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SIT ØYA: Life Cycle Performance in regard to its early design phase and decisions on construction materials

Master's thesis in Sustainable Architecture

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Abstract

Construction industries play a large role in contributing to the environmental problems. The building constructions in the future are inevitable, therefore we can only prevent the emission of hazardous gases. Construction materials have high embodied energy, resulting in a significant amount of carbon dioxide (CO₂) emissions. There are factors to decarbonize the building sector by considering the building material selections, material supply, lifetime, and reuse and recycling to optimize material use in reducing embodied emission. Life Cycle Assessment (LCA) promotes sustainable construction by providing a better understanding of the environmental impacts of the materials on the building. Integrating LCA on early design phase will influence the overall embodied emission of the building, a thorough selection of material with low environmental impact will help reduce greenhouse gas emission (GHG). Embodied emission of materials from production stage (A1-A3) used in the case study with 5 different scenarios [existing building (concrete vs. wood), refurbishment with extension and new constructed building (concrete v. wood)]. They are compared and calculated using Revit for the material quantities and OneClickLCA tool to calculate the embodied emission of materials and how it impacts each scenario. With existing buildings responsible for a major contribution to GHG emission, the result shows that existing building has a high GHG emission even with a lesser floor area than the other scenarios because it was made of pure concrete. Refurbishment scenario shows it has 24% lower GHG emission than constructing a new building, reusing the existing building reduces the GHG emission by avoiding demolition. Result indicates preliminary and are based on limited data information. Further work includes expansion of material information and selection, development of design, and full LCA analysis to have an accurate calculation of GHG emission on buildings.

Sammendrag

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Abbreviations

BIM Building Information Modelling

EPBD Energy Performance Building Directive EPD Environmental Product Declaration

GHG Greenhouse gas

GWP Global Warming Potential

IPCC Intergovernmental Panel on Climate Change

LCA Life Cycle Assessment LCI Life Cycle Inventory

PV Photovoltaic

SDG Sustainable Development Goals TEK Norwegian Standard Regulation

Introduction

Construction industries play a large role in contributing to the environmental problems. The building constructions in the future are inevitable, therefore we can only prevent the emission of hazardous gases. The massive depletion of resource also occurs because of the large volumes of construction materials. Construction materials have high embodied energy, resulting in a significant amount of carbon dioxide (CO₂) emissions (GlobalABC, 2019). The building sector is accountable of significant environmental impacts (Alwan et. al, 2016).

The objective of United Nations for sustainable development (UN SDG) is a focus on a range of issues that need to be addressed by the world; industries innovation and infrastructure (SDG 9), sustainable cities and communities (SDG 11), responsible and consumption and production (SDG 12), and climate action (SDG 13) (UN, 2015). Norway is committed to reduce greenhouse gas (GHG) emissions by 50% on 2030 compared to 1990 levels as a response to the Paris agreement in 2015 (UNFCCC, 2015). In addition, residential buildings in Europe are responsible for the 75% of the total building stock, and 273 of the total energy use in the building (De Boeck et. al, 2015). The European directive on Energy Performance of Buildings (EPBD) requires that all new buildings should be nearly zero energy by 2020 (EU, 2010).

Existing buildings are accountable for a major share of energy use and greenhouse gas emission of the construction sector (GlobalABC, 2019). Previous construction materials were not conceived if the design and its structure will withhold, especially if there is a budget that they must follow. Renovation of an existing building reduces the carbon emission as to not touching its building footprint, avoiding its demolition, and increases it energy performance. It also creates a high investment cost and additional environmental impact because of the additional materials and building integrated systems added to improve its energy performance. Concerning with these issues, there is a need to consider a life cycle approach to avoid and reduce high environmental impact between embodied and operational impacts.

There will be an increase renovation rate in industrialized countries to an average of 2% per year by 2025, and to 3% by 2040. Renovation rates in developing countries should reach 1.5% by 2025 and 2% by 2040. With the increase of in-depth renovation will enable to reduce energy consumption of an existing building by 30-50% or more (GlobalABC, 2019).

For new buildings, there is a need for higher understanding of the future net-zero buildings. With the increasing populations of 2.5 billion by 2050, new buildings will have an important effect on future buildings related to energy use and carbon emissions (GlobalABC, 2019).

Decarbonizing the buildings and construction sector is critical to achieve the Paris Agreement commitment and the United Nations (UN) Sustainable Development Goals (SDGs) (GlobalABC, 2019). There are factors to decarbonize the building sector by considering the building material selections, its material supply, lifetime, and reuse and recycling to optimize material use in reducing embodied emission. (GlobalABC, 2018).

Life cycle assessment (LCA) is introduced to evaluate the environmental performance of building throughout their life cycle. It influences designers' decision and brings a significant improvement in reducing greenhouse gas emissions. It promotes the development of sustainable construction by providing a better understanding of environmental impacts on the materials. (GlobalABC, 2018).

Background

This section provides background to the issues in the study. The definition of global warming issues, life cycle assessment and materials in the study is described.

Global Warming

During the COP21 in 2015, the Paris Agreement was formed to bring all countries to combat the climate change and assist countries with support to adapt to its effects in the environment. Its goal is to address and strengthen its response to the threat of climate change by keeping a global temperature below 2° C and pursue efforts to limit the temperature to 1.5° C (UNCC, 2015).

The projected impacts generated by climate hazards, exposure and vulnerability has increase due to climate change since the Fifth assessment Report (AR5). Risks are projected for the near term (2021-2040), the mid (2041-2060) and long term (2081-2100), at different global warming levels that exceed 1.5° C global warming level (IPCC, 2022).

According to an analysis of International Energy Agency (IEA), the global CO₂ emissions from energy combustion and industrial processes rebounded in 2021 to reach their highest annual level. An increase of 6% from 2020 pushed gigatonnes (Gt), a detailed estimation from region-by-region and fuel-by-fuel by IEA. (IEA, 2021)

Life Cycle Assessment as an early design tool

"A life cycle assessment (LCA, also known as life cycle analysis, ecobalance) is a technique for a product related estimation of environmental aspects and impact ... LCA assesses each and every impact associated with all stages of a process from cradle-to-grave (i.e., from raw materials through materials processing, manufacture, distribution, use, repair, maintenance, and disposal or recycling."- International Standard ISO 14040 (reference)

LCA method has been increasingly adapted to evaluate the environmental impact associated with the production, construction, use, maintenance, and demolition of buildings and applied to assess buildings throughout their life cycle (Röck et. Al. 2018). It is usually evaluated post-completion of the building as it has required detailed specifications for the assessment of embodied impacts of building materials. Full scale LCA is often complicated due to its time consuming and difficulty, especially when applied during early design stage due to insufficient information (Koller et. al, 2000). All LCA studies in early design will have a certain degree of uncertainty (Heinzle et. al, 1998). Currently, LCA needs to be utilized in the early design stage for environmental optimization of the building (Basic et. al, 2019).

Integration of LCA in early design phase should be the new normal practice in design and construction business. With buildings and construction materials consuming about 40% of energy annually in their life cycle stages in production, transportation, use and demolition. The total life cycle energy of a building consists of the embodied and operational energy. Embodied energy is the energy during the production, use (renovation and replacement) and demolition stage, whereas operational energy is the energy required to operate the building, such as lighting, mechanical and operating the building equipment (Petkar, 2014). Integrating LCA during the early design stage will greatly affect the environmental impact of the building.

The reduction of greenhouse gas emission will be achieved by having a well-designed building and a thorough selection of materials during early design stage. Material selection is one of the

critical stages in constructing a building. With the integration of LCA on the environmental performance of each material, greenhouse gas emission will be greatly reduced.

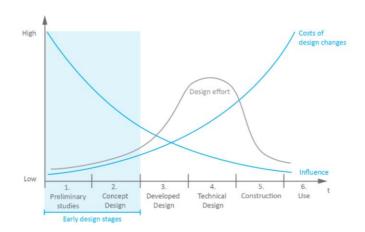


Figure 1 Influence of the early design stages (Paulson, 1976)

Decisions made in the early design stage have the most influence as they set the general conditions in the design process (Paulson, 1976) (see figure 1). It has affected the costs (Paulson, 1976), operational energy (Hegger et.al. 2007), and the environmental impacts (Bogenstätter, 2000). Thus, the greatest potential for optimization and reduction of greenhouse gas emissions lies in the initial stages of design.

Material

The building sector is the main contributor of carbon emission globally with nearly 40% of global energy demand. Building operations are responsible for the 28% carbon emission while materials which are the embodied carbon are responsible for the 11% (Architecture 2030).

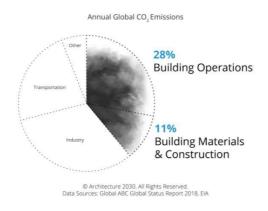


Figure 2 Annual CO₂ emission percentage by sector (architecture2030.org)

New construction that is projected to take place in the future base on UN environmental global status will have 57% embodied carbon and 43% operational carbon. It is important that we deal with the embodied carbon now if we hope to achieve zero emissions by 2040 (Architecture2030). In the coming decade is our opportunity to address buildings and construction emissions, and to prevent and avoid constructing inefficient buildings. (GlobalABC, 2019)

Materials selection will play a role to reduce the greenhouse gas emission. These 3 materials alone are responsible for the 23% of total global emissions and most of this is used in the built environment (Architecture 2030).

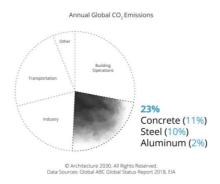


Figure 3 Annual CO₂ emission percentage by material (architecture2030.org)

In Europe, the construction and buildings are responsible for 42% of energy consumption, 35% of greenhouse gas emissions, and more than 50% of all extracted raw materials (European Commission, 2011).

Carbon emissions that result in material use in buildings is account for 28% of the annual buildings related CO₂ emissions. Most of these emissions are a result of cement and steel manufacturing, which have high process emissions and are used in enormous quantities. Aluminium, glass, and insulation materials are secondary contributors. The relative importance of embodied carbon in the global buildings and construction carbon footprint is therefore increasing. Cement and steel use in buildings increased 4% by weight annually from 2000 to 2015 because of construction in rapidly developing and emerging economies (GlobalABC, 2018).

Concrete is one of the most widely used construction materials in the world, but it contributes to a large amount of greenhouse gas emissions (Olivier and Peters, 2018). Cement is the highest CO₂) producing materials and its large amount of CO₂ is produced in the processing of the construction materials and the transport of these materials (Petkar, 2014) in which it is the most important ingredient of concrete.

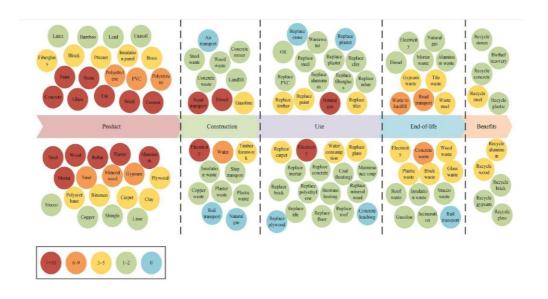


Figure 4 Materials reviewed in several studies (Dong and Liu, 2021)

In figure 4, several studies were conducted and indicated that the red color-coded materials in each stage are materials that contribute large amount of greenhouse gas emission such as concrete and steel (Dong and Liu, 2021).

Malmqvist et al. gave developed a set of strategies for reducing embodied emissions—substitution of materials (substitution with bio-based or recycled/reused materials), reduction of resource use (lightweight, more durable, or recycled/reused materials), reduction of construction and end-of-life stage impacts (construction-related strategies, waste management, seasonal timing etc.) (Malmqvist et. al, 2018).

Material efficiency strategies in residential buildings has potential to reduce the GHG emissions by 80-100%, and material and operation GHG emissions by up to 40% in G7 countries by 2050 (GlobalABC, 2020).

Implementing a life cycle approach can reduce the environmental impact of materials in the buildings and construction. (GlobalABC, 2019) Consumption of unrestrained construction materials will face environmental hazards and to reduce these impacts can be done with lessening of the consumption of construction materials as natural resources are gradually reducing with the growing population and demands. Recycling and reusing materials will avoid the need for new materials and thus saving the natural resources or reducing the consumption of materials. Another method is the selection of construction materials, Designers plays an important role in the selecting materials for their design by evaluating each material on their environmental performance and minimizing the environmental impacts of the materials (Petkar, 2014).

Motivation and Research Question

Motivation

A literature review was assumed to provide support and motivation for this thesis. The topic of integrating LCA during early design stage involves different research and reviews from various fields from construction engineering to building environment to sustainable energy.

Identifying and reviewing existing research publications in the field of Life Cycle Assessment during early design stage was done using the online Research gate, NTNU Open/Oria, etc.

The interests of the main research communities involved drove the choice of the two initial sets of keywords in the search. The first set was created to identify the publications related to life cycle assessment by using the keywords "LCA" and "life" and "cycle", whereas the second search result related to early design stage of design development by using keywords "early" and "design".

Research Question

Greenhouse gas emission is becoming a major problem in the world with the building sector contributing the most carbon emission. With this issue, prevention is the key to reduce the emission in building. One method to prevent the increase of greenhouse gas emission is to integrate LCA approach on buildings in their early design process.

How LCA can affect the environmental impact of building when applied during early design stage?

Early design stage is an important period for the whole building design when project goals, design requirements, site development, initial design concepts, etc. are analyzed and determined (Gao et.al, 2019). Energy performance of the building is affected by the early design decisions made (Elbeltagi et. al, 2017). Many researchers claimed that integrating environmental performance tool like LCA during early design stage will support and assist designers to achieve high performance building (Negendahl, Nielsen, 2015 and Hemsath, 2013) without sacrificing environmental impact of the building.

Structure of the report

This research is divided into 4 parts apart from the introduction and background chapter in which aim to fulfil the research goals and motivation discussed in the above paragraph.

The second chapter discusses the methodology that are needed to calculate greenhouse gas emissions. The chapter have been divided into three sections, which discusses the objectives. The second section deals with the case study and the Building Information Modelling (BIM) in which these models will be use for the material take-off. The third section discusses about the Life Cycle Assessment of the case study with sub-sections: material inventory and material selection.

The third chapter presents the result of the greenhouse gas emission calculation using OneClickLCA tool.

The fourth chapter discusses the result.

The fifth and last chapter highlights conclusion from the result calculated and gives recommendation and further research.

Methodology

This section presents the methodology and approach conducted in this report. To better understand the case study, the project manager of Student welfare organization (SIT) had a meeting together with my supervisor. Information gathered from the site visit and from supervisor were very important. The following methods was conducted to complete this report.

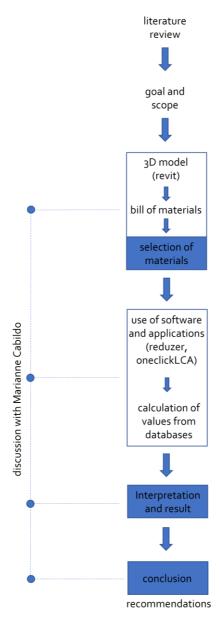


Figure 5 Methodology used to conduct this report

Quantitative method is one of the basis of this thesis' result. The quantitative LCA calculation on the BIM model are based on the material take-off generated in Revit as well as data received from the case study.

Objectives

This report explains how implementing Life Cycle Assessment on early design stage affects the environmental impact of the building towards nearly/zero building by carefully selecting construction materials which are important in LCA perspective in each methodology. It will conduct several analysis and calculation from the data collected of different scenarios of the building by aiming for the lowest environmental impact. To achieve the goal of reducing the environmental impacts during early design stage towards zero emission, the most important aspects have been compared in this report which includes the environmental impacts of the existing building/case study if it is built in the present, renovating of the building/case study rather than demolishing and building a new construction. Identifying the building's environmental hotspots and taking action to reduce them, calculation the lifetime impact of building materials and products to help find the most suitable materials are presented in this report.

Case Study

Sit Øya, a student housing of SIT located in Klostergate 56. It was constructed in 1991. This autumn 2022, SIT plan to build a new building to increase the number of units to cater to growing student population in Trondheim.

Building Description

The student housing is a three-storey residential building connected with their entrance stairs and metal bridge walkway. According to the property manager of the Studentsamskipnaden i Trondheim (SIT), it was constructed in concrete frame load bearing structure.



Figure 6 Sit Øya

Site Analysis

The building is located at a residential area near the city center. It is 1.0 km from NTNU Gløshaugen campus. 1,2 km to the city center. It is a perfect location for students where all their needs are in a walking distance.



Figure 7 Site Plan of Sit Øya

BIM

The case study SIT ØYA has been modelled using Revit program to get information about the quantities of each building element of the building. The quantities of the materials are extracted (tables) from Revit and used for the calculation using OneClick LCA to obtain the amount of carbon emissions of each building element. The models are obtained from Marianne Cabildo, who is working on the design-based project of Sit Øya.

There are 5 scenarios which includes the design of the existing building, and the other design is additional floor with new building beside it.

Scenario 1 and 2

The existing building will be the base reference with this scenario, it will show how much greenhouse gas emission will produce when the building is constructed on the present time.

Scenario 1: concrete materials for the whole building

Scenario 2: timber materials walls and floors for the 1st to 3rd floor of the building

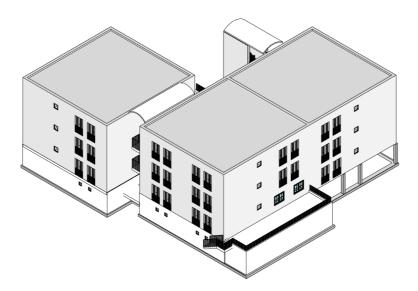


Figure 8 BIM model in reference to scenario 1 and 2 (Cabildo, 2022)

Scenario 3

The existing building will remain as is and will be reused with the exception of all windows due to poor thermal insulation. An additional floor has been added on top of the existing building and a new building extension to accommodate more students which are constructed in timber. Red hidden lines indicate the demolish part of the existing building.

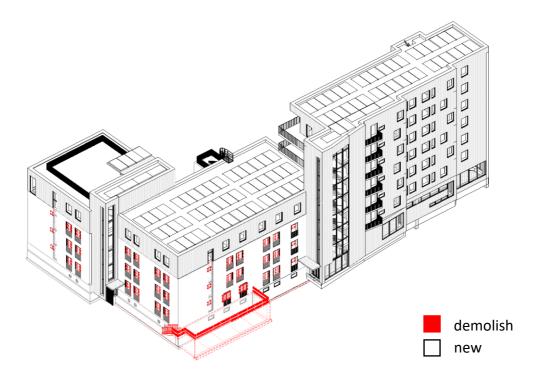


Figure 9 BIM model in reference to Scenario 3 (Cabildo, 2022)

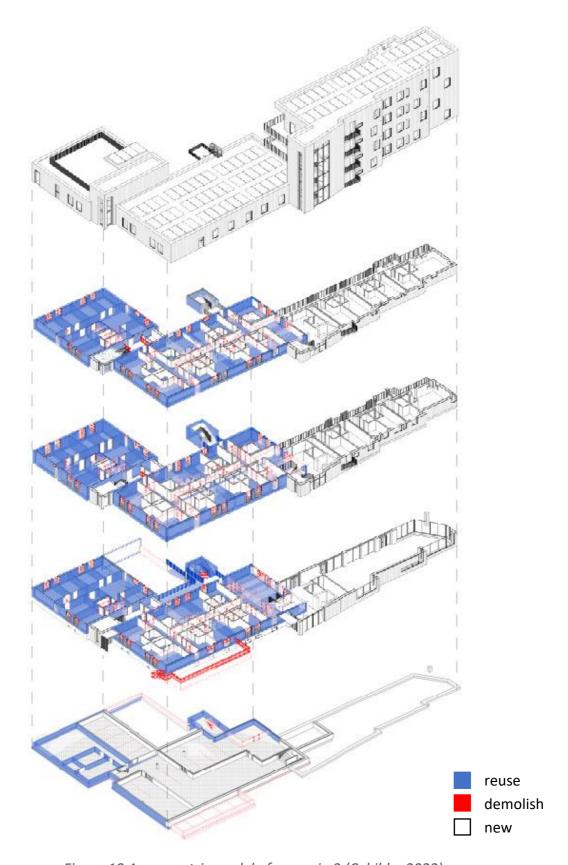


Figure 10 Axonometric model of scenario 3 (Cabildo, 2022)

Scenario 4 and 5

These scenarios have the same design as the scenario 3, but the building will be considered as a newly constructed building whereas,

Scenario 4: mixed concrete and timber construction using wooden wall and floor elements except for the basement.

