VALDEM PROJECT: FROM LCA OF DEMOLITION WASTE TO CIRCULAR ECONOMY OF BUILDINGS

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Context:

- Building and construction sector:
  - more than 1/3 of global resource consumption
  - generation of solid waste: 40% of the total waste volume
  - EU: CDW = largest waste stream (1/3 of all EU waste)

- CDW (Construction & Demolition Waste): mostly not recycled

- Causes:
  - heterogeneity
  - dispersion
  - economic viability
  - (policy / inconsistencies, discrepancies)
VALDEM project:

VALDEM aims to improve demolition waste treatment to reach a circular economy in North of France and Wallonia (BE) (and Vlanderen, BE) (01.07.2016 – 4 ans)

General information: http://www.valdem-interreg.eu/

Co-founders:

Life Cycle Assessment (MT3 – A4)
Life Cycle Management: detailed scope

- **Sorting, separation (density, jig):**
  - Residential buildings
    - Dismantling then demolishing
    - Sorting on site
      - Demolishing quality +
      - Storage platform
- Commercial and industrial buildings
  - Dismantling then demolishing
  - Demolishing quality -
  - Storage platform
- Downstream
  - Concrete + brick
  - Mixing
  - Concrete + plaster
  - Plaster
  - Concrete fines + brick
  - Fines + mixing
  - Concrete fines + brick + soil
  - Fines + mixing + soil
  - …

- **Brick, reexcavable self-compacting materials (MAR):**

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**Civil engineering/Demolishing**

**Road/Demolishing**
Demolition of Leroy Merlin store of Douai (59, FR)
Recycling of the "waste" (recycled aggregates, RA)
Construction of the new store in Tourcoing/Neuville-en-Ferrain (59, FR)
⇒ substitution of a part of natural aggregates (NA) in the concrete slab
Valorization of all the fractions:
  • 4-20 mm in concrete (Eqiom)
  • 0-4 mm in pavement (EtNISI)

https://www.youtube.com/watch?v=2IRb7PDcl_4
Goal and Scope

Goal:
• To assess the environmental impact of the substitution of a part of natural aggregates by recycled aggregates in the case of the demolition-construction of Leroy Merlin store in the Hauts de France

Scope:
• Cradle-to-gate (comparative) LCA
• Substitution of 20 % of natural aggregates (NA) with recycled concrete aggregates (RA)
• FU: 1 m³ of concrete
System boundaries

1. **RA**: demolition of Leroy Merlin store of Douai (59, FR)
   - Excavation, on-site transport, crushing and sieving
   - 4-20 mm: transport to Eqiom concrete plants
     - Wambrechies (→ Leroy Merlin Tourcoing)
     - Roost-Warendin (→ other projects)
   - 0-4 mm: transport to Recynov site, Santes
     - EtNISI in pavement

2. **NA**: production and transport to the site of use (Eqiom) or distribution (Recynov)
Inventory

1. RA:
   • Excavation, on-site transport, crushing: adaptation of generic entries to the French case
   • Transport distances: primary data

2. NA:
   • Production: adaptation of generic entries to the Belgian case (quarry in Belgium)
   • Transport distances: primary data
LCA Results – FU = 1 m³ Concrete, Wambrechies
Simapro 9.0; Ecoinvent 3.5; CML-IA 3.05
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Abiotic depletion (fossil fuels) Global warming (GWP100a) Ozone layer depletion (ODP) Photochemical oxidation Acidification Eutrophication

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<th>NA</th>
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<td>Abiotic depletion</td>
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<td>Abiotic depletion (fossil fuels)</td>
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LCA Results – NA/RA production and transport
Simapro 9.0; Ecoinvent 3.5; CML-IA 3.05
Conclusions

• **Substitution of 20% of NA with RA in concrete:**
  no significant impact difference on 1 m³ of concrete
  because cement in the most impacting element

• **NA – RA production and transport:**
  • GWP100a: gain depending on distance between the
    demolition and the valorization sites
    • Recynov - Santes: 1 kg CO₂ eq / tonne
    • Eqiom - Wambrechies: 1.6 kg CO₂ eq / tonne
    • Eqiom - Roost: 5.7 kg CO₂ eq / tonne
Conclusions

- Leroy Merlin Douai demolition: 3100 tonnes of RA
  - 4-20 mm: 1700 tonnes: 200 tonnes to Wambrechies
    1500 tonnes to Roost-Warendin
  - 0-4 mm: 1400 tonnes to Recynov - Santes

- Gain for the construction of the new store in Tourcoing/Neuville-en-Ferrain: 322 kg CO₂ eq
- Global gain if total reuse of the 3100 t of RA (0-4 and 4-20 mm): 10400 kg CO₂ eq
- 4-20 mm RA: 8500 m³ of concrete

- EtNISI pavement: to be continued...
Take home message

Globally, and in a circular economy perspective, the valorization of the demolition waste from Leroy Merlin Douai store provides a significant environmental gain compared to the use of natural aggregates only.
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http://www.valdem-interreg.eu/