

# Analysis of cost overruns originated in preconstruction phase in design-build pro...



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## INTRODUCTION

The main objective of construction management is the coordination of various construction tasks in order to successfully procure and deliver the project on time, in the budget and according to contract design-specification.

Construction cost as one of the most important criteria for the success of a project and might get affected by other criteria, is of high concern for everyone involved in construction.

Construction cost overrun reduces the contractor's profit leading to massive losses, and leaving the project and every part in financial strains.

For decades, construction projects, especially in developing countries, have been characterized by costs exceeding budget. According to CMAA, 71% of projects exceed the initial budget and according to a16z Podcast:

Construction Under Tech — The Build, 98% of construction projects above billion dollars run on average overage 80% over budget and this leads to a severe need to address the issue of cost overruns.

Within the construction industry, there are a number of project delivery systems that owners may choose to complete their project. Design-build is one of those choices, by Project Delivery, we mean a comprehensive process including planning, design, and construction required to execute and complete a building facility or other type of project.(DBIA, 2014)

Many owners choose design-build as a delivery approach with the objective of reducing the risk of cost overruns. In DB, the owner has the opportunity to transfer to the design-builder substantial design and construction risk and

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thereby significantly contain its contractual exposure for cost and time impacts that may be experienced by the design-builder. (David and Donovan, 2017)

In general, DB projects have better cost and time performance than DBB projects. However, time delays and cost overruns are still common in DB projects ( Xia and Chan 2008; Ling and Poh 2008).

Those involved in planning and budgeting know that cost overruns are not typically the result of any one mistake in the construction process, but rather the outcome of many minor mishaps in the initial stages of the lifecycle.

Time and cost are measured in the pre-construction and construction stages because for design/build projects, price and time are essential to success, which should be evaluated early at the pre-tendering phase. ( Albert P. C. Chan; David Scott; and Edmond W. M. Lam, 2008) They should also be closely monitored during construction to avoid subsequent delays.

It is essential to define the actual causes of cost overrun at the beginning of the project in order to minimize and avoid increasing cost in any construction project and to avoid any other negative effects. (Ibrahim and Nabil, 2013)

## RESEARCH OBJECTIVES

This research will attempt to identify the root causes of cost overruns originated in the preconstruction phase in Design-Build projects.

This research will also identify the mechanisms to minimize the cost overruns from decisions taken during the preconstruction phase in Design-Build projects.

## Research Questions

Table 2: Research questions with respect objectives

Objectives	Research Questions
To identify the root causes of cost overruns originated in the preconstruction phase in Design-Build projects.	<ul style="list-style-type: none"> <li>• What are the root causes of cost overruns originated in the preconstruction phase in Design-Build projects?</li> <li>• When are the root causes of cost overruns</li> </ul>

originated in  
the  
preconstruct  
ion phase in  
Design-Build  
Projects  
likely to be  
identified?

To identify

the

mechanisms

to minimize

the cost

overruns

from

decisions

taken

during the

preconstruc

tion phase

in Design-

Build

projects.

- What do you  
do to  
minimize  
the cost  
overruns  
from  
decisions  
taken during  
the  
preconstruct  
ion phase?

## RESEARCH DELIMITATIONS

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- The research will analyze the cost overruns originated in the preconstruction phase in Design-Build projects in Oklahoma City, Oklahoma.
- The research will assess the projects that are built between 2013 and 2018.
- The research will assess the commercial and public projects.
- The research will not go far beyond the objectives to meet research time.

## RESEARCH LIMITATIONS

In Oklahoma, Design-Build projects are not authorized without the approval of the Director of Central Services or his designee.(DBIA, 2017)

- This might decrease the population of the research, and the findings might not be generalizable.

## SIGNIFICANCE OF STUDY

Cost overruns being a worldwide problem has attracted many researchers. Most of the past researchers addressed the cost overruns in Design Bid Build projects and some researchers did the cost performance comparison between Design Bid Build projects and Design Build projects.

Although Design-Build cost performance is found to be better than Design Bid Build's in a number of previous studies, Design-Build projects still have cost overruns. And there are not many studies that focus on cost overruns in Design-Build projects. Hence the need for this study.

This research will identify the roots causes of cost overruns originated in the preconstruction phase and the mechanisms to minimize those cost overruns in Design-Build projects. This research will focus on cost overruns originated in the preconstruction phase because the preconstruction phase is a crucial phase for the success of Design-Build projects.

## LITERATURE REVIEW

### Background

Design-build has become more attractive options to owners wanting to tighten up project budgets. According to the June 2018“ Design-Build Utilization” report, Design-Build methods will represent nearly half, or 44%, of construction put-in-place in the United States by 2021.

Owners select design-build to establish the project’s total cost before the design is complete. Winning design-build proposals will present evidence that the design-builder can and will control cost growth during both design and construction. (DBIA, 2014)

The importance of gaining the initiative in the progressing of a project has gained a following in the construction industry and with owners as a method to reduce risk, increase cost and schedule predictability, deliver functionality, and stay within restrictive budgets and schedules. (Ling and Poh, 2008)

DB with the ability to overlap the design and construction process, early contractor involvement and improved communication between the design team and builder team, DB is supposed to have a good time and cost

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performance. And according to DBIA reports, Design-Build projects see 2.4% less cost growth than Construction Management at Risk and 3.8% less than Design Bid Build projects

Despite DB cost performance being found to be better than DBB's in a number of previous studies, according to Chen more than 50% of DBIA DB projects are over budget. (Chen, Jin, Xia, Wu, & Skitmore, 2015)

In a Design-build project, the pre-construction phase is crucial for setting the course for a successful job. Approximately 73% of construction professionals believe that design management is essential to ensure timely and quality design within the specified budget (Elmualim & Gilder, 2014).

