A BUILDING FOR DISASSEMBLY
THE HOME-GROWN LIBRARY

Laura Gorman

In times of the climate crisis, change on a macro scale is what needs to be addressed to make a more significant change to the world.
In terms of the built environment, which is a prominent contributor to the world's carbon emissions and unnecessary wastage, there is an urgent need for resource-efficient structures. Ideally, less energy should be utilised for construction and highly recyclable materials ought to be present in many aspects of a building. The life cycle of a building should be assessed during the early stages of construction in order to contribute more successfully to its circular economy.
A key factor ensuring the extended life cycle of materials, is to consider the disassembly of a structure into its retrospective components. The concept of DfD (Design for Disassembly), has been around for some time and has been shown to help minimise wasteful materials during construction.
The DfD process helps to reduce the energy usage of buildings. 20% of the full life cycle energy of a building comes from the materials and construction. With DfD featured early in the design stages, this process can be vital for achieving improved carbon emission figures, which would help to alleviate the speed of climate change.

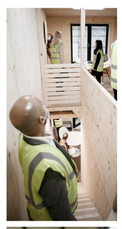
This project has 2 key drivers, 1 is having the ability to be disassembled and 2 makes use of the abundance of locally sourced timber that Scotland has to offer. The UK is currently the 2nd largest importer of timber in the world for construction use, all the timber from Scotland is used for mainly non-structural applications.
Initiatives are already in place to encourage home-grown Scottish timber use and this project makes use of the large Sitka Spruce population around the country.

This high rise timber library acts as a landmark in Pollokshields and a free/heated space for the residents, especially during this time with the cost of living crisis. The building itself showcases its structure, which is able to be taken apart and hosts a variety of spaces, for reading, learning and exhibiting sustainable construction - one of its key spaces. The building is topped with a double height library space which has 360 degree views of the city. The library acts as a building of importance at the top of Maxwell square - a place that seems unloved and underutilised.

NEARHOME CONSTRUCTION @ BE-ST









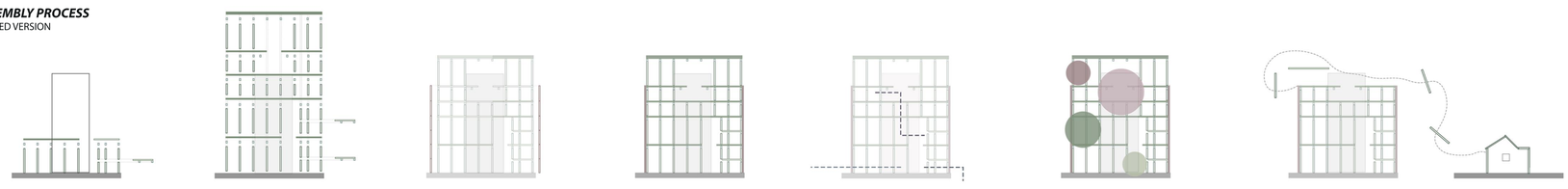


TESTING SCOTTISH HOME-GROWN TIMBER

Scotland is enriched with natural resources, timber in particular. Traditionally, this has been key in the production of non-structural goods such as fencing, cladding, decking etc, uncommon for construction use. The UK is currently the second largest importer of timber, behind China, despite 13% of its land inhabited by woodland
Sitka Spruce was key to rejuvenating the UK's woodland due to quick growth rates and adaptability to poorer soil conditions. Today, this species is responsible for more than 50% of productive forestry in the UK.
The Scottish Government is pushing for its home-grown timber to be incorporated into the construction industry as 3.2 million cubic metres of timber is produced in Scotland each year. Planting trees with rapid growth rates, such as cedar and spruce, to manufacture softwood is beneficial to the forestry industry and can promote the aim of constructing homes using 100% Scottish Wood

Scotland should be utilising its natural resources, a starting point to contributing to its circular economy model. The progression would be to assess this timber usage in the construction industry and to evaluate the demountability of this material. The Innovation Centre is currently working towards the change in attitude towards Scottish timber. The timber that is produced is of low grade and supposedly only sufficient for non-structural applications. BE-ST is testing the strength of Scottish timber in CLT panels within construction, hopefully gathering interest from larger private sector companies.

