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RISK ASSESSMENT FOR EXTERIOR PAINTING WORK WITH USING SPIDER KIT IN CIVIL CONSTRUCTION BUILDINGS

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Abstract— Construction activities comprise construction alteration modification and demolition of the buildings all of which have to ensure construction safety and exterior painting work risk assessment It has always been a challenge to the stakeholders such as building owners construction companies contractors sub-contractors and Government employees due to multiple factors involved and their complexity Construction sites in India are largely complex in terms of operations processes technologies personnel involved location geography and changing dimensions of the site on a continual basis and lack of adequate legal safe guards The incidence of large number of fatal and non-fatal accidents in the Sri Manakula Vinayagar Medical College and Hospital, Puducherry construction sites amply proves that holistic safety and exterior painting work risk assessment in construction sites always a distant dream since a comprehensive solution and strategy are yet to be realized in this regard Various potential hazards for workers in construction sites include Falling from heights Trench collapse Scaffold collapse Electric shock and arc flash arc blasting Failure to use proper personal protective equipment exterior painting work load and lack of exterior painting work extinguishing systems and repetitive motion injuries The research was carried out to understand a clear status on occupational safety health environment standards and compliances general safety construction safety and exterior painting work risk assessment in the residential and commercial construction sites such that the findings of the study will be utilized to protect workers by the reduction of accidents and dangerous occurrences newline.
Keywords— Construction Thermal power plant, Construction accidents, Construction safety, Fall from height, Formwork failures, Personnel safety, Worksite safety.

Introduction

Globalization has energized our country to compete world-wide with developed and other developing countries in all aspects. By this competence, we have engaged our productivity remarkably and our products and service are at par with the International Quality Standards (IQS) perfectly adhering all health and safety aspects as per international requirements.The main three segments in the construction industries are Real Estate construction which includes residential and commercial constructions, infrastructure of a building which includes roads, railways, power etc and industrial constructions that consist of oil, gas refineries, pipelines, textiles and other manufacturing industries.

Construction Safety

Safety is the state of being protected and guaranteeing opportunity from mishaps, wounds and sickness in places where exterior painting work occurs as a concoction response of a burnable substance with oxygen, which includes warm and typically joined by visual exterior painting work

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or glow. Construction activity involves construction, alteration, modification, and demolition of the buildings. Ensuring construction safety and exterior painting work risk assessment has always been a Challenge to the stakeholders, i.e. building owners, construction companies, contractors and sub-contractors, Government, employees due to multiplicity of the factors involved and their complexity.

Construction sites in India are largely complex in terms of operation, processes, technology, personnel involved, location and geography. The incidence of large number of fatal and non fatal accidents in the construction sites amply proves that holistic safety and exterior painting work risk assessment in construction sites are always a distant dream since a comprehensive solution and strategy is yet to be realized in this regard.

Exterior Painting Work Risk Assessment in Construction Sites

The exterior painting work hazards related to construction are High Rise Building exterior painting work loading using Spider kit, combustible finishes and furnishings, pillars, floors/ceilings and coverings, large open spaces, lightweight construction/truss, heavy content loading, combustibles stored in high piles next to each other, combustible furnishings/finishes, Wall shake shingles, Wallen floors and ceilings, and large open spaces which will contribute to spread. Exterior painting work reaction depends on following factors: Type and quantity of Wall used, Size of moisture content, application of water, Masonry, mortar between masonry, cast iron, bolt and other fastening devices like steels, reinforced concrete, gypsum, glass, plaster and lath, exposed Wall frames, Lack of barriers- doors, windows, etc., Structural characteristics with reference to exterior painting work hazards are:

- Type I Exterior painting work Resistive: Structural member's non- combustible or limited combustible, primary hazards-contents, and ability to confine exterior painting work compromised by openings.
- Type II Non-combustible: similar to Type I, only degree of exterior painting work resistance is less. In some cases, materials with no exterior painting work resistance are used, primary hazard-contents, heat buildup during exterior painting work may cause structural supports to fail, and roof materials may contribute to exterior painting work spread.
- Type III Ordinary: Exterior walls and structural members non-combustible or limited combustible, Interior structural members almost all Wall, Wall used in interior structure has smaller dimensions than Type IV, Primary exterior painting work hazard is exterior painting work and paint gas spread through concealed spaces, and Hazards reduced by using exterior painting work-stops.
- Type V Wall Frame : All walls and structural members are Wall, Presents unlimited exterior painting work hazards, spread, collapse, May present serious exposure problems, Balloon construction there are no exterior painting work stops

