Changes in Fire Station Design

By Robert Tutterow, F.I.E.R.O.

The design requirements of modern fire stations are evolving at an increasing pace. These changes represent new challenges for local governments looking to fund new or replacement stations, or for embarking on major renovation projects or additions to stations already in operation. A generation ago, there was minimal guidance available on how to design a fire station. This changed when, in 2000, the Fire Industry Education Resource Organization (F.I.E.R.O.) launched the first-ever Fire Station Design Symposium. In 2006, F.I.E.R.O. launched its concurrent Annual Fire Facilities Design Awards Program.

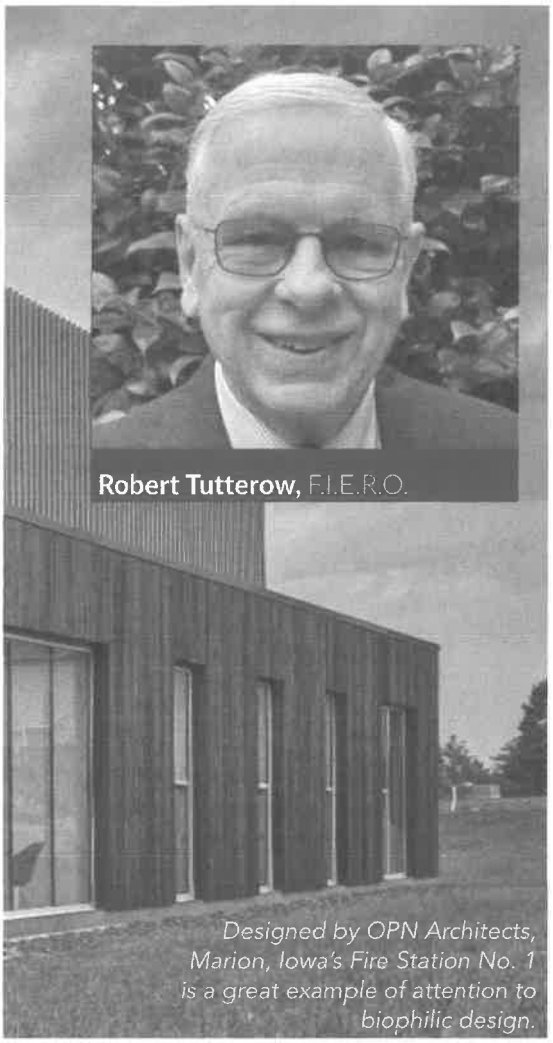
The winners of this award program are selected by a "jury" of current and retired fire service personnel who also have experience in architecture. By seeking out these specific individuals, the F.I.E.R.O. symposium and award program have been able to bring together a highly specialized group of subject matter experts and make a significant positive impact on the field of station design.

A look back on how stations have evolved puts it all in perspective. There is no doubt that this annual event has led to changes such as:

- Glass walls for fitness rooms so a possible downed firefighter can be spotted sooner;
- Zones for minimizing the spread of contamination;
- Apparatus floor drains located directly underneath the apparatus;
- Removal of ice machines and breathing air compressors from apparatus bays;
- Proper layout or decontamination areas for extraction access;
- Separate rooms for storage of personal protective equipment (PPE) with ventilation to the exterior of the facility; and
- Many other innovative design features.

EXPANDING ROLES

The fire service started taking on the role of EMS in the 1970s, which led to additional vehicles in fire stations and the need for more bay space. It was also around this same time that women started to join the fire service. The presence of female firefighters in stations led to unique challenges regarding bathrooms, showers, and sleeping arrangements. In the 1980s, the fire service started to expand to all-hazards response organizations. Response capability for HazMat, tech rescue, water rescue, natural disasters, and even civil unrest incidents led to an increased number of vehicles in stations, not to mention a need for additional storage related to these new response charges.



Designed by OPN Architects, Marion, Iowa's Fire Station No. 1 is a great example of attention to biophilic design.

