Lao Building Code

- Draft as of August 2016 -

Table of Content

Section 1: General Provisions

Article 1: Objectives
This building code is produced for determination of principles, regulations, technical standards, construction procedure standard, using and maintenance of controlled buildings.

Article 2: Building control
Building code is an inspection and permission of adoption in principles, regulations and technical standards in construction activities, using of controlled buildings. The aims of building control are as followed.

1. Provide the strength of buildings
2. Provide a safety for people in the buildings
3. Provide the comforts for general and also elderly and disabled people
4. Provide esthetics of harmony with surroundings, townscape and concerning in environment protection

Article 3: Principles of control
Construction and application of controlled buildings must meet the following standard:

1. All documents of permission have to be inspected and advised in design before submission
2. During the construction period, the inspection is need for technical procedures and construction standard. The admission is needed after finishing of construction.
3. Inspection and affirmation in the building condition, safety devices are needed during the occupation of building.

Article 4: Scope of control
This building code is applied for construction, maintenance and application of all types of controlled building both in government and private all around the country. In case, of previous construction, building must be inspected and comply with this building code.

Section 2: Type of buildings

Article 5: Classification of buildings
The controlled buildings are comprised of three categories, which determined by the largeness, high and risk in using of the buildings.

Category 1: Large buildings
Category 2: High –rise buildings
Category 3: Building in risks.

Article 6: Large Buildings
Large buildings consist of office buildings, apartment, service buildings, commercial buildings and cultural buildings, that use as public building. Large building must have the area of al stories not less than 10,000 sq.m.

Article 7: High-rise buildings
High-rise building is a building has more than 20 meters of height. The height of building is determined from ground floor to the ceiling level of highest story.

Article 8: Building in risks
The building in risks is public building e.g. buildings for entertainment, stadium, auditorium, airport and mass-transport passenger buildings, industrial buildings, buildings for storage of flue and explosive materials. (Referenced in dispatched no. 2.01)

Article 9: Reclassification of buildings
All the reclassification of building, by the purpose of the owner whether increasing or decreasing of the areas, must be designed and approved by architects and engineers and finally submitted to the authorized organization.

Section 3: Design of buildings

Article 10: General Principles
The design of all categories of controlled buildings must be complied with the following principles:

1. The controlled building must be designed in term of architectures and structure and be studied in environmental and social impacts as well.
2. The design must be conducted by authorized architectural design company or architectural consultant company.
3. The design must be complied with the urban master plan and regulations of construction.
4. The design must be referred to the existing data, collected from site survey, geographical, geological, etc.
5. All the documents of design, technical report and bill of quantities must have a signature of architects and engineers who made a design and be approved by architectural design company.

Article 11: Submission of design documents

Submission of design documents to authorized offices must consist of the following items:

1. Design documents of survey, architectural and engineering,
2. Architectural plans,
3. Structural plans,
4. Plans of electrical, mechanical, water supply and fire protection system,
5. Technical specifications of materials, construction procedure, devices and installations,
6. Bill of quantities report.

Article 12: Specification of construction materials

Construction materials applying in controlled buildings e.g. reinforcing bar, cement, gravel and sand must guarantee for safety, strength and duration of building, the quality of construction materials must comply with the national standards or international standards or equivalence to the national standards of trusted countries. (Details of this article are in Annex no. 3-01)

Article 13: Specification of decorative materials

Decorative materials must meet a standard of strength, easy for maintenance. Safety for users and suitable for function as follows:

1. Inflammable decorative materials are prohibited to apply in fire escape staircase,
2. The material which produced fine dust or power e.g. asbestos, cilica, except the material is coated completely,
3. The light reflecting material must be decorated to the external at least 30 % of the wall area,
4. Glaza assembled at the external wall of the large building and high-rise building must be a multi-layer glaza, if broken on impact, will back in a way that is not likely to cause injury to people.

Section 4: Structure of building control

Article 14: durability and using age of building structure

To make building have durability and a long age using based on indicates standard, structure must be able to resist to any action force from dead load, live load, nature for example: wind load, liquid load, earth pressure and change of temperature force.

Article 15: Analysis and structural design

Analysis and structure design for building control must ensure strength, durability, safety and economy based on principle, acceptable and believable theory in regional and international stage.

Article 16: Dead load

Dead loads are stationary loads of constants magnitude in each structure elements and components that fix which structure, it is constant load. For the structure that bears mechanical load which makes sudden actions must increase load rate.

For more detail of dead load and load increasing percentage of dead load are indicated in Annex no: 4-02, 4-02.1 and 4-02.2

Article 17: Live load

Live load are stable load or maybe dynamic load which impacts to each structural component. After the structure has finished or while using the building and the load which impacts to the structure while constructing

live, load are human weight, furniture, housing objects, materials, etc. value of live load are indicated in Annex no. 4-03.

In the summary, live load in each story of high building will decrease multiplex rate of load…..which are indicated in the Annex no. 4-04 or the true happened force. To ensure that design strength the value must be higher 4-07.

Article 18: Natural force and others
Natural force such as wind load, earthquake load, the value of these forces are based on the height of the building, especial point or constructional area. Other forces such as action load, liquid pressure, ground pressure and change of temperature, calculate the value of the force from these load types are indicated in the Annex no. 4-05.3, 4-05.4, 4-05.5, 4-05.6, 4-05.7.

Article 19: Load combination
Combination of load or force in structural building must consider each case of force and have coefficient for the safety of any types of load by any theory of structural calculation design guarantee by international or regional area, based on the appropriation of controlled level for material quality and building technology, indication of coefficient for safety of the load by any types of theory. The summary of load types for calculation design is based on each case below:

Case 1: location of the building is not effected by natural force, may consider only dead load and live load.
Case 2: location of the building is not effected by wind load, may consider of dead load, live load and wind load.
Case 3: location of the building is not effected by earthquake load, may consider of dead load, love load, earthquake load, wind load or other loads (if have) detail consists in the Annex no. 4-06 and no. 4-06.1.

Article 20: Factor of safety
Factor of safety is a ratio of force or structural ability divide to the load or the true happened force. To ensure that, design strength value must be higher or equal required strength value. Calculation for each theory has in Annex no. 4-09.

Article 21: Property of concrete in considering the durability
Concrete must have durable property and have a long age use at least 50 years up. High quality concrete must have protection of chemical penetration to concrete and reinforce steel, covering concrete to reinforce steel can adapt to any environment.

Quality consideration and property of concrete such as concrete mixing ratio, highest design strength indication, least covering concrete for reinforce steel are follow the suggestion in the Annex no 4-08, 4-08.1, 4-08.2, 4-08.3, 4-08.4, 4-08.5, 4-08.6, 4-08.7, 4-08.8, 4-08.9, 4-08.10.

Article 22: Fire resistant rate
Fire resistant rate of building control structure is indicated by two factors, type of construction and activities of building's using. Indication of least fire resistant rate follow the annex no. 4-09, 4-09.1, 4-09.2.

Section 5: Fire exist system

Article 23: The fire exit doorway
Every room in the building must have the fire exit doorway at least one way, for the meeting room contained roughly 200-10,000 people must have 2-3ways. In case, if there are more than 10,000 people must have 4 ways. On the other hand, if there is a room needs to have 2 doorways, the distance between the door should be larger than ½ of the biggest diagonal of the room.