The National Building Code 2016 provides standards and guidelines for construction and exterior painting work safety in construction sites. The building and other construction workers (Regulation of Employment and Conditions of Service) Act, 1996 and The building and other construction workers (Regulation of Employment and Conditions of Service) Central Rules, 1998 and various other state rules provide legal framework for ensuring construction safety and exterior painting work risk assessment in construction sites. Various international standards such as OSHA, NIOSH, HEALTH AND SAFTEY EXECUTIVE etc., also provide for framework on construction safety and exterior painting work risk assessment.

The buildings are normally provided with exterior painting workwalls during construction and these exterior painting workwalls separate two structures or divide a structure into smaller portions to prevent spread of exterior painting work. The lightweight construction and trusses are designed to support only their own weight and if one fails, a domino effect happens and they all fail under rapid failure under exterior painting work conditions usually within 5 to 10 minutes. The drawn out

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introduction to flame may result in basic fall and harming or slaughtering the tenants of the working under development. The emergencies in construction sites due to safety failures and exterior painting work are capable of causing devastating consequences on the buildings and workers employed in the construction sites. Emergency plans provide for various actions such as evacuation of building and assemble at assembly points by moving through escape routes.The construction safety and exterior painting work risk assessment in construction sites are still in primitive stages in India. There is a great necessity to improve general safety and exterior painting work risk assessment in construction sites to protect construction workers and other occupants of the building.

Spider Kit

A spider kit is a structural component commonly used in civil construction for building facades and glazing systems. It is a type of spider fitting that allows glass panels to be fixed to a building structure, providing both aesthetic appeal and functional support. The kit typically consists of various components, such as brackets, connectors, and spider fittings, that work together to secure large sheets of glass or other materials in place, allowing for the creation of curtain walls or other modern, open architectural designs.

Spider kits offer several advantages, including flexibility in design and the ability to support large, uninterrupted glass surfaces. This makes them ideal for modern commercial and high-rise buildings, where transparency and open views are important. The components are typically made of stainless steel or other durable materials to ensure resistance to weather and environmental factors.

Figure 1: Spider Kit in Civil Construction

The installation of a spider kit requires precision engineering to ensure safety and stability. It allows for minimal visible hardware, creating a sleek, modern look. Spider kits also offer the benefit of being highly customizable to suit different building shapes and glass configurations, providing a solution for a range of architectural styles. Spider kits are crucial for achieving contemporary building aesthetics while ensuring structural integrity and safety in large-scale construction projects.

Constitutional Provisions.

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The constitution of India under the order standards of state approach reveres detail arrangement identifying with wellbeing and strength of specialists in every single financial movement. These directive principles provide for securing the health and strength of employees, men and women, that the tender age of children are not abused, that citizens are not forced by economic necessity to enter avocations unsuited to their age or strength (Article 39), just and humane conditions of work and maternity relief are provided (Article 42), that the Government shall take steps, by suitable legislation or in any other way, to secure the participation of employee in the management of undertakings, establishments or other organizations engaged in any industry (Article 43A), for ensuring that no child below the age of 14 is employed to work in any factory or mine or engaged in any other hazardous employment (Article 24).

Motive Of The Study

- Ensure construction safety and enable effective exterior painting work attack planning, prevent accidents, injuries, harm, illnesses, exterior painting work incidents, accidents and exterior painting work emergencies in construction sites.
- Alert the employers and employees on potential construction hazards.
- Alert the concerned personnel on the effects of exterior painting work and exterior painting work suppression activities on selected building materials.
- Draw a status report on safety and exterior painting work risk assessment in construction sites to design a comprehensive construction safety and exterior painting work risk assessment system for a construction industry.
- The study will be conducted at construction sites and implementing a well-designed and validated questionnaire covering construction safety and exterior painting work risk assessment. The collected data will be analyzed and the outcomes of the data analysis will be utilized in designing a construction safety and exterior painting work risk assessment system and to arrive at implementation strategies of the same for validating the design.