Scenario 5: mixed concrete and timber construction using prefabricated concrete exterior wall elements and wooden floors

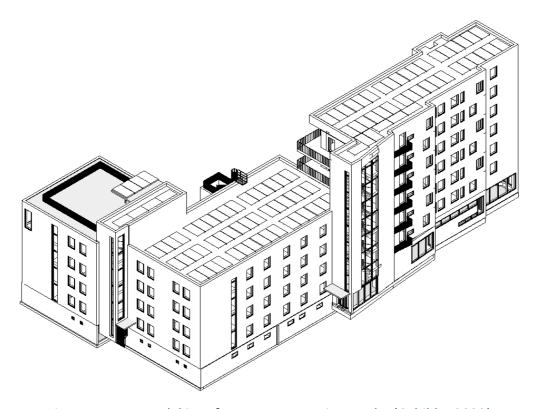


Figure 11 BIM model in reference to scenario 4 and 5 (Cabildo, 2022)

LCA

Life Cycle Assessment (LCA) is used to assess a products/materials' environmental impact over its whole life cycle, from raw product extraction to disposal (cradle to gate). LCA involves the use of Environmental Product Declarations (EPDs). This is fundamentally the systematic and certified definition of a product's environmental profile (OneClickLCA, 2015). The EPD will provide and support reliable information about the product and its effect on the environment throughout its lifetime

NS-EN 15978 gives calculation principles to assess the environmental performance of new and existing buildings (Standard Norge, 2011). In this standard, system boundaries are defined for LCA of buildings. The system boundaries defined in NS-EN 15978 are A1-A3 (product stage), A4-A5 (construction process stage), B1-B7 (use stage), C1-C4 (end of life stage) and D (benefits and loads beyond the system boundary) (Eliassen, 2019).

Goal and scope

The goal of this report is to determine the environmental impacts of different scenarios from constructing the existing building at present to refurbishment of the existing building to newly constructed building scenario. The case study is a three-story with 1618 sqm with basement parking. Located in Klostergate, Trondheim. Its construction system includes prefabricated concrete sandwich wall component on its exterior element with hollow core slab floors. The building was used as a student housing and was closed in 2021 due to future of constructing a new building to accommodate students.

Functional unit

The functional unit has been set to: (kgCO₂) of the operational building lifetime'. The results are normalized according to the heated floor area of 1618 m² for the existing building and 3482 m² for the refurbishment and new construction with a building lifetime of 60 years.

System boundary

The system boundary of the report includes A1-A3, production stages. With these stages, the report analyses each stage of the material used on the scenarios of the building. These boundaries were chosen to because it is assumed that these are the stages with the highest greenhouse gas emissions. Other stages were excluded in this report because of lack of data.

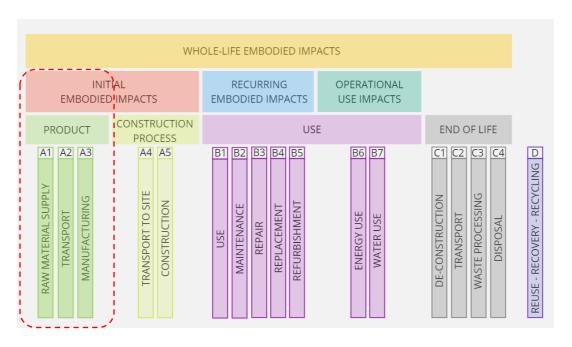


Figure 12 Life cycle stages according to EN-15978

Limitation

This report is limited by the data gathered from SIT about the condition of the existing building and the building information model (BIM) made by Marianne Cabildo. The proposal of the structural components was assumed according to the suggestions of Bunji Izumi, one of the consulting supervisors. However, the structural systems have not been calculated precisely. In terms of LCA system's boundary, there was a limitation as well and not a full scope of the boundary was included in this report. The stages of the system boundary included as shown in figure 13.

A full detailed LCA calculation of the scenarios has not been done on this report because the main goal of the study is to compare the construction materials selected and how it affects the environmental performance of the building.

Biogenic carbon is not included in the greenhouse gas emission calculation because end of life is excluded.

Life Cycle Inventory

In this report, different types of materials with its environmental product declarations (EPDs) were used to determine greenhouse gas emissions within the study's framework boundary. EPDs used were production based in Norway for most of the materials.

The case study with different scenarios has been modelled using Revit to get the information about the quantities of each building element of the building. The quantities of the materials are extracted from Revit and used for the calculation OneClickLCA to obtain the number of carbon emission of each building element within the boundary (See Appendix A for complete list of materials extracted in Revit).

The embodied emissions include the main building elements of the building envelope and the major internal building elements such as slabs and inner walls. Stairs, doors, and tiles are also included. Finishes like paints, varnish of the external and internal surfaces is not included due to uncertainties.

Building Envelope

An overview of material inventory extracted in Revit. It should be noted that formwork, metal studs and steel rebars have not been included in the inventory due to uncertainties. Tables show only the building element that shows high greenhouse gas emissions such as the external and inner walls, floors, and roofs. (See Appendix B for complete list of materials from OneClickLCA)

Table 1 Material quantities that emits most GHG emissions

materials		scenario 1	scenario 2
cast in situ concrete		226,15 m³	237,7 m³
prefabricated concrete			
	wall	914 ton	
	slab	1026 ton	151 ton
	column	1.05 m³	1,05 m³
	stairs	10,6 m³	10,6 m³
screed		179,2 ton	52,43 ton
vapour retarder		1555 m²	2556 m²
waterproofing		679 m²	679 m²
EPS insulation		5432 m²	5432 m²
gypsum board		6719 m²	10759 m²
mineral wool insulation		9766 m²	26843 m²
vinyl		1365 m²	49 m²
doors and windows		150,72 m²	150,72 m²
wood panel			
	cladding		22,32 m³
wind barrier			10,15 m²
particle board			1306 m²
Laminated plywood			3474 m²
pvc waterproofing sheet			431 m²

An overview of building construction on building elements on each scenario based on the material inventory.

Table 2 Construction of Building Elements on Scenario 1

Scenario 1: existing_concrete		
Outer wall	prefabricated concrete sandwich wall with insulation	
Inner wall	The inner wall consists of 2-13mm + 100mm + 2-13mm timber stud partitions with mineral wool insulation between the gypsum boards.	
Floor	Hollow core slab construction with 50mm mineral wool insulation and a homogenous vinyl finish. In the toilet and bath, a ceramic tile is used as the floor finish.	
Roof	roof has a concrete construction with 200mm mineral wool insulation. Roofing tile has been used.	

Table 3 Construction of Building elements on scenario 2

Scenario 2: existing_wood	
Outer wall	The outer wall element consists of 200 + 150 + 50mm mineral wool
	insulation with gypsum board internal finish, a vapour and wind
	barrier and an external timber cladding.
Inner wall	Same as scenario 1
Floor	floor structure is described by timber construction, with 200mm
	mineral wool insulation and timber floor finish. In the toilet and bath,
	a ceramic tile is used as the floor finish.
Roof	Roof consists of 100 + 350mm mineral insulation with gypsum board
	finish, vapour and wind barrier and roofing felt.

Table 4 Material quantities that emits most GHG emissions

materials	scenario 3	scenario 4	scenario 5
cast in situ concrete	171,21 m³	319,27 m³	319,27 m³
prefabricated concrete			
wall	11,6 ton		1790 ton
slab	11,4 ton		
column	0,6 m³	0,78 m³	0,78 m³
stairs	31,71 m³	32,32 m³	32,32 m³
screed	16,61 ton	54,33 ton	90,63 ton
vapour retarder	8651 m²	14612 m²	2070 m²
waterproofing	203 m²	711 m²	711 m²
EPS insulation	5728 m²	5688 m²	5688 m²
gypsum board	16039 m²	22974 m²	20469 m²
mineral wool insulation	41951 m²	75252 m²	45734 m²
vinyl	24 m²	16 m²	16 m²
doors and windows	563,34 m²	522,37 m²	522,37 m²
wood panel			L
cladding	35,48 m³	55,9 m³	
roofing	1,08 m³	4,15 m³	4,15 m³
wind barrier	1993 m²	3046 m²	512 m²
particle board	1796 m²	3554 m²	3194 m²
laminated plywood	7655 m²	7664 m²	7664 m²
glue laminated column	24,29 m³	24,29 m³	24,29 m³
pvc waterproofing sheet	563 m²		

Table 5 Construction of building element on scenario 3

Scenario 3	
Outer wall	The outer wall element consists of 200 + 150 + 50mm mineral wool insulation with gypsum board internal finish, a vapour and wind
	barrier and an external timber cladding.
Inner wall	The inner walls are described by timber stud partitions with mineral
	wool insulation and a gypsum board. It varies depending on where it
	will be installed. Walls have either 100mm, 150mm or 200mm mineral
	insulation with gypsum board internal finish.
Floor	floor structure is described by timber construction, with 200mm
	mineral wool insulation and timber floor finish. In the toilet and bath,
	a ceramic tile is used as the floor finish.
Roof	Roof consists of 100 + 350mm mineral insulation with gypsum board
	finish, vapour and wind barrier and roofing felt and the other part has
	roof decking.

Table 6 Construction of building element on scenario 4

Scenario 4	
Outer wall	
Inner wall	Same as scenario 3 but will be
Floor	considered as new constructed building
Roof	

Table 7 Construction of building elements on scenario 5

Scenario 5	
Outer wall	Same as scenario 1
Inner wall	
Floor	Same as scenario 3
Roof	

Construction detail of main building elements in the scenarios based on Byggforsk TEK17.

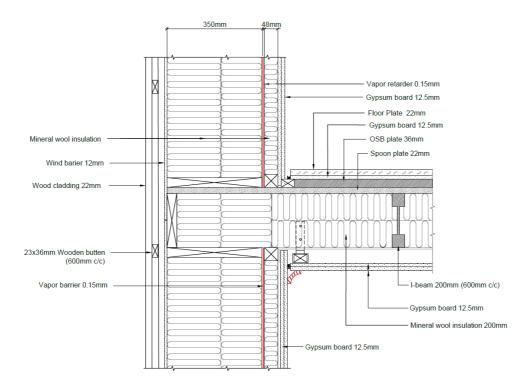


Figure 13 timber wall and floor detail (Byggforsk TEK17)

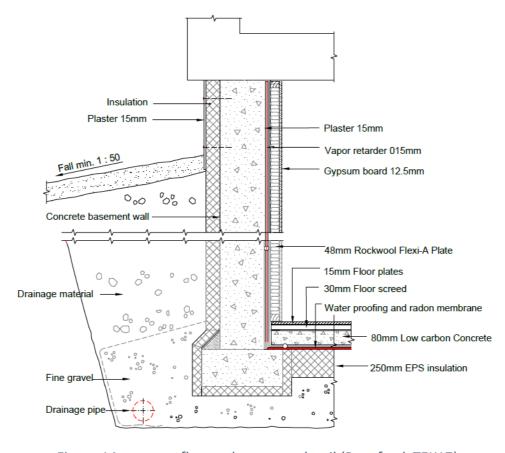


Figure 14 concrete floor at basement detail (Byggforsk TEK17)

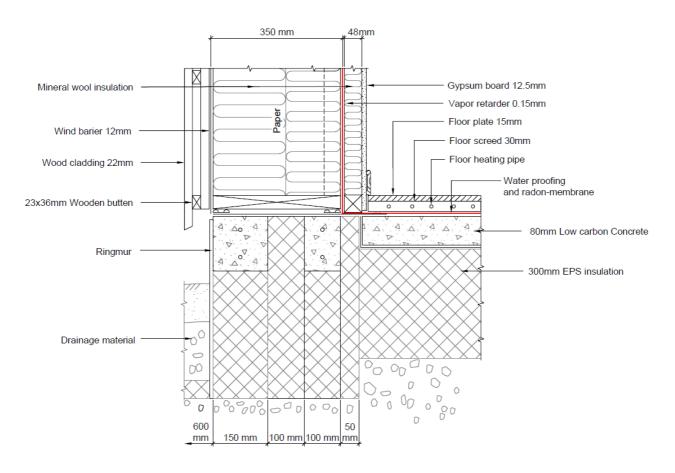


Figure 15 concrete floor with exterior timber wall detail (Byggforsk TEK17)

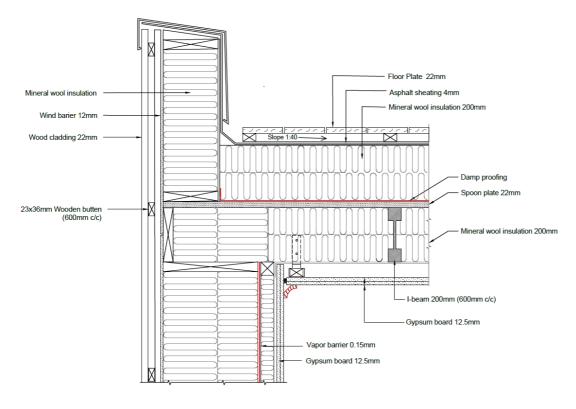


Figure 16 wooden roof detail (Byggforsk TEK17)

Building Materials

Scenario 1

The existing building of Sit Øya was built for student housing where materials used were meant for its purpose and location. It is located close to the city center and campuses. The building is a 3-strory concrete building with 63 units. It is built according to the Norwegian TEK97 standards. Exterior walls are made of prefabricated concrete sandwich wall with insulation. The slabs are hollow core slabs. The stair in the building is made of prefabricated concrete element. (See figure 8 for scenario 1 and table 3 for building construction of elements).

Scenario 2

The scenario 2 has the same design as the scenario 1 but has a mixed wood and concrete construction. Its exterior walls are made of timber frame with wind barriers and vapour barrier with gypsum board. The floors are also made of timber frame. Only the basement which houses the parking, service and technical rooms are made of concrete (See figure 8 for scenario 2).

Scenario 3

In scenario 3, the existing building was refurbished. The building does not comply to the current Norwegian TEK17 standard regulation, however, some of the materials can still be used. The original building frame was still used such as the prefabricated concrete sandwich wall and hollow core slabs. The exterior walls were used to preserve its architectural character and to reduce the emission of carbon from demolition. The windows needed to be replaced due to poor thermal insulation considering it was constructed in 1991 and doors, considering these materials have reached their replacement stage. (See figure 9 for scenario 3 and figure 11 for the axonometric model).

A floor on top of the existing building was added to accommodate more students and a communal kitchen, it was placed on top to utilize the view and daylight. With a total of 52 units together with the existing structure below, its exterior walls are made of timber frames with wind barrier and vapour barrier with gypsum boards. The façade cladding is wooden panels.

The concrete roof of the existing building was also replaced with timber frame flooring to reduce the load of the additional floor from the existing building.

There is a new building beside the existing which serves as an extension of the student housing. It is a 7-story wooden building with 36 units. The building was designed after the passive house standard NS 3700 to be more energy efficient (NS3700, 2013). The walls and floors are made of timber elements. Only the floor on the ground which the communal kitchen is located is made of concrete.

Scenario 4

The scenario 4 has the same design as scenario 3 but the difference is that it will be a newly constructed building built with mixed concrete and timber frame construction. The basement wall and floors and the floor at the ground, and staircases are made of concrete and the rest are all in timber frames (See figure 11 for scenario 4).

Scenario 5

Same as in Scenario 4 but only the succeeding floors are made of timber frame construction and the rest are built on concrete construction. The exterior walls are made of prefabricated concrete sandwich walls (See figure 11 for scenario 5).

Result

This section presents the result from the material inventory of the building and the materials used in the different scenarios. The result will be presented in kgCO₂-eq for the production stage A1-A3). It is also noted that the structural system in the groundworks included is not precise such as the quantities of rebars, foundation works such as footings, etc.

Scenarios

To perform an environmental assessment comparison, it was proper to compare several scenarios to understand different implication of construction materials affects the greenhouse gas emissions (See Appendix B for OneClickLCA list of materials).

The 5 scenarios were divided into 2 parts: Scenario 1 and 2 with the same heated floor area of 1618 m² and scenario 3, 4 and 5 with 3482 m² for an appropriate comparison. Though, scenario 3 is only a refurbishment, the existing building is considered 0 in term of its GHG emissions and the heated floor area from the existing is included.

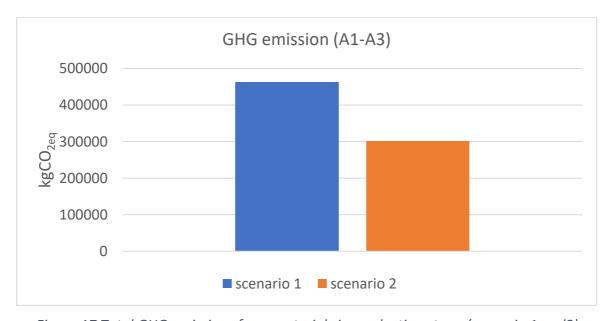


Figure 17 Total GHG emissions from materials in production stage (scenario 1 and2)

Scenario 1: existing_concrete Scenario 2: existing_wood

The result shown in figure 17 is the comparison between scenario 1 and 2. The total GHG emissions for the production stage (A1-A3) is 463 041,64 kgCO₂-eq for the scenario 1 and 300 938,65 kg CO₂-eq for scenario 2 for a building lifetime of 60 years.

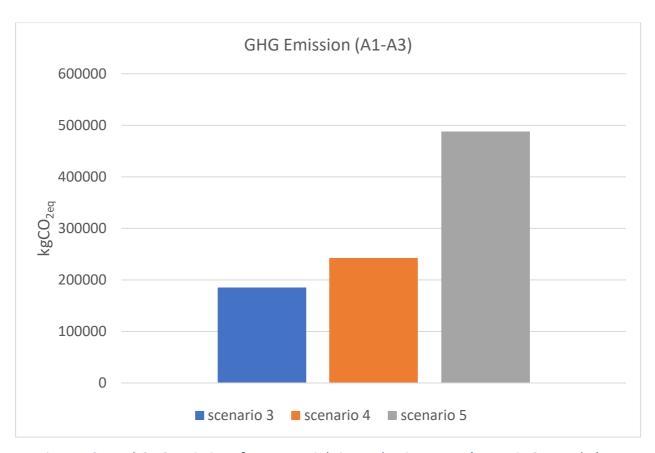


Figure 18 Total GHG emissions from materials in production stage (scenario 3, 4 and 5)

Scenario 3: refurbish

Scenario 4: newly constructed_wood Scenario 5: newly constructed_concrete

The result shown in figure 18 is the comparison between scenario 3, 4 and 5. The total GHG emissions for the production stage (A1-A3) for scenario 3 is 184 758,29 kgCO₂-eq, scenario 4 with 242 622,72 kg CO₂-eq and for scenario 5 is 487 192,12 kg CO₂-eq for a building lifetime of 60 years.

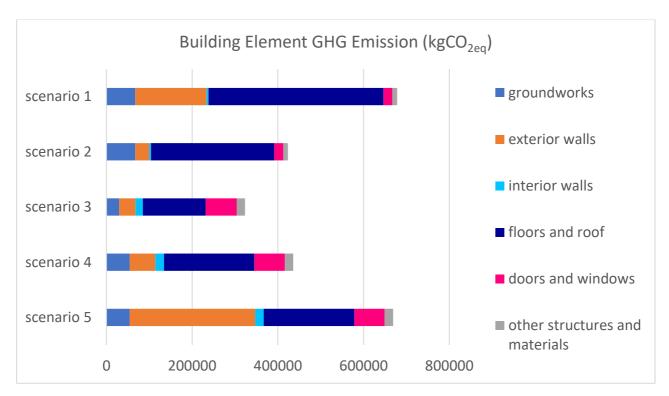


Figure 19 GHG emissions by building element

Scenario 1: existing_concrete Scenario 2: existing_wood Scenario 3: refurbish

Scenario 4: newly constructed_wood Scenario 5: newly constructed_concrete

In the figure 19, result shows that floors and roof have the highest amount of GHG emission from the other elements. The exteriors walls have the second highest amount of GHG emission. The scenario 1 has a huge amount of GHG emission due to its concrete flooring using hollow core slabs with 102 100 kgCO₂-eq. On the other hand, the scenario 5 has the biggest amount of GHG emission with the use of prefabricated concrete sandwich wall element with insulation amounting 135 000 kgCO₂-eq.

