

Fire Engineering and Structures a Fire Service View

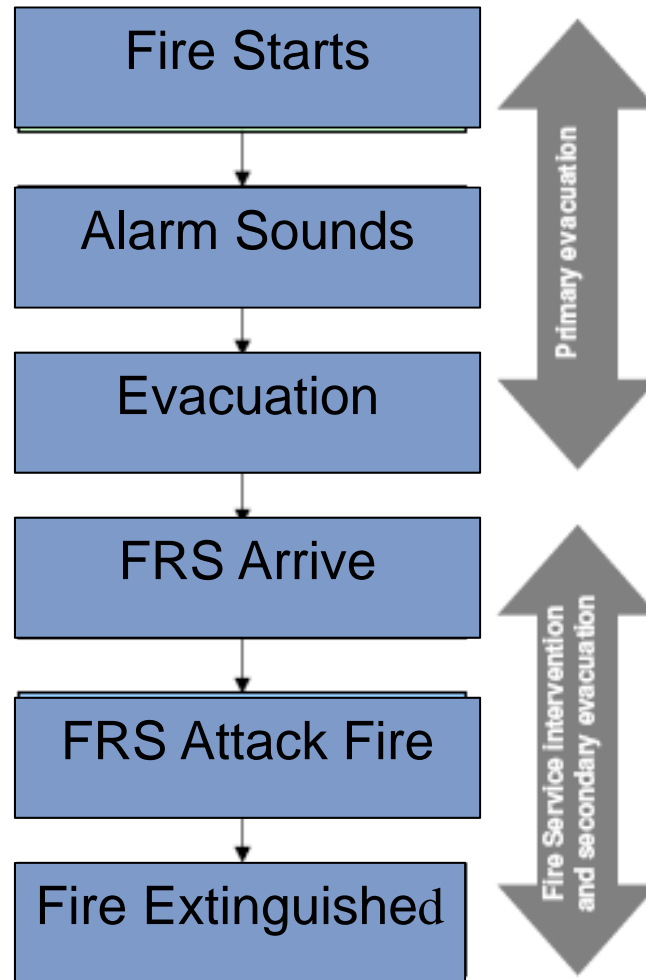
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What are the sprints of the Code?



Fire Safety Principles



Means of Escape

- Definition of the means of escape

Means of Escape is a structural means, whereby a safe route is provided for persons to escape in case of fire, from any point in a building to a place of safety, clear of the building, without outside assistance



Fire Engineering First Principles

Based upon.

- Understanding the fire behaviour within a particular environment (residential, assembly etc)
- Providing enough time for the occupants to escape by the use of principles such as.
 - Ventilation and pressurisation of escape routes.
 - Smoke control systems such as curtains etc
 - Active measures such as sprinklers and water good .
- Ensuring that there is a reasonable level of safety to allow the occupants to escape (ASET/RSET)



Fire Engineering First Principles

However.

- Generally employed to show an alternate method of achieving a satisfactory level of life safety to escaping occupants and does not consider the safety of fire fighters.
- Fire conditions and fire growth is generally ignored after all persons have escaped from the building.

But is this no different from a code compliant approach.



Code Compliant Assumptions

- Designed in the main that fire fighters can access the building and or make rescues using their own equipment.
- Travel distances and access inside the building are dictated by the limitations of fire service equipment (i.e. A heights above 30 meters).
- That the building can be accessed from the outside such as opening windows etc.



Fire Engineering Solutions

- Revert to code compliant solutions within fire engineering design (i.e. Fire fighting shafts and locations, wet and dry risers etc).
- Assume that fire fighters will be able to access all parts of the building easily and control the fire.



But what are the limitations?



Fire Service Limitations

- Fire Service ladders restricted to 10.5 (35ft) and 13.5 meters (45 ft) on appliances.
 - 10.5 Meter ladder will generally reach domestic dwellings and roof access 2 storey buildings.
 - 13.5 meter ladder will generally reach the 3rd storey of a building, but will access the sill on the fourth storey.
- Hydraulic Platform and Turn Table ladders restricted to 30 meters.





Fire Service Limitations

- Fire service pumps max pressure 13 Bars
 - Usually centrifugal type.
 - Fire service pumps can typically pump to a height of 50 meters.



Fire Service Limitations

- Typical fire fighter nozzles require 6 Bars pressure to be effective.
- Fire service rely upon the fire fighting features within the building such as.
 - Wet and dry riser systems.
 - Fire fighting lifts.
 - Fire fighting lobbies and protected shafts.
 - Water suppression systems such as sprinklers and water mist.
 - Compartment floors and walls



Fire Service Limitations

In the absence of such features fire fighters will have to.

