Technical Bulletin 29

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Guide to good practice – DECKFORM® steel for structural steel decking

INTRODUCTION

Since the mid-1960s concrete slab design has utilised various proprietary profiled steel sheeting systems that can act as both formwork and tensile reinforcement for composite structural elements. The compressive strength of concrete and the tensile strength of steel form a highly efficient and versatile system.

BlueScope manufactures DECKFORM® zinc-coated structural steel, a steel product specifically designed for use in structural decking and formwork applications.

Proper design, specification, installation and care of DECKFORM® steel will ensure many years of effective service. This Technical Bulletin provides general information regarding the use of DECKFORM® steel and is not a substitute for professional advice. BlueScope recommends that you seek specific professional advice regarding the use of DECKFORM® steel in your project.

APPLICATIONS

BlueScope has been researching the behaviour of composite slabs and formwork. Extensive testing of full-scale composite slabs has been performed and, as a result, it has been possible to gain a sound understanding of their physical behaviour. This information, coupled with corrosion studies of metallic coated products, enables BlueScope to confidently recommend DECKFORM® steel for a variety of formwork and composite slab applications. DECKFORM® steel is suitable for domestic applications such as home units and town houses, as well as commercial and industrial buildings.

DESIGN AND DURABILITY

As with all building materials, the performance and durability of DECKFORM® steel is dependent on building design, specification, detailing, construction and maintenance.

The design life of a structure is not typically the same as the durability range of the individual components used to construct the structure, or the warranty period of those individual components. This point is acknowledged in Australian/New Zealand Standard AS/NZS 2312.1:2014 *Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings Part 1: Paint Coatings*, Clause 1.6 *Durability Considerations*, which notes that the protection offered by coating systems is usually shorter than the expected service life of the structure. In order to achieve a nominated design life for a structure, due consideration must be given to the maintenance or renewal requirements of individual components at the planning and design stage. When components of the structure are not accessible for maintenance after assembly, it should be ensured that the corrosion protection system of those components remain effective for the design life of the structure.

The terms “durability” and “warranty” should not be used interchangeably. These terms have distinct meanings as confirmed by Clause 1.6 *Durability Considerations* and Clause 1.7 *Warranty Considerations* of AS/NZS 2312.1:2014:

- “The durability range is not a ‘warranty time’.”
- “Durability is expressed in terms of coating life to first major maintenance”
- “Durability is a technical consideration that can help the owner set up a maintenance programme.”
- “…there are no definite rules that link the two periods of time.”
- “A warranty is intended to protect against a fault in coating product or its application, which would be expected to manifest itself early in the life of the coating system.”

Effective inspections are the starting point to improve component durability. For example, if the underside of DECKFORM® steel is periodically inspected and recorded as stipulated in AS/NZS 2312.2:2014, Section 8 *Maintenance of Paint Coating Systems* (Clause 8.2), any potential corrosion issues can be addressed in the early stages.

DECKFORM® STEEL MAINTENANCE GUIDELINES AND EXPOSED SURFACE CONSIDERATIONS

Structural steel decking is used in a variety of external and internal environments.

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Typically, the top surface of DECKFORM® steel is encased in concrete while its reverse surface is exposed to the environment. As with other building materials, the environment to which the component is exposed must be taken into account when specifying a DECKFORM® steel product. Environmental considerations will also influence the selection of the most appropriate coating class, the frequency of maintenance and any additional corrosion protection which may be necessary. For specific advice on coating class specification, please contact BlueScope Steel Direct.

The maintenance requirements for DECKFORM® steel will vary depending on the local environment and whether the application is external or internal. External environments should be subject to a comprehensive maintenance regime while internal environments require infrequent maintenance due to a comparatively lower risk of corrosion. The maintenance guidelines in Table 1 below aim to prolong the life of DECKFORM® steel in service and avoid premature corrosion issues.

The information provided in:
Technical Bulletin TB-4
'Maintenance of COLORBOND® steel and ZINCALUME® steel', is also of relevance to DECKFORM® steel.

In order to meet the design life of a structure, additional corrosion protection measures may be required in some service conditions. These additional measures typically involve the application of a suitable barrier system (refer AS/NZS 2312.1:2014, Section 6 *Paint Coating Systems for Corrosion Protection*) to the exposed surface of the DECKFORM® steel. In all cases, the life of DECKFORM® steel can be extended through a regular maintenance and cleaning regime.

IMPORTANT: Application of a barrier system and/or adherence to maintenance routines does not negate the need for proper specification installation and good detailing practice to prevent corrosion emanating from within the slab.

If a painted finish is required on the exposed surface for aesthetic reasons, prepainted DECKFORM® steel with a BRITEWITE™ colour finish on one side is available. This painted finish is essentially an aesthetic feature and is NOT a substitute for application of a suitable barrier system as described above. DECKFORM® steel with a BRITEWITE™ finish is supplied with a removable plastic film, known as CORSTRIP®, which requires removal in-situ.