RELATED WORK

Pooja Tripathi and Yash Kumar Mittal, et al [1] The study highlights that constructing high-rise buildings is a complicated process impacted by multiple risk factors. The construction industry has a higher accident rate when compared with other economic sectors in India or worldwide. Effective safety management is crucial for the successful delivery of high-rise building construction projects and simultaneously keeping a check on accident rates. Proper safety implementation can be achieved by accurately assessing the level and types of risk associated with typical construction activities. The key objective of the study is to identify the most hazardous construction activity and critical risks in high-rise construction projects. The study has identified six typical construction activities and ten types of possible construction risks involved in different activities of high-rise construction projects.

Yunqing Gu, Lingzhi Yu, et al [2] Based on the analysis of the research and development results of spider silk bionic materials, Figure 8: Structure and experimental results of a humidity sensor (87). (a) Microscopic image of a SESS-based humidity sensor probe. (b) Side view of a SESS-based humidity sensing probe. (c) Front view of a SESS-based humidity sensing probe. (d) Scanning electron microscope (SEM) photograph of the SESS profile (partially enlarged). (e) SEM photograph of the SESS data. (f) The experimental result of the redshift of interference spectrum from 50% to 60% RH at 1.8° nm at 35°C. Copyright 2019, OSA Publishing.: Structural model of a sonic metamaterial (88). (a) Traction part. (b) Hoop direction. Copyright 2016, AIP. 454 Yunqing Gu et al. combined with the application needs in various fields, the research direction and application of spider silk bionic materials can be prospected. The research work on spider silk has gone through different stages from appearance, characteristics to structure and molecular composition. The application of spider silk has also experienced the development from natural

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spider silk to artificial spider silk, from primary to advanced applications. Today's spider silk technology involves multiple disciplines and fields, such as biology, chemistry, and polymers. In the future, the research work on spider silk should be further micronized, and the mechanical properties and biocompatibility mechanism of spider silk should be further analyzed from the perspective of molecular composition and structure, and its application should be used to improve the design of artificial fibers or enhance the performance of other materials. With the progress and development of science and technology, people's demand for superior performance materials is getting higher and higher, which puts forward higher requirements for the research work on natural spider silk bionic materials and related science. The application of spider silk bionic material in many fields has a broad prospect: Military field: spider silk fibers have excellent strength and toughness. The body armor and parachute made from them can not only improve performance but also greatly reduce weight. In addition, some cobweb structures can effectively absorb impact forces and help improve the strength of the material. They can be applied to the shells of equipment such as tanks, aircraft, and satellites, or the protective cover structures of military buildings. Textile field: spider silk is similar to silk but has a better performance than silk. Cloth made from spider silk has the characteristics of light weight, non-breakability, better breathability, strong water absorption, and UV resistance. Promote the development of spider silk spinning technology, spider silk cloth will bring revolutionary changes to the field of apparel textiles. Medical field: there is still huge room for development in the field of spider silk.

B Sommer, U Pont, G Moncayo1, P Bauer, et al [3] This research sets out fundamental consideration of new methods to retrofit historic buildings. It demonstrates that the redundancy of masonry could be used for thermal improvement and it shows new ways to use robots for retrofitting. The most promising approach seems to combine the method of porosification with a kind of "active insulation" that uses the power of the sun radiation on the façade for heating the walls, reducing heat losses by a higher interior surface temperature. The proposed "active" device must be further developed, especially regarding the applied materials. Using seasonally driven robots could facilitate retrofitting, especially in buildings where owners oppose work within their apartments to apply interior insulation and where there are little alternatives to otherwise preserve the ornamentation of the façade. The ultimate goal is to finally lower the heating demand to a level that allows for alternative renewable fuels to heat the Gründerzeit quarters of Vienna.

A. Arokia Prakash, Deepala K Naga Manikanta, et al [4] , Results obtained in this study shows that risks are caused by improper decisions made due to lack of the information, knowledge of risk management and unrealistic expectations where projects suffer from schedule related risks and risk of cost escalation which leads to dispute. Risk management should be made as an integral part of the project management in construction industries. The identification and assessment of project risks are the critical procedures for making success in a project. The knowledge attained from the previous situations should be effectively utilised for future decision making, this can only be obtained by effective utilisation of risk management and storing data. Thus the ability of fuzzy system to deal with inexact and vague information and its ability to explain the reasoning process made it to apply in this study for risk assessment. Thus the study is expected to deliver recommendations to project managers about fuzzy risk assessment methodology and proper risk response strategies should be selected which balances the costs and efforts of implementation against the benefits derived.

