Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 06, June - 2017

Identifying and Analyzing Critical Factors in Laying of MDPE Pipeline and GI Work

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Abstract: **The oil and gas sector is one of the core sector in India and plays a major role in influencing decision making for all the other important sections of the economy. The Government of India has adopted several projects and policies to fulfil the increasing demand of oil and natural gas. This paper investigates critical factors in laying of MDPE pipeline and GI work facing by city gas distribution Company in Mumbai. The success of any project depends on three major aspects i.e. cost, quality and time. Time delays lead to increase in variable cost of the project and non-attainment of the targets. In addition to this major constraints scope, resource and risk play significant role. Mumbai is a vast city to convert under PNG connection, daily hundreds of requests for new gas connection pool the system. In order to achieve this huge target proper planning and execution is needed. This report categorizes various phases of project in Gas Company providing domestic gas and analyzes critical factors associated with them with possible solutions. A discussion with people from different areas like ZICs, AICs, Contractors, TPEs and Plumbers, their perceptions have been taken with the help of questionnaires. The need for change in methods of doing work have been discussed to improve the existing ones. There are also various social, political and other internal factors which affects the project completion time. Though the effect of these factors can't be eliminated completely yet it can be minimized to spur the quality work.**

Keywords: Oil and gas, critical factor, ANOVA

I.INTRODUCTION

In organization like oil and gas company having several departments like Planning, PE Project, O&M, Marketing, Human Resource, CRM, Asset, Procurement, Quality, and inventory management etc. which helps to execute operations in the organization. Under PE Project department operations like laying of MP (Medium pressure), LP (Low pressure) line, GI work and last mile connectivity (LMC) are performed. The respective AICs (Area in Charge) set the target for conversions annually. But a deviation from the targeted to the achieved conversion is observed in almost every zone, every year as shown in figure below

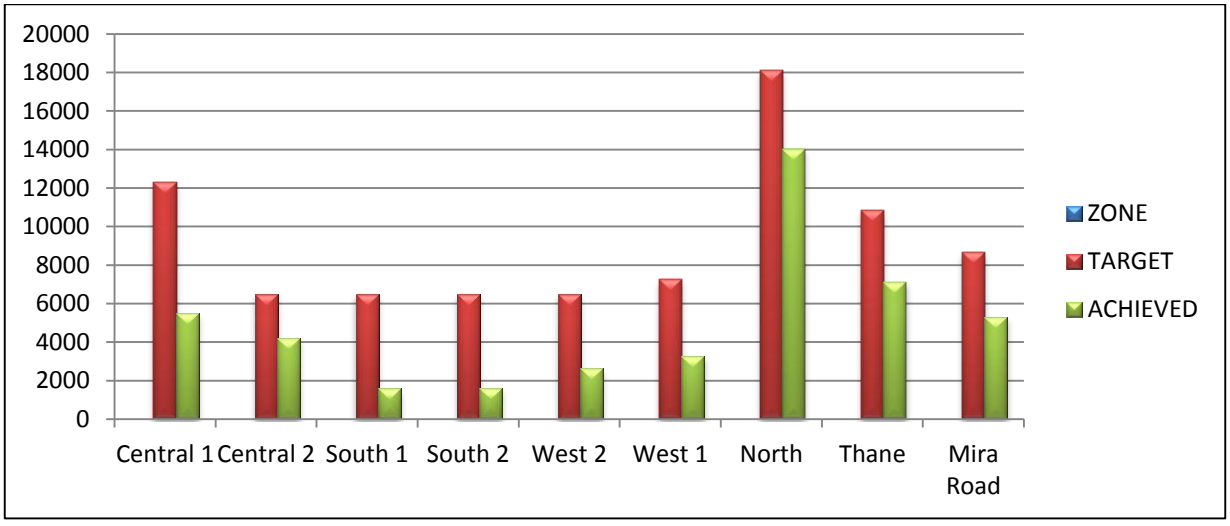

Figure 1: Target versus Achieved Conversion Graph

Graph shows different zones on X- axis and total conversion in that zones on Y axis. Also the different zone contains difference in potential like in north region potential is more as compared to south zone and central zone. In order to meet the set targets it is very important to understand the problems which are hindering from achieving the set targets. Aim of the project was to find out the critical factors which affect the completion time of projects directly or indirectly and suggest possible solutions to the problems. The activities and procedures which come under PE project department are studied, where we came to know about various pitfalls associated with the execution of work on and off site. Different parameters are also analyzed which vary with zones, hence, there is considerable variation in the ease and difficulty levels of execution of projects.

