

Building Control in Japan

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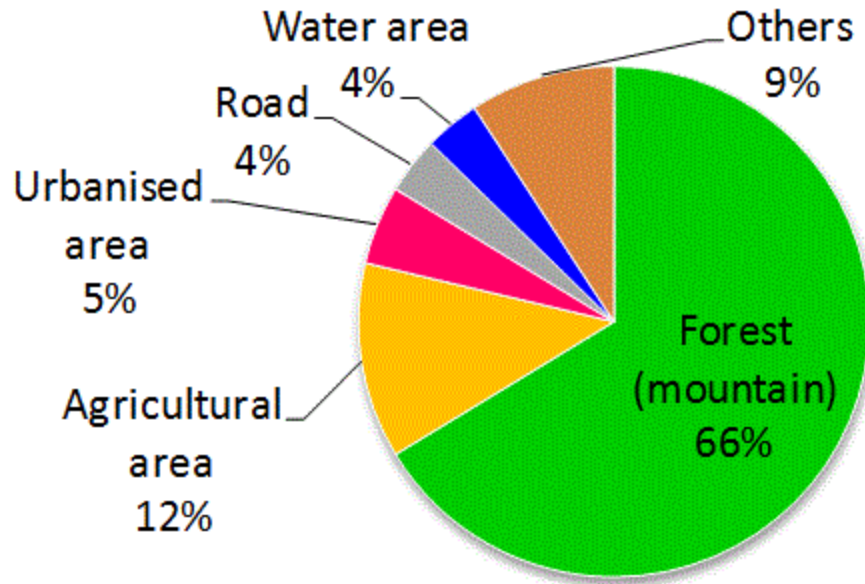
Chapter 3

Background on Cities and Architecture

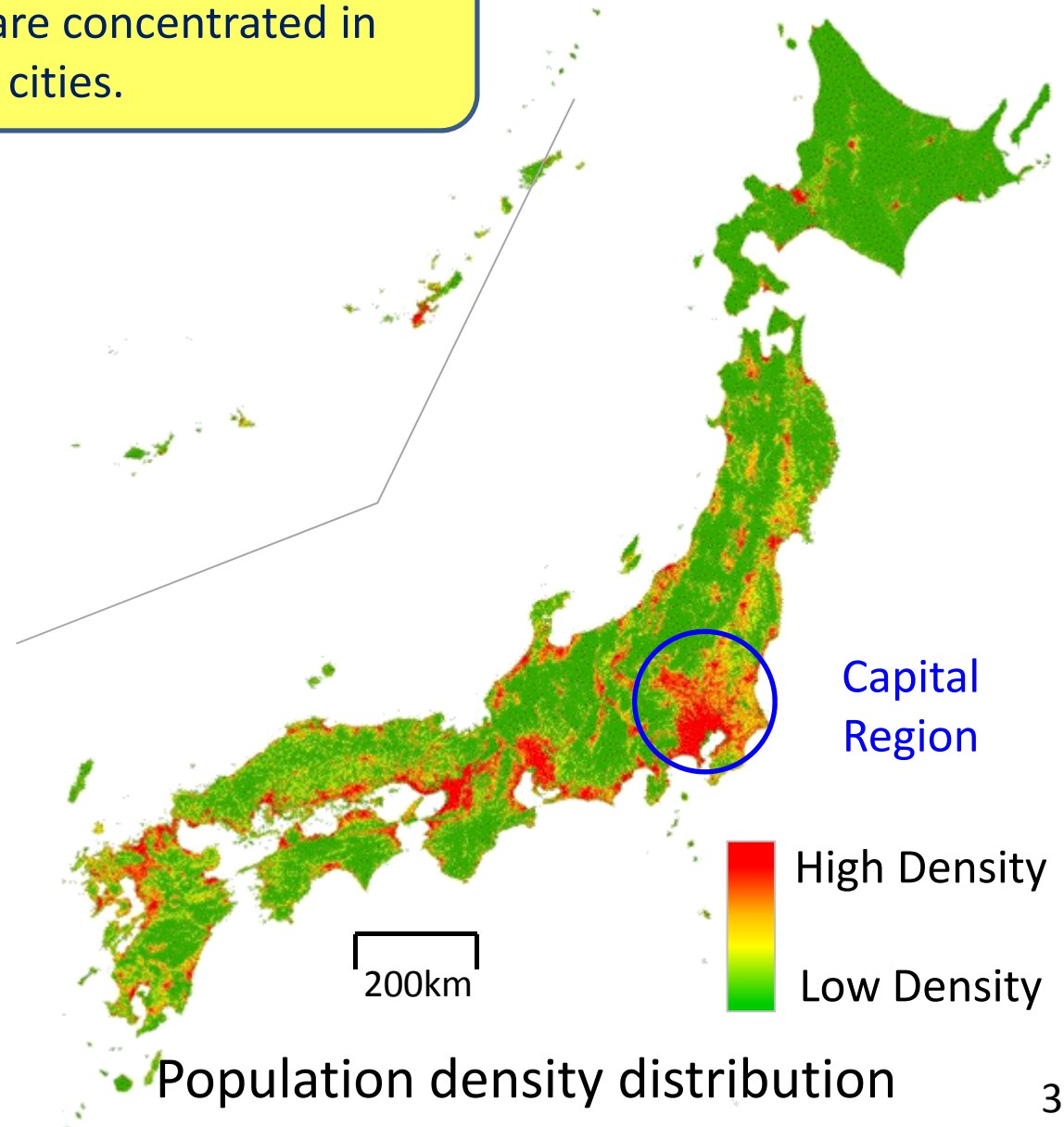
Geography

- Inhabitable land is very limited.
- Population and economic activities are concentrated in capital region and other some mega cities.

