

The Effectiveness of Installation Evacuation Signs on the Success of the Rescue Process in the 3-Floor Elementary School Building

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ABSTRACT

Yasmin Madaniah, 2026, The Effectiveness of Installation Evacuation Signs on the Success of the Rescue Process in the 3-Floor Elementary School Building

Schools must create an environment that is safe from disasters, one of which is safe from fire for their residents, especially elementary schools, where the majority are made up of children. The school which is the object of this research is one of the elementary schools in the Central Jakarta area which has a building height of up to three floors. With the height it has, the potential for other hazards to emerge in the evacuation process will be even higher because the shortest possible evacuation time is a way to reduce disaster victims. Therefore it is necessary to arrange proper evacuation guides. The research was conducted to determine the effectiveness of installing evacuation signs on multi-storey elementary school buildings. This type of descriptive qualitative research using a survey method was carried out by considering the characteristics of the children and the physical condition of the environment as well as information from related parties to solve the problem. The results of the study found that clear and orderly installation of evacuation signs in elementary schools can affect the success of the evacuation process in the event of an emergency. Having clear and regular evacuation signs makes it easier for students, teachers and staff to identify evacuation routes to follow in an emergency. Even though the environment is a familiar place because it is inhabited every day, installing these signs will speed up evacuation time and prevent confusion and panic. However, teachers and school staff are also the biggest influence in the success of an evacuation by guiding students to go to a safe place.

Key Words: Evacuation, Elementary School, High-rise Building, Rescue

INTRODUCTION

Fire is a serious emergency that can cause casualties, property damage, disruption of activities, and substantial social and economic losses. In densely populated urban areas, the consequences of fire can become more severe because buildings are located close to one another and access for emergency services may be limited. This condition remains relevant in DKI Jakarta, where fire incidents continue to occur every year. Official data from the Provincial Government of DKI Jakarta recorded 864 fire incidents in 2023 and 789 incidents in 2024, with electrical short circuits identified as one of the main causes [1]. These figures demonstrate that fire remains an important urban safety issue and emphasize the need for effective prevention, preparedness, and evacuation measures, particularly in buildings occupied by vulnerable populations.

Schools are among the public facilities that require particular attention in fire-safety management because they accommodate large numbers of children for considerable periods of time. The Statistik Pendidikan 2025 published by Statistics Indonesia provides an updated overview of the scale and conditions of education in Indonesia based on the March 2025 National Socioeconomic Survey and school registration data for the 2024/2025 academic year [2]. Ensuring that school environments provide adequate physical protection is also consistent with the current Indonesian education policy. Regulation of the Minister of Primary and Secondary Education of the Republic of Indonesia Number 6 of 2026 concerning a Safe and Comfortable School Culture emphasizes physical protection and the establishment of a conducive and safe learning environment for all members of the school community [3]. Therefore, school safety management should include preparedness for emergencies such as fire, supported by appropriate facilities, procedures, and human-resource readiness.

Children require particular consideration during fire emergencies because their ability to recognize hazards, interpret emergency information, determine appropriate actions, and move independently may differ from that of adults. Studies of evacuation involving young children indicate that pre-movement behavior is strongly influenced by instructions, routines, and assistance from adults [4]. Children's movement characteristics during evacuation are also affected by age and building conditions, particularly when stairs and other vertical circulation routes are involved [5].

More recent research on fire drills in educational facilities found that children frequently require assistance during evacuation, especially on stairs, and that more frequent drills are associated with fewer evacuation problems [6]. These findings demonstrate the importance of introducing fire-safety knowledge and evacuation procedures from an early age so that children can recognize hazards and respond appropriately when an emergency occurs.

Fire-safety education and training are therefore important components of school disaster preparedness. Modern fire-protection education for elementary school students should not be limited to theoretical explanations but should also involve appropriate learning methods that enable children to understand hazards and appropriate responses [7]. Fire evacuation training has been shown to improve familiarity with emergency procedures and perceived preparedness, while early exposure to safety education may support the retention of knowledge and appropriate behavior [8]. Evidence from Indonesia also demonstrates the benefit of practical fire-safety interventions. A study involving students at SMA X Depok found a significant improvement in students' knowledge following fire simulation activities and recommended conducting fire drills regularly in cooperation with local fire departments [9]. Consequently, fire prevention programs in schools should integrate education, simulation, and regular practice rather than relying solely on verbal information.

