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Factors in a Sustainability Assessment of New Types of Closed Cavity Facades

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Abstract : With the current increase in CO_2 emissions and global warming, the sustainability of both existing and new solutions must be assessed on a wide scale. As the implementation of closed cavity facades (CCF) is on the rise, a variety of factors must be included in the analysis of new types of CCF. This paper aims to cover the relevant factors included in the sustainability assessment of new types of CCF. Several mathematical models are being used to describe the physical behavior of CCF. Depending on the type of CCF, they cover the main factors which affect the durability of the façade: thermal behavior of various elements in the façade, stress, and deflection of the glass panels, pressure inside a cavity, exchange rate, and the moisture buildup in the cavity. CCF itself represents a complex system in which all mentioned factors must be considered mutually. Still, the façade is only an envelope of a more complex system, the building. Choice of the façade dictates the heat loss and the heat gain, thermal comfort of inner space, natural lighting, and ventilation. Annual consumption of energy for heating, cooling, lighting, and maintenance costs will present the operational advantages or disadvantages of the chosen façade system in both the economic and environmental aspects. Still, the only operational viewpoint is not all-inclusive. As the building codes constantly demand higher energy efficiency as well as transfer to renewable energy sources, the ratio of embodied and lifetime operational energy footprint of buildings is changing. With the drop in operational energy CO_2 emissions, embodied energy emissions present a larger and larger share in the lifecycle emissions of the building. Taken all into account, the sustainability assessment of a façade, as well as other major building elements, should include all mentioned factors during the lifecycle of an element. The challenge of such an approach is a timescale. Depending on the climatic conditions on the building site, the expected lifetime of CCF can exceed 25 years. In such a time span, some of the factors can be estimated more precisely than others. The ones depending on the socio-economic conditions are more likely to be harder to predict than the natural ones like the climatic load. This work recognizes and summarizes the relevant factors needed for the assessment of new types of CCF, considering the entire lifetime of a façade element and economic and environmental aspects.

Keywords : assessment, closed cavity façade, life cycle, sustainability
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