

(Tentative Translation)

**OUTLINE OF DRAFT ENFORCEMENT ORDER
OF THE BUILDING STANDARD LAW**

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REVISIONS RELATED TO BUILDING STRUCTURE

1. Introduction of Critical Strength Calculation (Article 82-6)

A method of directly calculating the stress and deformation which are incurred by a building subjected to load and external forces (Critical Strength Calculation) shall be introduced without specifications, in addition to the current provisions concerning structural calculations, allowing users to choose either method.

The existing structural calculation method is unable to accurately assess the amount of deformation. Therefore, the required strength is calculated, assuming that the designated specifications are satisfied. In contrast, the Critical Strength Calculation is a method of directly verifying the safety of a building subjected to an extremely severe snowfall and windstorm. It confirms safety by calculating the strength required to withstand seismic forces that could structural deformation in the event of a major earthquake. Therefore, unlike the existing structural calculations, the Critical Strength Calculation obviates the necessity of applying provisions for building specifications other than those concerning durability, etc.

A comparison of two structural calculation methods for verification assuming an earthquake of magnitude 7 on the seismic scale is shown below:

	Critical Strength Calculation	Retained Horizontal Strength Method (current)
Allowable deformation of a building	to be calculated	Not calculated
Forces acting upon each story	to be calculated in detail, taking into account the actual conditions of the building (such as irregular shape or heterogeneous construction) and its allowable distortion	to be calculated on the assumption that the building is of regular shape and homogeneous construction
Required strength for each story	to confirm that the strength exceeds the forces acting upon each story	to confirm that the required strength exceeds the forces acting upon each story with adjustments being made as necessary to such forces and taking into account such structural factors as irregular shape, heterogeneous construction, etc.

Outline of Critical Strength Calculation

To confirm that a building shall not suffer damage as a result of a snowfall, windstorm, etc. that are likely to be encountered at least once during the life of the building (specifically, to confirm that the stress in building members shall not exceed the allowable unit stress. This approach is the same as the current method)

As for verifications with respect to snowfalls and windstorms, to confirm that the building shall not collapse or fall down as a result of a large-scale snowfall or windstorm that may occur on extremely rare occasions, a verification that has not been performed before (specifically, by comparing the forces that act upon the building with the strength of building members calculated from the strength of the materials used) (This is new.)

To confirm that the aboveground part of the building shall not suffer damage as a result of an earthquake that is likely to be encountered at least once during the life of the building (This is new.)

To confirm that the seismic force obtained under c below shall not exceed the critical strength to the extent of causing damage to each story and that the relative story displacement obtained under d below shall not exceed 1/200
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- a. Calculate the critical relative story displacement that causes damage to each story of the building (damaging critical displacement).
- b. Calculate the natural period of the building corresponding to the damaging critical displacement (damaging critical natural period).
- c. Obtain the seismic force acting upon each story from acceleration corresponding to the damaging critical natural period (taking into account amplification due to unique ground conditions and regional coefficient), the mass of each story and acceleration distribution for each story.
- d. Calculate the relative story displacement for each story when it is under acceleration referred to in c above.

To confirm that the underground part of the building shall not suffer damage as a result of an earthquake that is likely to be encountered at least once during the life of the building (specifically, by confirming that the stress in

underground building members of the building shall not exceed the allowable unit stress. This approach is the same as the current method)

To confirm that the aboveground part of the building shall not collapse or fall down as a result of an earthquake that may occur on extremely rare occasions (This is new.)

To confirm that the seismic force obtained under c below shall not exceed the critical strength at which each story collapses

- a. Calculate the critical relative story displacement that causes each story of the building to collapse (critical safety displacement)
- b. Calculate the natural period of the building corresponding to the critical safety displacement (critical safety natural period)
- c. Obtain the seismic force acting upon each story from acceleration corresponding to the critical safety natural period (taking into account amplification due to unique ground conditions and regional coefficient), the mass of each story, acceleration distribution for each story and damping performance of the building.

To confirm that there is no deformation or vibration that hinders use of the building (the extent of deformation with respect to floors and beams is to be calculated. This approach is the same as the current method).

To confirm that exterior materials are safe from the viewpoints of structural strength (it is to be confirmed that the stress in exterior materials caused by the relative story displacement of the building and by the acceleration of each story both of which are calculated during the course of deriving above shall not exceed the allowable unit stress) (This is new.)

