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Comparative Study on Design of RCC and PSC Beams

Shaheenjaham, Akshata C Sureban, Megha Chappalagaon, Mudassar Sharif. (B.E Students)

Department of Civil Engg, SECAB Institute of Engineering & Technology, Vijayapur, Karnataka, India.

Prof. Sachin S Kulkarni

Asst. Professor**,** Department of Civil Engg, SECAB Institute of Engineering & Technology, Vijayapur, Karnataka, India.

ABSTRACT: In the present study, cost comparison between R.C.C. beam and Pre-stressed concrete beam is carried out. Pre stressed concrete consists of concrete resisting compression and reinforcement carrying tension. Pre stressing became essential in many applications in order to fully utilize the compressive strength of reinforced concrete and to eliminate or control cracking and deflection. This work includes the design and estimate of R.C.C. Beam and Post-tensioned Beams of 16.2m & 4.3m Spans. The analysis is done with SAP 2000 and design is done manually. The loads are considered as per IS 875 part-2.The paper is on analysis, designing, detailing of a function hall with cost comparison of RCC and Pre-stressed post tensioned beams. The building is planned to serve the purpose of a public building, consisting of ground floor + first floor. The aim of this work is to design & estimate 16.2m & 4.3m span beams of R.C.C as well as pre-stressed concrete beam and then compare the results. The idea is to reach a definite conclusion regarding the superiority of the two techniques over one another.

I. INTRODUCTION

In India RCC Structures are commonly used for Residential as well as commercial Buildings. Post-tensioned Pre-stressed beams are rarely used for the same Buildings, or we can say for short Span Buildings. Two Decade ago there was a big problem of Skilled Workers for Pre-Stressing work. But now there are so many agencies for execution of the same work. In RCC Beams, depth of beam increases with increase in Span, because of deflection limitation. Depth of beam can be reduced in Pre-stressed section, for longer span, pre-stressed beams are cheaper.

Prestressed concrete is the most recent major form of construction introduced in the structural engineering. It has become a well established method of construction as the technology is now available in all developed and in many developing countries. Today, prestressing is used in buildings, underground structures, communication towers, floating storage and offshore structures, power stations, nuclear reactor vessels, and numerous types of bridge systems.

One of the greatest assets of "homo-sapiens" is their quest for excellence. The human being has constantly refused to sit over his laurels and become complacent. This has often resulted in new invention and improved products and techniques. Reinforced cement concrete construction has been the most revolutionary construction technique of modern times. Combining the high compressive strength of concrete with high tensile strength and elasticity of steel has resulted in a composite material that is strong, durable and economical. Moreover, it is time tested. Very week tensile strength of concrete lead to discovery of R.C.C. Bulkiness of R.C.C resulted in the invention of shells. The problem of serviceability associated with the R.C.C. structures sent the human mind working over-time. The solution was found in pre stressing. Like ordinary reinforced concrete, pre stressed concrete consists of concrete resisting compression and reinforcement carrying tension. Pre stressing became essential in many applications in order to fully utilize the compressive strength of reinforced concrete and to eliminate or control cracking and deflection.

The Principal design objectives for structural engineers are safety, functionality, economy and now a days legality of design. When selecting a structural building system, it is important for the engineers and architects to understand the appropriate application of post-tensioned concrete and the effects that may result. If properly analysed and assembled, concrete structures from high quality materials can provide a superior combination of durability, sound control and fire

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safety needed in today's building market. Considering the current market factors of cost options, material supply and lower floor-to-floor heights, and available developer financing, concrete is often selected as the more cost effective material over steel. Concrete in which there have been introduced internal stresses of such magnitude and distribution that the stresses resulting from given external loadings are counteracted to a desirable degree.

