Huntly Crescent Raploch

Case Study produced by the A+DS Sust. Programme.

Architecture+Design Scotland
Ailtearachd is Dealbhadh na h-Alba

Huntly Crescent, Raploch

The first mixed-use retail/housing development of mass timber construction in Scotland.

BACKGROUND

^ Discussion on site at Huntly Crescent, Raploch

Huntly Crescent is a purpose-built 'towards zero carbon' mixed use development, comprising of commercial shop units at the ground floor with residential accommodation above. This is intended as a 'car free' development, which takes advantage of its location at the heart of the new Raploch village centre. The new shop units sit at the back of an existing pavement, helping to frame and shape the adjacent public space.

Raploch is an area adjacent to Stirling, one of Scotland's newest cities, with origins dating back to the 15th century. However it was during the 20th Century that Raploch's current character was defined as it underwent a major transformation as the location of a large-scale housing development.

According to Raploch Urban Regeneration Company, the area had become an increasingly excluded community in relation to the wider Stirling area – in terms of its higher unemployment rates, poorer health, poorer quality housing, lower educational achievement and a lack of choice and opportunity.

In 2004 Raploch received Urban Regeneration pathfinder status by the then Scottish Executive (now Scottish Government) which provided a catalyst to transform Raploch into a 21st Century community by delivering a 10-year programme, involving the creation of 900 new homes, 225 training and job opportunities, infrastructure and public realm in the area.

Through effective partnership working, the overall aim of Raploch URC has been to build a community where people choose to live, work and visit, with new homes, education and health facilities, within an economically sustainable environment. A number of projects are already complete or underway, including a new community campus comprising nursery, primary and secondary schools and a community college; major construction projects including housing and commercial developments and the setting up of Raploch Community Enterprise to provide opportunities for young people in the area to gain construction skills, that can be developed through the regeneration works.

The Huntly Crescent development, which was funded by the Scottish Government's Town Centre Regeneration Fund, is a flagship project that demonstrates the suitability of mass timber construction and the benefits of renewable technologies.

The development, designed by Glasgow based Anderson Bell Christie Architects, is a mixed-use residential and commercial building located on the corner of Raploch Road and Huntly Crescent, in the shadows of Stirling Castle.

