STRESSING & LAUNCHING ANALYSIS OF PRESTRESS GIRDER

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Abstract— **Offsite construction methods are increasingly popular in construction industry, offsite construction, also referred to as modern methods of construction (MMC) offers many advantages in terms of quality of construction, cost control, construction time and environmental credentials. It is also seen as a means to help reduce the amount of waste generated on site.**

Precast concrete manufactured offsite for structural and ornamental elements have been extensively used for a wide variety of projects, from railway sleepers to bridge elements, housing and stadia. Precast concrete products are reported to potentially reduce waste on construction site by as much as 50% when compared to more traditional approaches. The nature of concrete and off production methods allows manufactures to produce standardized elements using pre-set forms and shutters that are endlessly reused. Furthermore design and manufacturing process does not require temporary supports and scaffolding that are, or more conventional sites, waste generating, time consuming and a health and safety hazard.

Offsite construction relates to construction activities that are carried out in a factory environment away from the site. Due to set up of offsite production facilities, and possibilities offered to manufactures to improve the assembly process, offsite construction has a range of advantage compared to traditional build. The importance of offsite construction methods has increased since mid 1990.Offsite precast construction methods have been in use for over a century for a wide range of construction, from floor to high rise buildings, from single components to building system. Like other offsite method of construction, precast concrete offers the known advantages in terms of efficiency of construction process, improved construction program better budget control and improved quality.

Index Terms—**1.Profiling 2.Tensioning of Cable 3. Launching 4. Ram Area 5.Stressing**

I. INTRODUCTION

What is P.C.S. (Precast Concrete System?)

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Precast concrete manufactured off site negates the need for temporary works and reduces material wastage resulting in a more efficient use of material.

PRECAST CONCRETE

Solutions for structural and ornamental elements have been extensively used all over the world both for large construction projects such as bridges and stadia, as well as for modest dwellings. Precast concrete is most commonly used offsite construction method, precast provides the builders with:-

1. Quick erection times
2. Reduced need for plant on site
3. Easier management of construction sites.
4. Better overall construction quality
5. Ideal fit for simple and complex structures

Annually, the precast concrete industry produces over 35 million tonnes of products.These products are widely used in following sectors:-

1. Residential (floors)
2. Stadia
3. Infrastructure (roads, railways, bridges, sewage)
4. Prisms
5. Medium and high rise buildings
6. Hospitals
7. Commercial and industrial buildings.

METHODOLOGY OF PRESTRESSING SYSTEM

1. All prestressing strands shall have 7 ply uncoated stress reveled high tensile strand of 12.7mm dia conforming to class 2 of IS 14268
2. Bright metal sheathing shall be used for all cables

The parameter adopted for design are as follows:-

1. Anchorage type …….. 19T13/7T13
2. Slip at stressing end ……..... 6mm
3. Minimum sheath diameter ……. 65mm for 19T13
4. Sheath thickness ……... 0.5mm for 19T13
5. Nominal area of each strand …….. 98.7mm^2
6. Nominal ultimate breaking load of each strand … 183.71 KN
7. Modulus of elasticity of high tensile steel …… 1.95x105 MPA

PRESTRESSING OPERATIONS

1.All cables shall be laid in smooth profile passing the given coordinates and shall be supported at a spacing not exceeding

1000mm by a 16mm dia cross bar/tack weld securely held in position with vertical web reinforcement.
Cable length mentioned in the drawing is inclusive of 1000mm and 600mm extra at stressing end &dead end respectively. Total length of cable shall be verified.

1. Stressing of cables shall be tensioned from one end only
2. Grouting of cables shall be done in same sequence as stressing and shall conform with IRC 18-2000 AND also to MORTH specifications.
3. Anchorage pockets shall be filled with epoxy mortar/non shrink concrete after stressing and grouting.
4. Extensions shall be rechecked after 24 hours after anchoring to observe slow slippage.
5. Initial slackness in the prestressing cables shall be removed by applying small tension. Tension required to remove the initial slackness shall be taken as the starting point for measuring elongation and correction shall be applied as per clause 12.2.1.3 of IS 1343-1980.
6. The extension given in the drawing shall be modified at site in case actual value of area of strand A and modulus of elasticity E varies from those assumed in design revised extension shall be calculated as under.