Concurrent with these expanding roles for the fire service was the increasing understanding and prioritization of firefighter fitness and wellness. Trying to squeeze fitness rooms within existing stations often led to equipment being on the apparatus floor, which is the worst place for aerobic exercise. At the same time, the fire service is working to solve contamination control issues to help slow the cancer epidemic among firefighters. There has also been a growing focus on holistic design principles aimed at helping with the behavioral and mental health challenges facing firefighters — areas of wellness that have historically been ignored or considered the personal responsibility of responders themselves

Some of the emerging, near-future station design challenges are those related to the development of all-electric fire stations, particularly those intended to house electric fire apparatus and support vehicles. Underlying all the changes in the fire service's mission is the consistent need for more storage space to meet mission requirements in a wide variety of different categories.

HEALTH AND SAFETY

Almost all fire stations in the United States are in various stages of obsolescence. They were not designed for today's fire service needs.

A common hurdle, especially for municipal departments, is the lack of adequate site space for a functional station within many urban and suburban areas. Seattle's Station No. 22, designed by Weinstein A + U, illustrates one way this can be overcome by taking a different approach to street access while maintaining a drive-through apparatus bay. This and many other features of this station made it a F.I.E.R.O. Honor Award winner.

The architects were given a topographically challenging site with a very small footprint. By turning the station's apparatus bays 90 degrees to the street and placing the apparatus floor on the back of the station, the requirement for drive-through apparatus bays was achieved.

One juror commented, "This station is proof-positive that you do not necessarily need a big site to get a very functional response and return layout. With the cost of real estate in urbanized areas, more departments should look at this [as an] example of what is possible with proper study and understanding by both the architect and the fire department."

The contamination issue is one that cannot be ignored. It has been aptly stated that "firefighters are like farmers." Farmers harvest their crops, bring them to the barn, and then distribute them as needed. Firefighters are harvesters of carcinogens, and they transport their harvest back to the fire station where they are distributed to other parts of the station, and often into their personal vehicles and back to their homes. Many departments will also take those carcinogens to public spaces like the local grocery store for distribution.

Current thought on fire station layout has led to the designation of zones or areas within stations to identify contaminated areas, transition areas, and clean areas. The contaminated areas are typically the DeCon area and related apparatus bays. The transition area is where contaminated equipment is cleaned and firefighters can shower. There should be a separate group of rooms in this area for equipment such as washers/extractors and drying equipment for PPE. The area should have a large stainless steel double sink with hands-free faucets to clean loose emergency response equipment. This sink should be surrounded by stainless steel countertops and/or worktables for disassembly of equipment for cleaning and the subsequent re-assembly of the equipment.

It is important to keep stored PPE off the apparatus bay floor in a separate room, with motion-sensing light activation and dedicated ventilation to the exterior of the building. Another aspect of the carcinogenic issue is diesel exhaust from the apparatus. There are three approaches to exhaust capture, and each has its advantages and disadvantages.

The mental health needs of departments are also important when considering station design. Firefighters, due to the nature of their work, are at an elevated risk of depression, PTSD, substance abuse, and suicide. We are now learning that the design of a fire station, where career firefighters spend about 30% of their life, has a direct impact on behavioral health. During non-sleeping hours, there is a need for natural light and biophilic design. Colors used in a fire station, and even the inclusion of photos on the walls, can impact a firefighter's disposition and provide a sense of home.

PUTTING FIREFIGHTERS FIRST

Marion, Iowa's Fire Station No. 1 is a great example of attention to biophilic

design. The station was designed by OPN Architects and has an emphasis of "putting firefighters first." It was a F.I.E.R.O. Honor Award winner as well as a Commendation Award winner for "Attention to Firefighter Health and Wellness Issues." The addition of this two-level, 21,200-square-foot fire station in a rapidly growing community reduces response time, establishes a strong and transparent civic presence, and uses biophilic design principles to support firefighters' physical and mental wellness.

The plan and massing are anchored by a two-story apparatus bay. Full-height glass doors on both the north and south elevations maximize daylight and establish a tangible, visual connection to the community the department serves. Extending east, shou sugi ban wood, which is charred using controlled fire, wraps the living and office spaces to add depth, texture, and contrast with the smooth plane of the glass. Interior spaces are complemented by two ipe wood terraces sheltered by a roof and wall trellis. A green roof surrounds all the living spaces and sleeping rooms. The lobby is stretched to become the primary first level of circulation; it mediates between a tree grove and a history wall.

