



Deliverable Report D5.4

Small-scale Demonstration Unit(s) Complete

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- BioBuild -

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SMALL-SCALE DEMONSTRATION UNIT(S) COMPLETE

Table of Contents

1	BioBuild External Wall Panel (Biobuild EWP)	4
1.1	Design	4
1.2	Small-Scale Demonstration Unit.....	5
2	BioBuild External Cladding Kit (BioBuild ECK)	6
2.1	Design	6
2.2	Small-Scale Demonstration Unit.....	7
3	BioBuild Internal Partition Kit (BioBuild IPK)	8
3.1	Design	8
3.2	Small-Scale Demonstration Unit.....	9
4	BioBuild Suspended Ceiling Kit (BioBuild SCK)	10
4.1	Design	10
4.2	Small-Scale Demonstration Unit.....	11

1 Introduction

The goal of this work package is to combine the outputs of Work Packages 2, 3 and 4 to produce designs for the final demonstrator parts. As part of this it was decided that small scale test-bed integrated systems should be produced. There were a number of different combinations of panels, structures, joining methods and design concepts. The work package feeds directly into work package 7 which is concerned with the production of full-scale demonstrator components.

The aim of this deliverable is to present the smaller scale prototypes which were produced prior the full-sized demonstrators. In some cases this was for specific tests (such as SBI testing) that required a large representative part but not a full-scale part or simply as proof-of-concept for the manufacturing.

There are four distinct systems that are designed to work together in a single final demonstrator. The following sections describe briefly the role and design of the full scale demonstrator and introduce the small-scale demonstrator units that were produced.

SMALL-SCALE DEMONSTRATION UNIT(S) COMPLETE

2 BioBuild External Wall Panel (Biobuild EWP)

The BioBuild External Wall Panel system integrates bio-composites into a 4 m tall, unitized façade system. The triangulated geometry of the façade provides stiffness to the panel and the shape of folds provides shading to the glazing.

2.1 Design

The interior and exterior skin of the External Wall Panel is composed of flax fibres and bio-polyester. A plywood substructure supports the bio-composite skin and the cavities contain wood fibre insulation for enhanced thermal resistance. These material choices substantially reduce the embodied energy of the façade as well as its weight.

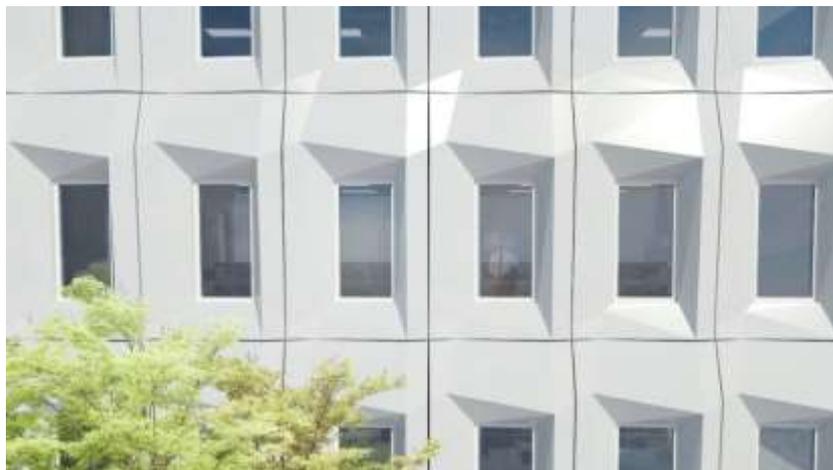


Figure 1: A render of the BioBuild EWP shown in context



Figure 2: The BioBuild EWP panel planned construction components.

DELIVERABLE REPORT D5.4

SMALL-SCALE DEMONSTRATION UNIT(S) COMPLETE

2.2 Small-Scale Demonstration Unit

As with the full scale demonstrator, the small scale demonstrator was produced by Fiber Tech. The small-scale demonstration part for the EWP comprises of a 1 m x 1 m section representative of the complex geometry required for the EWP. Instead of the timber frame and loose fill insulation it was made by wet layup of flax the flax fabric onto a machined polyurethane foam core. Through-thickness ribs were also included in order to stabilise the structure.



