

ANALYZING THE CAUSES AND PREVENTION OF FATAL ACCIDENT IN HIGH RISE BUILDING

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Abstract - This dissertation aims to tackle the challenges of accidents in high-rise buildings by thoroughly examining their causes, evaluating safety regulations, and suggesting practical measures for improvement. It investigates fatal accidents in high-rise construction, aiming to prevent future incidents by analyzing past ones and enhancing safety protocols. The proposed solution involves implementing sensors in construction areas to minimize accidents and ensure the safety of workers and the public, ultimately contributing to the successful completion of high-rise projects while prioritizing well-being.

Key Words: High-rise buildings, Fatal accidents, Workplace safety, Construction safety, Risk assessment, Hazard identification, sensors

1.INTRODUCTION

Construction accidents vary in severity from minor incidents to catastrophic events, often resulting in fatalities. An accident is an event that occurs unexpectedly and unintentionally, leading to human injury or property damage. Accidents bring suffering and loss to all involved parties. They rarely occur without a cause; rather, they are typically the result of specific factors or actions.

1.1 RISKS OF WORKING ON HIGH RISE CONSTRUCTION SITE:

Construction is a perilous field to work in, with falls, electrocutions, being struck by objects, and being caught in or between objects being the primary causes of worker fatalities. These four categories, dubbed the "Fatal Four" by OSHA, contribute to over half of all construction worker deaths annually.

1.2 SOME COMMON INJURIES ON CONSTRUCTION SITE:

Construction workers face a range of potential injuries on site. These include broken bones from falls or accidents with machinery, back and spinal cord injuries from heavy lifting or falls, burns from fires or chemical contact, illnesses due to exposure to hazardous substances, brain injuries from accidents, and eye injuries from debris or chemicals.

1.3 WHAT SAFETY MEASURE SHOULD BE IN PLACED WHEN WORKING ON HIGH RISE CONSTRUCTION SITE:

Employers should implement various safety measures tailored to the specific risks identified in their assessments. These measures typically fall into categories such as providing personal protective equipment (PPE), ensuring the use of appropriate equipment, displaying clear signage, deploying additional personnel as needed, and providing sufficient safety training for construction workers.

2. OBJECTIVE:

This study aims to identify and analyze the main reasons behind fatal accidents occurring in high-rise building construction. It will investigate how safety regulations and standards influence the occurrence of these accidents. Additionally, the research will propose evidence-based strategies to prevent fatal accidents in high-rise construction projects. By understanding the root causes of accidents, assessing the impact of safety regulations, and suggesting effective prevention measures, this study seeks to improve safety standards and minimize fatalities in high-rise construction.

3. LIMITATION:

This research will specifically exclude the examination of heavy machinery typically employed in high-rise building construction. Furthermore, it will narrow its focus solely on high-rise construction projects and will not delve into other typologies such as midrise or low-rise buildings. Additionally, the study will prioritize the safety of workers within the construction industry, omitting the analysis of machinery safety. By concentrating on high-rise construction and worker safety, this research aims to provide targeted insights and recommendations for enhancing safety standards in this specific context.

3.METHODOLOGY:

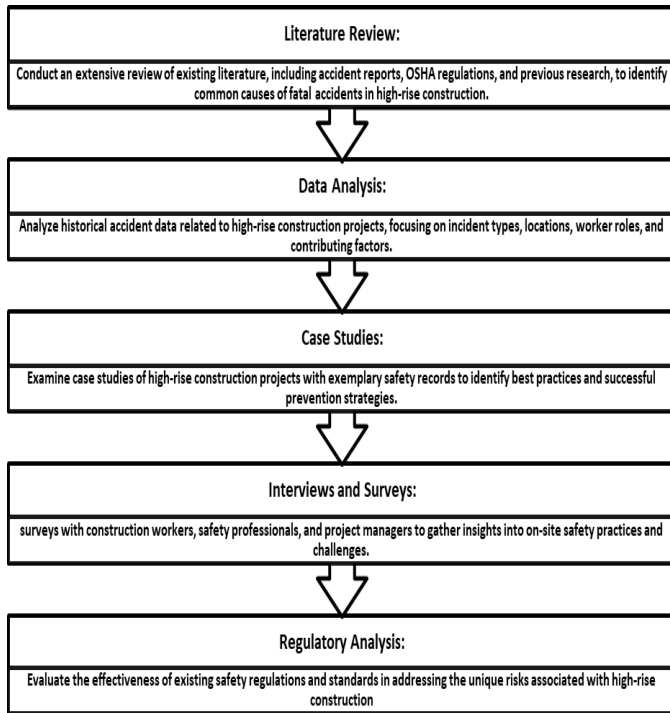


Chart -1: Methodlogy Flow Chart

4. LITERATURE STUDY:

4.1(WORKER FALL IN CONSTRUCTION IN MUMBAI)

