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PANEL ON FIRE RESEARCH AND SAFETY
MARCH 1-7, 2000**

VOLUME 1

Sheilda L. Bryner, Editor



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National Institute of Standards and Technology
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U. S. Department of Commerce

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Progress and Overview of Performance-based Codes and Standards in Japan

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If you search the item: “性能規定化 : Performance-based “& ”法 : regulation ” by Yahoo Japan, you can hit some 300 pages. About 60% of them are related to the amending process of Building Standard Law. And in the rest, there are no specific movements to amend the codes into performance-based except the technical standards on gas and electric facilities.

So the case of Building Standard Law of Japan (BSL, hereafter) occupies an important position among the performance-based transformation in Japan.

This paper summarizes the circumstances of these currents as follows,

- a) The end of fire codes of BSL
- b) The process to the performance-based code
- c) The present condition of Building Standard Law
- d) The present condition of Fire Services Law

a) The end of fire codes of BSL

It is natural to accept that the end of law such as Building Standard Law, is to realize the society as Roscoe Pound mentioned (1921),

“One such postulate, I think we should agree, is that in civilized society men must be able to assume that others will do them no intended injury -- that others will commit no intentional aggressions upon them.”¹⁾

In the field of building and construction, for example, to built the fence which is easy to collapse in case the foreknowable force is operated from outside, or to turn out a fire resulting in injury or death in case the fire protection manager of common building does not take proper care against fire, is the aggression.

In each case, the judicial decision according to the Civil Law or the Criminal Law was given using BSL or FSL as a standard of judgement.

In this context, the fire codes of BSL are the criteria to judge for the fundamental Laws (e.g. the criminal law, the civil law), the end of which is to realize the society that others will commit no intentional aggressions upon them .

(b) The process to the performance-based code

Then, what is “the intentional aggressions” in such regulation as the fire codes whose aim is to decrease the fire damage? The fire codes of Building Standard Law had no proper answer to this question at the time of legislation, 1950, because they were the patchwork of existing regulations written in prescriptive form. And Fire Services Law(1948) has the same root.

On the other hand, new regulations were legislated in 1970's with the background of the bad environment of cities or factory area and the elevation of the right of claim. They are, for example, Air Pollution Control Law (1968), Water Pollution Control Law(1970), Offensive Odor Control Law(1971). And they had a clear definition of “the intentional aggressions”.

In these new laws, “the aggressions” are defined by the physical property such as the energy of noise or the concentration of contamination, and its criteria. Compared with them, fire codes didn't have the clear definition of the aggression by fire, and the intention of the criteria is obscure because of the prescriptive form.

This is the reason why the amendment to performance-based code was required for from the standpoint of legislation in Japan.

Besides, there were more additional causes to the amendment of the Building Standard Law on July, 1998.

One is the development of new technology. As shown in Fig.1, the fruits of So-Pro on “Development of the Assessment Method of Fire Safety Performance of Buildings (1982-87)” resulted to increase the number of buildings which were accepted through the route of Article 38 of BSL. In this way, the use of fire resistant steel or the smoke control by accumulation in the upper vacant space of atrium became popular. As the system is getting greater success, limitations are becoming apparent. Article 38 accepts alternative design solutions that are equivalent to the specifications in the code without specifying the objectives. Lacking the information on the objective, or on the intentional aggression mentioned above, it is sometimes difficult to discuss the equivalency between “specification A” and “specification B”. That is why we need a performance-based approach.

And the other driving forces for amendment of BSL are as follows;

- to follow with the worldwide trend to amend the building codes from prescriptive to performance-based, which Building Act (1984) in England initiated
- to take a measure logically against the strong requirement from United States and Canada for permission of the 3-stories wooden houses

(c) The present condition of Building Standard Law

Judging from the legislation process mentioned above, it is clear that the purpose of the amendment of fire codes is to make clear the definition of “aggression by fire” and the acceptable

criteria of them. Translating it to the words of Fire Safety Design, what to do is to prepare the design fire and to make clear the functional requirements.

The basic concept of design fire is similar to seismic wave input used in the seismic resistance design. But in this concept, the frequency of fire occurrence is not considered. The frequency changes with occupancy of the building, and decreases as the scale of the building increases when the occupancy is office use.²⁾

Using the information of design documents at application (the information of combustibles from the occupancy and the lining, and the geometry of the room and the fire resistance of enclosure from the plan), the design fire shows the fire growth (typically t^2 -growth, including flashover onset), followed by either fuel surface controlled or ventilation controlled fire³⁾.