- Physically carry equipment in to the building.
- By not having access to a fire fighting lift will have to ascend staircases.
- In the absence of a wet riser/dry riser fire fighting the time taken to 'get water' onto the fire will be considerably longer.



The behaviour of the structure and the fire fighter role



The Impact of the building envelope

- Facade construction is such that there are little or no opening windows.
- Fire service operations gaining access to the outside of the building are limited.
- Due to the insulation requirements of the building any developing fire cannot easily ventilate (Euro-code assumes ventilation of the fire)







Traditional construction

- Wide use of brick, timber and slate.
- Had a natural fire resistance
- Load bearing elements were generally non combustible.
- Standards of workmanship were generally not an issue.



Modern Construction methods

- Use of concrete and steel in the case of high rise projects.
- Greater use of timber in high rise construction (currently 9 storeys in height)
- Load bearing elements can be combustible (Structural Timber)



Fire Tests vrs Real Fire B behaviour

- Undertaken in strict conditions
- Standards of preparation of the test differs from the standards of installation of the actual building.
 - Intumescent materials not correctly applied
 - No realistic
 - Compartmentation may differ from that designed.
-



Steel vrs Concrete

Steel

- Loses 2/3 strength at 600C.
- Rapid cooling by fire fighting jets can cause brittleness

Concrete

- Good fire resistance from fire.
- Rapid cooling can result in spalling of the concrete revealing ree bars



Timber vrs Steel or Concrete Structures

- Timber has little fire resistance when compared to steel or concrete.
- In the case of timber structural members the actual load bearing members are being attacked by fire if the fire protection applied is poor.



Uses of Timber

- Timber frame houses, flats and maisonettes have for many years been built to a maximum height of three storeys. However, following heavy changes to the Building Regulations, four storeys or more is no longer unusual and flats are now being constructed up to six or seven storeys high. Timber frame is being used extensively for hotels, hostels and nursing homes.



Understanding timber construction

- Designed to meet housing requirements
- Sustainable design
- Shorter construction times when compared to that of traditional construction
- Reduced costs

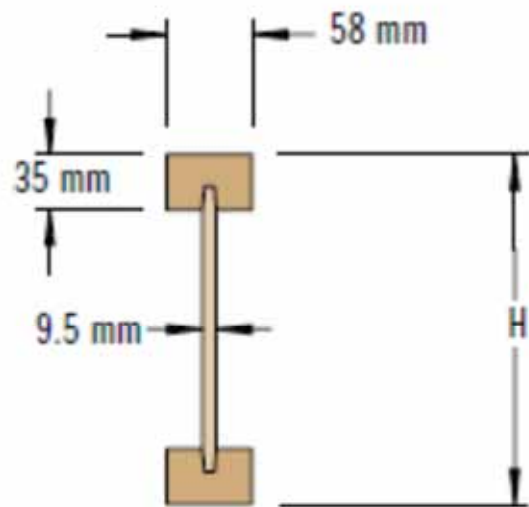


Engineered Floor Joists

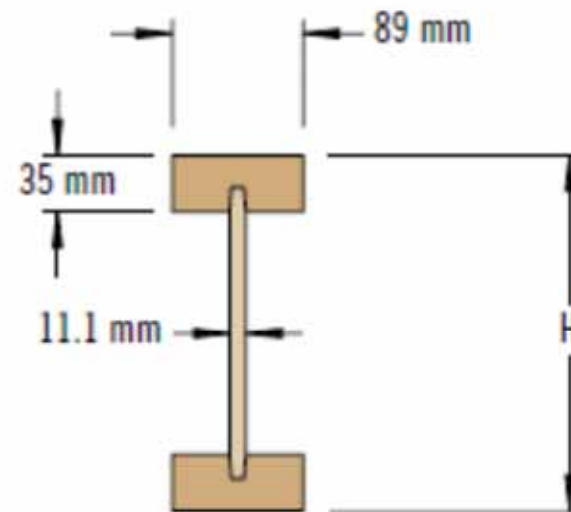




I joists sections



TJI® 360 Joists
H = 220, 241, 302, 356 or 406 mm



TJI® 560 Joists
H = 220, 241, 302, 356 or 406 mm



Lightweight Steel Frame



Fire performance of modern materials

- Differs from that of traditional build
- In timber frame the actual load bearing elements of structure are involved.
- Cavities are more susceptible to fire spread
- Load bearing elements of structural members easily affected by fire



