



# Factor affecting on tower crane performance in high rise building.

Meet Joshi, Prof. Ankit S. Patel, Prof. Jayraj V. Solanki

PG Student, Assistant professor, Assistant Professor & PG head

civil Engineering Department

U.V. Patel College of Engineering, Ganpat University, Kherva, Gujarat, India

**Abstract** : In any developing country, the construction industry plays a very critical role. This sector will encourage the infrastructure needed for socioeconomic development, as well as contributing significantly to overall economic growth. Tower Crane is very important equipment in construction industry. By using and maintaining crane in construction is very beneficial for project. But there are factors that affect the crane performance and decrease the productivity of crane equipment. Purpose of this study is to identify and analyse factors that affect the tower crane performance. The research focuses on the construction peoples in Ahmedabad city. Questionnaire for this research is prepared in 4 parts environmental factors, human factors, safety condition factors, project condition factors. 5 point likert scale is used for questionnaire survey. For this study questionnaire survey in Google form is distributed to construction profession peoples. 92 response is taken for the data analysis. Frequency index data analysis method use for the data analysis. The data analysis done showed that environment factors are most important factors for affecting the tower crane. By identifying the factors affecting tower crane performance, this can help the construction companies to make improvement in use of tower crane equipment.

**IndexTerms** – Tower crane performance in high rise building, Factors, Construction Projects, Frequency index method, Questionnaire survey

## I. INTRODUCTION

Cranes are regarded as the centrepiece of the construction tools used in projects. They are crucial in the vertical and horizontal transportation of a range of materials. Crane type, crane number, and crane placement all have a significant impact on their effectiveness. Because cranes are being used in more building projects, it is essential for construction engineers to have a solid understanding of equipment management, including cranes. There are many cranes, which have become an indispensable component of the building sector. However, tower cranes are frequently employed in India, and if they are utilised effectively, they may help us finish our tasks quickly. However, there are a few things that can affect how well tower cranes perform, which can cause delays and harm a project's economy.

## II. OBJECTIVES

- To identify factors affecting tower crane performance in high rise building.
- To analyze operational parameters that affects the performance of tower crane.

## III. RESEARCH METHODOLOGY :

### 1) LITERATURE REVIEW:

Literature review was done from previously published research paper on this topic from various international journals to know the previous work done on this type projects.

### 2) DATA COLLECTION:

Data collection done by questionnaire survey after identification of various factors from literatures and opinions of experts. Questionnaire will be prepared for the construction professionals in construction companies, consultancies for identify their views on factors affecting crane management in construction.

### 3) **DATA ANALYSIS:**

Data analysis done on how respondent's respondents rate the questions by the various parameters based on their own experience and knowledge.

## IV. LITERATURE REVIEW

Mr.K.D.Patel, Prof. P.P.Bhangale (2017) This study focuses on how to make tower cranes more effective in construction operations. The purpose of this study is to identify the variables that determine how cranes are managed in building projects. Respondents to the research questionnaire survey completed a 1 to 5 Likert scale questionnaire. In its final analysis, this study pinpoints and examines variables influencing tower crane performance in construction projects.

Budi Susetyo, Moh. Sholahuddin (2018) this study focuses on how to make tower cranes more effective in construction operations. The purpose of this study is to identify the variables that determine how cranes are managed in building projects. Respondents to the research questionnaire survey completed a 1 to 5 Likert scale questionnaire. In its final analysis, this study pinpoints and examines variables influencing tower crane performance in construction projects.

A.A. Saihu, S.S. Aliyu, M.Abubakr this research is about safety risk factors of tower cranes in construction sites. This research main objective is evaluating safety risk factors during installation and dismantling tower cranes and safety factors that affect tower crane productivity. For this structured questionnaire was designed for data collection. This research find and analyze most affecting factor on safety during installation and dismantling tower cranes.

## V. METHODOLOGY

### 5.1 DATA COLLECTION :

#### 5.1.1 GENERAL :

- Data collection, which may be divided into two categories, quantitative approach and qualitative approach, generally refers to a plan of action that allows the objectives of the study to be questioned.
- Qualitative and quantitative approaches are the two categories into which the information received is split in order to create a plan that can be reviewed in order to accomplish the study goal
- The less systematic research method known as a qualitative survey is used to gather information about people's innermost thoughts and sources of inspiration

#### 5.1.2 SURVEY PLANNING :

The Survey are sent through email and online platform is used for data collection work. The main goal is gathered information of factors affecting tower crane performance in high rise building.

#### 5.1.3 QUESTIONNAIRE DESIGN :

To obtain the opinions of diverse respondents in the construction business, questionnaire surveys were undertaken. The results of the survey are utilised to enhance the capabilities of construction MSMEs.