LOW GLARE COATED (LGC) DECKFORM® STEEL

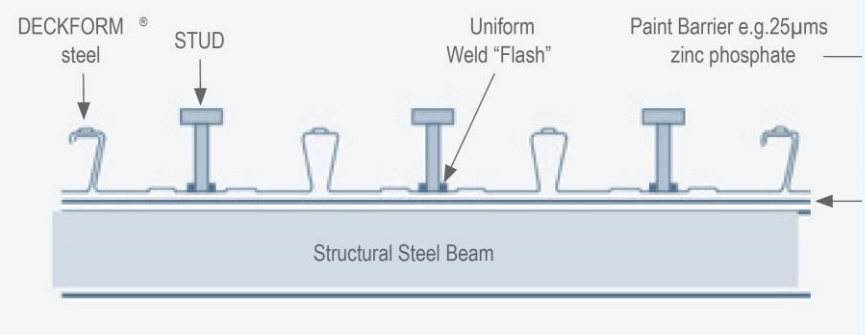
A variant of DECKFORM® steel, known as LGC DECKFORM® steel, is available with a thin blue resin coating on one side only which substantially reduces reflected light and glare, whilst also trapping almost 90% of harmful UV-B. The resin coating is water-based and is resistant to many chemicals that may be found on construction sites. However, the resin can be removed with alcohol, some hydrocarbon solvents and petroleum products such as petrol and diesel. The resin coating can be readily welded, and shear studs can be welded through the LGC DECKFORM® steel product in the same manner as regular DECKFORM® steel.

Table 1: Care and Maintenance Principles.

ELEMENT	ACTION	GUIDING PRINCIPLES
INSPECTIONS	Inspect for: – Detritus material; – Evidence of moisture; and – Signs of corrosion	– Determine frequency of detritus build-up on product (e.g. salt, dirt, debris, pollutants). – Inspect for signs of moisture on all surfaces. Moisture may be constant, frequent or cyclic in nature. – Inspect with special attention to: – Unwashed areas – Crevices and edge detailing – Around penetrations and plumbing – White corrosion product (zinc oxide) indicates corrosion is underway and should be addressed immediately (contact Steel Direct for recommendations)
CARE AND MAINTENANCE	– Regularly remove detritus material and prevent its build up; – Dry all moist areas promptly and ensure adequate ventilation; and – Prevent future contact with moisture.	– Detritus material accelerates corrosion due to the potential for increased time of wetness (if allowed to get wet) or increased electrolytic potential. – Moisture is a key driver of corrosion; as the time of wetness increases so too does the corrosion rate. – Removal of detritus material will reduce the corrosion rate of the product and reduce the risk of white corrosion product. – If the frequency of detritus build-up is higher than can practicably be removed, a barrier coating – should be used.
MAINTENANCE RECORDS	Retain records of: – Inspection observations; – Care and maintenance regime; and – Results of work carried out.	– Retaining records enables assessment and understanding of maintenance requirements for a site. – Records are also useful for confirming compliance to warranty* terms and conditions in event of a claim.

NOTE: For guidance on maintenance please refer to Technical Bulletin TB-4 Maintenance of COLORBOND® steel and ZINCALUME® steel.

Figure 1: Schematic of steel composite decking incorporating DECKFORM® steel prior to concrete pour (image not to scale).



CONCRETE REQUIREMENTS

When using DECKFORM® steel, as with ply-wood formed concrete suspended floors, the upper surfaces must comply with conditions stipulated in Australian Standard AS 3600:2018 *Concrete structures*, which prescribes detailing such as concrete cover thickness, deflection limits, crack prevention and specified concrete quality and strength. All these elements are vital to prevent moisture ingress and protect the reinforcement and structural performance of any suspended floor.

Conformance to AS 3600:2018 and prevention of water or corrosive media penetration from the top surface of the concrete deck is a condition of the DECKFORM® steel warranty*. It is recommended that the designing structural engineer follow AS 3600:2018, Section 4 *Design for Durability* in their assessment of durability design.

BEAM SUPPORT REQUIREMENTS

When DECKFORM® steel is used in a steel composite slab construction, the sheeting is placed on top of structural beams. If an uncoated steel beam is used isolation from the DECKFORM® steel must be ensured; this can be achieved by the inclusion of a neutral protective barrier (for example, by prepainting the beam). This is required to avoid the creation of a corrosion couple which would promote an attack of the zinc coating. In the case of steel composite decking, steel studs are then placed on top of the DECKFORM® steel sheet and welded through the sheeting, to the underlying beam, by using a proprietary stud-welding gun. It should be noted that zinc coating thickness, in conjunction with the paint thickness and type of paint used will affect the required current, time and plunge settings of the welding gun. The schematic in Figure 1 shows DECKFORM® steel that has been stud welded to a prepainted structural steel beam prior to the concrete slab being poured. Isolation of the structural steel beam from the DECKFORM® steel is achieved by the use of a paint barrier.

The use of a neutral protective barrier between uncoated steel beams or timber formwork is a condition of the DECKFORM® steel warranty*.

Figure 2: Example of 360º flash.

ON-SITE INSPECTION AND TESTING OF WELDS

When welding to structural steel beams is required, the weld flash around the base of the stud should be inspected. Generally, a good weld is one that has a uniform flash around the whole circumference of the base of the stud (see Figure 2).

Stud weld qualification tests should be conducted in accordance with Australian/New Zealand Standard AS/NZS 1554.2:2003 Structural steel welding
– PART 2: Stud welding (steel studs to steel).

RELATED TECHNICAL BULLETINS

Technical Bulletin TB-4
Maintenance of COLORBOND® steel and ZINCALUME® steel

REFERENCED AUSTRALIAN STANDARDS

AS/NZS 1554.2:2003 – *Structural steel welding – PART 2: Stud welding (steel studs to steel)*

AS/NZS 2312:2014 – *Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings*

AS 3600:2018 – *Concrete structures*