

# Appraisal of a Building Product



## The Steadfast Continuously Insulated Concrete Wall (CICW) Systems.

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## General Information

### Description of Product

The Steadfast Continuously Insulated Concrete Wall (CICW) systems are a collection of structurally reinforced concrete and polystyrene walls of differing thicknesses. The CICW systems allow the designer the flexibility of using a variety of external and internal, claddings and finishes.

When concrete is used as the external

surface it is finished with a flexible render over which is applied a weather coating system. When concrete is used on the interior side of the wall, either a plaster finish or a direct-fixed plaster board can be used. This collection of CICW systems provides the ability to design to a mix of structural, insulating and aesthetic



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Verification of Clauses B1, B2, C3, E2, E3, F2 and H1  
of the New Zealand Building Code



requirements while achieving high thermal mass, fire and sound benefits.

The suite of walls provide R-Values that range from 3.28 to 5.87.

This appraisal covers the verification of clauses B1, B2, C3, E2, F2 and H1 only.

## Trade Literature

The **Steadfast Continuously Insulated Concrete Wall (CICW) Systems Technical and Construction Manual dated June 2009** describes the correct method of construction.

## Applicant

The applicant is Steadfast Building Systems Ltd.

## Scope & Limitations

The Steadfast CICW systems are to be designed by an engineer to 'specific design' using the information provided by the **Steadfast Continuously Insulated Concrete Wall (CICW) Systems Technical and Construction Manual** and in accordance with NZS 3101 and AS/NZS 1170.

The foundations and floor shall be to specific design in accordance with NZS3101, AS/NZS 1170 and NZS 3404.

The roof design shall also be to specific design in accordance with NZS 3604 for timber framing or AS/NZS 1170 for steel framed roofing.

The Steadfast CICW systems have been designed for use with aluminium window and door joinery complying with NZS4211.

# Detailed Information

## Technical Description

The Steadfast CICW systems are a suite of concrete walls that consist typically of a reinforced concrete external wall with an Expanded Polystyrene (EPS) core which is 'sandwiched' by either a reinforced concrete interior wall or by vertical timber strapping complete with a plasterboard lining. The external concrete wall is over-coated by a nominated plaster coat render and finished with a nominated acrylic coating system.

The Steadfast CICW systems suite consist of four distinct wall systems as follows:

### THERMAL 250/300

All thermal walls have a 90mm to 110mm thick external concrete wall with a polystyrene core of selected thickness and finished off with 35mm\*45mm internal timber strapping and plasterboard lining. The thermal rating of the wall system is influenced by the thickness of the polystyrene and can achieve R - Values ranging from 3.27 to 4.55.

**Thermal 250** – consists of 100mm thick external concrete wall with plaster finish, 115mm thick polystyrene core and finished off with 35mm internal timber strapping and plasterboard lining. This wall system can be used for a two storey construction with a total height limit 9.0m.

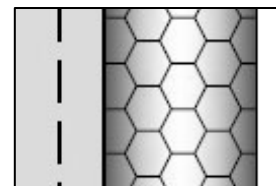
**Thermal 300** – consists of 100mm thick external concrete wall with plaster finish, 165mm thick polystyrene core and finished off with 35mm internal timber strapping and plasterboard lining. This wall system can be used for two storey construction with a total height limit 9.0m.

### SOLAR 250/300

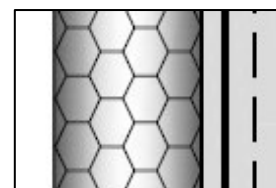
All Solar walls have a 100mm thick internal concrete wall with a polystyrene core of selected thickness and finished off with 35mm wide 45mm deep external timber strapping and an approved external wall cladding system. The timber strapping is fixed through the polystyrene core to the concrete with an engineer approved non-thermally conductive fixing bolt. As for the Thermal 250-300 wall, thermal rating of the wall system is influenced by the thickness of the polystyrene and can achieve R - Values ranging from 3.29 to 4.55.

**Solar 250** – consists of 100mm thick internal concrete wall, 115mm thick polystyrene core and finished off with 35mm external timber strapping and an approved exterior wall cladding system.

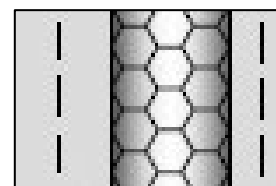
**Solar 300** – consists of 100mm thick internal concrete wall with plaster finish, 165mm thick polystyrene core and finished off with 35mm external timber strapping and an approved exterior wall cladding system.



