

Fire Service Considerations

A Primer for Building and System Designers



*Society of Fire Protection Engineers
Fire Service Committee*

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Target Audience

Any of these “designers” without fire service experience:

- Architects
- Fire protection engineers
- Engineers of other disciplines
- System design technicians (such as sprinkler or fire alarm)



Who are your "customers"?

- Owners
- Developers
- General contractor
- Occupants
- Tenants
- Others?



Photo by Mat Chibbaro



What about these “customers”?

The fire service makes use of many building features and systems.



Photo by Mat Chibbaro



What's so different about a firefighter's job?

- Hazardous environment
- Physically exhausting
- Infinite variety of "workplaces"
- Constantly changing conditions
- All times of day or night
- Any weather conditions
- Crew variations
 - Fill-in personnel / crews
 - Mutual aid
- Unfamiliar locations



Photo courtesy Linghocken Fire Co.

Why is decision-making so challenging for firefighters?

- Time-sensitive
- Lives & businesses in the balance
- Limited available information
- Conflicting information
- Erroneous information
- Frequent inability to wait for additional information



Photo by Vito Maggiolo



Initial Size-up

Imagine trying to process all this while you face:

- A rapidly progressing fire
- Occupants trapped or not accounted for
- Screaming bystanders



Size-Up Checklist	
LIFE SAFETY <ul style="list-style-type: none">• Structural stability• Collapse zone• Probability of extinguishment• Building complexity and layout• Adherence to SOPs (use of SCBAs, etc.)• Organization and coordination of the operation• Primary and alternative egress routes• Accountability and rapid intervention• Smoke and fire conditions• Occupancy type• Evacuation status• Estimated number of people in the building• Occupant proximity to fire• Mobility of occupants• Awareness of occupants• Occupants' familiarity with building• Rescue options (stairs, ladders, others)• Staffing needed to complete primary search and rescue• Staffing needed to complete secondary search and rescue• Medical status of occupants	<ul style="list-style-type: none">• Damage resulting from entry and ventilation• Water pathways to salvageable property• Salvage methods available• Alternative water removal methods
EXTINGUISHMENT <ul style="list-style-type: none">• Offensive/defensive• Automatic suppression equipment (sprinkler, deluge, other)• Manual suppression equipment (standpipe)• Water supply• Pump capacity• Rate of flow• Number and size of hose lines needed for extinguishment• Additional hose lines needed• Staffing needed for fire lines• Internal exposures• External exposures• Ventilation status	STRUCTURE <ul style="list-style-type: none">• Signs of collapse• Construction type• Roof construction• Previous damage• Live and dead loads• Water load• Accessibility• Extension probability• Fuel load of the structure (walls, ceilings, support members, etc.)• Age• Height and area• Location of large undivided areas• Enclosures and fire separations• Exit facilities
PROPERTY CONSERVATION <ul style="list-style-type: none">• Salvageable property• Location of salvageable property• Susceptibility of property to water damage• Susceptibility of property to smoke damage	RESOURCES <ul style="list-style-type: none">• Staffing needed versus staffing available• Additional staffing available (on call, on duty, or mutual aid)• Staffing available in staging• Apparatus needed versus apparatus on scene• Additional apparatus available (department or mutual aid)• Additional apparatus available in staging• Water supply needed versus water supply available• Special resource needs
	TIME <ul style="list-style-type: none">• Time of day• Day of week• Time of year• Special (e.g., holiday season)
	WEATHER <ul style="list-style-type: none">• Temperature• Humidity• Precipitation• Winds

FIGURE 7.23.3 Size-Up Checklist

Offensive vs. Defensive attack

Why do firefighters operate inside of a building instead of outside?



Photo by Vito Maggiolo



Initial Decisions

- Early decisions can set the stage for the entire operation
- It takes critical time to relocate apparatus, hose lines, ladders, etc.
- Better information to help early decision-making can be particularly helpful



Photo by Vito Maggiolo



Efficiency vs. Safety

If the fire service can operate more efficiently and effectively, they can:

- Operate more safely
- Mitigate an incident quicker

Photo by Vito Maggiolo



This should result in:

- Increased safety of occupants
- Decreased losses for owners and tenants



Incident Phases

- Discovery
- Notification
- Dispatch
- Turnout
- Response
- Size-up
- Set-up
- Utility control
- Entry
- Control
- Suppression
- Ventilation
- Overhaul
- Salvage
- investigation



Photo by Vito Maggiolo



What is not under the control of designers?

These scenarios account for many firefighter deaths and injuries every year:

- Vehicle safety (driving, seat belts)
- Medical events
(such as heart attacks, strokes)
- Exterior fires
(such as vehicles, wildland)



Photo courtesy of
FirefighterCloseCalls.com



How can designers make a positive impact on FF Safety?

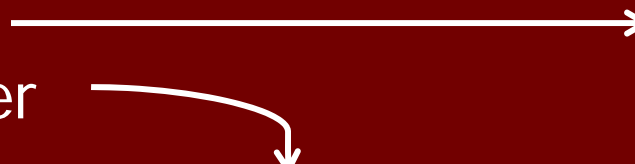
- Building:
 - Design
 - Construction
 - Commissioning
- Fire protection systems :
 - Design
 - Installation
 - Acceptance testing
- Uniformity of features within a given department's area.
- Pre-incident planning
- Drills / exercises
- Building code and fire code improvements

Photo by Mat Chibbaro



Fire Service Types (by compensation)

- Career
- Volunteer



- Call
- Combination

NOTE: Regardless of compensation, any firefighter can be "professional"



Fire Service Types (by response mode)

Stations can be:

- fully staffed
- unstaffed (home response)
- partially staffed



Photos by Mat Chibbaro

Fire Service Types (by area/population served)