Currently in the company, projects are selected mostly on random basis. There is no standard procedure to set priority for projects. As a result many projects lag behind the time limit and number of projects remain pending. Currently in

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
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most of the zones of the company target actually achieved is 30-40% of the pre-planned target. This causes loss to the company, customer dissatisfaction and drop in employee morale. Employees in the gas plant work with safety as their job priority. Failure in effective communication could be fatal. Literature however addresses the concern that the technical leaders today lack management training (Vieth & Smith, 2008) and opening up to two-way communication poses a big change to an engineer when assuming managerial role (Mhaskar, 2010). As engineers are trained to be task-oriented and highly technical, training such employees people skills i.e. communication skills, can be challenging especially when managing conflicts amongst the employees, and across the departments, to maintain supportive climate. The purpose of this study therefore is to find out critical factors in laying of MDPE pipeline in oil and gas company. As the organization is made up personnel from of various levels and job expertise, the analysis will be conducted in relation to the different levels of the personnel i.e. Management, Executives, Non-executives, and Technical staff.

II.OBJECTIVES

This paper studied a list of critical factors and construction delay causes gathered from literature having different types of construction, different countries, different periods and different numbers of delay causes and delay groups.

Paper aims following objectives

- Study the present situation of MP and LP network and GI work in company
- Identify the most important and least important critical factors in laying of MDPE pipeline
- Identify and assess the severity of the delay causes from contractor, consultant and site/design engineer's perspective
- Identify the possible ways to avoid the delay in execution of work

III.METHODOLOGY

As the research was conducted at natural gas distributing company in India and the organization is located in Mumbai. The study was exploratory in nature and utilized a survey methodology for data collection. The survey designed into four group questioning about the characteristics of critical factors during the pipeline laying in medium pressure (MP) and low pressure (LP) network. Different group's shows critical factors related to 1) Material 2) Waiting time 3) Human related 4) External. As shown in figure each group contains nearly equal number of critical factors.

Questionnaire includes 41 questions in likert type scale which identifies the critical factors.

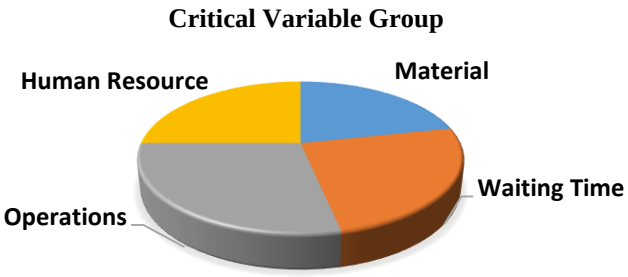

Figure 2

ANOVA technique is used as the multiple sample cases are involved. The ANOVA technique enables us to perform this simultaneous test and as such is considered to be an important tool of analysis in the hands of a researcher. When multiple groups were identified, a single factor ANOVA test was carried between the groups of highest and lowest means. Statistical tests were used to determine the descriptive statistics of the dependent variables. The first test was to investigate whether the sample means of various groups were statistically different or of equal variances.

IV. RESULT ANALYSIS

The survey data was studied using the analysis of variance (ANOVA) in MS Excel software. ANOVA was used to compare samples and to determine if their differences were statistically significant. The confidence level selected for the analysis was set to 95%. ANOVA assumed a null hypothesis, assuming that the means of compared samples were to be statistically equal. For the null hypothesis to be false, the p-value must be less than or equal to 0.05. If the p-value is less than 0.05, the difference between means is considered to be statistically significant (Weinstein, 2007).

International Journal of Engineering Research & Technology (IJERT)
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Table 1 shows the ANOVA analysis for four group. The result were not statistically significant at a significance level of 0.05.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1203.75	3	401.25	0.204785	0.891572	3.238872
Within Groups	31350	16	1959.375			
Total	32553.75	19				

Table 1 ANOVA

For ranking critical factors, The mean of the weighted scores were listed in descending order as shown in Table 2.The mean scores and the standard deviation (SD) were calculated to determine the rank order of the variables.

