NTNU

June 04, 2023

Results from the Design Tool

Project name: Conference_test

Construction site located at: 53.463, -2.295

Summary of results

Total score	Score without reuse	Savings	Substitutions
NOK 8 205 698	NOK 9 027 662	9.1%	94.3%

The best results was obtained by the following algorithm: Greedy Algorithm Plural. This algorithm sucessfully substituted 943/1000 (94.3%) of the demand elements with reusable elements. Using 'Combined' as the optimization metric, a total score of NOK 8 205 698 was achieved. For comparison, a score of NOK 9 027 662 would have been obtained by employing exclusively new materials. This resulted in a total saving of 9.1%, which corresponds to NOK 821 963. Note that impacts of transporting the materials to the construction site was accounted for and contributed to 0.92% of the total score. Open the Excel file "Conference_test_substitutions.xlsx" to examine the substitutions.

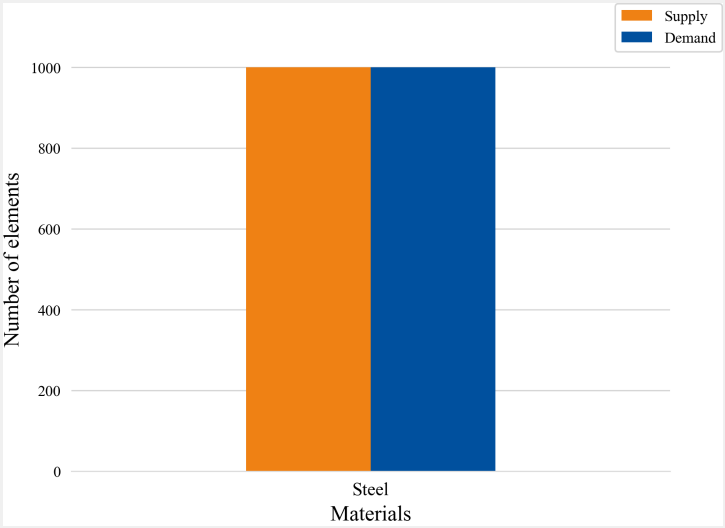
Constants used in the calculations

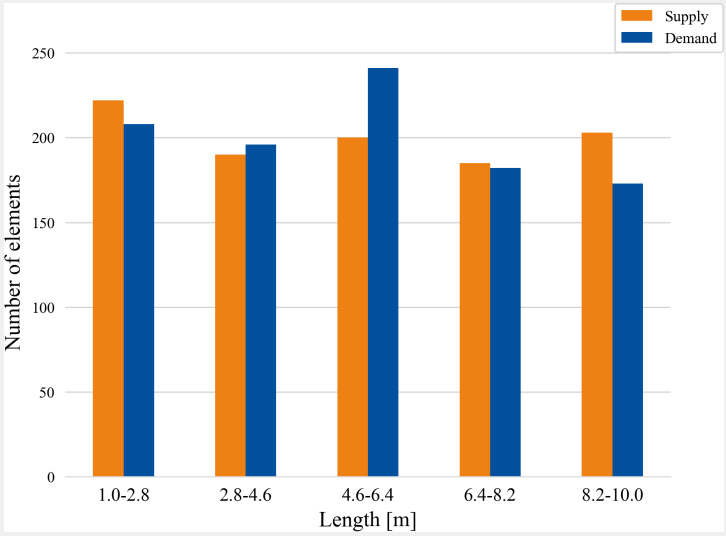
Constant	Value	Unit
Density timber	491.0	kg/m^3
Density steel	7850.0	kg/m^3
GWP new timber	28.9	kgCO2eq/m^3
GWP reusable timber	2.25	kgCO2eq/m^3
GWP new steel	9263.0	kgCO2eq/m^3
GWP reusable steel	278.0	kgCO2eq/m^3
Valuation of GWP	7.0	NOK/kgCO2eq
Price new timber	3400.0	NOK/m^3
Price reusable timber	3400.0	NOK/m^3
Price new steel	67.0	NOK/kg
Price reusable steel	67.0	NOK/kg
GWP transportation	89.6	g/tonne/km
Price of transportation	4.0	NOK/tonne/km