DISASSEMBLY PROCESS
A SIMPLIFIED VERSION



1. *Creating a structural core from fire resistant CLT components with the de-constructable glulam rame assembled around.*

2. *Rest of the timber frame assembled with the SIP floor panels as each floor gets constructed.*

3. *Demountable wall SIP's with the designated external cladding is attached to the frame, holding no structural significance of its own, simply for creating the building's thermal envelope.*

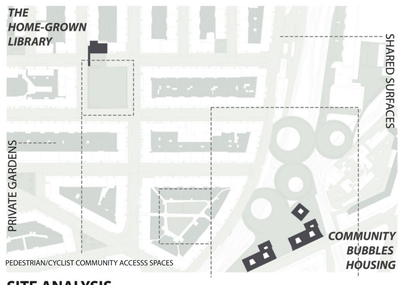
4. *SIP wall and roof panels in place with the option for interchangeable surfaces*

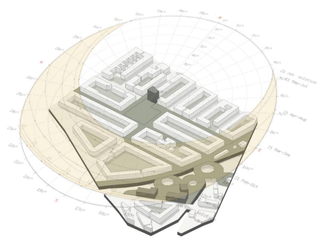
5. *Internal partition walls in place with service systems threaded through building structure. Industrial look for light finishes*

6. *Building Inhabitation of the variety of spaces.*

7. *Disassembly upon requirement, demountable SIP panels then Timber Glulam frame then CLT core structure.*

8. *Material reuse and relocation, with the incorporation of a materials passport, into a range of other projects or rebuilt again to the same library in a new location.*





SITE ANALYSIS
POLLOKSHIELDS, GLASGOW

There are varying levels of green space within the south of Pollokshields. From first glance there are lots of green areas however upon further analysis, most of the green space are private gardens to the tenements. Even with the large area of allotments, these are only open for the people renting, so can be classed as semi-public.
The Community Bubbles housing project upgrades the disused space left by the railway and acts as a cover above, allowing for safe journey by pedestrians etc.

By adjusting the street to a shared surface, existing cars maintain their routes however the space is reclaimed by the inhabitants, with their bikes, kids and garden needs. Maxwell Square can open up around the bounds set by the existing trees and can spill out into the shared surface spaces - allowing for more activity to occur with the necessity of allowing emergency services to access.
There are small community corner nodes along Leslie Street, however these seem underutilised and act as a continuation of the pavement rather than a place of stay.
The concept of the Urban Housing and Building enhances the existing community spaces within and incorporates the street as its own community entity.

SUN PATH ANALYSIS

Both projects utilise the southern sunlight by glazing most of the southern facade. There are features in place to allow for sufficient shading in this buildings such as the receding balconies for the housing and detachable timber shaded details for the library facade.

The Library building gains direct sunlight from its orientation, due to minimal obstructions from the permeable Maxwell Square trees. With the use of detachable timber components, these can be added due to the changing of the seasons or kept as a constant.

The spaces within such as the double height library space at the top of the building, requires plenty of natural lighting for the activities occurring within, in addition to the work spaces and exhibition spaces. The shaded covers allow for direct sunlight further down in a person's vision, causing minimal damage/irritation.

The project also accommodates users that may suffer from visual sunlight or migraine sensitivity by featuring a fully enclosed, dark room. Having a space with zero windows is key in case of a migraine attack.

AN EXISTING LIBRARY IN DISREPAIR

The Existing Pollokshields Library is a beautiful Edwardian structure however sits unloved in disrepair. The facilities of the library feature only 6 computers and not a lot of work/reading spaces. The small library features a range of books however. Yet this space could be upgraded to allow for more community use through the Home-grown Library's Hall, reading and heated work spaces. With the cost of living crisis, creating a range of heated spaces is necessary for the residents to keep bills low and allow for 'working from home' spaces away from home



1:2000 EXISTING HEIGHTS OF POLLOKSHIELDS LANDMARKS



1:500 SITE PLAN WITH MAXWELL SQUARE AND 1:500 SOUTH FACING ELEVATION HIGHLIGHT LIBRARY AND EXISTING LIBRARY



STREET VIEW OF SOUTH/WEST FACADE FROM LESLIE ST.