Devdatt P Purohit, Dr.N A Siddiqui, et al [5] The first step for emergency preparedness and maintaining a safe workplace is defining and analyzing hazards. Although all hazards should be addressed, resource limitations usually do not allow this to happen at one time. Hazard identification, and risk assessment can be used to establish priorities so that the most dangerous

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situations are addressed first and those least likely to occur and least likely to cause major problems can be considered later. They also require that health and safety risk to be communicated to workers and that PPE be provided for worker. Regular inspections, penalties and compliance certificates issued by regulatory institutions influence risk management more. Furthermore, the organizational culture of safety is another factor influencing risk management. It is observed that construction firms with a safety culture considered health and safety when employing the site manager, the safety coordinator and safety officer. Knowledge of health and safety is a criterion for employment. Meanwhile firms with a safety culture provide resources for site workers, such as PPE and training. Additionally, individual characteristics such as experience of those working on construction sites, their educational background and knowledge of health and safety matters also influence health and safety risk management. It was observed that risks were assessed based on experience and educational background. Furthermore, the study revealed that the work environment such as site layout and location, the nature and the size of the work, working methods and working team influence health and safety risk management. The study also provides factors hindering health and safety risk management in construction sites. The factors include the low level of public awareness of regulations, lack of resources such as personnel and funds, coverage of the regulations, complexity of design, the procurement system, and the low level of education, site configuration, and location. Thus the main ‘mantra’ is that every job on the construction site must be carried out with at-most activity

Rajesh, Vasanth Keshav, et al [6] The questionnaire survey was obtained from the project manager or engineers participating in construction projects at various locations. The Major risk in building projects was identified by analysing those questionnaires using AHP are: Change in the work order during the execution of project due to changes in the requirements of the client. Improper planning for the project without the consideration to site conditions. Shortage of Skilled manpower. Change in price of Construction Materials during the execution of the project. Unpredicted Weather conditions. Based on the conclusions, the following recommendations are made: Presenting the suggestions for the shift's practicality based on understanding of the complete implications of the desired change or modifications. Changes will not be made in some circumstances because the perceived benefit is smaller than the expense. In other circumstances, there may be enough gain to cover the expense of undertaking the extra labour. In other circumstances, changes will be unavoidable and beyond control, regardless of their negative consequences, as a result of regulatory or compliance concerns, or internal issues such as organisational reshaping. It can affect both delivery and cost. Land factors (or site conditions) can influence the cost of construction as well as the layout or style of a home. The quantity of site preparation (or site works) necessary to establish the foundations for the home will have an influence on the cost of construction like, the kind of soil; the distribution of dirt over the block; How high is the water table, and are there any trees or rocks in the soil. Many organisations have begun giving training to their existing workers in order to adapt them to meet current shortages in order to compensate for a scarcity of trained people. This might include inhouse training when a skilled employee shares their valuable knowledge with others. It's a good approach for organizations with a few excellent resources to boost their potential without investing a lot of time or money. In order to prevent the effects of market increases in building material prices, contactor should have a well-developed material strategy in place ahead of time. To minimise cost overruns, conflicts, and inflation, effective planning and scheduling during the early phases of construction is critical, which includes the early acquisition of building materials within the planned cost and appropriate storage of building materials. Understanding the weather trends in the region and accounting for these predicted weather interruptions in a plan will help us avoid or at least lessen many of the delays. Weather-dependent activities can also be arranged for periods when better weather is forecast with proper planning. During Scheduling considering extra

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buffer time for unpredicted weather condition. We can also introduce mitigation measures to minimise the damage and get the project back up and running as soon as feasible.

Problem Identification

The use of spider kits in civil construction has gained popularity due to their aesthetic and functional benefits, particularly in glazing and facade systems. However, their application introduces several risks that need careful assessment and management to ensure the safety, performance, and durability of the structures. One of the primary risks associated with the use of spider kits is the structural integrity of the connection between the glass panels and the building frame. Since spider kits are designed to hold large glass surfaces with minimal visible hardware, they rely heavily on precision engineering and quality materials. Any failure in the connection points can lead to glass breakage, detachment, or even structural collapse, posing safety hazards to occupants and pedestrians.