2.Review such as rationalization of prescriptive requirements

- (1) Revision of the provisions concerning the arrangement of earthquake-resistant walls in wooden buildings (Article 46)

While the current provisions require that wooden buildings be provided with a specified quantity of earthquake-resistant walls arranged properly, there were no clear evaluation criteria for structural calculation methods. For this reason, to clarify the applicable requirement, wooden buildings must conform to the standard regarding earthquake-resistant walls laid down by the Minister of Construction. The said standard shall specify such matters as the required quantity of earthquake-resistant walls for each part of the building.

- (2) Clarification of specification provisions concerning joints/connections, etc. used in wooden buildings (Article 47)

While the current provisions require that joints, connections, etc. used in wooden buildings be firmly fastened with columns, beams and so as to properly transmit the existing stress of the part concerned, there were no clear, detailed specifications for the hardware and structural methods used. For this reason, to clarify the specification, as regards the fastening of joints, connections, etc. with frames, etc. which are of principal parts necessary for structural strength, structural methods laid down by the Minister of Construction must be used. The said structural methods shall specify the shape of joints/connections as well as the type of material used.

3. Review of Load and External Forces

Load and external forces shall be reviewed on the basis of the latest scientific knowledge and research findings of studies conducted at the Architectural Institute of Japan.

(1) Snow load

There is considerable regional variation regarding the value of snow depth used for calculating snow load. In order to harmonize the procedure, it has been decided that snow depth shall be measured by a Designated Administrative Agency in accordance with the standards for snow depth measurement laid down by the Minister of Construction.

Also, snow depth may have to be adjusted downward according to the slope of roofs to harmonize the procedure with international standards (ISO4355).

(2) Wind pressure

While wind velocity pressure is currently set uniformly throughout the country, the procedure shall be revised taking into account the prevailing wind velocity in each region and the conditions of urban areas where the building is located. Specifically, wind velocity pressure shall be calculated by the following formula:

$$q = 0.6 E V_o^2$$

q: Velocity pressure (N/m²)

E: Coefficient reflecting the conditions of the urban area and the height of the building in question (with the calculation method laid down by the Minister of Construction)

V_o: Average wind velocity (m/s) at 10 m above ground in each region (to be determined by the Minister of Construction within the range of 30-46 m/s)

Wind force coefficient shall also be reviewed on the basis of the latest scientific knowledge and research findings, but a complex coefficient must be calculated and further provisions must be added to reflect the findings of future experiments and research, the matter shall be determined by the Minister of Construction.

4. Others

(1) Review of allowable unit stress and material strength for wood

As the relationship between the duration of load and the strength of wood has been clarified by recent surveys and research, the procedure for determining allowable unit stress and material strength for wood shall be revised. Currently, specific values are shown for each tree type. From now on, the concept of standard strength shall be adopted as in the case of steel. More specifically, the standard strength for each tree type shall be determined by the Minister of Construction.

(2) Adoption of the International System of Units (SI) following the amendment of Metric Law (Same applies to Equipment)

To achieve harmonization with the provisions of the Metric Law, units of weight such as kilograms shall hereafter be replaced by the international system of units such as Newton.

REVISIONS RELATED TO FIRE PREVENTION

1. Improvements to technical standards related to materials, structures, etc.

(1) Provisions related to materials (noncombustible, quasi-noncombustible and fire-retardant materials)

In response to Article 2, item (9) of the Building Standard Law which provides that noncombustibility (i.e., performance required of noncombustible materials) and the technical requirements concerning such performance shall be laid down by Enforcement Order, Article 108-2 of Enforcement Order establishes provisions concerning such noncombustibility and technical requirements applying thereto. Since every regulation thereunder is controlled by Enforcement Order, the performance and requirements in respect of quasi-noncombustible materials and fire-retardant materials as defined by Enforcement Order shall likewise be clarified. The performance required of each category of materials shall be as follows.

<Technical requirements for noncombustible materials>

When exposed to the flame and heat of normal fires the material concerned must satisfy the requirements as well as withstand the heat for a duration shown in the following table after heating has started:

Type of material	Duration	Requirements
Noncombustible material (per Enforcement Order, Art. 108-2)	20 minutes	* Does not burn * Does not suffer damage detrimental to fire prevention * Does not generate smoke or gas that obstructs evacuation
Quasi-noncombustible material (per Enforcement Order, Art. 1)	10 minutes	Ditto
Fire-retardant material (per Enforcement Order, Art.1)	5 minutes	Ditto

(2) Provisions related to construction

Fireproof construction, etc. (fireproof construction, quasi-fireproof construction, fire preventive construction and quasi-fire preventive construction)

The Law as amended requires that the technical requirements for performance of fireproof construction, etc. (Fireproof performance, etc.) be laid down by Enforcement Order. Based on this, it is decided that, while maintaining the level of existing standards for the performance of each type of construction needed to prevent a building from collapsing or catching fire, the following technical requirements shall be further clarified by subdividing the required performance into non-damage ability, heat insulation property and flame insulation property according to the part of the building concerned.