II. LITERATURE REVIEW

A.R.Mundhahda, Mohammad Shahezad (2012) Studied **"***Economics of Continuous R.C.C Beams Vis-À-Vis Continuous Pre Stressed Concrete Beams***"** the work includes the design and estimates of continuous R.C.C. beams and continuous pre-stressed concrete beams of various spans. The aim of this paper is to design medium span continuous R.C.C. beams as well as continuous pre-stressed concrete variety and then compare the results. Programming in MS EXCEL is done to design the beams. Results reveal that a continuous R.C.C. beam is cheaper than continuous pre-stressed concrete beam for smaller spans but vice versa is true for larger spans. [1]

Vaibhav G Tejani, Hitesh K Dhameliya, Jasmin Gadhiya (2015) Studied **"***Review For Study Of Pre Stressing Systems For All Structural Element*" the work includes research on structure which is economical for post tensioning, for a span, also high labour cost countries is to avoid external scaffolding, for low-rise structures to precast as far as practical and to pre stress concrete, not only horizontally, but also vertically so as to resist lateral loads. In most structures today, the increasing use of pre stressing has given new freedom to any concept of forms previously considered uneconomic or unfeasible or unduly bulky to resist loads. The use of pre stressing has also been found to be a way of achieving waterproof flat roof surfaces even without the application of normal bituminous waterproofing, since the concrete is kept in continual compression and resists cracking which can otherwise lead to water penetration in the long term. [2]

Anupam Sharma, Suresh Singh Kushwah (2015) Studied "*Comparative Analysis Of Reinforcement &Prestressed Concrete Beams*" the work includes analysis of prestressed concrete beams more effective as compared to reinforcement concrete beams in flexure. In this paper, introduced the simply supported beams under different loading conditions like point load & analysed done by the stadd pro. This paper evident that, all aspect of prestressed concrete beam better as compared to reinforced concrete beam in flexural against the different loading condition. [4]

Ankit Sahu, Prof. Anubhav Rai, Prof. Y. K. Bajpai (2014) Studied "*Cost & Constructional Comparison Between RCC & Prestressed Beams Spanning 16m*" the work includes design and estimate of R.C.C. Beam and post-tensioned Beam of span 16 m and then comparing the results. Result shows that, for span 16m Post-Tensioned Pre-stressed concrete beam is 14% cheaper than RCC beam. When we Design for various spans ranging from 6m to 26m & above than, Result shows that for 11.25 meter length cost of RCC Beam & PT Beam are same. RCC Beams are cheaper for spans up to 11.25 meter. And Post-Tensioned pre-stressed beams are cheaper for spans larger than 11.25 meter. [5]

III. OBJECTIVES

- To carry out analysis of function hall in SAP 2000.
- Based on the results drawn from the SAP2000, the beams with different spans of function hall is to be designed (RCC and PSC)
- And to compare the cost of RCC & Post-tensioned pre- stressed concrete beams**.**

IV. METHODOLOGY

To begin with, a R.C.C. beam manually designed by using the limit state method based on IS: 456-2000. Based on the steps & formulas involved. The result of the program is checked by first designing the manually designed beam by using the program & comparing the results. Since in field, a mix richer than M -20 used for RCC, the grade of concrete is maintained at M- 20 for R.C.C. An identical procedure is followed for Pre-stressed concrete beams. The manual design is based on the limit state method suggested according to Indian code provisions IS: 1343-1980. The result is checked by first solving the manual problem & comparing the results. For Pre-stressing, the beam is designed for M-40 grade concrete. Design is carried out for parabolic cable profile only, which is the most popular one. Programs is also prepare for estimating & costing. Rates will be taken from KPWD SR 2015-16. In case of pre-stressed concrete, some of the rates will be obtained from a well-known private infrastructure company.

