

# Fire Risk in Urban Bangladesh: A Case Study-Based Evaluation

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## Abstract

Fire hazards pose serious threats to human life, property, natural resources and the environment. Bangladesh has witnessed numerous devastating fire incidents across various sectors over the past two decades, with the majority occurring in urban area, resulting human casualties and substantial economic loss. This study aims to reveal the current state of fire risk in three urban districts of Bangladesh, focusing on vulnerable infrastructure and population density and to analyze different case studies of major urban fire events in recent years to determine the specific causes and impacts while formulating recommendations for long-term sustainability. The study uses both primary data which is field observations and secondary data which is collected from Google Earth Pro, Diva GIS, OSM, ESRI imageries, Bangladesh Bureau of Statistics, USGS, government reports, organization-based survey, journals and articles. Spatial-integrated mixed-method is applied by combining geospatial analysis, case studies and satellite imageries to assess urban fire risk and generate population density, fire station distribution, and land use maps, culminating in validated fire risk maps through overlay and proximity analysis. Population density map reveals that all city corporation areas exhibit high fire risk. Fire station distribution is most concentrated in Dhaka, moderately in Chattogram, and least integrated in Gazipur. Dhaka is the most urban fire-prone district due to high population density, chemical storage mismanagement in residential-commercial mixed areas and poor evacuation planning, while Chattogram shows relatively lower vulnerability, except industrial zones. Strengthening regulatory enforcement, improving infrastructure and comprehensive fire risk governance is necessary to tackle fire incidents in urban Bangladesh.

## Keywords

Fire Risk, Population Density, Spatial Distribution

## 1. Introduction

Fire represents a hazardous phenomenon due to posing threat to human life, built-up areas, property, resources, and environment (Kodur et al., 2019; Drysdale, 2011). It is considered the most dominant cause of burn-related issues i.e., injuries and deaths worldwide, accounting for around 1.8 to 3 million deaths annually (Li et al., 2022; Keeley, 2009). Despite technological advancement, the rate of fire incidents is booming worldwide simultaneously (Lee et al., 2023; Rahim, 2015). Developed nations experience more fire incidents than developing ones; however, developing countries suffer from higher causality rates (Alexander, 2006). For instance, USA experiences the highest number of fire events, with estimated 1000 to 10,000 deaths per year; meanwhile, developing countries like India, Pakistan, and Bangladesh face casualties of 10,000 to 25,000 per year while occurring fewer events comparatively (Brushlinsky et al., 2019). There is a rising trend of occurring fire events in Bangladesh, particularly in dense, industrialized, and busy urban centers like Dhaka, Gazipur, and Chattogram (Tishi & Islam, 2018; Islam & Adri, 2008). The number of fire cases was 21,073 in 2020 which became 24,102 in 2022; and is keeping a concerning pace (BFSCD, 2024). The amount of yearly economic loss due to these events is 50 million USD (\$), while death toll ranges from 700 to 1200 with thousands of injuries and loss of livelihoods (BFSCD, 2024). A major reason for the high casualties is non-compliance with the building codes, laws and regulations, leading to absence of basic mitigation measures in household, factory, industry, and office-oriented high rise to low rise buildings as well as haphazard slums (Islam et al., 2022; Fakunle et al., 2020; Ahmed, 2014). It makes firefighting, mitigating steps, and evacuation extremely challenging, leading to individuals getting trapped inside (Hossain et al., 2019). The created smoke and other toxic gas inhalation lead to nearly 85% deaths in this sort of entrapment, majorly in building fires (Zhang et al., 2019; Hanea & Ale, 2009). Hence, fire events and their corresponding damages are piling up with time in Bangladesh, posing significant problems for public safety, infrastructure, economy, and mental health (Datta et al., 2024; van Kamp et al., 2006). Different scholars and organizations have conducted various researches to enhance the current response of fire events to be addressed properly (Rahman et al., 2025; Abrar et al., 2024). Again, some researches focused on fire risk assessment of urban centers i.e., metropolitan areas and city corporations; while many have explored fire in readymade garment industries (RMGs) and slums along with illegal urbanization impacts (Uddin et al., 2023; Islam & Sahin, 2023; Alam et al., 2019; Islam & Roman, 2019). Majority of the fire related studies focus on Dhaka city only, while limited works are related to other hazardous areas of Bangladesh. Furthermore, different individual case studies imply a narrower view of the holistic aspect of this devastating event; whereas, multiple case-oriented studies are confined to one specific geographic area (Huda et al., 2024; Roni et al., 2022; Maniruzzaman & Haque, 2007). This study is of paramount significance as it will work on multiple fire events of different urbanized districts of Bangladesh, ensuring a holistic approach that extracts

key essence of the urban fire hazard state, similarities, and anomalies. Consequently, the research findings will delineate the major fire event hotspots across these districts leading to robust policy formulation by governmental and non-governmental organizations (NGOs) and pertinent stakeholders. Therefore, this study aims to reveal the current state of fire risk in the urban areas of Bangladesh, focusing on vulnerable infrastructure and population density; and to analyze different case studies of major urban fire events in recent years to ascertain the specific causes and impacts while formulating effective recommendations for long-term sustainability.

