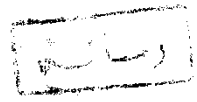
Ain Shams University
Faculty of Engineering
Public Works Department

A Comparative Study Among Various Sources of Data within Different Formats for the Production of Digital Mapping



By
Ayman Fouad Mohammed Ragab
B.Sc. Civil Engineering
Ain Shams University, 1989

A Thesis Submitted in Partial Fulfilment
for the Requirement of the Degree of
Master of Science in Civil Engineering
(Public Works Dept. - Surveying)

Supervised By

Prof. Dr. Mohammed M. Nassar
Professor of Surveying and Geodesy
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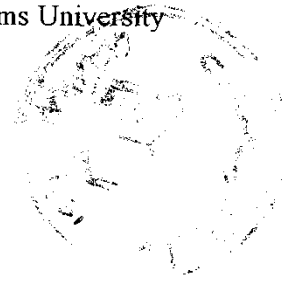

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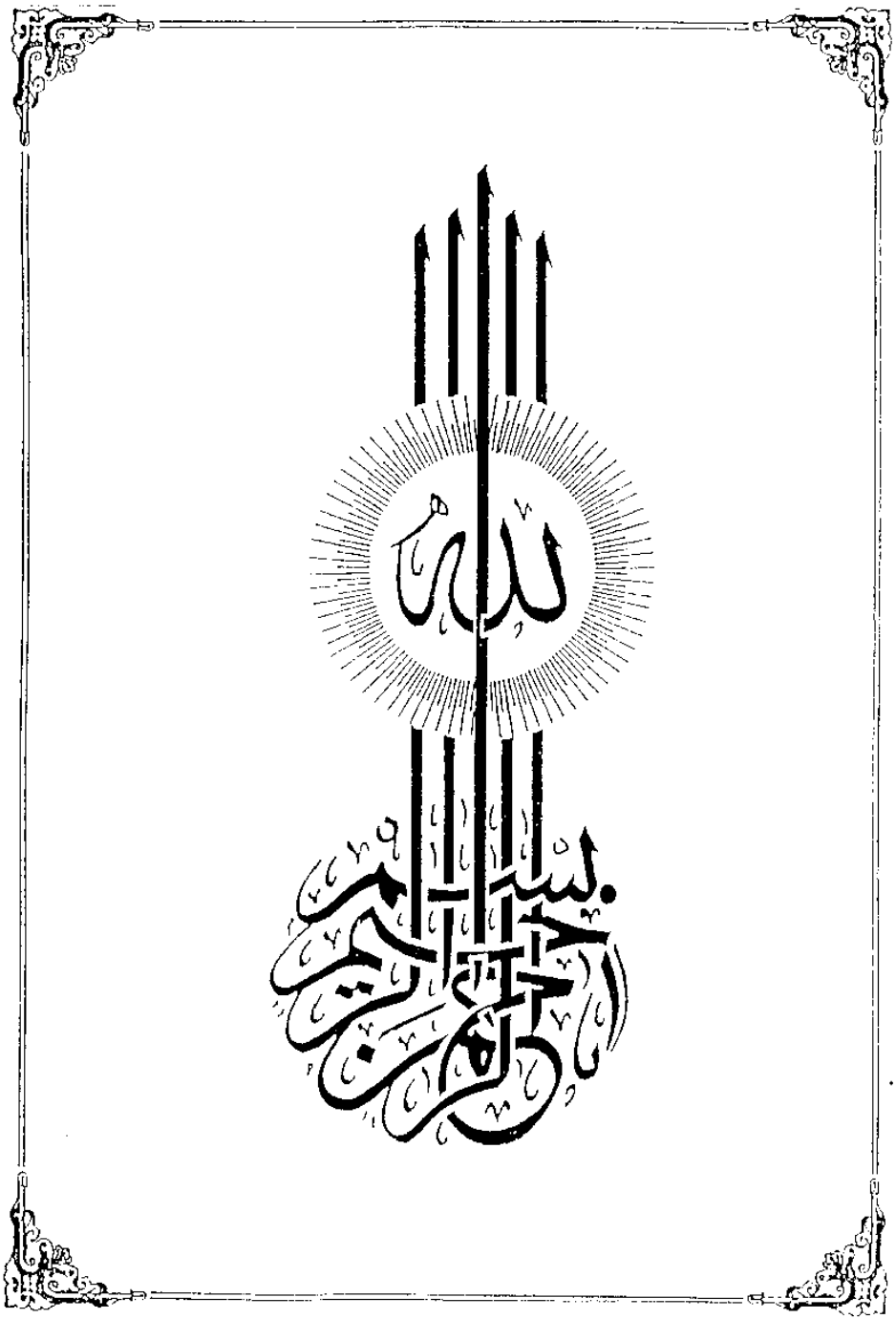

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Approval Sheet

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This thesis for M.Sc. degree had been approved by :

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Prof. Dr. AbdelHadi S. AbdelAal. Professor of Surveying and Geodesy Faculty of Engineering, Ain Shams University	
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STATEMENT

The dissertation is submitted to Ain Shams University for the degree of Master of Science in Civil Engineering.

The work included in this thesis was carried out by the author in the Department of Public Works Ain Shams University from October, 1990 to April, 1996.

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

Date : / /1996

Name : Ayman Fouad Mohammed Ragab

Signature : Ayman Ragab

ACKNOWLEDGMENTS

I am greatly indebted to my supervisor prof. Dr. **Mohammed M. Nassar**, professor of Surveying and Geodesy, Public Works Department, Faculty of Engineering, Ain Shams University, for his valuable support, encouragement and advice from which I have continuously gained enthusiasm and confidence. I also wish to express my deep appreciation to him for the useful information I have obtained from his own library and for his concern and careful revision of the manuscript of this thesis. He tirelessly gave me a lot of his precious time reviewing, organizing and documenting every small details in this work. Admiringly, I should mention that Professor Nassar effectively left alive his so special imprints on the style and final output of this thesis to come out in a good shape. Therefore, I am indeed indebted to him and no words can adequately express my gratitude to him.

