Chapter 9

Summary and C nclusi ns

The construction industry, as a whole, is heterogeneous and hugely complex There are several diverse classification of construction that differ markedly from one another Execution of construction work at various stages, including planning, coordination, monitoring, controlling as well as final delivery, could result in multiple hazardous situations due to several interwoven factors as well as simultaneous activities on ground Globally construction industry is among the most hazardous industries, in terms of occupational injuries and illnesses Several studies have shown that for a lifetime of employment in construction sector, each workman would get exposed to various safety and health risks leading to serious harm To prevent these adverse consequences of construction hazards and to protect the workers as well as their families and society at large, in depth research efforts are required for finding the best suitable and sustainable solutions, which can be chosen for implementation

This study aims to take forward the preventive efforts through a combination of contemporary approaches During the course of this work, several high risk activities came under review, based on various past studies, large database of incidents, work site assessment as well as audit reports Integrated with risk assessment, risk rating and hierarchy of controls, mitigation measures aimed to be evolved, technically evaluated and adopted for implementation

During the process, engineering control measures emerged as the most effective solution on multiple counts Taking this way forward, six mitigation measures were focused and further research was undertaken to validate their merits and suitability for purpose, in the context of Indian construction sector

To prevent occurrence of serious accidents in circular saw operations in civil engineering construction projects, need of finding an effective and sustainable solution emerged as a priority Various engineering control measures were reviewed and effective guarding arrangements were evaluated Important step towards evaluation of risk in various types of circular saw machine was done through hazard identification and risk assessment (HIRA) From the study it is

confirmed that Type I Circular saw without any guard will be having high potential for cut injuries Type II – fixed type saw guard made of steel plate hinders cutting operation and if the guard is removed for convenience , then it has high injury potential The visibility is slightly improved in the case of Type III – Suspended saw guard made of steel plate But the suspended arrangements hinders cutting process Visibility got further improved in Type IV saw guard with integrated sensor in which the infrared sensors stop the motor if any disturbance occurs However this could not be adopted due to nuisance tripping Subsequently Type V circular saw guard made of acrylic material was tried and found good for various attributes including high visibility of the blade and cutting process It also protects the user from the impact of saw dust / wooden chips However, on prolonged usage the visibility of the acrylic guard could get reduced due to scratches caused by flying saw dust Finally this became a sustainable solution and taken forward for implementation, as the best option

For prevention of working at height related incidents, which is a major cause of high potential incidents at construction sites, various measures are taken to ensure overall safety at site This requires safe access by portable ladders at prevention of fall related to working at height at construction sites Rigidity of the ladder when in use, recommended angle in which it is required to be placed are of primary importance This study analyzed impact of coefficient of friction, angle of inclination and forces on ladder It was observed that safe angle of ladder with reference to the ground level is 75° irrespective of the body weight The values of coefficient of friction increased as the ladder was decreased from the safe angle of 75° Coefficient of friction increased to 44% when the angle of ladder was reduced to 65° and it further increased to 55% when the angle of ladder was further reduced to 60° This included development of adaptable, flexible and user-friendly option for easy and safe anchoring of ladders at various locations, keeping pace with dynamic requirements of the job

Study on the various methods of gas cylinder handling at construction brought out several associate risks Observation includes dropping of gas cylinders manually from transport vehicles or adopting other unsafe measures for

unloading It is established that a ramp of 30° angle for unloading gas cylinders works well Eventually, a mobile ramp made of steel with tarpaulin sheet on its surface aided with tyre damping will be well suited for unloading cylinders at various work locations in project site On the other hand for unloading gas cylinders at project stores, which remains in a particular place, fixed concrete ramp with tyre damping found to be the best suited option

Exposure to welding fumes causes numerous health problems Illness patterns of large number of welders deployed at various project sites were studied in this context Based on the findings, suitable engineering intervention possibilities were explored A simple, easy-to-fix, forced ventilation equipment was conceptualized and developed to handle welding fumes The fabricated model established that welding fumes are effectively taken away from the breathing zone of the welder Concentrations of relevant common hazardous fumes/gases are recorded before and after the intervention Implementation of the above-mentioned engineering control measures is found to be effective in reducing the concentration of harmful substance at the breathing zone of workers exposed during manual metal arc welding process at construction sites

Potential harm due to fall of materials / hit by objects is a common hazard in construction Safety helmets are therefore very important to have an adequate head protection for all workers Three case studies were also given to realize the importance of wearing a safety helmet in the construction area Study depicted the design limitations of the existing standard helmet for head load caring purpose, including comparison of relevant parameters of the safety helmet for various standards (BIS, BS and AUS/NZ) A risk perception survey revealed that various risks and its categorization as high and low On the basis of the detailed analysis inclusion of load carrying option was validated subject to meeting of certain functional and design parameters

For the workmen deployed near overhead electrical power lines hazard of accidental contact and subsequent harm poses threat to their safety To find out suitable preventive measures, risk assessment of the activities were conducted and action required to contain the risk to an acceptable level Taking this forward