



Enhancing Safety for Rural Construction Workers

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Abstract: For being successful, safety is important for any industry. For that, identifying the risks associated, and manage them up to tolerable level is a must. In developing countries like India, construction industry is not so safe due to its complex activities and dynamic project environment. Prior the constantly developing technologies, those are barely reaching to the local sites. Since there are rules, regulations and norms for safety, it remains on paper only in rural areas. Rural construction workers in India face significant safety challenges in their daily work, often in remote and under-resourced areas. This research paper presents a comprehensive study aimed at improving the safety conditions and well-being of these vulnerable laborers. We analyzed the data collected from surveys of 150+ rural construction workers and officials across different sites. Our findings reveal alarming disparities in safety measures and risk exposure, as well as inadequate access to healthcare services. Key challenges include precarious working conditions, lack of safety training, insufficient protective equipment, and limited awareness of workers' rights. Notably, a significant number of injuries and health issues were reported, underscoring the urgent need for intervention. In response to these findings, we propose some recommendations for enhancing the safety of them. These recommendations encompass improved enforcement of existing labor laws, enhanced safety training programs, appointment of safety engineer, access to personal protective equipment, and greater collaboration between government agencies, construction companies, and local communities. This research contributes not only to the understanding of the safety issues faced by rural construction workers in India but also offers actionable insights for policymakers, employers, and stakeholders in the industry. By implementing the proposed measures, we can mitigate risks, reduce injuries, and ensure a safer working environment for these essential laborers, ultimately improving their overall quality of life. . Also, the quality of the project will be improved as well as the time required, cost and the wastage will be reduced in the project.

Index Terms- Awareness, Risks, Rural Construction Sites, Rural Construction Workers, Safety, Safety Equipment, Safety Training.

I. INTRODUCTION

The construction industry holds significant importance in India for several reasons, contributing significantly to the country's economy, infrastructure development, housing and real estate, employment generation, local supply chain, foreign investment, modernization, technological advancements, government initiatives, sustainability and green buildings, and rural development. Also, construction of hotels, resorts, and tourism-related infrastructure stimulates the tourism and hospitality sectors, which are crucial for local economies in tourist destinations. In summary, the construction industry in India is a vital driver of economic growth, infrastructure development, and employment generation. Its significance extends beyond bricks and mortar, impacting various sectors and contributing to the nation's overall progress and development. As India continues to grow and urbanize, the construction industry is expected to play an even more crucial role in shaping the country's future.

The industry also contributes 6% - 9% in the India's Gross Domestic Product (GDP). It varies from year to year based on economic conditions, government policies, and infrastructure development projects. These figures are subject to change over time due to economic fluctuations and policy developments. However, historically, the construction industry has consistently been one of the significant contributors to India's GDP.

On the other hand, only 13 lakh of the over 18 lakh construction workers in the state have registered with the Maharashtra Building and Other Construction Workers' Welfare Board and a section of officials from the labor department cited the mandatory 90-day work certificate rider for signing up with it as the reason for the poor show.

1.1 Reality of the rural construction industry in India:

Construction worker safety in rural India faces several unique challenges and problems that often differ from those encountered in urban areas. These challenges can make it more difficult to ensure the well-being of construction laborers in rural settings. Some of the problems in construction worker safety in rural India are: 1) Lack of awareness and education; 2) Limited access to training; 3) Limited workforce; 4) Inadequate safety gear; 5) Poorly Maintained Tools and Equipment; 6) Primitive Construction Methods; 7) Lack of Health Services; 8) Migrant Workers; 9) Unpredictable Weather Conditions; 10) Limited Regulatory Oversight; 11) Language and Cultural Barriers; and 12) Social and Economic Vulnerability.

1.2 The problems construction labor in rural India facing:

The condition of construction labor in rural India varies widely based on several factors, including region, socioeconomic factors, government policies, and the specific circumstances of individual workers. However, there are some common challenges and issues faced by construction laborers in rural areas of India: 1) Low Wages, 2) Lack of Job Security, 3) Unsafe Working Conditions, 4) Inadequate Housing and Living Conditions, 5) Lack of Social Security, 6) Exploitative Labor Practices, 7) Health and Education Issues, 8) Migration and Separation, 9) Gender Disparities, and 10) Debt Bondage.

Efforts have been made by the government and non-governmental organizations (NGOs) to improve the conditions of construction laborers in rural India. These initiatives include the implementation of labor welfare schemes, the provision of housing and sanitation facilities, skill development programs, and awareness campaigns on workers' rights and safety. However, challenges persist, and there is a need for continued advocacy and policy reforms to address the issues faced by rural construction laborers and improve their living and working conditions.

1.3 Importance of worker safety:

Worker safety in the construction industry in India is of paramount importance for several compelling reasons. Ensuring the safety and well-being of construction workers not only benefits the workers themselves but also has broader implications for the industry, the economy, and society as a whole. For reasons like Worker Welfare, Legal and Ethical Obligations, Economic Impact, Productivity and Efficiency, Reduced Costs, Project Timelines, Competitiveness, Sustainability, Skill Attraction and Retention, Social Responsibility, etc. worker safety plays an important role. In short, worker safety is a critical consideration in the Indian construction industry, with far-reaching implications for individuals, companies, and the nation as a whole.

1.4 Costs of Construction Accidents:

The construction industry is one of the most hazardous in all over the world. There are direct costs and indirect costs as well behind an accident. Accidents have a significant impact on construction projects, and can result in expenses that can quickly add up to lots of money.

1.4.1 Direct costs:

1. Medical bills,
2. Damage to materials, equipment, or property,
3. Litigation, and
4. Regulatory fines

1.4.2 Indirect costs:

1. Hiring replacement workers and their training,
2. Lost team productivity,
3. Penalties for missed deadlines,
4. Administrative time spent by supervisors and safety personnel,
5. Costs from implementing corrective measures, and
6. Damage in reputation.

