

# **BUILDING FOR PUBLIC SAFETY** EXPLORING THE NUANCES OF CONSTRUCTING FIRE STATIONS IN THE 21ST CENTURY

Whether it's a high rise that defines a skyline or a church that brings parishioners together, every structure of the built environment impacts its community in some way. Fire stations, which symbolize heroism and bravery for the communities they serve, are unique among structures in that they provide a base from which emergency service personnel can achieve their vital role as frontline responders in public safety.

The successful construction of these structures requires a focus on the highly specialized needs of emergency service personnel and their equipment. Everything from storage and mechanical features to living quarters and kitchens must work together to create a space that is functional for the first responders who will spend one-third of their lives there. Most notably, best practice in modern fire stations integrates the latest research in the prevention of cancer, a disease that affects firefighters due to their frequent exposure to carcinogenic particles.

When a construction firm has the knowledge and experience to engage with each of the unique variables of a fire station, the station becomes a powerful tool in a fire department's ability to save lives, preserve property, and protect firefighters themselves.



### RESEARCH DRIVES PRECONSTRUCTION

Knowledge might be power, but it's not always easily accessible and it often requires hands-on experience to gain. When it comes to fire station construction, garnering information about current best practices requires a commitment of time, energy, and resources as a construction firm seeks to bring the most up to date methods and the highest degree of value to a project.



For Willis Smith Construction, that research began with in-person visits to facilities around the region and country to learn from top firefighting consultants. These facilities give a construction firm's personnel the kind of immersive experience that translates into concrete insights. "Construction is very much a spatial and tactile industry," says Willis Smith Vice President, Brett Raymaker. "When you can be in a space that reflects the methods you're researching, it gives you so much more information than if you just read about the theoretical framework on paper."

Those insights include everything from layout and materials to industry-specific specs for mechanical features. With those insights in a construction firm's toolbox, they are better prepared to lead ownership groups through the preconstruction phase. "Once we've been on our educational fieldtrips, we can take clients on fieldtrips of their own," says Raymaker.

In Parrish, Florida, a community located in northwestern Manatee County, the fire department was in need of a second station to reduce response times for the rapidly expanding population. This 12,000-sq-ft. station with three apparatus bays will be the community's second fire station and will require a unique set of interior and exterior finishes to accommodate the needs of the department. Fortunately, Raymaker and the Willis Smith team, had lots of comparable fire station builds in the region to lean on for data.

During preconstruction, it was a huge benefit to be able to take the ownership group and design team to some of our past fire station projects to see all the different configurations we've been able to execute," says Raymaker. Willis Smith's 12 completed fire station projects highlight a multitude of materials available for use.

One notable visit was to Sarasota County Fire Station No. 8. located in Sarasota near Celery Fields Park. This fire station with four apparatus bays, offered a practical look at a number of options available for the Parrish ownership group. One of the primary facets of the project were the materials used in both the interior and exterior. For interior work, Willis Smith was able to highlight how many of the materials balanced durability with the inviting touches required for the residential uses. Special consideration was given to smooth, easily washable materials such as polished concrete, engineered stone, and cabinets with a natural wood finish.

The external materials were similarly focused on durability while also highlighting the way the chosen materials should reflect the surrounding site configuration. Florida's severe weather conditions prompted the selection of robust exterior finishes that can withstand hurricane force winds, flooding, and the heavy use they'll see during their lifecycle.

In addition, the visit to Fire Station No. 8 allowed Raymaker and the Willis Smith team to demonstrate just how complex the electrical and mechanical systems need to be. "The amount of specialized equipment these stations use is unlike any commercial or residential building," says Raymaker. Those complex needs include the



installation of two or sometimes three HVAC units, air scrubbers, heavy duty washing equipment, and other mechanical features that require their own unique electrical systems.

"A visit like that really gets an ownership group thinking about the kinds of questions they need to ask for their own project," says Raymaker, "and it's a great way to highlight what they should expect out of the finished product."

