

The History of Fires and Firefighting in Japan and Six of its Major Cities [#1]

The History of Fires and Firefighting in Japan

“The History of Fires and Firefighting in Japan and Six of its Major Cities” is a compilation of the history of fires and firefighting in Japan and six of its major cities and related data from 1950 to 2020 intended to introduce the state of fires and firefighting in Japan to the rest of the world. This series of special chapters will be presented in four installments. The first installment will focus on the state of fires and firefighting in Japan as a whole.

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Introduction

Three years ago, Peter Wagner of Germany asked me to participate in the project “100 Cities - 100 Years - Evaluation of Urban Fire Risks in the period 1900-2018”. This project aims to have experts working on a volunteer basis collect data on fires and firefighting in the world’s 100 major cities over a 100-year period and create a database so that the fire risks in each city can be compared.

I took on the task for six Japanese cities (Tokyo, Yokohama, Nagoya, Kyoto, Osaka, and Kobe) and collected and organized the data with the help of the National Research Institute of Fire and Disaster and current and former employees of each city (listed in the acknowledgments at the end of this series).

In the case of Japan, the firefighting system was drastically reformed following the country’s defeat in World War II and subsequent reconstruction, and data is only available from that point forward. However, the Fire and Disaster Management Agency (FDMA) collects data from all cities, towns, and villages in a uniform manner every year and organizes it into the Fire Service Annual Report and the Fire Annual Report, so the data collected is of consistent quality and extremely accurate.

Now, with the cooperation of this magazine and the International Fire Service Information Center, we have decided to use this data to organize and introduce to the readers of this magazine the history and related data on fires and firefighting in Japan and the six cities mentioned above, and to translate it into English and post it on the website of the International Fire Service Information Center for the benefit of overseas parties.

1. Architecture and Fires in Japan before the Edo Period

Because of Japan’s maritime climate and high rainfall, the entire country has been covered with forests since ancient times, producing an abundance of lumber, a high-quality building material. For this reason, until recently, all buildings in Japan were made of wood. Since large buildings such as temples and castles were also made of wood, the technology for constructing wooden buildings has long been developed, and in 758, Todaiji Temple, a huge wooden temple measuring 90 m wide, 50 m deep, and 50 m high, was built.

Because wooden buildings are vulnerable to fire, many temples and castles have been repeatedly destroyed and rebuilt due to civil war, arson, accidental fire, and the spread of fire from the surrounding area.

As there were no effective means of extinguishing fires back then, the only way to prevent a fire from developing into an urban fire was to destroy the surrounding buildings to create a firebreak. For this reason, when a fire broke out, carpenters and construction workers who were familiar with the structure of buildings would usually work as firefighters.

During the 267-year period from the beginning of the 17th century to the middle of the 19th century, large-scale urban fires occurred 49 times in Edo (present-day Tokyo), 9 times in Kyoto, and 6 times in Osaka.

Even so, people back then did not try to make their cities and buildings fire-resistant. The reasons for this are thought to be that brick and stone construction, which play a major role in the construction of fire-resistant cities around the world, were not suitable for Japan because of the country’s frequent earthquakes, the hot and humid summers that require wide openings in exterior walls