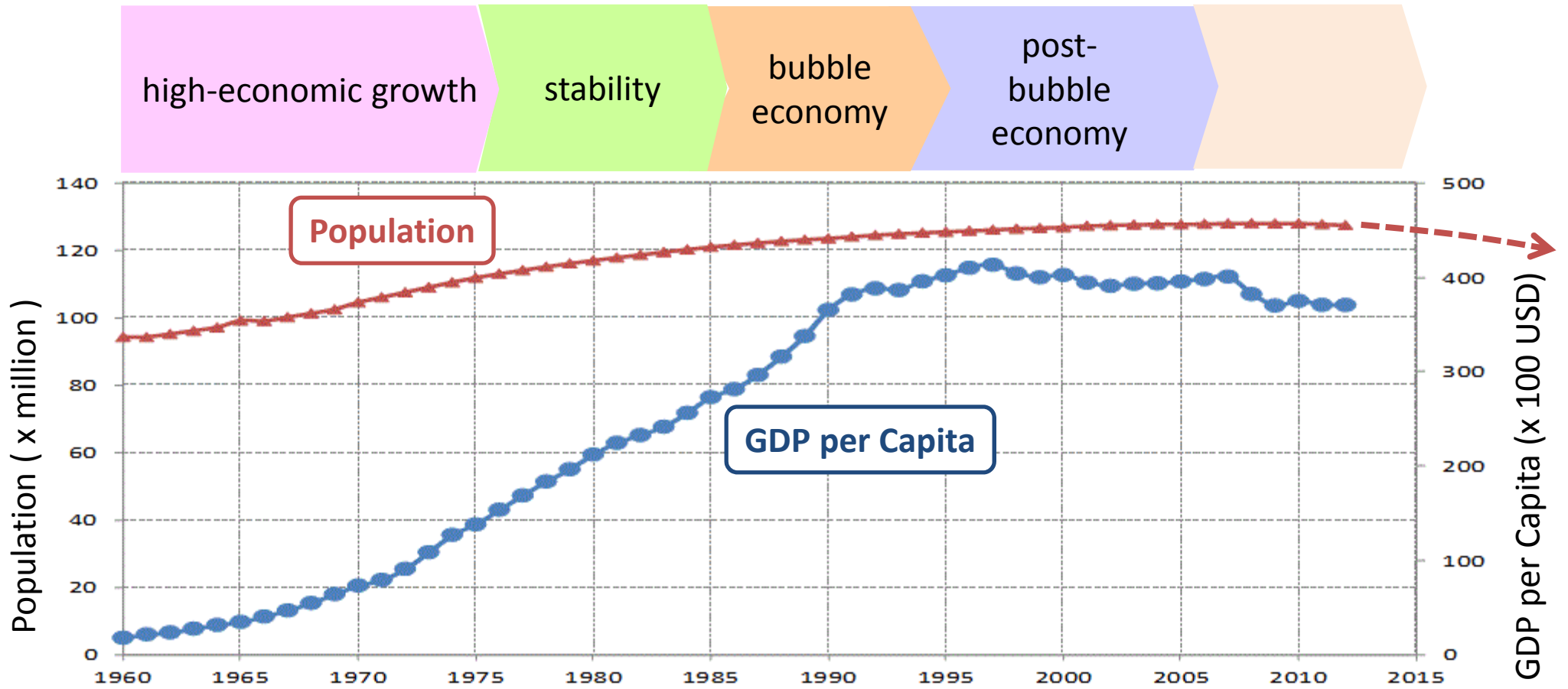
Land use (2010)



- Surface : 377,914 km²
- Population : 126 million (2012)
- GDP : 475.8 Trillion yen (2012)
(\$4.66 Trillion, 1\$=102yen)



Economy Growth



Heavy Industry & Electricity

Population Decrease

Pollution

Environmental Awareness

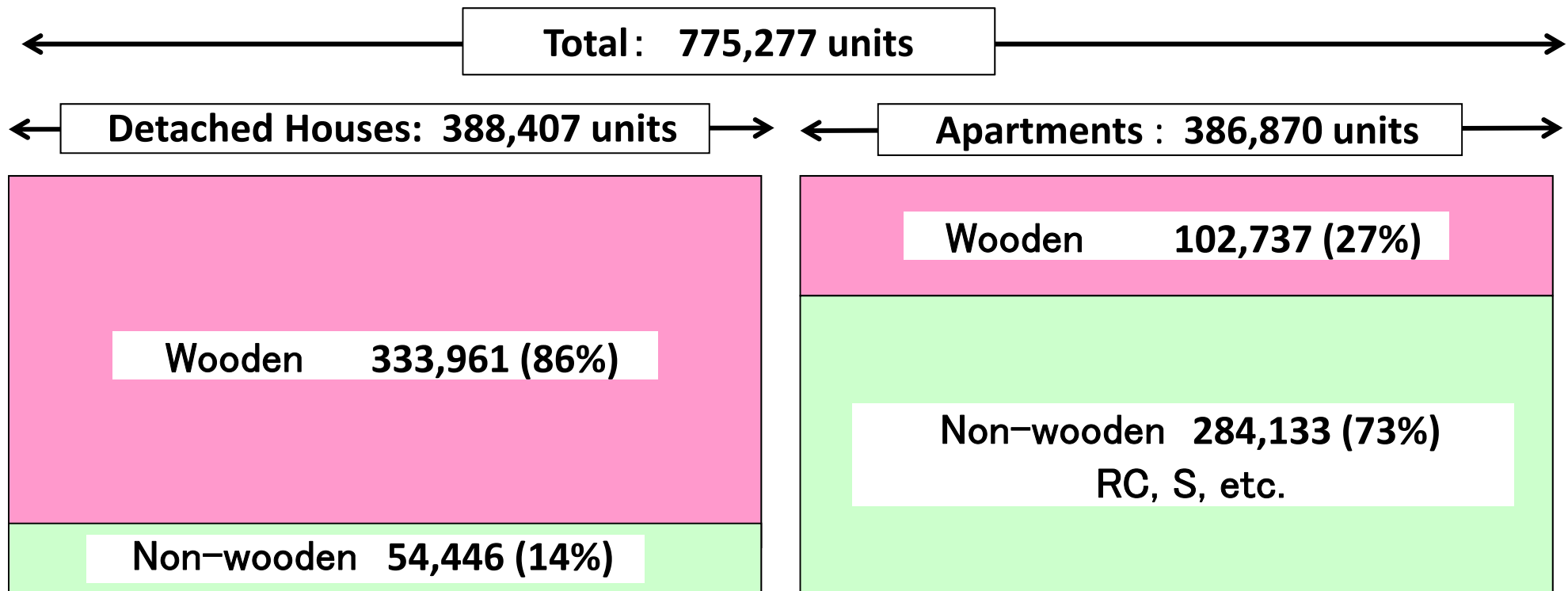
Energy Efficiency

Structural Methods of Buildings

(1) Residential buildings

- (a) In case of detached houses, share of wooden houses is around 90 %.
- (b) In case of apartments, share of wooden apartments is around 30 %.
- (c) It had been prohibited to construct wooden apartments with three or more stories for long time in Japan. Under the current codes, it is possible to construct them with required counter measures against fire.

