DESIGN and ANALYSIS of POST TENSIONED PRESTRESSED CONCRETE MEMBER by USING ADAPT SOFTWARE

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***ABSTRACT*— In this modern world, the requirements of construction are very high; we can't satisfy all the requirements using the conventional techniques of construction. So reformation were required and in 1886, Jackson of san Francisco applied for a patent for "construction of artificial stone and concrete pavements", in which prestress was introduced by tensioning the reinforcing bars set in sleeves. My main motive behind this dissertation is to bring out the fruitful usage of post-tensioning concrete in this era of construction and usage new techniques and new program for post tensioning. In this report, Design and Analysis the Post Tension Prestress Member using ADAPT software, which is mostly used now-a-days in the market. ADAPT has launch PT8 & most recently PT12 version.**

***KEY WORDS*—Post Tensioned, ADAPT Software, Prestressed Concrete Member & Design and Analysis of post tensioned member**

I: INTRODUCTION

A prestressed concrete structure is different from a conventional reinforced concrete structure due to the application of an initial compression on the structure prior to its use. The precompression or 'prestress' is applied to enable the structure to counteract the stresses arising during its service period.

The development of prestressed concrete was influenced by the invention of high strength steel. It is an alloy of iron, carbon, manganese and optional materials. The following material describes the types and properties of prestressing steel.

In addition to prestressing steel, conventional non-prestressed reinforcement is used for flexural capacity (optional), shear capacity, temperature and shrinkage requirements. The properties of steel for non-prestressed reinforcement are not covered in this section. It is expected that the student of this course is familiar with the conventional reinforcement.

The prestressing of a structure is not the only instance of prestressing. The concept of prestressing existed before the applications in concrete. Two examples of prestressing before the development of prestressed concrete are provided. Force-fitting of metal bands on wooden barrels. The metal bands induce a state of initial hoop compression, to counteract the hoop tension caused by filling of liquid in the barrels.

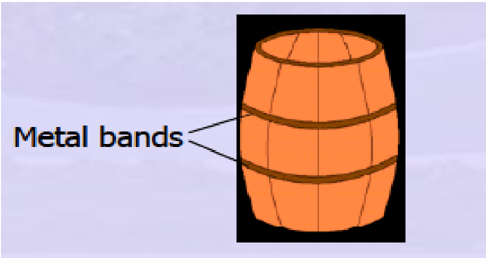

Fig: 1 Force-fitting of metal bands on wooden barrels

Pre-tensioning the spokes in a bicycle wheel. The pre-tension of a spoke in a bicycle wheel is applied to such an extent that there will always be a residual tension in the spoke.

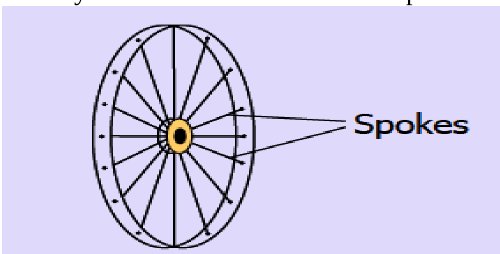

Fig: 2 Pre-tensioning the spokes in a bicycle wheel

For concrete, internal stresses are induced (usually, by means of tensioned steel) for the following reasons.

- The tensile strength of concrete is only about 8% to 14% of its compressive strength.
- Cracks tend to develop at early stages of loading in flexural members such as beams and slabs.

• To prevent such cracks, compressive force can be suitably applied in the perpendicular direction.
• Prestressing enhances the bending, shear and torsional capacities of the flexural members.
• In pipes and liquid storage tanks, the hoop tensile stresses can be effectively counteracted by circular prestressing.[4]

II POST TENSION PRESTRESSED CONCRETE

What is Post-Tensioning?

Concrete is strong in compression but relatively weak in tension. One way to overcome this shortcoming is to impose a field of compressive stress on the member so that even under maximum loading the member is still in compression, or limited tension. This is referred to as Prestressed Concrete as stress desired in magnitude and direction as deliberately imposed prior to the member being put into use.

