Selection of volume flow rate for mechanical smoke shaft systems

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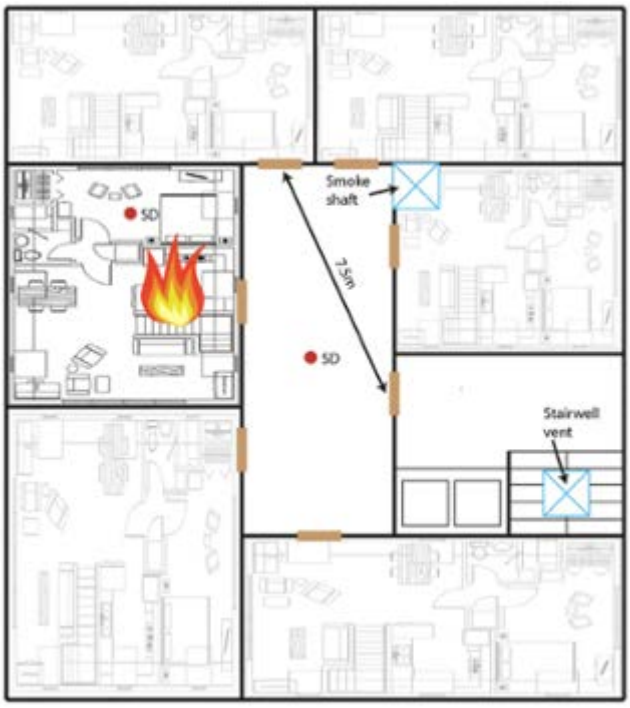
The primary purpose of a mechanical smoke shaft is to maintain a clear escape route for occupants of the building in the event of a fire in an apartment – this is known as 'Means of Escape mode'. For tall buildings there is also a requirement to maintain safe conditions for the fire brigade to enter the building to fight the fire, commonly known as 'Firefighting mode'.

Means of Escape mode

Each apartment in a residential building is a separate fire compartment, so in theory a fire in one apartment should not affect any other dwellings and occupants of flats and would not necessarily be aware of the incident.

Anyone leaving the apartment during the early stages of the fire would exit by the door onto the common lobby and this could allow some smoke to exit into the lobby in the time that the front door is open. In the 'Means of Escape mode', the smoke shaft would be used to extract any smoke that has leaked into the lobby to ensure the stairs and lobbies remain relatively smoke free to allow other occupants of the building to leave safely should the need arise.

Firefighting Mode



In buildings with a floor higher than 18m above ground level the fire brigade would have to enter the building to fight the fire as this is beyond the reach of the largest ladder. Under these circumstances, the firefighters would open the door to the apartment containing the fire allowing a lot of smoke to enter the lobby. In this condition, the smoke shaft would be required to exhaust this smoke and prevent it from entering the stairwell.

How do we arrive at an extract rate?

The common method of deciding on the smoke extract rate is by the constructing a computational fluid dynamic (CFD) model of the building and using a set of standard parameters such as the size and heat output of the fire to run a simulation to determine if the conditions within the building are acceptable.

In practice the smoke extract rates for apartment buildings are consistent and commonly used extract rates are x for means of escape protection, and y for firefighting ventilation for buildings up to around 20 storeys in height.

There is a case to be made for standardising on the higher flow rate subject to acceptable replacement air provision, as the size of equipment is not significantly different and having one extract unit for all buildings has some advantages in design, pre-assembly, and maintenance.

((A volume extract rate of between 5-6m^3/s is used which is capable of providing acceptable conditions for Means of Escape and also firefighting operations and this extract rate is delivered automatically on smoke detection within the lobby. There is no requirement for firefighters to activate a firefighting mode to switch the system to a higher duty, as there is a strong likelihood that they may be unfamiliar with the building or the particular system leading to a high risk that the system will fail to be deployed. This would add to the already high risks facing firefighters in such cases.))

Recommendation

For most mechanical smoke shaft applications under 20 storeys use a flow of 6m^3/s.