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Comparative analysis of environmental impacts between two structural methods: a Brazilian case study

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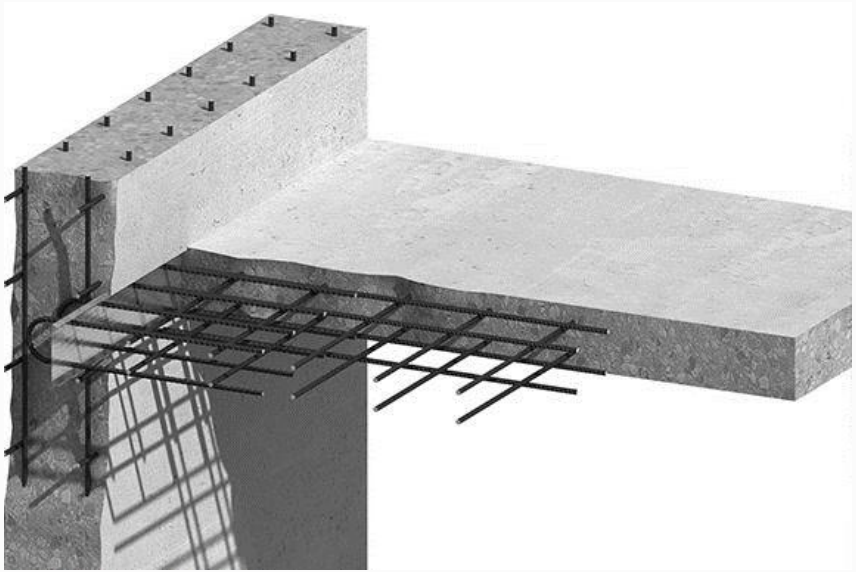
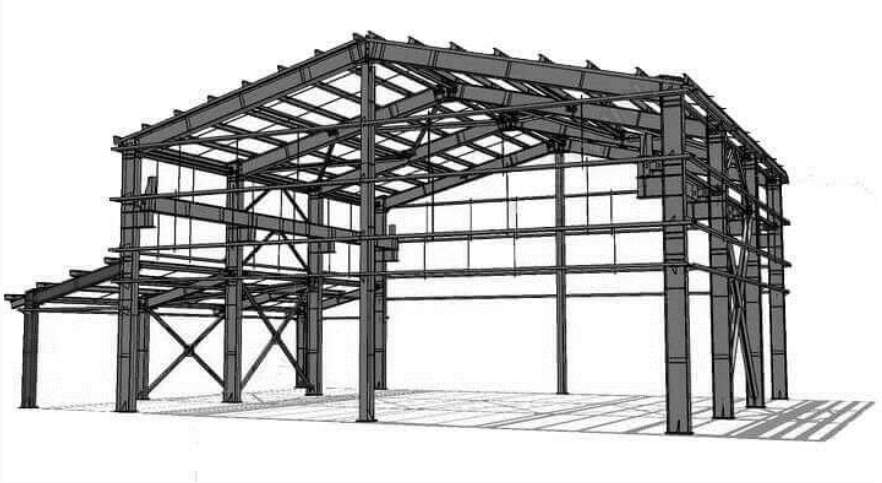
OBJECTIVES OF THE PAPER

Compare two of the most used structural systems in Brazil regarding its environmental impacts with the results of a **comparative LCA**

STRUCTURAL SYSTEMS





REINFORCED CONCRETE X STEEL STRUCTURES

APPROACH USED

This study was implemented based on the environmental Life Cycle Assessment methodology, as described in the ISO 14040 series of standards.

SimaPro software and the **EcoInvent** database were used to model inventory data that is relevant to Brazil.

The Life Cycle Inventory Analysis (LCIA) method chosen for this study was ReCiPe 2016 Midpoint.

In order to evaluate the systems, an element of comparison was established and its environmental impacts were quantified.