I wish to acknowledge Dr. **Mounir T. Selim**, Assistant Professor of Photogrammetry and Surveying, Public Works Department, Faculty of Engineering, Ain Shams University, who has provided me the valuable advice and encouragement during the development of the thesis. Also, his continuous stimulation incited me to reach the highest attainable level of the practical results. I am very obliged to him for giving me the opportunity to make the required analysis that is crucial to achieve the objectives of the research.

I would like to express my sincere gratitude to Dr. **Ibrahim F. Shaker**, Assistant Professor of Photogrammetry and Surveying, Public Works Department, Faculty of Engineering, Ain Shams University, for his help in providing the concepts and the ideas which were developed in this

thesis and who under his auspices the research work in this thesis was undertaken and achieved its objectives.

I would like to extend my thanks to Dr. **Osman Akif**, Lecturer of Photogrammetry and Surveying, Public Works Department, Faculty of Engineering, Ain Shams University, for his great help during my first recognition with digital mapping technology and GIS; his constructive criticism and useful suggestions during different stages of preparing this work.

The development described in this thesis would not have been possible without the help and cooperation of a number of other individuals. Thanks must go first to my colleague Eng. **Tamer F. Sorour**, Instructor-Department of Public Works, Faculty of Engineering, Ain Shams University, who has been incredibly helpful in many aspects connectd with the practical and computational works applied to this thesis. Special appreciations and thanks are extended to the other staff at the Public Works Department, Faculty of Engineering, Ain Shams University, for their cooperation and encouragement during the preparation of this thesis.

Last but not the least, I am so grateful and obliged to my family and my wife for their continuous moral support, their understanding of the circumstances and their appreciation and proud of what I have been doing, so they happily did all at their disposal and sacrifice to make me feel stable and concentrating through this study. Finally, I would like to dedicate this thesis to my dear son ***Omar***.

ABSTRACT

It is well known, nowadays, that working with digital maps has several practical advantages, especially with the great improvements in the design and capabilities of digital computers. Such advantages, in manipulating, handling and retrieval of information from digital maps, have pushed the concerned organizations all over the world to stipulate their plans towards the implementation of digital mapping systems. This has been extended to the implementation of automated cartography and multi-user geographic information system, to satisfy the increasingly current needs and future applications. This has been the basic motivation behind our interest here, of investigating some problems related to digital mapping manipulation and implementation. The final accuracy of the produced digital maps will be affected by two different phases of data preparation, namely data capture and data input. The first involves the methods by which the captured data can be acquired for input to a digital mapping system. These methods, for instance, are ground surveying using total station; photgrammetric technique using an analytical stereo plotter; and analogue photogrammetry with line map plotting transformed later into the corresponding digital form. The second phase comprises the techniques by which such data are transformed from the original sources to the required digital form. Scanners and digitizers are the commonly used devices for transforming the collected data into a computer readable form. Of course, the user of digital maps is always worrying about the overall accuracy of the final results.

The main objectives, of the current research, two different studies. the first is to hold a detailed comparison between both digitization and scanning, as being the used techniques for data input, on the accuracy of the produced

digital map, in particular, in its vector format. The second is the assessment of the relative accuracy among the three digital files obtained from ground surveying, analytical photogrammetry and analogue photogrammetry, as the three data capturing techniques under consideration. The adopted criterion for accuracy assessment has been the (RMS) of coordinate discrepancies of some check points, as measured in any involved two systems, after being unified in the same coordinate system. Such a requirement, has evolved a secondary objective to be investigated. This deals with the best way for georeferencing of the digital files (obtained from either digitization or scanning) coordinate system to the original hard copy line map coordinate system. In this context, the similarity and affine transformation models, as the two familiar ones used in practice, which can be processed by either the parametric or the combined least squares adjustment techniques, have been investigated.

The present practical work has been performed on actual data, for the selected test area in Nasr City District, whose hard copy map (scale 1:5000) produced by analogue photogrammetry, as well as the corresponding digital file produced by analytical photogrammetry, were available. The necessary ground surveying with total station, for a part of this area, has been conducted by the author. The obtained results have indicated that, the affine transformation mathematical model, processed by parametric adjustment technique, produces more reliable results for the associated coordinate transformations. Also, scanning is more advantageous over digitization process, in terms of the accuracy of the eventually produced vector digital file. The relative accuracy, expressed as (RMS) of coordinate discrepancies, between ground surveying and analytical photogrammetry digital files is in

the order of about 2.0 m, taking the ground coordinates as error free reference. The relative accuracy between the analytical photogrammetry and scanned analogue photogrammetry digital files is approximately equal 4.5 m, taking the analytical photogrammetry coordinates as error free reference. On the other hand, the relative accuracy between ground surveying and scanned analogue photogrammetry digital files was found to be in the order of about 5.0 m. Such figures can not be considered as final representative values, since they pertain to the quality and circumstances of the available information for the tested area. Nevertheless, such results are expected to be useful, as far as merging data from different sources is considered.

Consequently, it is recommended to merge different data capturing techniques, with different obtainable accuracies, for producing digital maps with a certain pre specified accuracy, rather than using a single expensive technique of data capture with higher accuracy, for economical purpose. In addition, whenever data sources are available in the form of hard copy maps, scanners are recommended to be used for automatic digitization of such maps, instead of using semimanual- semi automatic digitizers, from both obtainable accuracy and economy viewpoints.