Application of Advanced Surveying Techniques in Solving Traffic Problems

A Thesis
Submitted to the Faculty of Engineering
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In Civil Engineering

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DEDICATION

Statement

This dissertation is submitted to Ain Shams University, Faculty of Engineering for the degree of M. Sc. in Civil Engineering.

The work included in this thesis was carried out by the author in the department of Public Works, Faculty of Engineering, Ain Shams University, from 2014 to 2017.

No part of the thesis has been submitted for a degree or a qualification at any other University or Institution.

The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others.

Date: 22 / 7 /2018

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Abstract

Transportation networks represent an important issue for all residences and visitors in any city. Therefore, traffic congestion is a major problem that affects greatly the mobility of personals and goods. Then, a rapid emergency response should be always available, especially in case of accidents and/or fires to ease the transfer of injured to medical services. In this context, geographic information systems (GIS) became an essential and effective tool in specifying the shortest path between any two locations within the streets network.

This thesis addresses the application of GIS in computing the shortest path between an origin and a destination location within a certain part within the greater Cairo, Egypt. Initially, this tested network is surveyed in order to determine the precise length of all included segments. This will help greatly in specifying the actual moving speed on each segment, which will indicate the traffic condition quality of the network within monitoring hours in all weekdays.

Consequently, different surveying techniques are used to layout this network, such as GPS navigator in both kinematic and static modes besides Google applications. Although the static navigator with a stationary time up to 20 seconds gives better results, the kinematic navigator is the recommended one to be used in this field. This is of course due to a comparable result with the static mode and its versatility in performing the network layout ever with dense traffic volumes. Moreover, it delivers a relative error in all segments length of about 1/1629.2, which has no significant impact on the corresponding average

vehicle speed moving on the network. Also, the kinematic mobile navigator has a good positional precision with RMSE of its components as (ΔE = 0.870 m, ΔN = 1.225 m, ΔP = 1.503 m)

In addition, the network was monitored in different periods of the year, in order to investigate the change in the shortest path along with its corresponding travel time due to the variation of the traffic volume. The selected network consists of 42 segments, varying in length, width, orientation, classification, pavement conditions. The results show the power of GIS in the field of transportation network, besides its ability to overcome some drawbacks inherited in the commercial Google Map interface when compared together. The collected real data proved that the corresponding Google Map reported time has accuracy of nearly 70%.

Key Words

Geographic Information Systems in Transportation (GIS-T), Google Map, Peak Hours, and Network Quality.

Acknowledgement

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