There are two common ways of prestressing concrete; by pre-tensioning or by post-tensioning. With pre-tensioning, the tendons are stressed before the concrete is placed. The tendons are stretched between strong bulkheads which withstand the forces and the concrete is poured around them. This system is most frequently adopted in precasting yards.

Post-tensioning involves stressing the tendons after the concrete has been placed and cured. The tendons thread or insert ducts or sleeves to allow the strand to slide through the hardened concrete and corrosion protection is normally provided by injecting cement grout or grease. Post-tensioning is used in bridges, floor slabs, silos and many other forms of construction. It can bring significant benefits in terms of economy, construction programming, structural performance and reduction in material usage. [5]

III AIM and OBJECTIVE of WORK

The main objective of work to study new software, which mostly used in market for design and analysis of the post tension member as namely ADAPT. As normal R.C.C. cannot able fulfill the requirement of structure because of increase in self-wt of the structure and become uneconomical. The natural raw materials are become less day by day & they can produce more strength compared to artificial raw materials which is required in post tension prestress concrete. The artificial raw materials can fulfill requirement of normal R.C.C.

IV LITERATURE REVIEW

The effect of the diameter of prestressed strands providing the post-tensioned beam-to-column connections In this study, the effect of prestressed strand diameters, providing the beam-to-column connections, was investigated from both experimental and analytical aspects. In the experimental studies, the strength, stiffness and energy dissipation capacities of the precast specimens comprising two prestressed strand samples of 12.70 mm and 15.24 mm diameters, were compared with the reference specimen. The precast specimen with strands of 15.24 mm reached 96% of the maximum strength of the reference specimen; the amount of energy dissipated by this specimen by the end of the experiment reached 48% of the amount of energy dissipated by the reference sample; and the stiffness of the same specimen at a drift of 1.5% reached 77% of the stiffness of the reference specimen at this drift. Parallel results were obtained during the analytical studies from the aspects of strength and behavior, but the initial stiffness of the analytical models was lower than that of the test specimens.

Analytical study of the effect of the diameter of prestressed strands, we precast beam-to-column connections connected as post-tensioned and reference monolithic beam-to-column connections were modeled using an ANSYS finite elements program. For the analytical models, the size of the specimens, properties of the materials, loading program and boundary conditions were formed in accordance with the criteria in the experimental studies. In the analytical modeling of the test specimens:

(a) A hidden crack model was selected to define the cracked concrete.
(b) Full bonding was accepted between the concrete and steel. For this reason, the bonding element between the concrete and steel was not separately defined.
(c) A discrete model was used in the modeling of the reinforcement

During the first steps of the loading program (until 1.5% drift) the load capacity and stiffness of the analytical models greatly differed from the test specimens, while during the loading at 1.5% drift and later, the load capacity and stiffness of the analytical models only slightly differed from the test specimens.

Loading program was applied as load-controlled to the analytical models, however, for the test specimens; it was applied as load + displacement-controlled. It should be parallel to the loading program applied to the analytical models and test specimens.

For the affect of the concrete on the behavior of the model could be fully reflected, all concrete properties, including modules of elasticity, compressive stress, tension stress and Poisson ratio must be determined carefully.[1]

