



Multifamily buildings have been impacted by the events of 2020 in ways that influence their design and the effects on their residents.

Photo courtesy of NanaWall Systems

## Multifamily Design in 2020

New health concerns blend with standard criteria to foster new solutions

Sponsored by Inpro, NanaWall Systems, New Millennium Building Systems, Rocky Mountain Hardware, and TAMLYN

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The 2020 COVID-19 pandemic has affected many aspects of life, including multifamily residential design. With more people working or being schooled from home—a trend that is likely to continue into the future—the importance of the living/working/learning environment has received a lot of attention. This has played out in a variety of ways related to the design of multifamily buildings and living units, and it has also brought more attention to the health aspects of many materials and systems used in these buildings. Of course, there

remain all of the usual requirements of multifamily design and performance that need to be taken into account as well. This course explores a variety of strategies, products, and systems to help enhance the creation of multifamily housing in 2020 and beyond. Topics include big-picture issues such as indoor/outdoor connectivity and structural systems, as well as details related to facades, hardware, expansion joints, and elevator cabs. In all, it is attention to all of these important aspects that combine to create successful multifamily projects for this current time.

### CONTINUING EDUCATION

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#### Learning Objectives

After reading this article, you should be able to:

1. Identify the design opportunities to enhance the health of residents and visitors in multifamily buildings.
2. Assess the safety performance aspects of materials and systems that can be incorporated into multifamily properties.
3. Explain the significance of multifamily design as it promotes the welfare of the residents, particularly during extended periods at home.
4. Determine ways to incorporate the principles presented into multifamily buildings as shown in case studies.

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### INDOOR/OUTDOOR CONNECTIONS WITH OPENING GLASS WALLS

Many multifamily residents are interested in better ways to connect their indoor spaces to the outdoors for better ventilation, daylight, and a sense of expanding beyond the confines of a living unit. In particular, there is a desire to create the same sense of space of living in a single-family residence with the ability to integrate the indoors and outside. Toward that end, architects have used opening glass walls to achieve all of these objectives in many multifamily buildings. In locations where the geography provides desirable views, everybody likes that opening glass walls can provide unobstructed sight planes to take full advantage of these vistas. In most settings, the overall intent is to allow a large, uninterrupted opening between an indoor and outdoor space, thus making smaller spaces feel larger or simply allowing people to feel more connected to the outdoors. Further, building owners like that opening glass walls can enhance the value of dwelling units or help differentiate their buildings from other multifamily properties to create unique market offerings.

#### Opening Glass Wall Design Traits

All opening glass walls are comprised of individual panels that include the glass and, in most cases, a frame around it (some are frameless glass too). The makeup of the individual panels can be specified to suit a project based on a number of standard options. The frames can be either solid wood or aluminum, or a combination in the form of aluminum-clad wood.

There are two basic ways that the panels can be put together into a full opening glass wall systems. The first, and most common by far, is a folding glass wall system, which represents 80 percent of all systems installed in the United States. Some reasons for this include the fact that folding glass walls are easier to operate and have better air and water performance than other systems. From a structural standpoint, the dead load of a folding system is kept within the plane of the opening, with the panels capable of being either top supported or floor mounted. Floor-supported folding glass walls allow for easier design, as the weight of the system is on the floor and offers smoother operation.

The second type of opening glass wall system uses individual sliding panels that are guided on one or more tracks in the floor or overhead. While these are much less common in multifamily buildings, they may

Photos courtesy of NanaWall Systems



Opening glass wall systems provide a range of design options to help multifamily spaces achieve indoor/outdoor connections.



The performance of opening glass wall systems can be specified based on choices available in the glass, frame, and operational parts of the system.

## INDOOR/OUTDOOR CASE STUDY

**Project:** The Lofts at River East

**Location:** Chicago

**Architect:** Fitzgerald

**Developer:** Group Fox Management

**The Project:** Located in an iconic, historic building just one block from Navy Pier in Chicago, the Lofts at River East were more than 15 years in development. Originally built in 1905 as a shipping terminal, the building has been beautifully renovated into 258 luxury apartments featuring exposed brick, maple hardwood flooring, and more than 100 unique layouts from which to choose.

**The Challenge:** After acquiring the property, Group Fox Management had to determine how to construct the unique rental units within the space available. "We wanted to keep as many aspects of the original building as possible, but we wanted to add the newest and most high-tech finishes," says Liz Pietka, vice president of marketing for the developer. "Additionally, we had the task of figuring out how to construct these units with the space that was given, but we also wanted to give our residents an indoor/outdoor living experience."

