Safety in Precast Erection

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Abstract: Construction industry is known to be one of the most hazardous among different industries all over the world. The potential chances for accidents and near miss cases are very high during precast erection. It is therefore important to conduct risk assessment to plan and implement control measures during erection stage. The primary causes of incidents in precast erection are due to lifting operations and working at height. Author will cover the risk management, lifting related hazards and working at height that can lead to accidents and share Singapore good practices.

The precast erection involves lifting operations and working at height in construction industry. This needs careful safety planning and ensure risks are eliminated or minimized to most extent. The Singapore accidents statistics shows (Figure 1) an increase in the rate of accidents in 2006 in general and pre-cast sector (Figure 2) in particular.

Risk Management

In Singapore, the contractors/employers are required to eliminate or reduce workplace risks under the Workplace Safety & Health (WSH) Regulations. The first thing they have to do is assess the workplace risks and then take steps to remove or reduce them in order to protect workers safety and health. Formal procedures are available to indentify and assess the hazards that can lead to accidents and to implement control measures to eliminate or minimize risks.

Risk Assessment/ Management should cover all work activities related to precast and in particular precast erection at site. These include storage, handling, transportation and erection.

Carrying out Risk Assessment

A multidisciplinary Risk Assessment team should be formed to carryout risk assessment of the risks in precast production and erection together with contractors, sub-contractors and associated worker representatives.

Step 1: Identifying hazards

Employers/contractors plan to identify dangers and risks and deal with them. Methods of identifying hazards include;
- Consultation with workers
- Consulting with industry associations and governments
- Consulting specialist practitioners
- Past incident records

Step 2: Assess the level of risks involved

Find out how severe the risks are and determine the likelihood of it happening, given the existing control measures in place. Risk is defined as combination of two factors
- Likelihood of hazard and
- Severity of hazard

A simplest way of evaluating the risk in certain hazardous task is to quantify its likelihood and the severity of its consequences (Table 1). Each of the two factors may be given the values of 1 to 3 in 3 Point Scale.

Likelihood of occurrence of an accident, incident or ill health is also classified into 3 categories, Remote(1), Occasional (2) and frequent (3)

Severity is the degree or extent of injury or harm caused by accidents/incidents arising from workplace hazards. Severity is classified in to 3 categories, Minor(1), Moderate(2), major (3).

The risk is calculated as the product of likelihood and severity value. This product range from 1 (Low) to 9 (high)

Generally, low is acceptable, medium risk required to take
additional control measures and high risk is intolerable, where work can’t start until appropriate control measures in place.

**Step 3 Risk Control Measures**

The control of hazards and reduction of risks can be accomplished by following hierarchy of control measures as shown in Figure 3. These control measures are not usually mutually exclusive. e.g Engineering controls can be implemented together with administrative controls like training and safe work procedures (SWP’s).

### Common Lapses involving Lifting Activities

Accident involving lifting activities occur due to many reasons. However, investigations into such accidents often reveal that the primary causes could be attributed to poor planning, supervision and coordination of lifting operations. The common lapses involving Lifting activities are:

- Absence or lack of RA (Risk Assessment) prior to lifting operation
- Absence of lifting plan
- Absence of PTW (Permit to Work) system implementation
- Failure to adopt proper rigging methods
- Poor maintenance of lifting equipments
- Poor site control

### Common hazards Associated with Unsecured/ Slippage of loads

Many accidents occurred due to unsecured loads that slipped off during lifting. The following are some common hazards associated with lifting loads:

- Defective or damaged lifting gears such as slings, hooks, insers, eye, shackles
- Improper rigging of loads
- Under capacity of lifting gears

### Common hazards Associated with Lifting Operations Involving Cranes

Accidents involving cranes are one of the more common types of crane-related incidents. Many accidents occurred due to either structural failure of the load bearing part of crane or toppling or collapsing of cranes when they became unstable.

The following are some common hazards associated with lifting operations involving cranes.

- Structural Failure - Such as boom, jib, wire rope due to crane being loaded beyond capacity
- Contactor collision due to insufficient safe clearance space between mobile crane and other buildings or structures
- Falling objects as result of improper securing of loads during lifting operations or during precast erection activities

The typical lifting incident scenarios are shown in Figure 5.