- Municipal (county, city, town)
- State
- Federal
- Tribal
- Prison
- Military
- Industrial fire brigade
- Private subscription
 - Full service
 - Contract subscribers only



Photos by Mat Chibbaro

Types of services provided

- Structural fire suppression
 - Interior
 - Exterior only
- Aircraft fire suppression
- Wildland firefighting
- Maritime fire suppression
- Emergency medical service
 - Basic life support
 - Advanced life support
 - Aviation ("medevac")
- Vehicle suppression & extrication
- Technical rescue
- Hazmat
- Any combination of the above



Photo by Mat Chibbaro



Photo by Vito Maggiolo



Apparatus Types - Pumpers

Primary equipment carried:

- Water
- Pump
- Hose
- Portable extinguishers

Access considerations:

- Hose lays
- Pumper-mounted master stream

Other terminology:

- Engine
- Wagon



Photos by
Mat Chibbaro



Apparatus Types - Aerial

Primary equipment carried:

- Aerial (fixed) ladder
- Ground (portable) ladders
- Tools

Access considerations:

- Aerial ladder reach
- Aerial ladder obstructions
- Distance to carry ground ladders

Other terminology:

- Truck
- Ladder



Photos by Mat Chibbaro

Apparatus Types - Other

Types:

- Rescue squads
- HAZMAT units
- Breathing air or lighting units
- Brush fire vehicles

Primary equipment carried:

- Tools
- Specialized equipment

Access considerations:

- Most equipment can be hand-carried
- Access for pumpers will satisfy needs



Photo by Mat Chibbaro



Fire Department Staffing and Standards

- Number of firefighters per unit
- 2010 NIST study:
 - Crew sizes of 2, 3, and 4
- NFPA
 - 1710 – career
 - 1720 – volunteer
 - 1000 series: qualifications
 - 1500 series: safety



Photo by Vito Maggiolo

- OSHA regulations
 - Fire brigade standard
 - Respiratory standard



Standard Operating Procedures



Photo by Mat Chibbaro



Photo by Vito Maggiolo



How can I help firefighters plan before an incident?

- Communicate before & during design – with operations staff as well as fire code enforcement / planning
- Invite to acceptance testing of systems
- Provide plans to fire service - building & systems
- Store plans on site for easy retrieval
- Facility liaison
- Facility emergency contact



Specific considerations

- The next series of slides will look at specific categories of building and system considerations.
- Think in terms of how you can apply these concepts where the codes and standards allow variations or options



What will help firefighters locate the building?

- Street name signage / block numbering
- Address clarity
- On-site signage
- Diagrams
- Automatic alarm reporting



What will help fire apparatus access the site?

- Access to as much of perimeter as possible
- Fire lanes:
 - Closed to public: address security measures
 - Open to public: address parking issues, marking, & signage
 - Clearance height & width, radius, grade, load
- Dead ends: turnaround features
- Permanent paving material
- Avoid traffic calming devices
- Aerial access:
 - Proximity to building
 - Overhead obstructions
 - Outrigger extension



Photo by Mat Chibbaro



How can I facilitate water delivery?

- Hydrants
 - Location, spacing, & position
 - Marking, locking
- Adequate fire flow
- Adequate water quantity (storage)
- Dry hydrants
 - Cisterns
 - Natural or man-made ponds



Photo by Mat Chibbaro



What will help firefighters access and maneuver within the building?

- Site design (ground ladders)
- Key boxes
- Door identification / standards
- Stairs: marking, width
- Elevators & fire service lobbies
- Marking of utilities & fire protection systems
- Access for vertical ventilation
 - Photovoltaic systems
 - Rooftop gardens



Photo by Mat Chibbaro



What will help keep operating firefighters safe?

- Building info signs
- Lightweight construction marking
- Vacancy status signs
- HAZMAT management plan
- HAZMAT information statement
- Shaftway marking
- Skylight marking or barriers
- Photovoltaic system signage



FIGURE Q.1.2.3 Sample Sign for Fire Fighter Safety Building Marking System.

Diagram from NFPA 1



What suppression system features will help firefighters?

- Valve location, access, marking
- Fire pump location, access, marking
- Standpipe design pressure
- Avoiding pressure reducing valves
- Hose valve locations vs. stair enclosures
- Fire department connections:
 - type, interconnection
 - number, location, position
 - marking, signage
 - obstructions
 - security, physical protection



Photo by Mat Chibbaro



What alarm system features will help firefighters?



Photo by Mat Chibbaro

- Fire alarm annunciator
- Building diagram (can be on annunciator):
 - Surrounding streets, N arrow, entry & exit points
 - Stairs & elevators: ID and levels served
 - Utilities (water, gas, elec, generator, elevator machine)
 - Location of water service, fire pump, fire alarm panel
 - Standpipe & FDC locations
- Design to preclude unwanted fire alarms
- Fire command center location, size, equipment

What other systems will help firefighters?

- Radio coverage & retransmission systems
- Simple smoke control panels
- Firefighter emergency power systems
- Firefighter breathing air systems



Have I considered phases in construction or demolition?

- Temporary water supply
- Temporary stair, lighting, & enclosure
- Standpipe & connection
- Access points
- Phased occupancy



Photo by Mat Chibbaro



NY Deutsche Bank - photo from NIOSH report

Have I considered structures other than buildings?

- Tunnels
- Piers & wharfs
- Bridges



Photo by Mat Chibbaro



Resources

- National Emergency Training Center's Learning Resource Center
- OSHA's "Fire Service Features of Buildings and Fire Protection Systems"
- NFPA Standards
- ICC Codes
- Guidelines from AHJ



THANK YOU!

To find out more about the Society of Fire Protection Engineer's Fire Service Committee go to www.sfpe.org.