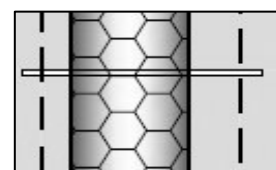
THERMAL



SOLAR



RADIANT



MASS

Exterior

Interior



### **RADIANT 300-400**

All Radiant walls have a 110mm thick external concrete wall with a polystyrene core of selected thickness and finished off with 65mm internal concrete wall and a selected plaster board lining or plaster finish. The thermal rating of the wall system is influenced by the thickness of the polystyrene and can achieve a R - Value ranging from 3.41 to 5.91.

**Radiant 300** – consists of 110mm thick external concrete wall, 125mm thick polystyrene core and finished off with a 65mm internal concrete wall and a selected plaster board lining or plaster finish. This wall system can be used for two storey construction with a total height limit of 9.0m.

**Radiant 400** – consists of 110mm thick external concrete wall with plaster finish, 225mm thick polystyrene core and finished off with 65mm internal concrete wall and a selected plaster board lining or plaster finish. This wall system can be used for two storey construction with a total height limit of 9.0m.

### **MASS 300**

All Mass walls have a 110mm thick internal concrete wall with a 125mm polystyrene core and finished off with a 65mm external concrete wall. The internal wall is finished with a selected plaster board lining or plaster finish. The thermal rating of the wall system is influenced by the thickness of the polystyrene and can achieve a R - Value of 3.41. This wall system can be used for two storey construction with a total height limit of 9.0m.

## Specific Performances with the NZ Building Code

### Clause B1 - Structure

The Steadfast CICW system when constructed in accordance with this Appraisal will meet Performance Requirements of B1.3.3 (a), (b), (c), (f), (g), (h), (i), (j) and (q) of the New Zealand Building Code.

### Clause B2 - Durability

The Steadfast CICW system when constructed in accordance with this Appraisal will meet Performance B2.3.1(a) of the New Zealand Building Code. In other words, the product as appraised will be durable for the life of the building, being not less than 50 years.

### Clause C3 - Spread of Fire

The Steadfast CICW system when constructed in accordance with this Appraisal will meet Performance C3.3.5 of the New Zealand Building Code.

### Clause E2 - External Moisture

The Steadfast CICW systems comply with clause E2.3.2 of the Building Code when constructed in accordance with this Appraisal.

In other words, the product as appraised will “prevent the penetration of water that could cause undue dampness, or damage to building elements”. In the opinion of BEAL the maximum Risk Score, based on intersections of roof to cladding to be by specific design, using the risk matrix process described in E2/AS1, is 20.

### Clause E3 – Internal Moisture

A building which incorporates the Steadfast CICW system when



Steadfast CICW System	Calculated R-Value
THERMAL 250	3.27 m <sup>2</sup> .°C / W
THERMAL 300	4.55 m <sup>2</sup> .°C / W
SOLAR 250 (typical)	3.30 m <sup>2</sup> .°C / W
SOLAR 300 (typical)	4.55 m <sup>2</sup> .°C / W
RADIANT 300	3.41 m <sup>2</sup> .°C / W
RADIANT 400	5.91 m <sup>2</sup> .°C / W
MASS 300	3.41 m <sup>2</sup> .°C / W

Note: Calculations were made according to NZS 4214:2006 Methods of determining the total resistance of parts of buildings



constructed in accordance with this Appraisal will meet Performance E3.3.1 of the New Zealand Building Code.

#### Clause F2 – Hazardous Building Materials

The Steadfast CICW systems contain no hazardous materials and complies with clause F2.3.2 of the Building Code.

#### Clause H1 – Energy Efficiency

The Steadfast CICW systems comply with clause H1 of the Building Code.

### How to install the product

The product shall be installed as described in the **Steadfast Continuously Insulated Concrete Wall (CICW) Systems Technical and Construction Manual dated June 2009**. Only Steadfast trained and approved installers are to construct the CICW systems.

## Basis of Appraisal

[BEAL use the Compliance Verification Procedure to demonstrate compliance with the relevant clauses of the NZ Building Code based on a risk-analysis procedure.]

#### Clause B1 - Structure

The ability of the Steadfast CICW systems to support self weight and wind loadings, was assessed by an independent registered engineer.

