FIRE - RESCUE - EMS FACILITY DESIGN HANDBOOK

Stewart · Cooper · Newell
Architects

719 East Second Avenue
Gastonia, North Carolina 28054

www.fire-station.com
1-800-671-0621

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At Stewart-Cooper-Newell Architects, we understand how difficult the process of planning and funding a new fire facility can be. It can evoke obvious excitement and anticipation among Rescue Workers along with a great deal of tension with local neighbors and wary council members. No matter the size of the station, your project will require many hours of planning, coordination, and building political support. Relax. You now have a tool that will help navigate this process.

Based on our 45 years of planning, designing, and overseeing construction of Fire/EMS stations, we have developed the ***FIRE / EMS FACILITY DESIGN HANDBOOK***. The purpose of this booklet is to provide you with a resource of information that will help you establish the basic knowledge needed to get your project underway. This booklet will help you begin the pre-planning process, discuss pitfalls that you should try to avoid, and hopefully take some of the mystery out of the process of working with an Architect and getting a new facility.

Here's what's inside:

- *Top Ten Things You Need to Know Before Getting Started*
- *Worksheets that walk you thru the planning process for your stations*
- *Latest copies of articles written by Ken Newell, AIA,LEED AP BD+C, IAFC*

How does this handbook benefit me?

Once you have completed the worksheets inside the booklet, send them back to us via fax, mail or email. We will take the information you have provided, talk with you more to answer any questions, and provide back to you estimates regarding the size of the station you need and range of construction costs depending on the type of construction you choose. ***This is a free service!***

Stewart-Cooper-Newell Architects has designed over 300 projects for city, county, and volunteer departments, along with many other types of public safety facilities. Our strengths as a firm include our pledge of **individualized** service, completing projects **on time** and **on budget**. Our architects are committed to assisting Fire & EMS Departments of all sizes with designing and building cost effective and functional facilities.

We are looking forward to working with you and further discussing how we can help make your project run smoothly and successfully. If you have any questions regarding the information in this handbook please visit our website at www.fire-station.com, call us at 1-800-671-0621 or send an email to knewell@scn-architects.com.

Sincerely.

Ken Newell

Kenneth C. Newell, AIA, LEED AP BD+C, IAFC
Principal-In-Charge

architecture
needs assessment
master planning
interiors
consulting

James C. Stewart, AIA Kenneth C. Newell, AIA James R. Stumbo, AIA

719 East Second Avenue, Gastonia, NC 28054
P: 704.865.6311
F: 704.865.0046
1.800.671.0621 **www.scn-architects.com**

Thinking about building a new station? Here are the Top Ten things you will need to get started.

By: Ken Newell, AIA, LEED AP BD+C, IAFC*

1. **Property**
   Consider the best locations in terms of easy street access, ISO ratings, and availability of the utilities you will need. The cost of the property is likely to be your biggest variable.

2. **Property Survey**
   Whether you are going to build this year or ten years from now, the survey should not substantially change. Getting the full survey early will save you time later.

3. **Environmental / Geotechnical Report**
   Some municipalities or lending institutions require this prior to property purchase. This report will reveal rock, bad soil, ground water, underground tanks, etc. Aside from the report, just knowing the site history can do much to predict the site development costs.

4. **Adjacent Property Acquisitions**
   Land usually does not get cheaper with time. If there is any chance that you may need future expansions, consider those available adjacent properties now.

5. **Architect**
   It is never too early to get the designer involved. The Architect can help you evaluate every item in this list and should be able to do so for little or no fee.

6. **Money**
   As soon as possible, you will need to identify how much money you'll need, when you'll need it, and where will it come from. An experienced Architect should be able to help you answer all of these questions.

7. **List of Current Building Activities**
   If the new building is to replace an existing building you should list all the things that are accommodated in the current spaces, including each vehicle and it's length.

8. **List of Current Needs**
   This is different from the Current Activities or you likely would not be considering a new facility.

9. **List of Future Needs**
   If you can afford it, it is usually cheaper to build extra space now instead of additions later on. At least consider how you can easily add to the facility in the future.