Nonlinear analysis method for continuous post-tensioned concrete members with unbonded tendons. In this study the unbonded post-tension (UPT) method has been often applied to continuous flexural members (e.g., slabs and beams), where tendons are typically placed continuously through the supports. Most of the previous studies, however, focused on simply supported UPT flexural members, whereas little research has been performed on continuous UPT members. Moreover, as the few existing studies on continuous beams mainly aimed at strength prediction, the results of these studies are not applicable to examine the service load behavior of UPT members. They also did not reflect the moment redistribution phenomenon in continuous members, which is quite important to accurately predict the flexural strength and behavior of continuous UPT members. Therefore, in this study, a flexural behavior model for continuous UPT members has been proposed, which is a nonlinear analysis model that reflects the moment redistribution. To verify the analysis model proposed in this study, the analysis results were compared to those of the tests conducted by Harajli, Burns and Tan and Tjandra. Table 2 shows the details of the referred specimens and the measurements from their experiments. All specimens were two-span continuous, among which six specimens were externally post-tensioned and two specimens were internally post-tensioned. The tendon profiles were in a straight line as well as in curved shapes, and the sections were in rectangular or T shapes. Also included in the test were one or two-point concentrated loading specimens In this study, the assumption of an idealized curvature distribution in the maximum moment region that was proposed in the analysis model of UPT members in authors' previous study was extended to continuous UPT members. [2]

V INTRODUCTION of ADAPT PT SOFTWARE

For 30 years, ADAPT has delivered leading structural engineering software, consulting services, and professional training programs to structural design professionals worldwide. From our headquarters in California and through our network of Associates and **Authorized Distributors**, ADAPT serves more than 5,000 customers in over 85 countries. Our customers have successfully relied on ADAPT software and services to more productively and accurately design hundreds of bridges and millions of square feet of buildings, resulting in fewer errors, improved quality and accuracy, and better projects overall. We provide a wide range of reliable and easy-to-use structural analysis software solutions for the design of building and bridge structures; these include ADAPT-PT, RC, FELT, PULT, BUILDER suite, Modeler/3D, Floor Pro, SOG, MAT and ABI. ADAPT-PT's proven reliability and ease-of-use have made it the most widely used software for the design of post-tensioned slabs and beams worldwide. It is based on the Equivalent Frame Method of analysis and leads the user through a simple to follow, step-by-step modeling and design process. Its unmatched ability to speedily produce optimized designs and quantity take-offs in minutes have made it the tool of choice for design professionals seeking to complete their post-tensioned projects profitably and consistently on time. Designers of beam and slab parking structures, in particular, find ADAPT-PT to be the best suited solution for their type of projects. And, ADAPT-PT is widely deployed as a training tool for engineers new to the design of post-tensioning.[8]

VI EXAMPLE

Design a post tension bridge girder of unsymmetrical I-section for an effective span 30m. The girder has to carry its own weight at the stage of stress transfer. The superimposed load due to all effects at the final stage is 39 kN/m. Concrete is of M-35 grade. Adopt Magnel-Blaton system of post-tensioning and working stress as per IS code for Type 2 (limited prestress) members. The strength of concrete at stress transfer, f_{ci} = 24 Mpa. Take f_{pu}= 1540Mpa [3]