## 2. Data and Methods

### 2.1. Study Area

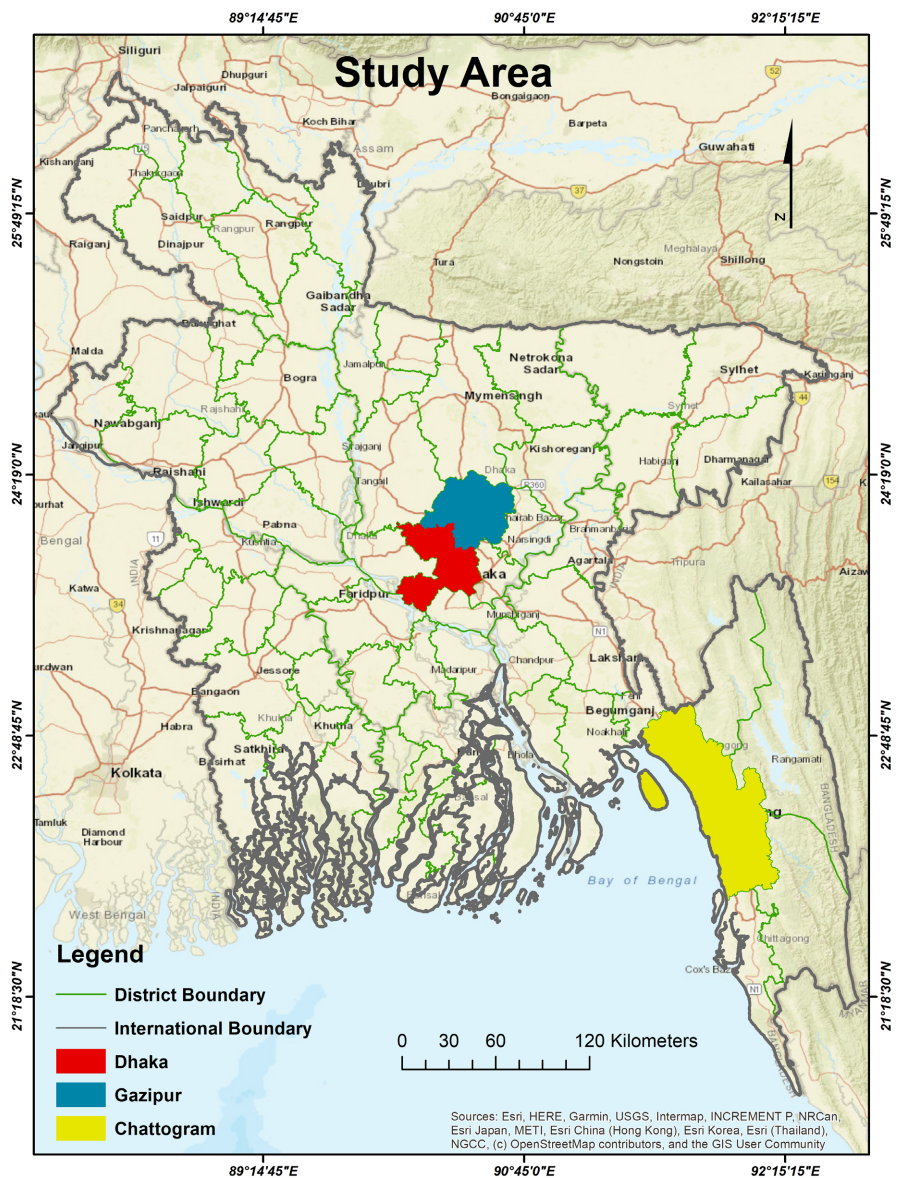


Figure 1. Study area map showing the districts of Dhaka, Gazipur, and Chattogram.

First, the study is based on three urban districts of Bangladesh i.e., Dhaka, Gazipur, Chattogram with latitudes and longitudes of 23°46'37.83"N and 90°23'58.03"E, 23°59'59.79"N and 90°25'12.98"E, 22°20'30.84"N and 91°48'55.93"E respectively (Figure 1). Dhaka district is located in the central Bangladesh with 5 sub-districts (Dhamrai, Dohar, Keraniganj, Nawabganj, and Savar) and 2 city corporations (Dhaka North City Corporation and Dhaka South City Corporation); whereas, Gazipur is located south adjacent to Dhaka with 5 sub-districts (Kapasias, Kaliakair, Kaliganj, Gazipur Sadar, and Sreepur) and 1 city corporation (Gazipur City Corporation) (BBS, 2023). On the contrary, Chittagong district administratively consists of 14 sub-districts (Anwara, Banskhali, Boalkahli, Candanaish, Fatikchhari, Hathazari, Lohagara, Mirsharai, Rangunia, Raozan, Sandwip, Satkania, and Sitakunda) and 1 city corporation (Chittagong City Corporation) (BBS, 2023).

