NTNU

May 06, 2023

Results from Element Matching

Project name: Sognsveien 17

Construction site located at: 59.9416, 10.7299

Summary of results

Total score	Score without reuse	Savings	Substitutions
738.58 kg CO2 equivalents	1249.99 kg CO2 equivalents	40.91%	74.0%

The 'Maximum Bipartite Matching' algorithm yields the best results, substituting 74/100 demand elements (74.0%). Using 'GWP' as the optimization metric, a total score of 738.58 kg CO2 equivalents is achieved. For comparison, a score of 1249.99 kg CO2 equivalents would have been obtained by employing exclusively new materials. This results in a total saving of 40.91%. Note that impacts of transporting the materials to the construction site is accounted for and contributes to 60.57% of the total score. Open the CSV-file "Sognsveien 17_substitutions.csv" to examine the substitutions.

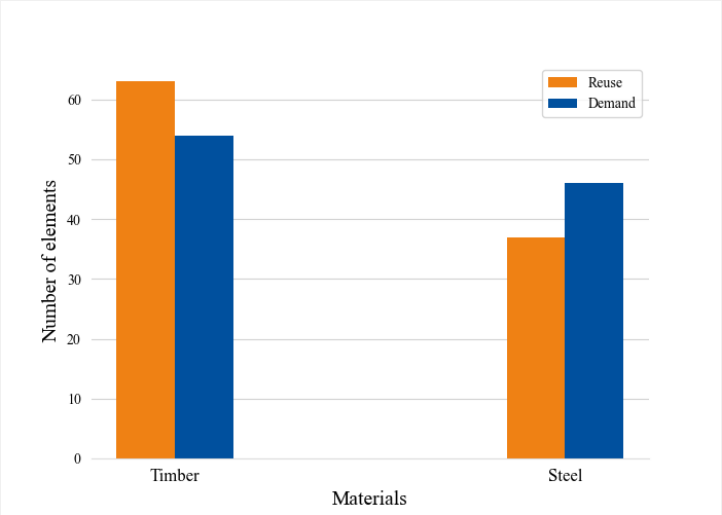
Constants used in calculations

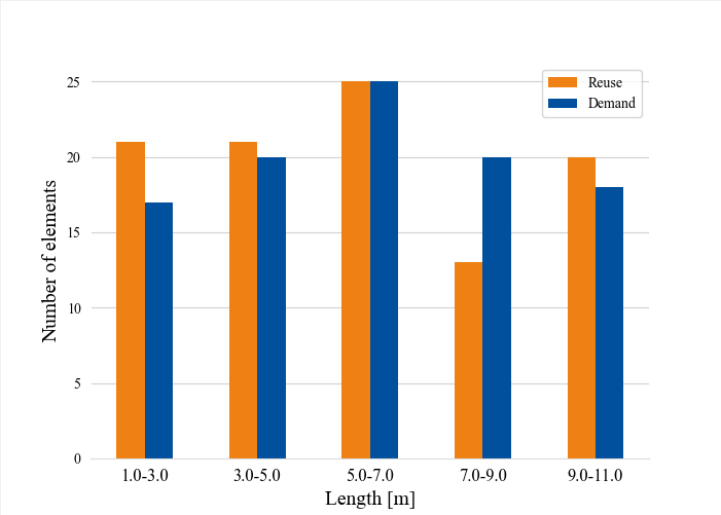
Constant	Value	Unit
Density timber	491.0	kg/m^3
Density steel	7850	kg/m^3
GWP new timber	28.9	kg C02 equivalents
GWP reused timber	2.25	kg C02 equivalents
GWP new steel	800	kg C02 equivalents
GWP reused steel	4	kg C02 equivalents
GWP transportation	96.0	kg/m^3 per tonne

