Material and design efficiency

Reducing the environmental footprint in construction

Olivier Vassart
CEO Steligence®
The impact of the construction to the climate change

Buildings and construction currently account for around 40% of CO2 emissions.

Global building floor area is expected to double by 2060.
Several numbers on steel carbon intensity
Each steelmaking route has its own carbon footprint

<table>
<thead>
<tr>
<th>Steelmaking route</th>
<th>Blast furnace-basic oxygen furnace (BF-BOF)</th>
<th>Direct reduced iron (DRI) followed by an EAF</th>
<th>Electric arc furnace (EAF)</th>
<th>EAF with renewably produced electricity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main input</td>
<td>Coal and iron ore</td>
<td>direct reduced iron (sponge iron)</td>
<td>scrap</td>
<td>scrap</td>
</tr>
<tr>
<td>Main CO₂ source</td>
<td><strong>Chemical interaction between carbon (coal) and iron ore</strong>: iron reduction produces pig iron which is converted into steel.</td>
<td>Emissions from the use of <strong>natural gas as reductant</strong> Emissions from purchased <strong>electricity</strong></td>
<td>Emissions from purchased electricity</td>
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</tr>
<tr>
<td>Emissions (incl. rolling mill)</td>
<td>Between 2.25 / 2.8 t. CO₂/t</td>
<td>Between 1.12 / 1.35 t. CO₂/t</td>
<td>Between 0.62 / 0.85 t. CO₂/t</td>
<td>Around 0.3 t. CO₂/t</td>
</tr>
</tbody>
</table>
Each steelmaking route has its own carbon footprint
The big picture

million tones, crude steel production

Focus on construction
Is the solution only focused decarbonizing material production?

World population

9 billion people by 2050

Habitat

200,000 people are moving to the cities everyday

Source: Circularity Gap Reporting Initiative 2022
The impact of the construction to the climate change

<table>
<thead>
<tr>
<th>Actions to reduce carbon footprint (on a yearly basis)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cut one return flight from New York to Chicago</td>
<td>![Plane]</td>
</tr>
<tr>
<td>Cut meat, dairy and beer from your diet</td>
<td>![No Food]</td>
</tr>
<tr>
<td>Stop driving your car</td>
<td>![Car]</td>
</tr>
<tr>
<td>Achieve 20% structural steel embodied carbon reduction of a 200m high rise building</td>
<td>![Ban]</td>
</tr>
</tbody>
</table>

The structural engineer has more opportunity to reduce carbon emissions than most other people.
Intelligent material selection makes ALL the difference

High rise construction

Multi-storey column subject to axial load, buckling length 3.5m

CO₂e saving is 3755 kg for each 3.5m column

In kg CO₂e/m

- S235 HD 400 x 1086* 25 254 kN 86%
- S355 HD 400 x 677* 24 580 kN 80%
- HISTAR 460 HD 400 x 463 25 256 kN + low carbon steel 154

* Central Europe Bauforumstahl EPD | A1-A3 | 1130 kgCO₂/t
Intelligent material selection makes ALL the difference

Single-storey industrial building
LVS3 * without envelope

Concrete S235
Bauforumstahl
European Average
(Sections + plate)

Concrete S460
Bauforumstahl
European Average
(Sections + plate)

S460 + low carbon steel

Transport
Reinforcement
Precast Concrete
Portal Frame

Module A – **Concrete** vs Steel S235 vs Steel S460

* LVS3 European project
https://op.europa.eu/en/publication-detail/-/publication/cbb3472d-fbbe-11e5-b713-01aa75ed71a1

**CO₂e saving can be as high as 73%**

**In tonnes of CO₂t**

- **Concrete**
- **S235**
- **S460**
- **S235 + low carbon steel**
- **S460 + low carbon steel**

73%
71%
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17%

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The Steligence® office building

CO₂e saving can be as high as 54%

Cradle to cradle | [A-C] + [D]

- Roof
- Floors
- Frame
- Basement
- Core
- Foundations
- Module [D]

Concrete

- 182 kgCO₂e/m²

“Best in Class” Steel

- 83 kgCO₂e/m²
Designing a building in the right way can already decrease its carbon content by 35-55%.
Refurbish & Re-use: European Court of Justice in Luxembourg

Dismantling of the building piece by piece

Re-conditioning and reuse of each piece in the new building
View of the Main Lobby after re-construction
Re-use : Mundo LLN (Belgium)
Re-purpose : project „Petite Maison“ (Esch-Belval / Luxembourg)