Article 24: Fire exit
Fire exit is a way to escape from the fire and emergency doorway (fire exit doorway) include a way to release people from the building when fire happens. Fire exit should support people immigration from the building within 1 hour. When the fire happens, the wall around fire exit must be protected the fire expansion in the

building. The area allocation in the building must provide more convenience and safe when there is immigration during fire happen and must not block the way for people according to those following criteria:

1. The fire exit should not be in complicated style, which will make people confuse when they are leaving.
2. The fire exit should not access to any room or dangerous areas, no design, no block.
3. The emergency door should not have any blocks accept fence which prevent vehicle parked.
4. In case, the emergency door opens to outside ground which is different level. The joint way should not be slope under 1:8
5. The emergency door of stair or mound way for building such as: movie theatres, schools, entertainment places which contain more than 500 people up. Should not open to empty place of auditorium in the building.

Article 25: The amount of fire exit

The amount of fire exit in controlled building must have at least 2 ways to choose which one to leave fire safety and manage the position of fire exit and far away from each other in order to avoid the door closed both sides when fire happen.

The consideration of fire exit amount properly base on the amount of building users in each area below:

- Building users ≤ 500 people should have fire exit 2 ways
- Building users > 500-1,000 people should have fire exit 3 ways
- Building users > 1,000 people should have fire exit 4 ways

Article 26: The distance from living point to fire exit

The distance from any point in the building to nearly fire exit base on building types and the use of construction materials, the nearly point should not over as below:

- Building which uses general construction materials but not fire resistant building 60m
- Building which uses construction material and fire resistant building 70m
- Building which uses construction material and fire resistant building with water spray system 90m.
- In case, the way to exit needs to pass roadblock must be under 10m.

Article 27: Fire exit location

Fire exit must be in obviously position and allocate way easy to leave fire. In case, there is no water spray system. The distance of fire exit should far from each other more than 1/3 of diagonal of all room's area and far more than ½ in case those area have water spray system.

Article 28: Fire exit size

Fire exit should not be small, should be without every roadblock in horizontal way, the height should be more than 2.30m up, the wide base on building users amount which wide at least 90cm, in case of the level of ceiling is lower or bubble lights, sign poster should be more than 2m up high. The determination of wide and basic regulation of fire exit have determined in Annex no. 5-02.

Article 29: Fire exit doorway

The character of fire exit doorway must base on basic principle as below:

Fire exit doorway is part of fire exit, must made of fire resistant materials. No shape changed and don't lead the heat more than usual. Must have tested and proved by one group or trustful institute. Fire exit doorway must obviously different from any wall.

Fire exit doorway's character and technique of installation have determined in Annex no. 5-03.

Article 30: Fire exit staircase

Fire exit staircase is an important part of escape system, it must be meet the following requirements:

1. No smoke and heat inside
2. Have the ability to safely transfer people from the building to the exit
3. Width of stairway, high of rise must be constant and continuing to the end of stair
4. Providing with a handrail and barrier, if the stairway is wider than 1.8m. The handrail at the center of stairway must be provided.
5. It should have an appropriate width in accordance with amount of people:
   ≥ 90 cm. of width for ≤ 50 people
   ≥ 110 cm. of width for > 50 to < 2,000 people
   ≥ 140 cm. of width for ≥ 2,000 people

Requirement of installation comply with the Annex no. 5-04.

Article 31: Exposed fire exit
Exposed fire exit must be installed on the firmed structure, fire resisted and safe. The outside wall must be built by the fire resistive materials and has a rate of resistance as same as the inside wall. Exposed fire exit frame from the level of 3rd story to the top must be covered, since avoiding awful sight. The requirement comply with the Annex no. 5-05.

Article 32: Exit of escape
Exit of escape is final part of escape way where people can exit the building. The point should allow people pass through the outside of the building to the yard or opened space. The exit has to be prepared adequate space for safe landing and providing the sign that indicate the direction to public space. If the building has a staircase directing to the basement or lower level of the exit, it needs to have a sign to indicate the exit and to provide the door or barrier.

Article 33: Sign of fire exit
In all categories of controlled building, a visible sign of fire exit must be provided in case of emergency. The signs should be comprised of details indicated the number of story, direction of exit, dead-end corridor, plan of existing position of the room, position of fire equipment and escapable doors. The signs must be provided with the sufficient light and be able to see all the time. The source of power for emergency signs must be separated from power source of the buildings. When electricity if off, the additional source of power must be worked at least 2 hours.
The requirement of size, standard type, installation and high of installation comply with the Annex no. 5-06.

Section 6: Fire Protection Systems

Article 34: Type of fire protection systems
Applying of fire protection system in building's control must be set for target of building's usage and specific features of fuel supplies. Type of fire protection systems in the present days:

1. Portable fire extinguisher: details, fitness of usage and all techniques were archived in the annex no. 6-01; 6-01.1; 6-01.2; 6-01.3; 6-01.4; 6-01.5; 6-01.6; 6-01.7; 6-01.8; 6-01.9; 6-01.10.
2. Fire Hose Reel system, automatic sprinkler system: fitness of usage and all techniques were archived in the annex no. 6.02; 6-02.1; 6-02.2; 6-02.3; 6-02.4; 6-02.5; 6-02.6; 6-02.7; 6-02.8; 6-02.9; 6-02.10.
3. CO_2 gas fire extinguisher system, halon and foam system, dry chemical system and wet chemical system.

Article 35: Selection for type of fire protection systems
The building type 1, 2 and 3 must require: portable fire extinguisher, fire hose reel system for the automatic sprinkler system is used for building types 1 and 2 or building that were used by more than 500 people for each floors. Gas fire extinguisher or foam or chemical systems are used for mechanical equipment room, electric-electronic equipment room and materials that cannot be extinguished by water room.

Article 36: Fire alarm and smoke detection system
To enhance security for building's users and more efficient to prevent the spread of fire on time, in every types of buildings control must require fire alarms and smoke detection system with fire extinguish system such as: fire alarm equipment: by hands, sound and light, and smoke detector equipment and heat detector equipment. Detail of regulation for usage, design and set up are archived in annex no. 6-04.

Section 7: Electric, light and ventilation systems

Article 37: Electric system inside building control
Electrical system inside building control must be designed and installed, assuring for using and safety and follow the standard of electrical installation in the building which has to concern these important components below:

1. Must be able to supply the electricity enough with the requirement in the building.
2. Must have the system and reserved electrical supply rate.
3. Must indicate the technical specification of objects, tools by following standards.

4. Must have protecting system such as thunderbolt protecting system, emergency, safety cut and protecting system for leak of electricity.
5. Must be a standard installation, belong to the technical indication or any believable standard. For any detail of electrical installation inside the building please look at L.P.D. no. 052.

Article 38: Light and natural ventilation
Every types of building control must have enough light and natural ventilation through window which has the area at least 10 % of the total room area and must be able for the air to come in. For hospital building, that area must no less than 15 %, school must no less than 20 % and for W.C or bathroom must no less than $0.2m^2$ per one lavatory.

Article 39: Emergency light
Every types of building control must consist of the emergency light to assist people in escaping from the building while the electricity is having trouble when the emergency situation occur. The emergency light must automatically brighten when cut off the electricity power, emergency light must be able to supply light at least 90 minutes, for emergency fire escape must be able to supply light at least 2 hours.

Article 40: Needed area for mechanically ventilation
Restroom, office, stores, bathrooms, washing room, etc. must have both natural ventilation and mechanical ventilation or the needed air conditioning to take care of people health. Every parking floors, expect the outdoor parking must have mechanical ventilation or permanent ventilation enough, to assist when it needs and emergency, the height of each room or the high distance from ground to roof must no less than $2.4m^2$ and must be based on each types of building using also.