Indirect costs can be much higher in high-risk industries like construction industry. Sometimes it is several times higher than direct costs. Safety is often viewed as a necessary expense on many construction projects, that must be included in the project but is often a waste of money and time. But the studies have shown that the cost of not doing anything is much higher than the cost of prevention. According to a study, accident rates decrease and profits increase by 4-7% per project when companies invest just 2.5% of project costs into safety training and procedures.

1.5 Scope of the research:

The scope of this research on the problems faced by rural construction workers in rural India is broad and multifaceted, offering opportunities for in-depth exploration and potential for meaningful impact. So finding out the safety and health issues, access to resources and services, employment conditions, migrant worker issues, their needs and suggesting solutions are some aspects and areas of scope for research in this domain.

Research on the problems faced by rural construction workers in rural India has the potential to inform policy decisions, drive social change, and improve the lives of a vulnerable workforce. By addressing these issues comprehensively, researchers can contribute to creating a safer and more equitable working environment for construction workers in rural areas.

II. LITERATURE REVIEW

This literature review typically aims to achieve several objectives like identifying existing knowledge, understanding the safety challenges faced by the rural construction workers, to review safety measures and practices, identifying risk factors, exploring interventions and solutions, comparison of rural safety versus urban safety, legislation and regulations, gaps in the research, recommendations and best practices, contribute to knowledge base, and the list goes on.

It is assumed that all the safety norms are followed by the labor working on the construction sites as well as the contractors. Since it is true for the sites situated in urban area but is not applicable for the local construction rural sites located at small towns or taluka places, and also for some of the sites on the district places too. On these sites, it is seen that labor as well as the owners, the managers, the supervisors, all of them ignore the safety norms and end up not using the safety equipment.

As per seen, construction worker safety in rural India face several unique challenges and problems that often differ from those encountered in urban areas. These challenges can make it more difficult to ensure the well-being of construction laborers in rural settings. Worker safety in the construction industry in India is of paramount importance for several compelling reasons. Ensuring the safety and well-being of construction workers not only benefits the workers themselves but also has broader implications for the industry, the economy, and society as a whole. Here comes our title- "Enhancing Safety Measures for Rural Construction workers".

Through their literature review, **N H Abas, N Yusuf, N A Suhaini, N Kariya, H Mohammad and M F Hasmori** have concluded several identified factors that can affect the safety performance of construction project in project level. There are many advantages by implementing these safety factors, such as reduce the number of accident on the construction project, increase productivity, project complete on time, and decrease compensation cost and increase morals among employees. According to them, the good safety performance in project level can lead to better improvement of safety performance in construction industry. Future research is needed to explore the factors affecting safety performance in organization level, they suggest.

Siyeon Kim, Heerim Lee, Sungjoo Hwang, June-Seong Yi & JeongWook Son investigated the relationship between levels 1 and 2 situation awareness (SA) and the physical and mental loads of construction workers in a real-world experiment. Four experimental sessions were created with different conditions of physical and mental load to measure subjects' SA by them. Regardless of the mental and physical load, the level 2 SA (comprehension) score was statistically lower than the level 1 SA (perception) score. Also, subjects' SA in their surrounding situation is significantly affected by the mental workload.

Dr. Dileep Kumar M. performed a case study and a survey of the construction workers. Through his study, he found out that the unorganized nomadic workers are facing high level atrocities from the construction contractors and sub-contractors. Many Acts like, Factory Act assures the quality of life of workers in the companies and factors, but are alien to the workers in the construction industry. Long working hours, poor housing facilities, lack of health and safety measures, atrocities on female workers, the illiterate condition of children of construction laborers, inadequate compensation factors and poor wage and salary structures invites more attention from the government and NGOs to intervene in this issue and provide better quality of life to these segments of the population.

Md.Shams Mukhtar and Dr. Preeti R.Gotmare found out that unorganized sector employees get very less returns of their work and they work in worst physical environment. They are mostly sensible for insecurity in employment and do not get socio-economic protection against the hazards in health, work and life. Health insurance plays essential role in health care and services in the unorganized workers. Lack of health and security awareness schemes between the workers are the reason of unenrollment in the various scheme for the workers. Therefore, they suggest the officials of central and state government to start awareness program and campaign for the unorganized sector employees to make them feel safe and be healthy.

Albert P. C. Chan, Junfeng Guan, Tracy N. Y. Choi and Yang Yang, Guangdong Wu and Edmond Lam was to identify the effects of the major LFI factors on safety performance of construction workers based on a generic BN model. The significance of their study lies in the proffering of a BN model that reveals the interrelationships of the LFI factors and safety performance of construction works. Their findings will help in formulating effective safety management strategies to improve the construction safety. The BN model can be a practical technique to diagnose effective LFI factors for improving safety performance according to them. The research outcomes are valuable to key project stakeholders to achieve better safety performance, and bring tremendous value in better safeguarding workers' health and safety. It contributes to provide an updated review of literature in the area of LFI factors on construction safety. It provides a method of analyzing LFI factors to derive effective strategies to promote construction safety. With the help of this tool, industrial practitioners may quickly identify best methods for decreasing construction accidents.

Guddi Tiwary and P. K. Gangopadhyay conclude through their literature review that in India, as the workers are mostly illiterate, it is desirable to impart health education to them, to apprise them of the ill effects of work and the remedial measures. Local group discussions and awareness programs are essential for improving the health and safety status of these working communities.

Manoranjan Dhal performed a field study encompassing the transcribed records of observation, field interaction with 84 migrant construction workers, and 118 still photographs. They analyzed the data by using qualitative analysis software and by developing categories and by doing comparative analysis. The findings reveal that these laborers experience precariousness and are challenged by no availability of regular work, shortages of food, burden of large family size, and social evils of to live in a slum, face harassment by goons and contractors with minimal support from trade unions and government. Employers are apathetic toward their legal obligations. With labor stands being a primary source of labor supply to the construction sector, the findings of this paper help in enriching labor relations and policy measures for its regulation.

