

Reference Source no.	
Project number	956840
Date of issue	07 December 2009
Security Code	

Site trials on practical roof system and evaluation of installation procedure

ROBUST Project: WP 4.4

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Summary

Site trials on practical roof system and evaluation of installation procedure

ROBUST Project: WP 4.4

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Date of issue: 13 May 2010

Version no:

Security Code:

This study focused on production and manufacture sequence as well as site trials and evaluation of the installation procedure of Corus Hi-point roof system. The roof system is a modular lightweight steel roof system. The outcome of this study has facilitated the development of process flow diagram for the roof system starting from manufacture to the construction stage.

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Site trials on practical roof system and evaluation of installation procedure

1. Introduction

This report documents site trials of a lightweight steel roof system and evaluates the installation procedure. The reported roof system is the Corus Hi-point.

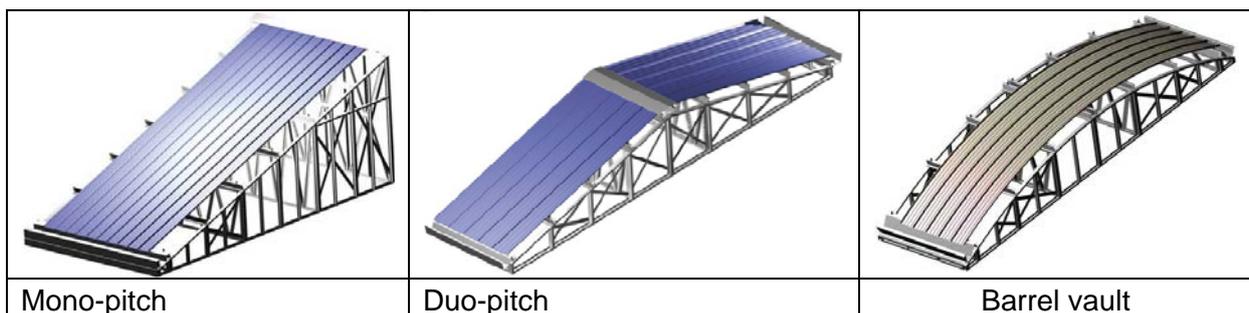
The study involved discussion with production manager of Hi-Point roof systems, visits to Hi-point roof factory and construction site during roof installations on a numbers of case study buildings. The outcome of this study has facilitated the development of process flow diagram for the roof system starting from manufacture to the construction stage.

2. Corus Hi-Point Roof System

2.1 System Overview

Hi-point is an advanced modular roofing system using lightweight cold form steel sections. The system is a cost effective solutions for both new build and refurbishment projects. Hi-point components are either pre-assembled under factory controlled conditions then transported as complete units to site ready for craning into position or, where space allows, delivered as a kit of parts ready for assembly at the ground level and then craned into position.

Hi-point roof construction is available as mono-pitch, duo-pitch and barrel-vault roofs (see below) with virtually any types of finish e.g. traditional slate and clay tiles, composite steel panels, and steel and aluminium liners, PV panels and so on. A range of insulation thickness and densities are possible to ensure optimum performance, complete design flexibility and regulatory compliance.



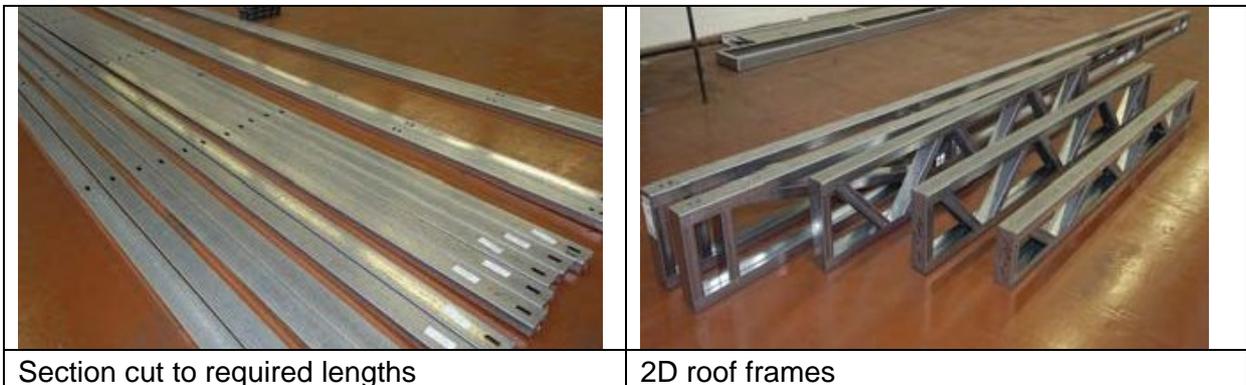
3. Sequence of manufacture/construction of Hi-point roof

Hi-point roofing consists of a primary and secondary frame. The primary frame is the module structure while the secondary frame includes the purlins and roof coverings. The key feature of Hi-point is the fact that the manufacture and construction of the roof system is undertaken in the factory and onsite at ground level with minimal work at height.