This welcoming, light filled space allows direct views into the apparatus bay and displays the fire department's rich history, pride, and tradition. Strategic sequencing of spaces, including a decontamination area, between the bays and the office and living areas mitigate exposure to carcinogens to protect the firefighters' health.

On the opposite side of the bays, the hose-drying tower also serves as a training area to simulate rescues. Training opportunities continue at the exterior, where a retention pond is also used to train for ice rescues. The living areas, wrapped in full-height glazing with exposed wood ceilings, include a full kitchen, a large family-style table, and a television and gaming area to ensure the firefighters have a variety of space types to relax and recharge in.

Circadian rhythm-based lighting is used throughout to ensure the firefighters' wake-sleep cycle is synchronized with natural light while escalating alarms reduce physiological and psychological stress upon waking. The implementation of biophilic principles is having a profound effect on firefighters' wellbeing, including stress reduction and increased awareness and cognitive ability.

"This fire station should be the national benchmark for how biophilic design can reduce PTSD in firefighters," says Chief Deb Krebil (retired).

Sleep deprivation is now a hot research topic within the fire service, and fire station design is at the forefront of this discussion. Should the sleeping areas be an open dorm concept, open dorm concept with partitions, individual bedrooms, suites, or some other configuration? The current thought is that individual

Richmond, Virginia's Station No. 12, designed by Moseley Architects, was built with involvement from and for the community (new design on page 8; old station on page 9).

bedrooms might be the best option. Ambient noise is a consideration, and equity among the sleeping compartments is crucial. How firefighters are alerted to a call while sleeping is particularly important. Both the audible alert system and the lighting need to "ramp up" slowly rather than being sudden disorienting blasts of noise and light.

Marion, Iowa's Fire Station No. 1 uses biophilic design principles to support firefighters' physical and mental wellness.

COMMUNITY-CENTERED

Most fire stations are supposedly built to last 70 years, yet many were built with the present in mind rather than the future. No one knows what the future holds with any certainty, but we do know there is a strong likelihood that stations will begin to house large drones and robots. Some departments are designing their new stations with a medical monitoring room for the public. The efficient use of electricity and the subsequent battery needs are critical in designing new stations. And, once again, you can never have enough storage.

Of course, no fire station should be built without some involvement from and for the community. Richmond, Virginia's Station No. 12, designed by Moseley Architects, is a great example. Public art is alive and well in the Carytown neighborhood of Richmond. This neighborhood culture of murals on the street is extended into the station through the public lounge and museum, meeting rooms, and even within the dayroom flooring. Art glass imagery of firefighting personnel from long ago hearkens back to the original station. Being a pedestrian and dog-friendly community is also expressed in the eclectic artwork of the station.

The third floor is almost entirely dedicated to the community. The stairwell to the space features a mural of one of the many bridges that crosses the James River. An ornate slide pole echoing those of the past is featured on the community floor.

SMALL BUT COMPLICATED

This article has just briefly touched on the changes in station design. Every room has its own particular "dos and don'ts." Fire stations are complicated buildings, and very few architects are up to speed on the service's current needs. If the local jurisdiction requires the use of a local architect, and that architect does not have extensive fire station design experience, it is imperative that the local architect be required to sub-contract with a fire station design consultant or an architectural firm experienced in station design before beginning work on the project.

There are many intricacies involved in the design and equipping of the areas within a fire station and on the broader site to ensure they all function effectively and efficiently. In short, a fire station is perhaps the most complicated small building project anyone involved will ever be involved in.

All of this is underscored by looking at the fire station topics offered by F.I.E.R.O. Annual Fire Station Design Symposium. The Symposium, now in its 25th year, offers nearly 50 different topic areas with nearly 40 different subject matter experts. This year's event will take place on September 21 to 24 at the Hyatt Regency Greenville in Greenville, S.C.

For more information, go to www.fieroonline.org and click on events. Attendees often leave saying over and over: "I would have never thought of that."

F.I.E.R.O. is a 501 (c)(3) non-profit organization run by a Board of Directors, all with a fire service background.

Robert Tutterow is President of F.I.E.R.O. He is retired from the Charlotte Fire Department where he served in the roles of Health and Safety Officer and Logistics Officer. Also a former volunteer firefighter, he has been an active participant in the NFPA Standards Development process for over 35 years.