Fire fighting and modern methods of construction

- ADB highly dependant upon rescue from the outside of the building.
- Heights based upon the reach of appliances
- Reliant upon ventilation of heat and smoke from the building (glazing failure)



Case Studies Steel



Steel



Steel



Steel



Steel



Steel



Steel



Steel







12.00 hrs



15.38 hrs



15.00 hrs

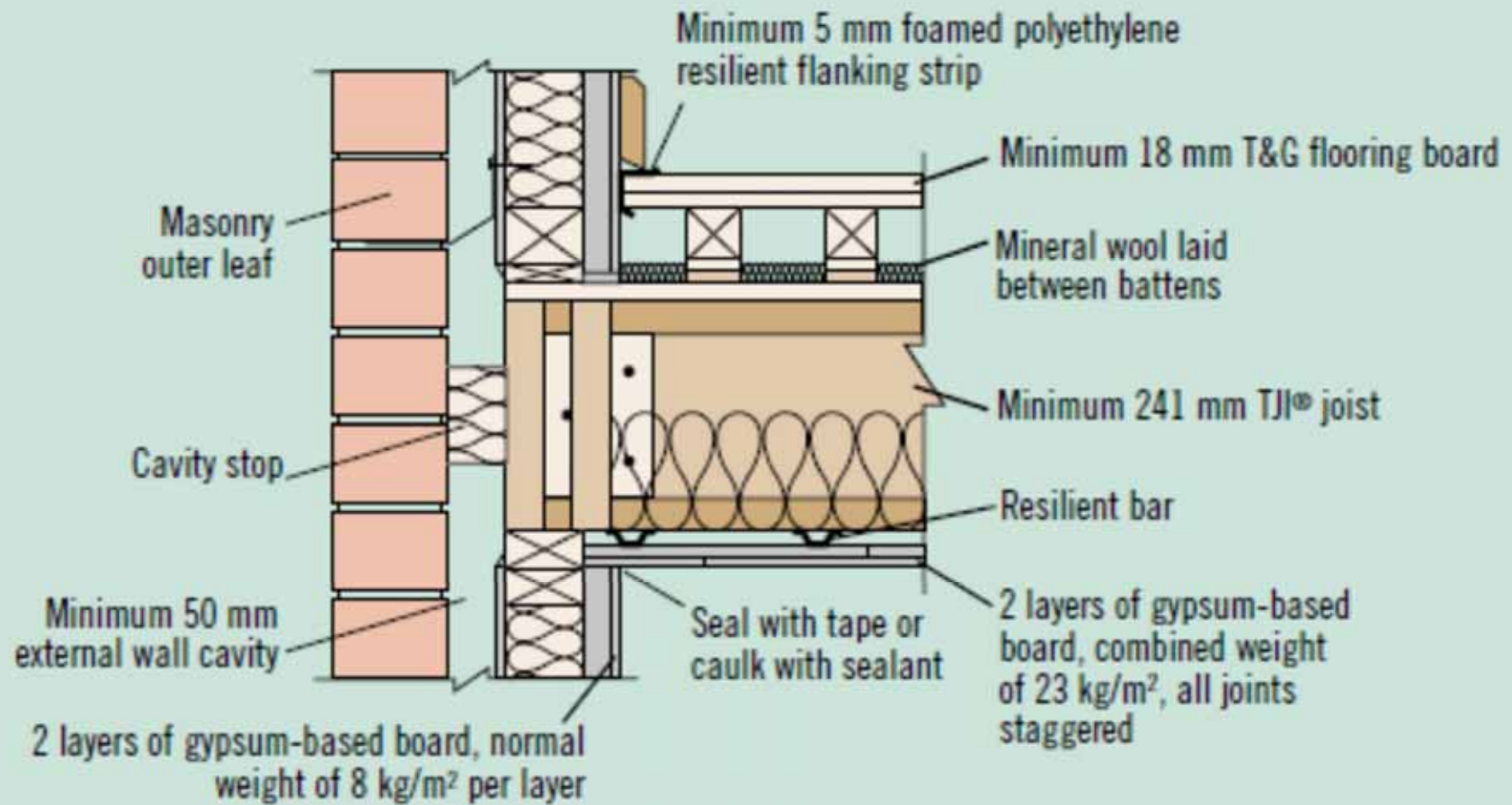


























Dwelling House Fire







Cost Malta April 2012

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Thanks for your attention

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