security guard forbids cars to park in the areas designated as assembly points or when the building managers forbid building users from storing goods in the emergency stair areas.

The evacuation/fire drills which involve the whole building users can be done once in three months each year or depending on the policy of the building management. The periodic evacuation drills help guarantee the cleanliness and the sterilization of the evacuation routes in apartment buildings. Aside from increasing the knowledge of the fire

V. CONCLUSION

The table instrument was developed so that the table can easily be filled out with the safety aspects of the fire. By including the whole aspects of the fire protection, facilities/means and infrastructures in the assessment, the instrument may help assess the safety aspects of building in a short amount of time without having to wait for the whole building evaluation. The placement of daily control instrument in strategic locations also enables the direct involvement of building users in the assessment. The study found that the daily assessment was able to avoid errors, damage and obstruction during fire.

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