All these three districts have tropical climatic conditions with annual average temperature ranging from 26°C to 29°C; whereas, annual precipitation is 1900 mm (74.8 inch) to 2700 mm (106.29 inch) (Time and Date, 2024; Weather Spark, 2024; Climate-Data.org, 2024). The districts are affected by extreme weather conditions such as heat waves, cyclones, along with other anthropogenic hazards i.e., accidents and fire events.

## 2.2. Data Collection

The study used two major sorts of data i.e., primary data which is field observations and secondary data which is collected from various sources. The secondary data collection involved Google Earth Pro, Diva GIS (for shape files), Open Street Map (OSM), ESRI imageries and base maps, Bangladesh Bureau of Statistics (BBS), United States Geological Survey (USGS), government reports, organization-based survey results, journals, and articles. The collected satellite imageries are from USGS (Table 1).

**Table 1.** Detailed information of used satellite imageries.

Satellite Sensor	Acquisition Date	Path/Row	Resolution	Cloud Cover
Landsat 9 Operational Land Imager (OLI)	30/12/2024	137/43	30 m	0%
Landsat 9 Operational Land Imager (OLI)	30/12/2024	137/44	30 m	0%
Landsat 9 Operational Land Imager (OLI)	23/12/2024	136/44	30 m	<5%
Landsat 9 Operational Land Imager (OLI)	23/12/2024	136/45	30 m	<5%

## 2.3. Data Analysis and Methodology

Before the methodological approach employed spatially-integrated mixed method, through which different important outcomes derived. In the beginning, collected

secondary data from BBS, ESRI, OSM, and Google Earth Pro were pre-processed and standardized for geospatial analysis (Figure 2). Then, fire station point data is loaded in ArcMap 10.5 software to visualize the locational distribution across the three districts. Subsequently, population data from BBS are being joined with the attribute table of the sub-districts (upazilas) of the selected districts. After that, population density is being calculated using Equation (1). Finally, these density data were classified in ArcMap 10.5 to get the population density map.

$$\text{Population Density} = \text{Total Population} / \text{Area (km}^2\text{)} \quad (1)$$

Different reports, journals, and newspaper articles were analyzed thoroughly about major 12 fire incidents during the time span of 2005 to 2024, for both long term trends and case-specific insights. This involved both qualitative and quantitative analysis. Quantitative part involved impact metrics (injuries, deaths, property damage); meanwhile, qualitative analysis identified trends of fire events, underlying causes, community response, and institutional feedbacks.

