

# Empirical Analysis On Construction Safety – A Case Study

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## Abstract:

During the Safety in the construction industry has always been a major issue. Though much improvement in construction safety has been achieved, the industry still continues to lag behind most other industries with regard to safety. The construction safety of any organization consists of employee's attitudes towards and perceptions of, health and safety behaviour. Construction workers attitudes towards safety are influenced by their perceptions of risk, management, safety rules and procedures. A measure of safety could be used to identify those areas of safety that need more attention and improvement. The aim of the study was to identify factors in the safety management that any lead project success. these factors influence construction safety. In this project questionnaire is framed to find safety in major organisations. data is collected on the basis of questionnaire. Employees of various construction firm are interviewed. Collected data is analysed statistically. this analysis is show the safety environment among organisation. it also gives suggestion to improve safety at construction site.

*Keywords* — Safety, Injuries, Organization Environment, Statistic

## I. INTRODUCTION

Safety in the construction industry has always been a major issue. Though much improvement in construction safety has been achieved, the industry still continues to lag behind most other industries with regard to safety. The safety climate of any organization consists of employee's attitudes towards and perceptions of, health and safety behaviour. Construction workers attitudes towards safety are influenced by their perceptions of risk, management, safety rules and procedures. A measure of safety climate could be used to identify those areas of safety that need more attention and improvement. The dynamic nature of safety climate, which has the ability to change on daily basis, means there is a great need for reliable tools that can measure safety climate. Safety climate is a leading performance indicator that can provide insight into safety performance before accidents have occurred.<sup>[1]</sup>

Management and planning is one way to avoid unplanned events. Since accidents are unplanned events, an effective safety management can help avoid job injuries. Safety management must be thorough, and it must be applicable to all aspects of the job, from the estimating phase of the project until the last worker has left the premise at the completion of the project. All parties to a construction project must be included in some way in the safety program every party is responsible. The construction industry continues to be one of the most physically demanding and dangerous industries in the India. Measuring safety climate is still relatively new when compared with the concepts of social and work climate. Previous to Zohar's [2002]<sup>[12]</sup>

The Construction activities in developing countries, such as Pakistan, China and India, are more labour intensive than in the developed areas of the globe, involving 2.5-10 times as many workers per activity. Typically workers tend to be

unskilled and migrate in a group, with or without their families, throughout the country in search of employment. In fact, they are usually divided into various factions. Communication problems related to difference in language, relation and culture tend to inhibit safety on the work site. The major injuries faced by contracting firms in India on their projects site, in descending order of occurrence, were given as follows:

- Fall injuries.
- Struck by wastage and raw materials.
- Heat stroke.
- Head injuries.
- Eye injuries.

The improvement of safety, health and working conditions depends ultimately upon people working together, whether governments, employers or workers. So safety management is applying safety measures before accidents happen. Effective safety management has three main objectives:

- To make the environment safe
- To make the job safe
- To make workers safety council

## II .CAUSES OF ACCIDENT

An incident is any unplanned event that causes injury. A dangerous occurrence is any event that could have caused injury, but did not. The term "incident" will be used to describe both incidents and dangerous occurrences. There are many possible causes of accidents as they are occasions. Among these are: technical defects in equipment and methods of work, defects in organization and dangerous acts by workers. To these have to be added those causes that come from the nature of construction operations themselves, defects in planning and construction, constant changes in

workplace and task, and the friction often found when workers from different trades are working in close proximity to each other.