Building Materials

In figure 20, it shows that prefabricated concrete elements have a huge impact amounting to 240 055 kgCO₂-eq in the scenario 1. Some of the materials have a similar or close in amount as only the exterior and floor elements were compared.

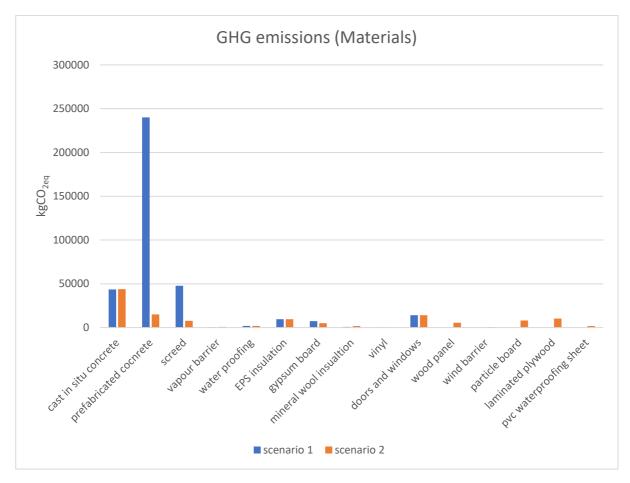


Figure 20 GHG emissions from materials in scenario 1 and 2 for production stage (A1-A3)

Scenario 1: existing_concrete Scenario 2: existing_wood

In the figure 21, the prefabricated concrete on scenario 5 has a very huge amount of GHG emission due to the exterior walls made of prefabricated concrete sandwich element with insulation which emits 265 000 kgCO₂-eq. As mentioned previously, some of the materials have a similar or close in amount as only the exterior elements were compared. Floor construction on the 3 scenarios have the same timber frame construction except for the basement and ground floor.

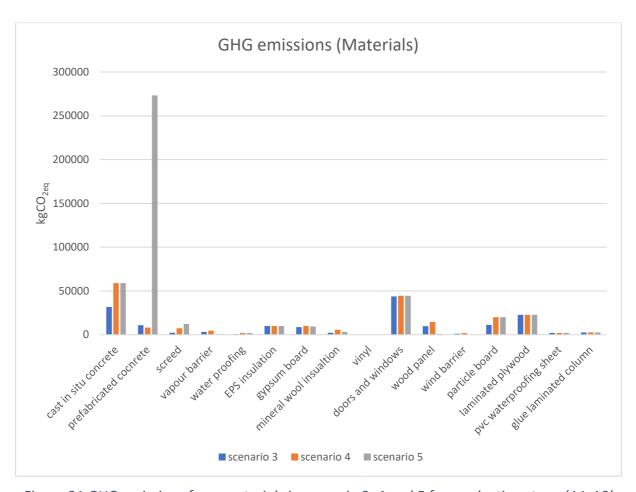


Figure 21 GHG emissions from materials in scenario 3, 4 and 5 for production stage (A1-A3)

Scenario 3: refurbish

Scenario 4: newly constructed_wood Scenario 5: newly constructed_concrete

Selection of Material

Different building materials with Environmental product declarations (EPDs) have been used in this report for the calculation of the emissions of greenhouse gas. Most of the EPDs used produce and manufactured in Norway.

A thorough selection of construction materials and multiple analysis was conducted to be more sustainable with lesser environmental impact as part of the process. Scenario 1 was made as the base reference of the materials. Materials used were according to the project manager of SIT and a condition assessment report made by Multiconsult.

Due to concrete having a huge amount of GHG emission. Prefabricated concrete sandwich wall was compared to timber wall construction. As seen in figure 19, GHG emission of external wall

in scenario 2 has 32 587,97 kgCO₂-eq which is 80% lower than the GWG emission in scenario 1 with 166 581,99 kgCO₂-eq.

Most of the materials selected and used has a low GHG emission on A1-A3 such as low carbon concrete, mineral insulation, timber wall and floor construction without affecting the design and standards while also preserving it.

Different insulations for the external and internal walls, and floors have been also conducted for comparison. Insulation is one of the materials that contributes to GHG emission so selecting a right insulation will affect the overall GHG emission to the building. 3 various insulations were compared, 2 of those are organic and 1 is glass wool. Insulations were compared by inputting the total area m² of insulation used on each scenario in OneClickLCA compare data.

Table 8 Total areas of insulation on each scenario

	wood fiber (38-40mm) *	mineral wool (38-40mm) *	cellulose fiber (100mm) *
Scenario 1	97	66 m²	3710 m²
Scenario 2	268	843 m ²	9017 m²
Scenario 3	500	586 m²	18185 m²
Scenario 4	752	252 m²	24789 m²
Scenario 5	449	924 m²	15979 m²

^{*}thickness of the insulation

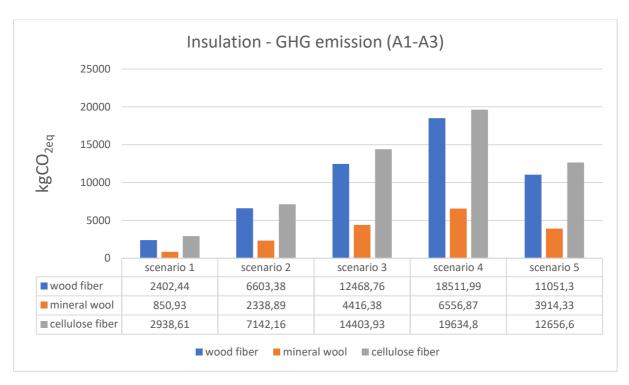


Figure 22 GHG emission of insulation materials from A1-A3

Scenario 1: existing_concrete Scenario 2: existing_wood Scenario 3: refurbish

Scenario 4: newly constructed_wood Scenario 5: newly constructed_concrete

In table 8, different insulations were compared. 2 insulations are organic and 1 is glass wool. Wood fiber blown insulation has 0,25 kgCO₂/m² GWP while glass mineral wool with 0,42 kgCO₂/m² and cellulose blown insulation with 0,12 kgCO₂/m². Figure 22 result shows that mineral wool insulation has the lowest GHG emission despite wood fiber having a lower GWP.

Discussion

This section discussed the result and calculation conducted. It is also noted that in this discussion of GHG emission of materials, the structural system in the groundworks included is not precise such as the quantities of rebars, foundation works such as footings, etc.

Scenarios

The result of scenarios 1 and 2 in figure 17 are as expected since scenario 1 is built in concrete construction and scenario 2 is mixed concrete and timber construction. The GHG emission on scenario 2 is 35% lower than in scenario 1, which the external wall made of timber frame construction contributed to reducing the environmental impact in A1-A3.

In figure 18, shows that scenario 5 has the largest amount of GHG emission. It is due to the prefabricated concrete sandwich wall were used as the external wall of the building. As for the scenario 3 and 4, there is a 24% difference in their GHG emission, albeit the materials in the existing building was not included, which shows that when choosing a much lower GHG emission in material for the scenario 4 can greatly reduce the emission in it.

Figure 19 shows that the building element which contributes the highest GHG emission are the floor and roof, and the next highest is the exterior walls in the case of scenario 1 and 5. These building elements have a high GHG emission as it is made of prefabricated concrete such as concrete sandwich wall and hollow core slab.

Figure 20 shows that for scenario 1, prefabricated concrete is the material that contributes with the most greenhouse gases, followed by screed and cast-in situ concrete as this was used in the exterior walls, floors, basement, and stairs. Selecting a material with low greenhouse gas emission is essential to lower the GHG emission from concrete buildings. For scenario 2, timber played a role in lowering the GHG emission especially to the exterior and floor elements as shown in figure 20. The cast in situ concrete has the most GHG for scenario 2 as it was used in the basement floor and walls.

In figure 21, result shows that prefabricated concrete has the highest amount of GHG emission on scenario 5 in which all its exterior walls are made of concrete sandwich wall element followed by the cast in situ concrete which are used in the basement floor and wall, and the

floor at the ground floor of the new extension building. Door and windows have the third highest GHG emission, and all scenarios have similarly amount of it. In scenario 3 while it's a refurbishment, all doors and windows were replaced due to poor thermal condition, so it adds up to the GHG emission.

Selection of material

From figure 19, external walls and floors has the most GHG emission for most of the scenarios. Materials used for these building elements were prefabricated concrete which are concrete sandwich wall with 0,15 kgCO₂/kg and hollow core slab with 0,0995 kgCO₂/kg.

For the case of scenario 1 and 5, prefabricated concrete is the material with the most GHG emission contribution (see figure 20 and 21). Replacing the prefabricated concrete with timber constructions has reduce the GHG emission as seen in figure 17 and 18.

In selecting the insulation, there are factors to consider such as thermal performance, environmental impact, and fire resistance.

Figure 22 shows that mineral wool has much lower GHG emission than the 2 organic insulations. It is also noted that the biogenic carbon in the GWP of wood fiber is disregarded as the end-of-life stage is excluded in the calculation. Mineral wool has a better thermal conductivity than wood fiber and cellulose with 0,038 W/mK than 0,04 W/mK and 0,039 W/mK respectively, it is also a good acoustic insulation and is moisture resistant.

Conclusion and Further Research

Conclusion

SIT wants to build a new building over the existing to accommodate more student. In line with lowering the GHG emission, this report was formed to conduct several calculations on different scenarios whether demolishing the existing building is better than refurbishing it and constructing a new building extension and how selected material affects the GHG emissions on each scenario on early design stage.

From the results in figure 17 and 18, it is concluded that scenario 3 which is the refurbishment has lowest GHG emission in A1-A3 stage. The result in figure 17 shows that scenario 1 which is the existing building with concrete construction has a higher GHG emission than scenario 2 with mixed concrete and timber construction if it will be built at present. It was also the base reference for the other scenarios. To avoid an increase in GHG emission due to demolition, it is often assumed that renovating/refurbishing of existing building will have a lower environmental impact compared to new construction. In figure 18, the scenario 3 which is the refurbishment has lower GHG emission with 24% lower than scenario 4 which is constructing a new building. Using the existing building reduces the emission enormously on groundworks.

Selecting the sustainable building materials with low GWP has massive contribution on reducing the GHG emission. GHG emission was considered the key design driver in this report. With the use of OneClickLCA and the EPDs gathered, this report has an overview of the calculation of GHG emission of materials in A1-A3 stage.

Prefabricated concrete is widely used materials at present as it is easy to transport and assemble on site, but concrete contributes a large amount of greenhouse gas emissions (Olivier and Peters, 2018). As an alternative, timber wall frame construction was used and as shown in figure 17 and 18). Scenario 2, 3, and 4 which uses timber walls and used wooden floors, their GHG emissions are significantly lower than scenario 1 and 5.

It is important to note that A4 transport may affect the GHG of each material and as much as possible to select materials that are locally produced and manufactured in Norway and B2-B5, materials have different service lifetime so maintenance and replacement will affect on the

GHG emission of the building. Also, Photovoltaic (PV) panels were not included in the materials as to properly compare the scenario 1 which do not have PV panels.

As early as start of the design project, designers should already visualize what materials the building will use. Selecting the materials with a low GHG emission is a must without affecting the integrity of each material.

Further Research

Result shows are preliminary and based on limited data information especially with the material on groundworks and foundation. A full LCA analysis where necessary system boundary of materials is to be included for an accurate calculation of GHG emission on buildings. Widen the selection of materials to fully comprehend which materials has the lowest environmental impact and can be used as a basis for designers on their decision on material selection during early design phase.

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Appendices

Appendix A - Material list obtained from Revit

EXISTING BUILDING

		EXISTING (16	18 m2)				
ELEMENT		EXIST	ING	DEMO	LISH	REU	SE
	THICKNESS	VOLUME m3	AREA m2	VOLUME m3	AREA m2	VOLUME m3	AREA m2
CISTING WALLS							
EEW_300mm_sandwich element with	h insulation						
concrete sand/cement	10mm	22,22	2222	2,2	220	20,02	2002
concrete cast in situ	350mm	388,82	1111	38,49	110	350,33	1001
concrete sand cement	10mm						
EEW_250mm_basement							
concrete cast in situ	250mm	77,89	309	28,24	113	49,65	196
EEW_150mm_service							
concrete cast in situ	150mm	15,38	103	2,76	18	12,62	85
EIW_148mm PARTITION_STUDS 148r	mm + insulation (rooms)						
gypsum board	13mm	52,1	4008	24,05	1850	28,05	2158
gypsum board	13mm						
insulation	98mm	150,21	1015	68,45	462	81,76	553
gypsum board	13mm						
gypsum board	13mm						
EIW_98mm PARTITION_STUDS 98mm	n + insulation + tiles(t&b)					
gypsum board	13mm	7,54	579	6,96	455	0,58	124
insulation	98mm	28,42	290	26,24	267	2,18	23
gypsum board	13mm						
tiles	15mm	5,09	339	4,62	308	0,47	31
EIW_98mm_insulated (T&S)							
gypsum board	13mm	4,28	329	4,28	329	0	0
insulation	98mm	16,45	164	16,45	164	0	0
gypsum board	13mm						

		EXIST	NG	DEMO	LISH	REU!	SE
	THICKNESS	VOLUME m3	AREA m2	VOLUME m3	AREA m2	VOLUME m3	AREA m2
EXISTING FLOORS							
Floor existing concrete_318mm (rooms)							
vinyl	5mm	6,82	1365	0,08	16	6,74	1349
concrete sand/cement	50mm	68,23	1365	0,79	16	67,44	1349
concrete cast in situ	200mm	272,92	1365	3,16	16	269,76	1349
insulation	50mm	68,23	1365	0,79	16	67,44	1349
gypsum board	13mm	17,74	1365	0,21	16	17,53	1349
Floor existing basement cocnrete 175mm	í						
concrete cast in situ	175mm	120,3	687	0	0	120,3	687
Floor 160mm cocnrete with 50mm metal	deck (balcony)						
concrete cast in situ	210mm	7,79	37	7,79	37	0	0
EXISTING ROOF							
EXISTING ROOF Existing warm roof - concrete							
	38mm	16,64	438	0	0	16,64	438
Existing warm roof - concrete	38mm 200mm	16,64 87,59	438 438	0	0	16,64 87,59	438 438
Existing warm roof - concrete roofing tile							
Existing warm roof - concrete roofing tile insulation	200mm	87,59	438	0	0	87,59	438
Existing warm roof - concrete roofing tile insulation vapor retarder/water proofing	200mm 0mm	87,59 0	438 438	0	0	87,59 0	438 438
Existing warm roof - concrete roofing tile insulation vapor retarder/water proofing concrete cast in situ	200mm 0mm 250mm	87,59 0 109,49	438 438 438	0 0 0	0 0 0	87,59 0 109,49	438 438 438
Existing warm roof - concrete roofing tile insulation vapor retarder/water proofing concrete cast in situ gypsum board	200mm 0mm 250mm	87,59 0 109,49	438 438 438	0 0 0	0 0 0	87,59 0 109,49	438 438 438
Existing warm roof - concrete roofing tile insulation wapor retarder/water proofing concrete cast in situ gypsum board Existing roof - stairs sheet	200mm 0mm 250mm 13mm	87,59 0 109,49 5,69	438 438 438 438	0 0 0	0 0 0 0	87,59 0 109,49 5,69	438 438 438 438
Existing warm roof - concrete roofing tile insulation vapor retarder/water proofing concrete cast in situ gypsum board Existing roof - stairs	200mm 0mm 250mm 13mm	87,59 0 109,49 5,69	438 438 438 438	0 0 0	0 0 0 0	87,59 0 109,49 5,69	438 438 438 438

ELEMENT		EXIST	NG	DEMO	LISH	REU	SE
	THICKNESS	VOLUME m3	AREA m2	VOLUME m3	AREA m2	VOLUME m3	AREA m2
EXISTING DOORS							
Single Flush							
662 x 2032		1,22	69	1,22	69	0	0
762 x 2032		3,03	167	3,03	167	0	0
915 x 2032		9,83	525	9,15	488	0,68	37
Swedoor double 1186 x 2089	61pcs	4,52	609	4,52	609	0	0
EXISTING WINDOWS							
White casement double							
1050 x 1050		0,31	30	0,31	30	0	0
1350 x 1050		0,29	29	0,29	29	0	0
Glass							
410 x 410	6pcs	0,01	1	0	0	0,01	1
610 x 610	12pcs	0,03	6	0,03	6	0	0
1050 x 1050	9pcs	0,05	17	0,05	17	0	0
1350 x 1050	2pcs	0,06	20	0,06	20	0	0
Sash							
410 x 410		0,08	7	0	0	0,08	7
610 x 610		0,36	28	0,36	28	0	0
EXISTING COLUMNS							
300x300		0,34	7	0	0	0,34	7
concrete cast in situ							
250x350		0,71	17	0	0	0,71	17
concrete cast in situ							

ELEMENT		EXIST	ING	DEMO	LISH	REU	SE
	THICKNESS	VOLUME m3	AREA m2	VOLUME m3	AREA m2	VOLUME m3	AREA m2
EXISTING FOUNDATIONS							
EEW_wall foundation							
concrete cast in situ 500x300		22,58	45	0	0	22,58	45
EXISTING RAILING							
Railing at windows							
vertical steel bar (1000 x 2000mm)	26,5 kg	793 kg		793 kg		0	
Railing at balcony							
vertical steel bar (1000 x 2000mm)	26,5 kg	292 kg		292 kg		0	
Railing at stairs							
vertical steel bar (1000 x 2000mm)	26,5 kg	662 kg		662 kg		0	
Railing at bridge							
vertical steel bar (1000 x 2000mm)	26,5 kg	238,5 kg		238,5 kg		0	
EXISTING BRIDGE							
Metal bridge							
galvanized steel	30mm	0.704	23.47	0.704	23,47	0	

REFURBISH BUILDING

FINAL_NE	W CONSTRUCTION (BRA-3482 sqm BTA	N-3072)		
ELEMENT	MATERIAL	THICKNESS	VOLUME m3	AREA ma
IOR WALLS				
EW_moelven royal_364mm housing				
wood cladding	kebony scott pine	22mm	35,48	1707
air/stud	metsa wood i-joist (360 x 45)			13119.3 K
vapor retarder	hunton vindtett	12mm	0	1606
insulation	glava mineral wool	350mm	561,1	1604
damp proofing	tomme plastic vapour layer	1mm	1,6	1587
rigid insulation		50mm	79,71	1587
gypsum board	fermacell gypsum	13mm	19,91	1585
Eksisterende 150mm - betong (additional)				
concrete cast in situ	low carbon concrete	150mm	5,56	37
EEW-250mm-basement (additional)				
concrete cast in situ	low carbon concrete	250mm	2,61	10
EEW-250mm-basement_insulated				
rigid insulation	glava mineral wool	98mm	27,72	341
concrete cast in situ	low carbon concrete	250mm	28,37	114
rigid insulation		98mm		
rigid insulation		48mm		
gypsum board	fermacell gypsum	13mm	1,48	114
EW_insulated BW_50mm+gips (for EEW basement wall)				
rigid insulation	glava mineral wool	98mm	18,85	255
rigid insulation		50mm		
ELEMENT	MATERIAL	THICKNESS	VOLUME m3	AREA m2
EW_48mm_insulation+fiberboard (for sandwich wall)				
insulation	glava mineral wool	48mm	32,63	680
gypsum board	fermacell gypsum	13mm	17,68	1360
gypsum board		13mm		
EEW_300mm - sandwich element (additional)				
concrete wall		10mm	0,17	17
concrete cast in situ	prefab sandwich wall	350mm	4,95	17
cement screed	heydi leveling screed	10mm	0,17	17
IOR WALLS				
IW_separation wall_198mm_2board+insulation+2board	1 2 2222 22 2		Name and Address of the Address of t	
gypsum board	fermacell gypsum	13mm	15,08	1160
gypsum board		13mm		
insulation	glava mineral wool	98mm	75,78	773
air/studs		20mm	7,73	387
insulation		98mm		
gypsum board plaster	gypsum plaster	13mm 13mm	5,03	387
NA 140 2band landslandslands				
IW_148mm_2board+insulation+2board		12	F 00	464
gypsum board	fermacell gypsum	13mm	5,99	461
gypsum board	glava mineral wool	13mm	17.05	115
	giava minerai wooi	148mm	17,05	115
insulation gypsum board	0	13mm		

