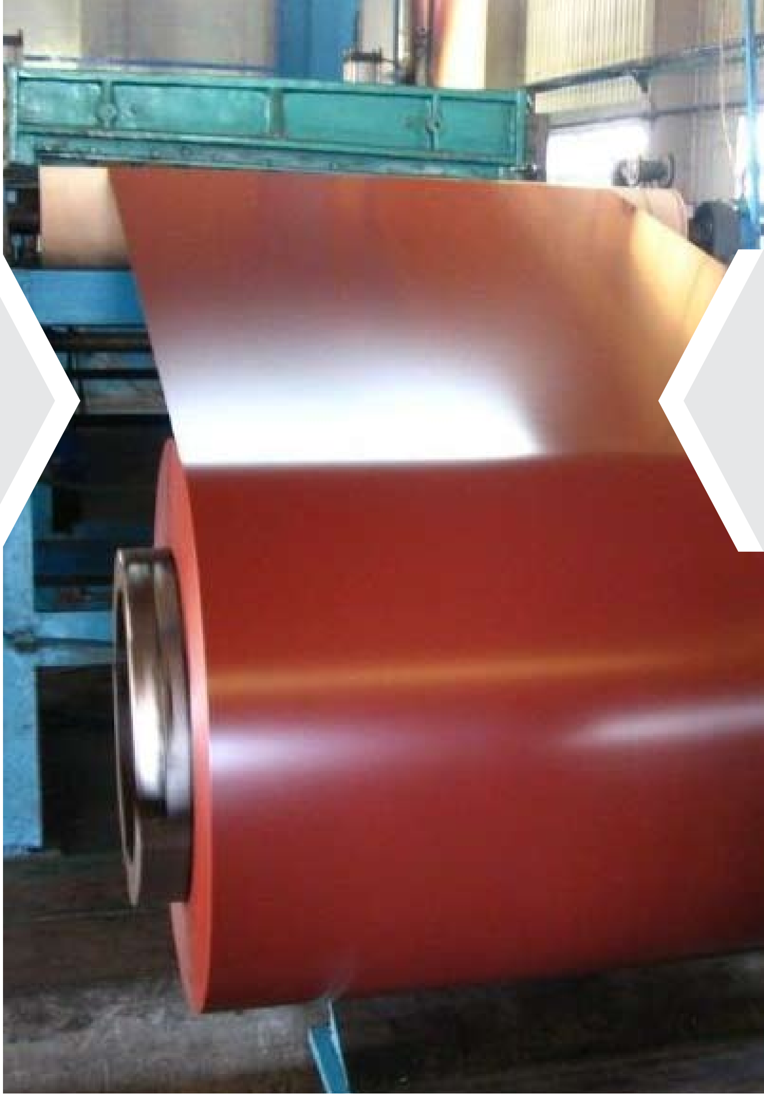
Colorbond®

Longer Lifespan of Pre-Painted Steel



Pre-painted steel

Pre-painted steel products offer increased corrosion resistance and enhanced aesthetics compared to bare metallic coated steel. The performance of a particular pre-painted product in a particular application and environment depends on both the metallic coating type, Coating Weight, the paint system design and application.

Key benefits of pre-painted steel

Two important benefits of pre-painted steel are the improved aesthetic appearance and the increased time to corrosion of base steel. Performance with regards to these benefits will depend primarily on paint durability, color retention and overall corrosion resistance attributes. Pre-painted steel products (especially light colors) have excellent solar reflective index value as compared to unpainted steel products.

A degree of weathering and fading over time is normal for all painted products. However, if a paint system weathers too quickly it can lead to large and premature changes in color and/or to delamination of the color coat. Non-uniform weathering can highlight difference in performance at different locations on structures. These effects can be minimized by the use of durable paint resins, quality pigments and appropriate paint film thickness and process control.

With regards to corrosion, the metallic coating on the substrate is still a key factor. The paint system provides additional few years of barrier corrosion protection. The effectiveness of the paint as a protective barrier film reduces with the erosion of the paint. Corrosion protection at cut edges and at piercings will also depend on the paint and primer formulations and how robust these are. In addition to perforation, the corrosion will also impact the aesthetics of the pre-painted product.

Attributes of Pre-painted steel

Paint Durability:

Paint has four components namely resin, pigment, solvent and additives. Paint durability refers to the resistance of paint to weathering and is largely determined by its resin. Weathering is the chemical degradation of the topcoat and primer resin due to the effects of temperature, rain and sunlight. During chemical breakdown the erosion of the resin happens, which results in a change in the appearance of the surface (i.e. change in surface gloss, color change, chalking,). When the erosion of the resin has sufficiently advanced, the paint pigments get exposed on the surface as chalk which can be washed away. (The typical stages of weathering are shown in Figure 1).

It is important for a paint system to be designed to resist weathering in the specific environment in which it is being used. This generally means resistance to combined high temperatures and high levels of UV light. Pre-painted products designed specifically for a set of conditions, will incorporate the required quality resin (binder) and pigments to ensure that the rate of chemical breakdown of the binder in target conditions is low, and therefore the rate of weathering is minimized.

