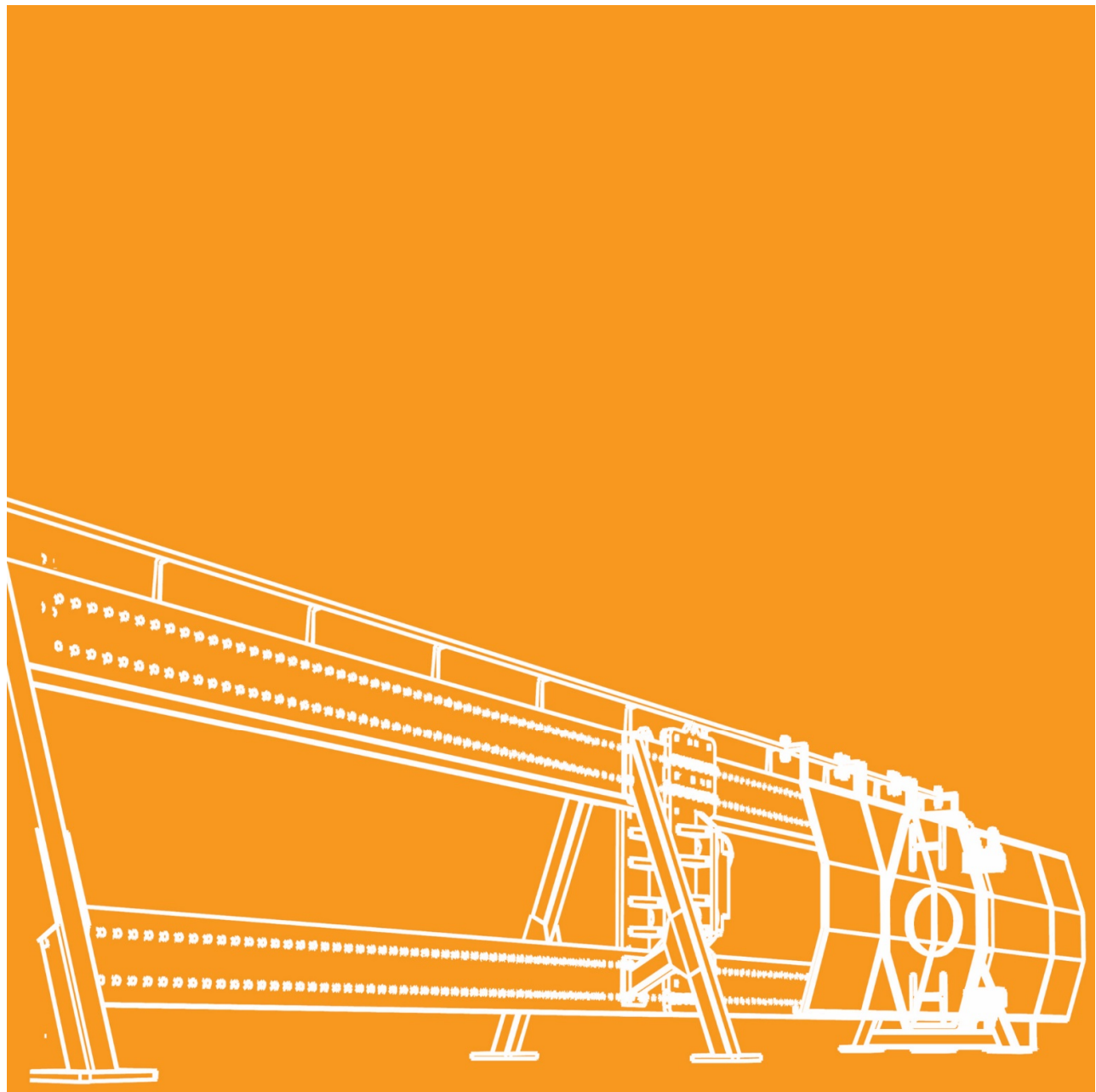




Viking Roofspec Warmroof Load vs. Span Testing

Substrate substitution – ST7

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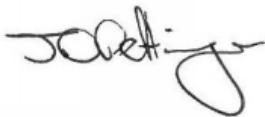
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1 EXECUTIVE SUMMARY

Viking Roofspec engaged Holmes Solutions LP (HSLP) to conduct a comparative analysis of the existing substrate used in their Warmspan system, Metcom7, with that of a similar substrate from an alternative supplier, and advise of actions required to make the substitution in confidence of maintaining a structurally sufficient Warmspan system.

