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Dynamic and Circular Buildings by High Transformation and Reuse Capacity.

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One long-standing conviction held by many is that buildings last longer when made of more durable materials. However, everyday demolition practice proves the opposite. Buildings are designed to last 150-300 years yet, today parts of the building or the whole buildings with an age of 15 years are demolished to give a way to new construction. Developers and real estate managers warn that there is a miss-match between the existing building stock and the dynamic and changing demands with respect to the use of buildings. 50% of investments in building construction in the Netherlands are spent on adaptation and 42% of new construction is due to the replacement of demolished buildings. Besides, European building industry accounts for 40% of the waste production 40% of the energy consumption and CO2 emissions and 50% of material resources taken from the nature are building related (CSB 2009).

One can argue that conventional construction methods are in large part responsible for the above figures and degradation of the living environment, due to the tons of waste materials that become burdens to society and increasing material scarcity. Demolition in general can be defined as the process whereby the building is broken up, with little or no attempt to recover any of the constituent parts for reuse.
Most buildings are designed for such end-of-life scenario. They are designed for assembly but not for disassembly and recovery of components. Different functions and materials comprising a building system are integrated (during construction) in one closed and dependent structure that does not allow alterations and disassembly. The inability to remove and exchange building systems and their components results not only in significant material consumption and waste, but also in the lack of spatial adaptability and technical serviceability of the building.

Emerging whole Life Cycle Design imposed on building design requires fundamentally different way of design and construction in the future. Buildings should be seen more as open upgradable platforms, where new technologies and requirements can easily be integrated, and adopted. In order to keep buildings and materials in an economic loop through their whole life cycle, three levels of building will need to be designed with high transformation and reuse capacity: building – adaptable spaces, structural-reusable/upgradable systems and material- upcyclable materials. (Durmisevic 2006) Rather than destroying structures and systems while adapting building to fit into new requirements, it should be possible to disassemble sections back into components and to reassemble them in new combinations. This means that we must consider how we can access and replace parts of existing building systems and components, and accordingly, how we can design and integrate building systems and components in order to be able to replace, ruse them later on. This process involves understanding certain level of reversibility of design and manufacturing processes.

Buildings whose structures and construction/ manufacturing processes can be reversed back to the basic elements which are then put back into a use loop through creation of new compositions with the same set off elements, (answering new requirements) would eliminate concept of waste and give a boost to circularity of building materials and circular economy in construction.

Reversible Building Design can therefore be seen as a new philosophy where waste is considered a design error. The intention of such design is designing for circular value chains so that buildings and their elements will continuously increase their value. These dynamically and flexibly designed buildings are the key to a circular economy. Instead of being to-be waste, buildings would function as banks of valuable materials once designed as such. This paper will discuss new design methodology and tools that will support transformation and reuse potential of buildings and its components and enhance new value propositions. As a part of EU Buildings as Material Banks project the paper will elaborate the role of reversible design within Buildings as Material Banks concept.