

PERIL DISSECTION CHIC FOR ROAD CONSTRUCTION PROJECT:

A Case Study Construction of the UpGradation of Road From Kerehuba to Runguzu Nasa Under NLCPR. Phase –I

Mr. Molay Reja¹, Prof Ashish P. Waghmare(PG Guide)²,

¹ M.E (construction and management) ² Assistant Professor, M.E (construction and management)
Dr D Y Patil School of Engineering & Technology, Savitribai Phule Pune University.

Abstract- In Indian scenario of infrastructure industry, there is a colossal vocation of peril analysis knacks and tools available for the management of affliction. In dogma, each peril analysis knack has its strengths and weaknesses. Knacks such as Probability Theory, Certainty Factors and Dempster-Shaffer theory of evidence are discussed with regard to their application to peril analysis in road projects. Suggestions on the most appropriate tools associated with the knacks are also presented. The mighty and emaciation of each knack are highlighted and discussed. This paper inferred the peril to be determined in project.

Index Terms- Peril analysis, construction, road projects, knacks, uncertainty.

I. INTRODUCTION

Peril management and peril planning are used interchangeably to describe a sequence of analysis and management activities focused on creating a project specific response to the inherent perils of developing a new capital facility. It can be scrutinize in different ways. Peril management is the discipline of identifying, monitoring and limiting perils. Peril management in infrastructure project is an organized method for identifying and measuring peril and for selecting, developing, and implementing options for the handling of peril. It is a process, not a series of events. Peril management depends on peril management planning, early identification and analysis of perils, continuous peril tracking and reassessment, early implementation of corrective actions, communication, documentation, and coordination .Though there are many ways to structure peril management, this book will structure it as having four parts: Planning, Assessment, Handling, and Monitoring. As depicted in Figure1 all of the parts are interlocked to demonstrate that after initial planning the parts begin to be dependent on each other.



Fig: 1 Elements of Peril Management

All these steps are interconnected and are part of a system, which means each should be properly addressed so as to enable an effective operation of the whole. Peril analysis aims to estimate or assess the likely outcomes or impacts of perils under consideration, in case they materialize.

II. PERILS IN CONSTRUCTION PROJECTS IN NORTH EAST INDIA

India's north eastern region, where the road ministry has made ambitious plans to improve road infrastructure, including an accelerated road development program is witnessing a lack luster demand from private road developers, largely due to security concerns and threats from local terrorist groups. Road developers have been staying away from road projects in the region as officials have been kidnapped and ransoms demanded for, in addition to machinery and equipment being burnt down by local

terrorist groups. The private sector is not interested in road projects here and they have to arrange for protection money. They are not interested in taking the perils and we do not think the problem can be resolved soon. India's road sector has been suffering since the past few years largely due to inactive participation from the private sector developers due to funding constraints. In addition, land acquisition has also become a major concern in Asia's third largest economy. There is a higher execution peril in the region but we think developers factor in these perils. There are other concerns such as labor and geographical constraints which has made the implementation of projects difficult. Others challenges things are Geographical dispersion, significant number of players, technical variability, technical complexity and large number of inputs are some of the variables that make construction projects defy. As a result of these interconnections the enumeration and peculiarity of perils tend to be toilsome. Peril classification is not a consensual exercise even among the construction community but the most important issue is the recognition of perils and the need to tackle them so as to increase the chance of project success. From this reasoning, it

follows that it is fundamental to identify the most effective knacks to perform the operation.

III. NATURE OF ROAD PROJECTS PERILS IN NAGALAND

(Construction of the UpGradation of Road From Kerehuba to Runguzu Nasa Under NLCPR. Phase – I):

Kerehuba to Runguzu Nasa Road project in Nagaland perils were classified in accordance with source as technical, legal, natural, logistic, social, economic, financial, and commercial and political. The road project starts from Kerehuba near the District Headquarter Phek and traverses through the villages of Shorhuba, Thevopisu, Runguzu Naghu and finally ends at Runguzu Nasa on the Kohima Zunheboto State Highway. Up Gradation of this road has been a long standing demand of the people of Phek District as this road will serve as the shortest possible route to connect the District Headquarter Phek to Chozuba and Chetheba ranges as well as commuter travelling to the state capital Kohima from Phek and beyond.