Section 8: Health and Easement

Article 41: Health and easement in buildings
Buildings such as hospitals, hotels, schools, terminals, shopping centers, banks, sport facilities and amphitheaters in controlled and non-controlled types, architects must consider significantly for elderly, the pregnant and the handicapped groups. Building should be considered under some criteria as follow:
1. Easy to access
2. Safe in using
3. Good environment

Article 42: Facilities
Entire public facility in controlled building types must be designed for elderly, pregnant and disable groups, including:
1. Entrances, stairs, ramps and car parks must be safe and easy to use
2. Public toilets must be provided
3. Entrances-exits inside buildings such as: bedrooms, living rooms, dining rooms, bar, lounge, retail, laundry and so forth must be designed notably.

Article 43: outside entrances-exits
The accessibility in building is a key component of public buildings. Thus, outside entrances and exits must be considered as follow:
1. Paths must be flat slops with accurate position and smooth surface. Along these paths, benches must be installed partly. For steps and transition spaces, stair rail must also installed. In addition, lamps and lights must be installed along the paths to guarantee that users will see the surrounding space clearly.
2. Car parks should be reached standard of parking lots which should be located close to the main entrance of buildings.
3. Slopes and ramps for disable groups must be designed under the standards of them. In particular, the 1:12 portion should be applied for a 3 meters long ramp and 1:20 portion should be designed for more than 6 meters long ramp with transition space (1.5 meters long).

Article 44: Safe and convenient entrance-exit doors
The entrance and exit doors should be made of transparent material such as glass or other see through material. The transition spaces (both inside and outside the door) should have 150cm x 150cm space, this space should

be provided for wheelchairs and disable people. In case of people come with their big belongings, close to the door should provide shelves or benched, then they can put their things and open the door easily.

Article 45: passages inside buildings
Passages or paths are designed under the functions of buildings and rooms. Passages of bedroom, living room, dining room, bar, lounge, retail and laundry must be wider than 1 meter and passages for pushcarts must be wider than 1.5 meters with 85-90cm wide exit-door. Beside the exit door, on the hinge position side should leave 45cm to the wall. Along the passages should be flat without steps and any barriers. In case of step and different floor-levels are needed, different texture and color should be used to distinct between passage and step. To install signboards inside building, the height of signboard must install over the human height.
For the elevators: multifamily residences should have 0.9m x 1.2m or bigger lift types and public buildings should have 1.1m x 1.4m or bigger types.

Article 46: disable restrooms
Public buildings in controlled areas must consist of disabled restrooms, which are easy to access with flat floor levels.

1. A disabled restroom should be based on disabled standard. Size of this room should be not smaller than 1.2m x 1.5m.
2. Doors should be designed appropriately regarding the size of wheelchair; size should be bigger than 85cm.
3. Surrounding the toilet seat should provide sufficient space to accommodate wheelchairs to the sides of seat and should install grab bars on the nearest wall.
4. Under the sink should left sufficient space to accommodate wheelchairs, then disabled people can be used easily.
5. Handle faucet type should be use in the disabled restroom.
6. Mirror should be installed regarding the height of wheelchairs.
7. Shower room should consist of shower and mini-plastic chair with separate dry and wet parts.

Article 47: Facilities for the blind
Clear braille letters and standard symbols should be installed in many public buildings, hospital, terminal buildings and other important places should install loudspeakers to accommodate both the blind and the deaf groups.

Signals and loudspeaker should also provide at the stairways, elevators, escalators and ramps to warn give them directions.

Article 48: increasing the level of hearing
Along with the loudspeakers for the emergency case, other loudspeakers should be installed in the important places: meeting rooms, parking lots, receptions, lobbies and public spaces.

Section 9: Inspection and approval

Article 49: controlled building inspection
Controlled buildings must be inspected and certified building' standard and safety by local authorities which inspect and approve drawings before construction process.

Article 50: verification and certification of the accuracy of building control
The verification and certification of the design accuracy is the inspection of the designing document of the building control which is verified by the administrative and verification agency of the building control work to add in the technical comments and must proceed before there is a permission for construction. The verification of the design accuracy must verify the following criteria:

1. Verify the structure of the design: structure system, indicating the force to design the side of the structure.
2. Verifying the strength of the structure; the size of structure surface, various technical system.
3. Verify the fire protection system
4. Verify the fire systems and the fire protection equipment
5. Verify the ventilation system and the emergency lights

6. Verify the efficiently.

Article 51: verification and certification of the accuracy of building control
The verification and certification of the accuracy of the building control is verifying the implementation of the building control operation of the construction and the consultant company. This verification must proceed by the administrative and the inspection agency and the building control work. Every constructing procedure must have the verification or certification document for construction. The inspection is verifying the actual construction compared to the design that designing the company has identified as following:

1. The construction must implement according to the designed model
2. The use of construction material must be accurate to the types, size and standard that the designer indicates
3. The main construction material must go through and experiment and is licensed
4. In case there is a change in model or types of materials and construction equipment and quality must follow as the initial requirements and must have a license from the consultant in document papers. Also, there must be a certification document to verify the quality of the manufacturer
5. There must be the physical construction model certified by the construction consultant.

Article 52: Normal verification for building control
Normal verification for building control is the inspection of the building circumstance in management using period, must be performed in every year or every 12 months which is verified by the work of controlled building administrative and verification agency. This normal verification is to verify the stability of a building and the using ability of every safety protector.

Article 53: large verification for building control
Large verification for controlled building is verification of building's condition in period defending-utilizing that must be managed every 5 years and verification by the building control work and verify using ability of protect materials also verification managed and organization the protection building owner of controlled building.

Article 54: Document form for verify and accuracy assure of controlled building
Private or organization purpose to construct or using building including controlled building must be run document for verify and accuracy assures from defending-verify control building work which have information:

1. Ask for verify and accuracy assure of building design
   - Verification form and accuracy assure of building design
   - Explore design document form as set in article 11
   - Environment writing in case controlled building in controlled building list.
2. Ask for verify and confirm the accuracy of construction (controlled building)
   - The proposal of verification and confirm the name of the contractor
   - The consultant company's report about technical for construction
   - The certificate result of the construction material's experiment
   - The certificate of health and system of others installation
3. Ask for verify and confirm the accuracy of the building's defending-utilizing
   - The proposal of verification and confirm the name of the contractor
   - The layout for actual construction.

Section 10: administration of agency and verification of controlled building

Article 55: administration of agency and verification of controlled building
The ministry of public works and transport manages and verifies the overall controlled building and is mutually agreed across the country to declare the construction and urban department as the central coordinator with other related sectors from central to local regions.

The administration of agency and verification of the controlled building divides into three levels as following:

- Central level: the department of construction and urban plan,
- Provincial level: the provincial and capital public works and transport sector,
- District level: the district and council public works and transport office.

