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Hazard Analysis of Precast Element Process

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ABSTRACT-Precast concrete is initially casted and later moved into its final position. A precast concrete element means any products made of precast concrete including a beam, column, floor slab, wall panel or cladding panel. These guidelines are for persons conducting a precast process like designers, manufacturers, installers and importers, as well as workers and any other people who handle, transport or erect precast concrete elements. So we must do the job hazard analysis and potential risk of particular activities. Then give the protective measures to be taken in work environments.

I. INTRODUCTION

Precasting is a technique of introducing stresses into a structural member during fabrication and construction to improve its strength and performance. There is greater control over material quality and workmanship in a precast plant compared to a construction site. So we must do the job hazard analysis and potential risk of particular activities. Then give the protective measures to be taken in work environments. More recently expanded polystyrene is being used as the cores to precast wall panels. This is lightweight and has better thermal insulation by producing precast concrete in a controlled environment the precast concrete is afforded the opportunity to properly cure and be closely monitored by plant employees. Using a precast concrete system offers many potential advantages over onsite casting. Precast concrete production can be performed on ground level, which helps with safety throughout a project. There is greater control over material quality and workmanship in a precast plant compared to a construction site. The forms used in a precast plant can be reused hundreds to thousands of times before they have to be replaced, often making it cheaper than onsite casting when looking at the cost per unit of formwork. There are many different types of precast concrete forming systems for architectural applications, differing in size, function, and cost. Some can be prestressed concrete structural elements like columns, slabs, walls, hollow pipes and beams.

KEYWORDS: Identification of hazards and risks in precasting process and give control measures on all activities.

I. ACTIVITIES IN PRECAST PROCESS

1. CONCRETING
2. TRANSPORTATION
3. INSTALLATION

I. CONCRETING

concrete - a strong hard building material composed of sand and gravel and cement and water. building material - material used for constructing buildings. cement - a building material that is a powder made of a mixture of calcined limestone and clay; used with water and sand or gravel to make concrete and mortar.

Concrete is a composite material, comprising a matrix of aggregate and a binder (typically Portland cement or asphalt), which holds the matrix together. Many types of concrete are available, determined by the formulations of binders and the types of aggregate used to suit the application for the material. These variables determine strength and density, as well as chemical and thermal resistance of the finished product. A cement, most commonly Portland cement, is the most prevalent kind of concrete binder. For cementitious binders, water is mixed with the dry powder and aggregate, which produces a semi-liquid slurry that can be shaped, typically by pouring it into a form.

1.1 AREA PREPARATION

Area preparation is a first stage of pre casting process. Prepare the area as per required space by using the air compressor and lifting vehicles. Dewatering the required space by using the dewatering pump. Then maintain the good house keeping for good bonding of structure.



1.2 PREPARATION OF MOLD

Take care to ensure that cleaning the architectural precast concrete panel does not damage adjacent materials, even if they are flushed with water prior to cleaning the precast mould or panel. Dust, dirt and simple stains may be cleaned by scrubbing the stain with a fiber brush, using a mild detergent and water. the compressed air using for effective clean and dry.

1.3 REINFORCEMENT

Reinforcing concrete with steel improves strength and durability. On its own, concrete has good compressive strength, but lacks tension and shear strength and can be subject to cracking when bearing loads for long periods of time. Steel offers high tension and shear strength to make up for what concrete lacks. Steel behaves similarly to concrete in changing environments, which means it will shrink and expand with concrete, helping avoid cracking.

1.4 SHUTTERING

Shuttering is a vertical temporary arrangement which is arranged to bring concrete in a desired shape or Formwork which supports vertical arrangement is known as shuttering. In a technical point of view, Formwork for columns, footings, retaining walls is called as a Shuttering. shuttering should have doka board for effective shuttering which is made by compressed wooden powders.