GOAL

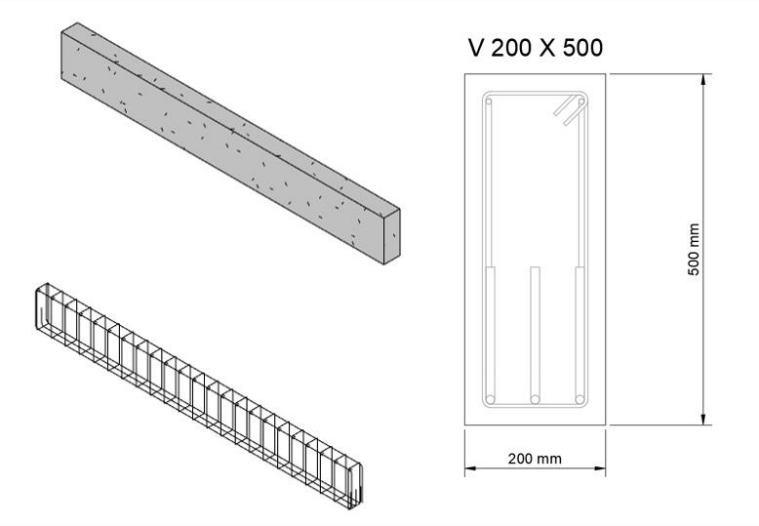
- **Subsidy decisions regarding most suitable structural system**

- Compare the impacts between **Reinforced concrete x Steel structures**

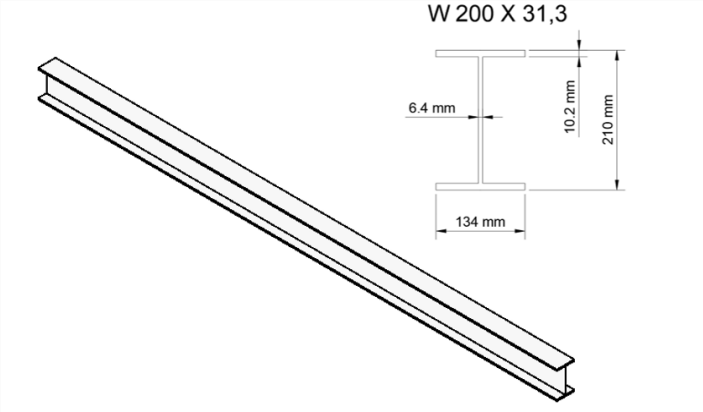
- Identify the life cycle stage with the major environmental impact for **both systems**

Functional unit

- 4 meter-long structural beam designed to support its self-weight and an accidental load of 2tf/m



