Earthmoving activity is considered a significant activity in the construction project. The cost of earthmoving activity in the construction projects in some cases reaches about 30% of the overall cost of the project. Moreover, heavy equipment selection needs to be utilized in this activity such as trucks and excavators. Such equipment emits a huge amount of carbon that has a negative effect on environmental dimensions. A mathematical model to optimize all design variables (i.e. capacity, number, and speed) related to this equipment is urgently required to prevent these negative impacts. The proposed model offers a genetic algorithm-based optimization technique for earthmoving activity. The model has four main phases: (1) define all related decision variables for earthmoving equipment, (2) detect all related constraints that impact the optimization model, (3) derive the mathematical optimization model, and (4) apply the multi-objective genetic algorithms. The optimization approach is utilized to minimize the cost and duration of earthmoving activity, along with reducing the carbon emissions and fuel consumption. A case study is applied to test and validate the addressed model. Optimization outputs have proven the model efficiency in saving substantial cost and time compared to the actual results. The results of the case study show that the innovative and original contribution of the created mathematical optimization model. These unique and new competencies are anticipated to support contractors and construction management engineers to minimize time and cost associated with earthmoving activities.

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Approved for distribution by Omer Tatari, Committee Chair, on March 19, 2019.

The public is welcome to attend.