



Material Selection for Handrails and Balustrades

A SPECIFIER'S GUIDE

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INTRODUCTION

The design and construction of handrails and balustrades is a crucial issue that may expose an architect, designer, specifier, builder, and/or contractor to expensive litigation if poorly thought out, executed, and especially if failure occurs. More significantly, there is a serious emotional and financial cost associated with injury, permanent disability, or death should this design element be overlooked.

Architectural handrails and balustrades are an essential part of the building design, so it is important to choose a material that complements your design goals. The end result must deliver on the design vision and satisfy the building owner's design requirements. The selected material must be functional rather than merely decorative, perform in accordance with safety requirements, and live up to all expectations in terms of appearance and durability. Even the smallest details, such as delivering a flush connection and a smooth continuous rail, are all essential to avoiding injury.

To achieve these outcomes when selecting materials for a balustrade or handrail, it is important to consider the rail's primary use, whether it will be used internally or externally, the environment in which it will be used, and the finish you want for your design. Below we consider these factors, and more, in detail.

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MATCHING MATERIAL TO SITE CONDITIONS

The raw materials used to create handrails and balustrades will need to provide a suitable level of durability based on the proposed location of the works. If timber is preferred, note that only specific species in durability class 1 or 2 are suitable for exterior works. If metal is being considered, the material should have an appropriate finish and be provided with a protection level class that is appropriate for the proposed location. Options include zinc coatings, stainless steel, aluminium or applied paint finishes.

Corrosive environments, such as buildings near the coast, environments where moisture is present, industrial zones and high-pollution areas, require special consideration. Challenging atmospheric conditions, including extreme temperatures, constant precipitation and the presence of chlorine, also fall within this category. To protect your investment and ensure its long life, you will need to choose materials that have been proven to withstand corrosive elements, such as hot dip galvanised steel, marine-grade aluminium or 316-grade stainless steel.





FACTORS IN MATERIAL SELECTION

Use and risk of damage

The installation environment and its expected use are also important considerations. For indoor and outdoor railing systems, for instance, the volume of traffic in a location has a significant impact and frequently necessitates stronger materials. A high volume of use can result in nicks, scratches, and more onerous maintenance requirements. For applications in public spaces, consider the potential for vandalism. The selected material should resist these types of damage to minimise maintenance and replacement costs.

Fixings and connectors

All metal connections must be chosen with consideration to their intended use and compatibility with the handrail or balustrade material. Coastal areas, industrial settings, and locations exposed to the elements all create highly corrosive conditions that can compromise the strength of such connections. The connections, which comprise all screws, nails, bolts, and brackets, must be specified with a specific level of corrosion protection to prevent premature breakdown due to exposure and/or corrosive reaction due to incompatibility with the base materials.

Loads and structural properties

The handrail and balustrade connections must be specified to have a specific level of strength based on where they are actually located within the building. Depending on whether the works are internal, external, a fire exit, or necessary to control crowds or people in a panic, requirements such as design loads will change. For more detail on load requirements for handrail and

balustrades, refer to the relevant Australian and New Zealand standards and building regulations.

In order to accommodate the design loads for the proposed works, members and components must be of an appropriate size. Going over the physical limits of the materials used to make handrails and balustrades is not advised. The amount of flexure that the member sections and connection points are exposed to will increase as the span of the handrail and balustrade sections grow.

Details and finishing

The handrail and balustrade finishes should be applied strictly in accordance with the manufacturer's instructions. If preparation or application is not performed correctly, the subsequent cosmetic and performance failures are difficult and expensive to rectify. In addition, be mindful of any local building regulations specifying tolerances with respect to handrail heights, climbable zones, baluster spacings and platform levels to eliminate the risk of rework.

Visual consistency and aesthetics

Besides serving their intended functional purpose and meeting legal requirements, handrails and balustrades can be much more. Elegant, contemporary, or vintage designs can add a striking focal point to any room and meld harmoniously with the architecture and interior decor in the vicinity. Different processes, such as anodising, powder coating, and plating, can produce a flawless aesthetic finish, resulting in a design element that is beautiful to look at, dependable and safe.

MAKING THE RIGHT CHOICE

Comparing common materials

While wood offers a more traditional appearance, metals like steel and aluminum are popular choices for commercial, industrial, and contemporary environments. When the view beyond the railing is significant, glass is frequently used. Below we compare these materials to help you determine which one is best suited to your requirements.

Steel

Steel or stainless steel is frequently recommended by architects as the material to use when balancing form, function, and cost value. It is commonly found in both modern and traditional designs, and it is known for its strength, durability and longlasting performance. Steel designs can also be highly ornate or decorative, providing designers with the ability to cut unique shapes into them to create striking architectural designs.

Note that there are different types and grades of steel, each with their own unique properties. For example, carbon steel, which is a cost-effective, long-lasting solution, especially when it is specified with a protective coating to prevent rust. While it requires coating touch-ups and may show signs of wear, carbon steel has an attractive black sheen, and it can perform to a high level when properly maintained. Stainless steel is also sometimes specified for its corrosion-resistant properties and modern finish.

