

Management Perspective of Fire Hazard Vulnerability of Shopping Centers in Bangladesh: A Case Study of Savar Municipality

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Abstract

Fire hazards have become a major concern in rapidly urbanizing areas of Bangladesh, particularly in commercial buildings where large numbers of people gather. Shopping centers are especially vulnerable due to high occupancy, complex building layouts, and the presence of combustible materials. Despite several major fire incidents in the country, many shopping centers still lack adequate fire safety measures. This study aims to assess the fire hazard vulnerability and fire safety level of shopping centers in Savar Municipality. The study covers 29 shopping centers officially listed by the Savar municipality. Both primary and secondary data were used for the analysis. Primary data were collected through field surveys, office interviews with shop owners' associations, and expert opinion surveys, while secondary data were obtained from previous studies and reports. Fire hazard vulnerability was assessed using the Analytical Hierarchical Process (AHP), a multi-criteria decision-making method that determines the relative importance of different vulnerability factors. Thirteen indicators were considered, including number of stories, floor area, accessibility, open space between buildings, fire sources, staircase width, firefighting tools, emergency exits, and fire drills. In addition, the fire safety level of shopping centers was evaluated using a checklist method based on nineteen fire safety indicators. A Fire Safety Rating (FSR) score was calculated for each shopping center to determine its safety level. The findings show that about 34.48% of the shopping centers fall under the high vulnerability category, while 41.38% are moderately vulnerable. Furthermore, 58.62% of the shopping centers have poor fire safety conditions. The study highlights the need for strict enforcement of building codes, improved firefighting facilities, and regular fire safety management practices to reduce fire risk and ensure safer commercial environments.

Keywords: Fire Hazard Vulnerability, Fire Safety Assessment, Shopping Centers, Analytical Hierarchical Process (AHP), Savar Municipality.

Introduction

Fire hazard in buildings can be defined as the potential of accidental or intentional fire to threaten life, structural, and property safety in a building (Kodur et al., 2019). With rapid

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development across the globe, fire hazard in buildings have undergone significant transformation in terms of severity and versatility and have become a growing concern in recent years (Brushlinsky *et al.*, 2017). Fire hazard has become a very common issue for Bangladesh, especially in urban areas (Rahman *et al.*, 2015). In recent few years, many fire incidents have taken place in urban areas. It is needless to argue that the potential risk of fire is higher in garment factories, industries, cinema halls, offices in tall buildings, high rise apartments, commercial buildings and shopping centers (Tasnim *et al.*, 2025 and Tabassum, *et al.*, 2014). In recent years, serious fire hazard occurred in Banga Bazar, Dhaka New Super Market, Bashundhara City, BSEC Bhaban, Japan Garden City, Nimtoli etc. On November 24, 2012 a catastrophic fire took place in Tazreen Fashion factory killing 117 people. In April 2009, at Shah Ali Bah Slum of Mirpur - 2, fire left 200 families shelter less (Burke, J. and Saad, H., 2012). Fire hazard vulnerability of urban dwellers has been increased due to reckless building construction. In most cases, lack of proper precautionary measures along with the institutional inefficiency, insufficient firefighting equipments and lack of public awareness are making the situation worse (Islam and Raja, 2008).

Fire risk is considered as the major catastrophic risk for any shopping center. (Tabassum, *et al.*, 2014). On the other hand, shopping centers of Bangladesh have failed to incorporate the factor of fire safety in overall design process of the shopping centers. It is evident from different newspaper reports and research that maximum shopping centers have no proper preparation for fire management and there is also shortage of necessary fire safety management tools. So, if any fire incidents occur, it may cause human life losses and damage of properties (Islam, 2017).

Savar Municipality is a Class "A" Municipality that contains a large area with big size population. There are many shopping centers in this area. To meet the demand of people some shopping centers are also developing and it is expected that in near future more shopping centers will also be developed here. Like other urban areas of the country, the most of the shopping centers of Savar Municipality are more or less vulnerable for occurring fire accident due to a wide range of reasons. From various relevant research it is observed that till now much research has been conducted on the issue of fire hazard including fire risk assessment, hazard analysis and fire prevention measure for residential and industrial areas. But no mentionable in-depth study on fire hazard problem of shopping centers in Savar Municipality has been carried out. In this context, the present research is aimed to assess the fire hazard vulnerability level and fire safety level of shopping centers of Savar Municipality. The major objective of this research is to determine the fire hazard vulnerability level of the shopping centers by Analytical Hierarchical Process (AHP) and assess the fire safety level of the shopping centers by Checklist method at Savar Municipality. This research is also aimed to recommend some guidelines to improve the present condition.

Methodology of the Research

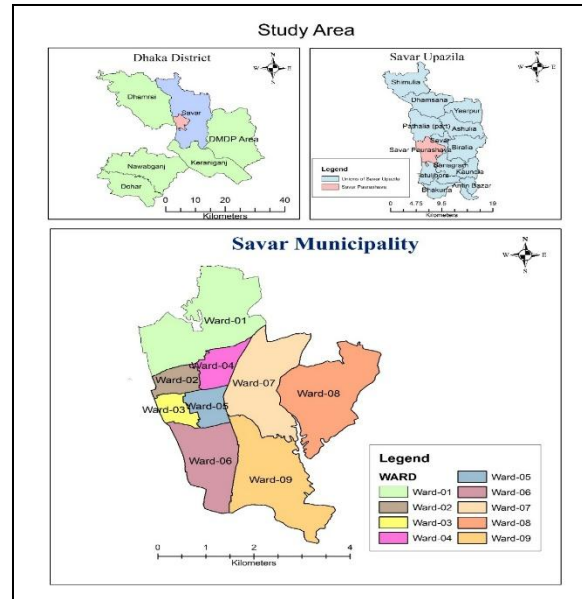
Selection of the study area: Savar Municipality was selected as the study area due to its status as a Class “A” municipality with a large and rapidly growing population. The area has experienced significant commercial development, resulting in the establishment of numerous shopping centers, with several more currently under construction to meet increasing consumer demand. Similar to many urban areas in the country, shopping centers in Savar are vulnerable to fire hazards due to various structural factors. Despite this risk, no comprehensive research has yet been conducted on fire hazard vulnerability in these facilities. Therefore, all 29 shopping centers officially enlisted by the municipal authority were selected to analyze the overall fire hazard vulnerability in the area.