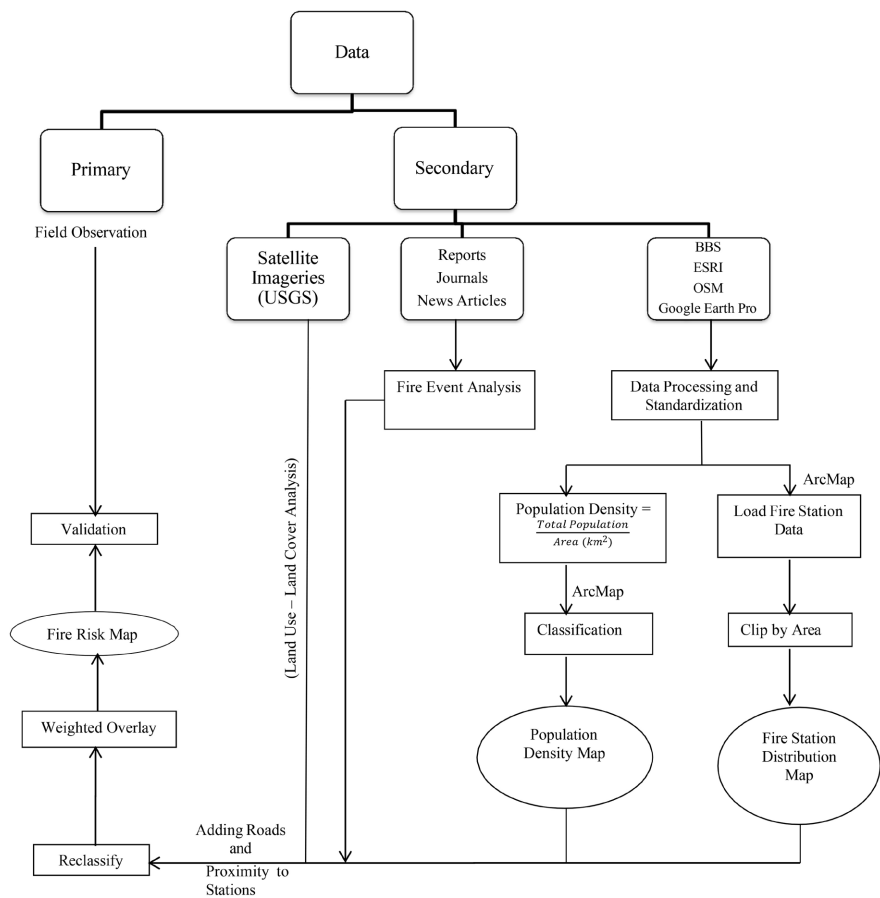


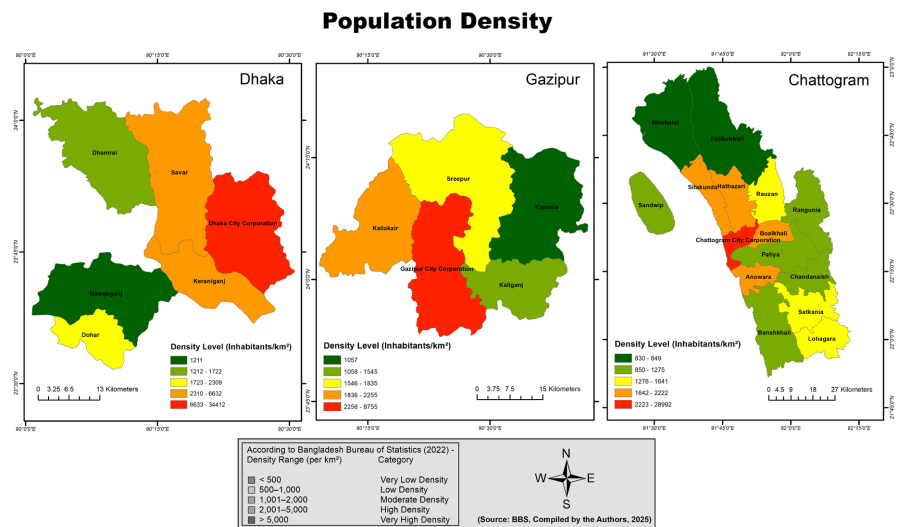
Figure 2. Methodological flow diagram of the study.

The satellite imageries obtained from USGS were taken in ArcMap and then band composition is performed to combine multiple bands in one composite image. After that, clipping is completed to work with the targeted area of interest

(AOI) only. Then natural color, false color combinations were used to create training samples for the imageries. These samples were then used to create land use – land cover (LULC) for the three districts. Subsequently, Accuracy assessment using kappa indicators scored over 80% for all three districts, ensuring perfect execution and reliability (De Almeida et al., 2022). All these created layers i.e., population density, fire station distribution, land use) along with road network data and proximity analysis were reclassified on a standardized scale of 1 (very low risk) to 5 (very high risk) using common feature identities (FIDs). Then, weights were assigned considering impact on fire risk (population density = 40%, LULC = 25%, station proximity = 20%, road network and accessibility = 15%) using overlay tool to create fire risk maps for the three districts. Risk maps were validated using field observation data in the final phase (Figure 2). Some important variables e.g., building age and vulnerability, hydrant availability, roadway width—were omitted due to data inconsistency, unavailability, and large areal extent of the study. These shall be considered in the future works based on data availability and reliability to enhance the accuracy and granularity of the risk assessment.