**The Solution:** Half of the units offer a unique indoor/outdoor design. By incorporating operable glass wall systems between the dwelling units and their balconies, they fold open to connect the interior living spaces directly to the balconies. Whether open or closed, the operable glass walls provide views of the gorgeous downtown Chicago architecture, the river, and the lake.

From a performance standpoint, the opening glass wall systems continue to add value even in the harsh Chicago winters. The closed glass panels offer an entire wall of windows from which to enjoy the beauty of downtown Chicago while sealing out the cold, providing the comfort of being warm inside of the apartments. When the weather is nice, renters can completely turn off their heat or air-conditioning, open up the wall, and in turn use less energy. Further,



the walls are very functional with the ability to be easily opened and closed with just a light push of a user's hand.

**The Results:** The apartments with the opening glass walls were the first to rent. Upon bringing prospects into the apartments, Pietka points out, "Renters see an entire wall of windows, and they think it will just be a patio door that opens, but when we open up the entire wall, they are just blown away. I would say that the operable glass walls have absolutely contributed to the success of this building and completely exceeded all of our expectations."

be considered as a more economical choice for separating common or public areas. The panels may also have swing doors incorporated into them wherever desired so that the entire wall does not need to be open for people to pass through.

### Opening Glass Wall Performance Characteristics

While windows and door systems are typically a performance weak spot, operable glass wall products can address thermal needs, high wind loads, and air and water infiltration suitable for mid-and high-rise applications. When aluminum frames are selected, they can include thermal breaks, while the glass in the panels can be selected to suit exterior conditions with single, double, or triple glazing from which to choose. There are also all of the usual

choices for treating the glass for enhanced energy performance (low-e coatings, inert gas filled, other coatings, etc.). Folding glass wall systems are available that have been independently tested and shown to be capable of meeting the demands of these situations, contributing to the availability of ENERGY STAR products.

When it comes to the structural integrity of opening glass walls in high wind conditions, they have been tested to perform well up to 70 PSF (positive) and 100 PSF (negative) for folding glass walls, and up to 60 PSF for sliding systems. In terms of maintaining security in the building, all have been shown to provide excellent forced-entry resistance when tested per AAMA 1304 and ASTM F842. And since sound is often a concern in multifamily housing, the systems have been tested and can achieve sound attenuation

ratings up to a significant STC 42.

When looking at these different performance characteristics, keep in mind that inward opening folding glass wall systems offer better performance and safety capabilities than outward opening systems since the wind dynamics are a bit different. They are also easier to clean since both sides of the glass panels are accessible from the inside. The sills of the folding glass wall systems will make an impact on performance as well. Folding glass wall systems with ADA (low-profile) sills need to be assessed in terms of water resistance compared to some others. Still other sills with higher profiles have been found to support higher water-resistance ratings during field testing.

Overall, it is easy to see why opening glass walls have been used in a variety of multifamily projects across North America.

**STRUCTURAL FLOOR SYSTEMS**

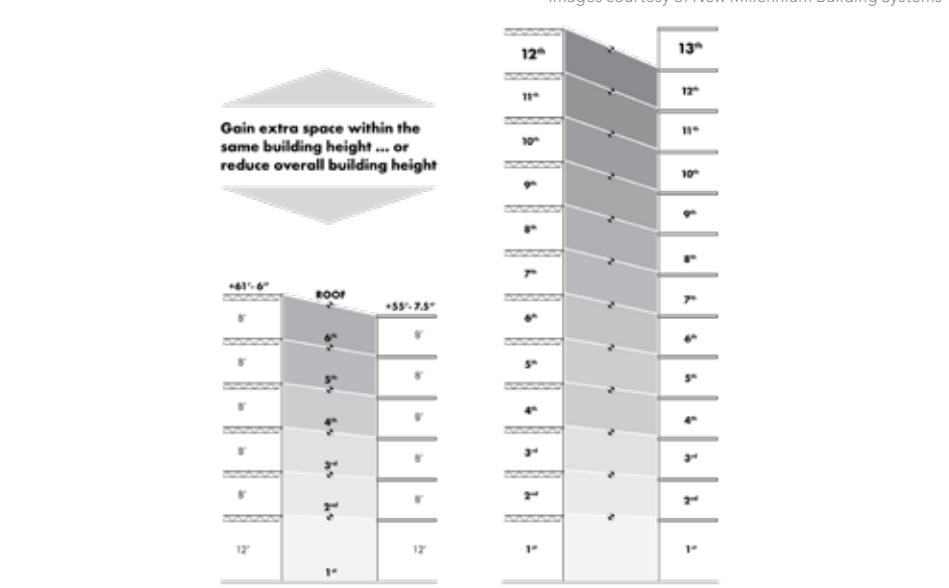
The most common structural systems used in multistory construction are based on either concrete or steel, a combination of the two, or even combinations with wood in some cases. The selection is typically determined by the specific criteria and needs of a given project for not only structural strength but also fire safety, sound separation, and coordination with other building systems and finishes. Some of these criteria are dictated by code and safety concerns, and others by comfort and marketing issues. To address all of these, one approach that is gaining in popularity is a “thin-slab” composite floor system. Fundamentally, this hybrid system is based on using engineered steel decks and poured concrete acting together to create a long-span floor that requires fewer intermediate supports. As such, it can be a more economical yet high-performing system to consider.

