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**Synchronized Worker and Vehicle Routing for
Ground Handling at Airports**

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Abstract:

Based on the problem setting of a major ground handling company, we introduce a new problem, the vehicle routing problem with worker and vehicle synchronization (VRPWVS), which belongs to the class of vehicle routing problems with multiple synchronization constraints (VRPMSs). The VRPWVS deals with routing workers to tasks while meeting each task's time window and incorporating each task's specific skill requirements. A worker uses vehicles to travel between tasks of different airplanes making movement synchronization in time and space necessary. In addition to movement, the VRPWVS is best characterized by the new concept of active load synchronization. For the problem, we propose a mixed integer linear programming (MILP) model based on the new concept of itinerary categories. To solve real world problems, we present a Hybrid Metaheuristic with Tabu Search, Guided Local Search and Large Neighborhood Search. We examine the performance of the MILP and the Hybrid Metaheuristic in computational experiments using data from Munich International Airport and achieve potential savings of 4:9 million Euros per year when comparing the results of the Hybrid Metaheuristic with those of the current planning procedure of the ground handling company.