New Housing Starts (FY 2009: April 2009 – March 2010)



(2) Buildings other than residential buildings

(a) Wooden structure was the dominant type of structure until the end of 19th century.

Before the introduction of **the brick structure in the 1860s**, and the introduction of **the steel structure and reinforced concrete structure in 1900-1920**, the wooden structure was the dominant type of structure, including structure for public use, temples, shrines, and commercial use. Some of them still remain in the country.

Todaiji-temple,
wooden building
with height of 46.8 m
1709



Himeji-castle,
wooden building
with height of 31.5 m
from the top
of the stone wall
1608



(b) From the end of 19th century, construction methods other than wooden construction method was promoted for large buildings.

Construction methods other than wooden construction method was promoted for large buildings, because wooden buildings were considered vulnerable to fires and inferior in terms of durability.

(3) Reevaluation of Wooden Buildings

In the 1980s, Japanese people reevaluated wooden buildings, and new engineering and new administrative measures made it possible to construct large wooden buildings again.

(4) High-rise Buildings

- (a) It was prohibited to construct buildings with height of more than 31 m for long time (until 1963), because Japan is earthquake-prone country.
- (b) In 1968, The first super high-rise building in Japan was constructed, of which height was 156 m, owing to the progress of building technology.
- (c) There are around 2,500 super high-rise buildings with height of more than 60 m.

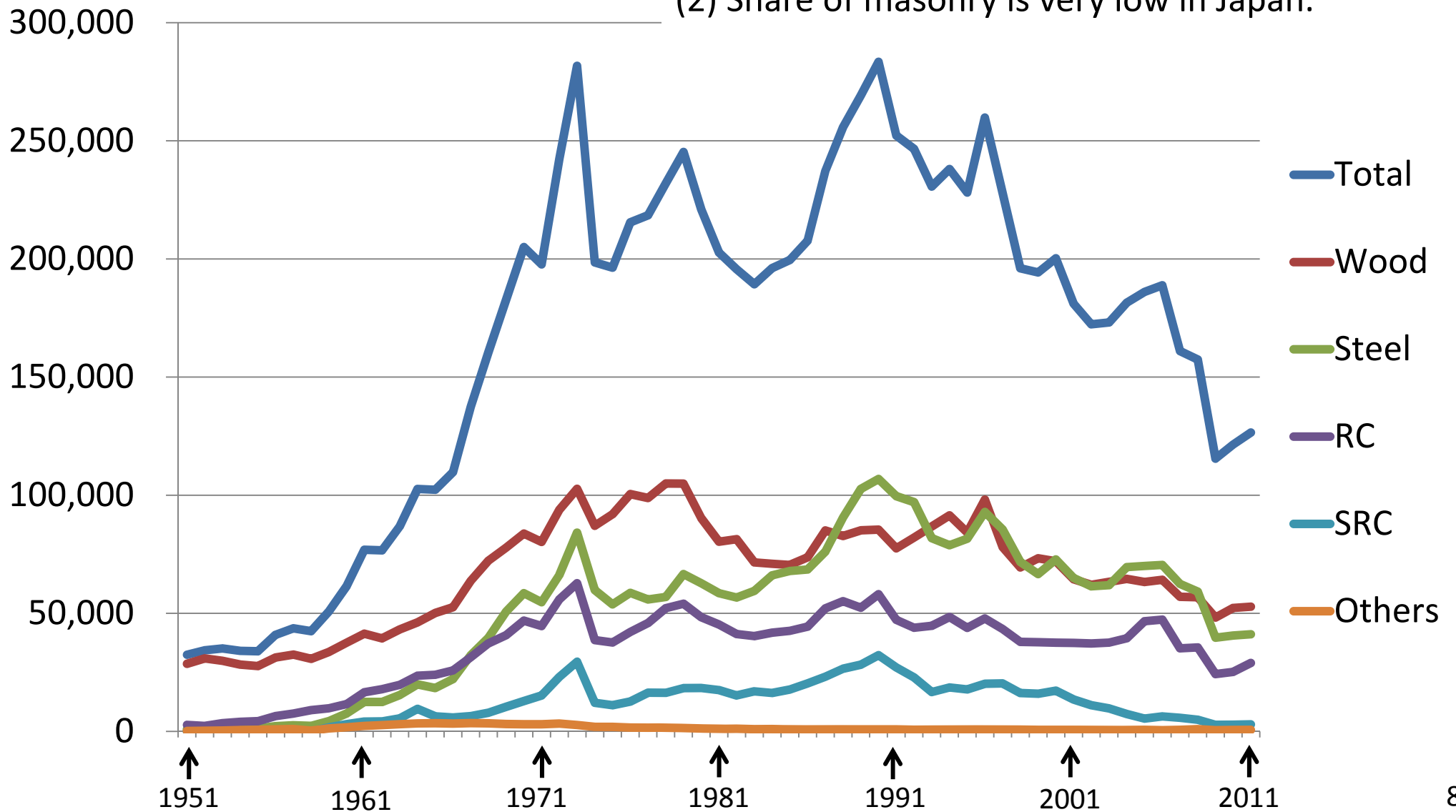
Kasumigaseki-building

Steel structure with height of 156 m
36 floors on the ground, 1968



Total Floor Areas of Annual Building Starts in Each Type of Construction in Japan (unit: 1,000 m²)

