JOURNAL OF CRITICAL REVIEWS

ISSN- 2394-5125 VOL 6, ISSUE 07, 2019

Contingency planning of highway projects by Modeling the Construction threat ratings

[1]L mounika Assistant Professor lmounika8591@gmail.com
[2]p mounika Assistant Professor mounikapeerla73@gmail.com
Department of CIVIL Engineering,
Pallavi Engineering College Hyderabad, Telangana 501505.

ABSTRACT

The relevance of risk assessment in construction projects has been underlined in previous research, and several methods for responding to possible hazards have been advocated for each phase of the project. The right distribution of contingency monies is one way to react to risk. The goal of this study is to determine the relative relevance of the risk factors mentioned in relation to the cost contingency amounts, as well as how much of an influence they are believed to have on costs and schedules. Survey answers from experts working on highway transportation projects were used to assess the pre-identified risk factors. Regression modeling was utilized to examine how preset cost contingency levels in these projects and the risk ratings given by project experts were related. According to the research, poor constructability evaluations had a large effect on calculating the owner's contingency amount, while adjustments by the owner's request had a substantial impact on a project timeline. Estimating risk-appropriate contingency percentages using these models and techniques might be useful throughout the planning phase of comparable highway building projects.

Author keywords: Risk; Planning; Contingency; Highway; Parametric modeling; Contracting."

1.Introduction and Problem Statement"

Creating contingency plans for specific project components or the entire project base cost is one way to accurately anticipate construction expenses in the future. Some estimates have found it difficult to designate the right amount of cost overrun and unused contingency to reduce project cost overruns at the project completion. If the predetermined distribution of contingency amounts is too low, it might lead to project cost overruns; on the other hand, if it is too high, it would tie up money that could be used for other purposes. Because of this, a more thorough evaluation of project risks is required in order to properly budget for contingencies.

Previous research has shown that transportation professionals are more concerned about the cost and time consequences of risk. Three-tier risk analysis and contingency estimates for highway projects have been developed via a large amount of research, which includes detecting risks, examining hazards qualitatively, identifying probable difficulties and then completing quantitative evaluations of risks. Active risk management is a component of this technique as well.. Risk and uncertainty methodologies used by Reilly and Brown (2004) are used to provide a project cost estimate that gives a range of probable expenditures. Estimated costs are being verified according to the name of this approach (CEVP). The Delphi approach, according to Olumide et al. (2010), was used to produce sliding-scale contingency graphs for three stages of highway construction. Road construction contingency costs may be predicted using a best-fit probability distribution function developed by Love et al. Artificial neural networks, according to Lhee (2009), may be used to estimate the cost effect of transportation infrastructure improvements. When estimating the amount of schedule contingency necessary at various times in project development, Gurgun and colleagues (2013) suggested a technique. The completion rate is between 25 and 50 percent. El-Touny and colleagues (2014) used the analytical hierarchy approach to model cost contingency based on the most important risk indicators. They found that (AHP). Chou et al. (2009) developed a cumulative probability distribution function that may be used to estimate the probabilistic cost of highway bridge replacement projects using real data from the Texas Department of Transportation (TxDOT) Using Bhargava's model-based economics, cost overruns in highway building projects may be predicted. Ashley et al. (2006) utilized risk management methodologies to create a guideline for examining risk in highway projects, including a quantitative risk analysis to anticipate cost unforeseen. A variety of dangers have been uncovered in the building business. Thus, it has not been well investigated how risk drivers affect the cost of contingency plans. There was no indication of a link between construction risks and project contingencies in published research articles. We carried out this study to fill in the information gaps about the risk factors in transportation construction and their link to project contingencies. According on a review of the scientific literature, 31 possible risk factors were identified (listed in Table 1). Risk drivers are a term used to describe the key causes of risk events. An extensive review of relevant literature and in-depth interviews with construction industry professionals enabled this analysis to uncover programmatic and project-specific construction risk indicators.

2.LiteratureReview

Uncertainty in a project may lead to increased costs and delays. Expenses might rise unexpectedly, so contingency is a safety net. "The amount of cash, budget, or time required above the estimate to decrease the risk of overruns of project goals to a level acceptable to the company" This phrase has been defined by the Project Management Institute (PMI). This amount is added to the estimate in order to account for any unknown items, circumstances, or events, according to the AACE Total Cost Management Framework's definition of contingency. Despite the fact that there are different approaches for determining contingency, a cost contingency is a reserve budget set aside to cope with the monetary implications of project risk and uncertainty. Contingency plans in the project schedule are used by project managers to guard against delays, oversights, and other unknown events, and to offer a safety net in the event that time estimates prove incorrect. According to Anderson et al. (2007), "the conventional state highway agency strategy for allocating contingency has been to either follow a predetermined proportion for the changing phases of project development or to depend completely on the project estimator's expertise" when it comes to making contingency plans. When calculating the cost of a project, risk and uncertainty should be taken into consideration, and if required, contingency charges should be added. Because of the macroenvironment, transportation agencies tend to focus on project risks rather than identifying and evaluating the individual hazards that contribute to a given project's overall risk profile.

