Designing Predictive Building Stock Models for Circular Urban Economies: Methodological Blueprint from the Beam Me Up Project

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Abstract A successful transition to circular urban development depends on the ability of cities to anticipate material flows and plan for the reuse of construction components at scale. However, most existing building stock models are limited by coarse spatial resolution, lack of disaggregated material data, and poor alignment with practical reuse scenarios. The Beam Me Up project, launching in early 2026, addresses these challenges by developing predictive, geo-referenced building stock models that estimate construction material streams for reuse, repurposing, and recycling. This paper outlines the conceptual and methodological foundations of the modelling framework as a contribution to the evolving discourse on data-driven circular economy strategies in urban contexts.

Our approach is based on integrating top-down national and municipal datasets—such as cadastres, building registries, and demolition permits—with bottom-up data from pre-demolition audits and building-specific attributes. The resulting hybrid model is designed to support regional planning, material cadastres, and urban mining projections. Key challenges include data harmonization across cities, managing gaps in historical records, and aligning building typologies with material estimation logic. A structured data schema and standardized metadata framework are being developed to ensure interoperability and scalability.

The model will be piloted and validated through multi-city case studies in Trondheim, Gothenburg, Copenhagen, and Chambery. These cases will allow the project to benchmark predictions against real demolition and reuse data, helping refine the modelling process iteratively. Special attention is paid to creating feedback loops between stakeholders—urban planners, public authorities, and reuse actors—so that model outputs are actionable and policy-relevant.

While the project is in its preparatory phase, this contribution shares early design decisions, methodological trade-offs, and cross-city coordination experiences. By articulating a common framework before implementation, we aim to initiate dialogue around modelling standards, practical data integration strategies, and the role of predictive tools in enabling circular construction flows at the urban scale.