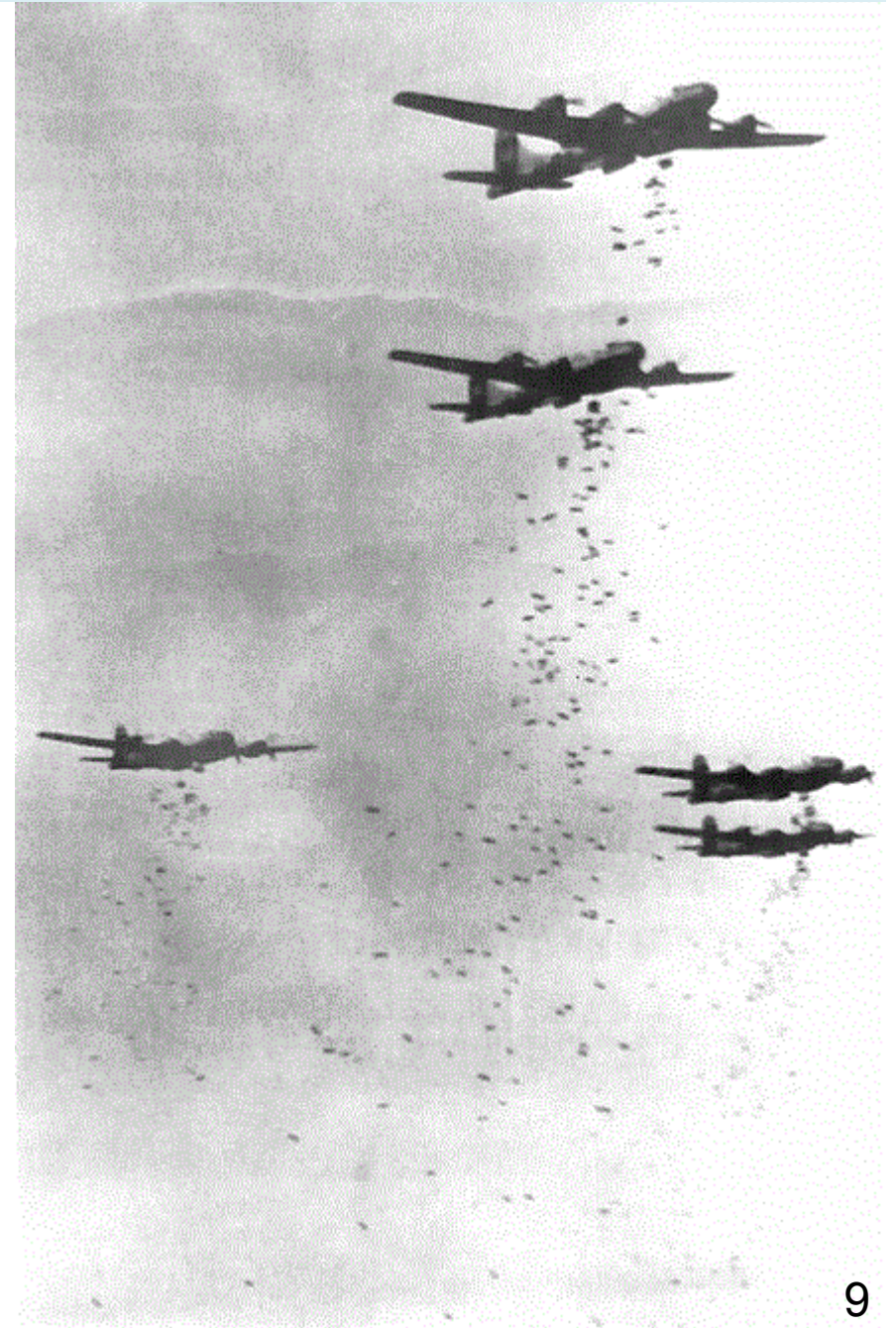
(1) Share of wood structure is stably high in Japan.
 (2) Share of masonry is very low in Japan.



