CONTINUING EDUCATION

# Prefabricated Ornamental Railings

## Beauty, safety, and ease of installation all come together when stainless steel railing systems are prefabricated instead of constructed on the job site

Sponsored by AGS Stainless, Inc. | *By Andrew A. Hunt*

All photos courtesy of AGS Stainless, Inc.

**Ornamental stainless steel railings can add a touch of luxury and class to both interior and exterior designs, and can be easier for builders and architects when prefabricated off the job site.**

Metal ornamental railing systems can provide an elegant and functional finishing touch to a building project. However, it is important for architects to understand the difference between the types of materials available, as well as where and how the railing system is manufactured, and how it will be installed. By understanding these aspects of the railing system, architects can better manage this aspect of the building project.

This course will discuss the overall advantages of choosing a custom-fabricated railing system built off-site compared to off-the-shelf products or locally fabricated railings. In addition to looking at the practical considerations of how different fabrication choices affect project time and budget, this course also identifies some ways to address health, safety, and building occupant welfare.

The traditional practice of building railing systems on-site can present architects and building professionals with several challenges that can affect overall project timelines, budget, and safety. When a general contractor builds a railing system on-site, he/she handles the entire process, from design to installation. This approach can add to project costs through time delays since the time spent on the railing system is time taken away from other aspects of the building project. Alternatively, contractors may choose off-the-shelf railing systems, which greatly limit the designer's ability to provide custom and personalized touches to the overall project design.

Contractors often tend to choose wood, composites, or aluminum as the materials for on-site railing systems because they are easier to work with. Aluminum, for example, is very popular because it is strong, lightweight, and durable. These materials, however, are not always the best choice for a specific project design. Stainless steel railings, on the other hand, are considerably stronger, more durable and offer greater design flexibility than the previously mentioned materials. Whereas these other materials can be bought off the shelf and cut

### CONTINUING EDUCATION

1 AIA LU/HSW

**Learning Objectives**

After reading this article, you should be able to:

1. Explain the advantages of a prefabricated custom railing system and an all stainless steel railing system.
2. Compare and contrast the railing system materials used for posts, top rails, and infill.
3. Describe common challenges with locally fabricated metal rail systems.
4. Evaluate how stainless steel railing systems meet health, safety, and welfare requirements.

To receive AIA credit, you are required to read the entire article and pass the test. Go to **ce.architecturalrecord.com** for complete text and to take the test for free.

AIA COURSE #K1608C

Commonly used materials for railing posts include wood, aluminum, composites, or stainless steel. Wood posts wear well if maintained, but steel posts are more durable.

to length on-site, stainless steel railings must be custom fabricated before they can be installed.

When a contractor chooses to include custom stainless railings on a project, he/she usually hires a local metal fabricator/job shop who will design, manufacture, and install the railing system. While this practice can result in unique work from local specialists, it runs the risk of adding to the overall project cost and completion time. On-site railing work also increases the health and safety risk to the fabricator/installer, the contractor, and the building team, especially when materials need to be welded on-site.

As an alternative, architects and building professionals can choose that the stainless steel railings they specify for their projects be prefabricated. This option is more efficient and more reliable than using a local metal fabricator. It also takes some of the workload off the general contractor. Architects can consult with a manufacturer's railing specialist to determine the best design choice for the project, and then provide their CAD designs to the manufacturer for customized fabrication. The manufacturer will deliver the finished product to the construction site as a ready-to-install, fully componentized system. The result is a project that benefits from customized, factory-crafted ornamental railings, without the time, expense, and uncertainty of local fabrication.

There are several benefits to using prefabricated railings. First, because the architect can custom design the railing, he/she can make sure that the design works perfectly with the rest of the building design. As noted above, architects can consult with railing specialists from the manufacturer if they have questions about their design or would like to explore design solutions they may not have initially considered.

Once the custom design is sent, the railing system is then produced in a centralized factory, where quality-control protocols ensure consistent product excellence and lean manufacturing processes reduce construction waste, when compared to local fabrication.