Figure 3: Production of the small-scale EWP demonstrator part.

The small scale part demonstrated the potential for the final appearance and emphasised a major advantage of working with these biocomposite materials; the flexibility of design in terms of geometry is wide.

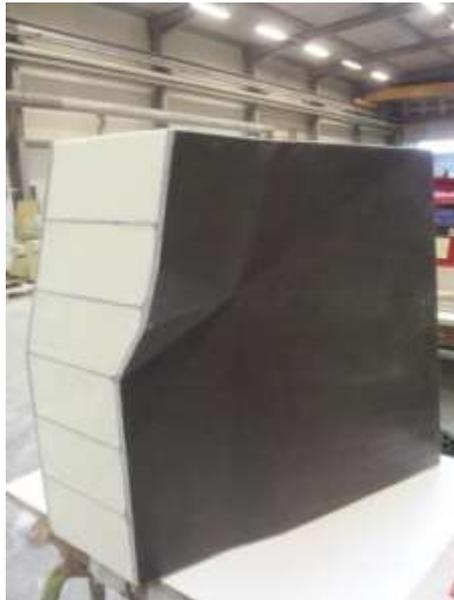


Figure 4: The EWP small-scale demonstrator part.

SMALL-SCALE DEMONSTRATION UNIT(S) COMPLETE

3 BioBuild External Cladding Kit (BioBuild ECK)

The BioBuild External Cladding Kit is a rain screen system composed of a lightweight, long span, bio-composite panel. The system's design allows easy assembly and freedom of form in design.

3.1 Design

The exterior panel and custom substructure are made from jute fibres and furan resin (waste from sugar cane production). These materials reduce agricultural waste, contribute to the lighter weight, and lower the embodied energy of the ECK. They are produced by semi-continuous compression moulding of pre-impregnated fabric.

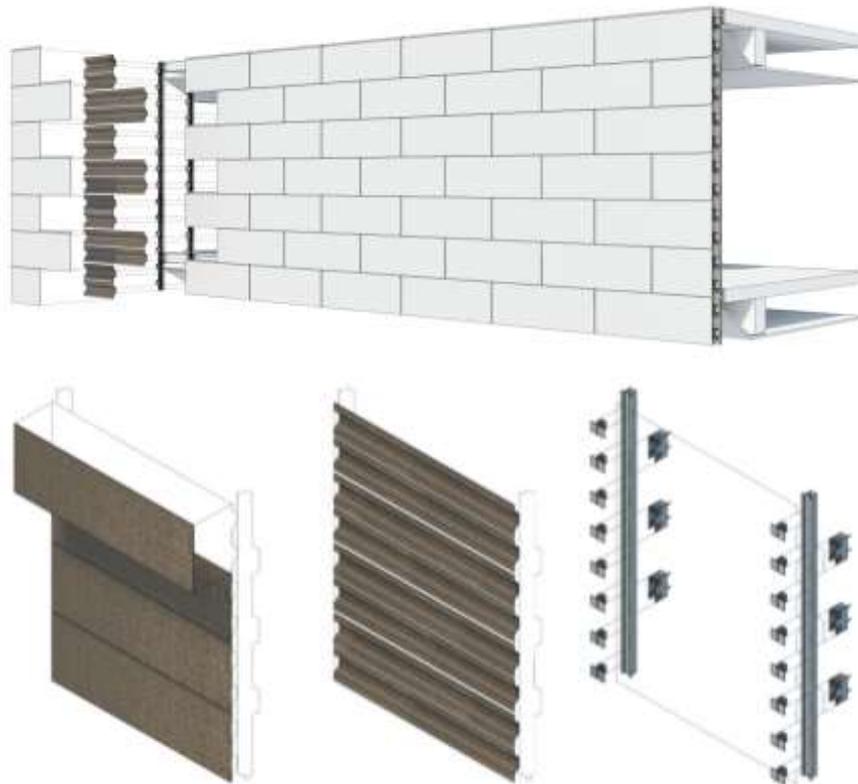


Figure 5: An exploded view of the planned BioBuild ECK.

