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Research paper

Analysis of time overruns in roads and highways sector in India using AHP ranking technique

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Abstract

In today's scenario there will be a competition exists among various construction firm, so the risk management come into picture to assess the various risk related to project. Assigning the right severity factor as per the possibility of occurrence will impart the success of organization as well as success will impart the growth of nation with increase in G.D.P. In construction of road the assessment of right severity factor, will be considered as strength to lower down the delay of time over run. Tremendous amount of effort are applied in quantitative and qualitative manner for assessment of risk severity factor. However, many criteria for risk severity factor enable the decision making methods will smoothen the process of arriving at a solution and enable decision makers to make the right decisions. Decision-making problems need systematic approach to appraise the various alternatives using quantitative and non quantitative factors. Standard methods for solving problems will lack considerations of non-quantitative factors, where numeric values are difficult to assign. Different techniques like, Analytic Hierarchy Process (AHP), Fuzzy set theory Making and Multi Criteria Decision are being used in risk severity factor. These techniques consider factors with concrete values or vague values. This research will provide solution to a risk severity factor for budget allocation problem, for allocating funds to competing and deserving organizations by using ranking analysis technique. Fuzzy set theory and AHP is used to calculate the Weights .Fuzzy set considers subjective values like preferred, strongly preferred etc. and Analytic Hierarchy Process (AHP) technique evaluates relative importance of factors by making pair wise comparison matrix. The evaluation technique will facilitate in ranking of various severity factors according to their possibility of occurrence after assigning weights to decision making factor.

Keywords: *AHP (Analytical Hierarchy Process); MCDM (Multi Criteria Decision Making Approach); Ranking and Severity Analysis.*

1. Introduction

India is developing country and transportation forms the cornerstone of the Indian Economy. Other modes of transportation may be used for long range but for door to door operation the transportation mode is one which majority of population use. Road construction enhances the integral part of the infrastructure and also responsible for nearby vicinity development [1].
Construction project, from inception to closure, encounter numerous risk that may affect the completion time of project. These risks may relate from initiation phase of project and probability of occurrence may be throughout project life cycle. These risk are unique in nature and there occurrence may vary from project to project. Managing the risk in construction project is considered as a very crucial process in order to minimise the risk throughout project life cycle. The occurrence of risk will be enhanced in two manner probability or likelihood of occurrence and there consequences or impacts if it does. Management of risk is an integral part of achievement of good business and successfully completion of project which directly affects the cost. Risk management provides a structured way of dealing and forecasting with uncertainty. The fuzzy logic method is often used in the analysis of such data. The Fuzzy AHP method, which is one of the multi-criteria decision making methods was used to positioning the rank to various associated risk in National Highway Road Project [2].

The occurrence of risk in the various phases of project termed as:

- Pre-feasibility phase.
- Feasibility phase.
- Execution phase.
- Operation phase.

These are the basics criteria for emphasising the risk, integration of risk will be more so that it must be analysed and solved in individual phase of project. The road and highway are the very complex project minor error shall be responsible for major loss [3].
As per the guideline preliminary phase in which the over-view of project should be seen it is in the form of various availability of various facility nearby the area of the site ,various source of material and availability of natural resources. If it allows then the further study shall be carried out in detail manner and accordingly the assessment of risk shall be a carried out. This is followed by the each phase of project [4].

2. Need for study

India is developing country increment in the stretch length of road network is worked out on wider basis and assessment of risks become very important factor to minimise the risk as well as time over run.

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3. Objective

To conduct micro level analysis of risk prone phase of road projects with the help of mathematical tool as well as expertise view.

4. Literature review

As per the observation and analysis of this paper Risk planning in construction of highway project. It will emphasise the different phase of project life cycle for the implementation of effective risk management planning in construction of highway project. Study on Risk planning on construction of highway project [5].
As per the observation and analysis of this paper Risk management for national highway project .The nature of work will be very complex in road sector while utilizing these technique one can assess the severity of risk in whole project life cycle and accordingly to mitigate the risk impact one can work with help of ranking of risk. Study of Risk management for national highway project [6]
As per the observation and analysis of this paper risk management in the infrastructure project in India the main Moto of risk assessment is to minimize the shortfall of risk to achieve the target in terms of Time ,Cost and quality . Risk policy will be introduced to mitigate the risk throughout project life cycle. Study on Risk Management in infrastructure project in India [7].

