
Advanced Certificate in Bridge Fire Protection

Fire modeling and simulation

Advanced Certificate in Bridge Fire Protection: a specialized program that provides comprehensive knowledge and training in the field of bridge fire protection, including fire modeling and simulation.

Air Change Rate (ACR): the number of times the air in a space is replaced with outside air in a given time period, usually expressed as air changes per hour (ACH). In fire modeling, ACR is an important factor in determining fire growth and smoke movement.

Bimetallic Element: a type of temperature-sensitive device used in fire detection systems. It consists of two metals with different expansion rates, which bend as the temperature changes, triggering an alarm.

Buoyancy-Driven Fire: a fire that spreads due to the movement of hot gases rising and cooler gases falling, creating a convective loop. This type of fire is common in enclosed spaces such as building compartments.

Compartment Fire Modeling: the process of simulating the behavior of a fire within a compartment or enclosed space, taking into account factors such as ventilation, fuel load, and fire suppression systems.

Computational Fluid Dynamics (CFD): a numerical method used to analyze and predict the behavior of fluids, including air and smoke in fire modeling. CFD models can simulate the movement of heat, smoke, and fire gases in complex geometries.

Convective Heat Transfer: the transfer of heat through the movement of fluids, such as air or water. In fire modeling, convective heat transfer plays a critical role in the spread of fire and smoke.

Fire Dynamics Simulator (FDS): a widely-used CFD model for fire modeling, developed by the National Institute of Standards and Technology (NIST). FDS can simulate the behavior of fires, smoke, and heat transfer in complex geometries.

Fire Growth Rate (FGR): the rate at which a fire grows in size and intensity over time. FGR is an important factor in determining the severity of a fire and the effectiveness of fire suppression systems.

Fire Modeling: the process of simulating the behavior of a fire using mathematical models and computer simulations, taking into account factors such as fuel load, ventilation, and fire suppression systems.

Fire Plume: the rising column of hot gases and smoke produced by a fire. Fire plumes can spread fire and smoke throughout a building, and are a critical factor in fire modeling.

Fire Protection Engineering (FPE): a specialized field of engineering focused on preventing and mitigating the effects of fire. FPE includes the design, installation, and maintenance of fire protection systems, as well as fire modeling and simulation.

Fuel Load: the amount of combustible material present in a space or area. Fuel load is an important factor in

determining the severity of a fire and the effectiveness of fire suppression systems.

Heat Release Rate (HRR): the rate at which a fire releases heat energy over time. HRR is a critical factor in fire modeling, as it affects fire growth, smoke production, and the effectiveness of fire suppression systems.

Ignition Temperature: the minimum temperature required to initiate and sustain combustion. Ignition temperature is an important factor in fire modeling, as it determines the likelihood of a fire starting and spreading.

ISO 13784-1:2013: an international standard for fire modeling, establishing requirements for the simulation of fire development and smoke movement in buildings.

Jet Fire: a type of fire characterized by high-velocity jets of flames and hot gases. Jet fires are common in industrial settings, such as oil and gas facilities, and can be difficult to extinguish.

Kinematic Viscosity: the measure of a fluid's resistance to flow. Kinematic viscosity is an important factor in fire modeling, as it affects the movement of fire and smoke.

Laminar Flow: the smooth, orderly flow of a fluid in a straight line. In fire modeling, laminar flow is often assumed in the early stages of a fire, before turbulence sets in.

Mass Burning Rate: the rate at which a fuel burns, expressed as mass per unit time. Mass burning rate is an important factor in fire modeling, as it affects fire growth and smoke production.

NFPA 921: a widely-used guide for fire and explosion investigations, published by the National Fire Protection Association (NFPA). NFPA 921 provides guidance on the use of fire modeling and simulation in fire investigation and analysis.

Ohmic Heating: a type of heat transfer that occurs when an electric current passes through a material. Ohmic heating is used in some fire suppression systems, such as arc fault circuit interrupters (AFCIs).

Radiant Heat Transfer: the transfer of heat through electromagnetic radiation, such as sunlight or infrared radiation from a fire. Radiant heat transfer plays a critical role in the spread of fire and smoke.

Risk Assessment: the process of evaluating the likelihood and consequences of a fire or other hazardous event. Risk assessment is an important part of fire protection engineering, as it informs the design and implementation of fire protection systems.

Soot: the black, carbonaceous particles produced by incomplete combustion. Soot is a major component of fire smoke, and can be hazardous to human health.

Smoke Management: the process of controlling the movement and concentration of fire smoke in a building or other enclosed space. Smoke management is a critical part of fire protection engineering, as it affects the safety and survivability of building occupants.

Smoke Viewer: a device used to detect and visualize the movement of fire smoke in a building or other

enclosed space. Smoke viewers are useful for fire investigation and analysis, as well as for fire protection system design and testing.

Thermal Radiation: the emission of electromagnetic energy in the form of heat. Thermal radiation plays a critical role in fire modeling, as it affects the spread of fire and smoke.

Turbulent Flow: the chaotic, disordered flow of a fluid. Turbulent flow is common in fire modeling, as it occurs in the later stages of a fire and can affect the movement of fire and smoke.

Under-Ventilated Fire: a fire that does not receive enough oxygen to burn at its full potential. Under-ventilated fires can be difficult to extinguish, as they can produce large amounts of smoke and toxic gases.

Ventilation-Limited Fire: a fire that is limited in size and intensity by the availability of oxygen. Ventilation-limited fires are common in enclosed spaces, and can be difficult to predict and control.

Well-Ventilated Fire: a fire that receives enough oxygen to burn at its full potential. Well-ventilated fires can be more predictable and easier to control than under-ventilated or ventilation-limited fires.

Zel'dovich Number (Ze): a dimensionless parameter used in fire modeling to describe the transition from laminar to turbulent flow. The Zel'dovich number is a function of the fire's heat release rate, the kinematic viscosity of the surrounding air, and the characteristic length scale of the fire.