Long-span composite floor systems are available in different deck profiles and a variety of depths. One of the most appropriate versions for multifamily buildings is a dovetail-shaped profile that provides a low profile that can integrate with virtually any beam (e.g., wide flange, low-profile composite steel, or concrete beam) or bearing-wall method. On top of the deck, monolithically poured concrete finishes flat so it eliminates the need for grouting and floor leveling activities. The system employs dovetail-shaped steel composite deck to establish the thinnest total floor depth possible, ideal for multistory projects. Combined with a concrete slab, the 2-inch and 3.5-inch dovetail composite deck profiles create floor depths as thin as 4 inches. Overall, this system blends the speed and versatility of steel with the performance and durability of concrete in a system that can weigh up to 40 percent less than comparable cast-in-place (CIP) concrete floors.

While a range of advantages are offered by the dovetail long-span composite floor system, the following three are most notable.

**Thinner Floors**

Thinner floor systems mean that floor-to-floor heights can be shorter while still maintaining desired ceiling heights. For example, a 12-story building using conventional cast-in-place concrete floors can alternatively be designed using a 2-inch dovetail composite floor and end up accommodating an entire extra floor within the same overall building height. Similarly, a six-story building can be reduced in height without reducing floor-to-ceiling heights. This space-efficient design translates into higher potential revenue options for the project owner with increased area and occupancy options. Alterna-



Dovetail long-span floor systems allow designers to gain space in the same building height or reduce the overall building height.



Long-span composite floor systems can reduce weight, interior supports, and overall project time and costs.

tively, it can optimize multistory construction since the floor-to-floor heights are reduced. This occurs because the structure spanning between load-bearing walls or beams is only comprised of the composite slab without the use of additional joists, trusses, or girders hanging down below. This is particularly helpful in locations where the overall building height is limited due to zoning requirements. Often an

added story means more income for a building owner and may improve the overall project’s financial picture considerably.

**UL Head-of-Wall Barriers**

Also unique to the dovetail long-span composite floor system is the ability to stagger the placement of the dovetail sections to create barriers to the transmission of fire, smoke,



Long-span composite floor systems in a dovetail profile can include an end-closure treatment that meets code-required barriers between adjacent spaces.

and sound. These elements cannot pass between separated spaces because they are sealed off at the top of the bearing wall with the inclusion of an end closure. The UL-tested solution eliminates the cost of placing expensive fire sealants in the deck flutes when set upon cold-formed steel (CFS) bearing walls.

**Overall Cost Efficiency**

Architects using long-span composite floor systems can contribute significantly to reductions in the construction timeline and the total cost of a multistory project. Specifying a dovetail composite floor deck and CFS load-bearing demising walls has provided a surprising set of cost benefits compared to other construction approaches, such as post-tensioned concrete. The significantly lighter-weight dovetail composite floors can often be supported by a spread concrete footing foundation and may eliminate the need for piles and pile caps in some cases. By virtue of the longer composite floor spans, support columns can be reduced, and those required can be smaller in girth. Floor spans can reach 16 feet without shoring. The thinner, faster-curing composite system allows for tighter scheduling of the trades that follow in the schedule, including plumbing and other rough-in work. There are documented cases where many weeks were removed from the project timeline using this approach.

With all of the above as a basis, multistory residential design can learn much about the total project cost and performance advantages made possible by a dovetail long-span composite floor system.

