NTNU

April 26, 2023

Results from Element Matching

Project name: Bod nidarosdomen

Construction site located at: 63.4269, 10.3969

Summary of results

Total score	Substitutions	Savings
4995.3 kg CO2 equivalents	50.0%	13.03%

The 'Maximum Bipartite Matching Plural' algorithm yields the best results, substituting 5/10 demand elements (50.0%). Using GWP as the optimization metric, a total score of 4995.3 kg CO2 equivalents is achieved. For comparison, a score of 5743.68 kg CO2 equivalents would have been obtained by employing exclusively new materials. This results in a total saving of 13.03%. Note that transportation is accounted for and contributes 0.62% to the total score. Open the CSV file with the file path './Results/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	10
Demand	pdf_demand.csv	10

Impact of transportation

Transportation score	Percentage of total score	Transportation all new
31.11 kg CO2 equivalents	0.62%	13.14 kg CO2 equivalents

All calculations in this report take transportation into consideration. Transportation is responsible for 31.11 kg CO2 equivalents. This accounts for 0.62% of the total score of 4995.3 kg CO2 equivalents. For comparison, the transportation score for exclusively using new materials would have been 13.14 kg CO2 equivalents.

Performance of algorithms

Name	Score	Substitutions	Time
Maximum Bipartite Matching Plural	4995.3	25.0%	0.009
Greedy Algorithm Plural	4995.3	25.0%	0.044
Maximum Bipartite Matching	5000.57	25.0%	0.005
Greedy Algorithm	5000.57	25.0%	0.047

The design tool is runned with 4 algorithms, namely: Maximum Bipartite Matching Plural, Greedy Algorithm Plural, Maximum Bipartite Matching, and Greedy Algorithm. The Maximum Bipartite Matching Plural yields the lowest score, as shown in the table. The substitutions by this algorithm are completed in 0.009 seconds.