Location of the site is in Mumbai the site Area is around 4.8 acres and the total build up area is 46256.46 square meter It consist of ground + 18 floors and it is high raised building while working in site workers were fall down 4 person got injured whereas 1 Fatal and three were hospitalized

The construction industry is inherently risky, with workers exposed to various hazards on a daily basis. In this case study, we'll examine an incident that occurred on a construction site involving a workers. The incident highlights the importance of safety protocols and the need for effective accident prevention measures.



Fig -1: fell down while casting beam

4.1.1 INCIDENT OVERVIEW:

4 construction workers, was involved in a serious accident at a high-rise construction site. He was part of a team responsible for installing steel beams on the 15th floor of the building. The accident occurred during the afternoon shift, when the team was rushing to meet project deadlines. On the day of the incident, they assigned to secure a steel beam using a safety harness and lanyard, while working at an elevated height. As they was positioning on the beam, lanyard got caught on a jagged edge of the beam. Despite efforts to free him, they slipped and fell approximately 25 feet to the floor below.

4.1.2 CONTRIBUTION FACTOR:

Time Pressure: The project was running behind schedule, and there was pressure to accelerate the construction process. As a result, workers might have felt compelled to cut corners and bypass safety procedures.

Inadequate Training: Some workers, had limited experience working at such heights and using safety equipment. Proper training on how to use safety harnesses and lanyards effectively was lacking.

Unsafe Work Practices: Due to the urgency to complete the task quickly, workers might have skipped crucial safety checks and improperly secured their safety equipment

Equipment Quality: The design and durability might have been inadequate to withstand the impact of getting caught on a sharp edge.

Immediate Response: After the accident, emergency services were called, and they was transported to the hospital. The construction site was temporarily shut down to allow for an investigation.

4.1.3 PRECAUTION TO AVOID THIS ACCIDENT:

Safety Training: Companies should invest in comprehensive safety training programs to educate workers about proper equipment use, hazard identification, and emergency procedures.

Time Management: Project deadlines should be realistic to prevent undue pressure on workers, which can lead to unsafe practices.

Regular Inspections: Routine inspections of safety equipment and work areas can identify potential hazards and prevent accidents.

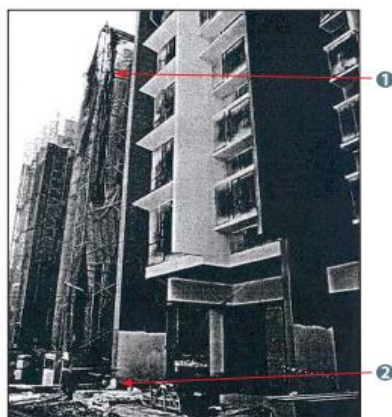
Communication: Workers should be encouraged to communicate openly about safety concerns without fear of repercussions.

4.2 WORKER ACCIDENT FROM SCAFFOLD

Worker A and his two co-workers were involved in the dismantling of an external scaffolding of a block One of the co-workers descended from the scaffold and called out to Worker A and another co-worker to come down from the scaffold for lunch. As the co-worker was waiting at the foot of the block, Worker A fell from the scaffold and hit him. Worker A was seen bleeding from the back of his head and was sent to the hospital where he subsequently passed away.

4.2.1 CAUSES AND CONTRIBUTING FACTOR

The scaffold supervisor was not with the worker when the dismantling work was in progress. He had left the worksite to buy lunch for his workers. Worker A was found with his safety harness on his waist after the accident. There were no eye-witness accounts as to how Worker A fell from the scaffold. Upon hearing his co-worker's call to come down, the worker might have detached his safety harness from the lifeline. The accident probably happened when he was descending from the scaffold, and lost his footing.