FLOOR SYSTEM CASE STUDY



Photos: Richard Jarvis, courtesy of New Millennium Building Systems

**Project:** Aloft Hotel  
**Location:** Ocean City, Maryland  
**Architect and Engineer:** lott Architecture and Engineering



**The Project:** The five-story, 78,000-square-foot Aloft Hotel in Ocean City, Maryland, provides a variety of short- and long-term residential options. lott Architecture and Engineering was the all-in-one firm that designed and engineered the hotel, taking a holistic view of building design, the construction timeline, total project costs, and the ways in which the structural floor design could impact all of these objectives.

**The Challenge:** Like many such projects, maximizing space, controlling costs, and expediting construction schedules were high priorities here. In particular, focusing on details such as head-of-wall construction to meet code requirements while streamlining the construction were topics of attention. The design concept called for an open-air-style common space uninterrupted by columns plus rooms/units with maximum floor-to-ceiling heights.

**The Solution:** To achieve the project objectives, lott designed the building to include a steel podium frame for the ground floor. The floors above feature load-bearing cold-formed steel (CFS) demising walls with a 3.5-inch dovetail long-span composite floor deck and a 2-inch lightweight concrete cover, which was chosen over the more regionally common post-tensioned concrete. The A&E firm’s president Keith lott says the thinner dovetail composite floors enabled a 2.5-inch increase in ceiling heights along with UL head-of-wall construction for faster construction. This provided an overall project cost savings due to reductions in floor-related materials, weight, size, and labor. Looking back on the decision, Keith lott says the project might not have proceeded without the cost and time savings made possible by the dovetail composite floor deck and CFS approach. He estimates that the timeline from foundation to certificate of occupancy was cut by 2.5 to 3 months. Further, the savings in total construction costs ranged from \$1.5 million to \$2.5 million.

**The Results:** This significant project was completed in just 14 months. According to Keith lott, “The dovetail composite floor deck in the upper floors was a game changer in terms of being able to accommodate what we wanted to do structurally, what we wanted to do from a fire-protection standpoint, and, more importantly, what we wanted to do in terms of driving the schedule.”

Photos courtesy of TAMLYN



Extruded aluminum trim can be used for a variety of conditions between similar siding materials or as smooth transitions between different types at inside and outside corners, edges, and other locations.

### EXTERIOR AND INTERIOR DETAILS

One of the key drivers to the short-term and long-term success of multifamily projects are the details that influence both the design and longevity of these buildings. Design details can tie different materials together or give them distinction and separation. Material details can make the difference between low maintenance and good looks over time or unsightly and costly deterioration. This attention to detail is true whether the building follows a traditional, contemporary, or modern design vocabulary. This is played out quite notably in the type of trim materials that are used on both the exterior and interior of multifamily buildings.

#### Exterior Panel Trim

One of the better ways to achieve a panelized, modern look on a building facade is to use a lightweight cladding over a framed wall assembly. Commonly, this cladding is incorporated from standard-size panels or lapped siding made from fiber cement, composite material, engineered wood, or even thin composite aluminum panels. Designing with such materials is fairly straightforward, but attention needs to be paid to the way the panels are secured to the building and how the edges, joints, transitions, and other details of the panels or siding are addressed. Typically some sort of trim has been applied to accomplish this using wood, composite, or plastic-based materials. While these are effective and can

be good for some buildings, their width, bulk, and ongoing maintenance can make them less desirable for use and detract from the overall facade design.

As an alternative to traditional exterior trim, many architects are turning to the use of thin extruded aluminum trim systems. The use of extruded aluminum in buildings in general is common due to the versatile nature of the material and its durability. When used to hold the edges of exterior wall panels, it provides architects with a unique means to detail corners, vertical and horizontal joints, and material transitions. It can be specified in common thicknesses and profiles to suit any of the lightweight cladding materials already mentioned. Extruded aluminum trim can even be provided in sizes and styles that work with multiple panels, enabling architects to vary the material choices within their facade designs while still keeping details that will have a similar language. The variety of available extrusion profiles can create a recessed reveal between cladding panels or project outward to accentuate the lines of the design. Used in any of these ways, it has typically been shown to be less expensive with a more elegant look of clean lines than with other options.

#### Interior Panel Trim

On the interior of multifamily buildings, similar systems can be used to carry a design scheme inside. Gypsum board or interior panel products can be surrounded by thin

extruded aluminum trim, creating similar clean lines and geometric delineation on interior wall surfaces. This can produce clean and advanced details for an otherwise utilitarian product without requiring specialized metal work in the field. Such interior aluminum trim can provide unique profiles, which help to take a strong, well-known product in drywall and give architects and designers the opportunity to add new details, patterns, and design impacts. In multifamily developments, aluminum trim can be used to create bold corners or wall bases in addition to delineating wall panel patterns.

