FIRE RESISTANCE EXPLAINED (2)

In our last edition of Explained, we introduced the concept of fire resistance. But how does one know what fire resistance is required for a building?

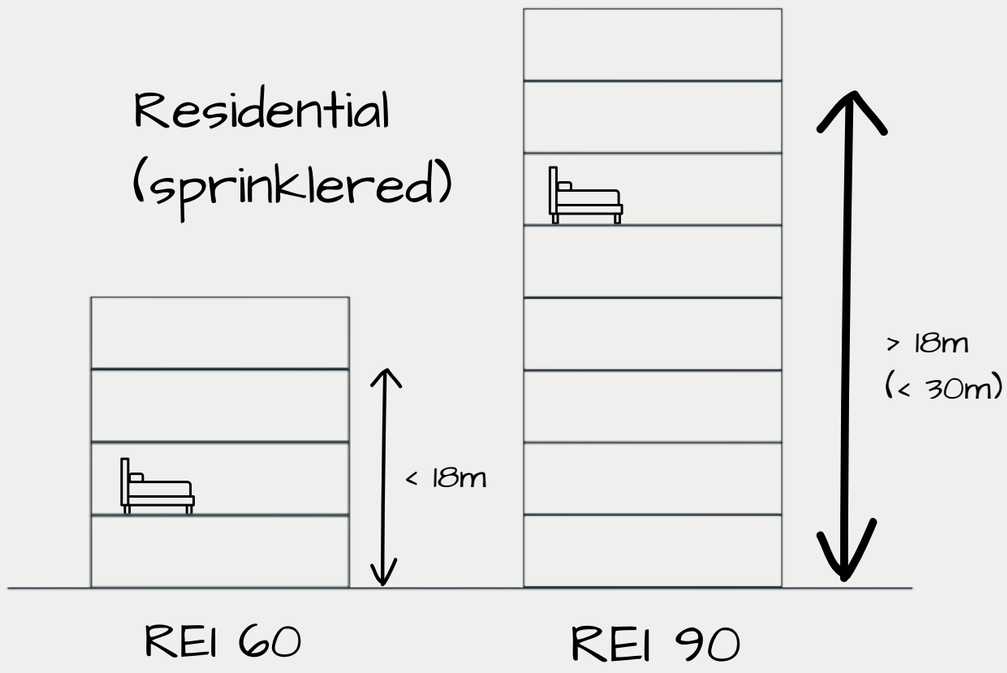
Guidance approach

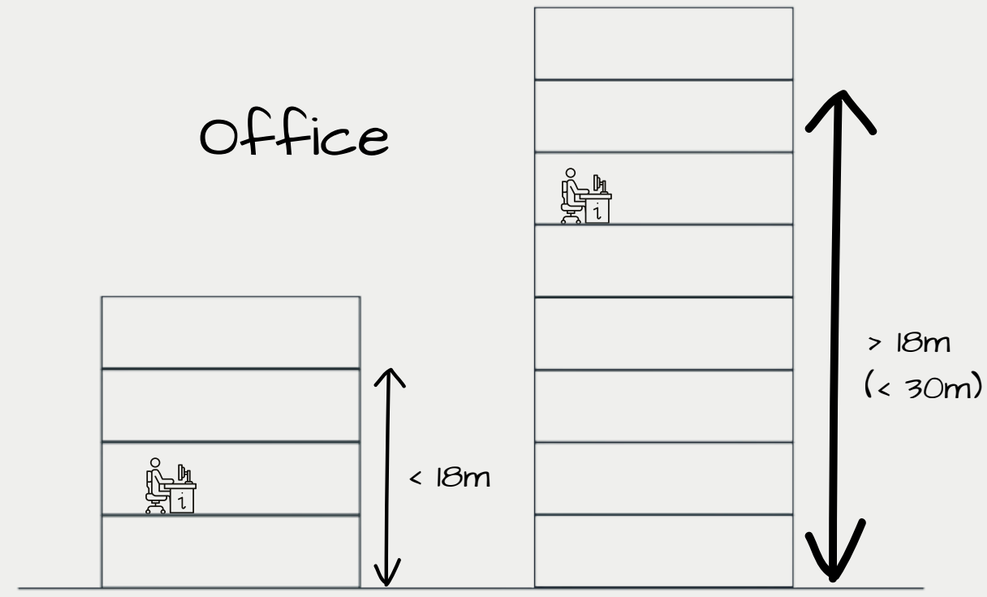
Key fire safety guidance documents (ADB, BS 9999, BS 9991, HTM 05-02 etc) will recommend periods of fire resistance for buildings. Those are usually dependent on the use of the building, its height and whether a water suppression system is provided. These will vary from 30 minutes to 120 minutes fire resistance (REI 30 to REI 120).