3.ResearchMethodandDesign

It was decided to conduct an online poll to gather primary data for this study. As a result of their previous work and expectations, transportation experts were able to provide qualitative information on the project's quantitative aspects. Collecting this information served primarily to provide

1. To gather information on a given project, such as the amount of contingency that was actually allocated and other factors that might be used to classify projects.
2. To learn more about the potential sources of construction-related risk.

For these purposes, the research followed these steps:

- Analyzed the available literature to identify and classify the various construction-related risks. A couple of public and private area transportation experts with whom the creators were familiar at various development and transportation-related proficient meetings were consulted about this material. For the sake of thoroughness, those risk factors that were thought to be very dangerous for meeting a project's cost and schedule goals were considered.
- Obtained the necessary information on the features of the project to be utilized in classifying the various kinds of projects.
- A survey instrument built by the author's connected institution was used to set up the survey's framework and collect data.
- An effective surveying procedure was developed, including methods to identify possible survey participants and how to collect data from them.
- Conducting the final questionnaire survey

In order to accomplish the stated goals, a variety of methods were used, as outlined in the following:

✓ The survey's format and content were evaluated via phone conversations with transportation specialists with whom the authors had personal contacts.

✓ Prior to sending out a complete online poll to a bigger sample, Personal interviews were done with a chosen group of transport experts.

✓ The results of an online poll were submitted. “Several trade organizations, including the American Road and Transportation Builders Association and the Construction Management Association of America, were contacted in order to help spread the information about the study to their members.” A link to the survey and instructions on how to participate were included in an email addressed to a randomly selected group of transportation professionals. In order to include the email addresses of all potential participants, this listserv was built by the authors on their own. This study's primary goal was to gather information on completed projects in which participants had been actively involved.

The 31 risk factors were developed from talks, personal experience in construction management and engineering, and a literature review. Many hypotheses were tested using the Statistical Analysis System (SAS)

In all, 660 specialists from 29 states were culled from a listserv. For this article's purposes, we did not analyze the location of the evaluated projects. Numerous transportation professionals from a variety of professional associations were listed on the listserv, including those from the Federal Highway Administration, state departments of transportation, architectural and engineering consulting firms, design firms, and general and subcontractors' contractors' subcontractors. A total of 246 answers were received, some of which included more than one project. A total of 98 responses were incomplete. In all, there were 48 answers that were completely completed (approximately 20 percent of all responses received). Only answers containing an observation regarding a parameter were used for calculating its value. An initial analysis was necessary, even if a higher response rate was needed to generalize research results, so that additional data could be gathered and used to further build on the study's suggested evaluation approach.

TheScope

According to this study's scope of work: determining which risk factors impact the distribution of costs for contingency plans. This project required the use of stepwise regression modeling. “In 2006, Lowe et al. (2006) used stepwise regression to forecast building costs. As an independent variable, the risk rating of each driver was included in this research. This was the dependent or response variable that reflected the reported cost contingency % from the evaluated projects provided by the owner or the contractor. x They were compared to these values in terms of their ranking. The SAS program was used to determine the most important independent variables in the study. The contingency rate of each independent variable shows how much of an impact it has on the severity of the dependent variable.”

“Sixregressionmodelsweredevelopedasfollows:

1. Owner’scontingencypercentageagainstRIratingsforall31riskdrivers.
2. Owner’scontingencypercentageagainstCIratingsforall31riskdrivers.
3. Owner’scontingencypercentageagainstSIratingsforall31riskdrivers.
4. Contractor’scontingencypercentageagainstRIratingforall31riskdrivers.
5. Contractor’scontingencypercentageagainstCIratingsforall31riskdrivers.
6. Contractor’scontingencypercentageagainstSIratingsforall31riskdrivers.”

The RI, CI, and SI ratings were used to develop hypotheses for the cost contingency amounts for each of the project's owners and contractors. The following hypotheses were put to the test:

H_0:RI, CI, and SI risk ratings for the selected highway project have no link with owner/contingency contractor's amounts.

H_a: This roadway project's risk rating (RI, CI, or SI) has a direct association with the amount of contingency money that a contractor has on hand.