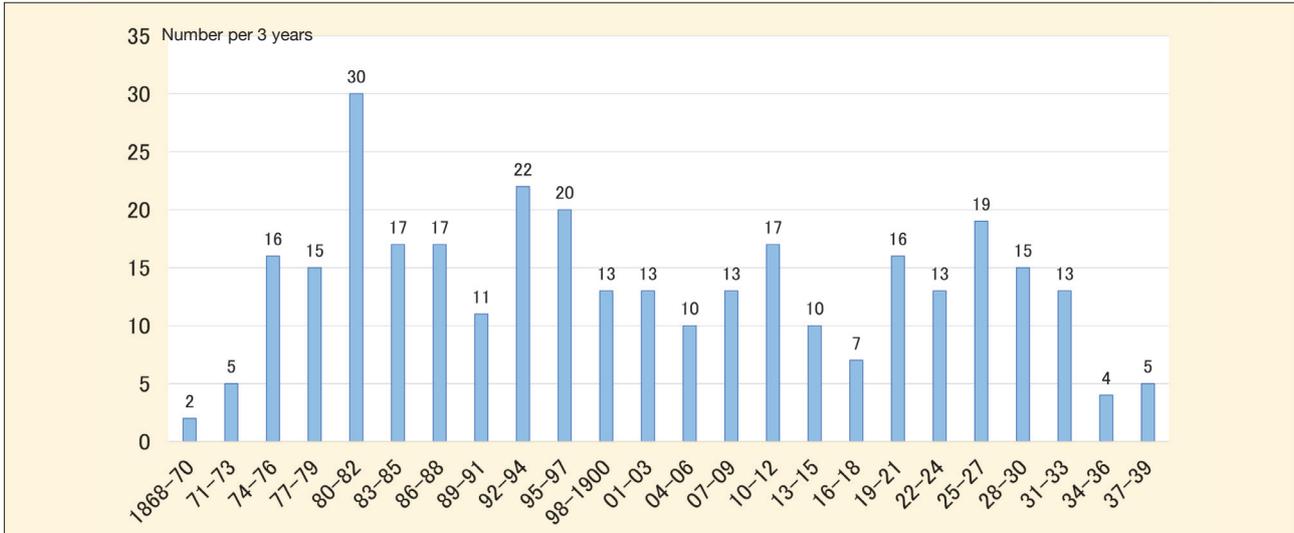


Figure 1 Large-scale urban fires that burned down 300 or more houses (1868-1939)
 (Prepared based on “The Encyclopedia of Environment, Disasters and Accidents (published by Maruzen)”)

for ventilation, and the high humidity that tends to cause condensation.

As a result, the citizens of Edo chose a different path to adapt to the repeated large-scale fires. The wealthy built earthen storehouses to store their goods, developed wooden construction methods that made it easier to rebuild in the event of a fire, and regularly stockpiled lumber in the suburbs for this purpose. In addition, the common people lived in rental houses built by the wealthy and borrowed their household goods, thereby achieving a lifestyle where they would not be impoverished even if their houses burned down in a fire.

Although firefighting teams consisting mainly of carpenters and construction workers were formed in various parts of the city, they were not able to completely prevent the outbreak of large-scale urban fires.

Some research suggests that the large-scale urban fires that occurred every few years in Edo may have created effective demand, which in turn helped to stimulate the economy.

(Reference materials: “The History of Firefighting”, Museum of Fire and Disaster, Institute of Scientific Approaches for Fire & Disaster)

2. Fires and Fire Service Systems in Modern Japan

In 1868, with the fall of shogunate and the beginning of the modern state, fire service systems were reorganized under the jurisdiction of the police. Although large-scale buildings were now built with fire-resistant construction introduced from Europe and the United States, the predominantly wooden construction of cities and their poor fire service systems remained basically unchanged from the samurai period until the end of World War II in 1945.

Figure 1 shows the number of large-scale urban fires (i.e., fires that burned down 300 or more houses), broken down into three-year periods. We can see from this figure that during the 72 years from 1868 to 1939, there were 323 such large-scale fires (an average of 4.5 per year), and that there was little improvement during this period.

In the final stages of World War II, the vulnerability of Japanese cities to fire was exploited by the U.S. military in large-scale air raids. The napalm bombs used in these raids were extremely effective in burning down Japan’s predominantly wooden cities, and by the end of the war, the main parts of Japan’s largest cities had been completely burned to the ground.

In mainland Japan (excluding Okinawa, where ground warfare took place), including the atomic bombings, 430 cities were hit by air raids, 2.3 million houses were completely destroyed, and 588,000 people were killed or went missing, with the majority of such losses attributable to fire.

