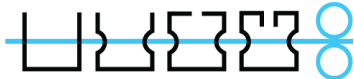




Appraisal No 23-119

DURABILITY OF MODULINE BARRIER FENCING

This Appraisal replaces Les Boulton & Associated Limited Report 161157



METAL ROLLFORMING LIMITED

39 Thomas Peacock

St Johns

Auckland 1741

Tel: 09-527 7897

Email: sales@mrf.co.nz

Website: www.moduline.co.nz

Introduction

1.1 Optimech International Ltd has performed a durability appraisal on the materials employed for the construction of Moduline barrier fencing manufactured by Metal Rollforming Ltd. The purpose of the appraisal was to assess the materials used to manufacture the barrier fencing to ensure that the materials comply with the durability requirements of the New Zealand Building Code (NZBC), Clause B2 Durability.

1.2 Moduline barrier fencing is designed to comply with the Building Code and the fencing system provides a barrier against people falling from heights. The barrier fencing system is available in three categories:

- a. Colorscreen which has solid panel and comes from 0.9 to 2.0 high. It is mainly set in concrete although we do have galvanised base plates for mounting to concrete or timber where the deck height is less than one metre.
- b. Poolside which consists of 19mm square vertical bars and comes from 0.9 to 1.8 high. It is mainly set in concrete although we do have galvanised base plates for mounting to concrete or timber where the deck height is less than one metre.
- c. Barrier From Falling for decks or retaining walls when the height is more than one metre. It can be made from Colorscreen or Poolside and is from 1.0 to 1.5 meter high.

1.3 The barrier fencing is fabricated from steel components and the fences are designed for installation using ground support structures. Moduline barrier fencing is available with different ground fixing methods for the fence support posts. Producer Statements (PS1) are available for each of the types of barrier fencing in the Moduline range.



OPTIMECH INTERNATIONAL LIMITED

1 Blacklock Avenue

Henderson

Auckland 0612

Tel: 09-836 7001

Email: optimech@optimech.com

Website: www.optimech.co.nz

1.4 The Moduline barrier fencing comprises two different structural support posts. The support posts are made of zinc-coated (galvanised) steel square hollow sections (SHS) that are fabricated from grades G350 and G450 steel and powder-coated in a range of colour options. The other barrier fence support posts are on the sides of the infill panels. They are roll-formed U-channels fabricated from G550 Colorsteel with the steel coated with the pre-painted Endura system.

1.5 Examples of Moduline safety fencing installations are shown in Figure 1 and Figure 2.



Figure 1: Moduline safety fence installed with fixings to a concrete retaining wall.



Figure 2: Moduline safety fence installed in concrete pile footings behind a retaining wall

1.6 The following documents and technical data sheets were submitted by Metal Rollforming Ltd to assist with the durability appraisal of the Moduline barrier fencing:

- Moduline Color Screen Fencing brochure, Metal Rollforming Ltd, 2023.
- Moduline Pool Side Fencing brochure, Metal Rollforming Ltd, 2023.

- Moduline barrier fencing technical descriptions, Metal Rollforming Ltd, 2023.
- Producer Statements for Moduline 900mm, 1200mm, 1500mm, 1800mm and 2000mm height barrier fencing, Marino Consultants and Associates Ltd, 2021.
- Colorsteel Endura, Product Technical Statement, NZ Steel Ltd, 2022
- Colorsteel used for fence posts, Product Technical Advice, NZ Steel Ltd, 2016.
- Cold-formed structural steel hollow sections, Test Certificate, Steelforce Pty Ltd, 2016.
- Technical information sheet, powdercoating galvanised steel; NZ Powdercoating Ltd.
- Technical information on self-drilling metal screws, Maccsim, 2023.

Assessment of Materials Employed for Barrier Fencing

2.1 The posts that support the barrier fencing infill panels are manufactured from square hollow section (SHS) pre-galvanised steel. The support posts are protected against corrosion by a factory applied zinc coating with a powder-coating system. The standard powder-coating chosen for Moduline support posts is Duralloy (Dulux) polyester powder-coating. For barrier fences installed in coastal environments the more durable Duratec (Dulux) powder-coating is used over an epoxy primer.

2.2 The barrier fencing posts are fixed to a ground support structure by different methods depending upon the model of the barrier fence. The support post fixing can be to: (1) timber deck, (2) concrete slabs and concrete walls, (3) timber retaining walls, (4) concrete piles. Producer Statements (PS1: Design) are available for each barrier fence ground fixing system, namely, fence heights of 900mm, 1200mm, 1500mm, 1800mm and 2000mm. The Producer Statements (PS1) give details of the barrier fence engineering design and the requirements for the different ground fixing methods.

2.3 The barrier fence support posts employ good corrosion protection measures that include quality surface coatings on the steel substrate. The barrier fence post tops have tight fitting plastic caps installed to minimise rain water ingress. Colorsteel Endura is approved for fence posts.

2.4 The infill panels for the barrier fencing are standard Moduline panels manufactured from Colorsteel Endura. The Colorsteel Endura paint system consists of a Zinalume steel substrate to which a coating system is factory-applied. Colorsteel Endura is designed to provide good corrosion protection at locations where moderate to severe environmental conditions are experienced. The barrier fence infill panels comprise channel side sections, top rail, bottom rail and vertical bars, all fabricated from Colorsteel Endura. Powder-coating (as per Section 2.1) can be chosen for special colour requirements.

2.5 The environmental conditions to which the powder-coated steel will be exposed play a significant role. Factors such as UV exposure, temperature fluctuations, humidity, and chemical exposure can impact the integrity and longevity of the powder coat. Choosing a powder coat with appropriate properties for the specific environment is crucial.