**III . TO STUDY CRITICAL FACTORS AFFECTING SAFETY**

Table 1 . Causes Of Accidents Have Been Grouped According To Their Nature

Sr. No	Nature	Causes Of Accident
1	<b>Planning, organization :</b>	<ul style="list-style-type: none"> <li>• Defects in technical planning.</li> <li>• Fixing unsuitable time limits.</li> <li>• Insufficient or defective supervision of the work.</li> <li>• Lack of co-operation</li> </ul>
2	<b>Execution of work:</b>	<ul style="list-style-type: none"> <li>• Constructional defects.</li> <li>• Use of unsuitable materials.</li> <li>• Defective processing of materials.</li> </ul>
3	<b>Equipment:</b>	<ul style="list-style-type: none"> <li>• .Lack of equipment.</li> <li>• Unsuitable equipment.</li> <li>• Defects in equipment.</li> <li>• Lack of safety devices or measures.</li> </ul>
4	<b>Management and conduct of work:</b>	<ul style="list-style-type: none"> <li>• Inadequate preparation of work.</li> <li>• Inadequate supervision.</li> <li>• Unskilled and untrained workers.</li> <li>• Inadequate instruction from supervisors</li> </ul>
5	<b>Worker's Behaviour:</b>	<ul style="list-style-type: none"> <li>• Irresponsible acts.</li> <li>• Unauthorized acts.</li> <li>• Carelessness.</li> </ul>
6	<b>Due to Unsafe Conditions:</b>	<ul style="list-style-type: none"> <li>• Poorly maintained machinery or equipment.</li> <li>• Defective or missing personal protective equipment.</li> <li>• Unguarded machinery or equipment.</li> <li>• Missing or inadequate warnings or safety and health signs.</li> <li>• Lack of housekeeping.</li> </ul>
7	<b>Due to Unsafe Acts:</b>	<ul style="list-style-type: none"> <li>• Conduct work operations without prior training.</li> <li>• Block or remove safety devices.</li> <li>• Clean, lubricate, or repair equipment while it's in operation.</li> <li>• Working without protection in hazardous places.</li> </ul>

**Introduction**

In general, accidents at work occur either due to lack of knowledge or training, a lack of supervision, or a lack of means to carry out the task safely, or alternatively, due to an error of judgment, carelessness, apathy or downright reckless. Never the less, according to a report by the HSE (cited in6 , nearly 90% of all construction accidents leading to death could (or should) have been prevented, 70% by positive management action. Therefore, the specific objectives of this research are: rest, to correlate the operatives' background and attitude towards safety with their accident or non accident records. Second, to determine the group of factors that has the most react on site safety, utilizing the Factor Analysis Technique.

**A. Organizational Context**

**i. Management Commitment**

Management commitment for safety is “The extent to which management is perceived to place a high priority on safety and communicate and act on safety issues effectively.”<sup>[1]</sup>

Organizations should have effective systems in place for the management and co-ordination of safety. This should be led by a strategic safety management team.<sup>[2]</sup>

**ii. Communication**

Spoken and written communication can be critical in maintaining safety. This can include general communications in the form of safety information, communications between team members or between different teams during operations or maintenance work, and emergency communications. The improvement of safety communication can provide immeasurable benefits for contractors by reducing accidents, lowering costs, improving productivity and providing improved value for the construction client.<sup>[3,4]</sup>

**iii. Priority Of Safety**

Organizational climate theory suggests that workgroup members form consensual conceptions on expected role behaviour, based on perceptions of organizational policy, procedures and practices. This contributes to perceived order, but also to the creation of order by inference from these perceptions. From perceptions of organizational policies, procedures and practices, organizational members thus infer the relative value of different organizational goals, such as for example safety performance. Accordingly, safety behavior may partially be considered contingent on beliefs that such behavior is expected, and will be awarded in the organization.<sup>[5,6]</sup>

**Iv Safety Rules And Procedure**

Construction is a high hazard industry that comprises a wide range of activities involving construction, alteration, and/or repair. Examples include residential construction, bridge erection, roadway paving, excavations, demolitions, and large scale painting jobs. Construction workers engage in many activities that may expose them to serious hazards, such as falling from rooftops, unguarded machinery, being struck by

heavy construction equipment, electrocutions, silica dust, and asbestos.

The issue of health, safety and environment (HSE) remains one of the top priorities in the local, regional and global construction industry. Efficient health and safety at workplace not only ensures that employees are happy and productive, but can also help to reduce both the human and business costs of injuries and unnecessary lawsuits. In common-law jurisdictions, employers have a common law duty to take reasonable care for the safety of their employees.<sup>[16]</sup> By making health and safety the priority, construction companies are effectively communicating that competent employees are a valuable resource in the industry. Additionally, improved health and safety standards help companies become more effective to finish projects on time and improve their business profile with customers and clients. By introducing basic health and safety standards, organisations can understand the human capital benefits this has across the company. Management must not only provide their workers with the right safety tools at work, but also equip and induct them with understanding on proper use and maintenance of these tools. Several organisations, for instance, focus on educating and explaining HSE rules and regulations to employees, contractors and vendors, as well as utilizing industry experience to implement such standards. HSE standards and technical specifications must first be discussed and implemented before any person steps onto any construction site, whether in an established building or a new site. Also, gaps between local and international HSE standards can be bridged through an approach that involves a method statement, risk assessment and job safety analysis.<sup>[4]</sup>