Revised extension= ($98.7mm^2$x1.95x10^5/NEW AREAXNEW MODULUS) X EXTENSION GIVEN IN DRAWING

7. If the calculated elongation is reached before the calculated gauge pressure is obtained, continue tensioning till attaining the calculated gauge pressure the elongation does not exceed 1.05 times the calculated elongation.
8. If the calculated elongation has not been reached continue tensioning by intervals of 5kg/sq cm. until the calculated extension is reached provided the gauge pressure does not exceed 1.05 times the calculated gauge pressure.
9. If the elongation at 1.05 times the calculated gauge pressure is less than 0.95 times the calculated elongation the following measures must be taken in succession to define the cause of this lack of elongation
10. Recalibrate the pressure gauge
11. Check the correct functioning of jack pump and leads
12. De-tension the cable slide it in its duct to check that it is not blocked by mortar which has entered through holes in the sheath, re-tension the cable if found free

ANALYSIS FOR STRESSING

ROAD OVER BRIDGE NEAR SHAMBU SPAN RP2-RP3(27.873 MTR.)

STRESSING CALCULATIONS

GIRDER NO. 1 CABLE NO.3
DATE……..
AREA OF STRAND(ACTUAL) 99.88mm2
E VALUE(ACTUAL) 1.9973X105 N/MM2
DESIGN EXTENSION(D.E.) 182.00MM
JACKING PRESSURE = 229.20X1000/1025.7X0.99= 225.71KG/CM^2
DESIGN JACKING FORCE=229.20 TONNE
MAX. JACKING PRESSURE(+5%)=236.99
MINIMUM JACKING PRESSURE=214.42KG/CM^2
MODIFIED EXTENSION= D.E.X98.7X1.95X10^5/99.88X1.9973X10^5= 175.11mm
MAX.EXTENSION(+5%)=184.37MM
MIN. EXTENSION(-5%)=166.81MM

GAUGE PRESSURE (IN KG/CM2)	EXTENSION OBTAINED IN MM	NET EXTENSION	CUMMULATIVE EXTENSION
50	37	144-37/3=35.66	35.66
100	74	37	72.66
150	105	31	103.66
200	144	39	142.66
235	179	35	177.66
245	185	6	183.66

SLIP OBSERVED 185-176=9MM
NET EXTENSION 183.66-9=174.67MM
Er. Ajeet Kumar taking reading of cable Extension at site in this image.

ANALYSIS & DIAGRAM OF LAUNCHING

IN Δ ABC

θ = TAN^{-1}(6.20/7.0)= 41□31'54"

IN Δ ADE

COS 41□31'54"= AE/AD=16.03/AD

AD= 16.03/COS41□31'54"=21.41 MTR.

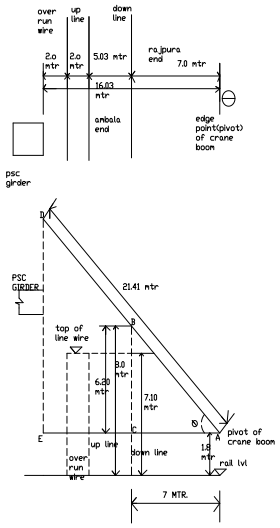
DE= 21.41 SIN41□31'54"=14.20 MTR.

REQUIRED TOP OF PSC GIRDER IN LIFTED POSITION

= 6.96+1.20+0.80+2.0=10.96 MTR <14 MTR

≈ 11 MTR

Er.Ajeet Kumar (at left) during Launching with contractor (at Right) at **R.O.B. Ambala**



CONCLUSION

After working on precast concrete technology conclusion has derived that it reduces cost and time of any construction project. Cost and time are two main factors in management. So this type of technology should be more used in future to improve quality of work done in construction technology and management

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REFERENCES

1. IS CODE 1343 (1980) : CODE FOR PRESTRESSED CONCRETE
2. IS CODE 456 (2000) : CODE FOR RCC CONCRETE
3. IRC :78 (SPECIFICATIONS AND CODE OF PRACTICE BY MORTH)

BIOGRAPHY

Er. Ajeet Kumar, currently doing M.TECH. in Construction Technology & Management from Haryana College of Technology & Management.He has done B.TECH.from same college (2008-2012).He has more than 2 year experience as a site engineer in the field of Bridges & Flyovers. He has done practically prestressing work, box pushing technique work under railway track, launching work over railway track, diaphragm wall foundation work, steel structure work, soil nailing techniques etc. at various sites.

Dr. Arvind Dewangan, Professor in Department of Civil Engineering, Haryana College of Technology & Management, Technical Campus KAITHAL. His highest academic qualification is PhD in Mining & Geological Engineering. He has 12years of experience in teaching and research. He has published 50 papers in International and National journals and won more than 15 times National level Essay Competition. He has published various articles about Technical & Higher education in national level competition magazine like – Competition Success Review, i-SUCCEED, Civil Services Chronicle, Pratiyogita Sahitya, Pratiyogita Vikas, and Pratiyogita Darpan also.