1	2	3	4	5
Very Low	Low	Medium	high	Very High

Table 1. Liker Scale

**5.1.4 DETERMINATION OF QUESTIONNAIRE & SAMPLE SIZE DETERMINATION :**

Several Owners, Engineers, Partners, and Project Managers received the questionnaire after being informed of the study's goals and having their agreement to participate in the study sought. Once the respondents in Ahmedabad demonstrated their initial consent. Calculator.net is used to determine the sample size. Here 98% confidence level is taken. The sampling error to be estimated is 12%

**Sample Size Calculator**

**Find Out The Sample Size**  
This calculator computes the minimum number of necessary samples to meet the desired statistical constraints.

**Result**

Sample size: **95**

This means 95 or more measurements/surveys are needed to have a confidence level of 98% that the real value is within  $\pm 12\%$  of the measured/surveyed value.

Confidence Level: 98%  
Margin of Error: 12%  
Population Proportion: 50% Use 50% if not sure  
Population Size: Leave blank if unlimited population size.

Calculate Clear

Figure 1. Sample Size

Sr. No	Factors
<b>Environmental Factors</b>	
1	High wind velocity
2	Low visibility
3	Heavy rain condition
<b>Human Factors</b>	
1	Language barrier
2	Proficiency of the lifting supervisor
3	Proficiency of signalman
4	Proficiency of riggers
5	Inadequate experience of crane operator
6	Crane operator's behavioral patterns and mental capacity
<b>Safety Condition Factors</b>	
1	Lack of tool box talk meeting
2	Site layout is not per as safety standards
3	Lack of safety training programs for crane operators
4	Lack of safety training programs for signal man
5	Not proper safety measures during dismantling
6	Lack of regular inspection of lifting devices like slings
7	Not proper use of personal protective equipment's (PPE)
8	Lack of time to time maintenance
9	Not presence of presence of health, safety and environmental department
10	Lack of presence of safety engineers and safety equipment's
11	Permits before starting crane operations
12	Inspection of crane by third party
13	Preparation of crane inspection checklist
14	Lifting supervisor experience and proficiency
15	Insufficient number of workers to perform during installation and dismantling of tower cranes
16	Trying to finish the work earlier than the required for safe work
17	Fracture of a wire rope during dismantling
18	Failure of working platform
19	Working at heights
20	Co-ordination between worker
21	Improper signs
<b>Project Condition Factors</b>	
1	Type of load and rigging method
2	Sight distance and angle
3	Presence of power lines
4	Presence of overlapping cranes
5	Presence of obstacles on site
6	Poor ground condition
7	Poor Management condition
8	Inconvenient work conditions in operator cabin

Table -2: List of Factors

**5.2 DATA ANALYSIS :**

For the data analysis Frequency Index Method was used and, formula of FI is given below;

$$\text{Frequency Index FI (\%)} = \sum a \times \frac{n}{N} \times \frac{100}{5}$$

Where,

a is the constant weight given to each response (range from 1 to 5),

n is the frequency of the index and

N is the total number of responses.

**5.2.1 SAMPLE SIZE DETERMINATION :**

No. of questionairedistributed	Total Responses	Responses in %
95	92	96.84 %

Table -3: Details of Responses

**5.2.2 RELIABILITY TEST :**

A researcher study's or a measuring test's consistency is referred to as its reliability.

Under this work, Excel was used for analysis using CRONBACH'Somethod.

$$\alpha = \frac{K}{K - 1} \left[ 1 - \frac{\sum s^2 y}{s^2 x} \right]$$

Where,

K = Number of the test items

$\sum s^2 y$  = Sum of the item variance

$s^2 x$  = Variance of the total score

$$= \frac{K}{K-1} \left[ 1 - \frac{s^2 y}{s^2 x} \right]$$

$$= \frac{39}{39-1} \left[ 1 - \frac{38.97}{292.36} \right]$$

$$= 0.88$$

Variables	Description	Values	Internal Consistency
K	No. of items	39	<b>Good</b>
$\sum s^2 y$	Sum of the item variance	38.97	
$s^2 x$	Variance of total	292.36	
$\alpha$	Cronbach's alpha	0.88	