## **B. SOCIAL ENVIRONMENT**

### ***i. Supportive Environment***

Supportive environment refers to the degree of trust and support within a group of workers, confidence that people have in working relationships with co workers, and general morale. Having a supportive work environment demonstrates workers' concern for safety and fosters closer ties between them. Co workers' attitude toward safety has been widely included in safety climate studies.<sup>[5]</sup> Thus, The higher the level of support given by co workers, the more positive the safety climate. Social support and production pressure can directly affect workers' safety behaviour, safety motivation and safety knowledge. Workers' on-site safety behaviour is related to their safety motivation and safety knowledge. Workers are more motivated and competent in a supportive environment. When production pressure increases, both safety motivation and knowledge decrease.<sup>[5]</sup>

### ***ii. Involvement***

Workers are a company's greatest asset. Nothing is possible without them, and the quality of the company's output is dependent on their efforts, skills, insights and commitment. Workers are directly affected by safety and health problems on a worksite. Usually, they are the ones hurt or killed when safety programs fail. As a result, they have a direct interest in their success. Worker involvement in safety is a two-way process where

employers and employees can work together on spotting, solving and owning health and safety problems.

It seems likely that employee involvement will be an important part of any Injury and Illness Prevention Plan (I2P2) Standard that OSHA proposes (an I2P2 standard is among the agency's top priorities).<sup>[6]</sup>

## **C. INDIVIDUAL APPRECIATION**

### ***i. Personal Priority And Need For Safety***

Construction work is a dangerous land-based job. Some construction site jobs include: building houses, roads, workplaces and repair and maintain infrastructures. This work includes many hazardous task and conditions such as working with height, excavation, noise, dust, power tools and equipment. Construction work has been increasing in developing and undeveloped countries over the past few years.<sup>[7]</sup>

### ***ii Personal Appreciation Of Risk***

Employees' attitudes towards safety are one of the most important indices of safety climate. Attitudes towards safety have been found to be associated with personal risk perception. Individuals, however, differ in their perception of risk and willingness to take risks.<sup>[8,9,10]</sup>

## **D. WORK ENVIRONMENT**

### ***I. Physical Work Environment*** [11]

It is not just management participation and involvement in safety activities that is important, but the extent to which management encourages the involvement of the workforce. Moreover, management must be willing to devolve some decision-making power to the workforce by allowing them to become actively involved in developing safety interventions and safety policies, rather than simply playing the more passive role of the recipient. Workers' involvement includes such issues as procedures for reporting injuries and potentially hazardous situations. Thus, The higher the level of workers' involvement in safety matters, the more positive the safety climate.

## **IV . RESEARCH METHODOLOGY**

Data required for investigation is collected from these sites. Main cause of injuries on construction site is lack of safety management. Safety management includes all level interest to reduce the accidents and injuries. Safety culture on construction site by observing the behaviour of workers during the activities. Also safety climate can be understand by not only observing the relationship between owner and employers but also their personal views about safety.

**A. QUESTIONNAIRE DESIGN**

In this project design, questionnaire is chosen as the method to collect data from different construction organizations. There are several reasons for accepting and rejecting the tender. From the first principle of research, opinion collected from questionnaire survey from a sample is reflective of the opinion of the population besides; using the questionnaire survey allows a great efficiency in collecting data in a rather short period of time and gives high flexibility to do different kinds of analysis based on the data collected.

**B. QUESTIONNAIRE CONTENT**

The questionnaire included Likert scale questions, which are divided according to critical factor

- Organizational context
- Social Environment
- Individual appreciation
- Work Environment

used to cover the all critical factor questionnaire. The aim of the questionnaire used in this study is to realize the real safety problems and responsibility of individual for safety at construction projects site and to investigate safety procedures, regulations, policies, and accident prevention methods related to the construction projects there; and to provide Suggestion to improve the safety performance in construction projects Likert scale.

The Likert Scale is a five (or seven) point scale which is used to allow the individual to express how much they agree or disagree with a particular statement.

