

UNIVERSITI TEKNOLOGI MARA

**TIME – BASED AMBULANCE ZONING
OPTIMIZATION (TAZ_OPT): A GOAL
PROGRAMMING MODEL FOR
AMBULANCE LOCATION
AND ALLOCATION**

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for the degree of
Master of Science

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Candidate's Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree of qualification.

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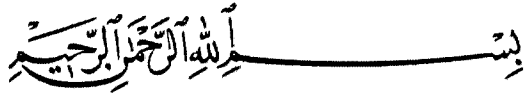


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ABSTRACT

Ambulance services are one of the main components of the Emergency Medical Services (EMS). EMS ambulances provide pre-hospital emergency medical treatments and transport patients to the nearest hospitals. Delay of ambulances to arrive at the emergency location and for the emergency crew to give the immediate medical attention may cause unwanted consequences to patients. An ambulance's performance is usually measured based on its response time. The ambulance response time is defined as the time elapse between the minutes an operator finished receiving information from a caller to the time an ambulance arrives at the emergency site. In Malaysia, the current average response time is three to four times longer than the international standard of 7 to 10 minutes. Longer response times may be due to distance of the emergency locations from the ambulance stations, poor choices of routes, which results in longer travelling times, or unavailability of ambulances. Strategic ambulance locations contribute towards ensuring that the ambulances' service coverage is maximized and their arrivals to the demand location is within targeted response time. Suitable ambulance allocations guaranty that there is at least one ambulance available when any emergency demand for the ambulance service arises. This study aims at maximizing the ambulance accessibility and availability through systematic planning of ambulance locations and allocations. The model developed, called the Time-based Ambulance Zoning Optimization (TAZ_OPT), is established using the grid-zoning approach, which is based on the estimated ambulance response times. TAZ_OPT is a goal programming model, consisting of two goals, first, to maximize the expected demand covered and second, to minimize the ambulance busyness likelihood. The values of these two goals dictate the number of ambulance satellite locations and the suitable number of ambulances to be allocated at these locations. Satellite ambulance location is defined as the grid where a host building (preferably government-own building, including existing hospital or polyclinics) can be identified to be the location to park the ambulance(s), based on trend of high demands, demand coverage and ambulance response time. TAZ_OPT model can be utilized to enhance the quality of services of the EMS ambulances, thus, would be beneficial to the public and the government. The study is also significant in terms of academic contribution towards pool of research in ambulance location and allocation, especially in Malaysia.

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