There are many cities around the world that were thoroughly destroyed by air raids and other means during World War II, but Japan is probably the only country whose urban areas were completely destroyed by fire. For this reason, it is impossible to discuss the history of fires in Japan without mentioning the large-scale fires caused by air raids.

(Reference materials: “The History of Firefighting”, Museum of Fire and Disaster, Institute of Scientific Approaches for Fire & Disaster)

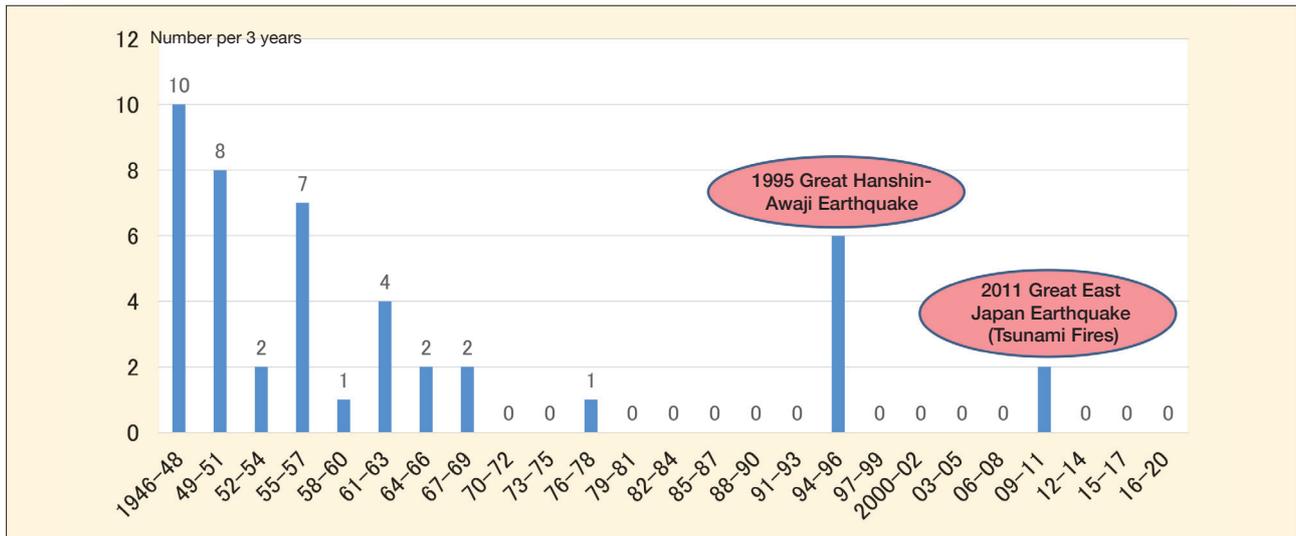


Figure 2 Large-scale Urban Fires with a burned area of 33,000m² or more (1946-2020)
(Prepared based on the White Papers on Fire Service)

3. Urban Fire Prevention Strategies and Fire Service Systems in Japan

Following the end of World War II, Japan was occupied by the Allies, who implemented major democratic reforms. As part of these reforms, fire services (including ambulance services) would now be performed by municipalities rather than the police, and fire defense organizations were given the legal authority not only to extinguish fires, but also to mitigate the damage caused by fires.

Immediately after the war, there was a series of large-scale urban fires in cities that had survived the air raids. As part of its postwar reconstruction efforts, the Japanese government aimed to build fire-resistant cities, but at that time the economy was in a state of collapse, and it was difficult to make all buildings in urban areas fire-resistant. Therefore, the government adopted a strategy of covering the exterior walls of wooden houses with mortar to prevent the spread of fire and establishing fire service systems that could rush to the scene of a fire and begin extinguishing it within eight minutes of receiving a call. This strategy was a great success, and by around 1970, large-scale fires in urban areas were almost completely eliminated (Figure 2).

However, there were two major problems with this strategy.

