Results from Element Matching

Project name: ASUS

Construction site located at: 63.4154, 10.3995

Summary of results

Total score	Score without reuse	Savings	Substitutions
9 083 kgCO2eq	73 074 kgCO2eq	87.57%	90.7%

The best results was obtained by the following algorithm: Greedy Algorithm Plural. This algorithm sucessfully substituted 907/1000 demand elements (90.7%). Using 'GWP' as the optimization metric, a total score of 9 083 kgCO2eq was achieved. For comparison, a score of 73 074 kgCO2eq would have been obtained by employing exclusively new materials. This resulted in a total saving of 87.57%.The amount of kgCO2eq corresponds to 354.0 round-trip flights between Oslo and Trondheim. Note that impacts of transporting the materials to the construction site was accounted for and contributed to 10.44% of the total score. Open the CSV-file "ASUS_Study_Case_2_substitutions.xlsx" 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
GWP transportation	89.6	g/tonne/km

Information about datasets

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

The files used contains 1000 reuse elements and 1000 demand elements. The graphs below depicts the distribution of some of the properties of the elements, including the materials, lengths, areas, and moment of inertias.
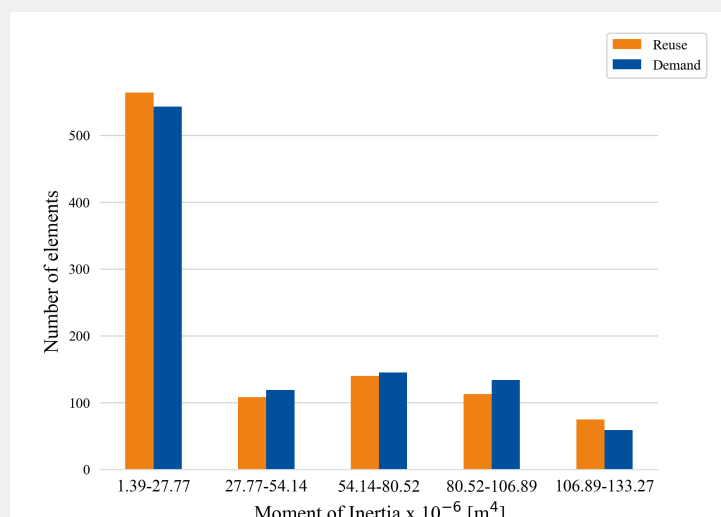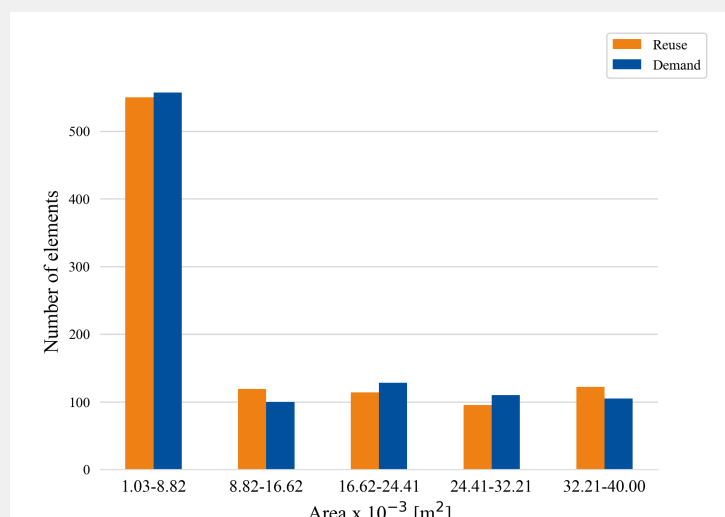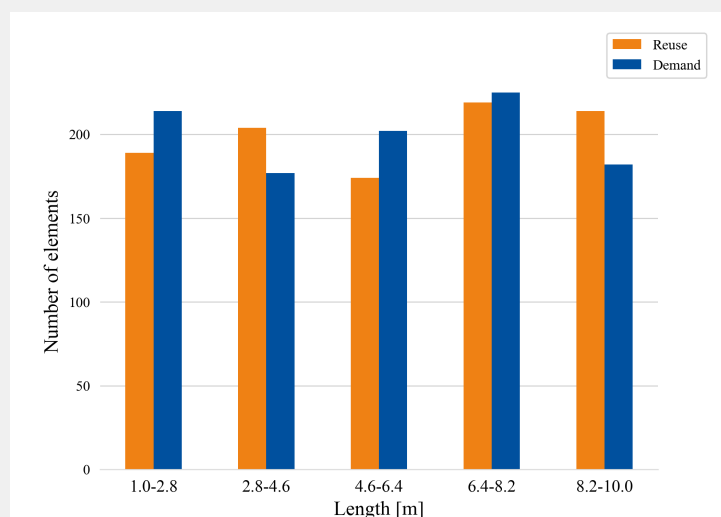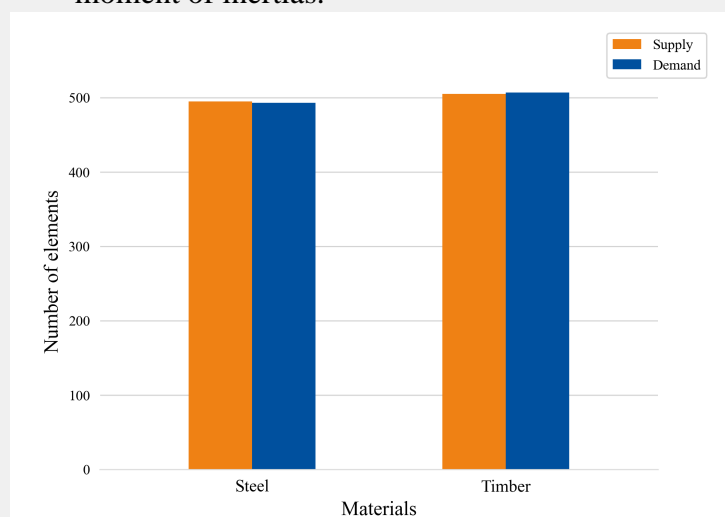
Impact of transportation