<< Exterior of Huntly Crescent, Raploch

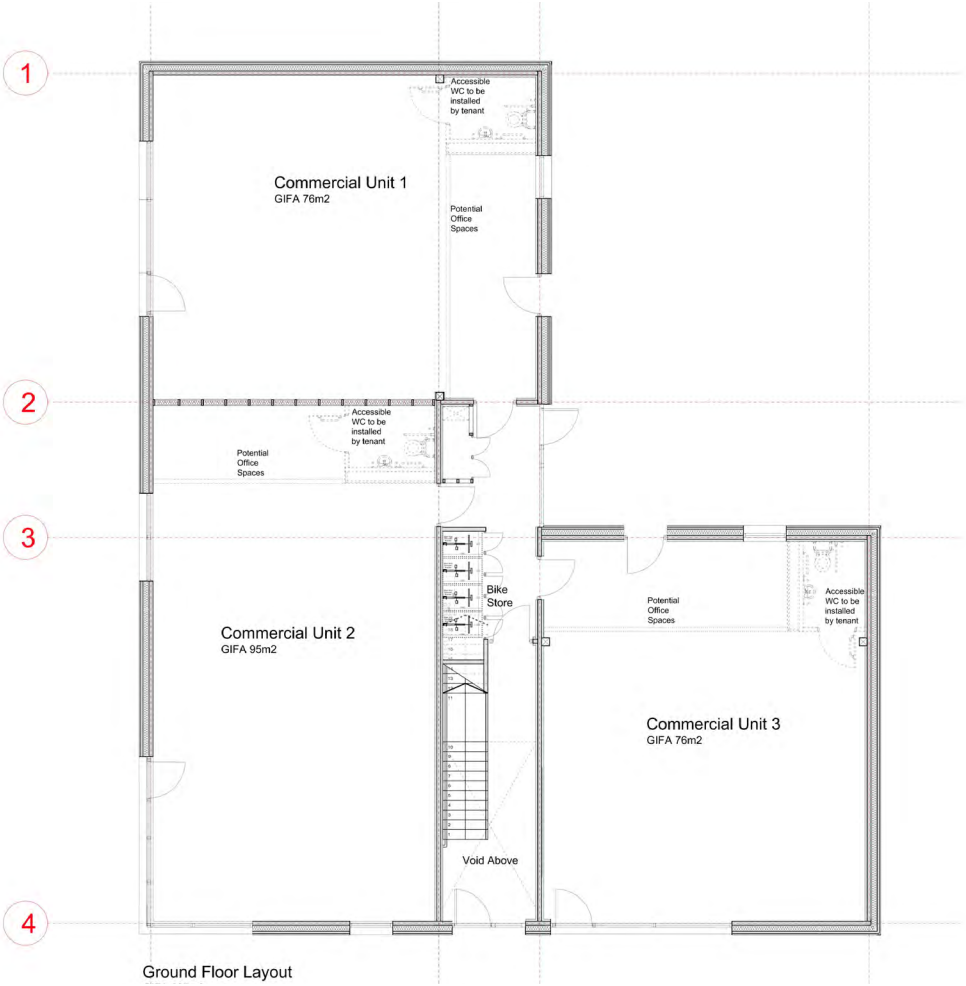
Site plan of the development >>


1800mm Fence
900mm Fence
Copper Bin Store
Widened Pavement
Level Threshold Parking
Garage
Bushes
Grass
HOUSING
RAPLOCH ROAD
HUNTLY CRESCENT
Tarmac Footway
Metal Fence
Hedge Row

First Floor Layout

First floor plan of Huntly Crescent, Raploch ^

Ground floor plan of Huntly Crescent, Raploch v



Ground Floor Layout

Huntly Crescent, Raploch

APPROACH

The project involves the complete redevelopment of a recently cleared site within the estate. The plot was previously used for housing, which had been demolished leaving a clear, grassed site. Aspirations for the development were that:

^ Visual representation of the development

- the building should be low energy using passive measures where practicable;
- the systems for the residential units should be designed to allow individual sale of each flat;
- the systems should be simple and easy to understand and install;
- the systems should be easily incorporated into the mass timber superstructure proposed for the project;
- the systems should be selected to assist with the certification of the scheme;
- the services for the retail units shall be provided for future fit-out once the units are leased;
- penetrations through the building envelope should be carefully considered, located and detailed with the mass timber superstructure manufacturer.

From the outset, Anderson Bell Christie admit that they adopted a 'fabric-first' approach to the design. According to Project Architect Stephen Miles of Anderson Bell Christie:

"It was important that given the nature of the client and the tenant that the innovation of the project was simple and holistically integrated.

Our recent experience in massive timber design from the BRE proposals – particularly looking at CLT (Cross Laminated Timber) again informed the 'fabric first' proposals. The CLT that we have utilised was manufactured by Storaenso in a bespoke factory in Austria using European spruce. CLT has a huge number of inherent properties which are innovative yet simple. The CLT has been designed to be left exposed within the living areas of the three apartments. A higher quality fair-faced finish was applied.

Using CLT allowed us to resolve a number of challenges that arose during the design, statutory approvals and construction. A few of the key properties are:

Air-tightness – Due to the 'massive' nature of the timber with cross-lattice lamellas, and simple construction jointing we expect the timber structure to achieve an air tightness value of around < 0.05 h/m^2 @ 50Pa. This is hugely more efficient than currently required within the technical standards. This informed the SAP results and LZCT (Low or Zero Carbon Technologies) design.

Structure - The CLT frame, has great ability to create large spans and free cut opening due to the nature of the cross lamination. Each panel acts compositely as both a column and a beam. The removal of other ancillary items such and lintels, trimming and any allowance for shrinkage simplifies the design, and partners with precision off-site manufacture for

Huntly Crescent, Raploch

^ Cross Laminated Timber

true lean construction. The building is easily erected with wall panels being built directly from a slab level, with floors being placed directly on top. This simple style of building could be compared to building a 'cardboard model'. This makes detailing interfaces much simpler, as the inherent structural capacity within the laminated panel allows freedom for creating openings.

Fire – The most onerous technical situation within the Scottish Building Standards is the conversation between non-domestic and domestic, and particularly relates to the specific term 'non-combustible'. Through partnership with Napier's Wood Studio we were able to demonstrate that CLT when designed properly through use of Eurocode 5: Design of timber structures to demonstrate charring rates and structural integrity in fire. Anderson Bell Christie successfully challenged the sub-clauses within the technical standards and gained ministerial consent to construct the whole structure in timber, most importantly including the protected enclosure which is a key challenge when looking at the future of timber construction within the Scottish market.