In addition to education and training, effective school fire-safety management requires adequate fire-protection facilities, clear emergency procedures, trained teachers and staff, accessible evacuation routes, and appropriate life-safety facilities. Research on fire-safety management in schools has demonstrated that weaknesses in preparedness, training, management programs, and fire-protection facilities can increase the vulnerability of school occupants during emergencies [10]. School evacuation studies also emphasize that building configuration and evacuation procedures can substantially influence how occupants respond and move toward safe areas [11]. For this reason, fire preparedness should include the ability to activate emergency warnings, communicate the emergency, assist students who require help, use predetermined evacuation routes, and move occupants toward designated safe assembly points. These measures should be practiced periodically so that teachers, education personnel, and students understand their respective responsibilities before an actual emergency occurs [6], [9], [10].

One particularly important component of evacuation preparedness is the availability of evacuation-route and emergency-exit signs. Evacuation signs provide visual information that assists occupants in identifying the direction of travel and locating a safe exit, especially when rapid decisions are required. A 2025 systematic review of school safety signs found that their effectiveness is influenced by design characteristics, visibility, comprehensibility, age-related cognitive abilities, and the context in which the signs are displayed [12]. Research involving primary school students has further demonstrated that adult guidance and graphical evacuation signs can improve evacuation performance, including under conditions of reduced visibility [13]. Simulation studies in primary school buildings have also shown that evacuation time is influenced by route configuration, bottlenecks, occupant characteristics, and building layout [14]. Therefore, evacuation signs should not merely be installed as administrative requirements but should be positioned and designed so that children can recognize, understand, and follow them rapidly during an emergency.

Based on a preliminary survey conducted at SDN X Jakarta, the school occupies a three-story building located very close to a densely populated residential area. This physical condition may increase the potential consequences of a fire because flames and smoke could affect surrounding buildings, while the relatively narrow access to the school may create difficulties for large fire-fighting vehicles. The multi-story configuration also requires students to use vertical evacuation routes, making evacuation time, route selection, adult assistance, and clear directional information important aspects of life safety. Previous studies have demonstrated that children may experience difficulties during evacuation, particularly on stairs [5], [6], while clearly designed safety signs can assist wayfinding and improve evacuation effectiveness [12], [13]. Furthermore, simulation research indicates that efficient route planning can influence the time required to reach a safe location [14]. Based on these considerations, this study aims to determine the effectiveness of installing evacuation-route signs on the success of the evacuation process among elementary school occupants, particularly from the perspective of life safety at SDN X Jakarta.

MATERIALS AND METHODS

This study used a descriptive qualitative research type with a literature review that attempted to describe the effect of installing evacuation route signs on the success of the evacuation process in elementary schools. In this study, various

written sources such as journals and relevant documents were used as secondary data. Components of life-saving facilities for evacuation signs were analyzed according to what was stated in DKI Jakarta Regional Regulation number 8 of 2008. Data on this matter was collected by direct observation and interviews with school principals, as well as surveys by school officials and designated students..

Condition of School Buildings

The characteristics of a building to meet fire safety standards are Permen PU No. 28 of 2002 that all buildings other than residential buildings must be equipped with passive and active protection systems, including elementary school buildings. The safety of children's lives is threatened if the school building is not equipped with facilities and infrastructure related to fire safety and training for teachers, principals and guards in the event of an unwanted incident. One of the most important aspects of a school building is the provision of means of egress. Safe and effective evacuation routes are an important aspect when a fire occurs, because it can help occupants efficiently escape from the fire area to arrive in a safe area.

The X elementary school building has a land area of 1,740 m² consisting of 3 levels with two access stairs, namely on the west and east sides of the building. The building is still in the stage of repair and development of facilities and infrastructure. The evacuation route facilities have been supported by the presence of two well-maintained access stairs. Evacuation route marking is provided in an effort to educate on fire safety by installing it on each access road to the stairs with 2 exit routes to the same gathering point with different exits.

Table 1. Facilities and Infrastructure at SDN X Jakarta

Room	Quantitiy	Location
Classroom	27	Floor 1, 2 & 3
Science Laboratory	1	Floor 2
Library	1	Floor 1
UKS	3	Floor 1
Canteen	1	Floor 1
Teacher`s Room	1	Floor 1
Warehouse	1	Floor 2 & 3
Field	2	Floor 1

The table above was obtained through a direct field survey so that a number of data regarding the facilities and infrastructure found in the elementary school were obtained. It is known that the Elementary School has a total of 27 classrooms divided on three different floors. On average, students in grades 1 and 2 have classrooms on the 1st floor, floors 2 for grades 3 and 4 and classrooms 5-6 on the 3rd floor. This is done by the school to minimize any risks that might arise occurs when unforeseen circumstances occur such as a fire, so that this facilitates the evacuation process for students who are at a vulnerable age. The school building has a lot of unused and poorly maintained space which results in a high fire risk due to a lack of supervision. As for the position of the teacher's room which is on the 1st floor, which with classroom conditions reaching 3 floors can have an impact on a lack of supervision for students when doing something dangerous.

