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
4 292 427 NOK	4 309 674 NOK	0.4%	44.2%

The 'Greedy Algorithm Plural' algorithm yields the best results, substituting 442/1000 demand elements (44.2%). Using 'Combined' as the optimization metric, a total score of 4 292 427 NOK is achieved. For comparison, a score of 4 309 674 NOK would have been obtained by employing exclusively new materials. This results in a total saving of 0.4%. Note that impacts of transporting the materials to the construction site is accounted for and contributes to 0.65% of the total score. Open the CSV-file " Study Case 3 10 pros_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
Valuation of GWP	0.7	NOK/kgCO2eq
Price new timber	3400.0	NOK/m^3

Price reused timber	3400.0	NOK/m^3
Price new steel	67.0	NOK/m^3
Price reused steel	67.0	NOK/m^3
GWP transportation	89.6	g/tonne/km
Price of transportation	4.0	NOK/tonne/km

Information about datasets

| Elements	Filename	Number of elements
Reused	master_thesis_study_case_supply_10prosTransport.xlsx	1000
Demand	master_thesis_study_case_demand_10prosTransport.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.
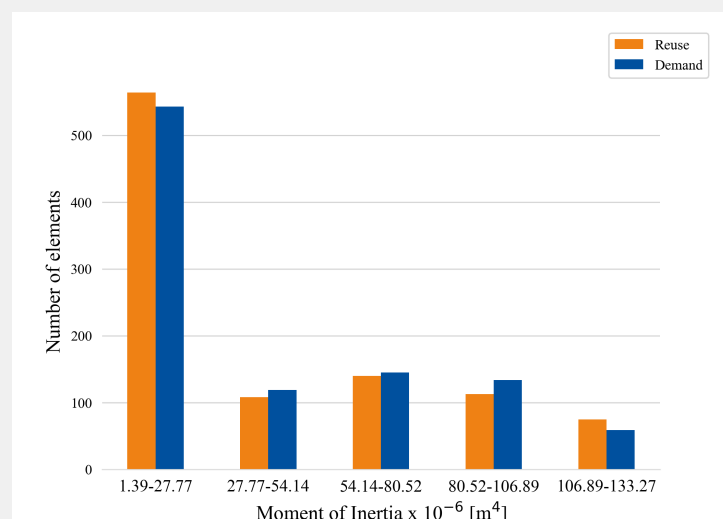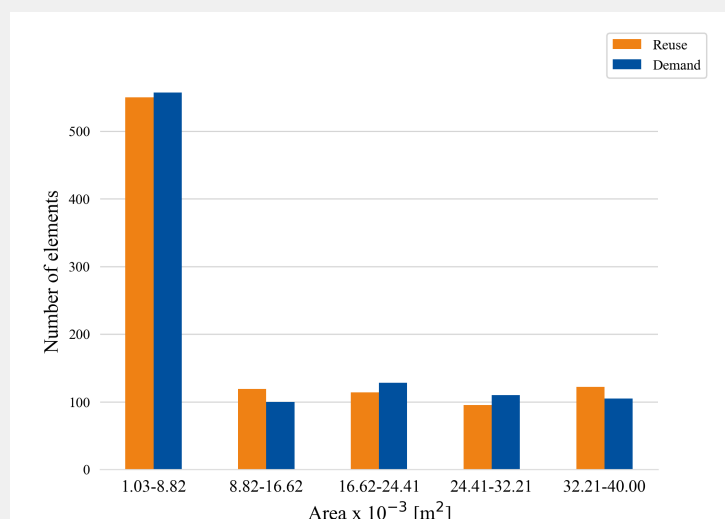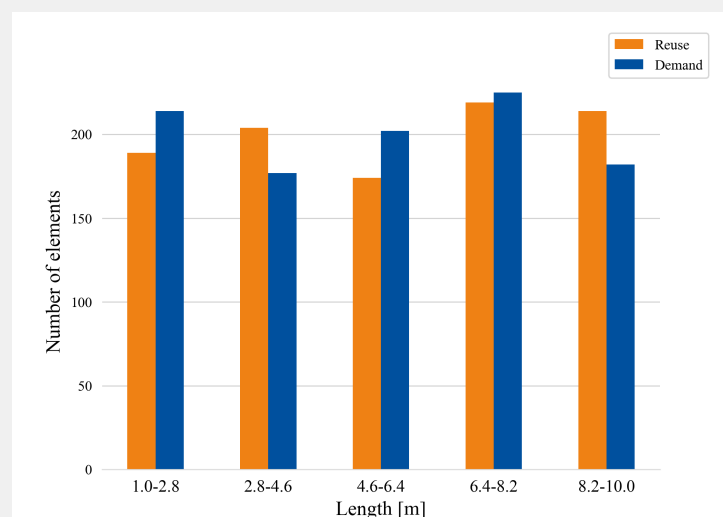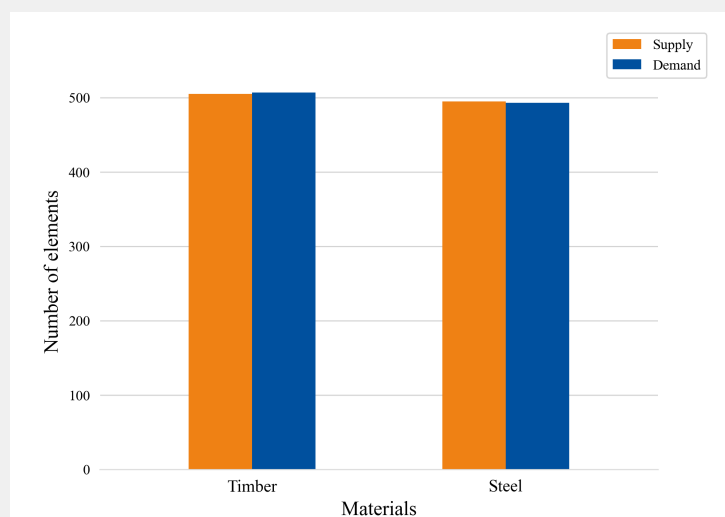
Impact of transportation