Table 4. Reliability test Result

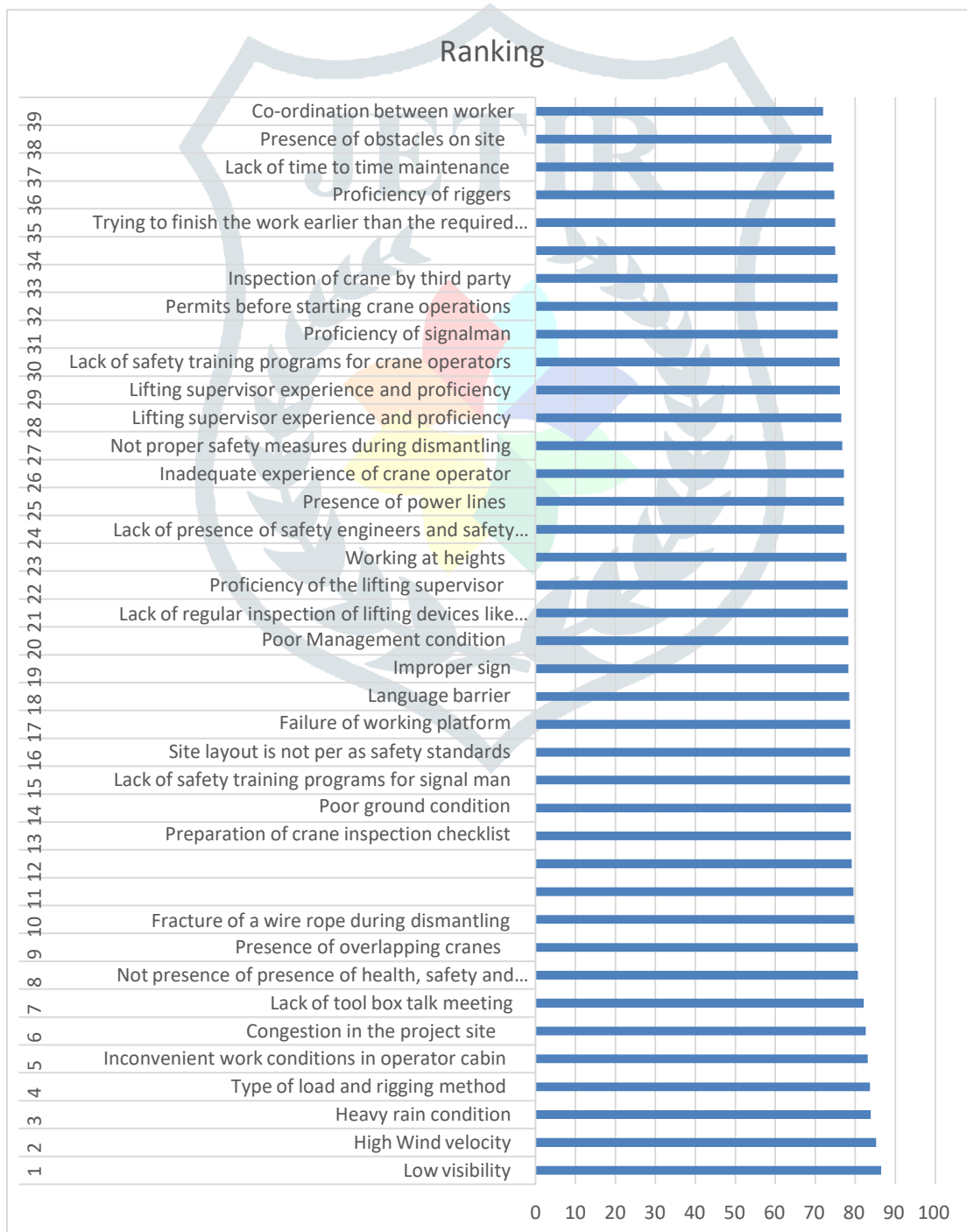
## 5.2.3 FI &amp; RANKING OF FACTORS AFFECTING TOWER CRANE PERFORMANCE IN HIGH RISE BUILDING :

Sr.No	Factors	FI	Ranking
1	Low visibility	86.51	1
2	High Wind velocity	85.21	2
3	Heavy rain condition	83.90	3
4	Type of load and rigging method	83.69	4
5	Inconvenient work conditions in operator cabin	83.09	5
6	Congestion in the project site	82.60	6
7	Lack of tool box talk meeting	82.16	7
8	Not presence of presence of health, safety and environmental department	80.64	8
9	Presence of overlapping cranes	80.64	9
10	Fracture of a wire rope during dismantling	79.76	10
11	Insufficient number of workers to perform during installation and dismantling of tower cranes	79.56	11
12	Not proper use of personal protective equipment's (PPE)	79.12	12
13	Preparation of crane inspection checklist	78.90	13
14	Poor ground condition	78.90	14
15	Lack of safety training programs for signal man	78.69	15
16	Site layout is not per as safety standards	78.69	16
17	Failure of working platform	78.67	17
18	Language barrier	78.47	18
19	Improper sign	78.25	19
20	Poor Management condition	78.25	20
21	Lack of regular inspection of lifting devices like slings	78.18	21
22	Proficiency of the lifting supervisor	78.04	22
23	Working at heights	77.82	23
24	Lack of presence of safety engineers and safety equipment's	77.25	24
25	Presence of power lines	77.17	25
26	Inadequate experience of crane operator	77.16	26
27	Not proper safety measures during dismantling	76.71	27