Based on the results of interviews with the school, it was explained that before December 2022 all school buildings did not yet have evacuation route signs and were less sensitive to awareness of the dangers of fire, however this was continuously improved after fire counseling was conducted and efforts were made to be more aware of fire hazards starting from sources of risk fire hazards and how to deal with fires. One of the schools took the initiative to carry out fire extinguishers as an effort to prevent and avoid fires.

Evacuation Sign

High-rise buildings have the potential to cause casualties in an emergency, because they can accommodate many people. Therefore it is necessary to have a good evacuation plan by providing fire prevention and control facilities by arranging evacuation access so as to speed up the occupant evacuation process and minimize the risk of casualties.

Direction signs are an important component for building occupants to find a way out if the situation encourages them to evacuate. During evacuation, occupants tend to choose to move towards familiar routes. But the study said demonstrated that emergency signs can affect people's behavior during an evacuation depending on how visible they are.



Figure 1. Evacuation Signs in Indonesia

Source : (Endradita 2021)

Installation of evacuation signs in general must be easily identifiable so that people can easily see them, apart from being easily visible, the installation of signs must also not be obstructed with a green base color and white writing with the ability to glow in the dark. The size of the writing and the distance between the evacuation signs must be proportional. Placement in the room can be combined according to the conditions of the placement of goods and the layout conditions of the room (Endradita 2021). Installation of signs on the wall can be done with the following provisions:

1. Installed on the wall with a height from the floor between 20-40 cm
2. And or mounted on the wall with a height from the floor between 140-170 cm
3. And or hung in a certain area that shows the direction of evacuation to a safe gathering point, easily identified, seen and not obstructed.
4. If using a pole in the area towards the field or a safe gathering point with a height of between 175-200 cm. The pole is not easy to shift and strong.
5. Maximum exit sign is installed 20 cm above the emergency door/access to exit the building.
6. Assembly point is installed at a predetermined gathering location at a safe location.



Figure 2. Exit Sign



Figure 3. Assembly Point

Source : (Endradita 2021)

The marking of means of egress is in accordance with SNI 03-1746-2000 and Permen PU No. 26 of 2008, means of egress in a building must be marked. Exit markings must be in place at each exit door that is required to exit, in addition to that, an exit sign that can be felt must be palpable and has complied with the applicable provisions. Exit markings must be placed so that no point on the exit access corridor is placed more than 30 m from the nearest sign..

The egress marking below which is to be installed must be placed at a vertical distance of not more than 20 cm above the upper end of the egress opening intended by the marking. Egress markings shall be located at a horizontal distance

not wider than that required for the egress opening, intended to be indicated by the marking to the nearest end of the marking.

RESULTS AND DISCUSSION

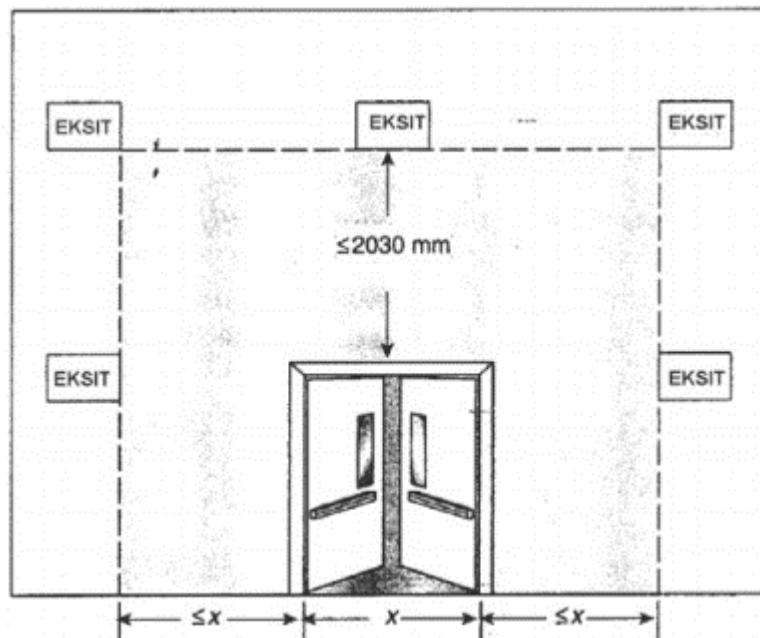


Figure 4. Installation of exit signs
Source : Permen PU No.26 of 2008

The location of the research was conducted at an elementary school in Central Jakarta. The elementary school building has three levels of floors where most of the teaching and learning process is carried out on the 2nd and 3rd floors. Based on the results of the field survey, it is known that the environmental conditions around the school building are densely populated and are located in close proximity to other schools. Access to reach the location of the elementary school building which is used as the object of research is quite difficult for fire engines to access because it is not on a relatively narrow road for fire engines to reach that location. Evacuation system is the main access to safety during fire, it should become the top priority. Therefore it is important to pay attention to access to a way out in mitigating an unexpected disaster where the majority are in the vulnerable category with a walking speed of 1.32 m/s.