Ananda P and Prof. Y.S.Siddegowda found out that the building construction industry is not providing the minimum facilities such as health and safety measures to the building construction workers in the worksite. Mainly, some of the workers working with cement, granite metals, water the mixture (Concrete) of sand, to build mouldings and build the buildings, constructing the houses, schools, hospitals etc., the building construction workers are facing physically, Mentally and economic problems in day to day life. Most building construction workers are leading their life below the poverty line due to numerous reasons. Fights for better minimum wages and good working conditions cannot yield result only by the formatting of trade unions of the building construction workers. Non- Governmental Organizations must play an active role in developing an affectionate model of intervention which can be adopted by the governmental agencies and the building construction owners.

S. Kanchana, P. Sivaprakash, and Sebastian Joseph concluded that the major cause for construction accidents is due to injuries. The average number of accidents was 16.03 in small sites. And the average number of accidents was 13.00 in large sites. In both small and large construction sites, more number of accidents occurred due to body injuries accounting to 44.1% and 26.4%, respectively. In general, safety of workers in all construction is to be improved. Contractors and owners must give utmost importance to the safety of the workers. Employer can check legislation and plan a proper health and safety schedule to the workplace and the employees.

Sadegh Aliakbarlou, Nishan Fernando Delcon, Javad Bakhshi and M. Reza Hosseini did a systematic review and post-hoc statistical analysis which reveals that particular risk categories are more likely in sustainable construction as opposed to non-sustainable construction. Overexertion (8.77 times), seeing and hearing injuries (10.64 times), electrocution (10.64 times) and exposure in harmful substances (20 times) are main categories. Apart from this analysis, this research has also summarized a list of risks which occur solely on sustainable building projects - injuries due to vegetated roofs, installation of PV, recycling of building material, additional piping and duct work for energy efficiency to name a few.

Case Studies

[1] On rehabilitation and up-gradation of Nandurbar (Kolde) -Prakasha -Shahada -Khetia state highway site near Shahada, a supervisor and two laborers were hit by a dump truck while working on the site. The supervisor Bhushan Patil, and labor Sagar Beldar were injured badly. Bhushan had a cut on his arm and was bleeding badly. Sagar got a fractured leg and some scratches on his body. Another labor Rakesh Mali had very few scratches on his leg. As Bhushan recalls, there was no first aid kit available on the site. The other workers took both of them to the hospital situated on 8-10 km away from the site.

The truck hit them was owned by the contractor which was driven by one of the labor, who hit them by mistake as the truck was heavily loaded and he missed the control on the dump truck. The driver complains that there were not a single barricade for parting the road under construction and other side which was been used by other vehicles. Also, the workers and supervisor, nobody was provided with the reflecting jackets, helmets, boots, and etc. safety equipment as the site was in the rural area.

The supervisor was appointed by the contractor H. G. Infrastructure Engineering Limited and the workers were provided by the sub-contractor Bhenda Construction Company. As the supervisor was registered and the laborers were not, the company only compensated the supervisor and not the workers. The contractors only provided medical expenses for the three of them but the supervisor got 3 months paid leaves for his recovery. And the worker Sagar didn't get any compensation for his fractured leg and

he had to manage the recovery leaves and his monthly expenses by his own as well. He didn't get any payment for the non-working days.

[2] On a private construction site of a house in Chopda dist. Jalgaon, a 14 year boy playing on the first floor of the site where his parents were working, fell off and died on the spot.

The contractor Tripti Constructions supported the parents emotionally. Also provided the required medical help. But the parents of the boy Lalu and Balibai were not compensated as the contractor raised their hands and said that the boy were their responsibility and not the firm's.

Lalu and Balibai come from a small village and they both work to provide the primary needs of their family including their children. As they both are illiterate, they say that they don't even know what registration is and the contractors also never informed them to get registered. Some of the people in their known told them to ask for the compensation to the contractor but the contractor refused it by giving the reason that they were not registered labors.

The people present on the site at the time of the accident tell that there were not proper safety taken. The safety net and barricades weren't provided to the site and nowhere mentioned about the risks. Also, no safety equipment was provided to the workers as the site was very small.

[3] Due to bitumen browser pipe leakage, a worker named Raju Yadav had a severe burn on his hand. Raju was working on the rehabilitation and maintenance site of a bitumen road near Dhule.

When the accident took place, it was seen that no safety norms were followed and no safety equipment was used. Even the first aid kit was unavailable on the site. And Raju had to go to the hospital after the accident happened immediately.

The contractor Mr. Patel (name was changed) gave Raju the compensation including medical allowance and paid leaves. But, the total amount was distributed to the officials working above Raju and finally he got 50% of the total amount issued by the contractor.

On complaining about this to the officials, they threatened Raju that they will restrict him from the job. So he had to shut his mouth and receive only 50% of the amount as his family was eating on his hands.

III. RESEARCH METHODOLOGY

The work methodology included a literature search, finding aim and objectives, collection of information, empirical questionnaire, structured face to face interviews with working labor, digital survey of working professionals, data analysis using different methods and finding and suggesting some of the methods for site management as well as to reduce the risk.

The research methods employed included: (1) desktop research; (2) structured face-to-face interviews with local site workers; (3) digital questionnaire survey of working professionals; and (4) weights assessment relating to the questionnaire survey results.

3.1 Material

The applications used for this research project was Google Chrome, Google Scholar, Pinterest, ResearchGate, Socratic, etc. These applications were selected as they are very convenient to use and easy to handle. Also, for survey of working professionals Google Forms was used. Apps like Gmail and WhatsApp were used to provide the Google form to the respondents of this survey.

But it was seen that the labor on the construction site are not really comfortable with this method of the survey, hence, their survey was carried out in the form of pen and paper in their mother tongue in which they were the most comfortable.

3.2 Procedure

In civil engineering fields, it is assumed that all the safety norms are been followed by the labor working on the construction site as well as the working professionals. Since it is true for the sites situated in metro cities and big cities but is not applicable for the rural construction sites situated in small towns or taluka places, and also for some of the sites on the district places like Jalgaon, Dhule, Nandurbar, etc. On these sites, it is seen that labor as well as the owners, the managers, the supervisors, etc. ignore the safety norms and end up not using the safety equipment. Here we got our topic for the research paper.