DELIVERABLE REPORT D5.4

SMALL-SCALE DEMONSTRATION UNIT(S) COMPLETE

3.2 Small-Scale Demonstration Unit

A short span of ECK was produced as a small-scale demonstration. The unit included two hat profiles bonded to a flat composite flax-furan-cork composite face. This was produced by IVW who will also produce the large demonstrator parts.

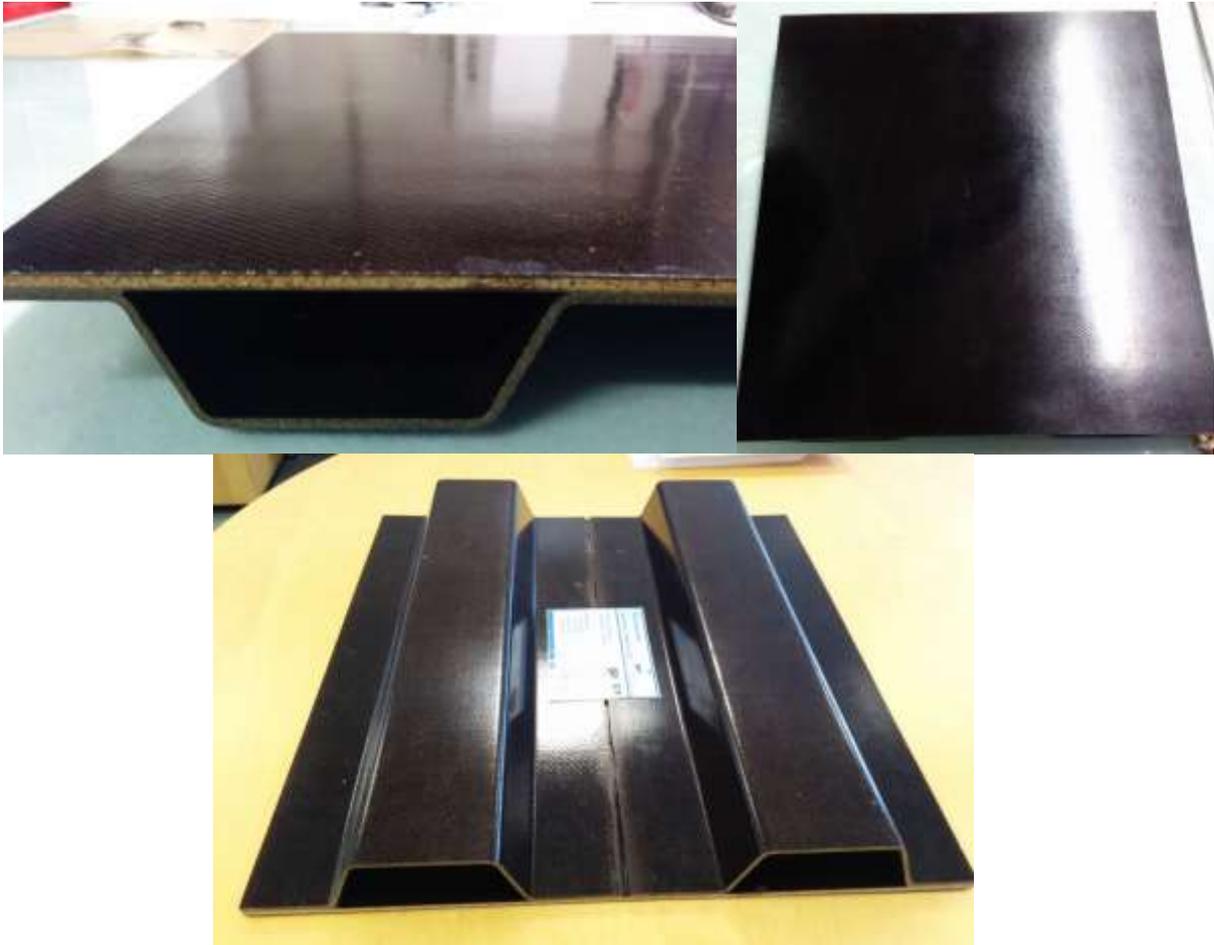


Figure 6: The small-scale ECK demonstration unit.