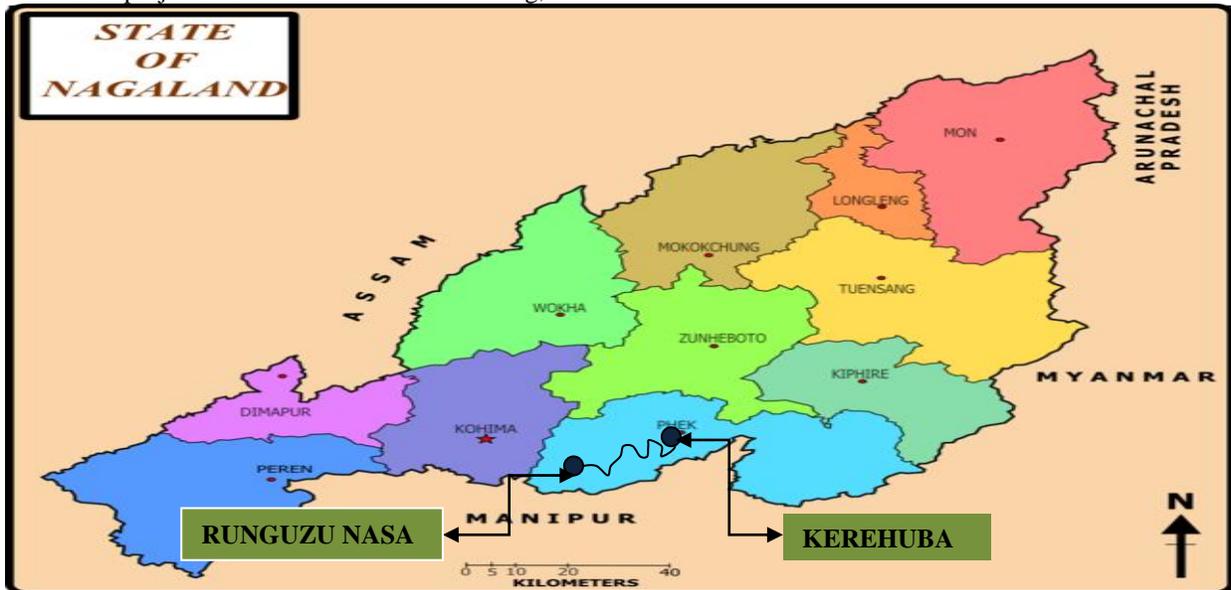


Fig: 2 Location of road

In order to facilitate the analysis and reduce the number of classes, these perils can be grouped at a higher level in the breakdown structure using the concept of environment layers. Before that is done it is important to present some important concepts. Following the project perils are assumed to be associated with the internal, operational and general environments. Projects perils are, therefore, classified

according to their primary source or cause and the environmental layers as:

- ✓ Industries Peril Factors
 1. Material Delay
 2. Labor Problem
 3. Equipment Break down

- 4. Estimator Error
 - 5. Management faux pas
 - 6. Flaw Construction
 - 7. Finance
- ✓ Catholic Peril Factors
 - 1. Environmental Issue
 - 2. Economic
 - 3. Political Issue
 - 4. Competition
 - 5. Project/Design
 - 6. Construction
 - 7. Estimation
 - 8. Scheduling
 - ✓ Acts Of God
 - 1. Heavy Floods;
 - 2. Massive Landslides;
 - 3. Earthquakes, And
 - 4. Others.

IV. CONVENANT KNACKS FOR PERIL PERSONATING AND DISSECTION

The kinds of perils that permeate construction of road projects have been presented and briefly described. Project managers have been confronted with the choice of right peril analysis knack. It is important for a manager for choosing appropriate knacks for different kind of peril as Acts of Gods peril modeling is not smellier to the model of industries specific peril. Though the outcome is linear but the sources are different. To substantiate the above parameter of peril, the dissection used is apropos commencing. The analysis is expected to shed some light on the diversity of modeling and analysis perspectives as well as their effectiveness.

