A Study on Safety At Construction Projects

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Abstract-
The present study focuses on the study of safety at construction projects that will enhance the efficient completion of projects. Construction activities are complex and have a tradeoff between different areas. It is often observed that safety activities have an impact on the successful completion of the projects. This study tries to analyze such activities (factors) and areas, which could be critical for the scope of improvements and lead to the completion of projects. A questionnaire-based approach was carried out for the present study and the analysis showed that three factors namely Identification of site-specific training needs, Measures to identify over-stressed workers, Incentives for subcontractors to encourage safe working environment need to be focused for improvement.
Keywords- Construction, Safety, Projects, Training

I. Introduction

IN this study, an attempt had being made to assess the factors that have impact of completion of projects in view of the safety factors. It is observed that a substantial part of construction projects have delays due to incidents/accidents occurring at construction sites. Based on the data received from the questionnaire floated to the industry professionals and a performance matrix were framed. Analysis was done to indentify the factors.

Ii. Literature Review

Hinze (1992) in their investigations studied the role of designers in the construction safety. It is well understood that the contractor has a prime responsibility of the safety, but the present study has attempted to study the role of designers. To investigate this issue of whether designers were sensitive to the safety of construction workers, a survey of major U.S. design firms were conducted by the authors to assess the extent to which design decisions were made with specific consideration being given to the safety of construction workers. Of the respondents, only one-third stated that they made design decisions with the specific intent of improving safety conditions for construction workers.

Hinze, et.al (1998) in their article examined the sorts of injuries and their main drivers, by separating them into subclasses. The information was compiled from the OSHA's Integrated Management Information System (lMIS). The results of this study have demonstrated that the reasons for construction accidents can be exhibited in more noteworthy point of interest with a minimum measure of exertion. The level of a subtle element that can be accomplished gives a great deal, more profitable data by which accident counteractive action plan that can be made more compelling. It is recommended by the authors that how the OSHA reports could be made more meaningful in context to indentify the accidents in different categories.

Hadikusumo and Rowlinson (2004) in their study did an assessment of the configuration for-safety-process device, which goes for helping a safety engineer to recognize safety hazards in construction extends and decide the safety measures required. Training understudies and unpracticed safety engineers in distinguishing safety hazards and the measures required. As per the safety engineers' knowledge, the identification of accident precautionary measures was caught by talks utilizing 2D construction drawings and content information, for example, system explanations, and examinations on location as contextual investigation apparatuses. Both of the routines, in any case, have impediments.

Cooper and Phillips (2004) safety atmosphere alludes to the extent to which representatives accept genuine need n to hierarchical safety execution, and its estimation is thought to give a barely cautioning of potential safety framework failure(s). On the other hand, scientists have battled in the course of the most recent 25 years to discover experimental confirmation to show genuine connections between safety atmosphere and safety execution. Strategy: A safety measure was appropriated to assembling representatives toward the start of a behavioral safety activity and redistributed one year later. Results showed that multiple relapse examination showed that view of the significance of safety preparing was prescient of genuine levels of safety conduct.

Brenda McCabe, DimtriosKarahalios et.al (2005) have examined in their paper about construction safety and safety culture. A pilot study was done , in which outward behavior toward safety in construction were explored. The study focuses on self-assessed questionnaires to gather demographic data, dispositions, and incidents. It demonstrates that the industry is extremely versatile; prove by the normal statistics 14.5 years in the industry, 6.8 years with their present bosses, and having worked for 3 managers and 14.1 projects in the previous 3 years. In spite of the fact that versatility as for projects is normal, it was intriguing to find that the circuit repairmen had more steady occupation connections and chipped away at essentially fewer projects in the course of recent years.

Gambatese et.al (2005) investigated the LCS (lifecycle administrations) process that was executed by Intel on the D1D construction venture. The investigation of safety-in-configuration would give essential experiences into how injury counteractive action in achieving the goals in the construction industry can start upstream by including designers, engineers, and exchange

contractors in preconstruction processes. With a specific end goal to amplify straightforwardness and replicability of the investigation, researchers can make a database of things that can be incorporated into the examination.

Navonand Kolton (2006): Did the study on computerizing the fall avoidance systems by utilization of such model that creates literary and graphical reports. The study was directed as open meetings among 16 expert's eight inhabitant engineers, four construction directors, and four supervisors in 12 construction destinations. The construction locales were chosen to have differences in the sort of structures keeping in mind the end goal to augment the quantity of issues rising up out of the study. This paper demonstrates that a model which persistently screens the current defensive measures continuously was executed, tried in a progressing extend, and exhibited to 14 specialists why should ask to assess it.

