Vehicle Routing Problem with Time Windows (VRPTW) is an important and computationally hard optimization problem frequently encountered in logistics. This problem can be described as the problem of designing least cost routes from one depot to a set of customers while considering their time window constraints. The VRPTW problem has been studied extensively during the last decade, and researchers have proposed different algorithms and heuristics for solving this problem. Most of the proposed algorithms, however, ignore the lower bound of customers’ time windows. More specifically, most of the proposed algorithms and heuristics allow the vehicle to wait at a customer’s premises if the vehicle arrives before the start of the customer’s specified time window. Further, these algorithms assume that all vehicles can be dispatched from the depot at the same time, which might not be realistic in some practical situations, e.g., the depot might have a limited number of dispatching/receiving docks.

This research addresses a new variant of VRPTW that considers two additional features that increase the complexity of the problem but they are often encountered in real-life situations, these features are:
1. Customers have strict time windows for receiving a vehicle, i.e., vehicles are not allowed to arrive at the customer’s location earlier than the lower limit of the specified time window
2. There is a limited number of loading/unloading docks for dispatching/receiving the vehicles at the depot

The main goal of this research is to develop an optimization framework for solving the VRPTW with the constraints stated above by generating near optimal routes for the vehicles so as to minimize a certain objective function (e.g. cost, time, distance). First, the proposed framework clusters customers into groups based on their proximity to each other. Second, a Probabilistic Routing Generation (PRG) algorithm is applied to each cluster to find the best route for visiting customers by each vehicle; multiple routes per vehicle are generated and each route is associated with a set of feasible dispatching times from the depot. Third, an assignment problem formulation determines the best dispatching time and route for each vehicle that minimizes the objective function.