NTNU

June 06, 2023

Results from the Design Tool

Project name: Con_new_test_high_valuation

Construction site located at: 53.463, -2.295

Summary of results

Total score	Score without reuse	Savings	Substitutions
NOK 51 553 895	NOK 56 693 564	9.07%	94.78%

The best results was obtained by the following algorithm: Greedy Algorithm Plural. This algorithm sucessfully substituted 2180/2300 (94.78%) of the demand elements with reusable elements. Using 'Combined' as the optimization metric, a total score of NOK 51 553 895 was achieved. For comparison, a score of NOK 56 693 564 would have been obtained by employing exclusively new materials. This resulted in a total saving of 9.07%, which corresponds to NOK 5 139 669. Note that impacts of transporting the materials to the construction site was accounted for and contributed to 0.98% of the total score. Open the Excel file "Con_new_test_high_valuation_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	0.5950000000000001	NOK/kgCO2eq
Price new timber	289.0	NOK/m^3
Price reusable timber	289.0	NOK/m^3
Price new steel	5.695	NOK/kg
Price reusable steel	5.695	NOK/kg
GWP transportation	89.6	g/tonne/km
Price of transportation	0.34	NOK/tonne/km

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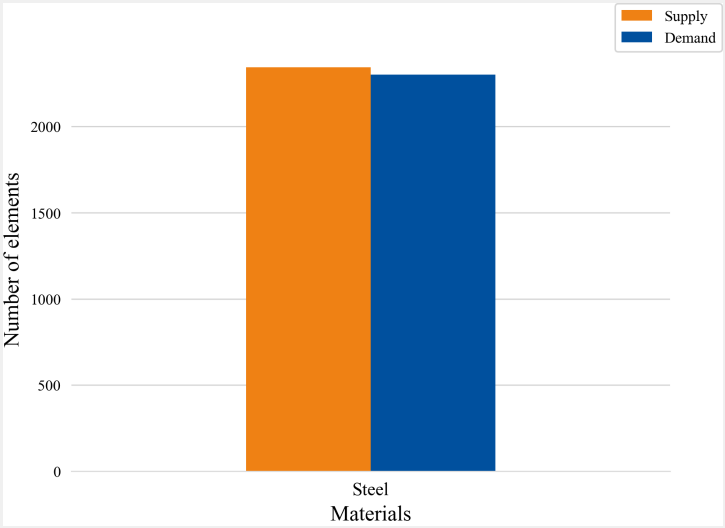
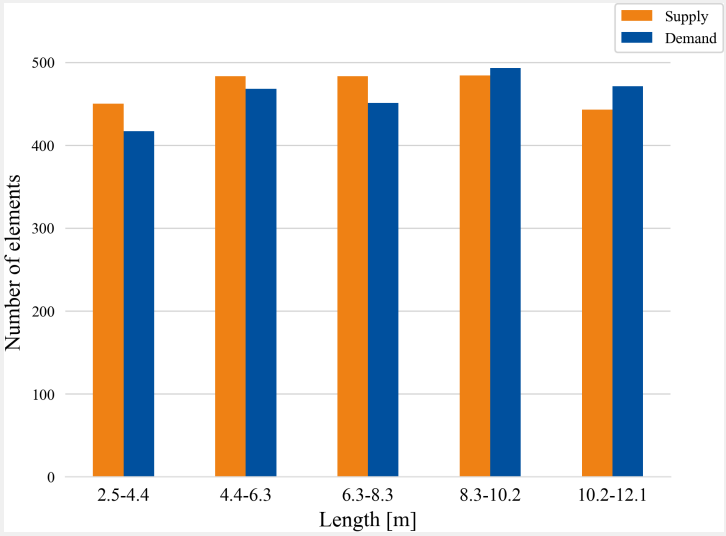
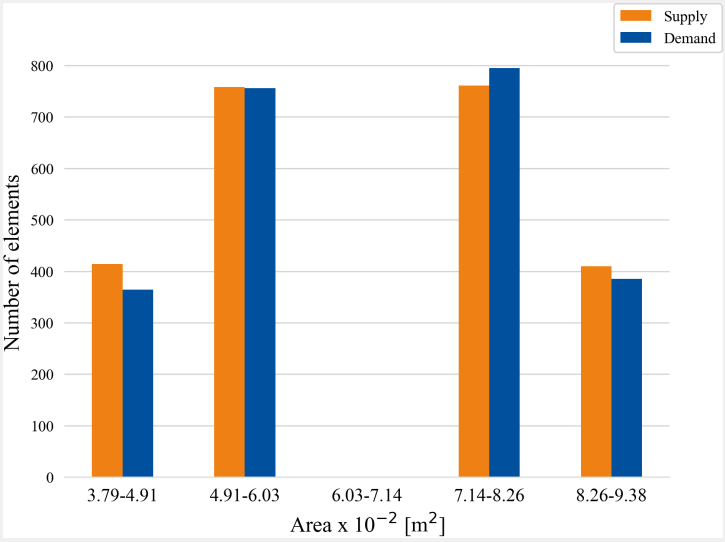
Information about the datasets