Huang (2003) In spite of the quick changes sensational upgrades in late decades, the construction industry keeps on being one of the commercial ventures with the poorest safety records. Late enhancements were expected, partially, to the coordinated endeavors of proprietors, contractors, \subcontractors, and designers. Earlier studies show that while past safety studies have researched the parts of contractors, subcontractors, and designers, the proprietor's effect on construction safety has not been beforehand explored.

Dorjiet.al (2006): in their review article of 40 construction organizations and the legislature administrative offices significant to the construction industry in Bhutan to comprehend better their safety management practices. The five key components of a construction safety management framework were deficiently connected in the Bhutanese construction industry. As far as safety approach, the greater part of the organizations did not have safety arrangement, and they had poor safety mindfulness. As far as sorting out, a large portion of them didn't have safety division, safety agent and safety board of trustees. Under 25% of them didn't have safety spending plan. Regarding arranging and usage, the majority of them knew about the safety regulation and guaranteed to have protection plans for the workers relying upon the customers' prerequisites.

Rafiq M. Choudhry; Dongping Fang et.al (2007): They gave a basic review of the expression "safety culture"; alongside unmistakable yet related ideas, i.e., safety climate, behavior-based safety, and safety framework. It likewise contrasts the proposed model and accessible safety culture models with a specific end goal to exhibit its relevance in construction site situations. Various studies were led, and models were readied characterizing the safety culture and relationship between them. Introductory results demonstrate that the model is effective in enhancing the general comprehension of safety culture on construction projects. This specialized note proposed a reasonable model that perceives human, specialized, situational, and organizational elements and their communications. The model serves as the intelligent premise for figuring out what and how to dissect and evaluate the distinctive parts of construction safety culture. It offers the chance to embrace an objective pursuing to set worldview different sub-objectives.

Gambatese (2009): Addressed construction safety in the project design - as a subset of general project constructability. A safety constructability review process can be produced that would give engineers and designers a rule for tending to safety constructability. The process gives a method by which design experts can viably oversee, address, and enhance construction site safety amid the design phase. Through a review of construction industry productions and design manuals, alongside meetings of construction experts (engineers, draftsmen, constructors, construction administrators), best design practices were aggregated which can be executed amid the design stage with a specific end goal to diminish or take out safety hazards in the construction stage. They described late research in the region of safety constructability. Execution of safety amid design can be upgraded to enhance correspondence amongst the project colleagues.

Mohammad S. El-Mashaleh, Shaher M. Rababeh (2009) This paper contributes a DEA approach for benchmarking safety performance of construction contractors. DEA measures the proficiency of construction contractors in using their costs on safety to minimize the quantity of endured accidents. Thusly, the DEA approach relates assets consumed on safety-to-safety performance. DEA examination scores safety performance of construction contractors on a size of 0–1.0. The investigation recognizes contractors E, CC, RR, SS, TT, ZZ, AAA, and CCC as proficient outskirts contractors. Contrasted with whatever is left of the contractors, these eight contractors are the industry pioneers in safety performance.

Krishnamurthy (2010) discussed the essential variables in connection with health and safety in the construction industry. Hazard Assessment and Control Methods of distinguishing hazards includes following factors (a) Consultation with workers (b) Consulting agents of industry affiliations, unions, and government bodies (c) Employing master specialists (d) Examining work environment injury and occurrence records according to the danger the number is given as 1, 2 or 3 to check the seriousness, grid for danger appraisal, with danger qualities, appeared in square sections. Solutions for accidents and disappointments: Good design, Careful construction, Correct training, Proper supervision, Efficient management Worker determination, Conformance to guidelines Government Regulation for all the safety precautionary measures to be watched and safety measures to be executed, the management must receive a decent Safety Management System (SMS). In this manner, accidents and disappointments might be anticipated by the advancement of the accompanying: Knowledge (Training and Education), Competence (Experience), and Care (control).

Hallowell (2011) studueid the investment in safety counteractive action which would lessen the direct and indirect expenses on accidents, money saving advantage investigation was done, and a cost model was readied. He analyzed the different injury counteractive action methods and their money saving advantage examination, and rattle off the strategies money saving advantage investigation are more than 1. The model clarifies here that if interest in safety was expanded it gives great returns like the anticipation of injury and roundabout expenses yet after ideal speculation it gives decreasing returns.

