8.6 Heavy Rain Management at Construction Worksites

Managing heavy rain at construction worksites is crucial for ensuring the safety and well-being of workers, protecting equipment and materials, and minimizing disruptions to project operations. Effective heavy rain management practices ensure a safe work environment, minimize disruptions, and prevent damage. Implementing proper protocols for managing heavy rain ensures compliance with regulatory standards, enhances worker confidence, and promotes a safe working environment.

8.6.1 Examples of Hazards Related to Heavy Rain at Construction Sites

- ***Flooding:*** *Accumulation of rainwater leading to site flooding, posing risks to workers and equipment.*
- ***Erosion:*** *Heavy rainfall causing soil erosion, undermining the stability of structures and slopes.*
- ***Slippery Surfaces:*** *Wet and muddy conditions creating slippery surfaces, increasing the risk of slips, trips, and falls.*
- ***Electrical Hazards:*** *Water ingress leading to electrical faults and hazards, posing risks of electric shock.*
- ***Foundation Instability:*** *Saturation of soil compromising the stability of foundations and excavations.*

8.6.2 Examples of Heavy Rain Management Measures

- ***Weather Monitoring:*** *Regularly monitoring weather forecasts and using rain detection systems to stay informed about approaching heavy rain.*
- ***Drainage Systems:*** *Implementing effective drainage systems, such as channels, trenches, and culverts, to manage and divert rainwater away from the site.*
- ***Erosion Control:*** *Using erosion control measures, such as silt fences, erosion control blankets, and vegetation cover, to prevent soil erosion.*
- ***Site Grading:*** *Properly grading the site to ensure that water flows away from work areas, structures, and equipment.*
- ***Temporary Shelters:*** *Providing temporary shelters and covers for sensitive equipment and materials to protect them from rainwater.*
- ***Mud Mats and Gravel:*** *Using mud mats and gravel to stabilize muddy areas and provide safe walking and working surfaces.*
- ***Waterproofing:*** *Applying waterproofing materials to foundations, excavations, and other critical areas to prevent water ingress.*
- ***Pump Systems:*** *Installing pump systems to remove accumulated water from low-lying areas and excavations.*
- ***Electrical Safety:*** *Ensuring that electrical systems and equipment are protected from water ingress and implementing safety measures to prevent electric shock.*

8.6.3 Negative Impacts of Poor Management of Heavy Rain

8.6.3.1 Health and Safety Impacts

- ***Increased Risk of Injuries:*** *Poor rain management can lead to slips, trips, falls, and other accidents due to wet and muddy conditions.*
- ***Electric Shock:*** *Inadequate protection of electrical systems can result in electric shocks and injuries.*

- ***Flood-Related Injuries:*** *Flooding can pose risks to workers, leading to injuries or entrapment.*

8.6.3.2 Operational Impacts

- ***Work Disruptions:*** *Heavy rain and flooding can cause significant disruptions to site operations, leading to project delays and increased costs.*
- ***Equipment Damage:*** *Water ingress can damage equipment and materials, leading to higher repair and replacement costs.*

8.6.3.3 Legal and Financial Impacts

- ***Non-Compliance Penalties:*** *Failure to implement proper heavy rain management measures can result in fines and penalties from health and safety authorities.*
- ***Reputation Damage:*** *Inadequate rain management can harm the company's reputation, affecting relationships with clients, stakeholders, and potential employees.*
- ***Operational Disruption:*** *Heavy rain can cause significant disruptions to daily operations, leading to prolonged downtime and lost revenue.*
- ***Increased Financial Costs:*** *The costs associated with heavy rain can escalate quickly, including expenses for repairs, equipment replacement, relocation, legal fees, and public relations efforts.*
- ***Loss of Productivity and Efficiency:*** *Without proper rain management, employees may not be able to work efficiently, resulting in reduced productivity and inefficient response measures.*
- ***Employee Safety and Well-being:*** *Neglecting rain management can put employees at risk, leading to potential costs related to medical expenses, workers' compensation claims, and higher turnover rates.*
- ***Insurance Premiums:*** *Poor rain management can lead to increased insurance premiums due to higher perceived risks by insurance companies.*
- ***Regulatory Fines:*** *Failure to comply with rain management regulations can result in significant fines and legal fees.*

8.6.4 Positive Impacts for Compliance with Heavy Rain Management Standards

8.6.4.1 Health and Safety Impacts

- ***Reduced Risk of Injuries:*** *Proper heavy rain management measures protect workers from slips, trips, falls, and electric shocks, ensuring their safety.*
- ***Enhanced Site Safety:*** *Effective rain management reduces the risk of flooding and erosion, promoting a safer work environment.*

8.6.4.2 Operational Impacts

- ***Increased Efficiency:*** *A well-managed worksite with effective rain management minimizes disruptions and ensures efficient work processes.*
- ***Equipment Protection:*** *Proper rain management helps protect equipment and materials from water damage, reducing repair and replacement costs.*

8.6.4.3 Legal and Financial Impacts

- ***Compliance with Regulations:*** *Adhering to heavy rain management standards ensures compliance with health and safety regulations, avoiding legal issues.*
- ***Enhanced Reputation:*** *Demonstrating commitment to proper rain management enhances the company's image and builds trust with clients, stakeholders, and the community.*

- ***Cost Savings:*** *Effective rain management reduces the financial burden associated with water damage, equipment repairs, and project delays. It also helps avoid penalties and fines related to non-compliance with regulations.*
- ***Operational Continuity:*** *Proper rain management ensures that business operations can continue with minimal disruption, preventing revenue loss.*
- ***Insurance Benefits:*** *Effective rain management may lead to reduced insurance premiums due to lower perceived risks by insurance companies.*
- ***Asset Protection:*** *Implementing rain management measures helps in protecting valuable assets and infrastructure from water damage, preserving their value.*
- ***Investment Opportunities:*** *A strong rain management plan can attract investors who value risk management and business continuity.*
- ***Employee Retention:*** *Ensuring the safety and well-being of employees through proper rain management measures can reduce turnover rates and associated recruitment and training costs.*

8.6.5 General Provisions for Heavy Rain Management at Construction Worksite

Ensuring effective heavy rain management at construction worksites is essential for maintaining safety, protecting assets, and ensuring uninterrupted operations. Proper heavy rain management involves thorough planning, training, and the implementation of measures to mitigate the risks associated with heavy rainfall. The General Provisions outline the necessary steps to develop robust heavy rain management plans, ensure regulatory compliance, and foster a culture of safety and preparedness at construction sites. By adhering to the following provisions, construction worksites can minimize the impact of heavy rain, enhance resilience, and promote a safer working environment for all:

8.6.5.1 When OHS Provisions for Heavy Rain Management Should Be Applied

- ***Site Assessment and Planning:*** *During initial site assessments and planning phases to identify potential heavy rain hazards and develop response plans.*
- ***Daily Operations:*** *Throughout daily construction activities, ensuring workers are prepared to respond to heavy rain at any time.*
- ***Weather Monitoring:*** *Continuously monitoring weather conditions to anticipate heavy rain and implement necessary precautions.*
- ***Waste Management:*** *When managing waste materials, particularly hazardous waste, to prevent contamination and spills during heavy rain.*
- ***Worker Training:*** *Providing regular safety training and education to workers about heavy rain management procedures and protocols.*
- ***Machinery and Equipment Use:*** *Ensuring that heavy rain management procedures are in place when using construction machinery and equipment that may be affected by rain.*
- ***Emergency Preparedness:*** *Implementing emergency preparedness measures to handle potential flooding or other rain-related emergencies.*

8.6.5.2 Where OHS Provisions for Heavy Rain Management Should Be Applied

- ***Construction Sites in Urban Areas:*** *Heavy rain management measures should be implemented to ensure the safety of workers and nearby residents in case of heavy rain.*

- ***Construction Sites Near Water Bodies:*** *Projects near rivers, lakes, or other water bodies should include heavy rain management plans to prevent flooding and water contamination.*
- ***Temporary Structures and Camps:*** *On-site temporary accommodations and structures should have heavy rain response plans in place to handle any incidents that may arise.*
- ***Excavation and Groundworks:*** *Areas where extensive digging and ground disturbance occur should have specific heavy rain management plans to address potential hazards.*
- ***High-Risk Areas:*** *Construction sites located in areas prone to heavy rain or flooding should have enhanced heavy rain management measures.*
- ***Storage Areas:*** *Ensuring that materials and equipment storage areas are protected from heavy rain to prevent damage and contamination.*

8.6.5.3 Heavy Rain Management Plans and Suitability

- *Heavy rain management plans should be developed and implemented based on specific site conditions and risks.*
- *Compliance with industry standards, such as OSHA regulations or equivalent national standards, must be ensured.*

8.6.5.4 Training and Awareness

- *Workers should be trained on heavy rain management procedures, including site drainage, equipment protection, and emergency communication.*
- *Regular drills and training sessions should be conducted to ensure workers are familiar with heavy rain procedures.*

8.6.5.5 Inspection and Maintenance

- *Drainage systems, protective covers, and non-slip surfaces should be regularly inspected and maintained.*
- *Manufacturer guidelines for the care and replacement of heavy rain management equipment and materials should be followed.*

8.6.5.6 Distribution and Accessibility

- *Access to heavy rain management equipment and resources should be provided at all stages of the construction process.*
- *Heavy rain management equipment and resources should be readily available and accessible to all workers, subcontractors, and visitors.*

8.6.5.7 Signage and Compliance

- *"**Heavy Rain Procedures**" signs should be posted prominently in all designated zones where heavy rain management equipment is located.*
- *Compliance should be regularly monitored and enforced through supervisor checks and audits.*

8.6.5.8 Customization and Comfort

- *Customization of heavy rain management measures to suit specific site conditions and requirements should be allowed.*
- *Resources and support should be provided for workers to adopt heavy rain procedures comfortably and effectively.*

8.6.6 Standards/Specifications for Heavy Rain Management at Construction Worksite

Effective heavy rain management is essential for maintaining safety, protecting assets, and ensuring uninterrupted operations at construction

worksites. Proper heavy rain management involves thorough planning, training, and implementing measures to mitigate the risks associated with heavy rainfall. The standards and specifications outline the necessary steps to develop robust heavy rain management plans, ensure regulatory compliance, and foster a culture of safety and preparedness at construction sites. By adhering to the following standards, construction worksites can minimize the impact of heavy rain, enhance resilience, and promote a safer working environment for all:

8.6.6.1 Site Drainage Systems

- *Drainage systems such as trenches, ditches, and pumps should be implemented to manage and redirect water away from the construction site.*
- *Drainage systems must be regularly inspected, maintained, and kept free of obstructions (Inspection Frequency: **weekly**).*

8.6.6.2 Protective Covers

- *Tarps, plastic sheeting, and other covers should be used to protect equipment and materials from water damage.*
- *Covers must be securely fastened and regularly inspected for damage (Inspection Frequency: **monthly**).*

8.6.6.3 Non-Slip Surfaces

- *Non-slip materials and treatments should be implemented on walkways, ramps, and other areas prone to becoming slippery.*
- *Non-slip surfaces must be regularly inspected and maintained (Inspection Frequency: **monthly**).*

8.6.6.4 Erosion Control Measures

- *Erosion control practices such as silt fences, sediment basins, and erosion control blankets should be implemented to prevent soil erosion and manage sediment runoff.*
- *Erosion control measures must be regularly inspected, maintained, and effective (Inspection Frequency: **biweekly**).*

8.6.6.5 Weather Monitoring Systems

- *Weather monitoring systems such as rain gauges and weather stations should be implemented to monitor weather conditions and provide advance warnings of heavy rain.*
- *Weather monitoring systems must be regularly inspected, calibrated, and maintained (Calibration Frequency: **quarterly**).*

8.6.6.6 Material Requirements

- *Heavy rain management equipment and materials must be durable, reliable, and meet industry standards (e.g., **ISO 22301**) or equivalent national Standards if available and applicable.*
- *Guidelines for the selection, use, and maintenance of heavy rain management equipment and materials should be followed.*

8.6.6.7 Adjustment Mechanisms

- *Adjustable systems and technologies to optimize heavy rain management measures and efficiency should be implemented.*
- *Systems must be easily adapted to changing conditions and requirements.*

8.6.6.8 Reflective Features

- *Reflective materials should be included in heavy rain signage and equipment to improve visibility in low-light conditions.*

8.6.6.9 Attachments and Accessories Compatibility

- *Compatibility with additional heavy rain management technologies and practices must be ensured.*
- *Accessories should not compromise the performance or reliability of heavy rain management equipment.*

8.6.6.10 Temperature Resistance

- *Heavy rain management equipment and materials should be effective in a wide range of temperatures, suitable for various working environments (Range: **0°C to 60°C**).*

8.6.6.11 Water and Chemical Resistance

- *Heavy rain management equipment and materials must be resistant to water and chemical exposure, enhancing durability and reliability.*

8.6.6.12 Equipment Marking and Identification

- *Each piece of heavy rain management equipment must include permanent markings indicating the manufacturer, standards compliance, and date of manufacture.*

8.6.6.13 Emergency Provisions

- *Heavy rain management equipment and resources should be available for immediate use during heavy rain events.*
- *A supply of spare heavy rain management equipment and materials must be maintained for emergencies.*

8.6.6.14 Inspection Protocols

- *Regular inspections of heavy rain management equipment and resources should be conducted to ensure performance and compliance (Inspection Frequency: **monthly**).*
- *Advanced methods such as weather simulations and audits should be used to monitor heavy rain preparedness.*

8.6.6.15 Slips, Trips, and Falls

- *Non-slip mats should be used, work areas must be well-lit and free from hazards.*
- *Non-slip mats must be regularly inspected and maintained (Inspection Frequency: **monthly**).*
- *Workers should be trained on slip, trip, and fall prevention techniques.*

8.6.6.16 Hypothermia and Cold Stress

- *Waterproof and insulated clothing should be worn, and regular breaks should be taken to stay warm.*
- *Heated shelters or rest areas must be provided for workers.*
- *Workers should be educated on the signs and symptoms of hypothermia and cold stress.*

8.6.6.17 Reduced Visibility

- *Reflective and bright-colored clothing should be worn.*
- *Additional lighting in work areas during low-light conditions must be used.*

- *Vehicles and equipment must have functioning lights and reflective markings.*

8.6.6.18 Electrical Hazards

- *Electrical equipment should be avoided in wet conditions.*
- *Waterproof covers and enclosures for electrical equipment must be used.*
- *Workers should be trained on electrical safety practices in wet environments.*

8.6.6.19 Fatigue

- *Regular breaks should be encouraged to avoid fatigue.*
- *A work rotation schedule should be implemented to prevent overexertion.*
- *Workers should be monitored for signs of fatigue and provided rest periods as needed.*

8.6.6.20 Poor Footing

- *Boots with non-slip soles should be worn.*
- *Footwear must be regularly inspected and maintained (Inspection Frequency: **monthly**).*
- *Walkways and work areas must be kept clear of debris and hazards.*

8.6.6.21 Emergency Situations

- *An emergency action plan should be in place for adverse weather conditions.*
- *Regular emergency drills and training sessions must be conducted.*
- *Emergency contact information and communication protocols must be maintained.*

8.6.6.22 Tool and Equipment Safety

- *Non-slip tools and equipment safe for wet conditions should be used.*
- *Tools and equipment must be regularly inspected and maintained (Inspection Frequency: **monthly**).*
- *Training on the safe use of tools and equipment in wet conditions should be provided.*

8.6.6.23 Weather Changes

- *Weather conditions must be monitored, and work should be stopped if conditions become unsafe.*
- *Weather monitoring systems and alarms should be implemented.*
- *Workers should be educated on how to respond to sudden weather changes.*

By implementing these standards and specifications for heavy rain management, construction worksites can ensure the safety and well-being of workers, minimize the impact of heavy rain, and maintain smooth project operations while complying with regulatory standards.

8.7 Strong Wind and Storm Management

Managing strong winds and storms at construction worksites is essential for ensuring worker safety, protecting equipment and materials, and minimizing disruptions to project operations. Implementing proper protocols for managing these conditions ensures compliance with regulatory standards, enhances worker confidence, and promotes a safe working environment. Managing strong winds and storms at construction sites is crucial to protect workers, equipment, and structures from the adverse effects of severe weather. Effective management practices ensure a safe work environment, minimize disruptions, and prevent damage.

8.7.1 Examples of Hazards Related to Strong Winds and Storms at Construction Sites

- ***Flying Debris:*** *Strong winds can cause loose materials and debris to become airborne, posing risks to workers and equipment.*
- ***Structural Damage:*** *High winds can damage temporary structures, scaffolding, and partially completed buildings.*
- ***Falling Objects:*** *Wind can cause tools, equipment, and materials to fall from heights, endangering workers below.*
- ***Electrical Hazards:*** *Storms can lead to downed power lines and electrical faults, posing risks of electric shock.*
- ***Flooding:*** *Heavy rain associated with storms can cause flooding, affecting site operations and stability.*

8.7.2 Examples of Strong Wind and Storm Management Measures

- ***Weather Monitoring:*** *Regularly monitoring weather forecasts and using storm detection systems to stay informed about approaching storms and high winds.*
- ***Securing Materials:*** *Ensuring that loose materials, tools, and equipment are securely stored or anchored to prevent them from becoming airborne.*
- ***Reinforcing Structures:*** *Strengthening temporary structures, scaffolding, and partially completed buildings to withstand high winds.*
- ***Safety Barriers:*** *Installing safety barriers and nets to catch falling objects and debris.*
- ***Emergency Action Plan:*** *Developing and implementing an emergency action plan (EAP) that outlines procedures for responding to strong winds and storms.*
- ***Evacuation Procedures:*** *Establishing clear and well-marked evacuation routes and assembly points to facilitate safe evacuation during storms.*
- ***Electrical Safety:*** *Ensuring that electrical systems and equipment are protected from storm-related hazards and implementing safety measures to prevent electric shock.*
- ***Drainage Systems:*** *Implementing effective drainage systems to manage rainwater and prevent flooding during storms.*
- ***Temporary Suspension of Work:*** *Ceasing all outdoor work and activities during severe storms or high wind conditions to ensure worker safety.*

8.7.3 Negative Impacts of Poor Strong Wind and Storm Management

8.7.3.1 Health and Safety Impacts

- ***Increased Risk of Injuries:*** *Poor management of strong winds and storms can lead to injuries from flying debris, falling objects, and structural damage.*
- ***Electric Shock:*** *Inadequate protection of electrical systems can result in electric shocks and injuries.*
- ***Flood-Related Injuries:*** *Flooding can pose risks to workers, leading to injuries or entrapment.*

8.7.3.2 Operational Impacts

- ***Work Disruptions:*** *Strong winds and storms can cause significant disruptions to site operations, leading to project delays and increased costs.*
- ***Equipment Damage:*** *High winds and storm-related hazards can damage equipment and materials, leading to higher repair and replacement costs.*

8.7.3.3 Legal and Financial Impacts

- ***Non-Compliance Penalties:*** *Failure to implement proper wind and storm management measures can result in fines and penalties from health and safety authorities.*
- ***Reputation Damage:*** *Inadequate wind and storm management can harm the company's reputation, affecting relationships with clients, stakeholders, and potential employees.*
- ***Increased Insurance Premiums:*** *Poor wind and storm management can lead to higher insurance costs due to the increased risk of damage.*
- ***Property Damage Costs:*** *Severe weather events without proper management can result in significant damage to company property, leading to high repair and replacement costs.*
- ***Business Interruption Losses:*** *Operational disruptions caused by inadequate storm management can result in lost revenue and additional costs to resume normal operations.*
- ***Legal Costs:*** *Expenses related to legal actions and settlements due to non-compliance or damage caused by poor management practices.*

8.7.4 Positive Impacts for Compliance with Strong Wind and Storm Management Standards

8.7.4.1 Health and Safety Impacts

- ***Reduced Risk of Injuries:*** *Proper wind and storm management measures protect workers from injuries caused by flying debris, falling objects, and structural damage.*
- ***Enhanced Site Safety:*** *Effective management reduces the risk of flooding and electrical hazards, promoting a safer work environment.*

8.7.4.2 Operational Impacts

- ***Increased Efficiency:*** *A well-managed worksite with effective wind and storm management minimizes disruptions and ensures efficient work processes.*
- ***Equipment Protection:*** *Proper wind and storm management helps protect equipment and materials from damage, reducing repair and replacement costs.*

8.7.4.3 *Legal and Financial Impacts*

- ***Compliance with Regulations:*** *Adhering to wind and storm management standards ensures compliance with health and safety regulations, avoiding legal issues.*
- ***Enhanced Reputation:*** *Demonstrating commitment to proper wind and storm management enhances the company's image and builds trust with clients, stakeholders, and the community.*
- ***Cost Savings:*** *Effective wind and storm management reduces the financial burden associated with weather-related damage, equipment repairs, and project delays. It also helps avoid penalties and fines related to non-compliance with regulations.*
- ***Decreased Insurance Premiums:*** *Effective wind and storm management practices can lead to lower insurance costs due to the reduced risk of damage and claims.*
- ***Reduced Property Damage Costs:*** *Proper management minimizes the likelihood of severe weather events causing damage to company property, leading to significant savings on repair and replacement costs.*
- ***Minimized Business Interruption Losses:*** *Proactive storm management ensures smooth operations with minimal disruptions, preventing lost revenue and additional costs required to resume normal activities.*
- ***Lower Legal Costs:*** *Adhering to wind and storm management standards helps avoid expenses related to legal actions and settlements due to non-compliance or damage.*

8.7.5 General Provisions for Strong Wind and Storm Management at Construction Sites

Strong winds and storms pose significant risks to construction sites, including potential damage to structures, equipment, and materials, as well as safety hazards for workers. Effective management of these weather conditions is crucial to ensure the safety and well-being of all personnel, maintain project timelines, and protect valuable assets. The provisions outline the essential measures that should be implemented to manage strong winds and storms at construction sites. By adhering to the following guidelines, construction companies/contractors can mitigate the impacts of adverse weather conditions, comply with industry regulations, and demonstrate a commitment to safety and excellence:

8.7.5.1 *When these OHS Provisions are Applicable*

- ***Pre-construction Phase:*** *Before the construction project begins, to plan and ensure all necessary wind and storm management measures are in place.*
- ***During Construction:*** *Continuously throughout the construction process, especially when severe weather is forecasted or observed, to protect workers and assets.*
- ***Emergency Situations:*** *During severe wind and storm events, to manage the immediate impact and ensure safety.*
- ***Post-incident:*** *After any severe weather event, to assess damage, review the effectiveness of the measures, and make improvements for future incidents.*

8.7.5.2 *Where these provisions should be used/applicable*

- ***Construction Sites:*** *Any construction site where the risk of strong winds and storms exists, regardless of the project's size or location.*

- ***High-Risk Areas:*** *Sites located in regions prone to severe weather events, such as coastal areas, open fields, or elevated locations.*
- ***Temporary Structures:*** *Areas with temporary structures or equipment that are particularly vulnerable to strong winds and storms.*
- ***Critical Zones:*** *Specific zones within the construction site that house essential equipment, materials, or personnel.*

8.7.5.3 Strong Wind and Storm Management Plans and Suitability

- *Strong wind and storm management plans Should be developed and implemented based on specific site conditions and risks.*
- *Compliance with industry standards, such as OSHA regulations or equivalent national standards, should be ensured.*

8.7.5.4 Training and Awareness

- *Workers Should be trained on strong wind and storm management procedures, including securing materials, equipment protection, and emergency communication.*
- *Regular drills and training sessions should be conducted to ensure workers are familiar with strong wind and storm procedures.*

8.7.5.5 Inspection and Maintenance:

- *Securing systems, protective covers, and anchoring mechanisms should be regularly inspected and maintained.*
- *Manufacturer guidelines for the care and replacement of strong wind and storm management equipment and materials should be followed.*

8.7.5.6 Distribution and Accessibility

- *Access to strong wind and storm management equipment and resources should be provided at all stages of the construction process.*
- *Strong wind and storm management equipment and resources should be readily available and accessible to all workers, subcontractors, and visitors.*

8.7.5.7 Signage and Compliance

- *"Strong Wind and Storm Procedures" signs Should be posted prominently in all designated zones where strong wind and storm management equipment is located.*
- *Compliance should be regularly monitored and enforced through supervisor checks and audits.*

8.7.5.8 Customization and Comfort

- *Customization of strong wind and storm management measures to suit specific site conditions and requirements should be allowed.*
- *Resources and support for workers to adopt strong wind and storm procedures comfortably and effectively should be provided.*

8.7.5.9 Emergency Response Coordination

- *Clear communication channels and protocols for emergency response during strong wind and storm events shall be established.*
- *Coordination with local emergency services and authorities to ensure prompt assistance if needed shall be ensured.*

8.7.5.10 Worker/Laborer Welfare:

- *Adequate shelter and protective gear for workers during severe weather conditions shall be provided.*
- *Access to drinking water, first aid, and other essential supplies during storms shall be ensured for workers.*

8.7.5.11 Monitoring and Forecasting

- *Systems to monitor weather conditions and receive real-time updates shall be implemented.*
- *Weather forecasting tools to predict strong wind and storm events, allowing for timely preparation and response, shall be utilized..*

8.7.5.12 Documentation and Reporting

- *Records of all wind and storm management activities, including training sessions, inspections, and incidents, shall be maintained.*
- *Significant weather-related incidents shall be reported to relevant authorities and stakeholders, as required..*

8.7.5.13 Continuous Improvement

- *Wind and storm management plans shall be regularly reviewed and updated based on lessons learned and best practices.*
- *Feedback from workers and stakeholders to continuously improve the effectiveness of management measures shall be encouraged.*

8.7.6 Detailed OHS Standards/Specifications for Strong Winds and Storms at Construction Worksite

Ensuring the safety and well-being of workers during strong winds and storms at construction sites is of utmost importance. These detailed Occupational Health and Safety (OHS) standards and specifications provide guidelines to minimize risks and maintain a safe working environment. By adhering to the following standards, construction companies can effectively manage the challenges posed by adverse weather conditions.

8.7.6.1 Securing Loose Objects and Materials

- *Sturdy containers or storage areas for loose materials that can withstand wind speeds of up to* ***60 mph (96.5 km/h)*** *should be used.*
- *Protective helmets and eyewear rated for impact resistance preferably according to ANSI Z87.1 standards (or equivalent national Standards if available and applicable) for protection from flying debris should be worn.*
- *Regular inspections to ensure all loose objects are properly secured should be implemented.* ***Frequency: Daily****, or* ***before forecasted storms****.*

8.7.6.2 Structural Stability

- *Working near unstable structures if wind speeds exceed* ***20 mph (32 km/h)*** *should be avoided.*
- *Scaffolding and ladders should be secure and properly anchored to withstand wind speeds of up to* ***40 mph (64 km/h)****.*
- *Stability checks on structures, especially after strong winds, should be conducted.* ***Frequency: Before and after storm events****.*

8.7.6.3 Electrical Safety

- *Using electrical equipment during storms when there is lightning within a* ***10-mile (16 km)*** *radius should be avoided.*
- *Proper grounding of electrical systems with ground fault circuit interrupters (GFCIs) rated for outdoor use should be ensured.*
- *GFCIs on electrical systems to enhance safety, per National Electrical Code (NEC) standards, should be installed.*

8.7.6.4 Visibility and Lighting

- *Reflective and bright-colored clothing with a minimum reflectivity of **400 cd/lux/m²** should be worn.*
- *Additional lighting with an illumination level of at least **50 foot-candles (538 lux)** to ensure visibility should be used.*
- *Lighting should be positioned to minimize glare and shadows, improving overall visibility. **Minimum height: 10 feet (3 meters) above ground level.***

8.7.6.5 Preventing Slips, Trips, and Falls

- *Non-slip mats with a coefficient of friction of at least **0.6** to ensure safety should be used.*
- *Work areas should be well-lit with at least **30 foot-candles (323 lux)** of illumination.*
- *Hazardous areas should be marked with clear signage and barriers. **Signage should be at least 18 inches (45 cm) in height.***

8.7.6.6 Fatigue Management

- *Regular breaks every **2 hours** to avoid fatigue should be encouraged.*
- *Sheltered rest areas with a minimum of **25 square feet (2.3 square meters) per worker** to protect from adverse weather conditions should be provided.*
- *Work rotations to prevent overexertion during storms should be scheduled. **Recommended duration: 4-hour shifts.***

8.7.6.7 Proper Footwear

- *Boots with non-slip soles rated for oil and water resistance, compliant with ASTM F2413 standards (or equivalent National Standard if available and applicable), should preferably be worn.*
- *Footwear should be waterproof and provide adequate ankle support, with a shaft height of at least **6 inches (15 cm).***
- *Footwear should be regularly inspected and replaced if worn or damaged. **Inspection frequency: Monthly.***

8.7.6.8 Emergency Preparedness

- *An emergency action plan for adverse weather conditions should be in place and updated annually.*
- *Regular emergency drills to ensure all workers are familiar with procedures should be conducted. **Frequency: Quarterly.***
- *A clear communication plan for weather-related emergencies, including a phone tree and emergency contact list, should be maintained.*

8.7.6.9 Tool and Equipment Safety

- *Non-slip tools and equipment safe for wet and windy conditions, compliant with ISO 10816 standards, should be used.*
- *Tools and equipment should be regularly inspected for signs of wear and damage. **Inspection frequency: Bi-weekly.***
- *Proper storage for tools and equipment to protect them from weather exposure should be provided. **Storage should be elevated at least 12 inches (30 cm) off the ground.***

8.7.6.10 Weather Monitoring

- *Weather conditions should be continuously monitored using reliable systems such as weather apps or on-site anemometers.*
- *Work should be prepared to stop if wind speeds exceed **25 mph (40 km/h).***

- *Protocols for resuming work safely after adverse weather events, including post-storm inspections, should be established.*

8.7.6.11 Protection from Flying Debris

- *All loose objects and materials should be secured to prevent them from becoming airborne at wind speeds above **30 mph (48 km/h)**.*
- *Protective helmets and eyewear should be worn at all times when strong winds are anticipated, rated for impact resistance according to ANSI Z89.1 standards.*
- *Temporary barriers or windbreaks to reduce the impact of flying debris should be installed, with a minimum height of **6 feet (1.8 meters)**.*

8.7.6.12 Protection from Structural Instability

- *Working near unstable structures, especially during wind speeds exceeding **15 mph (24 km/h)**, should be avoided.*
- *All scaffolding and ladders should be securely anchored and stable to withstand wind speeds of up to **35 mph (56 km/h)**.*
- *Additional bracing and support for structures during storms, following engineering best practices, should be implemented as needed.*

8.7.6.13 Protection from Electrical Hazards

- *Using electrical equipment during storms unless absolutely necessary, particularly when lightning is detected within a **5-mile (8 km)** radius, should be avoided.*
- *All electrical systems should be properly grounded and protected, compliant with NEC standards.*
- *Electrical systems should be regularly inspected for signs of damage or wear. **Inspection frequency: Monthly**.*

8.7.6.14 Protection from Reduced Visibility

- *Reflective and bright-colored clothing to enhance visibility, with a minimum reflectivity of **300 cd/lux/m²**, should be worn.*
- *Additional lighting to ensure all work areas are well-lit, with a minimum of **20 foot-candles (215 lux)**, should be used.*
- *Lighting should be positioned to minimize shadows and glare, with a minimum height of **8 feet (2.4 meters) above ground level**.*

8.7.6.15 Protection from Slips, Trips, and Falls

- *Non-slip mats with a coefficient of friction of at least **0.5** to ensure safety should be used.*
- *All work areas should be clear of hazards and well-marked with barriers and signage. **Signage should be at least 12 inches (30 cm) in height**.*
- *Clean and dry walkways to prevent slipping, especially during wet conditions, should be maintained.*

8.7.6.16 Protection from Fatigue

- *Regular breaks every **1.5 to 2 hours** to prevent overexertion and fatigue should be encouraged.*
- *Sheltered rest areas to protect workers from adverse weather, with at least **30 square feet (2.8 square meters) per worker**, should be provided.*
- *Work rotations to ensure workers are well-rested, with shift durations not exceeding **4 hours** during storms, should be implemented.*

8.7.6.17 Protection from Poor Footing

- *Boots with non-slip soles for better traction, compliant with ASTM F2913 standards, should be worn.*
- *Footwear should be appropriate for the conditions and provide adequate support, with a shaft height of at least* ***8 inches (20 cm).***
- *Footwear should be regularly inspected and replaced as needed.* ***Inspection frequency: Monthly.***

8.7.6.18 Handling Emergency Situations

- *A comprehensive emergency action plan for severe weather should be in place and updated annually.*
- *Regular drills to ensure workers are familiar with emergency procedures should be conducted.* ***Drill frequency: Quarterly.***
- *Clear communication channels for emergency situations, including a phone tree and emergency contact list, should be established.*

8.8 Temporary Traffic Management at Construction Worksite

Temporary traffic management is crucial at construction sites, especially for bridges, to ensure the safety of workers, motorists, and pedestrians. Effective traffic management practices help prevent accidents, minimize disruptions, and comply with traffic regulations. Managing temporary traffic at construction worksites, especially bridges, is important for ensuring the safety of workers, pedestrians, and motorists. Implementing proper protocols for traffic management ensures compliance with regulatory standards, minimizes disruptions, and promotes a safe working environment.

8.8.1 Examples of Traffic Hazards at Bridge Construction Sites

- ***Vehicle Collisions:*** *Risk of collisions due to lane closures, detours, and altered traffic patterns.*
- ***Pedestrian Safety:*** *Risks to pedestrians due to insufficient walkways and crossing areas.*
- ***Congestion:*** *Traffic congestion caused by construction activities leading to delays and frustration for motorists.*
- ***Worker Safety:*** *Risks to construction workers from passing vehicles and equipment movement.*
- ***Visibility Issues:*** *Reduced visibility due to construction barriers, equipment, and poor lighting.*

8.8.2 Examples of Temporary Traffic Management Measures

- ***Traffic Control Plans:*** *Developing and implementing comprehensive traffic control plans (TCPs) that outline procedures for managing traffic around construction sites.*
- ***Signage:*** *Installing clear and visible signage to inform motorists and pedestrians of construction activities, lane closures, detours, and speed limits.*
- ***Traffic Barriers:*** *Using traffic barriers, cones, and delineators to create safe zones and separate traffic from construction areas.*
- ***Flaggers:*** *Deploying trained flaggers to direct traffic and ensure safe passage through construction zones.*
- ***Pedestrian Walkways:*** *Establishing safe and accessible pedestrian walkways and crossings to protect pedestrians from construction hazards.*
- ***Speed Control:*** *Implementing speed control measures, such as temporary speed limits and speed bumps, to reduce vehicle speeds in construction zones.*
- ***Lighting:*** *Ensuring adequate lighting in construction zones to enhance visibility for motorists, pedestrians, and workers.*
- ***Traffic Signals:*** *Installing temporary traffic signals or modifying existing signals to manage traffic flow and reduce congestion.*
- ***Public Communication:*** *Providing timely and accurate information to the public about construction activities, traffic changes, and expected delays through various communication channels.*

8.8.3 Negative Impacts of Poor Temporary Traffic Management

8.8.3.1 Health and Safety Impacts

- ***Increased Risk of Accidents:*** *Poor traffic management can lead to vehicle collisions, pedestrian accidents, and injuries to workers.*

- ***Visibility Issues:*** *Inadequate lighting and signage can reduce visibility, increasing the risk of accidents.*

8.8.3.2 Operational Impacts

- ***Traffic Congestion:*** *Ineffective traffic management can cause significant congestion and delays, affecting traffic flow and project timelines.*
- ***Work Disruptions:*** *Traffic-related accidents and issues can disrupt construction activities, leading to delays and increased costs.*

8.8.3.3 Legal and Financial Impacts

- ***Non-Compliance Penalties:*** *Failure to implement proper traffic management measures can result in fines and penalties from traffic authorities.*
- ***Reputation Damage:*** *Inadequate traffic management can harm the company's reputation, affecting relationships with clients, stakeholders, and the community.*
- ***Increased Insurance Premiums:*** *Poor traffic management can lead to higher insurance costs due to the increased risk of accidents and claims.*
- ***Vehicle Damage Costs:*** *Inadequate traffic management can result in vehicle damage, leading to high repair and replacement costs.*
- ***Business Interruption Losses:*** *Traffic-related disruptions can cause delays in project timelines, leading to lost revenue and additional costs to resume normal operations.*
- ***Legal Costs:*** *Expenses related to legal actions and settlements due to non-compliance or traffic incidents caused by poor management practices.*
- ***Operational Efficiency:*** *Poor traffic management can increase operational costs due to inefficiencies and delays in transportation and logistics.*

8.8.4 Positive Impacts for Compliance with Temporary Traffic Management Standards

8.8.4.1 Health and Safety Impacts

- ***Reduced Risk of Accidents:*** *Proper traffic management measures protect motorists, pedestrians, and workers from accidents and injuries.*
- ***Enhanced Visibility:*** *Effective lighting and signage improve visibility, reducing the risk of accidents.*

8.8.4.2 Operational Impacts

- ***Improved Traffic Flow:*** *Proper traffic management minimizes congestion and ensures smooth traffic flow, reducing delays and improving efficiency.*
- ***Work Continuity:*** *Effective traffic management reduces disruptions to construction activities, ensuring project timelines are met.*

8.8.4.3 Legal and Financial Impacts

- ***Compliance with Regulations:*** *Adhering to traffic management standards ensures compliance with traffic regulations, avoiding legal issues.*
- ***Enhanced Reputation:*** *Demonstrating commitment to proper traffic management enhances the company's image and builds trust with clients, stakeholders, and the community.*
- ***Cost Savings:*** *Effective traffic management reduces the financial burden associated with traffic-related accidents, delays, and project disruptions. It also helps avoid penalties and fines related to non-compliance with regulations.*

8.8.5 General Provisions for Temporary Traffic Management at Construction Worksites (Especially Bridges)

Temporary traffic management is critical at construction sites, especially when working on bridges. Effective management ensures the safety of workers, motorists, and pedestrians, maintains smooth traffic flow, and minimizes disruptions. By adhering to the following provisions, construction companies can create a safe and efficient work environment:

8.8.5.1 When these provisions should be applicable

- ***Pre-construction Phase:*** *Before the construction project begins, all necessary traffic management measures should be planned and ensured.*
- ***During Construction:*** *Continuously throughout the construction process, especially during high traffic periods or complex construction activities, workers and road users should be protected.*
- ***Emergency Situations:*** *During incidents or unexpected events, traffic flow should be managed, and safety should be ensured.*
- ***Post-incident:*** *After any traffic-related incident, damage should be assessed, the effectiveness of the measures should be reviewed, and improvements for future incidents should be made.*

8.8.5.2 Where these provisions should be used/applicable

- ***Construction Sites:*** *Any construction site where temporary traffic management is required, particularly bridges, should be covered.*
- ***High-Traffic Areas:*** *Sites located in regions with high traffic volumes, such as urban areas, highways, or main roads, should be managed.*
- ***Temporary Structures:*** *Areas with temporary structures or equipment that could impact traffic flow should be considered.*
- ***Critical Zones:*** *Specific zones within the construction site that require special attention for traffic management, such as bridge approaches or exits, should be managed.*

8.8.5.3 Temporary Traffic Management Plans and Suitability

- ***Traffic Management Plans (TMPs):*** *Should be developed and implemented based on specific site conditions and risks.*
- ***Compliance with industry standards:*** *Such as OSHA regulations or equivalent national standards, should be ensured.*

8.8.5.4 Training and Awareness

- ***Worker Training:*** *Workers should be trained on temporary traffic management procedures, including the use of traffic control devices, emergency communication, and safety protocols.*
- ***Regular Drills:*** *Regular drills and training sessions should be conducted to ensure workers are familiar with traffic management procedures.*

8.8.5.5 Inspection and Maintenance

- ***Regular Inspections:*** *Traffic control devices, barriers, and signage should be regularly inspected and maintained.*
- ***Manufacturer Guidelines:*** *Manufacturer guidelines for the care and replacement of traffic management equipment and materials should be followed.*

8.8.5.6 Distribution and Accessibility

- ***Access to Resources:*** *Access to traffic management equipment and resources should be provided at all stages of the construction process.*
- ***Readily Available:*** *Traffic management equipment and resources should be readily available and accessible to all workers, subcontractors, and visitors.*

8.8.5.7 Customization and Comfort

- ***Customization:*** *Customization of traffic management measures to suit specific site conditions and requirements should be allowed.*
- ***Worker Comfort:*** *Resources and support for workers to adopt traffic management procedures comfortably and effectively should be provided.*

8.8.5.8 Emergency Response Coordination

- ***Communication Channels:*** *Clear communication channels and protocols for emergency response during traffic-related incidents should be established.*
- ***Coordination with Authorities:*** *Coordination with local emergency services and authorities to ensure prompt assistance if needed should be ensured.*

8.8.5.9 Worker/Laborer Welfare

- ***Protective Gear:*** *Adequate shelter and protective gear for workers managing traffic during severe weather conditions should be provided.*
- ***Essential Supplies:*** *Access to drinking water, first aid, and other essential supplies for workers managing traffic should be ensured.*

8.8.5.10 Monitoring and Forecasting

- ***Weather Monitoring:*** *Systems to monitor weather conditions and receive real-time updates should be implemented.*
- ***Traffic Forecasting:*** *Traffic forecasting tools to predict peak traffic periods, allowing for timely preparation and response, should be utilized.*

8.8.5.11 Documentation and Reporting

- ***Record-Keeping:*** *Records of all traffic management activities, including training sessions, inspections, and incidents, should be maintained.*
- ***Incident Reporting:*** *Significant traffic-related incidents should be reported to relevant authorities and stakeholders, as required.*

8.8.5.12 Continuous Improvement

- ***Plan Review:*** *Traffic management plans should be regularly reviewed and updated based on lessons learned and best practices.*
- ***Feedback:*** *Feedback from workers and stakeholders should be encouraged to continuously improve the effectiveness of management measures.*

8.8.6 Standards/Specifications for Temporary Traffic Management at Construction Worksite (Especially Bridges)

Temporary traffic management at construction sites, particularly for bridge projects, requires meticulous planning and adherence to Occupational Health and Safety (OHS) standards. These standards and specifications are designed to ensure the safety of workers, pedestrians, and vehicular traffic, while minimizing disruptions and maintaining efficient traffic flow. By following these guidelines, Standards/Specifications construction companies can effectively manage temporary traffic conditions and mitigate risks associated with construction activities.

8.8.6.1 Traffic Control Devices

- *Cones, barriers, and signs to direct traffic and ensure safety should be used.*
- *All traffic control devices should be compliant with local regulations and standards.*

- *Traffic control devices should be regularly inspected and maintained.* ***Inspection frequency: Daily.***
- *Cones that are at least* ***28 inches (71 cm)*** *in height and barriers with a minimum height of* ***36 inches (91 cm)*** *should be used.*

8.8.6.2 Lane Closures and Detours

- *Lane closures and detours to manage traffic flow around the construction site should be implemented.*
- *Clear signage and advance warnings for lane closures and detours at least* ***500 feet (152 meters)*** *before the closure should be provided.*
- *Detour routes should be safe and accessible for all vehicles, including emergency vehicles.*
- *Lane closures should not exceed* ***50% of the bridge width*** *to maintain traffic flow.*

8.8.6.3 Pedestrian Safety Measures

- *Clear pathways and barriers to protect pedestrians from construction activities should be provided.*
- *Pedestrian pathways should be well-lit and free from obstructions.*
- *Pathways should be at least* ***4 feet (1.2 meters)*** *wide to accommodate pedestrian traffic.*
- *Additional safety measures, such as crossing guards, during peak hours should be implemented.*

8.8.6.4 Signage and Compliance

- ***Clear Signage:*** *Specific signs such as:*
  - *Bridge Construction Ahead*
  - *Reduce Speed*
  - *Detour*
  - *Construction Workers Present*
  - *Narrow Lanes*
  - *Expect Delays*
  - *Temporary Traffic Signals and*
  - *No Parking*

  should be installed to guide and inform motorists and pedestrians.
- ***Variable Message Signs (VMS):*** *VMS should be used to provide real-time updates about traffic conditions, road closures, and alternative routes.*
- ***Compliance Monitoring:*** *Compliance should be regularly monitored and enforced through supervisor checks and audits.*

8.8.6.5 Speed Management

- *Temporary speed limits to ensure safe driving conditions around the construction site should be implemented.*
- *Speed limit signs and radar speed displays to enforce speed limits should be used. Temporary speed limits should not exceed* ***15 mph (24 km/h).***
- *Speed limits should be monitored and adjusted as needed based on traffic conditions and construction activities.*

8.8.6.6 Weather Monitoring Systems

- *Weather monitoring systems to provide advance warnings of adverse weather conditions should be used.*

- *Additional safety measures, such as temporary road closures, during severe weather should be implemented.*
- *All workers should be trained on weather-related safety procedures.*

8.8.6.7 Protection from Vehicle Collisions

- *Barriers and traffic control devices to separate vehicles from construction areas should be used.*
- *Flagging operations to direct traffic around the construction site should be implemented.*
- *All workers should wear high-visibility clothing compliant with ANSI/ISEA 107 standards.*
- *A minimum clearance of **10 feet (3 meters)** between active work areas and traffic lanes should be maintained.*

8.8.6.8 Protection from Pedestrian Accidents

- *Clear signage and barriers to guide pedestrians safely through the construction zone should be provided.*
- *Pedestrian pathways should be well-marked and free from hazards.*
- *Additional safety measures, such as pedestrian crossing signals, should be implemented where needed.*

8.8.6.9 Protection from Falls from Heights

- *Fall protection measures, such as guardrails and safety nets, when working on bridge structures should be implemented.*
- *All workers should be trained on fall protection procedures and use appropriate PPE compliant preferably with OSHA 1926 standards of National Standards (if available and applicable).*
- *Regular inspections of fall protection equipment should be conducted. **Inspection frequency: Weekly**.*

8.8.6.10 Emergency Preparedness

- *An emergency action plan for traffic-related incidents should be developed and implemented.*
- *Regular emergency drills to ensure all workers are familiar with procedures should be conducted. **Drill frequency: Quarterly**.*
- *Clear communication channels for reporting and responding to emergencies should be maintained.*

8.8.6.11 Tool and Equipment Safety

- *Non-slip tools and equipment safe for wet and windy conditions should be used.*
- *Tools and equipment should be regularly inspected for signs of wear and damage. **Inspection frequency: Bi-weekly**.*
- *Proper storage for tools and equipment to protect them from weather exposure should be provided. **Storage should be elevated at least 12 inches (30 cm) off the ground**.*

8.8.6.12 Weather Monitoring

- *Weather conditions should be continuously monitored using reliable systems such as weather apps or on-site anemometers.*
- *Work should be prepared to stop if conditions become unsafe, particularly if wind speeds exceed **25 mph (40 km/h)**.*
- *Protocols for resuming work safely after adverse weather events, including post-storm inspections, should be established.*

8.8.6.13 Traffic Flow Management

- *Real-time traffic monitoring systems to assess traffic flow and make necessary adjustments should be implemented.*
- *Dynamic message signs to inform drivers of current traffic conditions and any changes to detour routes should be used.*
- *Traffic flow should be managed to minimize congestion and ensure smooth movement around the construction site.*

8.8.6.14 Noise Control

- *Noise barriers to reduce the impact of construction noise on nearby residents and businesses should be installed.*
- *Construction activities should be scheduled to minimize noise during peak traffic hours and sensitive times.* ***Noise levels should not exceed 85 dB(A).***

8.8.6.15 Lighting for Night Work

- *Adequate lighting to ensure visibility and safety during night work should be provided.*
- *Light towers with a minimum illumination of* ***10 foot-candles (108 lux)*** *should be used.*
- *Lighting should be positioned to avoid blinding drivers and ensure clear visibility of traffic control devices.*

8.8.6.16 Communication and Coordination

- *Regular communication with local authorities, emergency services, and the community should be maintained to keep them informed of construction activities and any changes to traffic management plans.*
- *Coordination with other construction projects in the vicinity to ensure consistent traffic management and avoid conflicts should be ensured.*

8.9 Site Cleaning, Related Waste Removal and Disposal Activities at Construction Worksites

Site cleaning, removal, and disposal activities are crucial at construction sites to maintain a safe, organized, and environmentally friendly work environment. Proper management of these activities ensures compliance with regulations, prevents accidents, and promotes efficiency. Implementing proper protocols for these activities ensures compliance with regulatory standards, protects worker health and safety, and minimizes environmental impact.

8.9.1 Examples of Cleaning, Removal, and Disposal Needs at Construction Sites

- ***Debris Removal:*** *Clearing construction debris such as concrete, bricks, wood, and metal from the site.*
- ***Waste Segregation:*** *Separating different types of waste, including recyclables, hazardous materials, and general waste.*
- ***Dust Control:*** *Managing dust generated by construction activities to maintain air quality and visibility.*
- ***Spill Cleanup:*** *Addressing spills of chemicals, oils, and other hazardous substances to prevent environmental contamination.*
- ***General Cleaning:*** *Maintaining cleanliness of work areas, pathways, and facilities to ensure safety and hygiene.*

8.9.2 Examples of Site Cleaning, Removal, and Disposal Measures

- ***Waste Management Plan:*** *Developing and implementing a comprehensive waste management plan that outlines procedures for waste segregation, collection, and disposal.*
- ***Waste Bins and Containers:*** *Providing adequate and clearly labeled waste bins and containers for different types of waste.*
- ***Regular Cleaning Schedule:*** *Establishing a regular cleaning schedule to ensure that debris and waste are promptly removed from the site.*
- ***Dust Suppression:*** *Using dust suppression techniques, such as water spraying and dust suppressants, to control dust generation.*
- ***Spill Response:*** *Implementing spill response plans and providing spill kits to quickly address and clean up hazardous spills.*
- ***Recycling:*** *Setting up recycling programs to process and reuse materials such as metal, wood, and plastics.*
- ***Hazardous Waste Handling:*** *Ensuring proper handling, storage, and disposal of hazardous waste in accordance with regulations.*
- ***Training:*** *Providing workers with training on proper cleaning, removal, and disposal procedures to ensure compliance and safety.*
- ***Environmental Protection:*** *Implementing measures to minimize the environmental impact of construction activities, such as erosion control and sediment barriers.*

8.9.3 Negative Impacts of Poor Site Cleaning, Removal, and Disposal Management

8.9.3.1 Health and Safety Impacts

- ***Increased Risk of Injuries:*** *Poor cleaning and waste management can lead to slips, trips, falls, and other accidents due to debris and clutter.*

- ***Exposure to Hazardous Materials:*** *Inadequate handling of hazardous waste can expose workers to harmful substances, leading to health issues.*
- ***Poor Air Quality:*** *Ineffective dust control can result in poor air quality, affecting respiratory health of workers.*

8.9.3.2 Operational Impacts

- ***Work Disruptions:*** *Accumulation of waste and debris can disrupt site operations, leading to delays and reduced productivity.*
- ***Higher Cleanup Costs:*** *Poor waste management can lead to higher costs associated with cleanup and environmental remediation.*

8.9.3.3 Legal and Financial Impacts

- ***Non-Compliance Penalties:*** *Failure to implement proper cleaning, removal, and disposal measures can result in fines and penalties from health and safety authorities.*
- ***Reputation Damage:*** *Inadequate waste management can harm the company's reputation, affecting relationships with clients, stakeholders, and the community.*
- ***Increased Waste Disposal Costs:*** *Improper waste management can lead to higher disposal costs due to the need for additional handling and corrective measures.*
- ***Environmental Cleanup Expenses:*** *Failure to manage waste properly can result in environmental contamination, leading to significant cleanup expenses.*
- ***Operational Inefficiencies:*** *Ineffective waste management can disrupt workflow and reduce overall productivity, resulting in increased operational costs.*
- ***Legal Costs:*** *Expenses related to legal actions and settlements due to non-compliance with waste management regulations.*
- ***Insurance Premiums:*** *Poor waste management practices can lead to higher insurance premiums due to the increased risk of claims related to environmental damage or health and safety violations.*

8.9.4 Positive Impacts for Compliance with Cleaning, Removal, and Disposal Standards

8.9.4.1 Health and Safety Impacts

- ***Reduced Risk of Injuries:*** *Proper cleaning and waste management measures protect workers from accidents and exposure to hazardous materials.*
- ***Improved Air Quality:*** *Effective dust control measures enhance air quality, promoting respiratory health.*

8.9.4.2 Operational Impacts

- ***Increased Efficiency:*** *A clean and organized worksite promotes efficient work processes and minimizes disruptions.*
- ***Cost Savings:*** *Proper waste management reduces cleanup costs and prevents environmental remediation expenses.*

8.9.4.3 Legal and Financial Impacts

- ***Compliance with Regulations:*** *Adhering to cleaning, removal, and disposal standards ensures compliance with health and safety regulations, avoiding legal issues.*

- ***Enhanced Reputation:*** *Demonstrating commitment to proper waste management enhances the company's image and builds trust with clients, stakeholders, and the community.*
- ***Cost Savings:*** *Effective waste management can lead to significant cost savings by reducing the need for additional handling, disposal, and corrective measures.*
- ***Insurance Premium Reduction:*** *Proper waste management practices can result in lower insurance premiums due to the reduced risk of environmental damage and health and safety violations.*
- ***Increased Operational Efficiency:*** *Efficient waste management practices can improve workflow and productivity, leading to reduced operational costs.*
- ***Environmental Compliance Incentives:*** *Companies that adhere to environmental regulations may qualify for financial incentives and grants aimed at promoting sustainable practices.*
- ***Avoidance of Cleanup Costs:*** *Proper waste management prevents environmental contamination, thereby avoiding significant cleanup expenses.*

8.9.5 General Provisions for Site Cleaning, Removal and Disposal Activities at Construction Worksites

Effective site cleaning, removal, and disposal activities are essential to maintaining a safe, compliant, and efficient construction environment. These activities help prevent accidents, minimize health risks, and ensure regulatory compliance. The provisions outline the essential measures that should be implemented for site cleaning, removal, and disposal activities at construction worksites. By adhering to the following guidelines, construction companies/contractors can mitigate risks, comply with industry regulations, and demonstrate a commitment to safety and excellence.

