A new evaluation method for the end-of-life phase of buildings

Hildegund Figl

IBO – Austrian Institute for Building and Ecology
Driving question and objectives

How should the material composition of a building be designed so that it leaves
- as many recyclables as possible and
- as little problematic waste as possible at the end of its life time?

Basic conditions
• appropriate as evaluation method for BNB system
• integrable in the existing LCA tool (“Bauteileeditor”)
• based on the building elements approach
Qualitative assessment

Deconstruction → Emissions → Life cycle assessment
Deconstruction → Materials → Life cycle costs
Deconstruction → Man Power → Life cycle costs
Deconstruction → Machines...

Further Processing

Separated materials

End of waste status or waste

Future life „products“

Quality of the potential future life of the materials as a consequence of the previous steps
# Grading of material output

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reuse</strong></td>
<td>no preparation methods for reuse available</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Recycling</strong></td>
<td></td>
<td>no recycling</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Closed loop (CL)</strong></td>
<td>RC+</td>
<td>RC-</td>
<td>OU</td>
<td>noRec</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Combustion</strong></td>
<td>Fuel</td>
<td>EnRec+</td>
<td>EnRec-</td>
<td>ThDisp+</td>
<td>ThDisp-</td>
<td></td>
</tr>
<tr>
<td><strong>Landfill</strong></td>
<td>Landfill</td>
<td>GFO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RC ... Recycling
Fuel ... Derived fuel
Landfill ... class I, II and III
GFO ... Gypsum, Fibre, Organic
Procedure

Connections and joining technics

Building element

Virtual de-construction

Classification

Reference Elements

Material database from the LCA tool

Aggregation (volume)

Grades for EOL

Connections and joining technics
## Technology factor

<table>
<thead>
<tr>
<th>Technology description</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed technology, but is usually not practiced in Germany yet due to lack of interest.</td>
<td>0,75</td>
</tr>
<tr>
<td>Example: Separation of plaster from EPS in ETICS</td>
<td></td>
</tr>
<tr>
<td>Technology ready for the market, but not practiced widely in Germany yet; maybe used in other countries</td>
<td>0,5</td>
</tr>
<tr>
<td>Example: Reclaiming of post-consumer mineralwool</td>
<td></td>
</tr>
<tr>
<td>Technology is in active development and tested on a small scale.</td>
<td>0,25</td>
</tr>
<tr>
<td>Example: Regaining polystyrene from EPS (w/o HBCD)</td>
<td></td>
</tr>
<tr>
<td>The technology will lead to carryover of pollutants</td>
<td>0</td>
</tr>
<tr>
<td>Examples: Materials containing lead, SVHC</td>
<td></td>
</tr>
</tbody>
</table>
Example: Brick

1. Lime cement plaster
2. Brick (25 cm)
3. Adhesive, Dowel
4. EPS-F (32 cm)
5. Adhesive, Plaster
Scenarios and grade for the brick

<table>
<thead>
<tr>
<th>Present scenario</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brick, Mortar, Plaster, polluted with ETICS</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Future scenario</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brick, Residues of Mortar &amp; Plaster</td>
<td>3</td>
</tr>
<tr>
<td>Mortar, Plaster, Res of Brick and EPS</td>
<td>5</td>
</tr>
</tbody>
</table>

TF = 0.75

Total: 3.7
Conclusions and outlook

• Methodology is transparent, comprehensible and delivers the expected results.
  • Next steps (SWD 10.08.17.7–18.18)
    • Fine adjustment with stakeholders
    • Application to different buildings
    • Work out a scale on the building level for the assessment

• EOL-scenarios shall be used to improve the scenarios for LCA and LCC

• Shall encourage development from state of the art to front runner buildings
Co-Authors

• C. Thurner, F. Dolezal, IBO – Austrian Institute for Building and Ecology
• P. Schneider-Marin, Institute for energy efficient and sustainable planning and building, TU Munich
• I. Nemeth, College Ansbach, Sustainability – Focus Civil Engineering
Acknowledgements

This work was fully funded by Zukunft Bau, Research Programme of German Federal Ministry of the Interior and German Federal Institute for Building, Urban and Spatial Research (BBSR)

Special thanks go to Claus Asam, Nikolas Kerz, and Stefan Rössig from BBSR as well as to Robert Kellner from ak architekten (Munich) for their continuous advice.

File number: SWD 10.08.17.7–16.39