For this, we performed the desktop research, then found out the causes and its impacts as well as the environmental damage, etc. We also studied the benefits and profits of using the safety equipment. We also tried to find out the solution for the same and risk assessment. To find out the actual cause of the problem, we performed the surveys of the labour and the working professionals. Some of the methods which would help the workers to follow safety norms and reduce the risk are also suggested in this research project.

3.2.1 Desktop Research

The search engines "Scopus" and "Google Scholar" were used to conduct the literature search under the "Title/Abstract/Keyword" field. Search keywords included "Safety", "Rural Construction Sites", "Rural Construction Workers", "Safety Management", "Safety Equipment", "Rural Construction Site Accidents", "Construction Site Safety", etc. Publications related to construction safety from local government offices were also examined.

3.2.2 Questionnaire Design

A questionnaire survey for the professionals was designed aiming to get the opinion and understanding from the experienced respondents regarding to the construction challenges and problems in India. The questionnaire included the characteristics and backgrounds like: name of the respondents, their job title, education, and years of experience, about the equipment they provide, the training they provide, etc. As the survey was to be held in digital format, it was kept in the mind to be as precise and as easy as it could be for the comfort of the surveyors. As well as the method was kept easy to respond and require less time as well.

And another survey was designed for Direct Personal Interviews of the rural construction workers to collect the data. The questions included in this survey were about the facilities provided to them by the contractors, their views about the safety, training provided to them, etc.

3.3 The Survey

For this research, we have taken two types of survey, online and offline. The online survey was designed for the working professionals in the industry and the offline one was designed for the labor working on the field.

The Motivation behind both of these type of surveys was the working professionals can understand the language as well as are able to submit the response online by their own and it also takes a very small amount of time from their hectic schedule. And the

offline survey was designed especially for the working labor who are not used to the professional language as well as they aren't comfortable with the digital survey. The face-to-face personal interview method was the best suitable for them to respond and us for the survey.

A requesting message was sent to the known working professionals in the civil industry to participate in the small survey taken online on Google Forms as-

Dear Sir/Madam,

I have taken up a small survey on "Safety on Rural Construction Sites" to understand the problems faced by rural construction workers. And these problems will be analysed by the questionnaire attached.

Through this, I kindly request you and your members of organisation who have good experience in the construction industry to participate in this survey.

Participation in this survey will be very helpful for me.

The following link will lead you to the survey:

<https://forms.gle/2uTf4YSCUU6X5UJz9>

This survey is very brief and takes 4-5 minutes to complete. If you have any questions about the survey, please contact me at shindepradnya173@gmail.com

Please complete the survey by September 30, 2023 at 11:59 pm. Your assistance in providing invaluable information about this topic is much appreciated.

Thank you.

And the platforms used to share this requesting message was WhatsApp as well as Gmail. The message was spread within all the known working professionals in civil engineering and construction sites in the rural area. And as expected, many of them responded to the survey. We have received 87 responses in the Google Forms and still counting. This is a huge number for rural places.

The questions in this digital survey included:

1. Name and Contact
2. Job description
3. Experience in years
4. Level of education
5. Location of the site
6. Do you have safety manager on your site?
7. Are your sites properly managed?
8. Do you follow all the safety norms on our site?
9. Is your site safe for the workers?
10. Do you conduct hazard identification and risk assessment on your site?
11. Do you provide safety equipment to the workers? If yes, then what equipment?
12. Are you satisfied with the facilities you provide to the workers?
13. What are the problems in providing safety to the workers?
14. Do your workers has a union?
15. Do your workers have demands?
16. Do your workers go through any kinds of conflicts?
17. Do you provide training to the workers? If yes, then what kind of?
18. What problems do your workers face while working on the construction site?
19. What do you do to ensure the safety of the workers?
20. Have you ever witnessed a big accident on your site? Tell about its impact.

And the questions for another face-to-face direct personal interview type survey of rural construction workers included the below questions:

1. Name and Age
2. Education
3. Experience in years
4. Where do you live?
5. What facilities are provided on the site as well as in the labor colony by the contractor?
6. What problems do you face while working on the site?
7. Does your contractor provides you safety equipment?
8. Does your contractor provide you proper training?
9. How do you get to know the latest technology?
10. Do you think that safety is important?
11. Do you think your site is safe?
12. Are you able to pay all the expenses from the payment given to you?
13. Do you have workers' union?
14. Are you registered in the workers association?
15. Do you have health insurance?
16. Have you ever faced an accident on the site? If yes then what was the treatment and what facilities you've got then?
17. Do you have a first aid kit on the construction site? Do you know how to use it?
18. Do you have any demands from the contractor?
19. Are your co-workers supportive?
20. Do you go through internal conflicts?
21. Do you know about the safety norms?
22. Do you know about your rights?

3.4 Data Analysis

The data collected from the surveys were analyzed to find out the problems of the rural construction workers. And with that, we came to our final results. Also, we have suggested some implementations to make the lives of rural construction workers better.

IV. RESULTS AND DISCUSSION

The results of both of the surveys we have conducted one digital and another one face-to-face direct personal interview are shared below. The total of 87 responses were from the digital survey held of the professional working on the rural construction sites like Contractors, Supervisors, Engineers, Managers, etc. And 65 responses of the random rural construction workers working on different types, sizes and costs of the sites. These, in addition makes the 150+ responses in total. The data collected from these surveys was analyzed and it was tried to find out the solutions for the problems faced by rural construction workers.

From the 87 responses in digital questionnaire survey, 26.4% were Supervisors, 24.1% were Site Engineers, 19.5% were Project Managers, 16.1% Contractors, and the remaining were the Architects, Engineers, Student Interns, etc.