The environmental and weather-related challenges must be considered. Spider kits are exposed to various elements, such as wind, rain, and extreme temperatures. Over time, these factors can affect the durability of the components, leading to corrosion, material fatigue, and compromised performance. Installation errors also pose significant risks. Since spider kits require careful alignment and installation, even minor mistakes can result in misalignments, glass fractures, or an unstable facade. The lack of proper quality control and oversight during the installation phase can amplify these risks.

Lastly, there are potential maintenance and inspection challenges. Spider kits require ongoing monitoring to ensure that they remain in optimal condition. Failure to conduct regular inspections or address issues promptly can lead to undetected problems, increasing the likelihood of future failures. Therefore, the objective of this project is to systematically identify and assess these risks associated with the use of spider kits in civil construction to develop mitigation strategies and enhance safety and reliability

PROPOSED METHOD

A Risk Assessment for exterior painting work provides a systematic approach to identifying potential hazards, evaluating the likelihood and impact of those hazards, and implementing mitigation strategies to ensure worker safety. The table typically outlines various risks such as falls from height, equipment malfunction, exposure to harmful chemicals, and electrical hazards, among others. Each risk is assessed for its likelihood (e.g., unlikely, possible, or likely) and its potential impact (e.g., minor, moderate, or severe).

For each identified risk, the table also includes specific mitigation measures. These may involve safety protocols like the use of personal protective equipment (PPE), regular inspections and maintenance of equipment, proper handling and storage of hazardous materials, and strict adherence to safety standards for working at heights or with power tools.

The table further assigns responsibility to specific roles, such as the site supervisor, health and safety officer, or equipment technician, ensuring that each risk is managed by a designated individual. Finally, the table outlines a process for monitoring and reviewing risks through daily inspections, regular safety meetings, and equipment checks to ensure that risk levels remain under control throughout the painting project. Incorporating a comprehensive risk assessment table into project planning enhances safety and helps to prevent accidents, ensuring a safer working environment. A Risk Assessment Table for exterior painting work helps identify potential hazards, assess their likelihood and impact, and implement safety measures. Common risks include falls from height, equipment malfunction, chemical exposure, and electrical hazards. The table outlines specific mitigation strategies like using PPE, maintaining equipment, handling chemicals safely,

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and adhering to height and power tool safety standards. Responsibilities are assigned to roles like site supervisor or safety officer to manage risks.

