Tharinee Manisri 2009: Algorithm for Determining Robust Solutions of Vehicle Routing Problem with Time Windows and Uncertain Travel Times. Doctor of Engineering (Industrial Engineering), Major Field: Industrial Engineering, Department of Industrial Engineering. Thesis Advisor: Associate Professor Anan Mungwattana, Ph.D. 172 pages.

This research develops an algorithm to determine robust solutions using a hybrid-heuristic technique. The main objective was finding the robust solutions for a vehicle routing problem with time windows (VRPTW) and uncertain travel times. The travel times are explained by interval with finite set of data. This VRPTW model becomes complex when the travel times are uncertain due to traffic conditions such as accidents, traffic jams, or weather conditions. Accordingly, the critical elements of this research include the model development which accounts for uncertainty and the algorithm development for solving such problems. This research presents a scenario-based approach and a hybrid algorithm to find the robust solutions.

The algorithm is constructed based on a modified push-forward insertion heuristic (MPFIH) was used to find the initial solution which was improved by using a lambda- interchange local search descent method (λ-LSD) and tabu search (TS). The experiment used Solomon's benchmarking problems to find the robust solutions. Robust criteria were the absolute robustness, the robust deviation and the relative robustness. The performance of the scenario-based approach is comparing with the worst-case performance approach and the expected value approach. The experiments set the VRPTW with percentages of uncertainty, β , equal to 0.2, 0.4, 0.6 and 0.8. The number of scenarios, $\mid S \mid$ were 10, 20, 40 and 80, respectively. Finally, the algorithm performance was measured in the quality of solution and computer run time by comparing with the genetic algorithm. The experiment used the Solomon's VRPTW benchmarking problems with 25, 50 and 100 nodes of customers.

The experiments clearly show that the hybrid algorithm can find the robust solutions that are not affected substantially by the traffic or other uncertain conditions. The appropriate robust criteria for this problem are the robust deviation and the relative robustness. The performance measure results show the scenario-based approach has higher performance than the benchmarking approaches when the percentage of uncertainty increases over 60 %. The developed algorithm has higher performance than the genetic algorithm in the quality of solutions but lower performance in computer run time when the number of customers increases over 50 nodes.

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