POTENTIAL HAZARDS IN CONCRETING

Sl. No.	Sequence of the Job	Potential Hazards	Protective measures to be taken
1	Manual Cleaning of Pre Cast Mould	a) Air Pollution and inhalation of dust resulting pneumoconiosis	<ul style="list-style-type: none"> ➤ Water sprinkling in the working area should be ensured. ➤ Use of dust mask, goggles and hand gloves.
2	Moulding and demoulding of precast mould assembly using pick & carry crane	a) Defective Equipment.	➤ Competent operator can be engaged; operator shall be properly trained.
		b) Failure of crane during lifting.	<ul style="list-style-type: none"> ➤ The crane should be load tested and certified by a competent person. ➤ Do not over load the crane.
		c) Falling of Precast mould	<ul style="list-style-type: none"> ➤ Bolt and nut shall be properly tightened. ➤ Proper size of fasteners shall be used. ➤ Usage of reinforcement rods for locking moulds shall be avoided and adequate capacity slings & D-shackles shall be used. ➤ Area shall be barricaded. ➤ Unauthorized entry shall be restricted.
		f) Fire hazard	<ul style="list-style-type: none"> ➤ Remove the combustible materials from the work area. ➤ Firefighting equipment should be kept ready at workplace.



II. TRANSPORTATION

Transportation is a major hazardous process in precasting process. The most of materials like rebars and shuttering boards are lifted by the cranes and other materials are placed by using trailers and boom mixers then the least count of lite weight materials are lifted and place by human workers.

Considerational factors in material handling;

- The proposed system of material handling should be defined in terms of needs, objectives and functional specification.
- Methods and processes should be standardised to avoid confusion.
- Unnecessary handling or movement should be reduced or eliminated.
- Working conditions and methods should have worker safety as the primary objective.
- Unit loads should be optimised, to reduce work and risk.
- Storage areas should be kept organised and clean, maximising density as much as possible and eliminating damage to materials.
- Sites should be kept safe, clean and easy to move around.
- Deliveries should be received and handled promptly.

HAZARDS IN HUMAN MATERIAL HANDLING

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
1	Manual handling of materials.	Carrying too heavy load.	<ul style="list-style-type: none"> • As per rules the maximum weight that an adult male worker is allowed to lift, carry, push, or drag is 55kg Depending on the weight, shape and bulk of the material to be lifted sufficient number of person should be employed.
		Injuries in hand, leg and shoulder.	<ul style="list-style-type: none"> • Person engaged in handling materials should be provided with safety shoes, safety helmet, leather or latex coated cotton hand gloves and shoulder pads. • Maintain min 20 lux illumination for access and min 100 lux illumination for working area.
		Improper access	<ul style="list-style-type: none"> • Safe approach to be ensured to the working spot. • Ensure access should be free from material storage and protruding rebar's.



HAZARDS IN MATERIAL HANDLING BY TRAILER

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
1	Shifting of blocks using trailer	a) Engaging of Incompetent driver	➤ Competent driver approved by P&M and Safety Dept. shall be engaged, driver shall be properly trained.
		Overloading of Trailer	<ul style="list-style-type: none"> ➤ Trailer should not be overloaded. ➤ Net weight should not exceed the manufacturer recommended limit. ➤ Green card system shall be implemented. ➤ Daily inspection of Equipment/ Vehicles shall be done ➤ Daily Pre job briefing shall be given to the Driver/ work force
		Toppling of Trailer	<ul style="list-style-type: none"> ➤ Road compaction shall be ensured ➤ In turnings care shall be taken and drive the Trailer/ Dumper very slowly to avoid the toppling.
		Fall of load from the Trailer during shifting	<ul style="list-style-type: none"> ➤ Blocks shall be secured with Ratchet belt /Turn buckles with wire rope to avoid falling and sliding during shifting. ➤ Blocks should not be projected out of the trailer bed.

III.INSTALLATION

Erection is preparing the physical side of the site for the new piece of kit and fitting it in place. Installation is the preparation of the kit for working, filling with oil, connecting up air ducts, intercabling etc. Erection is the process of the structure is erected in accordance with the sequential erection procedure, pre-assembly of member and the movement and location of heavy members of considered prior to installation.



