COST CONTINGENCY ESTIMATION FOR HIGHWAY CONSTUCTION PROJECTS IN EGYPT

By

Hani Samir Soliman Ghattas

A Thesis Submitted to the
Faculty of Engineering at Cairo University
In Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
In
Structural Engineering

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Key Words: Contingency, Risk, Cost, Highway, Delphi

Summary :

The problem arose because the groups responsible for the cost estimation lack a definition of contingency and its estimating techniques, and this causes problems of increasing the cost of the project. Cost control problems due to error and inaccuracy of the basic cost estimate. This paper reviewed the previous research related to estimating the cost of emergency projects for the construction of the Egyptian highways, taking into account the main factors affecting the highway projects. The study produced a set of values for contingency reserves as percentage of the estimated budget distributed to various project sites, contract types and project components for use as reference when estimating emergency reserves. Risk reserves are calculated on the basis of calculating the probability of risk and its impact on the risk profile.

Acknowledgments

This thesis is a result of my M.Sc. studies during 2013-2018 in the Structural Department – Faculty of Engineering at Cairo University. Many people have contributed to this work. First of all, I would like to express my gratitude to my scientific advisors Prof. Moheeb Al-Said and Dr. Ahmed Saad, thank you for your continuous belief in me from the beginning of the research till its end, for the opportunity to join your research group and for all guidance and support you gave me during these years. Dr. Nael Yousri, thank you for your commitment to the project, your valuable advice and the positive attitude you had every time I needed your help. I would also like to thank all the participant engineers for their contributions in the study and filling the questioners through the requested rounds of the research. I appreciate very much the knowledge you shared with my study colleagues, the time and effort we spent together at Cairo University.

I would like to show thanks and gratitude to my Family, each one by his name. For their help, support and encouragement through the whole time, even when I felt down they kept encouraging me to reach my goal.

I am also so grateful to Dr. Mohamed Bakry and Dr. Manal Abd El-Hameed, I'm proud to have gained knowledge and learn work qualities from you. You have been great mentors, teachers, and guides. Your support and advice helped me shape my professional study. Thank you for guiding me professionally and personally!

My colleague Dr. Hany Leon, thank you for your comments, guidance and help through my study helping me to achieve the goal for each section. It's my pleasure that you helped me a lot and I am looking forward to our work together.

I would like also to thank Mr. Ashraf El-Shamy for his encouragement and support, which made it possible for me to learn, gain knowledge and experience and to be able to do my studies.

I am very grateful to Cairo University and especially to the structural department and its members all the Professors, Doctors and staff who built my knowledge and advanced my background. Thanks for helping me to find the balance between theory and practice.

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Nomenclature

CCP	Certified Cost Professional
M Eng.	Masters of Engineering
MSc.	Masters of Science
PHD	Doctor of Philosophy
PMI-SP	Project Management Institute Scheduling Professional Certification
PMP	Project Management Professional Certification
PSP	Project Scheduling Professional Certification
RMP	Risk Management Professional Certification
Sec.	Section
Sr.	Senior
TOE	Technical Office Engineer

ABSTRACT

Highway construction projects are the main developing projects which are very essential for the developing countries as they represent the backbone for the further development plan of the country, these projects are complicated because it takes typically many years for planning, designing and execution as the development projects are all connected together not just the highways but also several types of infrastructure projects and all the life existence signs for the new areas all are related and depending on each other these projects are executed as successive sections. Development projects' budgets are always cut from the country's budget which is not flexible for escalation. For the contractors cost estimates of the projects are prepared from the very early phases of the projects at the tendering phases, however those phases are characterized by uncertainty due to the large variety of risks and unknown conditions that may exist, teams related to the highway construction projects budget estimating add contingency reserve to cover over costs due to risks through the project life. However the responsible teams for the cost estimation lack the definition of contingency and its estimating techniques, this promotes project cost increasing and cost control problems due to the error and the non-accuracy of the baseline cost estimate. As a part of the solution this study develops an excel application that help estimators to have guide lines when estimating the cost contingency reserve for highway projects taking into consideration project location, complexity of the project, type of contract and major factors affecting contingency and their impact on the contingency application, which helps the estimators to set the required contingency reserve for the project.