10. **A Good Sense of Humor**
    Anyone with construction experience can tell you that the best facilities are the result of successful problem management. Without a sense of humor you should probably go ahead and invest in 10 cases of Maalox!

** Ken Newell, AIA, LEED AP BD+C, IAFC, a senior principal with Stewart-Cooper-Newell Architects, in charge of our Fire/EMS Facility designs since joining the firm in 1988. Ken has personally been involved with over 275 Public Safety projects. He has been a speaker at state and national fire conferences, a writer of multiple fire station design articles, and has served as a station design consultant for departments all across the USA.*

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Apparatus and Support Areas

SPACE:	Current Size	Needed Size	Notes:
Vehicle Bays			___ Drive Thru ___ Back- In
w/ 14' x 14' Doors			List Each Vehicle to be housed and length
			add "F" notation for all First Reponders
			a.
			b.
			c.
			d.
			e.
			f.
Turn- Out Gear			___ Room ___ Alcove ___Lockers in Bay
			___ No. of Lockers
Shop			
Decon Room			___ Stainless Steel Sink
			___ Emergency Shower/ eyewash
Tool Air Comp. /SCBA Cascade Room			___ SCBA Repair Area
Laundry Room			___ Washer ___ Extractor ___ Mop Sink
			___ Dryer ___ Tub Sink
EMS Storage			
Sprinkler Riser			___ Room or ___ In Bays
Hazmat Storage			List Equipment/Materials:
Outside Equip. Stor.			List Equipment/Materials:
Mechancal/ Storage Mezzanine			___ Stairs ___ Ships Ladder
Hose Drying			___ Room ___ Racks in Bays ___ Tower

Private Spaces

SPACE:	Current Size	Needed Size	Notes:
Dayroom			___ No. of People
			List Equip. besides Chairs & TV
Kitchen			___ Walk-in Pantry
			List Appliances and Equipment:
Dining Room			___ No. of Seated People
			or ___Dining in Kit. Or ___Dining in Dayrm.
Indiv. Sleep Rooms			___ No. of Rooms
or			
Group Bunk Rooms			___ No. of Beds
Exercise Room			___ No. of Workout Stations
Toilet/Shower/ Locker Rooms			___ No. of Male Lockers ___ No. of Female Lockers
or			
Indiv. Toilet/Shower			
Rooms w/ Locker			
Alcove(s)			
Residential Laundry			___ Washer/Dryer ___ Tub Sink
Linen Closet			
Janitor's Closet			

Public Spaces

SPACE:	Current Size	Needed Size	Notes:
Lobby			___ No. of Seated Visitors
			___ Airlock for Safe Harbor
Walk-in Triage/Visitor			with sink
Public Restrooms			
Receptionist			___ Pass window to Lobby
Radio/ Report Room			
Dispatcher			___ No. of Consoles
Chief's Office			___Sep. Toilet ___Sep. Shower ___Closet
			___No. File Cabinets
			___Small Conf. Area w/ ___@ table
Office _____			___No. File Cabinets ___Closet
Office _____			___No. File Cabinets ___Closet
Office _____			___No. File Cabinets ___Closet
Office _____			___No. File Cabinets ___Closet
Training Room			___ No. of Occupants
Community Room			___ No. of Occupants
Vending Area			___ No. of Machines
Work/ File Room			___ No. of File Cabinets
			Type of Cabinet _____
Conference Room			___ No. Seated at Table
Library			

Training Activities

SPACE:	Current Size	Needed Size	Notes:
Training Opportunities			
In-house & On-site			
Sprinkler Riser			___Energized or ___Dummy Riser
Drill Tower			___No. of Levels
			___Enclosed and/or ___Open-air
			___Dry Standpipe
Ground Ladder			___No. of Levels
Evolutions			
Confined Space			___Vertical with Tri-pod
			___Horizontal with Props
Elevator / Shaft			___No. of Levels or ___Height
Training			
Ropes / Rappelling			___No. of Levels or ___Height
			___ No. of Occasional Spaces
Drafting (Test) Pits			_____Gallon Size of Vehicle to be Tested
			___ Diesel ___ Natural Gas ___ Propane
Stokes Basket			___Vertical ___Horizontal
High-angle Rescue			Describe Goal:
Search & Rescue			Describe Goal:
Horizontal Hose			Describe Goal:
Advancement			