Prefabricated systems also mean fewer on-site worker safety concerns because the installation tends to be easier, safer, and quicker than with locally fabricated railings. No on-site cutting or welding is needed, and thus the building site and construction team can avoid the risk of sharp metal debris from the rails, or risk of electric shock or toxic fumes from the welding.

All of the above elements translate into shorter installation times, lower project costs, and improved safety for the on-site construction team. They also contribute to a more streamlined project schedule, which can also mean lower overall project costs.

## ELEMENTS AND EVALUATION OF RAILING SYSTEM MATERIALS

The basic components of ornamental railing systems include the post material, the top rail, and the infill. Together, these components make up the main visual elements of a railing system. There are many different options for component materials, with either a single material for the whole system or with different materials combined for a railing that is unique to the specific building project. In addition to being designed to enhance the building's aesthetic elements, railings should be designed for strength, durability, and safety.

### Railing Posts

Commonly used materials for railing posts include wood, aluminum, composites, or stainless steel. Wood posts provide a classic look, and as long as the wood is treated properly, they should be durable and have a relatively long lifespan. With wood posts, the force is directed to the joist and rim joist connections, and so builders need to pay close attention to post and joists framing procedures and select the most appropriate fasteners. There are a wide variety of framing techniques, each of which carries with it different challenges and costs.

Aluminum posts are commonly used in off-the-shelf systems because of their light weight and easy installation options, and because they tend to be more durable than wood or vinyl. They distribute the load well and are usually coated with a powder-coat finish to help prolong the life of the metal.

Composite railing posts tend to be a low-maintenance option that provides building professionals with a range of styles, colors, and design options. These systems are often sold to complement a manufacturer's flooring products and thus offer a unified, finished look when installed.

Stainless steel posts tend to combine the best of all worlds in that they are strong, durable, and are usually engineered to exceed most local building codes. Stainless posts can be fabricated with a range of finishes, including brushed, polished, or powder-coated paint, and they resist corrosion very well.

### Top Rail Materials

As with posts, the top rail is also usually made of wood, aluminum, composites, or stainless steel. While the top rails serve a different purpose than the posts (i.e., they do not deal with as much force as the posts), the material choices have similar pros and cons. For example, wood top rails make an aesthetic statement and work well for interior railing systems. However, even the best-treated wood will eventually give way to the elements when used outdoors.

Aluminum and composite materials are subject to wear and tear as well. Additionally, some composite materials require a supporting structural component to reduce the risk of deflection in the top rail. And, as with posts, stainless steel works as an ideal material because of its longevity, corrosion resistance, and finish options. For example, a brushed stainless or satin finish can be beneficial for top rails to retain less heat than highly polished surfaces, and thus ensure that the railings can be comfortably used even in the hot sun. This benefit takes into consideration the health, safety, and well-being of building occupants and the general public by allowing the rail to be used regardless of the time of year, all while allowing the designers the freedom of creative design for aesthetics.

### Welded Connections

An easy way to identify a custom-made stainless steel railing are the connections between the systems components. Most custom-made stainless steel railings have welded connections. On the other hand, a tell-tale way of identifying a kit is the snap-on pieces. For example, a top mount post on a custom-made stainless railing system will be welded to the base plate. Welding is typically done by hand and allows the skill and craftsmanship of the fabricator to shine through. With a kit, the post material is cut to length and then fitted over a sleeve on top of the base plate. The post and base plate are secured together with either an adhesive, screws, or both. The same is true for end caps. At the end of the run on a custom-made stainless steel top rail, the end cap will be welded to the top rail. When built by a true craftsman, there will be no evidence of a joint. It will be polished to create the illusion of a single piece of solid metal. With a kit, the end cap is inserted into the top rail and secured with an adhesive.