8.9.5.1 When These Provisions Should be Used/Applied

- ***Pre-construction Phase:*** *Before the construction project begins, to plan and ensure all necessary cleaning, removal, and disposal measures are in place.*
- ***During Construction:*** *Continuously throughout the construction process, especially when handling hazardous materials or large amounts of waste.*
- ***Emergency Situations:*** *During incidents involving hazardous materials spills or other waste-related emergencies.*
- ***Post-incident:*** *After any waste-related incident, to assess damage, review the effectiveness of the measures, and make improvements for future incidents.*

8.9.5.2 Where These Provisions Should be Used/Applied

- ***Construction Sites:*** *Any construction site where cleaning, removal, and disposal activities are required, regardless of the project's size or location.*
- ***High-Risk Areas:*** *Sites with significant amounts of hazardous materials or waste.*
- ***Temporary Storage Areas:*** *Locations where waste is temporarily stored before final disposal.*
- ***Critical Zones:*** *Specific zones within the construction site that require special attention, such as areas with heavy machinery or high worker activity.*

8.9.5.3 Hazardous Material Handling

- *Proper protective equipment (PPE) when handling hazardous materials, including gloves, masks, and safety goggles compliant with ANSI Z87.1 standards or equivalent national standards should preferably be used if available and applicable.*
- *Proper procedures for handling and disposing of hazardous materials, compliant with EPA regulations, should be followed.*
- *Hazardous materials should be labeled and stored in containers that meet DOT specifications.* ***Inspection frequency: Weekly.***

8.9.5.4 Efficient Processes

- *Efficient cleaning and disposal processes to minimize disruptions to project timelines should be implemented.*
- *Cleaning activities should be scheduled during off-peak hours to avoid interfering with construction work.*
- *Designated disposal areas should be used, and proper waste segregation practices should be followed.*

8.9.5.5 Regulatory Compliance

- *Compliance with waste management regulations, including local, state, and federal requirements, should be ensured.*
- *Records of waste disposal activities, including types of waste, quantities, and disposal methods, should be kept.*
- *Regular audits to ensure compliance with waste management regulations should be conducted.* ***Audit frequency: Annually.***

8.9.5.6 Protection from Hazardous Material Exposure

- *Protective equipment (PPE) such as gloves, masks, and safety goggles rated for chemical resistance should be used.*
- *Proper ventilation systems when handling hazardous materials to prevent inhalation should be implemented.*
- *Training on handling and disposing of hazardous materials should be provided.* ***Training frequency: Annually.***

8.9.5.7 Efficient Cleaning and Disposal Processes

- *Efficient cleaning and disposal processes to minimize disruptions should be implemented.*
- *Cleaning activities should be scheduled during off-peak hours.*
- *Designated disposal areas should be used, and proper waste segregation practices should be followed.*

8.9.5.8 Waste Segregation and Recycling

- *Waste should be segregated into categories such as recyclable, non-recyclable, hazardous, and non-hazardous.*
- *Recycling facilities and bins should be provided to encourage recycling practices.*
- *Regular inspections to ensure proper waste segregation and recycling practices should be conducted.* ***Inspection frequency: Monthly.***

8.9.5.9 Spill Response and Management

- *Spill response kits for hazardous material spills should be readily available on-site.*
- *Workers should be trained on spill response procedures and the use of spill response kits.*

- *Spills should be promptly reported and managed to prevent environmental contamination.* ***Training frequency: Semi-annually.***

8.9.5.10 Air Quality Control

- *Dust suppression measures, such as water sprays and dust barriers, should be implemented to control airborne particles.*
- *Regular air quality monitoring should be conducted to ensure compliance with air quality standards.*
- *PPE, such as respirators, should be provided to workers in areas with high dust concentrations.* ***Monitoring frequency: Monthly.***

8.9.5.11 Noise Control

- *Noise barriers should be installed to minimize the impact of construction noise on workers and the surrounding community.*
- *Construction activities should be scheduled to minimize noise during sensitive times.* ***Noise levels should not exceed 85 dB(A).***
- *Regular noise level monitoring should be conducted to ensure compliance with noise regulations.* ***Monitoring frequency: Quarterly.***

8.9.5.12 Water Management

- *Proper drainage systems should be installed to prevent water accumulation and flooding on-site.*
- *Wastewater from cleaning activities should be properly treated and disposed of according to environmental regulations.*
- *Water conservation measures, such as the use of low-flow nozzles, should be implemented to minimize water usage.*

8.9.5.13 Training and Awareness

- *Workers should be trained on all aspects of site cleaning, removal, and disposal activities, including hazard recognition and emergency procedures.*
- *Regular safety meetings should be held to reinforce safety protocols and address any concerns.* ***Meeting frequency: Weekly.***
- *Signage and informational materials should be provided to raise awareness about proper waste management practices.*

8.9.6 Standards/Specifications for Site Cleaning, Removal, and Disposal Activities

Maintaining a clean, safe, and compliant construction site is crucial for the health and safety of workers, the environment, and the surrounding community. Effective site cleaning, removal, and disposal activities are essential components of Occupational Health and Safety (OHS) management. These activities help prevent accidents, minimize health risks, and ensure regulatory compliance. The detailed standards and specifications provide comprehensive guidelines to manage hazardous materials, ensure efficient cleaning processes, and uphold environmental standards. By adhering to the following guidelines, construction companies can foster a safer work environment, enhance operational efficiency, and demonstrate a commitment to sustainable and responsible practices:

8.9.6.1 General Management

- *Conduct daily site cleanliness operations at least once a day*
- *Place separate, clearly marked waste bins for different types of waste*
- *Provide basic training to workers on cleanliness and waste handling*

8.9.6.2 Waste Classification and Collection

- Separate organic, inorganic, construction debris, and hazardous materials
- Label all containers in both Bangla and English clearly

8.9.6.3 Removal and Transportation

- Ensure daily or weekly scheduled waste removal
- Waste-transporting vehicles must be fully enclosed and clean

8.9.6.4 Hazardous Waste Management

- Safely store and remove chemicals, paints, oils, and other hazardous items
- Only certified HazMat personnel should manage such operations

8.9.6.5 Rainwater and Mud Management

- Install effective drainage and water evacuation systems
- Clear mud promptly to maintain navigable paths

8.9.6.6 Dust and Debris Control

- Spray water or use dust suppressant daily after work
- Remove broken or dangerous construction materials promptly

8.9.6.7 Inspection and Routine Evaluation

- Conduct cleanliness inspections weekly at minimum
- Maintain audit reports and notify relevant authorities

8.9.6.8 Signage, Instructions, and Awareness

- Display signs such as "Keep Clean", "Use Waste Bin", "Do Not Litter" prominently
- Provide daily briefings to raise hygiene awareness

8.9.6.9 Reusable and Recyclable Material Management

- Segregate and store recyclable items like wood, iron, concrete etc.
- Coordinate with local recycling organizations

8.9.6.10 Disposal of Unused Construction Materials

- Safely remove unused or scattered construction materials from site
- Reuse or recycle recoverable items when applicable

8.9.6.11 Health and Environmental Safeguards

- Implement airflow systems to mitigate odors or chemical exposure
- Follow environmental protection guidelines for waste handling

8.9.6.12 Public Health Awareness

- Provide surrounding communities with information on health risks and site conditions
- Install informative posters and banners at site entrances

8.9.6.13 Post-Construction Clean-Up

- Perform a final clean-up of the site after project completion
- Safely remove unnecessary signs and leftover materials

8.9.6.14 Daily Clean-Up Routine

- Sweep, clear debris, and maintain safe paths before and after work hours

8.9.6.15 Road and Pathway Cleanliness

- *Regularly clean areas where trucks and heavy equipment operate*

8.9.6.16 Disinfection Measures

- *Sanitize toilets, seating areas, and dining zones daily*
- *Maintain daily disinfection schedules for hygiene-sensitive zones*

8.9.6.17 Personal Hygiene Promotion

- *Provide hand-washing stations, safe drinking water, and hygiene supplies*
- *Promote messages like "Cleanliness = Safety" across the site*

8.9.6.18 Emergency Cleanliness Protocols

- *Prepare clean-up teams for emergencies such as flooding, fire, chemical spills, structural collapse, or outbreaks*
- *Follow HazMat guidelines for tools, protective gear, and disinfectants*
- *Conduct post-incident inspections and submit evaluation reports*

8.10 General Safety at Construction Worksites

Ensuring general safety at construction sites is crucial to protect workers, prevent accidents, and maintain a safe working environment. Effective safety practices help comply with health and safety regulations, promote efficiency, and reduce the risk of injuries.

8.10.1 Examples of General Safety Hazards at Construction Sites

- ***Slips, Trips, and Falls:*** *Hazards from uneven surfaces, wet floors, and obstacles in walkways.*
- ***Falling Objects:*** *Risks of objects falling from heights, such as tools, materials, and debris.*
- ***Machinery and Equipment:*** *Dangers associated with the use of heavy machinery and equipment.*
- ***Electrical Hazards:*** *Risks from live wires, faulty equipment, and improper use of electrical tools.*
- ***Confined Spaces:*** *Hazards in confined spaces, such as lack of ventilation and limited access.*
- ***Manual Handling:*** *Risks from lifting, carrying, and moving heavy objects.*

8.10.2 Examples of General Safety Measures

- ***Safety Training:*** *Providing comprehensive safety training to all workers, covering hazard recognition, safe practices, and emergency procedures.*
- ***Housekeeping:*** *Maintaining clean and organized work areas to prevent slips, trips, and falls. Regularly removing debris and obstacles from walkways.*
- ***Personal Protective Equipment (PPE):*** *Ensuring workers have access to and use appropriate PPE, such as hard hats, safety glasses, gloves, and safety boots.*
- ***Tool and Equipment Maintenance:*** *Regularly inspecting and maintaining tools and equipment to ensure they are in good working condition.*
- ***Fall Protection:*** *Implementing fall protection measures, such as guardrails, safety nets, and harnesses, to protect workers from falls.*
- ***Electrical Safety:*** *Following electrical safety protocols, including proper grounding, use of insulated tools, and regular inspection of electrical equipment.*
- ***Hazard Communication:*** *Clearly marking hazardous areas and providing signage to warn workers of potential dangers.*
- ***Emergency Preparedness:*** *Developing and implementing emergency action plans, including procedures for fire, medical emergencies, and evacuations.*
- ***First Aid Facilities:*** *Ensuring the availability of well-equipped first aid kits and trained first aid personnel on-site.*
- ***Safe Work Practices:*** *Encouraging safe work practices, such as proper lifting techniques, use of safety barriers, and adherence to safety protocols.*

8.10.3 Negative Impacts of Poor General Safety Management

8.10.3.1 Health and Safety Impacts

- ***Increased Risk of Injuries:*** *Poor safety management can lead to a higher incidence of injuries, such as cuts, bruises, fractures, and falls.*
- ***Fatalities:*** *Inadequate safety measures can result in serious accidents and fatalities.*
- ***Health Issues:*** *Long-term exposure to hazardous conditions can lead to chronic health problems, such as respiratory issues and musculoskeletal disorders.*

8.10.3.2 Operational Impacts

- ***Work Disruptions:*** *Accidents and safety incidents can cause significant disruptions to site operations, leading to project delays and increased costs.*
- ***Higher Medical Costs:*** *Injuries and health issues related to poor safety management can lead to costly medical treatments and rehabilitation.*

8.10.3.3 Legal and Financial Impacts

- ***Non-Compliance Penalties:*** *Failure to implement proper safety measures can result in fines and penalties from health and safety authorities.*
- ***Reputation Damage:*** *Inadequate safety management can harm the company's reputation, affecting relationships with clients, stakeholders, and potential employees.*
- ***Increased Project Costs:*** *Inefficient safety management can lead to cost overruns, including unexpected expenses for additional labor, equipment, or material repairs.*
- ***Insurance Premiums:*** *Poor safety management can result in higher insurance premiums due to increased risks associated with construction activities.*
- ***Litigation Costs:*** *Legal disputes arising from accidents or damage caused by inadequate safety management can result in significant legal fees and compensation claims.*
- ***Increased Profitability:*** *Proper safety management can lead to cost efficiencies, optimizing resource use and reducing unnecessary expenditures, which boosts overall profitability.*
- ***Investment Attraction:*** *Companies known for their rigorous safety and compliance measures are more likely to attract investors looking for stable and responsible investments.*
- ***Insurance Benefits:*** *Demonstrating excellent safety management can lead to lower insurance premiums, as insurers may perceive reduced risk in well-managed operations.*

8.10.4 Positive Impacts for Compliance with General Safety Standards

8.10.4.1 Health and Safety Impacts

- ***Reduced Risk of Injuries:*** *Proper safety measures protect workers from accidents and injuries, ensuring their safety and well-being.*
- ***Improved Health:*** *Effective safety management reduces the risk of long-term health issues and promotes overall worker health.*

8.10.4.2 Operational Impacts

- ***Increased Efficiency:*** *A safe work environment promotes efficient work processes and minimizes disruptions.*
- ***Cost Savings:*** *Proper safety management reduces the need for medical treatments and associated costs.*

8.10.4.3 Legal and Financial Impacts

- ***Compliance with Regulations:*** *Adhering to safety standards ensures compliance with health and safety regulations, avoiding legal issues.*
- ***Enhanced Reputation:*** *Demonstrating commitment to safety enhances the company's image and builds trust with clients, stakeholders, and the community.*

- ***Cost Savings:*** *Effective safety management reduces the financial burden associated with accidents, injuries, and project delays. It also helps avoid penalties and fines related to non-compliance with regulations.*
- ***Increased Profitability:*** *Proper safety management can lead to cost efficiencies, optimizing resource use and reducing unnecessary expenditures, which boosts overall profitability.*
- ***Investment Attraction:*** *Companies known for their rigorous safety and compliance measures are more likely to attract investors looking for stable and responsible investments.*
- ***Insurance Benefits:*** *Demonstrating excellent safety management can lead to lower insurance premiums, as insurers may perceive reduced risk in well-managed operations.*

8.10.5 General Provisions for General Safety Management at Construction Worksite

Effective safety management at construction worksites is essential to protect workers, ensure regulatory compliance, and promote efficient project execution. By adhering to the following provisions, construction companies can create a safe and productive work environment:

8.10.5.1 When these provisions should be used/applicable

- ***Pre-construction Phase:*** *Before the construction project begins, all necessary safety measures and management strategies should be planned and ensured.*
- ***During Construction:*** *Continuously throughout the construction process, especially during high-risk activities or complex operations, workers and the worksite should be protected.*
- ***Emergency Situations:*** *During incidents or unexpected events, the worksite should be managed, and safety measures should be ensured.*
- ***Post-incident:*** *After any safety-related incident, damage should be assessed, the effectiveness of the measures should be reviewed, and improvements for future incidents should be made.*

8.10.5.2 Where these provisions should be used/applicable

- ***Construction Sites:*** *Any construction site where safety management is required, particularly sites with significant hazards or complexity, should be covered.*
- ***High-Risk Areas:*** *Sites located in regions with potential hazards, such as unstable structures or high-traffic areas, should be managed.*
- ***Temporary Structures:*** *Areas with temporary supports or equipment that could impact safety should be considered.*
- ***Critical Zones:*** *Specific zones within the construction site that require special attention, such as entry points or intersections with existing utilities, should be managed.*

8.10.5.3 Safety Management Plans and Suitability

- ***Safety Management Plans (SMPs):*** *Should be developed and implemented based on specific site conditions and risks.*
- ***Compliance with Industry Standards:*** *Such as OSHA regulations or equivalent national standards should preferably be used if available and applicable.*

8.10.5.4 Training and Awareness

- ***Worker Training:*** *Workers should be trained on safety procedures, including the use of protective equipment, emergency communication, and safety protocols.*
- ***Behavioral Safety Programs:*** *Behavioral safety programs that promote safe behaviors and attitudes among workers should be implemented. Reward systems for safe practices should be considered.*
- ***Regular Drills:*** *Regular drills and training sessions should be conducted to ensure workers are familiar with safety management procedures.*

8.10.5.5 Inspection and Maintenance:

- ***Regular Inspections:*** *Construction sites, equipment, and protective systems should be regularly inspected and maintained.*
- ***Manufacturer Guidelines:*** *Manufacturer guidelines for the care and replacement of safety equipment and materials should be followed.*

8.10.5.6 Distribution and Accessibility

- ***Access to Resources:*** *Access to safety management equipment and resources should be provided at all stages of the construction process.*
- ***Readily Available:*** *Safety management equipment and resources should be readily available and accessible to all workers, subcontractors, and visitors.*

8.10.5.7 Customization and Comfort

- ***Customization:*** *Customization of safety management measures to suit specific site conditions and requirements should be allowed.*
- ***Worker Comfort:*** *Resources and support for workers to adopt safety management procedures comfortably and effectively should be provided.*

8.10.5.8 Emergency Response Coordination

- ***Communication Channels:*** *Clear communication channels and protocols for emergency response during safety-related incidents should be established.*
- ***Coordination with Authorities:*** *Coordination with local emergency services and authorities to ensure prompt assistance if needed should be ensured.*

8.10.5.9 Worker/Laborer Welfare:

- ***Protective Gear:*** *Adequate shelter and protective gear for workers during severe weather conditions should be provided.*
- ***Essential Supplies:*** *Access to drinking water, first aid, and other essential supplies for workers should be ensured.*

8.10.5.10 Monitoring and Forecasting

- ***Hazard Monitoring:*** *Systems to monitor potential hazards and receive real-time updates should be implemented. Modern technological solutions, such as safety monitoring systems and digital reporting tools, should be utilized.*
- ***Risk Forecasting:*** *Tools to predict potential risks, allowing for timely preparation and response, should be utilized.*

8.10.5.11 Documentation and Reporting

- ***Record-Keeping:*** *Records of all safety management activities, including training sessions, inspections, and incidents, should be maintained.*

- ***Incident Reporting:*** *Significant safety-related incidents should be reported to relevant authorities and stakeholders, as required.*
- ***Feedback and Continuous Improvement:*** *Feedback from workers and stakeholders should be encouraged to continuously improve the effectiveness of management measures.*

8.10.5.12 Continuous Improvement

- ***Plan Review:*** *Safety management plans should be regularly reviewed and updated based on lessons learned and best practices.*
- ***Review Industry Innovations:*** *Regularly review and incorporate new industry innovations and best practices in safety management.*

8.10.5.13 Stakeholder Engagement

- ***Engagement with Stakeholders:*** *Engaging with all stakeholders, including workers, subcontractors, and local communities, should be prioritized to foster a culture of safety and ensure everyone is on the same page.*

8.10.6 Standards/Specifications for General Safety at Construction Sites

Ensuring safety at construction sites is of paramount importance. The Occupational Health and Safety (OHS) standards and specifications outlined here serve as a comprehensive guide to maintaining a safe and secure working environment. Construction sites often present a variety of hazards, from falls and exposure to hazardous materials to the risks posed by tools and equipment. These detailed standards are designed to mitigate such risks and protect workers, visitors, and the general public.

The implementation of these standards not only complies with regulatory requirements but also fosters a culture of safety, enhancing overall project efficiency and worker morale. Adopting these measures leads to fewer accidents, minimizes disruptions, and ensures that all personnel can perform their tasks in a secure setting.

The following sections provide in-depth specifications on various aspects of safety management, including fall protection, hazardous material handling, tool and equipment safety, and more. By rigorously applying these standards, construction companies can uphold the highest level of safety, ensuring that every project progresses smoothly and safely.

8.10.6.1 Fall Protection

- *Fall protection systems such as guardrails, safety nets, and personal fall arrest systems* ***should be*** *used for work at heights of* ***6 feet (1.8 meters)*** *or more.*
- *Fall protection equipment* ***should be*** *compliant with OSHA 1926.502 standards or equivalent national standards if available and applicable should preferably be used.*
- *Fall protection systems* ***should be*** *inspected regularly.* ***Inspection frequency: Daily.***

8.10.6.2 Hazardous Material Handling

- *Proper protective equipment (PPE)* ***should be*** *used when handling hazardous materials, including gloves, masks, and safety goggles compliant with ANSI Z87.1 or equivalent national standards if available and applicable.*
- *Proper procedures for handling and disposing of hazardous materials, compliant with EPA regulations or equivalent national standards if available and applicable should preferably be used,* ***should be*** *followed.*

- *Hazardous materials **should be** labeled and stored in containers that meet DOT specifications. **Inspection frequency: Weekly.***

8.10.6.3 Tool and Equipment Safety

- *Tools and equipment **should be** used and maintained according to manufacturer instructions.*
- *Proper PPE, including gloves, safety goggles, and hearing protection, **should be** used when operating tools and equipment.*
- *Tools and equipment **should be** inspected and maintained regularly. **Inspection frequency: Monthly.***

8.10.6.4 Slip, Trip, and Fall Prevention

- *Non-slip mats **should be** used, and work areas **should be** well-lit with at least **30 foot-candles (323 lux)** of illumination.*
- *Hazardous areas **should be** marked with clear signage and barriers. Signage **should be** at least **12 inches (30 cm)** in height.*
- *Walkways and work areas **should be** kept free of debris and clutter. **Inspection frequency: Daily.***

8.10.6.5 Efficient Processes

- *Efficient safety processes **should be** implemented to minimize disruptions to project timelines.*
- *Safety training sessions **should be** scheduled during off-peak hours to avoid interfering with construction work.*
- *Designated areas for the storage of tools, equipment, and materials **should be** used to prevent accidents.*

8.10.6.6 Regulatory Compliance

- *Compliance with safety standards, including local, state, and federal requirements, **should be** ensured.*
- *Records of safety inspections and training activities **should be** kept.*
- *Regular audits to ensure compliance with safety standards **should be** conducted. **Audit frequency: Annually.***

8.10.6.7 Protection from Falls

- *Fall protection systems such as guardrails, safety nets, and personal fall arrest systems **should be** used.*
- *Fall protection equipment **should be** compliant with OSHA 1926.502 standards or equivalent national standards if available and applicable should preferably be used.*
- *Fall protection systems **should be** inspected regularly.*

8.10.6.8 Injury Prevention from Hazardous Materials

- *Proper protective equipment (PPE) such as gloves, masks, and safety goggles rated for chemical resistance **should be** used.*
- *Proper ventilation systems **should be** implemented when handling hazardous materials to prevent inhalation.*
- *Training on handling and disposing of hazardous materials **should be** provided. **Training frequency: Annually.***

8.10.6.9 Tool and Equipment Safety

- *Tools and equipment **should be** used and maintained according to manufacturer instructions.*
- *Proper PPE **should be** used when operating tools and equipment.*
- *Tools and equipment **should be** inspected and maintained regularly.*

8.10.6.10 Preventing Slips, Trips, and Falls

- *Non-slip mats **should be** used, and work areas **should be** well-lit.*
- *Hazardous areas **should be** marked with clear signage and barriers.*
- *Walkways and work areas **should be** kept free of debris and clutter.*

8.10.6.11Efficient Safety Processes

- *Efficient safety processes **should be** implemented to minimize disruptions.*
- *Safety training sessions **should be** scheduled during off-peak hours.*
- *Designated areas for the storage of tools, equipment, and materials **should be** used.*

8.10.6.12 Regulatory Compliance

- *Compliance with safety standards **should be** ensured.*
- *Records of safety inspections and training activities **should be** kept.*
- *Regular audits to ensure compliance **should be** conducted.*

8.10.6.13 Electrical Safety

- *Electrical equipment **should be** inspected for defects before use. **Inspection frequency: Daily.***
- *Proper PPE, including insulated gloves and safety boots, **should be** used when working with electrical equipment.*
- *Electrical installations **should be** compliant with NFPA 70E standards or equivalent national standards if available and applicable should preferably be used.*

8.10.6.14 Scaffolding Safety

- *Scaffolding **should be** erected, used, and dismantled under the supervision of a competent person.*
- *Scaffolding **should be** inspected regularly. **Inspection frequency: Weekly.***
- *Scaffolding **should be** compliant with OSHA 1926.451 standards or equivalent national standards if available and applicable should preferably be used.*

8.10.6.15 Fire Safety

- *Fire extinguishers **should be** readily accessible at all work areas.*
- *Workers **should be** trained in the use of fire extinguishers and emergency evacuation procedures.*
- *Fire safety drills **should be** conducted regularly. **Drill frequency: Quarterly.***

8.10.6.16 Noise Control

- *Noise levels at the construction site **should be** monitored regularly. **Monitoring frequency: Monthly.***
- *Hearing protection devices **should be** provided to workers exposed to noise levels exceeding **85 decibels (dB).***
- *Engineering controls, such as noise barriers and silencers, **should be** implemented to reduce noise exposure.*

8.10.6.17 Heat Stress Management

- *Work schedules **should be** adjusted to minimize heat exposure during peak temperature hours.*

- *Adequate drinking water* ***should be*** *provided to workers to prevent dehydration.*
- *Rest breaks in shaded or cool areas* ***should be*** *scheduled frequently during hot weather.*

8.11 Fall from Height at Construction Worksites

Managing the risk of falls from heights at construction worksites is crucial for ensuring worker safety and minimizing disruptions to project operations. Implementing proper fall protection protocols ensures compliance with regulatory standards, enhances worker confidence, and promotes a safe working environment. Preventing falls from height at construction sites is crucial to protect workers from serious injuries and fatalities. Effective fall prevention and protection measures ensure a safe work environment, comply with health and safety regulations, and promote efficient project execution.

8.11.1 Examples of Hazards Related to Falls from Height at Construction Sites

- ***Unprotected Edges:*** *Open edges on roofs, floors, and platforms without guardrails or barriers.*
- ***Scaffolding:*** *Risks associated with working on or near scaffolding, including improper assembly and lack of guardrails.*
- ***Ladders:*** *Hazards from using ladders, such as improper setup, overreaching, and using damaged ladders.*
- ***Roof Work:*** *Risks of falling from roofs due to unprotected edges, slippery surfaces, and fragile roof materials.*
- ***Openings:*** *Openings in floors, roofs, and walls without proper covering or protection.*
- ***Equipment and Machinery:*** *Working from elevated equipment and machinery, such as aerial lifts and cranes.*

8.11.2 Examples of Fall Prevention and Protection Measures

- ***Guardrails:*** *Installing guardrails, safety nets, and barriers to protect workers from unprotected edges and openings.*
- ***Personal Fall Arrest Systems (PFAS):*** *Providing workers with PFAS, including harnesses, lanyards, and anchor points, to arrest falls.*
- ***Scaffolding Safety:*** *Ensuring scaffolding is properly assembled, maintained, and equipped with guardrails and toe boards.*
- ***Ladder Safety:*** *Implementing ladder safety practices, such as proper setup, regular inspections, and using the right ladder for the task.*
- ***Roof Safety:*** *Using roof safety measures, such as guardrails, warning lines, and personal fall protection systems, when working on roofs.*
- ***Floor and Roof Openings:*** *Covering floor and roof openings with secure and marked covers or guardrails to prevent falls.*
- ***Training:*** *Providing workers with training on fall hazards, prevention measures, and the proper use of fall protection equipment.*
- ***Inspections:*** *Conducting regular inspections of fall protection systems, equipment, and work areas to identify and address potential hazards.*
- ***Safe Work Practices:*** *Establishing and enforcing safe work practices, such as maintaining three points of contact when climbing and avoiding overreaching.*

8.11.3 Negative Impacts of Poor Fall Prevention and Protection Management

8.11.3.1 Health and Safety Impacts

- ***Increased Risk of Injuries:*** *Poor fall prevention and protection management can lead to serious injuries, such as fractures, head injuries, and spinal injuries.*
- ***Fatalities:*** *Falls from height are a leading cause of fatalities in construction, and inadequate fall protection measures can result in fatal accidents.*

8.11.3.2 Operational Impacts

- ***Work Disruptions:*** *Fall-related accidents and injuries can disrupt site operations, leading to project delays and increased costs.*
- ***Higher Medical Costs:*** *Injuries related to falls from height can lead to costly medical treatments and rehabilitation.*

8.11.3.3 Legal and Financial Impacts

- ***Non-Compliance Penalties:*** *Failure to implement proper fall prevention and protection measures can result in fines and penalties from health and safety authorities.*
- ***Reputation Damage:*** *Inadequate fall protection management can harm the company's reputation, affecting relationships with clients, stakeholders, and potential employees.*
- ***Increased Insurance Costs:*** *Companies with poor safety records may face higher insurance premiums, increasing overall operating costs.*
- ***Legal Costs:*** *Legal expenses can accrue from defending against lawsuits or paying settlements related to workplace injuries.*
- ***Loss of Productivity:*** *Accidents resulting in employee injuries can lead to lost work time, reducing productivity and impacting the company's bottom line.*
- ***Direct Medical Costs:*** *Employers may be responsible for medical expenses and compensation for injured employees, directly affecting financial stability.*

8.11.4 Positive Impacts for Compliance with Fall Prevention and Protection Standards

8.11.4.1 Health and Safety Impacts

- ***Reduced Risk of Injuries:*** *Proper fall prevention and protection measures protect workers from serious injuries and fatalities, ensuring their safety and well-being.*
- ***Improved Confidence:*** *Effective fall protection measures enhance worker confidence and reduce anxiety related to working at heights.*

8.11.4.2 Operational Impacts

- ***Increased Efficiency:*** *A safe work environment with proper fall protection promotes efficient work processes and minimizes disruptions.*
- ***Cost Savings:*** *Proper fall prevention and protection reduce the need for medical treatments and associated costs.*

8.11.4.3 Legal and Financial Impacts

- ***Compliance with Regulations:*** *Adhering to fall prevention and protection standards ensures compliance with health and safety regulations, avoiding legal issues.*
- ***Enhanced Reputation:*** *Demonstrating commitment to proper fall protection enhances the company's image and builds trust with clients, stakeholders, and the community.*
- ***Cost Savings:*** *Effective fall prevention and protection management reduces the financial burden associated with accidents, injuries, and project delays. It also helps avoid penalties and fines related to non-compliance with regulations.*
- ***Increased Efficiency:*** *Reducing accidents leads to smoother operations and fewer disruptions, improving overall project efficiency.*
- ***Reduced Insurance Premiums:*** *A strong safety record can result in lower insurance premiums, further cutting costs for the company.*

- ***Minimized Legal Costs:*** *Avoiding accidents and injuries can significantly reduce expenses related to legal actions and settlements.*
- ***Improved Employee Morale and Retention:*** *A safe working environment can lead to higher employee satisfaction and retention, reducing costs associated with training new employees.*

8.11.5 General Provisions for Fall from Height at Construction Worksites

Ensuring safety at construction worksites is crucial, particularly when it comes to preventing falls from height. Falls are one of the most common and severe hazards in the construction industry, often leading to serious injuries and fatalities. To address these risks and promote a safer working environment, general provisions must be established and strictly adhered to. These provisions serve as guidelines for developing and implementing effective fall protection measures, conducting regular training and inspections, and ensuring compliance with industry standards and regulations. By following these guidelines, construction companies can reduce the likelihood of fall-related incidents and foster a culture of safety and awareness among all workers.

The following sections outline key measures, including the use of guardrails, personal fall arrest systems, and effective work area management, to ensure comprehensive fall protection at construction sites:

8.11.5.1 When OHS Provisions for Fall from Heights are Applicable

- ***Development Phase:*** *Fall protection plans should be developed and implemented at the start of a project based on specific site conditions and risks.*
- ***Onboarding Phase:*** *Training on fall protection procedures should be provided during the onboarding of new workers and conducted annually.*
- ***Daily Inspections:*** *Inspections of guardrails and safety nets should be conducted daily.*
- ***Monthly Inspections:*** *Inspections of personal fall arrest systems should be conducted monthly.*
- ***Annual Training:*** *Refresher training sessions should be conducted annually.*
- ***Emergency Drills:*** *Emergency drills should be conducted regularly to ensure prompt and efficient response to fall incidents.*

8.11.5.2 Where OHS Provisions for Fall from Heights are Applicable

- ***Heights of 6 Feet or More:*** *Fall protection measures should be implemented at all heights of* ***6 feet (1.8 meters)*** *or more where workers are at risk of falling.*
- ***Construction Sites:*** *Guardrails, safety nets, and personal fall arrest systems should be used at construction sites, especially in areas with unguarded edges, openings, and elevated work platforms.*
- ***Training Facilities:*** *Training sessions should be conducted at the construction site or a designated training facility.*
- ***On-Site Inspections:*** *Inspections and maintenance of fall protection equipment should be conducted on-site where the equipment is in use.*
- ***Designated Storage Areas:*** *Fall protection equipment should be stored in designated areas at the construction site to ensure it is properly maintained and easily accessible.*
- ***Designated Zones:*** *"Fall Protection Procedures" signs should be posted prominently in all designated zones where fall protection equipment is required.*

8.11.5.3 Fall Protection Plans and Suitability:

- *Fall protection plans should be developed and implemented based on specific site conditions and risks.*
- *Compliance with industry standards, such as **OSHA 29 CFR 1926.501 - 1926.503** regulations or equivalent national standard if available and applicable, should be ensured.*
- *Fall protection plans should be tailored to accommodate different tasks and work environments.*

8.11.5.4 Training and Awareness

- *Workers should be trained on fall protection procedures, including the proper use and maintenance of fall protection equipment.*
- *Regular drills and training sessions should be conducted to ensure workers are familiar with fall protection protocols.*
- *Ongoing education on identifying and mitigating fall hazards should be provided. **Training frequency: Annually.***

8.11.5.5 Inspection and Maintenance:

- *Fall protection systems, including guardrails, safety nets, and personal fall arrest systems, should be regularly inspected and maintained.*
- *Manufacturer guidelines for the care and replacement of fall protection equipment should be followed.*
- *Inspection and maintenance activities should be documented. **Inspection frequency: Daily for guardrails and nets, Monthly for personal fall arrest systems.***

8.11.5.6 Distribution and Accessibility:

- *Access to fall protection equipment and resources should be provided at all stages of the construction process.*
- *Fall protection equipment and resources should be readily available and accessible to all workers, subcontractors, and visitors.*
- *Specific storage areas for fall protection equipment should be designated to ensure it is properly maintained and easily accessible.*

8.11.5.7 Signage and Compliance:

- *"Fall Protection Procedures" signs should be posted prominently in all designated zones where fall protection equipment is required.*
- *Compliance should be regularly monitored and enforced through supervisor checks and audits.*
- *Corrective actions for non-compliance should be implemented, and additional training should be provided as needed.*

8.11.5.8 Customization and Comfort:

- *Customization of fall protection measures to suit specific site conditions and requirements should be allowed.*
- *Resources and support should be provided for workers to adopt fall protection procedures comfortably and effectively.*
- *Ergonomic factors should be considered when selecting fall protection equipment to ensure worker comfort and compliance.*

8.11.5.9 Emergency Preparedness:

- *Emergency response plans for fall incidents should be developed and communicated to all workers.*
- *Fall arrest rescue procedures should be established, and rescue equipment should be readily available on-site.*

- *Regular emergency drills should be conducted to ensure prompt and efficient response to fall incidents.*

8.11.6 Standards/Specifications for Fall From Height at Construction Worksites

Safety is paramount in construction worksites, where fall hazards pose significant risks to workers' health and well-being. To mitigate these risks and ensure a safe working environment, comprehensive Occupational Health and Safety (OHS) standards and specifications must be established and rigorously implemented. These standards serve as a framework for preventing falls from heights, which are one of the leading causes of injuries and fatalities in the construction industry. By adhering to these guidelines, construction companies can create a safer workspace, minimize accidents, and promote a culture of safety among all personnel.

The following sections detail the essential provisions, including the use of guardrails, personal fall arrest systems, training protocols, and compliance with industry regulations, ensuring that every aspect of fall protection is addressed effectively:

8.11.6.1 Guardrails and Safety Nets:

- *Guardrails and safety nets should be used at heights of **6 feet (1.8 meters)** or more.*
- *Guardrails should be compliant with OSHA 1926.502 standards, with a top rail height of **42 inches (107 cm)**, or equivalent national standard if available and applicable.*
- *Regular inspections of guardrails and safety nets should be conducted. **Inspection frequency: Daily.***

8.11.6.2 Personal Fall Arrest Systems:

- *Personal fall arrest systems should be used when working at heights of **6 feet (1.8 meters)** or more.*
- *Harnesses, lanyards, and anchors should be compliant with ANSI Z359 standards or equivalent national standard if available and applicable.*
- *Regular inspections of personal fall arrest systems should be conducted. **Inspection frequency: Monthly.***

8.11.6.3 Fall Protection Training

- *Fall protection training should be provided to all workers, including proper use and maintenance of fall protection equipment.*
- *Training should cover identification of fall hazards, inspection procedures, and emergency response.*
- *Refresher training sessions should be conducted. **Training frequency: Annually.***

8.11.6.4 Work Area Management

- *Work areas should be free of unguarded edges, openings, and other fall hazards.*
- *Warning lines and safety monitors should be used when guardrails and nets are not feasible.*
- *Work areas should be kept clean and free from clutter to prevent trips and falls. **Inspection frequency: Daily.***

8.11.6.5 Efficient Processes

- *Efficient fall protection processes should be implemented to minimize disruptions to project timelines.*
- *Fall protection equipment inspections and maintenance should be scheduled during off-peak hours.*
- *Designated storage areas for fall protection equipment should be used to prevent damage and ensure accessibility.*

8.11.6.6 Protection from Falls

- *Fall protection systems such as guardrails, safety nets, and personal fall arrest systems should be used.*
- *Fall protection equipment should be compliant with OSHA 1926.502 standards or equivalent national standard if available and applicable.*
- *Regular inspections of fall protection systems should be conducted.* ***Inspection frequency: Daily.***

8.11.6.7 Injury Prevention from Improper Equipment Use

- *Training on the proper use and maintenance of fall protection equipment should be provided.*
- *Compliant harnesses, lanyards, and anchors should be used.*
- *Regular inspections of fall protection systems should be conducted.* ***Inspection frequency: Monthly.***

8.11.6.8 Work Area Safety

- *Work areas should be free of unguarded edges and other fall hazards.*
- *Warning lines and safety monitors should be used when guardrails and nets are not feasible.*
- *Work areas should be kept clean and free from clutter.* ***Inspection frequency: Daily.***

8.11.6.9 Preventing Slips, Trips, and Falls

- *Non-slip mats should be used, and work areas should be well-lit.*
- *Hazardous areas should be marked with clear signage and barriers.*
- *Walkways and work areas should be kept free of debris and clutter.* ***Inspection frequency: Daily.***

8.11.6.10Efficient Fall Protection Processes

- *Efficient fall protection processes should be implemented to minimize disruptions.*
- *Inspections and maintenance should be scheduled during off-peak hours.*
- *Designated storage areas for fall protection equipment should be used.*

8.11.6.11 Regulatory Compliance

- *Compliance with fall protection standards, including OSHA 29 CFR 1926.501 - 1926.503, or equivalent national standard if available and applicable, should be ensured.*
- *Records of fall protection equipment inspections, training activities, and incident reports should be kept.*
- *Regular audits should be conducted to ensure compliance with fall protection standards.* ***Audit frequency: Annually.***

8.12 Flying and Falling Objects at Construction Worksite

Managing the risk of flying and falling objects at construction worksites is crucial for ensuring worker safety and minimizing disruptions to project operations. Implementing proper protocols for these hazards ensures compliance with regulatory standards, enhances worker confidence, and promotes a safe working environment.

8.12.1 Examples of Hazards Related to Flying and Falling Objects at Construction Sites

- ***Unsecured Materials:*** *Materials and tools not properly secured, risking them being dislodged and falling.*
- ***Overhead Work:*** *Risks from working beneath elevated structures or during overhead activities.*
- ***Lifting Operations:*** *Hazards from lifting and moving heavy objects that can become unstable and fall.*
- ***High Winds:*** *Strong winds can cause unsecured objects to become airborne and pose hazards.*
- ***Equipment Malfunctions:*** *Failures in equipment like cranes or hoists, leading to falling objects.*
- ***Improper Storage:*** *Poor storage practices that lead to objects becoming unstable and falling.*

8.12.2 Examples of Prevention and Protection Measures

- ***Securing Materials:***
  - *Properly securing materials and tools to prevent them from becoming dislodged.*
  - *Using appropriate storage solutions for stability.*
- ***Overhead Protections:***
  - *Installing netting, barriers, and overhead protection to catch falling objects.*
- ***Lifting Safety:***
  - *Ensuring safe lifting practices and using equipment correctly to prevent instability.*
  - *Regular maintenance and inspection of lifting equipment.*
- ***Weather Monitoring:***
  - *Monitoring weather conditions and securing loose items during high winds.*
- ***Equipment Maintenance:***
  - *Routine checks and maintenance of machinery to prevent malfunctions.*
  - *Ensuring equipment is used as per safety guidelines.*
- ***Training:***

- *Providing training to workers on the hazards of flying and falling objects.*
  - *Educating on proper handling, storage, and securing methods.*
- ***Inspections:***
  - *Conducting regular site inspections to identify and rectify potential hazards.*
  - *Ensuring compliance with safety protocols.*

8.12.3 Negative Impacts of Poor Management of Flying and Falling Objects

8.12.3.1 Health and Safety Impacts

- ***Increased Risk of Injuries:***
  - *Risk of injuries from being struck by flying or falling objects.*
  - *Example: A worker being hit by a tool falling from a height.*
  - *Increased risk of injury due to improper securing of materials and equipment.*
  - *Example: A worker being injured because construction materials were not properly secured.*
- ***Fatalities:***
  - *Flying or falling objects can cause fatal accidents.*
  - *Example: A worker being fatally struck by heavy falling debris.*

8.12.3.2 Operational Impacts

- ***Work Disruptions:***
  - *Delays in construction activities due to incidents involving flying or falling objects.*
  - *Example: Project timelines being extended due to an accident involving falling debris.*
- ***Damage to Equipment and Materials:***
  - *Damage to expensive equipment and materials from falling objects.*
  - *Example: Construction equipment being damaged by falling tools or materials.*
- ***Increased Costs:***
  - *Additional expenses for managing hazards related to flying or falling objects.*
  - *Example: Extra costs for implementing comprehensive protective measures.*

8.12.3.3 Legal and Financial Impacts

- ***Non-Compliance Penalties:***
  - *Failure to implement proper safety measures for flying and falling objects can result in fines and penalties from health and safety authorities.*
  - *Example: A construction site being fined for inadequate measures to prevent falling objects.*
- ***Reputation Damage:***
  - *Poor management can harm the company's reputation, affecting relationships with clients, stakeholders, and potential employees.*
  - *Example: Negative public perception and damage to corporate reputation.*
- ***Increased Insurance Costs:***
  - *Companies with poor safety records may face higher insurance premiums.*
  - *Example: Rising insurance costs due to a history of accidents involving falling objects.*
- ***Legal Costs:***
  - *Legal expenses from defending against lawsuits or paying settlements related to workplace injuries.*
  - *Example: Legal costs accruing from accidents involving flying or falling objects.*

- ***Loss of Productivity:***
  - *Accidents resulting in employee injuries can lead to lost work time.*
  - *Example: Reduced productivity due to work stoppages following an incident.*
- ***Direct Medical Costs:***
  - *Employers may be responsible for medical expenses and compensation for injured employees.*
  - *Example: Direct medical costs affecting financial stability.*

8.12.4 Positive Impacts of Proper Management of Flying and Falling Objects

8.12.4.1 Health and Safety Impacts

- ***Reduced Risk of Injuries:***
  - *Proper management protects workers from injuries caused by flying or falling objects.*
  - *Example: Safety measures preventing accidents involving unsecured materials.*
- ***Improved Confidence:***
  - *Effective safety measures enhance worker confidence.*
  - *Example: Workers feeling secure while working in areas with potential hazards.*

8.12.4.2 Operational Impacts

- ***Increased Efficiency:***
  - *Safe work environment with proper management promotes efficient work processes.*
  - *Example: Smooth operations due to minimized incidents involving falling objects.*
- ***Cost Savings:***
  - *Proper management reduces the need for medical treatments and associated costs.*
  - *Example: Savings from avoiding accidents and injuries related to falling objects.*

8.12.4.3 Legal and Financial Impacts

- ***Compliance with Regulations:***
  - *Adhering to safety standards for flying and falling objects ensures compliance with regulations.*
  - *Example: Avoiding legal issues by implementing proper safety measures.*
- ***Enhanced Reputation:***
  - *Commitment to safety enhances the company's image and builds trust.*
  - *Example: Positive public perception due to strong safety practices.*
- ***Cost Savings:***
  - *Effective management reduces financial burden associated with accidents and project delays.*
  - *Example: Lower costs from avoiding fines and penalties.*
- ***Increased Efficiency:***
  - *Reducing accidents leads to smoother operations and fewer disruptions.*
  - *Example: Improved project efficiency due to fewer incidents.*

- ***Reduced Insurance Premiums:***
  - *A strong safety record can result in lower insurance premiums.*
  - *Example: Cutting costs by maintaining a good safety track record.*
- ***Minimized Legal Costs:***
  - *Avoiding accidents and injuries can significantly reduce legal expenses.*
  - *Example: Savings from fewer legal actions and settlements.*
- ***Improved Employee Morale and Retention:***
  - *A safe working environment can lead to higher employee satisfaction and retention.*
  - *Example: Reduced costs associated with training new employees.*

8.12.5 General Provisions for Flying and Falling Objects at Construction Worksites

Ensuring safety on construction worksites requires stringent measures to manage the risks associated with flying and falling objects. These hazards pose significant threats to worker safety, operational efficiency, and overall project success. The following General provisions for flying and falling objects are designed to establish comprehensive safety protocols, promote a culture of vigilance, and implement preventative measures to protect workers, equipment, and materials from potential harm:

8.12.5.1 When the OHS Provisions for Flying and Falling Objects at Construction Worksite are Applicable

- ***Initial Site Assessment:***
  - *Provisions should be implemented during the initial assessment and planning stages of a construction project.*
  - *Assessing potential hazards and identifying areas at risk of flying or falling objects.*
- ***Active Construction Phases:***
  - *Continuous application of safety provisions throughout all active phases of construction.*
  - *Ensuring protective measures are in place whenever there is a risk of objects becoming dislodged or falling from heights.*
- ***High-Risk Activities:***
  - *During activities that involve working at heights, lifting heavy materials, or using machinery that could cause objects to become airborne.*
  - *Includes tasks such as scaffolding, crane operations, and material hoisting.*

8.12.5.2 Where the OHS Provisions for Flying and Falling Objects at Construction Worksite are Applicable

- ***All Work Areas:***
  - *Provisions should be applied across all areas of the construction site to ensure comprehensive safety coverage.*
  - *Includes both outdoor and indoor construction zones.*
- ***High-Risk Zones:***
  - *Specific focus on high-risk zones where the likelihood of flying or falling objects is higher.*

- *Examples include areas beneath scaffolding, around crane operations, and near material storage and handling zones.*

- ***Employee Workstations:***
  - *Ensuring that employee workstations, including those on elevated platforms, are safeguarded against the risk of falling objects.*
  - *Implementing barriers, netting, and personal protective equipment (PPE) to minimize hazards.*
- ***Material Storage Areas:***
  - *Applying safety measures in areas where construction materials are stored or stacked to prevent objects from falling or becoming dislodged.*

8.12.5.3 Protection Plans and Suitability

- *Protection plans should be developed and implemented based on specific site conditions and risks.*
- *Compliance with industry standards, such as **OSHA 29 CFR 1926.451 and 1926.452 regulations or equivalent national provisions** preferably be ensured if available and applicable.*
- *Protection plans should be tailored to accommodate different tasks and work environments.*

8.12.5.4 Training and Awareness

- ***Workers** should be **trained on safety procedures** related to **flying and falling objects**, including proper securing of materials and equipment.*
- ***Regular drills and training sessions** should be conducted to ensure workers are familiar with protective measures.*
- ***Ongoing education** on identifying and mitigating hazards related to **flying and falling objects** should be provided. **Training frequency: Annually**.*

8.12.5.5 Inspection and Maintenance

- ***Protective systems**, including **overhead protection** and **securing mechanisms**, should be **regularly inspected and maintained**.*
- ***Manufacturer guidelines** for the care and replacement of protective equipment should be followed.*
- ***Inspection and maintenance activities** should be documented. **Inspection frequency: Daily** for overhead protection, **Weekly** for securing mechanisms.*

8.12.5.6 Distribution and Accessibility

- ***Access to protective equipment** and resources at all stages of the construction process should be provided.*
- ***Protective equipment** and resources should be **readily available and accessible** to all workers, subcontractors, and visitors.*
- ***Specific storage areas** for protective equipment should be designated to ensure it is properly maintained and easily accessible.*

8.12.5.7 Signage and Compliance

- *"**Flying and Falling Objects Procedures" signs** should be **posted prominently** in all designated zones where protective measures are required.*

- ***Compliance** should be **regularly monitored and enforced** through supervisor checks and audits.*
- ***Corrective actions** for non-compliance should be implemented, and additional training should be provided as needed.*

8.12.5.8 Customization and Comfort

- ***Customization** of protective measures to suit specific site conditions and requirements should be allowed.*
- ***Resources and support** for workers to adopt safety procedures comfortably and effectively should be provided.*
- ***Ergonomic factors** should be considered when selecting protective equipment to ensure worker comfort and compliance.*

8.12.6 Standards/Specifications for Flying and Falling Objects at Construction Worksite

Ensuring the safety of workers from flying and falling objects is crucial in construction sites. Implementing comprehensive safety standards and specifications helps mitigate risks, protect employees, and maintain a safe work environment. The following standards should be based on site-specific conditions, industry best practices, and compliance with relevant regulations:

8.12.6.1 Overhead Protection

- ***Overhead protection systems**, such as debris nets, canopy structures, and guardrails, should be used to prevent falling objects.*
- ***Overhead protection systems** should be compliant with **OSHA 1926.451** and **1926.452 standards. OR equivalent national standards** should preferably be complied with if available and applicable.*
- ***Regular inspections** of overhead protection systems should be conducted. **Inspection frequency: Daily.***

8.12.6.2 Securing Materials and Equipment

- ***All materials and equipment** should be properly secured to prevent them from becoming airborne or falling.*
- ***Securing methods** such as tie-downs, straps, and braces that are rated for the load they are securing should be used.*
- ***Regular inspections** should be conducted to ensure materials and equipment are properly secured. **Inspection frequency: Weekly.***

8.12.6.3 Personal Protective Equipment (PPE)

- ***PPE** such as hard hats, safety glasses, and face shields should be used to protect workers from flying and falling objects.*
- ***PPE** should be compliant with **ANSI Z89.1 standards** for head protection and **ANSI Z87.1 standards** for eye and face protection. **OR equivalent national standards** should preferably be complied with if available and applicable.*
- ***Regular inspections** and maintenance of PPE should be conducted. **Inspection frequency: Monthly.***

8.12.6.4 Work Area Management

- ***Work areas** should be free of unguarded edges, openings, and other hazards related to flying and falling objects.*
- ***Warning signs and barriers** should be used to alert workers to areas with potential hazards.*

- ***Work areas*** *should be kept clean and organized to prevent accidents.* ***Inspection frequency: Daily.***

8.12.6.5 Efficient Processes

- ***Efficient processes*** *should be implemented to minimize the risk of flying and falling objects and disruptions to project timelines.*
- ***Inspections and maintenance*** *of protective measures should be scheduled during off-peak hours.*
- ***Designated storage areas*** *for materials and equipment should be used to ensure they are properly secured and easily accessible.*

8.12.6.6 Regulatory Compliance

- ***Compliance*** *with safety standards for flying and falling objects, including* ***OSHA 29 CFR 1926.451*** *and* ***1926.452, OR equivalent national standards*** *should preferably be ensured if available and applicable.*
- ***Records of inspections, training activities, and incident reports*** *should be kept.*
- ***Regular audits*** *should be conducted to ensure compliance with safety standards.* ***Audit frequency: Annually.***

8.13 Fire Management and Prevention at Construction Worksites

Managing the risk of fires at construction worksites is critical for ensuring worker safety, protecting equipment and materials, and maintaining smooth project operations. Proper fire management protocols ensure compliance with safety standards, enhance preparedness, and promote a secure working environment.

8.13.1 Examples of Hazards Related to Fires at Construction Sites

- ***Flammable Materials:*** *Use and storage of flammable liquids, gases, and combustible materials at worksites.*
- ***Electrical Hazards:*** *Faulty wiring, overloaded circuits, and improper use of electrical equipment.*
- ***Hot Work Activities:*** *Activities like welding, cutting, and grinding that produce sparks and heat.*
- ***Improper Storage:*** *Poor storage practices for flammable materials that increase fire risks.*
- ***Open Flames:*** *Unprotected open flames or equipment emitting high heat.*
- ***Neglected Equipment:*** *Lack of maintenance for heating systems, generators, and machinery increasing fire hazards.*
- ***Smoking Areas:*** *Designated smoking zones in improper locations.*

8.13.2 Examples of Prevention and Protection Measures

- ***Storing Flammable Materials:*** *Storing flammable liquids in fire-resistant containers rated for the type of material stored.*
- ***Designating Storage Zones:*** *Designating storage zones at least **50 feet (15 meters)** away from ignition sources.*
- ***Inspecting Electrical Systems:*** *Regularly inspecting wiring and equipment for faults or signs of wear to prevent electrical hazards.*
- ***Avoiding Overloaded Circuits:*** *Avoiding overloading circuits and installing **ground fault circuit interrupters (GFCIs)** where required.*
- ***Installing Fire Detectors:*** *Installing and maintaining smoke detectors and heat sensors across the worksite for early fire detection.*
- ***Protecting Hot Work Activities:*** *Using fire-resistant blankets or curtains to contain sparks during welding or cutting activities.*
- ***Conducting Equipment Checks:*** *Regularly checking and maintaining lifting equipment to prevent malfunctions.*
- ***Providing Fire Extinguishers:*** *Providing fire extinguishers rated **Class A, B, or C** within **75 feet (23 meters)** of work areas.*
- ***Training on Fire Extinguishers:*** *Training workers on the proper use of fire extinguishers to handle emergencies effectively.*
- ***Ensuring Clear Exits:*** *Keeping emergency exits unobstructed and marking them clearly with illuminated **EXIT signs**.*
- ***Conducting Fire Drills:*** *Conducting quarterly fire drills to familiarize workers with evacuation procedures.*
- ***Securing Loose Items in Winds:*** *Securing loose items during high winds to prevent fire-related risks caused by airborne debris.*
- ***Restricting Smoking Areas:*** *Restricting smoking to designated areas equipped with fireproof receptacles for discarded materials.*
- ***Implementing Fire Watches:*** *Assigning trained personnel to perform fire watches during and after hot work activities to monitor potential risks.*

8.13.3 Negative Impacts of Poor Fire Management

8.13.3.1 Health and Safety Impacts

- ***Increased Risk of Injuries:*** *Burns or injuries caused by uncontrolled fires.*
  - ***Example:*** *Workers sustaining injuries during evacuation due to improper safety measures.*
- ***Fatalities:*** *Fires can lead to tragic fatalities.*
  - ***Example:*** *Workers unable to evacuate during a large-scale blaze.*

8.13.3.2 Operational Impacts

- ***Work Disruptions:*** *Fires can cause significant delays in construction activities.*
  - ***Example:*** *Halting work for weeks to repair fire damage.*

8.13.3.3 Damage to Equipment and Materials

- ***Destruction of Machineries:*** *Construction machinery and materials destroyed by fire.*
  - ***Example:*** *Loss of costly equipment due to a fire incident.*

8.13.3.4 Increased Costs

- ***Additional Cost for Repairing:*** *Additional expenses for repairing fire damage or replacing damaged equipment.*
  - ***Example:*** *Costs rising from inadequate fire prevention measures.*

8.13.3.5 Legal and Financial Impacts

- ***Non-Compliance Penalties:*** *Failure to adhere to fire safety standards can result in fines from regulatory authorities.*
  - ***Example:*** *Fines imposed for improper storage of flammable materials.*
- ***Reputation Damage:*** *Poor fire safety management tarnishes a company's reputation.*
  - ***Example:*** *Clients losing trust after repeated fire incidents.*
- ***Insurance Costs:*** *Frequent fire-related incidents result in increased insurance premiums.*
  - ***Example:*** *Higher premiums for coverage of materials and workers.*
- ***Legal Costs:*** *Lawsuits and settlements stemming from fire incidents can drain company resources.*
  - ***Example:*** *Legal disputes over negligence leading to fires.*
- ***Loss of Productivity:*** *Work halts during investigations and cleanup after fire incidents.*
  - ***Example:*** *Missed deadlines and extended project timelines.*

8.13.4 Positive Impacts of Proper Fire Management

8.13.4.1 Health and Safety Impacts

- ***Reduced Risk of Injuries:*** *Adequate fire safety measures minimize risks of injuries during emergencies.*
  - ***Example:*** *Workers safely evacuating due to clear emergency exits and drills.*
- ***Increased Confidence:*** *Workers feel safer knowing fire risks are effectively managed.*
  - ***Example:*** *Confidence in fire alarms, extinguishers, and drills.*

8.13.4.2 Operational Impacts

- ***Uninterrupted Workflows:*** *Fires are effectively prevented, ensuring smooth construction operations.*
  - ***Example:*** *A project/Contract proceeding on schedule without interruptions.*
- ***Preservation of Assets:*** *Effective measures safeguard construction materials and equipment.*
  - ***Example:*** *Preventing loss of expensive tools due to fire incidents.*

8.13.4.3 Legal and Financial Impacts

- ***Compliance with Standards:*** *Following fire safety regulations ensures legal compliance.*
  - ***Example:*** *Avoiding fines through adherence to fire protection codes.*
- ***Enhanced Reputation:*** *A proactive approach to fire safety builds trust and strengthens brand reputation.*
  - ***Example:*** *Positive public perception for maintaining a fire-safe environment.*
- ***Cost Savings:*** *Implementing fire management reduces expenses related to accidents and delays.*
  - ***Example:*** *Avoiding additional costs for fire damage repairs.*
- ***Lower Insurance Premiums:*** *A strong fire safety record leads to reduced premiums.*
  - ***Example:*** *Saving costs through safe worksite practices.*
- ***Improved Morale:*** *Workers are more motivated in a fire-safe environment, improving productivity.*
  - ***Example:*** *Higher morale contributing to better work efficiency.*

8.13.5 General Provisions for Fire at Construction Worksites

Fire management and prevention are critical aspects of maintaining a safe construction worksite. These provisions aim to ensure compliance with industry standards or equivalent national provisions, minimize fire-related risks, and protect workers, equipment, and materials through effective planning, training, and maintenance practices.