a. Solution

The unsymmetrical I-section shown in fig4.1 may be tried

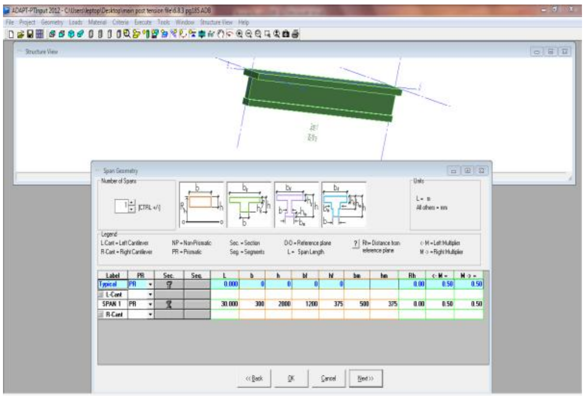

Fig:3 Model of Beam

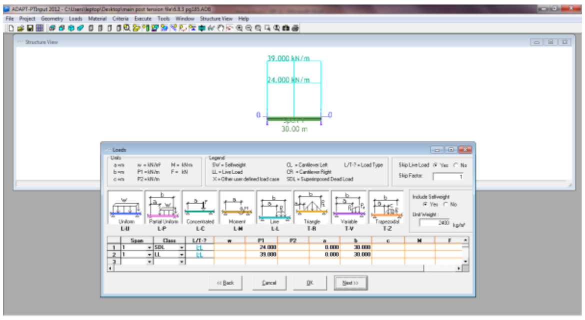

Fig:4 Different Types of Load on Members to Selected

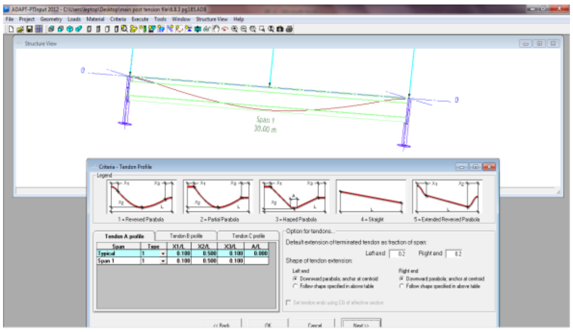

Fig:5 Different Cable Profile to Select

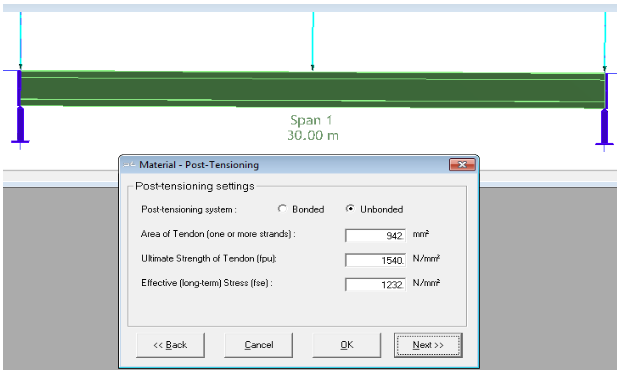

Fig:6 Setting of Post tensioning

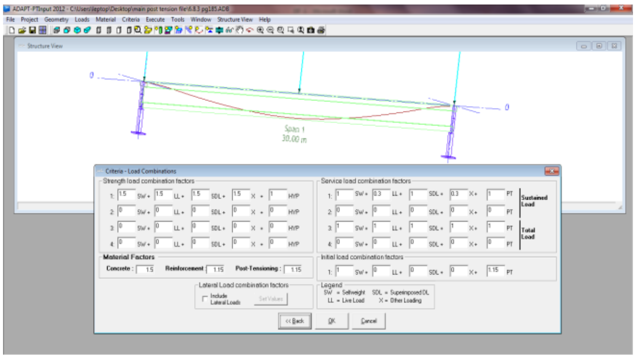

Fig:7 Selected load combination factors

B. result

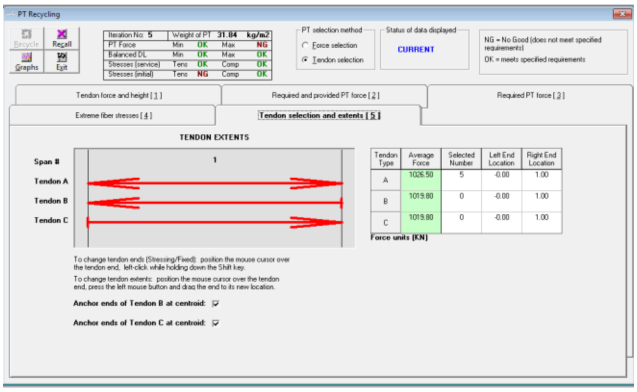

Fig:8 Give the Result That Number of Tendon Are Provide

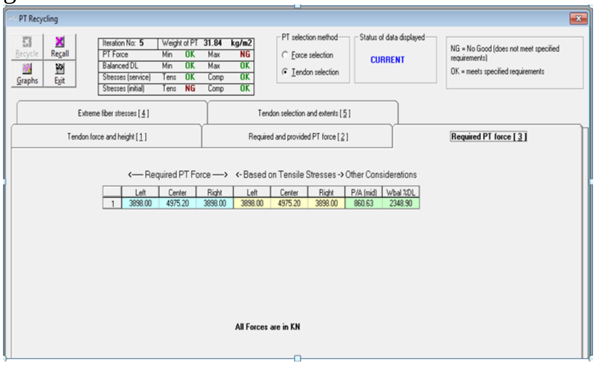

Fig:9 Requirement of PT force

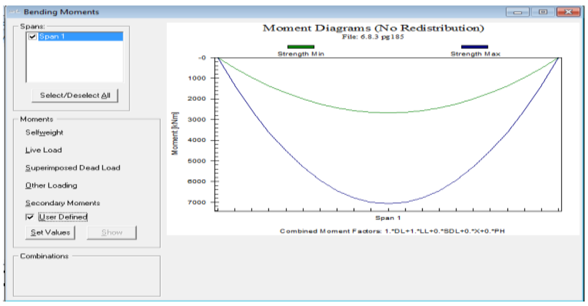

Fig:10 Bending Moment Diagrams of the beams

Table:1 Details Stresses for span

X/L	X	SW Top	SW Bot	SDL Top	SDL Bot	XL Top	XL Bot	LL Top Max-T	LL Top Max-C	LL Bot Max-T	LL Bot Max-C	PT Top	PT Bot
	m	MPa	MPa	MPa	Mpa	MPa	MPa	MPa	MPa	Mpa	MPa	MPa	MPa
0.00	0.00												
0.05	1.50	-0.93	1.43	-0.94	1.44	0.00	0.00	0.00	-1.52	2.34	0.00	-4.32	-5.72
0.10	3.00	-1.76	2.70	-1.78	2.72	0.00	0.00	0.00	-2.88	4.42	0.00	-2.73	-8.33
0.15	4.50	-2.50	3.83	-2.51	3.86	0.00	0.00	0.00	-4.09	6.27	0.00	-0.71	-11.55
0.20	6.00	-3.13	4.81	-3.16	4.84	0.00	0.00	0.00	-5.13	7.87	0.00	1.04	-14.35
0.25	7.50	-3.67	5.63	-3.70	5.67	0.00	0.00	0.00	-6.01	9.22	0.00	2.51	-16.73