### Infill Materials

The infill is an important component of the system and can be made of cable or bar rails (typically stainless steel) that can be oriented vertically or horizontally, glass panels, wire mesh panels, or specialty materials unique to the project. Depending on the placement and purpose of the railings, health and safety considerations will also factor into material and infill choices. For example, a railing system on a multistory apartment building or hotel may include tempered glass panels as infill to provide a solid physical barrier between the decks and the ground. Alternatively, a homeowner who installs a new deck in their yard may desire a railing that provides a clear line of sight to the yard without the frequent cleaning required of glass and, in this case, cable rails may be the perfect solution. Or vice-versa. In short, the project needs will determine the infill solution and the material.

Cable infill, or "cable rails," as they are commonly known, work well for both indoor and outdoor railing systems. They can easily be mounted to almost any post style or mounting configuration (top mount, side mount, core drill, etc.). Cables are a popular component of railing systems because they are thin, flexible, and yet very strong. In fact, stainless steel cables can usually withstand 1,000 to 3,000 pounds of force without breaking. Cable infill can provide a sleek and modern look, and can appear practically invisible from a distance, providing a nearly unobstructed view of the surroundings. This is why cable railings have become so common on decks where the view is striking (like around the ocean, mountains, lakes, etc.). Cable railing also looks great indoors, as it can tastefully define spaces, while maintaining a feeling of openness within the living areas.

Like all infill components, cables are subject to building code requirements. There are minimum loads to be resisted and maximum openings to be heeded. The load requirement is a 50-pound horizontal force applied on a 12-inch square area. The opening size is governed by a 4-inch sphere. What often happens is that both of these provisions are combined to where the specification documents or the inspectors refer to a 4-inch sphere being pushed by a 50-pound force. The fact of the matter is that the 4-inch sphere is intended to be a measuring device, not a load-delivering implement. Nowhere does the code mention the two requirements acting together.

Glass infill provides a railing system with a clean, transparent look that is ideal for situations where added safety is required. Tempered safety glass is frequently used, providing a strong, safe infill that protects building occupants from accidental injury, while delivering a classic look for the railing design. An added benefit of glass infill is that it also serves as a wind barrier, which can be useful for outdoor decks in coastal areas or on the upper levels of buildings, where winds tend to be strong.

Bar rails are another classic railing infill look. Bars may be square or cylindrical, providing a strong, secure infill for the railing system with an aesthetic appearance that highlights its strength. As a safety feature, railings with horizontal or vertical bars can prevent accidents or serious injury by providing a secure barrier as part of the railing system. Bar rails have traditionally required on-site fabrication and welding, which limited the aesthetic element because the welds could be difficult to "finish" on-site. New technologies now provide prefabricated systems that architects and building professionals can design ahead of time and have custom made at a fabrication facility. These component-based systems remove the need for the extensive on-site construction and welding, and they come perfectly "finished" and ready to be installed.

## UNDERSTANDING STAINLESS STEEL IN ORNAMENTAL RAILING SYSTEMS

There are several considerations to keep in mind when selecting the material type for a railing project. First, stainless steel is stronger than aluminum. Tensile strength is measured as force per unit area, and in the International System of Units (SI), the unit is the "pascal" (Pa); a multiple is called "megapascal," or MPa. The ultimate strength for stainless steel is 590 MPa versus that of 300 MPa for 6061-T6 aluminum. Moreover, the surface hardness of stainless steel is much higher than that of aluminum, and thus it resists scratches and is easier to maintain than its aluminum counterparts. Additionally, stainless steel's fatigue performance is twice that of aluminum, and that adds to a product's durability. In terms of railings,

**Glass as an infill material can help provide a sense of privacy, security, and also, when clear, open up visibility for occupants.**

a stainless steel rail will likely provide many more years of safe, aesthetically appealing use than an aluminum system.

The benefits of stainless steel's additional strength are evidenced in the railing system's posts and handrails, which can be constructed to be much thinner than those made of aluminum. A "strength-equivalent" stainless post is 50 percent thinner than an aluminum post.

Stainless steel is 100 percent recyclable, making it a material of choice for architects who design with sustainability in mind.

Appearance is also a key advantage of stainless steel. No other commonly used railing material can match the ease of maintenance and stunning good looks of stainless steel. This is one of the reasons you will find it used frequently on luxury appliances like high-end gas ranges and refrigerators.

