CITYLOOPS - SOIL TOOLS
Instruments for predicting future production of excavated soil (and CDW)

WP: 2
Jens L. Gregersen, Capital Region of Denmark
CityLoops work on soil

CityLoops soil partners:
- Høje-Taastrup Municipality (pop 51,000)
- Roskilde Municipality (pop 87,000)
- Capital Region of Denmark (pop 1.8 mil)

Soil instruments/tools:
- Framework for soil management
- Instrument for predicting future production of excavated soil
- Assessment of soil reuse potential within construction sites
- Identification and assessment of local sites fit for soil reuse

Soil instruments are important because
- Excavated soil is the largest single fraction of waste related to construction in Denmark (> 2x CDW)
- Removal of excavated soil causes massive emissions
- Dumping of excavated soil, especially on agricultural land, may constitute an environmental risk
- Excavated soil has a considerable potential for substitution of virgin non-renewable raw materials
- Early planning may reduce the production of excavated soil and support circularity and SDGs
Imagine…

You have a project involving
• 300 ha of urban development on agricultural land
• 20,000 new inhabitants
• 4000 new workplaces

…and a dream: All excavated soil to be reused locally

Now, what would you do?
Imagine…

You would probably…

1) **Make an estimate of soil volume to be excavated**
   - By assessing buildings’ footprint (typology, plot ratio, foundation)

2) **Make an estimate of volumes of individual soil types**
   - By employing existing geological data

3) **Establish timeframe of construction activity**

4) **Investigate options for local reuse of excavated soil**
   - By assessing geotechnical properties of excavated soil, and
   - Look into technical uses, landscaping, climate change, noise barriers etc.
   - Estimate social, environmental and economic benefits

5) **Recommend initiatives on planning, constructing, tendering etc.**
   - Report and further info, see [http://xn--jordhndtering-tfb.dk/](http://xn--jordhndtering-tfb.dk/)
Predicting production of excavated soil - on a municipal level

Cityloops work in Roskilde and Høje-Taastrup

Employ and adapt methodology developed by Niras A/S

Verify predictions (using historic data and knowledge of planned projects)

Explore options for use of prediction in municipal administration

Use prediction in a municipal effort to limit production of excavated soil (soil strategy)
Predicting production of excavated soil - on a municipal level

Methodology

Input data
- Data from national registers e.g. spatial planning and buildings
- Strategic development plans
- Housing construction programs and other planned construction activities

Model
- GIS tool for:
  Initial classification
  Automatic calculations of estimated excess soil production
  Verification workshop

Prediction
- Spreadsheet with:
  Prediction of yearly amounts of excess soil production on municipality level

Step 1 → Step 2 → Step 3
Predicting production of excavated soil - on a municipal level

Results (reflecting a business as usual scenario)

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<td>2031</td>
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<td>In total approx.</td>
<td>2.3 million tons</td>
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Roskilde (pop 88,000): Predicted soil production Per capita soil production (12 years): 26 tons

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<td>In total approx.</td>
<td>3.7 million tons</td>
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Høje-Taastrup (pop 51,000): Predicted soil production Per capita soil production (12 years): 72 tons
Uses of prediction

Municipal planning

Overview of expected production of soil in specific geographical areas within a certain timeframe can be integrated into municipal planning. Enabling planners to:

- Evaluate options for reducing the future generation of soil at an early planning stage
- Adapt development plans to minimize soil generation and to ensure that excess soil can be reused within the area in question
- Explore potential options for sustainable local reuse related to climate mitigation, liveability, infrastructure or recreational uses, etc.
Can production of CDW be predicted by employing the “soil approach”? 

Pilot study performed by Niras a/s, municipalities of Roskilde and Høje-Taastrup and Capital Region of Denmark

Why this pilot study?
◦ we need a better basis for regional resource planning, focusing on sustainability
◦ supply of natural raw materials is running low
◦ projected demand for raw materials is increasing
◦ we need to decouple consumption from economic growth
◦ increased circularity supports decoupling
◦ a transparent market supports a better match of demand and supply

Goal: what CDW-products will be produced where and when, and in what amounts?
Predicting the production of CDW on a municipal level

Methodology

Data
- Existent buildings
- Planned building and construction activities
- Historical experiences

Prognose Model
- Calculation
  - Buildings - concrete and brick
  - Flooring - concrete and asphalt (and gravel)
- Basis flow (living numbers that do not include concrete traffic)
- Planned demolition activities (demolition activities for deferred building and construction activities that do not include concrete traffic)

Prognose
- Total expected annual production of secondary raw materials

Trin 1
Trin 2
Trin 3
Predicting the production of CDW on a municipal level

Step 1
- Taking stock of buildings in entire municipality
- Planned construction activities
- History of demolition activity/volume of CDW
  (for calibration and verification)
Predicting the production of CDW on a municipal level

Step 2

Calculating materials in all existing buildings
Calculating CDW from planned demolitions
Establish area of paved surfaces (roads etc)
Estimate flow of CDW from demolitions not reported
Predicting the production of CDW on a municipal level

Step 3

Calculating materials produced annually in a 12-year period within areas to be developed/transformed

Adding estimated annual baseflow
Results, CDW-production in Høje-Taastrup

Predicted annual production of concrete, bricks, asphalt and gravel (high probability areas)

Predicted annual production of concrete, bricks, asphalt and gravel (baseflow)
Predicting the production of CDW on a municipal level

Next moves:

Prepare adapted prognosis model in two additional municipalities

Identify reliable indicators on future production of CDW in the entire Capital Region of Denmark

Integrate CDW in regional raw materials planning
The soil team

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Roskilde municipality: Pia W Bjerggaard, Julie Albers, Klaus Kellermann
Capital Region of Denmark: Jens L Gregersen

Jette Karstoft and Solvejg Qvist of consulting company Niras A/S did most of the more tedious work
THANK YOU VERY MUCH!

Website: www.circularcities.eu
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Join the conversation: #CityLoops
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