



Site Evaluation Framework; Case Study on Saqqara

By

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A Thesis Submitted to
Faculty of Engineering, Cairo University
In Partial Fulfilment of the
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In
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Site Evaluation Framework; Case Study on Saqqara

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Summary:

Fault Tree Technique has proved to be an effective tool in evaluating various types of systems in various fields. The author applied Probabilistic Fault Tree Procedures to produce a new framework for site evaluation using generic model along with applying Sensitivity Analysis on data produced.

Having such framework developed, a case study was made on Saqqara site aiming at evaluating the whole site status and giving a practical example on how such generic framework for site evaluation can be applied on other sites.

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Dedication

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Abstract

Fault Tree Technique has proved to be an effective tool in evaluating various types of systems in various fields. The author applied Probabilistic Fault Tree Procedures to produce a new framework for site evaluation using generic model along with applying Sensitivity Analysis on data produced.

The generic evaluation framework aims at summarizing and analyzing the overall site status (bird-eye view) through relating all the factors affecting any site under study in order to point out the most important factor(s) or group of factors affecting it using sensitivity analysis technique.

Relating the factors affecting the site value through a fault tree is a probabilistic approach to contribute to site's further development can be considered a pioneer approach in evaluating any site under study.

Having such framework developed, a case study was made on Saqqara site aiming at evaluating the whole site status and giving a practical example on how such generic framework for sites evaluation can be applied on other sites.

Chapter 1: Introduction

1.1 Subject Overview

Fault Tree Technique has proved to be an effective tool in evaluating various types of systems in various fields. The author applied Probabilistic Fault Tree Procedures to produce a new framework for site evaluation using generic model along with applying Sensitivity Analysis on data produced.

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1.2 Problem Statement and Objectives

The author decided to use the Fault Tree method in order to relate the factors affecting site under study and then applying sensitivity analysis technique in order to assess the contribution of each factor to the whole site status.

The objectives of this thesis can be summarized as follows:

1. Developing generic framework for site evaluation utilising fault tree and sensitivity analysis techniques.
2. Applying developed evaluation framework on Saqqara Site.

1.3 Approach and Methodology

Fault Tree is a probabilistic approach to contribute to site's further development. However, other mathematical approaches using numerical analysis methods could be applied to deeply investigate such variables, but this is out of the research scope conducted in this thesis; as the author is focused on developing a site evaluation framework from a macro scale point of view.

The Author started with assuming probabilities within the generic fault tree as a worked example for the application of Fault Tree and Sensitivity Analysis, furthermore, a more focused Fault Tree Analysis on the Basic Events at Saqqara Site is developed as a case study.

Due to the Absence of numeric data about the basic events at Saqqara Site, all the probabilities assumed were explained in due course.

1.4 Thesis Outline

- Chapter 1: Introduction
This chapter contains the basic idea and the logic followed by the author to develop this Master of Science Thesis.
- Chapter 2: Probabilistic Fault Tree and Sensitivity Analysis
This chapter contains general information on all the techniques used within this thesis as conducted from the literature review carried out by the author.
- Chapter 3: Saqqara Site
This chapter contains all basic information about Saqqara Site that will be integrated in the evaluation framework to be developed by the Author.
- Chapter 4: Generic Site Evaluation Framework and Case Study on Saqqara
This chapter is divided into two parts, the first part is concerned with the explanation of how such framework is developed on a generic basis with further analysis made on such model applying sensitivity analysis technique. The second part shows the necessity to apply a case on Saqqara area and shows the findings.
- Chapter 5: Results
This chapter contains all the results rendered by applying the framework which will be followed by a discussion on the interpretation of such results on site level.

- Chapter 6: Conclusions and Recommendations
Following the discussion of results, the author summarizes in this chapter, all his conclusions about the current situation as well as his recommendations.
- Chapter 7: References
This chapter contains a list of all references (books, studies, research papers) he used to produce the Master of Science Thesis at hand.

Chapter 2: Probabilistic Fault Tree and Sensitivity Analysis

2.1 Basic Definitions

What is Fault Tree ?

According to Clifton A. Ericson II [8], Fault Tree can be defined as a tool for analysing, visually displaying and evaluating failure paths in a system, thereby providing a mechanism for effective system level risk evaluations.

The fundamental concept of Fault Tree Analysis is the translation of the failure behavior of a physical system into a visual diagram and logic model. The diagram segment provides a visual model that very easily portrays system relationships and root cause fault paths. The logic segment of the model provides a mechanism for qualitative and quantitative evaluation. Fault Tree Analysis is based on Reliability theory, Boolean algebra and probability theory. A very simple set of rules and symbols provides the mechanism for analyzing very complex systems and complex relationships between hardware, software and humans.

Due to close similarity of relations between Probabilistic Fault Tree Basic Events, Boolean Algebra Operations (Figure 1) can be applied in order to perform a Sensitivity Analysis on such parameters.