Article 56: Rights and obligations of the construction and urban plans.
The administration and verification of controlled building in the construction and urban plan department have the rights and obligations as following:

1. Construct and renovate the regulations, guidelines and technical standards of the controlled building work.
2. Research, add in technical comments on the accuracy of the controlled building design that uses the capital from the high central sector and large controlled buildings according the purpose of the public works and transport province and capital in case the project exceeds their capability to support.
3. Verify and certify the quality of the controlled building at the period of using the capital from the central sector and large controlled buildings according to the purpose of the public works and transport province and capital in case the project exceeds the capability to support.
4. Coordinate with the fire department, the ministry of public security, the technological science standard department, the environmental sector, the ministry of natural and environments, the clean water sector, the ministry of public welfare to plan and implement and assess the work of controlled building.
5. Promote and present the policies, regulations, guidelines and technical standards on the work of controlled building for the province and capital public works and transport department and council across the country regions.
6. Research for source of investment capital, implement a work shop on techniques for the work of controlled building in provincial, capital and district level, in the council across the country regions.
7. Develop plans to construct and increase the level of human resource on the work of controlled building.
8. Regularly keep track, conclude, and report the implementation of the controlled building work for the ministry.

Article 57: Rights and obligations of public works and transport, capital
In managing and verifying the work of controlled building, the public works and transport department and capital consist of the following rights and obligations:

1. Promote and present the policies, regulations, guidelines and technical standards on the work of controlled building that the ministry issued to the construction and urban plan office, council extent to the regions that one is responsible of.
2. Research, add in the technical comments on the accuracy of controlled building design that uses the capital from provincial level, capital and every types of controlled building that the private sector invested under their province and capital of their own.
3. Verify and certify the controlled building quality in the period of managing-using the building control that uses the capital of the provincial level, capital and every types of controlled building that private sector invested under their province and capital of their own.
4. Have the rights to present to the upper controlled building managing department to research and add in technical comments on the accuracy of the controlled building design that they cannot consider by themselves.
5. Coordinate with the fire department, the ministry of public security, the technological science standard department, the environmental sector, the ministry of natural and environments, the clean water sector, the ministry of public welfare that are under their own province to keep track and assess the work of controlled building to plan and implement and assess the work of building control result.
6. Lead, keep track, store data, statistics on the work of controlled building in their own local.
7. Regularly conclude, report the result from the implementation of the controlled building work to their own higher sector and to provincial administrative, capital.

Article 58: Rights and obligations of the provincial and council's public works and transport office.
In managing and verifying the work of controlled building, the provincial and council's public works and transport office have the rights and obligations as following:

1. Implement the regulation, guideline and technical standards on the work of controlled building that provincial and capital's public works and transport, ministry and department has strictly issued.
2. Promote, raise awareness on the work of controlled building to the residents in the provincial area and council.
3. Consider giving the permission to construct the controlled building after researching, adding in technical comments on the accuracy of the controlled building design from the provincial and capital's public works and transport, ministry and department.

4. Lead, keep track on the construction process and the controlled building use in their local district and council.
5. Regularly conclude, report the result from the implementation of the controlled building work in their own local district and council to the related sector and the district administration office and council.

Article 59: Obligations and responsibilities of the controlled building owner
The owner of every type of controlled building must have the following responsibilities:

1. At the period of constructing or amending process, there must be a consultant company to keep track and verify on the quality and techniques.
2. At the period of operating, there must be an engineer to keep track-verify the operation, maintain the fire prevention equipment and other systems in the building.
3. Cooperate with the controlled building administrations in the period of verification process according to the time schedule.

Plan the fire prevention training, hoe to use the fire extinguisher equipment and how to escape fire to the occupants of the controlled building at the time when there is a fire incident.

Section 11: The policy of performers and regulation for violations

Article 60: The policy of performers
Individuals and forensics individual or the best organization for manage and allow the regulation of building control also b praised and achieved more policy in according.

Article 61: The regulation for violators
Individual, forensics individual or the organization which had violated rules will educate, discipline, fines, compensate for the civil or legal proceed as the case is light or heavy.

Article 62: The regulation for educate
Individual, forensics individual or the organization which had violated rules as especially not perform inspection specified in this rule shall be educated and warm.

Article 63: The disciplinary measures
Officer or employees the organization of building control and inspection that violated these rules, as disregard to perform duties but isn't the criminal, not significant damage and haven't honestly report their offences, escape from the offence will be disciplined as warming fault, suspend for upgrade and be fired.

Article 64: Measure fine
Individual, forensics individual or the organization that violated the rule, the damage that not element of a criminal offence will be fined cause the action as:

- In the case of the building control was damaged by the mistake from inspection, design, the inspect and design company will be responsible the indemnity damage for life and property in case light or heavy
- In the case of the building control has damaged from decision of building owner as not monitored-check the period during building and period of management for using that set in this agreement all of the damage the owner will be responsible.
- The building control damage due to error in inspection and technical comments from the building control organization, the organization will be warned, in situation that hard or light.

Article 65: The civil measures
Individual, forensics individual or the violated organization in this rule that make the damage to property of individual, forensics individual or the organization must compensate indemnity that they made.

Article 66: Criminal measures
Who violates this rule which is a criminal offence will be prosecuted as defined in criminal law.

Section 12: Final Provision

Article 67: Implementation
Transfer to department of housing and urban planning to implement as the central coordinate with another government organization to suggest the technical guidelines and detail technical standard, as a reference for the management organization and inspection of building control as a mutual agreement across the country.

Article 68: Effectiveness
The agreement as take effect from the date of the signature onward, until the new reformation, all rules and regulations that are unsuitable with the agreement shall be cancelled.

Minister

Annex 1

(not yet drafted)

Table 2-01: Type of building according to control classification

Type of building	Building use	Capacity
Building type 1: Large buildings	1. Sport stadium or theatre 2. Culture hall 3. Conference hall 4. Commercial center 5. Cinema 6. Office 7. Hospital 8. Hotel 9. School 10. Apartment	Total surface of every floor 10,000 m^2 or more
Building type 2: High buildings	1. Apartment 2. Hospital 3. Hotel 4. School 5. Commercial building 6. Office	Higher than 20m
Building type 3: Risk buildings	1. Sport stadium or auditorium	Surface ≥ 500 m^2 And/or with capacity of ≥ 15 servicing tables
	2. Airport terminal, land terminal	Surface smaller than 10,000 m^2
	3. Bar and club	Surface larger than 2,500 m^2
	4. Parking inside building or parking building	Capacity 50 cars
	5. Industrial building with capacity more than 50 horse force, and/or with more than 50 workers	Not limited
	6. Industrial building with capacity less than 50 horse force, and/or with more than 50 workers in case of explosive product manufacturing	Not limited
	7. Fire sensitive storage	Capacity more than 20 m^3
	8. Explosive storage	Not limited

Annex 3

(not yet drafted)

Table 4-02: Specific gravity of materials and building structures

No	Items	Weight
1	Roofing materials	5 – 50 kg/m^2
2	Timber roof	10 – 20 kg/m^2
3	Reinforced concrete roof	100 kg/m^2
4	Ceiling with ceiling frame	14 - 26 kg/m^2
5	Lumber ceiling with ceiling frame	15 – 30 kg/m^2
6	Normal concrete	2,300 kg/m^2
7	Reinforced concrete	2,400 kg/m^2
8	Precast concrete flooring with the top coat concrete at least 3cm thickness	175 kg/m^2
9	Wood floor or wood stairs with wood framing	30 kg/m^2
10	Brick wall with two sides plaster	360 kg/m^2
11	Brick wall with two sides plaster	100 - 240 kg/m^2
12	Lumber wall two sides with wood wall framing	12 – 30 kg/m^2
13	Plywood wall two sides with wood wall framing	22 kg/m^2
14	Parquet flooring	14 kg/m^2
15	Flooring mortar 2.5cm thickness with wax or rough	55 kg/m^2
16	Terrazzo flooring 2.5cm thickness with embedded copper	80 kg/m^2
17	Steel	7,850 kg/m^3
18	Wood	480 – 1100 kg/m^3
19	Brick	1800 - 1900 kg/m^3
20	Natural soil	1,750 kg/m^3
21	Wet sand	2,050 kg/m^3
22	Rock	1,950 kg/m^3