In Bangladesh, fire protection at construction worksites is governed by the Bangladesh National Building Code (BNBC), 2020, alongside regulations such as the Fire Prevention and Extinguishing Act, 2003 and the Fire Prevention and Extinction Rules, 2014. These provisions aim to ensure compliance with safety standards and mitigate fire-related risks. These provisions are as follows:

8.13.5.1 When Fire Management and Prevention Provisions are Applicable

- ***Initial planning and design phase:*** *Fire management and prevention provisions shall be implemented during the initial planning and design phases of the construction project.*
- ***Material storage and preparation phase:*** *Provisions shall be applicable when flammable materials, liquids, or equipment are stored or prepared on-site.*
- ***Active construction phase:*** *Fire management measures shall be enforced during active construction activities, including welding, cutting, grinding, or other hot work.*
- ***Maintenance and inspection phase:*** *Provisions shall apply during periodic inspections and maintenance of equipment and fire safety systems.*

- ***Emergency response phase:*** *Fire management protocols shall be activated during any fire-related incidents, ensuring swift response and mitigation of risks.*

8.13.5.2 Where Fire Management and Prevention Provisions are Applicable

- ***Material storage zones:*** *Provisions shall apply to areas designated for the storage of flammable or combustible materials, ensuring they are stored safely away from ignition sources.*
- ***Hot work zones:*** *Fire prevention measures shall be enforced in areas where welding, cutting, grinding, or other activities producing heat and sparks are performed.*
- ***Electrical equipment areas:*** *Provisions shall extend to locations with electrical equipment and wiring to prevent electrical fires.*
- ***Labor sheds and accommodation zones:*** *Fire management provisions shall be applicable in labor sheds and worker accommodation areas to protect occupants.*
- ***High-risk zones:*** *Provisions shall cover areas near open flames, heating equipment, or heavy machinery that pose heightened fire risks.*
- ***Site-wide coverage:*** *Fire management measures shall apply across the entire construction site, including temporary structures, offices, and storage units.*

8.13.5.3 General Provisions for Fire Protection as Per BNBC-2020 and Fire Prevention Act-2003 and Fire Prevention Rules-2014

a) Fire-Resistant Construction

- *Buildings shall be constructed using fire-resistant materials to prevent the spread of fire.*

b) Fire Detection and Alarm Systems

- *Construction sites shall be equipped with fire detection and alarm systems capable of detecting smoke, heat, and fire.*

c) Means of Escape

- *Multiple means of escape, such as staircases, corridors, and exits, shall be provided to enable safe evacuation during a fire.*

d) Firefighting Equipment

- *Fire extinguishers, fire hoses, and sprinkler systems shall be installed and maintained at construction sites.*

e) Smoke Management Systems

- *Smoke vents, exhaust fans, and pressurization systems shall be in place to control the spread of smoke.*

f) Fire Drills and Training

- *Regular fire drills and training sessions shall be conducted to ensure workers are prepared for emergencies.*

g) Approval and Compliance

- *Structural designs and layouts of multi-storied commercial buildings shall require approval from the Directorate General of Fire Service and Civil Defence.*
- *Occupancy certificates shall be obtained to ensure compliance with fire safety standards or equivalent national provisions, if available and applicable.*

8.13.5.4 General Fire Protection Provisions for Bridge and Road Construction as per BNBC-2020 and Fire Prevention Act-2003 and Fire Prevention Rules-2014

a) Fire-Resistant Materials

- *Fire-resistant materials shall be used for temporary structures, such as scaffolding and formwork, to minimize fire risks during construction.*

b) Fire Detection and Alarm Systems

- *Fire detection systems, such as smoke detectors and heat sensors, shall be installed in temporary site offices, storage areas, and worker accommodations.*

c) Firefighting Equipment

- *Fire extinguishers shall be provided at strategic locations, including near fuel storage areas and welding zones.*
- *Fire hoses and water tanks shall be ensured for larger fire emergencies.*

d) Storage of Flammable Materials

- *Flammable materials, such as fuel and chemicals, shall be stored in fire-resistant containers located at a safe distance away from ignition sources.*
- *Inventories of flammable materials shall be maintained, and storage areas shall be regularly inspected for compliance.*

e) Hot Work Safety

- *Safety measures for hot work activities, such as welding and cutting, shall be implemented by using fire-resistant blankets or shields to contain sparks.*
- *Fire watches shall be assigned during and after hot work activities to monitor for potential fire hazards.*

f) Emergency Preparedness

- *Emergency response plans, including evacuation procedures and fire containment strategies, shall be developed and communicated to workers.*
- *Regular fire drills shall be conducted to ensure workers are familiar with emergency protocols.*

g) Weather-Related Precautions

- *Weather conditions, such as high winds or extreme heat, shall be monitored to mitigate fire risks, especially when working with flammable materials or conducting hot work.*

h) Electrical Safety

- *Electrical systems, including temporary wiring and equipment, shall be inspected to prevent short circuits and overheating.*
- ***Ground fault circuit interrupters (GFCIs)** shall be used to minimize electrical fire risks.*

i) Signage and Awareness

- *"Fire Safety Procedures" signs shall be prominently posted at construction sites, especially in high-risk areas such as fuel storage zones and welding stations.*
- *Workers shall be trained on fire prevention and emergency response procedures.*

j) Collaboration with Authorities

- *Coordination with local fire departments and emergency services shall be ensured to facilitate a quick response in case of a fire.*
- *Approvals and certifications for fire safety measures shall be obtained from relevant regulatory bodies or equivalent national provisions, if available and applicable.*

8.13.5.5 Other General Provisions

a) **Safety Plans and Suitability**

- *Safety plans for fire prevention shall be developed and implemented based on specific site conditions and risks.*
- *Safety plans shall be tailored to accommodate different types of construction activities and work environments.*

b) **Training and Awareness:**

- *Comprehensive training for workers on fire prevention, proper use, maintenance, and safety procedures shall be provided.*
- *Regular drills and training sessions shall be conducted to ensure workers are familiar with fire safety protocols.*
- *Ongoing education on identifying and mitigating fire hazards shall be provided.* ***Training frequency: Annually.***

c) **Inspection and Maintenance**

- *Fire prevention equipment shall be regularly inspected and maintained to ensure it is in good working condition.*
- *Manufacturer guidelines for the care and replacement of fire prevention components shall be followed.*
- *Inspection and maintenance activities shall be documented.* ***Inspection frequency: Daily for critical components, Weekly for general fire prevention equipment.***

d) **Distribution and Accessibility:**

- *Fire safety equipment and resources shall be provided at all stages of the construction process.*
- *Fire safety equipment and resources shall be readily available and accessible to all workers, subcontractors, and visitors.*
- *Specific storage areas for fire safety equipment shall be designated to ensure it is properly maintained and easily accessible.*

e) **Customization and Comfort**

- *Fire safety measures shall be customized to suit specific site conditions and requirements.*
- *Resources and support shall be provided to workers to adopt fire safety procedures comfortably and effectively.*
- *Ergonomic factors shall be considered when selecting fire prevention equipment to ensure worker comfort and compliance.*

8.13.5.6 Emergency Preparedness

- *Emergency response plans, including evacuation procedures and fire containment strategies, shall be established and communicated to all workers.*
- *Fire drills shall be conducted at regular intervals to evaluate and improve emergency preparedness.* ***Drill frequency: Quarterly.***

- *Workers shall be trained in using fire extinguishers and other emergency equipment effectively.*

8.13.6 Standards/Specifications for Management and Prevention of Fire at Construction Worksite

The standards and specifications for fire management and prevention at construction worksites are designed to address potential fire hazards systematically. They emphasize proactive measures, compliance with industry standards or equivalent national provisions, and the integration of robust safety protocols to safeguard workers, materials, and infrastructure while maintaining operational efficiency. The following interconnected standards shall collectively create a comprehensive framework, ensuring seamless implementation of fire prevention practices across all aspects of construction site operations.

These following sections incorporate fire management and prevention standards and specifications including Bangladesh, ensuring compliance with regulations such as the Bangladesh National Building Code (BNBC), 2020, and the Fire Prevention and Extinguishing Act, 2003:

8.13.6.1 General Fire Protection Standards/Specifications for Bridge and Road Construction as per BNBC-2020 and Fire Prevention Act-2003 and Fire Prevention Rules-2014

8.13.6.2 Fire Prevention

- *Fire prevention measures shall be implemented to control potential fire hazards.*
- *Regular fire safety inspections shall be conducted.* ***Inspection frequency: Daily.***
- *A minimum of one fire extinguisher rated for* ***Class A, B, and C fires*** *shall be maintained within* ***10 meters (32.8 feet)*** *of any high-risk area.*
- *Fire watch personnel shall be present during high-risk operations and for at least* ***30 minutes*** *after completion.*
- *Suitable* ***Class A,B or C fire extinguishers*** *shall be kept nearby during high-risk activities.*
- *The extinguisher gauge shall be full. If an extinguisher is unavailable, fire hoses, sand buckets, or equivalent firefighting equipment shall be accessible.*
- *For work conducted within* ***35 feet (10.7 meters)*** *of flammable materials, a piece of sheet metal or fire-resistant blanket shall be placed over the flammable material, and a fire watcher shall monitor sparks.*

8.13.6.3 Ventilation

- *Proper ventilation systems shall be used to remove smoke and toxic fumes from the worksite.*
- *Local exhaust ventilation systems shall be installed to capture fumes at the source.*
- *Regular inspections of ventilation systems shall be conducted.* ***Inspection frequency: Weekly.***
- *Airflow rates of at least* ***100 cubic feet per minute (cfm)*** *shall be maintained in enclosed areas.*
- *Ventilation systems shall be equipped with* ***high-efficiency particulate air (HEPA)*** *filters to capture fine particles.*

8.13.6.4 PPE

- *Personal protective equipment (PPE), including fire-resistant clothing, gloves, and helmets, shall be provided to protect workers from burns and injuries.*
- *PPE shall be compliant with **OSHA 29 CFR 1910.132** standards or equivalent national provisions.*
- *Inspections and maintenance of PPE shall be conducted regularly. **Inspection frequency: Monthly.***
- *Fire-resistant clothing shall have an arc rating of at least **8 cal/cm²**.*
- *Gloves shall be made of leather or other heat-resistant materials and free from holes and tears.*

8.13.6.5 Regular Inspection:

- *Fire prevention equipment, including fire extinguishers, hoses, and alarms, shall be inspected and maintained. Inspection frequency: Monthly.*
- *Fire extinguishers shall be free from leaks and damage.*
- *Fire alarms shall be verified for correct functioning and set to appropriate sensitivity levels.*
- *Hoses shall be inspected for corrosion, dents, or other damage.*

8.13.6.6 Emergency Response

- *An emergency response plan for fire incidents shall be developed.*
- *All workers shall be familiarized with emergency evacuation routes and procedures.*
- *Clear access routes for emergency vehicles and personnel shall be maintained.*

8.13.6.7 Storage of Flammable Materials

- *Combustible or flammable materials shall be stored away from active worksites.*
- *Protective covers shall be used to shield equipment and materials from fire hazards.*
- *A safe distance of at least **10 meters (32.8 feet)** between flammable materials and high-risk activities shall be maintained.*

8.13.6.8 Site Security

- *Site security measures shall be implemented to prevent unauthorized access and mitigate potential fire hazards.*
- *Collaboration with local police authorities and utility companies for emergency electricity, gas, and water shutoff shall be ensured.*

8.13.6.9 Signage and Compliance

- *"Fire Safety Procedures" signs shall be posted prominently in all designated zones with potential fire hazards.*
- *Compliance with fire safety regulations shall be monitored and enforced through supervisor checks and audits.*
- *Corrective actions for non-compliance shall be implemented, and additional training shall be provided.*

8.13.6.10 Risk of Burns and Injuries from Fire

- *Barriers or screens shall be implemented to protect workers from fire hazards.*

- *A safe distance of at least **3 meters (10 feet)** shall be maintained between high-risk operations and other workers.*
- *Fire-resistant blankets shall be provided to cover nearby materials and surfaces.*

8.13.6.11 Exposure to Smoke and Toxic Fumes

- *Fume extraction systems shall be used to capture hazardous fumes at the source.*
- *Air quality shall be monitored to ensure fume levels do not exceed permissible exposure limits (PELs) set by OSHA or equivalent national standards if available and applicable.*
- *Respirators with appropriate filters shall be used when working in confined spaces with potential fire hazards.*

8.13.6.12 Delays in Construction Activities Due to Fire Incidents

- *Fire prevention schedules shall be developed to minimize disruptions to construction activities.*
- *Fire prevention operations shall be coordinated with other trades to avoid conflicts and delays.*
- *Contingency plans shall be implemented to address potential delays caused by fire incidents.*

8.13.6.13 Damage to Equipment and Materials from Fire

- *Fire prevention equipment and materials shall be stored in designated areas to prevent damage.*
- *Protective covers shall be used to shield equipment and materials from fire hazards.*
- *Regular inspections of stored equipment and materials shall be conducted to ensure they are in good condition.*

8.13.6.14 Fire Protection Standards/Specifications for Bridge and Road Construction as per BNBC-2020 and Fire Prevention Act-2003 and Fire Prevention Rules-2014

a) Fire-Resistant Materials
- *Temporary structures, such as scaffolding and formwork, shall be constructed using fire-resistant materials.*
- *Fire-resistant materials shall comply with BNBC standards for fire resistance, ensuring a minimum fire rating of **2 hours** for critical components.*

b) Fire Detection and Alarm Systems
- *Fire detection systems, such as smoke detectors and heat sensors, shall be installed in temporary site offices, storage areas, and worker accommodations.*
- *Alarm systems shall be capable of detecting smoke and heat within **30 seconds** and triggering alarms audible within a radius of **50 meters**.*

c) Firefighting Equipment
- *Fire extinguishers rated **Class A, B, or C** shall be provided at strategic locations, including near fuel storage areas and welding zones.*
- *A minimum of one fire extinguisher shall be available within **10 meters (32.8 feet)** of high-risk areas.*
- *Fire hoses with a diameter of **1.5 inches (3.8 cm)** and a water flow rate of **100 liters per minute** shall be installed for larger fire emergencies.*

d) *Storage of Flammable Materials*
   - *Flammable materials, such as fuel and chemicals, shall be stored in fire-resistant containers located at least **50 feet (15 meters)** away from ignition sources.*
   - *Storage areas shall be equipped with fireproof covers and inspected weekly to ensure compliance.*

e) *Hot Work Safety*
   - *Fire-resistant blankets or shields shall be used to contain sparks during welding and cutting activities.*
   - *Fire watches shall be assigned during and for at least **30 minutes** after hot work activities to monitor for potential fire hazards.*

f) *Emergency Preparedness*
   - *Emergency response plans, including evacuation procedures and fire containment strategies, shall be developed and communicated to all workers.*
   - *Fire drills shall be conducted **quarterly** to ensure workers are familiar with emergency protocols.*

g) *Weather-Related Precautions*
   - *Weather conditions, such as high winds or extreme heat, shall be monitored to mitigate fire risks.*
   - *During dry weather, additional precautions, such as wetting down materials, shall be implemented.*

h) *Electrical Safety*
   - *Electrical systems, including temporary wiring and equipment, shall be inspected to prevent short circuits and overheating.*
   - ***Ground fault circuit interrupters (GFCIs)** shall be used to minimize electrical fire risks.*

i) *Signage and Awareness*
   - *"Fire Safety Procedures" signs shall be posted prominently at construction sites, especially in high-risk areas such as fuel storage zones and welding stations.*
   - *Workers shall be trained on fire prevention and emergency response procedures. **Training frequency: Annually.***

j) *Site Security*
   - *Site security measures shall be implemented to prevent unauthorized access and mitigate potential fire hazards.*
   - *Collaboration with local fire departments and utility companies for emergency electricity, gas, and water shutoff shall be ensured.*

8.13.6.15Fire Protection Acts in Bangladesh

The **Fire Prevention and Extinguishing Act, 2003**, and the **Fire Prevention and Extinction Rules, 2014**, provide additional legal frameworks for fire safety in Bangladesh. Key provisions include:

a) *Licensing and Approvals:*
   - *Approval of structural designs for multi-storied buildings is mandatory to ensure fire safety compliance.*

8.14 Labor Shed at Construction Worksite

Managing labor sheds at construction worksites is crucial for ensuring worker safety, protecting equipment, and minimizing disruptions to project operations. Implementing proper protocols for labor sheds ensures compliance with regulatory standards, enhances worker confidence, and promotes a safe working environment.

8.14.1 Examples of Common OHS Hazards in Labor Sheds

- ***Overcrowding:*** *Cramped spaces leading to poor living conditions and increased risk of illness.*
- ***Ventilation Issues:*** *Inadequate airflow causing discomfort and accumulation of harmful fumes.*
- ***Sanitation and Hygiene:*** *Improper sanitation facilities leading to health risks and infectious diseases.*
- ***Pest Infestation:*** *Rodents or insects creating unsanitary living conditions.*
- ***Poor Lighting:*** *Insufficient or faulty lighting increasing risks of accidents and eye strain.*
- ***Noise Pollution:*** *Loud equipment or external noise affecting rest and causing stress.*
- ***Hazardous Materials:*** *Exposure to dangerous chemicals or improperly stored construction materials.*
- ***Temperature Extremes:*** *Lack of heating or cooling systems causing discomfort and health problems.*
- ***Structural Safety:*** *Substandard construction of labor sheds posing risks of collapse or injury.*
- ***Psychosocial Issues:*** *Stress, isolation, or lack of recreational facilities negatively impacting mental health.*

8.14.2 Examples of Mitigation and Prevention Measures

- ***Adequate Space Allocation:*** *Ensuring sufficient space per worker to avoid overcrowding.*
- ***Ventilation Systems:*** *Installing proper ventilation to maintain air quality and prevent accumulation of harmful fumes.*
- ***Clean Sanitation Facilities:*** *Providing clean toilets, showers, and washing areas for workers.*
- ***Regular Pest Control:*** *Conducting regular inspections and pest control to maintain hygiene.*
- ***Sufficient Lighting:*** *Installing appropriate lighting for visibility and safety.*
- ***Noise Reduction Measures:*** *Using noise barriers or scheduling loud activities during non-rest hours.*
- ***Safe Material Storage:*** *Storing hazardous materials away from living areas with clear labels and safety measures.*
- ***Climate Control:*** *Providing fans, heaters, or insulation to maintain a comfortable temperature.*
- ***Structural Inspections:*** *Regularly checking labor sheds for structural integrity and addressing maintenance issues.*
- ***Mental Health Support:*** *Offering counseling services, recreational facilities, or social programs to improve worker morale.*

8.14.3 Negative Impacts of Poor OHS Management in Labor Sheds

8.14.3.1 Health and Well-being Impacts

- ***Increased Illness Rates:*** *Spread of diseases due to unsanitary conditions.*
  - ***Example:*** *Workers suffering from respiratory infections due to poor ventilation.*
- ***Workplace Fatigue:*** *Lack of proper rest affecting productivity and safety.*
  - ***Example:*** *Accidents caused by fatigued workers on-site.*

8.14.3.2 Operational Impacts

- ***Worker Absenteeism:*** *Health issues leading to frequent absences.*
  - ***Example:*** *Delayed project timelines due to insufficient manpower.*
- ***Worker Absenteeism:*** *Health issues and poor living conditions lead to frequent absences.*
  - ***Example:*** *Delayed project timelines due to insufficient manpower.*
- ***Reduced Workforce Efficiency:*** *Discomfort or illnesses hinder workers' ability to perform at optimal levels.*
  - ***Example:*** *Fatigued workers struggling to meet productivity goals.*
- ***Delays in Workflow:*** *Poor OHS management disrupts workflows and impacts project schedules.*
  - ***Example:*** *Rescheduling work tasks due to accidents or health-related disruptions.*
- ***Higher Worker Turnover:*** *Unsafe and unhealthy conditions drive workers to seek alternative employment.*
  - *Example: Frequent need for hiring and training replacements, causing delays.*
- ***Interruption in Labor Supply:*** *Health risks or dissatisfaction among workers can disrupt workforce availability.*
  - *Example: Immediate labor shortages during critical construction phases.*
- ***Increased Liability for Operational Failures:*** *Poor OHS practices result in operational slowdowns or unforeseen shutdowns.*
  - *Example: Halting work operations due to lack of compliance with health standards.*

8.14.3.3 Financial and Legal Impacts

- ***Increased Healthcare Costs:*** *Additional expenses for treating worker illnesses.*
  - ***Example:*** *Medical expenses from prolonged exposure to hazards.*
- ***Regulatory Penalties:*** *Fines or legal action for failing to meet OHS standards.*
  - ***Example:*** *Fines imposed for lack of sanitary facilities.*
- ***Higher Healthcare Costs:*** *Expenses incurred in treating workers' illnesses or injuries due to poor conditions.*
  - ***Example:*** *Paying for medical treatment of respiratory infections caused by poor ventilation.*
- ***Increased Maintenance Costs:*** *Frequent repairs or upgrades needed for unsafe or poorly maintained labor sheds.*
  - ***Example:*** *Addressing recurring pest infestations or unsafe structural elements.*

- ***Loss of Productivity Costs:*** *Reduced output due to absenteeism or inefficient workforce performance.*
  - ***Example:*** *Costs associated with delays in meeting project deadlines.*
- ***Insurance Premium Increases:*** *Higher claims or frequent incidents leading to elevated insurance costs.*
  - ***Example:*** *Rising insurance premiums from repeated violations or accidents.*
- ***Costs of Training Replacement Workers:*** *Higher turnover results in increased costs for recruiting and training new staff.*
  - ***Example:*** *Expenses incurred to replace and train workers seeking safer environments.*

8.14.4 Positive Impacts of Proper OHS Management for Labor Shed

8.14.4.1 Health and Well-being Impacts

- ***Improved Health Outcomes:*** *Workers staying healthy due to better living conditions.*
  - ***Example:*** *Lower rates of disease outbreaks in labor sheds.*
- ***Boosted Morale:*** *Workers feeling valued and safe in their environment.*
  - ***Example:*** *Increased productivity due to happier, healthier workers.*

8.14.4.2 Operational Impacts

- ***Enhanced Efficiency:*** *Healthy workers contributing to smoother workflows.*
  - ***Example:*** *Timely completion of projects without delays.*
- ***Smooth Workflow Management:*** *Healthy and safe workers contribute to uninterrupted workflows.*
  - ***Example:*** *Projects completed within deadlines due to consistent worker efficiency.*
- ***Higher Workforce Retention:*** *A safe and comfortable environment encourages workers to remain employed.*
  - ***Example:*** *Reduced hiring and training costs due to low turnover rates.*
- ***Enhanced Collaboration and Morale:*** *Workers perform better as they feel secure and valued.*
  - ***Example:*** *Teams working cohesively, resulting in higher productivity.*
- ***Reduced Downtime:*** *Safe and efficient labor sheds prevent accidents or hazards that could halt operations.*
  - *Example: Construction schedules remain on track without disruptions.*
- ***Efficient Workforce Allocation:*** *Better health and working conditions allow workers to focus on tasks effectively.*
  - ***Example:*** *Labor efforts streamlined with no need for reallocating tasks due to absenteeism.*
- ***Positive Worksite Culture:*** *Proper OHS practices foster mutual respect and cooperation among workers.*
  - ***Example:*** *A motivated workforce that proactively supports safety initiatives.*

8.14.4.3 Financial and Legal Impacts

- ***Cost Savings:*** *Reduced healthcare costs and fewer legal liabilities.*
  - *Example: Savings due to adherence to OHS regulations.*
- ***Improved Reputation:*** *Enhanced trust from workers, clients, and stakeholders.*
  - *Example: Recognition for maintaining high safety and health standards.*
- ***Lower Healthcare Costs:*** *Healthy and safe conditions reduce the need for medical interventions.*
  - ***Example:*** *Savings from fewer medical emergencies or illnesses among workers.*
- ***Improved Productivity Savings:*** *Increased efficiency lowers the overall cost of labor per project.*
  - ***Example:*** *Faster project completion reducing operational expenses.*
- ***Insurance Premium Reductions:*** *Maintaining a stellar safety record results in lower insurance premiums.*
  - ***Example:*** *Reduced insurance costs from fewer claims filed due to accidents or injuries.*
- ***Cost Optimization in Labor Management:*** *Avoiding expenses related to worker turnover, such as recruitment and training.*
  - ***Example:*** *Retaining skilled workers ensures stability and continuity in project execution.*
- ***Fewer Equipment Maintenance Costs:*** *Safe environments minimize wear and tear caused by hazardous conditions.*
  - ***Example:*** *Prolonged lifespan of equipment used in the vicinity of labor sheds.*
- ***Mitigation of Penalties:*** *Adherence to OHS standards eliminates risks of non-compliance fines.*
  - ***Example:*** *Savings by meeting all regulatory requirements and passing inspections seamlessly.*

8.14.5 General Provisions for Labor Shed at Construction Worksites

Ensuring the health, safety, and well-being of workers in labor sheds is a critical aspect of occupational health and safety (OHS) management at construction worksites. Labor sheds often serve as essential spaces for rest, accommodation, or temporary shelter, making their safety a top priority to protect the workforce and support productivity. Proper implementation of OHS provisions not only reduces risks of accidents and hazards but also promotes a positive work environment, enhances compliance with regulations, and strengthens trust between workers and employers. The following general provisions outline key measures to ensure labor sheds are designed, maintained, and managed in accordance with industry standards and site-specific requirements, fostering safety, comfort, and operational efficiency for all:

8.14.5.1 When OHS Provisions for Labor Sheds are Applicable:

- ***Initial planning and design phase:*** *Provisions shall be implemented during the initial planning and design phases of the construction project.*
- ***Construction preparation phase:*** *Provisions shall be applicable during the setup and preparation of labor sheds prior to their usage.*

- ***Operational phase:*** *OHS measures shall be enforced while labor sheds are in use for worker accommodation, breaks, or temporary shelter.*
- ***Maintenance and modification phase:*** *Provisions shall apply whenever labor sheds are maintained, repaired, or modified.*
- ***Emergency situations:*** *Provisions shall be applicable during emergencies, such as adverse weather conditions requiring temporary use of labor sheds.*

8.14.5.2 Where OHS Provisions for Labor Sheds are Applicable

- ***On-site labor sheds:*** *Provisions shall apply to labor sheds located within the designated boundaries of construction sites.*
- ***Off-site accommodation facilities:*** *Provisions shall be applicable to off-site locations officially designated for worker accommodation.*
- ***Temporary shelters:*** *Labor sheds used for temporary shelter in emergency situations shall comply with these provisions.*
- ***High-risk zones:*** *Provisions shall extend to labor sheds situated in high-risk areas, such as near excavation zones or heavy machinery.*
- ***Shared facilities:*** *Provisions shall cover labor sheds shared by multiple subcontractors or work groups to ensure consistent safety standards.*

8.14.5.3 Safety Plans and Suitability:

- *Safety plans for labor sheds shall be developed and implemented based on specific site conditions and identified risks.*
- *These plans shall comply with international standards, Or equivalent national provisions if available and applicable.*
- *The plans shall be tailored to accommodate the diverse needs of various types of labor sheds and work environments.*

8.14.5.4 Training and Awareness

- *Comprehensive training shall be provided to workers on labor shed safety, including proper usage, maintenance, and emergency procedures.*
- *Regular drills and training sessions shall be conducted to ensure workers are familiar with labor shed safety protocols.*
- *Ongoing education shall be offered to workers on identifying and mitigating potential labor shed hazards, with training conducted at least annually.*

8.14.5.5 Inspection and Maintenance

- *Labor shed facilities shall be inspected and maintained regularly to ensure they remain in safe and operable condition.*
- *Manufacturer guidelines shall be followed for the care and replacement of labor shed components.*
- *Inspection and maintenance activities shall be documented systematically. Inspections shall be conducted daily for critical components and weekly for general labor shed facilities.*

8.14.5.6 Distribution and Accessibility

- *Safety equipment and resources for labor shed use shall be provided at all stages of the construction process.*
- *Equipment and resources shall be readily available and accessible to workers, subcontractors, and visitors.*

- *Specific storage areas shall be designated for safety equipment to ensure proper maintenance and ease of access.*

8.14.5.7 Signage and Compliance

- *Signs indicating "Labor Shed Safety Procedures" shall be posted prominently in all designated labor shed zones.*
- *Compliance with safety standards shall be regularly monitored through supervisor checks and audits.*
- *Corrective actions shall be implemented in case of non-compliance, and additional training shall be provided to address shortcomings.*

8.14.5.8 Customization and Comfort

- *Labor shed safety measures shall be customized to suit the specific conditions and requirements of the site.*
- *Resources and support shall be provided to enable workers to adopt labor shed safety procedures comfortably and effectively.*
- *Ergonomic factors shall be considered during the selection of labor shed equipment and safety gear to enhance worker comfort and compliance.*

8.14.6 General Provisions for Labor Shed as per Bangladesh Labor Act 2006 (and amendments)

Labor sheds at construction worksites in Bangladesh shall comply with relevant national labor laws and safety standards, such as the Bangladesh Labor Act 2006 (or its amendments as follows:

- ***Site Specific Risk Mitigation:*** *Adequate measures shall be taken to address site-specific risks such as overcrowding, poor ventilation, and lack of sanitation, in accordance with the local regulatory framework.*
- ***Weather Conditions:*** *Labor sheds shall be designed, constructed, and maintained to withstand local environmental and weather conditions;*
- ***Welfare of Laborers:*** *Labor Sheds should ensure the safety and well-being of workers.*

8.14.7 Standards/Specifications for Labor Shed at Construction Worksite

Ensuring the safety, comfort, and well-being of workers is a fundamental responsibility at construction worksites. Labor sheds, as essential facilities, must be designed and managed to minimize risks, promote health and safety, and provide an environment that supports productivity. The following **Occupational Health and Safety (OHS)** standards and specifications offer a comprehensive framework to address key safety concerns, enhance operational efficiency, and ensure compliance with safety requirements. By implementing these measures, construction teams can create a secure and organized workspace that prioritizes the welfare of workers while adhering to organizational best practices:

8.14.7.1 Specifications for Labor Sheds as per "The Bangladesh Labor Act, 2006 (with Amendments)

The Bangladesh Labor Act, 2006, outlines various provisions for worker safety, welfare, and working conditions. Here are the detailed specifications for labor sheds at construction worksites, along with relevant clauses:

- ***Space Requirements (Clause 51):***
  - *Minimum space per worker:* ***3.7 square meters (40 square feet).***
  - *Height of the shed:* ***2.4 meters (8 feet)*** *minimum.*
- ***Ventilation (Clause 53):***

- *Adequate ventilation with **at least 2 windows** for every **10 square meters** of floor area.*
- *Cross-ventilation must ensure **airflow of 5-10 air changes per hour.***

- ***Lighting (Clause 53):***
  - *Natural lighting: **300 lux** minimum during the day.*
  - *Artificial lighting: **150 lux** minimum for general areas.*
- ***Sanitation (Clause 52):***
  - *Toilets: **1 toilet per 20 workers.***
  - *Handwashing facilities: **1 basin per 10 workers.***
  - *Distance from the shed: Toilets must be within **50 meters.***
- ***Drinking Water (Clause 55):***
  - *Provision of safe drinking water with a capacity of **5 liters per worker per day.***
- ***Safety and Fire Protection (Clause 54):***
  - *Fire extinguishers: **1 extinguisher per 100 square meters.***
  - *Emergency exits: At least **2 exits** for sheds accommodating more than **20 workers.***
- ***Structural Stability (Clause 53):***
  - *Materials: Non-flammable and weather-resistant materials.*
  - *Load-bearing capacity: Must withstand **50 kg per square meter** of live load.*
- ***Rest and Dining Areas (Clause 55):***
  - *Separate rest areas with seating for **at least 50% of the workers.***
  - *Dining area: **1 square meter per worker.***

8.14.7.2 Other Standards/Specifications for Labor Sheds at construction worksites

a) Fire Prevention

- *Fire prevention measures shall be implemented to address potential fire hazards within the labor shed.*
- *Fire extinguishers compliant with OSHA 29 CFR 1926.150 Standards or national equivalent standards/specifications if available and applicable shall be readily available.*
- *Fire safety inspections shall be conducted at a frequency of **Daily**.*
- *At least **one fire extinguisher rated for Class A, B, and C fires** shall be maintained within **10 meters (32.8 feet)** of the labor shed.*
- *A fire watch shall be provided during high-risk operations and for at least **30 minutes** after completion.*
- *High-risk activities shall have a **Class ABC fire extinguisher or equivalent fire-fighting tools nearby**, ensuring the equipment gauge is full.*
- *Combustible materials within **10.7 meters (35 feet)** of operations shall be shielded using **fire-resistant blankets or sheet metal**, with a fire watcher monitoring spark.*

b) Ventilation

- *Adequate ventilation systems shall be installed to remove hazardous smoke and fumes from the labor shed.*
- *Ventilation systems equipped with **high-efficiency particulate air (HEPA) filters** shall be maintained for effective air purification.*

- *Inspections of ventilation systems shall occur* ***Weekly.***
- *Airflow rates shall meet a minimum of* ***100 cubic feet per minute (cfm)*** *within enclosed areas.*

c) *Training and Awareness*

- *Comprehensive safety training programs shall be provided to workers, covering* ***safety procedures, use of equipment, and hazard identification.***
- *The frequency of training shall be* ***Annually****, with* ***regular drills*** *held to familiarize workers with safety protocols.*
- *Training materials and sessions shall be designed to ensure inclusivity and accessibility for all workers, irrespective of language or literacy levels.*

d) *Personal Protective Equipment (PPE)*

- *Workers shall be equipped with* ***fire-resistant clothing, gloves, helmets, and other PPE compliant with OSHA 29 CFR 1910.132 Standards or national equivalent standards/specifications if available and applicable.***
- ***Monthly inspections*** *shall be conducted to ensure all PPE remains functional and safe.*
- *Fire-resistant clothing shall have an* ***arc rating of at least 8 cal/cm²****, and gloves shall be* ***leather or heat-resistant and free of damage.***

e) *Regular Inspections*

- *Labor shed facilities, including* ***fire extinguishers, hoses, and alarms****, shall undergo regular inspections.*
- *The inspection frequency shall be* ***Monthly.***
- ***Fire extinguishers*** *shall be checked to ensure they are* ***free from leaks and damage.***
- *Fire alarms shall be inspected to verify that they are* ***functioning correctly*** *and set at the appropriate sensitivity levels.*
- ***Hoses*** *shall be checked for any signs of* ***corrosion, dents, or other damage.***

f) *Emergency Response*

- *An* ***emergency response plan*** *for fire incidents in the labor shed shall be developed and communicated to all workers.*
- *All workers shall be made familiar with* ***emergency evacuation routes and procedures.***
- *Clear access routes for* ***emergency vehicles and personnel*** *shall be maintained at all times.*

g) *Storage of Flammable Materials*

- *All* ***combustible or highly flammable materials*** *shall be stored away from the labor shed in designated safe areas.*
- ***Protective covers*** *shall be used to shield equipment and materials from potential fire hazards.*
- *A safe distance of at least* ***10 meters (32.8 feet)*** *shall be maintained between flammable materials and high-risk activities.*

h) *Site Security*

- ***Site security measures*** *shall be implemented to prevent unauthorized access to the labor shed and potential fire hazards.*
- *Coordination with* ***local police authorities and utility companies*** *shall be established to ensure emergency shutoff of electricity, gas, and water when necessary.*

- *The labor shed area shall be well-lit during nighttime to deter unauthorized access and maintain worker safety.*

i) *Signage and Compliance*
- *"**Labor Shed Safety Procedures**" signs shall be prominently displayed in all designated zones where labor sheds are located.*
- *Compliance with safety standards shall be regularly monitored through **supervisor checks and audits**.*
- *Corrective actions for non-compliance shall be implemented immediately, with additional training provided as needed.*

j) *Customization and Comfort*
- *Safety measures shall allow for **customization** to suit specific site conditions and requirements.*
- *Resources and support shall be provided to ensure workers can adopt labor shed safety procedures **comfortably and effectively**.*
- ***Ergonomic factors** shall be considered when selecting labor shed equipment and safety gear to promote worker comfort and adherence.*

k) *Risk of Burns and Injuries from Fire*
- ***Barriers or screens** shall be implemented to protect workers from fire hazards within the labor shed.*
- *A safe distance of at least **3 meters (10 feet)** shall be maintained between high-risk operations and other workers.*
- ***Fire-resistant blankets** shall be provided to cover nearby materials and surfaces.*

l) *Exposure to Smoke and Toxic Fumes*
- ***Fume extraction systems** shall be used to capture hazardous fumes at the source.*
- *Air quality shall be regularly monitored to ensure fume levels do not exceed **permissible exposure limits (PELs)** set by OSHA or national equivalent standards/specifications if available and applicable.*
- ***Respirators with appropriate filters** shall be provided when working in confined spaces with potential fire hazards.*

m) *Delays in Construction Activities Due to Labor Shed Incidents*
- *A **labor shed safety schedule** shall be developed to minimize disruptions to construction activities.*
- *Labor shed operations shall be coordinated with other trades to avoid conflicts and delays.*
- ***Contingency plans** shall be implemented to address potential delays caused by labor shed incidents.*

n) *Structural Integrity*
- *The labor shed shall be structurally sound and capable of withstanding environmental conditions such as **wind, rain, and extreme temperatures**.*
- *Regular structural assessments shall be conducted to ensure integrity. Inspection frequency: **Monthly**.*
- *The shed shall withstand wind speeds of up to **100 km/h (62 mph)** and temperatures ranging from **-10°C to 50°C (6°F to 122°F)**.*

o) *Lighting*
- *Proper lighting shall be provided to prevent accidents and ensure workers can perform tasks effectively.*
- *Illumination levels shall be maintained at a minimum of **500 lux** in working areas.*

- ***Energy-efficient LED lights*** *shall be used to provide uniform lighting.*

p) *Access and Egress*
- *The labor shed shall have clear and unobstructed* ***access and egress points*** *to allow safe entry and exit in emergencies.*
- *A minimum of* ***two exit points*** *shall be provided for emergency evacuation.*
- *Exit pathways shall remain at least* ***1 meter (3.3 feet)*** *wide and free of obstructions.*

q) *Sanitation Facilities*
- *Clean and accessible toilets and handwashing stations shall be provided to maintain hygiene and health.*
- *Handwashing stations shall be equipped with* ***soap and running water.***

r) *Drinking Water Facilities*
- *Relevant standards for safe drinking water* ***(Sub-Chapter: 7.1 of this Book) shall be complied with;***
- *Drinking water facilities shall be readily available in every labor shed.*
- *Water Filters (if any) shall be regularly cleaned and disinfected.*

s) *First Aid*
- *Relevant standards for safe drinking water* ***(Sub-Chapter: 7.4 of this Book)*** *shall be complied with;*
- *A* ***well-stocked first aid kit*** *and trained personnel shall be available to handle minor injuries and emergencies.*
- *At least* ***one worker per shift*** *shall be trained in first aid procedures.*

t) *Temperature Control*
- *Measures shall be implemented to maintain a comfortable working environment within the labor shed.*
- ***Fans, heaters or other relevant facilities*** *shall be used to regulate temperature.*
- *Indoor temperatures shall be maintained between* ***18°C and 26°C (64°F and 79°F).***

u) *Pest Control*
- ***Pest control measures*** *shall be implemented to prevent infestations within the labor shed.*
- ***Regular pest inspections*** *shall be conducted, and treatments applied as needed. Inspection frequency:* ***Monthly.***
- *Food storage areas shall be kept clean and sealed to prevent pest access.*

v) *Storage and Organization*
- *Proper storage and organization of tools, equipment, and materials shall be ensured within the labor shed.*
- ***Labeled storage units and shelves*** *shall be provided to keep items organized and easily accessible.*
- ***Inventory checks*** *shall be conducted to ensure all items are accounted for. Inventory frequency:* ***Monthly.***

w) *Waste Management*
- ***Waste management protocols*** *shall be implemented to ensure the labor shed remains clean and free of hazards.*
- *Clearly labeled waste bins for different types of waste (e.g., recyclable, non-recyclable, hazardous) shall be provided.*

- *Regular waste disposal and cleaning activities shall be conducted. Cleaning frequency:* ***Daily.***

x) *Maintenance and Inspection*

- *Regular maintenance and inspection of the labor shed and its facilities shall be conducted to ensure ongoing safety and compliance with OHS standards.*
- *All maintenance and inspection activities shall be documented.*
- *Inspection frequency:* ***Daily for critical components, Weekly for general facilities.***

8.15 Safety Records at Construction Worksite (Including Incidents, Accidents and Near Misses)

Maintaining safety records at construction worksites is crucial for ensuring compliance with regulatory standards, enhancing worker confidence, and promoting a safe working environment. Implementing proper protocols for safety records helps in tracking safety performance, identifying hazards, and improving overall safety measures. Proper documentation of safety practices aids in evaluating risks, preventing incidents, and building a culture of safety.

8.15.1 Examples of Common OHS Challenges with Safety Records

- ***Incomplete Documentation:*** *Records not adequately maintained, leading to gaps in safety evaluation.*
- ***Data Inaccuracy:*** *Incorrect or outdated information resulting in flawed safety analysis.*
- ***Poor Accessibility:*** *Safety records not readily available for review during emergencies or inspections.*
- ***Non-compliance with Standards:*** *Failing to meet industry or regulatory documentation requirements.*
- ***Inefficient Recording Systems:*** *Manual processes leading to delayed or incorrect data entry.*

8.15.2 Examples of Mitigation and Prevention Measures

- ***Comprehensive Record-Keeping:*** *Ensuring all safety-related incidents, inspections, and measures are well-documented.*
- ***Digital Systems:*** *Using automated tools to manage and store safety records effectively.*
- ***Regular Updates:*** *Frequently updating safety records to reflect accurate and current information.*
- ***Periodic Audits:*** *Conducting internal audits to ensure compliance and identify gaps.*
- ***Staff Training:*** *Providing adequate training on maintaining and using safety records.*

8.15.3 Negative Impacts of Poor Safety Record Management

8.15.3.1 Health and Well-being Impacts

- ***Heightened Risk Exposure:*** *Untracked hazards leading to increased worker vulnerability.*
- ***Delayed Emergency Response:*** *Incomplete records hampering swift decision-making during incidents.*

8.15.3.2 Operational Impacts

- ***Process Inefficiencies:*** *Difficulty in identifying recurring safety issues, leading to unresolved risks.*
- ***Compliance Delays:*** *Failure to meet documentation requirements slowing project progress.*
- ***Increased Incident Rates:*** *Unrecorded safety violations causing repeated workplace hazards.*

8.15.3.3 Financial and Legal Impacts

- ***Fines for Non-compliance:*** *Regulatory penalties for incomplete or incorrect safety records.*

- ***Higher Legal Costs:*** *Legal battles arising from disputed safety incidents.*
- ***Insurance Premium Increases:*** *Poor safety documentation leading to elevated premiums.*
- ***Costs of Repeated Inspections:*** *Re-inspections required due to inadequate record-keeping.*
- ***Loss of Productivity:*** *Disruptions and delays resulting in reduced output and higher operational costs.*
- ***Increased Mitigation Expenses:*** *Retrospective safety improvements resulting in unplanned expenditures.*

8.15.4 Positive Impacts of Proper Safety Record Management

8.15.4.1 Health and Well-being Impacts

- ***Improved Hazard Identification:*** *Thorough records enabling proactive risk mitigation.*
- ***Enhanced Worker Safety:*** *Accurate tracking of incidents preventing repeat occurrences.*

8.15.4.2 Operational Impacts

- ***Efficient Safety Monitoring:*** *Streamlined systems reducing time spent on safety reviews.*
- ***Better Compliance Rates:*** *Accurate records ensuring seamless adherence to standards.*
- ***Enhanced Safety Culture:*** *Increased worker confidence in organizational safety measures.*

8.15.4.3 Financial and Legal Impacts

- ***Reduced Liability Costs:*** *Fewer legal claims due to proper safety documentation.*
- ***Lower Insurance Premiums:*** *Strong safety record-keeping reflecting positively during evaluations.*
- ***Optimized Budgeting:*** *Accurate safety data aiding in allocating resources effectively.*
- ***Cost Savings on Audits:*** *Improved compliance reducing the need for frequent audits and inspections.*
- ***Increased Profitability:*** *Efficient processes and reduced disruptions leading to higher project margins.*
- ***Long-Term Savings:*** *Enhanced worker safety reducing long-term expenditures on mitigation and healthcare.*

8.15.5 General Provisions for Safety Records at Construction Worksites

Safety is the cornerstone of successful construction projects, and maintaining proper records is a vital element of ensuring it. Safety records are more than just documents; they are the backbone of effective risk management, regulatory compliance, and a culture of accountability at worksites. These provisions aim to guide construction organizations in systematically managing safety records to minimize risks, ensure worker well-being, and foster efficiency across operations.

By adhering to these general provisions, construction sites can uphold industry standards, avoid operational delays, and reduce financial losses caused by safety oversights. The following sections provide a comprehensive roadmap for when and where these provisions are applicable and detail specific guidelines to ensure the successful implementation of safety record management systems.

8.15.5.1 When the Provisions Are Applicable

- ***During All Phases of Construction Activities:*** *The provisions shall apply throughout all phases of construction, including project initiation, execution, and completion.*
- ***Emergency Scenarios:*** *These provisions shall be applicable during emergency scenarios, ensuring readiness and response measures are documented.*
- ***Routine Inspections and Audits:*** *Routine inspections and safety audits shall also adhere to these provisions to maintain a proactive approach to health and safety management.*
- ***Post-Accident Reviews:*** *The provisions shall be followed during reviews conducted after any accidents to identify root causes and enforce corrective actions.*
- ***Worker Training Periods:*** *Whenever worker training or onboarding sessions are conducted, these provisions shall guide safety protocols and their documentation.*
- ***Amendments to Safety Policies:*** *The provisions shall apply during updates or revisions to safety policies to ensure alignment with the latest standards.*

8.15.5.2 Where the Provisions Are Applicable

- ***Construction Site Areas:*** *The provisions shall be applicable to all areas within the construction site, including work zones, labor accommodations, and hazardous material storage areas.*
- ***Off-Site Locations:*** *Subcontractor operations and any off-site locations associated with the construction project shall also fall under the scope of these provisions.*
- ***Equipment Storage and Maintenance Areas:*** *Safety provisions shall cover locations where equipment is stored or maintained to prevent risks associated with improper handling or breakdowns.*
- ***Administrative Offices:*** *The areas where project documentation is handled, such as safety offices or administrative buildings, shall also be included.*
- ***High-Risk Zones:*** *Areas identified as high-risk, including spaces with ongoing heavy machinery operations or hazardous material handling, shall specifically adhere to these provisions.*
- ***Worker Rest Areas:*** *Resting zones, including break rooms or temporary shelters, shall comply with the provisions to promote worker well-being and safety.*

8.15.5.3 Record-Keeping System

- *A robust record-keeping system shall be developed and implemented for all safety-related documents and records.*
- *Digital record-keeping systems shall be utilized to ensure easy access and retrieval of safety records.*
- *Compliance with international standards (e.g., OSHA 29 CFR 1904.33) Or equivalent national provisions/standards for record-keeping shall preferably be ensured if available and applicable. Authorized Engineer of LGED (not less than Executive Engineer) shall finalize the issue.*

8.15.5.4 Incident and Accident Reporting

- *All incidents and accidents that occur at the construction worksite shall be documented.*

- *Details such as date, time, location, individuals involved, description of the incident, and any injuries sustained shall be included.*
- *Incident and accident reports shall be submitted to the relevant authorities within 24 hours of occurrence.*
- *Thorough investigations of all incidents and accidents shall be conducted to identify root causes and implement corrective actions.*

8.15.5.5 Inspection and Audit Records

- *Records of all safety inspections and audits conducted at the construction worksite shall be maintained.*
- *Details such as date, time, location, inspection findings, and any corrective actions taken shall be included.*
- *Inspection and audit records shall be stored for a minimum of 5 years.*

8.15.5.6 Training and Certification Records

- *Records of all safety training sessions and certifications completed by workers shall be kept.*
- *Details such as training dates, topics covered, names of participants, and certification status shall be included.*
- *Training records shall be updated regularly and retained for a minimum of 3 years.*

8.15.5.7 Equipment Maintenance Records

- *All maintenance and inspection activities performed on safety equipment and machinery shall be documented.*
- *Details such as date, type of maintenance or inspection, equipment involved, and any repairs made shall be included.*
- *Equipment maintenance records shall be maintained for a minimum of 5 years.*

8.15.5.8 Safety Meeting Minutes

- *Minutes of all safety meetings held at the construction worksite shall be recorded.*
- *Details such as date, time, attendees, topics discussed, and any action items identified shall be included.*
- *Safety meeting minutes shall be stored for a minimum of 3 years.*

8.15.5.9 Hazardous Material Records

- *Records of all hazardous materials used or stored at the construction worksite shall be maintained.*
- *Details such as material name, quantity, storage location, safety data sheets (SDS), and disposal methods shall be included.*
- *Hazardous material records shall be updated regularly and retained for a minimum of 5 years.*

8.15.5.10 Health Monitoring Records

- *Records of health monitoring and medical assessments conducted for workers exposed to hazardous substances shall be kept.*
- *Details such as assessment dates, findings, recommendations, and any follow-up actions taken shall be included.*
- *Health monitoring records shall be maintained for a minimum of 30 years as per OSHA requirements.*

8.15.5.11 Emergency Response Records

- *All emergency response drills and actual emergency incidents at the construction worksite shall be documented.*
- *Details such as date, time, nature of the emergency, response actions taken, and any lessons learned shall be included.*
- *Emergency response records shall be retained for a minimum of 3 years.*

8.15.5.12Compliance and Certification Records

- *Records of all compliance audits and certifications obtained by the construction worksite shall be maintained.*
- *Details such as audit dates, findings, certification status, and any corrective actions taken shall be included.*
- *Compliance and certification records shall be stored for a minimum of 5 years.*

8.15.5.13Confidentiality and Data Protection

- *All safety records shall be stored securely and access shall be restricted to authorized personnel only.*
- *Data protection measures shall be implemented to safeguard sensitive information in compliance with relevant data protection regulations.*

8.15.5.14Periodic Review and Update

- *Periodic reviews of all safety records shall be conducted to ensure accuracy and completeness.*
- *Safety records shall be updated as needed to reflect any changes in procedures, regulations, or personnel.*

8.15.5.15Electronic Record-Keeping Systems

- *Electronic record-keeping systems shall be utilized to enhance efficiency and accessibility.*
- *Backup procedures shall be implemented to prevent data loss in case of system failure.*

8.15.5.16Record Retention Policy

- *A clear record retention policy outlining the duration for which each type of safety record must be retained shall be established.*
- *The record retention policy shall be communicated to all relevant personnel and compliance shall be ensured.*

8.15.5.17Auditing and Verification

- *Regular audits of safety records shall be conducted to verify compliance with OHS standards and identify areas for improvement.*
- *Audit findings shall be documented, and corrective actions shall be implemented as needed. Audits shall be conducted annually.*

8.15.6 Standards/Specifications for Safety Records at Construction Worksite

Safety records are an integral part of occupational health and safety (OHS) management at construction worksites. These records ensure transparency, accountability, and compliance with legal requirements. By documenting safety practices and incidents accurately, organizations can identify risks, prevent accidents, and create a safer working environment. In Bangladesh, these standards are governed by the **Bangladesh Labor Act 2006**, the

Bangladesh National Building Code (BNBC), and international regulations like OSHA and ILO standards. The following detailed provisions outline the standards and specifications for maintaining safety records at construction sites, with relevant clauses from the applicable regulations:

8.15.6.1 Standards/Specifications as per Bangladesh Labor Act 2006 (and amendments), the Bangladesh National Building Code (BNBC)-2020

a) Legal Framework

- ***Bangladesh Labor Act 2006:*** *Employers shall be required to maintain safety records, including accident reports, health monitoring records, and compliance documentation, to ensure worker safety and welfare.*
  - ***Clause Reference:*** *Chapter 6, Section 89 (Health and Safety Obligations).*
- ***Bangladesh National Building Code (BNBC):*** *Safety requirements for construction activities, including documentation of safety measures, inspections, and audits, shall be outlined in compliance with the BNBC.*
  - ***Clause Reference:*** *BNBC 2020, Part III, Section 3.2.1 (Site Safety Documentation).*

b) Record-Keeping Requirements

- ***Incident and Accident Records:*** *All workplace incidents and accidents shall be documented, including details of injuries, causes, and corrective actions.*
  - ***Clause Reference:*** *Bangladesh Labor Act 2006, Chapter 12, Section 150 (Accident Reporting and Investigation).*
- ***Health and Safety Inspections:*** *Regular inspections shall be conducted, and findings shall be recorded to ensure compliance with safety standards.*
  - ***Clause Reference:*** *BNBC 2020, Part VII, Section 7.2.3 (Inspection and Reporting Requirements).*
- ***Training Records:*** *Records of safety training provided to workers, including dates, topics, and participant details, shall be maintained.*
  - ***Clause Reference:*** *BNBC 2020, Part VII, Section 7.4.1 (Worker Training and Documentation).*
- ***Equipment Maintenance Logs:*** *Maintenance and inspection activities for machinery and safety equipment shall be documented.*
  - ***Clause Reference:*** *BNBC 2020, Part VII, Section 7.3.2 (Equipment Maintenance and Inspection).*

c) Compliance and Reporting

- ***Submission of Safety Reports:*** *Safety reports shall be submitted to relevant authorities, such as the Department of Inspection for Factories and Establishments (DIFE), to demonstrate adherence to safety regulations.*
  - ***Clause Reference:*** *Bangladesh Labor Act 2006, Chapter 10, Section 99 (Reporting to Authorities).*
- ***Penalties for Non-compliance:*** *Penalties, including fines and legal action, shall be imposed for non-compliance with safety provisions.*

- ***Clause Reference:*** *Bangladesh Labor Act 2006, Chapter 10, Section 100 (Penalties for Safety Violations).*

d) Worker Welfare Provisions

- ***Health Monitoring Records:*** *Records of health monitoring for workers exposed to hazardous conditions shall be maintained.*
  - ***Clause Reference:*** *Bangladesh Labor Act 2006, Chapter 6, Section 91 (Health Monitoring Requirements).*
- ***Emergency Preparedness Records:*** *Safety records shall include details of emergency drills and preparedness measures.*
  - ***Clause Reference:*** *BNBC 2020, Part VII, Section 7.2.3 (Emergency Preparedness and Drills).*

8.15.6.2 Other Standards/Specifications

a) Record-Keeping System

- *A robust record-keeping system must be developed and implemented for all safety-related documents and records.*
- *A digital record-keeping system should be used to ensure that safety records are easily accessible and retrievable.*
- *It is recommended that the applicable regulations and standards/specifications be aligned with international or equivalent national record-keeping standards (as applicable and available). Final decisions must be made by an authorized LGED engineer (not below the rank of Executive Engineer).*

b) Types of Safety Records

- ***Fire Safety Inspection Reports:*** *Reports must include details on maintenance, operational effectiveness, and risk reduction measures for each fire protection system.*
- ***PPE Issuance and Review Logs:*** *Logs should include quantity issued, wearing condition, quality inspection, and replacement details.*
- ***Training Sessions and Attendance Records:*** *Records must preserve training content, trainer's name, participants, and evaluation results.*
- ***Accident and Incident Reports:*** *Reports must contain the nature of the event, impact, involved workers/employees, initial response measures, and recommendations.*
- ***Emergency Drill Documentation:*** *Documentation should include drill date, time, worker response, identified gaps, and corrective instructions.*
- ***Health and Sanitation Assessment Logs:*** *Records must cover hygiene protocols, drinking water, sanitation, ventilation, and cleanliness conditions at the site.*
- ***Environmental Monitoring Logs:*** *Parameters such as smoke, gas, noise, temperature, and air quality must be regularly recorded.*
- ***Site Security Audit Logs:*** *Reports should include access control, lighting, security staff presence, and surveillance activities.*

- ***Equipment Safety Usage Logs:*** *Records must document usage and safety checks related to heavy machinery/ equipment.*

c) *Retention Period*

- *Each safety record must be retained for a minimum of 5 years or as per applicable national standards (where available and applicable). Finalization must be done by an authorized LGED engineer (not below the rank of Executive Engineer).*
- *Records must remain accessible for 12 months after the completion of the project/contract to facilitate further analysis.*

d) *Record Format and Media*

- ***Manual Registers:*** *Paper-based records stored securely at the site office, if necessary.*
- ***Digital Systems:*** *Password-protected and regularly backed-up software-based storage.*
- ***Language Selection:*** *Records should be maintained in both Bengali and English, as appropriate to the project/contract context.*

e) *Frequency of Updates*

- ***Monthly:*** *PPE, fire safety, ventilation, and health-related records*
- ***Annually:*** *Training and environmental assessment records*
- ***Within 24 hours of the incident:*** *Incident/accident reports*

Here is the translated section in English, precisely aligned with your formatting and tone:

f) *Responsibility and Authorization*

- *Responsibility for record preservation shall lie with the official/ employee/safety officer/supervisor (Sub-Assistant Engineer) implementing the project/contract-related work.*
- *Final approval shall be granted by an authorized LGED Engineer (not below the rank of Executive Engineer).*

g) *Data Confidentiality and Usability*

- *Sensitive records must have restricted access and maintain confidentiality.*
- *Records must be kept in an analyzable format to assist future decision-making.*
- *Every record should include reliable signatures/digital authentication, time/date, and associated personnel designation.*

h) *Audit and Compliance Readiness*

- *Records must be audit-ready at regular intervals.*
- *Safety audit reports must be able to be prepared based on the records.*
- *Corrective actions and work plans must be included to ensure completeness of the record.*

i) *Worker Access and Inclusion*

- *Essential records such as training, PPE, and health-related information should be accessible to workers.*
- *During training or supervisory sessions, workers may be allowed to review and update their personal information.*

j) *Risk Analysis and Data Visualization*

- *Key risk trends may be identified from records and stored as visual charts/graphs.*
- *Such analysis must be effective so that safety planning can be updated and clearly implemented.*

k) *Risk Assessment and Preventive Planning*

- *Risk assessment reports must be preserved for each activity, with analyses of potential hazards, likelihood, and impact.*
- *Records must contain details of preventive measures taken for risk control—e.g., PPE use, safe work practices, or alternative material selection.*
- *Job Safety Analysis (JSA) and Task Risk Assessment (TRA) records must be regularly updated.*

l) *Worker Health Monitoring Records*

- *Records must include health checkups, medical fitness certificates, and workplace health observations for workers/employees.*
- *Additional health screening reports should be preserved for workers involved in high-risk tasks.*
- *Health assessment records should be updated annually and include expert opinions where needed.*

m) *Safety Equipment Maintenance Records*

- *Records must include maintenance and functional testing of extinguishers, alarms, gas detectors, fans, heaters, etc.*
- *Each record should include inspection dates, observation results, and actions taken.*
- *Maintenance records should be updated monthly.*

n) *Site Access and Authorization Records*

- *Records must capture entry time, purpose, and authorization for workers, contractors, inspectors, and visitors.*
- *Safety agreements, induction forms, and site entry approval documents must be included.*
- *These records will support safety analysis and prevention of unauthorized access.*

o) *Environmental Impact and Control Records*

- *Records must include data on smoke, noise, temperature, air quality, and waste management.*
- *Environmentally friendly measures—e.g., use of recyclable materials, energy-efficient equipment—should be documented.*
- *Analysis of environmental records can support the development of site sustainability plans.*
- *Records must be regularly updated.*

p) *Safety Register Management*

- *The safety register is an integrated record book/database for consolidated safety documentation.*
- *Each register will have chapter-based tabs/folders—e.g., PPE, training, fire safety, health, incidents, equipment.*
- *Every entry will include date, record officer/inspector's name, and signature/authentication.*

- *The register must be regularly updated, with logs maintained for each change/addition.*
- *A designated person shall be responsible for secure and quality-controlled preservation of the register.*
- *The register must be maintained within an authorized access system to uphold confidentiality and analytical readiness.*
- *Included Registers Shall Be:*
    1. **PPE Register:** Information regarding distribution of personal protective equipment among workers
    2. **Training Register:** Detailed records of worker participation in safety/skill training programs
    3. **Incident/Near Miss Register:** All accidents, near misses, and related analysis
    4. **First Aid/Health Register:** Records of medical assistance, illness reports, and health-related entries
    5. **Fire Safety Register:** Records of fire drill, equipment testing, and maintenance
    6. **Equipment Safety Register:** Inspection, maintenance, and safety test reports of equipment
    7. **Waste Management Register:** Tracking and disposal of waste and hazardous materials
    8. **Worker Complaint/Suggestion Register:** Worker feedback, safety-related complaints, and responses
- Each register must be updated regularly in the prescribed format, including the correct date, signature, and responsible personnel.
- A designated custodian shall ensure register preservation and controlled access for data protection.