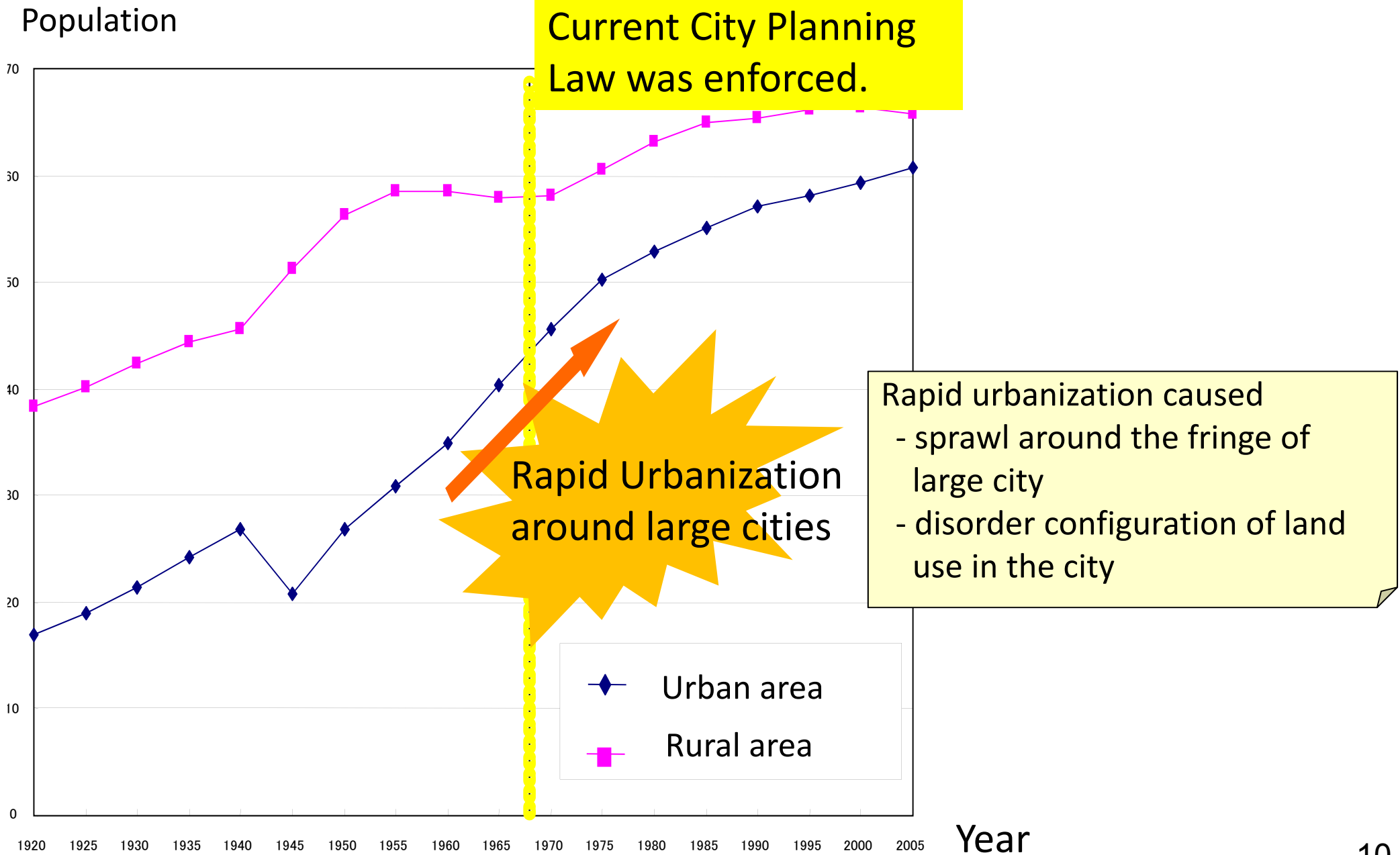
Urbanization

Damage of World War II (1945)

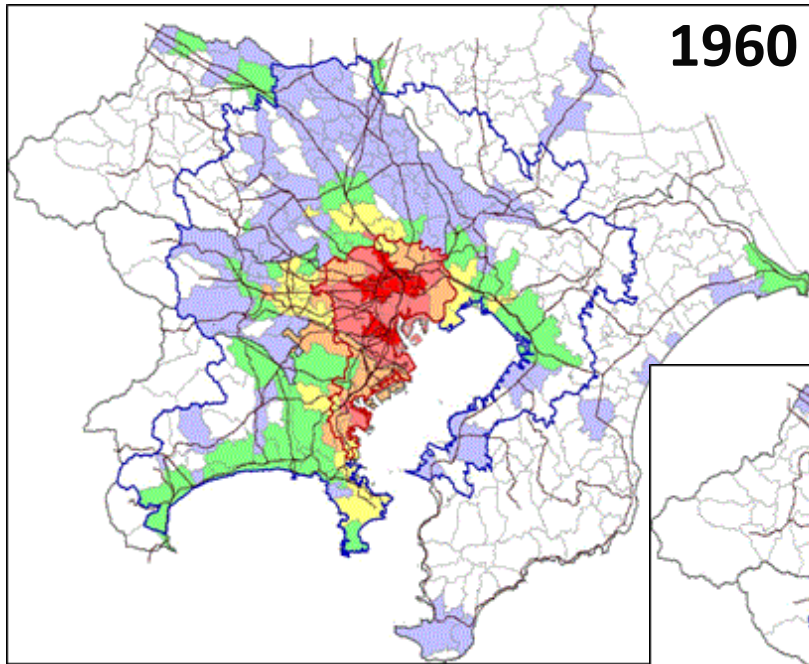
- More than 200 cities in Japan were heavily bombed in 1944 and 1945.
- Around 300,000 people were killed.
- 15 million people lost their houses.