In order to control the high-rated risk drivers, the owner and the contractor should give a bigger proportion of the project cost to a larger contingency percentage, both assumptions are important.

4.ResultsandDiscussions”

As shown in Table 1, a total of 31 risk factors were discovered and sorted into five major groups.Additionally, respondents provided true values for the proportion of owner and/or tractor cost contingency used in the reported projects. It was found that the majority of people said that their contingency percentages were either 5 or 10 percent. With two sets of contingency values, hypotheses testing was thus carried out Risk levels were divided into two categories: low (less than 5%) and high (above 5%). A total of 31 potential sources of risk were examined in hypotheses 1 and 2, which used these two degrees of contingency as well as RI, CI, and SI evaluations. No association was found between any of the 31 risk drivers' ratings and the owner's or contractor's contingencies. For this reason, stepwise regression analysis was also carried out, which will be addressed in the next sections.

There are 31 potential sources of danger. Independent variables included all drivers' risk rating scores in the model (e.g. CI, SI). In order to determine whether or not these ratings accurately reflected the stated contingency % by owner or contractor, we compared the ratings to the dependent or response variable, y. SAS was used to perform a multicollinearity test, and the findings did not show the existence of multicollinearity in the cost contingency percentage.

Also, owners' contingency amounts were altered as a result of modifications in risk driver R2. They recommend that this risk be assessed even with the low statistical significance (p-value of 0.0058). It was determined that more requests for adjustments would be made if the owner designated a greater contingency amount because of this. If the owner thought there would be minimal changes, the CI was rated as low and the owner's contingency was reduced accordingly. Due to multicollinearity, several of these parameter estimates were feared to be negative in their final results. Testing for multicol-coherence detection yielded variance inflation factors (VIFs). The results showed no indication of multicollinearity. The CIs of all 31 risk variables are then examined in a stepwise regression model to see whether there is a connection.“RiskdriverR17(inadequateconstructabilityreviews)wascon-

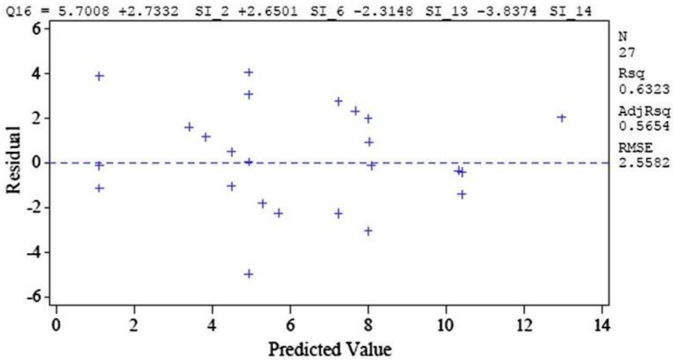

Figure:2 Stepwiseregressionofowners’contingencieswithSIratings

Owners’ContingencyandCIofRisks”

A stepwise linear regression study of the owners' contingency percentages to CI ratings provided no significant model or data.

“Owners’ContingencyandSIofRisks”

As stated in Eq. (2), stepwise linear regression analysis was performed on the association between owners' costs and SI ratings when utilizing RI, CI, and SI as independent variables. The coefficients for each of the three independent variables were 23, 20, and 19.

“Contractors’ContingencyandRIofRisks”

“The contractors' RI contingency percentages and ratings were examined using the following practical form”:

C_{Cont}%¼fðRI_1;RI_2;:::;RI_iÞ ð3Þ

Analysis and results of the predicted model based on the contingencies of the contractors and the ratings of RI are shown in Tables 6 and 7. (Fig. 3)

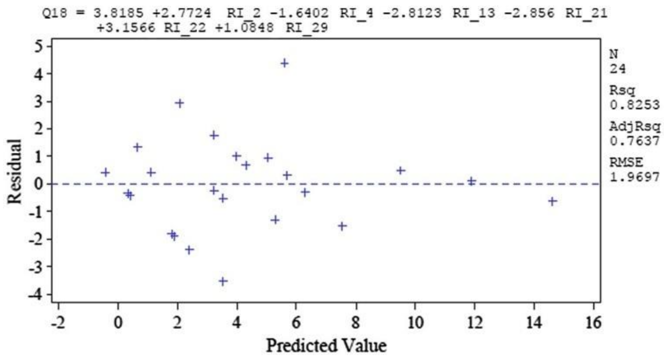

Figure:1 .Stepwiseregressionofcontractors’contingencieswithRIratingsofrisks

Table 11. Stepwise Regression of Contractors’ Contingencies with SIRatingsofRisks 2.41889”

1. It was shown that SI's risk drivers R2 (owner-requested modifications) had a positive impact on the contingency levels of contractors.

