Fire Protection
Code Consulting
Life Safety-Security

The Fire Protection International Consortium, Inc.

Fire Modeling

www.the-fpi.com

Using FPI's extensive knowledge of fire protection principles, along with cutting edge fire modeling techniques, FPI engineers reduce design and construction costs. Fire models can be used to evaluate smoke control systems, automatic fire alarm and suppression systems, and conditions of exit routes during required egress time. Fire growth can be predicted, based on different materials or fuel packages, in a wide range of building geometries.

Fire and smoke modeling utilizes mathematical modeling techniques to simulate and measure the growth of fire, development and movement of smoke, and to predict the activation time of detection and suppression systems. FPI can utilize basic manual modeling techniques derived from industry accepted methods to quickly provide fire models where basic fire compartment and combustible fuel loadings are present.

For situations of medium complexity, FPI employs zone-based fire modeling software such as CFAST. Zone-based fire modeling techniques work well for locations with up to 30 compartments (rooms) which may have openings between compartments or to the outside. The engineers at FPI will use the geometries of each compartment and their openings, the thermophysical properties of the ceiling, wall, and floor coverings, and combustible loading present in each compartment to determine the temperature and thickness of the hot gas layer in each compartment. Other data collected from zone-based fire models includes the surface temperatures, heat transfer/mass flow rates, ceiling jet algorithms, and heat transfer to targets.

In the most complex situations, FPI utilizes computational fluid dynamics (CFD) based modeling software such as FDS. CFD models examine the fire environment in much greater detail than zone-based models by utilizing hundreds of thousands of cells instead of two distinct zones. CFD models are particularly well suited for situations where compartments are irregularly shaped or where a large amount of air movement is present. The data collected in the output of CFD models provides time-varying predictions of temperature, gas velocity, and smoke concentrations on a three dimensional mesh within the area of analysis.

The extensive amount of data developed as a result from running these models is analyzed by FPI and interpreted into easy to understand recommendations for architects and owners to optimize building design and safety.

One common application of these models in building design is for smoke control. By using the latest fire modeling techniques, coupled with our fire protection expertise, FPI can predict how smoke may develop in a fire allowing us to optimize the design and integration of a building's fire protection systems. Early development of a fire protection strategy that utilizes the right combination of passive and active fire protection features such as fire and smoke barriers, smoke control systems, fire detection and alarm systems, and fire suppression systems, can help control costs later in the project while maximizing property and life safety as well as architectural flexibility.

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