As the majority of the primary data collected for this research was the respondents perception towards the activities Respondents were able to identify how frequently the critical factor occurred using five categories: (1) Never; (2) Rarely; (3) Occasionally; (4) Often; and (5) Always. In order to score the level of effect, The questionnaire gave each respondent an opportunity to rate variables perceived as likely to contribute performances on a scale from 1 (not at all or not relevant) to 5 (most relevant). In the last, respondents were asked to provide comments on responses provided. In order to clarify the survey results, interviews were conducted with the people who work both at management and operational levels in construction. The interviewees included: Project Managers, Site Managers, Supervisors, contractors and laborers/plumbers. Approximately 85% of the respondents were involved in the daily activities as they worked either as Project Managers, Site Managers or Construction Managers. Another 15% of the respondents were categorized as those who did not actively work daily on the MP and LP site. However, they support the team in order to carry out the project. They included the Estimator, Plan Manager, Contract Administrator and other consultants

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CRITICAL FACTORS	Mean	SD	Never	Rarely	Occasionally	Often	Always
Weather condition/Rainly season	4.47	4.06	0%	7%	7%	20%	67%
Plumber shortage	3.27	4.06	0%	7%	67%	20%	7%
Waiting for permission from govt statutory	2.40	2.24	27%	20%	40%	13%	0%
WAH/Unclear photoshoot	2.13	3.74	13%	60%	27%	0%	0%
Delays to schedule/WAH permit	2.13	3.08	20%	47%	33%	0%	0%
Delay of material delivery to site	1.93	3.32	27%	53%	20%	0%	0%
Plumber slow/ineffective	1.80	3.00	40%	40%	20%	0%	0%
Waiting for equipment to arrive	1.60	3.67	47%	47%	7%	0%	0%
Poor coordination among	1.60	4.24	40%	60%	0%	0%	0%
Material does not meet specification/SR Problem	1.53	3.74	53%	40%	7%	0%	0%
Waiting for society permission	1.53	4.12	47%	53%	0%	0%	0%
Equipment frequently break down	1.53	3.74	53%	40%	7%	0%	0%
Lack of supervision	1.53	3.74	60%	27%	13%	0%	0%
Lack of subcontractor's skill	1.53	4.12	47%	53%	0%	0%	0%
Damaged materials on site	1.47	3.94	60%	33%	7%	0%	0%
Poor distribution of labour	1.47	4.12	67%	20%	13%	0%	0%
Equipment shortage	1.40	4.24	67%	27%	7%	0%	0%
Slow in making decisions	1.40	4.24	67%	27%	7%	0%	0%
Loss of materials on site	1.33	4.64	73%	20%	7%	0%	0%
Waiting for instructions	1.33	4.47	67%	33%	0%	0%	0%
Poor site layout	1.33	4.47	67%	33%	0%	0%	0%
Inappropriate/misuse of material	1.27	4.80	73%	27%	0%	0%	0%

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Waiting for Permit WAH	1.27	4.80	73%	27%	0%	0%	0%
Supervision too late	1.27	4.80	73%	27%	0%	0%	0%
Waiting for equipment repair	1.20	5.61	87%	7%	7%	0%	0%
Lack of plumber skill	1.20	5.20	80%	20%	0%	0%	0%
Waste of raw materials on site	1.13	5.66	87%	13%	0%	0%	0%
Poor quality of materials	1.13	5.66	87%	13%	0%	0%	0%
Idle Plumber	1.13	5.66	87%	13%	0%	0%	0%
Too much material inventory on site	1.07	6.16	93%	7%	0%	0%	0%
Poor storage of material	1.07	6.16	93%	7%	0%	0%	0%
Unreliable equipment	1.07	6.16	93%	7%	0%	0%	0%
Excessive accidents on site	1.07	6.16	93%	7%	0%	0%	0%
Inappropriate construction methods	1.07	6.16	93%	7%	0%	0%	0%
Outdated equipment	1.07	6.16	93%	7%	0%	0%	0%
Poorly scheduled delivery	1.00	6.71	100%	0%	0%	0%	0%
Poor material handling on site	1.00	6.71	100%	0%	0%	0%	0%
Waiting for labour	1.00	6.71	100%	0%	0%	0%	0%
Inexperienced TPE	1.00	6.71	100%	0%	0%	0%	0%
Poor planning and scheduling	1.00	6.71	100%	0%	0%	0%	0%
Poor provision of information	1.00	6.71	100%	0%	0%	0%	0%

