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AN INTEGRATED APPROACH FOR ENHANCING READY MIXED CONCRETE UTILITY USING ANALYTIC HIERARCHY PROCESS (AHP) AND TECHNIQUE FOR ORDER PREFERENCE BY SIMILARITY TO IDEAL SOLUTION (TOPSIS)

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ABSTRACT

For Analytic Hierarchy Process (AHP) technique questionnaire include comparison of factors on 1 to 9 scale. In this technique, for each criteria questions should be asked. A numerical weight is derived for each element of the hierarchy, allowing diverse and often incommensurable elements to be compared to one another in a rational and consistent way. Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) selects the alternative that is the closest to the ideal solution and farthest from negative ideal alternative. To apply TOPSIS to our problem, numeric score is required to generate for each criteria. So, each criteria were given an evaluation scale from 1 to 9. Evaluation pattern was decided and finalized with expert advice. The respondents were selected from various construction occupancy mainly Ready Mixed Concrete (RMC) Plant Managers, Consultants and contractors. Total 100 Survey Questionnaires were distributed to Respondents in Anand, Nadiad, Vadodara, Ahmedabad, from which 60 Responses were collected as per sample size calculation, in that 21 were from Ready Mixed Concrete (RMC) Plant Managers, 26 were from Consultants and 13 were from Contractors. The result shows that there is a contradiction in Respondents ranking by two techniques. So, Researchers have to trust on any one methodology.

KEYWORDS: Analytic Hierarchy Process, Numerical Weight, Technique for Order Preference by Similarity to Ideal Solution, Respondents, Ready Mixed Concrete, Respondents, Questionnaires.

INTRODUCTION

The growth prospect of Ready Mixed Concrete(RMC) is enormous,provided requisite support is given by the regulatory authorities, consumers anddecision makers. At the present, the cost

differential between Ready Mixed Concreteand site mixed concrete is proving a major constraint in its growth. This problem willbe resolved with the increasing awareness about the advantages of Ready Mixed Concrete by the endconsumers.

It is never expected that a Ready Mixed Concrete (RMC)can be perfect, meeting allReady Mixed Concrete selection Criterias. For example, Ready Mixed Concrete mayhave a high quality, but the cost of the Ready Mixed Concrete may not be the lowest.On the other hand, another Ready Mixed Concrete cost may be the lowest, this is verygood for a company, but at the same time the delivery performance may be the worst.As seen from the example, for making good decisions, the Ready Mixed Concreteselection process must be handled systematically.

NEED OF THE STUDY

Present approach lacks scientific methodology and does not consider multi-criteria in decision making. There is a need of scientific methodology for Ready Mixed Concrete selection approach.

Hence, the need of this Research work based upon various utility measures like quality control, cost, delivery, quantity at which owners or plant managers have to concentrate for enhancing profit as well as maintaining standard by Analytic Hierarchy Process (AHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS).

OBJECTIVES OF THE STUDY

1. To Study,Analytic Hierarchy Process (AHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS).
2. To derive the relation between various Criterias for enhancing utility of Ready Mixed Concrete.
3. To achieve optimization by Analytic Hierarchy Process (AHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS).

SCOPE OF THE STUDY

The scope of this research work of development of Ready Mixed Concrete selection process is limited to four cities of Central Gujarat Region of India: Ahmedabad, Nadiad, Anand, and Vadodara.

RESEARCH METHODOLOGY

The relevant data for this investigation were collected by a structured, close-ended questionnaire survey. From the study of past research work and with the help of expert opinion, Criterias were identified which affects Ready Mixed Concrete selection process for construction companies of Central Gujarat Region of India.

ANALYTIC HIERARCHY PROCESS (AHP)

Analytic Hierarchy Process has been a tool at the hands of decision makers and researchers; and it is the most widely used multiple criteria decision making tools. The AHP method is developed by Thomas L. Saaty in 1980. AHP is very popular and widely applicable in various fields due to its simplicity, ease of use and flexibility. AHP is a reliable tool to facilitate systematic and logical decision making processes and determine the significance of a set of Criterias and Sub-Criterias.

AHP method is very suitable for complex social issue in which intangible and tangible factors cannot be separated.