1. Personal Protective Equipment (PPE) Register

a) Purpose of PPE Register

- ***Safety Assurance:*** *To document proof of correct PPE supply and usage according to each worker's job nature*
- ***Legal Compliance:*** *Ensure adherence to the Bangladesh Labor Act, ISO, and relevant national/international safety standards*
- ***Support for Review:*** *Collect analyzable data on PPE distribution, quality, and maintenance*
- ***Site Inspection Readiness:*** *Ensure presentable records during audits, inspections, or regulatory evaluations*
- ***Worker Accountability:*** *Worker confirmation through signature for PPE receipt, proper use, and responsibility*

b) Usage Guidelines

- *During PPE distribution, record each worker's ID, name, date, and item supplied;*
- *Collect the worker's signature/digital authentication upon PPE receipt;*
- *Inspector's observations on PPE quality, quantity, and usability must be included;*

- *Each entry must be preserved in the prescribed format at the site office/specific department;*
- *Monthly review of the register should inform PPE planning and risk assessment.*

c) Additional Recommendations

- *Monthly/quarterly refresh of the PPE Register helps identify management gaps*
- *Digital register with QR codes or RFID tracking improves implementation*
- *Integration with training records may support compliance linkage*

d) Sample Filled PPE Register

Register- 8-1: Sample Filled Personal Protective Equipment (PPE) Register

(Construction Site/Worksite: ----------, Date: ------July, 2025)

Date	Worker ID	Name	Equipment Items	Quantity	Receipt Signature	Inspector Comments
26.07.25	LAB–108	Md. Ariful Islam	Helmet, Safety Gloves, Hi-Vis Jacket	1x3	Md. Arif	PPE inspection complete, quality is appropriate
26.07.2025	LAB–109	Nasrin Akhter	Safety Boots, Dust Mask	1x2	Nasrin	Mask acceptable; boots too short—needs replacement
26.07.2025	LAB–110	Rafiqul Hossain	Helmet, Safety Gloves	1x2	Rafiqul	Gloves to be rechecked for quality in next inspection

Explanation:

- **Date:** PPE distribution date
- **ID/Name:** Worker identification details
- **Items:** Supplied protective equipment
- **Quantity:** Number of items issued
- **Signature:** Worker signature for receipt confirmation
- **Comment:** Inspector/Supervisor's observations

2. Training Register

a) Purpose of Training Register

- ***Evidence of Skill and Awareness Development:*** *Maintain records of which worker received which training, in a data-driven manner;*
- ***Legal Inquiry and Audit Presentation:*** *Serve as reference documentation during regulatory inspections or audits;*
- ***Part of Risk Management:*** *Ensure safety training for workers engaged in high-risk tasks;*
- ***Basis for Refresher Training Planning:*** *Help identify workers in need of refresher training or whose certifications have expired;*

- ***Team-Based Training Progress Evaluation:*** *Assist in assessing site-wide/project-wide training coverage under contract scope.*

b) *Usage Guidelines*

- *Record training date, venue, trainer's name, and specific module details;*
- *Collect names, IDs, and signatures of participating workers;*
- *Clearly list training types separately (e.g., General Safety and Health Equipment: SHE, Fire Safety, Electrical Safety, Height-Work);*
- *Include evaluation/test results of trained workers where applicable;*
- *Register must be preserved under the Safety and Health Equipment (SHE) section and updated/ reviewed monthly.*

c) *Additional Recommendations*

- ***Digital Register Integration:*** *Use QR-scanning systems for instant verification of worker training status;*
- ***Linked Compliance Matrix:*** *Integrate PPE Register with Training Register to strengthen competency evaluation;*
- ***Bilingual Format (EN-BN):*** *Keeping the register in both English and Bengali facilitates alignment at both international and local levels;*
- ***Retraining Alert System:*** *An alert system for expired training can enhance effectiveness.*

d) *Sample Training Register*

Register- 8-2: Sample Filled Training Register

(Construction Site/Worksite: ----------, Date: ------July, 2025)

Date	Training Title	Trainer	Duration	Participants	Signatures	Core Topics	Comments / Observations
28.07.25	Scaffold Safety & Fall Prevention	Engineer Md. Saiful Islam (Build Safe BD)	10:00–12:00	1) LAB–201: Md. Delowar Hossain 2) LAB–202: Roksana Parvin 3) LAB–203: Md. Alamgir Hossain	✅ ✅ ✅	- Scaffold erection guidelines - Fall protection PPE - Emergency response	- All workers actively engaged in Q&A - Delowar received certificate - Roksana's PPE practice was weak
28.07.25	Electrical Hazard Awareness	Md. Iqbal Hossain (Safety Ways)	12:15–1:30	1) LAB–204: Rafiqul Islam 2) LAB–205: Meherun Nahar	✅ ✅	- Live wire risk handling - Lockout/Tagout steps - Voltage safety limits	- Rafiqul scored 85% - Meherun raised critical questions; trainer appreciated it

3. Near-Miss and Incident Register

a) *Purpose of the Near-Miss & Incident Register*

- ***Identification and Mitigation of Safety Risks:*** *Detect issues within a defined timeframe and implement preventive measures;*

- ***Legal Recordkeeping:*** *Serve as case history during audits, inspections, and internal investigations;*
- ***Analysis and Trend Identification:*** *Enable assessment of incident types and locations with higher occurrences;*
- ***Awareness and Training Planning:*** *Recommend specialized risk or refresher training for workers based on incident types;*
- ***Accountability and Transparency:*** *Help both management and workers stay informed about Health and Safety Equipment (HSE) based on documented data.*

b) Usage Guidelines

- *Record the exact time, date, location, and description of the incident/near-miss;*
- *Include name, ID, and signature of involved worker(s) and/or witnesses;*
- *Document Root Cause Analysis (RCA) or Immediate Actions taken regarding the event;*
- *Specify the incident category (e.g., fall, electrical, ergonomic, fire);*
- *Include Corrective/Preventive Actions (CAPA) and their implementation status;*
- *Preserve the register within the Health and Safety Equipment (HSE) section and align with the Risk Register and Training Matrix through monthly review.*

c) Additional Recommendations

- ***Tracking ID System:*** *Assign unique IDs for efficient tracking and trend analysis;*
- ***Data Visualization Dashboard:*** *Automate updates on incident trends and CAPA status.*
- ***Integration with PPE & Training Registers:*** *Cross-reference incident data with related PPE usage and training records;*
- ***Bilingual Format (English–Bangla):*** *Maintaining the register in both languages supports balance between local relevance and international reporting standards.*

d) Example of a Completed Near-Miss/Incident Register

Register- 8-3: Sample Completed Near-Miss/Incident Register

(Construction Site/Worksite: ----------, Date: -----July, 2025)

Sl.	Date	Time	Type of Incident/ Near-Miss	Location	Description	Involved Personnel	Immediate Action	Follow-Up Measures	Reporter
1	25-07-2025	09:15 am	Near-Miss: Slip/Trip	Stair Wall	A worker lost body balance and was about to fall, but was saved by	Robiul	PPE check, site inspection	Reinforce railing, anti-slip strip	Safety Officer

Sl.	Date	Time	Type of Incident/ Near-Miss	Location	Description	Involved Personnel	Immediate Action	Follow-Up Measures	Reporter
					grabbing a nearby railing.				
2	26-07-2025	03:30 pm	Incident: Dropped Material	Beam Area	A plastic pipe fell from above; no injuries occurred as no one was standing below.	Not Applicable	Area cleared, warning tape placed	Redesign upper shelving	Supervisor
3	27-07-2025	11:45 am	Near-Miss: Electric Spark	Worker Shed No. 1	Due to water accumulation, an electric spark was observed; the connection was promptly cut off.	Montu	Circuit breaker shut down	Improve drainage system	Electrician

4. Purpose and Usage Guidelines of First Aid/Health Register

a) Purpose of First Aid/Health Register

- ***Ensuring Medical Service Delivery:*** *Accurately document all first aid treatments provided to injured or ill workers/employees;*
- ***Legal Compliance and Audit Preparedness:*** *Maintain treatment records in line with the Bangladesh Labor Act, ISO, and relevant national/international standards;*
- ***Risk Identification and Pattern Analysis:*** *Recognize frequent types of illness or injury and plan preventive actions accordingly;*
- ***Support for Training and PPE Selection:*** *Use injury/illness data to recommend refresher training and appropriate PPE selection;*
- ***Improvement of Emergency Response Management:*** *Plan timely medical access and follow-up procedures using data-driven insights.*

b) Usage Guidelines

- *Accurately record date, time, and location of the incident;*
- *Mention name, ID, department of the patient/injured worker/employee and the nature of the injury or illness;*
- *Include detailed information about treatment provided (e.g., type of first aid, medication, bandaging);*
- *Add the name and signature of the treating personnel or medical representative;*
- *Record root cause of the incident, any prior medical history (if applicable), and follow-up recommendations;*

- *Preserve the register within the Health and Safety section and consider incorporating it into the Risk Matrix through monthly reviews.*

c) Additional Recommendations

- *Digital First Aid Logbook: QR-scan or RFID-based tracking systems can help verify injury trends in real-time*
- *Integration with Incident Register: Linking this register with incident data strengthens root cause analysis*
- *Bilingual Format (English–Bangla): Maintaining both English and Bengali versions ensures balance in international reporting and local relevance—accessible to workers and external inspectors alike*
- *Health Surveillance Compatibility: Can be integrated with long-term illness tracking and general health-check registers*

d) Sample Completed First Aid/Health Register

Register- 8-4: Sample Completed First Aid/Health Register

Construction Site/Work Area/Worker Shelter: ----------Date: ------ July, 2025

Serial No.	Date	Time	Worker Name	Designation	Nature of Incident	Description of Treatment	First Aid Provider	Follow-Up Action
1	24-07-2025	08:40 AM	Jalil Hossain	Mason	Hand cut (minor)	Bandaging, antiseptic, rest	Rina: Safety Officer	Ensure glove usage
2	25-07-2025	02:15 PM	Majeda Begum	Worker – Helper	Dizziness, weakness	Hydration, rest, blood pressure check	Tanvir: First Aid Staff	Referred for medical check-up
3	26-07-2025	04:00 PM	Shov Rahman	Electrician	Burn on foot (minor)	Cooling gel, bandaging	Monir: Site Supervisor	Reorganize electrical safety training

5. Purpose and Usage Guidelines of the Fire Safety Register

a) Purpose of the Fire Safety Register

- *Maintain records on the functionality, maintenance, and condition of fire-fighting equipment such as extinguishers, hydrants, alarm systems, etc.;*
- *Store data on regular fire drills, training sessions, and simulation activities;*
- *Prepare appropriate documentation to ensure compliance with applicable national/ international standards;*
- *Track fire-related incidents to analyze recurrence and root causes;*
- *Gather supportive information to improve fire safety planning and risk management.*

b) Usage Guidelines

- *Record the location, type, model, quantity, inspection date, and refill date of each fire safety device;*

- *Attach performance observation reports related to fire extinguishers and other equipment;*
- *Include the date of fire training/drills, trainer's name, participating workers/employees, attendance, and evaluation results;*
- *In the event of an incident, document date, time, location, type of damage, and initial response in the register;*
- *All information must be stored in the prescribed format.*

c) *Additional Recommendations*

- *Assign a unique tracking number to each record to facilitate trend analysis;*
- *Incorporate alert systems in the digital register to notify inspection deadlines, refill needs, or expired training status;*
- *Integrate fire safety records with the PPE and Training Registers to enhance decision-making for management;*
- *Maintaining bilingual (Bangla–English) registers ensures optimal usability for both local workers and international inspectors.*

d) *Example of a Filled Fire Safety Register*

Register- 8-5: Example of a Filled Fire Safety Register

(Construction Worksite/Labor Shed: ----------, Date: ------July, 2025)

SL No.	Date	Time	Event/ Activity	Location	Description	Action/Resolution	Responsible Person
1	22-07-2025	10:30 am	Fire Drill Activity	Stairwell of 3rd Floor	Workers practiced the designated escape route; all evacuated within 4 mins	Training successful; next session scheduled in 15 days	Safety Officer
2	23-07-2025	03:10 pm	Fire Extinguisher Inspection	Basement Lobby	Low pressure found in CO_2 extinguisher	Refill order placed	Store Keeper
3	26-07-2025	01:45 pm	Hazard Report	Kitchen	Smoke due to electrical short in machine; no fire occurred	Connection cut off; requested electrical inspection	Supervisor

6. Purpose and Usage Guidelines of the Equipment Safety Register

a) *Purpose of the Equipment Register*

- *Record the safety verification and maintenance of all tools, machinery, and equipment used in the workplace;*
- *Support data-driven decision-making to prevent safety failures and unexpected incidents;*
- *Provide valid and well-organized documents during audits and evaluations by regulatory authorities;*

- *Aid in planning for Preventive Maintenance and Corrective Actions;*
- *Ensure instructions or training related to safe equipment usage for workers/employees.*

b) Usage Guidelines

- *Log each equipment's name, model, serial number, location, installation date, and inspection schedule;*
- *Clearly state functional status such as Operational, Under Maintenance, or Out of Service;*
- *Attach reports related to routine inspections, maintenance, and unexpected issues;*
- *Preserve the assigned engineer or inspector's name, comments, recommendations, and signature;*
- *Identify equipment-related risks, document Risk Category, and potential Corrective Actions;*
- *Review the register monthly and align it with the Risk Register.*

c) Additional Recommendations

- *Integrate QR code or RFID systems to enable real-time verification of equipment status*
- *Link this register with PPE, training, and incident registers to enhance overall management efficacy*
- *Keeping the register bilingual (Bangla–English) ensures usability for both local workers and international/donor agency inspectors*

d) Example of a Filled Equipment Safety Register

Register- 8-6 : Example of a Filled Equipment Safety Register

(Construction Site/Worksite: ----------, Date: ------ July, 2025)

Sl. No.	Equipment Name	Model/ Serial No.	Location	Current Status	Last Inspection	Issue/ Discrepancy	Action Taken	Next Inspection	Responsible Person
1	Tower Crane	TC-BTX-1342	Zone-B, Site-1	Operational	15-07-2025	None	Lubrication completed	15-08-2025	Maintenance Manager
2	Concrete Mixer	CM-PRO-776	Yard Section	Temporarily Out of Service	20-07-2025	Motor overheating issue	Motor replacement in process	05-08-2025	Site Supervisor
3	Welding Machine	WM-ALT-332	Basement Zone	Normal	18-07-2025	Missing warning label	New label affixed	18-08-2025	Safety Officer

7. Waste Management Register: Purpose and Usage Guidelines

a) Purpose of Waste Register

- *Recording the source, quantity, classification, and disposal details of waste generated at the workplace;*
- *Facilitating environmentally sound disposal and recycling of reusable materials;*

- *Presenting records to environmental and safety agencies to ensure legal compliance;*
- *Enabling site monitoring for risk assessment and improvement of waste management;*
- *Raising awareness among workers and officials and creating a basis for safety and environmental education programs.*

b) Usage Guidelines

- *Waste types (e.g., organic, chemical, electronic, hazardous, recyclable) must be recorded separately;*
- *Origin site, date of generation, quantity, and collector's name should be included;*
- *Disposal methods should be specified: incineration, landfill, recycling, hazardous waste treatment, etc.;*
- *Name and license number of the relevant authorized agency/contractor should be attached;*
- *The register must be reviewed monthly and incorporated into Waste Audit, Risk Register, and Standards Compliance Reports.*

c) Additional Recommendations

- *Using Waste Segregation Color Codes can improve monitoring of waste sources;*
- *Adding QR Code or Barcoding in a digital register can ease tracking of collection, transportation, and disposal;*
- *Integration with PPE and Training Register increases accountability in waste handling;*
- *Using bilingual registers (Bangla-English) fulfills inspection needs of local workers and international/donor agencies (where applicable);*
- *Linking with Environmental Incident Register makes trend analysis of nature-based risks easier.*

d) Sample Filled-in Waste Management Register

Register- 8-7: Sample Filled-in Waste Management Register

(Construction Site/Worksite: ----------, Date: ------ July, 2025)

Serial No.	Date	Type of Waste	Origin Site	Quantity (kg/L/units)	Disposal Method	Transport Agency	Responsible Person
1	20-07-2025	Construction Debris	Foundation Trench Excavation	420 kg	Landfill (DNCC Zone-2)	Clean Waste Services	Site Engineer
2	21-07-2025	Biomedical Waste	First Aid Unit	15 kg	Incineration	Medi Burn Ltd.	Safety Officer
3	22-07-2025	Used Electronic Components	Electrical Room	8 units	Recycling	E-Tech Recycling	Electrician
4	23-07-2025	General Garbage	Workers' Shed	95 kg	Municipal Pickup	DNCC Trucks	Storekeeper

8. Purpose and Usage Guidelines of Worker/Laborer Complaint & Suggestion Register

a) *Purpose of Worker/Laborer Complaint & Suggestion Register*

- *To systematically collect information related to workers' grievances and ensure appropriate resolutions;*
- *To record opinions and suggestions from workers on welfare measures such as housing, food, medical care, and safety;*
- *To foster transparency and mutual trust between employer and workers;*
- *To prepare relevant documentation in support of international/national labor welfare certifications;*
- *To promote psychological safety and a compassionate work environment.*

b) *Usage Guidelines*

- *Each complaint or suggestion must be entered in the register with date, time, worker's name/ID (optional), and subject matter;*
- *It must include verification, categorization, and follow-up remarks by the complaint receiver or designated representative;*
- *Details of actions taken for resolution, the responsible person, and estimated resolution time must be recorded;*
- *Based on workers' requests, certain complaints may be categorized as confidential;*
- *The register should be reviewed monthly/ quarterly and presented at the Welfare Committee (if available) or in Management Meetings.*

c) *Additional Recommendations*

- *Including a tracking number and status notification system in a digital register enables workers to monitor complaint progress;*
- *Linking with PPE, Health, and Training Registers can assist in analyzing root causes of issues;*
- *A bilingual register (Bangla-English) ensures effective communication between workers and management authority;*
- *Utilizing a Suggestion Box can enhance the register by inviting constructive ideas.*

d) *Sample Completed Worker Complaint/ Suggestion Register*

Register- 8-8: Sample Completed Worker Complaint/ Suggestion Register

(Construction Site/Worksite/Worker Shed: ----------, Date: ------ July, 2025)

Sl No.	Date	Worker Name	Designation	Type of Complaint/ Suggestion	Description	Action Taken	Decision/ Status	Responsible Person
1	20-07-2025	Rubel Mia	Welder	Complaint: Water Shortage	Water is supplied only once daily to the labor shed; It's causing problems during hot days.	Increased refill frequency of water tank	Resolved	Safety Officer
2	22-07-2025	Salma Akhter	Cleaner	Suggestion: Request for health posters	Posters regarding first-aid rules and healthy living should be provided	Concerned staff/ workers/team are preparing posters	Under Implementation	Labor Welfare Supervisor
3	24-07-2025	Shahin Alam	Helper	Complaint: Insufficient lighting	The labor shed lacks sufficient lighting during night shifts	New LED lights are being installed	In Progress	Site Engineer

8.16 Gas & Electric Welding & Cutting Operations

Gas and electric welding and cutting operations are essential processes at construction worksites, enabling the fabrication, joining, and shaping of materials critical to structural and functional integrity. However, these activities are accompanied by significant risks to health, safety, and the environment. Potential hazards, such as exposure to toxic fumes, electrical shocks, fire outbreaks, and injuries from flying debris, underline the need for stringent safety measures.

Occupational Health and Safety (OHS) provisions are designed to address these risks and establish a safe working environment that minimizes accidents, protects worker health, and ensures compliance with relevant safety regulations. These provisions provide detailed guidelines on hazard identification, risk mitigation, and proper handling of equipment and materials to promote sustainable, efficient, and safe operations on-site. By adhering to these standards, construction sites can safeguard workers, optimize processes, and achieve regulatory compliance while fostering a culture of safety.

8.16.1 Examples of Hazards from Gas Welding, Electrical Welding and Cutting Operations

8.16.1.1 Hazards From Gas Welding

- ***Gas Explosion:*** *Improper mixing of gases or contamination of oxygen supply can lead to explosions.*
- ***Burns:*** *High temperatures from the flame can cause severe burns if proper precautions are not taken.*
- ***Inhalation Hazards:*** *Fumes and gases, such as acetylene and oxygen, can cause respiratory issues if inhaled.*
- ***Eye Damage:*** *Intense light and potential splatter can harm the eyes without proper protective gear.*

8.16.1.2 Hazards from Electric Welding

- ***Electric Shock:*** *Contact with live electrical circuits during arc welding can result in severe or fatal shocks.*
- ***Radiation Exposure:*** *UV and IR radiation from the welding arc can cause skin burns and eye injuries.*
- ***Toxic Fumes:*** *Welding produces harmful fumes and gases, such as ozone and nitrogen oxides, which can lead to respiratory problems.*
- ***Fire and Explosions:*** *Sparks from the welding process can ignite flammable materials nearby.*

8.16.1.3 Hazards from Cutting Operations

- ***Flying Debris:*** *Small pieces of material can be ejected at high speeds, posing risks to workers' eyes and skin.*
- ***Sharp Tools:*** *Contact with sharp blades or cutting edges can cause lacerations or severe injuries.*
- ***Dust and Fumes:*** *Cutting certain materials, such as fiberglass or plastics, can release harmful dust and fumes.*
- ***Noise Pollution:*** *High noise levels from cutting tools can lead to hearing loss over time.*

8.16.2 Example of Mitigation Measures

8.16.2.1 Gas Welding

- ***Hazard Example:*** *Gas leaks can lead to explosions or fires during operation.*
- ***Mitigation Example:*** *Install flashback arrestors and conduct daily leak inspections of hoses and regulators.*

8.16.2.2 Electric Welding

- ***Hazard Example:*** *Exposure to UV radiation from the welding arc can cause severe eye injuries (arc flash).*
- ***Mitigation Example:*** *Use auto-darkening helmets and wear protective flame-resistant clothing.*

8.16.2.3 Cutting Operations

- ***Hazard Example:*** *Sparks and flying debris during cutting can cause injuries and start fires.*
- ***Mitigation Example:*** *Use spark-resistant barriers, fireproof containers, and safety goggles.*

8.16.3 Negative Impacts of Non-Compliance with OHS Provisions for Gas Welding, Electric Welding and Cutting Operations at Construction Worksites

8.16.3.1 Negative Impacts of Gas Welding

a) Health Impacts

- **Toxic Gases:** Inhalation of carbon monoxide and nitrogen oxides can lead to respiratory illnesses.
- **Burns:** Exposure to high-temperature flames may result in severe burns and eye injuries.

b) Operational Impacts

- **Gas Leaks:** Gas leaks may cause explosions, disrupting work and endangering workers.
- **Ventilation Issues:** Poor ventilation may create discomfort and unsafe working conditions.

c) Legal and Financial Impacts

- **Non-Compliance:** Failure to follow safety standards may result in fines or penalties.
- **Increased Costs:** Medical treatments and remediation for fire-related damages increase overall expenses.

8.16.3.2 Negative Impacts of Electric Welding

a) Health Impacts

- **Radiation Exposure:** UV and IR radiation can cause arc flash injuries and burns.
- **Toxic Fumes:** Welding fumes, such as ozone, harm respiratory systems.

b) Operational Impacts

- **Electric Shocks:** Faulty equipment or grounding may result in life-threatening injuries.
- **Sparks and Heat:** Sparks and heat can damage materials, delaying operations.

c) Legal and Financial Impacts

- **Workplace Injuries:** Unsafe practices may lead to penalties or lawsuits.
- **Increased Insurance Costs:** Compensation claims result in higher premiums.

8.16.3.3 Negative Impacts of Cutting Operations

a) Health Impacts

- **Flying Debris:** Small projectiles may cause eye injuries, cuts, or burns.
- **Dust and Fumes:** Cutting certain materials releases harmful particulates, affecting respiratory health.

b) Operational Impacts

- **Fire Hazards:** Sparks may ignite nearby materials, causing delays.
- **Equipment Wear:** Constant use causes frequent maintenance needs, increasing downtime.

c) Legal and Financial Impacts

- **Liability Claims:** Accidents caused by inadequate safeguards may lead to fines.
- **Environmental Non-Compliance:** Failing to manage dust and fumes properly can incur penalties.

8.16.3.4 Positive Impacts of OHS Compliance for Gas Welding

a) Health Impacts

- **Worker Safety:** Proper ventilation systems and PPE usage reduce exposure to toxic gases and flames.

b) Operational Impacts

- **Portability:** Portable equipment allows flexibility in remote locations.
- **Cost-Effectiveness:** Affordable setup supports small-scale operations.

c) Legal and Financial Impacts

- **Regulatory Compliance:** Adherence to safety regulations minimizes legal liabilities.
- **Enhanced Reputation:** Safe practices attract clients and foster a positive image.

8.16.3.5 Positive Impacts of OHS Compliance for Electrical Welding

a) Health Impacts

- **Safety Gear:** Helmets and protective clothing safeguard workers from radiation and burns.

b) Operational Impacts

- **Precision:** High-quality joints ensure reliability in construction.
- **Efficiency:** High-speed welding enhances productivity and reduces material wastage.

c) Legal and Financial Impacts

- **Compliance:** Meeting safety standards avoids penalties.
- **Cost Savings:** Optimized processes reduce expenses through fewer errors and delays.

8.16.3.6 Positive Impacts of OHS Compliance for Cutting Operations

a) **Health Impacts**

- **Safety Measures:** Barriers and PPE minimize exposure to harmful debris and fumes.

b) **Operational Impacts**

- **Advanced Techniques:** Technologies like laser cutting ensure precision and waste reduction.
- **Material Versatility:** Cutting tools handle a variety of materials efficiently.

c) **Legal and Financial Impacts**

- **Regulatory Compliance:** Adherence to safety standards prevents legal issues.
- **Cost Efficiency:** Reduced material wastage lowers project expenses.

8.16.4 General Provisions for Gas and Electric Welding and Cutting Operations

Gas and electric welding and cutting operations are critical processes at construction worksites, but they involve significant safety risks, including fire hazards, toxic fumes, electrical shocks, and mechanical injuries. The general provisions are established to mitigate these risks and ensure safe practices, focusing on worker safety, proper equipment handling, and compliance with regulatory standards. By implementing the following provisions, construction sites can minimize hazards, enhance operational efficiency, and promote a culture of safety and accountability:

8.16.4.1 When Provisions for Welding and Cutting Operations Are Applicable

- ***Preparation Phase:*** *During setup of welding and cutting equipment, including safety checks and workspace preparation.*
- ***Execution Phase:*** *While carrying out welding and cutting activities involving open flames, electric arcs, and heat-generating equipment.*
- ***Emergency Scenarios:*** *In case of fire outbreaks, gas leaks, or accidents involving welding and cutting operations.*
- ***Post-Operation Phase:*** *After completing welding tasks, ensuring proper disposal of waste materials and inspection of equipment for safety.*

8.16.4.2 Where Provisions for Welding and Cutting Operations Are Applicable

- ***Designated Work Zones:*** *Areas where welding and cutting tasks are performed, including workshops and field sites.*
- ***Hazardous Material Storage:*** *Spaces storing flammable gases, liquids, and welding consumables.*
- ***Ventilated Areas:*** *Zones requiring proper airflow to disperse toxic fumes generated during welding and cutting.*
- ***Worker Rest Areas:*** *Nearby zones where workers may require protective barriers against emissions or radiation.*

8.16.4.3 Mitigation Measures and Suitability

- ***Fire Prevention:*** *Use of fire-resistant blankets, barriers, and extinguishers to mitigate ignition risks.*
- ***Fume Extraction:*** *Installation of local exhaust ventilation systems or portable fume extractors for safe air quality.*

- ***Protective Gear:*** *Mandatory use of welding helmets, gloves, aprons, and safety boots by all workers.*
- ***Equipment Safety:*** *Regular maintenance of welding torches, cutting tools, and gas cylinders to prevent malfunction.*

8.16.4.4 Training and Awareness

- ***Safety Workshops:*** *Conduct hands-on training sessions for workers on safe handling of welding equipment.*
- ***Emergency Drills:*** *Regular fire and evacuation drills to prepare workers for unexpected incidents.*
- ***Health Awareness:*** *Educate workers about potential health impacts of exposure to welding fumes and UV radiation.*

8.16.4.5 Inspection and Maintenance

- ***Equipment Checks:*** *Routine inspections of all welding and cutting equipment to ensure they meet safety standards.*
- ***Fire Suppression Systems:*** *Regular testing and servicing of fire extinguishers and suppression systems at the worksite.*
- ***Infrastructure Maintenance:*** *Periodic checks on ventilation systems to ensure effective fume extraction.*

8.16.4.6 Distribution and Accessibility

- ***Equipment Access:*** *Ensure availability of safety equipment, such as masks and gloves, to all workers at all times.*
- ***Emergency Kits:*** *Place first-aid and fire response kits at strategic locations for quick access.*
- ***Signage:*** *Display clear and visible signs indicating high-risk areas and safety measures.*

8.16.4.7 Signage and Compliance

- ***Warning Signs:*** *Place signs like "Caution: Welding Zone" and "Wear Protective Gear" near work areas.*
- ***Compliance Monitoring:*** *Conduct regular audits to ensure adherence to safety protocols and regulations.*

8.16.4.8 Customization and Comfort

- ***Site-Specific Measures:*** *Adjust mitigation measures to suit the specific conditions and risks of the site.*
- ***Worker Comfort:*** *Provide ergonomic welding stations and heat-resistant clothing for worker safety and comfort.*

8.16.4.9 Testing and Onward Actions

- ***Air Quality Testing:*** *Perform regular assessments of air quality to detect harmful fumes and gases.*
- ***Equipment Functionality Testing:*** *Check welding and cutting equipment before each use.*
- ***Action Implementation:*** *Based on testing results, implement necessary corrective measures and provide feedback to contractors.*

8.16.5 Detailed OHS Standards/Specifications for Gas and Electric Welding and Cutting Operations

Gas and electric welding and cutting operations are integral to modern construction processes, contributing to the shaping, joining, and cutting of critical components. Despite their importance, these activities pose significant safety risks to workers, equipment, and the surrounding environment. The

combination of high heat, intense light, hazardous fumes, and flammable gases creates a complex hazard profile that requires stringent safety measures.

To ensure that these operations are carried out safely and efficiently, comprehensive Occupational Health and Safety (OHS) standards have been developed. These standards aim to prevent accidents, protect worker health, and mitigate environmental impacts. By adhering to the following specifications, construction sites can maintain regulatory compliance, reduce operational disruptions, and foster a culture of safety. The standards presented below provide clear, actionable measures with defined thresholds and values to guide safe practices across all phases of welding and cutting operations:

8.16.5.1 Standards/Specifications for Gas Welding

Gas welding involves the use of fuel gases and oxygen to produce a flame for joining materials. The following standards address safety, equipment handling, and operational practices:

a) **Securing Work Areas**

- Gas cylinders shall be stored upright and secured with non-combustible straps of at least **10 cm (4 inches)** in width.
- Flammable materials shall be kept at least **6 meters (20 feet)** away from gas welding zones.

b) **Handling Gas Cylinders**

- Oxygen and fuel gas cylinders shall be stored separately with a minimum distance of **6 meters (20 feet)** or by a fire-resistant wall with a fire rating of at least **30 minutes**.
- Gas cylinders shall be equipped with valve protection caps when not in use.
- Regulators and hoses shall be inspected **daily** for leaks or damage.

c) **Fire Safety**

- Flashback arrestors and check valves shall be installed on gas welding equipment to prevent flame backflow.
- Fire extinguishers rated for Class B and C fires with a minimum capacity of **4.5 kg (10 lbs)** shall be stationed within **10 meters (33 feet)** of gas welding work areas.

d) **Personal Protective Equipment (PPE)**

- *Goggles compliant with **ANSI Z87.1 standards (or equivalent national standards)**, with shade appropriate for gas welding, shall be worn.*
- *Flame-resistant gloves and clothing with a minimum ATPV of **8 cal/cm²** shall be provided to all workers.*

e) **Protective Measures**

Place of welding and cutting operations shall be enclosed by suitable stationary or portable screens to prohibit unauthorized trespassing. Specification of Protective Screen Screens shall be:

- Opaque;
- Strong enough to withstand rough usage of a material which will not readily be set on fire by sparks or hot metal;
- With minimum height of **2 m. (6.5 ft.)**;
- Preferably painted with light flat paint.

8.16.5.2 Standards/Specifications for Electric Welding

Electric welding uses electrical current to generate heat for joining materials. The following standards address its unique hazards, such as electrocution and arc radiation:

a) **Electrical Safety**

- Ground Fault Circuit Interrupters (GFCIs) rated for outdoor use and capable of handling at least **20 amperes** shall be installed.
- All electrical connections shall be insulated with materials rated for **1000 volts.**
- Welding machines shall be inspected weekly for proper grounding and circuit functionality.

b) **Arc Radiation Protection**

- Welding helmets with auto-darkening filters compliant with **ANSI Z87.1 standards (or equivalent national standards)**, rated for a minimum optical density of **OD 10**, shall be used.
- Skin protection, including flame-retardant clothing, shall cover all exposed areas to protect against UV and IR radiation.

c) **Ventilation**

- Local exhaust ventilation with airflow rates of **200 cubic feet per minute (cfm)** shall be installed to remove fumes and particulates from the welding zone.
- Enclosed work areas shall maintain oxygen levels of at least **19.5%**, monitored continuously.

d) **Fire Safety**

- Spark arrestors shall be installed on all electric welding torches.
- Fire blankets shall be placed below the welding area to collect sparks and prevent fires.

e) **Welding on Closed Containers**

Welding on closed containers filled with explosive/ flammable substance shall only be undertaken:

- After thoroughly cleaning the containers; and
- Being sure that those containers are completely free of combustible gases/vapors; OR
- The containers are filled with inert gas/water;

8.16.5.3 Standards/Specifications for Cutting Operations

Cutting operations, including both gas and plasma cutting, involve significant hazards due to sparks, fumes, and hot material. The following standards ensure safe and efficient cutting practices:

a) **Workspace Safety**

- *Cutting areas shall be free from combustible materials within a radius of **10 meters (33 feet)**.*
- *Non-slip mats with a coefficient of friction of at least **0.5** shall be used in wet conditions to prevent slips.*

b) **Fume Control**

- For plasma cutting, fume extraction systems with a minimum filtration efficiency of **99%** for particulates smaller than **0.3 microns** shall be used.
- Ventilation systems shall maintain airflow rates of **150 cfm** for each cutting torch in operation.

c) **Personal Protective Equipment (PPE)**

- Protective eyewear rated for cutting operations, compliant with **ANSI Z87.1 standards (or equivalent national standards)**, shall be worn at all times.
- Heat-resistant gloves with temperature resistance up to **600°C (1112°F)** shall be used to handle hot materials.

d) **Handling Hot Residues**

- Residues and debris from cutting operations shall be collected in fireproof containers with self-closing lids.
- Hot materials shall be allowed to cool in designated areas for at least **15 minutes** before disposal.

e) **Fire Safety**

- Cutting torches shall be equipped with backflow prevention devices to avoid gas mixing.
- Fire extinguishers rated for Class A, B, and C fires shall be placed within **5 meters (16 feet)** of the cutting zone.

f) **Allowances/non-allowance**

- *By no means welding or cutting operations on containers filled with explosives or flammable substance shall be allowed;*

8.16.5.4 Standards/Specifications for Gas and Electric Welding and Cutting Operations at Construction Worksites as per prevailing laws, acts, and rules in Bangladesh:

1. ***Fire and Explosion Prevention:*** *Welding or cutting operations near flammable materials, explosives, or gases shall be prohibited unless all fire hazards are eliminated.* ***(Bangladesh Fire Prevention and Extinguishing Act, 2003: Section-8)***
2. ***Personal Protective Equipment (PPE):*** *Workers engaged in welding and cutting operations shall be provided with appropriate PPE, including helmets, goggles, gloves, and flame-resistant clothing.* ***(Bangladesh Labor Act, 2006: Section-78)***
3. ***Ventilation Requirements:*** *Adequate ventilation systems shall be installed to prevent the accumulation of toxic fumes and gases in enclosed spaces.* ***(Environment Conservation Rules, 1997: Schedule-13)***
4. ***Electrical Safety:*** *All electrical welding equipment shall comply with safety standards, including proper grounding and insulation to prevent electric shocks.* ***(Electricity Act, 1910: Section-33)***
5. ***Confined Space Operations:*** *Welding and cutting in confined spaces shall require local exhaust ventilation or respiratory protective equipment to ensure worker safety.* ***(Bangladesh Labour Act, 2006: Section-79)***
6. ***Firefighting Equipment:*** *Portable fire extinguishers and fire blankets shall be available at all welding and cutting sites to address potential fire hazards.* ***(Bangladesh Fire Prevention and Extinguishing Act, 2003: Section-9)***
7. ***Hazardous Material Handling:*** *Storage and handling of gases and flammable materials shall comply with safety guidelines to prevent leaks and explosions.* ***(Explosives Act, 1884: Section-4)***
8. ***Training and Authorization:*** *Workers performing welding and cutting operations shall be trained and authorized to handle equipment safely.* ***(Bangladesh Labor Act, 2006: Section-78)***
9. ***Environmental Protection:*** *Emissions from welding and cutting operations shall be controlled to prevent air pollution and comply with*

environmental standards. ***(Environment Conservation Act, 1995: Clause-7)***

10. ***Inspection and Maintenance:*** *Regular inspection and maintenance of welding and cutting equipment shall be conducted to ensure compliance with safety standards.* ***(Bangladesh Labor Act, 2006: Section-80)***

8.17 Key Obligations

Key obligations to ensure compliance of all the Provisions and Standards/ Specifications for indicators illustrated above are as follows:

8.17.1 LGED Authority Concerned

1) *The obligation of LGED Authority concerned shall be as mentioned in the OHS Policy of LGED in complying with the OHS provisions at the worksite/ workplaces* ***(Provisions of Sub-section: 6.1,6.2,6.3.6.4 & 6.9, Section:6).***

2) *In case of clauses that refers international standards or equivalent national standards/specifications:*

   - ***International standards shall be complied with if equivalent national standards are not available;***
   - ***National (or international) standards will be complied with if available and applicable;***
   - ***The issue of national (or international) standards shall be settled/ finalized by the authorized Engineer of LGED (not less than Executive Engineer) for the specific case/contract concerned.***

8.17.2 Contractor Concerned

The obligation of Contractor concerned shall be as mentioned in the OHS Policy of LGED in complying with the OHS provisions at the worksite/workplaces **(Provisions of Sub-section: 6.6 Section:6)**

8.17.3 Laborer Concerned

The obligation of laborers concerned shall be as mentioned in the OHS Policy of LGED in complying with the OHS provisions at the worksite/workplaces **(Provisions of Sub-section: 6.8, Section:6)**

9. ENVIRONMENTAL ISSUES/INDICATORS AFFECTING OHS (AS PER PREVAILING/NON-PREVAILING LGED PRACTICE)

9.1 Wildlife and Plant Safety at Construction Worksites

Ensuring the safety of wildlife and plants at construction sites is crucial to protect biodiversity, prevent habitat destruction, and comply with environmental regulations. Proper management practices help minimize the impact on local ecosystems and promote sustainable construction.

9.1.1 Examples of Wildlife and Plant Hazards at Construction Sites

- ***Habitat Destruction:*** *Clearing of land and vegetation can lead to the loss of habitats for local wildlife and plants.*
- ***Disturbance:*** *Construction noise, vibrations, and human activity can disturb wildlife, leading to stress and displacement.*
- ***Pollution:*** *Contamination from chemicals, oil, and construction debris can harm wildlife and plant life.*
- ***Invasive Species:*** *Introduction of invasive species through construction activities can disrupt local ecosystems and outcompete native species.*
- ***Physical Harm:*** *Direct harm to wildlife and plants from machinery, vehicles, and construction materials.*

9.1.2 Examples of Wildlife and Plant Safety Measures

- ***Environmental Impact Assessments:*** *Conducting environmental impact assessments (EIAs) to identify potential effects on wildlife and plants and develop mitigation strategies.*
- ***Buffer Zones:*** *Establishing buffer zones around sensitive areas, such as wetlands, rivers, and wildlife habitats, to minimize disturbance.*
- ***Habitat Restoration:*** *Implementing habitat restoration and reforestation programs to compensate for habitat loss and support biodiversity.*
- ***Erosion Control:*** *Using erosion control measures, such as silt fences and vegetation cover, to prevent soil erosion and protect plant life.*
- ***Pollution Prevention:*** *Implementing pollution prevention measures, such as proper waste disposal, spill response plans, and use of non-toxic materials, to protect wildlife and plants.*
- ***Wildlife Relocation:*** *Relocating wildlife from construction areas to safe habitats before starting work.*
- ***Invasive Species Management:*** *Monitoring and controlling invasive species to prevent them from spreading and affecting local ecosystems.*

9.1.3 Negative Impacts of Poor Wildlife and Plant Safety Management

9.1.3.1 Environmental Impacts

- ***Biodiversity Loss:*** *Poor management can lead to the loss of wildlife and plant species, reducing biodiversity and ecosystem health.*
- ***Habitat Degradation:*** *Destruction of habitats can disrupt ecosystems and negatively affect wildlife populations.*

- ***Water Pollution:*** *Contamination from construction activities can pollute water bodies, harming aquatic life and plant species.*

9.1.3.2 Health and Safety Impacts

- ***Human-Wildlife Conflicts:*** *Displacement of wildlife can lead to increased encounters between humans and wildlife, posing risks to both.*
- ***Spread of Invasive Species:*** *Poor management can facilitate the spread of invasive species, affecting native plants and wildlife.*

9.1.3.3 Operational Impacts

- ***Work Disruptions:*** *Environmental damage can lead to work stoppages and delays, affecting project timelines.*
- ***Higher Remediation Costs:*** *Poor wildlife and plant safety management can lead to costly remediation efforts to address environmental damage.*

9.1.3.4 Legal and Financial Impacts

- ***Non-Compliance Penalties:*** *Failure to implement proper wildlife and plant safety measures can result in fines and penalties from environmental authorities.*
- ***Reputation Damage:*** *Inadequate safety measures can harm the company's reputation, affecting relationships with clients, stakeholders, and the community.*
- ***Increased Operational Costs:*** *Poor wildlife and plant safety management can lead to higher maintenance and restoration costs, resulting in increased operational expenses.*
- ***Loss of Revenue:*** *If construction activities are halted or projects are delayed due to non-compliance with environmental regulations, the company can face significant revenue losses.*
- ***Insurance Premiums:*** *Inadequate safety measures for wildlife and plants may lead to higher insurance premiums as the risk of claims increases.*

9.1.4 Positive Impacts for Compliance with Wildlife and Plant Safety Standards

9.1.4.1 Environmental Impacts

- ***Biodiversity Conservation:*** *Proper safety measures protect wildlife and plants, supporting biodiversity and ecosystem health.*
- ***Habitat Protection:*** *Effective management practices prevent habitat destruction and promote habitat restoration.*

9.1.4.2 Health and Safety Impacts

- ***Reduced Human-Wildlife Conflicts:*** *Proper wildlife management reduces the risk of encounters between humans and wildlife, ensuring the safety of both.*
- ***Invasive Species Control:*** *Effective management prevents the spread of invasive species, protecting native ecosystems.*

9.1.4.3 Operational Impacts

- ***Increased Efficiency:*** *A well-managed worksite with minimized environmental impact promotes efficient work processes and reduces disruptions.*
- ***Cost Savings:*** *Proper wildlife and plant safety management reduces the need for remediation efforts and associated costs.*

9.1.4.4 *Legal and Financial Impacts*

- ***Compliance with Regulations:*** *Adhering to wildlife and plant safety standards ensures compliance with environmental regulations, avoiding legal issues.*
- ***Enhanced Reputation:*** *Demonstrating commitment to wildlife and plant safety enhances the company's image and builds trust with clients, stakeholders, and the community.*
- ***Cost Savings:*** *Efficient wildlife and plant safety management can reduce the need for costly restoration and maintenance efforts, leading to significant cost savings.*
- ***Revenue Protection:*** *Proper safety measures help prevent project delays and disruptions, protecting the company's revenue stream.*
- ***Risk Mitigation:*** *Effective safety measures for wildlife and plants reduce the risk of costly insurance claims and potential legal liabilities.*

9.1.5 General Provisions for Wildlife and Plant Safety at Construction Worksite

To protect wildlife and plant species at construction worksites, the following general provisions shall be adhered to:

9.1.5.1 *Where OHS Provisions for Wildlife and Plant Safety are Applicable in Construction Worksites:*

- ***Construction Sites in Urban Areas:*** *Workers may encounter wildlife that enters the construction area from nearby urban wildlife habitats.*
- ***Construction Sites Near Natural Habitats:*** *Construction projects near forests, wetlands, or other natural habitats where wildlife and plant safety are a concern.*
- ***Temporary Structures and Camps:*** *On-site temporary accommodations and structures where workers may encounter wildlife.*
- ***Excavation and Groundworks:*** *Areas where soil and vegetation are disturbed, potentially displacing wildlife and exposing plant hazards.*

9.1.5.2 *When OHS Provisions for Wildlife and Plant Safety are Applicable in Construction Worksites:*

- ***Site Assessment and Planning:*** *During initial site assessments and planning phases to identify and mitigate wildlife and plant hazards.*
- ***Daily Operations:*** *During daily construction activities where workers may encounter wildlife or hazardous plants.*
- ***Waste Management:*** *When managing waste materials and food sources that could attract wildlife.*
- ***Worker Training:*** *When providing safety training and education to workers about wildlife and plant safety measures.*
- ***Machinery and Equipment Use:*** *When using construction machinery and equipment that may pose risks to wildlife and plant safety.*
- ***Environmental Regulations Compliance:*** *Ensuring compliance with environmental regulations related to wildlife and plant protection.*

9.1.5.3 *Pre-Construction Assessments*

- *Environmental impact assessments (EIA) should be conducted to identify sensitive wildlife and plant species in the project area.*
- *Mitigation plans based on EIA findings should be developed and implemented to minimize adverse impacts on wildlife and plants.*

9.1.5.4 *Habitat Preservation*

- *Buffer zones around sensitive habitats and ecosystems should be designated and protected.*
- *Measures to preserve existing vegetation and minimize the clearing of native plants should be implemented.*
- *Valuable plant species should be transplanted or relocated to a designated safe area, if necessary.*

9.1.5.5 *Wildlife Protection*

- *Wildlife corridors to ensure the safe movement of animals across the construction site should be identified and protected.*
- *Wildlife-friendly fencing to prevent animals from entering hazardous areas should be installed.*
- *Protocols for safely handling and relocating wildlife encountered during construction should be developed and implemented.*

9.1.5.6 *Pollution Control*

- *Erosion and sediment control measures to prevent soil runoff into nearby water bodies and habitats should be implemented.*
- *Environmentally friendly chemicals and materials should be used to minimize contamination risks.*
- *Waste should be properly managed, and hazardous materials should be disposed of to prevent environmental harm.*

9.1.5.7 *Noise and Light Management*

- *Noisy activities should be scheduled during times that are least disruptive to wildlife, such as daytime hours.*
- *Noise-reducing technologies and barriers should be used to minimize disturbance.*
- *Lighting control measures to reduce light pollution, such as using downward-facing lights and minimizing nighttime work, should be implemented.*

9.1.5.8 *Education and Training for Worker/Labprer*

- *Training sessions to educate workers about the importance of wildlife and plant conservation should be provided.*
- *Informational materials, such as pamphlets and posters, outlining best practices for minimizing environmental impact should be distributed.*
- *Workers should be encouraged to report sightings of protected or endangered species to the designated environmental officer.*

9.1.5.9 *Monitoring and Compliance*

- *The construction site should be regularly monitored for compliance with wildlife and plant safety protocols.*
- *Periodic environmental audits should be conducted to assess the effectiveness of mitigation measures.*
- *Any incidents or violations should be documented and reported to the relevant environmental authorities.*

9.1.6 Standards/Specifications for Wildlife and Plant Safety at Construction Worksite

To protect wildlife and plant species at construction worksites, the following Standards/Specifications shall be adhered to:

9.1.6.1 *Site Assessment Standards*

- *Ecological surveys should be conducted to identify wildlife habitats, plant species, and potential environmental impacts.*
- *Detailed reports outlining ecological conditions and recommended protective measures should be prepared.*

9.1.6.2 *Habitat Preservation Standards*

- *Buffer zones around sensitive habitats to minimize disruption should be implemented.*
- *Fencing, netting, or other barriers to protect wildlife from construction activities should be used.*
- *Wildlife should be relocated in accordance with legal and ethical guidelines if their habitats are impacted.*

9.1.6.3 *Vegetation Protection Standards*

- *Mulch, erosion control blankets, or silt fences should be used to prevent soil erosion and protect plant roots.* ***(Value: 3 inches of mulch, Threshold: 80% ground cover)***
- *Tree protection plans, including the use of barriers and minimal impact techniques, should be implemented to safeguard trees during construction.*
- *Re-vegetating disturbed areas with native plant species is essential to restore habitats post-construction. The specific number of plants per square meter can vary depending on the type of vegetation and local guidelines. However, General vegetation Specifications are illustrated as per following table (Table-9-1):*

Table 9-1: General Vegetation Specifications

Type Vegetations/Trees	Number of Plantation /Square meter
Small Shrubs	About 3–5 plants per square meter
Trees	Typically, 5–10 plants per square meter
Grasses and Ground Cover	1 tree every 5–10 square meters
Medium to Large Shrubs	Usually, Around 1–3 plants per square meter

- **Grasses and Ground Covers:** Typically, 5-10 plants per square meter.
- **Small Shrubs:** About 3-5 plants per square meter.
- **Medium to Large Shrubs:** Around 1-3 plants per square meter.
- **Trees:** Usually, 1 tree every 5-10 square meters.

9.1.6.4 *Water Protection Standards*

- *Sediment control measures, such as silt fences and sediment basins, should be implemented to prevent contamination of water bodies.* ***(Threshold: 95% sediment capture efficiency)***
- *Biodegradable erosion control products should be used to minimize harm to aquatic life.*
- *Proper disposal of construction materials to prevent water pollution should be ensured.*

9.1.6.5 *Equipment and Machinery Standards*

- *Machinery designed to minimize ecological disturbance, such as low-ground-pressure equipment, should be used.* ***(Measurement: pounds per square inch (psi))***

- *Equipment operators should be trained to recognize and avoid sensitive habitats and species.*
- *Machinery should be regularly inspected for leaks and spills to prevent environmental contamination.* ***(Frequency: monthly inspections)***

9.1.6.6 Personal Safety Measures

- *Workers should be provided with training on wildlife and plant safety, including the identification of protected species and habitats.* ***(Hours of training: 8 hours per worker)***
- *Workers should be equipped with appropriate PPE to safely handle wildlife and plants if necessary.* ***(Types of PPE: gloves, safety goggles)***
- *Emergency response plans for wildlife encounters or environmental incidents should be developed and implemented.*

9.1.6.7 Wildlife Monitoring Standards

- *Regular wildlife monitoring should be conducted to track the presence and behavior of wildlife in and around the construction site.* ***(Frequency: weekly monitoring)***
- *Motion-activated cameras and other monitoring devices should be installed to observe and document wildlife activity.*

9.1.6.8 Wildlife Rescue and Rehabilitation Standards

- *Wildlife rescue protocols should be established and followed for injured or trapped animals found on the construction site.* ***(Response time: within 1 hour of discovery)***
- *Collaboration with local wildlife rescue organizations should be arranged to ensure proper care and rehabilitation of rescued animals.* ***(Contacts: list of local wildlife rescue organizations)***

9.1.6.9 Plant Species Conservation Standards

- *Endangered or protected plant species should be identified and marked on the construction site to prevent unintentional damage.* ***(Markers: flags, signs, or barriers)***
- *Seed collection from rare plant species should be carried out for future replanting and habitat restoration efforts.* ***(Quantity: grams of seeds collected)***

9.1.6.10 Invasive Species Control Standards

- *Measures to prevent the introduction and spread of invasive plant species should be implemented.* ***(Methods: washing equipment, using certified clean soil)***
- *Invasive species should be actively removed and managed to protect native flora and fauna.* ***(Techniques: manual removal, herbicide application)***

9.1.6.11 Wildlife-Friendly Construction Practices

- *Construction activities should be planned to avoid key wildlife breeding and nesting seasons.* ***(Timeframes: breeding seasons of local wildlife species)***
- *Wildlife passageways should be integrated into construction designs to facilitate safe movement of animals.* ***(Structures: underpasses, overpasses)***

9.1.6.12 Community Engagement and Education Standards

- *Community awareness programs should be conducted to educate local communities about the importance of wildlife and plant conservation.* ***(Sessions: workshops, public talks)***
- *Volunteer programs should be established to involve community members in conservation efforts.* ***(Activities: habitat restoration, wildlife monitoring)***

9.1.7 Key Obligations

9.1.7.1 LGED Authority Concerned

The obligations of the LGED Authority concerned shall be as mentioned in the OHS Policy of LGED in complying with the OHS provisions at the worksite/workplaces ***(Provisions of Sub-section: 6.1, 6.2, 6.3, 6.4 & 6.9, Section:6).***

9.1.7.2 Contractor Concerned

The obligations of the contractor concerned shall be as mentioned in the OHS Policy of LGED in complying with the OHS provisions at the worksite/workplaces ***(Provisions of Sub-section: 6.6, Section:6).***

9.1.7.3 Laborer Concerned

The obligations of laborers concerned shall be as mentioned in the OHS Policy of LGED in complying with the OHS provisions at the worksite/workplaces ***(Provisions of Sub-section: 6.8, Section:6).***

9.2 Sustainable Use of Resources

Sustainable use of resources at construction worksites is crucial for minimizing environmental impact, reducing waste, and promoting the efficient use of materials and energy. Implementing sustainable practices ensures the long-term viability of construction projects, compliance with regulatory standards, and the enhancement of corporate social responsibility.

Sustainable resource use at construction sites is essential to reduce environmental impact, preserve natural resources, and contribute to long-term ecological balance. By incorporating sustainable practices, construction activities can minimize waste, conserve materials, and ensure environmental compliance, ultimately supporting a greener future.

