

**DEVELOPMENT ON FIELD REWORK INDEX TO MINIMIZE THE
IMPACT OF REWORK ON BITUMINOUS ROAD PROJECTS**

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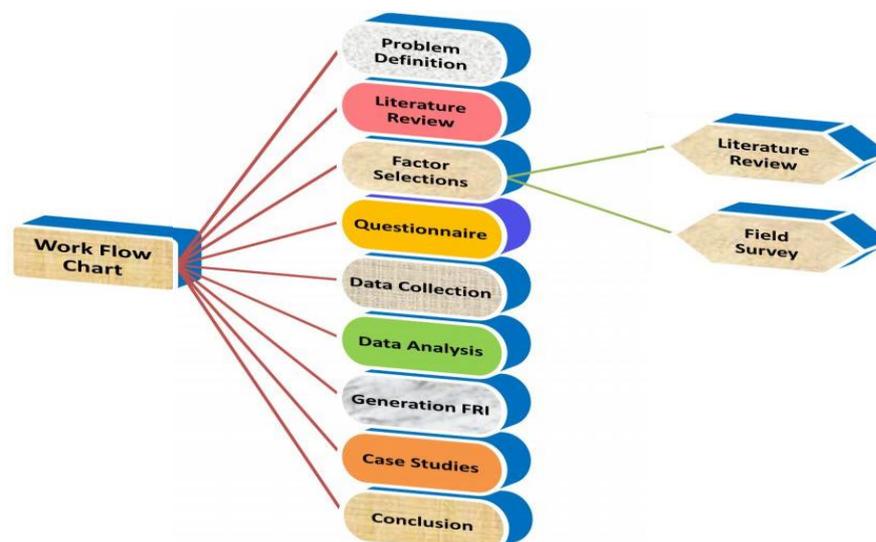
Abstract— The Roadway projects is faced with the significant problems of high cost of project delivery, bad financial performance and inability to deliver value to customers on time. As a result, the projects has been criticized extensively for poor performance and inefficient productivity. “The unnecessary work which incorrectly done for the first time is know as rework”. To investigate the causes of rework in road projects, a total of 52 causes were first identified.150 questionnaire survey was further distributed to stakeholders (owner, site engineer, contractor, labour) out of which 97 people has responded to it. Finally, a factor analysis revealed 14 major factors has been identified by applying IMPI method. Further this 14 factor will be identified with FRI method. In that reduction tool for field rework index (FRI) is developed for effective road work.

Keywords— Road projects, Construction cost performance, FRI, Reducing Rework, Rework

I - INTRODUCTION

The Roadway projects is faced with the significant problems of high cost of project delivery, bad financial performance and inability to deliver value to customers on time. As a result, the projects has been criticized extensively for poor performance and inefficient productivity. “The unnecessary work which incorrectly done for the first time is known as rework”. Rework is a common activity in construction projects and has been identified as one of the factors that can lower the project activity. The Roadway projects is mainly project-based and various problems occurs in the road projects such as dealing with diverse interests of multiple stakeholders and resultant changes. Due to these characteristic complexities of construction, amendments may be deemed inevitable in some instances; however, uncontrolled occurrences of rework and wastages should actually be more effectively controlled. This will essentially improve various targeted objectives of construction project management with respect to timeliness, cost targets and product and service quality. Rework have significant contributor to time wastage and schedule overruns which eventually impact on cost, resources and quality. The rework emerges as overtime, the additional hiring of resources such as labour and plant workers, schedule slippage, and reductions in project scope and quality. The adverse effect of rework include low profit, loss market share, damaged reputation, increased of management and workforce, lower productivity, high costs, costly litigation between participants over responsibility for overruns and delays.

II - WORK FLOW CHART



III - FACTOR CAUSES REWORK

1.	Scope & design changes	27.	Political situation (Siege-conflicts)
2.	Poor project document	28.	Economy (inflation, exchange rates, market)
3.	Incomplete information	29.	Natural climates (Weather, disaster)
4.	Software error/mistake	30.	Physical conditions (Infrastructure, transportation, etc)
5.	Qualification of designer	31.	Inadequate local education
6.	Untimely deliveries	32.	Social (Changing social environment, resistances)
7.	Non-compliance with specification	33.	Technological (techniques, facilities, machines)
8.	Materials not in right place when needed	34.	Failure to implement Quality management Practices
9.	Adulterated materials	35.	Rigidity to improvement Absence of clear uniform standard to accept work
10.	Invalidity of needed	36.	Unclear work
11.	Emergency conditions (siege & closures)	37.	specification
12.	Change in material	38.	Inadequate pre-project planning
13.	Class of material	39.	Constructability problems
14.	Maintenance issue relevant to material	40.	Lack of Audit and control
15.	Misreading of drawings & specifications	41.	Schedule pressures
16.	Low contract value	42.	Late designer input
17.	Attempts to fraud	43.	Not hire project manager for work
18.	Unqualified technically	44.	Lake scheduling of work
19.	Financial weakness	45.	Selection of wrong method
20.	Lack of knowledge of construction process	46.	Excessive overtime
21.	Inadequate briefing	47.	The absence of job security
22.	Lack of funding allocated for consultation	48.	Lack of employee motivation and rewards
23.	Changes because of change in officials	49.	Insufficient training and skill development
24.	Need early completion of work	50.	Unclear line of authority and responsibility
25.	Change of plan	51.	Conflict of interest
26.	Improper supervision	52.	Lack of safety and welfare commitment

IV – RESEARCH METHODOLOGY

IMPORTANCE INDEX (IMPI)

A. Importance Index technique: In this technique, firstly, frequency index is used to rank causes of late based on frequency of event as identified by the participant and secondly severity index is used to rank causes of late based on severity as show by the participant. After that each causes of rework is calculated by both frequency and severity.