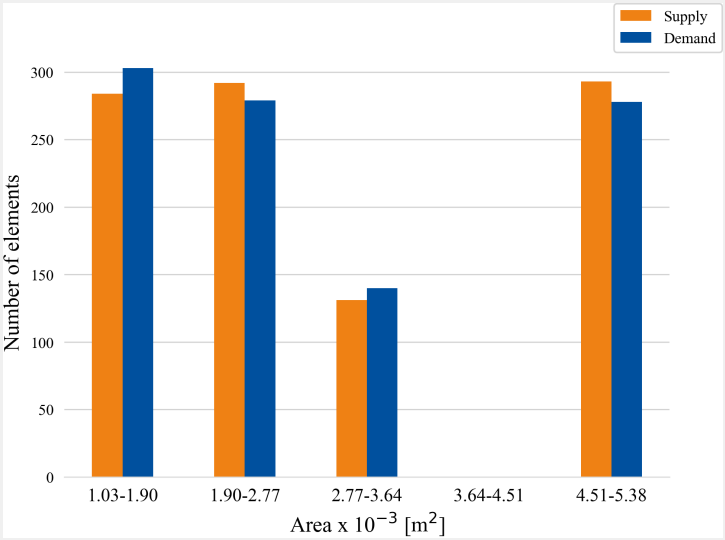
Information about the datasets

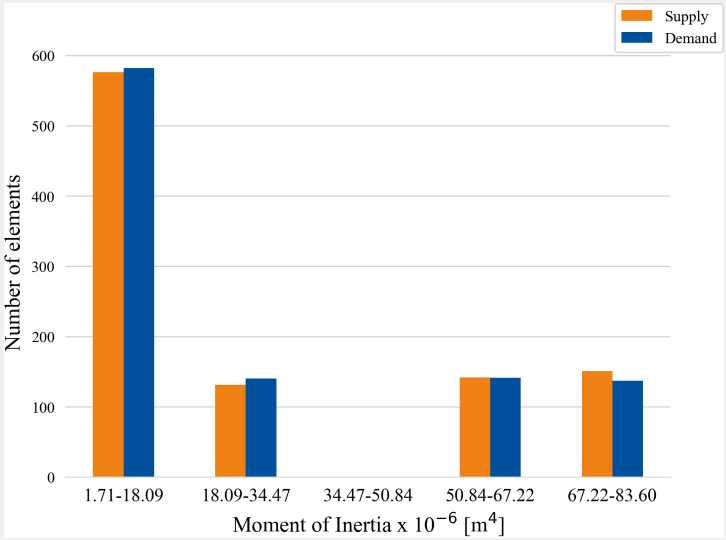
Elements	Filename	Number of elements
Supply	conference_supply.xlsx	1000
Demand	conference_demand.xlsx	1000

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





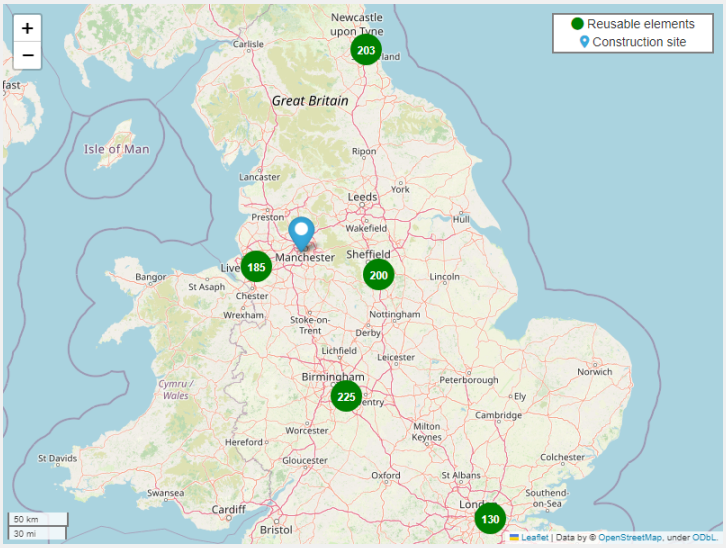


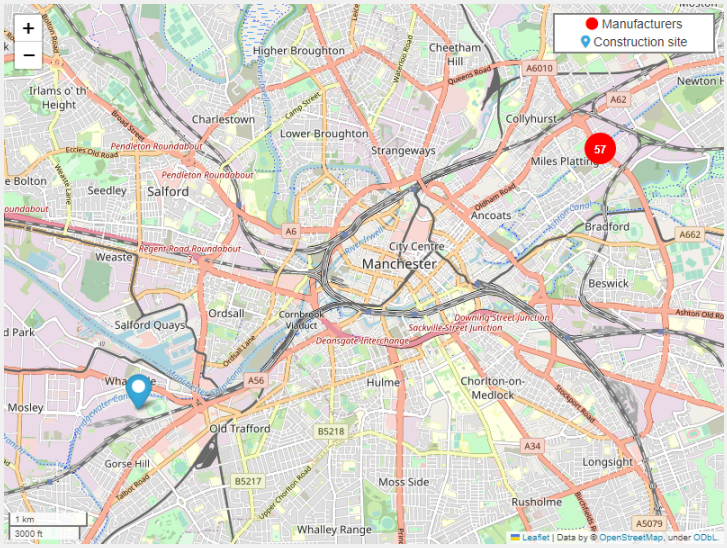


Impact of transportation

Utilizing reusable elements	Percentage of total score	Only manufactured elements
NOK 75 703	0.92%	NOK 4 924

All calculations in this report accouned for the effects of material transportation to the construction site. Transportation itself was responsible for NOK 75 703. This accounts for 0.92% of the total score of NOK 8 205 698. For comparison, the transportation impact for exclusively using new materials would have been NOK 4 924. Two maps are included to show the locations of the suggested element substitutions from the design tool. The numbers on the maps indicate the number of elements transported from each location.





Performance of the optimization algorithms

Algorithm name	Total score	Substitutions	Time
Greedy Algorithm Plural	NOK 8 205 698	94.3%	32.79s

The design tool achieved a score of NOK 8 205 698 with the following algorithm: Greedy Algorithm Plural. The substitutions by this algorithm are completed in 32.788 seconds