1. External scaffolding
2. The deceased was found here

Fig -2: accident happened area

When he fell, he hit the scaffold along the path of his fall and hit the worker who was waiting at the foot of the block Worker A and one of the co-workers involved in the dismantling work had not undergone any training course for the work. The safety manager and the scaffold supervisor were aware that the two workers did not have scaffold erectors certificates. It was reported that the workers were scaffold assistants and were expected to be stationed on the ground, not on the scaffold.

4.2.2 Follow Up

The occupier received instructions to exclusively employ trained scaffolds for conducting scaffolding work on the site. It was emphasized that proper supervision should be maintained during the dismantling process of the scaffolds. Additionally, supervisors were tasked with providing

comprehensive instructions to labourers involved in the dismantling activities. Moreover, strict adherence to safety protocols for the protection of labourers was emphasized and expected to be followed diligently. This included measures to prevent falls and ensure the overall safety of workers. By enforcing these instructions and protocols, the aim was to minimize the risk of accidents and injuries during the scaffolding work on the site. It was crucial for all personnel involved to prioritize safety and adhere to the established guidelines to create a secure working environment.

5. LIVE CASE STUDY:

5.1 SRIRAM WYT FIELD, BANGALORE

The site is Located in Budigere Cross, Old Madras Road, Off Whitefield Bangalore the site is totally surrounded with 11.3 acres and the plinth area is constructed with 380340square foot its consists of 1272 units totally with 2basement ground14 floors with the typology of 2,3 BHK apartment and consist of 2 tower the site surrounded with railway station, Schools, Colleges and tech park.

Shriram WYTfield, located near Whitefield Extension, offers a lifestyle with 40+ awe-inspiring amenities, large open spaces, and residences. property offers smartly designed 2 & 3 BHK homes featuring two big clubhouses, a rooftop swimming pool, an amphitheatre, and a plethora of other fun-filled and future-ready amenities. Structural System: Framed structure (Complete RCC wall and slab system). Masonry: Aluminium form work (Mivan) Floor: Floor height (incl. slab): Shall be maintained at 2.95m Slab thickness125mm.



Fig -3: SRIRAM WYT FIELD,BANGALORE

5.1.1 SAFETY PROTOCOLS:

Toolbox meetings, also known as toolbox talks, are crucial for discussing safety hazards at construction sites. These meetings occur daily and typically last for 10 to 15 minutes, aiming to raise workers' awareness of risks and safety protocols. Attendance is mandatory to ensure everyone remains vigilant. Workers are required to wear personal protective equipment (PPE), such as boots and gloves,

especially for concreting tasks. Site engineers and safety engineers conduct regular inspections to promptly address safety concerns and provide guidance and assistance when necessary. They also monitor activities to intervene in emergencies. Visitors are obligated to follow safety rules, including wearing helmets. Safety nets, installed using the MIVAN method, prevent falls or lessen their impact by absorbing energy. Platforms facilitate safe working conditions for tasks performed at heights. These safety measures, combined with toolbox meetings and engineer involvement, contribute to creating a safer construction environment

5.1.2 SAFETY MEASURES:

To enhance safety on-site, it's imperative to restrict the movement of personnel, vehicles, and equipment to designated areas, ensuring efficient ingress/egress and facilitating work operations. For instance, during the ongoing shuttering work on the 14th floor, barriers have been erected to deter unauthorized access, safeguarding workers and preventing potential accidents. Additionally, considering the proximity of a tower crane, another precautionary measure has been implemented by placing barriers beneath it. These barriers serve to protect workers from any objects that may fall from heights, minimizing the risk of injuries or accidents. By confining personnel and equipment to specific zones, the likelihood of mishaps is significantly reduced, contributing to a safer work environment overall. This strategic approach not only prioritizes the well-being of workers but also ensures smoother workflow and operational efficiency. Ultimately, these measures underscore the commitment to safety and mitigate potential hazards associated with construction activities at elevated levels.

At every 14th-floor opening, including balconies and lift access points, barricades have been installed to alert workers to potential hazards. These barriers serve as visual cues, ensuring that workers are aware of the openings and proceed with caution. By clearly marking these areas, the risk of accidents, such as falls or collisions, is significantly reduced. This proactive approach enhances safety on-site and minimizes the likelihood of injuries. Workers can navigate the area more confidently, knowing the locations of openings and taking appropriate precautions. Additionally, these barricades help maintain a structured and organized work environment, promoting efficiency and productivity. Regular inspections and maintenance of these barriers ensure their effectiveness in preventing accidents. Overall, this initiative underscores the commitment to prioritizing worker safety and creating a secure construction site environment.