Of course, the color of the trim is an important design consideration, regardless of the exterior or interior location. Fortunately, there are many options beyond the standard mill-finish aluminum coloring. Extruded aluminum trim can be specified as finished with only a paint primer ready to receive final finish coats in the field of virtually any color. Alternatively, it can be specified as prefinished in the factory reducing, further the on-site labor needs. The prefinished choices vary by manufacturer but typically include durable powder coat paint, conventional wet paint coatings, or anodized aluminum in standard colors. In this regard, the trim can appear to blend in with the adjacent panels or cladding, or it can be used to highlight all or some of the visual lines it creates. This flexibility using familiar and long-lasting finish options means that both the design and performance level can be controlled.

## FACADE CASE STUDY



Photos courtesy of TAMLYN

**Project:** Law Harrington Senior Affordable Housing  
**Location:** Houston  
**Architect:** Smith and Company Architects  
**Contractor:** Camden Construction

**The Project:** The Law Harrington Senior Living project is a 159,778-square-foot, four-level wood-frame housing development for seniors over 62 years of age. The project is located in the Third Ward area of Houston and includes 112 Living Units that consist of one- and two-bedroom units with full kitchens and washers and dryers. A 17,196-square-foot Club House building is also provided in the front of the facility housing a Social Workers Suite, a Leasing Office, a clinic, and multiuse and public spaces for residents.

**The Challenge:** The facade design for this project needed to reflect and respect the architecture and culture of the vastly changing historic Third Ward area in which the property sits. However, there was also a need for the design to be consistent with the modern movement currently taking place with new and proposed developments in the area. There were also the usual requirements for longevity, low maintenance, and quality for the very visible exterior facades of this project.

**The Solution:** The design team created a varied facade for this large multifamily complex to break up the mass and give it appropriate scale. In so doing, it decided to use a mixed palette of exterior materials, which required a variety of trim, accessories, and transition strips. Extruded aluminum and fabricated metal trim were the selected materials of choice for their ease of use, low maintenance, longevity, and cost-effectiveness compared to some other more traditional materials.

On the lap siding sections, an extruded aluminum “W-style inside corner” replaced a 1 x 2 wood corner board that would commonly be susceptible to rot and require replacement. The lap siding sections used higher-quality

extruded aluminum reveals to create a visual break and section highlight, replacing vertical wood trim between sections. For the panel sections of the facade, two different types of vertical aluminum trim were incorporated, allowing the designers to create larger formats for the panels. In some cases, they painted some of the trim the same color as the panel to contrast with a bolder, clear anodized profile for the edging of the now larger visual panels.



To transition between different materials, “XOCR” and “XOCLP” profiles of extruded aluminum allowed the designers to create complex shapes sized for two different panel thicknesses and make it a seamless transition—in this case from 3/8 inch to 3/4 inch. Similarly, an “XICLP” profile of extruded aluminum was used with traditional wood grain fiber cement siding. Such trim does not need to be restricted to use on projects with smooth finished siding.

**The Results:** According to Midtown TIRZ Executive Director Matt Thibodaux, “Affordable housing is imperative to developing and providing a vibrant community to Houston’s most vulnerable populations.” This multifamily project will offer 112 independent living apartments for low-income seniors ages 62 and older, a social services office managed by the Montrose Center, a geriatric primary care clinic provided by Legacy Community Health, a fitness center, a dog park, a vegetable garden, and other amenities.

**HARDWARE AS A UNIFYING DESIGN ELEMENT**

Multifamily properties typically have the need for a lot of hardware. Every door, window, cupboard, bathroom, kitchen, and other locations needs decorative and utilitarian hardware to open, close, lock, or simply perform a static function. The more living units and different types of spaces in a multifamily building, the more hardware that is needed. Of course, much of this hardware is not only visible, but it is also a surface that is regularly touched by hands, so it is noticed. Therefore, when looking at an overall design of individual dwelling units or a total building, this visible, touchable hardware can make a lasting impression on the people who use it.

In light of the above, some architects are starting to look for ways to select hardware that enhances the overall design scheme of a multifamily building. Further, to the extent possible, they are looking for hardware manufacturers that can provide a full range of hardware so a particular look or style can be repeated throughout the facility to create continuity of design and a consistent level of quality. This can create a level of sophistication across a project and, depending on the type and style of hardware selected, be a simple way to provide a sense of luxury.