### Different Types and Grades of Stainless Steel (304, 316)

Stainless steel is usually divided into five categories: ferritic, martensitic, duplex, precipitation hardening, and austenitic, the most commonly used stainless. Austenitic stainless steel comes in many different grades, used for different purposes, with the two most common grades for architectural applications being Type 304 and Type 316.

Type 304 stainless steel is the most common grade, also known as A2 stainless steel or "18/8 stainless steel" (18 percent chromium and 8 percent nickel, which are the main non-iron constituents). This grade of steel is a popular choice for building materials, machinery parts, and food-handling equipment because it has low electrical and thermal conductivity, and it resists corrosion remarkably well. Because of these traits, Type 304 is a popular choice of material for indoor and outdoor railings.

While Type 304 stainless steel is highly resistant to corrosion (both environmental and corrosive media), it is susceptible to pitting and crevice corrosion in warm environments when exposed to chlorides, namely marine environments. It is also susceptive to stress corrosion, cracking at high temperatures (above 140 degrees Fahrenheit, or 60 degrees Celsius).

Type 316 stainless steel, otherwise known as "marine-grade stainless," is the second most common austenitic stainless steel. Higher nickel content (10 to 14 percent) and the addition of molybdenum increase this grade's resistance to corrosion. Like Type 304, this type of stainless steel has a low conductivity of electricity and heat, and so it is appropriate for a wide range of uses. Unlike Type 304, this type of stainless steel resists pitting corrosion very well, making it desirable in exterior and even coastal environments.

### Post Gauges (11, 14)

Railing systems can fail if the post gauge is too thin, even if made of tubular steel. It is important to work with the railing manufacturer to ensure the tube size and the post gauge specified is appropriate for the application and use intended.

### Spacing and Line of Sight: Steel vs. Other Materials

The spacing between rails is a key building code requirement linked to the health, safety, and welfare of building occupants. Complicating matters, the International Residential Code (IRC) regulates single-family dwellings, and the International Building Code (IBC) regulates multifamily and commercial dwellings. Additionally, different codes apply to railing systems installed on stairs vs. decks. Prefabricated railing systems can make meeting these various code requirements easier.

Open stairs greater than 30 inches in height are required to have a guard installed on the open side, as well as a handrail. These rails must be at least 34 inches high, from the nosing of the stair treads. The spacing between the rails must prevent a 4⅜-inch sphere from passing through, except space where the stair riser, stair tread, and bottom edge of the rail meet, in which case, 6 inches is the minimum. As specified by R311.5.6.3 in the IRC, the top edge of the handrail must be between 34 and 38 inches above the nosing of the stair tread, and the handgrip must provide 1½-inch space between the handrail and the guardrail or wall.

Decks that are designed to be higher than 30 inches above grade are required by code to have a guardrail; however, in cases where a building professional chooses to install a guardrail on a deck below 30 inches, they still must meet the code requirements. For homeowners, the code requirements for single-family detached homes can be found in the IRC, which requires a railing to be a minimum of 36 inches from deck to the top of the rail. However, the railings can exceed that height as long as all other code requirements have been met.

Continues at ce.architecturalrecord.com

***Andrew A. Hunt*** *is vice president of Confluence Communications and has been a writer and consultant in the green building and building science industries for more than a decade. He has authored more than 100 continuing education and technical pieces as part of a nationwide practice.* ***www.confluencecommunications.com***

**Stainless steel is one of the most forgiving materials, resists corrosion, and is very easy to maintain. The ultra-thin cabling also allows the surrounding natural beauty to be highlighted with minimal distraction, yet the quality craftsmanship and fine detailing are just as breathtaking when in focus.**

The code is flexible regarding infill materials, but mandates that the spacing between the materials (e.g., rails, glass panels, and rods) does not include openings large enough to pass a 4-inch diameter sphere through.