### 3. Results

#### 3.1. Urban Fire Risk Distribution and Spatial Patterns

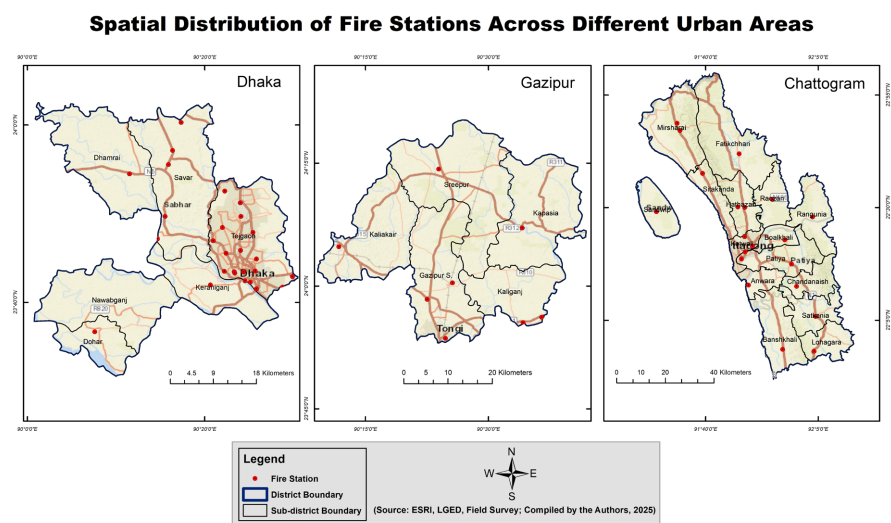


**Figure 3.** Population density map of Dhaka, Gazipur, and Chattogram districts.

Upon executing the methodologies, population density across the three districts is visualized that highlights a crucial spatial pattern. In Dhaka district, minimum population density is recorded for Nawabganj sub-district with 1211 inhabitants per square kilometers; whereas, maximum density reaches at Dhaka City Corporation with range of 6633 to 34,412 inhabitants per square kilometers (Figure 3). Meanwhile, Gazipur City Corporation exhibits the highest population density (2256 to 8755 inhabitants/km<sup>2</sup>) in Gazipur, while the lowest density is in Kapasia sub-district. Finally, Chattogram City Corporation has the maximum population

density (2223 to 28,992/km<sup>2</sup>) in Chattogram; while, minimum population density can be observed in Mirsharai and Fatikchhari sub-districts (830 to 849/km<sup>2</sup>) reflecting peri-urban characteristics. According to assigned density range by Bangladesh Bureau of Statistics (BBS, 2023), Dhaka and Gazipur districts exhibit moderate to very high population density, whereas, Chattogram district has some areas with low population density that extends to very high density (Figure 3). A common outcome is that, all the city corporation areas in the three districts exhibit the highest amount of population density, indicating the significant pull factor of these areas along with major probability of fire hazard and risk.

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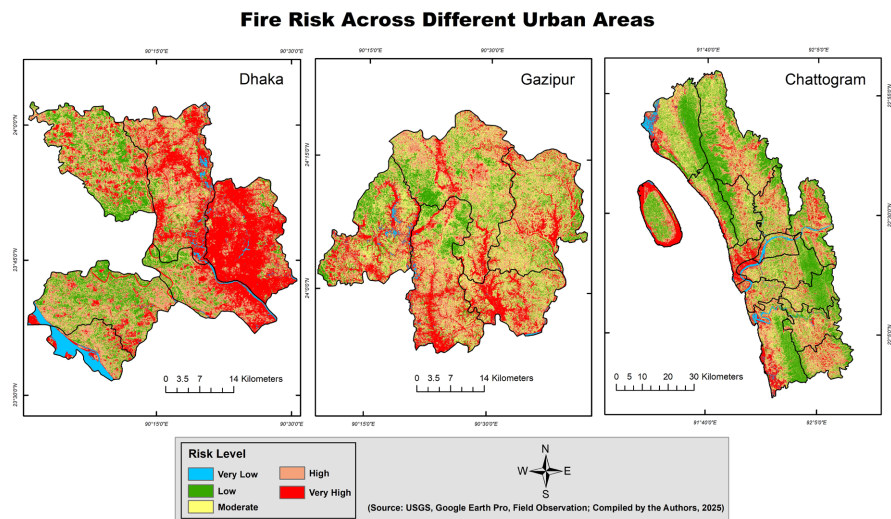
**Figure 4.** Fire station distribution map of Dhaka, Gazipur, and Chattogram.

In response to the growing fire incidents, different fire stations have been strategically placed for enhanced fire control, mitigation and risk reduction. In Dhaka district, there are total 27 fire stations with Dhaka City Corporation having 18, Savar sub-district having 5, and all other sub-districts having one for each; except for Nawabganj, having none (Figure 4). Then, Gazipur has total 8 fire stations only, where Gazipur City Corporation occupies 3 stations, Kaliganj sub-district accounts for 2 stations. In Chattogram, total 20 fire stations are distributed in Chattogram City Corporation (4 stations), Mirsharai and Hathazari sub-districts (2 Stations), and the remaining sub-districts (1 stations each). Unlike Dhaka and Chattogram districts, where all the fire stations are distributed across highways and local roads; fire stations are situated along the highways only in Gazipur (Fig-

ure 4). This indicates less integrated fire defense system in Gazipur, compared to Dhaka and Chattogram. Dhaka City Corporation overwhelmingly dominated the fire station concentration and coverage considering the other two districts.

Fire incident's likelihood of happening or fire risk is highly dependent on population density (affecting infrastructure and housing), road connectivity, fire station service, and enforcement of laws and regulations.