Job Description
87 responses

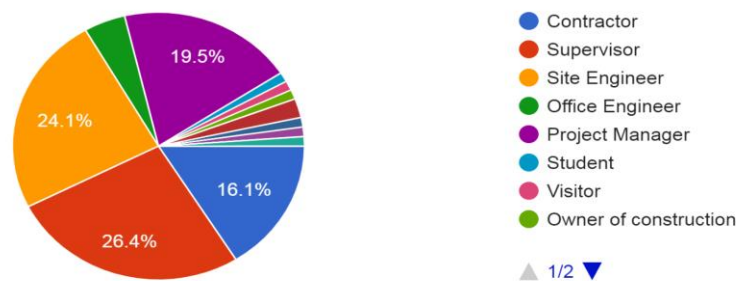


Fig. Pie Chart Showing Job Descriptions of the Respondents

From 87 responses, the experience in the industry of 32.2% was of 2-5 years, 27.6% had 5-10 years, 26.4% had 0-2 years, 7.8% had 20+ years and others had 10-20 years of experience.

Experience
87 responses

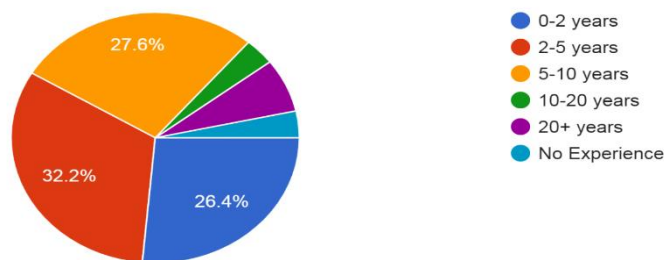


Fig. Pie Chart Showing Experience of the Responders

From 87 responses, 47 were holding bachelor's degree in the professional fields, whereas the 23 were holding master's degree, 21 had done their diploma and 1 had completed other courses in the field. Unfortunately, nobody holding PhD works in the rural area.

Level of Education

87 responses

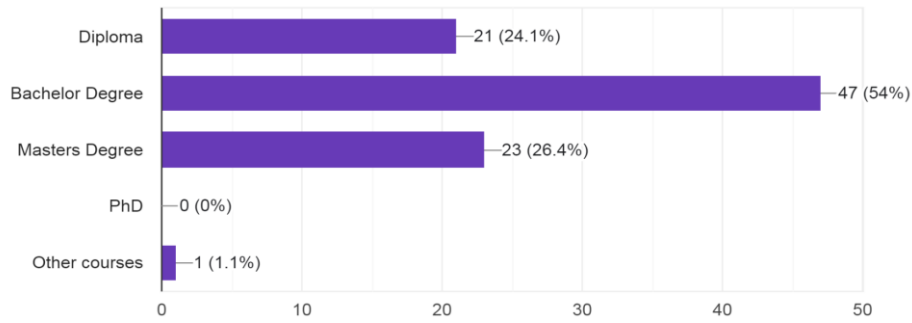


Fig. Bar Chart Showing Level of the Education of the Responders

The location of the sites of these 87 responders were Jalgaon, Dhule, Nandurbar, Bhusawal, Amalner, Chopda, Shirpur, Dondaicha, Shahada, Shindkheda, Lasur, Savkhede, etc. Some of the cities fall in urban area of this list but still the people are not much aware of the safety of the construction workers and the construction sites

Do you have safety manager on your site?

87 responses

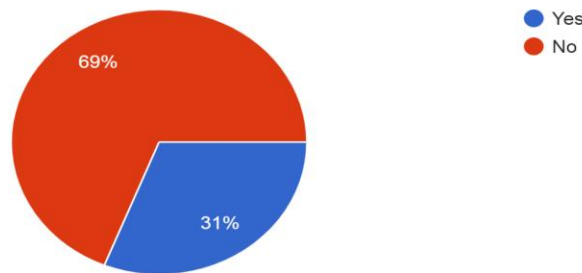


Fig. Pie Chart showing if responders have safety manager on their sites

The next question in the list was if they have a safety manager on their site and the 69% responders said that they don't have any safety manager on the construction site, while others have said that they take care of the safety through their site managers or supervisors etc.

From 87 responders, 57.5% think that there sites aren't properly managed. And 42.5% think that there sites are properly managed and the workers find the site easy to move from one place to other and don't have any difficulty finding the material as well as the moving things and material from one place to other.

Are your sites properly managed?

87 responses

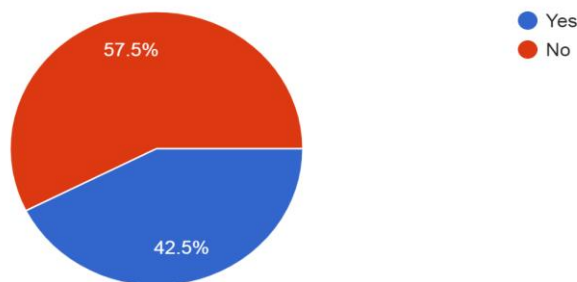


Fig. Pie chart showing if responders have their sites properly managed

Do you follow all the safety norms on your site?

87 responses

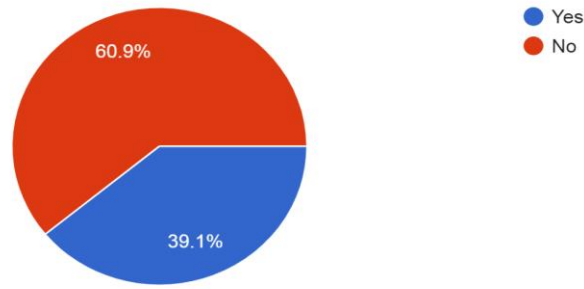


Fig. Pie Chart showing if the responders follow safety norms on their sites

60.9% responders of 87 said that they don't follow the safety norms, rules and regulations given by the government on their construction sites. And 39.1% said that they follow some of the safety norms on their sites.

Is your site safe for the working personnel?