For example, some building uses may require higher period of fire resistance than other buildings of the same height. This can be a result of a higher fire risk associated with the use, such as a sleeping risk in a residential building or high fire loading in industrial buildings, compared to other uses representing a lower fire risk, such as office buildings where occupants are awake and familiar, and fire loading is limited.

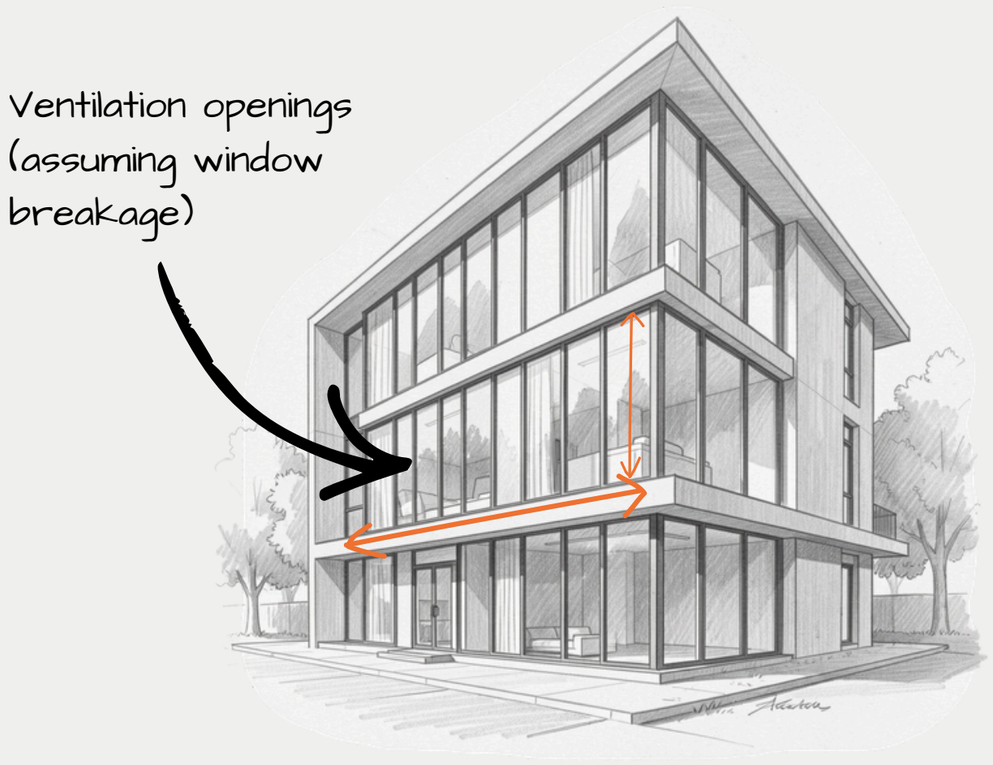
Similarly, as building height increases, the period of fire resistance may increase as well. This represents an increase in risk related to the potential for longer evacuation times, internal fire-fighting requirement or an increased consequence of failure on neighbouring buildings.

Sprinklers can also be used to reduce the required period of fire resistance as they will control the fire spread and therefore reduce its severity compared to an unsprinklered fire.





Unsprinklered	REI 60	REI 90
Sprinklered	REI 30	REI 60



Ventilation factors

However, the values given in guidance documents can be very generic and not perfectly tailored to every building. Expected fire conditions in a building can vary depending on a lot of other factors than just use, height or the provision of sprinklers.

For example, BS 9999 includes a methodology that can be used to reduce the required period of fire resistance based on the provision of favourable ventilation conditions. This is because increased ventilation in a compartment can lead to a reduction in fire severity due to the increased losses of energy via the façade openings. A Monte-Carlo analysis was undertaken in the development of BS 9999 to define parameters at which this increased ventilation could be used to offset a reduction of the fire resistance requirements. The methodology is available in Tables 24 and 25 of BS 9999.

Time-equivalency

Another methodology provided in EN 1991-1-2 allows fire engineers to define an equivalent time of fire exposure for elements of structure, also known as time-equivalency. The methodology aims at estimating the severity of a real fire scenario and relates that to a period of fire resistance, such that elements of structure can be protected to ensure that their fire resistance is greater than the fire severity.

Fire resistance > Fire severity

Parameters that are used to define this time-equivalency are fire load density, thermal properties of the enclosure and a ventilation factor. In addition, a multiplication/safety factor should be applied to the outputs from the calculations to take into account the complexity of the building evacuation, size and height of building, and consequence of failure.

MARS
FIRE ENGINEERING