# BASIC PRINCIPLES

FRAME is developed on six basic ideas:

- 1. In an adequately protected building there is a good balance between the threat and the available protection.
  When both are expressed in numbers, one can say that the value of both must be equal, or that the quotient " threat divided by protection " is equal or smaller than 1. A higher value will indicate some lack of protection compared to the risk; a lower value represents a better situation.

The balance between the fire threat and the fire protection that can be expected by "FRAME" is similar to what we may find "at home" in a modern non combustible house in an urban area: Property damage can be limited to the room of origin of a fire, there are no deaths, and life can be "back to normal" after a short period of time, necessary for clean-up and (temporary) repairs.

- 2. The possible severity of the fire can be calculated with of a number of influence factors.
  This set of influence factors will define numerical values for typical worst case scenarios, and these values will be named the Potential Risks, reflecting the severity. The influence factors are linked to the development of the fire (growth, duration, flash-over) and to the building characteristics.

- 3. The acceptability of a fire risk is lower when the exposure level is higher.
  The exposure level is defined by the probability of ignition, but also by the value of the contents, the circumstances of an evacuation, and the economic, monetary or societal impact of the fire. These points will give the values of the Acceptance Levels.

- 4. The level of fire protection can also be expressed as a combination of values for the different protection techniques. These values will represent the following elements:
  - The most universal extinguishing agent: water
  - The design of escapes routes
  - The fire proofing of the construction
  - The methods of detection and notification
  - The manual fire fighting means
  - The automatic fire extinguishing systems
  - The public and private fire brigades
  - The physical separation of risks
  - The organisation for rescue and salvaging

- 5. The risk assessment in a building is made separately for the property (building and content), for the occupants and for the activities in it. These three calculations are necessary because the worst case will be different for buildings, persons or activities, as well as there are differences in the effectiveness of the protection.

- For the building and its content, total destruction is assumed to be the worst case.
- For the occupants, any beginning fire is already a threat and is therefore "the worst case".
- For the activities, a fire that damages everything, even without complete destruction is considered to be the most harmful.

- 6. A separate calculation shall be made for each compartment. Within one building several different situations can exist: For this reason, "FRAME" uses a one level fire

compartment as the basic unit for the calculations. For multi-storey buildings, each level has to be considered separately. For buildings with more than one fire compartment, each compartment shall be reviewed on its own.

These principles are the basis of the following definitions and formulas.

## DEFINITIONS AND BASIC FORMULAS.

1. The Fire Risk R for the building and its content is defined as the quotient of the Potential Risk P by the Acceptance Level A and the Protection Level D

$$R = P / (A * D)$$

The Potential Risk P is defined as the product of the fire load factor q, the spread factor i, the area factor g, the level factor e, the venting factor v, and the access factor z.

$$P = q * i * g * e * v * z$$

The Acceptance Level A is defined as the maximum value 1.6 minus the activation factor a, the evacuation time factor t, and the value factor c.

$$A = 1.6 - a - t - c$$

The Protection Level D is defined as the product of the water supply factor W, the normal protection factor N, the special protection factor S and the fire resistance factor F.

$$D = W * N * S * F$$

2. The Fire Risk R1 for the occupants is defined as the quotient of the Potential Risk P1 by the Acceptance Level A1 and the Protection Level D1 :

$$R1 = P1/ (A1 * D1)$$

The Potential Risk P1 is defined as the product of the fire load factor q, the spread factor i, the level factor e, the venting factor v, and the access factor z.

$$P1 = q * i * e * v * z$$

The Acceptance Level A1 is defined as the maximum value 1.6 minus the activation factor a, the evacuation time factor t, and the environment factor r.

$$A1 = 1.6 - a - t - r$$

The Protection Level D1 is defined as the product of the normal protection factor N and the escape factor U.

$$D1 = N * U$$

3. The Fire Risk R2 for the activities is defined as the quotient of the Potential Risk P2 by the Acceptance Level A2 and the Protection Level D2

$$R2 = P2 / ( A2 * D2)$$

The Potential Risk P2 is defined as the product of the spread factor i, the area factor g, the level factor e, the venting factor v, and the access factor z.

$$P2 = i * g * e * v * z$$

The Acceptance Level A2 is defined as the maximum value 1.6 minus the activation factor a, the value factor c, the dependency factor d.

$$A2 = 1.6 - a - c - d$$

The Protection Level D2 is defined as the product of the water supply factor W, the normal protection factor N, the special protection factor S and the salvage factor Y.

$$D2 = W * N * S * Y$$

These formulas show the similarity between the three parts of each calculation. For an adequately protected compartment the values of the Risks R, R1 and R2 are equal to or below 1.

$$R = \frac{P}{A * D} \leqslant 1$$