87 responses

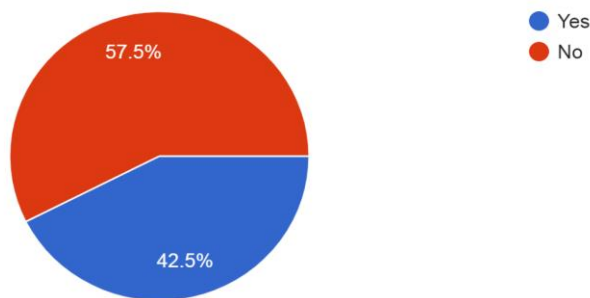


Fig. Pie Chart showing if the sites of responders are safe for workers

From 87, 57.5% think that their sites are unsafe for the workers working on the construction sites as well as the officials and visitors etc. And 42.5% said that they thin their sites are safe for the workers.

Do you conduct hazard identification and risk assessment for the safety on your site?

87 responses

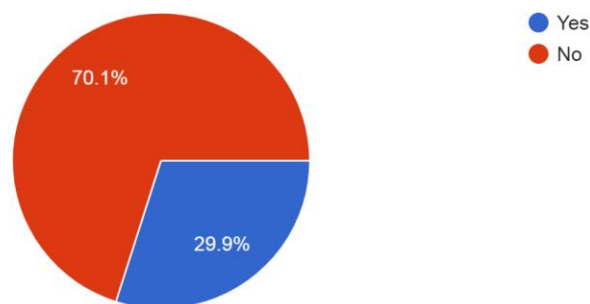


Fig. Pie chart showing if responders conduct hazard identification and risk assessment on their construction sites

From 87 responders, 70.1% said that they don't conduct hazard identification and risk assessment on their sites. And 29.9% said that they take care of risk management.

Do you provide safety equipment to the workers?

87 responses

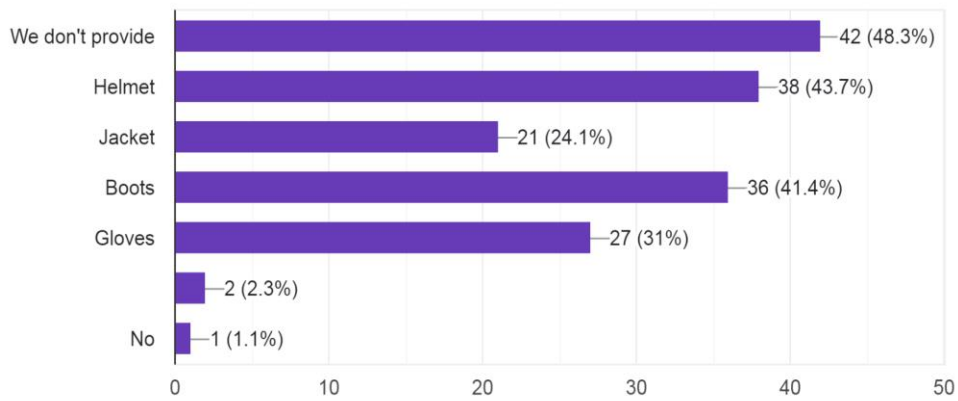


Fig. Bar Chart showing if responders provide the safety equipment to the workers and what equipment

From 87 responders, 48.3% don't provide any safety equipment on their sites while the others provide helmets, gloves and boots for some of the tasks. But only few of them provide all the equipment all the time for all the tasks.

On asking the problems faced for providing safety on the construction site, 39.1% think that nobody is aware about the safety and if they don't provide it, nobody is going to complaint about it. 33.3% said that if they provide safety, they will face money shortage and there are insufficient funds for the safety. 26.4% said that workers don't use the kit and hence they have stopped providing the safety kit. 16.1% said that they just follow the orders and their boss didn't tell them to provide the safety kits. And 14.9% of them think that safety is overrated and there is no need to provide any safety kit, the workers know how to do their works well.

From 87 responders, 63.2% are not satisfied with the facilities provided to the workers by them. And 36.8% think that the rural construction sites can provide only a few things and nothing else we can expect from them so they were satisfied by the very few facilities provided by them.

Are you satisfied with the fascilities provided to the workers by you?

87 responses

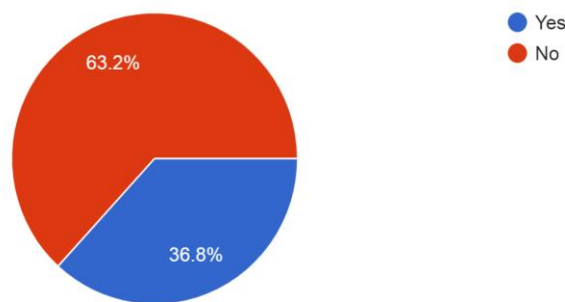


Fig. Pie Chart showing if the responders are satisfied with the facilities they provide to the construction workers on their sites

Do your workers go through any kind of conflicts?

87 responses

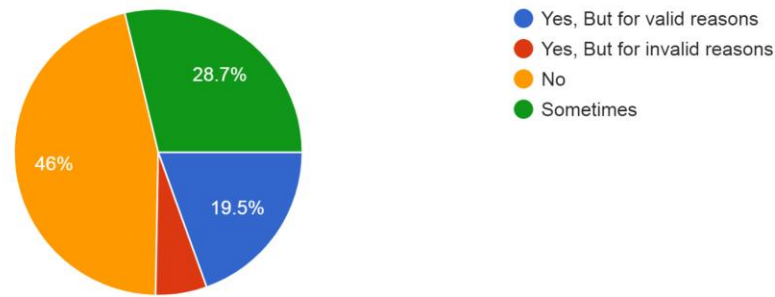


Fig. Pie chart showing if the responders' workers go through conflicts

When asked if the workers go through any conflicts, 46% responders from the total of 87 said that their workers don't fight with each other. But, 28.7% said that their workers sometimes go through the conflicts. 19.5% said that their workers fight for valid reasons and some of them said that their workers fight for invalid reasons.

On asking about the demands of the workers, most of the respondents said that their workers don't have demands but some of them said that the workers demand for safety gloves while working on cement mixing, etc. Only a few of them said that their workers demand for increased wages and some workers demand pure drinking water etc. facilities.

How do you provide training to the workers?