Transportation score	Percentage of total score	Transportation all new
948 kgCO2eq	10.44%	37 kgCO2eq

All calculations in this report accouned for the effects of material transportation to the construction site. Transportation itself was responsible for 948 kgCO2eq. This accounts for 10.44% of the total score of 9 083 kgCO2eq. For comparison, the transportation impact for exclusively using new materials would have been 37 kgCO2eq. 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.
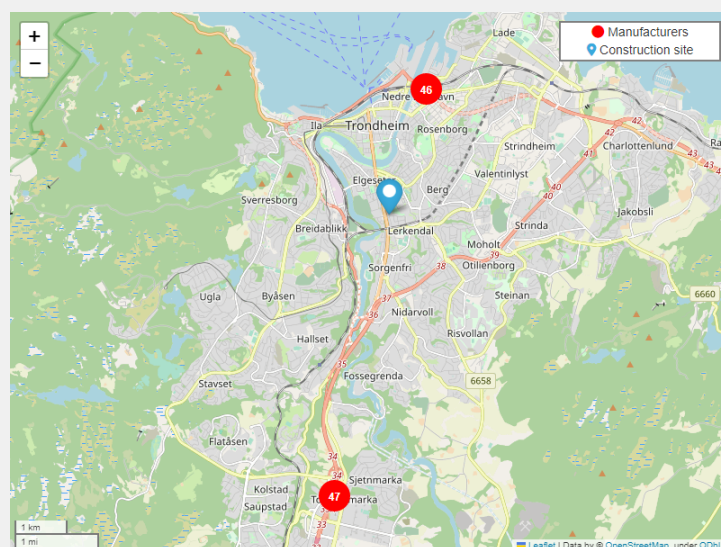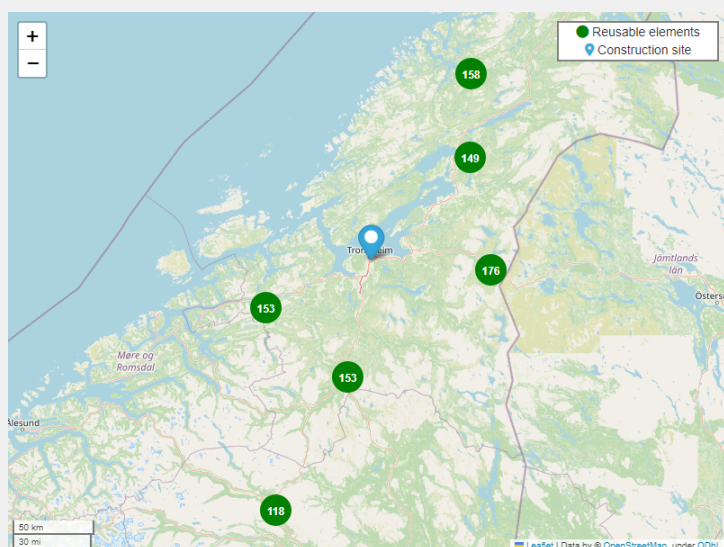
Performance of algorithms

Name	Total score	Substitutions	Time
MBM Plural Greedy Algorithm Plural Greedy Algorithm	Greedy Algorithm 10283	90.7%	9 083 .34s
MBM Plural 9224 MBM Plural Greedy Algorithm	Greedy Algorithm 10283	90.7%	922 4.6s
MBM Plural 9224.60 Greedy Algorithm Greedy Algorithm	Greedy Algorithm 10283	89.0%	10 283 .65s

The design tool was executed with 3 algorithms, namely: Greedy Algorithm Plural, MBM Plural, and Greedy Algorithm. The Greedy Algorithm Plural yielded the lowest score, as shown in the table. The substitutions by this algorithm was completed in 27.422 seconds.