ELEMENT	MATERIAL	THICKNESS	VOLUME m3	AREA m2
IW_soundproof wall_148mm_2board+insulation+2board				
gypsum board	fermacell gypsum	13mm	50,7	3900
gypsum board		13mm		
insulation	glava mineral wool	148mm	144,29	975
gypsum board		13mm		
gypsum board		13mm		
IW_98mm Partition_studs 98mm+insulation+tiles (t&s)				
gypsum board	fermacell gypsum	13mm	27,08	2083
insulation	glava mineral wool	98mm	102,06	1041
gypsum board		13mm		
tiles		15mm	15,62	1041
Interior-79mm Partition - 1hr (lift)				
gypsum board	fermacell gypsum	13mm	0,66	71
gypsum board		6mm		
metal stud		42mm	0,75	18
gypsum board gypsum board		6mm 13mm		
B) Poding		2311111		
basic wall: concrete_300mm (elevator)				
concrete cast in situ	low carbon concrete	300mm	49,03	169
ELEMENT	MATERIAL	THICKNESS	VOLUME m3	AREA m2
s				
existing concrete_318mm		Smm	0.12	24
vinyl cement screed	heydi leveling screed	5mm 50mm	0,12 1,22	24
concrete cast in situ	hollow core slab	200mm	4,86	24
insulation	glava mineral wool	50mm	1,22	24
gypsum board	fermacell gypsum	13mm	0,32	24
concrete_domestic 450mm (new bldg-ground)				
tiles		150mm	3,04	203
cement screed	heydi leveling screed	50mm	10,15	203
plastic	tomme plastic vapour layer	1mm	0,2	203
concrete cast in situ	low carbon concrete	80mm	16,23	203
vapour retarder insulation	icopal radon membrane EPS/XPS	1mm 300mm	0,2 60,87	203
	2000 * 0.09*0			
exist basement concrete 175mm				
pavement	asphalt pavement	175mm	18,08	103
basement insulated floor				
tiles		15mm	7,7	513
wood sheathing, chipboard	fibo trespo laminated plywood	22mm	11,29	513
plastic	tomme plastic vapour layer	0mm	0,2	513
insulation	EPS	300mm	153,92	513
lealth and an annual and				
insitu concrete 225mm pavement	asphalt pavement	50mm	0,64	13
damp proofing	tomme plastic vapour layer	0mm	0,04	13
concrete cast in situ	low carbon concrete	175mm	5,24	13
ELEMENT	MATERIAL	THICKNESS	VOLUME m3	AREA m2
	MATERIAL	THICKNESS	VOLUME m3	AREA m2
ELEMENT wooden floor wood finish	MATERIAL lamianate wood/parquet	THICKNESS 22mm	VOLUME m3	AREA m2
wooden floor				
wooden floor wood finish spoonplate gypsum board	lamianate wood/parquet arbor sponplate fermacell gypsum	22mm 22mm 12,5mm	38,73 38,73 66,02	1760 1760 5281
wooden floor wood finish spoonplate gypsum board wood sheathing, chipboard	lamianate wood/parquet arbor sponplate fermacell gypsum fibo trespo laminated plywood	22mm 22mm 12,5mm 36mm	38,73 38,73 66,02 63,38	1760 1760 5281 1760
wooden floor wood finish spoonplate gypsum board wood sheathing, chipboard insulation	lamianate wood/parquet arbor sponplate fermacell gypsum fibo trespo laminated plywood glava mineral wool	22mm 22mm 12,5mm	38,73 38,73 66,02	1760 1760 5281 1760 1760
wooden floor wood finish spoonplate gypsum board wood sheathing, chipboard insulation air/studs	lamianate wood/parquet arbor sponplate fermacell gypsum fibo trespo laminated plywood	22mm 22mm 12,5mm 36mm	38,73 38,73 66,02 63,38	1760 1760 5281 1760 1760
wooden floor wood finish spoonplate gypsum board wood sheathing, chipboard insulation	lamianate wood/parquet arbor sponplate fermacell gypsum fibo trespo laminated plywood glava mineral wool	22mm 22mm 12,5mm 36mm 198mm	38,73 38,73 66,02 63,38	1760 1760 5281 1760 1760
wooden floor wood finish spoonplate gypsum board wood sheathing, chipboard insulation air/studs gypsum board	lamianate wood/parquet arbor sponplate fermacell gypsum fibo trespo laminated plywood glava mineral wool	22mm 22mm 12,5mm 36mm 198mm	38,73 38,73 66,02 63,38	1760 1760 5281 1760 1760
wooden floor wood finish spoonplate gypsum board wood sheathing, chipboard insulation air/studs gypsum board gypsum board	lamianate wood/parquet arbor sponplate fermacell gypsum fibo trespo laminated plywood glava mineral wool	22mm 22mm 12,5mm 36mm 198mm	38,73 38,73 66,02 63,38	1760 1760 5281 1760 1760
wooden floor wood finish spoonplate gypsum board wood sheathing, chipboard insulation air/studs gypsum board gypsum board	lamianate wood/parquet arbor sponplate fermacell gypsum fibo trespo laminated plywood glava mineral wool	22mm 22mm 12,5mm 36mm 198mm	38,73 38,73 66,02 63,38	1760 1760 5281 1760 1760
wooden floor wood finish spoonplate gypsum board wood sheathing, chipboard insulation air/studs gypsum board gypsum board	lamianate wood/parquet arbor sponplate fermacell gypsum fibo trespo laminated plywood glava mineral wool	22mm 22mm 12,5mm 36mm 198mm	38,73 38,73 66,02 63,38	1760 1760 5281 1760 1760
wooden floor wood finish spoonplate gypsum board wood sheathing, chipboard insulation air/studs gypsum board gypsum board gypsum board roofing felt spruce/studs	lamianate wood/parquet arbor sponplate fermacell gypsum fibo trespo laminated plywood glava mineral wool metsa wood i-joist (45 x 200) protan pvc metsa wood i-joist (45 x 200)	22mm 22mm 12,5mm 36mm 198mm 12,5mm 12,5mm	38,73 38,73 66,02 63,38 352,1	1760 1760 5281 1760 1760 6236.1 KC
wooden floor wood finish spoonplate gypsum board wood sheathing, chipboard insulation air/studs gypsum board gypsum board gypsum board roofing felt spruce/studs asphalt bitumen/plastic	lamianate wood/parquet arbor sponplate fermacell gypsum fibo trespo laminated plywood glava mineral wool metsa wood i-joist (45 x 200) protan pvc metsa wood i-joist (45 x 200) tomme plastic vapour layer	22mm 22mm 12,5mm 36mm 198mm 12,5mm 12,5mm	38,73 38,73 66,02 63,38 352,1	1760 1760 5281 1760 1760 6236.1 KG
wooden floor wood finish spoonplate gypsum board wood sheathing, chipboard insulation air/studs gypsum board gypsum board gypsum board warm roof - wood roofing felt spruce/studs asphalt bitumen/plastic insulation	lamianate wood/parquet arbor sponplate fermacell gypsum fibo trespo laminated plywood glava mineral wool metsa wood i-joist (45 x 200) protan pvc metsa wood i-joist (45 x 200) tomme plastic vapour layer EFS/mineral wool	22mm 22mm 12,5mm 36mm 198mm 12,5mm 12,5mm	38,73 38,73 66,02 63,38 352,1 0,64 0,8 53,49	1760 1760 5281 1760 1760 6236.1 KG
wooden floor wood finish spoonplate gypsum board wood sheathing, chipboard insulation air/studs gypsum board gypsum board gypsum board swarm roof - wood roofing felt spruce/studs asphalt bitumen/plastic insulation vapour retarder	lamianate wood/parquet arbor sponplate fermacell gypsum fibo trespo laminated plywood glava mineral wool metsa wood i-joist (45 x 200) protan pvc metsa wood i-joist (45 x 200) tomme plastic vapour layer EPS/mineral wool tomme plastic vapour layer	22mm 22mm 12,5mm 36mm 198mm 12,5mm 12,5mm 1,5mm 1,5mm 1,5mm 100mm	38,73 38,73 66,02 63,38 352,1 0,64 0,8 53,49 0	1760 1760 5281 1760 1760 6236.1 KG
wooden floor wood finish spoonplate gypsum board wood sheathing, chipboard insulation air/studs gypsum board gypsum board gypsum board roofing felt spruce/studs asphalt bitumen/plastic insulation	lamianate wood/parquet arbor sponplate fermacell gypsum fibo trespo laminated plywood glava mineral wool metsa wood i-joist (45 x 200) protan pvc metsa wood i-joist (45 x 200) tomme plastic vapour layer EFS/mineral wool	22mm 22mm 12,5mm 36mm 198mm 12,5mm 12,5mm	38,73 38,73 66,02 63,38 352,1 0,64 0,8 53,49	1760 1760 5281 1760 1760 6236.1 KG
wooden floor wood finish spoonplate gypsum board wood sheathing, chipboard insulation air/studs gypsum board gypsum board gypsum board gypsum board sypsum board roofing felt spruce/studs asphalt bitumen/plastic insulation vapour retarder wood sheathing, chipboard	lamianate wood/parquet arbor sponplate fermacell gypsum fibo trespo laminated plywood glava mineral wool metsa wood i-joist (45 x 200) protan pvc metsa wood i-joist (45 x 200) tomme plastic vapour layer EPS/mineral wool tomme plastic vapour layer fibo trespo laminated plywood	22mm 22mm 12,5mm 36mm 198mm 12,5mm 12,5mm 12,5mm 10,5mm 0mm 0mm 22mm	38,73 38,73 66,02 63,38 352,1 0,64 0,8 53,49 0	1760 1760 1760 5281 1760 6236.1 KG

	ELEMENT	MATERIAL	THICKNESS	VOLUME m3	AREA m2
warm roof - wo					
	ood finish	kebony	1,2mm	3,07	139
	ruce/studs	metsa wood i-joist (45 x 200)			641.39 KG
	phalt bitumen/plastic	tomme plastic vapour layer	1,5mm	0,21	139
	sulation	EPS/mineral wool	100mm	13,94	139
	pour retarder	tomme plastic vapour layer	0mm	0	139
	ood sheathing, chipboard	fibo trespo laminated plywood	22mm	3,07	139
	id insulation	EPS/mineral wool	350mm	48,78	139
	psum board	fermacell gypsum	12,5mm	3,48	279
gyp	psum board		12,5mm		
basic roof: innga	ang				
	ood finish	kebony	38mm	1,08	37
roo	ofing felt	protan pvc	0mm	0	28
	st in situ	low carbon concrete	100mm	2,84	28
	psum board	fermacell gypsum	13mm	0,37	28
RS					_
Cast in place - m	nonolithic stair				
	ncrete cast in situ	precast?/low carbon concrete?		31,71	344
ORS					
Panel door	2 07:00:0			200	985
	2 x 2032			1,17	65
864	4 x 2032			5,44	293
915	5 x 2032			15,2	811
Double door					
				0,17	18
	90 x 2090				
129	90 x 2090 90 x 2090				69
129 149				0,68 0,13	
129 149	90 x 2090 nt door	MATERIAL	THIPVIECE	0,68 0,13	69 13
129 149	90 x 2090	MATERIAL	THICKNESS	0,68	69 13
125 145 ver	90 x 2090 nt door ELEMENT	MATERIAL	THICKNESS	0,68 0,13	69 13
125 148 ver ING Railing at hallw:	90 x 2090 nt door ELEMENT	MATERIAL	THICKNESS	0,68 0,13	69 13
125 145 ver ING Railing at hallwa	90 x 2090 nt door ELEMENT ay		THICKNESS	0,68 0,13	69 13
125 145 ver ING Railing at hallw wo Railing at stairs	90 x 2090 nt door ELEMENT ay ood	MATERIAL 336,71 meters	THICKNESS	0,68 0,13	69 13
125 145 ver ING Railing at hallwa	90 x 2090 nt door ELEMENT ay ood		THICKNESS	0,68 0,13	69 13
125 145 ver ING Railing at hallw wo Railing at stairs	90 x 2090 nt door ELEMENT ay ood		THICKNESS	0,68 0,13	69 13
125 145 ver ING Railing at hallwa wo Railing at stairs wo	90 x 2090 nt door ELEMENT ay ood		THICKNESS	0,68 0,13	69 13 AREA m2
125 145 ver ING Railing at halliw WO Railing at stairs WO DOWS	90 x 2090 nt door ELEMENT ay ood		THICKNESS	0,68 0,13	69 13 AREA m2
125 145 ver ING Railing at hallw. wo Railing at stairs wo DOWS west south	90 x 2090 nt door ELEMENT ay ood		THICKNESS	0,68 0,13	69 13 AREA m2
ING Railing at hallw wo Railing at stairs wo DOWS	90 x 2090 nt door ELEMENT ay ood		THICKNESS	0,68 0,13	69 13 AREA m2 137,92 89,92 97,57
125 145 ver ING Railing at hallw. wo Railing at stairs wo DOWS west south	90 x 2090 nt door ELEMENT ay ood		THICKNESS	0,68 0,13	69 13 AREA m2
ING Railing at hallw wo Railing at stairs wo DOWS	90 x 2090 nt door ELEMENT ay ood		THICKNESS	0,68 0,13	69 13 AREA m2 137,92 89,92 97,57
ING Railing at hallw. wo Railing at stairs wo DOWS west south north east	90 x 2090 nt door ELEMENT ay ood		THICKNESS	0,68 0,13	69 13 AREA m2 137,92 89,92 97,57
ING Railing at hallwa Railing at stairs wo Route Railing at stairs wo IDOWS west south north east IUNDWORKS EEW_wall four	90 x 2090 nt door ELEMENT ay ood		THICKNESS	0,68 0,13	69 13 AREA m2 137,92 89,92 97,57
ING Railing at hallw. wo Railing at stairs wo DOWS west south north east UNDWORKS EEW_wall four	ELEMENT ay ood food andation increte cast in situ 500x300	336,71 meters	THICKNESS	0,68 0,13	137,92 89,92 97,57 237,93
ING Railing at hallwa Wo Railing at stairs Wo DOWS west south north east MUNDWORKS EEW_wall four COI Glulam_column	ELEMENT ay ood indation increte cast in situ 500x300	336,71 meters low carbon concrete	THICKNESS	0,68 0,13 VOLUME m3	137,92 89,92 97,57 237,93
ING Railing at hallwa wo Railing at stairs wo DOWS west south north east UNDOWORKS EEW_wall four cor Glulam_column	ELEMENT ay ood andation ncrete cast in situ 500x300	336,71 meters	THICKNESS	0,68 0,13 VOLUME m3	137,92 89,92 97,57 237,93
ING Railing at hallwa wo Railing at stairs wo DOWS west south north east UNDOWORKS EEW_wall four cor Glulam_column	ELEMENT ay ood indation increte cast in situ 500x300	336,71 meters low carbon concrete	THICKNESS	0,68 0,13 VOLUME m3	137,92 89,92 97,57 237,93
ING Railing at hallwa Wo Railing at stairs Wo DOWS West south north east MUNDWORKS EEW_wall four Cor Glulam_column 5,1	ELEMENT ay ood indation increte cast in situ 500x300 125 x 6 x 20	336,71 meters low carbon concrete	THICKNESS	0,68 0,13 VOLUME m3	137,92 89,92 97,57 237,93
ING Railing at hallwa wo Railing at stairs wo DOWS west south north east UNDOWORKS EEW_wall four cor Glulam_column 51,1 20. Concrete colum	ELEMENT ay ood indation increte cast in situ 500x300 125 x 6 x 20	336,71 meters low carbon concrete	THICKNESS	0,68 0,13 VOLUME m3	137,92 89,92 97,57 237,93