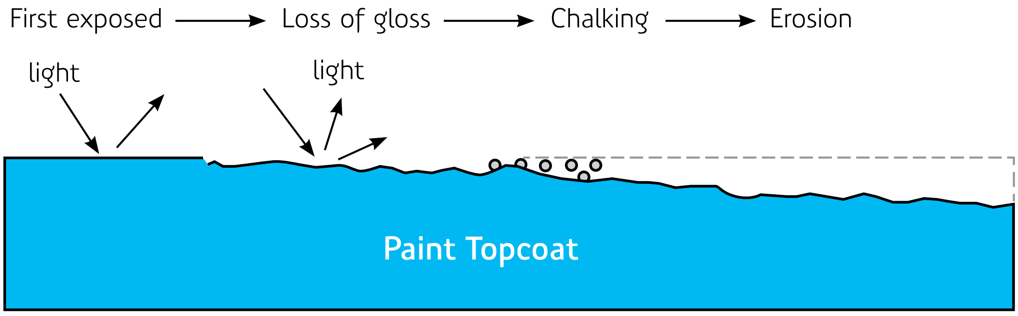


Figure 1. *Weathering of a paint topcoat showing the degradation over time.*

Colour Retention:

Color retention, or the "resistance to color change", is determined by the resin and pigments used in the topcoat.

Color pigments can be either organic or mineral/ ceramic (inorganic) based. Organic pigments are often brighter and usually have greater tint strength (this means less of a particular pigment can be used to achieve the desired colour). Organic pigments blends with the polymer or resin part of the paint more easily during paint manufacture. Hence, organic pigments typically offer a cheaper route to achieving a desired initial colour. However, these are typically less colour stable than in-organic pigments particularly in environments subject to high levels of UV light and will fade much more rapidly. Inorganic pigments normally have much greater environmental stability than organic pigments and are therefore key to producing topcoat paints that are resistant to high UV environments. All colours are not possible with inorganic, so your quality coated steel supplier may not able to supply you the bright colour requiring organic pigments.

Case Study: Pigments- Design for environment

Not all pre-painted products are formulated to withstand all conditions. Figure 2 shows the behavior of pre-painted steel exposed at an outdoor exposure test site in Queensland, Australia. The European designed paints exhibited significant color change after 3 years compared to products developed for Australian conditions.

Different manufacturers have different approaches with respect to pigment selection. Those with the highest performance requirements and most robust product evaluation and approval processes, involving rigorous accelerated and environmental testing, will ensure customer expectations are met or exceeded. Other paint components such as the resin and additives such as UV absorbers will contribute in varying degrees to colour retention. A durable resin will maintain its inherent UV resistance longer than a less durable resin that breaks down faster and ultimately weathers away. Additionally, more durable resins will degrade or "chalk" more slowly and therefore contribute less to colour change.

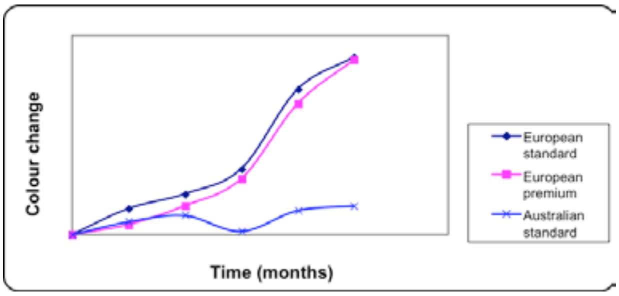


***Figure 2.*.** *The change in colour (dE) measured on samples of blue European polyester paint systems compared with a blue Australian designed polyester paint system.*

Case Study: Resin- Design for environments

Under hot outdoor conditions many paint resin systems break down by thermal oxidation reactions. The sites of oxidation damage are susceptible to further breakdown by UV light.

Manufacturers of premium products include resistance of the resins contained in the paint to this thermal oxidation process, as one of the principal criteria for designing durable paint systems.

After testing both the European and Australian designed pre-painted products in a laboratory for 1000 hours at 95°C, the absorption of UV radiation by the European sample is significantly increased, while the Australian sample has little or no change, as shown in Figure 3. The observed changes are indicative of actual changes in the resin as a result of chemical degradation.