The sequence of construction is dictated by the availability of space on site as summarised below.

3.1 In factory

- Coil of lightweight steel are cold formed into sections
- Sections cut to required lengths
- Jig table used to assemble 2D roof frames and Henrob riveted



Space available for site assembly? If No, then in the factory:

- 2D roof frames assembled into 3D modular units
- Purlins, roofing, gutters, flashings, Kalzip sheeting etc are assembled onto the roof to form a module
- Modules are typically 3m wide for ease of transportation
- Adjacent roof modules have strips of Kalzip roof sheeting left out to be fitted onsite
- Lifting brackets attached to roof module
- Roof module loaded onto low-loader for transport to site





3.2 Onsite

- Roof module craned from low-loader onto prepared roof of the building using a lifting frame
- Roof module is fixed down onto building (dependent on structure below roof module)
- Missing Corus Kalzip sheeting installed
- Flashings and finishing work carried out



Space available for site assembly? If Yes, then onsite:

- 2D fabricated frames/ roofing sheets/ etc brought to site and assembled into 3D modules
- All structural components such as purlins are incorporated together with the pre-prepared roofing and acoustic/ insulation material as specified.
- Completed roof module craned from ground level onto prepared roof of the building using a lifting frame
- Roof module is fixed down onto building (dependent on structure below roof module)
- Missing Kalzip sheeting installed
- Flashings and finishing work carried out

4. Site Installations: Case studies using Hi-point roof

Hi-point has been used for an extensive portfolio of projects ranging from multi-story residential apartments, military barracks accommodation, offices, health care centres and schools. Detail information on some of these case studies is very sensitive and as result is censored. Nonetheless, this report documents site installation of Hi-point system on three typical case study buildings.

4.1 Unity Building, Liverpool, UK

This case study is a 27 storeys residential development, which is part of a mixed use development. The scale of the project, height (94m above ground level) and the location of the building in the heart of city centre mean that speed of installation and increased safety by reducing man-hours working at height are paramount considerations.

Twenty-two Hi-point 3D modules were constructed in the factory, transported to site and craned into position in just 2 days. Hi-Point roof system was equipped with 1.2 mm clad stucco embossed Corus Kalzip 400 aluminium standing seam sheets. Verge and roof flashings, mono ridge and verge capping details were also specified in a stainless steel finish to complement the wall panels. The 398m² roof also features a new 25 metre long thermoplastic polyolefin (TPO) walkable insulated membrane gutter, produced by Corus in two modules for connection on site.

	
Hi-point Modules craned onto roof	Hi-point Modules bolted on the roof steel frame
	
Roof top view during module installation	Completed building

4.2 The Ministry of Defence project, UK

This case study is part of a ten-year building programme to provide modern, comfortable living accommodation for servicemen and women across the UK. The improvement programme is being implemented under Project SLAM (Single Living Accommodation Modernisation). This involves upgrading existing and rebuilding new ones by 2012. At Marne Barracks, ten brand new accommodation blocks were constructed using Corus prefabricated modules and Hi-point roof modules.

Each building houses 54 junior ranks in study bedrooms with en suite bathrooms. Each floor has a communal area, utility room and shared bathroom. A 748m² of pre-coated Hi-Point standing seam roofing were installed in just six hours. Thereafter the weathering process of joints, gutters and fascias was completed. The roofing 2D components were manufactured in the factory and transported to site as a 'kit of parts' for assembly into 3D modules due to availability of space within close proximity of construction site. The 3D modules assembly took place on a nearby, disused World War II runway where the roofs were transported to site and craned into position as required.



Hi-point module craned onto roof



Hi-point module connected to the top of modular building



Light steel modular building clad with brick wall



Hi-point roof completed

4.3 Snowdon Summit in Wales, UK

This project is an £8.3 million visitor centre located at the very top of the tallest mountain in England and Wales. The mountain stands at an altitude of 1,085 metres above sea level and has one of the wettest climates in Great Britain. With limited space, poor weather conditions and a strict build schedule, more than 300m² of Hi-Point roof modules were used to fast-track the installation programme.