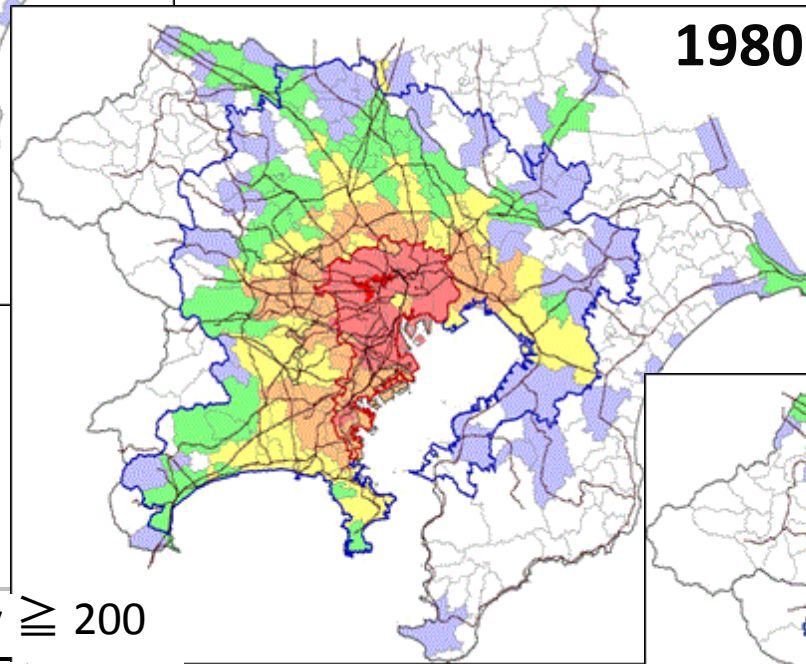
Rapid Urbanization in 1950-1970s



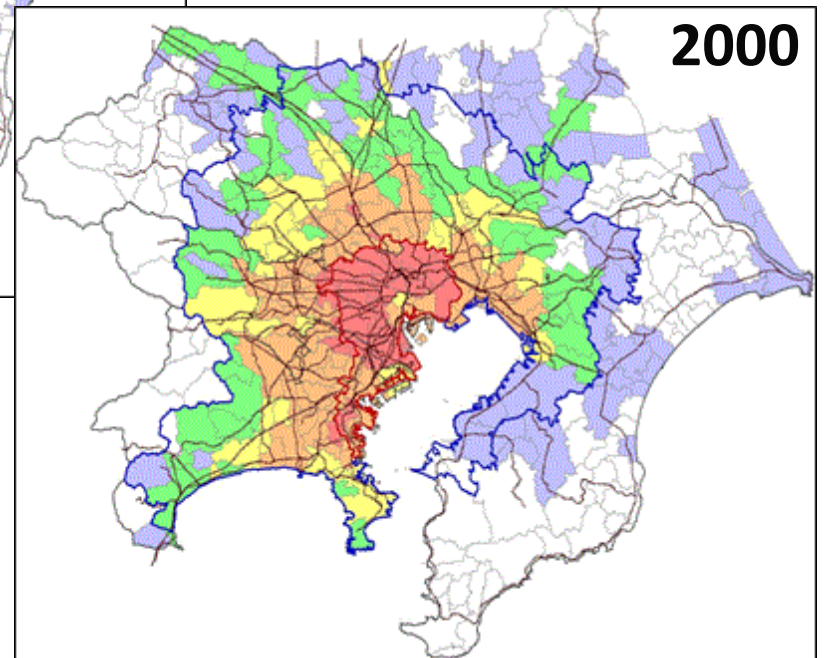
Urbanization in Tokyo Metropolitan Area



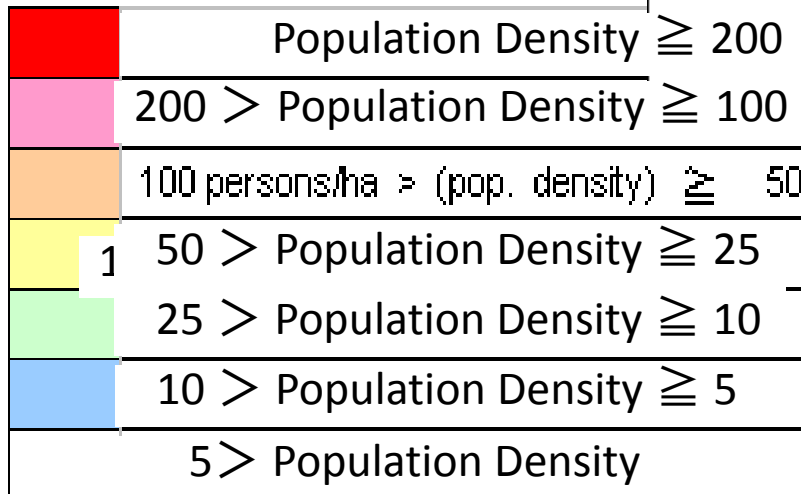
20 years



20 years



Population density
(persons / ha)



Sprawl around the fringe Area of city

Agricultural Land and built-up area coexist, here and there.

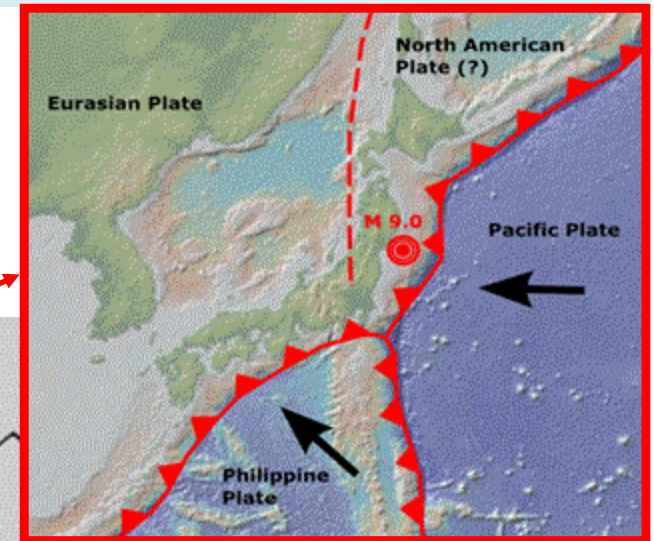
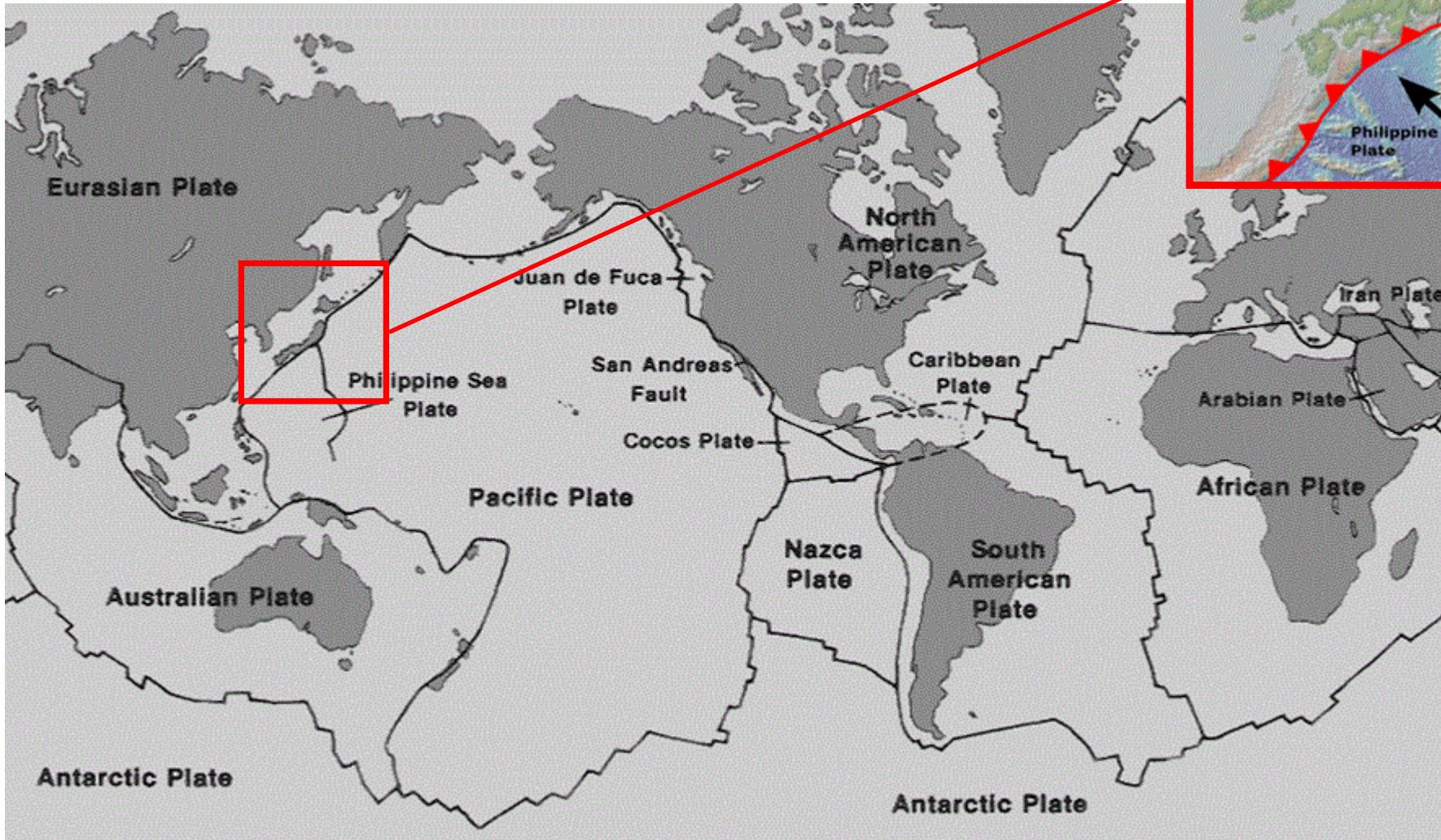