PERSPECTIVE SECTION OFLIBRARY HIGHLIGHTING VERTICAL ARRANGEMENT AND INHABITATION OF SPACES



LOCATION PLAN IN RELATION TO GLASGOW CITY CENTRE
Transport Links and Routes highlighted



SCOTLAND WOODLAND MAP
Scotland's Environment Website - Land - Woodlands and Forests



MAP HIGHLIGHTING COMMUNITY SPACES OF POLLOKSHIELDS
5 MINUTE WALKING RADIUS
1:20000



MAP HIGHLIGHTING COMMUNITY SPACES SUITABLE FOR WORKING IN A HEATED BUILDING
5 MINUTE WALKING RADIUS
1:20000



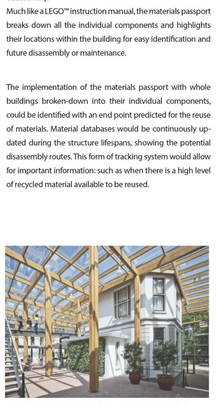
SITE MAP OF POLLOKSHIELDS HIGHLIGHTING LOCAL TRADESMAN AND SUPPLIERS



MATERIAL PASSPORT IMPLEMENTATION

Through advancements in architectural styles in addition to sustainable approaches, The Brummen Town Hall, Netherlands, has obtained a materials passport. It features 'information related to the building's materials, components, and products' along with the future journey of the materials after disassembly.
Much like a *LEGO™* instruction manual, the materials passport breaks down all the individual components and highlights their locations within the building for easy identification and future disassembly or maintenance.

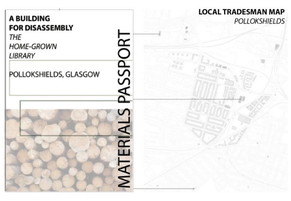
The implementation of the materials passport with whole buildings broken-down into their individual components, could be identified with an end point predicted for the reuse of materials. Material databases would be continuously updated during the structure lifespans, showing the potential disassembly routes. This form of tracking system would allow for important information: such as when there is a high level of recycled material available to be reused.