The study is based on Probabilistic Method which is The Expected value as the expert's knowledge and experience are the main trusted available references, the experts' experience was collected through Delphi technique. Delphi technique is the most appropriate for this study due to the nature of the study which needs interviewing many participants to get their reviews, analyze it and then repeat this step many times until reaching a nearly similar review from all participants to be able to proceed and build the study based on it. Thirty six professionals working at highway projects, estimating departments, risk departments, cost control sections, planning sections or technical offices agreed to participate in the study, data collected through four rounds of Delphi technique where data hypothesis was tested and analyzed quantitatively by the Univariate Analysis which requires calculation of mean and testing the consensus using Range between Quartiles (IQR) and then feedbacks at end of each round were sent to the participants of questionnaire to be used as a guide for the next round. These feedbacks contained the means of data collected through the round to show the general direction of data is it far away from the participant data or near which helped to create a general datum for the next round inputs.

Eventually an excel application and tables were developed based on the collected and analyzed data this application has different options for the user as choosing location of project, level of project complexity, contract type and the list of estimated values for each single risk event included in the contingency calculation to help the user and to reach accurate results for the contingency reserve required for his project. Contingency reserve calculation can be done at the initiation of the project or any successor stage even if the projects budget changed. The application is calculating a reference percentage for the project contingency as a percentage of the estimated raw cost, this reserve covers over costs occurred due to occurrence of the risk.

A part of the verification for the results of the application was to calculate contingency reserve for case studies using the application and then compare the final results and find out the accuracy percentage of the estimated contingency reserve. Three case studies of different types of projects were applied to calculate contingency reserve to verify accuracy of the calculated contingency reserves and the accuracy of the estimated reserve was over 95%.

Finally conclusion type of risks and values of probability of occurring or impact occurring dramatically depending on location, contract type and project's components. This must be taken into consider when estimating reserve that no exact fixed reserve can be used for all the projects, but taking into consider all the characteristics and properties of the project is very critical to

Chapter 1 : Introduction

1.1. What is Contingency?

Project's uncertainties generate risks, subsequently risk is used to estimate contingency reserve to be included in the budget cost at the early estimation during the project development phases. Risk is an unverifiable occasion or condition that if occurred has a negative or a constructive outcome on project's objectives (Anderson 2007) [7]. The procedure used to decide likelihood of event and effect of antagonistic occasions is called risk assessment, the estimated impact of risk should be added to the base budget estimate which is commonly called contingency reserve. Contingency is mainly divided into main types in all projects: float in budget money and float in schedule and tolerance in specification (Godfrey 1996) [30]. Cost contingency reserve is the estimation of costs related to the project's known uncertainties and risks, a sum of total reserves is added to the base cost estimate and then the markup is added to form the final project cost estimate, contingency reserve is meant to be used through the project construction process, where the base estimate is the most likely project estimate (Anderson 2007) [7]. The project's uncertainties and risks must be related to the scope where design specification, materials and costs studying each of these parts will be leading to the three contingency types stated by (Godfrey 1996) [30].

As a definition of contingency it can be defined as "the amount of funds, budget, or time needed above the estimated in order to reduce the risk of overrunning project objectives to a level acceptable to the organization" (PMBOK 2012) [58].

Baccarini (2006) [10] stated that there are many techniques for estimating the cost contingency, but according to his research the estimating contingency traditional percentage method is the most commonly used technique. The way of applying the traditional technique is not standard but it might be based on quantitative risk analysis. It might be chosen from a predetermined acceptable range which is accepted to the organizational polices. The best way of choosing between these techniques depends on polices and nature of each project.

Cost contingency reserves calculation different projects is a common research topic for construction project management researches. An extensive impart of level headed discussion was managing to proposing and the applying of most appropriate strategies and procedures for estimating the contingency reserve (Tseng et al. 2009 [18], Idrus et al. 2011 [1]). Contingency reserves is referred to as an amount of money embedded into the project's cost baseline to cover the identified accepted risks, where contingent or mitigating responses for such risks are planned (Pmbok 2012) [58]. Contingency reserve is used avoid any deviations from the baseline finances (Harper et al. 2014) [34].