Evacuation Route

Evacuation routes are designed to find the shortest route using existing roads so that the time needed to reach a safe area can be reached in a short, fast and precise distance. The fire evacuation needs to take into account the cultural habit of the people in the countries. Therefore the building has two different access stairs up and down with each different exit. The installation of evacuation routes in this school building has been carried out on each floor and there is a marking of the location of the gathering point which is located on the 1st floor of the field at the front of the school building which is usually used as a vehicle parking area. The evacuation route for this three-storey elementary school building has two different routes for exit access. The following shows the evacuation route markings in one of the three-story elementary school buildings in Central Jakarta.

The image above shows one of the evacuation routes from the third floor to the assembly point. The marking of evacuation routes in this building is quite good and in accordance with applicable regulations, it's just that the installation of evacuation route signs on the walls is considered inefficient because with a green background and the many posters mounted on the walls, the function of placing evacuation route signs becomes not maximal. This is because the posters on the walls are seen as more conspicuous than the evacuation route signs. Therefore it is necessary to make changes, if changing the color of the walls is not possible, changes can be made by moving the placement of posters on the school bulletin so that the evacuation route sign becomes more optimal considering its function as a guide to a gathering point or a safe place. In addition, the exit sign building at the gate leading to the gathering point has not been installed which will cause confusion and delays in the evacuation process where the branching after this gate can go to the central field instead of heading to the gathering point which is a safe point because it can go straight to the release exit.

