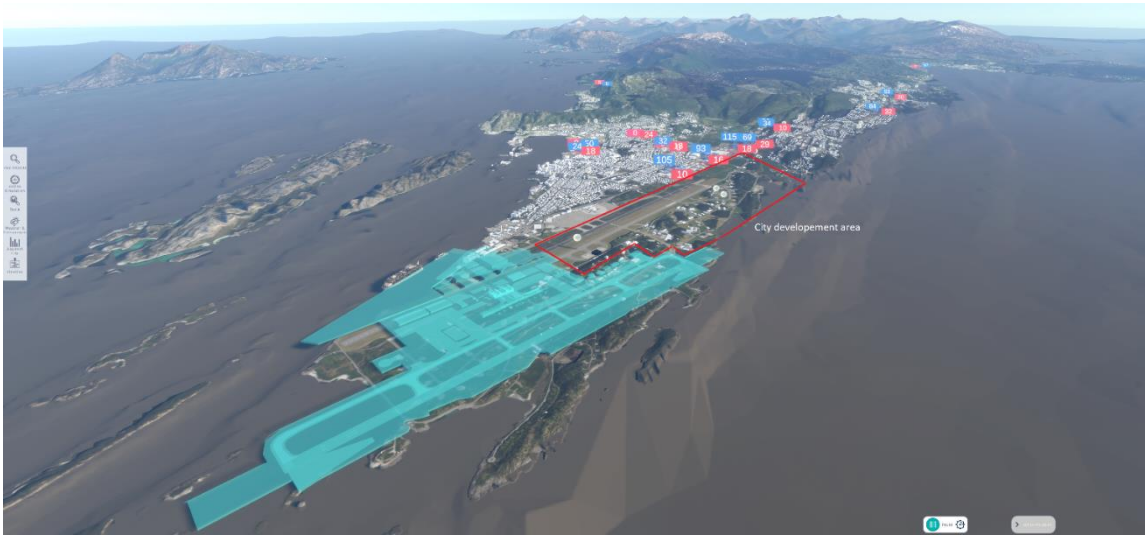
3D GIS-based Visualisation Tool for Monitoring and Planning

CDW



Description

This tool visualises all city structures, materials, emissions and flows such as energy use in real time. It integrates qualitative data such as SDG indicators as well. The purpose of the tool is (1) to allow for future scenario planning by considering the surrounding context and simulated impacts, and (2) to present sophisticated data in a visual way for involvement of citizens and non-specialists in city-planning through Bodø's CityLab. By documenting and making the material and energy aspects of Bodø's built environment accessible, the city can make data-driven planning decisions to promote circularity. Though the technology solution is unique to Bodø, a report documenting the process of data collection and visualisation will make the solution replicable by other cities.

For construction applications in CityLoops, the tool is used to map masses and materials including their quality, degree of pollution, mass and type. This information allows the user of the tool to evaluate the and plan for the reuse potential of the resources identified. As the tool is gathering data on traffic and emissions, it can visually represent with simulated or real-time data how circular CDW management correlates with these values. This feature will be used to demonstrate the environmental benefits of circular economy.

Keywords:

- #Decision making; #Planning
- #Flow tracking
- #Data visualisation
- #Coordination

Complementary tools:

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- CityLab Stakeholder platform, Material databank, LCA tool

Target user:

- Local governments (e.g. departments of buildings & infrastructure, urban development, environment, business & development)
- Businesses (e.g. building owners, environmental consultants, construction and demolition contractors)

Format:

- Digital city twin in a data-dashboard, for use by the city of Bodø
- Report documenting the process and solution properties – in English

Development

The city of Bodø wanted a digital solution that both supported data-driven and holistic understanding of the city's resources and sustainability indicators, and allowed the information to be visualised to be more accessible to decision makers and citizens. First a set of needs was established; a fitting technological solution needed to satisfy these requirement specifications:

- Incorporate and visualise any useful data fed into it, storing this in a databank
    - Visualise identified materials, masses, structures on a 3D map in a digital city twin
    - Visualise where materials are located and their qualities, including below groundlevel
    - Visualise material flows and patterns in order to show improvement potential
- Integrate BIM – detailed information about existing and planned buildings
- Model hypothetical structures to plan the new city, plan for reuse of salvaged materials and visualise scenarios for stakeholders
- Monitor data with regards to (social) sustainability – such as housing, schools, household waste generation, energy consumption, traffic and noise
    - Offer analysis options to facilitate optimisation and emissions impact calculations

After searching the market for such a solution, Bodø engaged in a RnD-contract with the UN Partner Augment City, which provided a digital twin city solution that meets the foreseen functionalities. This is a tool developed by using existing technology in new ways, by feeding the 3D system with data.

Barriers:

As 3D visualisation for circular development has not been done in a large scale before, we found it somewhat challenging to decide what type of technology would be suited for the purpose of this type of digital innovation. It was difficult to scan the market for a fitting technological solution, and required market engagement and clear definition of functional needs from the outset.

While the tool is very user friendly in terms of monitoring and planning, the data flow architecture might be somewhat challenging for users that are not experienced in data management.

Deployment

In **Bodø**, the tool is being used to evaluate the reuse potential of all masses and materials represented in the tool. This information is stored in a databank that we can incorporate into a

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marketplace when developing a new part of the city using as many reused resources as possible. Furthermore, the tool is used to simulate how the buildings consisting of these materials are placed in the city.

The tool is connected to several data sources, including sensors that measures traffic and emission. This helps us to measure and simulate the correlation between circular treatment of CDW and emission. Also, having visualized data in a geographical environment, helps us reveal correlation between circular practise with quality of life for citizens. We're actively using the tool in our mass handling strategies, as the tool gives us a visual representation of the degree of pollution in different areas. Using the CityLoops developed LCA-tool, enables us represent quantified emission savings in specific areas when transport is reduced as a result of increased circular practise.

Replication

Bodø's digital twin solution -*Augment City*- is a licensed software. However, the software that it is built on -*Unity*- is avaliable as an open access freeware. The method of measuring masses, material, and circularity using any 3D visualisation tool is what will be directly replicable by others across the EU. Other cities can follow the documented process to learn from Bodø and develop their own 3D visualisation tool. A guide will show how the replicator, amongst other things, can:

- Make 3D-environments using the freeware *Unity*
- Use heat maps that represent the degree of mass pollution in specific areas in a 3D environment
- Identify data correlations in a GIS, such as the correlation between emissions values and circular treatment of CDW
- Methods on how to geographically visualise characteristics on structures, materials and masses on specific areas (such as type of materials, quality/ pollution, quantity/ weight).
- Integrate a material databank (and market place) into a 3D GIS-tool
- Visualise city metabolism and material flow data, including municipal waste generation and flows
- Implement BIM-models in a GIS-tool

For others interested in replication of this approach, Bodø recommends that you first identify the sources from which you can get existing data to the GIS-tool. It would be wise to experiment in a small scale area first and involve BIM/ 3D-modelling competent colleagues.

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