Multifamily dwellings and commercial properties are subject to the codes provided in the IBC. Because many apartments and commercial buildings extend multiple stories in height, the guard railing height requirements are higher than for single-family buildings. The IBC height requirement for guardrails is a minimum 42 inches, from the finished floor to the top of the rail. However, as long as all other code requirements are met, the railing can exceed that height. These railings have the same infill opening spacing requirements as railings for single-family homes.

### Line of Sight

When architects design a porch or deck for a house that has a view, the last thing they want to do is obscure that view with a bulky railing system. With a stainless steel railing system, cable infill can provide a seamless connection between the built and natural environments. As noted earlier, thin cables can often become "invisible" from a distance, thus giving the illusion of an unobstructed view, and yet provide the necessary safety for the building occupants.

Cable infill can withstand the wear and tear of different weather throughout the year, and because it is corrosive resistant, it requires minimal maintenance. While glass infill can keep the line of sight clear, it does risk being coated in dirt, and thus will require frequent cleaning. In comparison to materials such as wood or aluminum, stainless steel provides options for clear sight lines (as noted above) along with strength.

## AESTHETIC BENEFITS OF STAINLESS STEEL

Stainless steel is one of the most forgiving materials when it comes to a reliable aesthetic. The material resists corrosion and is very easy to maintain, whether used for railing systems or home appliances. The aesthetic element stems primarily from how the steel is finished, whether that finish achieves a highly polished marine look, a refined brushed-satin look, or adds color and texture through a powder coating.

### Proper Care & Maintenance

This highly durable material is called "stainless" steel and not "stain-free" steel. When specifying stainless steel for an exterior application, and especially when the location of the project is an environment that is in close proximity to a mixture of highly corrosive elements (salt, chlorines, heavy industry, etc.), periodic cleaning of the railings will improve both the appearance and the performance of the product.

### Finishing Options

The Specialty Steel Industry of North America (SSINA) provides on its website a list of architectural finishes for stainless steel used for railings. The most common finishes are: 180 grit polish, finer polished finishes (240, 280, and 320 grit), and buffed finishes.

180-grit polish is the most common polish finish for railings, and virtually all railing components made of stainless steel can be polished. For example, welded products or components can be polished, as can different shapes of steel tubing (e.g., round, square, or rectangular).

For projects that emphasize the aesthetic element of stainless steel, or where a smoother finish is needed, finer polished finishes (240, 280, and 320 grit) can be used. These finer finishes are more reflective than lower-grit finishes, and the finished product is smoother and easier to clean; finer grit finishes also resist corrosion better than low-grit finishes.

Buffed finishes tend to be selected for aesthetic purposes when a highly polished look is preferred, or when corrosion resistance and easy cleaning are desired. This finishing process is done mechanically, usually with a 320-grit, and then followed with a buffing process.

A final finishing option for railing systems is a powder coat. This type of finish is great for adding a pop of color to a railing system, while also helping improve the product's durability. Powder finishes are applied as a dry powder and then hardened under heat, and the treatment can provide an appearance similar to paint, but it is considerably more durable. Moreover, the treatment process is less toxic than paint, and it can withstand extreme temperatures. This final point can be very useful when it comes to hot weather and railing systems in that a good powder coat can help reduce the heat retention on the top rails. In climates with hot summers, such a finish can ensure that the railing is safe to touch, and thus functional even during hot weather.

## PRACTICAL BENEFITS OF SPECIFYING PREFABRICATED STAINLESS STEEL RAILING SYSTEMS

This section offers practical examples of how and why selecting a prefabricated stainless steel ornamental railing system is the best option for architects and builders. It will look at the common issues encountered when railing systems are manufactured and installed by local metal working companies, and also discuss the three main advantages of a high-quality railing manufacturer.

### Common Challenges in Designing Railing Systems

Railing systems are often thought of as a secondary element of a building in part because they do not contribute to the building's structural design. What they do contribute to—and are essential for—is the safety of the building occupants. Whether the project is residential, commercial, or government, the challenges of incorporating a safe, secure, and site-appropriate railing system is anything but a secondary design decision.

Some of the most common design challenges come in the form of balancing the railing systems appearance and function, all while staying within the project budget. Let's look at these issues one at a time.