<Technical requirements for fireproof construction, etc.>

- As for fireproof construction, each part of the building must satisfy the requirements shown in the following table, when exposed to the heat generated by the type of fire shown in the table for the duration shown in the same table.
- As for constructions other than fireproof construction, each part of the building, when exposed to the heat generated by the type of fire shown in the table, must satisfy the requirements shown in the table for the duration shown in the table after heating has started.

Type of Construction	Building Part	Type of fire	Duration	Requirement
Fireproof construction (per Enforcement Order, Art. 107)	Bearing walls, columns, floors, beams, roofs, stairs	Normal fire	Basically 1 hour, to be increased up to 3 hours depending on the story of the building concerned (or 30 minutes for roofs and stairs)	Non-damage ability
	Walls, floors	Normal fire	1 hour (or 30 minutes for the parts of exterior walls not liable to catch fire)	Heat insulation property
	Exterior walls, roofs	Normal fire originating within the building	1 hour (or 30 minutes for the parts of roofs and exterior walls not liable to catch fire)	Flame insulation property
Quasi-fireproof construction (per Enforcement Order, Art. 107-2)	Bearing walls, columns, floors, beams, roofs, stairs	Normal fire	45 minutes (or 30 minutes for stairs and roofs)	Non-damage ability
	Walls, floors, soffits	Normal fire	45 minutes (or 30 minutes for exterior walls and soffits not liable to catch fire)	Heat insulation property
	Exterior walls, roofs	Normal fire originating within the building	45 minutes (or 30 minutes for parts of roofs and exterior walls not liable to catch fire)	Flame insulation property
Quasi-fireproof construction (per Enforcement Order, Art. 115-2-2)	Bearing walls, columns, floors, beams	Normal fire	1 hour	Non-damage ability
	Walls, floors, soffits (the parts liable to catch fire)	Normal fire	1 hour	Heat insulation property
	Exterior walls	Normal fire originating within the building	1 hour	Flame insulation property
Fire preventive construction (per Enforcement Order, Art. 108)	Exterior walls (bearing walls)	Normal fire originating outside of the building	30 minutes	Non-damage ability
	Exterior walls, soffits	Normal fire originating outside of the building	30 minutes	Heat insulation property
Quasi-fire preventive construction (per Enforcement Order, Art. 109-6)	Exterior walls (bearing walls)	Normal fire originating outside of the building	20 minutes	Non-damage ability
	Exterior walls	Normal fire originating outside of the building	20 minutes	Heat insulation property
Construction of roofs (per Enforcement Order, Art. 109-3, Art. 113)	Roofs	Normal fire originating within the building	20 minutes	Flame insulation property
Floors (construction of ceilings) (per Enforcement Order, Art. 109-3, Art. 115-2)	Floors and ceilings directly underneath the floors	Normal fire originating within the building	30 minutes	Non-damage ability Heat insulation property
Construction of pent roofs, etc. (per Enforcement Order, Art. 115-2-2, Art. 139-2-3)	Pent roofs, etc.	Normal fire	20 minutes	Flame insulation property

Note:

“Non-damage ability” means that the part in question suffers no damage detrimental to structural strength.

“Heat insulation property” means that the temperature of the surfaces other than the surface exposed to heat will not rise up to a point where combustible materials touching any of the surfaces concerned start burning.

“Flame insulation property” means that the part in question suffers no damage such that flames become visible from the outside of the building.

“Normal fire” is a term used to describe fires that can generally take place in the building and includes both fires originating within the building and those originating outside of it. Terms such as “normal fire originating within the building” or “normal fire originating outside of the building” are used to specify the type of fire as necessary.

Roofs in Fire Protection, Quasi-fire Protection Districts and Areas Subjected to Article 22

The technical requirements concerning the performance requirements for roofs in Noncombustible Roof Districts, Fire Protection Districts and Quasi-fire Protection Districts, which currently must be made of or covered with noncombustible materials, shall be established by Enforcement Order. It is decided that in order to control generation of flames on roofs due to sparks, causing the fire to spread around the building, or to prevent roofs from being burned through by sparks, causing the building concerned to catch fire, the necessary technical requirements shall be established as follows.

