

# RIVERFORD GARDENS

## General information

Riverford Gardens is a 6-acre site in the south side of Glasgow. This contemporary development benefits from a unique location on the White Cart Water and offers a variety of accommodations types arranged to maximise views and amenity.

The site is currently under development by CCG Homes and is scheduled to be completed in 2020.

One of the house types featured in the development has been the subject of further research by Edinburgh Napier University Centre for Offsite Construction + Innovative Structures (COCIS) as described in the 'Research Focus'.

## Project description

Riverford Gardens will include a mix of 156 homes and apartments, variously distributed throughout the site to create open public space and shared and private green areas and amenities for residents.

All house types are bespoke to Riverford Gardens and include:

- 10 one-bedroom flats;
- 94 two-bedroom flats;
- 12 three-bedroom semi-detached homes;
- 40 four-bedroom terraced villas.

The design benefits from a mix of styles, open plan living

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<b>LOCATION</b>	Glasgow, Scotland
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<b>YEAR</b>	under construction
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<b>PARTNERS</b>	CCG Homes, MAST Architects, Ramage Young, Edinburgh Napier University (ENU)
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and flexible rooms to meet the different customer needs.

The development will be undertaken entirely by CCG Group, including the manufacture of the timber system, the construction and the fit-out of all internals and services. CCG's timber panels will provide enhanced environmental and energy performance and encourage long-term energy savings.

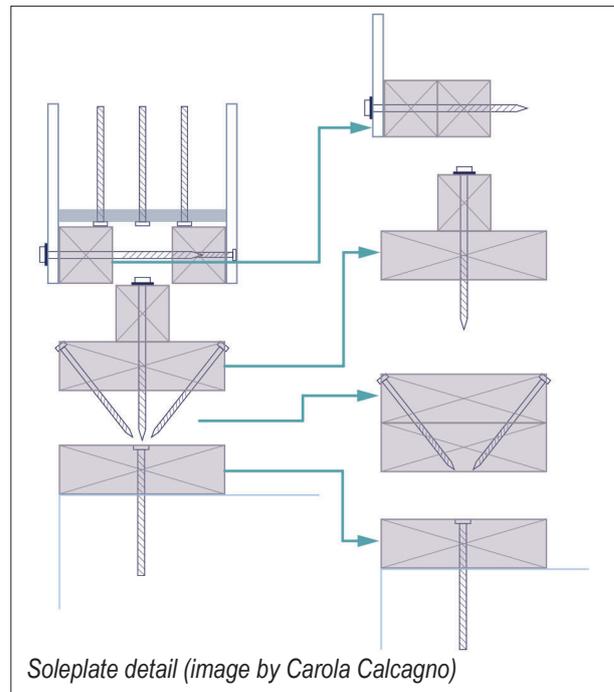


## Timber system

The entire development at Riverford Gardens features the application of CCG's timber offsite panelised system. For this case study, the three-bedroom semi-detached house is taken as reference and presented in detail.

For this house type a platform frame construction method was adopted; the double-storey design consists of: a structural open panel timber frame system; a suspended intermediate solid timber joist floor; a timber fink truss system with a 45° roof pitch, clad with external sarking boards and covered with interlocking concrete roof tiles; and an external leaf of non-loadbearing self-supporting masonry, connected to the timber frame system via metal wall ties.

In addition, an advanced soleplate detail, researched and designed in partnership with ENU COCIS, is applied throughout the project.



## Research focus

### Measuring the impact of European codes of practice

From the housing mix of the site, the three-bedroom semi-detached house type was selected for further research with an emphasis on the structural design.

In the UK there are currently two standards which are used in industry practice for the structural design of Timber Frame systems, those being the old 'BS 5268-2: 2002, Structural Use of Timber', referred to as 'the superseded British Standard' and the current 'BS EN 1995-1-1: 2004+A2:2014, Design of Timber Structures', referred to as 'Eurocode 5 (EC5)'.

In 2010 the British Standard was withdrawn and Eurocode 5 was implemented as the new and current British Standard Institute (BSI) structural timber

design code.

This introduced a major change in the design philosophy for structural timber in the UK, requiring designers and manufacturers to transition from the use of permissible stress design to the more onerous limit state principles of Eurocode 5. Specifically, the superseded British Standard uses 'k' design factors to define loads and material properties; EC5 defines limit states beyond which a structure no longer satisfies its performance requirements, either in an ultimate limit state (ULS) (collapse or similar forms of structural failure that may endanger the safety of people) or a serviceability limit state (SLS) (discomfort, dissatisfaction or a lack of functionality).

Although BS 5628 has been withdrawn as the BSI approved standard, structural engineers still utilise British Standards as account of it being a simpler approach to EC5. However, EC5 offers opportunity for innovation and system optimisation.

Using the Riverford Gardens 3 bedroom semi-detached house the structural capacity of the panels was assessed in accordance with the design requirements of both the superseded British Standard and EC5.

A number of timber frame racking panels (panels providing stability to applied wind actions) were analysed



applying both BS 5268 and EC5 design principles. In terms of racking performance utilisation values, both approaches were shown to provide very comparative results, giving a marginal difference of 2% in favour of the superseded British Standard design approach. However, to achieve such racking performance values, the BS 5268 design method required a higher degree of additional material specification to that of EC5. Via Eurocode 5 there is also opportunity to further improve system performance by optimising specification.



## Key findings

- There is strong evidence that the EC5 design principles are suitable to supersede the now non-maintained and withdrawn BS 5268 design standard. Data obtained from the study demonstrates that the final results obtained are comparable.
- To achieve racking performance values, the BS 5268 design method required a higher degree of additional material specification to that of Eurocode 5, making it a less efficient approach.
- EC5 provides the notable advantage of being capable of incorporating new building technology approaches on the basis that is a more analytical approach, based upon validated calculations rather than being based upon extrapolated values from historical test data.