Table 2: Ranking of Factors

Based on the result shown in table 2. Critical factors are ranked in descending order i.e. most severity factor ranked as one and so on. It can be seen that in rainy season laying of MP, LP pipeline gets delayed by weather conditions. About 67% of respondent agreed on this and considered as most critical factor. Next ranked critical factor is a Plumber shortage. Actually this problems occurs due to poor distribution of plumbers on various sites. It is suggested that appointment of more contractors for MP tap offs in one region/DRS so that number of MP tap offs will be generated in multiples hence subsequently more MCV front will be available for GI contractor.

Delay in government permission and statutory process leads to delay in laying of pipeline and their commissioning. Therefore it is also ranked as one of the most severe critical factor and so on.

V.FINDINGS AND DISSCUSSION

PE Projects are unique in a sense that it is ongoing project unlike the conventional projects by definition. These projects forms the basis for network expansion of Polyethylene gas pipeline in residential areas under its operation and to achieve last mile connectivity by installing GI pipes, meter and copper pipes in customer's kitchen premises.

Factors are considered mainly on project management perspective. Survey details are collected in three section i.e MP network, LP network. GI and LMC work. This paper identified critical factors in each section, analyzed them and ranked them according to its severity and suggested possible solution to the company.

In MP and LP network challenges like delay in permission from government statutory, Joint survey with them, lack of coordination with other departments in an organization, delay in material delivery at site, material does not meet specification ,Service regulator(SR) leakage problem their positioning issues, reinstate complaints also external factors like escalated complaints, political influence, weather condition and so on. There are various causes at technical and management level responsible for this factor are also considered. Effective communication skills can be the most useful tool in dealing with organizational and personal conflicts. Alternative methods for SR installation such as underground installation of SR or Barriers shall be provided to protect the housing dome, relief valve discharge stacks, filling risers and any appurtenances that extend above grade level such protection shall extend to sufficient height are also discussed. Also suggests the revise payment system for plumbers so that plumbers issue solve at some level. For GI and LMC work advanced technology can be used to avoid technological problems and to avoid too much documentations.

VI.CONCLUSION

A gas pipeline is a complex system used to transport natural gas. The route of the pipeline traverses different terrain and during the laying of pipeline certain obstacles can be encountered.

The responsibility of the elimination of critical factors does not depend only on ZIC and AIC's Managers, but also on the TPI, supervisor, contractors and laborers. This means all project participants need to be committed, involved, and work together to detect any critical factor and eliminate it as soon as it occurs. It is suggested that workers should be highly trained and multi-skilled. They often do not realize that many activities they carry out do not add value to the work. These issues contribute to a reduction in the value of construction productivity and could reduce company performance. By identifying the critical factors during a laying of MDPE pipeline, site engineer and managers are able to easily identify the best solutions and ways to apply any new technique. All company personnel need to be kept informed of work progress including project time and cost targets by use of information displays so everyone is able to monitor the status of the execution of work.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
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AKNOWLEDGEMENT

It is great pleasure for me to express my thanks to my guide Dr. D. K. Shinde for their consistent support and valuable guidance. I am immensely delighted to present this project performed at Mahanagar Gas Ltd Mumbai I would like to sincerely thank Mr. Hemal Vora, Mr. Prashant Khotegavkar, Mr. Mayur Borhade who guided me at every step through my training period at Mahanagar Gas Ltd. ensuring that all my queries were answered.

Last but not the least, I express my sincere thanks to all teachers who have always motivated me.I am very proud to have such good friends whose constant encouragement and motivation making me to achieve this endeavor in a peaceful and cheerful manner. I am also thankful to the concerned authorities who directly or indirectly helped me to finished this task successfully.

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