The reduction in the total duration and amount of reworks depends on the accuracy of early information that is the primary inputs in the preconstruction phase (Hossain & Chua, 2014).

During this phase, the Design-Build team is supposed to make decisions that will help to avoid change orders, delays even cost overruns.

A root cause is the most primary reason for an unwanted situation or problem, which, if treated properly, will permanently solve the problem. (Rosenfeld, 2014)

### Root Causes

Most cost overruns in infrastructure projects in Sweden occur at any time from the planning phase to final design stage because of the uncontrolled change orders and the ensuing input required for technical and



administrative reasons (Lind & Brunes, 2015). Design problems factor is the single largest contributing factor to costs overrun and schedule delays in Turkey (Polat., 2014).

Early stage cost estimates miss a large number of details and information because such data are uncertain or unavailable at the project inception stage (Dominic & Smith, 2014). Approximately 37% of the assumptions made at earlier stages of the project's lifecycle are invalid and have negative effects on the project process, which may create extra materials cost caused by rework (Gao, 2014).

According to Rosenfeld, unclear, ambiguous, and contradicting terms in the tender documents and unbalanced distribution of risk between owner and contractor are some of the most crucial root causes of cost overruns in Israel construction Industry. These causes can easily cause cost overruns in Design-Build projects.

Unclear division of responsibilities and lack of clear requirements for professional management is another causes of cost overruns in Design-Build projects, although in Design-Build it is a teamwork it is important that all parts involved know what their assignments are.

Top risks that may cause project cost overruns and schedule delays are related to changes from the client side (Alinaitwe et al., 2013; Amoatey et al., 2015; Rosenfeld, 2014; Syed Jamaluddin et al., 2014).

Minimizing the construction cost overruns

Researchers and practitioners tried to increase the efficiency of cost to improve performance but could not find a common solution to overruns and delays (Alinaitwe et al., 2013; Rosenfeld, 2014; Spalek, 2014). Stakeholders need to treat the root causes of overruns and delays rather than treating symptoms that result from the problem (Rosenfeld, 2014).

Project managers should consider six aspects while managing the stakeholders (Storvang & Clarke, 2014).

The six aspects include identifying the stakeholders in construction, what influence they have and what they can do when involved, which stages need their involvement, how to involve them, how to create a space for meeting them, and identifying their useful information and input needed to enhance the development process.

When roles and responsibilities are clear among stakeholders across the project lifecycle, less chance exists for gaps in any stage of the project phases, which may introduce positive indicators of enhanced project control process and relationships (Doloi, 2013).

Continually improving the pre-design stage to provide more accurate estimations and more value for money is important (Azman et al., 2013).

Engaging players such as the client, financial representative, land surveyor, and geotechnical experts, materials engineers, and suppliers in the estimation process is helpful to improve the whole project cost estimation (Ochieng, Shedrack, & Douglas, 2015)

## METHODOLOGY

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## Introduction

This research falls under the general category of descriptive quantitative research. The research intends to answer the what and how questions to the phenomenon.

In order to investigate the research problem, the review of literature of the last 10 years is being carried out where the researcher will draw the root causes of construction overruns originated in preconstruction phase in Design-Build projects.

The root causes of construction overruns originated in preconstruction drawn in literature review will be ranked by groups of industry professionals through an online survey questionnaire.

Another major source of secondary data is online DBIA project database. The research will also collect cost related data from project archives, government websites.

## Population

According to the latest unofficial list of Design-Build firms dated May, 10, 2018 found Oklahoma government website, Oklahoma has 25 registered Design-Build firms.

The researcher chooses Oklahoma city because it is a metro area and it can represent what is going on in Oklahoma.

## Sample

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The research will use commercial and government Design-Build projects built in Oklahoma City, Oklahoma between 2013 and 2018 as the population.

To determine the number of survey questionnaires that will be sending out, the researcher will use the online sample calculator. The research will use different construction professionals who take decisions during the preconstruction phase to increase the randomness.

Because of a small number of Design-Build projects in Oklahoma City, the researcher cannot guarantee that these research findings can be generalized across the United States.

#### Measurement

The research will use an online survey questionnaire as the instrument to collect data. The survey questionnaire will have multiple choice questions with ordinal, nominal measurement scales.

The ordinal measurement scales will allow the respondents to rank the root causes of construction cost overruns originated in the preconstruction phase in Design-Build projects.

The survey questionnaire also will have open-ended questions to minimize the other possible explanation of the research conclusion.

#### Data Analysis Procedure

The research will analyze data using descriptive statistics such as average, percentage, and graphs.

The research will use a nominal scale to determine the mode, chi-square and the research will use the ordinal scale to determine the percentile rank and correlation. The analysis of variance might be used as an explanatory tool to explain the answers to open-ended questions.

### Reliability and Validity

Conclusions drawn from analyzing survey data are only acceptable to the degree to which they are determined valid. ( Leedy and Armond, 2013)

This research will use the content validity study that will inform if the nominal and ordinal measurement scales used in a survey represent the research content domain.

Since the population is small, the researcher will use reliability calculations like Cronbach Alpha to determine the internal consistency of the research. The researcher will also use the calculation of the level of inter-rater agreement to improve the reliability of the study.

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