Appearance is an important consideration when designing a railing system for a building. For example, the railing system can be designed to highlight a certain area of the building or serve as the highlight of the building. Alternatively, the railing system can be designed to be as unobtrusive as possible and to let other building features hold the aesthetic focus. Either way, the fact is that the design options for railing systems are seemingly endless, and thus the design process and initial drawings should be done in consultation with a railing specialist who can work with the architect to find the most suitable design for the project.

The second and related issue is function. While an architect might at first wish to include a railing system that is custom designed to meet the aesthetic needs of the building, the railing first and foremost must function as a safety barrier for the building occupants. All railings must also meet safety code requirements for the specific building type. In some cases, the function may be not just to provide a barrier between an exterior deck and a dangerous drop to the ground, but also to block the wind, as with glass infill. Alternatively, the function may be to provide a barrier but also clear sightlines for the vista a client has chosen on their property. In either case, the function of the system is something that an architect needs to discuss in detail with a railing specialist, as well as with the client.

Finally, the budget is an ongoing challenge when designing all aspects of a building, and railing systems are no exception. The difference between off-the-shelf railings, custom-designed and locally fabricated railings, and

custom-designed and prefabricated railing systems can greatly impact the overall project budget. Again, architects should work with a railing specialist to help them find a solution that works best within their budget. As noted earlier, custom-designed, prefabricated stainless steel railing systems are one of the most reliable and budget-friendly options currently on the market.

All of the points above support the practice of verifying CAD design plans with a manufacturer before moving ahead with final railing design decisions. A railing manufacturer can work with the architect or building design team to make sure that all elements of the design are appropriate for the specific situation. Moreover, each of these challenges can be minimized by choosing a prefabricated stainless steel railing system with stainless steel components rather than working with mixed material systems, such as composites and vinyl.

### TIG Welding On-site vs. Custom Prefabricated

Tungsten inert gas (TIG) welding, technically termed "gas tungsten arc welding," or GTAW, uses an electrode made of tungsten shielded by a gas nozzle, usually argon or helium. The gas displaces the oxygen and other elements, and thus produces a high-quality weld.

TIG welding can present some possible safety hazards that are best managed in the controlled environment of the manufacturing plant rather than in a residential or job-site environment; for example, exposure to welding fumes, fire, and welding flash.

**One of the main benefits of prefabricated ornamental railing is that it removes the need for TIG welding. TIG welding can present some possible safety hazards that are best managed in the controlled environment of the manufacturing plant rather than in a residential or job-site environment.**

Aside from the possible health and safety risks of on-site TIG welding, when the process is done on-site for a railing system, the welds may not be finished properly, thus reducing the overall aesthetic appearance of the rail system.

The best way to prevent the potential problems of on-site welding is to have stainless steel railings custom designed and prefabricated by a professional manufacturer. This process removes the primary risks of fire, fume exposure, flash burn, and weld flash on the work site, and adds the benefit of having all the railing system's welded connections precisely finished in a quality-controlled environment. The finished product is thus much cleaner than one completed on-site, and saves the general contractor the time and responsibility of building it from scratch or employing and overseeing a local fabricator/job shop to do the work.

### The Challenges of Subcontractors, Scheduling, and Job-Site Management

One of the main benefits of custom-designed, prefabricated stainless steel railing systems is that they are designed for easy assembly. Most manufacturers will ship the prefabricated railings with the components numbered for easy identification in easy-to-handle packages. In these packages, the manufacturer will include easy-to-follow installation instructions with all of the required hardware, and the contractor or builder simply has to assemble the system. If all of the work has been done properly

ahead of time, and the architect has shared the CAD work and consulted with the manufacturer before having the railings fabricated, the system should be quick and easy to install. Moreover, it should be fabricated with the highest level of quality control.

In comparison, stainless steel railings that are designed and installed by a local fabricator/job shop can present many challenges, some of which stem from the fact that the fabricator is a subcontractor. While independent railing fabricators certainly can provide excellent customized work, any time a subcontractor is employed for a project, the general contractor runs the risk of unexpected time and cost delays, both of which can affect project management and project scheduling.