## FOCUSING ON SPECIALIZED NEEDS

Exhaustive research and extensive experience also yields an understanding of the highly specialized needs of fire stations and their personnel. In layman's terms, a fire station is like a garage, mechanic shop, storage unit, office building, and multi-family home all in one. The difference is how heavily those elements are used and how each one must work cohesively with the others to create a functional structure.



One important element to consider during a fire station project is the durability of the materials used in the

apparatus bays. "An apparatus can weigh over 30 tons depending on the type of vehicle," says Raymaker, "and that's before you factor in the firefighters themselves and their equipment."<sup>1</sup> That kind of tonnage calls for special attention to the slabs on grade of the building, the driveways that lead in and out of the apparatus bays, and the curbs that surround the facility.

These robust, industrial aspects of the build must then be balanced with the residential features of the structure. "With firefighters often working 24-hour shifts, these structures have to feel like home," says Raymaker. A newer trend in firefighter preferences is the move towards individual rooms rather than bunk rooms. In addition, firefighter culture increasingly emphasizes large communal meals for the team. This means kitchens have become focal points of the interior living spaces.

All of these specialized elements come together seamlessly at Sarasota County Fire Station No. 8, which also incorporates a training tower where the county's personnel can engage in stairwell exercises. "When we think of a fire station that exemplifies every single thing we've learned, this is the one," says Raymaker. The 12,500-sq-ft. facility sits on a 2.5-acre site and includes the addition of a 7,000-sq-ft. Special Ops Building. With four apparatus bays, an energy efficient solar array on the roof, and all the latest specs for decontamination zoning, the fire station still meets the residential needs of the team. The addition of a fitness room further supports the firefighters as they look to remain physically and mentally ready for the dangers they face on a daily basis.

As important to the community as all of these fire stations are, the firefighters themselves must be highly trained to perform in the most dangerous of circumstances. East Manatee Fire Rescue District engaged Willis Smith Construction to build a new training tower at the administration site and home of Fire Station 1. The training and drill tower is a valuable resource where first responders can train for aerial rescues, fire suppression, repelling, hazardous materials and special rescue.

1. Emergency Vehicle Size and Weight Guide, prepared by Fire Apparatus Manufacturers' Association Technical Committee, https://www.fama.org/wp-content/uploads/2017/12/1514564588\_5a466bec19c41.pdf



The tower is a five level structure built of concrete, masonry, steel and precast concrete with an enclosed two-level smoke room adjacent to the five-level stairwell tower. Repelling points are specifically located throughout the tower for safely practicing repelling training. This training tower allows EMFR to train day or night, 24/7.

The East Manatee Fire District also built two new fire stations to serve the growing areas that make up east Manatee County. Fire Station No. 7 is located on Covenant Drive in Lakewood Ranch to provide service to the Southeast corner of Manatee County and Fire Station No. 8 is located on Bourneside Drive and SR-70. Both of these stations consist of two halves under one roof. One half is comprised of three apparatus bays and storage rooms for equipment. The other half of each building contains the living quarters where the firefighters wait at the ready for their next call. The living quarters have six private rooms so each firefighter on duty can catch a quick nap between calls. Outside the private rooms include an LP gas powered generator sized to run the





entire building during power failures allowing Station 7 to remain fully operational when severe weather strikes. Both stations are built to withstand extreme weather such as CAT 4 hurricanes and heavy summer thunderstorms.

Both stations include fully stocked workout rooms with state-of-the-art fitness gear, fully stocked kitchens with plenty of storage for groceries to cover multiple shifts, dining rooms, and day rooms for relaxation.

East Manatee Fire Rescue District also built a replacement station for Fire Station No. 2 just west of I-75 on State Road 64 in Bradenton. This station includes three bays for apparatus and rescue vehicles. The living and sleeping accommodations include six individual form rooms to provide a residential feel for the crews while at the station. There is also a workout room, full bathrooms, a dayroom, and a kitchen dining area. Attached to the apparatus bay, includes rooms for gear storage, laundry, and an attic storage area.