Data Collection: For this study, information and data were collected both from “Primary” and “Secondary” sources. “Primary data” were collected through “Field Survey”, “Office Interview” and “Expert Opinion Survey” in order to fulfill the requirements of this study. “Secondary data” were collected from various sources.

Hazard Vulnerability Assessment - The Concept of Analytical Hierarchical Process (AHP): Analytical Hierarchical Process (AHP) is one of Multi Criteria decision making method that was originally developed by Prof. Thomas L. Saaty(1980). In short, it is a method to derive ratio scales from paired comparisons. AHP allows some small inconsistency in judgment because human is not always consistent. It is also a comprehensive, logical and structural framework, which allows improving the understanding of complex decisions by decomposing the problem in a hierarchical structure.

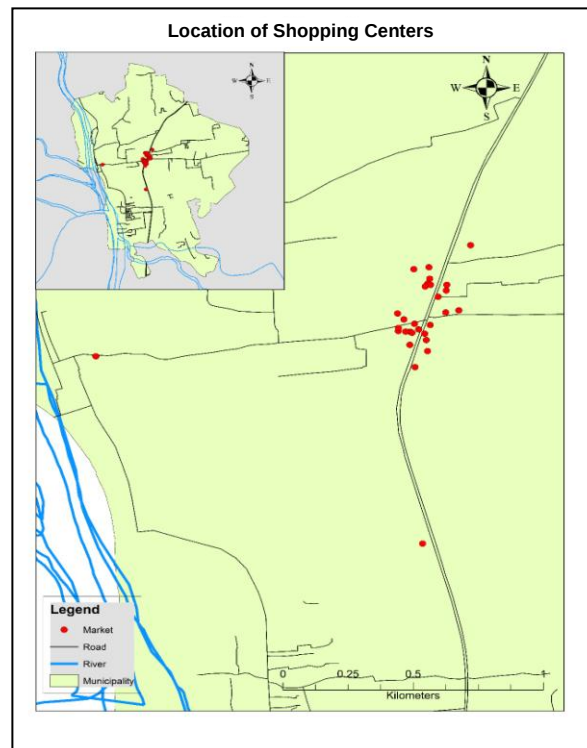
Factors Use in AHP for Determining Vulnerability: For this study, based on expert opinion, seven factors were selected to determine the vulnerability of shopping centers to earthquake. These factors are: (1) Building Type, (2) Number of Floors, (3) Age of Building, (4) Area of Plot, (5) Land Use, (6) Road Width and (7) Soil Type. By the similar way thirteen factors were selected for determining vulnerability of shopping center to fire hazard. These factors are: (1) No. of Story, (2) Floor Area, (3) Accessibility, (4) Open Space between Two Buildings, (5) Fire Source around Building, (6) Use of the Building, (7) Fire Source in Building, (8) Nearby Water Body, (9) Width of the Stair Case, (10) Fire Fighting Tool, (11) Fire Fighting Drill, (12) Emergency Exit and (13) Emergency Exit Sign.

Defining Vulnerability Category: After calculating the vulnerability scores of the selected structures under study by AHP, the vulnerability of these structures were categorized into four types – (1) Low Vulnerability, (2) Moderately Low Vulnerability, (3) Moderate Vulnerability and (4) High Vulnerability (Das, 2018).



Source: Field Survey, 2025

Figure 01: Base Map of the Study Area



Source: Developed by the Authors, 2026

Figure 02: Location of Shopping Centers at Savar Municipality

Defining Vulnerability Category: After calculating the vulnerability scores of the selected structures under study by AHP, the vulnerability of these structures were categorized into four types – (1) Low Vulnerability, (2) Moderately Low Vulnerability, (3) Moderate Vulnerability and (4) High Vulnerability (Das, 2018).



Source: Field Survey, 2025

Figure 03: Photograph of Some Shopping Centers at Savar Municipality

Assessment of Fire Safety Level - The Concept of Checklist Method: The Bangladesh Fire Service and Civil Defense (BFSCD) uses this method when certifying buildings for fire safety (Uddin, 2019). In this research, the checklist method was applied to assess the fire safety level of selected shopping centers. Experts assigned importance values (weights) from 1–10 to different fire safety factors, representing the maximum possible score for each factor. Based on field survey data, experts then awarded obtained scores within that range. The total and obtained scores across 19 sub-factors under three major categories were summed to produce a numerical fire risk index for each building. These factors were selected by expert opinion survey. **Table 1** shows the factors with

importance value. The importance value of these factors was also assigned by fire experts.

Table 1: Factors with Assigned Importance Value for Assessing Fire Safety Level of Shopping Centers by Checklist Method

Factors		Importance Value (Out of 10)
Location related Factors	F1 Accessibility	10
	F2 Open space in between two apartments	6
	F3 Power lines and transformer	7
	F4 Nearby water sources	4
	F5 Fire station	5
Fire Escape Route Related Factors	F6 General stairwell	5
	F7 Emergency exit	10
	F8 Fire safety sign and symbol	8
	F9 Lift with fire switch	3
Fire Fighting Tools Related Factors	F10 Fire alarm	7
	F11 Fire extinguisher	10
	F12 Hose reel	8
	F13 Smoke detector	7
	F14 Heat detector	7
	F15 Water reservoir	8
	F16 Stand pipe	6
	F17 Wet riser and Dry riser	5
	F18 Fire sprinkler	5
	F19 Fire drill	10
Total		131

Source: Expert Opinion Survey, 2025

Calculating Fire Safety Rating (FSR): After completing the survey, obtained marks or values are given for each factor on the basis of different legislation's standards. Then Fire Safety Rating (FSR) is calculated. After the summation of all assigned weights (importance value) and obtained marks or values of all factors, the total of obtained marks or values is divided by the total weights and finally multiplying with 100. The Fire Safety Rating (FSR) was calculated by the following equation (Uddin, 2019):

$$\text{FSR} = (\text{Total achieved values} / \text{Total weights}) * 100$$

The FSR score ranges from 0 to 100. The FSR score represents the overall fire safety level of a building. Here high score indicates higher safety level and low score indicates low safety level (Uddin, 2019).