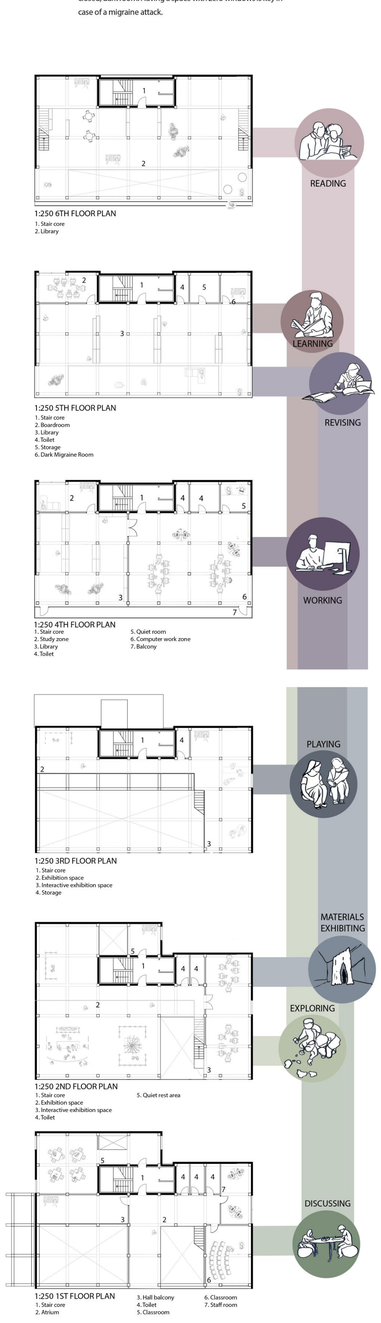


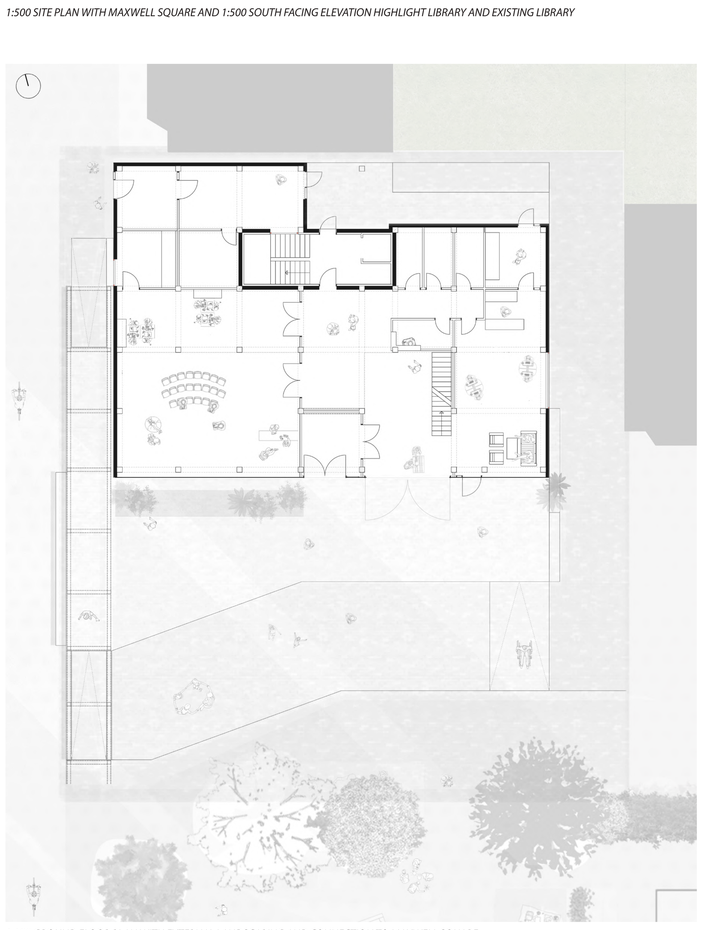
BRUMMEN TOWN HALL, NETHERLANDS

This type of information is beginning to be applied to projects today, and could show valuable results by greatly reducing waste in the construction industry. However, in order to assess the successes of this circular system, results would have to be analysed with projects such as the Brummen Town Hall extension.
The Town Hall acts as a lightweight contrast to the existing Villa. The structure utilises prefabricated timber components, as this type of material along with the choice of connections can be readily disassembled. Steel plates and bolts are used throughout the design for efficient deconstruction

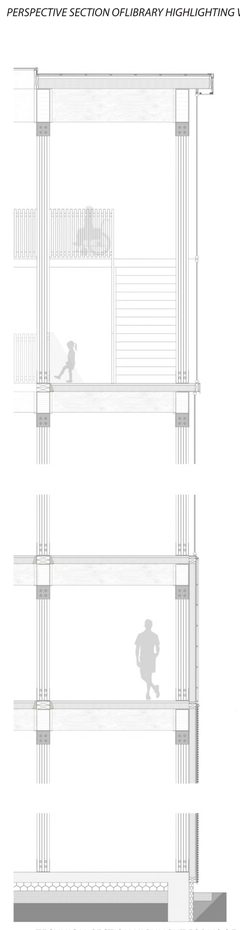
MATERIALS PASSPORT EXAMPLE FOR THE HOME-GROWN LIBRARY







1:100 GROUND FLOOR PLAN WITH EXTERNAL LANDSCAPING AND CONNECTION TO MAXWELL SQUARE



1:50 TECHNICAL SECTION HIGHLIGHT FORMS OF STRUCTURE

ROOF MAKE UP
The building is topped off with a double height open library space. This space allows for 360 degree views of the surrounding city, letting users view the past whilst standing in the future - of construction processes.