This building has also been designed to withstand Category 4 hurricane winds that allows the full six member crews to respond to emergencies even after severe weather events. This facility replaces a metal building structure that required the crews to evacuate in the face of a major storm, and thus were unable to maintain a presence in the community in the time of crisis. In the event the power goes out, this facility also has back-up generator power that will keep them in operation.

## **CONSTRUCTING FOR CANCER PREVENTION**

Though the widespread use of modern fire retardants in new construction has helped protect property from total loss, these chemicals pose new risks for firefighters when they're on scene. These retardants



include benzene, formaldehyde, butadiene, toluene, acrylonitrile, isocyanates, the now-declining use of asbestos, and more. Each of these are designed to smoke rather than fully combust, which gives the modern fire scene its ubiquitous cloud of black smoke.

Contained within those thick smoke clouds are a mass of carcinogenic chemicals that compound cancer risks for firefighters, which are even absorbed through the skin at an alarming rate according to a Blais University of Ottawa study.<sup>2</sup>



In addition to toxic exposure at the site of a fire, firefighters also face daily exposure to diesel exhaust fumes, which often accumulate in apparatus bays prior to and following fire runs. But with the right methods, these risk factors can be mitigated.

The primary framework to mitigate these risks is the separation of a fire station into three distinct hazard zones: Hot, Warm, and Cold.<sup>3</sup> Also known as "Hot Zone" design, the concept commonly uses a color-coding system to denote different levels of contamination, including Red (contaminated), Yellow (transition areas), and Green (clean) zones.

Hot/Red zones include apparatus bays when trucks and personnel first return from a fire scene, and also the rooms where turnout gear and contaminated equipment/gear are washed. Warm/Yellow zones are the transition areas between living quarters and work spaces that often include showers, hand wash stations, and boot washing equipment. The Green/Cold zone includes all living quarters, dayroom, administrative offices, and kitchen areas.

Unsurprisingly, Hot/Red zones see the highest concentration of contaminated objects. Those objects primarily include the Personal Protective Equipment (PPE) worn by firefighters during fire runs and the equipment used.<sup>4</sup> Larger pieces of equipment like the fire trucks themselves are cleaned outside of the apparatus bays, but smaller PPE and other gear are thoroughly cleaned in gear wash rooms.

These rooms have highly specialized stations and scrubbers where decontaminants can be washed and captured. In addition, the gear wash rooms and the apparatus bays have separate HVAC systems than the Cool/Green zone, with the commercial grade filters in the air handler being replaced at or beyond manufacturer specifications. "This is an emerging practice that began around 2014," says Raymaker, "but early indications are that toxic exposure is greatly reduced."

By carefully implementing HVAC systems, air scrubbers, wash stations, storage rooms, and personal hygiene facilities, a construction firm can be a powerful ally in the mitigation of health risks associated with firefighting. For Willis Smith, stations like Sarasota County Fire Station No. 16 offer prospective ownership groups an opportunity to see these methods in action.

The 12,800-sq-ft. single story structure features three drive-through apparatus bays for fire and rescue vehicles, living quarters with everyday home features, four full baths for on-duty personnel, and all of the aforementioned decontamination features that help firefighters maximize their own health and safety while keeping their communities safe.

<sup>4.</sup> PPE and Fire Service Gear Cleaning Validation, National Fire Protection Association, https://www.nfpa.org/News-and-Research/Resources/Fire-Protection-Research-Foundation/Current-projects/Investigation-of-Turnout-Clothing-Contamination-and-Validation-of-Cleaning-Procedures



<sup>2.</sup> Before-and-after study by university shows firefighters absorb toxins, CFJC Today, 2017, https://cfjctoday.com/2017/10/18/before-and-after-study-by-university-shows-firefighters-absorb-toxins/

<sup>3.</sup> Fire Fighter Cancer Awareness and Prevention, International Association of Fire Fighters, https://www.iaff.org/wp-content/uploads/FFCancer\_FireStationDesign.pdf

## MIXED USE FIRE STATIONS

Like Sarasota County Fire Station No. 16, its twin station, No. 17, includes administrative offices and ancillary spaces for other first-responder personnel. In the case of No. 16, that ancillary space is for the fire department's Fire Marshal Office.