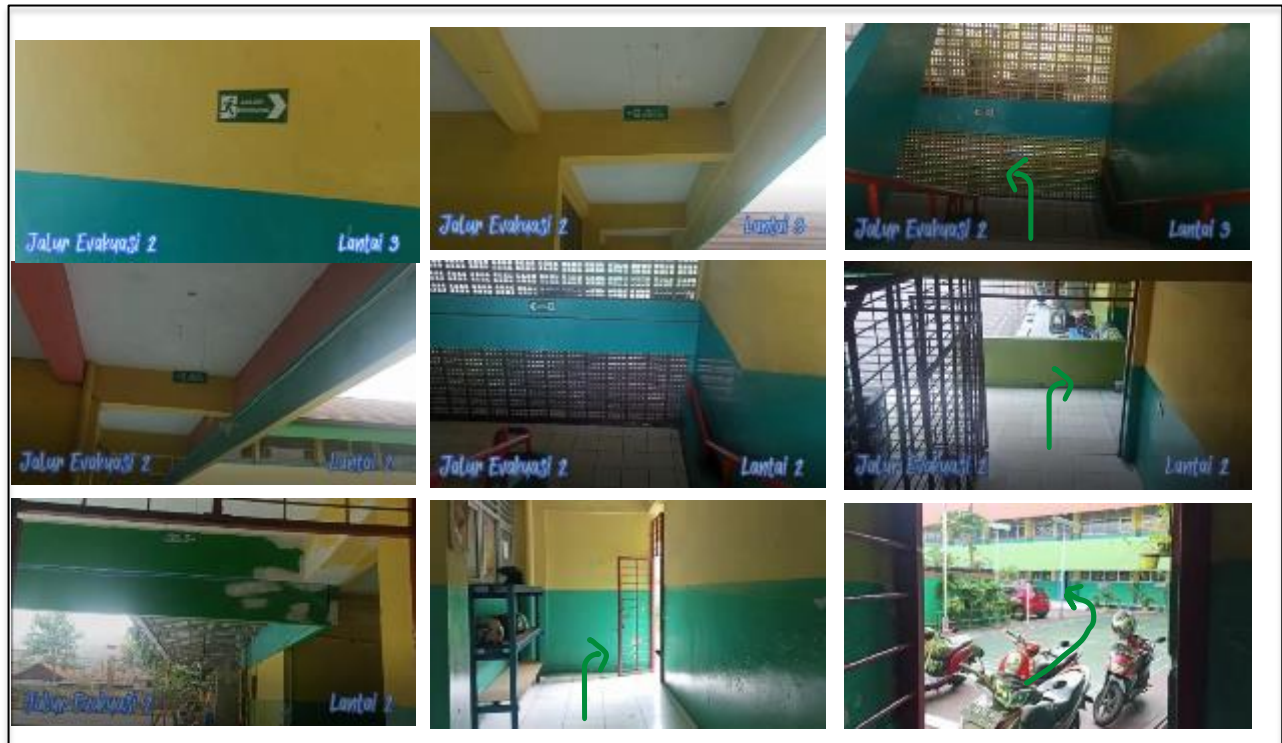


Figure 5. 2nd Evacuation Route

The picture above shows another evacuation route route using a different ladder from the main ladder. This route is more accessible for classrooms on the east side. It is feared that this route will not be used optimally because if the school continues to let students use the main stairs as access up and down it will cause a buildup on the main stairs later. For routes to the two buildings, this building is in accordance with the standards, it's just that the exit door cannot be considered an exit because it only has a width of ± 60 cm which if this door is used as an exit in an emergency situation can cause accumulation which causes delays in the evacuation process. This door leads directly to the release exit and gathering point, it's just that there is no exit sign above the exit indicating the way out.

The stairs used for the evacuation route are stairs that are usually used up and down from the 1st to the 3rd floor and vice versa. Route 1 is the main route that is commonly used for students to access the way up and down because this ladder is the main staircase in the building making it easier for students to reach most of the class areas which are both on the 2nd and 3rd floors. The duration of time required to get down from the 3rd floor to the gathering point under normal circumstances is around ± 1 minute.

Unlike the 1st route, the 2nd evacuation route has a different exit route to reach the gathering point. In this route, the stairs on the east side are used, where these stairs are slightly hidden compared to the main stairs with the exit which is known to be smaller than the route 1 exit. This route is effectively used for those in the east side of the classroom, where the design this building this room is slightly jugged and angled so that the most appropriate access to go up and

down is by using this east staircase. The duration of time needed to get down from the 3rd floor to the gathering point under normal conditions on this route is slightly slower than using route 1, this is due to the location of the main staircase being more efficient and easier to reach than the east stairs, only Of course, if left unchecked, there will be accumulation on the main stairs if the installation of evacuation signs is not accompanied by giving warnings and outreach to students as building users in their daily activities at school.

Exit Access

High-rise buildings have unpredictable risks, so easy access to evacuation in the event of an emergency is very important. So, it is necessary to plan a good evacuation process so that casualties or other losses can be minimized. Arranging evacuation access is also important to speed up the occupant evacuation process so as to minimize the risk of casualties, with an evacuation route that shows directions to exit the building or to a safe shelter can help building occupants to save themselves more quickly.



Figure 6. Exit access

From the picture above it can be seen that the two routes have two different exits leading to the gathering point which is on the front side of the building, the field in the middle of the building cannot be used as a gathering point because it is still considered dangerous because the exit release does not go directly to the main road and is a dead end. In this elementary school building, it is divided into two exit accesses. The difference in exit paths is carried out to minimize the buildup that may occur in the event of a disaster, especially a fire. Evacuation route marking is considered effective and in accordance with applicable standards. However, the use of stairs as emergency stairs cannot be said to be effective because they are not in accordance with the provisions of Permen PU No. 26 of 2008, where the main condition is that the location of the stairs must be separate from the open stairs or activity stairs because emergency stairs must have a protector so that people passing by can be protected from blaze.

CONCLUSION

Installing clear and orderly evacuation signs in elementary schools can affect the success of the evacuation process in the event of an emergency. This can also be seen from the condition of the school environment which is quite extensive so that with clear and orderly evacuation signs, students, teachers and staff will more easily identify evacuation routes to follow in the event of an emergency. Even though the environment is a familiar place because it is inhabited every day, installing these signs will speed up evacuation time and prevent confusion and panic. With properly installed evacuation signs, students and teachers will get used to seeing and paying attention to evacuation

routes. This can increase their readiness and awareness of evacuation measures in the event of an emergency, because by simply looking at the evacuation signs every day indirectly this will be well ingrained for students to be more focused in the evacuation process. Apart from providing information about evacuation routes, evacuation signs can also warn of potential hazards in an area or room. This allows students and teachers to take precautions before an emergency occurs. With prompt and regular evacuation, the risk of injury or loss of life can be minimized. Evacuation signs that clearly frame the area can help guide students and teachers directly to a safe place. Overall, installing evacuation signs correctly and according to the guidelines can maintain the safety of students and teachers in elementary schools and increase the effectiveness of evacuation when an emergency occurs.

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