Dhaka City Corporation has the highest amount of fire risk across all other sub-districts with only the eastern part registering in low to moderate risk zones (Figure 5). Meanwhile, in Keraniganj and Savar sub-district, fire risk is very high in the eastern part and mid-northern part respectively. The western sub-districts i.e., Dhamrai, Nawabganj, and Dohar occupy lower fire risk comparatively. In Gazipur, high to very high-risk zones are mainly concentrating majorly the criss-crossing highways whereas only a smaller portion occupies very low to low-risk zones located on the mid-western part of the district. The maximum low risk areas can be found in Chittagong district (Figure 5). The largest fire risk coverage can be seen in the Chattogram City Corporation area. Apart from that, high to very high-risk zones are located along the coastline, because of different chemical-related industries, dense settlement patterns. Among the three districts, Dhaka is the most vulnerable district to fire risk while Chattogram is the least vulnerable one.



**Figure 5.** Fire risk map of Dhaka, Gazipur, and Chattogram. Here, “Very Low” indicates water bodies.

### 3.2. Major Fire Incidents in Bangladesh from 2005 to 2024

In this chapter, the main goal is to point out major fire incidents that occurred in last twenty years from 2005 to 2024. Nearly 2650 individuals died and over 13,000 were injured in fires over the past 20 years. All these incidents have serious impact on country's economy. Study reveals that these events are not isolated accidents, rather the consequences of systemic vulnerabilities rooted within the country's urban governance, industrial practices, regulatory frameworks, and socio-economic

structures. Thematic categorizing of these events will help to understand beyond technical failures to reveal the institutional and structural factors that cause fire hazards in urban Bangladesh.

### **Factor 1: Poor Governance**

#### 1) *KTS Textile Factory, Chattogram* (2006)

KTS textile factory is located in industrial area of Chattogram which supply garments for export. It is important part of Bangladesh's vital RMG industry, employing mostly low-wage workers. A fire in 2006 due to Boiler explosion, killed 65 workers and injured 80, as exits were blocked (NBC News, 2006).

#### 2) *Tazreen Fashions, Ashulia, Dhaka* (2012)

Tazreen Fashions is a major RMG exporter serving international brands like Walmart and C&A. It is located in an industrial zone near Dhaka with minimal safety enforcement. Due to electrical short circuit in 2012, fire spread rapidly; 112 workers died after being trapped in locked stairwells (Reuters, 2022).

#### 3) *FR Tower, Banani, Dhaka* (2019)

FR Tower is a high-rise commercial building with housing, offices and businesses. An electrical short circuit ignited a fire that spread rapidly; 25 died and 73 injuries due to blocked exits (Sobuj, 2011).

### **Factor 2: Regulatory Gaps**

#### 1) *Nimtoli, Old Dhaka* (2010)

It's a mixed residential-commercial zone where an illegal chemical warehouse was located. It is situated in dense, unregulated urban area with historic buildings and narrow alleys. A transformer spark in 2010 ignited the stored chemicals, killing 124 and injuring 200, known as one of Dhaka's deadliest fire incidents (Molla, 2019).

#### 2) *Chawkbazar, Old Dhaka* (2019)

Chawkbazar is centuries-old mixed-use area where residential buildings, warehouse of flammable chemical are situated. It has congested historical neighborhood with no zoning or fire access planning. Gas cylinder ignition caused a chemical explosion, killing and injuring more than 80 and 50, respectively (Molla, 2019).

#### 3) *BM Container Depot, Sitakunda, Chattogram* (2022)

BM Container Depot is a private inland container depot involved in import-export operations. It is located in an industrial zone near Chattogram port, handling dangerous chemicals. Stored hydrogen peroxide exploded during a fire, killing 49 and injuring over 450, including firefighters with USD (\$) 110 million asset loss (Al Jazeera, 2022).

### **Factor 3: Economic Inequality/Labor Exploitation**

#### 1) *That's It Sportswear, Dhaka* (2010)

That's It Sportswear is an export-oriented sportswear manufacturer linked to global fashion supply chains. It is located in a multi-story industrial building in a Dhaka suburb. An electrical short circuit in 2010 led to 29 deaths and 100+ injuries. Escape was impossible due to locked exits (Geertjan, 2011).

#### 2) *Cotton Club Limited Gazipur* (2012)

Cotton Club Limited is a garment manufacturing unit located within Gazipur's industrial belt, contributing to Bangladesh's export economy. An electrical fire in 2012 killed 7 workers and revealed poor evacuation procedures and no active fire systems in the factory (Sobuj, 2011).

### 3) *Tampaco Ltd., Gazipur* (2016)

Tampaco Ltd. is a packaging company supplying Nestlé and British American Tobacco, located in a semi-industrial area of Gazipur. A boiler explosion triggered a massive fire, killing 25 and injuring 70+, exposing industrial mismanagement (Dhar, 2016).