Regarding the roofs of buildings possessing performance equal to that of the buildings, the principal parts of which are of quasi-fireproof construction, the existing requirement that roofs be made of or covered with noncombustible materials shall be amended for a similar reason. As a result, the construction of roofs of such construction must conform to the same technical requirements.

<Technical requirements for performance necessary for roofs>

The requirements that must be satisfied by roofs are as shown in the following table, according to the district where the building is located and the type of fire shown.

Roof	Fire	Requirement
Roofs of buildings within Areas specified by Article 22 (per Enforcement Order, Art. 109-5)	Normal fire	* No flame detrimental to fire protection shall be generated. * The building suffers no damage allowing flames to penetrate into the interior of the building.
Roofs of buildings within Fire Protection and Quasi-fire Protection Districts	Normal fire in urban areas	The building suffers no damage detrimental to fire protection (except for roofs of warehouses, etc. containing noncombustible articles, the principal parts of which are made of quasi-noncombustible materials except roofs)

Note: The sparks generated during normal fires in urban areas are expected to be larger than in other areas. Moreover, there are many buildings close together in urban areas. It has therefore been decided to require the level of performance that can withstand larger sparks, taking into consideration the nature of fire in the particular area concerned.

(3) Provisions related to fire preventive equipment

The Law as amended requires that technical requirements as well as performance requirements concerning fire preventive equipment to be installed on the exterior walls of fireproof buildings, etc. and of buildings within Fire Protection and Quasi-fire Protection Districts be laid down by Enforcement Order. In accordance with the revision, the required fire preventive equipment shall be clearly defined along with its performance standard.

A similar performance requirement is also introduced with respect to the equipment possessing a fire preventive performance of more than 1 hour as previously specified by Enforcement Order. Such equipment must use such structural methods as laid down by the Minister of Construction or be approved by the Minister of Construction.

<Fire preventive equipment specified by Enforcement Order> (Art. 109)

Fire doors, drenchers, and other flame-insulation equipment shall be clearly defined.

Following the current provisions, any external walls, fences, etc. that can effectively divide openings and boundary lines with adjacent land lots shall also be deemed to be fire preventive equipment.

<Technical requirements concerning the performance for fire preventive equipment>

Each type of fire preventive equipment must possess the level of performance in terms of duration and other requirements as shown when exposed to heat generated by the fire mentioned in the following table:

Fire preventive equipment	Fire	Duration	Requirement
Fire preventive equipment to be installed at openings of exterior walls of fireproof buildings (per Enforcement Order, Art. 109-5)	Normal fire	20 minutes	* No flame shall be generated on surfaces other than the surface exposed to heat.
Fire preventive equipment to be installed at openings of buildings constructed within Fire Protection and Quasi-fire Protection Districts (per Enforcement Order, Art. 136-2-2)	Normal fire originating outside of the building	20 minutes	
Fire preventive equipment used in fire separations (Designated Fire Preventive Equipment) (per Enforcement Order, Art. 112 paragraph1)	Normal fire	1 hour	

2. Provisions related to the performance requirements for principal building parts of fireproof building (per Enforcement Order, Art. 108-3)

(1) Principal building parts of fireproof buildings

While in the past the principal building parts of fireproof buildings had to be of fireproof construction without exception, the Law as amended now provides that the principal building parts of fireproof buildings shall either be (per Article2 item(9-2) of the Law):

of fireproof construction, or

of construction that meets the technical requirements laid down by Enforcement Order concerning their ability to withstand the heat until the fire is extinguished

Under the current regulations, the principal building parts of fireproof construction must withstand heat for a specified period of time, which applies uniformly to each part of the building concerned. However, recent progress in the field of building fire prevention technology has led to the development of engineering techniques for predicting the nature of building fires. Therefore, it has now been decided that provided the principal building parts can withstand fires with properties predicted by those engineering techniques, such parts shall

be treated as if they were also of fireproof construction.

Accordingly, the Enforcement Order establishes the technical requirements concerning the principal building parts of fireproof buildings by specifying their compliance with the following requirements, which must be confirmed by normal verification methods (Fireproof Property Verification Methods), or must be approved by the Minister of Construction:

Performance requirements (per Paragraph 1)

The following requirements must be satisfied when exposed to heat generated by a fire likely to take place within the building:

- Bearing walls, columns, floors, beams, roofs and stairs must not be damaged under the stress of dead or live load (in heavy-snow areas, dead load, live load and snow load; hereinafter the same) (non-damage ability requirement).
- Walls and floors must possess heat insulation property.
- Exterior walls and roofs must possess flame insulation property.