STEP BY STEP PROCEDURE OF AHP

Step-1: Model the problem as a hierarchy containing the decision goal, the alternatives for reaching it, and the criteria for evaluating the alternatives.
Step-2: Establish priorities among the elements of the hierarchy by making a series of judgments based on pair wise comparisons of the elements.
Step-3: Synthesize these judgments to yield a set of overall priorities for the hierarchy.
Step-4: Check the consistency of the judgments.
Step-5: Come to a final decision based on the results of this process.

TECHNIQUE FOR ORDER PREFERENCE BY SIMILARITY TO IDEAL SOLUTION (TOPSIS)

TOPSIS (for the Technique for Order Preference by Similarity to Ideal Solution) was developed by Yoon and Hwang [1980] as an alternative to the ELECTRE method and can be considered as one of its most widely accepted variants.

The basic concept of this method is that the selected alternative should have the shortest distance from the ideal solution and the farthest distance from the negative-ideal solution in a geometrical sense. The method evaluates the decision matrix, which refers to n alternatives that are evaluated in terms of m criteria. The only subjective input needed is relative weights of attributes.

STEP BY STEP PROCEDURE OF TOPSIS

Step 1: Construct the Normalized Decision Matrix.
Step 2: Construct the Weighted Normalized Decision Matrix.
Step 3: Determine the Ideal and the Negative-Ideal Solutions.
Step 4: Calculate the Separation Measure.
Step 5: Calculate the Relative Closeness to the Ideal Solution.
Step 6: Rank the Preference Order.

RESULTS COMPARISON OF AHP AND TOPSIS

Table 1: Overall Ranking of Respondents through AHP and TOPSIS

Rank	Respondents	
	AHP	TOPSIS
1	R34	R3
2	R4	R2
3	R3	R45
4	R33	R47
5	R21	R56
6	R8	R13
7	R37	R30
8	R42	R43
9	R16	R26
10	R44	R53

11	R39	R9
12	R56	R50
13	R53	R10
14	R40	R40
15	R43	R28
16	R30	R18
17	R26	R27
18	R50	R55
19	R58	R58
20	R28	R59
21	R7	R60
22	R18	R31
23	R19	R51
24	R23	R7
25	R10	R24
26	R57	R20
27	R48	R12
28	R25	R35
29	R46	R49
30	R14	R48
31	R51	R34
32	R49	R57
33	R17	R16
34	R15	R8
35	R9	R22
36	R2	R17
37	R20	R5
38	R24	R46
39	R22	R54
40	R5	R33
41	R55	R52
42	R45	R32
43	R29	R19
44	R27	R1
45	R32	R6
46	R47	R38
47	R12	R11
48	R52	R15
49	R54	R29
50	R41	R39
51	R13	R36
52	R11	R37
53	R36	R4
54	R6	R44
55	R60	R41
56	R31	R14
57	R38	R25
58	R1	R23
59	R35	R21
60	R59	R42

CONCLUSIONS

From this research work, following conclusions are drawn

- In AHP Technique result shows that: R34 > R4 > R3 > R33 > R21 > R8 > R37 > R42 > R16 > R44 > R39 > R56 > R53 > R40 > R43 > R30 > R26 > R50 > R58 > R28 > R7 > R18 > R19 > R23 > R10 > R57 > R48 > R25 > R46 > R14 > R51 > R49 > R17 > R15 > R9 > R2 > R20 > R24 > R22 > R5 > R55 > R45 > R29 > R27 > R32 > R47 > R12 > R52 > R54 > R41 > R13 > R11 > R36 > R6 > R60 > R31 > R38 > R1 > R35 > R59. AHP technique gives first five respondents as: (1) Respondent 34, (2) Respondent 4, (3) Respondent 3, (4) Respondent 33, and 5) Respondent 21.
- In TOPSIS Technique result shows that: R3>R2>R45>R47>R56>R13>R30>R43>R26>R53>R9>R50>R10>R40>R28>R18> R27>R55>R58>R59>R60>R31>R51>R7>R24>R20>R12>R35>R49>R48>R34>R57>R16>R8 >R22>R17>R5>R46>R54>R33>R52>R32>R19>R1>R6>R38>R11>R15>R29>R39>R3 >R37>R4>R44>R41>R14>R25>R23>R21>R42. TOPSIS technique gives first five respondents as: (1) Respondent 3, (2) Respondent 2, (3) Respondent 45, (4) Respondent 47 and (5) Respondent 56.
- Finding from this study reveals that there is a contradiction in Respondents ranking by two techniques. So, Researchers have to trust on any one methodology.

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