

**OPTIMIZATION OF READY-MIXED CONCRETE
TRUCK SCHEDULING USING METAHEURISTIC
APPROACHES**

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Degree of Master of Science

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Science in Computer Science

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ABSTRACT

Ready-Mixed Concrete (RMC) is a perishable product; hence, specifications such as ASTM C94 recommend the delivery of RMC under 1.5-hours to ensure the quality. It is known that certain scheduling practices and driving behaviors lead to operational inefficiencies and poor-quality RMC. We propose a model to schedule RMC trucks while maximizing both the profit and job coverage, as well as meeting constraints such as ASTM C94 and continuous casting. The proposed solution consists of a rule checker and a scheduler. Rule checker enforces constraints such as deadlines, working hours, and ASTM C94 specification for travel time. The scheduler uses simulated annealing to assign as many jobs as possible while maximizing the overall profit. We consider two scenarios where trucks are attached to a given RMC plant, as well as allowed to move across plants as per job requirements. Using a workload derived from an actual RMC delivery company, we demonstrate that the proposed solution has good coverage of jobs while maximizing the overall profit. For example, compared to the manual job allocation, proposed solution in the fixed-plant scenario increases the average job coverage and profit by 13% and 9%, respectively. Moreover, the solution could automatically adjust the first unload time by a few 10s of minutes to reduce job conflicts, and this further enhances average job coverage and profit to 21% and 13%, respectively. Further, free-to-move scenario enhances the average job coverage and profit by 16% and 14%, respectively indicating that the scheduling could be further optimized by allowing trucks to move across the plants as per the job requirements.

Keywords: Fleet Management; Ready-Mixed Concrete; Scheduling; Simulated Annealing

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LIST OF ABBREVIATIONS

ACO	Ant Colony Optimization
ANN	Artificial Neural Network
ANS	Artificial Neural Systems
API	Application Programming Interface
DPSO	Discrete Particle Swarm Optimization
GA	Genetic Algorithm
GPS	Global Positioning System
HC	Hill Climbing
IBK	Instance Based Learner
ILP	Integer Linear Programming
J48	Decision Tree (Implementation of algorithm ID3)
ML	Machine Learning
NB	Naïve Bayes
PART	Rule based algorithm
RMC	Ready Mix Concrete
SA	Simulated Annealing
SMO	Sequential Minimal Optimization