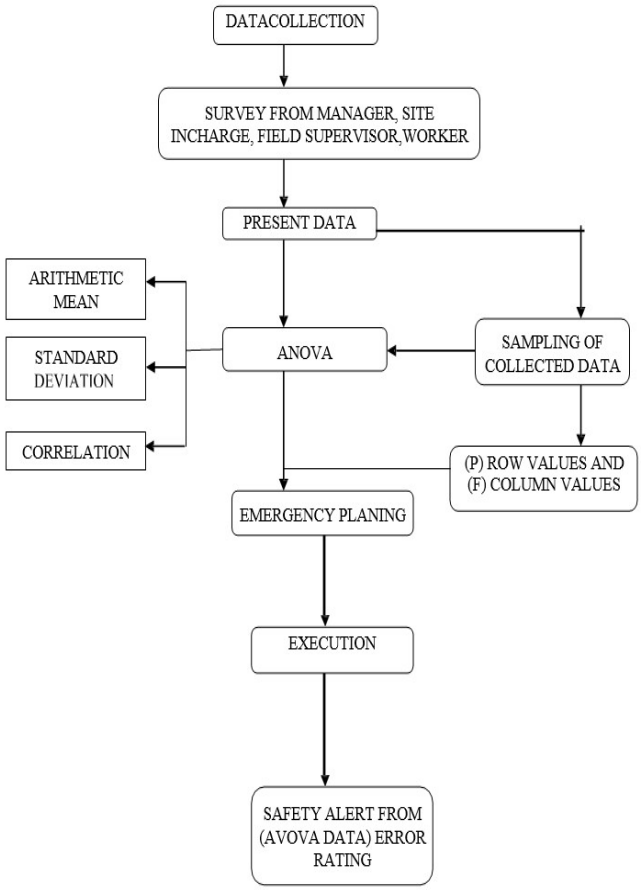

Figure 2: Design Flow for Research Methodology

Spider Kit For Construction Work

A Spider Kit for construction work refers to a specialized set of tools and equipment used to ensure safety, efficiency, and effective handling of various tasks in construction environments. The name "spider kit" often arises in contexts where workers are involved in high-risk operations, including using a spider crane or working at height. The kit includes not only essential tools but also safety gear and fall protection systems, which are crucial for mitigating hazards associated with construction sites.

Table 1 Risk Assessment for Exterior Painting Work

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Risk No.	Risk Description	Impact	Risk Mitigation Measures	Monitoring/ Review
1	Fall from Height	Severe	Ensure proper fall protection systems (harnesses, ropes), inspect equipment, and provide training on safe use of the spider kit.	Daily inspections before use.
2	Equipment Malfunction (Spider Kit)	Major	Regular maintenance and inspection of the spider kit, ensure all safety features are functional, and train operators in emergency procedures.	Weekly equipment checks.
3	Exposure to Harmful Chemicals (Paint/Thinners)	Major	Use appropriate PPE (gloves, masks, goggles), ensure proper ventilation, and store chemicals safely.	Regular monitoring of safety compliance.
4	Electrical Hazards (Contact with Power Lines)	Severe	Conduct a thorough site assessment to avoid power lines, maintain a safe distance, and use insulated tools.	Daily pre-task safety briefings.
5	Weather Conditions (Wind/ Rain)	Moderate	Monitor weather forecasts, halt work during severe weather, and ensure workers are trained to recognize unsafe conditions.	Daily weather check before work.
6	Spider Kit Usage		using the spider kit, including emergency response procedures.	sessions.
7	Injury from Power Tools (Sprayers, Sanders)	Moderate	Ensure proper PPE (gloves, goggles), inspect tools before use, and provide training on safe operation.	Regular tool inspections.

Components of a Spider Kit for Construction Work

1. Personal Protective Equipment (PPE)

The backbone of any Spider Kit is the Personal Protective Equipment (PPE). Construction workers face a multitude of risks on-site, ranging from falling debris to machinery accidents. PPE is vital to protect workers from these dangers. The kit should include hard hats, high-visibility vests, steel-toed boots, gloves, hearing protection, and eye protection. A harness and fall arrest system are also crucial when working at heights. These items ensure that workers are well- protected from the most common hazards found in construction work, including head injuries, falls, and exposure to flying particles or hazardous substances.

2.Spider Crane

A spider crane is a type of small, compact crane designed for use in tight or confined spaces, often in construction sites with limited access or in areas requiring precise and efficient lifting. This crane is often used for lifting heavy loads in confined spaces such as narrow passages, multi-story buildings, or outdoor spaces where large cranes cannot fit. A spider kit will generally include the necessary maintenance tools and equipment to ensure the spider crane operates safely, including lifting slings and pulleys.

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Figure 3: Spiker Kit Model

3.Fall Protection Equipment

When working at heights, construction workers are at risk of falling. Therefore, a Spider Kit is equipped with comprehensive fall protection systems, such as harnesses, lanyards, and self-retracting lifelines. These items are essential to ensure that workers are tethered to a stable structure or anchor point, preventing falls. Additionally, guardrails, safety nets, and edge protection are also included to offer extra protection. Fall protection systems are often customized based on the specific needs of the site and the nature of the work.

4.Tools for Safe Operation

The spider kit also contains a variety of tools essential for safe and efficient operation. This includes hand tools like wrenches, screwdrivers, hammers, measuring tapes, and cutting tools. These tools are necessary for assembly, disassembly, or adjustment of equipment, as well as for handling construction materials. Cordless drills and power tools may also be included for heavy-duty tasks that require high levels of precision and speed.

5.Safety Inspection & Maintenance Items

Maintaining equipment in optimal condition is critical for safety in construction work. A spider kit will include inspection tools such as safety nets, lifting equipment checks, and crane inspection forms. Regular inspection of tools and machinery is necessary to ensure that all equipment is functioning as expected, preventing failures that could lead to accidents. Proper documentation, such as inspection records and maintenance logs, is also important to ensure compliance with safety regulations and to identify potential hazards before they become critical.