### Precast Erection

In precast erection lifting activities and multiple handling of precast elements are very critical, therefore care planning is crucial. Considerations shall be given to:

- Planning of Lifting Operations
- Erection Preparation
- Rigging
- Planning Cranes
The purpose of lifting Plan is to facilitate common understanding amongst the lifting team for safe lifting operations. A typical lifting plan incorporated with Permit-to Work System is recommended. It addresses some key factors affecting safe lifting operations such as:

- Details of the load
- Details of lifting equipment/lifting gears
- Means of communication
- Personnel’s involved in lifting operations
- Sequence/special precautions
- Sketch/Zone of operations

Working at Height

Generally the precast installation of stairs, columns, beams etc will require operatives to work at height. This work will require careful planning with control measures to reduce risk of working at height.

Work Environments that pose a Fall from Height Risk

- Unprotected edges
- Uncovered openings
- Building materials, large tools or equipment that need to be manually carried
- Overloading of working platforms, which may lead to collapse
- Struck by moving object or equipment, for example load from lifting operation
- Not use of personnel protective equipment

Access and egress safety

Safe means of access to the working area also requires careful planning particularly where work progress during installation. In providing safe and proper access to and egress from a work area by taking in to account the tools and equipments that people will be required to carry.

The risk of falls due to tripping and slipping can be reduced by proper planning for material storage and good housekeeping. Such good practices not only result in a cleaner and safer workplace, it can also improve productivity.

Edge Protection, Perimeter Guard-Railing

Edge protection (often referred to as a “guard rail”) is used to reduce the risk of a person falling from open sides and through openings. Wherever, a person is at risk of falling from open sides. The protection must also be able to withstand the impact of a person falling against it. Typical proper and improper end protections are shown in Figure 5.

The edge protection must also be provided at any other edge at the workplace where a person could fall. Such protection must adhere to dimensions and other requirements.

The guard rail system must be of good construction and in good condition and be able to withstand the weight of person.

Guarding of Openings

Openings on floors present significant hazards. A person may fall through an opening, which may result in serious injury or death. If the opening that is stepped upon is small, cuts and bruises may result on the legs or feet. When opening is protected by a cover, a suitable signage should be placed nearby or onto the cover itself to warn people of hazard.

Fall Arrest System

A personnel fall arrest system is a collection of components that work in conjunction to:

- Safely stop a person from falling an uncontrolled distance
and reduce impact of fall
- In general, a complete personal fall arrest system consists of three vital components
  - Anchorage
  - Body support
  - Connectors

It is critical to note individually, these components will not provide protection from a fall. It is only when they are used correctly and in conjunction with each other that they will be able to arrest or sustain a fall. This can be used where workers are required to carry out their work near unprotected edge such as rigging and erection.

Fall Prevention Plan

A site specific fall prevention plan shall be established and implemented for the purpose of reducing or eliminating risks of fall.

A fall prevention plan shall address, fall from height hazards comprehensively shall be communicated among the parties involved for better understanding hazards.

Conclusion

Precast Erection can be a very risky operation, unless its hazards are clearly identified and control measures implemented. Singapore’s consistent efforts are steadily improving its hazards control. With clear understating of better implementation of Risk Management, Lifting Plan and fall prevention plan at work place will relatively improve safety performance in precast erection in construction industry.

References

3. Approved Code of practice for The Safe Handling, Transportation and erection of Precast Concrete, Department of Labor, Wellington, New Zealand, May 2002
4. Thomas Teo, Asst Manager, Planning 7 Development, DHS Division, Dialogue Session on Programme based Engagement for Precast Sector, Overview of accidents Statistics and Trends involving Precast industry, Ministry of Manpower, Singapore Feb 2007
6. The Safe Installation of Precast Concrete flooring and associated components, Precast Flooring Federation, 2013

Figure 6 Cover Openings (Source: Singapore Ministry of Manpower, Singapore)

The government today officially launched an online portal for job seekers in the micro, small and medium enterprises (MSME) sector. The portal – www.eex.dcmsme.gov.in – will also help the industry to find skilled manpower. "In line with the Prime Minister’s vision of Digital India, Skill India and Make in India, our ministry has developed this employment exchange portal for industries where job seekers can find employers or vice-versa,” Micro, Small and Medium Enterprises (MSME) Minister Kalraj Mishra said here while inaugurating the portal. Addressing the gathering, Special Secretary in the MSME Ministry, Amaresh Sinha said that gradually more features would be added to the portal to make it more friendly to industry and entrepreneurs. "It is a game changer. It took over an year to prepare this portal. Currently this is only for manufacturing sector. Job seekers will not have to pay any fees,” Sinha said, adding that the industry would have to pay fees to use this portal. He further said that the ministry is also thinking to provide this facility for services sector as well.

The MSME sector provides employment to a large section of population and contributes about 45 per cent in the country’s total exports and about 40 per cent in the manufacturing sector.