Bhattacharje and Ghosh et.al (2011): The common safety change approaches in the construction industry have put the weight of obligation regarding the workers‟ safety on the contractors. While the part of the contractors in the word related safety and health dangers of the workers is unquestionable, yet the absence of change in the safety performance of construction industry in the examination to others have asked the professionals and researchers to search for novel ideas. PtD is such an idea, which if

grasped by the construction industry and used appropriately can minimize word related safety and health dangers. Use of this idea calls for planners and engineers to take an interest in improving construction site safety.

Shirouyehzad, et.al (2011): During the previous decade, an incredible number of accidents hasinvited researchers to examine the variables which might impact effective usage of a safety program. Following a safety program include diverse parts of an office, it is essential to recognize the most vital elements which might impact effective execution of a safety program. This research displayed a functional methodology for recognizing the primary reasons for achievement in safety programs usage and positioning offices taking into account 16 basic achievement components of safety.

Panchal, et.al (2013) Discussed the safety issues in a high rise and disaster management and its suggestions The attempted to study the disposition of our construction organizations towards the attention to safety on a construction site. Information on construction casualty rate of various nations, the financial effect of the accident.Reasons for the accident, monetary effect of the accident. Part of Private Security foundations in helping Govt. offices in Disaster Management Role of Emergency Medical Services play in reacting to disasters and the scope for Public-Private Partnerships are the key issues.

Kumar and Bansal (2013): They learned about the safe work practices in the construction industry. Construction industry includes hazardous and unhealthy operations; if the attention is for the most part on productivity regarding cost, quality, and time, the construction project can never accomplish its objectives unless construction experts get to be mindful of the safety-related issues. Safety culture and climate would assume an imperative part in the alleviation of site hazards.

Dongping Fang, Chunlin Wu et.al (2014) They went for finding those management practices which can altogether affect worker safety conduct in construction projects Hypotheses Development, Research variables and their estimation scales, questionnaire. Their research managed the effect of director on safety at the construction site as chief has restricted authority yet he is all the nearer workers, so his methods for managing workers with respect to safety regulations gives a support to safety environment at the site. It is not simply management cooperation and contribution in safety exercises that is vital, yet the degree to which management energizes the association of the workforce. On the off chance that the worker stays in a gathering which has high safety measures and regulations, the worker won't have the mettle to disregard the safety controls. The paper clarifies how the part of manager is critical to safety at the site with the help of questionnaire and speculation.

Tudayekar, and Kulkarni (2014) They utilized safety and Emergency management (SEM) rule Model for powerful safety management. A great many people originate from country parts, so the absence of knowledge about their safety further more absence of training is a portion of the real reasons for accidents. The contextual analysis was taken for four organizations of Pune city, and different results are done on the safety measures and utilization of emergency safety model in the construction industry.

Subramani, and Lordsonmillar (2014) The industry needs many ventures and includes different sorts of partners and members. From the perspective of safety, the conditions typically experienced in the construction industry does not loan themselves to the level of control, Possible in different commercial enterprises where more steady conditions are for the most part needed. The construction industry is complex, and not the same as different commercial enterprises. Consequently, it is inclined to various health hazards. The workplaces in construction exercises are largely more hazardous, than different commercial ventures because of the utilization of heavy equipment's, unsafe apparatuses, and hazardous materials, all of which build the potential for genuine accidents and injuries. In this way, it is apparent that an engaged commitment inwards safety is required from construction at all levels.

Kadiri et.al (2014) Carelessness was the significant reason for accidents on construction sites. The fundamental impact of accidents on construction destinations is the loss of time in project execution. To ensure a safe and accident free construction site, management must comprehend, embrace and actualize all or a portion of the accompanying measures which are customary supervision and review by safety authorities and leaders on site. Steady preparing on the utilization of devices and gear, legitimate utilization of safety things and clothing, signs and notification ought to be given on construction sites and ought to be situated in vital territories on location, preparing programs ought to be given time to time, which ought to incorporate how to handle instruments, hardware, and plants. Need to understand and translate signs and images, administration must guarantee safety arrangements comply, plants, apparatuses and types of gear ought to be looked after frequently, restorative test ought to be carried on representatives for medication use, liquor intake and other and future purposes.