Table 4-02.1: Weights of building materials

Materials and types of building	Weight (kg/m^3)	Weight (kg/m^2)
Fiber cement roofing sheet	15	
Small corrugation		
Large corrugation		
Double corrugation		
Corrugated cement roof tile 0.98 x 5 m		
CPAC Monier	18	
Zinc	60	
Brick wall 10cm thickness with 2 sides plaster	6	
Brick wall 20 cm thickness with 2 sides plaster	180	
Block wall 7cm thickness	360	
Block wall 9cm thickness	120	
Block wall in full strut		
Block wall in half strut		
Glass block wall 7.25'' x 7.25'' x 3	160	
Cello grid wall with frame	240	144
Plywood wall 2 sides 6cm thickness with wood framing	120	32
Wood floor 2.5cm thickness with wood framing	90	
Cord sheet	30	2,512
Fiberglass		880
Glass	22	
Gypsum board		7,840
Steel		2,672
Aluminum alloy	30	8,784
Copper		2,480
Rock		

Sand	1,600
General soil	1,900
Compact soil	2,400
Reinforced concrete	2,230
Concrete	1,658
Mortar	700
Hard wood	

(There are some mistakes in the relationship between matearls and values in the process of translation.)

Table 4-02.2: Increase dead loads

Type of part of buildings and dead loads	Increase percentage of dead loads (%)
- The structure consists column and beam on a building structure to support weight of the lift or weight of lifting lock	100%
- Foundation, corridor, pier supported the lift and other equipment related with lifting lock.	50%
- Light machine, miscellaneous pile or motor	At least 20%
- Light machine piston type appliance	At least 20%

Table 4-02.2: Live load

Types and part of buildings	Unit (kg/m^2)
(1) Roof	30
(2) Awning or concrete roof	100
(3) Housing, kindergarten school, restroom and toilet	150
(4) Row house, apartment, dormitory, hotel and VIP room in the hospital	200
(5) Office and bank	250
(6) (a) Commercial building, row house for commercial, university, school and hospital	300
(b) Lobby, stair, corridor in commercial apartment/ dormitory/ hotel/ office and bank.	300
(7) (a) Market, supermarket, hall, theater, restaurant, meeting room, reading room or library, car parking or carrage.	400
(b) lobby, stair, corridor in commercial building/ university/ college and school	500
(8) (a) warehouse, gymnasium, museum, auditorium, industrial factory, printing house, document storage room and packing	500
(b) Lobby, stair, corridor in supermarket, meeting room, hall, theatre, restaurant and library	500
(9) Document storage room in library	600
(10) Car parking or garage for empty truck	800

Table 4-04: Regulation of decrease live load of building

Floor load	Decrease value of live load
Roof or deck	0
1st floor next to roof or deck	0
2nd floor next to roof or deck	0
3rd floor next to roof or deck	10
4th floor next to roof or deck	20
5th floor next to roof or deck	30
6th floor next to roof or deck	40
7th floor next to roof or deck and next floor	50

Formulation 4-05: wind pressure on horizontal structure

Wind pressure on horizontal structure can calculated by following formula:

$$q = 0.0048*Cd*V2$$

Where: q – wind pressure (kg/m^2) (Annex AA)
Cd – Factor of wind pressure (Annex AA)

V – Wind pressure (m/s)

In case of top roof, perpendicular win pressure (P) against roof gable facing the wind can be defined through formulation below:

a. Wind angles 20 degrees or less than (leeward pressure)
   $P = 0.7*q$
b. Slope between 21-30 degrees (leeward pressure)
   $P = (0.7*\alpha-2.1)*q$
c. Slope between 31-60 degrees (windward pressure)
   $P = (0.03*\alpha-0.9)*q$
d. Slope more than 60 degrees (windward pressure)
   $P = 0.09*q$

Where slope of roof is degrees unit
In case of leeward gable, depress equal $P = 0.60*q$ for a single percentage of roof pitch, pressure and depress perpendicularly impose roof surface. Level of wind load please refer to Annex AA.

Provision 5-02: characters and properties of fire escape route

1. Emergency exit doors must be higher than 1.8 m and the width no less than the width of a fire escape route deducted 25cm. In the case where the door is discharge to the equipment room or restroom, the width should deduct of 0.75m;
2. If the emergency exit discharge to a path that leads to a street, the width of that path must not be less than the minimum width required for fire escapes;
3. If the floor layer or the higher floor layer of the building accomodates more than 100 people, and if the open stadium contains over 2000 audience, the width of the the open area to the emergency exit must calculate by the following formula:

Location	The number of building users	The minimum width
Floor layer or higher floor layer	100＜The number of building users＜200	Y (meter) = X(persons)× 1/100
	200＜The number of building users	Y(meter) = X(persons)×1/150+2/3
The open stadium	2,000＜the number of building users	Y(meter) = X(persons)×1/600+41/3
Y:unit (meter); X the number of building users (persons)		

Provision 5-03: characters and properties of fire escape route

1. The fire escape door must have a device to help control the door to shut tight at all times to prevent the smoke and heat spreading to other areas that need to be secure.
2. The fire escape door must not be locked and able to open at all times. Those who intend to exit does not have to use any keys, and only turn or push out the door handle that is attached to the door 90cm-120cm high from the surface.
3. In case of a fire escape plan in jail or special case room, at the time when the door is shut, there will not be anyone allow in or if there are any neccessary case, the door can be opened immediately by pressing the button open-close or open by a supervisory authorized by the owner of the building and is given a detailed duty to be responsible for helping those inside to escape if there are any smoke alert from the fire security system (springer) or if there are any fire alarm.
4. The fire escape door must be able to open no less than 90 degrees wide and must not be an obsticles for the escape.
5. For a tall building, in every 5 floors and in the roof top floor, the fire escape door must be able to open back inside to help those that had mistaken the path to go back for the correct safety path.
6. The door that the fire exit route leads to (the door that opens directly to the fire escape route) must have a width no less than 80cm, for the double exit door, at least one of them must have a width no less than 80cm when open wide. In the case that it is already widely opened, the door must not block the area of the path more than 180mm and the radius of the swing must not block over ½ of the path of the fire escape route.

Provision 5-04: characters and properties of fire escape route

The fire escape ladder is a significant provision of the fire evacuation plan. It must be at a safe location away from smoke and heat, it must have the capability to guide the people out of the buidling continuously until discharged to a safe destination.

