

Comparing the environmental impact of a steel frame versus a wood frame construction

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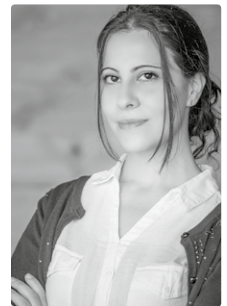
Construction is considered an energy intensive activity with a considerable carbon footprint. Thus, knowing the effects of building elements on the environment is important for any engineering assessment. This thesis aims to compare the environmental impacts of building elements made with either steel or wood frames in a two-story single-family house built in Basel, Switzerland.

The house is made of eight exterior wall elements, two interior wall elements, two floor elements, two roof elements and two exterior wall elements at the roof level. Once the frames were designed, a life cycle assessment (LCA) was then conducted to study the impacts from the acquisition of materials, their transport to the frame manufacturer and then the transport of the building elements to the building site.

For steel, an additional scenario was considered where 100 % recycled steel was used instead of new steel. The thesis had two transport scenarios. Scenario one for transport assumed that building elements for steel and wood were manufactured in the same company in Switzerland. The second transport scenario assumed that the steel building elements were manufactured in Germany while the wood building elements were manufactured in Switzerland.

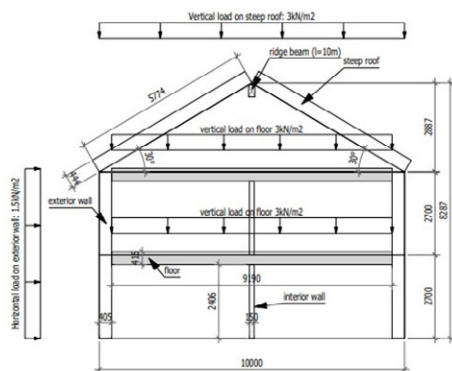
The assessment showed that in all wall elements, CO₂ fossil emissions in steel building

elements were higher than in wood building elements. However, the emissions from all steel wall elements, floor elements and roof elements decreased when recycled steel was used instead of new steel. The thesis also found that the wood frame house achieved favorable results in acidification (~ 12.5 % less than new steel) and in ozone depletion potential (~ 8 % less than new steel).



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The total life cycle assessment based on scenario one for transport, showed that the steel frame house had total emissions of 68500 kg CO₂ eq, compared to 45900 kg CO₂ eq in the wood frame house. For both transport scenarios and when compared to the impacts from the acquisition of materials, transport showed a low impact on the environment. Results also showed that the differences in the transport impacts of wood and steel elements were not significant.



Plan view of the single-family house with a 10 m to 10 m floor area.