2. A large influence on contractor contingency percentages was due to SI risk drivers R6 (inadequate plan evaluations by designers and contractors) and R28 (maintenance of traffic/staging/auxiliary lanes).

As R2 (changes requested by the owner) has a p-value of less than 0.005, the authors propose that contractors take into account the SI of this risk factor when setting contractor cost contingency levels.

4.ConclusionandSummary

The study's purpose was to find out how risk variables affected the amount of money put aside by the project's owner and/or contractor for unanticipated expenditures. The contingency amounts were predicted using a regression model that rated the possible risk drivers. Risk factors such as RI, CI, and SI may be used to determine the proper contingency percentages to utilize in highway construction projects using the methods presented in this study. It is important to note that the models can not be generalized and utilized until you know where the limits are.

When creating the owners' and/or contractors' contingency plans, these three risk factors should be taken into account:

1. This risk should be taken into consideration when developing each party's baseline timetable, as it might have a significant impact on the owner's and contractor's cost contingency levels. During the design and implementation of highway projects, contractors must also consider the impact of this risk factor on other risk factors.
2. It is critical that the owner's contingency be calculated with enough resources allocated to handle the constructability assessment endeavor in order to avoid a substantial risk driver.
3. Inaccuracies in structural design have a significant influence on other risk factors and might have an impact on the project's overall cost and the contractor's contingency budget.

All three models may be used to anticipate construction contingency amounts from contractors' viewpoints when the stated risk drivers have a high likelihood of occurring during the construction phase of the project (RI, CI, and SI models). Contingency plans may be tailored to the individual needs of each company, and risk rating parameters can be assigned levels based on the three values that were calculated in this research and evaluated by experts' assessments. These values may be used to figure out the construction cost estimate for the project's contingency plan. Models should be updated on a regular basis, even if not all risk drivers information is accessible in most projects, to reflect any new risk information and specifics that may come to light.

References

1. AACE (Association for the Advancement of Cost Engineering). (2009).“Risk analysis and contingency determination using parametric estimat-ing.”*AACERecommendedPracticeNo.42R-08*,Morgantown,WV.
2. Akintoye,A.,andMacLeod,M.(1997).“Riskanalysisandmanagementinconstruction.”*Int.J.ProjectManage.*,15(1),31–38.
3. Anderson, S., Fisher, D., and Rahman, S. (1999). “Constructability issuesfor highway projects.” *J. Manage. Eng.*, 10.1061/(ASCE)0742-597X(1999)15:3(60),60–68.
4. Anderson, S., Molenaar, K., and Schexnayder, C. (2007). “Guidance forcostestimationandmanagementforhighwayprojectsduringplanning,programming,andpreconstruction.”*NCHRPRep.57 4*,TransportationResearchBoard,Washington,DC.
5. Ashley,D.,Diekmann,J.,andMolenaar,K.(2006).“Guidetoriskassess-mentandallocationforhighwayconstructionmanagement.” *No.FHWA-PL-06-032*, Office of International Program, FHA, Washington,DC,4–17.
6. Bakhshi, P., and Touran, A. (2014). “An overview of budget contingencycalculationmethodsinconstructionindustry.” *ProcediaEng.*,85,52–60.
7. Bhargava, A. (2009). “A probabilistic evaluation of highway project costs.”ProQuestDissertationsPublishing,AnnArbor,MI. Chen,D.,andHartman,F.T.(2000).“Aneuralnetworkapproachtoriskassessmentandcontingencyallocation.” AACEInternational,Morgantown,WV.
8. Chou,J.,Yang,I.,andChong,W.K.(2009).“Probabilistic simulationfordevelopinglikelihooddistribution ofengineeringprojectcost.”*Autom.Constr.*,18(5),570–577.
9. Diab, M., Varma, A., and Nassar, K. (2012). “Using risk assessment toimprove highway construction project performance.” *48th ASC AnnualInt.Conf.Proc.*,AssociatedSchoolsofConstruction,FortCollins,CO.
10. El-Touny,A.S.,Ibrahim,A.H.,andAmer,M.I.(2014).“Estimatingcostcontingencyforhighwayconstructionprojectsusinganalytic

ISSN- 2394-5125 VOL 6, ISSUE 07, 2019

hierarchyprocess."*Int.J.Comput.Sci.Issues*,11(6),73.
11. Flyvbjerg, B., Bruzelius, N., and Rothengatter, W. (2003). *Megaprojectsandrisk:Ananatomyofambition*,CambridgeUniversityPress,Cambridge,U.K.