Table 2 Likert 5 Point Scale

KEY	
Strongly Disagree	1
Disagree	2
Moderate	3
Agree	4
Strongly Agree	5

**C. ANALYSIS PROCEDURE**

While visiting sites, interview method is used to collect data. Above questionnaire is used to ask them. Opinion of labour is clear from this questionnaire. Collected data should be analysed to get the result. We used statistical method to find out the results. Following are the statistical methods used :

**I. Mean And Mode**

Mean, median, and mode are three kinds of "averages". But we have taken only mean and mod in analysis. The

"mean" is the "average" you're used to, where you add up all the numbers and then divide by the number of numbers. The "mode" is the value that occurs most often. If no number is repeated, then there is no mode for the list.

**ii. Standard Deviation**

Standard deviation is a measure of the dispersion of a set of data from its mean. The more spread apart the data, the higher the deviation. Standard deviation is calculated as the square root of variance.

$$\sigma = \sqrt{\frac{\sum(x - \bar{x})^2}{N}}$$

Where,  $\sigma$  = The standard deviation  
 $x$  = each value in the population  
 $\bar{x}$  = the mean of the values  
 $N$  = the number of values.

**iii. Variance**

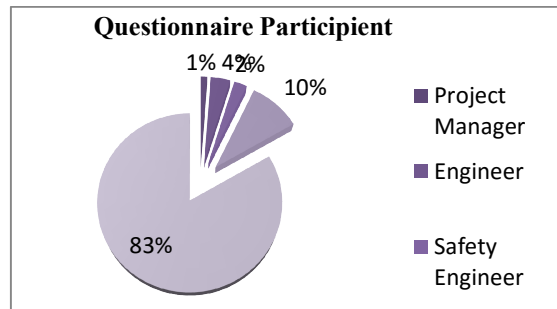
Variance is a measurement of the spread between numbers in a data set. The variance measures how far each number in the set is from the mean. Variance is calculated by taking the differences between each number in the set and the mean, squaring the differences (to make them positive) and dividing the sum of the squares by the number of values in the set.

$$\sigma^2 = \frac{1}{N} \sum_{i=1}^N (x_i - \mu)^2$$

Where,  
 $x_i$  = each value in the population  
 $\mu$  = Mean  
 $N$  = Population size

**D. PARTICIPATION AMONG THE CONSTRUCTION PROJECT RESPONDENT**

Participated in the questionnaire by interview method of the respondents taking part of company Project Manager, Engineer, Safety Engineer, Supervisor, Worker. Questionnaires have been taken and fill with their response having their number Project Manager (1), Engineer(4), Safety Engineer (2), Supervisor (8), Worker (70). Following figure shows % participation rate among respondents of construction site



Graph 1 Questionnaire Participated number

**V . RESULT AND DISSCUSSION**

Having completed the analysis of the findings from the questionnaire survey, documentation review and interview discussion, it was found that some findings in certain safety factor have certain different with the each others in two companies. In order to facilitate further discussion, all findings were consolidated in this chapter.

While quantitative results from the Questionnaire Survey showed that the respective departments have encouraged safety performance related to hazard control and implementation, the qualitative results from the interview suggested a somehow different scenario in which respondents still considered that a lot had to be done in this area. This reflected a situation in which continuous improvement in related safety performance needed to be maintained to meet

We have surveyed two different companies. All the data is drawn from interview of respondents. It includes all four factor opinion of respondents. This data shows the deviations of opinion in employees of organisation. And deviation indicates safety concern of safety. If SD is increasing towards 1 then it shows variations of opinion. Which means there is dissatisfaction of safety.

**A. STATISTICAL RESULT OF PROJECT I FOR CRITICAL FACTOR**

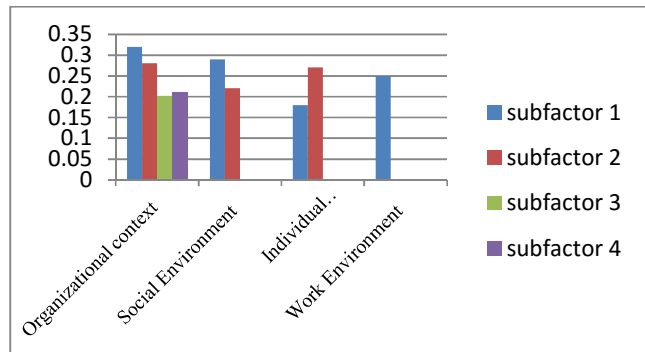
This is the summarized data from all stages of people in company on construction site and this chart gives their average of likert scale answer on the main critical factor and their sub factor in that data. Table no.7.1 Shows the likert scale answer for the factor as the safety point of view less value of SD is shows the similar opinion of the participant on the critical factor response and also the variance also shows that no variation in safety thinking