1. The entrance to the fire escape ladder must not have any obsticle in between.
2. The fire escape ladder must be made out of materials that will not catch fire at all moment. In the case of the fire escape ladder outside the building, the walls that the ladder hook against must be fire-resistance rate wall,
3. The landing of the ladder must have a size in width and length equal to or more than the ladders.
4. The stair steps must be more than 22cm wide and more than 22cm high. In the case when it is also use by the disable people, then the width of the stair steps should be more than 28cm side and between 10cm-18cm high,
5. The fire escape ladders and the landings must have handrails in both side and have one more set of layer of landing to protect from falling over. If the ladder is more than 1.8m wide, there must be another handrail in the middle of the stair path and the distance between each handrail must not be more than 90cm. In the case that the width of the ladder is no more than 1.2m or is the type of ladder that is use for typical

residential building, it may have only one handrail in either side and the handrail should be attached inward of the ladders,

6. The handrail should be connected continuously along the length that is between 85cm-95cm high and must have a considerable size to hold on to effeciently which must be 30-50mm in size. The handrail must turn in a curve towards the landing and must have a space of no more than 10cm away from the wall. For the handrail at the outer side, it should reach towards the inside of the landing set equal to the length of the side of the steps and curve the end to attach it to the wall of the ladders,
7. The fall over protection landing will be set at the side of the stairs that aren't next to the walls or at the side that is open and has a height level no less than 1,10m, it will be made into thick walls or with chains that has space between each chain no more than 10cm to prevent the fallover of people and things.
8. The balcony at the exterior of the building that is use as a route to the fire escape which has 2 fire escape ladders set at a distance away connected, it is not neccessary to isolate the fire escape ladder away from the building,
9. In a tall and large building structure that has an underground floor with height from 7m or more than 3 floors must have at least a fire escape ladder in 2 places and must set in distance away from each other no more than 60m. There must be a pretection to prevent the smoke and heat from transfering,
10. The fire escape ladder must have a protection to prevent the danger from smoke and heat with walls and doors of the fire escape ladder which must be fre-resistance with rate of resistance no less than 2 hours for a building no higher than 4 floors, if the building is less than 3 floors, the fire resistance rate may be lower to 1 hour,

Provision 5-05: characters and properties of fire escape route

The fire escape ladders at the exterior of the building must have a structure that is stable and fire resistance, it must be a secure fire escape ladder with the following criteria:

1. The walls that is attached to the ladders must be fire-resistance with the rate of resistance equal to the walls inside the building. The walls must have a width wider than the width of the stairs that is facing the buidling with each side no less than 3m and the doors that lead to the ladders must attach a material device to allow the door to close by itself,
2. In the case that the fire resistance wall can not be 3m each and if the corner between the ladders and the walls are less than 180 degrees wide then the side of the ladders should be alternate by a fire resistance wall,
3. If the fire-resistance walls have an open air it must be able to resist fire no less than 45 minute sand is able to close by itself automatically,
4. The fire escape ladders at the exterior of the building must have a wall at one side to be an open space at all time and has a space area no less than 50% to prevent the smokes to gather up, windoes are not allow to be an altenative open area,
5. The fire escape ladders at the exterior of the building that connects to each other more than 3 floors must prepare a material that controls the people's sight to help those who has fear of height to not be afraid with the material that is no less than 1.3m from the surface,
6. The exception for a fire escape ladder that does not have to have a fire-resistance walls are:
   - The exterior balcony of the building that is use as a route to the fire escape with 2 fire escape ladders set at a distance away connected, it is not neccessary to isolate the fire escape ladder away from the building,
   - The fire escape ladder at the exterior of the building connected to each other no more than 2 floors, which also counts the discharging floors, does not have to isolate the fire escape ladder away from the building if there is another fire escape route that is at a distance away which is another alternative path to evacuate.

Provision 5-06: characters and properties of fire escape route

Every types of building containment must have a sign or symbol to show the path for the fire escape so that the building users can know the exit way in case of an emergency as following:

1. The signs that tell the building floor, the fire escape route, the dead-end (not the fire escape route);
2. The map of the building that show the location of rooms, fire equipments, doors and emergency exits (fire escape route);
3. Each signs and symbols must give adequate brightness and must be able to see at all time;
4. The electricity power that distribute to the signs must detach away from the electricity that distirbute to other equipments in the building so that in case the electricity occurs a problem there would be spare power to distribute to the signs continuously for at least 2 hours;

Document 6-01: ***Portable Fire Extinguisher***

Handheld extinguisher system or portable fire extinguisher is an essential system that should be equipped in every types of containment building along with other fire extinguisher equipments that are already available. The portable fire extinguisher is very important in tackling the starting flames in an attempt to put out the fire at the first stage where the people who face this incident can reach for the fire extinguisher immediately. The size of the handhled extinguisher is preferably use about 4.5 kg but not more than 18.4 kg because it will be too heavy and not effeiciently use.
There are many classes of fire extinguisher and each one has different capability in putting out the fire as the following detail:

1. Class A is fire that start from typical materials that are flammable such as: wood, fabric, paper, rubbber and plastic.
2. Class B is fire that start from combustible material such as : gas, oil, tint, paint, lacker and cooking gas.
3. Class C is fire that start from electicity materials such as: electricity circuit.
4. Class D is fire that start from materials that can burn such as: magnesium, sodium, Lithium, Potassium and groups of Chrodium.

- The capability of using the handheld fire extinguisher depend on the clasification of the starting flames that is shown in table xx. 3.1.
  .
- The method for equiping the fire extinguisher must gaurantee the sufficient amount and put in a spot where people can easily get access through as required in the table xx. 3.2 and table xx. 3.3

Table 6-01.1: Choosing the class of a fire extinguisher with the types of flame

Class of fire extinguisher	classes of flame			
	class A	**class B**	**Class C**	**Class D**
Water	√			
Acid-soda	√			
Foam	√	√		
Aqueous Film Forming Foam (AFFF)	√	√		
Dry chemical ABC	√	√	√	
Dry chemical (potassium carbonate)		√	√	
Halon 1211 (BCF)		√	√	
Halon 1301	√	√	√	
carbondioxide (CO_2)		√	√	
special fire extinguisher				√

* source: Plumbing Systems Design and Building Environment, Volume II, Thailand.

Table 6-01.2: the maximum protection against fire area size per one Class "A" fire extinguisher

Handheld fire extinguisher Class "A"	the maximum protection against fire area size per one Class "A" fire extinguisher (m^2)		
	Building type 1	Building type 2	Building type 3
1 A	-	-	-
2 A	557	280	-
3 A	836	418	-
4 A	1,045	557	372
6 A	1,045	836	557
10 A	1,045	1,045	930
20 A	1,045	1,045	1,045
30 A	1,045	1,045	1,045
40 A	1,045	1,045	1,045

* source: Plumbing Systems Design and Building Environment, Volume II, Thailand.

Table 6-01.3: The maximum size and distance to access to the fire extinguisher class "B"

Types of building	Handheld fire extinguisher Class "B"	Maximum distance to access (meter)
1	5 B	9
	10 B	15
2	10 B	9
	20 B	15
3	40 B	9
	80 B	15

* source: Plumbing Systems Design and Building Environment, Volume II, Thailand.

Document *Fire Hose System*

The fire hose system has 2 systems which are: dry pipe system and wet pipe system that has the following element:

1. **Fire extinguisher water source :**
   -from the public water pipe that has sufficient pressure and amount of water,
   -from the automatic water pump system.,
   -from the water pump system authorize by the fire departments,
   -from the pressure tank,
   -from the water storage tank
2. **Increase water pressure system**
   Which may be pumping from fire extinguisher water supply that runs by fuel or electricity or increasing the pressure to allow natural water flow from the high water storage tank. The increase water pressure system must give pressure to the fire hose at least no less than 4.4 barrel or 44 meters of water.
3. **Standing pipe or vertical pipe**
   This has the size and amount of water flowing depending on the usage of the work and the amount of standing pipes (see table)
4. **Fire extinguisher hose**
   There are many size of the fire extinguisher hose which is separate into 3 types according to the users as following:
   - Type 1: use by the fire departments and primarily trained personnel in using heavy stream hose particularly.
   - Type 2: use by the ones that are inside the building until the fire department arrives.
   - Type 3: use by the fire departments or those who are inside the building who has experience in using the heavy stream hose before.