III .METHODOLOGY

In the present study, structured questionnaires were designed to serve as the measuring instrument for safety at construction sites. 20 questions were formulated based on the important factors that contribute to the safety at any real estate construction site. These were floated to various stakeholders in construction sector like Project Managers, Sr. Engineers, Jr. Engineers, Contractors, Supervisors, Builders, Interns and Trainees at various construction sites working in different reputed companies across India. Methodology of the same is given in Figure 1The original version of the scale included five response categories, and each response category was assigned a value within. Generally, the least important response was given a numerical value one, whilst the most important response has a numerical value of five. The numerical value of three was considered to be neutral. The final questionnaire contained questions on twenty factors that are in detailed discussed and presented in Table 1. Performance Management Technique was used to evaluate various safety operations to ensure that they are being performed at an acceptable level. Here we use performance index to create a benchmark measurement for the safety operations.

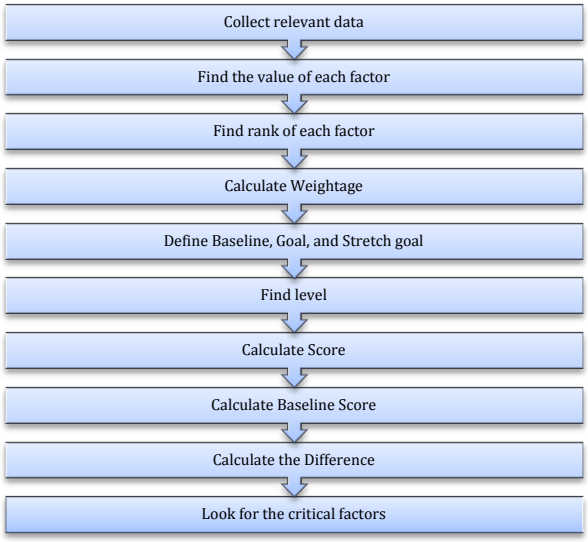

Figure 1 flow chart of the methodology

Iv.Analytical Procedure

Collection of data - data was collected from more than 100 responses across India. The data was collected in the form of Likert scale, with 1 being least importance and 5 being most importance. The performance indicators that are chosen are clearly defined. The appropriate performance indicators are chosen and listed in the left column of the matrix

Finding value - the value of each factor was calculated by dividing the responses into 25 and by calculating the sum of all four 25 responses and finding the Four quarter average, the maximum value of each factor being 125. The total of the weight of the constituent performance indicators must add up to 100%. Write the value of the weights in the "Wt." column.

Finding rank of each factor - the rank of each factor was found out on the basis of a number of most importance (Likert scale 5) given at a site. The factor which got a higher number of 5 rating is ranked first and which factor got least number of 5 rating on Likert scale is ranked last

Weightage calculation - The total of the weight of the constituent performance indicators must add up to 100%. The value of the weights was written in the "Wt." column. For each factor, the number of responses marked 5 on the Likert scale was calculated. Now we calculate the weight by dividing the number of responses to an individual factor which got the value of 5 on Likert scale with the total number of responses for all the factors having value 5, and then multiplying this value with 100 to get individual weight.

Dividing Likert scale (1-5) into various goals, where 3, 4, 5 corresponds to **Baseline, Goal, and Stretch goal** respectively. Considering stretch goal as the summation of most positive responses from all the sites, i.e. achieving the ideal case.The goal is taken as 80% of stretch goal and baseline as 65% of stretch goal.

Finding level - The level of each factor was found out on Likert scale on 1-5 with the help of value of factor.

Score calculation - The score for each performance indicator is determined by multiplying the level times the weight. Once this is done, the scores are added together to determine the composite results. In this case, it yields a value of 287.75for the index. This could be compared to a baseline value of 300. Ideally, values for this index would be calculated every month, quarter, or whatever time period is chosen and tracked over time. We calculated the score by multiplying the level with individual weights to calculate a score for each factor, and we found out the total score by summation of individual scores of all factors.

Baseline score calculation - we calculated the baseline score by multiplying the weight of each factor by baseline level. And by the summation of all individual baseline scores, we arrive at the baseline total scores. We have taken baseline level as 3 on Likert scale.

Difference calculation - we calculated the difference between score and baseline score. The difference means that improvement is required in the safety performance of various industries. The differences were found in factors such as Identification of site-specific training needs, Measures to identify over-stressed workers, Incentives for subcontractors to encourage a safe working environment which means that improvement is required these areas to make these make these factors reach an acceptable level in industry and to improve overall health and safety in site.