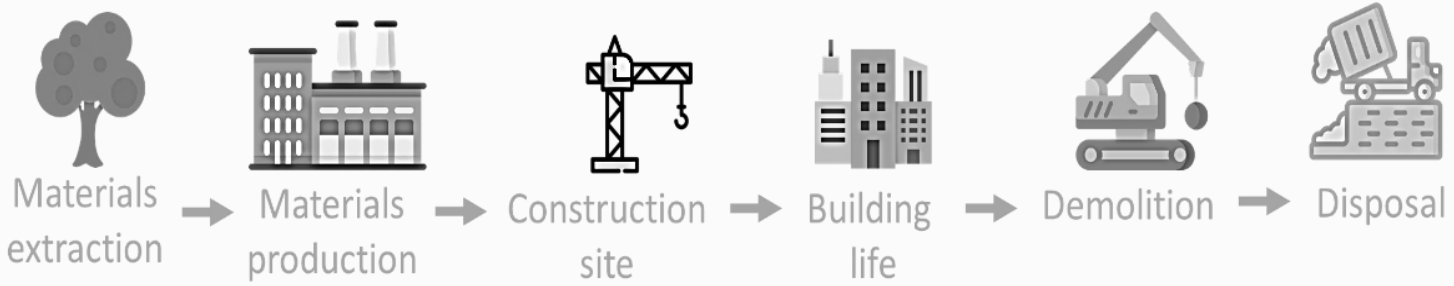
REINFORCED CONCRETE BEAM



STEEL BEAM

System boundary

CRADLE TO GRAVE



Impact categories

- Global warming
- Stratospheric ozone depletion
- Human health impact

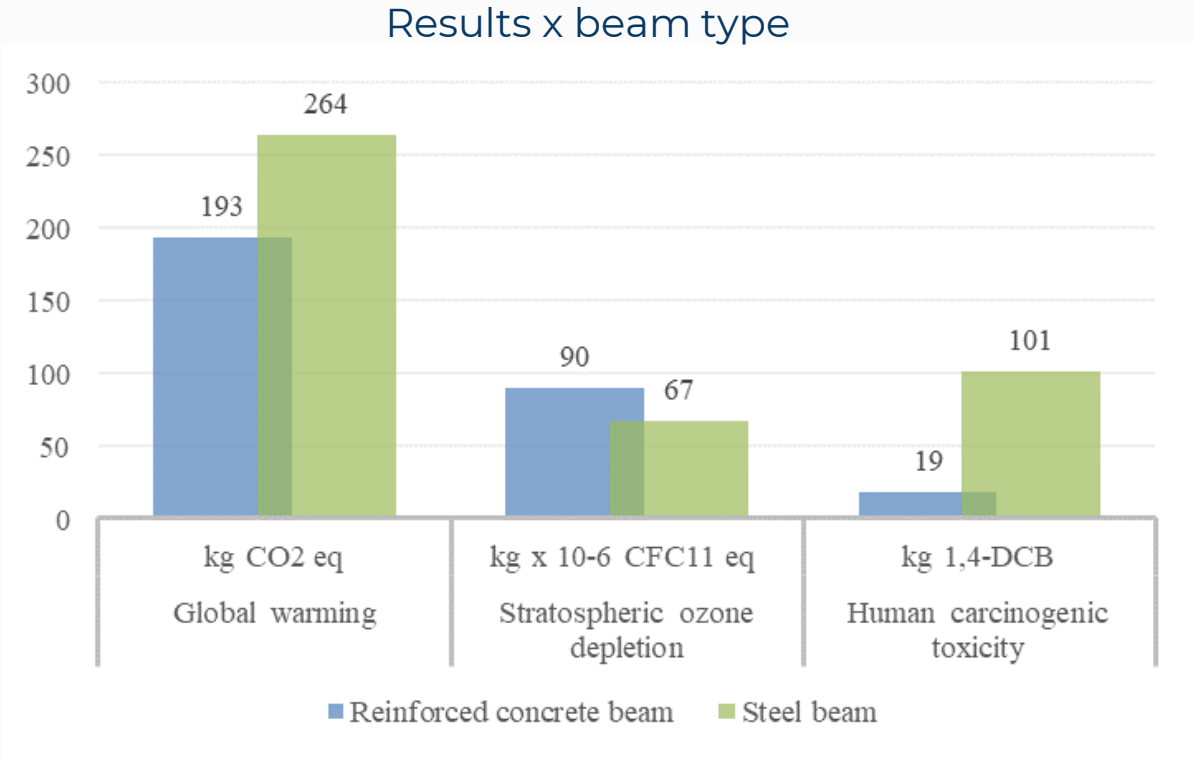
Analysis

- Considered two different scenarios: before and after demolition.

- Also, two options of disposal were considered and compared:

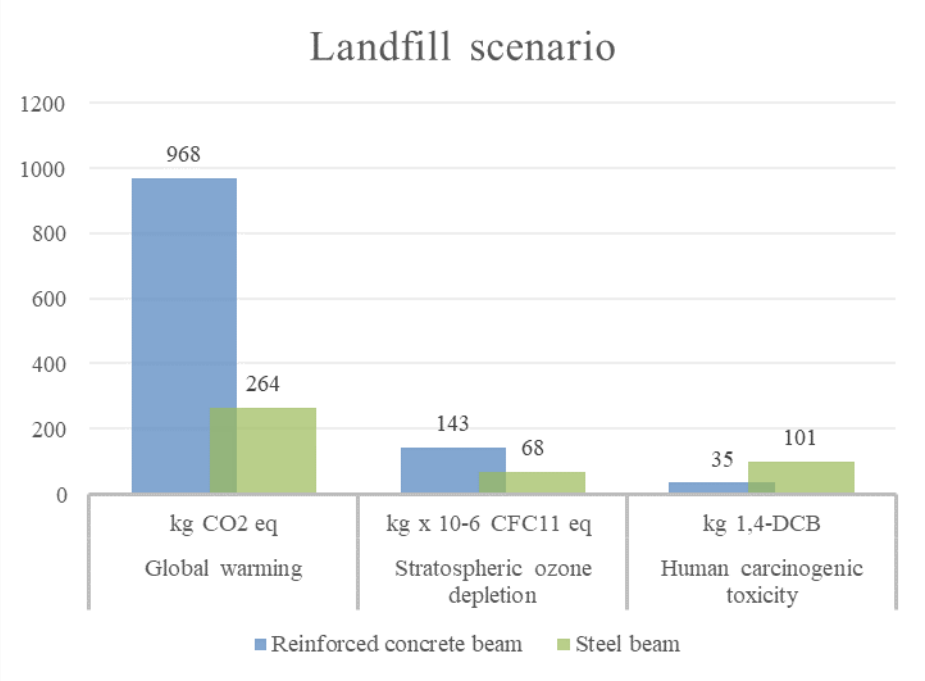
Destination to landfill x Recycle or reuse of materials