Earthquake and Tsunami

Japan is located on the boundaries of four Plates.

Around Japan

World Map of Plate Boundary



(1) Great Kanto Earthquake (1923)

It hit Tokyo and surrounding regions and caused simultaneous outbreaks of fire in many places, with approximately:

- 450,000 buildings being destroyed by fire, and
- some 143,000 persons dead or missing.



Devastated area in Tokyo

It became one of the main concerns in building control to construct buildings that can withstand earthquakes. The Japanese Building Code has required **structural calculation in considering seismic force since 1924 (The next year of the Great Kanto Earthquake)**. This was a forerunner of such requirement in the world.

Specific structural provisions were also strengthened. Strengthened provisions are, for instance;

- Wooden braces for wooden buildings (Before amendment, wooden braces were required only for wooden buildings of 3 or more stories.)
- Tie hoops for RC buildings.

(2) Great Hanshin-Awaji Earthquake (1995)

It hit Kobe city and surrounding regions, and 104,906 buildings collapsed, and 6,148 buildings were severely damaged, causing 6,433 deaths. It is estimated that 80 % of the deaths were due to falling buildings or furniture.

Most of the collapsed buildings were those which were constructed before 1981. 1981 is the year that the new seismic building regulations were enforced. Therefore, seismic retrofit of old buildings became an urgent issue in Japan.



(3) Great East Japan Earthquake (2011)

It hit the Pacific coast of Tohoku of Japan. The seismic damage to buildings was not so much in considering the scale of the earthquake. Extremely destructive tsunami waves attacked the coast area of Tohoku of Japan and caused around 20,000 people of death or missing.

Followings became focused issues in the field of buildings.

- Restriction of buildings in tsunami hazardous area, and
- Placement of tsunami evacuation building (buildings to help people vertically evacuate from tsunami)

In addition to the building control methods, tsunami detecting system and warning system was improved.



In case where the flood water depth was more than 2 m, tsunami-induced damage was much severer than the case where the depth was less than 2 m.

Tsunami Evacuation Building

As of March 2010, 1,790 tsunami evacuation buildings were designated in the whole country, according to the design guideline for tsunami evacuation buildings, which provide necessary evacuation height, accommodation capacity, structural requirements, etc. responding to the particular conditions, such as expected flood water depth and location.

Learning from the lessons of the Great East Japan Earthquake, Structural Design Method from the Viewpoint of Structural Safety against Tsunami was compiled.

The structural design method will be utilized for:

- Designation of tsunami evacuation building, and
- Structural requirements to the buildings in the tsunami hazardous areas.

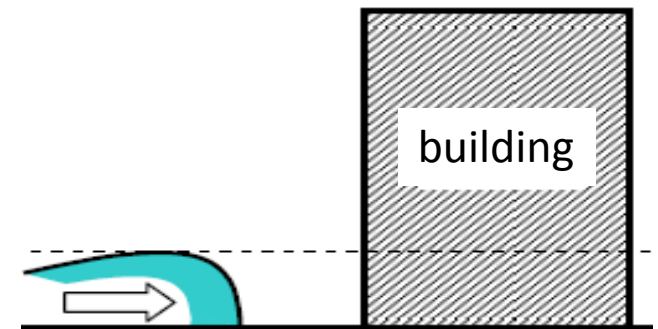


Image of tsunami evacuation building



Tsunami evacuation building that withstood tsunami

- 200m from the coast
- Flood water depth was more than 13m.

Fire incidents

After large buildings became popular, there were sometimes conflagrations in these buildings. Therefore, Japanese fire code was revised to strengthen fire safety of such buildings.

(1) Fire code concerning **necessary number of stairs, interior finishing materials, etc. was strengthened in 1973**, in considering such fire incidents below.

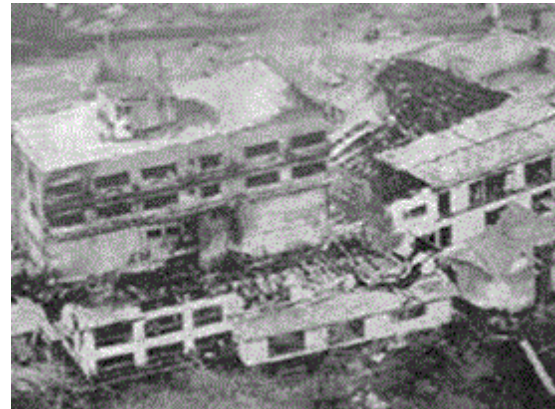


Sen-nichi department store (1972), 118 deaths



Taiyo department store (1973), 100 deaths

(2) Fire code concerning **automatic sprinkler systems, etc. was strengthened in 1980s**, in considering such fire incidents below.