Exterior walls must satisfy the following requirements when exposed to heat caused by fire taking place outside of the building:

- Exterior walls constituting bearing walls must not be damaged under the stress of dead or live load (non-damage ability requirement).
- Exterior walls must possess heat insulation property.

Note:

“Non-damage ability” means that the building part in question suffers no damage detrimental to structural strength.

“Heat insulation property” means that the temperature of the surfaces other than the surface exposed to heat will not rise up to a point where combustible materials touching any of the surfaces start burning.

“Flame insulation property” means that the part in question suffers no damage such that flames become visible from the outside of the building.

Outline of Fireproof Property Verification Methods (per Paragraph 2)

Regarding indoor fires, the predicted duration of a fire in each room of a building and the period of time for which the principal building parts of the room concerned can withstand the fire (Retained Fireproof Time for Containment of Indoor Fire) shall first be obtained, and then it shall be confirmed that the Retained Fireproof Time for Containment of Indoor Fire exceeds the duration of the fire.

- The duration of a fire shall be calculated by dividing the total calorific value of combustible materials found in the room concerned by per-hour calorific value. The total calorific value shall be calculated according to the use of the room and the interior materials used in accordance with the methods laid down by the Minister of Construction. The per-hour calorific value shall be calculated according to the use of the room and the shape of openings, etc. in accordance with the methods laid down by the Minister of Construction.
- The Retained Fireproof Time for Containment of Indoor Fire of principal building parts shall be calculated according to the structural methods used for principal building parts, the stress generated in the principal building parts due to dead load, etc. of the building and changes in temperatures resulting from an anticipated fire, by means of methods specified by the Minister of Construction.

The period of time for which the exterior walls can withstand a fire originating outside of the building (Retained Fireproof Time for Containment of Outdoor Fire) shall first be obtained, and then it shall be confirmed that the Retained Fireproof Time for Containment of Outdoor Fire is at least 1 hour (or 30 minutes for the parts other than those liable to catch fire).

- The Retained Fireproof Time for Containment of Outdoor Fire for exterior walls shall be calculated according to the structural methods used for the exterior walls and the internal stress generated by the dead load, etc. of the building, in accordance with the methods laid down by the Minister of Construction.

In order to facilitate the proper application of the provisions of the Enforcement Order to buildings, if the principal parts of the buildings have been confirmed, by means of Fireproof Property Verification Methods, to be able to withstand a fire until it is extinguished or they have been approved by the Minister of Construction, then those parts of the building shall be deemed to be of fireproof construction for the purposes of applying the relevant provisions of the Enforcement Order (per Paragraph 3).

Furthermore, of the fire preventive equipment to be installed at the openings on walls or floors of buildings, the principal parts of which have been confirmed, by means of Fireproof Property Verification Methods, to be able to withstand a fire until it is extinguished or have been approved by the Minister of Construction, the types of equipment confirmed, by means of Fire Separations Verification Methods, not to emit flames to surfaces other than the surface exposed to the heat generated by fire likely to take place within the building concerned or the equipment approved by the Minister of Construction shall be deemed to be Designated Fire Preventive Equipment for the purposes of applying the relevant provisions of the Enforcement Order (per Paragraph 4)

Outline of Fire Separations Verification Methods (per Paragraph 5)

The duration of an anticipated fire in each room of a building and the period of time for which the fire preventive equipment installed at the openings of walls or floors of the room can withstand the said fire (Retained Flame Insulation Time) shall first be obtained, and it shall then be confirmed that the Retained Flame Insulation Time exceeds the duration of the fire.

- The duration of fire shall be calculated by the same methods as Fireproof Property Verification Methods.
- Retained Flame Insulation Time shall be calculated according to the structural methods used for the fire preventive equipment and changes in temperature resulting from the anticipated fire, in accordance with the methods laid down by the Minister of Construction.

(2) The parts of large-scale buildings specified by the Enforcement Order (per Enforcement Order, Art. 109-4)

The principal building parts of large-scale buildings referred to in Article 21 paragraphs 1 and 2 of the Law, and which use combustible materials in the parts specified by the Enforcement Order, must conform to Article 2 item 9 (2) (a) of the Law. For this reason, in order to prevent the building from collapsing in the event of a fire, those parts which shall sustain dead or live load (in heavy snow areas, dead load, live load or snow load) shall be specified (per Enforcement Order, Article 109-4).