The first is that large-scale urban fires can still occur if fire brigades are unable to function adequately as a result of an earthquake, tsunami, etc.

As Figure 2 clearly shows, both the 1995 Great Hanshin-Awaji Earthquake and the 2011 Great East Japan Earthquake caused large-scale fires in urban areas. In the Great Hanshin-Awaji Earthquake, six large-scale urban fires destroyed a total of 4,420 houses, leaving 234 people dead. In the Great East Japan Earthquake, there were no fatalities due to fire, but two large-scale urban fires destroyed a total of 493 houses.

In 2013, the Japanese government announced that a magnitude 7-class earthquake with an epicenter directly under Tokyo and a magnitude 8-class megathrust earthquake with an epicenter in the Pacific Ocean west of central Japan both have a 70% or greater probability of occurring within 30 years. The damage predicted in this report is horrendous, but even just looking at the fire-related estimates, up to 412,000 houses would be destroyed and 16,000 people killed in an earthquake directly under Tokyo, and 750,000 houses would be destroyed and 22,000 people killed in a megathrust earthquake.

The second problem is that it requires enormous firefighting expenses as well as a large number of firefighters.

In 2020, municipalities maintained 166,628 full-time firefighters (including 5,270 ambulance team members) in 1,719 fire stations, along with 818,478 volunteer firefighters from the general public. The expenses for this amounted to JPY 2,001.2 billion, or 2% of the government's general-account budget. With a population of 126.227 million, Japan is forced to maintain fire service systems that may be considered excessive in relation to the size of its population when compared to other countries.

It must be said that in a country like Japan, where major earthquakes occur frequently, the strategy of covering the exterior walls of wooden houses with mortar while improving fire service systems to prevent large-scale urban fires was a mistake.

It is my opinion that Japan, like many other countries throughout the world, should have redirected its efforts toward building fire-resistant cities 50 years ago, when the postwar reconstruction period had passed and the Japanese economy had become more affluent.

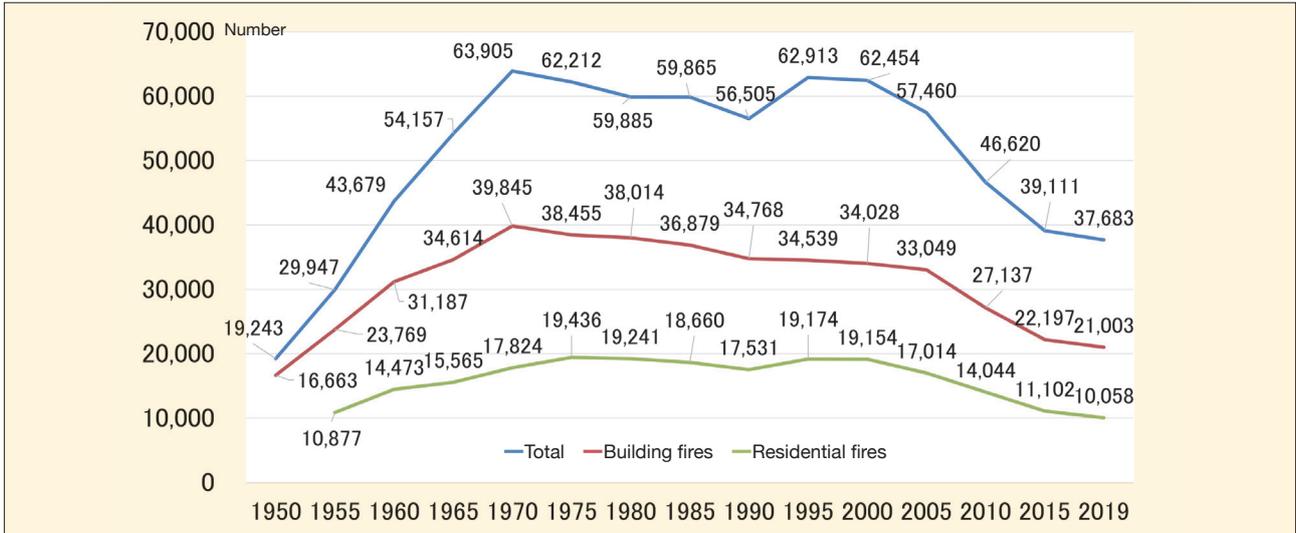


Figure 3 Number of fires in Japan (1950-2020)
(Prepared based on the White Papers on Fire Service)

