

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
8063.66 kgCO ₂ eq	74 302 kgCO ₂ eq	89.15%	90.3%

The 'Maximum Bipartite Matching Plural' algorithm yields the best results, substituting 903/1000 demand elements (90.3%). Using 'GWP' as the optimization metric, a total score of 8063.66 kgCO₂eq is achieved. For comparison, a score of 74301.85 kgCO₂eq would have been obtained by employing exclusively new materials. This results in a total saving of 89.15%. Note that impacts of transporting the materials to the construction site is not accounted for. Open the CSV-file "Study Case 1_substitutions.csv" to examine the substitutions.

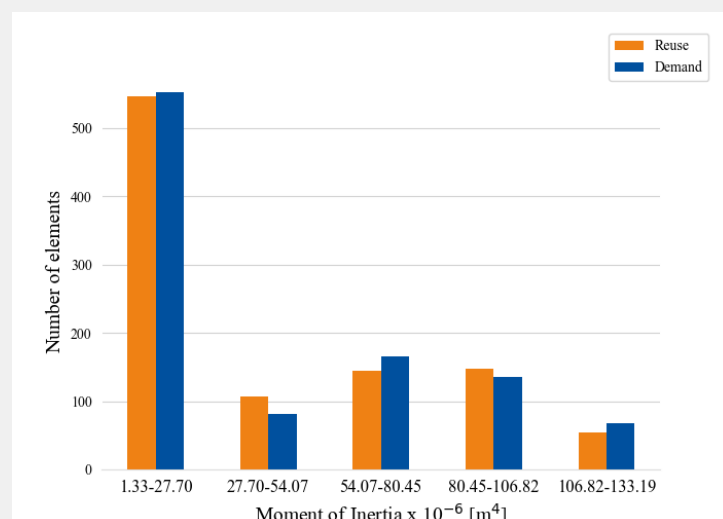
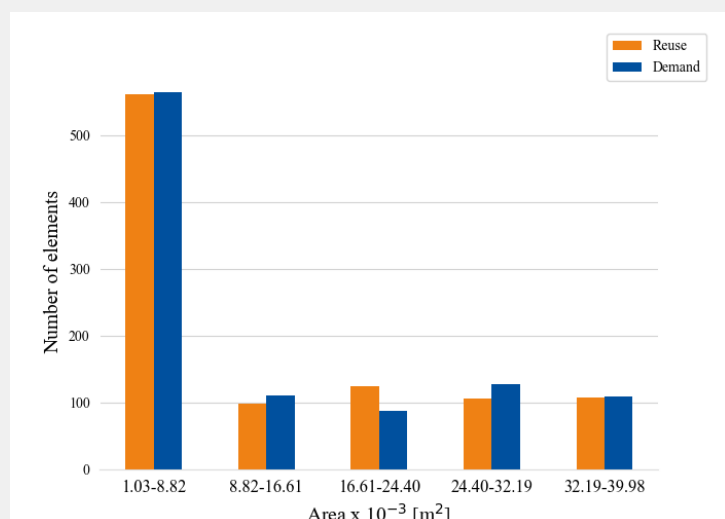
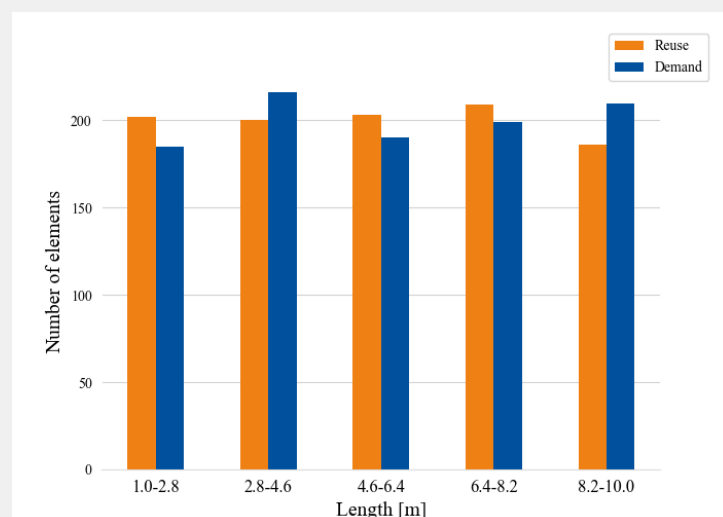
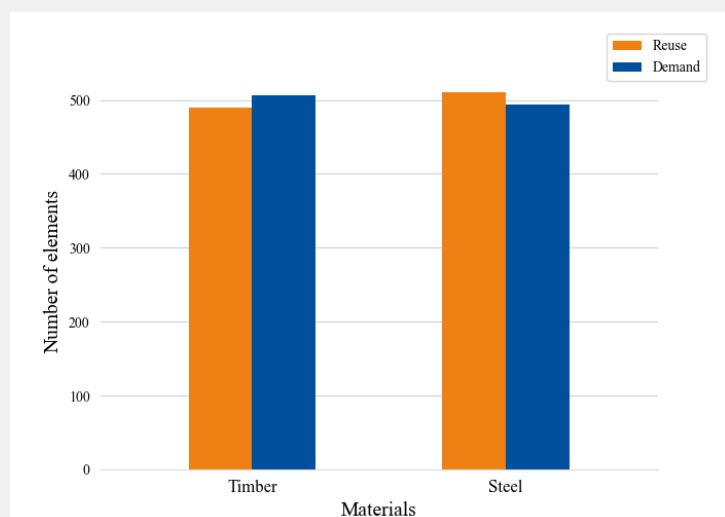
Constants used in calculations

Constant	Value	Unit
Density timber	491.0	kg/m ³
Density steel	7850.0	kg/m ³
GWP new timber	28.9	kgCO ₂ eq
GWP reused timber	2.25	kgCO ₂ eq
GWP new steel	9263.0	kgCO ₂ eq
GWP reused steel	278.0	kgCO ₂ eq

Information about datasets

Elements	Filename	Number of elements
Reused	master_thesis_study_case_supply.csv	1000
Demand	master_thesis_study_case_demand.csv	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
Maximum Bipartite Matching Plural	8063.66 kgC0\$_2\$eq	90.3%	37.482s
MILP	8990.74 kgC0\$_2\$eq	54.8%	388.964s
Greedy Algorithm Plural	9014.67 kgC0\$_2\$eq	88.9%	53.685s
Greedy Algorithm	9017.96 kgC0\$_2\$eq	88.8%	28.403s

The design tool is runned with 4 algorithms, namely: Maximum Bipartite Matching Plural, MILP, Greedy Algorithm Plural, and Greedy Algorithm. The Maximum Bipartite Matching Plural yields the lowest score, as shown in the table. The substitutions by this algorithm are completed in 37.482 seconds.