NEW CONSTRUCTED BUILDING

ELEMENT	MATERIAL	THICKNESS	VOLUME m3	AREA m2
RIOR WALLS EW_moelven royal_364mm housing				
wood cladding	kebony scott pine	22mm	55,9	2613
air/stud	metsa wood i-joist (360 x 45)	2211111	33,3	19523,25 k
vapor retarder	hunton vindtett	12mm	0	2534
insulation	glava mineral wool	350mm	884,83	2534
damp proofing	tomme plastic vapour layer	1mm	252	2508
rigid insulation	tomme piastic vapour layer	50mm	125,79	2508
gypsum board	fermacell gypsum	13mm	31,42	2505
дурзин воли	rermacen gypsum	1311111	31,42	2303
Eksisterende 150mm - betong (additional)				
concrete cast in situ	low carbon concrete	150mm	11,29	75
EEW-250mm-basement_insulated				
rigid insulation	glava mineral wool	98mm	70,9	871
concrete cast in situ	low carbon concrete	250mm	72.6	290
rigid insulation		98mm		
rigid insulation		48mm		
gypsum board	fermacell gypsum	13mm	3,79	290
	O1 Page 1		-17.5	
RIOR WALLS IW_separation wall_198mm_2board+insulation+2board				
gypsum board	fermacell gypsum	13mm	19,96	1536
gypsum board	0,6	13mm		
insulation	glava mineral wool	98mm	100,34	1024
air/studs	giava minerai wooi	20mm	10,24	512
			10,24	512
insulation		98mm		
gypsum board	1000-0000 000-100-00-00	13mm	0.00	1000
plaster	gypsum plaster	13mm	6,65	512
ELEMENT	MATERIAL	THICVNESS	VOLUME m2	ADEA m3
ELEMENT	MATERIAL	THICKNESS	VOLUME m3	AREA m2
IW_148mm_2board+insulation+2board				
	MATERIAL fermacell gypsum	THICKNESS 13mm	VOLUME m3	AREA m2
IW_148mm_2board+insulation+2board				
IW_148mm_2board+insulation+2board gypsum board		13mm		
IW_148mm_2board+insulation+2board gypsum board gypsum board	fermacell gypsum	13mm 13mm	30,13	2317
IW_148mm_2board+insulation+2board gypsum board gypsum board insulation	fermacell gypsum	13mm 13mm 148mm	30,13	2317
IW_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board gypsum board	fermacell gypsum	13mm 13mm 148mm 13mm	30,13	2317
IW_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board gypsum board gypsum board	fermacell gypsum glava mineral wool	13mm 13mm 148mm 13mm	30,13 85,75	2317 508
IW_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board gypsum board gypsum board IW_soundproof wall_148mm_2board+insulation+2board gypsum board	fermacell gypsum	13mm 13mm 148mm 13mm 13mm	30,13	2317
IW_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board gypsum board gypsum board IW_soundproof wall_148mm_2board+insulation+2board gypsum board gypsum board	fermacell gypsum glava mineral wool fermacell gypsum	13mm 13mm 148mm 13mm 13mm	30,13 85,75 50,96	2317 508 3920
IW_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board gypsum board gypsum board IW_soundproof wall_148mm_2board+insulation+2board gypsum board insulation	fermacell gypsum glava mineral wool	13mm 13mm 148mm 13mm 13mm 13mm 13mm	30,13 85,75	2317 508
IW_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board gypsum board gypsum board IW_soundproof wall_148mm_2board+insulation+2board gypsum board insulation gypsum board insulation gypsum board	fermacell gypsum glava mineral wool fermacell gypsum	13mm 13mm 148mm 13mm 13mm 13mm 13mm 148mm	30,13 85,75 50,96	2317 508 3920
IW_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board gypsum board gypsum board IW_soundproof wall_148mm_2board+insulation+2board gypsum board insulation	fermacell gypsum glava mineral wool fermacell gypsum	13mm 13mm 148mm 13mm 13mm 13mm 13mm	30,13 85,75 50,96	2317 508 3920
IW_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board gypsum board gypsum board IW_soundproof wall_148mm_2board+insulation+2board gypsum board insulation gypsum board insulation gypsum board gypsum board gypsum board gypsum board gypsum board	fermacell gypsum glava mineral wool fermacell gypsum glava mineral wool	13mm 13mm 148mm 13mm 13mm 13mm 13mm 13mm 13mm 148mm 13mm	30,13 85,75 50,96 145,04	2317 508 3920 980
IW_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board gypsum board gypsum board gypsum board gypsum board gypsum board insulation gypsum board gypsum board gypsum board gypsum board	fermacell gypsum glava mineral wool fermacell gypsum glava mineral wool fermacell gypsum	13mm 13mm 148mm 13mm 13mm 13mm 13mm 148mm	30,13 85,75 50,96 145,04	2317 508 3920 980
IW_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board gypsum board gypsum board IW_soundproof wall_148mm_2board+insulation+2board gypsum board insulation gypsum board insulation gypsum board gypsum board gypsum board gypsum board gypsum board	fermacell gypsum glava mineral wool fermacell gypsum glava mineral wool	13mm 13mm 148mm 13mm 13mm 13mm 13mm 13mm 13mm 148mm 13mm	30,13 85,75 50,96 145,04	2317 508 3920 980
IW_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board gypsum board gypsum board gypsum board gypsum board gypsum board insulation gypsum board insulation gypsum board	fermacell gypsum glava mineral wool fermacell gypsum glava mineral wool fermacell gypsum	13mm 13mm 148mm 13mm 13mm 13mm 13mm 13mm 13mm	30,13 85,75 50,96 145,04	2317 508 3920 980
IW_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board gypsum board gypsum board gypsum board gypsum board gypsum board insulation gypsum board gypsum board gypsum board insulation gypsum board gypsum board gypsum board gypsum board gypsum board insulation gypsum board gypsum board insulation gypsum board insulation	fermacell gypsum glava mineral wool fermacell gypsum glava mineral wool fermacell gypsum	13mm 13mm 148mm 13mm 13mm 13mm 13mm 13mm 13mm 148mm 13mm	30,13 85,75 50,96 145,04	2317 508 3920 980
IW_148mm_2board+insulation+2board gypsum board insulation gypsum board gypsum board gypsum board IW_soundproof wall_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board insulation gypsum board insulation gypsum board insulation gypsum board insulation gypsum board tiles	fermacell gypsum glava mineral wool fermacell gypsum glava mineral wool fermacell gypsum	13mm 13mm 148mm 13mm 13mm 13mm 13mm 13mm 13mm 148mm 13mm 13mm	30,13 85,75 50,96 145,04 27,48 103,59	2317 508 3920 980 2114 1057
IW_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board gypsum board gypsum board gypsum board gypsum board gypsum board insulation gypsum board tiles	fermacell gypsum glava mineral wool fermacell gypsum glava mineral wool fermacell gypsum glava mineral wool	13mm 13mm 148mm 13mm 13mm 13mm 13mm 13mm 13mm 13mm 1	30,13 85,75 50,96 145,04 27,48 103,59 15,06	2317 508 3920 980 2114 1057
IW_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board gypsum board gypsum board IW_soundproof wall_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board gypsum board gypsum board gypsum board insulation gypsum board insulation gypsum board insulation gypsum board tiles Interior-79mm Partition - 1hr (lift) gypsum board	fermacell gypsum glava mineral wool fermacell gypsum glava mineral wool fermacell gypsum	13mm 13mm 148mm 13mm 13mm 13mm 13mm 13mm 148mm 13mm 13mm 13mm	30,13 85,75 50,96 145,04 27,48 103,59	2317 508 3920 980 2114 1057
IW_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board gypsum board gypsum board gypsum board gypsum board gypsum board insulation gypsum board gypsum board gypsum board gypsum board gypsum board gypsum board insulation gypsum board tiles Interior-79mm Partition - 1hr (lift) gypsum board gypsum board gypsum board	fermacell gypsum glava mineral wool fermacell gypsum glava mineral wool fermacell gypsum glava mineral wool	13mm 13mm 148mm 13mm 13mm 13mm 13mm 13mm 13mm 148mm 13mm 13mm 15mm	30,13 85,75 50,96 145,04 27,48 103,59 15,06	2317 508 3920 980 2114 1057 1057
IW_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board insulation gypsum board gypsum board gypsum board gypsum board gypsum board insulation gypsum board tiles Interior-79mm Partition - 1hr (lift) gypsum board gypsum board metal stud	fermacell gypsum glava mineral wool fermacell gypsum glava mineral wool fermacell gypsum glava mineral wool	13mm 13mm 13mm 13mm 13mm 13mm 13mm 13mm	30,13 85,75 50,96 145,04 27,48 103,59 15,06	2317 508 3920 980 2114 1057
IW_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board gypsum board gypsum board IW_soundproof wall_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board gypsum board gypsum board insulation gypsum board insulation gypsum board insulation gypsum board tiles Interior-79mm Partition - 1hr (lift) gypsum board	fermacell gypsum glava mineral wool fermacell gypsum glava mineral wool fermacell gypsum glava mineral wool	13mm 13mm 148mm 13mm 13mm 13mm 13mm 13mm 13mm 148mm 13mm 13mm 13mm 13mm 13mm 14mm 13mm	30,13 85,75 50,96 145,04 27,48 103,59 15,06	2317 508 3920 980 2114 1057 1057
IW_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board insulation gypsum board gypsum board gypsum board gypsum board gypsum board insulation gypsum board tiles Interior-79mm Partition - 1hr (lift) gypsum board gypsum board metal stud	fermacell gypsum glava mineral wool fermacell gypsum glava mineral wool fermacell gypsum glava mineral wool	13mm 13mm 13mm 13mm 13mm 13mm 13mm 13mm	30,13 85,75 50,96 145,04 27,48 103,59 15,06	508 3920 980 2114 1057 71
IW_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board gypsum board gypsum board IW_soundproof wall_148mm_2board+insulation+2board gypsum board gypsum board insulation gypsum board gypsum board gypsum board insulation gypsum board insulation gypsum board insulation gypsum board titles Interior-79mm Partition - 1hr (lift) gypsum board gypsum board metal stud gypsum board	fermacell gypsum glava mineral wool fermacell gypsum glava mineral wool fermacell gypsum glava mineral wool	13mm 13mm 148mm 13mm 13mm 13mm 13mm 13mm 13mm 148mm 13mm 13mm 13mm 13mm 13mm 14mm 13mm	30,13 85,75 50,96 145,04 27,48 103,59 15,06	2317 508 3920 980 2114 1057 1057

ELEMENT	MATERIAL	THICKNESS	VOLUME m3	AREA m2
basic wall: concrete_200mm				
concrete cast in situ	low carbon concrete	300mm	0,47	2
RS				
existing concrete_318mm				
vinyl		5mm	0,08	16
cement screed	heydi leveling screed	50mm	0,79	16
concrete cast in situ	hollow core slab	200mm	3,14	16
insulation	glava mineral wool	50mm	0,79	16
gypsum board	fermacell gypsum	13mm	0,2	16
existing concrete_318mm no insulation				
vinyl		5mm	0,14	28
cement screed	heydi leveling screed	50mm	1,38	28
concrete cast in situ	hollow core slab	200mm	5,5	28
gypsum board	fermacell gypsum	13mm	0,36	28
concrete_domestic 450mm (new bldg-ground)				
tiles		150mm	10,67	711
cement screed	heydi leveling screed	50mm	35,56	711
plastic	tomme plastic vapour layer	1mm	0,71	711
concrete cast in situ	low carbon concrete	80mm	56,9	711
vapour retarder	icopal radon membrane	1mm	0,71	711
insulation	EPS/XPS	300mm	213,36	711
exist basement concrete 175mm				
pavement	asphalt pavement	175mm	19,96	114

ELEMENT	MATERIAL	THICKNESS	VOLUME m3	AREA m2
insitu concrete 225mm				
pavement	asphalt pavement	50mm	0,64	13
damp proofing	tomme plastic vapour layer	0mm	0	13
concrete cast in situ	low carbon concrete	175mm	5,24	13
wooden floor				
wood finish	lamianate wood/parquet	22mm	69,48	3158
spoonplate	arbor sponplate	22mm	69,48	3158
gypsum board	fermacell gypsum	12,5mm	118,44	9475
wood sheathing, chipboard	fibo trespo laminated plywood	36mm	113,7	3158
insulation	glava mineral wool	198mm	631,68	3158
air/studs	metsa wood i-joist (45 x 200)			9642,9 KG
gypsum board		12,5mm		
gypsum board		12,5mm		
FS				
warm roof - wood				
roofing felt	protan pvc	1,2mm	0,64	535
spruce/studs	metsa wood i-joist (45 x 200)			1344.21 KG
asphalt bitumen/plastic	tomme plastic vapour layer	1,5mm	0,8	535
insulation	EPS/mineral wool	100mm	53,49	535
vapour retarder	tomme plastic vapour layer	0mm	0	535
wood sheathing, chipboard	fibo trespo laminated plywood	22mm	11,77	535
rigid insulation	EPS/mineral wool	350mm	187,2	535
gypsum board	fermacell gypsum	12,5mm	13,37	535
gynsum hoard		12.5mm		

	ELEMENT		MATERIAL	THICKNESS	VOLUME m3	AREA m2
	ELEIVIEINI		IVIATERIAL	THICKINESS	VOLUME III3	AREA M2
warm roof	- wood (terrace)					
	wood finish		kebony	1,2mm	3,07	139
	spruce/studs		metsa wood i-joist (45 x 200)	0.00000000	200,000	641.39 KG
	asphalt bitumen/plastic		tomme plastic vapour layer	1,5mm	0,21	139
	insulation		EPS/mineral wool	100mm	13,94	139
	vapour retarder		tomme plastic vapour layer	0mm	0	139
	wood sheathing, chipboard		fibo trespo laminated plywood	22mm	3,07	139
	rigid insulation		EPS/mineral wool	350mm	48,78	139
	gypsum board		fermacell gypsum	12,5mm	3,48	279
	gypsum board			12,5mm	13.040	
basic roof:	inngang					
Dasic 1001.	wood finish		kebony	38mm	1,08	37
	roofing felt		protan pvc	0mm	0	28
	cast in situ		low carbon concrete	100mm	2,84	28
	gypsum board		fermacell gypsum	13mm	0,37	28
	Бурзанг волга		Territacen Bypsain	1311111	0,37	20
3						
Cast in plac	e - monolithic stair					
	concrete cast in situ		precast?/low carbon concrete?		32,32	352
Panel door	762 x 2032	12				
	864 x 2032	50				
	915 x 2032	162				
Double doo	or					
Double doo	or 1290 x 2090	2				
Double doo						
Double doo	1290 x 2090	2				
Double doo	1290 x 2090 1490 x 2090	2				
Double doo	1290 x 2090 1490 x 2090	2				
Double doc	1290 x 2090 1490 x 2090	2				
Double doc	1290 x 2090 1490 x 2090	2				
Double doc	1290 x 2090 1490 x 2090	2				
Double doc	1290 x 2090 1490 x 2090	2				
Double doc	1290 x 2090 1490 x 2090	2	MATERIAL	THICKNESS	VOLUME m3	AREA m2
	1290 x 2090 1490 x 2090 vent door	2	MATERIAL	THICKNESS	VOLUME m3	AREA m2
	1290 x 2090 1490 x 2090 vent door ELEMENT	2	MATERIAL	THICKNESS	VOLUME m3	AREA m2
i G Railing at h	1290 x 2090 1490 x 2090 vent door ELEMENT	2	MATERIAL	THICKNESS	VOLUME m3	AREA m2
ug	1290 x 2090 1490 x 2090 vent door ELEMENT	2	MATERIAL 336,71 meters	THICKNESS	VOLUME m3	AREA m2

ING			
Railing at hallway			
wood			
Railing at stairs	336,71 meters		
wood			
DOWS			
west			126
south			78,41
north			91,81
east			226,15
UNDWORKS			
EEW_wall foundation			
concrete cast in situ 500x300	low carbon concrete	80,66	163
Glulam_column			
	timber	0,21	6
5,125 x 6	timber	0,22	0
5,125 x 6 20 x 20	timber	24,08	245
	umber		

Appendix B - Materials list in OneClickLCA tool

Construction	Resource	User	Global warming kg CO ₂ e	Additionation kg 80ge	Eutrophication Ng PO _e e	Ozone depiedon potential Ag CFC11e	Formation of exons of lower atmosphers kg Etherse	Total use of primery energy ex. new materials MJ	Biogenic carbon storage kg CO _{ye} bio	Comments
	Oypeum board, for floor, 12.8 mm, 14.4 kg/m2, 1162 kg/m3, R1?	1 386 m2	6,0963	1,4061	2,6850	4,046-4	7,386-1	1,0360,1	1,1763	ast, concrete_318mm
	Pasto vapour control layer, 0,15 mm (Tonnen Gram.) ?	438 m2	1,3862	5,200-1	3,6711-2	9-8	2,746-2	2,5863	030	concrete roof
	Pasto vapour control leyer, 0.15 mm (Toneren Gram.) ?	438 m2	1,386.2	6,286-1	3,878-2	P H	2,748-2	2,9803	8	consults noof
		Bection	2,1985	4,0622	1,6123	7,488-3	3,881	2,1905	1,1703	
Bullding	Building materials > Other structures and materials > Other structures and materials	als > Othe	e structures	and material						
	Concrete baloons, CASISS (BAS MBS), low certion dass is (Bloc?	37 m2	2,4863	6,4850	1,6650	0,005-6	1,1450	2,000.4	090	
	Start products, powder costed (Bredrene Midfaug) ?	1 886,5 Mg	6,063	1,3261	1,7360	1,306-4	1,0360	6,5754	000	gulla
	Concrete staintees and intermediate landings, COOKT (\$30 Mb?	10,6 m3	2,6663	6,0750	2,0350	8,886-6	1,0250	2,1654	990	
		Section	1,0884	2,4781	8,6188	3,336-4	3,1980	1,0803		
Building	Building materials > Other atructures and materials > Windows and doors	als > Winc	dows and de	2018						
	Wooden entenne door, per unit, 808x2863 mm, 42x62 mm herne, ?	18 unit	1,7363	6,8489	2,2160	136-1	4,2850	8,4154	1,6763	
	Wooden Interior door, per unit, 808x2053 mm, 42x62 mm frame?	18 unt	6,886.3	3,8961	1,1661	8,04E-4	4,07E0	2,9965	1,0864	
	Top Swing Window, 0.841 Wint2K, 67.78 kg, 1.23x1 all in (Norsew, ?	160,72 m2	6,986.3	7,63€1	8,6150	8,55E~4	4,0780	1,7266	9,1963	
		Section	1,4264	1,205	2,3451	1,986-3	1,8461	93803	2,264	
Bulldle	Building materials > Other structures and materials > Pinishes and coverings	als > Finis	thes and co	verings						
	Carerric Bas, Ballan average, 10mm, 19.9 kg/m2 (Confinshet ?	339 m2	5,1162	1,1369	1,455-1	2,82E-8	1,086-1	6,2364	000	Menn partfor-ties
		Section	6,1162	1,1358	1,486-1	2,826-6	1,066-1	13024		

Donatruction R	Resource	input i	warming kg CO ₂ e	kg SO ₂ s	tographication in the property of the property	potential kg CPCT1a	lewer atmosphere kg Elbanee	ex. rew materials	carbon storage kg CO ₂ e bio	Com
Building n	Building materials > Foundations and substructu	re > Foun	dation, sub	surface, base	ment and retaining walls	ng walls				- 4
~ 0	Radon and moleture membrane for allie construction, PP, 1.2 m ?	679 m2	1,6363	6,3350	7,086-1	4,995-6	3,846-1	3,350.4	030	oznowia_450m besented
20	Ready-mix constrain, CSGS7 B30 M6G, low- carbon class A (Rlan ?	82,52 E	4,1703	6,566.0	7,9450	13854	1-316-1	3,456.4	000	well foundation
m 8	Ready-mix constitute, CBDS7 B30 MBD, knet- carbon class A (San ?	120,3 Em	2,225.4	3,861	3,9151	7,435-4	3,6359	1,3425	OED	basement compress 175mm
шб	EPS Insulation panels, 38 mm, 600 x 1200mm, 0.57 kg/hz, 15 k?	6 432 TD	9,61E3	2,5861	2,6250	3,686-4	6,48E1	1,986.6	000	concrete_460mm becernent
2.6	Hollow core concrete slab, low-carbon A, th.210 - 500 mm x 1?	128 ion	1,2754	3,16E1	1,08E1	3,246-4	1,6350	6,5454	OED	concrete_420mm beserved
00 +	Self-leveling screed, floer-reinforced, 8-60 mm, 1,7 kg/k, 2 ?	48,9 ton	6,6853	2,881	3,2860	7,686~4	1,3750	6,2864	090	concrete_450mm basement
2.0	Pastic vapour control layer, 0.15 mm (Tommen Gram) ?	679 m2	2,1362	6,156-1	66-2	3,16-6	425E-2	3	000	concrete_40mm basement
		Saction	5,7364	1,342	13923	2,46-3	1302,7	5363		
Building m	Building materials > Vertical structures and faced	le > Exter	nal walls and	d facade						
ш 3	Ready-mix concrete, G3037 830 M60, low- earton case A (than?	15,38	2,8463	4,4789	9	8,486-5	4,84E-1	23854	90	EEW_150mm_service
па	Ready-mix controlls, C3037 530 MFG, low- sarbon class A (Blan ?	77,88 må	1,4484	2,2881	2,0361	F-3L0'Y	2,3650	1,1963	080	EEW_200mm_bes
0.8	Concrete sendwich well, impleted, 850 lighting (Epersund Beton?)	974 ton	1,3965	9,7462	1,6112	6,916-3	1,69[2	1,5300	Ollo	EEW_300mm sandwich alament
0.5	Connect, CEM Hills 42,5 L-LHSR (m), Low heat Commo) ?	32 Ea	1,0164	9,2900	1,2461	1,486-4	3276-1	6,946.4	¢ III o	EEW_300mm sandwich alement
		Section	1,6368	1,0163	2,0062	7,636-3	1,6262	1,7368		
Building	Building materials > Vertical structures and facade > Colu	le > Colur	eol bra and los	d-bearing veri	Boal structures					
2	Precest column, low carbon class A (Corrigal) ?	1,08 m3	3,086/2	4,28-1	4,028-1	8,988-6	4,4811-2	2,386(3	080	besement
		Saction total	3,0862	1-32-1	4,02E-1	8,91E-8	4,416-2	2,8853		
Building rr	Building materials > Vertical structures and faced	le > Intern	bris allaw le	non-bearing st	structures					
0.6	Oppsum Bereboset, 12,5 mm, 1180 lights (Fermacet) ?	329 m2	1,4862	8,97E-2	1,31E-2	1,875-9	2,885-3	7,1863	980	OED Semm_insubsted
0.8	Oppum Breboant, 12.5 mm, 1180 lights (Fermical) ?	579 m2	2,5862	1,236-1	2,316-2	2,94E-0	4,71E-3	1,385.1	080	96mm partfor-fine
0.6	Orpsum foreboars, 12.5 mm, 1180 kg/m3 (Fermacel) ?	4 000 m2	1,7763	6,08-1	1,3851	2,046-0	3,216-2	82464	090	148mm
0.8	Gless wool Issulation, Lind D40 White, Re1.00 mSKW, 40 mm, 6?	493 m2	3,786.1	3,026-1	2,916-1	2,226-0	3,666-2	6,2163	080	96mm_maulated
0.6	Glass wool Insulation, Lind 040 White, Riv I, 00 m2KW, 40 mm, 6?	\$70 m2	1,000,0	6,215-1	1-382-1	3,916-6	6,270-2	1,184	930	Menn parttor-the
O E	Gless wool freulation, LnD 040 Winsk, Rn1 00 m2CWL 40 mm, 6?	3 045	2,326.2	2,1700	1,8620	1,376-6	2,190-1	3,8364	Office	148mm
П		fection total		4,1920	2,470	1,586-4	1,5776-1	(1883)		Ш
Building	Building materials > Horizontal structures: beams	s, floors an	d roofs >	Toor slabs, co	cellings, roofing de	decks, beams and roof	roof 2 seen	19064	96	DES and concession 318mms
	spin2, iO Nature?	35								
36	Oyeum fbreboard, 12,5 mm, 1160 lights (Fermicoli) ?	438 m2	1,8862	8,835-2	1,085-2	2,54E-9	3,436-3	8,1853	990	oou esaucuo
96	Galvanicad profiled stoel sheets, polyester- cealed, for cell?	3,86 m3	8,500.4	1,862	2,1881	7,686.4	2,2561	1,1206	030	stains roof
2.6	i obow core concerte state, low-certon A, th.210 -	20 18	2,505.4	6,3561	2,12[3	£31E.4	3,0710	1,7385	GIIO	concrete root
re	Hollow core concrete strib, low-cerbon A, B-210 - 500 mm x 1?	20	6,386.4	1,862	5,2961	1,828-3	7,6700	SHIP	000	est concrete_318
0 6	Gless wool Insulation, L+0.040 WinsK, R+1.00 m3KW, 40 mm, 8 ?	2 628 m2	22	1,8850	1,660	1,186-6	1,896-1	33164	959	pou essuouso
0 €	Glass wool Hauleton, L-0 040 Wirnis, R-1 00 m2KW, 40 mm, E ?	2 730 m2	2,0862	1,9860	1,6660	1,236-6	1,97E-1	3,4654	060	aut concrata_318mm
d	Cansert, CEM IIIB 42,5 L-LHSR (na), Low heat	98,3 ton	3,164	2,85E1	3,8£1	4,536-4	31	1,736.6	090	ast concrete, 318mm