87 responses

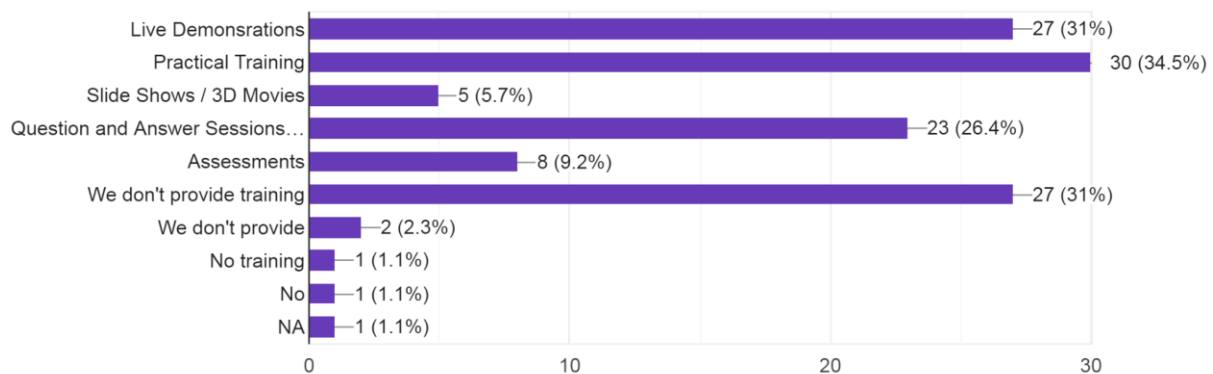


Fig. Bar chart showing the method of providing training by the responders

On asking about the methods of providing training to the workers, many of them show practical demonstrations, some of them show slideshows or 3D movies, some of them take question and answer sessions, some of them provide training by different assessments. But, 36% of them said that they don't provide any kind of training to their workers on their sites.

From our study done in the form of case studies, digital survey of working professionals in rural area and the face-to-face personal interview type survey of rural construction workers leads us to the following reasons of the unawareness of safety and not following the safety norms by the officials as well as the workers:

1. **Lack of Awareness:** The rural workers are unaware about the most of safety norms and don't even know about the safety that much. Also, they don't understand the importance of the safety hence avoid following safety norms.
2. **Cost:** The contractors think of cost saving and hence avoid safety equipment and following safety norms. They also save money from this because rural workers actually don't demand for the safety kits.
3. **Lack of Training:** Due to lack of safety training, the rural workers don't even know about the methods of use of some of the equipment as well as the safety kits.
4. **Lack of Regulation Enforcement:** On rural construction sites, the contractors think that it can be neglected in the case of following safety norms. They think that the workers themselves are unaware and don't give enough importance to the safety and nobody is going to ask them about the safety regulations.
5. **Inadequate Supervision:** In rural construction sites, it is seen that the contractors appoint a single supervisor for multiple sites to save the money. Hence, due to the inadequate supervision provided to the rural workers, it leads to the small or big accidents.

6. **Short Term Focus:** The contractors in rural area think that the site is small and it will be completed easily within few months so they avoid providing the safety equipment and don't follow the safety regulations. On the other hand, the workers are not really so comfortable in the safety kit. Instead, they like to follow their conventional construction methods and avoid using provided safety kits.
7. **Inadequate Safety Planning:** on the rural construction sites, most of the accidents take place due to the inadequate safety planning. As the rural area is not much aware about this, the contractors avoid focusing on the safety planning.
8. **Informal Economy:** The contractors in rural area also avoid providing safety equipment as already the funds are irregular and the budgets are small. They think that if they will provide the safety from the funds then the profits will be decreased.
9. **Corruption:** Another major problem seen in every field is the corruption. Due to corruption, for releasing the bills, passing tenders and for other documentation, he contractors has to pay to the corrupt officers. Hence, the budgets are already tight for any rural construction sites.

V. SUGGESTIONS

5.1 5S Method

The 5S method, originally derived from Japanese terms, stands for Sort, Set in order, Shine, Standardize, and Sustain. It is a systematic approach to organize and maintain a clean, safe, and efficient workplace. Implementing the 5S method for safety in rural construction can help reduce accidents, improve productivity, and ensure a more organized and efficient work environment.

5.2 6 SIGMA Method

Six Sigma is a methodology which is data-driven and focused on improving processes and reducing defects. While Six Sigma principles can be adapted for safety in rural construction. The goal is typically to achieve a high level of process performance, often measured in terms of defects per million opportunities (DPMO).

To implement Six Sigma principles for safety in rural construction, we have to 1) Define the Problem, 2) Measure, 3) Analyze, 4) Improve, 5) Control, 6) Monitor and Validate.

5.3 KAIZEN Method

The term "Kaizen" is a methodology that is often used in various industries, including construction, to drive continuous improvement. In Japanese, Kaizen means "continuous improvement." It involves small, incremental changes and improvements to processes and systems over time. To implement Kaizen principles for safety in rural construction, we have to 1) Establish a Safety Culture, 2) Involve Everyone, 3) Safety Committees, 4) Identify Safety Concerns, 5) Set Clear Objectives, 6) Data Collection, 7) Brainstorm Improvements, 8) Prioritize Projects, 9) Small, Incremental Changes, 10) Monitor and Measure, 11) Feedback Loops, 12) Training and Education, 13) Document and Standardize, 14) Review and Repeat, and 15) Celebrate Successes.

By applying Kaizen principles to safety in rural construction, we can foster a culture of continuous improvement and make steady progress in reducing accidents and enhancing safety in challenging rural environments. We should remember that safety should always be a top priority, and worker involvement and feedback are crucial for success.