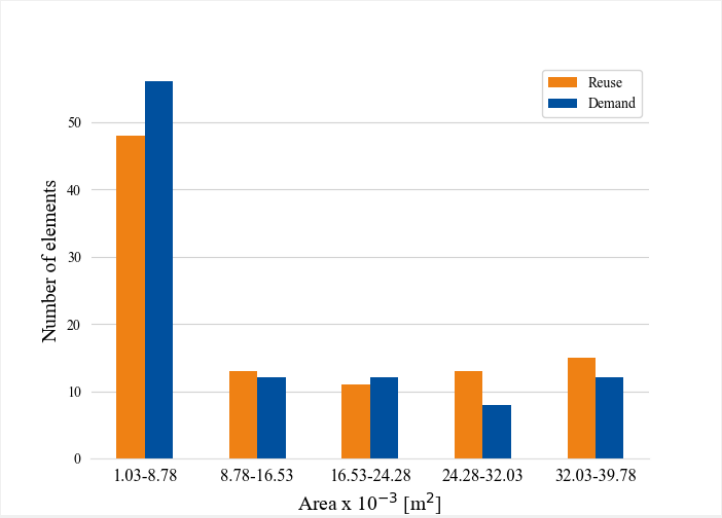
Information about datasets

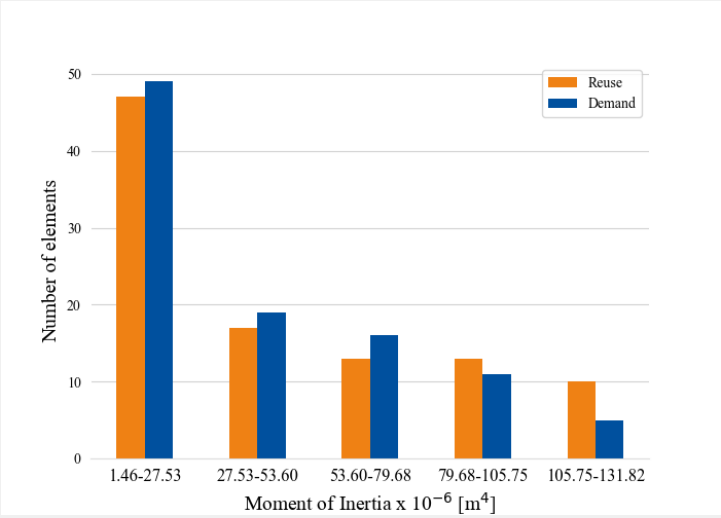
Elements	Filename	Number of elements
Reused	pdf_supply.csv	100
Demand	pdf_demand.csv	100

The files contains 100 reuse elements and 100 demand elements. The graphs below depicts some of the properties of the elements, including length, area, moment of inertia and the material distribution.





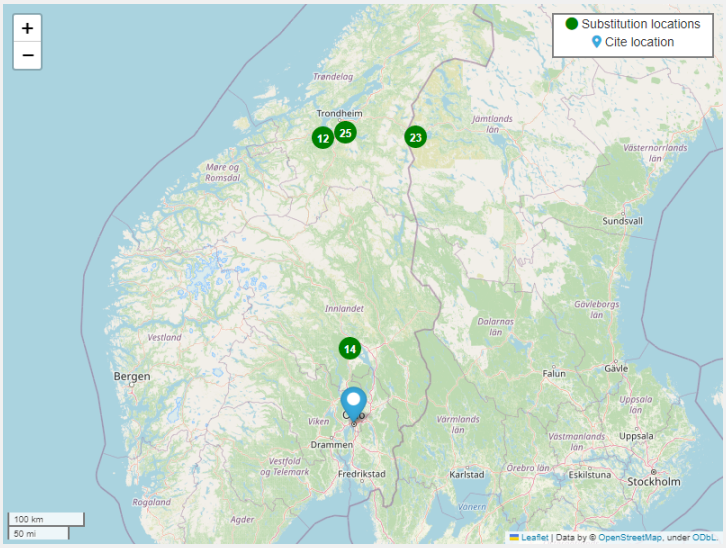


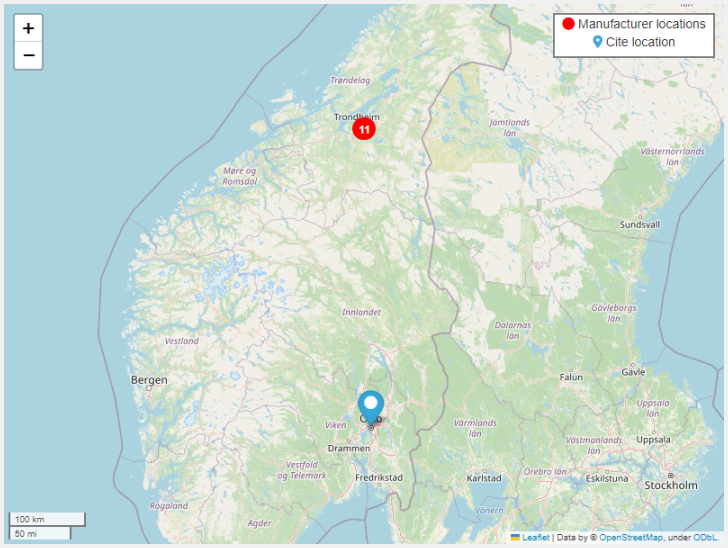


Impact of transportation

Transportation score	Percentage of total score	Transportation all new
447.33 kg CO2 equivalents	60.57%	436.7 kg CO2 equivalents

All calculations in this report take impacts of transportation of the materials to the construction site into consideration. Transportation itself is responsible for 447.33 kg CO2 equivalents. This accounts for 60.57% of the total score of 738.58 kg CO2 equivalents. For comparison, the transportation impact for exclusively using new materials would have been 436.7 kg CO2 equivalents. 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
Maximum Bipartite Matching	738.58 kg CO2 equivalents	74.0%	0.124s
Greedy Algorithm Plural	740.67 kg CO2 equivalents	74.0%	0.524s

The design tool is runned with 2 algorithms, namely: Maximum Bipartite Matching, and Greedy Algorithm Plural. The Maximum Bipartite Matching yields the lowest score, as shown in the table. The substitutions by this algorithm are completed in 0.124 seconds.