Defining Fire Safety Level Category: For this study, fire safety levels of the selected shopping centers were classified into the following five categories with help of “Expert Opinion Survey”:

Table 2: Fire Safety Category of Selected Shopping Centers

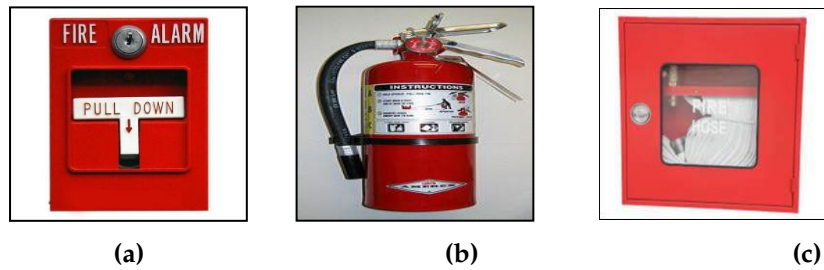
FSR Score	Fire Safety Category
0-15	Very Poor
16-30	Poor
31-45	Average
46-60	Good
Above 60	Excellent

Source: Developed by the Authors, 2026 with help of “Expert Opinion Survey, 2025”

Standard to Assign Marks or Values to Different Factors of Checklist Method to Determine Fire Safety Level of Shopping Centers

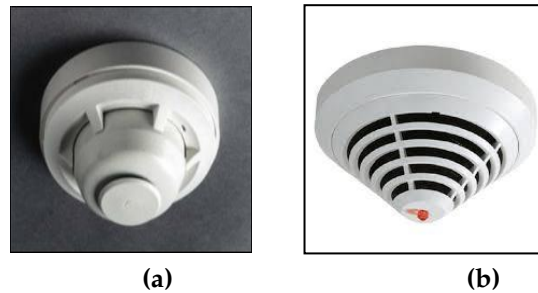
There is some legislation of different organizations, such as Bangladesh Fire Service and Civil Defense (BFSCD), RAJUK, National Building Authority etc. to prevent fire accident in shopping centers. These legislations set following standard for different factors to assess fire safety (Islam, 2017 and Uddin, 2019):

- **Accessibility:** Adjacent Road width of the shopping center will be minimum 30 feet.
- **Open space between two buildings:** 15 feet or above space is required between two buildings.
- **Power lines and transformers:** High voltage electric line and transformer is to be laid at minimum 10 feet distance from the shopping center.
- **Emergency exit:** It should be 25 meters from any places of the shopping center. Minimum width of the fire stair (emergency stair) will be 1.5 meter. It should be connected with the ground floor and its lobby should be separated from the lobby of the lift.
- **General stair:** There is no standard for this factor. Concerning with expert the value of this factor is usually determined.
- **Lift with fire switch:** Shopping center with 7 - 9 stories should have at least 1 lift with fire alarm switch and shopping center with 10 - 15 stories should have at least 2 lifts with fire alarm switch.
- **Fire safety sign and symbol:** There is no standard for this factor, too. But concerning with expert the value of this factor is usually determined.
- **Fire alarm:** Sufficient number of alarm bell must be arranged in every floor.
- **Fire extinguisher:** In every floor, there should be a fire extinguisher for 1000 sq. ft. area and extra one instrument for above 1000sq. ft. area.



Source: Islam, 2017 and Uddin, 2019

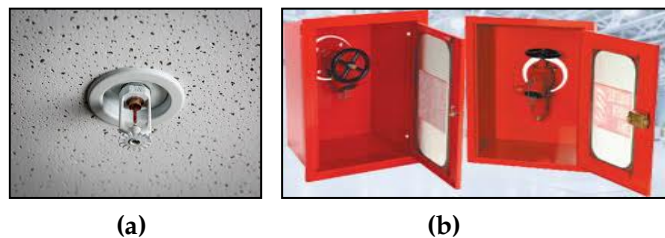
Figure 04: (a) Fire alarm, (b) Fire extinguisher and (c) Hose reel



Source: Islam, 2017 and Uddin, 2019

Figure 05: (a) Heat detectors and (b) Smoke detectors

- **Hose pipes:** The length of a fully extended fire hose is between 18 and 36 meters with a diameter of 13 or 19 mm. A 38-meter hose reel will be set up for every 1000 sq. ft. floor area and extra one 38-meter hose reel will be set up for above 1000 sft.
- **Heat detectors and Smoke detectors:** There is no standard for these instruments. But concerning with expert the value against these factors is assigned.
- **Wet riser and Dry rise:** Wet risers are water-filled vertical pipes used in buildings taller than 60 meters to support firefighting. Dry risers are empty vertical pipelines used by fire engines to supply water to different floors during emergencies and are typically installed in buildings below 60 meters. If a shopping center has these systems, it receives the importance value assigned by fire experts.
- **Fire sprinkler:** Wet or dry sprinklers release water instantly when activated, usually with one sprinkler head for every 100 sq. ft. area.



Source: Islam, 2017 and Uddin, 2019

Figure 06: (a) Fire sprinkler and (b) Wet riser and Dry rise

- **Nearby water sources:** There is no specific standard for distance between nearby water sources and shopping center, but it should be as near as possible.
- **Fire station:** There is no standard for this factor. Concerning with expert the value of this factor is usually determined.
- **Fire drill:** There should be at least two fire drills in a year.

Existing Condition of the Selected Shopping Centers

- **Accessibility (Adjacent Road):** Access way shall be provided for accessibility of site to firefighting appliances. To allow access of those appliances 30 feet wide road is required. From field survey it is observed that the access way width for most of the shopping centers is below 30 feet.



Source: Field Survey, 2025

Figure 7: Narrow Access Way in front of the Shopping Centers

- **General Stairway, Lift, Emergency Exit etc.:** Only 27.58% case study shopping centers have the provision of emergency exit. It is also observed that the average width of general stairway of all the shopping centers is narrow.
- **Distance with Adjacent Buildings:** All the shopping centers are closely bounded with other buildings. Only 6.89% case study shopping centers have maximum distance of 7 feet from the adjacent buildings. Most of the shopping centers have 5 feet gap between or among adjacent buildings. But 27.58% case study shopping centers don't have any gap between or among adjacent buildings.