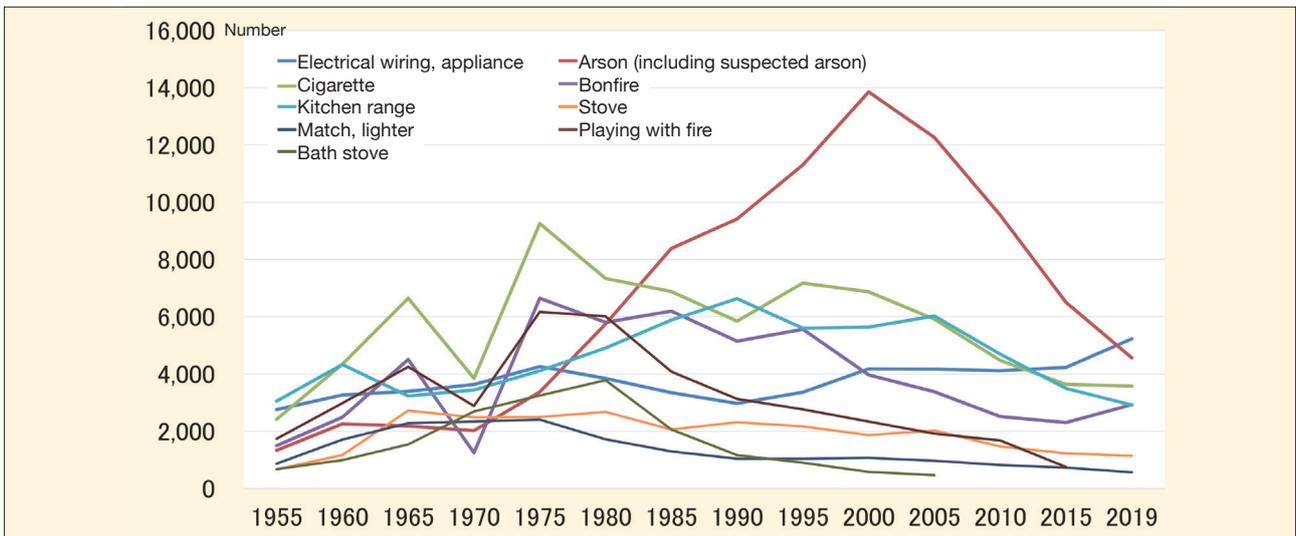


Figure 4 Causes of fires in Japan (1955-2020)
(Prepared based on the White Papers on Fire Service)

4. The Current State of Fires in Japan

1) Occurrence of fires

Figure 3 shows the occurrence of fires in Japan over the past 70 years, broken down into five-year periods.

The number of fires increased rapidly until around 1975 due to economic growth and increased energy consumption, etc. Since then, however, the number of fires has begun to decline, especially since the year 2000.

This trend also applies to the six cities discussed below.

Figure 4 shows the occurrence of fires during the same period, organized by primary cause.

There are many theories as to the reasons for the sharp decline in fires in recent years, but based on Figures 3 and 4, as well as other data, I suspect the following five reasons to be the most likely.