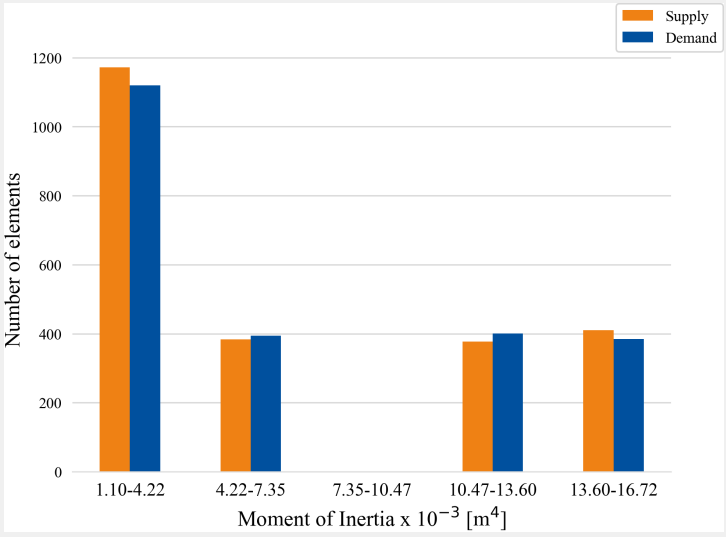
Elements	Filename	Number of elements
Supply	con_new_supply.xlsx	2343
Demand	con_new_demand.xlsx	2300

The datasets contains 2343 supply elements and 2300 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.





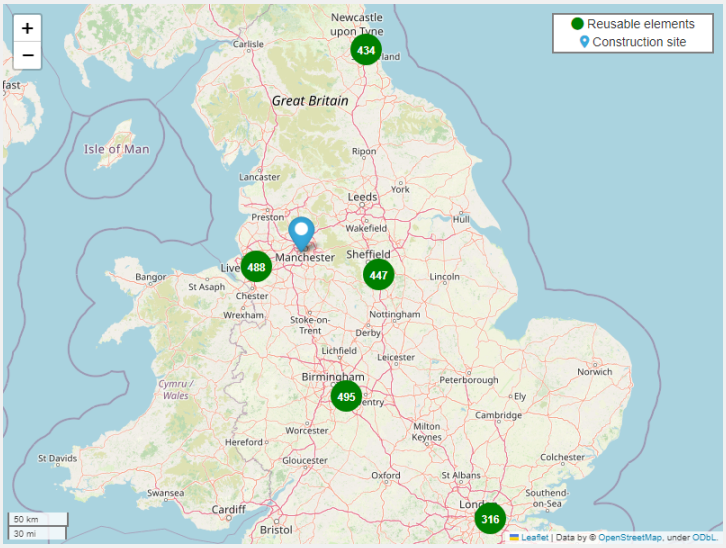


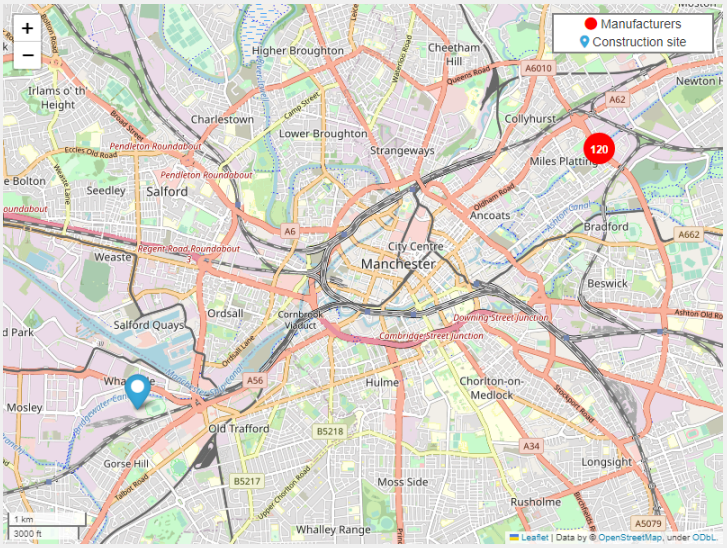


Impact of transportation

Utilizing reusable elements	Percentage of total score	Only manufactured elements
NOK 507 075	0.98%	NOK 30 921

All calculations in this report accouned for the effects of material transportation to the construction site. Transportation itself was responsible for NOK 507 075. This accounts for 0.98% of the total score of NOK 51 553 895. For comparison, the transportation impact for exclusively using new materials would have been NOK 30 921. 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 51 553 895	94.78%	234.84s

The design tool achieved a score of NOK 51 553 895 with the following algorithm: Greedy Algorithm Plural. The substitutions by this algorithm are completed in 234.84 seconds