0.30	9.00	-4.11	6.31	-4.14	6.35	0.00	0.00	0.00	-6.73	10.32	0.00	3.71	-18.68
0.35	10.50	-4.46	6.84	-4.49	6.88	0.00	0.00	0.00	-7.29	11.18	0.00	4.63	-20.20
0.40	12.00	-4.70	7.21	-4.73	7.26	0.00	0.00	0.00	-7.69	11.80	0.00	5.28	-21.31
0.45	13.50	-4.85	7.44	-4.88	7.49	0.00	0.00	0.00	-7.93	12.17	0.00	5.65	-21.98
0.50	15.00	-4.90	7.51	-4.93	7.56	0.00	0.00	0.00	-8.01	12.29	0.00	5.83	-22.15
0.55	16.50	-4.85	7.44	-4.88	7.49	0.00	0.00	0.00	-7.93	12.17	0.00	5.65	-21.98
0.60	18.00	-4.70	7.21	-4.73	7.26	0.00	0.00	0.00	-7.69	11.80	0.00	5.28	-21.31
0.65	19.50	-4.46	6.84	-4.49	6.88	0.00	0.00	0.00	-7.29	11.18	0.00	4.63	-20.20
0.70	21.00	-4.11	6.31	-4.14	6.35	0.00	0.00	0.00	-6.73	10.32	0.00	3.71	-18.68

VII CONCLUSION

This paper has aimed to investigate optimal profile of cable for post tension beam. From previous study have presented profile of cable for post tension beam are according to bending moment diagram. From above result that cable profile is eccentric then it can carry 20% more load then non eccentric. In addition into one illustrative example is add for validation for the software and to check accurate of the software and founded that software is perfectly good and simple for understanding for design & drafting plan and selection of the member for design

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