

ABSTRACT

Open pit mines account for more than 60 percent of all surface mines, and haulage costs account for almost 60 percent of total operating costs for these mines. It necessitates maintaining an efficient haulage system where all fleet equipment performs effectively to achieve the mine's objectives. Discrete event simulation supported by animation offers a powerful method for evaluating such systems. This research has developed a simulation software program using Visual Basic for Application (VBA), GPSS/H (General Purpose Simulation System), and PROOF 5 animation. Remaining within the defined assumptions and boundary conditions, the research combines the powers of three software languages to build a general-purpose, data-driven, and user-friendly simulation program. The research focuses on the study and simulation of some of the important complexities of the truck haulage system. These include uncertainty or system randomness, fleet heterogeneity, multi-loader multi-dump sites, bunching of haulers, and hauler dispatching. In the developed simulation program, the user is required to provide the inputs in the user-friendly environment of VBA. The simulation program arranges the inputs in a pre-arranged format and then sends them to GPSS/H. The simulation language generates a discrete event simulation model based on the receiving structural and operational data. After simulating the system, the model generates the simulation outputs and animation commands in separate files. VBA displays a summary of the simulation results, and PROOF 5 demonstrates the results in a 2-dimensional graphical animation along with detailed information. This research also includes three case studies based on hypothetical mines for the analysis of simulation results. It establishes comparisons between the dispatching policies of fixed allocation and variable allocation of Minimize Production Requirements (MPR), and shows that the MPR policy is more suitable to achieve the quality control objectives. The developed simulation program contributes by demonstrating the powers of simulation to analyse open pit haulage systems. It also shows how simulation can be utilized as a useful technique to answer many 'what-if?' questions and scenarios.