

## Multi-Point Simulated Annealing Algorithm for Solving Truck and Trailer Routing Problem with Stochastic Travel and Service Time

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### Abstract

The truck and trailer routing problem with stochastic travel and service time (TTRPSTT) is a development model of the truck and trailer routing problem (TRRP). In this case, travel and service times between customers are considered stochastic. Many researchers considered TRRP with deterministic parameters, but in real-life due to traffic congestion, different weather conditions, level of driver's skills may be influenced by distribution technology, often travel and service times are not really deterministic between two customers and normally follow stochastic distributions. Therefore, TTRPSTT has practical significance. TRRP has been solved by different algorithms but TTRPSTT has not been addressed yet. Here multi-point simulated annealing (M-SA) is applied to solve the TTRPSTT. Forty-eight instance problems have been modified for this case and solved by using this algorithm. The purpose of the paper is to introduce and solve TTRPSTT in a reasonable time by the simulated annealing algorithm. Also, the paper gives some suggestions for further researches.

Keywords: Stochastic travel and service time, Trailer routing problem, Multi-point simulated annealing, Customers

### 1. Introduction

Our contemporary universe is so demanding and competitive today. If companies and business entities aim to be sustainable in this competitive atmosphere, they are required to cut down on their costs to increase their profit. The transportation cost accounts for a minimum of 30% of the total cost of a company (Derigs et al., 2013). This cost can be reduced significantly by improving the transportation plan (Sarder, 2021). All management teams are willing to decline this expenditure without a reduction in the satisfaction level of customers. Consequently, coming up with the best method to ideally optimize this problematic area will assist the copious number of corporations to continue in a better manner in this competitive market regime (Bartolini and Schneider, 2020).

One of the significant aspects in the management of transportation is for the transportation to be coordinated with the remaining tasks in the firm, particularly within customer service and warehouse. Sometimes, the last contact of the sellers with the customer is the transport, thus, the companies need to pay extra attention to the fulfilment of the customer needs and expectations and use this relationship for improving their sales (Fallahpour et al., 2017). The transport coordination of the various elements in a supply chain can be of significant importance because

all of them presumably benefit by having a fast delivery to a particular customer. Consequently, a large number of issues in integrating transportation with the other network tasks can become a challenge to the industrial and academic communities (Fallahpour et al., 2016; Wang et al., 2020).

Truck and trailer routing is one of the well-known and basic transportation problems. A series of instructions need to be output by a vehicle routing system to inform the drivers what to deliver, where and when. One of the solutions, which is known to be "efficient", is enabling goods to be delivered where and when required at the minimum cost, subject to political and legal constraints. The legal constraints are the ones that concern with the unloading restrictions, vehicle use and construction regulations, speed limits, and hours of work and so on. Since the sales are growing with the internet use and the times for delivery are often very short, this problem is getting more importance and the customers can be distributed in an area. Every day a different type of customer emerges and they require very short time-windows for their products to be delivered (Parragh and Cordeau, 2017).

TTRP is one of the well-known and basic transportation problems. A series of instructions need to be output by a vehicle routing system to inform the drivers what to