## Factor 4: Urban Design Limitation

### 1) *Pacific Jeans, Chattogram* (2013)

Pacific Jeans is one of Bangladesh's leading denim exporters with global client, located in modern industrial complex in Chattogram. Florescent light burst created panic among the workers leading to 40 injuries (bdnews24.com, 2013).

### 2) *Bangabazar Market Fire* (2023)

Bangabazar is a clothing wholesale market crucial to low-cost retail across the country. It is located in central Dhaka, with unauthorized expansions and dense vendor setups. Electrical short circuit ignited fire that destroyed over 3800 shops causing US \$27.7 million damages. No death was reported, but massive economic loss occurred (BBC News, 2023).

### 3) *Restaurant, Bailey Road, Dhaka* (2024)

It is a six-story commercial building hosting trendy eateries and family restaurants, located in dense urban commercial block with high visitor traffic. A gas explosion caused a nighttime fire, killing at least 45 and trapping people on upper floors due to blocked exits (New York Post, 2024).

Based on these cases, a comparative analysis has been completed (Table 2).

**Table 2.** Comparative analysis table of urban fire case studies in Bangladesh.

Case Study Name	Location Type	Cause of Fire	Fatalities/Injuries	Asset Loss (USD)	Active Fire Protection Present?	Passive Fire Protection Present?	Response Time (Approx.)	Building Code Violations?	Major Challenges Identified	Lessons Learned
<b>KTS Textile Factory, Chattogram</b> (2006)	Industrial	Boiler explosion	65 deaths, 80 injured	Not reported	×	×	Delayed	√	Factory over-crowded, exits blocked	Need for emergency exits and code enforcement
<b>That's It Sportswear, Dhaka</b> (2010)	Industrial	Electrical short circuit	29 deaths, 100 injured	US \$0.27 million	×	×	Delayed	√	No fire exits, panic among workers	Importance of fire drills and accessible exits
<b>Nimtoli, Old Dhaka</b> (2010)	Residential	Chemical explosion	124 deaths, 200 injured	Not reported	×	×	Over 1 hour	√	Narrow roads, illegal chemical storage	Urban zoning reform and chemical regulation
<b>Tazreen Fashions, Ashulia, Dhaka</b> (2012)	Industrial	Electrical short circuit	112 deaths, 150+ injured	US \$3 5 million	×	×	Delayed	√	Locked exits, no alarms	Enforcement of workplace fire safety
<b>Cotton Club Limited Gazipur</b> (2012)	Industrial	Electrical fire	7 deaths	Not reported	×	×	Not reported	√	Poor evacuation planning	Invest in fire awareness and exit protocols

## Continued

<b>Pacific Jeans, Chattogram (2013)</b>	Industrial	Florescent light burst	40 injured	Not reported	×	×	Delayed	√	Panic, Poor evacuation planning	Need for emergency exits
<b>Tampa-Co Ltd., Gazipur (2016)</b>	Industrial	Boiler explosion	25 deaths, 70+ injured	US \$7.8 million	×	×	Slow	√	Chemical mishandling, no alarms	Ensure industrial boiler regulation
<b>Chawkbazar, Old Dhaka (2019)</b>	Old Town, Dhaka (Mixed-Use)	Chemical explosion	80+ deaths, 50+ injured	US \$68.8 million	× (No extinguishers, alarms)	× (No fire exits, narrow alleys)	1 hour	√	Chemical storage in residential areas, Inaccessible Road	Urgent need for chemical zoning and access
<b>FR Tower, Banani, Dhaka (2019)</b>	Commercial high-rise, Dhaka	Electrical short circuit	25 deaths, 73 injured	Not reported	× (No sprinklers or alarms)	× (Staircases blocked, no signage)	40 min	√	Unauthorized floors, blocked stairs	High-rise safety enforcement, Enforce building codes
<b>BM Container Depot, Sitakunda, Chattogram (2022)</b>	Industrial area, Chattogram	Chemical explosion	49 deaths, 450+ injured	US \$110 million	× (Insufficient fire safety systems)	× (Highly flammable storage materials)	Over 2 hours	√	No chemical handling training, massive explosions of hazardous materials, inadequate planning	Specialized response for hazardous storage, Safety in industrial storage
<b>Bangabazar Market Fire (2023)</b>	Commercial	Electrical short circuit	0 death	US \$27.7 million	×	×	Delayed	√	Poor wiring, unplanned market growth	Urban market regulation required
<b>Restaurant, Bailey Road, Dhaka (2024)</b>	Commercial	Gas explosion	45+ deaths, dozens injured	Not reported	×	×	3 hours	√	Blocked stairs, overcrowding	Fire safety in eateries must be enforced

