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?
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 Lingohocken 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

**Figure 7.23.3** Size-Up Checklist

<table>
<thead>
<tr>
<th>LIFE SAFETY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural stability</td>
</tr>
<tr>
<td>Collapse zone</td>
</tr>
<tr>
<td>Probability of extinguishment</td>
</tr>
<tr>
<td>Building complexity and layout</td>
</tr>
<tr>
<td>Adherence to SOPs (use of SCRs, etc.)</td>
</tr>
<tr>
<td>Organization and coordination of the operation</td>
</tr>
<tr>
<td>Primary and alternative escape routes</td>
</tr>
<tr>
<td>Accountability and rapid intervention</td>
</tr>
<tr>
<td>Smoke and fire conditions</td>
</tr>
<tr>
<td>Occupancy type</td>
</tr>
<tr>
<td>Evacuation status</td>
</tr>
<tr>
<td>Estimated number of people in the building</td>
</tr>
<tr>
<td>Occupant proximity to fire</td>
</tr>
<tr>
<td>Mobility of occupants</td>
</tr>
<tr>
<td>Awareness of occupants</td>
</tr>
<tr>
<td>Occupant familiarity with building</td>
</tr>
<tr>
<td>Rescue options (stairs, ladders, others)</td>
</tr>
<tr>
<td>Staffing needed to complete primary search and rescue</td>
</tr>
<tr>
<td>Staffing needed to complete secondary search and rescue</td>
</tr>
<tr>
<td>Medical status of occupants</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EXTINGUISHMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offensive/defensive</td>
</tr>
<tr>
<td>Automatic suppression equipment (sprinkler, deluge, others)</td>
</tr>
<tr>
<td>Manual suppression equipment (standpipe)</td>
</tr>
<tr>
<td>Water supply</td>
</tr>
<tr>
<td>Pump capacity</td>
</tr>
<tr>
<td>Rate of flow</td>
</tr>
<tr>
<td>Number and size of hose lines needed for extinguishment</td>
</tr>
<tr>
<td>Additional hose lines needed</td>
</tr>
<tr>
<td>Staffing needed for fire lines</td>
</tr>
<tr>
<td>Internal exposure</td>
</tr>
<tr>
<td>External exposure</td>
</tr>
<tr>
<td>Ventilation status</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PROPERTIES CONSERVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salvageable property</td>
</tr>
<tr>
<td>Location of salvageable property</td>
</tr>
<tr>
<td>Susceptibility of property to water damage</td>
</tr>
<tr>
<td>Susceptibility of property to smoke damage</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STRUCTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signs of collapse</td>
</tr>
<tr>
<td>Construction type</td>
</tr>
<tr>
<td>Roof construction</td>
</tr>
<tr>
<td>Previous damage</td>
</tr>
<tr>
<td>Live and dead loads</td>
</tr>
<tr>
<td>Water load</td>
</tr>
<tr>
<td>Accessibility</td>
</tr>
<tr>
<td>Exterior probability</td>
</tr>
<tr>
<td>Fuel load of the structure (walls, ceilings, support members, etc.)</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Height and area</td>
</tr>
<tr>
<td>Location of large undivided areas</td>
</tr>
<tr>
<td>Endurables and fire separations</td>
</tr>
<tr>
<td>Exit facilities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staffing needed versus staffing available</td>
</tr>
<tr>
<td>Additional staffing available (on call, on duty, or mutual aid)</td>
</tr>
<tr>
<td>Staffing available on scene</td>
</tr>
<tr>
<td>Apparatus needed versus apparatus on scene</td>
</tr>
<tr>
<td>Additional apparatus available (department or mutual aid)</td>
</tr>
<tr>
<td>Additional apparatus available in staging</td>
</tr>
<tr>
<td>Water supply needed versus water supply available</td>
</tr>
<tr>
<td>Special resources needed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time of day</td>
</tr>
<tr>
<td>Day of week</td>
</tr>
<tr>
<td>Time of year</td>
</tr>
<tr>
<td>Special (e.g., holiday season)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WEATHER</th>
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</thead>
<tbody>
<tr>
<td>Temperature</td>
</tr>
<tr>
<td>Humidity</td>
</tr>
<tr>
<td>Precipitation</td>
</tr>
<tr>
<td>Winds</td>
</tr>
</tbody>
</table>
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

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

Photo by Bill Supplee

- Call
- Combination

Photo by Mat Chibbaro

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 Vito Maggiolo

Photo by Mat Chibbaro
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

- OSHA regulations
  - Fire brigade standard
  - Respiratory standard

Photo by Vito Maggiolo
Standard Operating Procedures
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

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?

- 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.