9.2.1 Types of Sustainable Resources:

- ***Energy-Efficient Equipment:*** *Reduces energy consumption and greenhouse gas emissions.*
- ***Eco-Friendly Materials:*** *Includes recycled, biodegradable, and low-impact materials.*
- ***Water-Saving Technologies:*** *Promotes efficient water use and recycling.*
- ***Waste Management Systems:*** *Enhances recycling and reduces landfill waste.*

9.2.2 Examples of Resource Sustainability Issues at Construction Sites

- ***Excessive Resource Consumption:*** *Overuse of materials such as concrete, steel, and water, leading to resource depletion.*
- ***Waste Generation:*** *High levels of construction waste, including debris and unused materials, contributing to landfill overflow.*
- ***Water Mismanagement:*** *Excessive water usage for construction processes, creating stress on local water supplies.*
- ***Energy Inefficiency:*** *Dependence on energy-intensive machinery and equipment, resulting in high carbon footprints.*
- ***Material Transportation Impacts:*** *Long-distance transportation of construction materials increasing fuel consumption and emissions.*
- ***Neglecting Renewable Resources:*** *Insufficient use of renewable materials, such as bamboo or recycled aggregates, in construction.*
- ***Pollution from Improper Waste Disposal:*** *Harmful effects of improper disposal of hazardous waste, such as chemicals or plastics.*

9.2.3 Examples of Sustainable Resource Management Measures

- ***Resource Auditing:*** *Conducting comprehensive audits to assess resource usage, identify inefficiencies, and establish reduction targets.*
- ***Use of Renewable Materials:*** *Prioritizing renewable and sustainable materials such as bamboo, recycled aggregates, and timber from certified sources.*
- ***Efficient Material Usage:*** *Designing and planning projects to minimize material wastage during procurement, transport, and construction.*
- ***Water Conservation Techniques:*** *Implementing water recycling systems, rainwater harvesting, and efficient water usage practices for construction activities.*

- ***Energy Efficiency Measures:*** *Using energy-efficient equipment and machinery, coupled with renewable energy sources like solar or wind, to power construction sites.*
- ***Local Material Sourcing:*** *Procuring materials locally to reduce transportation-related emissions and support local economies.*
- ***Waste Management Strategies:*** *Establishing robust waste sorting, recycling, and disposal systems to reduce construction-related waste.*
- ***On-Site Material Reuse:*** *Reusing materials like steel, concrete, and bricks from demolition activities to reduce demand for new resources.*
- ***Sustainable Procurement Practices:*** *Engaging in eco-friendly procurement by selecting suppliers that adhere to environmental and sustainability standards.*
- ***Worker Training:*** *Educating workers on resource-efficient methods and the importance of sustainability practices during construction.*

9.2.4 Examples of Sustainable Practices:

- ***Energy Efficient Technologies:*** *Implementing energy-efficient technologies and renewable energy sources.*
- ***Eco-friendly materials:*** *Using eco-friendly materials and sustainable construction techniques.*
- ***Recycling:*** *Reducing water consumption and promoting water recycling.*
- ***Low Waste Generation:*** *Minimizing waste generation and enhancing recycling efforts.*

9.2.5 Negative Impacts of Non-compliance with Sustainable use of Resources Provisions at construction Worksites

9.2.5.1 Environmental Impacts

- ***Unintended Pollution:*** *Improper handling of hazardous waste during transitions to sustainable systems may harm the environment.*
- ***Depletion of Resources:*** *Overreliance on certain "green" technologies (e.g., rare earth metals) could lead to resource scarcity.*

9.2.5.2 Operational Impacts

- ***Disruption During Implementation:*** *Transitioning to eco-friendly methods may temporarily disrupt workflows and productivity.*
- ***High Initial Costs:*** *Initial investments in sustainable technologies or training programs can strain project budgets.*
- ***Resistance to Change:*** *Workers or management unfamiliar with new practices may resist adoption, impacting team dynamics.*

9.2.5.3 Legal and Financial Impacts

- ***Failure to Meet Standards:*** *Inadequate implementation of sustainability measures could lead to non-compliance with environmental regulations.*
- ***Liability for Greenwashing:*** *Companies overstating their environmental impact reductions may face legal and reputational risks.*
- ***Unanticipated Expenses:*** *Maintenance or updates to eco-friendly systems can incur higher-than-expected costs.*

9.2.6 Positive Impacts of Compliance with Sustainable uses of Resources Provisions at Construction Worksites

9.2.6.1 Environmental Impacts

- ***Reduction in Greenhouse Gas Emissions:*** *Implementing sustainable practices minimizes emissions, contributing to a cleaner atmosphere.*
- ***Conservation of Natural Resources:*** *Efficient resource utilization protects ecosystems and promotes biodiversity.*
- ***Waste Management Improvements:*** *Recycling efforts and reduced waste generation help in maintaining ecological balance.*

9.2.6.2 Operational Impacts

- ***Enhanced Efficiency:*** *Sustainable practices streamline processes, leading to faster and more effective project completion.*
- ***Cost Savings:*** *Adopting renewable energy and eco-friendly methods reduces operational costs over time.*
- ***Worker Engagement and Morale:*** *Workers feel more motivated in environmentally responsible workplaces, boosting productivity.*
- ***Reduced Costs of Waste Disposal:*** *Efficient waste management reduces expenses associated with disposal and landfill usage.*
- ***Long-Term Operational Savings:*** *Use of energy-efficient technologies decreases recurring expenses such as electricity and fuel costs.*
- ***Lower Insurance Premiums:*** *Maintaining environmentally responsible and safe practices can lead to reductions in insurance costs.*
- ***Improved Market Position:*** *Enhanced reputation for sustainability can attract more investors and clients, leading to increased profitability.*

9.2.6.3 Legal and Financial Impacts

- ***Compliance Benefits:*** *Adhering to sustainability standards prevents legal penalties and ensures smooth operations.*
- ***Market Competitiveness:*** *A positive reputation for environmental responsibility attracts clients and partners.*
- ***Reduced Resource Expenses:*** *Efficient resource use leads to significant financial savings.*
- ***High Implementation Costs:*** *Initial outlays for sustainable equipment, technologies, and certifications can be significant.*
- ***Increased Maintenance Costs:*** *Eco-friendly systems or renewable technologies may require specialized maintenance, leading to higher expenses.*
- ***Risk of Non-Compliance Penalties:*** *Failure to meet evolving sustainability standards could result in fines or penalties.*
- ***Market Risks:*** *Investments in niche green technologies may not yield the expected returns due to fluctuating market demands.*

9.2.7 General Provisions for Sustainable Use of Resources at construction Worksites

Sustainability in construction is a vital component of responsible development, aiming to minimize environmental impact and conserve natural resources. By adopting sustainable practices, construction worksites can contribute to the global effort to combat climate change while fostering innovation, improving operational efficiency, and complying with environmental standards. The following provisions serve as a guideline for the sustainable use of resources at

construction sites, ensuring that materials, technologies, and practices are leveraged efficiently and responsibly:

9.2.7.1 *Resource Selection and Suitability*

- *Materials and technologies shall be selected based on sustainability criteria, including environmental impact, resource efficiency, and recyclability.*
- *Compliance with industry standards, such as LEED or equivalent national standards, shall be ensured.*

9.2.7.2 *Training and Awareness*

- *Workers shall be trained on the importance of sustainability and the efficient use of resources.*
- *Sustainability induction sessions shall be conducted to educate workers about site-specific sustainability practices and goals.*

9.2.7.3 *Inspection and Maintenance*

- *Equipment and systems shall be regularly inspected and maintained to ensure optimal efficiency and performance.*
- *Manufacturer guidelines shall be followed for the care and replacement of sustainable technologies and materials.*

9.2.7.4 *Distribution and Accessibility*

- *Access to sustainable materials and resources at all stages of the construction process shall be provided.*
- *Sustainable practices shall be made readily available and accessible to all workers, subcontractors, and visitors.*

9.2.7.5 *Signage and Compliance*

- *"Sustainable Practices" signs shall be posted prominently in all designated zones where sustainability measures are implemented.*
- *Compliance shall be regularly monitored and enforced through supervisor checks and audits.*

9.2.7.6 *Customization and Comfort*

- *Sustainable practices shall be customized to suit specific site conditions and requirements.*
- *Resources and support shall be provided to enable workers to adopt sustainable practices comfortably and effectively.*

9.2.8 Standards/Specifications for Sustainable Use of Resources at Construction Worksites

Sustainable construction is a pivotal step toward reducing environmental impact, conserving natural resources, and ensuring long-term ecological balance. By implementing resource-efficient practices, construction worksites can reduce operational costs, enhance compliance with sustainability standards, and contribute to a greener planet. The following provisions outline detailed standards and specifications to facilitate the sustainable use of resources, ensuring efficiency, durability, and adaptability while complying with global and national environmental benchmarks:

9.2.8.1 *Energy Efficiency*

- *Equipment and technologies shall meet energy efficiency standards, such as **ENERGY STAR**.*

- *Energy-saving practices, such as using **LED lighting** and energy-efficient **HVAC systems**, shall be implemented to optimize consumption.*

9.2.8.2 Eco-Friendly Materials

- *Materials with **recycled content**, low **volatile organic compounds (VOCs)**, and minimal environmental impact shall be utilized.*
- *Materials certified by recognized sustainability organizations, such as the **Forest Stewardship Council (FSC)** for wood products, shall be prioritized.*

9.2.8.3 Water Efficiency

- *Water-saving technologies, such as low-flow fixtures and greywater recycling systems, shall be implemented.*
- *Water usage shall be monitored and managed to minimize consumption and waste.*

9.2.8.4 Waste Management

- *Waste management systems shall be established to segregate and recycle materials, reducing landfill waste.*
- *Practices such as **composting organic waste** and reusing construction materials shall be implemented.*

9.2.8.5 Material Requirements

- *Materials shall be durable, long-lasting, and have a low environmental impact.*
- *Sourced materials shall meet sustainability and environmental certification standards.*

9.2.8.6 Adjustment Mechanisms

- *Adjustable systems and technologies shall be implemented to optimize resource use and efficiency.*
- *Systems shall be adaptable to changing conditions and requirements.*

9.2.8.7 Reflective Features

- *Reflective materials shall be included in construction to reduce heat absorption and improve energy efficiency.*

9.2.8.8 Attachments and Accessories Compatibility

- *Compatibility with additional sustainable technologies and practices shall be ensured.*
- *Accessories shall not compromise the sustainability or performance of materials and systems.*

9.2.8.9 Temperature Resistance

- *Materials and systems shall be effective across a wide range of temperatures, suitable for diverse working environments.*

9.2.8.10 Water and Chemical Resistance

- *Materials and systems shall be resistant to water and chemical exposure to enhance durability and sustainability.*

9.2.8.11 Equipment Marking and Identification

- *Each sustainable resource shall include permanent markings indicating the **manufacturer**, **standards compliance**, and **date of manufacture**.*

9.2.8.12 Durability Testing

- *Sustainable resources shall pass tests for **durability**, **efficiency**, and **environmental impact**.*
- *Integrity and performance shall be maintained after repeated use and exposure to varying conditions.*

9.2.8.13 Service Life and Replacement

- *Sustainable resources shall be replaced regularly based on performance, efficiency, and manufacturer recommendations.*
- *Resources exposed to significant degradation shall be replaced immediately.*

9.2.8.14 Ventilation Features

- *Ventilation features shall be implemented in buildings to improve indoor air quality and reduce energy consumption.*

9.2.8.15 Emergency Provisions

- *Sustainable resources shall be available for immediate use during emergencies and evacuations.*
- *A supply of spare sustainable materials and technologies shall be maintained for emergency situations.*

9.2.8.16 Inspection Protocols

- *Regular inspections of sustainable resources shall be conducted to ensure performance and compliance.*
- *Advanced methods, such as **energy audits** and **environmental assessments**, shall be used to monitor sustainability practices.*

9.2.8.17 Lightweight Design

- *Sustainable materials shall be **lightweight** to reduce transportation energy and costs.*

9.2.8.18 Environmental Sustainability

- *Recyclable and biodegradable materials shall be encouraged to minimize environmental impact.*
- *Partnerships with suppliers offering **take-back** or recycling programs for old or damaged materials shall be promoted.*

9.2.8.19 Compliance with international/national standards

- *Compliance with applicable sustainability standards, such as **LEED (Leadership in Energy and Environmental Design)**, **BREEAM (Building Research Establishment Environmental Assessment Method)**, and **Green Globes** or equivalent national standards shall preferably be ensured if available and applicable.*
- *Certifications (if any) shall be maintained on file for review during audits by environmental regulators.*

9.2.9 Key Obligations

9.2.9.1 LGED Authority Concerned

*The obligations of the LGED Authority concerned shall be as mentioned in the OHS Policy of LGED in complying with the OHS provisions at the worksite/workplaces **(Provisions of Sub-section: 6.1, 6.2, 6.3, 6.4 & 6.9, Section:6)**.*

9.2.9.2 *Contractor Concerned*

The obligations of the contractor concerned shall be as mentioned in the OHS Policy of LGED in complying with the OHS provisions at the worksite/workplaces ***(Provisions of Sub-section: 6.6, Section:6).***

9.2.9.3 *Laborer Concerned*

The obligations of laborers concerned shall be as mentioned in the OHS Policy of LGED in complying with the OHS provisions at the worksite/workplaces ***(Provisions of Sub-section: 6.8, Section:6).***

9.3 Environmental Degradation at Construction Worksites

Environmental degradation at construction worksites is a critical issue that can lead to widespread ecological, operational, and financial challenges. It includes phenomena such as habitat destruction, resource depletion, pollution, and biodiversity loss. Failure to address these impacts not only results in long-term environmental harm but also jeopardizes regulatory compliance, corporate reputation, and project timelines. Adopting proper protocols and mitigation measures ensures sustainable construction practices and minimizes adverse effects.

9.3.1 Examples of Hazards Related to Environmental Degradation at Construction Worksites

- ***Soil Contamination:*** *Spillage of hazardous chemicals, oils, and paints can lead to contamination of soil, affecting plant growth and agricultural potential.*
- ***Air Pollution:*** *Emissions from machinery, dust from construction activities, and burning of waste materials degrade air quality.*
- ***Water Pollution:*** *Runoff carrying sediments, oils, and chemicals pollutes nearby water bodies, affecting aquatic life.*
- ***Wildlife Displacement:*** *Noise, vibrations, and land clearing can disturb wildlife, leading to habitat fragmentation and species migration.*
- ***Increased Waste Generation:*** *Excessive construction waste disposed of improperly adds to landfill burden and environmental pollution.*

9.3.2 Sources of Environmental Degradation at Construction Worksites

- ***Land Clearing and Habitat Destruction:*** *Extensive clearing of vegetation for construction activities often results in habitat loss for plants and animals.*
- ***Emission of Pollutants:*** *Heavy machinery, vehicles, and equipment release significant levels of greenhouse gases and other pollutants.*
- ***Improper Waste Disposal:*** *Inadequate segregation and disposal of hazardous waste materials (e.g., asbestos, chemicals) contribute to soil and water contamination.*
- ***Runoff and Sedimentation:*** *Construction runoff carrying sediments and chemicals pollutes nearby water bodies, affecting aquatic ecosystems.*
- ***Excessive Resource Use:*** *High consumption of water, fossil fuels, and raw materials strains natural resources and leads to depletion.*

9.3.3 Negative Impacts of Environmental Degradation at Construction Worksites

9.3.3.1 Environmental Impacts

- ***Habitat Destruction:*** *Loss of wildlife habitats and biodiversity due to deforestation and land clearing.*
- ***Soil Degradation:*** *Polluted soil impacts agriculture and limits future land use.*
- ***Air and Water Pollution:*** *Reduced air and water quality affects both local communities and ecosystems.*

9.3.3.2 Operational Impacts

- ***Project Delays:*** *Environmental remediation efforts may disrupt project timelines.*
- ***Cost Escalations:*** *Addressing pollution and habitat restoration increases operational expenses.*

- ***Legal Penalties:*** *Non-compliance with environmental regulations results in fines and work stoppages.*

9.3.3.3 *Financial Impacts*

- ***Higher Remediation Costs:*** *Cleaning up contaminated sites or restoring habitats can be expensive.*
- ***Loss of Reputation:*** *Poor environmental practices damage public trust, resulting in reduced opportunities and market competitiveness.*
- ***Increased Insurance Premiums:*** *Frequent incidents of environmental harm lead to higher insurance costs.*

9.3.4 Positive Impacts of Environmental Degradation Mitigation at Construction Worksites

9.3.4.1 *Environmental Impacts*

- ***Habitat Restoration:*** *Restoration efforts lead to healthier ecosystems and support biodiversity.*
- ***Improved Air and Water Quality:*** *Reduced pollution levels enhance the quality of local air and water, benefiting both humans and wildlife.*
- ***Sustainable Resource Management:*** *The adoption of conservation strategies ensures the efficient use of natural resources, reducing depletion.*

9.3.4.2 *Operational Impacts*

- ***Smooth Project Execution:*** *Proactive mitigation measures prevent delays caused by environmental concerns.*
- ***Cost-Effective Solutions:*** *Efficient resource use and reduced remediation efforts save operational costs over time.*
- ***Enhanced Employee Satisfaction:*** *Workers feel more motivated and engaged in projects committed to environmental protection.*

9.3.4.3 *Financial Impacts*

- ***Reduced Legal Risks:*** *Compliance with environmental regulations avoids fines, penalties, and legal disputes.*
- ***Reputation Boost:*** *Positive public perception enhances corporate reputation and improves market competitiveness.*
- ***Long-Term Savings:*** *Investments in sustainable construction practices lead to reduced costs in waste management, resource procurement, and remediation.*

9.3.5 General Provisions for Environmental Degradation at Construction Worksite

In every construction project, it is vital to prioritize the environment alongside occupational health and safety (OHS). The provisions have been designed to minimize the environmental degradation caused by construction activities. The following provisions outline when and where they shall be applied, as well as the essential mitigation measures to ensure compliance with relevant laws/Acts/ Rules etc.:

9.3.5.1 *When OHS Provisions for Environmental Degradation Are Applicable*

- ***During Site Preparation:*** *Provisions shall apply during initial land clearing, vegetation removal, and excavation activities.*

- ***Throughout Construction Phases:*** *Monitoring and compliance shall continue during all stages of construction, including material transportation and onsite activities.*
- ***Emergency Situations:*** *Provisions shall be implemented during spills, leaks, or any incidents that pose a threat to the environment.*
- ***Post-Construction:*** *Restoration and waste management measures shall be enforced after project completion to minimize lasting environmental harm.*

9.3.5.2 Where OHS Provisions for Environmental Degradation Are Applicable

- ***Construction Worksites:*** *These provisions shall apply to all active work zones, including excavation areas, material storage zones, and vehicle operation sites.*
- ***Surrounding Ecosystems:*** *Neighboring habitats, water bodies, and agricultural lands impacted by construction activities shall fall under the scope of these provisions.*
- ***Material Transport Routes:*** *Transport corridors used to move materials to and from the site shall be covered to mitigate emissions and leaks.*
- ***Waste Disposal Sites:*** *Offsite locations designated for the disposal of construction waste and hazardous materials shall comply with environmental regulations.*

9.3.5.3 Mitigation Measures and Suitability

- *Mitigation measures shall be selected based on site-specific conditions and environmental risks.*
- *Compliance with EPA standards or equivalent national provisions, if available, shall be ensured.*

9.3.5.4 Training and Awareness

- *Workers shall be trained on the importance of environmental protection and the application of proper mitigation practices.*
- *Environmental induction sessions shall be conducted to educate workers about site-specific environmental risks and protocols.*

9.3.5.5 Inspection and Maintenance

- *Mitigation measures shall be inspected and maintained regularly to ensure their effectiveness and compliance.*
- *Manufacturer guidelines shall be followed for the maintenance or replacement of equipment and materials used in mitigation.*

9.3.5.6 Distribution and Accessibility

- *Resources and equipment for mitigation shall be made accessible at all stages of construction.*
- *Measures shall be provided to all workers, subcontractors, and visitors to ensure environmental protection.*

9.3.5.7 Signage and Compliance

- *Signs indicating "Environmental Protection Required" shall be prominently displayed in designated zones.*
- *Compliance shall be monitored regularly through supervisor checks and audits.*

9.3.5.8 *Customization and Comfort*

- *Mitigation measures shall be customized to address specific site conditions and project requirements.*
- *Support and resources shall be provided to ensure workers adopt environmental protection practices effectively and comfortably.*

9.3.6 Standards/Specifications for Environmental Degradation at construction worksite

Environmental protection is a critical aspect of sustainable construction practices. These standards and specifications have been developed to minimize environmental degradation at construction worksites. By adhering to these guidelines, construction projects can comply with relevant regulations, reduce their ecological footprint, and ensure a balance between development and environmental stewardship. The following provisions outline key measures to address environmental challenges during construction activities:

9.3.6.1 *Erosion and Sediment Control*

- *Silt fences, sediment basins, and erosion control blankets shall be implemented to prevent soil erosion and manage sediment runoff.*
- *Standards such as **EPA's Construction General Permit (CGP)** or equivalent national provisions, if applicable, shall be followed for erosion and sediment control.*

9.3.6.2 *Pollution Prevention*

- *Low-emission machinery and vehicles shall be used to reduce air pollution.*
- *Measures such as vegetative buffer zones and water treatment systems shall be implemented to prevent water pollution.*
- *Standards such as the **Clean Air Act (CAA)** and **Clean Water Act (CWA)**, or equivalent national provisions, if available and applicable, shall be followed for pollution prevention.*

9.3.6.3 *Waste Management*

- *Systems for waste segregation, recycling, and the safe disposal of hazardous materials shall be established.*
- *Practices such as composting organic waste and reusing construction materials shall be implemented.*
- *Standards such as the **Resource Conservation and Recovery Act (RCRA)** or equivalent national provisions, if available and applicable, shall be followed for waste management.*

9.3.6.4 *Resource Conservation*

- *Sustainable materials with recycled content and low environmental impact shall be used.*
- *Practices such as water-saving technologies and energy-efficient equipment shall be implemented.*
- *Standards such as **LEED (Leadership in Energy and Environmental Design)** or equivalent national standards for resource conservation shall preferably be followed if available and applicable.*

9.3.6.5 *Material Requirements*

- *Materials used in mitigation measures shall be durable, long-lasting, and have a low environmental impact.*

- *Materials shall meet environmental certification standards, such as the **Forest Stewardship Council (FSC) OR equivalent national organizations if available and applicable** for wood products.*

9.3.6.6 Adjustment Mechanisms

- *Adjustable systems and technologies shall be implemented to optimize mitigation measures and efficiency.*
- *Systems shall be easily adapted to changing conditions and requirements.*

9.3.6.7 Reflective Features

- *Reflective materials shall be included in construction to reduce heat absorption and improve energy efficiency.*

9.3.6.8 Attachments and Accessories Compatibility

- *Compatibility with additional environmental protection technologies and practices shall be ensured.*
- *Accessories shall not compromise the sustainability or performance of mitigation measures.*

9.3.6.9 Temperature Resistance

- *Materials and systems shall be effective in a wide range of temperatures, suitable for various working environments.*

9.3.6.10 Water and Chemical Resistance

- *Materials and systems shall be resistant to water and chemical exposure, enhancing durability and sustainability.*

9.3.6.11 Equipment Marking and Identification

- *Permanent markings indicating the manufacturer, standards compliance, and date of manufacture shall be included in each mitigation resource.*

9.3.6.12 Service Life and Replacement

- *Mitigation resources shall be replaced regularly based on performance, efficiency, and manufacturer recommendations.*
- *Resources exposed to significant degradation shall be replaced immediately.*

9.3.6.13 Emergency Provisions

- *Mitigation resources shall be available for immediate use during emergencies and environmental incidents.*
- *A supply of spare mitigation materials and equipment for emergencies shall be maintained.*

9.3.6.14 Inspection Protocols

- *Regular inspections of mitigation resources shall be conducted to ensure performance and compliance.*
- *Advanced methods such as environmental assessments and audits shall be used to monitor mitigation practices.*

9.3.6.15 Environmental Sustainability

- *Recyclable and biodegradable materials shall be encouraged to reduce environmental impact.*
- *Partnerships with suppliers offering take-back or recycling programs for old or damaged materials shall be promoted.*

9.3.6.16 Testing and Compliance Certification

- *Compliance with all applicable environmental standards, such as EPA regulations (USA), ISO 14001 for Environmental Management Systems, and LEED (Leadership in Energy and Environmental Design) OR equivalent national standards shall preferably be ensured if available and applicable.*
- *Certifications shall preferably be maintained on file for review during audits by environmental regulators if applicable.*

9.3.7 Standards/Specifications for Environmental Degradation for Construction/ at construction worksites as Per prevailing Laws/Acts/ Rules of Bangladesh

There are quite a good number of Acts/Laws/Rules regarding conservation and/ or protection of environmental integrity throughout the country. These also includes standards/specifications/provisions regarding environmental degradation in construction/at construction sites. These are as follows:

1. ***Harmful Pollutants:*** *Activities emitting harmful pollutants, such as construction dust and emissions, are restricted.* ***(Environment Conservation Act, 1995: Clause-6)***
2. ***Environmental Clearance:*** *An Environmental Clearance Certificate must be obtained before construction projects are initiated.* ***(Environment Conservation Act, 1995: Clause-12)***
3. ***Remedial Measures:*** *Remedial measures for environmental damage caused during construction activities must be undertaken.* ***(Environment Conservation Act, 1995: Clause-7)***
4. ***Environmental Clearance Procedure:*** *The procedure for obtaining an Environmental Clearance Certificate, including environmental impact assessment, is detailed.* ***(Environment Conservation Rules, 1997: Rule-7)***
5. ***Classification of Projects:*** *Construction projects are classified based on their environmental impact, and mitigation measures for high-impact projects are required.* ***(Environment Conservation Rules, 1997: Schedule-1)***
6. ***Pollution Standards:*** *Standards for air, water, and noise pollution applicable to construction sites are specified.* ***(Environment Conservation Rules, 1997: Schedule-13)***
7. ***Jurisdiction of Courts:*** *Jurisdiction to address environmental violations at construction sites is granted to Environment Courts.* ***(Environment Court Act, 2010: Section-7)***
8. ***Penalties and Compensation:*** *Penalties and compensation for environmental degradation caused by construction activities are empowered to be imposed by the courts.* ***(Environment Court Act, 2010: Section-14)***
9. ***Hazardous Waste Management:*** *Stricter controls on hazardous waste management, including construction debris, have been introduced.* ***(Bangladesh Environment Conservation (Amendment) Act, 2010: Clause-6A)***
10. ***Ecologically Critical Areas:*** *Activities harming ecologically critical areas, which may include construction zones, are prohibited.* ***(Bangladesh Environment Conservation (Amendment) Act, 2010: Clause-6B)***
11. ***Waste Disposal Guidelines:*** *Guidelines for the safe disposal of hazardous waste from construction sites are provided.* ***(Hazardous Waste and Ship Breaking Waste Management Rules, 2011: Rule-5)***

12. ***Brick Usage Regulation:*** *The use of bricks in construction to minimize air pollution is regulated.* ***(Brick Manufacturing and Brick Kilns Establishment (Control) Act, 2013: Clause-4)***
13. ***Water Pollution Prevention:*** *Construction activities polluting water bodies, including runoff, are prohibited.* ***(Water Act, 2013: Clause-8)***

9.3.8 Key Obligations

9.3.8.1 *LGED Authority Concerned*

The obligations of the LGED Authority concerned shall be as mentioned in the OHS Policy of LGED in complying with the OHS provisions at the worksite/workplaces ***(Provisions of Sub-section: 6.1, 6.2, 6.3, 6.4 & 6.9, Section:6).***

9.3.8.2 *Contractor Concerned*

The obligations of the contractor concerned shall be as mentioned in the OHS Policy of LGED in complying with the OHS provisions at the worksite/workplaces ***(Provisions of Sub-section: 6.6, Section:6).***

9.3.8.3 *Laborer Concerned*

The obligations of laborers concerned shall be as mentioned in the OHS Policy of LGED in complying with the OHS provisions at the worksite/workplaces ***(Provisions of Sub-section: 6.8, Section:6).***

9.4 Airborne Contaminants (As per Prevailing LGED Practice)

Airborne contaminants at construction worksites pose significant health, environmental, and operational risks. These include dust, particulate matter, gaseous emissions, and chemical vapors that affect both the workforce and surrounding communities. Failure to mitigate these risks can lead to serious health issues, regulatory non-compliance, and project delays. Adopting proper management and mitigation measures ensures a safer working environment and minimizes adverse effects on air quality.

9.4.1 Examples of Hazards Related to Airborne Contaminants at Construction Worksites

- ***Dust and Particulate Matter:*** *Generated from cutting, grinding, drilling, or demolition activities, causing respiratory issues and reduced visibility.*
- ***Chemical Vapors:*** *Released from paints, adhesives, and solvents, posing risks of toxicity and irritation to workers.*
- ***Gaseous Emissions:*** *Emissions from diesel-powered machinery and vehicles contribute to air pollution and greenhouse gas accumulation.*
- ***Asbestos and Silica Exposure:*** *Fibers or particles released during demolition or handling of specific materials can cause severe health complications like asbestosis and silicosis.*
- ***Burning of Waste Materials:*** *Releases harmful pollutants like carbon monoxide, dioxins, and volatile organic compounds (VOCs), degrading air quality.*

9.4.2 Sources of Airborne Contaminants at Construction Worksites

- ***Construction Equipment:*** *Use of diesel generators, excavators, and other machinery leads to the release of exhaust gases and particulate matter.*
- ***Material Handling and Processing:*** *Cutting, crushing, and mixing activities generate fine dust and particulate emissions.*
- ***Improper Storage of Chemicals:*** *Volatile compounds from improperly stored paints, adhesives, and fuels contribute to atmospheric contamination.*

- ***Demolition Activities:*** *Demolition of structures made with hazardous materials like asbestos releases harmful fibers into the air.*
- ***Waste Burning:*** *Open burning of construction waste generates toxic fumes and particulate emissions.*

9.4.3 Negative Impacts of Airborne Contaminants at Construction Worksites

9.4.3.1 Health Impacts

- ***Respiratory Problems:*** *Long-term exposure to dust, fumes, and gases can cause asthma, bronchitis, and other respiratory issues.*
- ***Toxicity and Irritation:*** *Vapors from chemicals and solvents lead to eye irritation, skin allergies, and in severe cases, chemical poisoning.*
- ***Chronic Diseases:*** *Prolonged exposure to asbestos or silica particles is linked to chronic conditions like silicosis, mesothelioma, and lung cancer.*

9.4.3.2 Environmental Impacts

- ***Air Quality Degradation:*** *Release of harmful gases and particulate matter deteriorates local air quality.*
- ***Contribution to Climate Change:*** *Emissions of greenhouse gases like CO_2 and methane contribute to global warming.*
- ***Impact on Surrounding Ecosystems:*** *Airborne contaminants can settle on plants and water bodies, affecting local flora and fauna.*

9.4.3.3 Operational Impacts

- ***Project Delays:*** *Suspensions caused by non-compliance with air quality standards may disrupt project timelines.*
- ***Increased Costs:*** *Investments in pollution control measures and health treatments for affected workers inflate budgets.*
- ***Legal Penalties:*** *Non-compliance with air emission regulations can result in fines, lawsuits, and work stoppages.*

9.4.4 Positive Impacts of Mitigation of Airborne Contaminants at Construction Worksites

9.4.4.1 Health Impacts

- ***Improved Worker Health:*** *Measures such as dust suppression and proper ventilation lead to a healthier workforce.*
- ***Reduced Exposure Risks:*** *Proper use of personal protective equipment (PPE) minimizes exposure to harmful airborne contaminants.*
- ***Fewer Chronic Diseases:*** *Implementing safety protocols reduces cases of long-term health complications.*

9.4.4.2 Environmental Impacts

- ***Enhanced Air Quality:*** *Measures like emission controls and dust suppression improve overall air quality.*
- ***Ecosystem Protection:*** *Minimization of air pollution reduces harm to surrounding plants, animals, and water bodies.*
- ***Contribution to Sustainability:*** *Reduced emissions align with global climate action goals.*

9.4.4.3 Operational Impacts

- ***Regulatory Compliance:*** *Adherence to air quality standards avoids legal penalties and work interruptions.*
- ***Cost Savings:*** *Fewer pollution incidents reduce cleanup costs and medical expenses for workers.*

- ***Enhanced Productivity:*** *Cleaner air and healthier workers lead to a more productive work environment.*

9.4.4.4 *Financial Impacts*

- ***Reduced Insurance Premiums:*** *Proactive mitigation lowers insurance premiums tied to health and safety risks.*
- ***Reputation Enhancement:*** *Sustainable and worker-friendly practices improve corporate image and client trust.*
- ***Long-Term Profitability:*** *Investments in clean technologies and training yield financial returns through operational efficiency and cost reductions.*

9.4.5 General Provisions for Airborne Contaminants at Construction Worksites

In every construction project, it is critical to prioritize air quality alongside occupational health and safety (OHS). These provisions have been designed to minimize airborne contaminants generated by construction activities. The following provisions outline when and where they shall be applied, as well as the essential mitigation measures to ensure compliance with relevant laws, acts, and rules.

9.4.5.1 *When OHS Provisions for Airborne Contaminants Are Applicable*

- ***During Site Preparation:*** *Provisions shall apply during land clearing, excavation, and demolition activities that generate dust and particulate matter.*
- ***Throughout Construction Phases:*** *Monitoring and compliance shall continue during all stages of construction, including material handling and machinery operation.*
- ***Emergency Situations:*** *Provisions shall be implemented in response to chemical spills, gas leaks, or incidents that release harmful airborne substances.*
- ***Post-Construction:*** *Air quality restoration and removal of harmful residues shall be enforced after project completion to ensure safe conditions.*

9.4.5.2 *Where OHS Provisions for Airborne Contaminants Are Applicable*

- ***Construction Worksites:*** *These provisions shall apply to active work zones where dust, fumes, or emissions are produced.*
- ***Surrounding Communities:*** *Areas impacted by construction-related air pollution, including residential zones and public spaces, shall be included.*
- ***Material Storage Zones:*** *Locations storing volatile chemicals or dust-generating materials shall fall under the scope of these provisions.*
- ***Transport Routes:*** *Roads and pathways used for material transportation shall be monitored for emissions and leaks.*

9.4.5.3 *Mitigation Measures and Suitability*

- ***Mitigation measures shall be tailored*** *to address site-specific conditions, sources of contamination, and associated risks.*
- ***Compliance with national and international air quality standards*** *shall be ensured, such as those outlined by the Clean Air Act (CAA) or equivalent provisions.*

9.4.5.4 Training and Awareness

- ***Workers shall be trained*** *on the importance of air quality management and the use of mitigation practices, such as dust suppression and ventilation.*
- ***Environmental induction sessions shall be conducted*** *to educate workers about air quality risks, safe practices, and the proper handling of hazardous materials.*

9.4.5.5 Inspection and Maintenance

- ***Air quality mitigation systems shall be inspected and maintained*** *regularly to ensure proper functioning and compliance with standards.*
- ***Manufacturer guidelines shall be followed*** *for the maintenance, replacement, or upgrading of air quality control equipment.*

9.4.5.6 Distribution and Accessibility

- ***Air quality mitigation resources and equipment shall be made accessible*** *throughout all construction stages.*
- ***Protective measures and tools shall be provided*** *to all workers, subcontractors, and visitors to minimize exposure to airborne contaminants.*

9.4.5.7 Signage and Compliance

- ***Signs indicating "Air Quality Protection Required" shall be prominently displayed*** *in high-risk zones.*
- ***Compliance with air quality standards shall be monitored*** *through regular inspections and audits.*

9.4.5.8 Customization and Comfort

- ***Mitigation measures shall be customized*** *to address specific site conditions, pollutant types, and project needs.*
- ***Resources and support shall be provided*** *to ensure workers can comfortably adopt air quality protection practices.*

9.4.5.9 Air Quality Testing and Onward Actions

- *Ambient air test as per available laboratory facilities shall be performed at the worksite;*
- *The results shall be examined by the concerned officials/Engineers of LGED;*
- *Based on the results, suggestions for necessary interventions shall be given to the contractor;*
- *The contractor shall implement the suggestions within the scope of contact agreement.*

9.4.6 Standards/Specifications for Airborne Contaminants at Construction Worksites

Air quality management is a vital aspect of sustainable construction practices. These standards and specifications are designed to minimize airborne contaminants at construction worksites. By adhering to these guidelines, construction projects can ensure compliance with relevant regulations, reduce their impact on air quality, and promote both environmental and human health. The following provisions outline key measures to address air quality challenges during construction activities:

9.4.6.1 Dust and Particulate Control

- *Dust suppression systems, such as water spraying, shall be implemented to manage dust emissions from construction activities.*
- *Standards such as the Clean Air Act (CAA) or equivalent national air quality regulations shall preferably be followed for dust and particulate control if available and applicable.*

9.4.6.2 Emission Reduction

- *Low-emission machinery and vehicles shall be used to minimize greenhouse gas and air pollutant emissions.*
- *Regular maintenance of equipment and engines shall be conducted to ensure compliance with emission standards.*
- *Standards such as ISO 14001 for Environmental Management Systems or equivalent national provisions, if available and applicable, shall be adhered to.*

9.4.6.3 Airborne Chemical Containment

- *Storage areas for paints, adhesives, and solvents shall be properly ventilated and equipped with vapor control systems.*
- *Standards such as the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard or equivalent national provisions shall preferably be followed if available and applicable.*

9.4.6.4 Personal Protective Equipment (PPE)

- *Workers exposed to harmful airborne contaminants shall be provided with respiratory protective equipment, such as masks and filters.*
- *PPE specifications shall preferably align with national health and safety standards, such as those outlined by OSHA or equivalent national standards.*

9.4.6.5 Monitoring and Reporting

- *Air quality monitoring systems shall be installed onsite to continuously assess contaminant levels.*
- *Reports on air quality shall be submitted regularly to ensure compliance with legal and environmental requirements.*

9.4.6.6 Emergency Response for Airborne Contaminants

- *Emergency measures, such as evacuation protocols and containment systems, shall be implemented for incidents involving harmful gas leaks or chemical spills.*
- *Contingency plans aligned with the Clean Air Act or equivalent national provisions shall be enforced if available and applicable.*

9.4.6.7 Training and Awareness

- *Workers shall be trained on air quality risks and the proper use of mitigation systems.*
- *Induction sessions shall be conducted to educate workers on the environmental and health impacts of airborne contaminants.*

9.4.6.8 Inspection and Maintenance

- *Dust suppression and emission control systems shall be inspected and maintained regularly to ensure effective performance.*
- *Maintenance logs shall be kept onsite and made available for regulatory audits.*

9.4.6.9 Environmental Sustainability

- *Sustainable practices, such as using eco-friendly construction materials and alternative fuels, shall be encouraged.*
- *Partnerships with suppliers offering low-emission technologies shall be promoted.*

9.4.6.10 Compliance and Certification

- *Compliance with air quality standards, such as the Clean Air Act (CAA), ISO 14001, or equivalent national regulations, shall preferably be ensured if available and applicable.*
- *Certifications for air quality management practices shall be maintained and made available during audits.*

9.4.6.11 Test Results and Onward Actions as per EMP

- *Test results shall be compared with the values and intervention provisions of ESMP of LGED and necessary interventions shall be taken;*
- *In case of Development partner aided Project/Contract provisions of the ESMP of the Development partner (s) concerned shall be complied with;*
- *In case of the unavailability of the provisions in the ESMP of LGED/Development Partner national standard for concerned element as indicated in the National Environmental Law and as applicable for LGED shall be complied with.*

9.4.7 Standards/Specifications for Airborne Contaminants for Construction/at Construction Worksites as Per Prevailing Laws/Acts/Rules of Bangladesh

There are several Acts, Laws, and Rules in Bangladesh that address air quality and the management of airborne contaminants. These provisions are applicable to construction worksites to ensure environmental protection and worker safety. Key regulations include:

1. ***Harmful Pollutants:*** *Activities emitting harmful air pollutants, such as dust, fumes, and emissions from machinery, shall be restricted.* ***(Environment Conservation Act, 1995: Clause-6)***
2. ***Environmental Clearance:*** *An Environmental Clearance Certificate shall be obtained before construction projects are initiated.* ***(Environment Conservation Act, 1995: Clause-12)***
3. ***Remedial Measures:*** *Measures for addressing air quality degradation caused by construction activities shall be implemented.* ***(Environment Conservation Act, 1995: Clause-7)***
4. ***Emission Standards:*** *Standards for air pollution applicable to construction sites shall be adhered to.* ***(Environment Conservation Rules, 1997: Schedule-13)***
5. ***Machinery Emissions:*** *Machinery and vehicles used in construction shall comply with national standards for emission control.* ***(Bangladesh Environment Conservation (Amendment) Act, 2010: Clause-6A)***
6. ***Health Protection:*** *Workers shall be safeguarded from exposure to harmful airborne contaminants by providing proper protective equipment and ventilation.* ***(Bangladesh Labour Act, 2006: Section-61)***
7. ***Waste Burning Restrictions:*** *Open burning of construction waste that generates airborne pollutants shall be prohibited.* ***(Brick Manufacturing and Brick Kilns Establishment (Control) Act, 2013: Clause-4)***

8. ***Air Quality Monitoring:*** *Continuous monitoring of air quality onsite shall be conducted to ensure compliance with regulatory standards.* ***(Environment Court Act, 2010: Section-7)***

9.5 Waterborne Contaminants (As per Prevailing Practice of LGED)

Waterborne contaminants at construction worksites present significant risks to the environment, human health, and construction operations. These contaminants, including oils, chemicals, sediments, and waste, can affect nearby water bodies, aquatic life, and surrounding communities. Failure to mitigate these risks can lead to ecological damage, health hazards, and regulatory violations. Proper management and mitigation measures ensure sustainable practices and prevent water pollution.

9.5.1 Examples of Hazards Related to Waterborne Contaminations at Construction Worksites

- ***Sediment Runoff:*** *Sediments from excavation and grading activities enter nearby water bodies, causing turbidity and harming aquatic ecosystems.*
- ***Oil and Chemical Spills:*** *Leakages from machinery, fuels, and storage tanks contaminate water sources, affecting aquatic and human health.*
- ***Construction Waste:*** *Improper disposal of waste materials, such as cement slurry or debris, pollutes nearby rivers, lakes, and wetlands.*
- ***Hazardous Substances:*** *Chemicals used in construction, such as adhesives and paints, may leach into groundwater and surface water sources.*
- ***Sanitary Waste:*** *Inadequate facilities at construction sites result in sewage discharge into water bodies, leading to contamination and health risks.*

9.5.2 Sources of Waterborne Contaminants at Construction Worksites

- ***Excavation and Grading:*** *Disturbance of soil leads to runoff, carrying sediments and pollutants into water bodies.*
- ***Chemical Handling and Storage:*** *Leaks and spills from improperly stored chemicals contribute to water pollution.*
- ***Machinery and Equipment:*** *Oil, fuel, and lubricant leaks from construction machinery enter surface water or groundwater.*
- ***Concrete and Cement Work:*** *Residues from cement and concrete mixing can wash into nearby water systems, affecting pH levels and aquatic life.*
- ***Sanitation Facilities:*** *Poorly managed worker sanitation facilities contribute to sewage pollution.*

9.5.3 Negative Impacts of Waterborne Contaminants at Construction Worksites

9.5.3.1 Environmental Impacts

- ***Water Pollution:*** *Contaminants degrade water quality, affecting aquatic ecosystems and human use of water.*
- ***Habitat Disruption:*** *Polluted water harms aquatic plants and animals, disturbing the ecosystem balance.*
- ***Eutrophication:*** *Excessive nutrients from construction runoff lead to algae blooms, depleting oxygen levels in water bodies.*

9.5.3.2 Health Impacts

- ***Waterborne Diseases:*** *Contaminated water spreads diseases such as diarrhea, cholera, and skin infections among nearby communities.*

- ***Chemical Exposure:*** *Toxic chemicals in polluted water pose health risks to workers and local residents.*
- ***Reduced Potable Water:*** *Pollution reduces the availability of clean drinking water for nearby communities.*

9.5.3.3 *Operational Impacts*

- ***Project Delays:*** *Pollution incidents may lead to work stoppages and remediation requirements, delaying construction timelines.*
- ***Increased Costs:*** *Expenses for treating water pollution and implementing remediation measures inflate project budgets.*
- ***Legal Penalties:*** *Non-compliance with water management regulations results in fines, lawsuits, and reputational damage.*

9.5.4 Positive Impacts of Mitigation of Waterborne Contaminants at Construction Worksites

9.5.4.1 *Environmental Impacts*

- ***Improved Water Quality:*** *Effective water management reduces pollutant levels and protects nearby water bodies.*
- ***Aquatic Habitat Preservation:*** *Preventing water pollution safeguards aquatic ecosystems and biodiversity.*
- ***Sustainability Promotion:*** *Sustainable practices align with national and global environmental goals.*

9.5.4.2 *Operational Impacts*

- ***Regulatory Compliance:*** *Adherence to water management standards prevents legal and operational disruptions.*
- ***Cost Savings:*** *Proactive measures reduce the need for costly remediation and waste management expenses.*
- ***Enhanced Efficiency:*** *Improved water quality minimizes risks of equipment damage and operational inefficiencies.*

9.5.4.3 *Financial and Legal Impacts*

- ***Reduced Legal Risks:*** *Compliance with regulations avoids fines, lawsuits, and penalties.*
- ***Market Competitiveness:*** *Sustainable practices improve corporate reputation and attract environmentally conscious clients.*
- ***Long-Term Savings:*** *Investments in water management technologies yield financial returns through cost reductions and operational efficiency.*

9.5.5 General Provisions for Waterborne Contaminants at Construction Worksites

These provisions are designed to minimize waterborne contamination caused by construction activities. The following provisions outline when and where the provisions shall be applied, as well as the mitigation measures necessary to ensure compliance with relevant laws, acts, and rules:

9.5.5.1 *When OHS Provisions for Waterborne Contaminants Are Applicable*

- ***During Site Preparation:*** *Provisions shall apply during land clearing, excavation, and grading activities that lead to sediment runoff.*
- ***Throughout Construction Phases:*** *Water pollution prevention measures shall be implemented during all construction phases, including material handling and storage.*

- ***Emergency Situations:*** *Provisions shall be enforced in response to spillages of chemicals, oil, or other pollutants.*
- ***Post-Construction:*** *Restoration of water bodies and removal of pollutants shall be ensured after project completion.*

9.5.5.2 Where OHS Provisions for Waterborne Contaminants Are Applicable

- ***Construction Worksites:*** *Provisions shall cover all activities within construction zones affecting water quality.*
- ***Nearby Water Bodies:*** *Rivers, lakes, and wetlands in proximity to construction sites shall be monitored and protected.*
- ***Storage Zones:*** *Areas storing hazardous materials or equipment with potential for water contamination shall fall under these provisions.*
- ***Sanitation Facilities:*** *Worker sanitation facilities shall be managed to prevent sewage leakage into water sources.*

9.5.5.3 Mitigation Measures and Suitability

- ***Sediment Traps:*** *Systems such as sediment basins and silt fences shall be installed to prevent soil runoff.*
- ***Spill Control Systems:*** *Equipment for rapid containment and cleanup of spills shall be deployed.*
- ***Water Treatment:*** *Onsite water treatment facilities shall be implemented to treat wastewater before discharge.*

9.5.5.4 Training and Awareness

- ***Workers shall be trained*** *on best practices for water pollution prevention and spill response measures.*
- ***Environmental awareness programs shall be conducted*** *to educate workers on the impacts of waterborne contaminants.*

9.5.5.5 Inspection and Maintenance

- ***Water management systems shall be inspected and maintained*** *regularly to ensure proper functioning.*
- ***Contingency plans shall be reviewed*** *periodically to remain effective in managing waterborne contaminants.*

9.5.5.6 Distribution and Accessibility

- ***Mitigation resources and equipment shall be accessible*** *to all workers at all stages of construction.*
- ***Spill response kits shall be placed*** *at strategic locations for immediate use.*

9.5.5.7 Signage and Compliance

- ***Signs indicating "Protect Water Sources" shall be prominently displayed*** *near high-risk zones.*
- ***Compliance with water management standards shall be monitored*** *through regular inspections and audits.*

9.5.5.8 Customization and Comfort

- ***Mitigation measures shall be customized*** *to suit site-specific water pollution risks and conditions.*
- ***Workers shall be provided with tools and resources*** *to comfortably and effectively manage waterborne contamination.*

9.5.5.9 Testing and Onward Actions

- *Surface water test as per available laboratory facilities shall be performed at the worksite;*

- *The results shall be examined by the concerned officials/ Engineers of LGED;*
- *Based on the results, suggestions for necessary interventions shall be given to the contractor;*
- *The contractor shall implement the suggestions within the scope of contact agreement.*

9.5.6 Standards/Specifications for Waterborne Contaminants at Construction Worksites

Water quality management is a vital component of sustainable construction practices. These standards and specifications are designed to minimize waterborne contaminants at construction worksites. By adhering to these guidelines, construction projects can ensure compliance with relevant regulations, reduce their impact on water resources, and promote environmental and human health. The following provisions outline key measures to address water quality challenges during construction activities:

9.5.6.1 Erosion and Sediment Control

- *Sediment control systems, such as silt fences, sediment basins, and erosion control blankets, shall be implemented to prevent runoff into nearby water bodies.*
- *Standards such as EPA's Construction General Permit (CGP) or equivalent national water quality regulations shall be followed for erosion and sediment control.*

9.5.6.2 Wastewater Management

- *Onsite treatment facilities for wastewater, including construction slurry and runoff, shall be implemented before discharge.*
- *Standards such as ISO 14046 for Water Management or equivalent national provisions shall be adhered to.*

9.5.6.3 Spill Prevention and Control

- *Spill control measures, such as bunded storage areas for hazardous chemicals, shall be implemented to contain leaks and spills.*
- *Rapid response systems for spill containment and cleanup shall be deployed at high-risk zones.*

9.5.6.4 Water Reuse and Conservation

- *Construction practices shall incorporate water-saving technologies, including recycling and reusing water used for activities such as concrete mixing or dust suppression.*
- *Standards such as LEED Water Efficiency or equivalent sustainability practices shall be followed.*

9.5.6.5 Sanitation Facilities Management

- *Sanitation facilities for workers shall be adequately maintained to prevent leakage of sewage into nearby water bodies.*
- *Compliance with local sanitation regulations and guidelines shall be ensured.*

9.5.6.6 Inspection and Monitoring

- *Water quality monitoring systems shall be installed onsite to continuously assess contamination levels in nearby water bodies.*
- *Reports on water quality shall be submitted regularly to ensure compliance with legal and environmental requirements.*

9.5.6.7 *Environmental Sustainability*

- *Sustainable construction materials and practices shall be encouraged to reduce water pollution and resource consumption.*
- *Partnerships with suppliers offering eco-friendly products shall be promoted.*

9.5.6.8 *Compliance and Certification*

- *Compliance with water management standards, such as ISO 14046 or equivalent national regulations, shall preferably be ensured.*
- *Certifications for water quality management practices shall be maintained and made available during audits.*

9.5.6.9 *Testing and Onward Actions*

- *Test results shall be compared with the values of the* ***Table:7-1: Water Quality Parameters Bangladesh Standards & WHO Guide Lines" as illustrated in Sus-Section- 7.1.3 of this standards;***
- ***After comparison of the values*** *necessary interventions shall be taken as per ESMP of LGED;*
- *In case of Development partner aided Project/Contract provisions of the ESMP of the Development partner (s) concerned shall be complied with;*
- *In case of the unavailability of the provisions in the ESMP of LGED/Development Partner national standard for concerned element as indicated in the National Environmental Law.*

9.5.7 Standards/Specifications for Waterborne Contaminants for Construction/ at Construction Worksites as Per Prevailing Laws/Acts/Rules of Bangladesh

There are several Acts, Laws, and Rules in Bangladesh addressing water quality and management of waterborne contaminants. These provisions ensure environmental protection at construction sites. Key regulations include:

1. ***Water Pollution Prevention:*** *Construction activities polluting water bodies, including runoff carrying sediments and pollutants, shall be prohibited.* ***(Water Act, 2013: Clause-8)***
2. ***Waste Disposal Guidelines:*** *Guidelines for safe disposal of wastewater and hazardous materials shall be followed.* ***(Hazardous Waste and Ship Breaking Waste Management Rules, 2011: Rule-5)***
3. ***Environmental Clearance:*** *An Environmental Clearance Certificate shall be obtained before construction projects are initiated.* ***(Environment Conservation Act, 1995: Clause-12)***
4. ***Remedial Measures:*** *Measures to address waterborne contamination caused by construction activities shall be implemented.* ***(Environment Conservation Act, 1995: Clause-7)***
5. ***Runoff and Sedimentation Control:*** *Runoff carrying sediments and pollutants shall be controlled using mitigation systems.* ***(Environment Conservation Rules, 1997: Schedule-13)***
6. ***Spill Management:*** *Spill prevention and control measures for hazardous materials shall comply with environmental guidelines.* ***(Bangladesh Environment Conservation (Amendment) Act, 2010: Clause-6A)***
7. ***Sanitation Management:*** *Worker sanitation facilities shall prevent leakage or contamination of water sources.* ***(Bangladesh Labor Act, 2006: Section-61)***
8. ***Ecologically Critical Areas:*** *Activities harming ecologically sensitive water bodies shall be prohibited.* ***(Bangladesh Environment Conservation (Amendment) Act, 2010: Clause-6B)***

9.5.8 Obligations of LGED Authority

1) *The obligation of LGED Authority concerned shall be as mentioned in the OHS Policy of LGED in complying with the OHS provisions at the worksite/ workplaces (Provisions of Sub-section: 6.1,6.2,6.3.6.4 & 6.9, Section:6).*

2) *In case of clauses that refers international standards or equivalent national standards/specifications:*
   - ***International standards shall be complied with if equivalent national standards are not available;***
   - ***National (or international) standards will be complied with if available and applicable;***
   - ***The issue of national (or international) standards shall be settled/ finalized by the authorized Engineer of LGED (not less than Executive Engineer) for the specific case/contract concerned.***

10. STORAGE & HANDLING OF MATERIALS

10.1 Storage, Stacking/Piling of Materials

Occupational Health and Safety (OHS) provisions for the storage of construction materials at the worksite are crucial to ensure a safe working environment. Here are some key guidelines:

10.1.1 General Requirements to be Considered for Storing Materials

Storing materials in worksite is evidently significant to maintain a safe and systematized working environment. Therefore, it needs to ensure some general requirements in storing materials as bellows:

10.1.1.1 Consistency

- *During storing materials:*
  - *Ensure consistency issues;*
  - *Ensure prevention of probable reactions between different substances (in applicable cases);*
  - *Store hazardous materials separately;*
  - *Strictly follow safety guidelines and regulations during storage of hazardous materials like chemicals etc..*

10.1.1.2 Labelling the Stacks/Piles of different materials Properly

- *In order to identify the contents all the materials shall be properly labelled;*
- *Labels of stacks/piles shall include:*
  - *Name of materials;*
  - *Potentials associated dangers;*
  - *Brief instructions how to handle.*

10.1.1.3 Proper Ventilation for Stored Materials

- *Proper ventilation shall be ensured especially for materials those release gases/fumes or need specific temperature;*
- *Satisfactory ventilation shall be provided at the storage area to prevent creation of potentially harmful substances or disapproving environment.*

10.1.1.4 Isolation of Chemical/Hazardous Materials

- *Chemical/Hazardous materials shall be stored so as to prevent cross-contamination or mixing especially if they are incompatible;*
- *Mismatched substances shall be separated to avoid potential chemical reactions or dangers;*

10.1.1.5 Necessary Safety to Fire

- *Measures for safety to fire shall be complied with perfectly during storage of materials;*
- *Applicable PROVISIONS/regulations/laws and/or guidelines shall be followed for fire protection;*
- *Flammable materials shall be kept away at a safe distance from sources of ignition;*
- *Appropriate fire prevention systems shall be used;*
- *Clear passageways shall be maintained for emergency exit of employees.*

10.1.1.6 Cleanliness/Housekeeping

- *Storage area shall be regularly inspected/visited to ensure standard condition of storage including cleanliness especially for equipment;*
- *Any types of spills/debris/barriers shall be cleaned sharply to prevent accidents or potential deterioration of stored materials.*

10.1.1.7 Proper Security for Stord Materials

- *Proper protection of stored materials from unauthorized access/theft/tampering shall be ensured;*
- *Security measures like locks/restricted access/ surveillance systems shall be applied depending on the nature of materials.*

10.1.1.8 Training and information

- *Appropriate training/orientation for employees (as per applicability) on proper procedures of material storage shall be ensured;*
- *Employees shall be made properly aware of any specific danger associated with the materials during handling them;*
- *Access to necessary documentation shall be ensured to educate employees about the properties of stored materials and requirements regarding handling them.*

10.1.1.9 Systematic Monitoring & Evaluation, Audits and Reviews

- *Material storage practices shall be Monitored & Evaluated and reviewed thereby periodically to assess the compliance with related and applicable regulations/procedures;*
- *Areas for improvement shall be identified from the report/result of review and the procedures shall be update as required;*
- *Systematic audit may be conducted in applicable cases to ensure proper storage, labelling etc. of materials.*

10.1.1.10 Divergence of Materials/Worksite etc.

- *Specificity of requirements for storage of material shall be noted carefully as it varies with the type of materials and category of contracts and worksites as well;*
- *Relevant safety regulations/standards/ guidelines etc. shall be complied with as applicable to the worksite and materials to ensure safety of employees.*

10.1.1.11 Information to Laborers, Safe space etc.

- *Laborers shall be informed about Potential hazards and the precautions necessary when moving materials manually or mechanically;*
- *Proper storage methods must be followed to avoid hazards.*
- *Materials shall be stored away from areas where they could be damaged or contaminated;*
- *Storage shall in such a way to ensure easy access to the materials;*

10.1.1.12 Easy Accessibility for Employees

- *Materials shall be stored ensuring easy access for employees to handle them without undue effort or risk;*
- *Appropriate arrangements like shelves, cabinets, racks etc. shall be used to store materials in an organized manner and ensure easy access;*
- *To reduce potential risk of injury during repositioning/movement, heavier/bulkier martials shall be stored at waist height or lower.*

10.1.2 General Storage Requirements

- *Materials should be stored properly to prevent damage and maintain workplace organization;*
- *Appropriate storage solutions, labeling, and handling methods shall be used.*

10.1.3 Space between Stacks

- *Sufficient space must be allowed between stacks for safe movement;*
- *Easy accessibility shall be ensured to prevent accidents.*

10.1.4 Fall/spill Control and Fire Protection

- *Appropriate equipment to control Fall/Spill and protect fire shall be made readily available near the storage area;*
- *Secondary containment trays can be used to protect potential Falls/ spills.*

10.1.5 Access Restrictions

- *Access to chemical storage areas shall be restricted to authorized personnel only;*
- *Unauthorized handling shall be ensured to prevent potential accidents.*

10.1.6 Safety Compliances

- *Abiding by to the LGED OHS standards shall be ensured;*
- *Storage areas must be kept free from materials that may cause dangers like tripping/fire/explosion etc.*

10.1.7 Importance of Cleanliness in storage/Piling/Stacking of Materials

Worksites can easily become very untidy if housekeeping and stacking/piling is not properly managed. Spoil/debris piling at the vicinity of excavations, piles of new materials, miscellaneous waste can all accumulate very quickly. **This may:**

- *Hamper/prevent safe movement of laborers/related pedestrians and vehicles round the worksite;*
- *Cause blocking lighting facilities;*
- *Cause block easy access to essential services, like fire equipment etc.;*
- *In considerable cases, stacks and piles of materials may be the cause of collapse resulting immediate danger;*
- *Fall over and result in unpredictable danger if they are not stacked/piled correctly.*

10.1.8 Design and Layout of Worksite

Sufficient space shall be allocated for storing/stacking/piling materials at the planning stage. This may include:

- *Areas for storage of materials shall be clearly and visibly defined;*
- *To facilitate comfort of identification, separate areas shall be demarcated for different items of materials;*
- *Materials/substances shall be segregated based on the types before storage;*
- *Special arrangement may be needed to store certain materials and substances like gas-bottle cages etc.;*

- *Storage areas/spots shall be remained neat and clean and in order all the way;*
- *The arrangement of the storage shall be inspected regularly;*
- *Applicable and appropriate warning signs shall be displayed (especially for flammable materials);*
- *Storage areas shall be remained restricted for the use of construction and other related activities.*

10.1.9 Efficient Way to Use Space in Stacking/Piling Materials

- *Each stack should be for one material only (not mixed).*
- *A maximum stack height must be set (depending on the material's strength and stability).*
- *Stacks should be vertical (not leaning).*
- *Pallets should be used to keep materials off the ground.*
- *Sufficient space must be allowed between stacks for safe movement.*
- *Stacks must be protected from being struck by vehicles.*

10.1.10 Storage of Chemicals and Hazardous/Dangerous Materials

For safe storage of chemicals and other hazardous/dangerous materials strict regulations and procedures and standard compliances are essential. Following standards shall be complied with:

- *Chemical substances shall be stored according to their compatibility groups;*
- *Unmatched/dissimilar chemicals substances shall be stored separately to prevent potential reactions.*
- *Chemical substances shall be kept in original containers with appropriate labels;*
- *In case of transferring any chemical substance(s) to a secondary/different container(s), the container(s) shall also be relabeled appropriately;*
- *Chemical substances shall never be stored on high shelves or in high cabinets to avoid potentially dangerous spill borne from fall;*
- *Flammable chemical substances shall be stored in approved flammable storage cabinets.*
- *Corrosive chemical substances shall be stored below eye level;*
- *Acidic and base chemical substances shall be stored separately;*
- *Appropriate ventilation for the stored chemical substances shall be ensured.*

10.1.11 Procedures for Handling Materials

Storage and Handling of materials are closely integrated in the perspective of construction activities at any worksite irrespective of category, size and diversity of contract/project/worksite. Therefore, safety concerns during Handling of construction materials are as important as storage. To ensure safety when handling materials following important steps shall be considered:

10.1.11.1 General Requirements

- ***Thorough Inspection for sharp-edged Materials***

  Thorough inspection shall be performed for materials:

- Like slivers/nails/objects that might be sticking out for rough or slippery surfaces;
- Materials like sharp or jagged edges or pericarps that may cause potential dangers.

- ***Creating Solid Grips***

  A solid grip/Hold shall be created on the object before handling to reduce reduces the chances of accidental drops leading to injury or damage to materials;

- ***Being Aware of the Pinch Points of Materials***

  - "Pinch points" are areas where a part of the body, typically a finger or hand can get caught between objects or surfaces.
  - Proper care shall be given regarding pinch points of materials during handling them especially when placing them down;
  - During handling longer objects like planks/pipes etc. especially hands of the handler shall be clear of the ends to prevent them from getting pinched.

- ***Cleaning Slippery Materials***

  - Any substance that may cause for slipping during handling or storing any object shall be cleaned off before commencement of the handling operation to reduce the risk of slips leading to injury;
  - This types of materials could include grease/water/ dirt/mud etc..

- ***Making Hands Clean and Free from Slippy Substances***

  - The handler shall make sure to clean his hands before commencing the handling operation;
  - The handler shall make sure to keep his hands free from substances like oil/grease etc. that may cause problem to grip materials easily.