Sl. No.	Sequence of the Job	Potential Hazards	Protective measures to be taken
1	Lifting of blocks using crane	a) Failure of crane while lifting loads.	<ul style="list-style-type: none"> ➤ Crane shall be checked on daily basis and recorded. Outriggers to be fully extended. ➤ Crane shall not be moved while holding heavy load. ➤ Crane should have competent person load testing certificate and load test details shall be displayed on crane.
		b) Slings breakage/ failure	<ul style="list-style-type: none"> ➤ Lifting equipment and accessories shall be fit for purpose, tested for its capacity, certified by competent person and pre-inspected before every use. ➤ Ensure the competent person certificate for the slings & shackles.
		c) Adverse weather & Excessive Wind	<ul style="list-style-type: none"> ➤ No lifting shall be done in unfavorable climatic/Adverse weather conditions.
		d) Tyre mounted crane run over on person while shifting the material.	<ul style="list-style-type: none"> ➤ Lifting and shifting activity shall be performed under the supervision of authorized Signal man.

IV. CONCLUSION

The available literature on precasting element process in construction safety was reviewed and relevant information was provided. Hazards associated with related activities where rate of fatality/injury is high like concreting, shuttering, reinforcement, working in confined space, use of material handling equipment, temporary electrical works and control measures to avoid the hazards are described briefly in this paper. Illustrative tables are also presented at appropriate places. New case studies of accidents due to precasting process along with the lessons learn from the accident are also added to create awareness to prevent recurrence of such accidents.



REFERENCES

1. Graybeal, B.A. UHPC in the U.S. Highway Transportation System. In Proceedings of the Second International Symposium on Ultra High Performance Concrete, Kassel, Germany, 5–7 March 2008; pp. 11–17.
2. Rebetrost, M.; Wight, G. Experience and Applications of Ultra-High Performance Concrete. In Proceedings of the Second International Symposium on Ultra High Performance Concrete, Kassel, Germany, 5–7 March 2008; pp. 19–30.
3. Graybeal, B.A. Design and Construction of Field-Cast UHPC Connections; Report No. FHWA-HRT-14-084; USDOT FHWA: Washington, DC, USA, 2014.
4. Badie, S.S.; Tadros, M.K. Full-Depth Precast Concrete Bridge Deck Panel Systems; NCHRP Report 584; Transportation Research Board: Washington, DC, USA, 2008.
5. Graybeal, B.A.; Swenty, M. UHPFRC for Prefabricated Bridge Component Connections. In Proceedings of the Third International Symposium on Ultra High Performance Concrete, Kassel, Germany, 7–9 March 2012; Volume 1223.
6. Hwang, H.H.; Park, S.Y. A study on the flexural behavior of lap-spliced cast-in-place joints under static loading in ultra-high performance concrete bridge deck slabs. *Can. J. Civ. Eng.* 2014, 41, 615–623. [CrossRef]
7. Arafa, A.; Farghaly, A.; Ahmed, E.; Benmokrane, B. Laboratory testing of GFRP-RC panels with UHPFRC joints of the Nipigon River Cable-Stayed Bridge in Northwest Ontario, Canada. *J. Bridge Eng.* 2016, 21, 05016006. [CrossRef]
8. Mantawy, I.; Chennareddy, R.; Genedy, M.; Taha, M.R. Polymer Concrete for Bridge Deck Closure Joints in Accelerated Bridge Construction. *Infrastructures* 2019, 4, 31. [CrossRef]
9. MOLIT (Ministry of Land, Infrastructure and Transport). Korean Highway Bridges Design Code (Limit State Design Method); MOLIT: Sejong-si, Korea, 2015.
10. KCI (Korea Concrete Institute). The Structural Design Guideline of the Fiber Reinforced SUPER Concrete; KCI: Seoul, Korea, 2019.
11. ASTM C78/C78M, Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading); ASTM International: West Conshohocken, PA, USA, 2018.



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