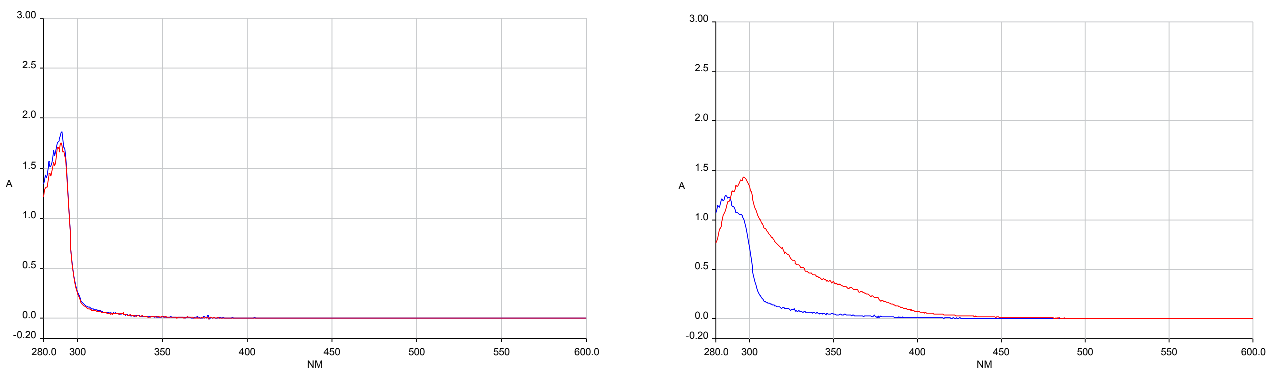
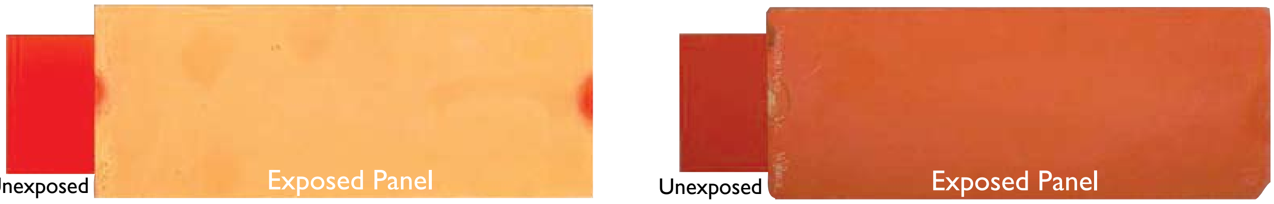


Figure 3. *Ultraviolet radiation absorption of (left) Australian pre-painted sample and (right) European pre-painted sample. The blue line is the measurement of UV absorbance prior to heat resistance testing, while the red line is the measurement of absorption after heat resistance testing.*

E-mail: coatedsteel@tatabluescopesteel.com, Website: www.tatabluescope-cs.com

Case study: The impact of resin and pigment combinations

The combined effect of poor choice of pigments and resins is illustrated in Figure 4, which compares the performance of a product not designed for high UV conditions (top) versus one designed for high UV conditions. The top sample uses lower quality resins and organic pigments which result in significant colour change after only four years of environmental exposure.



Pre-painted steel designed for low UV conditions exposed in high UV condition

Pre-painted steel designed for high UV conditions

Figure 4. *Samples of different design pre-painted steel after 4 years in high UV condition area. The small control samples on the left are original sample not exposed and stored under ambient laboratory conditions for comparison.*

Corrosion Resistance:

Corrosion may occur as undercutting at cut edges and piercings, at scratches, or under the paint causing blistering. Even the best paint systems will eventually weather off after many decades, exposing the metallic coated substrate.

Paint is generally described as barrier corrosion protection to coated steel. It should be noted, however, that paint is not completely impervious to moisture. If panels are wet for long periods of time, water molecules may penetrate the paint and reach the metallic coating. Pretreatments and primers play an important role in enhancing corrosion resistance to blistering, as well as cut edges, and perforations. Corrosion of the metal coating under a paint system can be visible as blistering of the paint film in the early stages.

The metallic coating type and class also plays a critical role in the overall corrosion resistance of pre-painted product. Real world performance indicates that different metallic coatings will have significantly different corrosion performance under the paint. The corrosion resistance of different metallic coatings under paint impacts the overall time to perforation and aesthetics. Variation in corrosion resistance effectiveness means that different coating types will require different coating classes to meet the performance requirements of standards such as AS/NZS 2728.

Case Study: The impact of metallic coating on pre-painted product corrosion

Figure 5. *Pre-painted panels exposed for 66 months at very close to sea (unwashed severe marine condition) AZ150 (left), Z275 (right) – both with the same paint system.*
Figure 5 shows that for the same paint system, corrosion is significantly more for the Z275 coating, than for the AZ150 coating in same environment.

In terms of corrosion protection of pre-painted steel, the most important protective mechanism is provided by the metallic coating. Long term exposure and building evaluation shows that pre-painted ZINCLAUME AZ150 (150 g/m2 of 55% Al-Zn coating) has an expected life (up-to 4 times) significantly greater than pre-painted Z275 (275 g/m2 of Zn coating) in many building applications.

Conclusions:

With its corrosion resistant ZINCALUME® steel (55% Aluminium, 43.4% Zinc and 1.6% Silicon with a guaranteed minimum coating mass of AZ150 (150g/m2) to provide corrosion resistance of up to four times the life of Z275 galvanized steel in a similar environment) base and baked on advanced paint finish that resists chipping, peeling and cracking, COLORBOND® steel delivers renowned long life performance.

COLORBOND® steel with its wide designer color palette and Thermatech™ solar reflectance technology, can be an effective way to reduce the energy load of your building through less reliance of air-conditioning, providing you with more comfort, by losing less energy.

COLORBOND® steel is also noncombustible, termite resistant and weather tight, protecting your investment against severe / harsh conditions.

COLORBOND® steel also utilizes advanced Super Durable Polyester pre-painted coating technology, ensuring your roof stays newer for longer.