Source: Field Survey, 2025

Figure 8: Less or No Gap with Adjacent Building

- **Fire Fighting Tools, Fire Drills, Emergency Signs and Symbols, etc.:** None of the shopping centers have any emergency signs and symbols. Only 37.93% case study shopping centers have fire extinguisher. But the number of fire extinguishers is not in satisfactory level compared with the standard. Only one shopping center has provision of fire alarm. Whereas only 17.25% case study shopping centers have hose reel and one shopping center has stand pipe. None of other fire-fighting tools are available in these shopping centers.
- **Basement Floor Condition:** It is observed that, only about 28% case study shopping centers have basement floor. Basement floor is used for parking lot in only 6.89 case study shopping centers. For other shopping centers it is used as god down and or shops. But according to fire safety standard, no shops are allowed in basement area.
- **Location of Transformer, Electric Poles etc.:** It is observed that there are several numbers of transformers and electric poles around most of the selected shopping centers within below 10 feet distance. About 73% case study shopping centers have this problem. For only 27.58 case study shopping centers there is no provision of transformer, electric pole within 10 feet distance.
- **Water Reservoir, Other Water Source and Fire Station:** It found that except Hazi Sarat Ali Super Market other shopping centers have provision of water reservoirs. In most of the cases, there is no location of water body near the shopping centers that

can play a vital role during a fire fighting operation. The nearest fire station is located near Ulail Bus Stand. Except heavy traffic jam in the Dhaka-Aricha Highway, it is possible for fire service team to reach the shopping centers in any emergency case of fire accident within a very short time.

Fire Hazard Vulnerability Analysis of the Selected Shopping Centers at Savar Municipality Area by Analytical Hierarchical Process (AHP)

There are thirteen factors that determine vulnerability of shopping centers to fire hazard. These factors are No. of Story (A1), Floor Area (A2), Accessibility (A3), Open Space between Two Buildings (A4), Fire Source around Building (A5), Use of the Building (A6), Fire Source in Building (A7), Nearby Water Body (A8), and Width of the Stair Case (A9), Fire Fighting Tool (A10), Fire Fighting Drill (A11), Emergency Exit (A12) and Emergency Exit Sign (A13). The weighted value of each factor was derived through an expert opinion survey using AHP method.

Table 03: Normalization of Factors of Fire Hazard Vulnerability of Shopping Centers

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	Average Value of Normalized Factor
A1	0.070	0.025	0.124	0.058	0.021	0.030	0.237	0.078	0.049	0.072	0.015	0.019	0.132	0.929
A2	0.070	0.075	0.124	0.029	0.187	0.030	0.026	0.026	0.033	0.215	0.015	0.172	0.033	1.033
A3	0.014	0.037	0.062	0.174	0.062	0.090	0.026	0.078	0.049	0.024	0.077	0.019	0.066	0.780
A4	0.035	0.015	0.186	0.058	0.062	0.018	0.040	0.016	0.049	0.024	0.015	0.029	0.013	0.559
A5	0.209	0.025	0.031	0.058	0.062	0.030	0.158	0.016	0.197	0.024	0.386	0.114	0.033	1.342
A6	0.035	0.025	0.062	0.058	0.031	0.090	0.026	0.016	0.033	0.215	0.015	0.029	0.132	0.766
A7	0.209	0.224	0.062	0.012	0.012	0.030	0.079	0.026	0.033	0.215	0.077	0.114	0.022	1.114
A8	0.070	0.037	0.062	0.174	0.062	0.018	0.026	0.078	0.049	0.024	0.077	0.057	0.066	0.801
A9	0.023	0.224	0.031	0.029	0.187	0.271	0.040	0.157	0.099	0.036	0.025	0.019	0.022	1.162
A10	0.023	0.224	0.031	0.058	0.031	0.045	0.158	0.235	0.296	0.072	0.025	0.029	0.197	1.424
A11	0.139	0.037	0.020	0.058	0.062	0.030	0.079	0.039	0.049	0.024	0.077	0.172	0.022	0.809
A12	0.070	0.037	0.186	0.174	0.031	0.271	0.079	0.157	0.033	0.024	0.039	0.057	0.197	1.355
A13	0.035	0.015	0.020	0.058	0.187	0.045	0.026	0.078	0.033	0.036	0.154	0.172	0.066	0.925

Source: Developed by the Authors, 2026 with help of Expert Opinion Survey, 2025

The average value of normalized factors was computed and then the column was divided by the corresponding sum which is the weight of factors of fire hazard.

Table 04: Weight of Different Factors of Fire Hazard Vulnerability

No	Factors	Average Value of Normalized Factor	Weight
A1	No. of Story	0.929	0.072
A2	Floor Area	1.033	0.079
A3	Accessibility	0.780	0.060

No	Factors	Average Value of Normalized Factor	Weight
A4	Open Space between Two Buildings	0.559	0.043
A5	Fire Source around Building	1.342	0.103
A6	Use of the Building	0.766	0.059
A7	Fire Source in Building	1.114	0.086
A8	Nearby Water Body	0.801	0.062
A9	Width of the Stair Case	1.162	0.089
A10	Fire Fighting Tool	1.424	0.110
A11	Fire Fighting Drill	0.809	0.061
A12	Emergency Exit	1.355	0.104
A13	Emergency Exit Sign	0.925	0.071
		13.000	

Source: Developed by the Authors, 2026 with help of Expert Opinion Survey, 2025

Thirteen attributes or factors of fire hazard were given numeric values for vulnerability calculation. Each value was multiplied by corresponding weight derived from above mentioned AHP.