Transportation score	Percentage of total score	Transportation all new
27 749 NOK	0.65%	1 693 NOK

All calculations in this report take impacts of transportation of the materials to the construction site into consideration. Transportation itself is responsible for 27 749 NOK. This accounts for 0.65% of the total score of 4 292 427 NOK. For comparison, the transportation impact for exclusively using new materials would have been 1 693 NOK. Two maps are included to show the location of the suggested substitutions of reused elements and the manufacturer locations where new elements can be obtained. The numbers on the maps indicate the number of elements present at each location.
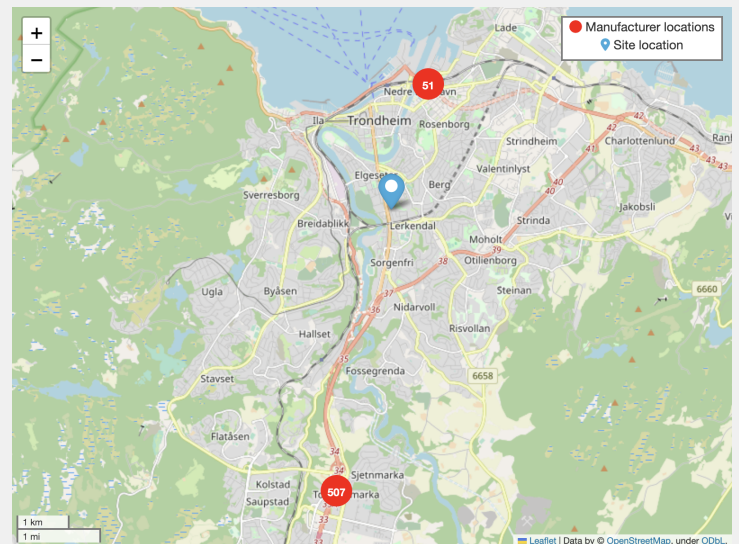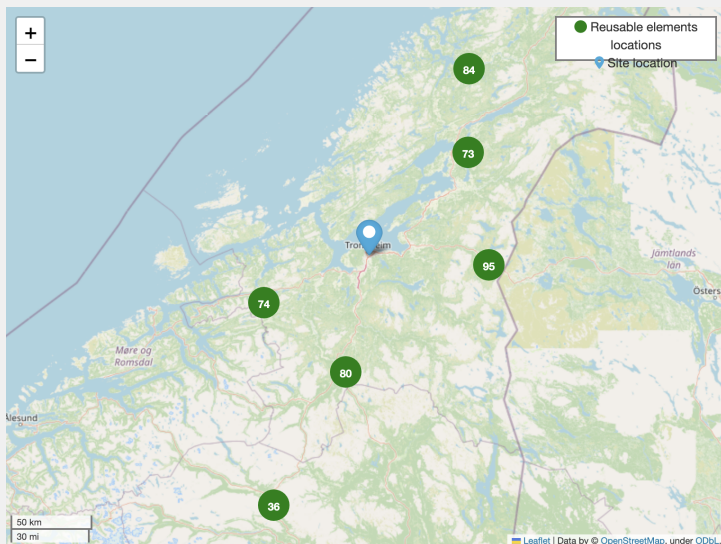
Performance of algorithms

Name	Total score	Substitutions	Time
Greedy Algorithm Plural	4 292 427 NOK	44.2%	11.226s
MBM Plural	4 292 438 NOK	44.0%	5.579s
Greedy Algorithm	4 292 519 NOK	42.8%	7.029s

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 11.226 seconds.