Aluminium

Aluminum is a naturally-occurring metal with the extra benefit of not needing any additional treatment to prevent rust and corrosion. Furthermore, its light weight, malleability, ductility, weight-to-strength ratio and non-toxic composition makes it suitable for a wide range of indoor and outdoor applications. Aluminium's strength is generally reliant on the thickness of the structure and the particular aluminium being used. Accordingly, design plays a crucial role in ensuring the design has the required structural properties.

Though it can be cast, melted, formed, machined and extruded into a variety of shapes, the downside of aluminium's flexibility is that it is prone to dents and other types of damage that pose a concern for its long-term maintenance and appearance. For many applications this is a fair trade-off for the design freedom it offers.

Additionally, there are several finishing options available for aluminium rails, including polished and satin looks. Aluminum needs intensive upkeep to get rid of smudges and prints, even though satin finishes would help to hide fingerprints. It is important to consider how the finish is applied, with some methods, such as powder coating, polyvinylidene fluoride (PVDF) coatings and plating, offering more durability than others.

Wood

Wood is a strong, longlasting, and affordable material that can be carved into complex shapes and patterns. While it is considered a traditional material, it has been used to great success in contemporary settings. Wooden balustrades can be made in both soft and hardwoods. Softwoods feature warm, rich colours with a traditional rustic vibe and soft touch, whereas hardwoods have deeper richer colours and are more durable. Both can be stained or painted to enhance their colour, texture and appearance.

Although you can polish and apply sealants to wood railings, they will eventually decay outdoors. This will cause issues in highly-trafficked environments as damaged or cracked railings become a safety hazard for people who need to grab handrails for security. Therefore, railings and balustrades should be manufactured from an exceptionally durable species for above-ground exterior applications and moisture-laden environments.

Glass

Glass is a common material for balustrades because it lets light penetrate through and reflect throughout the space. In typical stair applications, glass is used for the primary structure and other types of materials, like metal or wood, are used for the handrails. It is brittle and prone to breaking, so it is not as secure as other options, though it can be reinforced with other materials. Steel cabling offers a viable, durable and cost-effective alternative if transparency is a key requirement.

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WORKING WITH A TRUSTED SUPPLIER

MODDEX

Moddex are Australasia's leading manufacturer of modular, no-weld, hot dip galvanized barrier systems. Pre-engineered for structural integrity, their proprietary systems are load tested and configured to Australian and New Zealand Standards (AS/NZS), Workplace Health and Safety guidelines (WHS/OSH), Australia's National Construction Code (NCC/BCA) and the New Zealand Building Code (NZBC).

Moddex has had the opportunity to work within diverse industry sectors. Having collaborated with clients across different industry spaces such as three-waters, education, multi-level commercial construction, road and rail, Moddex has been able to create unique solutions for different applications and environments.

Design through to installation

Investing in the Moddex system means they take care of the design, manufacture and installation of your project barrier requirements, delivering a turnkey, design build package. Being pre-engineered, with many years of research, development, design and engineering behind every pre-designed configuration, Moddex engineers can conduct a detailed evaluation of your handrail and balustrade design to ensure your Moddex system complies with the relevant building code and standards.

Moddex eliminates design and engineering costs, reduces installation costs, and minimises onsite fabrication issues with their smart modular handrail, balustrade and barrier systems. Supplied as a series of components with simple assembly instructions, every Moddex system can be adapted or extended with additional components or cut to size on-site.

Modular handrail, balustrade and barrier systems

Moddex hot dip galvanized systems are assembled via a simple, no-weld construction method, reducing

opportunities for corrosion. Modular components and fittings eliminate the need for specialist trades, hot works permits, fire spotters and welding protection to finished surfaces. The company have advanced safety conditions for installers by eliminating toxic fumes, welding in wet areas and fire risk hazards.

Their versatile range of products includes:

- **Assistrail®** - Disability Handrails. Offers smooth continuous top rail and complies with the Disability Discrimination Act and all classifications within the National Construction Code and the New Zealand Building Code.
- **Bridgerail™** - Bridge Barriers. Ensures balustrades on bridges can be specified and fitted effortlessly, with compliance guaranteed.
- **Conectabal®** - Commercial Balustrades. Mitigates risk and prevent falls from height.
- **Tuffrail®** - Industrial Handrails. Tough, corrosion-resistant handrails for use in areas where chemical fumes or sea spray could cause corrosion.
- **Ezibilt™** - Modular Ramp, Deck & Stair Solution. The ultimate pre-engineered modular solution for fast-tracked construction of accessibility stairs, ramps and decks.
- **KlipTread™** - Clip-On Walkway & Handrail System. A pre-engineered, clip-on walkway and handrail system specially designed and manufactured for bridge infrastructure.
- **Ezibilt®** - Trolley Bays. Safe and secure bays for trolleys with nine configurations.
- **Intac®** - Tactile Indicators. Tactile indicator pads to give direction on sites to the blind or visually impaired



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AU - 1800 663 339 | info@moddex.com.au
NZ - 0800 663 339 | info@moddex.co.nz

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