**Table No .3** Statistics of Results. for Project I

Factor	Max	Min	Mean	Std	Cv
<b>1. Organizational context</b>					
A.Management Commitment	5	3	4	0.535	0.4
b. Communication	5	4	4.67	0.44	0.25
c. Priority of Safety	4	4	4.1	0.12	0.075
d. Safety Rules and Procedures	4	4	3.94	0.21	0.129
<b>2. Social Environment</b>					
A .Supportive Environment	5	4	4.8	0.31	0.1714
b. Involvement	5	4	4.65	0.44	0.25
<b>3. Individual appreciation</b>					
a. Personal priority and need for safety	4	4	4.08	0.18	0.1
B .Personal Appreciation of Risk	5	4	4.47	0.36	0.20
<b>4.Work Environment</b>					
Physical work environment and work hazard	3	2	2.16	0.30	0.17

Table No.4 Summarized Questionnaire Survey Result of PROJECT I

Main Factors	Mean SD of Sub Factor				Average SD
<b>1. Organizational context</b>	0.32	0.28	0.20	0.21	0.27
<b>2. Social Environment</b>	0.29	0.22	-	-	0.25
<b>3. Individual appreciation</b>	0.18	0.27	-	-	0.22
<b>4. Work Environment</b>	0.25	-	-	-	0.25



Graph No.2 Mean SD of Questionnaire Survey Result of Project I

From Graphical representation The Project I is having the Average SD is different for the different critical factor of safety at construction site. In this survey Analysis of questionnaire shows that all responses are resulting towards satisfactory safety implementation. This organization has more involved in safety of employees. They have good communication with workers and very good safety environment on construction site. I have also observed that organization provides all necessary trainings and preventive measures of safety. They are much concern about safety of worker. This type of safety environment promises the safety of workers. Due to such environment they have less percentage of hazards and injuries because of unsafe work. Which results into fully satisfied project success.

Even though results are satisfactory, some factors should be given more attention to improve safety. Some factors like organizational commitment, supportive nature and personal appreciation of risk, has a chance of improvement.

**B. STATISTICAL RESULT OF PROJECT II FOR CRITICAL FACTOR**

This is the summarized data from all stages of people in company construction site and this chart gives their average of likert scale answer on the main critical factor and their sub factor in that data. Table no. 7.3 Shows the likert scale answer for the factor as the safety point of view less value of SD is sows the similar opinion of the participant on the critical

factor response and also the variance also shows that no variation in safety thinking.

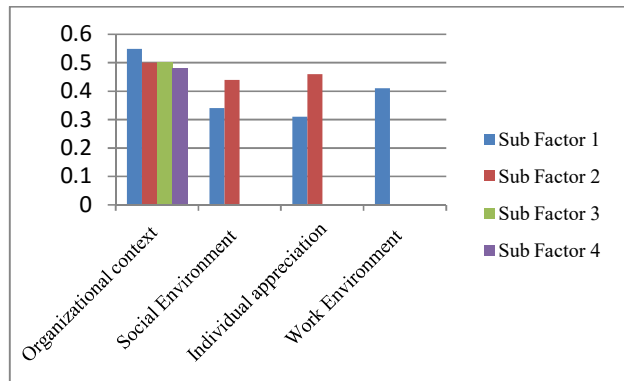
Table No .5 Statistics of Results. for PROJECT II

Factor	Max	Min	Mean	Std	Cv
<b>1. Organizational context</b>					
a. Management Commitment	5	3	4	0.535	0.4
b. Communication	5	4	4	0.50	0.317
c. Priority of Safety	4	3	3.7	0.50	0.325
d. Safety Rules and Procedures	4	3	3.4	0.48	0.300
<b>2. Social Environment</b>					
a. Supportive Environment	4	3	3.66	0.34	0.2000
b. Involvement	4	3	3.6	0.44	0.25
<b>3. Individual appreciation</b>					
a. Personal priority and need for safety	4	3	3.44	0.31	0.22
b. Personal Appreciation of Risk	4	3	3.32	0.46	0.27
<b>4. Work Environment</b>					
Physical work environment and work hazard	4	3	3.45	0.41	0.32