Other Activities Checklist

SPACE:	Current Size	Needed Size	Notes:
Sep. Facility Users			List Space Needs:
List any other spaces			
Outside Patio			___ Uncovered ___Covered
Parking			___ No. of Daily Spaces
			___ No. of Occasional Spaces
Back- Up Generator			___ Full Building ___ Partial Building
			___ Diesel ___ Natural Gas ___ Propane

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"Plan Your Practical Training "At" the New Firehouse"

Written by: **Kenneth C. Newell, AIA, LEED AP BD+C, IAFC**

One of the biggest challenges of any department is providing the needed hands on, practical training for the firefighters. For paid departments the training usually results in dedicating so many hours per year of the firefighters "on the clock" time to send them to the proper facilities. This increases the department budget by duplicating personnel needed to cover the one away at training. The volunteer departments face the problem of finding opportunities for their personnel to have time away from their regular jobs for training, which usually means evenings or weekends. Much of this training will require that valuable apparatus be out of service as well. Out of service personnel and apparatus will have adverse effects on your ISO ratings. None of these scenarios are unfamiliar to any department.

While most stations have some sort of space that can be used for classroom training, very few have the luxury of an *emergency training center* on site. Understanding that fact, let us consider how you can achieve some much needed and required training through some fairly inexpensive additions to your new facility. Some of these ideas can even be incorporated into your existing buildings for very little money.

Inside Training Opportunities

If your new facility is to be a multi-story building, it will have to include stairwells. Most stairwells are configured in a "scissor" pattern – back and forth with two landings per vertical floor. By adding another five to six feet to the width of the stairwell, a clear vertical space can be accommodated with the stairs wrapping around it. This vertical space can even be enclosed to create a shaft if desired. The resulting vertical space can be utilized with rope training from floor to floor. If the vertical space is enclosed, an elevator shaft simulator is formed. Since the stairwell is likely already rated, the training shaft should not have to be rated. The vertical and horizontal spaces in the stairwell can also be configured with large diameter plastic or metal pipes for confined space rescue training.

Most buildings will have an above ceiling or attic type space. These spaces are normally a maze of framing, ducts, conduits, etc. Once the building operating systems are put in place, a narrow catwalk (or catcrawl) can be looped through the overhead space. Numerous training opportunities exist with such a platform. Care must be taken to provide side rails. Also, the attic access hatch should be planned for a lot of wear and tear.

There are many training opportunities that can be built into the apparatus or support spaces. If the building is to be fire protected, consider housing the riser in an alcove or corner of the apparatus bays. The firefighters need training around a riser pipe so why not use your riser for that purpose. Be sure to plan enough room around the riser so that groups can be gathered for instruction. If the riser is close to a vehicle bay, be sure to place a steel bollard between it and the "wayward" vehicle. Even if your building is not protected, a simulated riser can be set up in the bays for training purposes.

Most stations have enough height to accommodate some sort of storage or mechanical mezzanine as part of the apparatus support spaces. There are several training revolutions that can be planned in conjunction with the mezzanine. The wall that separates the mezzanine from the apparatus bays can include several door and window openings. These openings are excellent props for ladder training when the weather may be bad outside. The extra space in a mezzanine can also be configured with large, portable, plastic pipe for confined space rescue training. These pipes can even penetrate the mezzanine floor for greater vertical challenges. Strategically placing a roof hatch in the floor of the mezzanine to a storage space below, allows for simulated rooftop training. If the apparatus bays are to have mezzanines on each side, consider placing upper doors or windows to each mezzanine that align. Hooks and pulleys can be added to the overhead structure that will allow basket rigging and rescue training from one mezzanine to the other.

Outside Training Opportunities

If the building is to be multi-story, the stairwells will likely be placed on the outside perimeter. By incorporating large, operable window openings in the upper levels of the stairwell, you can gain valuable ladder training opportunities from below. Placing outside door openings at each upper level of the stairwell will allow for rope training. Just be sure to plan on the landing pad below and the anchoring mechanisms for the ropes.