The space features the tallest of columns at 6.3m with deeper 800mm beams. Roof SIP panels sit on top of the beams, hosting more insulation and topped in metal roffing and cap. The Fascia are Rock Panel Chameleon panels, hosting a fun colour change in the light from blue - green - purple.

There are a series of skylights that fit into the shape of the grid beam system, allowing for an abundance of natural light into the library space.

DE-MOUNTABLE SIP PANELS
In order to create a straightforward disassembly for the building, SIP panels have been used. The SIP's are attached to the timber frame and add no structural support to the primary structure frame. The panels host the buildings insulation and the 2 types of external cladding, timber and brick slips.

The interior of the building is presented using the plywood board of the SIP Panels, however have the ability to add additional layers, with high de-mountability, to create a variety of internal panels. These could be adding a whiteboard, living wall or anything that requires no wet materials. Wet materials host minimal to no seperation and difficult disassembly.

TIMBER DE-MOUNTABLE STRUCTURE
Timber framed structures can be made readily demountable through simple forms and structures. The design follows a 3.5m x 3.5m grid with the use of three beam types and two column types of glulam timber that will maintain minimal damage upon disassembly via bolted and steel plate connections.
The standard components will be highly recyclable into other projects if this building is disassembled.

The project will use 100% of Scottish Homegrown Timber, the majority being Sitka Spruce and Douglas Fir due to their abundance in Scotland. The Innovation Centre is currently working towards the change in attitude towards Scottish timber. The timber that is produced is of low grade and supposedly only sufficient for non-structural applications. BE-ST is testing the strength of Scottish timber in CLT panels within construction, hopefully gathering interest from larger private sector companies.

CLADDING DETAILS
The external cladding devides the building visually in half. The upper floors represent a lighter visual response to cladding, vertical strips of ScotLarch are attached via screws which over time should turn a silver colour, a visual representation of its life-cycle. ScotLarch utilises locally sourced timber for their products, minimising the carbon transport emissions for the build.

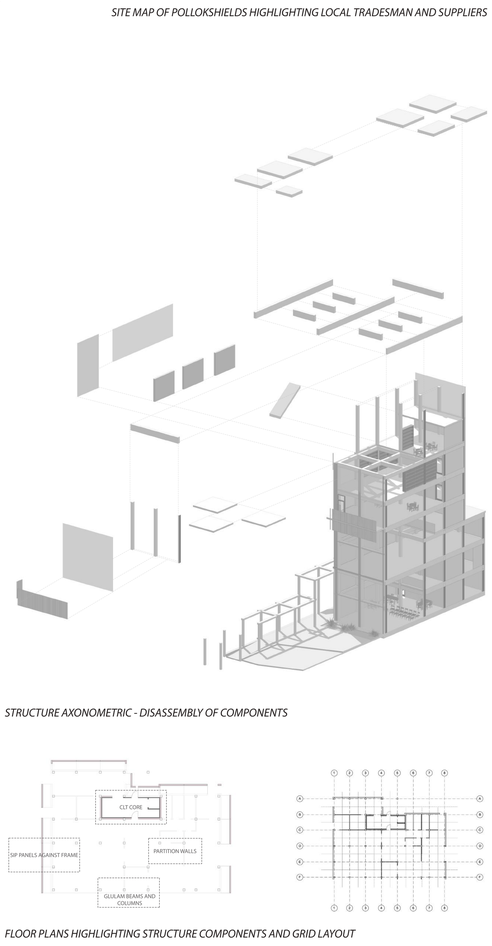
The lower half follows the line and materials of the existing tenements, using cream/blonde brick slips in the Kingspan BrickClad collection. These brick slips are slid onto a metal sheet, meaning no wet materials are used - a big factor for DfD design.

FOUNDATION MAKE-UP
The structure is situated on a concrete slab based on concrete strip foundations. The concrete base acts as the internal finish for the ground floor and is make up of aggregates from other projects, formally inorganic material from construction use. This method is currently used for concrete highway structures however more testing and research is taking place therefore for this future projection project, this form of construction is key for the lowering of carbon emissions for concrete use.

If this building required disassembly, the concrete base has the abilty to be kept and to place otther timber structures on top, following similar grid layouts, a future thinking for Architectural reuse.