Next to do is to make clear the functional requirements of fire safety, which are evaluated by using the design fire. About this, the performance-based framework of the building fire safety in Fig.2 was shown as the result of So-Pro "Development of assessment methods for fire safety performance (1993-98) "

The functional requirement of the fire safety design is summarized into five terms "prevention of fire initiation", "provision of means of egress", "prevention of collapse", "provision of fire base and access" and "prevention of fire spread to/from adjacent buildings".

The evaluation method and its criteria for each functional requirement is called for. This time, two verification methods, Evaluation Methods of Egress Safety and Structural Fire Resistance are prepared by BRI.

The draft of the revised Enforcement Order of BSL is now on the HP (<http://www.moc.go.jp/policy/publiccomment/publiccomlist.htm>) because of the period of public comments. And the ministerial notifications concerning with the Enforcement Order will be announced by at late April 2000, and be enforced by June 2000. About the detail of the evaluation methods and the coordination between existing codes and new ones, please refer the papers by Yusa, Hagiwara and Ohmiya on this Panel.

Through this movement, there are two topics. One is the hot eyes which structural engineers turn to the Evaluation Methods of Structural Fire Resistance. With this method, structural engineer can design the structure in the same way as earthquake or wind.

The other is the continuity to FLS. If FSL adopt the same concept of design fire, the fire fighting equipment can be evaluated on the same model. For example, the estimation of operation time of fire detectors started experimentally using the heat source which simulates t^2 -growth.

(d) The present condition of Fire Services Law

According to Fire Services Law (FSL, hereafter), about 10 cases of deregulation have been done in 1995-98, for example,

- deregulation about the ratio of public space in underground market
- deregulation about the number of sprinkler heads which should actuate in fire

As the first step to performance-based code, Fire & Disaster Management Agency, Ministry of Home Affairs started the committee in 1999, " Development of Fire Safety Measure against Fire Risk of fire prevention property (Shobo So-Pro)"