Kawaji Prince hotel (1980), 45 deaths



Hotel New Japan (1982), 33 deaths

Conflagrations

The traditional Japanese building structure is wooden. Even now, most newly-built detached houses are wooden structures. On the other hand, Japan has a characteristic climate of dry air in winter, seasonal strong winds, and foehn phenomena that arises in certain areas because of the mountainous land. Densely-built wooden buildings and the characteristics of climate produce a very high threat of fires of both small and large.

Therefore, it has been one of the main concerns in building control to prevent conflagrations by means of covering roofs and exterior walls with noncombustible materials, especially in central urban areas. Such restrictions have been in effect in Japan for around 350 years.



Wooden built-up area in Japan



Other factors

(1) Typhoon and snow

Japan is also situated in the path of typhoons. Buildings face the threat of strong winds from typhoons, and buildings near mountains are threatened by landslides caused by heavy rainfall of typhoons. Therefore, buildings must be able to resist the strong winds from typhoons. The possibility of landslides must be considered when planning for construction in hilly areas. Additionally, in the northern part of Japan, the weight of accumulated snow on roofs must be considered.

(2) Health

In order to secure the health of occupants and public health in general (including sick house issues), buildings must have an adequate sanitary system and so on.

(3) City planning

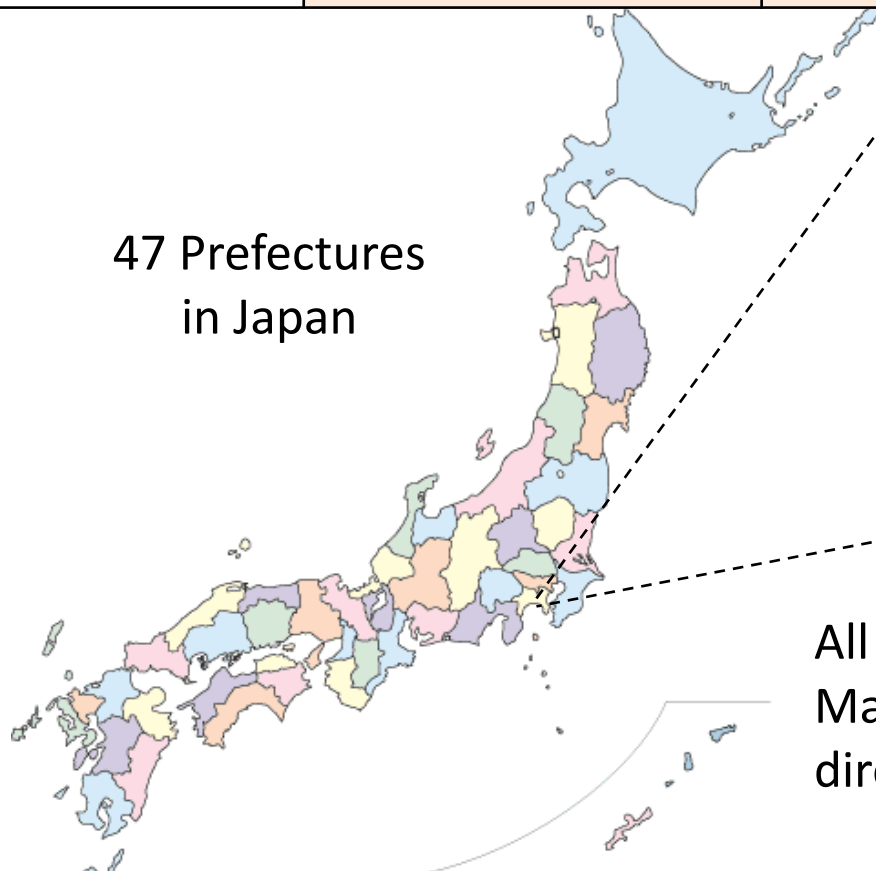
From the viewpoint of city planning, buildings are required to be designed within a certain height, to meet land-use planning, and so on. In many countries, such requirements (zoning codes) are provided apart from the requirements for building safety.

Chapter 4

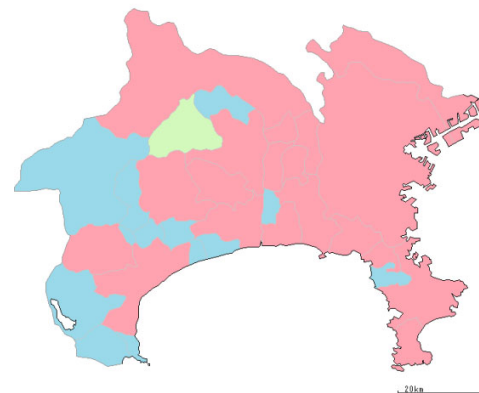
Local Authorities in Japan

Local Authorities in Japan (as of Jan.2013)

administrative entity		responsible area
National Government		National Government is responsible for whole country of Japan.
local authorities	47 prefectures	Japanese territory is composed of 47 prefectures.
	1,742 municipalities	Japanese territory is composed of 1,742 municipalities. All municipalities belong to any prefecture. Each municipality is called a city, town, or village. There are 812 cities, 746 towns, and 184 villages. They are municipalities.



<Kanagawa Prefecture, for example>



Kanagawa prefecture is composed of 33 municipalities (19 cities, 13 towns and 1 village). They are shown in the left figure with red, blue and green respectively.

All presidents of local governments (Governors and Mayors) and all council members of local authorities are directory elected by their local residents.

Governance System in Japan

<Japan>

Japan Constitution gives:

- governance powers (Legislative, Administrative, and Judicial) to the National Government, and
- limited governance powers to local authorities.

Therefore, Japanese National Government issues Building Standard Law and relating official documents. Then, local authorities administrate building control on individual building projects.

<USA, for example>

USA (United States of America) is a federation of states, which is quite different from Japanese governance system. In case of USA, each state originally had all governance powers, then all states agreed to transfer part of their governance powers, such as diplomatic right and defense right, to the federal government through their constitution. Therefore, in USA, governance power relating to building control is still owned by each state and large municipalities. Federal government does not get involved in building control.