5.1.3 INFERENCE:

Workers are required to wear personal protective equipment (PPE), and their compliance is regularly inspected

by site safety engineers. Daily evening inspections are conducted by senior management to address safety concerns promptly. Waste disposal chutes are installed in each tower for proper waste disposal. The construction site must be kept clean, and unwanted materials should be promptly disposed of to minimize hazards. Regular cleaning and debris disposal enhance safety and productivity. These measures reduce the risk of accidents and injuries, fostering a safety-conscious environment. Continuous monitoring and enforcement of safety protocols ensure safety remains paramount throughout the project. Overall, these initiatives demonstrate a commitment to maintaining a safe workplace for all personnel.

5.2 : CASAGRAND ATHENS, AMBATTUR CHENNAI

The site is Located in Amabattur, chennai the site is totally surrounded with 8.0 acres and the plinth area is constructed with 231360square foot its consists of 954 units totally with basement, stilt,14 floors with the typology of 2,3 BHK apartment and consist of 2 tower the site surrounded with IT, Schools, Colleges and Hospitals.

Casagrand Athens in Mogappair, one of the upcoming under-construction housing societies in Chennai North.Structural System: RCC Framed Structure designed for seismic compliant (Zone 3).Masonry: 200mm for external walls & 100mm for internal walls.Floor: Floor height (incl. slab): Shall be maintained at 2.95m.100+ worldclass amenities .



Fig -4: Casagrand Ambattur

5.2.1 SAFETY MEASURES:

These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards. Provides protection against hazards. Promotes good hygiene. Encourages safety in the workplace. Protects you and those around you. Workers will not get affected for minor accident which occurs in site.

Construction safety nets, typically made from flexible plastic nets composed of HDPE or High-density Polyethylene materials, form a crucial part of construction safety measures. These nets, also referred to as debris netting, can be installed

both horizontally and vertically as per project requirements. It is imperative that safety nets are installed as close as feasible beneath the walking or working surface where employees are engaged, ensuring they are never positioned more than 30 feet (9.1 meters) below such levels. These safety nets are strategically placed around the working floor area to provide comprehensive protection to workers. Additionally, workers are mandated to use safety glasses while cutting steels and to tie their hair back with a compulsory cap. Hand gloves are also obligatory to be worn during work. Sturdy footwear must be worn at all times in work areas. Cutting machine should be placed in the dust free area where the spark which accurs from the steel is highly flammable Be aware of other people in the area. Ensure the area is clear before using equipment.

When operating machinery, it is essential to wear sturdy footwear in all work areas. The cutting machine should be placed in a dust-free area to prevent sparks from steel, which can be highly flammable. Workers should remain aware of others in the vicinity and ensure the area is clear before using equipment. Live wires should not be grounded but rather run at heights to prevent contact with workers. Additionally, insulation must be worn to prevent electric shock. Disposal chutes offer construction teams a safe and efficient method for disposing of unwanted materials from elevated positions. These temporary installations effectively remove debris and other waste materials from taller buildings without endangering workers or compromising the structure's integrity. Steel members are utilized to reinforce the sand in deep excavation sites for sewage treatment plants (STP) to prevent landslides. Failure to do so could pose significant danger to workers in the event of a landslide occurring while working in the area.

5.2.3 INFERENCE:

The masonry workers diligently follow safety rules and precautions, attending weekly safety meetings held every Saturday at the site. However, temporary workers, including bar benders, shuttering workers, and electricians, do not consistently adhere to safety protocols. To enhance safety awareness, it is essential to place mandatory signage boards in deep excavation areas. Unfortunately, there is a noticeable absence of regular inspections conducted at the site. It is crucial to enforce consistent safety measures across all types of workers to minimize risks and prevent accidents. Management should prioritize safety training and ensure that all workers understand and comply with safety procedures. Additionally, regular inspections should be implemented to identify and address any safety hazards promptly. Creating a culture of safety where every worker is accountable for their actions is essential for maintaining a safe working environment. By addressing these issues proactively, the overall safety standards at the construction site can be significantly improved.