After a product review, Steel and Tube's ST7 0.55 mm BMT profile was determined a suitable substitute. Based on the similarity of the geometry, and the slight increase in section modulus of the ST7 it was concluded that a substitution of the ST7 profile may be made for the existing Metcom7 profile without the need for further testing. However, despite the similarity of the two substrates, the maximum span of the Warmspan system may not exceed 2950 mm as specified by Steel and Tube for the ST7 0.55 BMT profile. Further testing is necessary to verify performance at spans greater than 2950 mm.

2 INTRODUCTION

In October 2015 Holmes Solutions LP (HSLP) was contracted by Viking Roofspec to generate, via testing, load span tables suitable for specifying a Viking Roofspec product: the Viking Warmspan. The results of this testing are summarised in report 113359 RP 0815 (1.0).

During this process, HSLP was engaged to offer engineering guidance on specifying materials for use within the Warmspan product, in particular the steel substrate which forms the base of the product. Due to external factors, it is now in the interest of Viking Roofspec to substitute the selected and tested substrate for a substrate of an alternative supplier. Viking Roofspec engaged HSLP to undertake a comparative study of products suitable for use in place of the existing substrate such that the Warmspan system will still function as required following implementation of the substitution.

3 TECHNICAL DISCUSSION

3.1 Application

The Viking Warmspan product is a three layer product consisting of a steel substrate layered with rigid polyisocyanurate (PIR) panels, and completed with a sheet of waterproofing membrane.

Viking Roofspec's chosen PIR panels are suitable for spanning troughs of a maximum length of 70 mm under the manufacturer's specification when used in roofing applications. To avoid creating spans of longer than 70 mm the current substrate, Metalcraft's Metcom7, must be installed upside down in the Warmroof system. The engineering justification for this variation, and associated fixing details is based on testing and summarised in 113359 RP 0815 (1.0).



Figure 1: Cross-section of Warmspan Roof

3.2 Analysis of Substrates

Steel and Tube's ST7 0.55 mm BMT profile possesses similar but not identical properties which shall form the basis of the comparison in this report. Appended to this report are the publically available technical data sheets for both the Metcom7, and the ST7.

3.2.1 Geometry

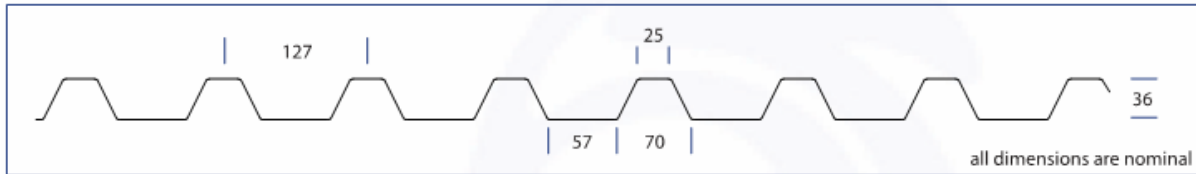


Figure 2: Existing Substrate - Metcom7, Geometry

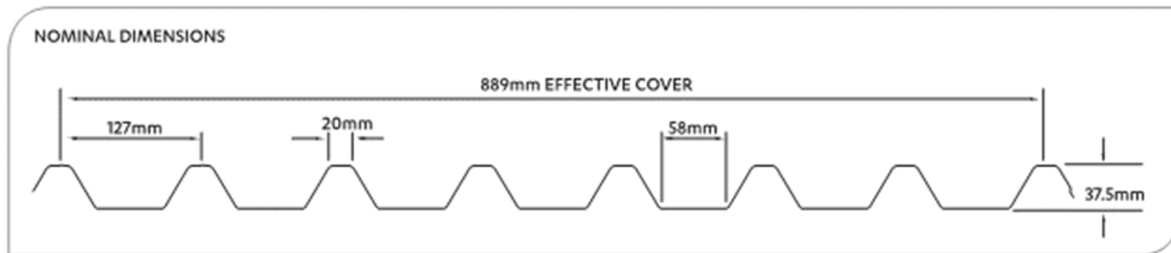


Figure 3: Proposed Substrate - ST7, Geometry

It can be seen in Figure 2 and Figure 3 that the proposed substrate ST7 has a 1.5 mm deeper profile, with a 5 mm narrower crest (when viewed in its intended orientation as shown). Both the Metcom7 and ST7 profiles exhibit 7 crests per 889 mm of coverage, and when inverted leave spans of 70 mm and 69 mm respectively, equal to or under the maximum specified for PIR support. Both profiles are rolled from grade 550 MPa, 0.55 mm BMT steel.

