NTNU

May 13, 2023

Results from Element Matching

Project name: Campussamling Hesthagen

Construction site located at: 63.4154, 10.3995

Summary of results

Total score	Score without reuse	Savings	Substitutions
8 333 kgCO2eq	73 037 kgCO2eq	88.59%	90.1%

The 'Greedy Algorithm Plural' algorithm yields the best results, substituting 901/1000 demand elements (90.1%). Using 'GWP' as the optimization metric, a total score of 8 333 kgCO2eq is achieved. For comparison, a score of 73 037 kgCO2eq would have been obtained by employing exclusively new materials. This results in a total saving of 88.59%. Note that impacts of transporting the materials to the construction site is not accounted for. Open the CSV-file "Campussamling Hesthagen Study Case 1_substitutions.csv" to examine the substitutions.

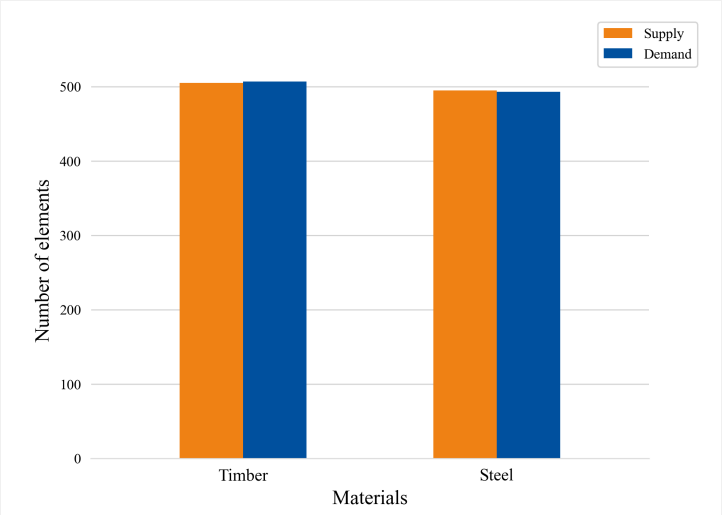
Constants used in calculations

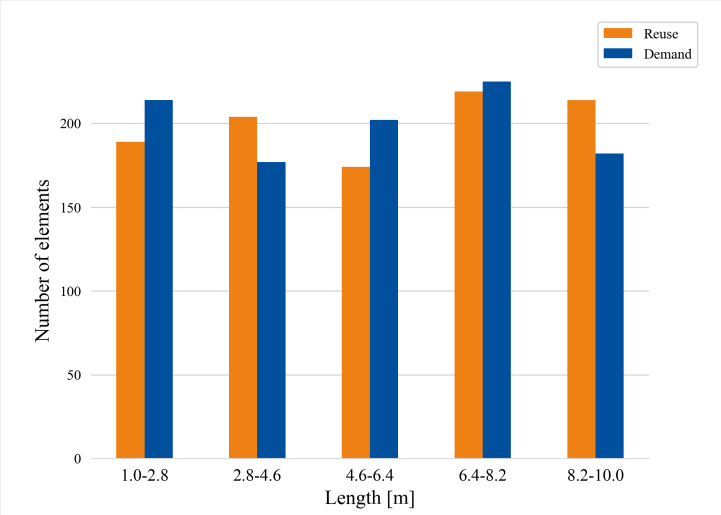
Constant	Value	Unit
Density timber	491.0	kg/m^3
Density steel	7850.0	kg/m^3
GWP new timber	28.9	kgCO2eq
GWP reused timber	2.25	kgCO2eq
GWP new steel	9263.0	kgCO2eq
GWP reused steel	278.0	kgCO2eq

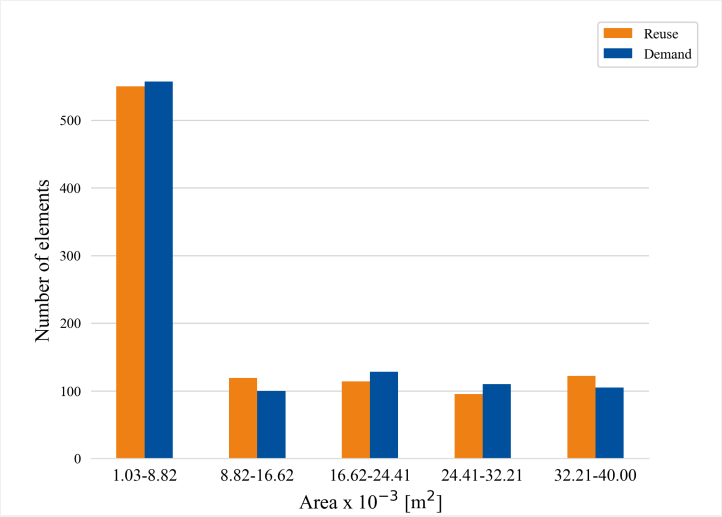
Information about datasets

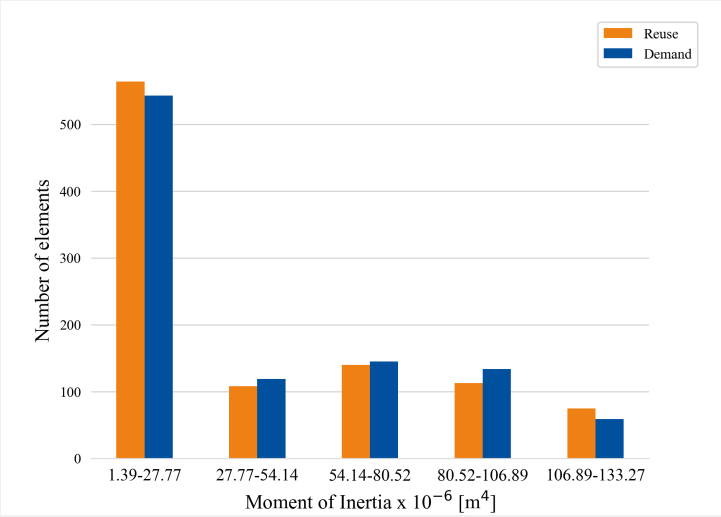
Elements	Filename	Number of elements
Reused	master_thesis_supply.xlsx	1000
Demand	master_thesis_demand.xlsx	1000

The files contains 1000 reuse elements and 1000 demand elements. The graphs below depicts some of the properties of the elements, including length, area, moment of inertia and the material distribution.









Performance of algorithms

Name	Total score	Substitutions	Time
Greedy Algorithm Plural	8 333 kgCO2eq	90.1%	32.424s
MBM Plural	8 465 kgCO2eq	90.6%	46.248s
Greedy Algorithm	9 320 kgCO2eq	89.0%	18.096s

The design tool is runned with 3 algorithms, namely: Greedy Algorithm Plural, MBM Plural, and Greedy Algorithm. The Greedy Algorithm Plural yields the lowest score, as shown in the table. The substitutions by this algorithm are completed in 32.424 seconds.