- ***Using Equipment for Heavy Materials***

  - Equipment like hand pallets/hand trucks shall be used to move heavy materials to help make the handling operation easier especially to prevent strain injuries.

- ***Limiting Lifting Overweight***

  - Lifting of weights shall be limited to the safe handling capacity;
  - Lifting or carrying items that weigh more than 50 pounds without assistance may be avoided to prevent injuries such as muscle strains or more severe damage.

10.1.12 Use of Related Personal Protective Equipment (PPE)

Ensuring incorporation of Personal Protective Equipment (PPE) into the work routine when materials are to be handled is crucial for maintaining safety. Following key guidelines regarding the use of Personal Protective Equipment shall be complied with during Handling of Materials:

- ***Handles/Holders/Similar Equipment***

Handles/holders/similar equipment shall be used when lifting loads to help prevent accidents like pinching/ smashing fingers etc.

- ***Safety Shoes/Boots***

  For moving/Handling heavy/cumbersome materials (preferably steel-toed) safety shoes/ boots shall be put on to protect feet of the handler concerned from injuries in case of accidental drop of load or slip while carrying them.

- ***Hand Gloves/Similar Hand Protection Equipment***

  In most circumstances, you should wear gloves or other hand protection to safeguard your hands from potential injuries during handling.

- ***Protection of Eyes and Strong Gloves***
  - *During handling of Large Box/ pack/bale bounded with wire equipment for eye protection and strong hand gloves shall be used to prevent the ends of the wire from cracking/becoming loose and striking the handler;*
  - *Similar measures shall be taken during handling wire/strapping/cable coils etc.*

- ***Cutters***

  Cutters shall be used during cutting wire/similar materials to secure the ends and prevent the cut ends from springing out and causing injury.

10.1.13 Lifting And Carrying

- ***General Requirements***
  - *Prior to the commencement of heavy and/or frequent lifting operation, it shall be ensured that the laborer/operator concerned is physically fit for performing the job;*
  - *The laborer/operator concerned shall seek for/ take help/ use a lifting aid to perform the lifting operation safely if it is deemed that the load is beyond the capacity of one laborer to handle with.*

10.1.14 Appropriate Techniques for lifting Materials/Loads/ Objects

The following steps shall be complied with perfectly for safe lifting of materials:

- ***Feet of the lifter shall be kept separated:***
  - *One alongside; and*
  - *One behind the Material/Load/Object.*
- *Back of the lifter shall be kept straight and nearly vertical;*
- *The lifter shall bend at the knees instead of the waist;*
- *The lifter shall keep his mouth/chin folded to avoid potential danger of cutting tongue;*
- *The lifter shall grasp the material/load/object with entire hand;*
- *The elbows and arms of the lifter shall be remained folded;*
- *The lifter shall keep the weight of body directly on his feet;*
- *If as per demand of situation and/or necessity it needs to carry the bulky material/load/objects on the shoulder, the lifter(s) concerned shall be trained in these techniques for such special situations.*

10.1.15 Handling Round Shaped Materials Like Barrels/Drums etc.

- ***General Requirement***

  Barrels/drums etc. shall be moved by using mechanical devices as per convenience.

- ***Handling by Two Handlers***

- *The handlers shall stand on opposite sides of the drum facing each other;*
- *Both rolled edges at both ends of the barrel near their high points shall be griped, then one end shall be lifted and the other end shall be pressed down;*
- *When the drum is up-ended and balanced on the bottom rolled edge, the grip on the bottom rolled edge shall be released and the drum shall be straightened.*

- ***Overturning a Full Drum/Barrel by Two Handlers***
  - *Provision for enough space for the movement of drum/barrel shall be ensured;*
  - *Overcrowded places/location shall preferably be avoided to prevent bad injuries to hands.*
  - *Both handlers shall stand near each other, facing the drum/barrel;*
  - *The handlers shall grip the closest point of the top rolled edges of the drum/barrel with both hands;*
  - *The palms of the handlers shall rest against the side of the drum/barrel;*
  - *The handlers then shall push the drum/barrel until it balances on the lower rolled edge.*
  - *Then both the handlers shall step forward a short distance;*
  - *Then each handler shall release one hand from the top rolled edge to grip the bottom rolled edge;*
  - *After that the handlers shall ease the drum down horizontally until it rests solidly on its side.*
- ***Rolling/Changing the Direction of Rolling of Drum/ Barrel***
  - *For rolling, the handler shall push against the sides of a barrel/drum with his/her hands;*
  - *For changing the direction of the roll, he/she shall grip the rolled edges, not kick the drum with his/her feet.*
- ***Handling Drums/Barrels in Skiddy Spot***
  - *To lower a drum or barrel down a skiddy passage, the handlers shall turn it and slide it end-wise;*
  - *The Barrel/Drum shall never be rolled in such cases;*
  - *To raise a drum or barrel up a skiddy passage, two handlers shall stand on opposite sides of the skiddy spot. Then the handlers shall roll the drums/barrels object up the inclination.*

10.1.16 Handling Materials/Loads/Objects with Cylindrical Shape

- ***General Provisions***

  Due to the shape and size, storing, handling and Moving of the materials/ Loads/Shapes like pipes, bars, tubes and other cylindrical objects are exceptionally challenging. Therefore, it needs special considerations for safe storage, handing and movement.

- ***Special Guidelines***

  In addition to the appropriate lifting and carrying procedures mentioned earlier following guidelines shall be followed when dealing with cylindrical materials/ loads/objects:

  - *Pipe-handling equipment like pipe hooks/ forceps shall preferably be used (i.e. whenever possible);*
  - *Cylindrical material/load/object shall never be made stand on its end to avoid easy tipping and rolling;*
  - *Cylindrical material/load/object shall never be stored on a slope;*

- *Blocks/chocks/suitable methods shall be used to prevent cylindrical material/load/object from rolling (in applicable cases).*
- *For stacking cylindrical material/load/objects safe height shall not be exceed to ensure the safety and security.*

10.1.17 Obligations of LGED Authority

1) *The obligation of LGED Authority concerned shall be as mentioned in the OHS Policy of LGED in complying with the OHS provisions at the worksite/ workplaces (Provisions of Sub-section: 6.1,6.2,6.3,6.4 & 6.9, Section:6).*

2) *In case of clauses that refers international standards or equivalent national standards/specifications:*

   - ***International standards shall be complied with if equivalent national standards are not available;***
   - ***National (or international) standards will be complied with if available and applicable;***
   - ***The issue of national (or international) standards shall be settled/ finalized by the authorized Engineer of LGED (not less than Executive Engineer) for the specific case/contract concerned.***

11. OCCUPATIONAL HEALTH AND SAFETY RELATED TO CONSTRUCTION

Occupational health and safety in construction is essential for safeguarding the well-being of workers in one of the most hazardous industries. This field focuses on identifying and mitigating risks associated with construction activities, such as falls, equipment-related injuries, exposure to harmful substances, and structural hazards. Effective practices include implementing safety protocols, regular training, personal protective equipment (PPE), and adhering to legal regulations. Prioritizing health and safety not only prevents accidents but also promotes a productive and sustainable working environment.

11.1 General Requirements

The general requirements for occupational health and safety in construction aim to create a safe and healthy working environment by addressing key risk factors. These provisions typically include regulations for hazard identification, use of personal protective equipment (PPE), proper training for workers, safe operation of machinery, emergency preparedness, and regular health monitoring. They emphasize compliance with national and international safety standards to prevent accidents, injuries, and illnesses, ensuring the well-being of workers while enhancing efficiency and productivity on construction sites. The leading requirements are as bellows:

11.1.1 Formation of Occupational Health and Safety Committee (OHSC)

At every Worksite/Construction site an Occupational Health and Safety Committee (OHSC) shall be formed and maintained conforming with Provision 4.2 of this Standards.

11.1.2 Protective Considerations for Potential Electrical Dangers

Prior to the commencement and during the construction of any construction work necessary measures shall be taken to:

- *Prevent potential dangers to the laborers;*
- *Operating the equipment from any live electric cable or equipment:*
  - Either by making the cable or apparatus electrically dead; OR
  - By providing barriers to prevent any contact that may cause danger.

11.1.3 Protection of Machines and Parts Thereof

All the machineries along with moving parts shall be protected in accordance with the prevailing provisions of LGED.

11.1.4 Arrangement for Fire Protection

- *Appropriate measures shall be taken to:*
  - Avoid the risk of fire;
  - Combat any occurrence of fire quickly and efficiently;
  - Arrange for a quick and safe evacuation of laborers and others persons.
- *Appropriate and adequate storage shall be provided for flammable liquids, solids and gases.*

- *Fire Protection equipment shall be provided in accordance with the PROVISIONS/regulations of* ***"Department of Fire Service and Civil Defense"****;*

11.1.5 Arrangement for Lights at Worksites

Arrangement for sufficient and suitable lights *(including portable lights where appropriate)* shall be ensured in:

- *Every working area;*
- *Every Approaches;*
- *Every place where lifting or dropping operations using lifting appliance are in progress;*
- *Every opening especially potentially harmful to laborers.*
- *Every workplace and any other place on the construction site where a laborer may have to pass.*

11.1.6 Manual Lifting of Weights

In case of continuous lifting of weight:

- *A male laborer alone shall not lift/carry/move any load more than* ***50 (Fifty) kilograms (50 kgs.);***
- *A female laborer alone shall not lift/carry/move any load more than* ***25 (Twenty-Five) kilograms (25 kgs.);***
- *Weights over the limits mentioned in (a & b) shall either be handled by more than one laborer (as applicable for male and female) or by mechanical means.*

11.1.7 Repair/Replacement of Pipelines (Gas/Water/Electric etc.)

Repair/replacement of any section of a pipeline under pressure of gas/water/electricity etc. shall not be made until the pipeline is:

- *Released from the pressure; or*
- *The section under repair/replacement is blocked off the line pressure;*
- *It is ensured that no laborer during this operation will be endangered.*

11.1.8 Protection of Pedestrians from Falling Substances

If a sidewalk or public road exists at a distance less than 2.3 m. (7 ft.) from a construction site (bridge/building/other construction works), construction of a safe and covered walkway over the sidewalk for the use of pedestrians is preferable.

11.1.9 Protection of Laborers/related Employees from Potential Dangers of Falling Materials

- Necessary measures shall be taken to protect laborers from dangers of falling materials, For example:
  - *The provision of safety helmets;*
  - *Safety shoes;*
  - *Other applicable protective measures.*
- Any materials (including tools, objects and waste materials etc.):
  - *Shall not be thrown or tipped from a height;*
  - *Shall be properly dropped/descended by appropriate machine/ equipment (like crane etc., as applicable, feasible and safe);*

- In practical situation where the arrangement of (b) is not practicable, the area where the material is thrown or lowered:
  - *Shall be fenced safely and perfectly; and*
  - *No person (laborers and others) shall be allowed in the area restricted by fence.*

11.1.10 Loose /Fragile/Harmful Materials

- *Material like wooden boards/Planks with swollen nails shall not be used in any work or be allowed to remain in any place of potential danger to the laborers;*
- *Movable materials shall not be placed or left on working platforms, gangways, floors or other workplaces;*
- *Movable materials shall be removed/stacked/stored so that it may not be the cause of obstruction to the passage of movement of laborers/ persons;*
- *Movable/Loose materials shall not be stored/stacked in such a way so that:*
  - *It may cause harm to the laborers; OR*
  - *Platform, gangway, floor, roof or any other part of the bridge/ building/ structure concerned may experience overload and be unsafe.*

11.1.11 Protection Against Probable Breakdown/Collapse of Unstable/ Temporary Structure

- *Appropriate support shall be provided to all temporary structure by using fixings materials necessary to ensure stability during construction;*
- *Shoring shall be constructed to prevent the probable collapse or fall of any part of the structure in case of construction work with potentiality of reducing the stability of an existing or adjacent structure.*

11.1.12 Arrangement for Safe Access and Exit

- *Arrangement for safe access to and exit from every place where work is ongoing at the worksite shall be provided and maintained properly.*

11.1.13 Safe Storage of Construction Materials

- *Construction materials and equipment shall not be placed or stored on a permanent/under construction structure (bridge/building /other structure) exceeding its safe load carrying capacity;*
- *Boards/Panels etc. of structural steel/similar construction materials shall be properly stored and secured against collapsing/ tilting;*
- *Cross pieces shall be used in a pile of Boards/Panels etc. of structural steel* ***crossing 1 m. (3 ft.) height;***
- *Pipes/reinforcing steels shall be stacked in racks/frames with sufficient supports to prevent unwanted movement;*
- *Construction materials/tools etc. shall not be stored on passages/ platforms.*

11.1.14 Safe Storage of Materials with Cylindrical Shape

Materials with cylindrical shape *(like compressed gas cylinders)* shall be:

- *Stored in standing position;*
- *Protected against heat and overturning; and*

- *The control valves shall be covered by protective caps screwed to proper positions when not in use.*

11.1.15 Temporary Control of Vehicular Traffic

In construction sites where safety of laborers is likely to be threatened by moving vehicular traffic, following measures shall be ensured/complied with:

- *Appointing necessary flagmen;*
- *Installing adequate warning signs;*
- *Installing/erecting/placing necessary barriers/lane control devices.*

11.1.16 Staying in Vehicle During Loading/Unloading

- *No employee shall remain/stay on/in a vehicle during loading/ unloading except those mandatorily required to be there (e.g., Driver/helper);*
- *Irrespective of category/class of employee it shall be allowed to stay/remain in/on a vehicle during loading/unloading only when all necessary protective measures against potential dangers are ensured.*

11.1.17 Driving Vehicle/Equipment Inside the Worksite

No employee shall be allowed to drive/operate any vehicle/ equipment inside a construction site without:

- *Adequate training and experience to operate such vehicle or equipment; and*
- *Authorization/permission from competent authority.*

11.1.18 Operating Internal Combustion Engines in the Worksite

- *Internal combustion engines shall not be allowed to operate in an enclosed area within the worksite;*
- *The embargo shall not be applicable for the following instances:*
  - *The exhaust gases/fumes are discharged directly outside to a place/point where the discharged gases/fumes have no chance to reenter into the enclosure;*
  - *Appropriate ventilation for the place concerned is ensured to protect laborers from the hampers of exhaust gases.*

11.1.19 Use of Personal Protective Equipment (PPE)

- *Personal Protective Equipment (PPE) shall be provided the laborers as required in Sub-section: 7.9 of Chapter-7 of this Standards.*

11.1.20 Other Applicable Standards

The provisions of this standards are the minimum requirements applicable for worksite of project/contract package under the jurisdiction of LGED. In case of any applicable provisions which is not covered by this standard but any other regulation of other government authority of the same nature covers the provision, LGED may apply that Provision/standard if it seems reasonable.

11.2 Deep and Steep Excavations/Earthworks and Underground Works

Occupational health and safety (OHS) provisions for excavations, earthworks, and underground works at construction worksites are designed to protect workers from potential hazards. These include measures to prevent cave-ins, ensure proper shoring and bracing, monitor air quality, and maintain adequate ventilation in confined spaces. They also emphasize the safe use of equipment, continuous risk assessments, worker training, and emergency response protocols. By addressing these aspects, OHS provisions aim to create a safer and more efficient working environment for all involved.

Managing Deep and Steep Excavations at construction worksites is crucial for ensuring worker safety, protecting equipment, and minimizing disruptions to project operations. Implementing proper protocols for these activities ensures compliance with regulatory standards, enhances worker confidence, and promotes a safe working environment. Effective excavation management practices help maintain a safe work environment, comply with regulations, and ensure efficient project execution.

11.2.1 Examples of Hazards Related to Deep and Steep Excavations at Construction Sites

- ***Cave-Ins:*** *The collapse of excavation walls, posing risks to workers within the excavation area.*
- ***Falls:*** *The risk of workers falling into excavations, leading to injuries or fatalities.*
- ***Sharp Edges:*** *Sharp edges and protruding objects within Deep and Steep Excavations that can cause cuts, lacerations, and puncture wounds.*
- ***Heavy Equipment:*** *Risks associated with the operation of heavy equipment near excavation areas.*
- ***Utility Strikes:*** *Accidental contact with underground utilities, such as gas lines, water pipes, and electrical cables.*

11.2.2 Examples of Excavation Management Measures

- ***Pre-Excavation Assessment:*** *Conducting thorough assessments to identify potential hazards, ground conditions, and the presence of underground utilities.*
- ***Shoring and Shielding:*** *Using shoring and shielding systems, such as trench boxes and hydraulic shoring, to prevent cave-ins and protect workers.*
- ***Sloping and Benching:*** *Implementing sloping and benching techniques to stabilize excavation walls and reduce the risk of collapse.*
- ***Fall Protection:*** *Installing guardrails, barriers, and covers to prevent falls into excavation areas.*
- ***Marking and Signage:*** *Clearly marking excavation boundaries and installing warning signs to alert workers and visitors of potential hazards.*
- ***Safe Entry and Exit:*** *Providing safe access and egress points, such as ladders and ramps, for workers entering and exiting excavations.*

- ***Utility Location:*** *Identifying and marking the location of underground utilities before excavation to prevent accidental strikes.*
- ***Monitoring:*** *Continuously monitoring excavation conditions, including soil stability and weather changes, to detect signs of instability.*
- ***Training:*** *Providing workers with training on safe excavation practices, hazard recognition, and emergency response.*

11.2.3 Negative Impacts of Poor Excavation Management

11.2.3.1 Health and Safety Impacts

- ***Increased Risk of Injuries:*** *Poor excavation management can lead to injuries from cave-ins, falls, and sharp objects.*
- ***Utility Strikes:*** *Accidental contact with underground utilities can result in explosions, electrocution, and other serious hazards.*
- ***Entrapment:*** *Inadequate excavation practices can lead to workers being trapped in collapsed excavation areas.*

11.2.3.2 Operational Impacts

- ***Work Disruptions:*** *Excavation-related accidents and hazards can disrupt site operations, leading to project delays and increased costs.*
- ***Equipment Damage:*** *Poor excavation management can result in damage to equipment and machinery.*

11.2.3.3 Legal and Financial Impacts

- ***Non-Compliance Penalties:*** *Failure to implement proper excavation management measures can result in fines and penalties from health and safety authorities.*
- ***Reputation Damage:*** *Inadequate excavation management can harm the company's reputation, affecting relationships with clients, stakeholders, and potential employees.*
- ***Increased Project Costs:*** *Inefficient excavation practices can lead to cost overruns, including unexpected expenses for additional labor, equipment, or material repairs.*
- ***Insurance Premiums:*** *Poor safety management can result in higher insurance premiums due to increased risks associated with excavation activities.*
- ***Litigation Costs:*** *Legal disputes arising from accidents or damage caused by inadequate excavation management can result in significant legal fees and compensation claims.*

11.2.4 Positive Impacts for Compliance with Excavation Management Standards

11.2.4.1 Health and Safety Impacts

- ***Reduced Risk of Injuries:*** *Proper excavation management measures protect workers from injuries related to cave-ins, falls, and sharp objects.*
- ***Utility Safety:*** *Effective utility location and protection measures reduce the risk of utility strikes and associated hazards.*

11.2.4.2 Operational Impacts

- ***Increased Efficiency:*** *A well-managed excavation site promotes efficient work processes and minimizes disruptions.*
- ***Equipment Protection:*** *Proper excavation management helps protect equipment and machinery from damage.*

11.2.4.3 Legal and Financial Impacts

- ***Compliance with Regulations:*** *Adhering to excavation management standards ensures compliance with health and safety regulations, avoiding legal issues.*
- ***Enhanced Reputation:*** *Demonstrating commitment to proper excavation management enhances the company's image and builds trust with clients, stakeholders, and the community.*
- ***Cost Savings:*** *Effective excavation management reduces the financial burden associated with accidents, equipment damage, and project delays. It also helps avoid penalties and fines related to non-compliance with regulations.*
- ***Increased Profitability:*** *Proper excavation management can lead to cost efficiencies, optimizing resource use and reducing unnecessary expenditures, which boosts overall profitability.*
- ***Investment Attraction:*** *Companies known for their rigorous safety and compliance measures are more likely to attract investors looking for stable and responsible investments.*
- ***Insurance Benefits:*** *Demonstrating excellent excavation management can lead to lower insurance premiums, as insurers may perceive reduced risk in well-managed operations.*

11.2.5 General Provisions for Large/Sharp Deep and Steep Excavationsat Construction Worksite

Large/sharp excavation management is critical at construction sites. Effective management ensures the safety of workers, motorists, and pedestrians, maintains smooth site operations, and minimizes disruptions. By adhering to the following provisions, construction companies can create a safe and efficient work environment:

11.2.5.1 When these provisions should be used/applicable

- ***Pre-construction Phase:*** *Before the excavation project begins, all necessary safety measures and management strategies should be planned and ensured.*
- ***During Construction:*** *Continuously throughout the excavation process, especially during high-risk periods or complex activities, workers and surrounding areas should be protected.*
- ***Emergency Situations:*** *During incidents or unexpected events, the worksite should be managed, and safety measures should be ensured.*
- ***Post-incident:*** *After any excavation-related incident, damage should be assessed, the effectiveness of the measures should be reviewed, and improvements for future incidents should be made.*

11.2.5.2 Where these provisions should be used/applicable

- ***Construction Sites:*** *Any construction site where large/sharp Deep and Steep Excavations are required, particularly sites with significant depth or complexity, should be covered.*
- ***High-Risk Areas:*** *Sites located in regions with potential hazards, such as unstable soil or high groundwater levels, should be managed.*
- ***Temporary Structures:*** *Areas with temporary supports or equipment that could impact excavation safety should be considered.*
- ***Critical Zones:*** *Specific zones within the excavation site that require special attention, such as entry points or intersections with existing utilities, should be managed.*

11.2.5.3 Excavation Management Plans and Suitability

- ***Excavation Management Plans (EMPs):*** *Should be developed and implemented based on specific site conditions and risks.*
- ***Compliance with Industry Standards:*** *Such as OSHA regulations or equivalent national standards should preferably be used if available and applicable.*

11.2.5.4 Training and Awareness

- ***Worker Training:*** *Workers should be trained on excavation safety procedures, including the use of protective equipment, emergency communication, and safety protocols.*
- ***Regular Drills:*** *Regular drills and training sessions should be conducted to ensure workers are familiar with excavation management procedures.*

11.2.5.5 Inspection and Maintenance

- ***Regular Inspections: Excavation sites, supports, and protective systems should be regularly inspected and maintained.***
- ***Manufacturer Guidelines: Manufacturer guidelines for the care and replacement of excavation equipment and materials should be followed.***

11.2.5.6 Distribution and Accessibility

- ***Access to Resources:*** *Access to excavation management equipment and resources should be provided at all stages of the excavation process.*
- ***Readily Available:*** *Excavation management equipment and resources should be readily available and accessible to all workers, subcontractors, and visitors.*

11.2.5.7 Customization and Comfort:

- ***Customization:*** *Customization of excavation management measures to suit specific site conditions and requirements should be allowed.*
- ***Worker Comfort:*** *Resources and support for workers to adopt excavation management procedures comfortably and effectively should be provided.*

11.2.5.8 Emergency Response Coordination:

- ***Communication Channels:*** *Clear communication channels and protocols for emergency response during excavation-related incidents should be established.*
- ***Coordination with Authorities:*** *Coordination with local emergency services and authorities to ensure prompt assistance if needed should be ensured.*

11.2.5.9 Worker/Laborer Welfare:

- ***Protective Gear:*** *Adequate shelter and protective gear for workers managing Deep and Steep Excavations during severe weather conditions should be provided.*
- ***Essential Supplies:*** *Access to drinking water, first aid, and other essential supplies for workers managing Deep and Steep Excavations should be ensured.*

11.2.5.10 Monitoring and Forecasting:

- ***Geotechnical Monitoring:*** *Systems to monitor soil conditions and receive real-time updates should be implemented.*
- ***Risk Forecasting:*** *Tools to predict potential risks, allowing for timely preparation and response, should be utilized.*

11.2.5.11 Documentation and Reporting:

- ***Record-Keeping:*** *Records of all excavation management activities, including training sessions, inspections, and incidents, should be maintained.*
- ***Incident Reporting:*** *Significant excavation-related incidents should be reported to relevant authorities and stakeholders, as required.*

11.2.5.12 Continuous Improvement:

- ***Plan Review:*** *Excavation management plans should be regularly reviewed and updated based on lessons learned and best practices.*
- ***Feedback:*** *Feedback from workers and stakeholders should be encouraged to continuously improve the effectiveness of management measures.*

11.2.5.13 Other General Provisions

Following General safety provisions shall be ensured/complied with in any excavation earthworks/ underground works:

- *Suitable shoring/ guard against applying other means shall be ensured to protect laborers from dangers borne from a fall/ dislodgement of earth/rock/other similar materials;*
- *Appropriate protection shall be ensured against dangers arising from the fall of laborers/employees/persons concerned/ materials/ objects/ the inflow of water into the excavation, shaft, earthworks, underground works;*
- *Sufficient ventilation at every workplace shall be ensured so as to maintain:*
  - ✓ *An atmospheric fitness for respiration;*
  - ✓ *Limits of fumes, gases, vapors, dust or other impurities below danger level or non-injurious to health;*
  - ✓ *Other limits as provided by this Standards;*
- *Laborers shall be enabled to reach safety in the event of fire or an inflow of water or other material having potentiality of danger;*
- *Appropriate investigations shall be undertaken and identify locations to avoid risk to laborers arising from possible underground dangers like:*
  - ✓ *The circulation of fluids;*
  - ✓ *The presence of pockets of gas etc.*

11.2.6 Standards/Specifications for Large/Sharp Deep and Steep Excavationsat Construction Worksite

These standards and specifications outline the necessary protective measures, equipment requirements, and procedural guidelines to mitigate risks associated with large and sharp excavations. By implementing these practices, construction companies can create a safer work environment, reduce the likelihood of accidents, and comply with regulatory requirements.

The following sections provide detailed provisions for the management of large and sharp excavations, including protective systems, sharp object handling, atmospheric monitoring, efficient processes, regulatory compliance, and continuous improvement. By understanding and applying these standards, construction professionals can ensure the highest level of safety and operational efficiency at their worksites:

11.2.6.1 Protective Systems

- *Protective systems such as shoring, shielding, and sloping **should be** used to prevent cave-ins.*
- *Trenches **5 feet (1.5 meters)** deep or greater **should be** equipped with a protective system unless made entirely in stable rock.*
- *Trenches **20 feet (6.1 meters)** deep or greater **should be** equipped with a protective system designed by a registered professional engineer.*
- *Protective systems **should be** inspected regularly. **Inspection frequency: Daily.***

11.2.6.2 Sharp Object Handling

- *Proper protective equipment (PPE) **should be** used when handling sharp objects, including gloves and safety goggles compliant with ANSI Z87.1 standards or equivalent national standards if available and applicable should preferably be used.*
- *Sharp objects and debris **should be** disposed of in designated containers that meet OSHA specifications or equivalent national standards if available and applicable should preferably be used.*
- *Regular inspections **should be** implemented to ensure sharp objects are properly managed. **Inspection frequency: Weekly.***

11.2.6.3 Atmospheric Monitoring

- *Atmospheric hazards such as low oxygen, hazardous fumes, and toxic gases **should be** tested for in Deep and Steep Excavations**4 feet (1.2 meters)** deep or greater.*
- *Gas detectors and ventilation systems **should be** used to manage hazardous atmospheres.*
- *Regular atmospheric monitoring **should be** conducted. **Monitoring frequency: Before each shift.***

11.2.6.4 Efficient Processes

- *Efficient excavation processes **should be** implemented to minimize disruptions to project timelines.*
- *Excavation activities **should be** scheduled during off-peak hours to avoid interfering with other construction work.*
- *Designated disposal areas **should be** used, and proper waste segregation practices **should be** followed.*

11.2.6.5 Regulatory Compliance

- *Compliance with excavation safety standards, (international or equivalent national standards if available and applicable) preferably the following should be ensured:*

a) Surface Encumbrances

- ✓ All surface encumbrances that create a hazard to employees **shall be removed or supported** as necessary to safeguard employees.

b) Underground Installations

- The estimated location of underground utility installations, such as sewer, telephone, fuel, electric, and water lines, **shall be determined** prior to opening an excavation.
- Utility companies or owners **shall be contacted** within established or customary local response times to establish the location of underground installations.
- Underground installations **shall be protected, supported, or removed** as necessary to safeguard employees while the excavation is open.

c) Access and Egress

- A safe means of egress, such as a stairway, ladder, or ramp, **shall be located** in trench Deep and Steep Excavationsthat are **4 feet (1.22 meters)** or more in depth, ensuring no more than **25 feet (7.62 meters)** of lateral travel for employees.

d) Soil Classification

- Soil classification **shall be determined** by the contractor with the help of concerned LGED Engineer to identify the appropriate protective system.
- Sloping or benching systems **shall be designed** in accordance with the soil type and the requirements of LGED or national Standards.

e) Spoil Placement

- Excavated soil (spoils) and other materials **shall be kept** at least **2 feet (0.6 meters)** from the edge of the excavation.

f) Fall Protection

- Employees working near Deep and Steep Excavations **shall be protected** from falling by guardrails, fences, or barricades when the excavation is not readily visible.
- Personal Fall Arrest Systems (PFAS) **shall be used** when required.

g) Equipment Safety

- Heavy equipment **shall be kept** away from the edges of Deep and Steep Excavationsto prevent collapse.
- Employees **shall not work** under suspended or raised loads and materials.

h) Emergency Preparedness

- Emergency rescue equipment **shall be available** when hazardous conditions are present.
- Employees **shall be trained** in emergency procedures and hazard recognition.

- *Records of excavation activities, including types of protective systems used and inspection reports, **should be** kept.*
- *Regular audits **should be** conducted to ensure compliance with excavation safety standards. **Audit frequency: Annually.***

11.2.6.6 Protection from Cave-Ins

- *Protective systems such as shoring, shielding, and sloping **should be** used to prevent cave-ins.*
- *Trenches **5 feet (1.5 meters)** deep or greater **should be** equipped with a protective system unless made entirely in stable rock.*

- *Trenches **20 feet (6.1 meters)** deep or greater **should be** equipped with a protective system designed by competent engineer and approved by the LGED Engineer concerned.*
- *Protective systems **shall have the capacity** to resist all intended loads without failure.*

11.2.6.7 Injury Prevention from Sharp Objects

- *Proper protective equipment (PPE) such as gloves and safety goggles rated for impact resistance **should be** used.*
- *Sharp objects and debris **should be** disposed of in designated containers.*
- *Regular inspections **should be** implemented to ensure sharp objects are properly managed.*

11.2.6.8 Atmospheric Hazard Management

- *Atmospheric hazards **should be** tested for in Deep and Steep Excavations**4 feet (1.2 meters)** deep or greater.*
- *Gas detectors and ventilation systems **should be** used to manage hazardous atmospheres.*
- *Regular atmospheric monitoring **should be** conducted.*

11.2.6.9 Shoring/Timbering

- *The walls of every excavation **over 1 m. (3 ft.) deep** shall be supported by adequate shoring/timbering (as applicable) to prevent collapse;*
- *Shoring/timbering provisions shall be approved by the **concerned Official/supervising Engineer of LGED** before commencing the excavation;*

11.2.6.10 This provision shall not apply to an excavation

- *In which a laborer/employee is not required to enter for any purposes;*
- *Excavation is operated in solid rock;*
- *The slopes the walls of excavation are more than or equal to forty-five-degree (45°) from the vertical line or cut to the angle of repose;*
- *In which laborer/employee is deployed for timbering/ necessary steps to comply with the of this section to ensure safety of laborers supposed to work of excavation.*

11.2.6.11 Design of Shoring/Timbering

- *Shoring/timbering in excavation **over 6.6 m. (29 ft.) deep** and protective measures installed to prevent the movement/collapse of any adjacent structure shall be designed by a competent engineer and approved by the proper authority of LGED (preferably the Executive Engineer/Upazila Engineer) concerned.*

11.2.6.12 No Excavation at unsafe Distance

- *If there remains any structure within an unsafe distance from the spot of excavation, no excavation shall be undertaken unless necessary measures as mentioned in this sub-section are taken to prevent danger to laborers/employees concerned;*

11.2.6.13 Before Excavation to do

- *Before shoring/timbering, the walls of the excavation shall be made free of loose rocks/other materials that might slide/roll or fall on laborers/employees concerned;*

11.2.6.14 Keeping Free of Water

- *Every excavation **over 1 m. (3 ft.) height** shall be kept free of water all the way.*

11.2.6.15 Provision of Berm

- *Excavated material shall be kept away from the edge of the excavation providing a clear berm maintaining a distance at least one third of the depth of the excavation;*
- *If the disposal area is limited, a berm of reduced width not less than 1 m. (3 ft.) may be allowed, provided that:*
  - ✓ The materials being excavated are stable;
  - ✓ The shoring is designed to carry the additional load; and
  - ✓ Barriers are provided to prevent roll back of the excavated materials.

11.2.6.16 Preservation of Excavating Tools/ Materials/Machineries

- *Tools/materials/machineries of excavation shall be kept at **a minimum of 1 m. (3 ft.)** away from the edge of the excavation to prevent their potential knocking down into the excavation;*
- *No vehicle or other machinery shall be driven/ operated/placed within a minimum distance **equal to one-third (1/3)** of its depth from the edge of an excavation.*

11.2.6.17 Provision for Barricades:

- *The top of the walls of an excavation **more than 2.0 m. (6 ft.) deep** shall be barricaded to a height of at least 1 m. (3 ft.) to prevent the fall of laborers/employees concerned.*

11.2.6.18 Provision of Access and Exit

- *Every excavation **over 1 m. (3 ft.) deep** shall be provided with arrangements of access and exit in case of flooding/collapse of the excavation work;*
- ***One (1) ladder in every 16.6 m. (50 ft.) of length** or fraction thereof shall be provided for every excavation **with a 0.83 m (2'6") extension** above the top of the excavation to provide a firm handhold when stepping on or off the ladder.*

11.2.6.19 Inspection and Examination of Excavation Work

- *Every part of an excavation **over 2 m. (6 ft.) deep** where laborers/employees engaged in work shall be inspected and examined by the person/employee deployed as in charge by the contractor at least once every day;*
- *Supervising Engineer **(Sub-Assistant Engineer)** in charge shall inspect such excavation at least **once in every 3 (three) days;***
- ***Upazila Engineer** shall inspect and examine such excavation at least once in every week;*
- ***OHS Officer/Consultant (if any)** shall inspect and examine such excavation at least once in a week;*
- ***Executive Engineer** shall inspect and examine such excavation at least once in 15 (Fifteen) days or as per his available opportunity;*

11.2.6.20 Supervision and Quality Assurances of Timbering and Other Work

- *Timbering or support for any excavation shall be erected, added, altered or dismantled only under the direction of the Supervising Engineer of LGED and with the approval of Upazila Engineer/ Executive Engineer (as per applicability and prevailing administrative norms);*

- *Timbering and other support for any excavation shall be of:*
  - ✓ *Good construction;*
  - ✓ *Sound materials;*
  - ✓ *Adequate strength for the purpose for which it is used; and*
  - ✓ *Appropriately maintained;*
- *All struts and bracings and other protective measures shall be properly secured to prevent displacement;*
- *Timber giving off toxic fluids or substance soluble in water shall not be used for timbering.*

11.2.6.21 Protection from Harmful Materials like Dust, Gases, Fumes etc.

- *When harmful material like dusts, gases and fumes exists in an excavation threatening the safety and health of the laborers, all possible measures shall be taken either by exhaust ventilation or by other means to free the area of such contaminants;*
- *Harmful Gas/Fume producing machineries (like internal combustion engine) shall only be operated in an excavation when provision is made to ensure that:*
  - ✓ *The exhausted gases and fumes are harmless; OR*
  - ✓ *Gases and Fumes are discharged to a point located at a safe distance from the excavation.*

11.3 Scaffolding

Scaffolding at construction worksites is a temporary structure designed to provide secure access and support for workers performing tasks at heights or in hard-to-reach areas. To ensure OHS compliance, scaffolding systems must meet established safety standards, including proper design, secure assembly, and regular inspections. Features such as non-slip platforms, guardrails, toe boards, and safe access points are mandatory. Workers should receive adequate training on scaffolding use and adhere to protocols for load limits and hazard management. These measures prioritize worker safety, reduce risks, and enhance overall worksite productivity.

11.3.1 Types of Scaffolds in Common Use

Scaffolding is an essential component of construction worksites, providing temporary structures for workers to safely perform tasks at elevated heights. Here are some common types of scaffolds used in construction:

- ***Single Scaffolding:*** *Commonly used for brick Masonry and General Construction, this consists of standards, ledgers, and putlogs placed parallel to the wall.*
- ***Double Scaffolding:*** *Often used for stone Masonry and General Construction, it includes two rows of scaffolding for added stability.*
- ***Cantilever Scaffolding:*** *Used when the ground does not support standards, this type is anchored to the building.*
- ***Suspended Scaffolding:*** *Platforms are suspended by ropes or chains, ideal for tasks like painting or window cleaning.*
- ***Trestle Scaffolding:*** *Supported on movable tripods or ladders, this is used for indoor work at lower heights.*
- ***Steel Scaffolding:*** *Made of steel tubes, it is durable and used for heavy-duty tasks.*
- ***Patented Scaffolding:*** *Prefabricated and equipped with special couplings and frames, it is easy to assemble.*
- ***Mobile Scaffolding:*** *Mounted on wheels, this type is portable and used for tasks requiring frequent movement.*
- ***Bamboo Scaffolding:*** *Common in throughout the country irrespective of Government Organizations related to construction in Bangladesh, it is an eco-friendly option made from bamboo poles.*

11.3.2 Examples of Hazards Related to Scaffolding at construction Worksites

- ***Falls from Heights:*** *One of the most common hazards involves workers falling from scaffolding due to lack of guardrails, improper assembly, or unbalanced platforms.*
- ***Structural Collapse:*** *Poorly constructed or overloaded scaffolding can lead to structural failure, causing injuries to workers and damage to equipment.*
- ***Falling Objects:*** *Tools, materials, or debris can fall from scaffolding, posing a risk to workers below.*
- ***Electrical Hazards:*** *Scaffolding erected near electrical lines can expose workers to the risk of electrocution.*
- ***Slips and Trips:*** *Slippery or uneven surfaces on the scaffolding platform can cause workers to slip, trip, and fall.*

- ***Overloading:*** *Exceeding the weight capacity of scaffolding can compromise its stability and lead to accidents.*
- ***Unstable Ground Conditions:*** *Setting up scaffolding on uneven or loose ground can cause instability and tip-overs.*
- ***Weather Conditions:*** *High winds, rain, or icy conditions can affect the stability of scaffolding and endanger workers.*

11.3.3 Examples of OHS Measures for Hazards related to Scaffolding at Construction Worksites

- ***Falls from Heights:***
  - *Installing guardrails and toe boards.*
  - *Using personal fall arrest systems (e.g., harnesses).*
  - *Ensuring proper assembly of scaffolding.*
- ***Structural Collapse:***
  - *Conducting regular inspections by competent personnel.*
  - *Avoiding overloading scaffolds.*
  - *Using scaffolds compliant with safety standards.*
- ***Falling Objects:***
  - *Installing safety nets or debris containment systems.*
  - *Securing tools and materials to prevent falling objects.*
  - *Ensuring workers wear hard hats.*
- ***Electrical Hazards:***
  - *Maintaining a safe distance between scaffolds and power lines.*
  - *Insulating scaffolds near electrical hazards.*
  - *Conducting hazard assessments before scaffold setup.*
- ***Slips and Trips:***
  - *Keeping scaffolding platforms clean and free of debris.*
  - *Using anti-slip coatings or materials on platforms.*
- ***Overloading:***
  - *Marking scaffold load limits clearly.*
  - *Training workers to avoid exceeding weight limits.*
  - *Distributing loads evenly across scaffold platforms.*
- ***Unstable Ground Conditions:***
  - *Stabilizing scaffolding with base plates or adjustable leg supports.*
  - *Avoiding loose or uneven soil for scaffold setup.*
- ***Unauthorized Access:***
  - *Restricting scaffold access to trained and authorized personnel.*
  - *Using barriers and signage to deter unauthorized entry.*
- ***Weather Conditions:***
  - *Suspending scaffolding work during severe weather.*
  - *Using weather-resistant scaffolding features, such as proper drainage.*
  - *Stakeholders and attracts clients.*

11.3.4 Negative Impacts of Non-Compliance with OHS provisions for Scaffolding at Construction Worksites

11.3.4.1 Health and Safety Impacts

- *Risk of falls from scaffolding.*
  - *Example: A worker falling from an improperly secured scaffold.*

- *Injuries from collapsing scaffolding structures.*
  - *Example: A worker being injured due to scaffold planking giving way.*
- *Exposure to hazardous conditions due to lack of proper fall protection.*
  - *Example: Workers being exposed to unguarded edges and openings.*

11.3.4.2 Operational Impacts

- *Delays in construction activities due to scaffolding-related incidents.*
  - *Example: Project timelines being extended due to a scaffold collapse.*
- *Damage to equipment and materials from falling scaffolding components.*
  - *Example: Construction materials being damaged by falling scaffold parts.*
- *Increased costs associated with managing scaffolding hazards.*
  - *Example: Additional expenses for implementing comprehensive scaffolding safety measures.*

11.3.4.3 Legal and Financial Impacts

- *Non-compliance with scaffolding safety standards can result in fines and penalties.*
  - *Example: A construction site being fined for inadequate scaffolding safety measures.*
- *Increased costs associated with scaffolding-related accidents and damage.*
  - *Example: Additional expenses for repairing damaged equipment and compensating injured workers.*
- *Negative public perception and damage to corporate reputation.*
  - *Example: Community backlash due to poor scaffolding safety practices.*

11.3.5 Positive Impacts of Compliance with OHS Provision for Scaffolding at Construction Worksites

11.3.5.1 Health and Safety Impacts

- *Reduced risk of accidents and injuries*
  - *Example: Workers protected from falls due to properly installed guardrails and harnesses.*
- *Improved worker confidence and morale:*
  - *Example: Employees feeling safer and more focused while working on well-maintained scaffolds.*

11.3.5.2 Operational Impacts:

- *Fewer work disruptions ensuring steady progress*
  - *Example: Construction projects proceeding smoothly without delays caused by scaffold-related incidents.*
- *Enhanced equipment lifespan through regular maintenance and safe practices*
  - *Example: Proper care extends the life of scaffolding materials, reducing replacement costs.*

11.3.5.3 Legal and Financial Impacts

- *Avoidance of fines and penalties by adhering to regulations:*

- *Example: Construction companies passing inspections without penalties for non-compliance.*

- *Cost efficiency achieved through reduced accident-related expenses*
  - *Example: Lower medical costs and compensation expenses due to a strong safety record.*
- *Improved reputation leading to better business opportunities*
  - *Example: A company recognized for prioritizing worker safety earns more trust from stakeholders.*

11.3.6 General Provisions for Scaffolding at Construction Worksites

General provisions for scaffolding at construction worksites focus on ensuring the safety and stability of temporary structures used to support workers and materials during elevated tasks. These provisions include proper design, secure assembly, and regular inspections to prevent accidents. Key elements such as guardrails, non-slip platforms, toe boards, and safe access points are essential. Workers must receive adequate training to handle scaffolding safely, and load limits must always be observed. By adhering to the following provisions, construction sites can promote a safer and more efficient working environment:

11.3.6.1 Where to be Provided

a) **In case of Major Maintenance, Rehabilitation, Capacity Expansion, Replacement and New Constructions**

Where work cannot safely be done on or from the ground or from part of the structure (bridge/building/others) either existing (in case of maintenance works) or other permanent structure (in case of replacement or new construction):

- *A safe and suitable scaffold shall be provided and maintained;*
- *In applicable cases, other equally safe and suitable provision shall be provided.*

b) **If Alternate Means of Access can't be Provided**

If alternative safe means of access to elevated working places can't be ensured anyway:

- *Suitable and sound ladders shall be provided;*
- *Ladders shall be properly secured against unintended movement.*

c) **Construction Provision of Scaffold/Ladder**

- *All scaffolds/ladders shall be constructed and used in accordance with the engineering standards as mentioned in this Sub-section and prevailing standard practice of LGED for construction works;*

d) **Inspection of Scaffold**

- *Scaffolds shall be inspected by the Sub-assistant Engineer (in charge for the supervision of the contract)/Upazila Engineer/ Executive Engineer as per administrative norm of LGED regularly;*

e) **No Casting Before Approval**

- *No casting shall be commenced before the approval of Executive Engineer concerned regarding competency and specification of the scaffold as per contract agreement.*

11.3.6.2 *When General OHS Provisions for Scaffolding are Applicable in Construction Worksites*

- ***Erection and Dismantling:*** *During the assembly and disassembly of scaffolding structures.*
- ***Daily Operations:*** *While workers are using scaffolding for daily construction activities.*
- ***Routine Inspections:*** *When inspecting scaffolding for structural integrity and safety compliance.*
- ***Training Sessions:*** *During the training of workers on proper scaffolding use and safety protocols*
- ***Incident Response:*** *When addressing accidents or hazards involving scaffolding to prevent reoccurrence.*
- ***Compliance Checks:*** *Ensuring ongoing adherence to safety standards.*

11.3.6.3 *Scaffold Group-wise General Provisions*

a) Single and Double Scaffolding (Traditional Scaffolds for Masonry and General Construction Work)

- ***Safety Plans and Suitability:***
  - *Safety plans for single and double scaffolds* ***shall be developed and implemented*** *based on specific Masonry and General Construction site conditions and associated risks.*
  - *Compliance with* ***international OR equivalent national provisions if available and applicable shall be ensured.***
  - *Safety measures* ***shall address*** *alignment, fastening, and stability required for Masonry and General Construction work.*
- ***Training and Awareness:***
  - *Workers shall be trained and certified in the proper use, assembly, and dismantling of scaffolds to minimize risks.*
  - *Regular drills and awareness sessions shall be conducted to familiarize workers with hazard identification and fall protection measures.*
  - *Ongoing education on Masonry and General Construction-specific hazards shall be provided annually to enhance worker safety.*
- **Inspection and Maintenance:**
  - *Scaffolds, including platforms, guardrails, and fastenings,* ***shall be inspected daily*** *to ensure stability and safety.*
  - *Maintenance* ***shall be performed*** *following manufacturer guidelines to address wear and tear or structural issues.*
  - *Inspection and maintenance activities* ***shall be documented*** *for compliance and accountability. Inspection frequency: Daily for critical components, weekly for general scaffolding.*
- ***Signage and Compliance:***
  - *Prominent signage indicating "Scaffolding Safety Procedures"* ***shall be posted*** *in Masonry and General Construction zones to enhance safety awareness.*

- *Compliance with safety standards **shall be monitored** regularly by supervisors through inspections and audits.*
- *Corrective actions for non-compliance **shall be implemented** immediately, and additional training **shall be provided** as needed.*

- ***Specific Safety Provisions:***
  - *Guardrails and toe boards **shall be installed** to prevent falls during Masonry and General Construction work.*
  - *Scaffolds **shall be secured** on stable, level ground to avoid tilting or collapse.*
  - *Fall arrest systems, including personal harnesses, **shall be used** where there is a risk of workers falling.*
  - *Access to scaffolding **shall be restricted** to trained and authorized personnel only to minimize accidents.*
  - *Work zones **shall be equipped** with safety nets or other debris containment systems to prevent falling objects from harming workers below.*

b) Cantilever and Suspended Scaffolding (For Difficult or Elevated Access)

- ***Safety Plans and Suitability:***
  - *Safety plans for cantilever and suspended scaffolds **shall be developed and implemented** to address elevated access risks.*
  - *Compliance with **international OR equivalent national provisions if available and applicable shall be ensured.***
  - *Load-bearing requirements **shall be assessed** to confirm structural stability.*
- ***Training and Awareness:***
  - *Workers **shall be trained and certified** in securing platforms and operating suspension mechanisms safely.*
  - *Drills and emergency response protocols **shall be conducted regularly** to prepare for elevated work scenarios.*
  - *Awareness programs for identifying suspension hazards **shall be provided annually**.*
- ***Inspection and Maintenance:***
  - *Daily inspections of ropes, suspension systems, and anchors **shall be conducted** to identify wear and tear.*
  - *Maintenance of suspended scaffold components **shall adhere** to manufacturer guidelines.*
  - *Documentation of inspections and maintenance activities **shall be maintained**. Inspection frequency: Daily for suspension devices, weekly for general components.*
- ***Signage and Compliance:***
  - *"Suspension Scaffolding Safety" signs **shall be displayed** prominently at elevated work zones.*
  - *Supervisors **shall monitor and enforce** compliance during scaffold operation. Deviations **shall be corrected** promptly.*
- ***Specific Safety Provisions:***
  - *Suspension devices **shall be capable** of withstanding at least four times the intended load.*

- *Safety harnesses and fall arrest systems **shall be used** to protect workers from falling.*
- *Access to cantilever and suspended scaffolds **shall be restricted** to trained personnel to prevent accidents.*

c) Trestle and Mobile Scaffolding (Portable and Temporary Scaffolds)

- ***Safety Plans and Suitability:***
  - *Safety plans **shall be developed and implemented** to address mobility, locking mechanisms, and ground conditions for portable scaffolds.*
  - *Compliance with **international OR equivalent national provisions if available shall be ensured.***
  - *Plans **shall include** specific measures to prevent scaffold rolling or tilting.*
- ***Training and Awareness:***
  - *Workers **shall be trained and certified** in protocols for moving and stabilizing mobile scaffolds.*
  - *Awareness sessions focusing on slip hazards and locking mechanism operations **shall be conducted.***
  - *Education on height limitations and portable scaffold risks **shall be provided annually.***
- ***Inspection and Maintenance:***
  - *Locking mechanisms and stability of portable scaffolds **shall be inspected daily** to ensure functionality.*
  - *Maintenance tasks **shall follow** manufacturer guidelines for portable scaffold components.*
  - *Inspection records **shall be documented** for compliance. Inspection frequency:* Daily.
- ***Signage and Compliance:***
  - "Caution: Mobile Scaffolding in Use" signs **shall be posted** in work zones.
  - Supervisors **shall enforce** compliance with safety standards during scaffold movement and use.
- ***Specific Safety Provisions:***
  - Wheels of mobile scaffolds **shall be locked** during use to prevent movement.
  - Platforms **shall not exceed** the height limits outlined in national regulations.

d) Steel and Patented Scaffolding (Heavy-Duty and Prefabricated Scaffolds)

- ***Safety Plans and Suitability:***
  - *Load limits, structural integrity, and assembly instructions **shall be addressed** in safety plans for heavy-duty scaffolds.*
  - *Compliance with **international OR equivalent national standards if available shall be ensured.***
  - *Prefabricated scaffold components **shall be verified** for compatibility during setup.*
- ***Training and Awareness:***
  - *Workers **shall be educated and certified** in the safe assembly and use of steel scaffolds.*

- *Training programs on recognizing corrosion risks and managing heavy loads **shall be organized.***
- *Refresher courses for patented scaffolding systems **shall be conducted annually.***

- ***Inspection and Maintenance:***
  - *Steel components **shall be inspected daily** for corrosion, cracks, or damage.*
  - *Maintenance schedules recommended by manufacturers **shall be followed** strictly.*
  - *Records of inspections **shall be documented** regularly. Inspection frequency: Daily for structural components; Weekly for general checks.*
- ***Signage and Compliance:***
  - *Load limits and safety procedures **shall be clearly displayed** on or near scaffolds.*
  - *Compliance audits **shall be performed regularly**, and non-compliance issues **shall be corrected** immediately.*
- ***Specific Safety Provisions:***
  - *Access to heavy-duty scaffolds **shall be restricted** to authorized personnel only.*
  - *Guardrails and fall protection systems **shall be installed** for worker safety.*

e) Bamboo and Customized Scaffolding (Traditional/Eco-Friendly Options)

- ***Safety Plans and Suitability:***
  - *Safety plans for bamboo scaffolds **shall be developed and implemented** to address regional and site-specific risks.*
  - *Compliance with **national provisions if available and applicable shall be ensured.***
  - *Structural reinforcements and secure bindings **shall be outlined** in safety measures.*
- ***Training and Awareness:***
  - *Workers **shall be educated** on proper assembly techniques and the safe use of eco-friendly scaffolding materials.*
  - *Training programs **shall include** sessions on inspecting and reinforcing bamboo components.*
  - *Awareness of traditional scaffold safety practices **shall be updated annually.***
- ***Inspection and Maintenance:***
  - *Bamboo poles **shall be inspected daily** for cracks, splitting, or other signs of weakness.*
  - *Reinforcement bindings **shall be maintained** to ensure long-term durability.*
  - *Maintenance activities **shall be documented.** Inspection frequency: Daily for critical poles, weekly for overall structure.*
- ***Signage and Compliance:***
  - *"Traditional Scaffolding in Use" signs **shall be installed** at work areas.*

- *Supervisors **shall oversee** compliance and implement corrective measures where necessary.*

- ***Specific Safety Provisions:***
  - *Platforms on bamboo scaffolds **shall be reinforced** to minimize sagging.*
  - *Work zones **shall be equipped** with safety nets or barriers to prevent accidents.*

f) Scissor and Boom Lifts (Elevated Access Platforms)

- ***Safety Plans and Suitability:***
  - *Plans for elevated access platforms **shall include** provisions for fall protection, electrical risks, and safe operation protocols.*
  - *Compliance with **international OR equivalent national safety provisions if available shall be ensured.***
  - *Site-specific risks **shall be evaluated** to ensure safe lift operation.*
- ***Training and Awareness:***
  - *Operators **shall be trained and certified** in the proper use of scissor and boom lifts.*
  - *Awareness sessions on fall arrest systems and electrical precautions **shall be conducted** annually.*
  - *Emergency handling procedures for lift malfunctions **shall be included** in training.*
- ***Inspection and Maintenance:***
  - *Hydraulic systems, mechanical parts, and safety locks **shall be inspected daily** for malfunctions.*
  - *Manufacturer recommendations for lift maintenance **shall be adhered to.***
  - *Logs of inspections and maintenance activities **shall be kept** for compliance. Inspection frequency: **Daily.***
- ***Signage and Compliance:***
  - *"Lift Safety Procedures" signs **shall be posted** near scissor and boom lift operation zones.*
  - *Supervisors **shall monitor compliance** and provide corrective actions where necessary.*
- ***Specific Safety Provisions:***
  - *Scissor and boom lifts **shall be operated** only by trained and certified personnel to minimize risks.*
  - *Personal safety harnesses and fall arrest systems **shall be used** at all times.*

11.3.7 Standards/Specifications for Scaffolding at Construction Worksite

Standards and specifications for scaffolding at construction worksites provide comprehensive guidelines to ensure safety, stability, and efficiency. These standards cover the use of durable materials, proper assembly techniques, and adherence to load capacity limits. Key components include guardrails, toe boards, secure access points, and non-slip platforms to prevent falls and injuries. Regular inspections, maintenance, and compliance with national and international safety regulations are critical. By following these specifications, worksites can minimize risks, enhance worker safety, and maintain high productivity levels:

11.3.7.1 Fall Protection from Scaffolding

a) Single and Double Scaffolding (Traditional Scaffolds for Masonry and General Construction Work)

- *Guardrails, mid-rails, and toe boards shall be installed on platforms to prevent falls.*
- *Top rails shall comply with* ***international*** *or equivalent national standards, with heights between* ***38 inches (96.5 cm)*** *and* ***45 inches (114.3 cm).***
- *Platforms shall be fully planked, leaving no gaps wider than* ***1 inch (2.5 cm).***
- *Personal Fall Arrest Systems (PFAS) shall be used when working at heights exceeding* ***6 feet (1.8 meters).***

b) Cantilever and Suspended Scaffolding (For Difficult or Elevated Access)

- *Suspension ropes and connecting hardware shall support loads at least* ***6 times*** *the maximum intended load.*
- *Counterweights shall resist tipping forces of at least* ***4 times*** *the applied load.*
- *Guardrails and PFAS shall be mandatory for workers at heights exceeding* ***10 feet (3.1 meters).***

c) Trestle and Mobile Scaffolding (Portable and Temporary Scaffolds)

- *Wheels or casters shall be locked to prevent movement during use.*
- *Scaffolds shall support their own weight plus* ***4 times*** *the maximum intended load.*
- *Guardrails and toe boards shall be installed when platform heights exceed* ***10 feet (3.1 meters).***

d) Steel and Patented Scaffolding (Heavy-Duty and Prefabricated Scaffolds)

- *Components shall be inspected daily for structural integrity.*
- *Steel scaffolds shall withstand a force of at least* ***200 pounds (890 N)*** *applied outward or downward on guardrails.*
- *Platforms shall be designed to carry at least* ***75 pounds per square foot (366 kg/m²).***

e) Bamboo and Customized Scaffolding (Traditional/Eco-Friendly Options)

- *Bamboo poles shall be treated to resist pests and weathering.*
- *Joints shall be secured using ropes or clamps capable of withstanding loads of at least* ***150 pounds (667 N).***
- *Platforms shall have a minimum thickness of* ***2 inches (5 cm)*** *for stability and safety.*

f) Scissor and Boom Lifts (Elevated Access Platforms)

- *Guardrails shall be installed on all sides of the platform.*
- *Operating in wind conditions exceeding* ***28 miles per hour (45 km/h)*** *shall be avoided.*
- *Load limits specified by the manufacturer shall not be exceeded.*

11.3.7.2 Safety Standards/Specifications for protection from Collapsing Scaffolding Structures

a) Single and Double Scaffolding (Traditional Scaffolds for Masonry and General Construction Work)

- *Debris nets and canopy structures shall be installed to protect workers from falling objects during activities* ***such as bricklaying.***
- *Proper ventilation and dust control measures shall be ensured in enclosed areas where airflow is limited.*
- *Regular safety assessments shall be conducted to identify unstable structures or hazardous materials.*
- *Scaffolding shall be erected, dismantled, or moved under the supervision of a qualified person, as required by* ***international Standards OR equivalent national standards/ specifications*** *if available and applicable.*
- *Stable and secure footings, such as base plates or mud sills, shall be used to comply with OSHA requirements.*
- *Components, including braces and screw legs, shall be inspected daily for structural soundness.* ***Inspection frequency: Daily.***

b) Cantilever and Suspended Scaffolding (For Difficult or Elevated Access)