V. PROBABILISTIC ANALYSIS KNACK

Probability analysis tools one of the most sophisticated methods of identifying the construction peril. As such, probabilistic modeling and analysis has been the prominent way to handle perils regardless their nature. Probability is a mathematics deals with random variables. As such, it deals with stochastic processes and events through frequents, outcomes of repeated experiments, and subjective views. Probability theory has been widely used to model precisely described, repetitive experiments with observable but uncertain outcomes. Normal distribution is one of the tools to finding out the uncertainty of landslides occurrence etc. Fig.3 shows the landslide occurrence or not occurrence.

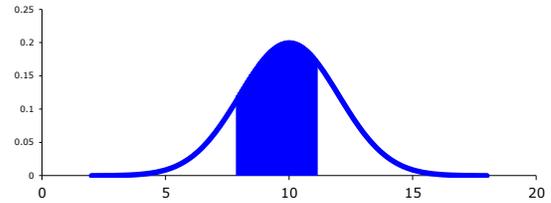


Fig. 3 Normal distribution curve

VI. INDUSTRIES PERILS

A more disciplined process involves using checklists of potential perils and evaluating the likelihood that those events might happen on the project. Some companies and industries develop peril checklists based on experience from past projects. These checklists can be helpful to the project manager and project team in identifying both specific perils on the checklist and expanding the thinking of the team. The past experience of the project team, project experience within the company, and experts in the industry can be valuable resources for identifying potential peril on a project.

Identifying the sources of peril by category is another method for exploring potential peril on a project. Some examples of categories for potential perils include the following:

- 1. Technical
- 2. Cost
- 3. Schedule
- 4. Client
- 5. Contractual
- 6. Weather
- 7. Financial
- 8. Political
- 9. Environmental
- 10. People

The people category can be subdivided into perils associated with the people. Examples of people perils include the peril of not finding the skills needed to execute the project or the sudden unavailability of key people on the project. David Hillson [1] uses the same framework as the work breakdown structure (WBS) for developing a peril breakdown structure (RBS). A peril breakdown structure organizes the perils that have been identified into categories using a table with increasing levels of detail to the right. Industries perils are related to the internal environment of industries and these are supposed to manage them. Industries level of knowledge about the operations is significantly higher than other type of peril. Indeed, issues such as planning, finance, human resources, equipment and materials logistics are dealt with on a daily basis. Industries can conduct operations studies in order to build robust databases

and learn systematically. Very often databases are used as a means for routine programmed decision making. The large quantity of information obtained in this way can be retrieved in order to make probabilistic estimates. For example, important aspects such as labor productivity and cost can be estimated in probabilistic terms in the planning process through probability distributions. From this point of view, it appears that probabilistic modeling and analysis is suitable for this kind of perils. As a great deal of knowledge is available, predictions about the likelihood and impacts of perils can be made with some degree of certainty. The prominent uncertainty associated with industries related perils is assumed to be eminently random. In term of tools, simulation and analytical models can be utilized for peril modeling analysis. One of the most effective tools for this purpose would be Decision Support Systems – DSS, which are computer information systems that provide information in a given domain of application by means of analytical decision models and databases, in order to support a decision making in complex and ill structured problems.

VII. GLOBAL PERIL FACTORS

Global peril factors are beyond industries' control. They relate to a more complex, erratic and dynamic environment. As such, the possibility for collecting data and information in order to draw useful lessons becomes limited. Even taking into account the cyclic nature of some factors such as economy ups and downs, it is very difficult to make reasonable estimates about them. Although there have some attempts to estimate the degree of peril associated with global perils the amount of available data make the exercise difficult. An example of probabilistic modeling applied to global peril factors is the production of political peril indices covering a large number of countries around the world as explained by Bremmer⁹. The exercise has been conducted and the results marketed systematically over the years. The indices measure the stability perception over specific countries and aim to help investors and other interested parties in their business decision making. Political variables are complex and dynamic and, as consequence, very difficult to grasp. In general, political phenomena are rarely repetitive, which creates serious challenges for effective modeling. The same applies to the economic and social variables. Furthermore, political, economic and social events are rarely mutually exclusive, exhaustive and conditionally independent. First, there have been strong interrelationships among these variables. Economy, for example, is strongly associated with social and political events. In the light of these characteristics it can be concluded that probabilistic

modeling of global peril factors poses serious challenges in terms of robustness and validity. The uncertainty inherent in this group of peril factors is much more epistemic rather than random.