6. RECOMMENDATION AND INFERENCE:

Sensor-based technology consists of location sensor-based technology, vision-based sensing and wireless sensor network. Technology including GPS, RFID, WLAN, UWB, Zigbee and ultrasound, and gave a brief introduction to vision-based sensing and wireless sensor network. Construction sites are dynamic and complicated systems. The movement and interaction of people, goods and energy make construction safety management extremely difficult. Due to the Ever-increasing amount of information, traditional construction safety management has operated under difficult circumstances. As an effective way to collect, identify and process information, sensor-based technology is deemed to provide new generation of methods for advancing construction safety management.

Applications in Construction Safety Management	Sensor-Based Technology	Application Significance
Safety training and education	GPS, RFID; Vision-based sensing	Provide a new platform for workers' safety training and education
Accident forewarning system	GPS, RFID, UWB, Zigbee, ultrasound; Sensor and WSN	Explore to build forewarning system for collision accidents of machinery equipment and high altitude falling accidents
Highly dangerous operations management	RFID, UWB, Zigbee, WLAN	Lay a solid foundation for real-time safety monitoring for dangerous zones

It makes the real-time construction safety management with high efficiency and accuracy a reality and provides a solid foundation for facilitating its modernization, and informatization Nowadays, various sensor-based technologies have been adopted for construction safety management, including locating sensor-based technology, vision-based sensing and wireless sensor networks.

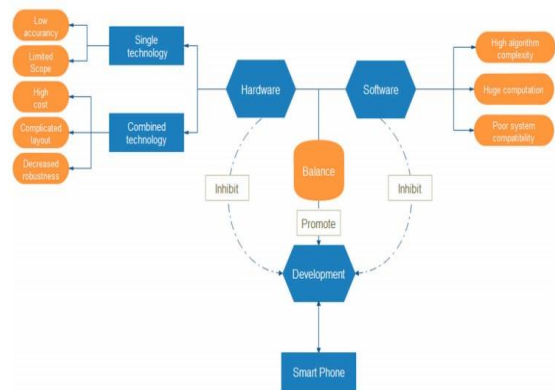


Chart -2: Sensor Flow Chart

The sensors applied in construction safety management mainly include temperature sensors, displacement sensors, light sensors, optical fiber sensors and pressure sensors. They play an indispensable role in real-time monitoring of structures or structural components. In addition, due to the data processing ability and overall performance of smartphones, they have the potential to become an

information management platform based on an open source system.

Applications in Construction Safety Management	Sensor-Based Technology	Application Significance
Accident prevention	RFID, UWB, Zigbee; Sensors and WSN	Prevent collision accidents of heavy machinery equipment
Safety Design	(1) Route prediction and planning for machinery equipment	Predict trajectory of machinery equipment and workers
	(2) Route prediction and planning for workers	
Hazard identification	(1) Classification and identification of dangerous zones	Prevent workers entering into dangerous zones unintentionally; Identify workers' unsafe behavior
	(2) Identification of workers' unsafe behavior	
Integrated safety management	(1) Quality inspection and management of construction material and resource	Inspect construction materials and resource quality; Provide fresh ideas for workers' safety management
	(2) Health and safety management of workers	
Structural health monitoring	Sensor and WSN	Monitor structural health

Table 1: sensor significance

6:2 BASED ON THE ANALYSIS:

The installation of sensors at the construction site level during the construction stage has the potential to significantly reduce accidents. Safety measures are meticulously followed and documented at the site level, ensuring compliance with regulations and standards. However, it has been observed that some safety precautions have been neglected due to labor lethargy, improper monitoring, and the use of low-quality safety equipment. Weekly and daily inspections are emphasized over monthly visits to the site to address safety concerns promptly and prevent accidents. It is imperative that both labor safety and equipment safety are given equal weight to ensure comprehensive safety measures are in place. Proper training and awareness programs should be conducted to educate workers about the importance of adhering to safety protocols. Additionally, supervisors and managers must actively monitor and enforce safety guidelines to prevent lapses in safety measures. Regular maintenance and upgrading of safety equipment should be prioritized to ensure their effectiveness. Implementing a culture of safety and accountability among all workers can further enhance safety standards at the construction site. Collaboration between management, supervisors, and workers is essential for creating a safe working environment where accidents are minimized, and the well-being of all personnel is prioritized.

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