Critical factors - Now look for the factors whose score comes out to be lesser than the baseline score, which means that these factors need improvement and better implementation

	Performance level					Calculations						
Performance											**Baseline**	
Indicator	**1**	**2**	**3**	**4**	**5**	**Value**	**Rank**	**Level**	**Weight**	**Score**	**Score**	**diff.**

V. Results

A) Identification of site-specific training needs	44	60	83	100	125	81.75	15	2	4.56	9.12	13.68	4.56
B) Providing basic training programs	44	60	83	100	125	85.75	13	3	4.84	14.53	14.53	0.00
C) Providing training at regular intervals	44	60	83	100	125	84.25	18	3	3.70	11.11	11.11	0.00
D) Discussion with workers about hazards and preventive measures to be taken before starting any work; e.g. toolbox talk	44	60	83	100	125	88	1	3	6.27	18.80	18.80	0.00
E) Conducting safety committee meetings in presence of workers and officials	44	60	83	100	125	85.5	20	3	3.13	9.40	9.40	0.00
F) Comfort level of workers in communicating with immediate supervisors regarding safety issues	44	60	83	100	125	86.5	15	3	4.56	13.68	13.68	0.00
G) Inspection of site and equipment before working	44	60	83	100	125	86	9	3	5.13	15.38	15.38	0.00
H) Provision of stopping the work if unsafe and adoption of required safe design/ procedure.	44	60	83	100	125	85.5	1	3	6.27	18.80	18.80	0.00
I) Regular inspection by safety officer	44	60	83	100	125	90.5	9	3	5.13	15.38	15.38	0.00
J) Mandatory report submission by site engineer at regular intervals about hazards identified and mitigated in	44	60	83	100	125	87.75	5	3	5.41	16.24	16.24	0.00
K) Assigning safety responsibilities to people at all level	44	60	83	100	125	87.5	9	3	5.13	15.38	15.38	0.00
L) Development of occupational hazard and safety policy for organization	44	60	83	100	125	89.5	3	3	5.98	17.95	17.95	0.00
M) Setting up of safety department and appointment of qualified safety officers	44	60	83	100	125	90.25	5	3	5.41	16.24	16.24	0.00
N) Allocation of sufficient funds in time for safety	44	60	83	100	125	86.75	13	3	4.84	14.53	14.53	0.00
O) Measures to identify over-stressed workers	44	60	83	100	125	77	17	2	3.99	7.98	11.97	3.99

P) Positive attitude of workers towards PPE (Personal protective equipment)	44	60	83	100	125	88.25	3	3	5.98	17.95	17.95	0.00
Q) Incentives for subcontractors to encourage safe working environment	44	60	83	100	125	79.5	18	2	3.70	7.41	11.11	3.70
R) Acknowledgment of worker for helping fellow worker in mitigating a probable hazard	44	60	83	100	125	86	9	3	5.13	15.38	15.38	0.00
S) Development of emergency response system beforehand	44	60	83	100	125	88.5	5	3	5.41	16.24	16.24	0.00
T) Testing of evacuation plans in case of fire	44	60	83	100	125	90	5	3	5.41	16.24	16.24	0.00
						TOTAL			**100.00**	**287.75**	**300.00**	**12.25**

From the above table, we see that the total score comes out to be less than the baseline total score, which shows that there are factors, which need to be given more importance and better implementation at the construction site. Factors, which need improvement and better implementation

Factors	**Difference between score and baseline score**
Identification of site-specific training needs	4.56
Measures to identify over-stressed workers	3.99
Incentives for subcontractors to encourage safe working environment	3.70

Vi. Conclusion

In our research, the factors defining the safety, that are given less importance and having scores which are below baseline scores are identified. We had set the benchmark of acceptability via Performance Index. The three levels of performance correspond to **Baseline, Goal, and Stretch Goal.**

The Stretch Goal is equivalent to 100% effective safety implementation. The Goal is equivalent to 80% effective safety implementation, and the baseline is equivalent to 65% effective safety implementation.

1. As per the analysis, there is a significant difference in the score and the baseline score for three factors, and thus, there is a need of improvement in the same. The three factors are namely
   - Identification of site-specific training needs,
   - Measures to identify over-stressed workers,
   - Incentives for subcontractors to encourage safe working environment
2. These three factors need improvement to reach simply the baseline, which brings us interpretation that there is a dearth of importance and implementation given to these factors.
3. In order to reach the goal of 80% effective safety implementation, we need to work with all the factors defining safety at a site.