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6.Emergency Equipment and Documentation

The spider kit should contain emergency equipment such as a first aid kit, fire extinguishers, and communication devices like radios. These tools are vital for responding to accidents or emergencies quickly. In addition, it is important to keep all documentation related to safety, including work permits, risk assessments, and emergency contact information. These documents help ensure that the site remains compliant with local regulations and standards and that all workers are adequately trained and informed of potential risks.

7.Environmental and Miscellaneous Considerations

Construction sites can generate waste and dust, making it necessary to have environmental controls in place. The spider kit may include waste disposal bags, dust suppression tools, and hydration stations. Workers' comfort and safety in extreme weather conditions should also be considered, so weather protection gear is often part of the kit. Additionally, signage and barricades may be included to ensure that all hazards are properly marked and workers can easily identify restricted zones.

A Spider Kit for construction work is an essential package that ensures safety, efficiency, and compliance on-site. The kit's focus on fall protection, equipment maintenance, personal protection, and emergency preparedness is crucial for preventing accidents and minimizing risks. The inclusion of spider cranes and specialized tools makes it an ideal solution for handling complex lifting tasks in challenging environments. As construction work can be unpredictable, a well-equipped spider kit helps construction workers perform their duties confidently while maintaining the highest safety standards.

RESULT & DISCUSSION

Investigating the working platform, both the commercial and residential building satisfies only around 50% of the working platform criteria. Comparing the mean, median and mode, it follows skewed distribution. Standard deviation and hence variance are higher and the R2 value is nearing zero as all the data points do not best fit on the line.

To look for the forecasted values of the industrial and residential buildings, confidence level with 95% probability for the mean is calculated and reported. The data has margin of error 1.0 and hence the mean has the upper limit of 26-1=25 as lower limit and 26+1=27 as upper limit. Confidence interval for commercial and residential status is 21.31-23.19. F and p-values are calculated to decide the significance as F statistic compares the joint effect of all the variables together. Here, p-value is greater than alpha level and F<Fcritic and hence null hypothesis is not rejected when grouped as rows and hence statistically insignificant.

Twelfth commercial and residential building satisfies all the requirements of construction safety. The following commercial buildings (1st, 2nd, 3rd, 17th, 18th, 34th, and 43rd) satisfy all the construction safety items. However, fourteenth, fifteenth, nineteenth, twenty fifth, forty first commercial buildings do not satisfy any of the criteria. Similarly, seventh, tenth, forty eighth, fiftieth residential buildings do not satisfy criteria forty first commercial buildings do not satisfy any of the criteria. Similarly, seventh, tenth, forty eighth, fiftieth residential buildings do not satisfy criteria. Hence, commercial buildings are better than residential building.

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Table: 2 Spider Kit Response

Items	Commercial Status		Residential Status	
	YES	NO	YES	NO
Is the Position at an angle of 1:4	37	13	39	11
Whether Adequately secured at top and foot	41	9	38	12
Whether Uniform and proper spacing of rung.	36	14	39	11
Have warning notices stating "Caution. do not use the scaffold" been fixed in prominent positions whilst erection is in progress?	39	11	41	9
Are the sole plates and the base plates still in good condition and in its original position?	39	11	38	12
Are all bracings completed?	33	17	34	16
Are the ties to the structure correctly installed and in sufficient number and correct position to ensure the stability of the scaffold?	27	23	34	16
Are the working platforms, access ways and landing cleared off any obstructions, loose objects and tripping hazards?	28	22	35	15
Is Scaffold Tag System being in use	29	21	34	16
Whether the periodicity of Inspection of scaffolds by Competent Person is ensured	23	27	28	22
Is there a provision of anchoring Full Body Harness - lanyards to be tied to life line	27	23	29	21
Is experienced and trained Person employed for erection and Dismantling of Scaffolds	26	24	28	22

Status, analysis and ANOVA of construction safety of Spider Kit from commercial and residential respondents are illustrated in Table 1, and Table 2. Also graphical representation of status of health and safety policy from commercial and residential respondents is shown in Figure 4.

