NTNU

April 25, 2023

Results from Element Matching

Project name: Bod nidarosdomen

Construction site located at: 63.4269, 10.3969

Summary of results

Total score	Substitutions	Savings
6660.09 kg CO2 equivalents	65.0%	58.79%

The 'Maximum Bipartite Matching Plural' algorithm yields the best results, substituting 13/20 demand elements (65.0%). Using GWP as the optimization metric, a total score of 6660.09 kg CO2 equivalents is achieved. For comparison, a score of 16161.65 kg CO2 equivalents would have been obtained by employing exclusively new materials. This results in a total saving of 58.79%. Note that transportation is accounted for and contributes 36.54% 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	20
Demand	pdf_demand.csv	20

Impact of transportation

Transportation score	Percentage of total score	Transportation all new
2433.45 kg CO2 equivalents	36.54%	5241.87 kg CO2 equivalents

All calculations in this report accounts for transportation. Transportation accounts for 2433.45 kg CO2 equivalents. This accounts for 36.54% of the total score of 6660.09 kg CO2 equivalents. For comparison, the transportation score for exclusively using new materials would have been 5241.87 kg CO2 equivalents.

Performance of algorithms

Name	Score	Substitutions	Time
Maximum Bipartite Matching Plural	6660.09	32.5%	0.017
Greedy Algorithm Plural	6660.31	32.5%	0.073
Maximum Bipartite Matching	6691.89	32.5%	0.013
Greedy Algorithm	6692.11	32.5%	0.057

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 0.017 seconds.