## 4. Discussion

Bangladesh has witnessed various devastating fire incidents across industrial, residential, and commercial sectors over the past two decades. These incidents have not only resulted in the loss of thousands of lives and assets but have also shown weaknesses in the country's fire safety infrastructure, urban planning, and emergency response systems. The study reveals some major disparities in fire risk zones across Dhaka, Gazipur, and Chattogram Districts that is shaped by demographics, infrastructure, planning, road accessibility, land use and other key factors. City Corporations exhibits higher population density, infrastructure, housing leading to enhanced risk of fire events in these areas compared to other areas of the district i.e., consistent to the statement of Hasan et al. (Hasan et al., 2021). While Dhaka benefits from extensive fire station networks, different spatial arrangement and haphazard development indicates higher risk here. Gazipur's limited stations concentrating highways indicate service gap which is common in peri-urban areas (Yfantidou et al., 2023). The fire stations and population density are varied across Chattogram, making the overall exposure to fire event is the lower. The high-risk zones are concentrating alongside the coast here. Among the three districts, Dhaka emerges as the most vulnerable one, especially Dhaka City Corporation aligning with the prior studies regarding this capital of Bangladesh (Jaman & Pantha, 2023; Rahman et al., 2015). The case study analysis exposes several recurring causes, for example: electrical short circuits, boiler explosions, chemical storage mismanagement (especially in residential-commercial mixed areas, leading to catastrophic explosions) and gas explosion. This reveals that major fire incidents in Bangladesh

occur are not only due to technical failures but also outcomes of deeply rooted systemic failure such as poor governance, regulatory gaps, infrastructure negligence and socio-economic inequality. Majorities of the death and injuries occurred in the fire incidents were due to poor evacuation planning, blocked exits, or lack of emergency staircases. Due to inadequate urban and industrial safety regulations, serious gaps in fire prevention and management are perceived. Densely populated areas are at high risk due to lack of zoning laws, unauthorized expansions and unregulated chemical storage. Impact of these fire incidents on Bangladesh's economy cumulatively is high, especially in the RMG (Ready-Made Garment) sector. It also affects the international reputation, discouraging foreign investors and trade. While early fire incidents occurred mostly in industrial zone, recent incidents are increasing in urban commercial spaces like high-rise buildings, making urbanization without fire risk planning a new hotspot for potential disasters. Despite of these incidents, the repetition of similar causes and institutional negligence indicates failure of concerned authorities in fire safety planning.

## 5. Recommendations

The recurring natures of fire incidents in Bangladesh put emphasis on urgent need for actions to fire risk reduction. With the aim of strengthening fire safety frameworks, improving emergency preparedness, and installing fire resilience into national development planning, the following section provides recommendations that cover both short-term and long-term strategies. Proper implementation of these will significantly improve fire protection and safety of the urban areas of Bangladesh, lessening the amount of property damage, injuries, and losses of life.

### Short-Term Strategies:

1) For high-risk industrial zones and container depots, installation of alternative fixed fire systems, including foam suppression and halogenated hydrocarbon vapor systems are necessary. The system must provide total coverage depending on vulnerability.

2) To ensure availability and usability of portable fire extinguishers:

- Mandate the installation of portable fire extinguishers in all residential, commercial, and industrial establishments.
- Launch community training programs on the use and maintenance of extinguishers.

3) To ensure product reliability and performance, third-party certification and testing of all fire safety installations, including alarms, extinguishers, and sprinkler is required.

### Long-Term Strategies:

1) Integrate Fire Risk into Urban Planning and Infrastructure Design: maintain fire safety standards into building codes by prioritizing fire-resistant materials, rooftop escape necessities, and accessible emergency exits.

2) Develop fire-resilient masterplans for commercial zones and high population density areas.

3) To relocate illegal or unsafe chemical warehouses from congested urban ar-

areas like Old Dhaka to designated and monitored industrial zones.

## 6. Conclusion

Fire hazards have caused significant losses in Bangladesh by threatening human lives, infrastructure, and economic stability. This study contributes to spatial integrated analysis of fire hazards in urban Bangladesh through the evaluation of population density, fire station distribution, land use, and major fire incidents of last twenty years. Dhaka City Corporation emerges as the most vulnerable area, with high intensity, while Chattogram, though comparatively less exposed, still faces significant risks in industrial zones. Critical gaps in fire station placement, especially in Gazipur although being a high frequency of fire risk in the RMG sectors, where coverage is limited to highways, indicating an underdeveloped fire response system. Overall, the research indicates urgent need for improved urban planning, enforcement of fire safety regulations and equitable distribution of emergency services. These measures are essential to mitigate fire risks in the context of Bangladesh's rapid urbanization and to safeguard both human lives and economic assets.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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