28	Lifting supervisor experience and proficiency	76.51	28
29	Lifting supervisor experience and proficiency	76.18	29
30	Lack of safety training programs for crane operators	76.08	30
31	Proficiency of signalman	75.64	31
32	Permits before starting crane operations	75.64	32
33	Inspection of crane by third party	75.64	33
34	Crane operator’s behavioral patterns and mental capacity	74.99	34
35	Trying to finish the work earlier than the required for safe work	74.99	35
36	Proficiency of riggers	74.77	36
37	Lack of time to time maintenance	74.56	37
38	Presence of obstacles on site	74.11	38
39	Co-ordination between worker	71.95	39

Table 5. FI & Ranking of Factors

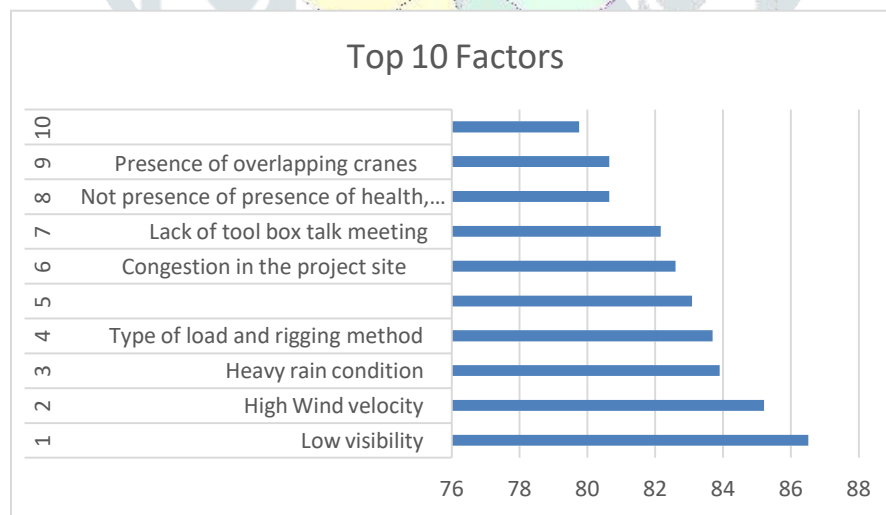
Chart 1. FI of Factors



## 5.2.4 TOP 10 FACTORS AFFECTING TOWER CRANE PERFORMANCE IN HIGH RISE BUILDING:

Table 6. Top 10 Factors

1	Low visibility	86.51
2	High Wind velocity	85.21
3	Heavy rain condition	83.90
4	Type of load and rigging method	83.69
5	Inconvenient work conditions in operator cabin	83.09
6	Congestion in the project site	82.60
7	Lack of tool box talk meeting	82.16
8	Not presence of health, safety and environmental department	80.64
9	Presence of overlapping cranes	80.64
10	Fracture of a wire rope during dismantling	79.76



## VI. CONCLUSION :

From this study we can conclude that use of tower crane is very beneficial in construction industry sector. Proper use and management of tower crane is very beneficial in constructions projects. And there are some factors which are affect the tower crane performance in construction projects. My thesis work on identifies the factors that affect the tower crane performance in high rise building and analyze the top factors I collected the factors which affects the tower crane performance. And prepare a questionnaire with help of 3 industry experts that will help me to get my desire calculation. In data validation with the help of experts add some factors and remove some factors and finalize 39 factors for survey create Google form and distributed to construction professionals people.

My sample size is 95, in all form 92 responses are receive and after all that I collection and analysis data from respondent send.

In all data collection & analysis done major finding is top 10 factor are affected in construction industry.

1. Low Visibility
2. High wind velocity
3. Heavy rain condition
4. Type of load and rigging method
5. Inconvenient work conditions and operator cabin
6. Congestion in project site
7. Lack of tool box talk meeting
8. Not presence of health, safety and environment department
9. Presence of overlapping cranes
10. Fracture of a wire rope during dismantling

**VII. FUTURE SCOPE:**

In this thesis all kind of construction industry was occupied for this research. Outcome of study, the researcher can do any further study and state, this study conducted in Ahmedabad city. Frequency analysis method is used for collection data and analysis from survey.

This factor is from survey form and best of my knowledge and takes references from literature, all researcher can do work for this topic and find another answer and finding factor affecting on construction industry

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