Table 05: Fire Hazard Vulnerability Factors, Values and Weights

No	Factors	Value	Criteria	Weight
A1	No. of Story	1	Up to 1-storey	0.072
		2	2-5 stories	
		3	6 and above stories	
A2	Floor Area	1	Up to 1000 sq. ft	0.079
		2	1001 sq. ft – 2000 sq. ft	
		3	2001 sq. ft and above	
A3	Accessibility	1	Road > 30 ft	0.060
		2	Road $\leq$ 30ft	
A4	Open Space between two building	1	Space > 15 ft	0.043
		2	Space $\leq$ 15 ft	
A5	Fire Source around Building	0	No	0.103
		1	Yes	
A6	Use of the Building	1	Commercial	0.059
		2	Residential	
		3	Mixed Use (Residential+ Commercial +Other)	
A7	Fire Source in Building	1	No	0.086
		2	Commercial/Mixed	

No	Factors	Value	Criteria	Weight
		3	Hazardous	
A8	Nearby Water body	1	Distance > 300 ft	0.062
		2	Distance ≤ 300 ft	
A9	Width of the stair case	1	Width > 6 ft	0.089
		2	Width ≤ 6 ft	
A10	Fire Fighting Tool	1	Yes	0.110
		2	No	
A11	Fire Fighting Drill	1	Yes	0.061
		2	No	
A12	Emergency Exit	1	Yes	0.104
		2	No	
A13	Emergency Exit sign	1	Yes	0.071
		2	No	

Source: Developed by the Authors, 2026 with help of Expert Opinion Survey, 2025

Consistency of the Comparison Matrix for Fire Hazard

To determine whether or not a level of consistency is reasonable a quantifiable measure for comparison matrix M was developed. To determine the consistency of the comparative matrix Consistency Ratio (CR) was computed by the following equation.

$$CR = \frac{CI}{RI}$$

$$CI = \frac{N_{max} - n}{n - 1}$$

$$RI = \frac{1.98(n-2)}{n}$$

In this case, $n = 13$

$$N_{max} = (0.072 \times 14.36) + (0.079 \times 13.39) + (0.060 \times 16.16) + (0.043 \times 17.2) + (0.103 \times 16.03) + (0.059 \times 11.05) + (0.086 \times 12.65) + (0.062 \times 12.76) + (0.089 \times 10.15) + (0.110 \times 13.98) + (0.062 \times 12.96) + (0.104 \times 17.49) + (0.071 \times 15.19) = 14.13$$

$$CI = \frac{14.13 - 13}{13 - 1} = 0.09$$

$$RI = \frac{1.98(13-2)}{13} = 1.67$$

Consistency Ratio,

$$CR = \frac{0.09}{1.67}$$

$$= 0.053 < 0.1$$

CR is acceptable if it is less or equal to 0.1. As the calculated CR comes below 0.1, consistency of comparison matrix is acceptable.

Where,

CI= Consistency Index of M

RI= Random Consistency Index of M

n = Number of Attributes

N_{max} = $M \times W$ (Weighted Matrix)

Determining the Vulnerability Category of the Case Study Shopping Centers

For this study fire hazard vulnerability was categorized into the following types (Table 06):

Table 06: Fire Hazard Vulnerability Category based on FS Value

Vulnerability Category	FS Value
Low Vulnerability	1.51 – 1.65
Moderately Low Vulnerability	1.66 -1.80
Moderate Vulnerability	1.81 – 1.95
High Vulnerability	Above 1.95

Source: Developed by the Authors, 2026 with help of Expert Opinion Survey, 2025

Calculation of Fire Hazard Vulnerability Score (FS) of the selected Shopping Centers

Table 07 shows the Fire Hazard Vulnerability Score (FS) of selected shopping center. Here Fire Hazard Vulnerability Score (FS) of each shopping center were calculated using the following formula:

$$FS = (\text{Number of Story} \times 0.072) + (\text{Floor Area} \times 0.079) + (\text{Accessibility} \times 0.060) + (\text{Open Space between two Buildings} \times 0.043) + (\text{Fire Source around Building} \times 0.103) + (\text{Use of the Building} \times 0.059) + (\text{Fire Source in Building} \times 0.086) + (\text{Nearby Water Body} \times 0.062) + (\text{Width of the Stair Case} \times 0.089) + (\text{Fire Fighting Tool} \times 0.11) + (\text{Fire Fighting Drill} \times 0.061) + (\text{Emergency Exit} \times 0.104) + (\text{Emergency Exit Sign} \times 0.071)$$

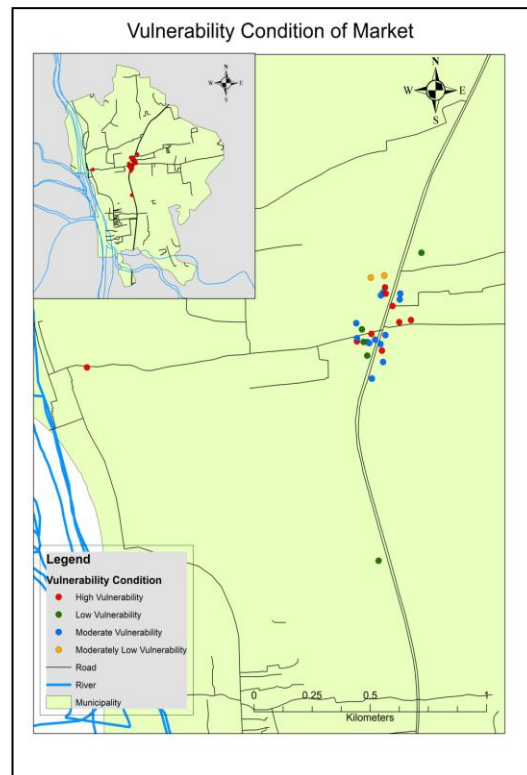
Following table shows the fire hazard vulnerability category of the shopping centers at Savar Municipality based on their calculated FS value. **Figure 09** shows the map of fire hazard vulnerability category of the shopping centers in the study area.