Thermal Mass – By calculating the 'U-Values' dynamically, understanding the ability of the CLT to trap and retain heat – we were able to efficiently design the wall assembly for the best performance.

Insulation and assembly – By insulating externally we were able to completely remove repetitive thermal bridges through the wall assembly, which aided greatly the energy performance of the building. The ability of the CLT to also act internally as a moisture buffer is exploited by removing all ancillary 'plastic wraps' such as VCL (Vapour Control Layers) and Breather Membranes. CLT has the ability to aid regulation of seasonal variation of indoor humidity, which was tested using Wu-fi dynamic calculation methods.

Carbon Capture – At 587m^2 Raploch's CLT frame effectively captures approximately 141 tonnes of Carbon from the atmosphere. Whilst not yet recognised under the technical standards – SAP 'A' rated development will have an annual carbon footprint of approximately 2 tonnes. This effectively means that Huntly Crescent could be classified as a true 'Carbon Neutral' building for the first 70 years of its lifecycle when compared against non-timber construction methods.

Off-Site Manufacturing – Due to the high level of precision design, undertaken by Eurban Timber engineers, the timber frame which was manufactured in Austria, the site construction time was massively reduced over more common building methods in Scotland such as traditional masonry or timber frame. The whole CLT structure was erected, air tight and water tight in 8 working shifts – with some panels as long as 15m being lifted directly from the lorry to an elevation. The ability to construct quickly greatly reduces site management fees and preliminaries, as well as reduces human error building key construction details. Where the CLT is being exposed internally, services routes and locations were factory routed into the structure before it arrived on site.

In essence, the CLT has been designed to perform a number of functions; it is a weathering line, a structure, and regulator and fire stop as well as being a natural carbon sink. Although typically more expensive than

Site construction

Interior view of first floor ^

Exterior view during construction v

^ External view of the finished development

v Zinc cladding

Huntly Crescent, Raploch

more common construction types in Scotland – when balanced against lifecycle energy performance, holistic performance and rapid construction it is much more readily comparable. The whole CLT structure is easily demountable and fully recyclable.

Services and LZCT's – In order to achieve the brief, a passive approach was taken when considering the building service strategy. Reducing consumption before trying to offset it with renewable energy was key. Natural ventilation and a high daylight factor were a focus. Detailed comfort calculations were carried out to assess the viability of natural ventilation. The external walls were constructed to specifications, which are recognised for their advantages in terms of sound absorption and transmission, air-tightness and thermal conductivity.

With the high levels of air-tightness and low U-Values heating demand is minimised. When heating or hot water is required it will be supplied by solar thermal panels and an air source heat pump. The heat pumps extract latent heat from the air. This system has been designed to heat the apartments even on the coldest days of the year. The heat pumps can have an efficiency of 300%. This means that for every one unit of electrical energy 3 units of heat energy can be produced. The result is less primary fuel consumption and reduced CO^2 emissions. No chimneys, fuel tanks or gas connections are required. Its main components are a roof-mounted solar panel, an outdoor unit and an indoor storage cylinder.

The indoor cylinder is then connected to low temperature radiators, which are connected to sensors in the various spaces to control the room temperature to the occupants' requirements. These controls allow for more flexible and responsive room heating so the desired amount of room heating can be delivered when and where it's required. This system therefore is low energy, low carbon and low cost.

The ventilation of spaces was provided by natural ventilation where possible. Natural ventilation provides a low cost, passive approach to fresh air supply. In the commercial units in the summer months the fresh air will leave through the high level grilles connected to the roof openings. These natural ventilation shafts can be opened and closed as required.

The bathrooms have heat recovery fans. These fans extract the air from the space. This air is passed over a heat exchanger then extracted to the outside air. This warm air heats the exchanger. The incoming air passes over this heat exchanger thus supplying warm fresh air into the bathrooms subsequently reducing the heat demand in the space.

A Building monitoring system was also specified to allow users the opportunity to control the heating system thereby giving occupants a chance to understand their energy system and allow them the chance to fine tune it to their needs and requirements."