#### B2 - Durability

For assessing the durability of the Steadfast CICW systems, an evaluation was carried out in five stages:

Durability of:

- The shotcrete-applied concrete
- The EPS core
- The steel reinforcement
- The materials used for sealing windows and doors
- The materials used for sealing meter boxes and other penetrations

#### Clause C3 - Spread of Fire

For assessing the resistance to spread of fire of the nominated render and protective coating system testing was carried out to AS/NZS 1530 Part 3. Refer to BEAL Appraisal

C406 for Euroset Renders and Coatings.

#### E2 - External Moisture

The Steadfast CICW system was assessed for proper design to verify or otherwise compliance with Clause E2.

The Steadfast CICW systems were also evaluated in practical building situations to assess the following:

- Ease of installing the product / system
  - Potential risks of non performance when being installed
  - Any external factors that could effect the quality of the installed product
  - Ease of repair or maintenance (where applicable)
  - The impact of other building products /systems when in contact
- Comparison with other similar Products.

These assessments and test results demonstrated compliance with the requirements of Clause E2 (External Moisture) of the NZ Building Code.

#### Clause E3 - Internal Moisture

Buildings incorporating the Steadfast CICW system were shown to meet the R-value requirement for walls, being not less than 1.9 for climate zones 1 and 2, and not less than 2.0 for climate zone 3 as set out in Table 1 of H1/AS1 to mitigate surface condensation. While the roof, floor and glazing shall also comply with the requirements of Table 1 of H1/AS1, management of internal moisture shall comply with the requirements of Para 1.3 of G4/AS1.

#### F2 Hazardous Building Materials

For assessing the potential for Steadfast CICW systems to become hazardous to health, BEAL considered the materials used in the manufacture of the manufactured stone and adhesive and concluded that no threat is presented. Installers of a Steadfast CICW system shall wear appropriate protective clothing.

#### Clause H1 – Energy Efficiency

For assessing the ability of the Steadfast CICW systems to comply with clause H1 of the Building Code, a series of calculations were made using NZS 4214.



## Product QA Information

- The Steadfast CICW systems are constructed from materials supplied under their Building Product Quality Plan regime. This includes -
  - The shotcrete concrete being manufactured and supplied under the NZ Ready Mix Concrete Association's Plant Audit Scheme. [Refer to [www.nzrmca.org.nz](http://www.nzrmca.org.nz)]
  - The steel reinforcement shall comply with AS/NZS 4671 'Steel Reinforcing Materials'
  - The LVL shall comply with AS/NZS 4357:1995 Structural Laminated Veneer Lumber.
  - The EPS shall comply with AS 1366.3 'Rigid cellular plastic sheets for thermal insulation - Rigid cellular polystyrene - Moulded (RC/PS - M)'
  - The render and protective coating system shall comply with the relevant requirements of E2/AS1'

## Design Considerations

Steadfast wall systems can be designed to the maximum permitted recession plane height in accordance with the local district plan and this may vary from one local authority to another. In practice, a maximum height of 9m has been adopted for the structural wall system used in two storey construction.

The wall systems can be designed to resist wind and earthquake loadings within all designated locations of New Zealand as defined in the current Australian/New Zealand loadings code (AS/NZS 1170:2002). The wall systems are designed to meet the 50 year specified working life in accordance with the Building Code 2004. However, the wall system can be specifically designed to exceed a 50 year design life but the durability of the exterior plaster system may limit the practical design life of the wall system to 50 years, in which case the plaster system would need to be replaced after 50 years to extend the working design life of the wall system.

The steadfast wall system is not intended to be used as an internal load-bearing wall or as a partition wall separating habitable spaces within the dwelling. However, the wall system can be used to separate a living space from a non-habitable space such as a garage or workshop

area.

The maximum unsupported span of the wall depends on the particular steadfast wall system used. In the case of the 'Radiant' and 'Mass 300' wall systems, the wall can span lengthways up to 7.5m between transverse walls without the lateral support of a ceiling diaphragm. In cases where the Radiant and Mass 300 wall systems are required to span up to a maximum length of 9m, based on the strength capacity of the bond beam, a ceiling diaphragm is required to provide lateral support along the top edge of the walls.

In the case of the 'Solar' and 'Thermal' wall systems, a ceiling diaphragm is required to provide lateral support along the top edge of the walls. These walls can span a maximum of 15m between transverse supporting walls which is the maximum span for a GIB Braceline ceiling diaphragm between supporting walls.

## Health & Safety Considerations

Steadfast trained and approved installers are to wear appropriate safety clothing and use appropriate equipment to prevent any injury during the course of the work.