**Bronze Door Hardware**

One type of hardware that is increasingly being used to achieve these results is bronze hardware. Bronze has been used for artistic and utilitarian purposes for thousands of years. In recent times, it has become a choice for quality, artisan products that are

Photos courtesy of Rocky Mountain Hardware



**Bronze can be used for a wide range of other products throughout multifamily buildings in kitchens, common areas, and elsewhere.**

quite economical over the life of the building. As an alloy of copper and other non-ferrous metals, it is inherently strong and resistant to rust and corrosion. Although a dark appearance is most common and provides a distinctive look, there are actually a variety of colors that bronze hardware can be finished in based on the metals used.

The range of hardware and accessory items made from bronze for multifamily construction is broad and diverse. Door hardware is available in a wide range of choices of styles, types, sizes, and appearances. In multifamily settings, the durability and integrity portrayed by a

substantial bronze handset and lockset promote a sense of security and safety. And, in fact, quality products are available that are stronger and more secure than some lesser-quality products, hence comparing different manufacturers' products is worthwhile. In keeping with the times, these entry door systems are available with electronic controls and locking to enhance the user experience and security of the entry doors to individual dwelling units or building common areas. These include touch pad and keyless options and other smart lock entry systems. Further, some manufacturers offer special pricing



**Bronze hardware for entry and passage doors are a popular choice for multifamily buildings in a variety of styles and colors.**



for multiple entry door lock and hardware systems of the same type, helping projects stay within budget.

Beyond entry doors, the passage hardware for other doors can be provided in bronze too. These can be made in lever style or knob style as a project may require, and in a wide variety of looks that are standard or custom. Relatedly, miscellaneous hardware associated with doors such as door stops, hooks, hangers, etc. are all available in coordinated bronze offerings too. Even cabinetry doors and drawers can use a matching bronze hardware style to round out a complete unit design. In this case, knobs, handles, and other related hardware can be selected from a wide range of traditional, contemporary, and modern styles.

#### Additional Bronze Hardware

Windows are another area where bronze hardware can be used quite successfully. The handles for casement, awning, or European-style tilt/turn windows can be made from bronze, as can hardware for double-hung, sliding, and other window types. Coordinating the style and color with door hardware can be an effective and sometimes unexpected way to create design continuity within a building.

There is also the opportunity to use bronze in a variety of other discreet ways in multifamily housing. Bronze accessories are available for things such as apartment/unit door numbers and mail slots, or signs for common public spaces like restrooms. For stairways, handrail brackets and balusters can be used that can match or complement other bronze hardware. Carrying this a bit further, even electrical switch plates and outlet covers are available in bronze to create a very coordinated look.

Not to be overlooked, bathrooms, kitchens, and lighting fixtures can be considered too. Nonferrous bronze is ideal for any wet location since it does not oxidize (rust) the way that iron-based metals do. Faucets, sinks, shower controls, and other offerings fabricated from bronze overcome these issues and create striking visuals. Similarly, bronze lighting fixtures hold up extremely well outdoors and are available in a variety of artistic styles and looks for all locations.

Overall, bronze hardware, fixtures, and accessories can help unify and upgrade the design of multifamily buildings in a significant and sophisticated way to promote the look and appeal desired.

## ANTIMICROBIAL CHARACTERISTICS OF COPPER-BASED HARDWARE



Photos courtesy of Rocky Mountain Hardware

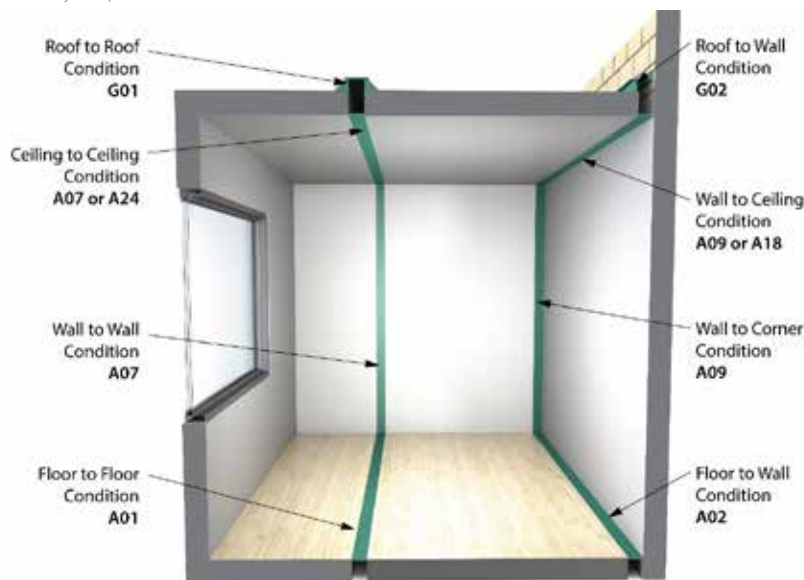
These are examples of the range of antimicrobial copper alloy hardware and accessories that can be produced using bronze products to kill bacteria.\*

