

## Sustainable construction: the role of the high-rise timber buildings requirements during the service cycle of the building

### Summary

The Doctoral Project intends to evaluate the state of high-rise timber building industry and develop the set of sustainable requirements for these constructions, from the design to the end of life of the building components, as the conscious decision-making tool for professionals. Obtained outputs will help to identify the irregularities and create the guidelines for good practices. The objective is to not only collect available information about the use of such material for multi-story buildings but also investigate and recognize conditions and different possibilities for the erection of tall timber structures, evaluating their sustainability through the phase-by-phase assessment, as well as study existing practices, indications and available orientations for the design and construction in this method. The outcomes shall determine whether the current construction practices of high-rise timber buildings are sustainable, what determines their sustainability and what the devastating habits to avoid are. Finally, the set of requirements that needs to be followed to keep the construction of high-rise timber buildings justifiable and safe will be presented, as the contribution to the international and national sustainability goals. The studies base on selection of the normative and buildings from Europe, Australia and America. The initiative to investigate the role of high-rise timber buildings is deeply motivated by the fact that such construction presents itself on the market as a sustainable alternative to steel and concrete.

According to global institutions, the number of people on Earth will reach 9.7 billion by 2050 and 2018 revision of the World Urbanization Prospect declares that the number of residents of urban areas will rise significantly during next thirty years, resulting in two-thirds of the population living in cities and consequently causing the cities' expansion (Buhaug and Urdal, 2013; United Nations, 2018, 2017). Such move leads to intensified social and economic development and, thus, requires a fast response of the construction sector (Hamadyk et al., 2020; Huang et al., 2018). Buildings tend to become taller and existing building methods consume even more raw materials and unrenovable energy, generate a large amount of direct CO<sub>2</sub>, affect negatively the environment and are far from sustainable ("Eco-Construction and Rehabilitation," 2020; Zabalza Bribián et al., 2011a). At this point, climate change turns out to be a key issue to focus on. Global awareness is growing. The Sustainable Development Goals of Agenda 2030 and many governmental actions like the Green Deal were undertaken to react at multiple phases (European Commission, 2019; United Nations, 2015). There are many ways to participate in the war against climate change effects. One of them might be the alteration of the structural material used in the building sector. That is why recently engineered wood became a popular alternative within the scientific community. More and more technical articles appear, confirming its positive performance in terms of carbon sequestration, embodied energy, fire reaction and seismic resistance (Asdrubali et al., 2017; Ceccotti et al., 2006; Crawford and Cadorel, 2017; Izzi et al., 2018; Li et al., 2019; METSÅ WOOD, 2016; SERIES 227887, 2013; SERIS, 2013; Skullestad et al., 2016). Additionally, as a matter of proof, there were identified over 30 mid and high-rise buildings (6 to 24 floors) designed and erected in timber during the last decade and many more are in the design phase.

### Keywords

High-rise timber buildings, sustainability requirements, sustainable construction, building materials.



Mjøstårnet- the tallest residential timber building (credit: Ricardo Foto & Voll Arkitekter AS, 2019).



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#### Period

2018-2024

#### Funding

FCT scholarship (PD/BD/150403/2019)