Table 07: Fire Hazard Vulnerability Category of the Shopping Centers at Savar Municipality

Name of Shopping Center	FS Value	Vulnerability Category
Khan Super Market	1.68	Moderately Low Vulnerability
Hazi Sarat Ali Super Market	1.73	Moderately Low Vulnerability
Rupkatha Plaza	1.96	High Vulnerability
Jakir Plaza	1.92	Moderate Vulnerability
Sugandha Market	2.07	High Vulnerability
Hazi Market	1.90	Moderate Vulnerability
Siraj Auto Market	1.90	Moderate Vulnerability
Hobi Plaza	1.79	Moderately Low Vulnerability
Razzak Plaza	1.81	Moderate Vulnerability
Nur Super Market	1.90	Moderate Vulnerability
Yakub Plaza	1.90	Moderate Vulnerability
Jahangir Super Market	2.02	High Vulnerability
Alom Plaza	1.96	High Vulnerability

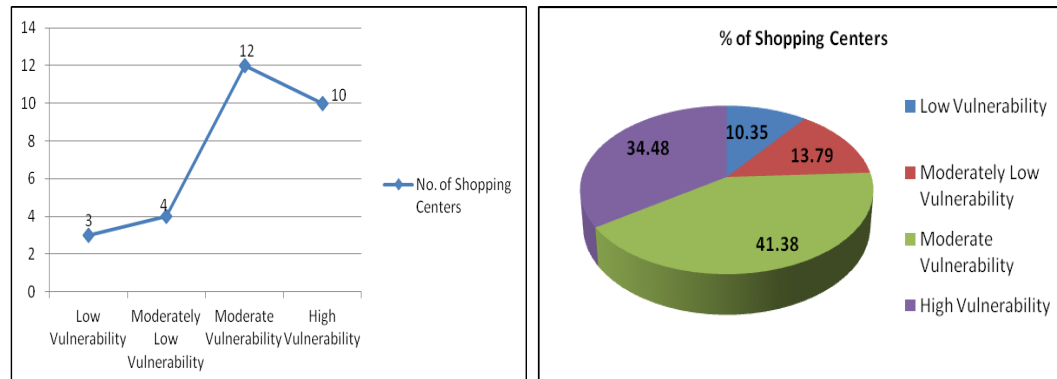
Name of Shopping Center	FS Value	Vulnerability Category
Monsur Super Market	2.00	High Vulnerability
R. S. Tower	1.84	Moderate Vulnerability
Captain Samad Tower	2.00	High Vulnerability
Chowrongi Super Market	2.07	High Vulnerability
Vorosha Super Market	2.00	High Vulnerability
Yusuf Tower	1.85	Moderate Vulnerability
Dilkhusha Super Market	1.82	Moderate Vulnerability
Savar City Centre	1.71	Moderately Low Vulnerability
Savar New Market	1.60	Low Vulnerability
Utshob Plaza	1.82	Moderate Vulnerability
Sharif Plaza	2.08	High Vulnerability
Koraishi Super Market	1.54	Low Vulnerability
Janota Gold Plaza	1.97	High Vulnerability
Modern Plaza	1.62	Low Vulnerability
Hamid Super Market	1.83	Moderate Vulnerability
Afnida Super Market	1.93	Moderate Vulnerability

Source: Developed by the Authors, 2026 with help of Field Survey, 2025 and Expert Opinion Survey, 2025



Source: Developed by the Authors, 2026

Figure 10: Fire Hazard Vulnerability Categor Map of the Shopping Centers at Savar Municipality



Source: Developed by the Authors, 2026 with help of Field Survey, 2025 and Expert Opinion Survey, 2025

Figure 10: Fire Hazard Vulnerability of the Shopping Centers at Savar Municipality in Number and in percentage

From Figure 10 it is observed that, 10 (34.48%) shopping centers are highly vulnerable for fire hazard. Whereas 12 (41.38%) shopping centers are moderate vulnerable. 4 (13.79%) shopping centers are moderately low vulnerable and only 3 (10.35%) shopping centers are low vulnerable for fire accident.

Fire Safety Level Analysis of the Shopping Centers at Savar Municipality: Application of Checklist Method

Table 08 shows the obtained values for the 19 factors of checklist method to determine fire safety level of the selected study shopping centers in the study area.

Table 08: Importance Value for Different Factors of Checklist Method to Determine Fire Safety Management Level of Shopping Center

Factor No.	Factors	Importance Value
Factor 1	Accessibility	10
Factor 2	Open space in between two apartments	6
Factor 3	Power lines and transformer	7
Factor 4	Nearby water sources	4
Factor 5	Fire station	5
Factor 6	General stairwell	5
Factor 7	Emergency exit	10
Factor 8	Fire safety sign and symbol	8
Factor 9	Lift with fire switch	3
Factor 10	Fire alarm	7
Factor 11	Fire extinguisher	10
Factor 12	Hose reel	8

Factor No.	Factors	Importance Value
Factor 13	Smoke detector	7
Factor 14	Heat detector	7
Factor 15	Water reservoir	8
Factor 16	Stand pipe	6
Factor 17	Wet riser and Dry riser	5
Factor 18	Fire sprinkler	5
Factor 19	Fire drill	10
Total		131

Source: Developed by the Authors, 2026 with help of Expert Opinion Survey, 2025

Table 09: Obtained Values for Different Factors of Checklist Method to Determine Fire Safety Management Level of Shopping Centers in the Study Area

Name of Shopping Center	Obtained Values for Different Factors regarding Fire Safety Management																			Total
	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19	
Khan Super Market	6	2	3	2	3	2	0	0	0	0	0	0	0	0	6	0	0	0	0	24
Hazi Sarat Ali Super Market	6	2	6	2	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	21
Rupkatha Plaza	7	2	4	2	3	3	0	0	0	0	0	0	0	0	6	0	0	0	0	27
Jakir Plaza	7	3	3	2	3	2	0	0	0	0	0	0	0	0	6	0	0	0	0	26
Sugandha Market	8	2	4	2	3	2	0	0	0	0	8	0	0	0	6	0	0	0	0	35
Hazi Market	8	2	6	2	3	2	0	0	0	0	0	0	0	0	6	0	0	0	0	29
Siraj Auto Market	7	3	6	2	3	2	0	0	0	0	0	0	0	0	6	0	0	0	0	29
Hobi Plaza	8	2	7	2	3	2	5	0	0	0	0	0	0	0	6	0	0	0	0	35
Razzak Plaza	8	2	4	2	3	4	0	0	0	7	8	2	0	0	6	0	0	0	0	46
Nur Super Market	7	2	6	2	3	2	0	0	0	0	0	0	0	0	6	0	0	0	0	28
Yakub Plaza	7	2	6	2	3	2	0	0	0	0	0	0	0	0	6	0	0	0	0	28
Jahangir Super Market	7	2	7	2	3	2	0	0	0	0	0	0	0	0	6	0	0	0	0	29
Alom Plaza	7	2	4	2	3	2	0	0	0	0	7	0	0	0	6	0	0	0	0	33
Monsur Super Market	7	2	4	2	3	2	0	0	0	0	0	0	0	0	6	0	0	0	0	26
R. S. Tower	7	1	3	3	3	3	6	0	0	0	0	0	0	0	6	0	0	0	0	32
Captain Samad Tower	7	1	3	2	3	2	0	0	1	0	0	0	0	0	6	0	0	0	0	25
Chowrangi Super Market	8	1	3	2	3	3	0	0	3	0	0	0	0	0	6	0	0	0	0	29
Vorosha Super Market	6	2	3	2	3	4	0	0	3	0	0	0	0	0	6	0	0	0	0	29