3.2.2 Sectional Properties

Metalcraft does not make sectional properties of their substrates publically available, however CAD modelling and analysis of the above geometry have allowed for calculation of the properties of the Metcom7 as displayed in Table 1 below. The CAD model of the Metcom7 from which the sectional properties are derived is shown in Figure 4.

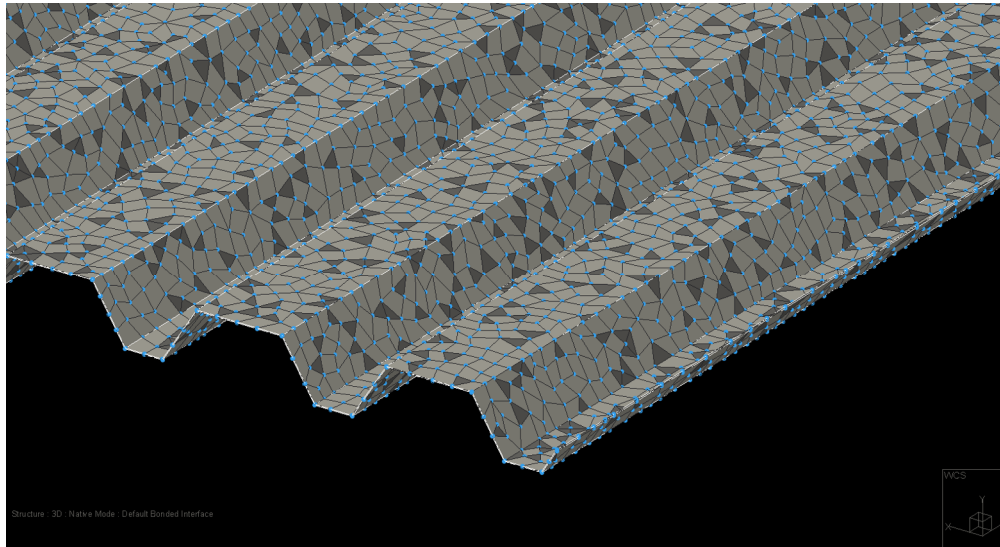


Figure 4: CAD Modelling of Metcom7

Sectional properties of the ST7 profile are available in the ST7 datasheet, and are tabulated for comparison against the derived properties of Metcom7 in Table 1. Both data sets are based on a 1 m width of substrate.

Table 1: Comparison of Sectional Properties for Metcom7 and ST7

Substrate	BMT [mm]	Area [mm ²]	I [mm ⁴]	Z _{TOP} [mm ³]	Z _{BOTTOM} [mm ³]	Y[Centroid] [mm]	Max quoted internal span [mm]
Metcom7	0.55	726	157369	6487	9079	14.7	3600
ST7	0.55	736	158114	7059	10135	15.6	2950

4 DISCUSSION

As the substrate is installed upside down, the narrower crests (as shown) are subject to compression stresses due to bending from wind uplift conditions; It is likely, as observed in testing, that localised buckling of the crest as a result of bending will initiate failure of the specimen, therefore the section modulus with regard to the distance from the centroid to the crest (Z_{TOP}) is the pertinent mechanical property to compare.

Table 1 shows that the ST7 profile has larger section moduli in both top and bottom orientations, however all sectional properties are very similar (within 10 %). Based on the similarity of the geometry, and the slight increase in section modulus of the ST7, the ST7 profile may be substituted for the existing Metcom7 profile without the need for further testing. However, despite the similarity of the two substrates, the maximum span of the Warmspan system may not exceed 2950 mm as specified by Steel and Tube for the ST7 profile. Further testing is necessary to verify performance at spans greater than 2950 mm.