5.4 DFMEA Method

Design Failure Mode and Effects Analysis (DFMEA) is a structured methodology used to identify, assess, and mitigate potential failure modes and their effects in a product or system design. While DFMEA is typically applied in manufacturing and product design, its principles can also be adapted for rural construction safety. Implementing DFMEA for rural construction safety involves the following steps: 1) Cross-Functional Team Formation, 2) Scope Definition, 3) Identify Failure Modes, 4) Analyze Failure Modes, 5) Determine Risk Priority Numbers (RPN), 6) Prioritize Failure Modes, 7) Risk Mitigation and Control, 8) Verification of Controls, 9) Documentation and Communication, 10) Continuous Improvement, 11) Training and Education, 12) Feedback Loop, 13) Emergency Response Planning, 14) Regulatory Compliance, 15) Regular Audits and Inspections.

Implementing DFMEA for rural construction safety helps systematically identify and address potential safety risks and hazards. By continually assessing, prioritizing, and mitigating safety concerns, you can create a safer construction environment in rural areas and reduce the likelihood of accidents and incidents.

5.5 TPM Method

Total Productive Maintenance (TPM) is a comprehensive approach aimed at improving equipment and process reliability and, by extension, overall operational efficiency. While TPM is more commonly applied in manufacturing settings, its principles can be adapted for rural construction safety by focusing on equipment, tools, and processes that contribute to a safer working environment. Here's how to implement TPM for rural construction safety: 1) Team Formation, 2) Set Objectives, 3) Identify Critical Equipment and Processes, 4) Assessment of Current State, 5) Develop and Document Standard Operating Procedures (SOPs), 6) Equipment Maintenance and Inspection, 7) Autonomous Maintenance, 8) Training and Skill Development, 9) Safety Metrics and KPIs, 10) Continuous Improvement (Kaizen), 11) Root Cause Analysis, 12) Total Productive Safety (TPS), 13) Routine Inspections, 14) Communication and Reporting, 15) Regulatory Compliance.

By implementing TPM for rural construction safety, we aim to minimize equipment-related accidents and disruptions, resulting in a safer construction environment and more efficient project execution. The key is to maintain a strong focus on safety while maximizing equipment and process reliability.

5.6 HIRA Method

Hazard Identification and Risk Assessment (HIRA) is a systematic process used to identify and evaluate potential hazards in a workplace and assess the associated risks. Implementing HIRA for rural construction safety is crucial to ensure the safety of workers and the successful execution of construction projects in remote and challenging environments. Here's how to implement HIRA for rural construction safety: 1) Establish a HIRA Team, 2) Define the Scope, 3) Identify Hazards, 4) List Hazards, 5) Assess Risks, 6) Prioritize Hazards, 7) Risk Mitigation Strategies, 8) Implement Controls, 9) Training and Education, 10) Emergency Response Plans, 11) Documentation, 12) Regular Review and Update, 13) Safety Inspections and Audits, 14) Worker Involvement, 15) Continuous Improvement, 16) Regulatory Compliance.

HIRA is a dynamic and ongoing process that must adapt to changing conditions and emerging risks. Regularly reviewing and updating the HIRA ensures that safety remains a top priority in rural construction environments.

VI. CONCLUSIONS

In developing countries like India, construction industry is not so safe due to its complex activities and dynamic project environment. Prior the constantly developing technologies, those are barely reaching to the local sites. Rural construction workers in India face significant safety challenges in their daily work, often in remote and under-resourced areas. Since there are all the safety norms, rules and regulations present but still it remains on the paper only. The rural construction workers doesn't get to know these norms and it was also seen that they were unaware about their own rights. The illiteracy is their greatest enemy. The government should appoint different committees to take the feedback of the policies set by government and they should check regularly if the workers are getting their deserved benefits or not.

Previous studies was found to be working on factors affecting construction safety, mainly focused on their local studies and industries in particular countries validated through surveys and interviews with professionals and companies. On the other hand, there is evidence of global research that classifies and categorizes relevant issues but is limited to a small number of factors. Other studies consider different factors but fail to classify their typologies of action. It was aim to fill the identified research gaps by developing a comprehensive framework that details the factors which influence safety in construction, classifies them and identifies their roles in preventing accidents. Thus, the objective of this work was to identify and describe the factors that influence safety in rural construction as well as finding solutions and suggesting actions to improve safety of the rural construction workers.

This research has delved into the critical issue of safety among rural construction workers in India, shedding light on the multifaceted challenges they face daily. Our investigation has unearthed a stark reality: these laborers endure precarious working conditions, inadequate safety measures, and limited access to healthcare services, resulting in a high incidence of injuries and health issues.

Our study underscores the urgent need for intervention and the moral imperative of addressing the safety concerns of rural construction workers. The human and economic toll of these unmet needs is too great to ignore. In conclusion, these points emerge from our research:

1. **Inequity in Safety:** Rural construction workers are disproportionately burdened by unsafe working conditions and are often excluded from the protective measures commonly available to urban laborers. This inequity is a social injustice that must be rectified.
2. **Healthcare Disparities:** Inadequate access to healthcare services exacerbates the consequences of injuries and health issues, putting additional stress on both the workers and the healthcare system.
3. **Recommendations for Change:** We have proposed a set of recommendations aimed at enhancing safety in the rural construction sector. These include better enforcement of labor laws, appointment of safety manager, expanded safety training programs, affordable provision of personal protective equipment, and collaborative efforts among government agencies, construction companies, and local communities, etc. As well as, some methods to be implemented like 5S, KIZAN, 7 SIGMA, etc.
4. **Holistic Approach:** Improving the safety of rural construction workers demands a comprehensive, multifaceted approach. It is not only a matter of policy but a call to action for all stakeholders, from governments to employers, communities, and workers themselves.
5. **Long-term Impact:** The implementation of these recommendations has the potential to mitigate risks, reduce injuries, and enhance the quality of life for these essential laborers. This, in turn, will have far-reaching social and economic benefits, improving the well-being of workers and their families. As well as the quality of the project can be improved along with reduction in the cost, wastage and time of completion.

In conclusion, our research underscores the imperative to prioritize the safety of rural construction workers in India. It is a collective responsibility to ensure that these laborers, who play a pivotal role in India's development, are not subject to unnecessary risks in their workplace. This research is a stepping stone toward a safer, more equitable future for these workers and a more just society for all.

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