   The descriptions on the size of the fire extinguisher lines and tubes are identified in the table.
   - For type I and III there must be pressure left at the cap of the hose 4.4 barrel or 44 meter of water and must have 32liter/second amount of flowings in a 30 minutes time.
   - The hose must have a length that can reach the fire incident point at least no less than 10 meters from the pipe location. The length is 15 meters, 23 meters and 30 meters. If the building splits rooms into zone, the amount of the standing pipe or hose connections increases.
   - The height of the fire cable box must not be less than 1.5 meter and must set at a spot with no obsticles and has a indicate sign that can be seen clearly. See the design of the fire hose cabinet in the table.

Table 6-02.1: The description of the Fire Hose Cabinet Design using folding type.

Types of use	Size of the fire extinguish hose tip (mm)	Size of the fire extinguish hose wires (mm)
1. For the firefighters or those who are already trained	65	65
2. For those that are inside the building	40 25*	40 25*
3. For firefighters or those who are already trained and those inside the building	40 and 65^{+} 25* and 65^{+}	40 25*

* for the hard suction hose
+for the connect by tube type
source: Plumbing Systems Design and Building Environment, Volume II, Thailand.

Document 6-02.2:

Automatic Sprinkler System

The automatic fire extinguisher uses water through sprinkler system, it is an effective systems preventing loss of life and property from fire potential. This system contains the pressure increase system, a fire extinguisher hose, a retail of the hose with pressure that distribute to the head of the extinguisher hose or the sprinkler. When a predetermined temperature has been exceeded, the chemical bulb on the sprinkler cap will break and discharges water. The most common use system is the wet pipe which has water and pressure available in the pipe at all time.

The designing of the sprinkler system depends on the following charateristics: (detail shown in table xx.5.1)

1. Group 1 is the building with light hazard occupancies
2. Group 2 is the building with ordinary Hazard Occupancies
3. Group 3 is the building with extra hazard occupancies

- The maximum fire extinguish area of each type of building is shown in table xx.5.2,
- The maximum fire extinguish per head and the distance between the sprinkers is shown in table xx. 5.3 and 5.4,
- The size for the amount of sprinklers are shown in table xx. 5.5, 5.6 and 5.7,
- The designing of the sprinklers for ceilings with various temperature are shown in table xx. 5.8,
- The radius of the sprinklers, the rate of water flow and the pressure of the size of the common use hose is 12.5 mm which can sprinkle out water at the rate of 80l/minute or 1.33l/second with the pressure that can be estimate with the unit K factor which is shown in table xx. 5.9.
- The level of water pressure that the water from the sprinkler should be about 11 meter of water of 1 barrel for the building types in group 1 and 2. For Group 3, there must be a specialist engineer to design and condider together with the authority due to the building type that has high risk of fire potential.
- The rate of the sprinkler's water flow for building types in group 1 should be between 30-45 l/second and for group 2 should be between 42-90l/second. For Group 3, there must be a specialist engineer to design and consider together with the authority due to the building type that has high risk of fire potential.
- The amount of time to put out fire with sprinkler for building types in group 1 should be between 30-60 minutes and in group 2 it should be between 60-120 minutes. For Group 3, there must be a specialist engineer to design and consider together with the authority due to the building type that has high risk of fire potential.

Table 6-02.3: The maximum fire extinguisher area and the distance between the sprinklers.

Level of risk	**the maximum fire extinguisher per one unit sprinkler (m^2/unit)**	**The maximum distance between sprinklers (m)**
Level risk 1	16	4.6
Level risk 2	12	4.6
Level risk 3	8.5	3.7

Source: NFPA13, 1996 Edition Standard for the Installation of Sprinkler Systems

Table 6-02.04: Indicating the distance between each sprinklers

	Building group **1**	Building group **2**	Building group **3**
The distance between the top lines	4.5 meter	4.5 meter	3.6 meter
The maximum distance of the sprinklers in line	4.5 meter	4.5 meter	3.6 meter
The maximum area per sprinkler	18.6 meter	12.0 meter	8.4 meter

source: NFPA13, 1996 Edition Standard for the Installation of Sprinkler Systems

Table 6-02.5: The size of the tubes for the amount of risk level 1 sprinklers

The tube size equals to or more than (mm)	The amount of soft iron tube sprinklers that equals to or less than	The amount of copper tubesprinklers that equals to or less than
25	2	2
30	3	3

40	5	5
50	10	12
65	30	40
80	60	65
90	100	115
100	>100	>115

source: NFPA13, 1996 Edition Standard for the Installation of Sprinkler Systems

Table 6-02.6: The size of the tube for the amount of risk level 2 sprinklers

The tube size equals to or more than (mm)	The amount of soft iron tube sprinklers that equals to or less than	The amount of copper tubesprinklers that equals to or less than
25	2	2
30	3	3
40	5	5
50	10	12
65	20	25
80	40	45
90	65	75
100	100	115
125	160	180
150	275	300
200	>275	>300

source: NFPA13, 1996 Edition Standard for the Installation of Sprinkler Systems

Table 6-02.7: The size of the tube for the amount of risk level 3 sprinklers

The tube size equals to or more than (mm)	The amount of soft iron tube sprinklers that equals to or less than	The amount of copper tubesprinklers that equals to or less than
25	1	1
30	2	2
40	5	5
50	8	8
65	15	20
80	27	30
90	40	45
100	55	65
125	90	110
150	150	170
200	>150	>170

Table 6-02.8: Sprinklers for ceilings with various temperatures

Maximum ceiling temperature (°C)	Fire Sprinkler temperature (°C)	FUSIBLE TYPE color code	GLASS BULB color code
38	57-77	uncolor	Orange or red
66	79-107	white	Yellow or green
107	121-149	blue	blue
149	163-191	red	purple
191	204-246	green	black
246	260-302	orange	black

Table 6-02.9: K factor unit for each size of sprinkler head

The size of the sprinkler head holes (mm)	K	Sprinkler rating calculate in % Of sprinkler head size **12.5** mm
6.4	18.6-21.4	25
7.8	25.7-28.6	33.3
9.4	37.1-41.4	50
11.0	57.1-62.8	75
12.5	75.7-82.8	100

13.3	105.6-117.1	140

source: NFPA13, 1996 Edition Standard for the Installation of Sprinkler Systems

Document 6-02.10: *Standpipe System*

The size of each standpipe depends on both the amount and size of the hose line that may use at the same time and if there aren't any issue with deviding rooms into sections then the distance between the hose and water storage can indicated the location of the standpipes by the use of the building areas.

Class I and III of standpipe system

1. A standpipe with height no more than 30m must have the size no less than 100mm
2. A standpipe with height over 30m must have a size at least 150mm
3. A standpipe must have the height no more than 84m. If the building is taller it must design a standpipe system that can distribute weter into zones.
4. In the case of using the standpipe to both a hose system size 65mm and the automatic sprinkler, the standpipe must have the size of 150mm,
5. In case the setting of the fire extinguisher that distribute water to the area with high floor level compiles with the ones distributing to the lower floor level, the distributing pipe of each zone must have a size over 200mm. For high floor level with more than 2 standpipe shall have a direct distributing pipe with size no less than 200mm for at least 2 pipes to discharge water to the standpipes.