Construction	Resource	User	warming lig CO ₂ e	Acidification kg 80ge	Eutrophication kg PO _e e	potential kg CPC11e	lower atmosphera kg Ethense	ex, rew materials	alterage kg CO ₂ e bio	
	Ready mix concrete, 03037 B30 MIO, low carbon drass A (Ban ?	1,55 m3	2,8862	1.80	5,048-1	9,57E-6	4,07E-2	2,3753	030	Concrete 175mm base
	Oppsum fbreboard, 12.5 mm, 1180 light5 (Formscall) ?	2m 100	3,6862	1,788-1	3,38-2	4,216-9	6.746-3	1,0184	030	wood roof
	Oypeum threboem, 12.5 mm, 1160 lights? (Fermanit) ?	3978	1,0803	7,886-1	1-86.1	1,926-0	3,076-2	6,232.4	030	wooden floor
	Galveriand profiled street streets, polyester-contrad, for cell?	3,95 m3	8,008.4	1,962	2,1801	7,496-4	22881	1,1283	080	stains roof
	Hollow core concrete stab, low-cerbon A, \$1,210 - 500 mm x 1 ?	23 fpm	2,2963	5,6800	1,980	8.836-6	2,756-1	1,888.4	000	stains landing
	Class woul insulation, L=0.040 Winst, R=1.00 m200M, 40 mm, 0 ?	4741	3,6162	3,3800	2,8800	2,136-5	3,416-1	5,9754	020	loo boow
	Gless wool Issulation, L-0.040 White, R-1.05 m2KM, 40 mm, 6 ?	85 SE	4,9862	4,8650	3,9650	2,936-5	4.76-1	6,225.4	950	wooden floor
	Consent, CEM IIIS 42,5 L-LH/SR (m), Low head (Conner) ?	3,53 km	1,1163	1,0250	1,3650	1,836-5	3,66-2	62829	030	stairs landing
	Pasto vapour control layer, 0.15 mm (Tonman Grem.) ?	431 m2	13862	5,175-1	3,81E~2	1,97E-6	2,7E-2	2,5483	030	wood roof
	Pastic vapour control layer, 0.16 mm (Towner Green) ?	431 m2	1,3862	5,176-1	3,81E-2	1,97E-6	2,7E-2	2,5483	980	wood rod
	Laminahol phywcod, waterpood, 10.2 mm (Floo Treepol) ?	862 m2	2,68E3	5,5761	1,0861	7,ME-4	03979	3,9655	1,0064	wood roof
	Laminshid plywood, wellerproof, 10.2 mm (Fibo Treaps) ?	2 612	7,7863	1,0962	3,286.1	2,10E-3	156	1,0968	3,1364	wooden floor
	-joist, wood (Metall Wood) 🖁	22,528 21,33	4,87Es	3/6-1	1,786-1	1,186-6	1-300,1	1,3364	1,3363	accord roof
	Holes, wood (Methal Wood) 🕈	2.487,39 m3	7,384	5,182	2,8712	1,7716-3	1,586.2	287	1,9988	wooden floor
		Section	1,965	1,0003	3,6262	7,626-3	2,4782	2,3367	2,0768	
Bulldin	Building materials > Other structures and materials	> Other	tructures and	nd materials						
	Concrete baloons, CAMES (BAS MES), low carbon dates B (Bloc., 7	37 TE	2,4663	5,4800	1,8800	8,986-5	1,5480	2,010.4	030	
	Shed products, powder coated (Beadwas Mothang)	1 886.5 pl	5,5823	1,000,1	1,73(0	1,336.4	1,0360	6,57(4	030	affings
	Concords statroses and intermediate landings, COOKT (SO ME. ?)	10,6 m3	2,6563	6,0780	2,0300	9,865-5	1,0000	2,1964	030	
		Section	LOREA	2,4781	8,4189	3736-4	3,1963	1,0803		
Bulldin	Building materials > Other structures and materials	> Windows	ws and doon							
	Wooden entrense door, per unit, 808x2053 mm, 42x62 mm france?	15 8	1,7363	0,8400	2,216.0	1,341-4	4,280	6,410.4	1,8763	
	Wooden Interior door, per unit, 80842053 mm, 42,622 mm Yerre. → ?	100 unit	5,8863	3,656.1	1,3601	8,046-4	4,97E0	2,8405	1,0964	
	Top Swing Window, 0.841 With CK, 67.78 kg, 1.2345 48 m (Nordwe?	250,25 Sm	6,5863	7,6361	8,8100	6,536-4	4,0760	1,7265	8,1963	
		Saction total	1,42E4	1,2262	23481	1,386-3	1,346,1	4,3925	2,254	
Bullding	Building materials > Other structures and materials	> Finishes	a and coverings	tons						
	Coramic bles, balan average, 10mm, 19.9 light2 (Confindant?)	339 m2	8.HE2	1,1360	1,486-1	2.82E-8	1,086-1	6,2354	960	
		Section	\$,1162	1,1360	1,488.7	2,826-6	1,086-1	0,2364		

1,200 1,20	1,200 1,20	1,000 1,00	1,000 1,00	1,000 1,00	a op
1,100 1,00	1,000 1,00	1,000 1,00	1,000 1,00	1,000 1,00	1,000
1,110 1,11	1,120 1,12	1200 1200	1200 1200	1200 1200	nd 120,3 2,226.4 nd
1,125 1,12	1, 1, 1, 1,	1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,	150 150	1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,	5.422 8,61E3
12 12 12 12 12 12 12 12	14 14 14 15 15 15 15 15	10 10 10 10 10 10 10 10	10 10 10 10 10 10 10 10	142 142	128 ton 1,2754
145 145	145 145 145 145 155	100 100	100 100	145 145	48,9 ton 6,68E3
1-26 1-26 <th< td=""><td>1-200 <th< td=""><td>1244 <th< td=""><td> 1,000 1,00</td><td>1-20 <th< td=""><td>679 m2 2,1362</td></th<></td></th<></td></th<></td></th<>	1-200 1-200 <th< td=""><td>1244 <th< td=""><td> 1,000 1,00</td><td>1-20 <th< td=""><td>679 m2 2,1362</td></th<></td></th<></td></th<>	1244 1244 <th< td=""><td> 1,000 1,00</td><td>1-20 <th< td=""><td>679 m2 2,1362</td></th<></td></th<>	1,000 1,00	1-20 1-20 <th< td=""><td>679 m2 2,1362</td></th<>	679 m2 2,1362
1,000 1,00	1,000 1,00	1,000 1,00	1,000 1,00	1970 1970	Section 5,73EA total
120	200 200	200 200	2000 2000	1200	al walls and
120 120	120 120	1200 1200	2,250 2,50	1,000 1,00	
1200 1200	1200 1200	1,100 1,10	1,100 1,10	1,100 1,10	
1200 1200 1201-1 1200-	1,100 1,10	1,100 1,10	1,100 1,10	1700 1700 1701-5 1700-	1015 4,31E2 n2
1300 1300	1,000 1,00	1,100 1,00	1700 1700 1800 1800 1800 1800 1700 1800	1	1 015 6,0562 m2
1,000 1,00	1,000 1,00	1,000 1,00	120 120	1 1 1 1 1 1 1 1 1 1	11 165 4,51E2 m2
1980 1980 1984 1980	1500 1500	12 12 12 12 12 12 12 12	1980 1980 1984 1980 1984 1980	1982 1982 1983 1984	1015 3,19E2 m2
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,	1, 100 1	1,000 1,00	1	1	22,32 5,47E3 m3
1840 1840	1842 1842 1842 1842 1843	1	1	1982 1982 1982 1982 1983	6 735,96 3,9802 kg
Color Colo	Section Sect	Applies Appl	Comparison Com	Section Sect	Saction 2,53E4 total
Cart	125 125	CHE	GE GE GE GE GE GE GE GE	15 15 15 15 15 15 15 15	Columns and load-b
488-70 488-70<	GENERAL CHARGE ASSESSION ASSESSIO	424 4884 4	424 4884 4884 4888 4		1,05 m3 3,05£2
Statisty smoothers Little	Colored Colored <t< td=""><td> 1,100-10-10-10-10-10-10-10-10-10-10-10-10-</td><td> 1,100 1,200 1,100 1,20</td><td>Colored streams Colored st</td><td>Section 3,0582 sotal</td></t<>	1,100-10-10-10-10-10-10-10-10-10-10-10-10-	1,100 1,200 1,100 1,20	Colored streams Colored st	Section 3,0582 sotal
1200-2 1	1,100-2 1,200-2 1,100-2 1,200-3 1,20	1,160 1,260 1,160 1,26	CTC CTRC	1,185 1,285 1,185 1,185 1,28	Internal walls and non
1200-4 1	1,100-1 1,200-2 1,200-2 1,00	1,100 1,200 1,200 1,50	1,100 1,200 1,200 1,200 1,00	1,100 1,200 1,200 1,200 1,00	326 m2 1,402
1,000 1,00	March 19864 1986	1,000	1,100 1,00	1867 1964 3462 646 666 6	579 m2 2,48E2
23664 23764 23764 23602 6405 640	1,000 1,00	12 12 12 12 12 12 12 12	13.00 13.0	12 12 12 12 12 12 12 12	4 008 1,7E3
1006-1 2016-1 (44) 1006-1 2016-1 (44) 1006-1 2016-1 (44) 1006-1 2016-1 (44) 1006-1 2016-1 (44)	1,000	1,000 1,00	1,000 1,00	1,100 1,10	492 m2 3,75E1
1,580 (,585-4 3,580-1 3,588-4 60 1	2,000 1,00	1,000 1,00	1,000 1,00	1,100 1,10	870 m2 6,6361
2,880-1	4:060 2,000 (18E-5 3,000-1	Common States States Cute- States Cute-	Cuto	1,000 1,00	3 Des 2,2062 m2
	stabs, cellings, roofing decks, bear	sides, cellings, roofing decisis, beams and roof size	siths, colling, roding detail, beam and rode current current <td>sith, coling death, beam and road cutter cutt</td> <td>Saction 2,42E3 total</td>	sith, coling death, beam and road cutter cutt	Saction 2,42E3 total
2.200 LMM-4 LMM-1 LMM-1 LMM-2 LMM-2 <th< td=""><td>JAPE-1 VARCA LATICA LATICA LATICA LATICA REG LATICA CARCA LATICA LATICA CATICA CATICA</td><td>3,98-1 8,88-4 1,78-2 2,883 690 1,1381 4,440-8 5,3100 2,843 6,7153</td><td>1,1361 4,446-6 6,3850 2,6455 6,7153</td><td></td><td>1336 A,1903</td></th<>	JAPE-1 VARCA LATICA LATICA LATICA LATICA REG LATICA CARCA LATICA LATICA CATICA	3,98-1 8,88-4 1,78-2 2,883 690 1,1381 4,440-8 5,3100 2,843 6,7153	1,1361 4,446-6 6,3850 2,6455 6,7153		1336 A,1903

	Input	warming ing coye	Acid floation kg 50 _g s	Estrophication bg PO ₄₈	polential kg C/C11e	Formation of ozone of lower atmosphere pt Ethenes	total use or primary energy ax, raw materials	stones or not	Comments
Moleture resistant participand, PG / PB, Athor Sporplans?	30 m2	2,2562	1-305-1	1,226-1	8,04E-6	6,636-2	6,316,3	7,8162	79mm - Shristud
Roady-eis oceramia, C30.07 830 M60, low-carbon class A (Ban ?	49,03 Em	8,0683	1,428.1	1,000.1	3,008-4	1,4800	7,488.4	000	300mm - elevator
Oypeum threboard, 12.5 mm, 1160 lights) (Fermaced) ?	ž.	3,020.1	1,455-2	2,72E-3	3,47E-10	9788-4	1,4803	99	78mm - thr
Orpaum (breboard, 12.5 mm, 1180 light) (Fermacel) ?	461 m2	1,9612	9,46-2	1,776-2	2,756-9	3,616-3	9,6753	0110	Marin
Oypeum Breibaert, 12.5 mm, 1180 kg/m3 (Fermanel) ?	8 g	4,9382	2,386-1	4,448-2	8-97E-9	6-380'6	2,43[[4	000	esparation wall 196mm
Oypeum fibuboard, 12.5 mm, 1180 kg/m3 (Fermanot) ?	2 063 m2	8,8612	4,285-1	7,980-2	1,008-6	1,636-2	4,3754	000	Menn
Oypum fibebaart, 12.5 mm, 1180 kg/m3 (Fermooti) ?	8 5	1,860.5	1,985-1	1,486-1	1,916-8	3,086-2	8,1854	950	soundproof wall Millenn
Wholbreaker, 12/19/25 mm, 230 hg/m3, Hunlan Vinsted phanton. ?	387 m2	2,316.2	1,3860	4,146-1	9,586-6	1,000-1	1,2254	1,6263	separation wall 198mm/stad
Glass wool insultion, L-0.040 While, R-1.00 m2KW, 40 mm, 8 ?	480 m2	3,5161	3,285-1	2,78E-1	2,07E-8	3,815-2	6,7953	090	148mm
Glass wool heulition, L=0.040 Wimit, R=1.00 m2KW, 40 mm, 6 ?	2319	1,7762	1,66E0	1,4160	1,04E-5	1,67E-1	2,9254	090	separation wail 198mm
Gess wool reutation, L-0.040 Wirsf, R-1.00 m2KW, 40 mm, 8 ?	3123	2,3862	2,2360	1,960	1,48-6	2,286-1	3,9384	090	mage
Gass wool insustion, L=0.040 WimK, R=1.00 m2KW, 40 mm, 6?	3 900 m2	2,9782	2,7160	2,3760	1,736-5	2,016-1	4,9184	090	soundproof waii 148mm
Oppeum interior planter, gross density; 900.0 kg/m3	387 m2	4,1262	1286-1	3,196-2	8,626-13	336-2	6.1963	900	
	Section total	1,385.1	2,4261	2,386.1	-1007	2,440.0	3,9825	2,463	
Building materials > Horizontal atructures: beams, Applail percent for light whichs, polestions	floors and	roofs > Fig.	Andrea	ings, roofing deck	cks, beams and roof	4,676-2	C186/1	CORD	in sflu concrete
PVD-weiserproofing sheet, 1.2 mm (Protein) ?	20 m2	1,0862	4,486-1	1,486-1	76-6	2,66-2	2,7783	090	
PVC-waterproofing sheet, 1.2 mm (Plotan) ?	535 m2	2,0623	8,5860	2,84E0	1,346-4	4,985-1	6,2854	090	
Honogeneous Viryl foor covering, 2 mm, 2.8 Ngm2, 13 Neture. ?	24 m2	5,3861	1-367.4	1,886-1	6,176-5	4,588-2	1,5863	OHO	sat. concrete, 318
High preserve luminate floor covering, 9 mm, 8.7 kg/m2, Bern., 7	25 JE	6,1653	13821	13061	5,985-6	7,1600	3,4265	83908	wooden foor
Mosture resistant participand, PS / PS, Abor Sporpher?	2 JE	1,154	438E1	5,9650	2,48E-3	3,1960	2,5905	3,825.4	wooden floor
Roady-mix connests, C30/57 830 M80, low-carbon dress A (Flam?	2,84 m3	5,2452	8,28E-1	9,23E-1	1,786-6	8,986-2	(382)	980	langang toof
Roady-mic committe, C30.57 830 M50, low-carbon draw A (Ban., ?)	5,24 m3	8,6752	1,4260	1,750	3,236-6	1,886-1	9	090	in situ concrete 225mm
Roady-mix connente, C3037 B30 M80, low-carbon dwar A (Ran?)	18,08 Cm	3,3463	5,2560	6,87E0	1,126-4	5,48€-1	2,7854	090	concrole_178mm
Oypum throboans, 12.8 mm, 1160 light2 (Permanell) ?	2E ES	1,19E1	6-3678	1,07E-3	1,375-10	2,185-4	5,6752	090	langeng roof
Oypaum fbreboard, 12.5 mm, 1180 lights) (Permanal) ?	130 m2	1816.8	2,836-2	6,306-5	6,86-10	1,006-3	2,9103	000	wood roof-terms
Oypeum fibreboard, 12,5 mm, 1180 light3 (Fermacet) ?	536 m2	2,2782	1.086-1	2,056-2	2,626-9	4,198-3	1,0284	090	loca bose
Oypeum Bewbowni, 12.5 mm, 1180 light3 (Fermanoll) ?	8 281 m2	2,2483	1,080.0	2,t0E-1	2,500-8	4,136-2	1,1168	030	wooden floor
Hobbye days concesses slab, low-carbon A, BL210 - 500 mm x 1 ?	11,4 tos	1,1363	2,8050	9,41E-1	2,80E-5	1,386-1	7,753	000	ant. concrete_318
Class woul insulation, j60 040 Winst, Re-1.00 m2KW, 40 mm, 8 ?	40 m2	3,6600	3,436-2	2,916-2	2,105-7	3,46E-3	0,0402	000	est. concesse_316
Chass wood Insulation, Lieb SAD Witney, Re-1.00 m2XXXX,46 mm1,6?	7.80 E	1,380.2	1,2960	1,100	6,128-6	138-1	2,280.4	ogo	wood roof-terrex
Glass wool Intuition, L-ID 040 Winst, R+1.00 m3HW, 46 mm, 8?	0 0 0 0	6,36.2	4,965.0	4,7200	3,136-5	1-310'9	8,7854	0000	sood root
Gless wool heuteton, L-IDS60 WhinK, R-1.00 m2KW, 40 mm, 8?	8 600 5m	6,7182	0,226.0	0,3400	3,966-6	6,346-1	1,1165	OHO	wooden floor
SetHereing screed, fiber-reinforced, 840 mm, 1.7 kg/. 2.—?	1,70 lon	2,462	1,0160	1,986-1	2,766-6	4,946-2	2,0053	050	est. concrete_318
Oypeum board, for floor, 12.5 mm, 14.4 kg/m2, 1152 kg/m3, R., ?	24 m2	8,9621	2,57E-1	5,01E-2	7,1E-6	1,286-2	1,826.3	2,005	est. concrete_316
Pastic vapour control layer, 0.15 mm (Tonmen Gram.) ?	SE SE	5,4480	2,096-2	1,536-3	7,911-6	1,000-3	1,000.2	080	in situ concrete 225em
Paedic vapour control layer, 0,15 mm (Tommen Gram.) ?	Sm oct	4,3681	1.878-1	1,236-2	5.346-7	8.7E-3	6,1982	OBO	wood roof-lamson
Preside vaccour control lever 0.15 mm (Towner)	130 m2	4,3651	1,675-1	1,235-2	6,34E-7	8.7E-3	8.1922	050	wood roof-teme

