AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
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Abstract of the thesis submitted in partial fulfillment of the degree of doctor of philosophy by:

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Title of the thesis: Safety Management in Construction Projects in Egypt

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Abstract:

Construction work has become one of the most hazardous jobs in civil engineering. In the construction industry, falling from elevation is the most occurring type of accidents. These accidents were prevented by the Egyptian law. They may affect on cost, quality and the total project duration of the project. If the construction companies apply the safety models which are proposed in this research, the accidents will be prevented or at least reduced.

There are three objectives of this research study; the first objective is identifying the main causes of fall accidents and to identify any additional information that might be helpful in reducing the incidence of construction worker accidents in the future. Second is estimating the integrated risk in construction industry in Egypt. The third objective is presenting simplified proposed models for safety of construction projects in Egypt.

This research study is based on the data obtained from the field surveying on construction accidents. These interviews were made by the top construction engineer of the project.

The study shows that most fall accidents take place at elevations of less than 10.0 meter. Furthermore, experience does not seem to diminish accident occurrence. Falling from elevation accidents are often due to carelessness of the safety conditions and misjudgement by workers. This study shows that, the effect of falling accidents is low for the stopping works in the project. The effect on cost, quality, performance rate, and increasing in total project duration are very low.

The accident risk method is one of the most current methods that are used for evaluating the safety performance. There are many trades in construction industry. Only five construction trades were selected for occupational injury and fatality risk in this study. These five trades are concrete mixers, concrete carpenters, iron workers, workers on scaffolds, and ordinary workers. The risk plane approach is used in this study to evaluate the construction risk. This method depends on both frequency and severity of accidents. The integrated risk is calculated by converting the fatal risk to the equivalent nonfatal risk then added it to the nonfatal risk.

A model for measuring the integrated risk for each trade is proposed. The model was built using Monte Carlo method with Crystal Ball simulation with one million trials to minimize the error in sampling. The study indicates that "workers on scaffolds" trade is the highest trade in integrated accident risk in construction industry in Egypt. Intermediate risk scores were observed for concrete carpenters, iron workers and concrete mixers, while ordinary workers showed the lowest risk scores.

The need for construction safety models is not only for measuring companies' safety performance, but also for evaluation of the performance for determining the points of losses and shortages, which is very important for continuous safety improvement. Where the accidents may or may not be happened in unsafe condition, so the current methods which depend on accidents' rate and their severity are not suitable methods for measuring the safety performance.

As the construction industry is a complex one, so there must be a general method for measuring the safety performance in all activities and especially methods for measuring additional safety performance for each activity. For example, an especial method for measuring the safety performance in excavation works. So if there is an excavation works the company should comply with both of general safety model and safety excavation model.

In this research, safety construction models were developed for measuring and evaluation this performance. The general safety model consists of seventy subfactors in eight groups. These eight groups are personal protective equipment, safety program, medical aid, housekeeping & sanitation, fire prevention and protection, tools, barricades & fencing and storage. The safety excavation model consists of fifty nine subfactors in eleven groups. These eleven groups are surface encumbrance, mobile equipment, falling loads, water accumulation, stability of adjacent structures, traffic, access & egress, underground installations and utilities, fall protection, protective systems and hazardous atmosphere. These classifications are done due to previous researches, experts' notes, OSHA requirements. (www.osha.org), and (www.buildsafe.org)

There are four main critical groups, which are regarded as the most important factors in success of general safety construction in Egypt. The first group is "safety program" which has an importance factor of 25.22% and the second group is "personal protective equipment" which has an importance factor of 16.00%. "Medical aid" group is coming third with an importance factor of 14.97%. "Fire prevention and protection" group is the fourth group which has an importance factor of 13.45%.

There are two main critical groups, which are regarded as the most important factors in success of safety excavation in construction industry in Egypt. The first group is surface encumbrance with an importance factor of 17.47% and the second group is mobile equipment with an importance factor of 17.25%.

The safety models are programs written by visual basic language. These models use for measuring and evaluation of the safety performance for any construction project in Egypt. These models depend on the overall importance for all subfactors. The safety models evaluate any construction project in two steps; one for group evaluation and the other for the whole project evaluation. The safety models draw charts for the safety performance ratio for all groups and propose how to improve the safety performance.

Three cases are studied. Two of them are taken from the first grade companies and one is taken from the third grade companies.

There are many programs that deal with heath and safety in construction industry. These programs give some advices for the project managers to improve their safety performance. "Health and Safety Xpert" is considered as the most common programs in this field in United Kingdom. This program determines all risk assessments which are associated through all construction activities.

Both of the safety models which are obtained from this research and the "Health & Safety Xpert" software included approximately all the risk assessment for construction works. The safety models which are presented in this study can evaluate the safety performance for any construction project, while Health & safety Xpert software cannot do this evaluation. The safety models also guide the managers for the correct way to improve their safety performance.

Ain Shams University
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SAFETY MANAGEMENT IN CONSTRUCTION PROJECTS IN EGYPT

BY

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Dr. AHMED MOSTAFA SAAD

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Mohamed Badawy Abd El-Megeed

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ABSTRACT

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STATEMENT

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

The work presented in this thesis has been carried out by the author in the Department of Structural Engineering, Ain Shams University from 2005 to 2010.

No part of this thesis has been submitted for a degree or a qualification at any other university or institution.

Date: ---/---/-----

Signature: ----------

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PUBLISHED PAPERS

Papers published in-press or submitted out of this thesis:

- ☒ El-Nawawy O.A. , Saad A.M., Abd El-Megeed M.B., Accidents Risk in Construction Industry in Egypt, Al-Azhar University, 2009.
- ☒ El-Nawawy O.A., Saad A.M., Abd El-Megeed M.B., Safety Construction Model, Journal of Construction Engineering and Management, ASCE, 2010, in press.
- ☒ El-Nawawy O.A., Saad A.M., Abd El-Megeed M.B., Proposed Model for Safety of Construction Projects in Egypt, Journal of Construction Management and Economics, 2010, in press.

ABBREVIATIONS

CLT	Cost of lost time
CSF	Critical success factor
DW	Daily wage
E	Number of workers
F	Number of fatalities
FR	Fatality rate
FRS	Fatality risk score
i	Index of harm
IRR	Index of relative risk
IRS	Integrated risk score
MDAFW	Median number of days away from work
NF	Number of nonfatal injuries
NFR	Nonfatal injury rate
NFRS	Nonfatal injury risk score
NIOSH	National Institute for Occupational Safety and Health
OSHA	United States Occupational Safety and Health Administration
P	Probability
PPE	Personal protective equipment
S	Severity
σ	Standard deviation

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