2.6 The fasteners used to connect the infill panels to the barrier fence support posts are self-drilling metal screws with a factory-applied mechanically galvanised coating with an additional conversion coating. The self-drilling screws (tek screws) are of two types, either wafer-head or hexagon-head. The tek screw type employed depends upon the Moduline barrier fence model that is being installed. The self-drilling screws employed on the barrier fences comply with the corrosion resistance requirements for Class 3 fasteners¹ suitable for external use in marine environments.

2.7 For external use in severe marine environments, Class 4 fasteners are required.

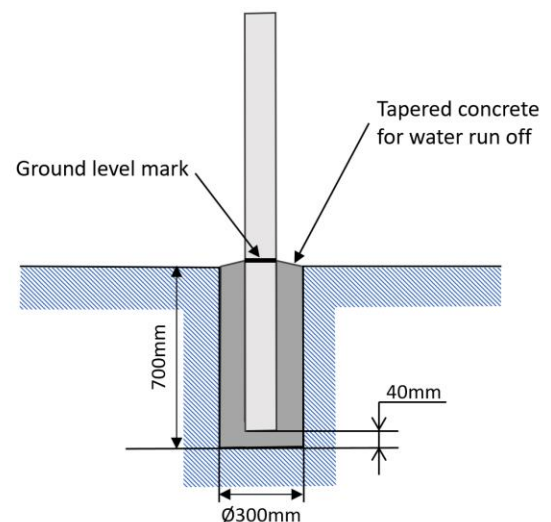
2.8 If the support structure for the barrier fence is a timber deck or a timber retaining wall, the fixings for the support posts are specified to be grade 316 stainless steel

bolts and washers, with neoprene washers between the washers and bolts. Damp proof course (DPC) material is required to isolate the bottom fixing plate of the post from the timber surface. The specified fixing methods are designed to give a long life without any corrosion on the fence post support structures.

2.9 If the support structure for the barrier fence is a concrete slab or concrete block wall the fence post fixings used are specified to be grade 316 stainless steel bolts and washers, with neoprene washers between the washers and the bolts. DPC is used to isolate the bottom fixing plate of the support post from the concrete.

2.10 If the barrier fence support posts are installed directly into soil at ground level, then the support posts are embedded in a concrete footing (17.5 MPa concrete) to a depth of 700mm and diameter 300mm with compacted hard fill surrounding the concrete pile. Quick set concrete must not be used.

2.11 The Colorsteel Endura coating is approved for use with fence posts embedded in concrete pile footings in moderate environments. This coating has provided more than 30 years of successful performance to the Moduline safety fence systems.



2.12 Fence stability relates to the concrete footing starts at the bottom. The depth of the fence post footings will vary according to fence height, wind loading, and soil type as well as other factors.

¹ Australian Standard 3566.2: 2002, *Self-drilling screws for the building construction industries*; Part 2: Corrosion resistance requirements.

2.13 The application of an epoxy mastic paint 100 to 200mm above and below the ground level mark on the post is required for C4 and C5 marine environments and for swimming pool fencing. This will prevent contact with any salt residue buildup and moisture at the base of the post.

2.14 The bottom of the post should be situated 40mm minimum from the bottom of the concrete footer.

2.15 The concrete bed is critical to prevent contact between soil, moisture, and the bottom of the post. It is important to dome or taper the top of footing to eliminate water pooling.

2.16 The terrain around the posts is contoured so that water drains away from the post.

Maintenance

3.1. The recommended maintenance schedule that barrier fence owners should adhere to in order to provide the expected durability of the barrier fencing materials is twice yearly cleaning with fresh water and bristle brushing to remove deposits of airborne grime and debris from the fence component surfaces. Routine cleaning of the fencing materials, particularly in coastal environments, ensures that the barrier fence provides a long trouble-free service life.

Durability Appraisal of Barrier Fencing Materials

4.1. A durability appraisal of the barrier fencing materials indicates that the structural members and the infill panels are protected against corrosion by the choice of appropriate materials, good design, and the application of high quality coating systems on the steel components.

4.2. The materials employed for the Moduline barrier fence should withstand all weather conditions in New Zealand. In addition, Moduline offer a barrier fence coating that is specifically designed for exposure in marine environments. The likelihood of corrosion occurring on the barrier fence components during normal service is low, as long as the fence is maintained according to the manufacturer's recommendations. The barrier fence members and the fixings should provide a

service life of at least fifteen years if the fence owner carries out recommended routine cleaning.

4.3. The external coating on the barrier fence members may require maintenance after a number of years of service life. The years in service before re-painting of an installed barrier fence depend upon how well maintained the fence has been by the owner. Maintenance of the protective coating consists of washing the fence members with fresh water at intervals of about four months in a coastal environment and at six monthly intervals for inland or rural areas. If the barrier fence is well maintained the coating systems employed will provide a service life of at least five years before any remedial painting is required.

Conclusions

5.1. A durability appraisal has been carried out on the design of the Moduline barrier fencing system. The assessment included evaluation of material data sheets for the materials and the corrosion protection measures employed on the barrier fence systems.

5.2. After the durability appraisal it was considered that the Moduline barrier fencing will meet the durability requirement of the NZ Building Code, Clause B2, Durability. The NZBC B2 durability requirements are as follows:

Items	Durability requirements
Fixings for fencing members	15 years
Barrier fencing members	15 years
Protective coatings; easy to access and repair	5 years

5.3. The Moduline barrier fencing systems appraised for durability should provide a service life of at least fifteen years. The coating systems employed on the fence components may require maintenance painting after five years in service depending upon the service environment and the maintenance schedule carried out by the owner.

Durability Appraisal prepared by:

Jonathan Smith, Bmet, PhD
Principal Metallurgist
Optimech International Ltd
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