regon	Resource	II II		Asid/fosition kg 50 ₂ e	ă	Ozone depletion potential kg CPC11s	forms atmosphere ignerial representations	ax. raw materials	atorage kg CO ₂ e bio	Comments
anidir	Building materials > Foundations and substructure	> Founds	ition, sub-su	rface, basem	ent and retaining	walls				
	Radon and moleture resminers for alle construction, PP, 1.2 m ?	200 m2	5,4822	1,960	2,356-1	1,490-5	1,156-1	154	000	concrute_450mr
	Ready-mis compress, CSQGT B30 telto, low-carbon class A (Blan., ?	26.25 E. 55	Sign	4,72E0	8,2760	Į	4,886-1	2,4854	036	concrete_450mm
	Ready-mix consums, CBDS7 B30 MB0, low-carbon cress A (Ren?	2,2	7,986.5	1,2861	1,4161	2,675-4	1,800	6,854	090	wal foundation
	EPS insulation panels, 38 mm, 800 x 1200mm, 0.57 light2, 15 k. ?	48 E	2,8463	7,7160	7,546-1	15	1381	4,9854	000	concrete_450mm
	EPS insulation parells, 38 mm, 800 x 1200nm, 0.57 ligning, 15 k?	4 10k	7,1863	1,8651	1,960	2,78€-4	13861	1,2955	090	insulated
	Self-leveling screed, floe-reinforced, 8-60 mm, 1.7 kg/t 2?	14,6 ton	1,9983	8,3750	8,796-1	2286-4	4,1E-1	2,4754	090	concrete_450mm
	Posto vapour control layer, 0,15 mm (Tonmen Gram) ?	200 m2	63751	2,446-1	1,796-2	9,206-7	1,27E-2	(283)	090	concrete_400mm
	Postic vapour control layer, 0,15 mm (Tonmen Gram.) ?	513 E	1,616.2	6,166-1	4,536-2	234E-6	3,216-2	2300°C	090	insufered basement
	Laminshed plywood, wellespood, 10.2 mm (Tho Trespo) ?	50 E	3,0623	6,636.1	12861	198	7,8850	4,2855	1,2364	insulating basement
		Section	2,6854	1,2852	3,61E1	1,161-3	7,8451	7,3263	1,2364	
Sulldir	Building materials > Vertical structures and facade	> Externa	walls and	acade						
	Ready-mic compres, 030,07 B30 M80, low-carbon dass A (Blan ?	2,61 m3	4,4282	7,886-1	8,486-1	1,818-6	7,816-2	239672	000	besentent - additional
	Resdy-mic constrain, C30.07 B30 M80, low-carbon class A (Slan ?	8,88 m3	1,0063	1,6200	1,8160	3,436-6	1,686-1	0,46[3	080	elasisterunde - additional
	Resulpents consistes, C30.07 B30 M80, low-cerbon class A (3km?	28.37 m3	5,2453	8,2460	9,2260	1,756-4	0,566-1	4,30EA	000	basement - insulated
	Concestie send-kith well, insulated, 650 light? (Egensund Beton?)	11.6 ton	1,7263	1,246.1	2,04E0	8,776-6	2,0160	1,9454	030	seddlons sandwith wall
	Oypeum Brebowni, 12.5 mm, 1180 kg/m3 (Fermacel) ?	114 m	4,8481	2,325-2	4,376-5	6,576-10	A, 928~4	2,9853	000	basement - insulated
	Oypeum Breboant, 12.5 mm, 1180 kg/m3 (Fermanel) ?	5 E	5,7802	2,776-1	6,216-2	0-300'9	1,000-2	2,880.4	000	sandwich wall - additions!
	Orpsum Streboard, 12.5 mm, 1180 lights (Fermansis) ?	£ 5	6,7362	3226-1	6,07E-2	7,756-0	1,346-2	9,325.4	000	EW_mosken wood
	Windowsier, 12/19/25 nm, 230 kg/m3, Hurton Vinsted pluston. ?	1 808 5n	8,6782	6,728.0	1,7280	3,978-4	4,24E-1	6,4854	6,7363	EW_moshen wood
	Gress wool Insulation, Linibbid WilmK, Riv1.00 m2KWI, 40 mm, E ?	080 m2	5,18E1	1-3887	4,136-1	3,006-6	4,96-2	6,000.3	000	sandwich wall- additional
	Glass wool fraultion, L-0.040 WimK, R-1.00 m2KNK, 40 mm, 6 ?	5 g	7,78E1	7.28E-1	6,196-1	4,50E-6	7,396-2	1,2854	030	EEW - basemen
	Gless wool Insulation, L-6 S40 Wilmir, R-1 50 m310M; 40 mm, 8 ?	2 387 m2	1,826.2	1,710	1,4580	1,078-6	1-827,	3,0164	090	basement - insulated
	Gless wool Insulation, L-6.040 WimiC R-1.00 m200N; 40 mm, 6?	3 174 TE	2,4262	22760	1,8360	1,436-6	2,296-1	454	8	EW mostken wood
	Gless wool hautefor, L=0.040 Whit; R=1.00 m3/0Al, 40 mm, 0 ?	85 8 5 5	1,2263	1,1461	9,74ED	7.21E-6	(1980)	2,0055	98	EW_mostven wood
	Self-leveling acreed, fiber-reinforced, 8-80 mm, 1,7 kg/, 2 ?	0,24 ton	3,36E1	1-84	1,846-2	3,866-8	6,986-3	7,182	98	additional sendwith wall
	Plastic vapour control layer, 0.15 mm (Tonmen Grenn) ?	7 938 GE	2,48E3	9,5250	7,01E-1	3,6266	4,97E-1	4,8754	080	EW_moelven wood
	Wood Scots Pine Cladding, 640kg/m3, Meistr. 12%, Ketheny Scoti ?	35,48	8,6953	9,1261	1,426.1	1,036-3	1,9450	2,4955	3,2464	EW_moshen wood
	i-jost, wood (Metall Wood) ?	13 TR.3	7,7162	5,3850	2,8250	1,876~6	1,6750	2,1165	2,164	EW_mosken wood
		Seoffen	2,4554	1,5552	4,780	2,48-3	0392'8	9,963	6,000.4	
Buildie	Building materials > Vertical structures and faceds	> Golumn	8	saring vertical	al struc		į	,	1	
	Process country, one carbon case A (Lornga) of	24.25	2,4783	1,620.1	3,0480	1,065-4	2,3667	1,600.0	1 696.4	
	ooburns (Kontaket?	5								estarlor
		Section	2,85E3	1,8861	3,2450	4,01E-4	1,8450	1,536.5	1,8854	

Construction	Resource	User	Global warming kg COye	Acidfloston Ng 50 _{pt}	Estrophication kg PO _e e	Ozone depletion potential kg CFC11e	Formation of agone of lower abnosphere kg Ethense	Total use of primary energy ax, raw materials	Blogsnic cerbon stonege kg CO ₂ e bio	Cerrments
	Pleate vapour control layer, 0,16 mm (Tommen Gram) ?	535 m2	1,6862	1-828-1	4,726-2	2,448-6	3,386-2	3,1863	090	loca boom
	Pleatic vapour control layer, 0,15 mm (Tonmen Gram.) ?	536 m2	1,400.2	0.426-1	4,726-2	2,448-6	3,366-2	3,1883	030	Jose poem
	Laminuthet plywood, weterproof, 10.2 mm (Pileo Treapo) ?	270 m2	8,2812	1361	3/47IID	2,38-4	2,1300	1,7888	3,3483	wood noof-termon
	Lambusini plywood, welespood, 10.2 mm (Fibo Treapo) ?	5 gr	3,1883	6,9151	13401	8,878-4	6,1900	4,4603	1,286.4	wand real
	Leminated physical, weterproof, 10.2 mm (Files Trespo) ?	6.28 II.2	1,578,4	3,4162	6,087	4,308-3	4,0481	2,216	63464	wooden foor
	Fjorkt, wood (Mettal Wood) ?	2 2	3,7761	2,636-1	1,386-1	9,156-7	8,166-2	1,0384	1,000.9	wood roof-lampse
	i-jost, wood (Metal Wood) ?	1346.21	7,981	1-316-1	2,885-1	1,926-6	1,716-1	2,1654	2,15(2)	wood roof
	l-joiet, wood (Mettel Wood) ?	6 236,1 Ig	3,6652	2,5860	13460	8,505-6	7,026-1	125	9,863	wooden floor
	Wooden roofing, 642kg/m3, Molec 12%, Sools Pina Roofing (Ks ?	1,08 m3	2,6652	2,7860	1-385-1	4,646-5	5,626-2	7,4553	9,8862	jos Buddus
	Wooden reofing, 643 kg/m3, Molec 12%, Scole Pine Roofing (No?	3,07 m3	7,6262	7,88E0	1,2360	1,385-4	136-1	2,1254	2,8163	wood roof ferrace
		Section	5,1264	2985	1,3162	8,48E-3	13651	3,9966	1,4465	
Bulldlin	Building materials > Other structures and materials	s > Other	> Other structures and	nd materials						
	Steel products, powder costed (Bredwins Milthrag) ?	4 032 iq	1,1254	2,87E1	3,5220	27/E-4	2,0860	1,3955	980	
	Concrete staircase and intermediate landings,	31,71 E	7,9253	1,8261	9'0860	2,96E-4	3,0850	9,5554	99	
		Beeffors	SME	1389'5	9,9860	5,808-4	6,1980	1,9965		
mildin	Building materials > Other structures and materials	» - Windows	ws and door	,						
	Aunthham frame gless door, 1230 x 2180 mm, frame rate rate.	10 unit	2,9663	1,386.1	1,2860	6,92E-6	-3,96E1	4,6254	090	
	Wooden entranse door, per unit, 809s2063 mm, 42x82 mm frams?	133 unit	1,2864	6,006.1	1,0461	9,106-4	3,5461	4,7365	1,386.4	
	Wooden Interfer door, per unit, 85842563 mm, 42x62 mm harns?	62 unit	3,4763	2,2861	6,6250	3,605-4	2,4180	1,7788	0,4883	
	Top Swing Window, 0.841 WindX, 67.78 kg, 1.23k1 48 m (Northes ?	683,34 m2	2,468.4	2,868.2	3,2201	3,106-3	1,6203	0,4185	3,436.4	
		Beofess	43754	3,726.2	6,000.1	4,63E-3	8,420	1,546.0	1,486.4	
Buildin	Building materials > Other structures and materials	> Finishes	s and coverings	signi						
	Caramic blas, Ballan irrenga, 10mm, 19.9 light2 (Confindant?	200 m2	3,0652	8,786-1	8,686-2	1,606-8	6,125-2	3,7354	090	concrete_425rrm
	Control Ster, Ballen average, 10mm, 19.8 light 2 (Confindust?	513 m2	7,7362	1,7250	2,196-1	4,27E-8	1,86-1	9,4354	990	Installed
	Control that, Italian average, 10mm, 19.8 light2 (Confindust?	£ &	1,8763	3,4860	4,446-1	8-399'9	3,346-1	1,9168	090	Sem wal
		Section	2,4653	5,8850	7,486-1	1,486-7	6,47E-1	3,2365		

Construction	Resource	User	Clobel warming kg CO ₂ e	Acidfication kg 50 ₂ e	Eutrophication kg PO ₄ s	Ozora depletion potential kg GFC11s	Formation of ozone of lower atmosphere Ag Ethense	Total use of primary energy oc. raw materials	Blogenic cerbon storage kg CO ₂ e bio	Comments
	Glass wool insulation, L=0.040 Winst, R=1.00 mg/kM, 40 mm, 6?	2 032 ==2	1,4862	1,4880	1,2360	8,136-6	1-309/1	2,9864	080	Milm
	Gress wool insulation, L=0.040 Winst, R=1.00 m2KW, 40 mm, 6?	3 171 m2	2,4262	2,2960	1,9000	1,436-5	2,286-1	3,996.4	0300	Mem
	Green wool insulation, L=0.040 Winsk, R=1.00 m2KW, 40 mm, 0?	3 920 m2	2,900.2	2,800	2,3800	1,766-5	2,625-1	4,9454	000	souniproof well 148mm
	Gless wool insulation, L=0.040 While, R=1.00 m2KW, 40 mm, 6?	5 120 m2	3,902	3,69(0	3,1160	2,36-5	3,696-1	6,4564	000	separation well 196mm
	Oypeum Interfor planton, grose density; 900.0 legim3	612 m2	5,4802	1,886-1	5,146-2	1,36-12	4,385-2	1,0864	000	esparation sail 198mm
		Section total	1,8884	2,858.1	2,5861	5.485.4	2,5400	4,9725	2,8383	
Bullding	Building materials > Horizontal structures: beams,	floors and r	oofs > Flox	or slabs, cells.	ngs, roofing dec	ks, beams and roof	Ť.			
	Asphal pervenent for light vehicles, pedestrans and Boyste?	S S	761	4.965-1	4,786-2	1,046-5	4,875-2	(383)	000	in situ constrete 225mm
	PVC-winterproofing aheet, 1.2 mm (Protein) ?	25	1,0822	4,486-1	1,486-1	7E-8	2,86-2	2,7763	050	pos Busbas
	8	535 m2	2,0603	0,5900	2,8400	1,346-4	4,985-1	6,280.4	0000	wood roof
	Homogeneous viny foor country, 2 mm, 2.8 kg/m2, R Neture ?	18 m2	3,586.1	3,156-1	1,28E-1	4,116-5	3,046-2	1,0963	090	est. concrete_318
	High preserve laminate floor covering, 9 nm, 8.7 spm2, 8em,?	3 158 m2	1,1164	1,1962	2,73E1	1,076-5	1,286.1	6,1465	1,8254	wooden floor
	Moleture resistant particleboard, PS / PS, Arbor Sporplane ?	3 158 m2	1,9754	7,816.1	1,0761	4,426-3	6,7860	4,0165	6,8854	wooden Scor
	Roady-mix conzents, C3037 630 MR0, low-carbon cases A (Blan ?	2,M m3	6,2402	1-385-1	9,235-1	1,786-6	0,565-2	4303	000	langang roof
	Ready-mix constrain, C30G7 830 M80, low-carbon cress A (Stan ?	6,2k m3	9,6711.2	1,8200	1,7110	3,236-5	1-300/1	699	000	in situ concrete 225mm
	Ready-mix consents, C3007 IS30 MISD, low-carbon class A (Start ?	7,38 m3	1,306.3	2,5480	2.480	4,036-5	2,238-1	1,1364	080	est. contrete_316
	Ready-mix constrain, C30.07 830 M80, low-cerbon class A (Slan?	12,8 m3	2,3823	3,7500	4,1900	7,965-5	3,695-1	1,8754	000	concrete_318_no
	Ready-mix concress, C30.07 630 M80, low-carbon dose A (Bart?	8,8	3,6803	5,800	6,490	1,236~4	6,008-1	3,0364	000	soncrele, 175mm
	Oypsum fibreboard, 12.5 mm, 1180 kg/mS (Fermoot) ?	E E	1,1961	5.71E-3	1,076-3	1,376-10	2,186.4	SARRE	GEO	Jose Buedlass
	Oyseum Bredown, 12.5 mm, 1160 lights (Fermoott) ?	tts at	5,915.1	2,655-2	5.30E-3	6,85-10	1,000-3	2,9123	99	wood roof-terrace
	Oyseum foreboars, 12.5 mm, 1160 lights (Fermoott) ?	556 50 50 50	2,2TE2	1,00E-1	2,096-2	2,62E-9	4,186-3	1,000	960	wood roof
	Oppour fireboard, 12.5 mm, 1180 lights (Fermont) ?	9 476 m2	4,0363	1,9360	3,686-1	4,636-8	1,686-2	1,8865	99	wooden floor
	Gass wool insulation, L=0.040 WhinK, R=1.00 m3KW, 40 mm, 5?	22	2,4460	228E-2	1,946-2	1,44E-7	2,35-3	4,0362	99	est concrete_318
	Glass wool insulation, L+0.040 WhmK, R+1.00 m0/WHK, R+1.00	1 807 m2	1,3852	1,2960	1,150	8,126-6	1年	2,3864	090	wood noof-terrace
	Gross wool Insulation, L-0.040 WimK, R-1.00 m2KW, 40 mm, 8 ?	8 965 m2	0,362	4,9880	4,7250	3,536-6	5,01E-1	8,7664	080	foot boom
	Gless wool Insulation, Ln0 040 WimK, Rn1 00 m2KW, 40 mm, 6 ?	15 780 III	1,263	1,1361	0360'6	7,18-6	1,5400	1,8963	000	wooden foor
	Settleweing screed, floer-reinforced, 8-60 mm, 1,7 agit, 2?	1,14 lon	1,6802	1-3953	7,646-2	1,796-5	3,285-2	(,8363,	Ollo	est_concrete_318
	Betfeveling screed, flore-reinforced, 8-60 mm, 1,7 apt 2?	1,80 lon	2,7262	1,5460	1,385-1	3,136-5	5,586-2	3,3753	000	concrete_318_no insul
	Oypeum board, for floor, 12.5 mm, 14.4 kg/m2, 1162 kg/m3, FL. ?	16 m2	5,97E1	1,716-1	3,386-2	4.746-6	8,600-3	(3/6)	1,376.1	ad. concrate_318
	Oypeum board, for floor, 12.5 mm, 14.4 kg/m2, 1152 kg/m3, R ?	20 m2	1,0402	ķ	5,916-2	8,396-6	1,816-2	2,1203	2,3961	concrete_318_no insul
	Pastic vapour control layer, 0.16 mm (Toremen Gram.) ?	Sa Co	6,4400	2,086-2	1,536-3	7,96-6	1,086-3	2300,1	000	in ellu concrete ZZSmm
	Plastic vapour control layer, 0.15 mm (Tonsman Geam.) ?	130 m2	4,305.1	1,070-1	1,236-2	4.346-7	8,76-3	A,1962	000	wood roof farmon
	Pastic impost control layer, 0.15 mm (Toneran Gram.) ?	130 m2	4,36£1	1,878-1	1,236-2	6,346-7	8.75-3	8,1962	080	wood noof farrace
	Pastic vapour control layer, 0.16 mm (Tohernen Geam) ?	536 m2	1,6862	1-32/9	4,726-2	2,44E-6	3,386-2	3,1063	090	wood noof
	Pastic vapour control layer, 0,15 mm (Tommen Gram.) ?	285 m2	1,6862	1-3297	4,72E-2	2.44E-6	3,335-2	3,1963	98	food roof
	Laminahed plywood, weterproof, 10.2 mm (Fibe Treapo) ?	278 m2	8,2562	1,000	3,4780	2,385-4	2,1300	1,1883	3,3463	wood real-terrace
	Laminsted phywood, weterpool, 10.2 mm (Fibo Trespo) ?	1 070 m2	3,18E5	6,916.1	13461	8.87E-4	8,1960	9397	1,2854	wood roof
	Laminsted physicod, weterproof, 10.2 mm (Fibe Trespo) ?	8 316 m2	1,8854	4,0862	7,8861	\$23E-3	1367	2,6168	7,58E4	wooden Boor
	Holst, wood (Methil Wood) ?	24,38 kg	3,77E1	2,635-1	1386-1	9,15E-7	8,165-2	1,0364	1,0063	wood roof-lamace

