A Zero-Waste Approach in the Design of Buildings

Introducing a new way of approaching sustainability in buildings with a conceptual industrial building design as an illustrative example.

Large amounts of waste and debris are currently produced by the building industry. This indicates that less sustainability should be achieved when considering the environment, social and economic factors.

This demand sets the main goal of zero-waste. It is important that for this goal the complete function of the material is desired. The materials is either landfilled or incenerated. This demand states that materials that can not be reused or recycled are required but not available, the option to demolish the building, generating waste, is therefore does also not require special tools or transportation to be removed easily. Therefore, it is important that for this demand the correct method for disassembly is not known, it is important that for this demand the correct method for disassembly is not known, it is important that for this demand the correct method for disassembly is not known.

If all parts can be easily reached without destructive methods, it will prevent the amount of different used materials should be kept to a minimum. In this way damage is less likely to occur, which could cause the component to be more. In this way damage is less likely to occur, which could cause the component to be more.

Dangerous materials are less likely to be reused, as special precautions should be taken for the removal process.

A sustainable source is defined as a way of gathering materials that can be continued, this can not be reused or recycled.

Connections making full use of demountable connections. Every component is assembled to another using simple mechanical connections and components by using a box shape for the building.

Connections and components by using a box shape for the building.

The system designed should be able to be prefabricated. No polluting, toxic or hazardous materials are used.

Waste is heterogeneous mix of materials which can not be reused or recycled.

The primary zero-waste demands, aunque materials should be provided.

The amount of different used materials should be kept to a minimum.

The system designed should be able to be prefabricated. No polluting, toxic or hazardous materials are used.

A Zener-Waste Industrial building Graduation Project

Design part Structural

Plan & Sections

Location/name

Scale

Detail number

Closure sections -

- No polluting, toxic or hazardous materials are used.

Connections and components by using a box shape for the building.

The system designed should be able to be prefabricated. No polluting, toxic or hazardous materials are used.

Waste is heterogeneous mix of materials which can not be reused or recycled.
Zero-waste facade system

Minimal types of materials
For the facade system only 3 materials are used: expanded cork, galvanised steel and glass.

Integrated functional detailing
Sheet metal and milled glass are used as an integrated element of the facade system, allowing flexibility for variations and doors are made using only the expanded cork.

Flexibility
Without adding additional components, the integrated utility rail allows for non permanent attachments to the element without damage.

Unified system
By using the system modular and readable, removal and replacement is considerably.

Minimal types of connections
The facade system should allow a non destructive removal and replacement. Only one type of efficient connection type is required between the two elements.

Integrated system connections
Connections to other parts of the building such as the foundation, and integrated in the shape of the element to additional components or installation steps are not needed.

Material choice
The identified important design aspects for using cork as a sealant is correct quality and grain size is required. Additionally, enough pressure is required. These aspects are used in the design of the facade system.

Correct grain size
Connections to openings such as windows are made without additional elements. Instead, shear studs are made as an integrated element for the facade system, allowing flexibility for variations and doors are made using only the expanded cork.

Shear studs are made as an integrated element of the facade system, allowing flexibility for variations and doors are made using only the expanded cork.

Connections to other parts of the building such as the foundation, and integrated in the shape of the element to additional components or installation steps are not needed.

Figure 1.2: Wall to foundation connection, 2D detail drawing, Scaled down from 1:5. Full size detail in the final description and drawings of the building.
**Zero-waste structural system**

**Stable elements**
The components are prefabricated into elements that fit into regular trucks. The foundation is designed to function as a sandwich structure. The outer layers of the prefabricated slab are made of lightweight aluminium foam which is bonded to the aluminium sheets during the foaming process, creating a metallic bond. The sheets are interconnected between elements using steel nodes. The connections between elements are made using a small amount of bolts, reducing the number of total elements and connections.

**Safe in fire**
Timber is used for the superstructure as it can be engineered for fire safety. The predictable charring rate of timber is used to protect the superstructure. The load bearing capacity of the foundation is designed from timber to handle the internal moments caused by the columns and other elements.

**Smart connections**
Steel nodes are used to provide the connection between the elements. These connections are designed to be pinned and do not need to transfer moments. The connections between the elements are made using only a small amount of bolts.

**Tensile design**
The foundation is designed to be a portal frame. The columns and other elements are designed to function as a portal frame. The foundation can be assembled in the building site using the steel nodes and bolts.

**Demountable**
Large prefabricated elements allow for fast and easy assembly on the building site using a minimum amount of connections and elements. The columns and other elements are made using a small amount of bolts.

**Integrated facade connection**
Connections to the facade are made using a cork layer. Grooves are integrated into the facade to allow for piping and wiring. A steel plate is welded onto a steel grate and inserted into the cork. The connection is friction based and the steel plate can be removed using the gaps integrated onto the side of the element. The facade elements are connected to the facade using the steel nodes and bolts.

**Integrated climate system**
The climate system is designed to function in the floor plates.

**Large elements**

**Lightweight**

**Demountable**

---

The foundation is designed to function as a portal frame. The columns and other elements are designed to function as a portal frame. The foundation can be assembled in the building site using the steel nodes and bolts. The connections between the elements are made using only a small amount of bolts.

---

The foundation is designed to function as a portal frame. The columns and other elements are designed to function as a portal frame. The foundation can be assembled in the building site using the steel nodes and bolts. The connections between the elements are made using only a small amount of bolts.

---

The foundation is designed to function as a portal frame. The columns and other elements are designed to function as a portal frame. The foundation can be assembled in the building site using the steel nodes and bolts. The connections between the elements are made using only a small amount of bolts.

---

The foundation is designed to function as a portal frame. The columns and other elements are designed to function as a portal frame. The foundation can be assembled in the building site using the steel nodes and bolts. The connections between the elements are made using only a small amount of bolts.

---

The foundation is designed to function as a portal frame. The columns and other elements are designed to function as a portal frame. The foundation can be assembled in the building site using the steel nodes and bolts. The connections between the elements are made using only a small amount of bolts.