SMALL-SCALE DEMONSTRATION UNIT(S) COMPLETE

4 BioBuild Internal Partition Kit (BioBuild IPK)

The BioBuild Internal Partition Kit is a modular solution for non-structural interior partitions. The system's design allows easy assembly and provides high acoustic performance.

4.1 Design

The outer faces of the partition are composed from jute fibre and fire-retardant furan resin; custom finish options are available. A wooden substructure supports the bio-composite skin and the cavity contains wood fibre insulation for enhanced acoustic performance. The partition is supported on a track system embedded into the wooden substructure.



Figure 7: A render of the BioBuild IPK shown in context



Figure 8: The BioBuild IPK panel planned construction components.

DELIVERABLE REPORT D5.4

SMALL-SCALE DEMONSTRATION UNIT(S) COMPLETE

4.2 Small-Scale Demonstration Unit

The small-scale demonstration unit was produced at 1.6 m length rather than 2.4 m primarily to test the manufacturing technique and to provide material for fire testing.

Originally it was intended that these parts were to be produced by compression moulding but due to equipment availability within the consortium they had to be produced by vacuum bagging by NetComposites. The small scale parts were produced on a heated-tool which caused some defects on the surface due to non-uniform heating. For the large scale parts a decision was made to produce these in a large oven.

The small scale units were used for fire tests (single burning item) at LNEC and comprised a single biocomposite skin bonded to a cork core with a particle board rear.



Figure 9: Vacuum bagging process for production of small-scale IPK.



Figure 10: A small-scale IPK skin made from fire retardant furan resin and jute.

DELIVERABLE REPORT D5.4

SMALL-SCALE DEMONSTRATION UNIT(S) COMPLETE

5 BioBuild Suspended Ceiling Kit (BioBuild SCK)

The BioBuild Suspended Ceiling Kit integrates bio-composites into a light and flexible ceiling baffle. This highly customizable system provides a great level of formal freedom to the designer.

5.1 Design

Each Lamella is composed of jute fibres and bio-polyester. A computer controlled milling machine cuts each Lamella allowing a high degree of formal customization. A conventional suspended ceiling system supports the Lamellas, with aluminium clips anchoring the panels to hanging rails.

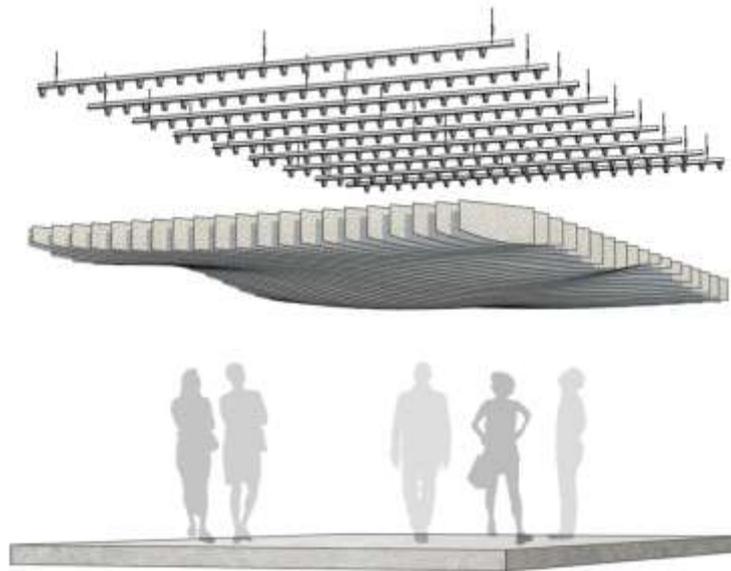


Figure 11: An exploded view of the planned BioBuild SCK.

DELIVERABLE REPORT D5.4

SMALL-SCALE DEMONSTRATION UNIT(S) COMPLETE

5.2 Small-Scale Demonstration Unit

Infusion trials were carried out by Acciona with the flax bio-polyester system (Figure 12).



Figure 12: Infusion trials with flax/bio polyester resin.

Shorter scale laminates were then produced using infusion for fire testing and coated with flame retardant coatings.



Figure 13: Flax-Polyester small-scale ceiling lamellar prepared for fire testing.