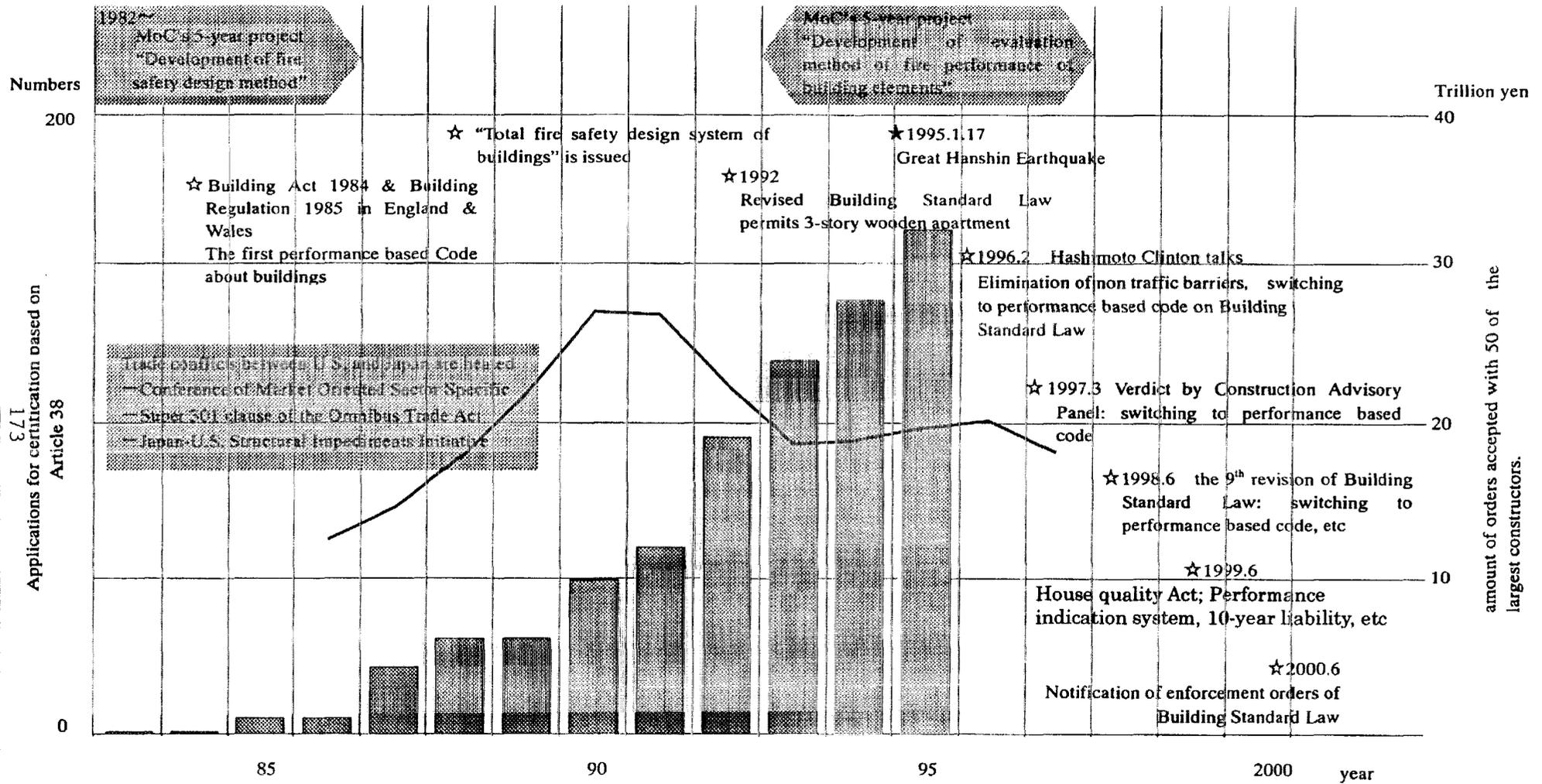
The ends of committee are

- to assess the fire risk of fire prevention property considering the progress of technology
 - to examine the existing fire safety measures systematically from the viewpoint of technology and to verify their effectiveness.
 - to survey the fire safety measures about the possibility of development, which can synthesize fire fighting equipment, fire loss prevention and control management, structure type of building, and so on.
 - to develop the assessment methods which correspond to each area as follows, and to verify the new fire safety technology based on performance by them,
- ① Prevention of fire origin & flame retardation of materials
 - ② Fire detection & fire alarm
 - ③ Fire suppression
 - ④ Evacuation safety & support of fire fighting

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Figure 1. Background



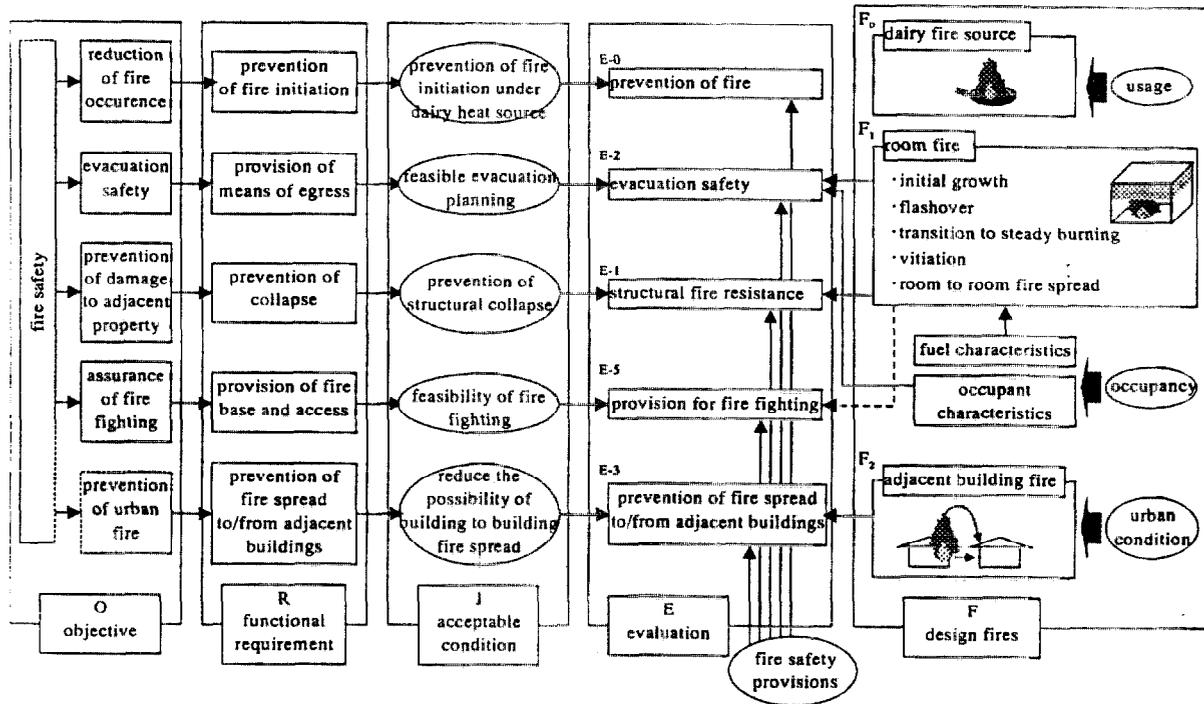


Figure 2 An example of the performance based fire safety design (evaluation) system