RESULTS – BEFORE DEMOLITION



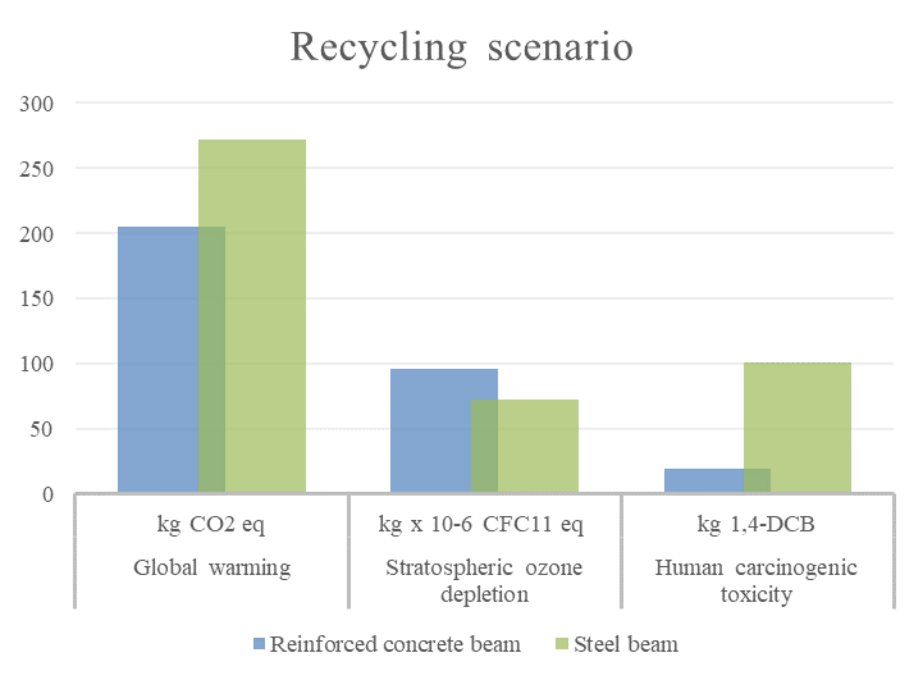
RESULTS – AFTER DEMOLITION – LANDFILL SCENARIO

Results x beam type



RESULTS – AFTER DEMOLITION – RECYCLING SCENARIO

Results x beam type



MAIN CONCLUSIONS

- Considering the stages of extraction and production of materials until the construction of the building, the steel beam generates a greater impact on the environment.
- If the analysis is extended until final disposal of materials all disposal options must be analyzed in order to provide a final result.
- Reinforced concrete when taken to a landfill generate an enormous amount of waste, which increase its impact on the environment. However, reinforced concrete recycling processes generate less impact than steel one.

MAIN CONCLUSIONS

- Steel is only less important, regarding environmental impact, when compared to reinforced concrete if it is reused or if both materials are taken to landfill.
- The greatest advantage of steel structures is their possibility of disassembly instead of demolition providing a reuse of materials without the need of more processes and energy inserted on cycle for recycling.
- With this study we can conclude that the most significant part of the impact, regarding structural systems, regards in its final disposal. Systems that can be disassembled and not demolished should be prioritized since their impact can be reduced with its reutilization.

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