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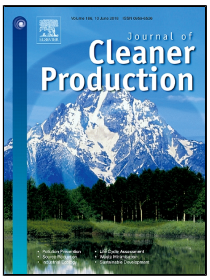

Life cycle impact comparison of different concrete floor slabs considering uncertainty and sensitivity analysis

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Life cycle impact comparison of different concrete floor slabs considering uncertainty and sensitivity analysis

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Highlights:

Environmental impacts of precast, composite and cast-in-situ slabs are conducted.

All life cycle stages from cradle-to-grave (including end-of-life stage) are included.

Both midpoint and endpoint of LCA results are analyzed.

The floor slabs are designed based on two functional units.

Uncertainty analysis and sensitivity analysis are carried out.

Abstract:

The traditional construction industry is characterized as a labor-intensive, wasteful, and inefficient sector. Currently, prefabrication has become a common practice in residential development and has reduced energy consumption and waste generation compared to traditional on-site practices. This study investigates the differences in life cycle environmental impacts among three different floor systems (precast slab, composite slab (semi-precast slab) and cast-in-situ slab) based on two functional units (delivering the same carrying capacity and maintaining consistent floor depth) using both LCA midpoint and endpoint methods using the software tool SimaPro. This study sets a calculation boundary for the construction process: raw material production, slab production, transportation, construction activities on-site, demolition and recycling of buildings at the end-of-life stage. Moreover, uncertainty and sensitivity analysis are carried out to help decision-makers identify major environmental impact factors and develop eco-friendly plans to facilitate housing industrialization. The results indicate that (1) the environmental impact of precast slab outperforms those of cast-in-situ and composite floors regardless of different design functional units and evaluation methods. (2) While under different functional units, the environmental performance of composite and cast-in-situ floors varies considerably. (3) From the