- (1) The installation of a large number of surveillance cameras for crime prevention beginning around the year 2000, and the deterrent effect of these cameras has led to a sharp decline in arsons.
- (2) The installation of fire alarm devices, which has been mandatory in all homes since 2006, has led to a sharp decline in residential fires as occupants are able to detect and respond to abnormalities before they become a fire.
- (3) A decrease in cigarette fires due to fewer smokers.
- (4) A decrease in fires caused intentionally, by tampering, or through negligence, due to fewer matches and lighters in close

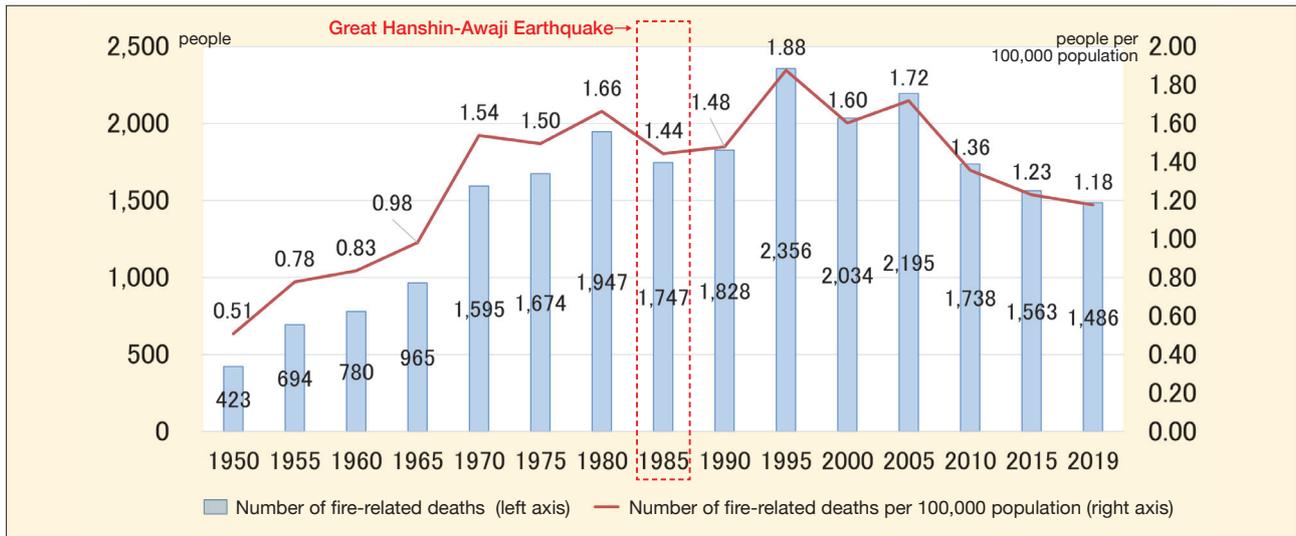


Figure 5 Number of fire-related deaths and Number of fire-related deaths per 100,000 population in Japan (1950-2020)
(Prepared based on the White Papers on Fire Service)

