

# Detailed Haul Unit Performance Model

Jose Luis Perdomo

(Abstract)

In order to make a profit in any earthmoving operation it is important to plan the operation, select the appropriate equipment and use the haul units efficiently in order to obtain the maximum productivity. Maximizing productivity is one of construction project management personnel's primary objectives, but can also be one of their greatest challenges. The need for effective productivity planning is obvious since productivity ultimately translates into profit. In order to plan an earthmoving operation it is important to understand the travel times of the hauling equipment. Travel time is a variable that, in turn, depends upon other variables associated with the haul unit, and the haul road conditions. Presently there is no travel time model that appropriately considers these factors and simulates the interactions among them such that more detailed analysis could be performed. Such a model needs to be developed. The objective of this research is to develop a detailed model to simulate the travel time considering, in the amount of detail needed, the variables upon which travel time is dependent. The key in the development of the model is the calculation of acceleration. The simulation of how instantaneous acceleration varies may be a complex procedure because instantaneous acceleration is a function of numerous variables, many of which are in turn functions of the velocity and position, which are themselves integral functions of acceleration. The acceleration of a vehicle is dependent on the vehicle characteristics, road conditions, and operator. It is very difficult to consider changes in instantaneous acceleration by using analytical procedures. A numerical method should be used in order to analyze the complex system and determine the travel time or velocity profile of the vehicle. MATLAB™ software was used to analyze and solve the complex system numerically. A model that considers that the machine is working at full capacity was developed. It considers the variables that affect travel time in the amount of detail needed. The impact that the operator has in the machine performance can be highlighted after a comparison of the results obtained with actual field data, once the model is calibrated.

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