A subcontractor means extra work for the building team, and it also means potential time delays that can affect other aspects of the project.

In the case of railing fabrication and installation, the subcontractor will require the space to work, and that includes providing a safe space for any on-site welding that needs to be done. If, for example, a railing installation requires that the subcontractor set up the site, spend several hours welding, and clean up when finished, this process may mean that other workers cannot safely work in the local area during this phase of the project. This sort of delay can cost both time and money, and can compromise work scheduled for other elements of the project. From a project management standpoint, subcontractors can be somewhat of a wild card, and if there is a practical way to avoid using them for certain elements of the project, the project may go more smoothly and be more likely to be completed on time and within budget. In short, with prefabrication, job-site superintendents/project managers have fewer scheduling crises.

## CONCLUSION

Prefabricated stainless steel railing systems provide architects and building professionals with a straightforward and reliable means to design and install customized, strong, and durable railing systems for their clients. The benefits of the material and the off-site fabrication process can result in shorter project times and lower maintenance costs in the long term.

## ALUMINUM VS. STAINLESS STEEL RAILING SYSTEMS

When it comes to choosing a material for a railing system, architects and building professionals need to weigh the options in terms of their project goals and budgets. Two of the more common base materials for railing systems are aluminum and stainless steel.

Aluminum is a popular choice because the material is strong, lightweight, easy to work with and, when properly separated from more noble metals like stainless steel, rust and corrosion resistant. It is also durable and can handle long-term exposure to most weather, all while keeping its original appearance for many years. This popularity has made aluminum railing systems common for off-the-shelf purchases. Because aluminum is relatively easy to cut to length on-site, it allows the contractor to self-install, thus helping to keep project costs low. It also lends itself to a wide variety of styles. Aluminum railing systems can be designed to look old fashioned or more modern, depending on the railing design. As mentioned, the railings can (and should) be powder coated, which provides not only specific color choices but improves the longevity and durability of the product. Aluminum railings are also easy to maintain and require very little in the way of cleaning. They are also eco-friendly in the sense that the material is recyclable.

While aluminum is a popular choice for many reasons, stainless steel has several advantages over it for railing systems. As a major benefit, the surface hardness and strength of stainless steel is much greater than that of aluminum, making it more scratch resistant, durable, and easier to maintain. This means a stainless railing system is more likely to provide a lifetime of use.

Because stainless steel is a much stronger material, it takes less material to generate an equally strong railing system, which is why aluminum posts and handrails tend to be much larger than their stainless steel counterparts. A “strength-equivalent” stainless steel post is 50 percent thinner than an aluminum post.

**Steel has many advantages over aluminum, including strength and longevity. In exterior applications, stainless steel can outlast aluminum by decades with little maintenance. This image shows stainless steel railing configured with a side mount post, cable rail, and flat top rail.**

Aside from the strength and maintenance benefits, stainless steel railing systems can be customized by the architect or designer to meet the specific aesthetic and practical needs of the project. Rather than relying on the pre-designed options of aluminum railings, architects can optimize their design to make the most of the sightlines of a deck railing, and provide their clients with a personalized visual aesthetic that meshes seamlessly with the building design.

Stainless steel railings offer a wider variety of infill options that can maximize safety, while minimizing visual obstruction of the surroundings by the railing. For example, in situations where physical safety is of paramount importance, a tempered glass infill may be used to provide a solid barrier between the building occupants and the other side of the railing. Glass infill can also help reduce the impact of the wind, which can also be a hazard on some buildings. The strength and durability of a stainless steel railing system can provide this added level of safety, all while emphasizing a sleek, modern design.

Finally, stainless steel provides a much greater visual impact to the project. While a well-designed aluminum railing system will be functional and can look nice, stainless steel delivers that "wow" factor that makes people stop, look again, and admire.