1:50 FACADE MATERIALS STUDY



FLOOR PLANS HIGHLIGHTING STRUCTURE COMPONENTS AND GRID LAYOUT



AERIAL VIEW OF THE LIBRARY PROPOSAL SITUATED AT THE TOP OF MAXWELL SQUARE



1:200 CROSS SECTION A-A HIGHLIGHTING BUILDING MATERIALITY AND THE INHABITATION OF MAXWELL SQUARE

URBAN HOUSING
COMMUNITY GREEN BRIDGES



The railway cuts harshly through the site, separating the East from West. I would propose that these fragments of Pollokshields could be threaded together with a series of rounded green bridges to allow for the safe journey for pedestrians, cyclists and wildlife. This would provide a more pedestrian/cycle friendly route and would connect all the existing community spaces of Pollokshields such as Tramway, The Hidden Gardens and the Gurdwara to the rest of the site.

These bridges would lead to a range of housing, from 2 bed to 5 bed maisonettes to suit a variety of family types and sizes. The balconied flats would make use of the southern sun and views of the green bridges along with a full green roof. The housing would take the typical layout of a tenement and open it up creating external courtyard spaces within for gathering spaces and to enter the ground floor flats - with balcony access to the ones above.
The data shine maps show the higher percentage of the residents of Pollokshields leaving the area to work elsewhere - typically by car.

I would propose to create flexible work spaces/business opportunities. This project features a community/commercial ground floor for one of the blocks with the other remaining entirely residential.

Due to the cost of living crisis - it's important to create free, warmed spaces for the residents along with rent-able work units for shop owners etc. Existing provisions such as the library - only has 6 computers and a building that looks like it's falling into disrepair, the proposal would add more community gathering/open green space to the area, which through our research is what Pollokshields needs.

The main living spaces would sit behind the recessed balconies - with most of the rooms having balcony access. In addition to the research about the current residents of the site, it would be helpful to design with the larger multi-generational families for the flat types themselves. To accommodate for these families this project features double storied homes - with the potential for a separation within the flat for grandparents privacy etc.

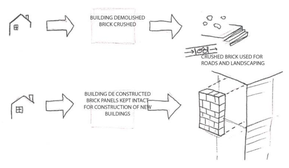


SOUTH FACADE HIGHLIGHTING RECYCLED BRICK RENDER



1:300 CROSS SECTION OF THE 2 COURTYARD HOUSING BLOCKS FACING NORTH

MATERIAL RECYCLING



There is potential use of recycled brick for the construction of this project. Re-ued brick panels can be used for the facade in order to create a visually interesting and environmentally considered external elevation.

For this project, it is important to consider the life cycle materials - this this case brick, which is known to be difficult especially for routes of disassembly. The use of recycled brick allows for a more sustainable construction with considerations for its after life, feeding back into material flows and paying homage to the surrounding sandstone block tenements.



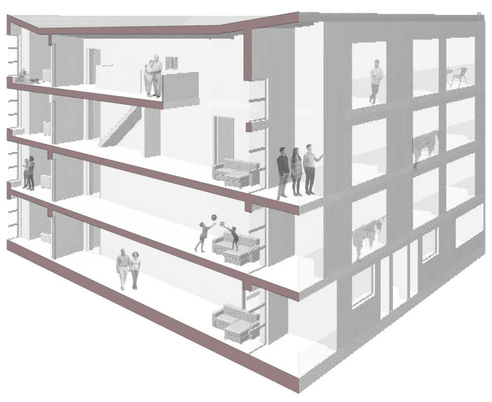
CONNECTING THE COMMUNITY SPACES DIAGRAM





The diagrams above highlight the internal circulation of the existing tenements and how the existing structures have influenced the design of the courtyard housing.

3D SECTIONAL AXONOMETRIC HIGHLIGHTING MAISONETTE FLATS AND RECESSED SOUTH FACING BALCONIES





1:200 CROSS SITE SECTION OF THE HOUSING BLOCK AND THE GREEN COMMUNITY SPACE BRIDGES