As a result of the COVID-19 pandemic, there is a renewed interest in keeping public spaces clean and safe from the spread of disease. There are a number of ways to go about this in buildings, but there is one very successful approach based on using antimicrobial materials wherever people need to touch a surface. This approach has been recognized and registered with the U.S. Environmental Protection Agency (EPA) based on field testing as well as documentation in more than 40 peer-reviewed and professionally published papers. The material that has received the most attention is a copper-based metal alloy that may take several forms, such as different types of bronze or brass. These copper-based metal alloys have been shown to be the only class of solid material with the inherent ability to kill bacteria harmful to human health.\*

The science behind these results suggests that copper surfaces affect these bacteria in two sequential steps. The first step is a direct interaction between the surface and the bacterial outer membrane, causing the membrane to rupture. The second is related to these rupture holes in the outer membrane, through which the cell loses vital nutrients and water, causing a general weakening and death of the cell. Based on these results, bactericidal copper alloy is the only class of solid surfaces (i.e., not a liquid or gas that EPA has recognized) that is registered with the EPA and capable of supporting public health claims of killing harmful bacteria that pose a risk to human health.\* No other solid-surface material, no coating, nor any additive has this kind of registration and can currently support any such claims.

When bactericidal copper alloy is used as the material for producing hardware and accessories, these products carry the same ability to kill the tested bacteria. The installed hardware can be used in a conventional manner, meaning that door handles, pulls, door plates, etc. that people need to touch on a regular basis to operate doors still function in the usual manner. Similarly, cabinetry can be equipped with hardware made from antimicrobial copper for pulls and handles. And just as significantly, accessories such as hooks, shelves, switch plates, grab bars, and towel bars can be made of bactericidal copper alloy to help in those heavy-use locations as well. Other applications are possible too, including sink faucets and handles, handicapped door activation switches, and even custom-fabricated elements for particular needs in specific building designs.

Images courtesy of Inpro



Typical locations of expansion joint systems in building construction.

## EXPANSION JOINTS

Large buildings, including multifamily buildings and their associated parking structures, often require expansion joints to control movement. When this is the case, there are several things to consider, including the following.

### Type of Movement

Thermal movements are caused by daily environmental temperature changes in and around the structure. Thermal movement is primarily one directional in nature and is the result of the expansion and contraction of the building as it is affected by heat, cold, and humidity. Seismic activity is caused by shifting of the earth's tectonic plates (i.e., earthquakes, tremors, etc.). Seismic movement in buildings may be horizontal, vertical, in shear, or a combination of all three. Wind-load-induced movement is caused by high winds forcing the structure to sway. Wind-load-induced movement is normally perpendicular and/or parallel to the joint. This is common where a low horizontal building span meets with a taller vertical element, such as the communal space of a multifamily building adjacent a high-rise component.

### Nominal Joint Size

The nominal joint size is the designed width of an opening at a median temperature as dictated by the structural engineer. The expansion joint system selected needs to accommodate the minimum and maximum



The form and appearance of expansion joints in multifamily buildings can vary based on the selection of type and materials.

dimensions of the movement range for the given joint width. For thermal concerns, this means the joint needs to move at least 25 percent in both directions (e.g., a 4-inch joint needs to be able to shrink to 3 inches or expand to 5 inches at any given time). For seismic and wind-load concerns, the joint needs to be able to move 50 percent in either direction (e.g., a 12-inch joint needs to be able to shrink to 6 inches or expand to 18 inches at any given time). Note that seismic joint widths may increase with higher floor levels as well.

### Joint Applications and Locations

The design of the project will determine whether it includes interior joints, exterior joints, or both. Typical interior application conditions of expansion joint systems include floors, walls, ceilings, and roofs.

However, joints may be needed on exterior building veneers, soffits, parking decks, patios, and roofing systems as well.