Name of Shopping Center	Obtained Values for Different Factors regarding Fire Safety Management																			Total
	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19	
Yusuf Tower	7	1	4	2	3	3	4	0	0	0	8	3	0	0	6	3	0	0	0	44
Dilkhusha Super Market	7	1	4	2	3	3	8	0	0	0	7	0	0	0	6	0	0	0	0	41
Savar City Centre	9	3	4	2	3	4	5	0	0	7	10	7	5	0	6	0	0	0	0	65
Savar New Market	8	4	4	2	3	4	8	0	0	7	9	4	0	0	6	0	0	0	0	59
Utshob Plaza	7	2	6	2	3	5	0	0	0	0	5	0	0	0	6	0	0	0	0	36
Sharif Plaza	6	2	6	2	3	2	0	0	0	0	3	0	0	0	6	0	0	0	0	30
Koraishi Super Market	8	2	7	2	3	4	6	0	0	0	7	2	0	0	6	0	0	0	0	47
Janota Gold Plaza	6	2	3	2	3	2	0	0	0	0	0	0	0	0	6	0	0	0	0	24
Modern Plaza	8	2	7	2	4	3	5	0	1	0	2	0	0	0	6	0	0	0	0	40
Hamid Super Market	7	1	7	2	3	0	0	0	0	0	0	0	0	0	6	0	0	0	0	26
Afnida Super Market	8	1	3	2	3	0	0	0	0	0	0	0	0	0	6	0	0	0	0	23

Source: Developed by the authors, 2026 with help of Expert Opinion Survey, 2025 and Field Survey, 2025

Table 10 shows Fire Safety Rating (FSR) score of the selected shopping centers in the study area. FSR score was calculated with the following formula:

$$\text{FSR} = (\text{Total achieved values} / \text{Total weights}) * 100$$

Table 10: Fire Safety Rating (FSR) Score of the Shopping Centers at Savar Paurashava

Name of Shopping Center	FSR Score
Khan Super Market	24
Hazi Sarat Ali Super Market	21
Rupkatha Plaza	27
Jakir Plaza	26
Sugandha Market	35
Hazi Market	29
Siraj Auto Market	29
Hobi Plaza	35
Razzak Plaza	46
Nur Super Market	28
Yakub Plaza	28
Jahangir Super Market	29
Alom Plaza	33
Monsur Super Market	26
R. S. Tower	32
Captain Samad Tower	25

Name of Shopping Center	FSR Score
Chowrongi Super Market	29
Vorosha Super Market	29
Yusuf Tower	44
Dilkhusha Super Market	41
Savar City Centre	65
Savar New Market	59
Utshob Plaza	36
Sharif Plaza	30
Koraishi Super Market	47
Janota Gold Plaza	24
Modern Plaza	40
Hamid Super Market	26
Afnida Super Market	23

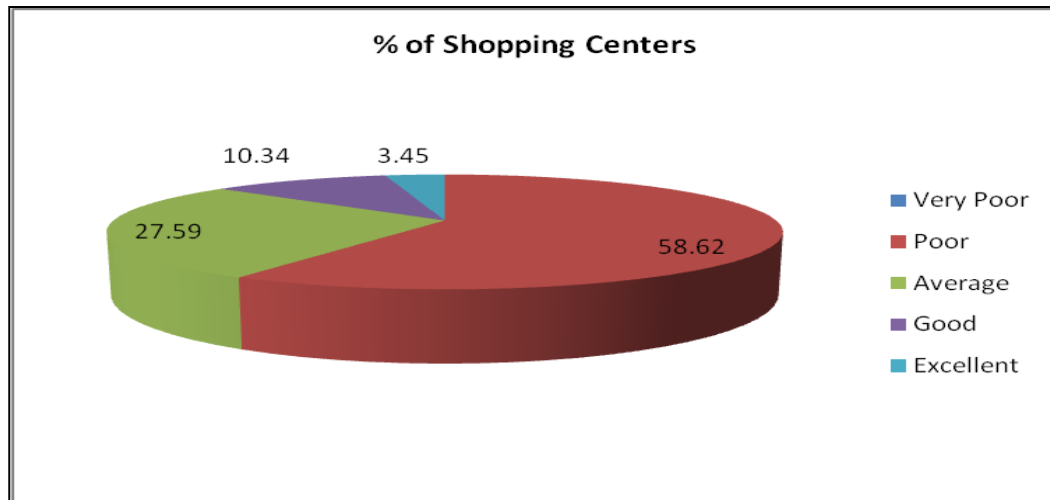
Source: Developed by the Authors, 2026 with the help of Expert Opinion Survey, 2025 and Field Survey, 2025

Table 11 shows fire safety level category of the selected shopping centers in the study area. Here the shopping centers are categorized for fire safety level based on the value of **Table 02**.