Investigating the paint Spider Kit followed in the commercial and residential buildings, ladders are adequately secured at top and foot in most of the commercial and residential buildings, caution alarm is more appropriate at residential building and most of the buildings satisfy the criteria. However, scaffold inspection is not ensured in most of the commercial and residential buildings. Comparing the mean, median and mode, it follows skewed distribution. Standard deviation and hence variance are higher and the R2 value is nearing zero as all the data points do not best fit on the line. To look for the forecasted values of the industrial and residential buildings, confidence level with 95% probability for the mean is calculated and reported. The data has margin of error 1.7 and hence the mean has the upper limit of 32-1.7 = 30.3 as lower limit and 32+1.7= 33.7 as upper limit. Confidence interval for residential status is 33.46-36.04. Third commercial building and twenty ninth residential building satisfies all the requirements of Spider Kit. Twenty fifth commercial building and forty seventh residential building do not satisfies most of the items. At this case, commercial buildings satisfy the Spider Kit criteria better than the residential building. building and most of the buildings satisfy the criteria. However, scaffold inspection is not ensured in most of the commercial and residential buildings. Comparing the mean, median and mode, it follows skewed distribution.

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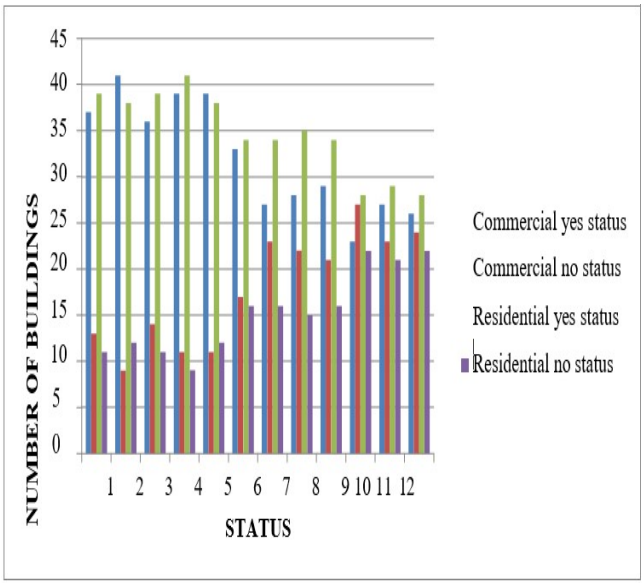

Figure 4: Spider Kit Response

CONCLUSION

The project on risk assessment for exterior painting work using a spider kit in civil construction buildings has highlighted the critical need for identifying and mitigating potential hazards associated with high-altitude painting tasks. The use of spider kits, or rope access systems, is a growing trend in the construction industry due to their flexibility, cost-effectiveness, and efficiency. However, these systems come with unique risks that must be carefully evaluated to ensure the safety of workers and the successful completion of the task.

The risk assessment process for exterior painting work with spider kits includes the identification of potential hazards such as falls from heights, exposure to hazardous chemicals in paints, and equipment malfunctions. Each of these hazards poses significant safety risks, and comprehensive preventive measures are essential to minimize their impact. The assessment process also considers environmental factors like weather conditions, which can further influence the risks involved in exterior painting work. It is crucial to account for these conditions to avoid accidents and ensure optimal work conditions.

The project outlines essential safety protocols, including the proper training of workers, the use of personal protective equipment (PPE), and ensuring that spider kits are maintained in good condition. Training workers in using the spider kit safely is paramount, as it directly influences their ability to manage risks while working at height. Similarly, regularly inspecting and maintaining equipment to avoid failures, such as rope or harness malfunction, is crucial for maintaining safety standards. Additionally, ensuring proper supervision during the painting process helps ensure that safety protocols are adhered to. Furthermore, the project emphasizes the importance of emergency preparedness. Having a well-structured emergency plan in place, including rescue procedures, is vital for minimizing the severity of accidents should they occur. This involves creating clear communication channels and training workers in first aid and emergency response techniques. This risk assessment underscores the importance of comprehensive planning, training, and continuous monitoring in ensuring the safety of workers during exterior painting work with spider kits in civil construction buildings. By addressing potential hazards and implementing necessary safety measures, construction companies can protect their workers, reduce accident rates, and improve the overall quality and efficiency of their projects

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