### Loading Requirements

Different expansion joint systems have different capabilities to withstand the daily wear and tear of the building use. Floor joints in particular are subject to different types of traffic, such as pedestrians, equipment, or vehicular. The room location, such as a heavily used lobby or corridor compared to storage spaces or ancillary spaces, will influence the loading as either uniform, rolling, or concentrated. Consider the route for tenants to move their belongings in and out of a multifamily building. If there is an expansion joint in that location, it will be subject to repeated rolling loads.

### Form and Appearance

Different expansion joint systems bring different appearances: some look simple and utilitarian, others include metallic covers, while still others can accept inserts of finish materials. Depending on the desired aesthetic, anodized metal finishes, Kynar coatings, or foam seal colors can all be considered to either complement the decor, provide an accent, or minimize its appearance. Final selection can be based on things like the room location, adjacent finishes, or simply the nature of the multifamily building.

### Fire Resistance or Moisture Control

Sometimes, expansion joints need to cross areas that must fire resistive or retard vapor and moisture. In these cases, the selected expansion joint systems need to provide evidence of providing such capabilities. Vapor-resistant expansion joints need to be tested to show their degree of permeability to moisture or vapor. Fire-rated joints should be tested to meet ASTM E1966 and E1399. Note that water infiltration will usually destroy fire barriers, therefore systems with an integrated water guard (with proper drainage) can keep barriers dry and effective.

### ELEVATOR CABS

Among the most used spaces in a multi-story, multifamily building are the elevator cabs. As such, these cabs are subject to deterioration and damage precisely because of their heavy use. This damage gives the impression that the owner does not care about upkeep of the building, which in turn may create a negative perception of the entire organization. Therefore, the elevator

cabs need to be upgraded regularly either to overcome a worn and unsightly appearance or simply upgrade the look to be consistent with the rest of the building.

Further, leaving an old, damaged, dark, and dingy elevator cab out of a larger building renovation project can very well make the appearance look worse and leave an otherwise beautiful upgrade project with a serious black eye.

The most cost-effective and innovative way to carry out such an elevator cab upgrade is to use preconfigured elevator cab renovation systems from a manufacturer that has a specialty line of products to address these needs. This system can include any or all of the following elements.

- **New panels:** The elevator panels that line the walls primarily make up the appearance of the cab. These panels

also typically take quite a beating from tenant move-ins and outs, maintenance equipment, vandalism, and whatever else may come their way. Fortunately, the panels can be made of durable and rugged materials that can look like any range of materials, from wood to metal to stone or custom choices. Picking the best looking and most durable material at the outset means that the building owner will not need to replace it with a more durable product that should have been installed in the first place.

- **New ceilings and lighting:** Elevator ceilings come in many different styles and can be selected to suit an overall design concept. Lighting in elevator cabs can be chosen from among common lamping options, such as halogen, incandescent, fluorescent, or energy-efficient LED.

Keep in mind that people tend to be more comfortable in a well-lit interior, so combining a brighter ceiling with increased lighting output can help people feel more relaxed inside, not to mention create a newer and cleaner look. The energy efficiency of increased elevator cab lighting may not seem significant at first, but consider that, in most cases, these lights stay lit 24 hours a day, seven days a week, which can add up to a lot of energy cost. By selecting energy-efficient LED lighting, energy costs are reduced, and their longer service life notably reduces maintenance costs for replacements.

- **New handrails:** Handrails in elevators not only address ADA or accessibility code requirements, but they also provide stability for users (i.e., something to grasp) when the elevator stops and starts. Beyond the people aspect of handrails, they provide a means for a complete look to the cab and can act as a wall guard too. By providing a stand-off surface from the wall of the cab, it can reduce the chance of equipment or furniture striking the wall panels. As part of a total system for elevator cabs, handrails come in different shapes, sizes, and finishes.

Paying attention to both the appearance and durability of elevator cabs can clearly pay off in terms of creating successful, innovative interiors for multifamily buildings.

**CONCLUSION**

Residents of multifamily housing are understandably affected by the events of 2020 and looking for places where they feel safe, such that their health and welfare are protected. Building owners are usually happy to meet this need as long as it can be integrated appropriately into the building construction and budget. Architects and other design professionals can use the approaches presented in this course to meet these needs in creative, appropriate, and affordable ways.

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Photos courtesy of Inpro

Discussions with clients about elevator cab updates should be part of preplanning for any renovation project. New cab panels, trims, ceilings, and LED lighting bring such projects to full-circle completeness (left). Renovation projects to modernize elevator cabs can include wood patterns with custom graphics plus new ceilings and stainless steel handrails (right).