VIII. ACTS OF GOD

Acts of God are generally classified as ‘*force majeure*’ under the contractual terms, because no party is supposed to be able to manage them and, consequently, bear the associated costs. They represent extreme events stemming from nature and, as such, tremendously difficult to predict. It would be important for a contractor, for example, to know the likelihood of an earthquake striking and disrupting construction works. Unfortunately, such estimates are not available. That is the reason why the best response strategy to this type of peril has been transfer to a third party. Attempts have been made to predict the probability of occurrence of these events, but very little progress has been achieved so far. Concerns over the problem have led analysts to develop some probabilistic models but, it should recognized, these can hardly be robust due to prevailing nature of uncertainty. Therefore, such estimates may be precise but not accurate. In addition, since most nature related peril factors are poorly defined and fuzzy in nature they cannot be evaluated with such high precision inherent in numerical expressions. These models have used subjective probabilities instead of objective ones, as the latter are difficult to obtain due to lack of data. The fact that subjective probabilities cannot be distinguished from objective ones once in the model, is likely to hinder the quality of the analysis. There is guarantee that subjective probabilities capture uncertainty effectively. As a result, probabilistic modeling and analysis of nature related perils is debatable.

IX. CERTAINTY THEORY ANALYSIS KNACK GLOBAL PERIL FACTORS AND ACTS OF GOD

As previously shown, while industries related peril factors can be well modeled through probabilistic means, global perils and Acts of God are far more difficult to handle in the same way due to the inherent kind of uncertainty and scarcity of data and information. MYCIN (an expert system for the diagnosis and therapy of blood infections and meningitis) introduced certainty factors theory, based on belief MB(H, E) and disbelief MD(H, E). These functions indicate the degree to which a belief/disbelief in hypothesis H would be increased by observing E. $MB(H, E) = (1 \text{ if } p(H) = 1 \text{ max}[p(H|E),p(H)]-p(H) \text{ max}[1,0]-p(H) \text{ otherwise}$
 (11) $MD(H, E) = (1 \text{ if } p(H) = 0$

$\min[p(H|E),p(H)]-p(H)$ $\min[1,0]-p(H)$ otherwise
 (12) To determine the total strength of belief or disbelief, we use the following equation: $cf = MB(H, E) - MD(H, E) 1 - \min[MB(H, E), MD(H, E)]$. (13)
 Certainty theory is mainly a theory for handling uncertainty in knowledge based systems KBSs. It was developed in attempt to overcome some of the weaknesses of the so called idiot Bayes approaches for inexact reasoning, according to Duda.¹⁰ Certainty theory relies on defining judgmental measures of belief rather than adhering to strict probability estimates. Therefore, certainty factors (CF) are not probabilities but informal measures of confidence for a piece of evidence. They represent the degree to which people believe that the given evidence is true. In other words, they express how accurate, reliable, truthful people judge statements or evidences. Certainty theory fundamentals are the concepts of certainty measures which are associated with factual statements .The certainty measures or factors CFs consist of numbers ranging from -1 to +1 and factual statements, (rules). A negative value of the certainty factor indicates that one believes that a fact is not true and a positive value indicates the one believes that a fact is true with complete knowledge. $CF = 1$, there is complete certainty that a proposition is true $CF = -1$, there is complete certainty that a proposition is false $CF = 0$, there is no information at all about or no change in belief $1 < CF < 1$, measure of the degree of belief about the proposition with decreasing and increasing beliefs respectively. Global peril factors and Acts of God in engineering projects can be modeled using CFs within knowledge based systems, where the following format is common: If *A* Then *B* with certainty factor $CF = CF(\text{rule})$, where *A* is the antecedent and *B*, the consequent. The antecedent comprises facts (evidence) that support the derivation of the consequent (hypothesis). The CF is the net degree of belief in hypothesis, given that the evidence

is observed (given). For example: If the rate of inflation increases then the prices will be high $CF = 1$, where the rate of inflation increases is the evidence and the prices will be high is the consequence. The degree of belief associated with the rule is 1, which means the analyst is 100% sure.