Class II of standpipe system

1. There are 2 types of hose lines which are: folded flexible hose line hanged inside a cabinet with size equivalent to 40mm and the rolled suction hose line with size 20mm or 25 mm.
2. The size of the standpipe must be adequate to distribute the water fore at lwast 6.3 l/second.
3. The standpipe sith height no more than 15m must have a size at least 50mm. In case the standpipe with height no more than 15m, the size should be at least 65mm. Normally, the size of the standpipe should not be less than 100mm.

Table 6-02.11: Design information on the size of fire extinguisher pipes

Number of standpipe	Rate of fire extinguish water flow (l/second)	Size of fire extinguish pipe (mm)
1	32	150
2	48	150
3	64	200
4	80	200
5	96	250
6	112	250
7	128	250
8	144	250
9	160	300
10	176	300

Source: NFPA14, 1996 Edition Standard for the Installation of Standpipe and Hose Systems

Table 6-03: the level of risk measure to the fire protection

Level of risk	Leve of risk measure to the fire protection design
Risk level 1 (Light Hazard Occupancies)	Has less volume of flaming fuel, rate of burning and has slow fire expansion which consist of: wooden residential area, commercial area, grocery, small shops, restaurants or mansion, assembly, church, temple, religious community center, hospital, rehabitation, cinema, opera, education departments (school, university) small museum, prison, office skyscraper, residential skyscraper
Risk level 2 (Ordinary Hazard Occupancies)	Has intermediate volume of flaming fuel, rate of burning and the expansion of fire which consist of: parking lot (over the ground and an open are), electronic manufacture, drink manufacture, bakery factory, laundry shop, palace (for service use), accessory manufacture, cigarette factory, printing company, wooden furniture manufacture, chemical manufacture, parking lot (undergrounf floor), car garage, paper, plastic manufacture. Warehouse that keeps flammable materials such as: paper, furniture, paint. Alcohol and others like: paper manufacture, cruise and bridges that reach towards the water.

Risk level 3 (Extra Hazard Occupancies)	Has a high flaming fue, rate of burning and expansion of fire is high such as: wooden manufacture, tint and paint manufacture which uses an evaporative chemical that catches heat below 37°C**,** sawmill factory**,** aircraft warehouse, car manufacture, aircraft repair garage, aircraft manufacture, plactic factory, mineral development factory, chemical factory, fuel engine manufacture.

Source: NFPA14, 1996 Edition Standard for the Installation of Standpipe and Hose Systems

Table 6-03.1: The risks of the highest fire extinguish area

Risk level	Highest fire extinguish area **(**m^2**)**
Risk level 1	4,831
Risk level 2	4,831
Risk level 3	2,323

source: NFPA13, 1996 Edition Standard for the Installation of Sprinkler Systems

Document 6-04: Fire Alarm and Detector System

The most common reason to the damage of life and property is from fire accident which happens from not being able to evacuate the occupants out of the buidling in time and before knowing there is a fire, it would already be too late. Therefore, it is neccessary to have a fire alarm to increase the protection to the occupants and have a heat detector system in addition to qualify the prevention of fire spreading in time as the following detail:

1. **fire alarm using hand**
   Is a device that sends warning by the stimulating of an individual. It is an electric switch that is seen in a red symbol and easy to comprehend, the reset will be done by the included equipments which are: the keys which cannot be reset with bare hans. The portable fire alarm must set at a clear location at the entrance or exit of a building with distance between the material no more than 60m, height distance from the ground between 1.3-1.5m to allow the disabled people to be able to use it as well.
2. **fire alarm using sound**
   There are many kinds of this type of device such as: ringing, whistle, sirens and through speakers. The sound of this device must be differetn from tother alarm in the normal situation such as: alarms for end of work period, the volume of this type of sound must be louder than the ambience around no less than 15 decibel and the sound in each point must not be less than 65 decibel and no more than 120 decibel. In case the building is a residential type, the volume of the sound must not be less than 70 decibel to wake the residence who are sleeping. The amount of time of the alarm must nor be less than 60 seconds. In case the ambience has a volume louder than 95 decibel, there should be a fire alarm with lights involve. The height in setting the fire alarm deive is 2.3m and has a distance from the ceiling no less than 15cm.
3. **Fire alarm using lights**
   It is a device that sends beaming lights to allow the occupants know the incident. This type of device is suitable for lacating in a place with sound louder than 95 decible and at an area that lacks of hearing capability. Normally, the device will send white light out in a ratio of 1-2 times/second. The fire alarming device using lights must set in a place to see clearly and covers an area. The distance of this device depend on the brightness of the light but must not be more than 30m. (the detail of the fire alarm process is indicated in the attachment files)
4. **Smoke detector**
   This is a device that is use to detect the amount of smoke resulting from the burning of a material. Each device has the capability to detect a fire faster than the thermal detector. In some case, a fire incident can create smoke without any change in the room temperature (detail of the settings are indicated in the attachment files).
5. **Thermal detector**
   The thermal detector is mostly located in an area with limited space for a smoke detector such as: the car garage, kitchen and other places thatsmoke happens but not because of a fire incident. In some case, an additional settingof a thermal detector is located along with the smoke detector to increase the capability of detecting a fire. Even so, the thermal detector cannot be a replacement for the smoke dectector particularly along the fire escape route. (detail of setting indicated in the attachement files)
6. **Flow switch**
   The flow switch is a device that detects in the fire extinguishor system by water. When the water flows due to the process of the sprinkler pr the hose to put out fire, the flow switch will send signals to the monitor and sent an alarm to the building occupants.

Table 9-01: Regular and frequent inspections

No	Inspections	List	Regular Inspection	Major Inspection
1	Durability and strength inspections	Buidling extension, modification and improvement	A	A
		(1) Changing of floor load	A	A
		(2) Changing of building's function	A	A
		(3) Changing of building's materials and decoration components	A	A
		(4) Deterioration of buildings	A	A
		(5) Destruction of building structures	A	A
		(6) Foundation settlements	A	A
2	Buiding system and equipment			
	2.1 Utility systems	(1) Elevator systems	A	AA
		(2) Escalator systems	A	AA
		(3) Electrical systems	A	AA
		(4) Air conditioning systems	A	AA
	2.2 Environment and sanitary	(1) Water supply systems	A	AA
		(2) Waste water treatment system	A	AA
		(3) Drainage systems	A	AA
		(4) Waste disposal systems	A	AA
		(5) Ventilation systems	A	AA
		(6) Noise and air pollution control system	A	AA
	2.3 Fire prevention and suppression	(1) Fire exit stairs and fire escape	A	AA
		(2) Emergency signs and boards	A	AA
		(3) Smoke ventilation and control systems	A	AA
		(4) Emergency and standby power system	A	AA
		(5) Elevator fire safety systems	A	AA
		(6) Fire alarm systems	A	AA
		(7) Fire suppression systems	A	AA
		(8) Sprinkler systems	A	AA
		(9) Auto-fire extinguisher	A	AA
		(10) Lightning protection system	A	AA
3	Equipment and systems inspection for evacuating people in cases of fire	(1) Competences of fire emergency-exits and stairs	A	AA
		(2) Competences of emergency sign and boards	A	AA
		(3) Compentences of fire reporting systems	A	AA
4	Safety management system inspections	(1) Fire prevention and suppression plans	A	AA
		(2) Emergency evacuation drill plans	A	AA
		(3) Safety management system plans	A	AA
		(4) Management plan for building inspectors	A	AA

Notes:

- A : Inspection without equipment's capability test
- AA : Inspection with equipment's capability test