B. Frequency index: is used to rank causes of late based on frequency of event as identified by the participants.

Frequency Index (F.I.) (%) = $\sum a (n/N) * 100/4$ (1)

C. Severity index: is used to rank causes of late based on severity as show by the participants.

Severity Index (S.I.) (%) = $\sum a (n/N) * 100/4$ (2)

D. Importance index: The importance index of each cause is calculated by frequency and severity indices, as follows:

Importance Index (IMP.I.)(%) = $[F.I. (%) * S.I. (%)] / 100$ (3)

THE FIELD REWORK INDEX (FRI)

The FRI tool is developed to alert if a project is going through high level of field rework. The FRI is been plan to give warning before starting of project work.

A questionnaire survey was done to develop the FRI, from different road project, list of people was carried out of field rework was first developed and the analysed. The data, consisting of rework measurements, project identified as properly related to field rework, was then developed based on the findings of the road survey.

An analysis was carried out to cause how these liable to change to field rework. The Field Rework Index (FRI) able to resulted from analysis of the data. The research team was able to decide that significant relationships existed between field rework and certain project variables. Table 1 is a list of the project variables (14) related to field.

V - ANALYSIS AND DISCUSSION

TABLE 1: OVERALL IMPI

SR NO.	TOP 14 FACTORS	F.I	S.I	IMPI	RANK
A1	Scope & design changes	57.4	59.4	34.10	1
C1	Misreading of drawings & specifications	55	58.4	32.12	2
F2	Rigidity to improvement	53.6	55.8	29.91	3
B1	Untimely deliveries	57.4	50.8	29.16	4
D1	Lack of knowledge of construction process	55	50.8	27.94	5
F10	Not hire project manager for work	53.8	51.4	27.65	6
D4	Changes because of change in officials	54.8	50.2	27.51	7
B9	Maintenance relevant to material	55.4	49.5	27.48	8
E1	Political situation (Siege- conflicts)	52.6	51.4	27.04	9
D6	Change of plan	49.2	54.4	26.76	10
B2	Non-compliance with specification	50.8	51.2	26.01	11
D7	Improper supervision	49.4	52	25.69	12
G2	Improper supervision	50	51	25.50	13
F3	Absence of clear uniform standard to accept work	49.2	50.4	24.80	14

TABLE 2 : VALIDATION FOR FRI

SR NO.	Rework Questionnaire Index	SCORE	SELECTED SCORE
1.	Are you having a qualified team on your site?	1,2,3,4,5	
2.	Is there change in scope & design during your project?	1,2,3,4,5	
3.	Are you adopting any quality check? At some interval?	1,2,3,4,5	
4.	Are you changing your team of architecture, designer etc. during project?	1,2,3,4,5	
5.	Are you getting planning & designing at pre-defined times?	1,2,3,4,5	
6.	How many times you need to change the original plan with existing plan?	1,2,3,4,5	
7.	Is your supervisor supervising work at regular interval?	1,2,3,4,5	
8.	Are you testing the material before is your site equipped with material storage facilities?	1,2,3,4,5	
9.	Are you using materials as per design & specification?	1,2,3,4,5	
10.	How many time you seen that the delivery was not done on time?	1,2,3,4,5	
11.	Did you follow up all the control & audit as per requirement?	1,2,3,4,5	
12.	While improvement in planning are you considering feasibility?	1,2,3,4,5	
13.	Are you aware with advanced construction process?	1,2,3,4,5	
14.	Are you getting enough time to complete the work/ project?	1,2,3,4,5	

Questionnaire Field Rework Index (FRI) and rework chart are found in Table 2.0 and Fig 1. All answers with a rating of 1 receive 1 point; and so on through to a maximum of 5 points. The score for each question is then combined to give a total score; those with a score between 14 and 70 are grouped according to the FRI score chart. Scoring more than 45 are classified as Rework high stage.

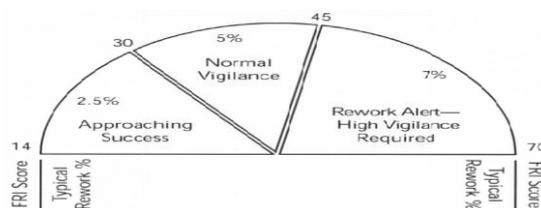


Fig 1:-FRI Scoring Chart

VI - CONCLUSION

The study is Concentrated on Development of FRI for road projects to work as a warning system for Chances of rework. For that after studying various literatures and site visits total 52 reasons of rework have been identified and they were grouped in 7 Major reasons of Rework. Questionnaire including awareness questions and rework reasons were prepared and sent to 150 stakeholders of road projects out of which 97 were received and further they were analyzed by IMPI method to check the Frequency and Severity of Individual factors and on the basis on that Top factors have been identified and by using those factors FRI has been developed which works as Warning System of road projects.

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