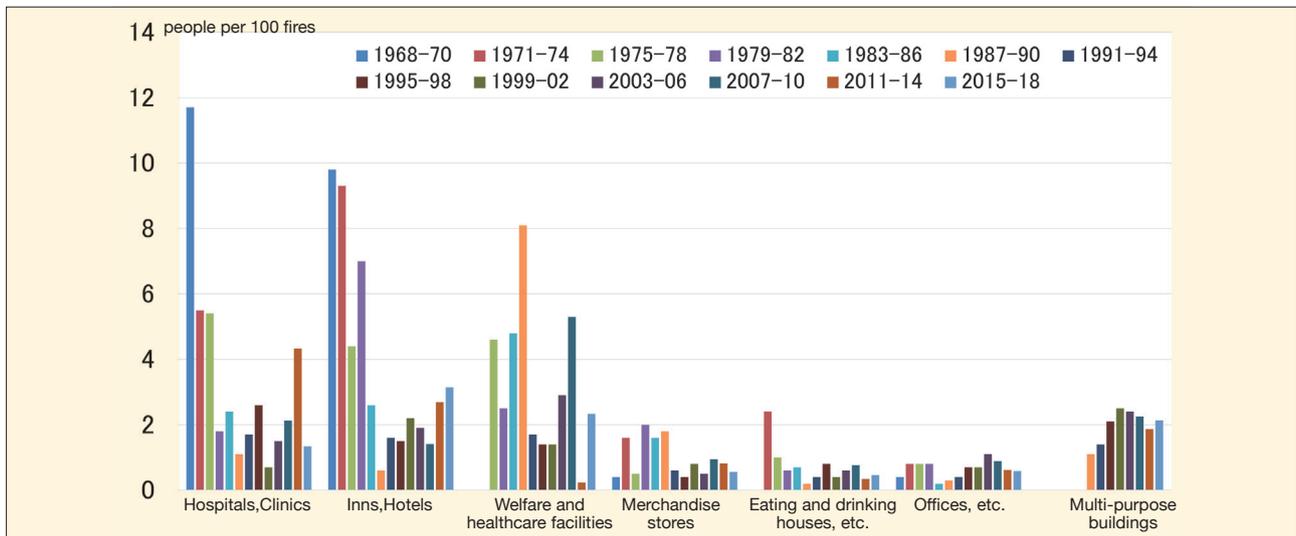


Figure 6 Number of fatalities per 100 fires by building purpose (1968-2018)
(Prepared based on the White Papers on Fire Service)

proximity as a result of the decline in smoking and the introduction of automatic ignition in cooking and heating appliances, etc.

- (5) The transition to easier-to-control energy sources for heat-producing machinery and appliances such as cookware, heaters, bathtubs, and automobiles, as well as advances in fire prevention technology.

In Japan, regulations on electrical construction and improvements in safety measures for individual products were effective early on in preventing electrical fires, but in recent years the number of electrical appliances and wiring has increased faster than safety measures have improved, leading to an increase in the number of such fires.

2) Occurrence of fire-related deaths

Figure 5 shows the number of fire-related deaths and their occurrence per 100,000 population over the past 70 years, broken down into five-year periods. With the exception of 1995, the year of the Great Hanshin-Awaji Earthquake, the number of fire-related deaths had steadily increased until around 2005, after which it began to decline.

The majority of fire-related deaths are caused by residential fires, and many of the victims are elderly. Because of the potential for a sharp increase in fire-related deaths as population aging progresses, the Japanese government mandated the installation of fire alarm devices in all new homes in 2004, and in all older homes beginning in 2006.

While this may be the reason why the number of fire-related deaths began to decline after around 2005, there is concern that the number of such deaths may increase again in the future, as population aging is expected to progress even more rapidly than before.