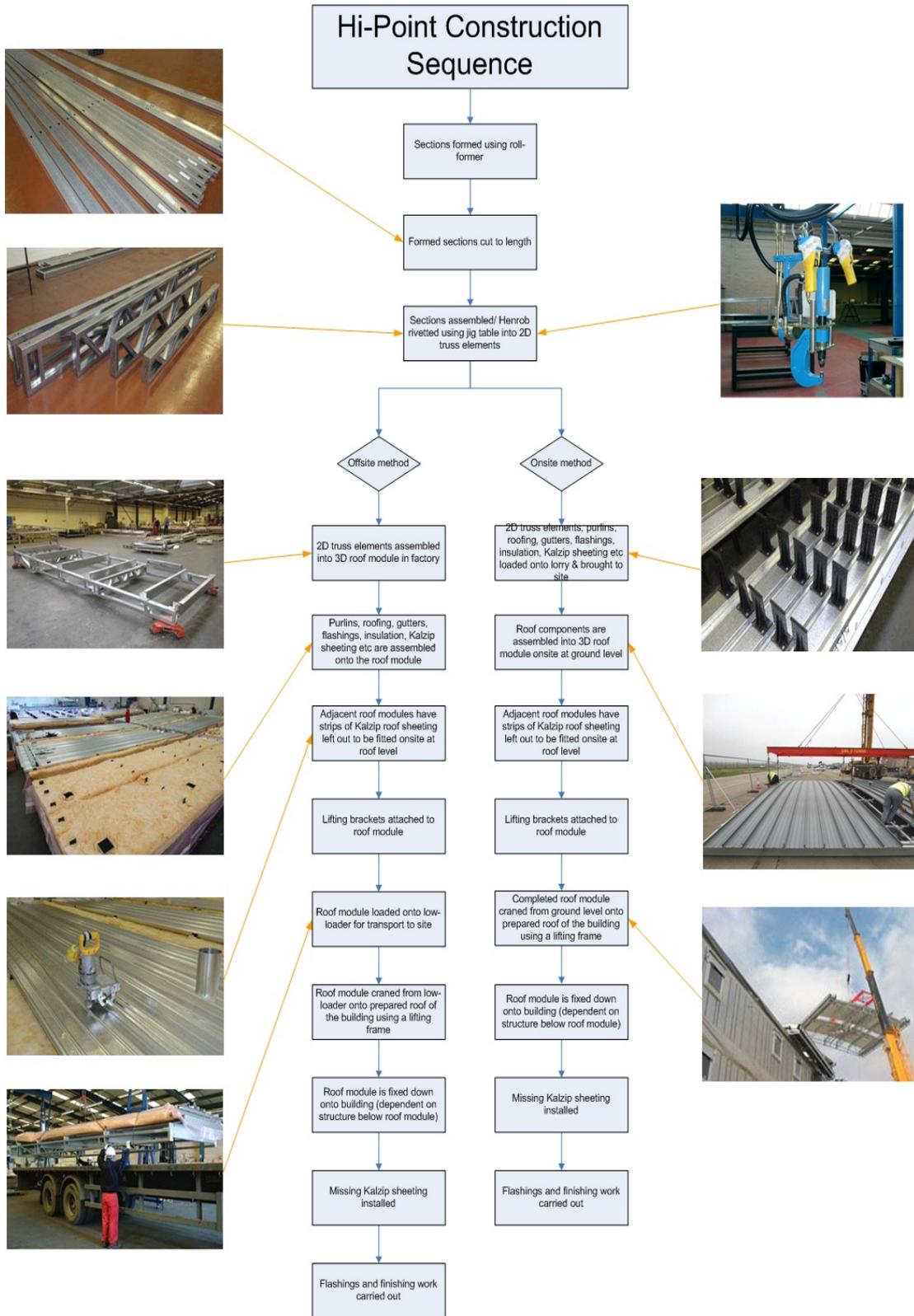
Hi-point modules were manufactured and assembled in the factory, transported to the foot of the mountain and delivered to site by the mountain's dedicated railway link, then craned into position. It took less than four days to install Hi-point roof compared to four or five weeks to complete a traditional roof build under the same conditions. The roofing system is a mono-pitch design, curved to a radius of 60 metres, which merges with the sloping contours of the mountainside.

	
<p>Building material flown into site</p>	<p>Hi-point modules craned into roof</p>
	
<p>Hi-point module in place and roof sections finishing applied</p>	<p>Hi-point roof completed</p>

5. Process Flow of Hi-point roof system

The outcome of the study of the manufacture and construction sequence and site installation has informed the development of a process flow diagram for Hi-point roof system as shown below. As can be seen in the diagram, Hi-point roofing consists of a primary and secondary frame. The primary frame is the module structure while the secondary frame includes the purlins and roof coverings.

The key feature of Hi-point is the fact that the manufacture and construction of the roof system is undertaken in the factory and onsite at ground level with minimal work at height. The sequence of construction is dictated by the availability or lack of space on site as summarised below.



6. Conclusion

This report has documented the manufacture and construction sequence, and installation procedure of Corus Hi-point modular roof system on real life case study buildings. The study involved discussion with production manager of Hi-Point roof systems, visits to Hi-point roof factory and construction site during roof installations on a numbers of case study buildings. The outcome of this study has facilitated the development of process flow diagram for the roof system starting from manufacture to the construction stage.

Hi-point is an advanced modular roofing system using lightweight cold form steel sections. Hi-point components are either pre-assembled under factory controlled conditions then transported as complete units to site ready for craning into position or, where space allows, delivered as a kit of parts ready for assembly at the ground level and then craned into position.