Table No..6 Summarized Questionnaire Survey Result of PROJECT II

Main Factors	Mean SD of Sub Factor				Average SD
<b>1. Organizational context</b>	0.48	0.5	0.5	0.48	0.49
<b>2. Social Environment</b>	0.34	0.44	-	-	0.39
<b>3. Individual appreciation</b>	0.31	0.46	-	-	0.385
<b>4. Work Environment</b>	0.41	-	-	-	0.41

Above table Shows the factor wise responses of interviewed workers. Table includes all standard deviation results. Each factor affects the safety of workers. This values shows how much importance are given to factors.



Graph .No.3 Questionnaire Survey Result of PROJECT II

Above table and graph represents the results of questionnaire survey. The values showed in table no 7.4 are increasing towards 1. Which indicates the conflict about safety on construction site. Value shows that there is too much negligence about worker safety. As we observed on site, there is minimal communication between management and employees. Which is not good for safety, it results into hazards at construction site. Also priority of safety has second choice of management, they give more importance to work and duration. It also shows that the work environment is really need to be improved. This results and observations show hazard and injury risk are increased. Which increases the project duration and create problems to success the project?

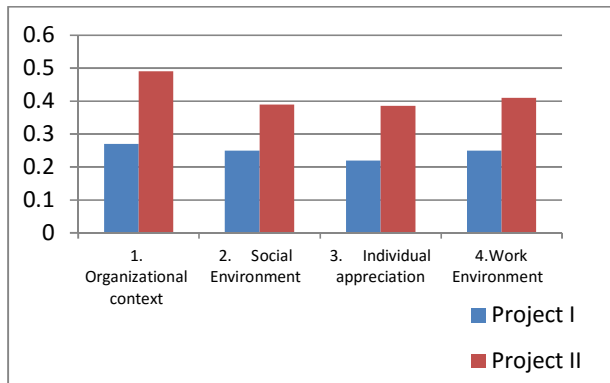
However employees are very supportive in nature. They are aware about safety of their own life. Workers are also involves in safety related programmes.

### C. COMPARATIVE ANALYSIS OF PROJECT I AND PROJECT II

This is the summarized data from all stages of people in both company construction site and this chart gives their standard deviations on the main critical factor and their sub factor in that data. Table no. shows SD result of both companies for the factor as the safety point of view.

Table No.7 Comparative analysis of Project I And Project II

Main Factors	Project I	Project II
<b>1. Organizational context</b>	0.27	0.49
<b>2. Social Environment</b>	0.25	0.39
<b>3. Individual appreciation</b>	0.22	0.385
<b>4. Work Environment</b>	0.25	0.41



**Graph. No. 4 Comparative analysis of PROJECT I AND PROJECT II**

The result shows that Project I is nearer to zero which accepts our condition. Value nearer to zero shows that employees responses are constant. In project II it is increasing towards one. Which shows there are conflicts on safety providation. Employees are not satisfy with safety providation. In project II quality and safety should be integrated to achieve better coordination and utilization of resources.

## VI. CONCLUSIONS

Construction industry is considered as the back bone of the country. As this industry contributes to development of country. By going through the project work the following conclusions are drawn; As the safety is most important issue also Duties and responsibilities of each and every one in construction industry are at- most important, failing to which leads to various consequences. Also Rules and regulation of safety are discussed in this study. As We compared two companies, critical factors of safety should be taken account in safety polices of company. It will help to reduce hazards at construction sites shows the exact safety policies The significant difference in the level of safety among companies under consideration is mainly due to organizational Context consists of Priority of Safety and Safety Rules and Procedures and Individual Appreciation consist of personal priority and need for safety and personal appreciation of risk. Results of this project analysis show that Project I has excellent safety environment than project II. As we seen results of Project II (SD 0.49, 0.39, 0.385, 0.41 >0) are much variance among all workers in that company. The supervisors who act as bridge between management and workers are strongly of the opinion that management commitment is crucial variable to improve safety climate in construction industry. As two Projects shows the different result. The company having more standard deviation is having the deviated response of the individual of all category so the project II should have improve the condition of safety.