Many of you are already using the large, plastic pipes for confined space rescue training on your grounds. Planning the locations of these props during the facility design will help guarantee their success. You may also want to have several sections of the pipe buried during construction with both ends surfacing so that you can incorporate these underground portions with the above ground pipe. This will increase your ability to reconfigure your confined space “trail”, thus keeping even the old-timers on their toes with different challenges.

With a little more space and money, a drafting pit can be places on site to test your pumpers and personnel. Depending on the capacity of your apparatus, a single pit or two pits will be necessary. These normally will take no more space than the average dumpster pad. In order to work correctly these pits must be designed properly and will likely cost over ten thousand dollars each.

Conclusion

Most of the training opportunities mentioned can be incorporated into the design of a new facility for between five to twenty thousand dollars. The valuable training received, not to mention keeping your personnel and apparatus in service during training, is well worth the money and preplanning.

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"Station Construction Types: Which Will Fit Your Needs… and Budget?"

Written by: **Kenneth C. Newell, AIA, LEED AP BD+C, IAFC**

The building and design industry is a complex and complicated arena of technologies that evolve every year. There are a wide variety of construction types that are used throughout the industry by qualified owners, designers and builders. Knowing the major categories of these construction types and the advantages/disadvantages of each is important for any group anticipating a building project. Cost of construction, duration of construction, and anticipated building life span are just a few of the issues that can vary with various construction types. Your familiarity with the differences will assist you in deciding which construction type is right for you.

For simplicity sake, we will define *construction types* as the materials and methods used to build facilities. Probably 95% of all stations fall into one of two construction types: conventional or pre-engineered. First let's define *conventional construction* and *pre-engineered construction* for the purposes of today's conversation.

Conventional Construction: Defined

Conventional Construction is what most of you think about when you think of construction. Most of your homes are conventional construction. Almost all older stations are of this construction type. The site is prepared and materials arrive on site to be assembled into a building. Brick, block, studs, trusses, beams, shingles, etc., are put together piece by piece to finally evolve into a built structure. The structure includes load bearing exterior and/or interior walls…or a structural column grid throughout the building. The roof is usually supported by wood, steel, or concrete members.

City of Gastonia Prototype Sub Station: Example of Conventional Construction

Conventional Construction: Pros

- Best suited for facilities with irregular floor plan arrangements
- Best suited for multi-story buildings
- Unlimited aesthetic styling that blends will into any surrounding, including residential areas

Conventional Construction During Construction

Conventional Construction: Cons

- Load bearing walls and columns limit flexibility and future reconfiguration of interior spaces
- Historically, conventional wood, steel, or concrete structural members can have longer delivery times
- In the case of wood, the building components are combustible
- The total construction time is typically longer that other construction types

Example of Conventional Construction Wood Roof Trusses

Pre-Engineered Construction: Defined

Pre-engineered Construction typically means that major components of the building were manufactured elsewhere and delivered to the site to be erected. Most common for stations is that the structural frame of the building is pre-engineered as large, tapered columns with connected roof beams all made from heavy steel…often referred to as a “butler building” frame. When metal skins are used to form the outside walls of these large frames, the structure is commonly referred to as a metal building. However, more and more of these frames are wrapped in exterior, masonry walls or a wide variety of other finishes. The roof structure is typically heavy gauge steel purlins over the major frames.

Hilton Head Island SubStation: Example of Pre-Engineered Construction

Pre-Engineered Construction: Pros

- Historically speeds construction through shorter delivery times and faster erection of major building components
- Easily allows for large clear spans and partition walls which can be reconfigured in the future
- Is usually a non-combustible construction type
- Building cost is typically less

Hilton Head Island SubStation: Pre-Engineered Under Construction

Pre-Engineered Construction: Cons

- Best suited for rectilinear buildings with few changes in the building profile and simple roof configurations
- Requires careful planning of structural member sizing and placement so as not to conflict with building openings and clearance requirements
- Economic benefit decreases in multi-story structures
- Some of the building materials often used with pre-engineered structures have performance and longevity limitations
- Some communities are opposed to the concept of pre-engineered construction due to their perception of the construction type based on examples they are familiar with

Regarding the last item above, many laymen only know pre-engineered as buildings like “Joe’s Auto Shop” down on the corner. These are often unattractive, metal-skin buildings. Pre-engineered stations can be designed and built so that the only time anyone will know that the structure is pre-engineered is when they walk into the apparatus bays and look up at the rigid steel frames.