X. DEMPSTER SHAFER THEORY OF EVIDENCE ANALYSIS KNACK

The Dempster Shafer theory is based on two ideas: the idea of obtaining degrees of belief for one question from subjective probabilities for a related question, and Dumpster’s rule for combining such degrees of belief when they are based on independent items of evidence. To illustrate the idea of obtaining degrees of belief for one question from subjective probabilities for another, suppose I have subjective probabilities for the reliability of my friend Betty. My probability that she is reliable is 0.9, and my probability that she is unreliable is 0.1. Suppose she tells me a limb fell on my car. This statement, which must true if she is reliable, is not necessarily false if she is unreliable. So her testimony alone justifies a 0.9 degree of belief that a limb fell on my car, but only a zero degree of belief (not a 0.1 degree of belief) that no limb fell on my car. This zero does not mean that I am sure that no limb fell on my car, as a zero probability would; it merely means that Betty's testimony gives me no reason to believe that no limb fell on my car. The 0.9 and the zero together constitute a belief function.

XI. SUMMARY OF THE KNACKS

The strengths and weaknesses of the knacks that have been discussed are summarized in Table 1. For each of therefore peril analysis knacks, the evaluation of type of peril, prominent uncertainty and tools to be employed are shown.

Sr.No.	Technique	Modeling and Analysis Suitability			
		Peril Groups			Probability of Uncertainty
		Industry (A)	Global (B)	Acts of God(C)	
1	Probablity	Very Good	Very poor	Very poor	Random A
2	Certainty Factor	Very poor	Good	Good	Epistemic B & C
3	Dempster_Shaffer	Poor	Good	Good	Epistemic B & C

Table 1 : Summary of peril analysis techniques and tools.

The indications provided in the table constitute a guide on what a specific knack can help to manage. For example, probabilistic modeling can be effectively to model industries specific and global perils factors where the underlying uncertainty is

mainly random. For that purpose Decision Support Systems DSS seem to be the most appropriate tools. On the other hand, probabilistic modeling is very poor in tackling natural events or Acts of God as data for these is scarce and frequently unavailable. The

same procedure is followed with regard to other peril analysis knacks.

XII. CONCLUSIONS

The importance of managing construction of road project engineering peril factors has been discussed. An extensive analysis of construction projects implementation with emphasis on cost performance has triggered work on peril modeling and analysis. It has been concluded that the nature of perils under consideration is determinant in the selection of modeling and analysis knacks. As it has been shown, not all uncertainty is random in nature. A great deal of engineering management and technical issues do not comply with randomness properties. They are mainly cognitive and thus do not lend themselves to precise measurement. Three groups of peril factors inherent in construction engineering projects have been presented and explained. It is understood that the nature of the peril factors is diverse and thus their handling requires appropriate knacks and tools. Indeed, the type uncertainty associated with each of the groups differs. While industries specific peril factors can be effectively modeled through probabilistic analysis, uncertainty underlying global and acts of god peril factors appears to be much more difficult to capture using the same approach. The uncertainty type associated with the latter peril factors derives mainly from reduced knowledge rather than natural variability. As such, epistemic uncertainty handling knacks are likely to be more effective than probabilistic approaches. Several uncertainty modeling knacks namely uncertainty theory and Dempster Shaffer Theory of Evidence have been discussed with emphasis on appropriateness and robustness. Although there is no consensus on the applicability of these knacks to bridge the gap between the ideal and feasible solutions provided by the probabilistic analysis, it appears that they can be employed for such purpose. In particular, Dempster Shafer Theory is capable of modeling epistemic uncertainty through belief and membership functions. Nevertheless, research is required to ascertain the extent to which these and additional knacks can be applied to improve construction engineering perils modeling and analysis.

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