- *Safety nets beneath* ***suspended platforms*** *shall be installed to prevent falling objects.*
- *Dust suppression methods shall be implemented, particularly for tasks such as painting or sandblasting.*
- *Platforms and suspension systems shall be inspected daily to address wear and hazardous conditions.*
- *Suspension ropes and connections shall support loads at least* ***6 times*** *the maximum intended load, in compliance with practical needs and type of construction works.*
- *Counterweights shall resist tipping forces of at least* ***4 times*** *the applied load, as required in compliance with practical needs and type of construction works.*
- *Support beams and brackets shall be inspected weekly to ensure compliance with structural integrity requirements.*

c) Trestle and Mobile Scaffolding (Portable and Temporary Scaffolds)

- *Lightweight components shall be secured to prevent dislodgement during mobile operations.*
- *Dust and ventilation systems shall be implemented when scaffolding is used for sanding or finishing tasks.*
- *Hazardous zones around mobile scaffolding units shall be marked to* ***avoid accidental collisions.***
- *Casters or wheels shall be locked during use, following safety guidelines.*
- *Platforms shall remain stable during movement, avoiding unsteady objects such as* ***bricks or barrels.***
- *Components such as wheels and brackets shall be inspected* ***daily*** *to comply with standards.*

d) Steel and Patented Scaffolding (Heavy-Duty and Prefabricated Scaffolds)

- *Protective guards and nets shall be installed during high-rise operations involving steel scaffolds.*
- *Dust filtration methods shall be used at steel construction sites to reduce inhalation hazards.*
- *Monthly structural inspections shall be scheduled to identify risks caused by environmental exposure.*
- *Heavy-duty steel components shall be inspected daily for signs of wear or damage, in adherence to standards.*
- *Stability shall be ensured with firm bases, avoiding unstable surfaces like loose debris.*
- *Loads shall not exceed the rated capacity of the scaffold system, as mandated by standards/specifications.*

e) Bamboo and Customized Scaffolding (Traditional/Eco-Friendly Options)

- *Bamboo joints shall be secured to prevent instability and falling elements.*
- *Ventilation systems shall be implemented in settings where bamboo scaffolding is used extensively.*
- *Workers shall be trained to recognize hazards specific to natural materials such as bamboo.*
- *Bamboo poles shall be inspected daily for cracks, wear, or structural weaknesses to meet LGED OR national standards if available.*
- *Secure bindings or ropes shall be checked before use, **ensuring the stability of joints** as required by safety guidelines.*
- *Bases shall be made stable with **proper support** to prevent collapse.*

f) Scissor and Boom Lifts (Elevated Access Platforms)

- *Enclosed platforms or guardrails shall be utilized to shield workers from falling objects.*
- *Fume extraction systems shall be ensured when lifts are used in industrial facilities.*
- *Pre-operational checks shall be conducted to prevent equipment failures that could pose hazardous conditions.*
- *Lifts shall only be operated on firm, level ground to ensure stability, in compliance with **international or equivalent standards.***
- *Outriggers or stabilizers shall be deployed as required by manufacturers' guidelines and specifications.*
- *Equipment shall be inspected **daily** for operational safety and structural integrity.*

11.3.7.3 Top Rail Standards/Specifications

a) Single and Double Scaffolding (Traditional Scaffolds for Masonry and General Construction Work)

- *Top rails shall be installed to prevent falls, with the height measured **between 38 inches (96.5 cm)** and **45 inches (114.3 cm).***
- *Rails shall be positioned **parallel to the walking or working surface** and securely fastened at terminal posts.*
- *Rails shall provide **sufficient clearance** above tools and materials to ensure unobstructed workspaces.*

- ***Inspection frequency: Daily*** *for positioning and stability.*

b) Cantilever and Suspended Scaffolding (For Difficult or Elevated Access)

- *Top rails shall comply with* ***international OR national equivalent standards,*** *positioned* ***between 38 inches (96.5 cm) and 45 inches (114.3 cm)*** *above the platform.*
- *Rails shall be affixed securely to ensure stability even under significant* ***wind or load variations.***
- *Rails shall include smooth finishing to* ***prevent snagging or punctures.***
- ***Inspection frequency: Daily*** *for stability and integrity.*

c) Trestle and Mobile Scaffolding (Portable and Temporary Scaffolds)

- *Guardrails shall be installed at heights* ***between 38 inches (96.5 cm) and 45 inches (114.3 cm),*** *as required by international mor equivalent national standards if available and applicable.*
- *Rails shall withstand external forces applied* ***during movement or load adjustments.***
- *Rails shall be checked for proper alignment* ***during scaffold relocation.***
- ***Inspection frequency: Daily*** *during scaffolding use.*

d) Steel and Patented Scaffolding (Heavy-Duty and Prefabricated Scaffolds)

- *Rails shall be installed* ***between 38 inches (96.5 cm) and 45 inches (114.3 cm)*** *above the working surface, as required by international mor equivalent national standards if available and applicable.*
- *Rail ends shall be secured to avoid* ***overhang or projection hazards.***
- ***Inspection frequency: Daily*** *for heavy-duty scaffolds under dynamic loading conditions.*

e) Bamboo and Customized Scaffolding (Traditional/Eco-Friendly Options)

- *The height of bamboo scaffold rails shall range* ***between 38 inches (96.5 cm) and 45 inches (114.3 cm)*** *to comply with LGED or national standards.*
- *Rails shall be tied or bound securely using* ***eco-friendly materials.***
- ***Inspection frequency: Daily*** *for stability and wear.*

f) Scissor and Boom Lifts (Elevated Access Platforms)

- *Top rails on scissor and boom lifts shall be installed at heights* ***between 38 inches (96.5 cm) and 45 inches (114.3 cm)*** *as required by international mor equivalent national standards if available and applicable.*
- *Rails shall remain stable under* ***varying wind and load conditions.***
- ***Inspection frequency: Daily*** *before operation.*

11.3.7.4 Standards/specifications of Mid-rails

a) Single and Double Scaffolding (Traditional Scaffolds for Masonry and General Construction Work):

- *Mid-rails shall be installed midway between the top rail and the working surface, positioned at a height of* ***approximately 19 inches (48.3 cm) above the platform.***
- *Rails shall be securely fastened to terminal posts to prevent displacement during operations.*
- *Mid-rails shall be free of sharp edges or rough surfaces to prevent injuries to workers.*
- ***Inspection Frequency:*** *Daily.*

b) Cantilever and Suspended Scaffolding (For Difficult or Elevated Access)

- *Mid-rails shall comply with OSHA specifications, positioned midway between the platform and top rail at* ***19 inches (48.3 cm).***
- *Structural elements such as mesh or screens may supplement Mid-rails to enhance safety by preventing tools or materials from falling.*
- ***Inspection Frequency:*** *Daily.*

c) Trestle and Mobile Scaffolding (Portable and Temporary Scaffolds):

- *Mid-rails shall be positioned* ***19 inches (48.3 cm)*** *above the working surface, to prevent worker movement outside the guarded area.*
- ***Inspection Frequency:*** *Daily for alignment and stability.*

d) Steel and Patented Scaffolding (Heavy-Duty and Prefabricated Scaffolds)

- *Mid-rails shall provide intermediate protection, placed midway along the vertical height between the top rail and platform at approximately* ***19 inches (48.3 cm).***
- *Rails shall withstand a force of at least* ***150 pounds (667 N)*** *applied in any direction.*
- ***Inspection Frequency:*** *Daily.*

e) Bamboo and Customized Scaffolding (Traditional/Eco-Friendly Options)

- *Mid-rails shall be installed securely using environmentally safe fastening methods, positioned* ***19 inches (48.3 cm)*** *above the platform.*
- *Rails shall be designed to resist external forces in compliance with equivalent safety standards, ensuring stability during use.*
- ***Inspection Frequency:*** *Daily.*

f) Scissor and Boom Lifts (Elevated Access Platforms)

- *Mid-rails shall be installed midway between the top rail and lift platform, maintaining a height of* ***19 inches (48.3 cm)*** *above the platform.*
- *Mid-rails shall meet all requirements for placement and structural integrity to ensure safety during lift operations.*
- ***Inspection Frequency:*** *Daily prior to operation.*

11.3.7.5 Standards/Specifications for Strength Requirements of Scaffolds/Components

a) Single and Double Scaffolding (Traditional Scaffolds for Masonry and General Construction Work)

- *Guardrails shall preferably withstand, without failure, a force of* ***at least 200 pounds (890 N)*** *applied outward or downward at any point along the top edge.*
- *Mid-rails, screens, or intermediate structural members shall resist a force of* ***at least 150 pounds (667 N)*** *applied outward or downward at any point.*
- *Toe boards shall withstand a force of* ***at least 50 pounds (222 N)*** *applied outward or downward.*
- ***Inspection frequency: Daily*** *to ensure compliance with standards.*

b) Cantilever and Suspended Scaffolding (For Difficult or Elevated Access)

- *Guardrails shall resist a force of 200 pounds (890 N), and Mid-rails* ***shall resist 150 pounds (667 N).***
- *Suspension ropes and hardware shall be* ***capable of supporting 6 times the maximum intended load.***
- *Counterweights shall* ***resist tipping forces of at least 4 times the applied load.***
- ***Inspection frequency: Daily*** *for load-carrying elements.*

c) Trestle and Mobile Scaffolding (Portable and Temporary Scaffolds)

- *Guardrails shall withstand* ***a force of 200 pounds (890 N),*** *and Mid-rails shall* ***withstand 150 pounds (667 N).***
- *Casters, locks, and structural supports* ***shall be tested*** *for stability under loads.*
- ***Inspection frequency: Daily*** *for mechanical strength and stability.*

d) Steel and Patented Scaffolding (Heavy-Duty and Prefabricated Scaffolds)

- *Guardrails and Mid-rails shall withstand* ***forces of 200 pounds (890 N)*** *and* ***150 pounds (667 N),*** *respectively.*
- *Platforms shall be designed to carry* ***at least 75 pounds per square foot (366 kg/m²)*** *of uniformly distributed load.*
- ***Inspection frequency: Daily*** *under dynamic loading conditions.*

e) Bamboo and Customized Scaffolding (Traditional/Eco-Friendly Options)

- *Guardrails and Mid-rails shall resist forces* ***equivalent to 200 pounds (890 N)*** *and* ***150 pounds (667 N, respectively.***
- *Fastening methods such as* ***ropes or clamps shall be tested*** *to ensure adequate strength.*
- ***Inspection frequency: Daily*** *for joint integrity.*

f) Scissor and Boom Lifts (Elevated Access Platforms)

- *Guardrails and Mid-rails shall withstand* ***forces of 200 pounds (890 N)*** *and* ***150 pounds (667 N).***
- *Stabilizers or outriggers shall support the rated load without failure.*
- ***Inspection frequency: Daily*** *for lifting equipment.*

11.3.7.6 Standards/Specifications for Scaffold Surfaces

a) Single and Double Scaffolding (Traditional Scaffolds for Masonry and General Construction Work)

- *Guardrails, Mid-rails, and platforms shall be smooth and free of sharp edges to prevent injuries or snagging of clothing.*
- *Finishes shall be inspected for rust, splinters, or other hazards that could compromise safety.*
- *Inspection frequency: **Daily** for wear and tear.*

b) Cantilever and Suspended Scaffolding (For Difficult or Elevated Access)

- *Suspension components shall have smooth finishes to avoid damage during operation.*
- *Guardrails and platforms shall be free of rough surfaces or protrusions.*
- *Inspection frequency: **Daily** to eliminate snagging hazards.*

c) Trestle and Mobile Scaffolding (Portable and Temporary Scaffolds)

- *All surfaces shall be free of corrosion, rough edges, or deformities that may pose risks.*
- *Inspection frequency: **Daily**, especially after moving the scaffold.*

d) Steel and Patented Scaffolding (Heavy-Duty and Prefabricated Scaffolds)

- *Steel components shall have rust-resistant coatings to maintain integrity over time.*
- *Surfaces shall be free of sharp edges or weld projections to prevent injury.*
- *Inspection frequency: **Daily** during assembly and disassembly.*

e) Bamboo and Customized Scaffolding (Traditional/Eco-Friendly Options)

- *Bamboo components shall be treated and sanded to ensure smooth finishes that prevent splinters.*
- *Bindings and ropes shall be inspected for fraying or deterioration.*
- *Inspection frequency: **Daily** to detect early signs of degradation.*

f) Scissor and Boom Lifts (Elevated Access Platforms)

- *Guardrails and lift platforms shall have smooth, debris-free surfaces to enhance worker safety.*
- *Inspection frequency: Daily before and after operation.*

11.3.7.7 Standards/Specifications for Steel and Wire Rope

a) Single and Double Scaffolding (Traditional Scaffolds for Masonry and General Construction Work)

- *Steel guardrails shall have a nominal thickness of at least **1/4 inch (0.6 cm)** to prevent bending or failure.*
- *Wire ropes, where used, shall meet the necessary standards for tensile strength and durability as follows:*
  - *Capacity and Tensile Strength:*
    - ✓ *Wire ropes used in single and double scaffolding shall be capable of supporting at least **6 times** the maximum intended load applied or transmitted to the rope.*

- ✓ *The tensile strength of the wire rope shall ensure safe handling of the scaffold's load requirements without failure or deformation.*

- *Durability and Resistance:*
  - ✓ *Wire ropes shall be resistant to wear, corrosion, and damage caused by environmental conditions.*
  - ✓ *Appropriate protective measures, such as lubrication or galvanization, shall be used to extend the life of the wire ropes.*
- *Inspection Requirements:*
  - ✓ *Wire ropes shall be inspected daily by a competent person to identify deficiencies such as broken strands, kinks, or crushed sections.*
  - ✓ *Any rope showing signs of damage or reduced strength must be removed from service immediately and replaced.*
- *Connections and Attachments:*
  - ✓ *Wire ropes shall be properly terminated using secure end connections, such as clamps, thimbles, or splices, to prevent slipping or detachment.*
  - ✓ *All connections must comply with standard requirements to maintain safety and stability in scaffolding.*
- *Load Capacity Marking:*
  - ✓ *Wire ropes shall be clearly marked with their load capacity, specifications, and safety ratings to ensure proper selection and use on-site.*
- *Use in Suspended Components (If Applicable):*
  - ✓ *When wire ropes are used in suspended scaffolding components for Masonry and General Construction Work, they shall meet standards for load-bearing capacity and tensile strength.*
  - ✓ *Rope configurations must ensure proper weight distribution to prevent stress concentration and failure.*
- *Environmental Considerations:*
  - ✓ *Wire ropes exposed to wet or corrosive environments shall be inspected more frequently to ensure safety.*
  - ✓ *Protective measures, such as weather-resistant coatings or coverings, shall be applied to mitigate environmental risks.*
- *Strength and Safety Factors:*
  - ✓ *Wire ropes must meet the factor of safety of 6, meaning they must withstand 6 times the maximum intended load applied to them without failure.*
  - ✓ *The ropes shall be tested to meet these safety thresholds, ensuring compliance with standards.*

- ***Inspection frequency: Daily** to ensure integrity.*

b) Cantilever and Suspended Scaffolding (For Difficult or Elevated Access)

- *Suspension ropes, including connecting hardware, shall be capable of supporting* ***6 times the maximum intended load****, as per specifications.*
- *Wire ropes shall be inspected for fraying, corrosion, or other damage.*
- *Inspection frequency:* ***Daily*** *for all ropes and cables.*

c) Trestle and Mobile Scaffolding (Portable and Temporary Scaffolds)

- *Steel or wire components, if used, shall comply with international requirements or equivalent national standards if available and applicable for minimum thickness and tensile strength.*
- *Inspection frequency:* ***Daily*** *for portable structures.*

d) Steel and Patented Scaffolding (Heavy-Duty and Prefabricated Scaffolds)

- *Steel guardrails and Mid-rails shall meet a minimum thickness of* ***1/4 inch (0.6 cm).***
- *Wire ropes used for structural connections shall* ***support loads of 6 times the maximum intended load.***
- *Inspection frequency:* ***Daily*** *for load-bearing steel components.*

e) Bamboo and Customized Scaffolding (Traditional/Eco-Friendly Options)

- *Wire ropes, where used in conjunction with bamboo scaffolds, shall meet LGED OR equivalent national standards for tensile strength and load capacity.*
- *Inspection frequency:* ***Daily*** *to check for wear.*

f) Scissor and Boom Lifts (Elevated Access Platforms)

- *Wire rope components, if present, shall comply with international OR equivalent national standards for tensile strength and load capacity requirements.*
- *Inspection frequency:* ***Daily*** *prior to operation.*

11.3.7.8 Standards/Specifications for Toe Boards

a) Single and Double Scaffolding (Traditional Scaffolds for Masonry and General Construction Work)

Toe Boards shall:

- *Be installed to prevent tools, materials, or equipment from falling to a lower level where they might strike workers below.*
- *Have a minimum height of* ***3.5 inches (8.9 cm)*** *measured vertically from the top edge to the working surface.*
- *Have Clearance between the toe board and the working surface not exceeding* ***1/4 inch (0.6 cm).***
- *Be capable of withstanding a force of* ***at least 50 pounds (222 N)*** *applied in any outward or downward direction.*
- *Be used Personal Fall Arrest Systems (PFAS) shall in conjunction with toe boards when working at* ***heights exceeding 6 feet (1.8 meters).***
- *Be conducted* ***Daily*** *inspections to ensure the integrity and proper fastening of toe boards. Inspection frequency: Daily.*

b) Cantilever and Suspended Scaffolding (For Difficult or Elevated Access)

- *Toe boards shall prevent objects such as tools or debris from falling off scaffolds where pedestrians or workers may be present below.*
- *A minimum height of **3.5 inches (8.9 cm)** from the top edge to the working surface shall be maintained.*
- *Clearance above the platform **shall not exceed 1/4 inch (0.6 cm).***
- *Toe boards shall resist a force of **at least 50 pounds (222 N)** applied outward or downward at any point.*
- *PFAS shall be mandatory for workers operating at heights of **6 feet (1.8 meters) or more**, in addition to toe board usage.*
- *Toe boards and suspension components shall undergo daily inspections. Inspection frequency: **Daily.***

c) Trestle and Mobile Scaffolding (Portable and Temporary Scaffolds)

- *Toe boards shall be installed securely to prevent falling objects during scaffold movement.*
- *A minimum vertical height of **3.5 inches (8.9 cm)** shall be maintained, and clearance above the platform shall not exceed 1/4 inch (0.6 cm).*
- *Toe boards shall be designed to withstand a force of **at least 50 pounds (222 N)** applied in any direction.*
- *PFAS shall supplement toe boards when workers operate at **heights above 6 feet (1.8 meters).***
- *Daily inspections shall ensure the compliance and stability of toe boards. Inspection frequency: **Daily.***

d) Steel and Patented Scaffolding (Heavy-Duty and Prefabricated Scaffolds)

- *Toe boards shall prevent falling debris or equipment from causing injuries to workers below.*
- *The height of toe boards shall be **at least 3.5 inches (8.9 cm)** from the top edge to the surface of the working platform.*
- *Clearance above the surface shall **not exceed 1/4 inch (0.6 cm).***
- *A downward or outward force of **at least 50 pounds (222 N)** shall be resisted by the toe boards without failure.*
- *PFAS shall be mandatory for workers at **heights exceeding 6 feet (1.8 meters).***
- *Regular inspections shall verify compliance with strength and stability requirements. Inspection frequency: **Daily.***

e) Bamboo and Customized Scaffolding (Traditional/Eco-Friendly Options)

- *Toe boards shall be installed securely to avoid the falling of tools, materials, or debris onto lower levels.*
- *The vertical height of bamboo or customized toe boards shall be **at least 3.5 inches (8.9 cm)**, as per equivalent national standards.*
- *A clearance of **1/4 inch (0.6 cm) or less** shall be maintained between the toe board and the platform surface.*

- *Toe boards shall resist a* ***force of 50 pounds (222 N)*** *applied outward or downward at any point.*
- *Personal Fall Arrest Systems (PFAS) shall supplement toe boards for work conducted* ***at heights exceeding 6 feet (1.8 meters).***
- *Inspections shall be conducted to detect wear or damage in bamboo toe boards or bindings. Inspection frequency:* ***Daily.***

f) Scissor and Boom Lifts (Elevated Access Platforms)

- *Toe boards shall be installed on all sides of the platform to prevent falling objects from injuring workers below.*
- *Toe boards shall provide vertical protection of* ***at least 3.5 inches (8.9 cm)*** *and leave* ***no more than 1/4 inch (0.6 cm) clearance*** *above the working surface.*
- *Toe boards shall withstand* ***a force of 50 pounds (222 N)*** *applied downward or outward.*
- *PFAS shall accompany toe boards when operating at elevated* ***heights of 6 feet (1.8 meters) or more.***
- *Regular inspections shall ensure the compliance and stability of toe boards. Inspection frequency:* ***Daily.***

11.3.7.9 Standards/Specifications for Weight Capacity (All Scaffold Types)

a) Capacity of Scaffold Components:

- *All scaffolding components shall be capable of supporting their weight plus at least 4* ***times*** *the maximum intended load.*
- *Materials used for scaffolding shall meet the required standards for weight-bearing capacity.*

b) Direct Connections and Counterweights:

- *Direct connections to walls or structures shall be securely fastened to bear loads effectively.*
- *Counterweights shall be adequately anchored and of sufficient mass to stabilize scaffolding systems.*

c) Suspension Ropes:

- *Suspension ropes shall support at least* ***6 times*** *the maximum intended load.*
- *Ropes and related hardware shall be regularly inspected to ensure structural integrity and compliance with safety standards.*

d) Stall Load:

- *Hoist mechanisms shall not exceed a stall load greater than 3* ***times*** *their rated capacity.*
- *Hoist equipment shall be tested to confirm functionality within permissible stall load limits.*

e) Design and Construction:

- *Scaffolding shall be designed and constructed to prevent tipping, collapse, or overloading during use.*
- *Environmental factors, such as wind loads and site conditions, shall be taken into account in the design process.*

11.3.7.10 Application Standards/Specifications for Weight for All Scaffold Types

a) Single and Double Scaffolding (Used for Bricklaying and Masonry and General Construction Work Work)

- *Shall support its weight plus at least 4 times the maximum intended load.*
- *Direct connections and counterweights shall ensure stability against lateral forces.*
- *Suspension ropes, if used, shall conform to **6 times load** standards.*

b) Cantilever and Suspended Scaffolding (Used for High-Rise Construction and Maintenance Work)

- *Components shall bear at least **4 times** the maximum intended load.*
- *Suspension ropes and counterweights shall meet OSHA standards to stabilize elevated structures.*
- *Hoists shall operate within stall load limits of **3 times** their rated capacity.*

c) Trestle and Mobile Scaffolding (Used for Lightweight Indoor and Outdoor Applications):

- *Shall support at least **4 times** the maximum load, ensuring stability during dynamic operations.*
- *Mobility features shall include secure locking mechanisms to prevent accidental movement or instability.*

d) Steel and Patented Scaffolding (Used for Heavy Construction and Industrial Applications)

- *Steel components shall comply with the **4 times** weight capacity requirement and resist environmental stress factors.*
- *Direct connections shall be reinforced to meet heavy load standards and maintain safety.*

e) Bamboo Scaffolding (Used for Traditional and Temporary Construction Work)

- *Shall be capable of safely bearing loads of at least **4 times** the intended weight.*
- *Securing systems, such as ropes or fasteners, shall comply with **6 times** load requirements for suspension systems.*

f) Elevated Access Platforms (Scissor and Boom Lifts) (Used for Industrial Facilities and High-Reach Applications)

- *Platforms shall meet the requirement to support their weight plus at least **4 times** the maximum intended load.*
- *Lift mechanisms shall conform to stall load limits of **3 times** their rated capacity.*

11.3.7.11 Standards/Specifications Tailored for Wooden Scaffolds

a) Capacity of Scaffold Components

- *All wooden scaffold components shall be capable of supporting their own weight plus **at least 4 times** the maximum intended load.*
- *Wooden planks and support frames shall be made from high-quality, **defect-free wood** to ensure maximum strength and durability.*
- *Suspension ropes, where applicable, shall be able to withstand **at least 6 times** the maximum intended load without failure.*

b) Connections and Fasteners

- *All connections, such as joints, brackets, and fasteners, shall be securely installed to **prevent movement or instability**.*

- *Fasteners, including nails, screws, or bolts, shall be* ***corrosion-resistant and appropriately sized*** *to handle the required loads.*
- *Wooden* ***joints shall be reinforced*** *to provide sufficient structural stability and avoid loosening over time.*

c) Platform Construction

- *Platforms shall be fully planked, with gaps* ***not exceeding 1 inch (2.5 cm)*** *between planks.*
- *Planks shall overlap the scaffold frame by* ***at least 6 inches (15.2 cm)*** *for added stability or be cleated to prevent displacement.*
- *The maximum deflection of wooden planks* ***shall not exceed 1/60th*** *of their span length.*

d) Guardrails

- *Guardrails shall be installed on all open sides and ends of the scaffold platform, with the top rail placed at* ***a height of 38 to 45 inches (96.5 to 114.3 cm)*** *above the platform.*
- *Guardrails shall be capable of withstanding a force of* ***at least 200 pounds (890 N)*** *applied outward or downward.*
- *The ends of rails shall be* ***smoothly finished*** *to prevent injury or snagging of clothing.*

e) Mid-rails

- *Mid-rails shall be installed* ***midway*** *between the top rail and the platform surface.*
- *Mid-rails shall be capable of withstanding a force of* ***at least 150 pounds (667 N)*** *applied outward or downward.*

f) Toe Boards

- *Toe boards shall be installed* ***along the edges*** *of scaffold platforms where there is a risk of tools, materials, or equipment falling.*
- *Toe boards shall be* ***at least 3.5 inches (8.9 cm)*** *high and securely fastened with* ***no more than 1/4 inch (0.6 cm)*** *clearance above the platform.*
- *Toe boards shall be capable of withstanding a force of* ***at least 50 pounds (222 N)*** *applied downward or outward.*

g) Strength Requirements

- *Wooden scaffolding components, including planks, frames, guardrails, and Mid-rails, shall be* ***capable of withstanding the required load*** *without failure.*
- *Guardrails shall withstand a force of* ***200 pounds (890 N)****,* ***Mid-rails 150 pounds (667 N)****, and* ***toe boards 50 pounds (222 N)*** *applied in any direction.*
- *All structural elements shall be* ***regularly tested and inspected*** *to confirm compliance with strength standards.*

h) Inspection and Maintenance

- *Wooden scaffolds shall undergo* ***daily inspections*** *for damage, such as cracks, warping, or decay.*
- *All connections, fasteners, and structural components shall be* ***assessed regularly*** *to ensure they remain secure and compliant with safety standards.*

- *Damaged or **defective parts shall be replaced** immediately to maintain the safety and integrity of the scaffold.*
- *Wooden components **shall be treated** with protective coatings to resist moisture, pests, and environmental wear.*

i) Environmental Considerations

- *Wooden scaffolds shall be shielded from excessive exposure to moisture, which can weaken the wood and compromise safety.*
- *In outdoor environments, wooden scaffolds shall be treated with weather-resistant finishes to prevent decay caused by rain or humidity.*
- *Wind loads and other environmental factors shall be accounted for in the scaffold design to ensure stability during use.*

j) Design and Construction

- *Wooden scaffolds shall be designed by **a qualified person** and constructed in accordance with the design specifications as follows:*
  - ✓ ***For single scaffold:***
    - ✓ *Placed **at 1.18 to 2.43 meters (4 to 8 ft.) apart** at a distance of **1 m. (3 ft.)** from the wall;*
    - ✓ *Connected horizontally by ledgers spaced vertically at **1.51 m. (5 ft.) to 1.81 m. (6 ft.)** on centers;*
- *Putlogs shall be placed in the holes made/left in the walls;*
- *The size of the standard shall be greater than or equal to 8.9 cm. (3 in.) in diameter;*
- *In case of necessity to extend a standard, the overlaps shall be greater than or equal to 60 cm. (23 in.);*
  - ✓ ***In double scaffold:***
    - ✓ *The outer row of standards shall be at a **distance of 1.22 (50 in.) to 1.32 m (52 in.)** from the wall;*
    - ✓ *The putlogs shall rest entirely on the ledgers;*
    - ✓ *In addition to the diagonal braces, inclined supports shall be provided to prevent the scaffold from leaning away from the wall;*
    - ✓ *The supports shall be strutted at intermediate heights against the standards;*
  - ✓ ***The standards for size of double scaffold:***
    - ✓ *Shall be greater than or equal to 10 cm. in diameter;*
    - ✓ *In case of necessity to extend a standard, the minimum overlap shall 15 cm.;*
    - ✓ *Ledgers, standards and putlogs shall be securely fastened by bolts, dogs or sufficiently strong ropes;*
    - ✓ *The distance between two consecutive putlogs shall be designed considering the anticipated load and the nature of the flooring of the platform;*
    - ✓ *As a conservative Provision, the minimum provisions for spacing shall be as follows:*
      - *For **3.2 cm. (1.25 in.)** thick planks, maximum spacing shall be 1 (One) m (36.3 in.);*

- For **3.8 cm. (1.5 in)** thick planks maximum spacing shall be **1.5 m. (60 in.);**

- *The displacement of the foot of the standard shall be prevented either by sinking it into the ground or by fixing it on a base plate.*
- *The structural design shall incorporate* ***safety measures*** *to prevent tipping, collapse, or overloading during use.*
- *Environmental factors, such as* ***wind loads and moisture,*** *shall be considered during the design process.*

k) Fall Protection

- *Personal* ***Fall Arrest Systems (PFAS)*** *shall be utilized by workers when operating at heights of 6 feet (1.8 meters) or more.*
- *Guardrails, Mid-rails, and toe boards shall be* ***inspected*** *and maintained to ensure compliance with safety standards.*

11.3.7.12 Standards/Specifications Tailored for ***Bamboo Scaffolds***

a) Capacity of Scaffold Components

- *All bamboo scaffold components shall be capable of supporting their own weight plus at least* ***4 times the maximum intended load.***
- *Bamboo poles and support frames shall be made from* ***high-quality, mature bamboo*** *free from cracks, splits, or rot to ensure maximum strength and durability.*
- *Suspension ropes or ties, where applicable, shall be capable of withstanding at least* ***6 times the maximum intended load*** *without failure.*

b) Connections and Fasteners

- *All connections, including joints, brackets, and fasteners, shall be securely tied or installed to prevent movement or instability.*
- *Ties, such as synthetic ropes or metal wires, shall be* ***corrosion-resistant*** *and appropriately sized for the required loads.*
- *Bamboo joints shall be reinforced with lashings or mechanical fasteners to ensure structural stability and avoid loosening over time.*

c) Platform Construction

- *Platforms shall be* ***fully planked****, with gaps not exceeding* ***1 inch (2.5 cm)*** *between planks.*
- *Bamboo planks or boards shall overlap the scaffold frame by at least* ***6 inches (15.2 cm)*** *for added stability or be fastened to prevent displacement.*
- *The* ***maximum deflection*** *of bamboo planks shall not exceed* ***1/60th of their span length.***

d) Guardrails

- *Guardrails shall be installed on all open sides and ends of scaffold platforms, with the top rail placed at a height of* ***38 to 45 inches (96.5 to 114.3 cm)*** *above the platform.*
- *Guardrails shall be capable of withstanding a force of at least* ***200 pounds (890 N)*** *applied outward or downward.*
- *The ends of bamboo rails shall be* ***smoothly finished*** *to prevent injury or snagging of clothing.*

e) Mid-rails

- *Mid-rails shall be installed midway between the top rail and the platform surface.*

- *Mid-rails shall be capable of withstanding a force of at least **150 pounds (667 N)** applied outward or downward.*

f) Toe Boards

- *Toe boards shall be installed along the edges of scaffold platforms where there is a risk of tools, materials, or equipment falling.*
- *Toe boards shall be at least **3.5 inches (8.9 cm)** high and securely fastened, with no more than **1/4-inch (0.6 cm)** clearance above the platform.*
- *Toe boards shall be capable of withstanding a force of at least **50 pounds (222 N)** applied downward or outward.*

g) Strength Requirements

- *Bamboo scaffold components, including poles, frames, guardrails, and mid-rails, shall withstand the required load without failure.*
- *Guardrails shall withstand a force of **200 pounds (890 N)**, mid-rails **150 pounds (667 N)**, and toe boards **50 pounds (222 N)** applied in any direction.*
- *All structural elements shall undergo **regular testing and inspection** to ensure compliance with strength standards.*

h) Inspection and Maintenance

- *Bamboo scaffolds shall be inspected daily for **damage, such as cracks, splits, or rot.***
- *All lashings, connections, and structural components shall be assessed regularly to ensure stability and compliance with safety standards.*
- *Damaged or defective parts shall be **replaced immediately** to maintain scaffold safety and integrity.*
- *Bamboo components shall be treated with **protective coatings** to resist pests, moisture, and environmental wear.*

i) Environmental Considerations

- *Bamboo scaffolds shall be shielded from excessive **exposure to moisture** to prevent weakening or decay.*
- *For outdoor environments, bamboo shall be treated with **weather-resistant finishes** to ensure longevity in humid or rainy conditions.*
- *Environmental factors, such as **wind loads**, shall be considered in the scaffold design to maintain stability during use.*

j) Design and Construction

- *Bamboo scaffolds shall be **designed by a qualified person** and constructed in accordance with approved specifications.*
- *Safety measures to prevent **tipping, collapse, or overloading** shall be incorporated into the structural design.*
- ***Environmental conditions**, such as wind and moisture, shall be addressed during the design phase.*
- *The material shall be strong enough and construction shall be of standard quality sufficient to **carry at least 4 (four) times** the design-imposed load;*

k) Fall Protection

- *Workers operating at heights of **6 feet (1.8 meters) or more** shall use **Personal Fall Arrest Systems (PFAS).***

- *Guardrails, mid-rails, and toe boards shall be inspected and maintained to ensure compliance with safety standards.*

l) Other Standards/Specifications

- *In case of light construction works like painting of constructed structure/ minor maintenance, bamboo scaffold may be used;*
- *During working only one worker shall be allowed in any one span;*
- *The maximum distance between posts of span shall be **266 cm. (8 ft.);***
- *In case of a height or fall **greater than 6.6 in. (20 ft.)**, the use of safety belt shall be ensured;*
- *In case of a height **greater than or equal to 10 meters (30 ft.):***
  - ✓ *The scaffold shall be designed preferably by an engineer;*
  - ✓ *Design shall be approved by the competent authority of LGED;*
  - ✓ *Construction/installation shall be executed under supervision of the supervision engineer/authorized engineer of LGED;*
- *Maximum allowable height for bamboo scaffold shall **not exceed 20 meters (60 ft.).***

11.3.7.13 Materials, Quality of Construction etc. (All Types as per Applicability)

- *Scaffold irrespective of type/category shall be of quality construction with sound materials and strength for the purpose of which it is intended.*
- *Timber used for scaffolds shall be in good condition with bark free surface and shall not be painted or treated in any manner to hide the defect;*
- *Materials/parts/members of scaffold not in use or intended for reuse shall be preserved under good condition and be stored separately from other materials unsuitable/harmful for scaffolds;*
- *Timber/bamboo scaffoldings shall be limited to **a height of 20 meters (60 ft.)** from the ground or base;*
- *Scaffolds and all other related installations irrespective of type and category over a height **of 10 meters (32 ft.)**, shall be designed by a competent engineer and duly approved by the appropriate authority of LGED;*
- *For construction/installation of scaffolds over 20 meters height:*
  - ✓ *Structural metals shall be used;*
  - ✓ *Shall be designed by preferably an experienced engineer and duly approved by the appropriate authority of LGED;*
- *If structural steel is used as load bearing members of scaffolding:*
  - ✓ *It shall be destressed at the point welding or bent joints;*
  - ✓ *The design and construction shall be approved by the competent authority of LGED.*

11.3.7.14 Ensuring Maintenance of Scaffolds

- *Scaffolds irrespective of category and types shall be maintained appropriately;*

- *Every part/member of scaffolds irrespective of category and types shall be kept, fixed and secured in position to prevent displacement;*
- *Partly dismantled scaffolds shall not be used unless it is considered stable, strong and safe for the purpose by the competent authority/Engineer of LGED;*
- *Scaffolds left standing for longer period more than 4 (four) months shall not be used until and unless:*
    - ✓ *Damaged members are replaced and the whole structure returned to its original strength;*
    - ✓ *Approved as workable for the construction works by the competent authority/Engineer of LGED.*

11.3.7.15 Supervision and Inspection of Scaffolding Works by LGED Engineers

- *Scaffold shall be erected, added, altered or dismantled only under the supervision of the **Official/Engineer of LGED** and the employee of the contractor in charge of the construction;*
- *All the materials used in construction/installation of any scaffold shall be inspected by the supervision engineer in charge of LGED before use.;*
- *Timber boards/planks with **2 (two) nail holes aligned crosswise or 4 (four) nail holes along its length** shall not be used as horizontal load bearing member of scaffolds.*

11.4 Platform, Ramps, Stairs etc.

At construction sites/worksites, OHS-compliant arrangements for platforms, ramps, stairs, and similar structures ensure the safety of workers and help prevent accidents during movement and access. Key measures include appropriate design and construction, durable materials/components, slip-resistant surfaces and safe handrails, regular inspection, adherence to load/weight/pressure limits and maintenance, adequate lighting, clear markings, and training of workers for safe use. These arrangements support compliance with OHS standards and are essential for creating a safe working environment.

11.4.1 Examples of Hazards Related to the use of Platform, Ramps, Stairs etc. at Construction Worksites

11.4.1.1 Platform-Related Hazards

- ***Unstable Structure:*** *If the platform is made of weak wood, thin steel, or is not properly connected, there is a risk of collapse. Workers may be seriously injured.*
- ***Lack of Guardrails:*** *If elevated platforms lack side rails, especially during the transport of heavy equipment, there is a risk of falling for workers and others involved.*
- ***Slippery Surface Risk:*** *If oil, water, or dust accumulates on the platform, workers may slip and unexpected accidents may occur.*
- ***Insufficient Lighting:*** *If there is inadequate lighting on the platform during evening hours or in dark areas, movement becomes difficult and the risk of accidents increases.*

11.4.1.2 Ramp-Related Hazards

- ***Excessive Slope:*** *If the slope of the ramp exceeds 1:10, there is a possibility of losing control while moving with heavy materials.*
- ***Irregular Surface:*** *Cracks, waves, or unevenness on the ramp may cause tripping or overturning of wheelchairs/trolleys, etc.*
- ***Absence of Non-Skid Surface:*** *If the ramp lacks slip-resistant coating, workers may slip.*
- ***No Side Support:*** *If there are no railings on the sides of the ramp, users may fall off the edge*

11.4.1.3 Staircase-Related Hazards

- ***Uneven Steps:*** *If the steps of the staircase are not uniform (in height or depth), workers may stumble.*
- ***Absence of Handrail:*** *Without handrails on the side of the staircase, there is a risk of losing balance and falling.*
- ***Overly Steep Staircase:*** *If the slope of the staircase is greater than 45°, climbing or descending becomes difficult and the risk of accidents increases.*
- ***Obstruction on Stairs:*** *If construction materials, wires, or similar items are left on the stairs, they obstruct movement and may cause accident.*

11.4.2 Examples of Mitigation Measures for Hazards Related to the Use of Platform, Ramps, Stairs etc. at Construction Worksites

11.4.2.1 Examples of Mitigation of Platform-Related Hazards

- ***Using Robust Materials:*** *Using high-quality wood, steel, or aluminum in platform construction to ensure structural stability.*
- ***Installing Guardrails and Toe Boards:*** *Installing side rails and toe boards on elevated platforms to reduce the risk of falling.*
- ***Ensuring Non-Slip Surface:*** *Using rubber mats, grated steel, or anti-slip coating on platforms.*
- ***Providing Adequate Lighting:*** *Installing high-intensity LED lights on platforms in evening or dark areas to maintain visibility.*

11.4.2.2 Examples of Mitigation of Ramp-Related Hazards

- ***Maintaining Prescribed Slope:*** *Keep the ramp slope at a maximum of 1:10 to maintain balance.*
- ***Surface Leveling and Maintenance:*** *Regularly repair cracks, waves, or unevenness on ramps.*
- ***Applying Non-Skid Coating:*** *Especially during rainy days, apply anti-slip paint or mats on ramps.*
- ***Installing Side Railings:*** *Install railings on both sides of ramps to reduce the risk of falling off the edge.*

11.4.2.3 Examples of Mitigation of Staircase-Related Hazards

- ***Ensuring Uniform Step Dimensions:*** *Keep the height and depth of each step uniform to reduce the chance of tripping.*
- ***Installing Handrails:*** *Place handrails on both sides of the staircase to help workers maintain balance.*
- ***Controlling Staircase Slope:*** *Keep the staircase slope between 30°–40° to ensure safe movement.*
- ***Keeping Staircase Clear and Clean:*** *Regularly inspect and keep the staircase free from construction materials, wires, or debris.*

11.4.3 Negative Impacts of Non-Compliance with the Provisions for Management of Platforms, Ramps, Staircases at Construction Worksites

11.4.3.1 Health and Safety Impacts

- ***Increased Risk of Injuries:*** *Workers may be seriously injured by falling from weak or guardrail-less platforms, overly sloped ramps, or staircases without handrails—injuries may include fractures, head trauma, or permanent disability.*
- ***Slips and Loss of Balance:*** *Especially while carrying heavy materials, workers may slip and fall if ramp surfaces are slippery or uneven.*
- ***Trips and Falls:*** *Workers may trip and fall if staircase steps are uneven or lack handrails, potentially causing long-term physical harm.*
- ***Mental Stress and Anxiety:*** *Unsafe environments involving platforms, ramps, stairs, and similar structures may cause fear, anxiety, and lack of concentration among workers.*

11.4.3.2 Operational Impacts

- ***Work Disruptions:*** *Collapse of platforms, accidents on ramps, or falls on staircases may temporarily halt related activities, causing delays in project/contract implementation.*
- ***Obstruction in Movement:*** *Lack of safe ramps or staircases may hinder worker movement, disrupting coordination and workflow.*

- ***Reduced Productivity:*** *Safety concerns may lower worker morale, reducing overall productivity.*
- ***Failure in Safety Audits:*** *Non-compliance with safety provisions may result in negative reports during site safety inspections, affecting project/ contract acceptability.*

11.4.3.3 Legal and Financial Impacts

- ***Fines and Penalties:*** *Regulatory bodies may impose fines or take punitive actions for non-compliance with safety standards/provisions.*
- ***Reputation Damage:*** *Non-compliance with safety provisions may harm the reputation of the project, contractor, or construction firm, affecting future contracts and stakeholder relations.*
- ***Equipment Damage:*** *Equipment may break if it falls from ramps or platforms, leading to additional costs for replacement or repair.*
- ***Increased Project Costs:*** *Accidents due to non-compliance may increase labor, medical, equipment repair, and timeline extension costs.*
- ***Higher Insurance Premiums:*** *Increased safety risks may lead insurance companies to raise premiums, causing long-term financial pressure.*
- ***Litigation Costs:*** *Accidents resulting from non-compliance with safety provisions may lead to legal disputes, incurring significant legal expenses and compensation claims.*

11.4.4 Positive Impacts of Compliance with the Provisions for Management of Platforms, Ramps, Staircases etc. at Construction Worksites

11.4.4.1 Health and Safety Impacts

- ***Reduced Accidents:*** *The use of safe platforms, ramps, and staircases significantly reduces incidents of falling, slipping, or tripping.*
- ***Ensured Physical Safety:*** *Ensuring railings, handrails, and proper slope on platforms, ramps, and staircases helps maintain physical safety of workers.*
- ***Mental Comfort:*** *A safe working environment increases workers' confidence and concentration, reducing mental stress.*
- ***Lower Long-Term Health Risks:*** *Safe movement on platforms, ramps, and staircases reduces long-term risks related to back, waist, and knee problems.*

11.4.4.2 Operational Impacts

- ***Operational Continuity:*** *Ensuring safety in platforms, ramps, and staircases reduces the likelihood of work stoppage due to accidents, allowing uninterrupted operations.*
- ***Increased Productivity:*** *A safe and organized work environment boosts worker morale, directly contributing to increased productivity.*
- ***Improved Coordination and Mobility:*** *Properly constructed platforms, ramps, and staircases ease worker movement, saving time and labor on site.*
- ***Success in Safety Audits:*** *Compliance with provisions related to platforms, ramps, and staircases yields positive results in site safety inspections, enhancing project/contract acceptability.*

11.4.4.3 Legal and Financial Impacts

- ***Reduced Legal and Penalty Risks:*** *Compliance with safety standards for platforms, ramps, and staircases reduces the chances of fines or legal complications from regulatory bodies.*

- ***Enhanced Insurance Benefits:*** *Compliance with safety standards may lead insurance companies to offer coverage at lower premiums for safe site management, providing financial benefits.*
- ***Controlled Project Costs:*** *Reduced accidents due to compliance minimize the need for additional medical, repair, or labor expenses, keeping the budget under control.*
- ***Improved Reputation and Trust:*** *Compliance with safety standards enhances the reputation of the project, contractor, or construction firm, positively influencing stakeholders and future contracts.*

11.4.5 General Provisions for Management of Platforms, Ramps, Stairs etc. at Construction Worksites

Platforms, ramps, and stairs are essential structures at construction sites/worksites for safe movement of workers, transportation of materials/equipment, and management of elevation. Compliance with prescribed safety standards and provisions in the design, construction, and maintenance of these elements reduces accident risks, increases productivity, and ensures legal and ethical acceptability of the project/contract.

11.4.5.1 When to Comply with the Provisions for Management of Platforms, Ramps, Staircases at Construction Worksites

- ***During Work at Heights:*** *When workers are working at designated heights above ground, such as on roofs, slabs, or lift shaft edges, safe platforms and railings must be ensured.*
- ***During Material or Equipment Transfer:*** *When heavy materials or equipment are transferred via ramps, standards related to slope, width, and surface safety must be maintained.*
- ***For Permanent or Temporary Access:*** *Especially where level differences exist, safe stairs or ramps must be installed for regular worker movement.*
- ***For Workers with Limited Mobility:*** *Ramp slope and handrails must be specially adapted to ensure safe movement for all.*
- ***During Wet or Slippery Conditions:*** *If surfaces become wet due to rain, anti-slip measures must be ensured on ramps and stairs.*
- ***During Night Work or Low Visibility:*** *During evening or nighttime work, adequate lighting and visibility must be ensured.*
- ***Prior to Safety Inspections:*** *Before government or internal safety inspections, full compliance with relevant provisions must be ensured.*
- ***During Induction of New or Inexperienced Workers:*** *Safety standards for movement paths, platforms, ramps, and stairs must be ensured for new workers or trainees.*
- ***During Site Design Modifications:*** *When new levels, access points, or movement paths are created, proper management of platforms, ramps, and stairs must be reconsidered.*
- ***During Post-Incident Reassessment:*** *After any previous incident, standards and conditions of platforms, ramps, and stairs must be re-evaluated during safety reassessment.*

11.4.5.2 Where to Comply with the Provisions for Management of Platforms, Ramps, Staircases at Construction Worksites

a) Elevated and Uneven Work Zones

- ***Roof, Slab, and Lift Shaft Edges:*** *Where elevation exists and there is a risk of falling, safe platforms and railings are mandatory.*

- ***Basement, Pit, or Excavation Zones:*** *Safe ramps or stairs must be installed for entry and exit at lower levels.*
- ***Corridors with Level Changes:*** *Where there are elevation differences along movement paths, connection must be ensured via stairs or ramps.*

b) Access and Egress Points

- ***Main Entry Points and Site Gates:*** *Where applicable, ramps or stairs must be installed to ensure safe entry and exit for workers.*
- ***Temporary Access Routes:*** *Safety standards must be maintained even on temporary movement paths during construction.*
- ***Emergency Exit Routes:*** *Standards for ramps and stairs must be ensured for quick and safe evacuation during emergencies.*

c) Material and Equipment Transfer Zones

- ***From Storage to Work Zones:*** *Safety of ramp slope, width, and surface must be ensured for transferring heavy materials or equipment.*
- ***Loading/Unloading Zones:*** *Stability and load-bearing capacity of ramps or platforms must be ensured where materials are loaded or unloaded.*

d) High-Traffic and Worker Movement Zones

- ***Common Walkways:*** *Safety standards for stairs or ramps must be maintained along regular movement paths of workers.*
- ***Tool Stations, Washrooms, and Rest Areas:*** *Platform/stair/ ramp management is required to ensure safe entry and exit at these locations.*
- ***Multi-Level Sites:*** *Where multiple levels exist, safe stairs or ramps must be installed to connect each level.*

11.4.5.3 Design and Construction Standards

- *BNBC, LGED's OHS standards, and applicable international standards must be followed.*
- *Structures must be adequately load-bearing and stable to prevent deformation under excessive pressure.*
- *Drainage and anchoring systems must be in place to prevent waterlogging, slips, or structural failure.*

11.4.5.4 Material Selection

- *Wood, steel, or aluminum must be corrosion-resistant and load-bearing tested.*
- *Especially for ramps and stairs, materials with slip-resistant surfaces must be used.*
- *Use of corroded, brittle, or weak recycled materials is prohibited.*

11.4.5.5 Guardrails and Handrails

- *Guardrail height must be at least 1.0 meter, and handrail diameter must be 3.5–5.0 cm.*
- *Gaps between guardrails must be designed to prevent children or equipment from falling.*
- *Handrails must be firmly attached and continuous along the entire length.*

11.4.5.6 Slope and Width

- *Ramp slope must be a maximum of 1:10, and stair riser height should be 15–18 cm (6–7 inches), tread depth 25–30 cm (10–12 inches).*

- *Minimum width for movement should be 90 cm (36 inches); for two-way movement, ≥1.5 meters (5 feet or 60 inches).*
- *Special ramps for wheelchairs or material trolleys must have a width of ≥1.2 meters (48 inches or 4 feet).*

11.4.5.7 Surface Safety

- *Anti-slip coverings such as rubber mats, grated steel, or textured paint must be used.*
- *Proper slope and drainage systems must be in place to prevent water accumulation during rain.*
- *Oil, dust, or mud on platforms, ramps, or stairs must be cleaned immediately.*

11.4.5.8 Lighting and Visibility

- *Each stair and ramp must have lighting of ≥200 lux.*
- *Warning signs, colored strips, and glow-in-the-dark indicators must be used.*
- *Emergency backup lighting must be available for night work.*

11.4.5.9 Inspection and Maintenance

- *Weekly inspections must be conducted, and reports must be maintained, including structural integrity and safety audit data.*
- *Any corrosion, cracks, or loose parts must be repaired immediately.*
- *At least once a month, guardrails, handrails, and surface grip must be checked.*

11.4.5.10 Safe Access and Egress

- *Emergency exit routes must always be marked, illuminated, and unobstructed.*
- *No obstacles or hazardous materials/equipment may be placed at entry points.*
- *Emergency assembly point instructions must be displayed near exit routes.*

11.4.5.11 Training and Awareness

- *Orientation and hands-on training must be arranged for workers.*
- *Instructions must be provided on caution during use of stairs and ramps, hazard identification, and use of personal protective equipment (PPE).*
- *Safety discussions related to these structures must be included in regular toolbox meetings.*

11.4.6 Standards/Specifications for Management of Platforms, Ramps, Stairs etc. at Construction Worksites

At construction worksites, adherence to structural features and construction standards for platforms, ramps, and stairs is extremely important for safe movement, transportation of materials/equipment, and elevation management. Failure to follow the prescribed specifications for such structures significantly increases the risk of accidents and undermines the legal and ethical acceptability of the project. The applicable standards and specifications for these structures are presented below:

11.4.6.1 Standards/Specifications for Platforms

a) Height and Width

- *Minimum width of platforms must be ≥1.0 meter (39 inches), regardless of type/category.*
- *For platforms ≥2.0 meters (6 feet 2 inches) in height, fall protection measures are mandatory.*
- *A setback of ≥30 cm (12 inches) must be maintained from the entry edge of each platform.*

b) Flooring

- *Anti-slip surface must be ensured.*
- *Anti-slip surface must include any of the following materials:*
    - *Grated steel;*
    - *Textured plywood;*
    - *Rubberized coating.*
- *Load-bearing capacity must be ≥500 kg/m².*
- *Expansion joints and vibration dampening systems must be included.*

c) Guardrail and Toe-board

- *Guardrail height must be 1.0–1.1 meters (39–43 inches).*
- *Toe-board height must be ≥10 cm (4 inches).*
- *Gaps between guardrails must be ≤15 cm (6 inches); slot openings ≤10 cm (4 inches).*

d) Connection and Anchoring

- *At least 2 anchor bolts must be installed every 1.5 meters (5 feet).*
- *Diagonal bracing and lateral support must be mandatorily installed.*
- *Temporary platforms must include quick-release locking mechanisms.*

11.4.6.2 Standards/Specifications for Ramps

a) Longitudinal Slope

- *Maximum longitudinal slope for ramps:*
    - *For wheelchair access: 1:10*
    - *For manual transport: 1:8*
    - *For emergency use: 1:6*
- *If slope is ≥1:12 or steeper, resting platforms must be installed every 9 meters (29 feet 6 inches).*
- *Lateral slope for drainage must be ≤2%.*

b) Width of Ramps

- *For single-direction movement: ≥90 cm (36 inches)*
- *For equipment movement: ≥1.2 meters (4 feet)*
- *For dual-direction movement: ≥1.5 meters (5 feet)*
- *If ramp width is ≥1.8 meters, center divider or dual handrails must be installed.*
- *For curved ramps, turning clearance must be ≥1.5 × 1.5 meters (5 feet × 5 feet).*

c) Surface of Ramps

- *Ramp surface must be protected with anti-slip surface materials.*
- *Acceptable anti-slip materials include:*
    - ✓ *Rubber mat;*
    - ✓ *Grooved concrete;*
    - ✓ *Epoxy grit coating;*
- *Drainage groove depth must be ≥1 cm (0.4 inches).*
- *Surface reflectivity must be ≥30% for visibility.*

d) Handrails of Ramp

1. **Diameter & Height**
   - Handrail diameter must be 3.5–5.0 cm (1.5–2.0 inches) for comfortable and slip-resistant grip.
   - Handrail height must be 85–95 cm (34–37 inches) to ensure ease of use, especially for persons with disabilities and the elderly.
2. **Terminal Extension**
   - Each handrail must have a terminal extension of ≥30 cm (≥12 inches) at both ends for guidance and safety.
   - Ensure that the extension does not collide with adjacent walls or obstacles.
3. **Grip Test & Lateral Force Resistance**
   - Each handrail must withstand ≥50 kg (≥110 pounds) of lateral force.
   - Grip test is mandatory, especially for high-traffic or emergency exit ramps.
4. **Connection and Anchoring**
   - Handrails must be anchored with ≥2 bolts every 1.5 meters (5 feet) to ensure stability under vibration, pressure, and daily use.
   - Anchoring points must use corrosion-resistant materials and ensure secure fixing without disengagement.
5. **Visibility & Safety**
   - Handrail ends must be marked with warning colors (e.g., yellow or red) for easy identification by visually impaired individuals.
   - Lighting of ≥200 lux must be ensured, and emergency backup lighting must be active during emergencies.
6. **Continuity & Accessibility**
   - Handrails must be continuous along the entire ramp without any breaks.
   - Grip surface must be anti-slip and designed for comfortable hand positioning.

11.4.6.3 Standards/Specifications for Stairs

a) Step Dimensions

1. **Height & Depth**
   - Each step must have a height of 15–18 cm (6–7 inches) and a depth of 25–30 cm (10–12 inches) to ensure comfortable and safe movement.
2. **Step Variation**
   - The difference in height and depth between consecutive steps must be limited to ≤5 mm (≤0.2 inches) to reduce the risk of tripping.
3. **Spiral Staircase**
   - At the narrow end, tread width must be ≥20 cm (≥8 inches) to ensure sufficient foot placement.

b) Width of Stairs

1. **General Stairs**
   - For single-direction movement: width must be ≥90 cm (≥3.0 feet).

- For dual-direction movement: width must be ≥1.5 meters (≥5.0 feet).
- If stair width is ≥1.8 meters (≥6.0 feet), central handrail installation is mandatory.

2. **Emergency Stairs**
   - For emergency ascent and descent: width must be ≥2.0 meters (≥6.5 feet) to allow rapid evacuation.
3. **Stairwell Clearance**
   - Clearance above the stair must be ≥2.1 meters (≥7.0 feet) to prevent head or equipment injury.

c) Handrail and Guardrail

1. **Height**
   - Guardrail height must be ≥1.0 meter (≥39 inches).
   - Handrail height must be ≥80 cm (≥31 inches).
2. **Continuity**
   - Handrails must be continuous throughout the staircase without any breaks.
3. **Anchoring**
   - Handrails must be anchored with ≥2 bolts every 1.2 meters (4 feet) to ensure stability and safety.

d) Surface and Visibility

1. **Anti-slip & Markings**
   - Each step must have anti-slip strips, edge markings, and warning colors.
2. **Lighting**
   - Lighting of ≥200 lux must be ensured on stairs.
   - Emergency backup lighting must be active during emergencies.
3. **Color Contrast**
   - First and last steps must have distinct color markings for easy identification by visually impaired individuals.

e) Landing and Turning

1. **Landing Space**
   - At stair ends, there must be a clear space of ≥1.5 × 1.5 meters (≥5 × 5 feet) for rest and turning.
2. **Surface Quality of Landing**
   - Landing surface must be anti-slip and drainable to prevent water accumulation.
3. **Signage & Exit**
   - Directional and emergency exit signs must be clearly displayed at each landing.