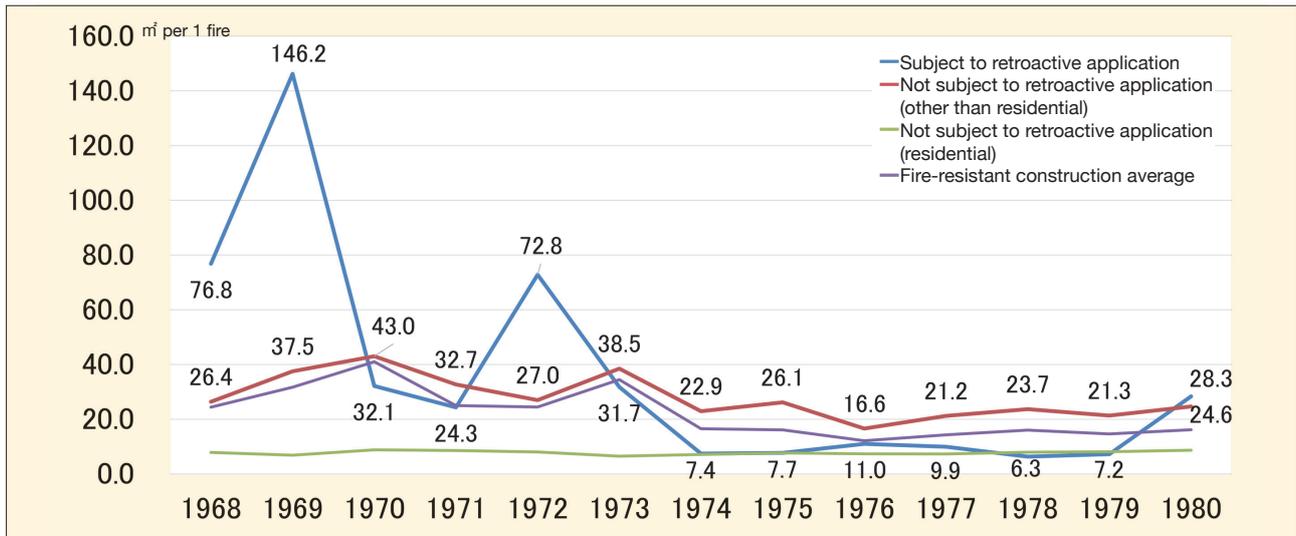


Figure 7 Burned floor area per 1 fire in fire-resistant buildings (1968-1980)

Retroactive application: This refers to the retroactive application of the latest stringent regulations to older buildings. Under the Fire Service Act, since 1974, sprinkler systems, automatic fire alarm systems, etc. have been subject to retroactive application only in buildings used for applications that pose a high risk to human life in the event of a fire, such as hospitals, hotels, restaurants, and theaters.

3) Fire prevention measures for buildings other than houses

Figure 6 shows the number of fatalities per 100 fires (hereinafter referred to as the “fatality rate”) by building use, broken down into four-year periods. Around 1970, the fatality rate was extremely high for hospitals, hotels, welfare facilities, and other sleeping facilities, but this rate has improved dramatically since 1975.

The reason for this is that each time a particular fire involving a large number of fatalities occurred, the Building Standards Act and the Fire Service Act were revised to strengthen fire safety regulations.

I believe that the 1974 revision of the Fire Service Act, in particular, contributed greatly to the reduction in fatality rate by retroactively applying the latest stringent regulations to older buildings, especially with regard to automatic fire alarm systems and sprinkler systems (see Figure 7).

4) The current state of fires and fire service systems in Japan

Table 1 summarizes key firefighting-related data for Japan as of 2020.

As mentioned in section 3, Japan’s fire service systems are in a state of overcapacity relative to the size of the population. On the other hand, as mentioned above, the number of fires has decreased sharply, and fire-related deaths are also on the decline, indicating a dramatic reduction in damage caused by fires.

The reason this mismatch has not become more apparent is that in recent years, major earthquakes, storms, and floods have become more frequent, and combined with the increased demand for emergency services due to population aging, it has become normal for public fire protection capacity to be used to respond to needs other than fire, and the public supports this.

Unless the urban structure undergoes major changes, such as by making buildings fire-resistant, this relationship can be expected to remain stable. However, it is becoming necessary to develop a system that directly addresses the current situation, including the improvement and enhancement of training programs for firefighters.

Table 1 Key firefighting-related data for Japan (2020)

Population	126,227,000	
Total Area	378,000km ²	
No. of Fire departments	726	
No. of Fire stations	1,719	
Firefighting expenses (based on the 2018 settlement of accounts)	JPY 2,001,200M (USD 18,192.7M)*	
No. of public firefighters	166,628	
No. of volunteer firefighters	818,478	
Fire pumps	Fire department	7,769
	Volunteer fire corps	13,989
	Total	21,758
Ladder trucks	1,132	
Chemical firetrucks	950	
Rescue cars	1,243	
Ambulances	6,443	
Other fire trucks	50,330	
Fire boats	48	
Fire and disaster prevention helicopters	33	

Prepared based on the 2020 White Paper on Fire Service

*Converted at JPY 110 to USD 1 (exchange rate at the time of 2018)