VII. REFERENCES

[1] B. H. W. Hadikusumo and Steve Rowlinson: "Capturing Safety Knowledge Using Design-for-Safety-Process Tool", 2004, Journal of Construction Engineering and Management, 31 - 38.
[2] Brenda McCabe, DimtriosKarahalios and Catherine Loughlin: "Attitudes in construction safety", 2005, Journal of Construction Research Congress, 45, 19 – 24.
[3] Dongping Fang, Chunlin Wu et.al: "Impact of the Supervisor on Worker Safety Behavior in Construction Projects.'', 2014, Journal of Management in Engineering.
[4] HadiShirouyehzad, MazdakKhodadadi-Karimvand et.al: "Prioritizing Critical Success Factors Influencing Safety, Using TOPSIS.'', 2011, Journal of Construction Research Congress.
[5] John A. Gambatese "Safety constructability: Designer involvement in construction safety site, 2009, Conference proceeding paper at Construction Congress.
[6] Jimmie Hinze: "Role of designers in construction worker safety", 1992, Journal of construction engineering and management, 126(5), 399 – 403.
[7] Jimmie Hinze, Matthew Hallowellet.al: "Construction-Safety Best Practices and Relationships to Safety Performance.'', January/February 1998, Journal of Construction Engineering and Management, Vol. 124, No. I.
[8] Kadiri Z. O, Nden T et.al: "Causes and Effects of Accidents on Construction Sites.'', 2014, Journal of Mechanical and Civil Engineering (IOSR-JMCE).
[9] Kin Dorji and Bonaventura H. W. Hadikusumo: "Safety Management Practices in the Bhutanese Construction Industry.'', 2006, Journal of Construction in Developing Countries, Vol. 11, No. 2.

[10] M. D. Cooper, R.A. Phillips: "Exploratory analysis of the safety climate and safety behavior relationship.'', 2004, Journal of Safety Research,35.
[11] Marc Weinstein, John Gambatese et.al: "Can Design Improve Construction Safety: Assessing the Impact of a Collaborative Safety-in-Design Process'', 2005, Journal of Construction Engineering and Management.
[12] Matthew R. Hallowell: "Risk-Based Framework for Safety Investment in Construction Organizations.'', 2011, Journal of Construction Engineering and Management 20, 7 – 19.
[13] Matthew R. Hallowell, Jimmie W. Hinze et.al: "Proactive Construction Safety Control: Measuring, Monitoring, and Responding to Safety Leading Indicators.", 2013, Journal of Construction Engineering and Management.
[14] Mohammad S. El-Mashaleh, Bashar M. Al-Smadi et.al: "Safety Management in the Jordanian Construction Industry.'', 2010, Jordan Journal of Civil Engineering, Volume 4, No. 1.
[15] N. Krishnamurthy: "Safety in the Construction Industry", 2010, Journal of Frontiers in Construction Engineering.
[16] PanchalVarshaGovindbhai, DodiyaParthIshwarbhai: "Safety Measurement of High-Rise Building.'', 2013, INDIAN JOURNAL OF RESEARCH.
[17] PiaPerttula, PekkaKorhonen, JouniLehtela, Pirkko-Liisa Rasa, Jari-PekkaKitinoja,SimoMäkimattila, and TimoLeskinen: "Improving the Safety and Efficiency of Materials Transfer at a Construction Site by Using an Elevator", 2006, Journal of Construction Engineering and Management.
[18] R. Navon and O. Kolton: "Model for Automated Monitoring of Fall Hazards in Building Construction.'', 2006, Journal of Construction Engineering and Management.
[19] Rafiq M. Choudhry; Dongping Fang et.al:" Developing a Model of Construction Safety Culture.'', 2007, JOURNAL OF MANAGEMENT IN ENGINEERING.
[20] RohitLaxmanTudayekar, SushmaShekharKulkarni: "Safety and Emergency Management on Construction Sites", 2014, Current Trends in Technology and Science, Volume 3.
[21] "Satish Kumar, V.K. Bansal: "Construction safety knowledge for practitioners in the construction industry.'', 2013, Journal of Frontiers in Construction Engineering.
[22] Xinyu Huang: "The owner's role in construction safety", 2003, Journal of Construction Engineering and Management.
[23] SuchismitaBhattacharjee, SomikGhosh et.al:" Safety improvement approaches in construction industry: A review and future directions.'', 2014,ASC Annual International Conference Proceedings.
[24] T. Subramani, R. Lordsonmillar: "Safety Management Analysis in Construction Industry.'', 2004, Journal of Engineering Research and Applications, Vol. 4.