11.4.6.4 Other Standards/Specifications

a) Free from Obstructions

- All platforms, paths, ramps, and stairs must be free from any obstructions, materials/equipment, debris, or protruding nails.

b) Keep Roughening the Surface

- If platforms/ramps/paths become slippery due to work conditions, the surface must be roughened using sanding, cleaning, or other methods.

c) Strong Enough Supporting Structure

- Supporting components used in the construction of platforms, runways, ramps, and stairs must:
  - ✓ Be firmly connected and braced.
  - ✓ Be placed on solid foundations to prevent lateral displacement.
  - ✓ Be properly installed and supported to prevent sagging or movement.

d) Design Load

- Minimum uniformly distributed design load for platforms, paths, ramps, or stairs must be 650 kg/m² (133 lb/ft²).
- Stress caused by concentrated load at any point on the floor must not exceed the stress of the uniformly distributed design load.

e) Planks

- Planks used in platforms must be made of high-quality wood with a minimum thickness of 3 cm (1 inch).

f) Sloping

- Slope of paths or ramps must not exceed 2:3.
- If stepping planks are required due to excessive slope:
  - ✓ Minimum section must be 5 × 8 cm (2 × 3 inches), and spacing must be a maximum of 46 cm (18 inches) center-to-center.
  - ✓ Planks must span the full width of the path or ramp.

11.5 Cofferdams and Caissons

Occupational Health and Safety (OHS) compliance for cofferdams and caissons at construction worksites focuses on protecting workers from hazards associated with underwater and below-ground structures. Key measures include proper design, secure installation, and continuous monitoring of structural integrity to prevent collapses or water ingress. Ventilation, dewatering systems, and protection against hazardous gases are critical for maintaining a safe working environment. Worker training, the use of personal protective equipment (PPE), emergency preparedness, and regular inspections ensure adherence to OHS standards, minimizing risks and promoting safety.

11.5.1 Examples of Cofferdams

- ***Earthen Cofferdam:*** *Constructed using a mixture of clay and sand or gravel, often used in shallow water depths of* ***1.2–1.5 meters.***
- ***Rockfill Cofferdam:*** *Built with stone or rubble for water depths up to* ***18–30 inches****, with voids filled using earth and stone chips.*
- ***Cellular Cofferdam:*** *Made of steel sheet piles forming circular or diaphragm cells, suitable for deep excavations and marine works.*
- ***Double-Walled Cofferdam:*** *Consists of two parallel walls filled with soil or concrete, used for large-scale projects.*

11.5.2 Examples of Caissons

- ***Box Caisson:*** *A watertight structure closed at the bottom, floated to the site and sunk into position, often used for bridge piers.*
- ***Open Caisson:*** *A hollow box-like structure open at the top and bottom, sunk into the ground by excavating soil within it.*
- ***Pneumatic Caisson:*** *A pressurized chamber used for underwater construction, allowing workers to excavate soil in dry conditions.*

11.5.3 Hazards Related to Cofferdams and Caissons

11.5.3.1 Hazards Related to Cofferdams

- ***Flooding:*** *Failure of cofferdam walls can lead to sudden flooding, endangering workers.*
- ***Falls from Height:*** *Workers may fall from the dam walls into water or excavated areas.*
- ***Contaminated Water:*** *Exposure to polluted water can cause health issues.*
- ***Structural Instability:*** *Improper design or maintenance can lead to collapse.*
- ***Collision Risks:*** *Moving equipment, such as boats or cranes, can collide with the cofferdam.*

11.5.3.2 Hazards Related to Caissons

- ***Compressed Air Hazards:*** *Workers in pressurized caissons may suffer from decompression sickness (caisson disease).*
- ***Structural Failures:*** *Weak caisson walls can collapse under pressure.*
- ***Confined Space Risks:*** *Limited ventilation can lead to hazardous gas accumulation.*

- ***Water Ingress:*** *Leaks in caissons can cause flooding and endanger workers.*
- ***Noise and Vibration:*** *Piling operations can expose workers to excessive noise and vibrations.*

11.5.4 Examples of OHS Measures for Cofferdams and Caissons

11.5.4.1 Examples of OHS Measures for Cofferdams

- ***Flooding Prevention:*** *Designing cofferdams to withstand high water levels, and installing controlled flooding systems.*
- ***Fall Protection:*** *Providing guardrails and safety harnesses for workers on cofferdam walls to minimize fall risks.*
- ***Water Quality Monitoring:*** *Conducting regular testing of water for contaminants, and equipping workers with protective gear.*
- ***Structural Inspections:*** *Performing routine checks to ensure the stability and integrity of cofferdams.*
- ***Collision Avoidance:*** *Establishing barriers and warning systems to prevent equipment collisions with cofferdams.*

11.5.4.2 Examples of OHS Measures for Caissons

- ***Compressed Air Safety:*** *Implementing proper pressure controls and decompression procedures to prevent caisson disease.*
- ***Structural Integrity:*** *Conducting regular testing to ensure caisson walls are safe and durable under pressure.*
- ***Ventilation Systems:*** *Installing ventilation systems to prevent hazardous gas accumulation in caissons.*
- ***Leak Prevention:*** *Inspecting and maintaining seals to detect and repair leaks, ensuring watertight caissons.*
- ***Noise Control:*** *Monitoring noise levels and providing ear protection for workers during caisson installation and operations.*

11.5.5 Negative Impacts for Non-Compliance with OHS Provisions and Standards/ Specifications

11.5.5.1 Negative Impacts of Cofferdams

a) Flooding and Structural Collapse:

- *Failure to meet standards for wall stability or water resistance.*
- *Sudden flooding or collapse endangering workers and equipment.*

b) Worker Fatalities and Injuries:

- *Inadequate fall protection systems.*
- *Lack of warning mechanisms leading to accidents.*

c) Environmental Damage:

- *Leakage from poorly constructed cofferdams contaminating nearby water and soil.*
- *Harm to aquatic ecosystems from unsafe practices.*

d) Delays in Project Timelines:

- *Structural failures causing operational delays.*
- *Need for repairs and investigations leading to extended downtime.*

e) Legal Penalties:

- *Fines and lawsuits for violating safety and environmental standards.*
- *Risk of project suspension due to non-compliance.*

11.5.5.2 Negative Impacts of Caissons

a) Decompression Sickness:

- *Improper pressure controls in pneumatic caissons.*
- *Medical emergencies affecting workers due to decompression hazards.*

b) Structural Failures:

- *Weak caisson walls collapsing under pressure.*
- *Equipment damage and worker injuries from structural deficiencies.*

c) Confined Space Hazards:

- *Limited ventilation causing gas accumulation.*
- *Risks of asphyxiation or poisoning for workers inside caissons.*

d) Flooding Risks:

- *Poor seals and maintenance leading to water ingress.*
- *Equipment damage and operational interruptions due to leaks.*

e) Noise and Vibration Issues:

- *Excessive exposure to noise from piling operations.*
- *Harm to workers' hearing and physical well-being.*

11.5.6 Positive Impacts for Compliance with OHS Provisions and Standards/ Specifications

11.5.6.1 Positive Impacts of Cofferdams

a) Enhanced Structural Stability:

- *Cofferdams designed to withstand high water levels and external forces.*
- *Reduced risk of flooding and collapse ensuring worker safety.*

b) Worker Safety:

- *Proper fall protection systems like guardrails and harnesses in place.*
- *Monitoring systems installed to detect potential risks.*

c) Environmental Protection:

- *Leakage prevention methods protecting nearby ecosystems.*
- *Compliance reducing contamination risks in water and soil.*

d) Efficient Operations:

- *Well-constructed cofferdams enabling smooth workflows.*
- *Reduced downtime from structural stability and hazard control.*

e) Legal and Financial Security:

- *Adherence to regulations avoiding fines or lawsuits.*

- *Improved reputation and trust among stakeholders and clients.*

11.5.6.2 *Positive Impacts of Caissons*

a) *Improved Worker Health:*

- *Proper decompression procedures preventing caisson disease.*
- *Regular medical checks ensuring workers' fitness for pressurized environments.*

b) *Structural Integrity:*

- *Regular testing maintaining safe and durable caisson walls.*
- *Minimized risk of collapse through compliance with engineering standards.*

c) *Confined Space Safety:*

- *Effective ventilation systems ensuring safe air quality.*
- *Gas detectors reducing risks of hazardous accumulation.*

d) *Operational Efficiency:*

- *Watertight caissons preventing flooding and delays in construction.*
- *Smooth progress in underwater operations without incidents.*

e) *Compliance Benefits:*

- *Safe practices fostering trust and reliability among workers and clients.*
- *Legal and environmental compliance reducing penalties and improving reputation.*

11.5.7 General Provisions for Cofferdams and Caissons

Occupational Health and Safety (OHS) provisions for cofferdams and caissons at construction worksites are crucial for ensuring worker safety and structural integrity in underwater and below-ground projects/contracts. These provisions focus on proper planning, secure installation, and continuous monitoring to prevent risks such as collapses, flooding, or exposure to hazardous gases. Compliance with OHS provisions are integral to managing the unique challenges of these complex operations. Following are the leading general provisions to be complied with:

11.5.7.1 *When OHS Provisions for Cofferdams and Caissons Are Applicable*

a. Cofferdams

- ***During Construction:***
  - *When cofferdams are installed to create a dry working environment;*
  - *When materials are being positioned and secured to prevent water entry.*
- ***During Operation:***
  - *When workers perform tasks such as excavation or concrete pouring inside the cofferdam;*
  - *When monitoring and adjustments are required to maintain stability.*
- ***During Inspections:***

- *When structural assessments are conducted to check for leaks or weaknesses;*
- *When regular evaluations are performed to ensure compliance with safety standards.*

- ***During Emergencies:***
  - *When flooding or a structural failure of the cofferdam occurs;*
  - *When evacuation and safety protocols are implemented to protect workers.*

b. Caissons:

- ***During Installation:***
  - *When caissons are being sunk into position for underwater construction;*
  - *When alignment and stabilization are ensured during setup.*
- ***During Pressurized Operations:***
  - *When workers are operating in pneumatic caissons under compressed air conditions;*
  - *When air pressure levels are adjusted to maintain safety and prevent water ingress.*
- ***During Maintenance:***
  - *When caissons are being inspected for watertightness and structural integrity;*
  - *When repairs or reinforcements are made to damaged sections.*
- ***During Emergencies:***
  - *When leaks, structural failures, or decompression issues arise;*
  - *When safety measures and evacuation procedures are implemented for affected workers.*

11.5.7.2 Where OHS Provisions Are Applicable

a. Cofferdams:

- ***Riverbeds and Waterways:***
  - *Where cofferdams are used to divert water for safe construction;*
  - *Where flow control is necessary to protect the work area.*
- ***Marine Construction Sites:***
  - *Where cofferdams are installed for constructing bridge piers, docks, or other marine structures;*
  - *Where underwater conditions require containment systems for construction.*
- ***Excavation Areas:***
  - *Where cofferdams are used to keep water and soil out of excavation zones;*
  - *Where stable and dry conditions are essential for foundation work.*

- ***Flood-Prone Zones:***
  - *Where cofferdams are needed to manage water levels during construction;*
  - *Where temporary flood protection is required for worksites.*

b. Caissons:

- ***Underwater Construction Sites:***
  - *Where caissons are employed for bridge piers, tunnels, or offshore structures;*
  - *Where stable foundations are needed in submerged conditions.*
- ***Deep Excavation Areas:***
  - *Where caissons are required to provide support and safe access for workers;*
  - *Where excavation is conducted below the groundwater table.*
- ***Pressurized Work Environments:***
  - *Where pneumatic caissons are used to maintain dry working conditions under high pressure;*
  - *Where precise air pressure levels are required for safe operations.*
- ***Confined Spaces:***
  - *Where caissons are employed for tasks in restricted and enclosed workspaces;*
  - *Where controlled environments are necessary for worker safety and efficiency.*

11.5.7.3 Common General Provisions for Cofferdams and Caissons

a) Flood Water Control

- *If there remains possibility of entering high water flow overtopping of the cofferdam, sufficient means shall be provided for controlling flooding of water in the working area.*

b) Warning Signs

- *In case of emergency, warning Signs/signals for evacuation of laborers/employees concerned shall be developed and posted in suitable ways.*

c) Rapid Access with Guardrails

- *For Cofferdam, walkways/passageways, bridges, or ramps shall be provided with at least two means of rapid exit with guardrails.*

d) Protection from Water Transports

- *Cofferdams located close to navigable channels shall be protected from for water transports (vessels/engine boats etc.) (in applicable and possible cases).*

e) Every Cofferdams and caisson shall be:

- *Of good and standard construction;*
- *Suitable in the perspective of perfect use;*
- *Constructed with sound material;*
- *Constructed with adequately strong materials;*

f) Safety from inrush of water/other materials

- *Appropriate and sufficient means shall be provided with for laborers to ensure safety in the event of an inrush of water/other materials.*

g) Presence of Supervision Engineer

The following tasks activities of caisson or cofferdam shall take place only under the supervision of Supervision Engineers (Sub-Assistant Engineer in-charge of supervision/Upazila Engineer/ Executive Engineer (as per applicability and prevailing administrative norm of LGED):

- *Construction;*
- *Positioning;*
- *Modification;*
- *Dismantling.*

h) Regular Supervision

The tasks mentioned in (g) shall be inspected by the Supervising Engineers of LGED at reasonable intervals

11.5.7.4 General Provisions for Cofferdams and Caissons (Specific)

a. Cofferdams

- ***Water Exclusion:***
  - *Ensuring the design of cofferdams excludes water effectively;*
  - *Creating a dry work environment for safe operations.*
- ***Safety Equipment:***
  - *Providing workers with life jackets to prevent drowning;*
  - *Equipping workers with safety harnesses for protection near cofferdams.*
- ***Emergency Preparedness:***
  - *Establishing clear evacuation plans for emergency situations;*
  - *Installing alarm systems to alert workers in case of flooding or structural failures.*
- ***Inspections:***
  - *Conducting regular inspections to detect leaks and structural weaknesses;*
  - *Ensuring timely repairs to maintain the integrity of cofferdams.*
- ***Worker Training:***
  - *Training personnel on proper installation techniques for cofferdams;*
  - *Educating workers on emergency protocols to handle risks effectively.*

b. Caissons

- ***Safe Access:***
  - *Providing access points such as ladders or walkways for easy entry and exit;*
  - *Ensuring these access systems are stable and secure.*
- ***Emergency Protocols:***
  - *Establishing comprehensive evacuation plans for caisson-related emergencies;*

- *Ensuring emergency equipment is readily available for workers.*

- ***Regular Inspections:***
  - *Inspecting caissons prior to use to verify structural stability;*
  - *Addressing any detected issues immediately to ensure operational safety.*
- ***Worker Health:***
  - *Assessing workers' medical fitness to operate in confined or pressurized environments;*
  - *Monitoring their health periodically for potential issues.*
- ***Work Environment:***
  - *Providing a controlled workspace that minimizes external risks;*
  - *Ensuring adequate safety measures for tasks performed inside caissons.*

11.5.8 Standards/Specifications for Cofferdams and Caissons at Construction Worksites

Standards and specifications for cofferdams and caissons provide essential guidelines for ensuring safety and efficiency in underwater and below-ground construction. These standards focus on proper design, secure installation, and the use of high-quality materials to prevent structural failures and water ingress. Adherence to the following specifications, combined with regular inspections and compliance with safety regulations, creates a safer and more effective working environment:

a. Cofferdams

- ***Water Pressure Resistance:***
  - *Designing cofferdams to withstand water pressure up to **10 kPa**;*
  - *Ensuring stability to prevent deformation or collapse.*
- ***Material Strength:***
  - *Using construction materials with a minimum tensile strength of **250 MPa**;*
  - *Ensuring durability to withstand site-specific conditions.*
- ***Guardrails:***
  - *Installing guardrails of at least **1.1 meters** in height on walkways;*
  - *Reducing fall risks for workers operating on or near cofferdams.*
- ***Flooding Prevention:***
  - *Incorporating controlled flooding systems to manage overtopping;*
  - *Minimizing damage from water-related emergencies.*
- ***Inspection Schedule:***
  - *Conducting inspections of cofferdams at least once **every 3 months**;*
  - *Ensuring early detection and resolution of hazards.*

b. Caissons

- ***Provision for Ladders, Stairs etc.***

- *In applicable cases, whenever shaft is used for caisson works, it shall be provided with (if space permits):*
  - ✓ A safe, proper, and suitable staircase for its entire length, including landing platforms;
  - ✓ Where this is impracticable, suitable ladders shall be installed with landing platforms.
- *Caissons having a diameter or side greater than 3 meter (10 feet) shall be provided with a man lock and shaft for the exclusive use of laborers/employees concerned.*

- ***Accurate Gauge/Scale***
  - *An accurate gauge/scale shall be maintained on the outer and inner side of each bulkhead;*
  - *Gauges/scales shall be accessible at all times and kept in accurate working order.*
- ***Necessary Protective Measures***
  - *In caisson operations where laborers/employees concerned are exposed to compressed/contaminated air working environments, necessary protective measures shall be complied with as per recommendation of concerned and competent authorities of LGED.*
- ***Pressure Control:***
  - *Maintaining internal air pressure* ***between 0.5–1.0 bar*** *for pneumatic caissons;*
  - *Preventing water ingress and ensuring worker safety.*
- ***Structural Integrity:***
  - *Constructing caisson walls to withstand external water pressure of* ***up to 50 kPa;***
  - *Reducing risks of collapse under high-pressure environments.*
- ***Ventilation Systems:***
  - *Installing ventilation systems providing* ***at least 30 cubic meters per hour*** *of airflow per worker;*
  - *Ensuring proper air quality and circulation.*
- ***Leak Prevention:***
  - *Testing seals and joints to ensure leakage rates* ***do not exceed 0.1 liters per minute;***
  - *Repairing defects promptly to maintain watertight conditions.*
- ***Noise Levels:***
  - *Limiting noise exposure inside caissons to* ***a maximum of 85 dB;***
  - *Providing ear protection to workers to mitigate risks of hearing damage.*
- ***Inspection Schedule:***
  - *Inspecting caissons for structural integrity and safety* ***at least once every 6 months;***
  - *Ensuring compliance and operational reliability.*

11.6 Construction Machineries/Equipment

Occupational Health and Safety (OHS) compliance for construction equipment at worksites ensures the safe and efficient operation of equipment/machineries while protecting workers from potential hazards. Compliance measures include regular inspection, maintenance, and proper storage of equipment/machineries to prevent malfunctions or accidents. Workers must be trained in the safe use and handling of machinery, including adherence to operational guidelines and load limits. The use of personal protective equipment (PPE) and implementation of hazard control measures, such as signage and restricted zones, are critical. These practices promote safety, minimizing risks, and enhancing overall worksite efficiency.

11.6.1 Examples of Construction Equipment/Machineries/Hand tools etc.

The Following table (Table-11-1, 11-2 and 11.3) illustrates the examples of Equipment/Machineries/Hand tools generally used in construction worksites:

Table 11-1: Examples of Construction Machinery Used at Construction Worksites

Serial	Name of Machinery	Usage
1	Excavator	Used for digging, grading, and demolition activities
2	Crane	For lifting and moving heavy objects (mobile, tower, overhead)
3	Bulldozer	Used for land leveling, clearing, and earthmoving
4	Loader	For loading and transporting materials (wheel and skid steer)
5	Forklift	For moving materials in warehouses or construction sites
6	Dump Truck	For transporting sand, gravel, soil, etc.
7	Concrete Mixer	For mixing concrete directly at the site
8	Pile Driver	For driving piles into the ground for foundations
9	Compactor/Roller	For compacting soil, asphalt, or other materials
10	Scissor Lift	For working at or accessing elevated areas
11	Boom Lift	For accessing distant elevated areas
12	Generator	For supplying electricity to equipment or tools
13	Trencher	For digging trenches for cables or pipes
14	Drill	Handheld and heavy-duty construction drilling
15	Paver	For laying asphalt in road construction
16	Grader	For creating a level surface in road construction

Table 11-2: Examples of Equipment Used at Construction Worksites

Serial	Name of Equipment	Usage
1	Concrete Mixer	For mixing concrete directly at the site
2	Compactor/Roller	For compacting soil or asphalt
3	Scissor Lift	For working at or accessing elevated areas
4	Boom Lift	For accessing distant elevated areas
5	Generator	For supplying electricity to equipment or tools
6	Trencher	For digging trenches for cables or pipes
7	Air Compressor	For operating pneumatic tools
8	Welding Machine	For assembling and repairing metal structures
9	Concrete Cutter	For cutting concrete panels or slabs

Serial	Name of Equipment	Usage
10	Water Pump	For draining or supplying water at the site
11	Ladder/Step Ladder	For safe climbing at small heights
12	Hand Trolley	For transporting light materials
13	Barricade/Safety Cone	For defining safety boundaries at the site
14	Light Tower	For illumination during night work
15	Forklift	For moving heavy materials
16	Wheel Barrow	For transporting concrete, sand, or bricks
17	Drill Machine	For drilling holes in wood, metal, or concrete

11.6.2 Examples of Hazards Related to Construction Equipment/Machineries at Construction Sites

- ***Heavy Machinery Operation:*** *Risks of operating heavy machinery such as excavators, bulldozers, and cranes, including operator error and equipment malfunctions.*
- ***Blind Spots:*** *Hazards due to limited visibility and blind spots around construction machinery.*
- ***Maintenance Issues:*** *Risks associated with poorly maintained machinery, leading to mechanical failures and accidents.*
- ***Unauthorized Access:*** *Hazards from unauthorized personnel accessing construction machinery or work areas.*
- ***Struck-by Accidents:*** *Risks of workers being struck by moving machinery or falling loads.*
- ***Noise and Vibration:*** *Health risks from prolonged exposure to excessive noise and vibration from construction machinery.*

11.6.3 Examples of Safety Measures Related to Equipment/Machineries Hazards

- ***Operator Training:*** *Ensuring operators are trained and certified to use construction Equipment/Machineries safely. Providing ongoing training and refresher courses.*
- ***Maintenance and Inspections:*** *Conducting regular maintenance and inspections of Equipment/Machineries to ensure proper functioning.* ***Inspection frequency: Daily****. Following manufacturer guidelines for maintenance schedules.*
- ***Visibility Enhancements:*** *Installing mirrors, cameras, and proximity sensors to improve visibility and reduce blind spots.*
- ***Access Control:*** *Implementing access control measures to prevent unauthorized personnel from operating Equipment/Machineries.*
- ***Safety Barriers:*** *Using safety barriers and warning signs to delineate work areas and protect workers from moving Equipment/Machineries.*
- ***Personal Protective Equipment (PPE):*** *Providing workers with appropriate PPE, such as high-visibility clothing, helmets, and hearing protection.*
- ***Noise and Vibration Control:*** *Implementing measures to control noise and vibration, such as using quieter Equipment/Machineries and providing hearing protection.*

11.6.4 Negative Impacts of Poor Equipment/Machineries Management

11.6.4.1 Health and Safety Impacts

- ***Increased Risk of Injuries:*** *Poor Equipment/Machineries management can lead to serious injuries, such as crush injuries, lacerations, and amputations.*
- ***Fatalities:*** *Accidents involving construction Equipment/Machineries can result in fatal incidents.*

11.6.4.2 Operational Impacts

- ***Work Disruptions:*** *Equipment/Machineries-related accidents and breakdowns can disrupt site operations, leading to project delays and increased costs.*
- ***Higher Maintenance Costs:*** *Poorly maintained Equipment/ Machineries can result in frequent breakdowns and costly repairs.*
- ***Decreased Efficiency:*** *Inefficient Equipment/Machineries operation can result in reduced productivity and longer project timelines.*

11.6.4.3 Legal and Financial Impacts

- ***Non-Compliance Penalties:*** *Failure to implement proper Equipment/Machineries safety measures can result in fines and penalties from health and safety authorities.*
- ***Reputation Damage:*** *Inadequate Equipment/Machineries management can harm the company's reputation, affecting relationships with clients, stakeholders, and potential employees.*
- ***Increased Insurance Costs:*** *Companies with poor safety records may face higher insurance premiums.*
- ***Legal Costs:*** *Legal expenses can accrue from defending against lawsuits or paying settlements related to Equipment/Machineries-related accidents.*
- ***Loss of Productivity:*** *Accidents resulting in employee injuries can lead to lost work time, reducing productivity and impacting the company's bottom line.*
- ***Direct Medical Costs:*** *Employers may be responsible for medical expenses and compensation for injured employees.*

11.6.5 Positive Impacts for Compliance with Equipment/Machineries Safety Standards

11.6.5.1 Health and Safety Impacts

- ***Reduced Risk of Injuries:*** *Proper Equipment/Machineries management protects workers from serious injuries and fatalities, ensuring their safety and well-being.*
- ***Improved Confidence:*** *Effective safety measures enhance worker confidence and reduce anxiety related to operating Equipment/Machineries.*

11.6.5.2 Operational Impacts

- ***Increased Efficiency:*** *A safe work environment with proper Equipment/Machineries management promotes efficient work processes and minimizes disruptions.*
- ***Improved Equipment/Machineries Lifespan:*** *Proper maintenance and operation practices can extend the lifespan of Equipment/ Machineries, reducing replacement costs.*

11.6.5.3 Legal and Financial Impacts

- ***Compliance with Regulations:*** *Adhering to Equipment/Machineries safety standards ensures compliance with health and safety regulations, avoiding legal issues.*
- ***Enhanced Reputation:*** *Demonstrating commitment to proper Equipment/Machineries management enhances the company's image and builds trust with clients, stakeholders, and the community.*
- ***Cost Savings:*** *Effective Equipment/Machineries management reduces the financial burden associated with accidents, injuries, and project delays. It also helps avoid penalties and fines related to non-compliance with regulations.*
- ***Increased Efficiency:*** *Reducing accidents leads to smoother operations and fewer disruptions, improving overall project efficiency.*
- ***Reduced Insurance Premiums:*** *A strong safety record can result in lower insurance premiums.*
- ***Minimized Legal Costs:*** *Avoiding accidents and injuries can significantly reduce expenses related to legal actions and settlements.*
- ***Improved Employee Morale and Retention:*** *A safe working environment can lead to higher employee satisfaction and retention.*

11.6.6 General Provisions for Construction Equipment/Machineries at Construction Worksites

These provisions are aimed at minimizing risks and enhancing the overall work environment. The following provisions are established to ensure the safety and efficiency of Equipment/Machineries use at construction worksites:

11.6.6.1 When OHS Provisions for Construction Equipment/Machineries are Applicable

- ***Development Phase:*** *Safety plans for Equipment/Machineries use should be developed and implemented at the start of a project based on specific site conditions and risks.*
- ***Onboarding Phase:*** *Training on Equipment/Machineries safety procedures should be provided during the onboarding of new workers and conducted annually.*
- ***Daily Inspections:*** *Inspections of Equipment/Machineries, especially critical components, should be conducted daily to ensure they are in good working condition.*
- ***Weekly Inspections:*** *General Equipment/Machineries inspections should be conducted weekly.*
- ***Monthly Inspections:*** *Inspections of emergency stop mechanisms and vibration controls should be conducted monthly.*
- ***Annual Training:*** *Refresher training sessions should be conducted annually to keep operators updated on safety procedures.*
- ***Emergency Drills:*** *Emergency drills should be conducted regularly to ensure prompt and efficient response to Equipment/Machineries incidents.*

11.6.6.2 Where OHS Provisions for Construction Equipment/Machineries are Applicable

- ***Construction Sites:*** *Safety measures such as guardrails, barriers, and warning signs should be implemented at construction sites, especially in areas with high Equipment/Machineries activity.*

- ***Training Facilities:*** *Training sessions should be conducted at the construction site or a designated training facility to ensure operators are familiar with the equipment they will be using.*
- ***On-Site Inspections:*** *Inspections and maintenance of Equipment/Machineries should be conducted on-site where the equipment is in use to ensure it is in good working condition.*
- ***Designated Storage Areas:*** *Equipment/Machineries and related safety equipment should be stored in designated areas at the construction site to ensure they are properly maintained and easily accessible.*
- ***Designated Zones:*** *"Equipment/Machineries Safety Procedures" signs should be posted prominently in all designated zones where Equipment/Machineries is used to remind workers of safety protocols.*
- ***High-Risk Areas:*** *Additional safety measures should be implemented in areas identified as high-risk for Equipment/Machineries accidents to prevent incidents and ensure worker safety.*

11.6.6.3 General Requirements:

- ***Equipment Visibility:*** *All equipment left unattended at night, adjacent to a highway in normal use, or adjacent to construction areas where work is in progress, should have appropriate lights or reflectors, or barricades equipped with appropriate lights or reflectors, to identify the location of the equipment.*
- ***Tire Safety Protection:*** *A safety tire rack, cage, or equivalent protection should be provided and used when inflating, mounting, or dismounting tires installed on split rims, or rims equipped with locking rings or similar devices.*

11.6.7 General Provisions by Equipment/Machineries Group

11.6.7.1 Group A: Lifting and Earthmoving Equipment (Excavators, Cranes, Bulldozers, Loaders, Graders):

- ***Certified Operator:*** *Operators must be trained, certified, and familiarized with safety protocols before operating any construction Equipment/Machineries.*
- ***Regular Inspection:*** *Equipment/Machineries should undergo regular inspections to ensure it is in good working condition before use.*
- ***Warning Arrangement at Worksites:*** *All work areas must be equipped with proper warning signs, barriers, and visibility enhancements.*
- ***Use of PPE:*** *Personal Protective Equipment (PPE), such as helmets and safety vests, must be provided to all operators and workers.*

11.6.7.2 Group B: Transport and Material Handling ***Forklifts, Dump Trucks, Concrete Mixers***

- ***Weight Capacity of Forklift:*** *Forklifts and dump trucks must not exceed their weight capacities (dump truck limits vary per manufacturer).*
- ***Inspection of Brake condition and Tire Functioning:*** *Brake functionality and tire conditions must be inspected* ***weekly.***
- ***Cleaning Mixture Machines:*** *Concrete mixers must be cleaned after use to prevent mechanical jams and accidents.*

11.6.7.3 Group C: Compacting and Access Equipment/Machineries: Pile Drivers, Compactors/Rollers, Scissor Lifts, Boom Lifts

- ***Noise Levels:*** *Noise levels from pile drivers must not exceed* ***the allowable limit*** *, and workers nearby must use hearing protection.*

- ***Minimizing Vibration Exposure:*** *Compactors and rollers must be operated on flat surfaces to minimize vibration exposure.*
- ***Height of Scissors Lift:*** *Scissor lifts must not exceed the allowable height unless properly stabilized.*
- ***Leak Inspection for Boom Lift:*** *Boom lifts must undergo hydraulic leak inspections before operation.*

11.6.7.4 Group D: Specialized Tools: Generators, Trenchers, Drills, Pavers

- ***Ventilation:*** *Generators must be placed in well-ventilated areas and inspected monthly for fuel leaks.*
- ***Dust Suppression in Drilling:*** *Drills must use dust suppression systems, and bits must be checked for wear* ***weekly.***

11.6.8 Other General Provisions

11.6.8.1 Safety Plans

- *Customized safety plans must be developed for all Equipment/Machineries types, considering site-specific risks.*
- *Plans must comply with relevant safety provisions (e.g.,* ***OSHA 29 CFR 1926.600*** *or equivalent national Provisions if available and applicable):*

11.6.8.2 Visibility and Identification

- *All equipment left unattended at night, near highways or active construction areas, must have appropriate lights, reflectors, or barricades equipped with lights or reflectors to identify its location.*

11.6.8.3 Suspended Equipment:

- *Heavy Equipment/Machineries or parts suspended by slings, hoists, or jacks must be securely blocked or cribbed to prevent falling or shifting before workers are allowed to work underneath or between them.*
- *Bulldozer blades, end-loader buckets, dump bodies, and similar equipment must be fully lowered or blocked when not in use or during repairs. Controls must be in a neutral position, motors stopped, and brakes set unless work requires otherwise.*

11.6.8.4 Parking Safety

- *When equipment is parked, the parking brake must be set. For inclines, wheels must be chocked in addition to setting the parking brake.*

11.6.8.5 Battery Handling

- *The use, care, and charging of batteries must conform to the following Provisions:*

  General Requirements:

  - *Batteries of the unsealed type must be located in enclosures with outside vents or in well-ventilated rooms to prevent the escape of fumes, gases, or electrolyte spray into other areas.*
  - *Adequate ventilation must be provided to ensure the diffusion of gases and prevent the accumulation of explosive mixtures.*
  - *Racks and trays for batteries must be substantial and treated to resist the electrolyte.*
  - *Floors in battery areas must be acid-resistant unless protected from acid accumulations.*
  - *Workers handling acids or batteries must be provided with face shields, aprons, and rubber gloves.*
  - *Facilities for quick drenching of the eyes and body must be available within 25 feet of battery handling areas.*

- *Facilities for flushing and neutralizing spilled electrolyte and fire protection must also be provided.*

Charging Requirements:

- *Battery charging installations must be located in designated areas.*
- *Charging apparatus must be protected from damage by trucks or other equipment.*
- *Vent caps must be kept in place during charging to avoid electrolyte spray, and they must be maintained in functioning condition.*

11.6.8.6 Cab Glass

- *All cab glass must be safety glass or an equivalent material that does not introduce visible distortion affecting the safe operation of Equipment/Machineries.*

11.6.8.7 Training and Awareness:

- *Comprehensive training for Equipment/Machineries operators on proper use, maintenance, and safety procedures should be provided.*
- *Regular drills and training sessions should be conducted to ensure operators are familiar with safety protocols.*
- *Ongoing education on identifying and mitigating Equipment/Machineries hazards should be provided. Training frequency: Annually.*

11.6.8.8 Inspection and Maintenance:

- *Equipment/Machineries should be regularly inspected and maintained to ensure it is in good working condition.*
- *Manufacturer guidelines for the care and replacement of Equipment/Machineries components should be followed.*
- *Inspection and maintenance activities should be documented. Inspection frequency:* ***Daily*** *for critical components,* ***Weekly*** *for general Equipment/Machineries.*

11.6.8.9 Distribution and Accessibility:

- *Access to safety equipment and resources for Equipment/Machineries use at all stages of the construction process should be provided.*
- *Safety equipment and resources should be readily available and accessible to all workers, subcontractors, and visitors.*
- *Specific storage areas for safety equipment should be designated to ensure it is properly maintained and easily accessible.*

11.6.8.10Signage and Compliance:

- ***"Equipment/Machineries Safety Procedures"*** *signs should be posted prominently in all designated zones where Equipment/Machineries is used.*
- *Compliance should be regularly monitored and enforced through supervisor checks and audits.*
- *Corrective actions for non-compliance should be implemented and additional training provided as needed.*

11.6.8.11 Ergonomics and Laborers Comfort:

- *Safety measures should be customized to suit specific site conditions and requirements.*

- *Resources and support for workers to adopt safety procedures comfortably and effectively should be provided.*
- *Ergonomic factors should be considered when selecting Equipment/Machineries and safety equipment to ensure worker comfort and compliance.*

11.6.9 Standards/Specifications for Construction Equipment/Machineries at Construction Worksite

These guidelines aim to minimize accidents and enhance overall safety. The following standards and specifications are illustrated to address potential risks and ensure the safe operation of Equipment/Machineries at construction worksites:

11.6.9.1 Group A: Lifting and Earthmoving Equipment

- ***Certified Operators:*** *Operations shall only be performed by certified operators who have undergone equipment-specific training.*
- ***Comprehensive Inspections:*** *Equipment/Machineries shall undergo comprehensive inspections for hydraulic systems, load limits, and structural stability before operations.*
- ***Safe Clearance:*** *A minimum clearance of* ***10 feet*** *shall be maintained from energized power lines up to* ***50 kV****, with additional clearance for higher voltages as specified.*

11.6.9.2 Group B: Transport and Material Handling

- ***Forklift Designated Areas:*** *Forklifts shall be operated only within designated areas with clearly marked boundaries to ensure worker safety.*
- ***Forklift Load Limits:*** *The load capacity of forklifts shall not exceed* ***2,000 kg*** *or the manufacturer's specified limit.*
- ***Dump Truck Operations:*** *Dump trucks shall not exceed their rated capacity, and tipping operations shall only be conducted on stable, leveled ground to prevent rollover incidents.*
- ***Parking Safety Measures:*** *All parking brakes shall be engaged when equipment is not in use, especially on inclined surfaces. Wheels shall be chocked as required.*
- ***Concrete Mixer Maintenance:*** *Concrete mixers shall be cleaned after each use, and moving parts shall be shielded to prevent entanglement accidents.*

11.6.9.3 Group C: Compacting and Access Equipment/Machineries

- ***Pile Driver Noise Control:*** *Noise levels from pile drivers shall be monitored and kept below* ***85 dB****; workers in proximity shall use hearing protection that complies with safety standards.*
- ***Safe Compactor Use:*** *Compactors and rollers shall only be operated on stable, even surfaces to prevent vibrations from exceeding* ***2.5 m/s²****, and exposure shall not exceed* ***8 hours per day****.*
- ***Scissor Lift Stability:*** *Scissor lifts shall be stabilized using outriggers or leveling devices. A maximum operational height of* ***10 meters*** *shall not be exceeded unless specific measures are taken.*
- ***Boom Lift Inspections:*** *Boom lifts shall be inspected daily for hydraulic leaks, and operators shall use safety harnesses that meet national compliance standards.*

11.6.9.4 Group D: Specialized Tools and Equipment

- ***Generator Placement:*** *Generators shall be placed in well-ventilated areas to avoid accumulation of exhaust fumes. Carbon monoxide (CO) levels shall not exceed* ***50 ppm****, and quarterly emission checks shall be conducted using calibrated gas analyzers.*
- ***Trencher Depth Limits:*** *Trencher operations shall maintain a depth limit of* ***2 meters*** *unless additional support systems are installed. Equipment must be inspected weekly for mechanical integrity.*
- ***Drill Dust Suppression:*** *Drills shall be equipped with dust suppression systems to minimize airborne particulates, and drill bits shall be replaced as soon as signs of wear are detected. Inspections shall be conducted weekly.*
- ***Paver Operating Conditions:*** *Pavers shall operate on stable surfaces, and asphalt temperatures during application shall be maintained at* ***150°C*** *using calibrated thermometers.*

11.6.9.5 Heavy Equipment/Machineries

- *Heavy Equipment/Machineries, equipment, or parts thereof, which are suspended or held aloft by use of slings, hoists, or jacks should be substantially blocked or cribbed to prevent falling or shifting before employees are permitted to work under or between them.*
- *Bulldozer and scraper blades, end-loader buckets, dump bodies, and similar equipment should be either fully lowered or blocked when being repaired or when not in use.*
- *All controls should be in a neutral position, with the motors stopped and brakes set, unless work being performed requires otherwise.*

11.6.9.6 Power Lines

- *All equipment covered by this subpart should comply with the following requirements when working or being moved in the vicinity of power lines or energized transmitters, except where electrical distribution and transmission lines have been deenergized and visibly grounded at the point of work or where insulating barriers, not a part of or an attachment to the equipment or Equipment/Machineries, have been erected to prevent physical contact with the lines:*
  - *For lines rated 50 kV or below, minimum clearance between the lines and any part of the crane or load should be* ***10 feet****.*
  - *For lines rated over 50 kV, minimum clearance between the lines and any part of the crane or load should be* ***10 feet*** *plus* ***0.4 inch*** *for each* ***1 kV*** *over* ***50 kV****, or twice the length of the line insulator, but never less than* ***10 feet****.*
  - *In transit with no load and boom lowered, the equipment clearance should be a minimum of* ***4 feet*** *for voltages less than* ***50 kV****, and* ***10 feet*** *for voltages over* ***50 kV****, up to and including* ***345 kV****, and* ***16 feet*** *for voltages up to and including* ***750 kV****.*

11.6.9.7 Risk of Injuries from Equipment/Machineries Malfunctions and Improper Use

- *Proper usage guidelines and protocols for all Equipment/Machineries should be implemented.*
- *Equipment/Machineries should be regularly inspected to ensure it is in good working condition.*
- *Risk assessments for all Equipment/Machineries operations should be conducted.* ***Assessment frequency: Monthly****.*

11.6.9.8 Lack of Operator Training

- *Comprehensive training for Equipment/Machineries operators on proper use, maintenance, and safety procedures should be provided.*
- *Training should include both theoretical and practical components.*
- *Refresher training sessions should be conducted. Training frequency: Annually.*

11.6.9.9 Exposure to Hazardous Conditions:

- *Protective measures such as guards, barriers, and safety switches should be used to safeguard workers from moving parts and electrical hazards.*
- *Protective measures should be compliant with OSHA 29 CFR 1926.600 standards or equivalent national provisions/standards if available and applicable.*
- *Regular inspections of protective measures should be conducted.* ***Inspection frequency: Daily.***

11.6.9.10 Delays in Construction Activities:

- *Efficient processes to minimize disruptions to project timelines should be implemented.*
- *Equipment/Machineries inspections and maintenance should be scheduled during off-peak hours.*
- *Designated storage areas for Equipment/Machineries and equipment should be used to ensure they are properly maintained and easily accessible.*

11.6.9.11 Damage to Equipment and Materials:

- *Materials and equipment should be properly secured to prevent damage.*
- *Securing methods such as tie-downs, straps, and braces that are rated for the load they are securing should be used.*
- *Regular inspections should be conducted to ensure materials and equipment are properly secured.* ***Inspection frequency: Weekly.***

11.6.9.12 Maintenance Programs:

- *Regular maintenance programs should be implemented to ensure Equipment/Machineries is in good working condition.*
- *Manufacturer guidelines for maintenance schedules and procedures should be followed.*
- *Regular inspections and maintenance should be conducted.* ***Inspection frequency: Daily for critical components, Weekly for general Equipment/Machineries.***

11.6.9.13 Work Area Management:

- *Work areas should be free of hazards related to Equipment/Machineries use.*
- *Warning signs and barriers should be used to alert workers to areas with potential Equipment/Machineries hazards.*
- *Work areas should be kept clean and organized to prevent accidents. Inspection* ***frequency: Daily.***

11.6.9.14 Regulatory Compliance

- *Compliance with Equipment/Machineries safety standards, including OSHA 29 CFR 1926.600 or equivalent national provisions/standards if available and applicable, should be ensured.*

- *Records of Equipment/Machineries inspections, training activities, and incident reports should be kept.*
- *Regular audits should be conducted to ensure compliance with safety standards. Audit* ***frequency: Annually.***

11.6.9.15 Operator Training

- *Comprehensive training for Equipment/Machineries operators on proper use, maintenance, and safety procedures should be provided.*
- *Training should include both theoretical and practical components.*
- *Refresher training sessions should be conducted.* ***Training frequency: Annually.***

11.6.9.16 Protective Measures

- *Protective measures such as guards, barriers, and safety switches should be used to safeguard workers from moving parts and electrical hazards.*
- *Protective measures should be compliant with OSHA 29 CFR 1926.600 standards or equivalent national provisions/standards if available and applicable.*
- *Regular inspections of protective measures should be conducted.* ***Inspection frequency: Daily.***

11.6.9.17 Temperature Monitoring

- *Equipment/Machineries operating temperature should be maintained within the range of* ***15°C to 35°C*** *to prevent overheating and ensure optimal performance.*
- *Temperature readings should be taken using infrared thermometers.* ***Measurement frequency: Daily.***

11.6.9.18 Load Capacity

- *The maximum load capacity of Equipment/Machineries should be clearly marked and adhered to, ensuring it does not exceed* ***80%*** *of the manufacturer's rated capacity.*
- *Load measurements should be verified using calibrated load cells.* ***Measurement frequency: Daily.***

11.6.9.19 Environmental Safety Standards

- ***Noise Control***
  - Equipment/Machineries noise shall be monitored and kept below **85 dB** at all times.
  - Sound level meters shall be used weekly to measure and document noise levels.
  - Noise-dampening techniques, such as installing silencers and using noise barriers, shall be employed for high-noise equipment.
- ***Vibration Standards:***
  - *Vibration exposure for operators shall not exceed* ***2.5 m/s^2*** *in an* ***8-hour workday.***
  - *Equipment shall be designed or retrofitted with vibration-dampening systems.*
  - *Monthly vibration measurements using calibrated vibration meters shall be conducted.*
- ***Emission Compliance:***

- *Equipment/Machineries emissions shall meet environmental standards, ensuring carbon monoxide (CO) levels do not exceed **50 ppm**.*
- *Quarterly emission tests using gas analyzers shall be performed to confirm compliance.*
- *Equipment/Machineries with excessive emissions shall be repaired or replaced.*

▪ ***Dust Suppression:***

- *Dust-producing equipment shall be equipped with suppression systems such as water sprays or vacuum systems.*
- *Regular maintenance of dust suppression equipment shall be conducted to ensure effectiveness.*

11.6.9.20 Emergency Preparedness

▪ ***Emergency Stop Mechanisms***

- *All construction Equipment/Machineries shall be equipped with functional emergency stop systems capable of halting operations within **2 seconds**.*
- *Emergency stop systems shall be tested monthly to ensure reliability.*

▪ ***Lighting for Emergency Areas***

- *Emergency lighting systems providing illumination of at least **500 lux** shall be installed in work areas prone to power failures.*
- *Weekly checks shall be conducted to confirm the functionality of emergency lighting.*

▪ ***Evacuation Routes***

- *Clearly marked evacuation routes shall be established around Equipment/Machineries zones.*
- *Drills simulating Equipment/Machineries-related emergencies shall be performed semi-annually.*

11.6.10 Lifting Appliances and Gears (especially cranes and other Gears)

11.6.10.1 General Provisions

▪ *Lifting appliances and items of lifting gear including integral elements, attachments, anchorages and supports shall comply with the following provisions:*

- ✓ Be of good and standard construction
- ✓ Be suitable in the perspective of intended use;
- ✓ Be constructed with sound material;
- ✓ Be constructed with adequately strong materials;

▪ *Lifting appliances and items of lifting gear shall be:*

- ✓ Properly installed and used;
- ✓ Maintained in good working order so as to ensure instant use on emergency;
- ✓ Examined and tested by a competent technician/ mechanic/engineer at reasonable time of intervals as suggested by the competent authority/engineer of LGED;
- ✓ Operated by appropriately trained laborers/ employees.

▪ *The results of examinations of lifting appliances and items of lifting gear shall be recorded;*

- *Raising, lowering or carrying of laborers/ employees/ persons by a lifting appliance shall be permitted unless it is constructed/ installed and used for this purpose;*
- *This embargo shall not be applicable an emergency situation in where there is potentiality of serious personal injury or fatality for which the lifting appliance can be used safely.*

11.6.10.2Standards/Specifications

a) Lifting Appliances

- Every lifting appliance including working gear and all other plant/equipment used for anchoring or fixing shall:
  - ✓ *Be of good mechanical construction, of sound material and adequate strength for the load it will carry;*
  - ✓ *Be properly maintained and inspected at least once a week and the result of such inspection shall be recorded in a log book maintained by the contractor or the employee/person deployed by the contractor.*
- Anchoring or fixing arrangement provided in connection with a lifting appliance shall be adequate and safe to withstand the design-imposed load.

b) Controlling Brakes and Safety Devices

- Cranes/crabs/winches shall be provided with a brake adequately functional to prevent the fall of the load and to control the operation lowering/raising of load;
- Handles/levers etc. provided for controlling the operation of a lifting appliance shall be:
  - ✓ *Provided with suitable locking arrangement to prevent accidental movement;*
  - ✓ *Clearly marked to indicate the purpose and mode of operation.*

c) Safety/Protection of Crane Driver

- Platform used for crane drivers and signalers shall:
  - ✓ *Cover sufficient command area;*
  - ✓ *Be closely planked and plated;*
  - ✓ *Be provided with safe means of entrance and exit.*
- Sides of a platform higher than 2.16 meters (6.5 ft.) shall be provided with guard rails and toe-boards.
- The driver of every power-driven lifting appliance shall be provided with a cabin which shall:
  - ✓ *Be capable of protecting the user from the effect weather and potential risks of falling objects; and*
  - ✓ *Contain facilities to ensure ready access to operating parts of the lifting appliance within the cabin;*
  - ✓ *Be periodically inspected and maintained.*

d) Anchorage and Load Test of Cranes

- If lifting appliances are used on soft/uneven ground/on a slope then adequate measures shall be taken to ensure their stability i.e. unwanted movement/displacement;
- Cranes shall not be allowed to use for the purpose of raising or lowering loads/laborers if:
  - ✓ *Not anchored strongly;*

- ✓ *Not balanced adequately by weight, appropriately placed and protected;*

- After erection of a crane for any kind of alteration or change it shall be tested by the contractor/supervising engineer of LGED with their own responsibility either:
  - ✓ *By a load of twenty-five per cent (25%) higher than the maximum design lifting capacity of the crane at the original erected position on each anchorage; OR*
  - ✓ *By lesser load arranged to provide an equivalent test of the anchorages or balancing arrangements.*
- Result of the test shall be recorded in a log book and maintained/preserved by the contractor.
- The maximum allowable load shall be attached in a place readily noticeable and readable by the crane operator.
- Use or erection of crane shall be allowed under conditions with potentiality to threaten stability.

e) Operation and Signaling of Crane

- Lifting appliances shall only be allowed to operate by a trained, competent, physically fit, and authorized person/employee.
- If the operator doesn't clearly view and read the load for safe working unrestrictedly, operation shall not be allowed.
- In such cases, one or more signal men as per requirement shall be deployed to give necessary signals to the operator.
- Every signal transmitted/provided by the signalman (men) for the movement or stopping of a lifting appliance shall be distinctive in character.
- The signals shall be clearly and easily viewable and/or hearable to the operator.

f) Carriage of laborers/employers/persons by Lifting Appliances

- Laborers/employers/persons shall be allowed to raise, lower or carry by a power-driven lifting appliance only:
  - ✓ *On the platform of driver in case of a crane; or*
  - ✓ *On an approved suspended scaffold; or*
- The use of crane or suspended scaffold shall not be reasonable for the following reasons:
  - ✓ *The appliance is operable from one position only;*
  - ✓ *No person/laborer/employee is possible to carry without:*
    - ✓ Chair or cage; or
    - ✓ Safe skip or at least 1 m. (3 ft.) deep holder;
    - ✓ Ensuring arrangements to prevent from dangerous spinning or tilting of the chair, cage, skip or receptacle.

g) Lifting Gears/Chains/Ropes etc.

- Chains/ropes/lifting gears shall be allowed to use if it is of:
  - ✓ *Good and standard construction;*
  - ✓ *Sound material with adequate strength;*
  - ✓ *Suitable quality;*
  - ✓ *Free from substantial defects.*
- Shall be examined and tested by a competent technician/ mechanic/engineer specifying the safe working load.

- If in any 10 meters length the total number of visible broken wires exceed five percent of the total number of wires in the rope, it shall not be allowed to use for lifting and lowering any load.
- Chain/rope of lifting gear shall not be loaded beyond its safe working load except for testing purpose.
- Altered or repaired (by welding or other means) chain, ring hook, link, clamp, shackle, swivel or eyebolt etc. shall not be allowed to use unless:
  - ✓ *It is tested and examined; and*
  - ✓ *It is capable to withstand the working load as specified in the test.*
- Hooks for lowering of load shall have standard devices to prevent displacement of load.
- Double or multiple slings shall not be allowed to use if:
  - ✓ *The upper ends are not connected by shackle, ring or link of adequate strength;*
  - ✓ *The safe working load is exceeded.*
- Chains with knots/shortened by bolts and knots inserted through the links or by welding shall not be allowed to use.
- Chain, rope or lifting gear shall not be allowed to use until and unless:
  - ✓ *It is thoroughly examined by a competent mechanic/ technician/engineer at minimum 6 (Six) months interval; and*
  - ✓ *The result of examination recorded in a log book; and*
  - ✓ *Preserved/maintained open for the purpose of inspection by the competent/ implementing authority/ Officials/ engineers of LGED.*

11.7 Hand Tools in Construction Worksites

Occupational Health and Safety (OHS) provisions for hand tools at construction worksites focus on ensuring the safe use, proper maintenance, and secure storage of tools essential for various tasks. By adhering to general provisions, such as worker training, regular inspections, and the use of Personal Protective Equipment (PPE), and following specific standards and specifications for tool quality, handling, and storage, these measures safeguard workers from injuries, enhance efficiency, and ensure compliance. These comprehensive provisions and standards contribute to the well-being of laborers and the overall success of construction projects.

11.7.1 Examples of Hand Tools Used at Construction Worksites

The following table (Table-11.3) illustrates the examples of Hand tools generally used at Construction worksites:

Table 11-3: Examples of Hand Tools Used at Construction Worksites

Serial	Tool Name (English)	Category	Construction Work Usage
1	Tape Measure	Measurement & Layout	Site layout, distance determination
2	Spirit/Laser Level	Leveling	Checking levelness, finishing work
3	Framing Square	Framing	Determining structural angles, framing
4	Chalk Line	Marking	Marking straight lines

Serial	Tool Name (English)	Category	Construction Work Usage
5	Hand Saw	Cutting	Cutting wood/plastic
6	Utility Knife	Cutting	Cutting boards, plastic, insulation
7	Bolt Cutter	Cutting	Cutting rods, wires, bolts
8	Wire Cutter	Cutting	Cutting electrical wires
9	Crowbar/Prybar	Demolition & Opening	Removing old structures
10	Wrecking Bar	Demolition	Breaking/demolition, opening tasks
11	Claw Hammer	Attachment & Removal	Driving and removing nails
12	Sledgehammer	Attachment & Demolition	Heavy breaking tasks
13	Screwdriver	Attachment	Fixing and removing screws
14	Adjustable Wrench	Fastening	Loosening and tightening nuts/bolts
15	Needle-nose Plier	Electrical Connection	Holding small parts, electrical connections
16	Chisel	Shaping	Carving wood or stone
17	File	Smoothing	Smoothing edges of metal/wood
18	Trowel	Plastering	Applying mortar, plastering
19	Shovel	Excavation & Earthwork	Digging and moving soil
20	Spade	Excavation	Digging holes, cutting soil
21	Pickaxe	Breaking	Breaking hard soil
22	Hand Drill	Miscellaneous	Making small holes
23	Wheelbarrow	Transport	Carrying construction materials
24	Brick Hammer	Breaking	Breaking bricks, finishing
25	Mason's Tools	Masonry	Plastering, brickwork, etc.

11.7.2 Examples of Hazards Related to Hand Tools at construction Worksite

- ***Misuse of Tools***
  - *Example: Using a screwdriver as a chisel can cause the tip to break and lead to injuries.*
- ***Improper Maintenance***
  - *Example: A hammer with a loose head can detach during use.*
- ***Defective or Poor-Quality Tools***
  - *Example: A poorly constructed wrench may slip and cause hand injuries.*
- ***Lack of Personal Protective Equipment (PPE)***
  - *Example: Failing to wear safety goggles may result in eye injuries from flying particles.*
- ***Flying Particles***
  - *Example: Striking or cutting materials produces debris that can injure workers.*
- ***Electrical Hazards***
  - *Example: Using metal tools near live electrical circuits can cause shocks.*

- ***Forced Postures***
  - *Example: Prolonged use of a screwdriver with a bent wrist can cause strain injuries.*

11.7.3 Examples of OHS Measures for Hand Tool Hazards

- ***Misuse of Tools***
  - ***Training** workers on the proper use of each tool to avoid misuse.*
  - ***Providing** instructions and supervision to ensure tools are used for their intended purpose.*
- ***Improper Maintenance***
  - ***Inspecting** tools regularly to identify and address any loose or defective components.*
  - ***Replacing** or repairing damaged tools immediately to maintain safety.*
- ***Defective or Poor-Quality Tools***
  - ***Using** tools only from reputable manufacturers with proven quality standards.*
  - ***Inspecting** tools before use to ensure they meet required safety and performance criteria.*
- ***Lack of Personal Protective Equipment (PPE)***
  - ***Providing** appropriate PPE, such as gloves, goggles, and face shields.*
  - ***Ensuring** that all workers wear PPE during tool use through consistent monitoring.*
- ***Flying Particles***
  - ***Using** tools equipped with guards or shields to contain debris.*
  - ***Ensuring** workers wear safety goggles or face shields to protect against airborne particles.*
- ***Electrical Hazards***
  - ***Using** insulated tools when working near live electrical circuits.*
  - ***De-energizing** circuits before commencing work and following electrical safety protocols.*
- ***Forced Postures***
  - ***Providing** ergonomically designed tools to minimize strain during prolonged use.*
  - ***Training** workers on proper posture and tool handling techniques.*

11.7.4 Negative Impacts of Non-Compliance with OHS Provisions and Standards/ Specifications for Hand Tools

11.7.4.1 Laborers Health

- *Increased risk of injuries and fatalities due to unsafe working conditions.*
- *Long-term health issues caused by exposure to hazardous materials (e.g., asbestos, dust, chemicals).*
- *Immediate health risks from the lack of Personal Protective Equipment (PPE), such as cuts, falls, or eye injuries.*

11.7.4.2 *Operational*

- *Frequent disruptions in operations caused by accidents or equipment failure.*
- *Delayed project timelines due to incident investigations and worker absenteeism.*
- *Reduced efficiency stemming from unsafe environments lowering worker morale.*

11.7.4.3 *Legal and Financial*

- *Heavy fines, lawsuits, or suspension of operations for OHS violations.*
- *Financial losses from medical expenses, compensation claims, and equipment damage.*
- *Damaged reputation, leading to loss of trust among employees, clients, and stakeholders.*

11.7.4.4 *Environmental*

- *Unsafe practices causing environmental hazards like chemical spills or improper waste disposal.*
- *Increased cleanup costs and fines for environmental violations.*
- *Damage to ecosystems affecting project viability and community relations.*

11.7.5 Positive Impacts of Compliance with OHS Provisions and Standards/ Specifications for Hand Tools

11.7.5.1 *Laborers Health*

- *Reduced injuries and fatalities due to safe working conditions and preventive measures.*
- *Prevention of long-term occupational diseases from exposure to hazardous substances.*
- *Access to PPE and safety protocols ensuring immediate physical safety for workers.*

11.7.5.2 *Operational*

- *Streamlined operations with minimal disruptions due to a safe and well-organized worksite.*
- *Increased productivity as motivated workers perform better in secure environments.*
- *Timely completion of projects owing to fewer accidents and smoother workflows.*

11.7.5.3 *Legal and Financial*

- *Legal protection from fines or lawsuits through adherence to regulations.*
- *Significant cost savings by avoiding medical expenses, equipment damage, and operational downtime.*
- *Enhanced reputation, attracting clients and retaining skilled workers, boosting profitability.*