Table 11: Fire Safety Rating (FSR) Score of the Shopping Centers at Savar Municipality

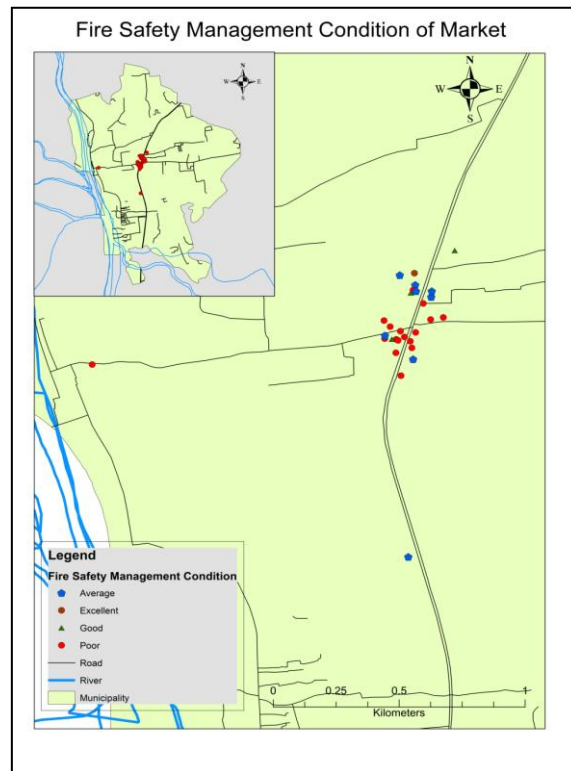
Name of Shopping Center	FSR Score	Fire Safety Level Category	Name of Shopping Center	FSR Score	Fire Safety Level Category
Khan Super Market	24	Poor	Captain Samad Tower	25	Poor
Hazi Sarat Ali Super Market	21	Poor	Chowrongi Super Market	29	Poor
Rupkatha Plaza	27	Poor	Vorosha Super Market	29	Poor
Jakir Plaza	26	Poor	Yusuf Tower	44	Average
Sugandha Market	35	Average	Dilkhusha Super Market	41	Average
Hazi Market	29	Poor	Savar City Centre	65	Excellent
Siraj Auto Market	29	Poor	Savar New Market	59	Good
Hobi Plaza	35	Average	Utshob Plaza	36	Average
Razzak Plaza	46	Good	Sharif Plaza	30	Poor
Nur Super Market	28	Poor	Koraishi Super Market	47	Good
Yakub Plaza	28	Poor	Janota Gold Plaza	24	Poor
Jahangir Super Market	29	Poor	Modern Plaza	40	Average
Alom Plaza	33	Average	Hamid Super Market	26	Poor
Monsur Super Market	26	Poor	Afnida Super Market	23	Poor
R. S. Tower	32	Average			

Source: Developed by the Authors, 2026 with the help of Expert Opinion Survey, 2025 and Field Survey, 2025



Source: Developed by the Authors, 2026 with the help of Expert Opinion Survey, 2025 and Field Survey, 2025

Figure 11: Fire Safety Level Category of the Shopping Centers at Savar Municipality in %



Source: Developed by the Authors, 2026

Figure 12: Fire Safety Level (Condition) Category Map of the Shopping Centers at Savar Municipality

From **Table 11** and **Figure 11** it is observed that, most of the shopping centers under study have poor level of fire safety. About 58.62% of the shopping centers fall under the poor fire safety level category, whereas only about 27.59% fall under average fire safety category. Only about 10.34% and 3.45 shopping centers in the study area fall under good and excellent fire safety category repetitively. **Figure 12** shows the map of fire safety level category of shopping centers at Savar Municipality.

Recommendations

The findings reveal that a large proportion of shopping centers in Savar Municipality are vulnerable to fire hazards, with 34.48% classified as highly vulnerable and 58.62% exhibiting poor fire safety conditions. These results indicate inadequate firefighting equipment, limited emergency exits, and narrow access roads. Similar findings were reported by Islam (2017) and Uddin (2019), who observed poor fire safety management in shopping centers in Dhaka due to insufficient equipment and weak enforcement of safety regulations. Likewise, Tabassum et al. (2014) highlighted that overcrowding and combustible materials increase fire risk in commercial buildings. Compared with these studies, the Savar case reflects a similar pattern of vulnerability, emphasizing the urgent need for improved planning, regulatory enforcement, and regular fire safety management practices. From fire hazard and fire safety management perspective, this study suggests following recommendations to reduce fire hazard vulnerability and also improve the present fire safety management condition of the selected shopping centers at Savar Municipal area:

- **Enforcement of Building Code:** Excellent provisions have been made for fire protection and safer buildings under the National Building Code 2012. The proper enforcement of the code may reduce the possible risk of fire hazard and improve safety level too.
- **Measures related to Open Space between Two Buildings:** RAJUK should have to take corrective measures (demolish the unauthorized portion of the buildings) as per the approved plan to create open space between adjacent buildings in order to reduce the fire hazard risk and improve safety level.
- **Measures related to Emergency Exit:** Sufficient number of emergency exits should be developed in these shopping centers as per standard of BNBC and RAJUK.
- **Measures related to Location of Transformers and Electric Poles:** To improve the fire safety level and reduce the fire vulnerability as well, the transformers and electric poles need to be relocated on an emergency basis.
- **Measures related to Fire Fighting Equipments:** To ensure satisfactory level of fire safety, first of all these shopping centers should have to install sufficient number of fire alarms. Besides, arrangement of sufficient fire extinguishers should be ensured along with other firefighting equipments like smoke and heat detectors, hose reels, water sprinklers, wet and dry risers etc.
- **Arrangement of Regular Fire Drill:** According to BNBC 2012, each shopping center should have to arrange at least two firefighting drills annually. Regular arrangement of fire drill may help to reduce loss of life and property at the time of fire hazard and any other hazard, too.

- **Appointment of Fire Safety Manager and Other Fire Safety Personnel:** All the selected shopping centers need to appoint a Fire Safety Manager along with other Fire Safety Personnel.
- **Regular Monitoring by BFSCD:** Bangladesh Fire Service and Civil Defense authority should ensure regular inspection of shopping centers of the city to understand their fire safety management capacity.

Conclusion

Shopping centers are vital public spaces, yet many in the country, including those in Savar Municipality, lack adequate fire safety measures, posing serious risks. Years of neglect have left these centers vulnerable, highlighting the urgent need for public awareness and proactive safety management. The study emphasizes that both government authorities and shopping center management must take immediate steps to ensure the safety of staff and visitors. Strengthening fire safety protocols, improving technical capacity, and increasing the manpower of the Fire Service and Civil Defense are essential to effectively prevent and respond to fire hazards.

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