^ External view of Huntly Crescent, Raploch

<< Rear view of the development

Huntly Crescent, Raploch

^ External view of the development

PROCESS

Project Timeline

March 2010 – Project initiation. At the outset of the project proposals using CLT technology were tabled, outlining the carbon reduction possibilities and highlighting opportunities for promoting the use of Scottish Timber. Working closely with the timber engineers, Napier University's Wood Studio and the Institute for Sustainable Construction, the architects were able to successfully navigate a series of difficult challenges in the pre-construction approvals. The design team and client worked closely with the Sust. Programme at A+DS in terms of documenting the design and construction of the project.

Spring/Summer 2010 – Flat site on the corner of Raploch Road and Huntly Crestcent was selected.

Spring/Summer 2010 – Anderson Bell Christie Architects were commissioned by Raploch URC. Brief set to design and construct a new mixed use development with mass timber construction. The project is funded by the Scottish Government Town Centre Regeneration Fund.

November 2010 – Sustainability Checklist of outline proposal produced.

August 2011 – Construction team goes on site.

March 2012 – Building is completed.

May 2012 – Domestic residents/tenants move in.

Ongoing – Commercial tenants move in.

Ongoing – Funding to carry out energy monitoring pending.

Ongoing – Evaluation of project from partners, stakeholders and users pending.

RESULT

Constructed by specialist house developer Cruden Homes, Huntly Crescent was completed in March 2012, and comprises three commercial units (two at 76sqm and one at 96sqm) on the ground floor with three two-bedroom apartments on the first floor. The project to date has supported 6 jobs in the local area.

It is hoped that the design and construction of the Huntly Crescent project will inspire and educate other developers, encouraging a greater number of low carbon developments to be built in Scotland.

IN USE

At the time of writing this case study, the building was not occupied.

Interior view of the residential units during construction

Huntly Crescent, Raploch

KEY LESSONS

This project was a huge learning curve for Anderson Bell Christie. They had to learn to detail a material that they had never worked with before. In some ways it's simple to detail but complex in that it is solid so there are acoustic issues. They were also testing the water in terms of waterproofing. The office has an avant-garde approach in terms of embracing new technologies and techniques. It was a great chance for Anderson Bell Christie to look at a new typology.

Cruden Homes would describe this project as research and development for them. They discovered that the fire resistance issue for the Cross Laminated Timber ended up costing the project a lot of money. There were large areas of exposed timber that they thought would be a feature, but in the end these had to be plasterboarded and this was a cost that was not built in. So this prevented them from doing some bells and whistles that they would have liked to have incorporated. It opened their eyes to the fact that the technology hasn't really been widely tried and tested as yet.

Huntly Crescent serves to highlight the benefits and introduce the Scottish construction industry to CLT. However this is only part of the story, according to Stephen Miles of Anderson Bell Christie.

"To understand the true potential of CLT in Scotland it is important to understand why CLT was first made. On the continent CLT was first derived as an innovative way of using offcuts from the sawmilling industries. The layering and bonding process creates a panel whose collective strength is greater than that of its component parts. On the continent CLT is a very cost effective building material as it is close to source. It is widely used and there is a well-established industry that is rapidly evolving the technology.

In Scotland a similar situation exists. Scotland's forests are largely populated by trees, which are fast growing and produce low structural grade timber. This timber is largely felled for use as paper pulp, fencing and transportation pallets. In 2009 Scottish woods value share of the UK market was only 5.1% (FCS SFS Progress Indicators 2011). Scottish forestry is a substantially under exploited resource.

If Scottish timbers could be used to form a CLT panel then there is a potential competitor to lightweight frame construction as well as European imports. This would allow an industry to be created in Scotland, which could generate jobs, infrastructure and additional revenue from our natural resources. We are excited by this prospect and are keen to see the Scottish construction industry realise CLT as a solution to the challenge of 2016 building standards."

FURTHER INFORMATION

To find out more about this project visit:

www.huntlycrescentraploch.co.uk/

Project Information

Location:	Corner of Raploch Road and Huntly Crescent, Raploch Estate, Stirling
Client:	Raploch Urban Regeneration Company
Date Completed:	March 2012
Project Value:	£0.75 million
Gross floor area:	Commercial units – two at 76m^2 and one at 96m^2 Flats – one at 76m^2 and one 172m^2
Architect:	Anderson Bell Christie
Consulting Engineer:	Roy Easton Company
Quantity Surveyor:	Keegans Group
Main Contractor:	Cruden Construction (Cruden Homes East)
Funders:	Town Centre Regeneration Fund – The Scottish Government
Image credits:	Anderson Bell Christie Jonathan McQuillan Stephen Miles

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