There are following suggestion that the company improve their weak critical sub factor

## VII. SUGESSITION

1. To Treat employees with respect, honesty and fairness as their safety point of view
2. Give account to the managers to realize the need for excellence in safety. Develop a vision for safety. Prove the employer that How can safety help you meet your important business objectives?"
3. Demonstrate that you value worker safety.
4. Providing education safety seminar for new employees about company's workplace safety:
5. Getting information should be easygoing:
6. Employ safety incentive plan To Involve employee in safety
7. To make protective environment for worker Amendment for Safety procedure
8. Make the procedure which having whole information of safety

Always make the procedure as it having all information

## REFERENCES

1. Raja Prasad S.V.S. and Reghunath K.P., "Empirical Analysis of Construction Safety Climate – A Study", 'International Journal of Engineering Science and Technology', 2010, Vol.No. 2(6), PP 1699-1707
2. Neal, A. and Griffin M. A. "Safety Climate and Safety at Work In the Psychology of Workplace Safety" . 'I. J. B. M. R.' 2004. , PP 15–34
3. Hamida H. A. , Asmonib M. N. A. M. , Lokmana M.A.A., Shaaria N "An Overview of the Management Commitment to Safety Elements for Mitigating Accidents in the Construction Industry " 'Jurnal Teknologi' 2015, PP1-8
4. "Guidance note: General duty of care in Western Australian workplaces 2005" Government of Western Australia. Retrieved 15 July 2014.
5. Goldberg, A.I., Dar-El, E.M., & Rubin, A.E. "Threat perception and the readiness to participate in safety programs." 'Journal of Organizational Behaviour', 1991, Vol- 12, PP 109-122.

6. Schneider S , "What Does Worker Involvement Mean in Construction? " , 'LHSFA', 2013; Vol 10, PP.1- 4
7. Cox S.J., Cheyne A.J.T. "Assessing safety culture in offshore environments " , 'Safety Science ', 2000 , Vol. 34, PP 111-129
8. Cox, S.J. and Cox, T.R., , "The structure of employee attitude to safety: A European example. *Work and Stress*", 1991, Vol- 5, . 93–106
9. Riza Yosia Sunindijo ,Patrick X. W. Zou, "Conceptualizing Safety Management in Construction Projects", *J. Constr. Eng. Manage.*, Sept 2013, 1144-1153
10. Riza Yosia Sunindijo ,Patrick X. W. Zou, "Political Skill for Developing Construction Safety Climate", *J. Constr. Eng. Manage.*, May 2012, 605-661
11. McGrath E, "The Construction Industry's own Health, Safety, and Welfare Initiative" , '7th Annual GCC Occupational Health and Safety Conference', Dubai, UAE, 2009.
12. Zohar, D. (2002). *Safety Climate: Conceptual and measurement Issues*. In James C. Quick, Lois E. Tetrick, & Lennart Levi (Eds.), *Handbook of Occupational Health Psychology*. American Psychological Association (APA).
13. L. S. Pheng, and S. C. Shiua, "The maintenance of construction safety: riding on ISO 9000 quality management systems", *Journal of Quality in Maintenance Engineering*, vol. 6, no. 1, pp. 28–44, 2000.
14. S. Seetharaman, *Construction Engineering & Management*, fourth edition, Umesh Publications Delhi, 2008.
15. Davis V., et al., 1990: *Construction Site Safety*. Internal Publications. Thomas Telford, London.
16. Sawacha E., et al. *Factors Affecting Safety Performance On Construction Sites*. *Int. J. Proj. Manage.* 1999. 17; 309-315.
17. O'Toole M. *The Relationship between Employees' Perceptions of Safety and Organizational* Levitt R.E., et al. 1993: *Construction Safety Management*. 2nd Ed., Wiley, New York, 216.
18. Benjaoran, V., and Bhokha, S. (2010). "An integrated safety management with construction management using 4D CAD model." *Saf. Sci.*, 48(3), 395–403.
19. Holt, A. S. J. (2005). *Principles of construction safety*, Blackwell Science, Boston
20. Anumba, and G. Bishop, "Importance of safety considerations in site layout and organization," *Canadian Journal of Civil Engineering and Management*, vol. 24, no. 2, pp. 229-236, 1997.