5. Methodology

a) FUZZY-AHP Method

The analytic hierarchy process (AHP) is a systematic technique for the purpose of analyzing and organizing complex decision making technique based on data evaluation in terms severity factor and psychology. The scientist who developed this method is Thomas Saaty in the year 1970s and the method has been continuously studied and refined since then.[8] It will not prescribing the "correct" decision but probably it will be one of the best method applying to the goal and understanding of the problem[5]. It provides a comprehensive and rational framework for structuring a decision making problem, for representing and quantifying its elements, understanding relations of those elements to various goals, and for assessing alternative solutions.
To solve the decision problems with AHP, the following are some steps which are mentioned below [9].
STEP 1: Determination of geometric mean of the data collected.
STEP 2: A comparison matrix between factors is formed, which is an nxn dimensional square matrix. The matrix components on the diagonal of this matrix take value 1.
STEP 3: Determine the weight of each factor.
After collection of the expert views & compiling data collected, next is to determine the weight of each factor. Weights are calculated by applying AHP method technique. First revise comparison matrix, compare the importance of one alternative than other.
STEP 4: Percentage distribution for importance of the criteria is determined
Comparison matrix determines importance levels of factors to each other within a certain logic framework. Calculating the weight of these factors in total, in other words to determine the percentage importance distribution.
STEP 5: Calculation of most probable value.
As per the data collected in terms of various ranking assign to the for the different types of questionnaire we will assign the ranking with the help of AHP-FUZZY

Table 1:

Factor ID(A)	VARIOUS SEVERITY FACTOR	GEOMETRIC MEAN C
1	Law and order situation/Security threats/Local Agitations	3.567958
2	Land acquisition delays	3.375707
3	Change in government policies affecting project	3.902599
4	Delay in Center/State government document clearance process	2.502215
5	Change in political power at State/ Center	2.864157
6	Excessive bureaucracy with organization	1.960781
7	Favoritism in consultant/contractor selection	1.742024
8	Price fluctuations due to Inflation	4.043857
9	Global/National Economic crises	3.518009
10	Lack of project funding	3.192508
11	Improper project feasibility study	2.651692
12	Project complexity (Project type, project scale,etc)	3.799014
13	Change/Transfer of project personnel during project execution	2.41744
14	Force majeure activities/unforeseen circumstances	2.531694
15	Unrealistic contract/project duration	1.716488
16	Haste in preparing project design	2.131215
17	Delay in selection of PMC/contractors/suppliers	4.165288
18	Issues in client procured materials	1.610862
19	Ignorance in penalizing for delay	1.84455
20	Wrong Type of project award (Turnkey,BOT,etc)	1.67633
21	Lackadaisical attitude towards work completion	1.90676
22	Coordination with foreign consultants	2.058957
23	Environmental concerns and restrictions	4.094911
24	Geological problems on site	3.492622
25	Poor site access	1.820024
26	Lack in follow-up procedure with government to start project	2.152002
27	Improper conflict resolution process adopted	2.938057
28	Severe weather conditions at site	2.800151
29	Ambiguous project requirements	2.190524
30	Improper contractor/Consultant selection	2.728591
31	Delay in progress payments	3.05378
32	Frequent project scope/Design changes	3.301318
33	Slow decision making process	3.728198
34	Lack of competent/expert project domain people	2.16008
35	Delay in finalization of rates for extra items	3.016275

After collection of the expert view for these all questionnaire followed by compiling of data collection, next is to determine the

weights for each factor. So that pair wise comparison matrix is formulated. With the help of this matrix we are in a position to compare the important of one matrix over other [10].

b) Sample calculation

C1/C1=3.567958/3.56958 (This will be shown in horizontal order in a matrix). =1

Again C1/C2=3.567958/3.375707 (This the reverse order). =1.05695.

With the help AHP method we are in a position to get the various severity factor for these data .To understand the below matrix, let us take the case of another matrix

Consider

C34/c34=2.16008/2.16008 =1

C34/c35=2.16008/3.016275 =0.71614.

Basically comparison is made between both each of factors to relative one from C1to C35.The diagonal element have value one.

Evaluation of weight age:

c) Determination of matrix.