## THE MILL HOUSE

**Aluminum posts and handrails tend to be much thicker than their stainless steel counterparts. A "strength-equivalent" stainless steel post is 50 percent thinner than an aluminum post, which can help open up interior spaces and create a more contemporary design.**

Building design and construction along the Maine coast presents some challenges unique to the rocky geography and the maritime environment. The rugged coastline is beautiful, and the weather is variable, with hot summer days to wild winter storms, and everything in between. But no matter the weather, residents who choose to live in Maine, either for the summer or year round, do so to appreciate the natural beauty of the area.

In 2014, the Maine chapter of the American Institute of Architects (AIA Maine) awarded its biennial Design Award to the Mill family's island retreat on Chebeague Island, which is located in Casco Bay, several miles off the coast of Portland. Designed by Carol A. Wilson Architect, the 2,600-square-foot home is built on two acres of land and boasts a 180-degree view of the immediate coastline and seascape. One of the key design features of the house is its railing system, which seamlessly integrates the indoor and outdoor spaces, while providing an added layer of safety for the building occupants.

The patio and porch areas include a cable railing system with sleek post profiles and a flat stainless steel top rail. The thin cabling infill and minimalistic posts helped the designers ensure that the view from the patio was virtually unobstructed, all while gracefully merging the aesthetic of other elements of the home design with the outdoor space. The designer featured the integrated railing system as a way to accent the entire home, rather than simply using it as an afterthought.

The decision to incorporate a prefabricated stainless steel railing system into the Mill House design was prompted in part by the challenges of building on an island: all materials for the project needed to be ferried in from the mainland, and all building waste needed to be ferried out. By selecting a prefabricated railing system, the design-build team benefitted from a custom system that was easy to transport and simple to install, and that minimized waste on the site. Given the parameters of construction on this site, the benefit of having customized railings that did not have to be fabricated on-site saved project time and cost.

But the decision to use a prefabricated stainless steel railing system went beyond the benefits of reducing time and money: the durable nature of stainless steel is ideal for the harsh Maine coast environment, and the railing design options allow for a minimalist aesthetic that does not detract from the view.

A final element of this design choice is that the strength of the stainless steel system meets the safety needs of the structure, while providing a nearly transparent barrier along the porch. The prefabricated system also greatly reduces the chances of injury on the job site, particularly in comparison to having a railing system built and installed by a local fabricator.

## QUIZ

1. Which is a benefit of prefabricated stainless steel railings?
   a. They can be custom designed with CAD software.
   b. The in-factory fabrication means high quality control.
   c. They can be delivered to the construction site for easy and safe installation.
   d. All of the above

2. Which components make up the main visual elements of an ornamental railing system?
   a. Post material, top rail, and infill
   b. Post material, top rail, and base plate
   c. Top rail, infill, and foundation
   d. Infill, foundation, and snap-fit connectors

3. Which of the following materials is among the more commonly used for both railing posts and top rails?
   a. Vinyl
   b. Granite
   c. Stainless steel
   d. Bamboo

4. Which characteristic is the best indicator that a stainless steel railing has been custom made?
   a. Snap-on pieces
   b. Screw-in sections
   c. Welded connections
   d. All of the above

5. Which type of infill material might be used for a stainless steel railing system?
   a. Cable infill, or “cable rails”
   b. Wire mesh panels
   c. Glass panels
   d. All of the above

6. A "strength-equivalent" stainless steel post is what percent thinner than an aluminum post?
   a. 15 percent
   b. 50 percent
   c. 70 percent
   d. 85 percent

7. What is the most common grade of stainless steel?
   a. Type 102
   b. Type 304
   c. Type 316
   d. Type 440

8. According to the International Residential Code (IRC), on the main span of an open staircase, the rail spacing must prevent what diameter sphere from passing between the rails?
   a. 4 inch
   b. 1½ inch
   c. 6 inch
   d. 3¼ inch

9. Which architectural grit finish for stainless steel railings produces the finest-polish finish?
   a. 180-grit
   b. 240-grit
   c. 280-grit
   d. 320-grit

10. Which item in the list is NOT a basic component of an ornamental railing system?
    a. Post material
    b. Base plate
    c. Top rail
    d. Infill