# Verification of Compliance

[Methods suggested by the Department of Building and Housing - refer [www.dbh.govt.nz](http://www.dbh.govt.nz)]



## Methods Used

- In service history
- Trade literature
- A calculation or test method from a laboratory or testing facility

This appraisal uses in service history and the technical literature provided by the manufacturer, together with assessments and testing carried out by BEAL as the 'methods' for demonstrating compliance with the relevant clauses of the Building Code.

## Sources of Information

The following documentation was consulted:

- New Zealand Building Code
- Acceptable Solutions E2/AS1
- AS/NZS 1170:2002 Structural Design Actions
- NZS 3101:2006 Concrete Structures
- NZS 3109:1997 Concrete Construction
- NZS 3112:1986 Part 1 Methods of test for concrete
- NZS 3404.1:1997 Steel structures standard
- AS/NZS 4671:2001 Steel reinforcing materials
- AS 1366.6:1992 Rigid cellular plastics sheets for thermal insulation - Rigid cellular polystyrene - Moulded (RC/PS - M)
- AS/NZS 1328.1:1998 Glue laminated structural timber
- AS/NZS 1530 Part 3:1999 Spread of fire
- AS/NZS 4284:2008 Testing of building facades
- NZS 4211:2008
- NZS 4214:2006 Methods of determining the total thermal resistance of parts of buildings
- NZS 4218:2006 Energy efficiency - Small building envelope
- AS/NZS 4357:1995 Structural Laminated Veneer Lumber
- NZRMCA Concrete Plant Audit Scheme compliance document from the nominated supplier
- BEAL Appraisal C406 for Euroset Renders and Coatings.
- An assessment for ease of use carried out by BEAL.
- Technical and trade literature provided by the manufacturer.
- The Steadfast Building Product Quality Plan document.

## NOTE

For information about AS/NZS or NZS Test Methods, refer to [www.standards.co.nz](http://www.standards.co.nz)



## Conditions of this Appraisal

1. The Steadfast Continuously Insulated Concrete Wall (CICW) systems continue to comply with the quality assurance measures in the form of a Building Product Quality Plan for Steadfast Building Systems Ltd. These quality assurance measures have been viewed and approved by BEAL.
2. The Steadfast CICW systems comply with the conditions of this appraisal and with the **Steadfast Continuously Insulated Concrete Wall (CICW) Systems Technical and Construction Manual dated June 2009**.
3. Steadfast Building Systems Ltd. continues to have the product range reviewed and quality assurance programme audited at least annually by BEAL.
4. The overall quality and performance of the Steadfast CICW systems are maintained.
5. Steadfast Building Systems Ltd. shall notify BEAL of any changes in specification or quality assurance measures prior to them coming into effect.
6. The system has been tested against one or more of the following criteria which was applicable at the time of the initial assessment:
  - a measurable criteria described in the Building Code
  - a relevant New Zealand or Australian or International Standard
  - an appropriate requirement set out in a New Zealand Department of Building & Housing document
8. BEAL's verification of the building product or system as complying with one or more criteria is given on the basis that the criteria used were those that were used to demonstrate compliance with the Building Code at the date of this appraisal. In the event that the criteria are withdrawn or amended at a future date, this Appraisal may no longer remain valid.

### BEAL's approval logo is the assurance that a building product complies with the requirements of the New Zealand Building Code.



Using the latest in Australasian and overseas testing and assessment methods and criteria, BEAL's logo is a sign of confidence -

- ◆ Confidence for the architect or designer that the product literature and details will meet their specific needs;
- ◆ Confidence for the Building Certifying Authority that the product has been evaluated in a rigorous manner to demonstrate or otherwise, compliance with the relevant Clauses of the NZ Building Code;
- ◆ Confidence for the builder and installer that the Technical Manuals are clear and easy to understand.

BEAL's 'Approval Logo' is being promoted throughout the building industry thus ensuring maximum exposure for all products that carry this logo. For further information contact Colin Prouse at BEAL on (+64) 4 233 6661 or e-mail at [sales@beal.co.nz](mailto:sales@beal.co.nz)

# Contact Details



**The Steadfast Continuously Insulated Concrete Wall (CICW) systems are distributed by Steadfast Building Systems Ltd.**

Steadfast Building Systems Ltd. can be contacted at:

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Fax 03

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Web Site [www.steadfastbuilding.co.nz](http://www.steadfastbuilding.co.nz)

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Further information about this Appraisal can be directed to Mr Colin Prouse