Table 2:

FINAL RESULT OF SEVERITY FACTOR			
NO.	Severity factor of column 1	Final result of severity factor	RANK ODER
C1	1	0.03691374	7
C2	0.946117359	0.0349	10
C3	1.093790622	0.0404	4
C4	0.701301697	0.0259	21
C5	0.802744035	0.0296	16
C6	0.549552713	0.0203	28
C7	0.488241173	0.0180	32
C8	1.133381335	0.0418	3
C9	0.986000676	0.0364	8
C10	0.894771743	0.0330	12
C11	0.743195968	0.0274	19
C12	1.06475861	0.0393	5
C13	0.677541608	0.0250	22
C14	0.709563846	0.0262	20
C15	0.481084138	0.0178	33
C16	0.597320652	0.0220	26
C17	1.167415087	0.0431	1
C18	0.45148009	0.0167	35
C19	0.516976377	0.0191	30
C20	0.469828961	0.0173	34
C21	0.53441212	0.0197	29
C22	0.577068732	0.0213	27
C23	1.14769036	0.0424	2
C24	0.978885402	0.0361	9
C25	0.510102417	0.0188	31
C26	0.603146674	0.0223	25
C27	0.823456162	0.0304	15
C28	0.784804922	0.0290	17
C29	0.613943326	0.0227	23
C30	0.764748632	0.0282	18
C31	0.85589012	0.0316	13
C32	0.925268179	0.0342	11
C33	1.044910843	0.0386	6
C34	0.605410714	0.0223	24
C35	0.845378505	0.0312	14

d) Ranking of Factor

Table 3:

Sr. No	Ranking According To Order	severity factor	Rank	Severity Factor
C1	Delay in selection of PMC/contractors/suppliers	0.0431	1	Very High
C2	Environmental concerns and restrictions	0.0424	2	Very High
C3	Price fluctuations due to Inflation	0.0418	3	Very High
C4	Change in government policies affecting project	0.0404	4	Very High
C5	Project complexity (Project type, project scale, etc)	0.0393	5	High
C6	Slow decision making process	0.0386	6	High
C7	Law and order situation/Security threats/Local Agitations	0.0369	7	High
C8	Global/National Economic crises	0.0364	8	High
C9	Geological problems on site	0.0361	9	High
C10	Land acquisition delays	0.0349	10	High
C11	Frequent project scope/Design changes	0.0342	11	High
C12	Lack of project funding	0.0330	12	High
C13	Delay in progress payments	0.0316	13	High
C14	Delay in finalization of rates for extra items	0.0312	14	High
C15	Improper conflict resolution process adopted	0.0304	15	High
C16	Change in political power at State/ Center	0.0296	16	High
C17	Severe weather conditions at site	0.0290	17	Moderate
C18	Improper contractor/Consultant selection	0.0282	18	Moderate
C19	Improper project feasibility study	0.0274	19	Moderate
C20	Force majeure activities/unforeseen circumstances	0.0262	20	Moderate
C21	Delay in Center/State government document clearance process	0.0259	21	Moderate
C22	Change/Transfer of project personnel during project execution	0.0250	22	Moderate
C23	Ambiguous project requirements	0.0227	23	Moderate

C24	Lack of competent/expert project domain people	0.0223	24	Moderate
C25	Lack in follow-up procedure with government to start project	0.0223	25	Low
C26	Haste in preparing project design	0.0220	26	Low
C27	Coordination with foreign consultants	0.0213	27	Low
C28	Excessive bureaucracy with organization	0.0203	28	Low
C29	Lackadaisical attitude towards work completion	0.0197	29	Very Low
C30	Ignorance in penalizing for delay	0.0191	30	Very Low
C31	Poor site access	0.0188	31	Very Low
C32	Favoritism in consultant/contractor selection	0.0180	32	Very Low
C33	Unrealistic contract/project duration	0.0178	33	Very Low
C34	Wrong Type of project award (Turnkey,BOT,etc)	0.0173	34	Very Low
C35	Issues in client procured materials	0.0167	35	Very Low

6. Conclusion

As per the data available based on expertise view as well as analysis of data with help of AHP technique we are in position to assess the various phase of risk cover throughout life cycle of project if we take into consideration as per the value of factor ID C1 has been assigned as very high risk categories till factor C4. These are the major categories of risk which cause delay in highway sector for initiation of project. Similarly if take into consideration the second most effective factor which is termed as C5 shall be also seen on micro level because assessment of risk is dynamic in nature we don't know what is coming next occurrence because as per the stretch length should increase accordingly the monitoring of risk prone area shall be taken into consideration in advance so it will not going to affect the schedule time for achievement of milestone on time. Once again our Moto to priorities this risk factor is to client or employer should look directly and very high risk prone area should be taken into consideration to save the time and cost effectively.

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