However, No. 17 includes a Sarasota County Sheriff wing that houses separate administrative offices, full bathrooms, storage facilities, and an attached garage for the Sheriff departments resources that are used to execute their duties in and around the busy commercial and residential district they serve. Mixed-use stations like No. 17 serve a two-fold purpose. The first is to alleviate some of the added costs of constructing completely separate facilities for the two departments.<sup>5</sup> "When you consider all the site preparation, materials, and land use, these mixed-use structures create a lot of value for ownership groups," says Raymaker, "and in the case of firefighters and law enforcement, that also means generating value for taxpayers."

The second benefit of this mixed-use trend is to improve communication across departments that must frequently work together on emergency calls like car accidents, for example. With a shared public safety facility, fire and law enforcement personnel can conduct joint exercises, build better relationships across departments, and pool operational resources such as bathrooms, meeting rooms, and even kitchens in some cases. Furthermore, since fire stations such as No. 17 are designed to serve as robust centers of operation during natural disasters, it gives both departments the ability to coordinate relief efforts from a centralized location.

These concepts can be seen in the North Port Public Safety Building, a 24,300-sq-ft. mixed-use structure in the City of North Port. The facility houses North Port Fire Station No. 8<sup>6</sup> and a police substation that will house all training operations for North Port police.

A noteworthy consideration for the police wing includes interview rooms that can be used in service of the North Port PD's investigative protocols. "We're very happy to be co-housed here with our brothers and sisters in the fire department," said North Port Police Chief Todd Garrsion at the facility's public unveiling, "this is one area where we blend the blue line with the red line."

Another example of a mixed-use Fire Station is No. 9 located on Bee Ridge Road. The original station at this location was demolished to make way for the new facility with three apparatus bays, eight individual bunk rooms, kitchen and dining room, and fitness room. Additionally, this facility serves as the County fueling station with two underground 20,000 gallon storage tanks – one for diesel and one for gasoline as well as numerous redundant systems to ensure that in the event of a power outage and/or natural gas disruption this essential facility operational until utilities can be restored.



5. Pros and Cons of Shared Facilities, Firehouse Magazine, Michael Healy and Craig Carter, 2020, https://www.firehouse.com/stations/article/21131146/pros-and-cons-of-shared-public-safety-facilities
6. New public safety building in North Port for police and fire department, ABC7 Suncoast, Staff and James Hill, 2022, https://www.mysuncoast.com/2022/04/16/new-public-safety-building-north-port-police-fire department/

7. North Port opens new \$13 million public safety complex in Wellen Park, Sarasota Herald-Tribune, Earle Kimel, April 16, 2022, https://www.heraldtribune.com/story/news/local/2022/04/16/north-port-florida-opens-new 13-million-public-safety-complex-wellen-park/7318659001/





### CONCLUSION

The construction of fire stations requires attention to a unique set of details. Those details and specialized needs call for a construction firm that has experience in the industry or a demonstrable track record of conducting thorough research on behalf of the client. In addition, with firefighters being exposed to extraordinarily high levels of carcinogens and other health hazards, the management of fire station projects is about more than the building itself—it's about the health and safety of the heroes that protect their communities.

#### **ABOUT WILLIS SMITH CONSTRUCTION**

Willis A. Smith Construction, Inc. is a privately held construction management firm based in Sarasota, Florida. Since 1972, we have provided expert commercial builder services in the state's Southwest region. Our full-service construction and construction management capabilities are customized to address each project's specific requirements at every stage of work, creatively overcoming barriers and always meeting deadlines. Every day, area locals and visitors likely pass a Willis A. Smith project, and we are proud of the many iconic buildings we have had the opportunity to bring to the community. The growth of the area has matched our own, and today we are the region's largest commercial construction company.