Pleasant Valley Volunteer Fire Station: Example of Pre-Engineered Construction

Conclusion

There are many factors to consider when contemplating your choice of construction. The decision by most Owners is usually determined by their available construction budget. Our experience has revealed that there is typically more than $20 per square foot difference in the cost of construction for these two construction types.

Both conventional and pre-engineered are valid construction types in the proper applications. Designed and built properly, the structural integrity and longevity of both types are equivalent and should be expected to provide great service for 50 to 75 years. Keep in mind that there are good and bad examples of both construction types. Don't let the bad examples of either type influence your choice.

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"Station Renovations & Additions"

Written by: **Kenneth C. Newell, AIA, LEED AP BD+C, IAFC**

Have you ever gone through a major renovation of your home? It's exciting, but what a challenge (nightmare?) it can be. If your station project looks more likely to be renovations and/or additions instead of a new facility there are dozens of considerations. Let's look at just a couple of the issues that you'll likely have to address.

Move-in or move-out?

The most pleasant location for your department to be during construction is ***not*** in the building being renovated. If you can relocate during the construction period do it! Running the department day-to-day can be challenging enough by itself. Add to that the hustle of a building being demolished or built around you and you've got a real circus on your hands.

A whole variety of reasons may dictate that you must live in the building…or at least on-site, during construction. This may mean renting modular admin/living units to locate on an "out-of-the-way" portion of the site or this may mean playing musical chairs with the building as your move out of the parts of the building that the contractor needs next.

Keep in mind that phasing construction means multiple mobilizations for many of the same sub contractors and extended construction schedules. All of this results in higher construction costs and coordination efforts on your part.

"The Erwin Fire Station renovation required construction staging in order for vehicle bays to remain operational."

Upgrades

Even if there are portions of your facility that you did not intend to renovate, you may find yourself required to do so. Most building codes only allow a defined quantity of renovations before other code upgrades are triggered. Many of these required code upgrades center on accessibility, life safety and handicap. Other code required upgrades to non-renovated portions of the building may be structural, plumbing, mechanical, electrical, hazardous materials and even landscaping.

Don't assume that the current general building code is your only choice. For example, North Carolina has adopted a Rehabilitation Code that solely applies to renovations of existing buildings. The Rehab Code allows for much more flexibility than the International Building Code that is required for new construction.

There are potential "non-code" upgrades that you may be required to address. These may include; roofing, paving, parking locations and emergency power back-up.

Facelift

The aesthetics of the remaining portions of the existing facility may be worthy of preserving and continuing in the new structures. If so, you will likely need to address some overdue maintenance issues on the older facades. If not, you may desire to modify or redesign the appearance of the existing building to compliment the new.

Tidbits

Generally speaking, we have found on addition & renovations projects that it is less expensive (and less headaches) to add new vehicle bays sized for modern equipment and clearances, than renovate the old bays into the required administrative or living spaces.

As the building owner, you already have property insurance on the existing facility you will be renovating. It is less expensive for the building owner to purchase a Builder's Risk rider from the current insurance company that insures property during construction than it is for the general contractor to purchase a separate Builder's Risk policy.

Conclusion

These and a thousand other issues are reasons that you would be well served to have a design professional on board for the project that has weathered the storms of renovations & additions to public safety stations. Renovations are typically less expensive than new construction, but those savings can come with a price if not considered properly.

Before

After

SCN Architects was the Program Design Consultant to Moseley Architects for the Renovation & Addition of Henrico Fire Station No. 13.

Fax Worksheets to:
704-865-0046

Please visit
www.Fire-Station.com
for additional projects and articles.