Construction Resource Building materials > Foundations and substruct	ture > Found	lig CO2s titon, sub-su	kg 30 ₃ s rface, baseme	kg PO _{de} nt and retaining	Nails	ing Etherne	3	tig CO ₂ s bio	The same of the sa
Radon and moleture members for alle construction, Pt. 1.2 m ?	Zin HT	-	020019	8,28E-1	8,236-6	1,046-1	3,0124	98	concrée_450mm
Ready-mix concrete, C30(37 B30 M60, low-carbo doss A (Blan?	58.9 mS	1,0854	1,886.1	1,086.1	3,516-4	1,7260	4,6864	030	concrete_450mm
Ready-mix constitut, C3037 830 MBD, low-carbon closes A (Nan?	5m 89,08 m	1,4064	2,3461	2,626.1	4,986-4	2,4360	1,2855	000	wall foundation
EPS Insulation panels, 38 mm, 800 x 1200mm, 0.57 tiginz, 15 k. ?	5 658 m2	9,9663	2.7E1	2,64E0	3,886-4	B,77E1	1,7866	98	concrete_450mm
Self-leveling acreed, fiber-reinforced, 8-50 mm, 1.7 kg/, 2?	J 51,2 los	6,9963	2,94£1	3,43£0	8,D4E-4	1,4460	8,0754	090	concrole_450mm
Plastic vapour control layer, 0.15 mm (Tommen Grem.) ?	711 m2	2,2362	8,006-1	6,286-2	3,246-6	4,488-2	4,1963	080	concrete_450mm
	Section	4,4564	1,0462	5,1761	2,096-3	7,3761	6,0165		
Building materials > Vertical structures and fac	ade > External	walls and	Scade	34750	A 077E-5	Ž	962	8	destinant
class A (Blan ?									
Residy-mic concernin, CSDIZF B30 MR0, low-carbo drass A (Ban ?	72,6 m3	1,3464	2,1161	2,38E1	448-4	2,1950	1,7168	000	basement -
Oypeum fibreboard, 12,5 mm, 1180 light3 (Farmanal) ?	280 m2	1,2362	5,916-2	1,116-2	1,428-9	2,27E-3	6,0163	080	besement -
Oypeum (breboard, 12.5 mm, 1180 light) (Fermical) ?	2 506 m2	1,0663	8,116-1	9,598-2	1,228-8	1,986-2	6,2964	000	EW_mostve wood
Windowsier, 12/1925 nm, 230 kg/m3, Hunton Vinded (Hunton, ?	2 634 m2	1,6163	8,0280	2,710	8-38E-4	6,696-1	A,84E4	1,086A	EW_mosher wood
Glass wool haulelon, Li-0.040 While, Ri-1.00 m2KW, 40 mm, 8 ?	5 018 m2	3,4352	3,5860	3,0860	2,286-5	3,615-1	6,3254	030	EW_mostwe wood
Gless word haubsten, L-6.040 Winst, R-1.00 m200W, 40 mm, 8 ?	8 097 m2	4,4662	4,360	3,760	2.74E-5	4,396-1	7,886.4	030	besendent -
Glass wool traubiton, Li-6 040 Winst, Ri-1 00 m2KM, 40 mm, 6 ?	28 310	1,9003	1,8161	1,6481	1,346-4	1,6000	3,1963	0000	EW_mostver wood
Plustic vapour control layer, 0.16 mm (Tonman Gram) ?	12 540	3,9403	1,001	1,110	6,736-6	7,886-1	7,386.4	000	EW_moshen wood
Wood Scole Pline Cladding, 640light3, Moletr 12%, Kebony Scol ?	79, 55,9 mS	1,3754	1,4462	2,3461	2,46-3	2,916.0	3,0655	8,1164	EW_mosken wood
i-joist, wood (Methal Wrood) ?	16 623,25	1,1563	8,0160	4,1960	2,786-5	2,4800	3,14835	3,1284	EW_mosken wood
	Section	3,9754	2712	7,8861	1,06-1	(ABIL)	SERG'S	1384	
	A spe	5	E .	stro					
Proced column, low cerbon class A (Confgal) ?			3,126-1	2,98E-1	6,67E-6	3,326-2	2,1483	960	
Glued tembrated Briber (Gluiam) shude and ockums (Ngeldstad?	24,29	2,678.3	1,878.1	3,0160	3,966-4	08187	1,518.5	1,588.4	new_kitchen excelor
	Bactlon total	2,063	1,781	3,3160	4,038-4	1,8400	4,5363	1,8864	
Building materials > Vertical structures and fac	ade > Internal	walls and n	in-bearing struct	ncgrues					
Moisture resistent particiologisti, PS / PS, Athor Spocphine?	86 51	2,2562	1-3059	1,226-1	5,04E-5	6,536-2	63/63	7,8162	7,81E2 Term - Tlohkud
Roady-mix concrete, C30037 IGS0 M80, low-carbo drose A (Blan ?	0,47 m3	8,6761	1,376-1	1,536-1	2,96-6	1,426-2	7,1762	000	concrete_200mm
Ready-etx concrete, CSDI37 B30 M80, low-carbo crass A (Blan?	50 DO 00	8/08/53	1,426.1	1,586.1	3,036~4	1,4860	7,4864	989	300mm - elevato
Oyseum fibreboand, 12.5 mm, 1180 kg/m3 (Permacel) ?	Zin LT	3,0261	1,486-2	2,726-3	3,47E-10	6,586-4	1,4853	090	Zhun - thr
Oypeum Ehrbboant, 12.5 mm, 1180 kg/m3 (Permanel) ?	1 536 m2	6,882	3,126-1	5,88E-2	7,51E-9	126-2	3,2264	99	separation wall 138mm
Oppsum fibreboant, 12.5 mm, 1180 kg/m8 (Fermanni) ?	2.114 m2	8,9862	13161	8,1E-2	1,036-8	1,666-2	1987	090	wwg.
Oypeum fbreboant, 12.5 mm, 1180 light3 (Petmaced) ?	2317 m2	9,8462	4,726-1	8,876-2	1,136-8	1,818-2	4,8854	98	Mem
Oypean fibeboars, 12.5 mm, 1180 light 3 (Fermann) ?	3 820 m2	1,6753	7,996-1	1/86-1	1,926-6	3,07E-2	6,2254	000	soundproof wall Minn
Windbrasise, 52/1925 rgs, 230 lealing, Hurlan	612 == 2	* 00000					Party .		1

Construction	Resource	D Common of the	Clobal warming kg CO ₂ e	Acidfication kg SO ₂ s	Eutrophication kg PO _d e	Ocons depletion potential kg CFC11e	Formstion of ozone of lower atmosphere kg Ethense	Total use of primary energy ax. raw meterials	Biogenic carbon storage kg CO ₂ s bio	Comments
	l-joist, wood (Metall Wood) 🖓	1344.21	7,961	1,516-1	2.88E-1	1,926-6	1,716-1	2,1864	2,1163	host roof
	Holes, wood (Metsk Wood) ?	9 642,9	5,6662	3,9650	2,0780	1,386-5	1,230	1,898%	1,5484	wooden floor
	Wooden roofing, 640kg/m3, Molec, 1276, Scale Phos Roofing (Na ?	1,08 m3	2,656.2	2,7800	4,338-1	4,646-5	5-828-2	7,4983	9,0002	langang roof
	Wooden roofing, 840kg/ks3, Moter, 1216, Scots Phre Roofing (Na?	3,07 m3	7,5262	7,8960	1,2360	1,326-4	1.00-1	2,1264	2,8163	wood roof-ternoe
		Section	7,388,4	7,4862	1,7362	1,166-2	Lasca	6,1983	1,896.5	
Bulldling	Building materials > Other structures and materials > Other structures and materials	» > Other s	tructures as	d materials						
	Shed products, powder coated (Bradhene Michbarg) ?	4 052 kg	1,1264	2,67E1	3,526.0	271E-4	2,080.0	1,3865	090	
	Concrete staincase and intermediate landings, CONST (SO) ME. ?	32,32 m3	8,07E3	1,856.1	6,1850	3,016-4	3,1250	6,6754	090	
		Section	1,825.4	4,5001	9,7110	\$-31/5°	8,2480	202		
Mildin	Building materials > Other atructures and materials > Windows and doors	s > Window	we and door							
	Auminian furns glass door, 1230 x 2180 mm, frame min = 32?	9 mg	2,6663	1,2251	1,13E0	6,236-5	-3,68E1	4,3454	090	
	Wooden entranze door, per unit, 809s2053 mm. 42x62 mm frams?	162 unit	1,5654	8,1661	1,886.1	1,126-3	3,8261	6,7756	1,8864	
	Wooden interior door, per unit, 878s/2053 mm, 42x62 mm huma?	62 unit	3,4763	22861	6,625.0	3,585-4	2,4150	1,7768	6,4553	
	Top Swing Window, 0 841 Wilm2K, 67.78 kg, 1,23k1 48 in (Nevens?	1622.3V	2,27E4	2,6462	2,9861	2,966-3	1,4161	0,8965	3,1864	
		Section	4,4484	3,6162	1,1117,2	4/400-3	1981	1,3908	8,5184	
mildin	Building materials > Other structures and materials > Finishes and coverings	s > Finishe	and cover	100						
	Ceramic Stee, Italian average, 10mm, 19.9 light2 (Confinduel?	SE III	1,07E3	2,3860	3,036-1	6,916-6	2,278-1	1,2165	000	concrate_455rrm
	Generic Stet, Italian everage, 10mm, 19.9 light2 (Confindust?	1 067 m2	1,6963	3,5460	4,518-1	8.796-8	3,286-1	1,9463	080	Stem was
		Section	2,6603	5,9200	7,848-1	1,478-7	1-80	3,2905		

		Input	warming kg COye	Ng 30 _{ps}	Estrophication kg PO ₄₈	Ozone depletion potential kg CFC11e	Formation of azons of lower atmosphere kg Ethense	Total use of primary energy ax. raw materials	Blogenic cerbon storage kg CO ₂ e No	Comments
	Moleture resistant particleboard, PG / PB, Attor Sporepiese?	3 168 Em	1,9754	7,80€1	1,0761	4,428-3	0,7360	4,8655	6,855.4	wooden floor
	Ready-mix occurrets, C3037 830 M60, low-carbon data A (Ban?	2,84 m3	6,248,2	0.258-1	9,23E-1	1,758-6	0,000-2	4,3383	000	impang nof
	Ready-mix constrain, C3007 830 MRS, low-cerbon date A (Stern?	5,24 m3	8,6722	1,526.0	1,700	3,2306	1,588-1	g	000	in who concrete 225mm
	Ready-mix consistes, C\$037 B30 M80, low-carbon onside A (Blan?	7,38 m3	1,3683	2,5480	2,400	4,300-5	2,238-1	1,1384	000	est. concrete_316
	Roady-mix connevies, C30037 830 MR0, low-carbon class A (Blan?	12.9 m3	2,3883	3,756.0	4,1900	7,900-5	1-360°C	1,9784	Ollo	concrete_318_no tesd
	Roady-mix connevies, CSQS7 B30 MB0, low-carbon class A (Stern?	10.86 SE	3,600.5	5,800	6,490	1,236-4	1-300'9	3,0854	000	corcrube_175rm
	Oypum Broksant, 12.5 mm, 1180 lights (Fermacel) ?	28 m2	1,1861	5,716-3	1,07E-3	1,37E-10	2,185-4	5,8752	090	longang nof
	Oyseum fibeboard, 12.5 mm, 1180 light8 (Fermanel) ?	130 m2	SprEt	2,836-2	6,326-3	6,8E-10	1,006-3	2,9153	989	wood nod tampo
	Oypeum fibreboant, 12.5 mm, 1160 kg/m3 (Fermsonf) ?	535 m2	1,000	1,086-1	2,08E-2	2,626-9	4,165-3	1,1264	060	accel roof
	Gypeum fbreboart, 12.5 mm, 1180 isplinit (Fermecell) ?	9 475 m2	4,0353	1,8060	3,636-1	4,638-8	7,426-2	1,9955	050	wooden floor
	Gess wool haulation, L-0.040 WimK, R-1.00 m2KW, 40 mm, 0 ?	30 m2	2,4480	2,286-2	1,546-2	1,448-7	2.26-3	4,0362	080	set, concrete_316
	Gass wool Insulation, L=0.040 WilmK, R=1.00 m2kW, 40 mm, 0 ?	1807	1,3852	1,2960	1,160	8,128-6	1-167	2,2864	090	wood nod-lemen
	Gass wool traubtion, L-6,040 WinK, R-1,00 m2KW, 40 mm, 6 ?	8 G 6 G	6352	4,946.0	4,2260	3,136-6	6,016-1	0,7854	090	wood roof
	Class wool Insulation, L-6.040 Wirst, R-1.00 m2VW, 40 mm, 6 ?	87 SE SE SE	1,283	1,1361	0366'8	7,18-6	1,1480	1,988.5	090	wooden foor
	Self-lewing screed, fiber-self-kroed, 8-80 mm, 1.7 agr, 2?	1,14 km	1,5652	8.546-1	7,84E-2	1,796-6	326-2	1,9353	090	ed. concrete_318
	Self-lewing screed, fiber-winferoed, 8-60 mm, 1.7 kg/, 2?	1,90 ton	2,7262	1,1460	1,335-1	3,13E-6	6,996-2	3,3753	000	concrole_318_no insul
	Oypeum board, for floor, 12.5 mm, 14.4 kg/m2, 1162 kg/m3, FL., ?	10 m2	5,9751	1,716-4	3,38E-2	4,746-6	0-309/0	1,2153	1,376.1	est concrete_316
	Oppsum board, for floor, 12.5 mm, 14.4 light2, 1152 light3, FL. ?	20 m2	1,0482	ž	6,916-2	8,790-6	1,518-2	2,1283	2,390.1	concrete_318_no insul
	Pastic vapour control layer, 0.15 mm (Townson Qeam) ?	13 mg	8,4450	2,086-2	1,536-3	7,00-6	1,086-3	1,0202	000	in silu controto 225mm
	Pastic vapour control layer, 0.15 mm (Townson Qoym.) ?	130 m2	4,300.1	1,576-1	1,236-2	6,346-7	6.75-3	8,1902	030	wood nod-temboe
	Pastic vapour control layer, 0.15 mm (Townson Gram.) ?	130 m2	4,3601	1,676-1	1,236-2	6,34E-7	8.76-3	0,1982	000	wood roof-terrace
	Pastic vapour control layer, 0.15 mm (Toversen Gram) ?	536 m2	1,686.2	1-329/3	4,728-2	2,448-6	3,388-2	3,1623	OBO	wood vool
	Pastic vapour control layer, 0.16 mm (Tommen Geam) ?	535 m2	1,6862	1-329'3	4,726-2	2,446-6	3,366-2	3,1603	OBO	loor book
	Laminulad phywood, writerproof, 10.2 mm (Plbo Trespo) ?	278 m2	8,3562	1,061	3,4760	2,36-4	2,1360	1,1655	33453	wood rod-amaca
	Lansinsted plywood, witospood, 10.2 mm (Flbo Trespo) ?	1 070 5m	3,18E3	8,91E1	13461	8,87E-4	8,1960	4,4855	1,2864	locy boow
	Laminship plywood, wsterproof, 10.2 mm (Flao Trespo) ?	8 316 m2	1,8854	4,0862	7,8961	6,23E-3	4,8461	2,6358	7,5864	wooden floor
	Holet, wood (Metall Wood) ?	8 3	3,7761	2,636-1	1,386-1	B,15E-7	8,165-2	1,0854	1,0063	wood roof-tempoo
	Holst, wood (Metsil Wood) ?	1344,21	7,9E1	SSIE-1	2,885-1	1,926-6	1,716-1	2,463	2,1953	aco poor
	- Joist, wood (Metall Wood) ?	9.842,9	5,0052	3,916.0	2,0760	1,306-6	1,2360	1,0003	1,8464	wooden foor
	Wooden moting, \$40kg/m3, Moter, 12%, Scots Pine Rouding (No ?	1,88 m3	2,8662	2,7860	4,336-1	4.04E-5	5,625-2	7,4563	9,0002	larging rod
	Wooden roofing, Bablopints, Moser, 1276, Scole Plee Roofing (Na ?	3,07 m3	7,520,7	7,8900	1,2360	1,308,1	1,00-1	2,1254	2,8163	wood noof-tempos
		Saction	7,386.4	7,6822	1,7362	1,166-2	13161	Aysees	1,896.5	
Bulldh	Building materials > Other structures and materials	> Others	structures a	nd materials						
	Sheel products, powder coaled (Bradwise Midfaug) ?	4 032 kg	1,1284	2,676.1	3,4280	2716-4	2,0900	1,3388	000	
	Concrete staintees and intermediate landings,	32,32 m3	8,070.5	1,808.1	6,1950	3,018-4	3,1200	0,676A	000	
		Baction	1,9284	4,5207	8,780	7853	8,2100	200		
Bulldh	Building materials > Other structures and materials	- Window	no pur sw	,						
	Aunterium forms glass door, 1230 x 2180 mm, frame nate = 32?	9 016	2,661.3	1,226.1	1,1360	6,231-6	-3,880.1	4,346,4	000	

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10 10 10 10 10 10 10 10	22/10 23/10 2	200 to 100 to 10		1000 1000 1000 1000 1000 1000 1000 100	8 8 8 8	
Manufacture and CORD ED MAN be seen to Robe (1454) To the seed of	2,751 2,761 2,862 2,863 2,864 2,865 2,864 2,865 2,864 2,865 2,	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2 ARES 2	1255 1775 1775 1775 1775 1775 1775 1775	9 9 9	sall foundation concrete_450n concrete_450n
The control of the co	2,751 (ARC)	200 100 100 100 100 100 100 100 100 100	1,4469 4,4882 1,4882 1,4882 1,4883 1,4882 1,4883 1,	SECT SECT SECT SECT SECT SECT SECT SECT	9 9	concrete_450n
the second control layer, 61 fam. (Trees) Third Second control la	236E1 (MC2)	285 285 285 285 285 285 285 285 285 285	1,440 4,082 1,382 1,382 1,480 1,480 1,480	State	99 99	concrete_450n
The control lay C. M. It and (Domes) The control lay C. M. It and (Do	(ARC)	236 246 246 246 246 246 246 246 246 246 24	13862 13862 14869 1489 1489 1489	6995. 6995. 6957. 6957.	8	-
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The state of the s	Ę.	6.87E-6 3.80E-4 4.00E-4 2.9E-6	3.00E-2 1,AHE0 1,AHE0 6.00E-2	2,1423		
23 24 25 25 25 25 25 25 25	Proclams	5.04E-4	1,410	5316,1	000	besement
March	tructure	\$50E-5	95	SIEST)	1,006.4	new idohen antañor
Internation > Vectoral directions and based > International or and ones of south and other directions and based > International or and other directions and	Preclar	5,04E-6 2,9E-6	9		1,888.4	
1975 1975		8,04E-5 2,9E-6	6,686-2			
A		2,96-6	-	6,3153	7,8162	Zerm - Shishad
ACCORDING Section 1820 1820 1820 1820 1820 1820 1820 1820			1,428-2	7,1762	030	concrete_200mm
### 1250 7100 2001 1000		3,036-4	1,4860	7,4864	030	300mm - eleve
1 100 6.000 1 100	Abe-2 2,728-3	3,47E-10	6,588.4	1,4963	090	78mm - 1hr
2 277 8,6412	3,136-1 6,886-2	7,516-9	1,26-2	3,2264	000	seperation wat 196mm
2 517 9,846 2 m2 1,6713 m2 1,771 2,7713 m2 1,771 2,	4,31E-1 8,1E-2	1,036-8	1,886-2	4,4354	090	Slearn
3 8820 1,8783 m2	4,726-1 A,076-2	1,136-8	1,816-2	4,0054	090	148mm
2 2 003 P P P P P P P P P P P P P P P P P P	1,000-1	1,928-6	3,075-2	0,2284	080	soundproof wall Memm
2002 m2 rtte	1,6250 5,485-1	1,285-4	1,305-1	1,7824	2,1953	separation wai
3177	1,4800 1,2300	9,136-6	1,485-1	2,9854	000	148mm
	2,2860 1,6960	1,436-6	2,280[-1	3,996.4	030	Menn
Gless wool trushism, L=0.040 WmK, R=1.00 3 920 2,990.2 m2CM, 40 mm, 6?	2,800 2,3800	1,702-6	2,625-1	4,9454	000	souniproof well 148mm
Gless wool fraudation, Li-ClORD WilmS, Re-1.00 6 120 3,98(2 m20cM, 40 mm, 6?	3,690.0	2,36-6	3,586-1	0,455.4	000	separation wall 196mm
Oxygeum treatur pleaster, grose density; 500.0 lightnS 512 m2 5,4662	1,886-1 5,146-2	1,36-12	4,386-2	1,0854	000	separation was 198mm
Section 1,9864 total	2,99E1	2,486.4	2,8460	4,0755	2,000.0	
ctures: beams, floors and roofs > Floor sit	Ings, ro	ks, beams and roof				
Angebeil prevented for lightly vehicless, prodestriams 15 m2 75.1 4 and Mayche?	4,785-2	1083	4,875-2	1,5803	000	in situ conzeste 22fmm
28 m2 1,08E2		76-6	286-7	2,7763	050	imping roof
535 m2 2,0883	8,5660 2,8460	1,346-4	4,982-1	6,2854	090	wood roof
7000		-	2.0000	CHRON'S		asc. concess, 310



Appendix C - Comparison of all scenarios regardless of their different floor areas