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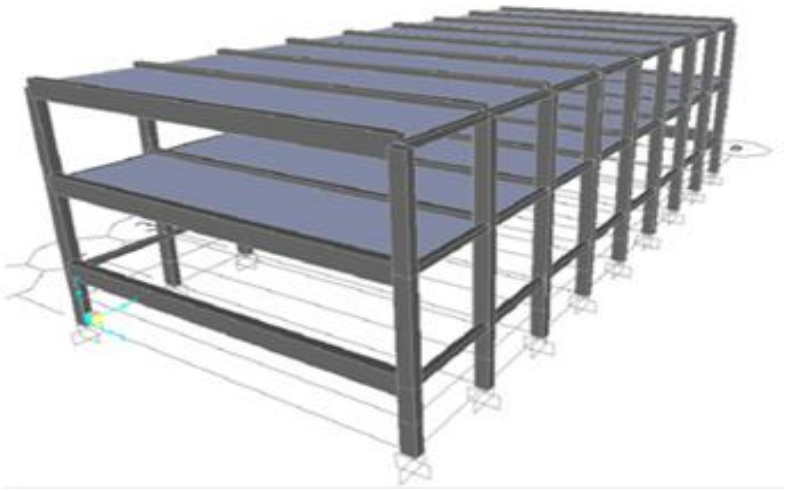

Fig 4.1 Model of function hall in SAP 2000

V. RESULTS AND DISCUSSIONS

The following results shows that, for all spans the Post-Tensioned Prestressed concrete beams are cheaper than RCC beams.

Table 5.1 Bending Moment and Shear Force (SAP 2000)

Sl.No	Beams	Shear force (Vu) KN	Bending moment (Mu) KN-m
1	Primary Beam at 12m Outer	349.92	709.5012
2	Primary Beam at 12m Intermediate	109.350	214.748
3	Primary Beam at 7.5m Outer	590.49	1373.7642
4	Primary Beam at 7.5m Intermediate	109.35	244.9095
5	Primary Beam at 3m Outer	590.49	1366.7877
6	Secondary Beam at 7.5m Outer	288.288	198.6182

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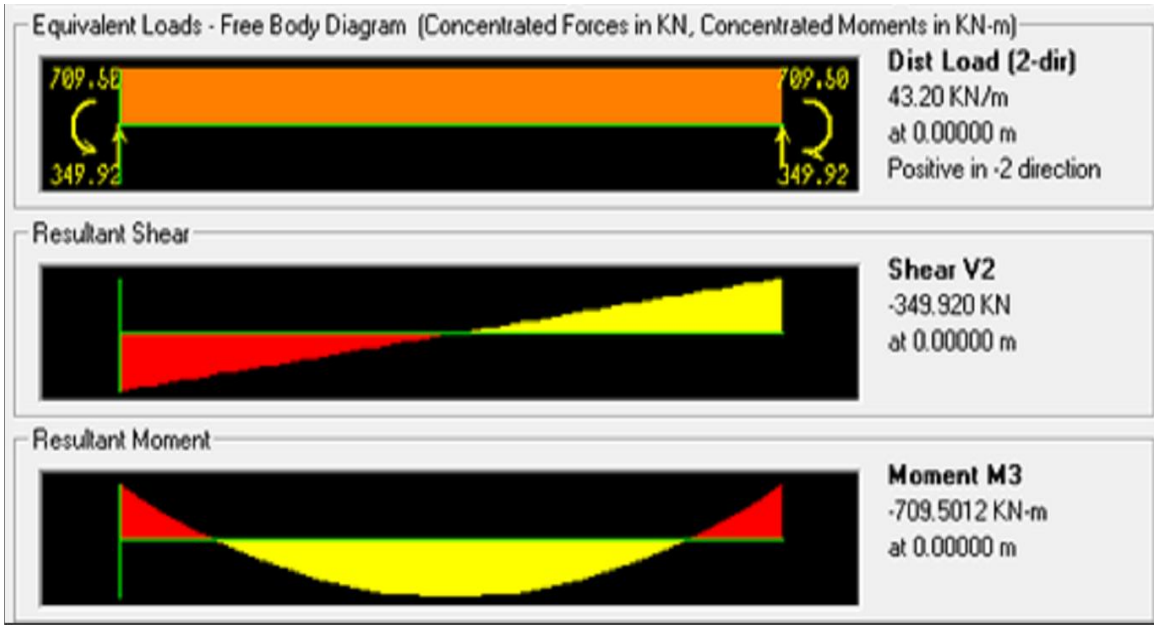

Fig 5.1 Bending Moment & Shear Force of Primary Beam at 12m Outer

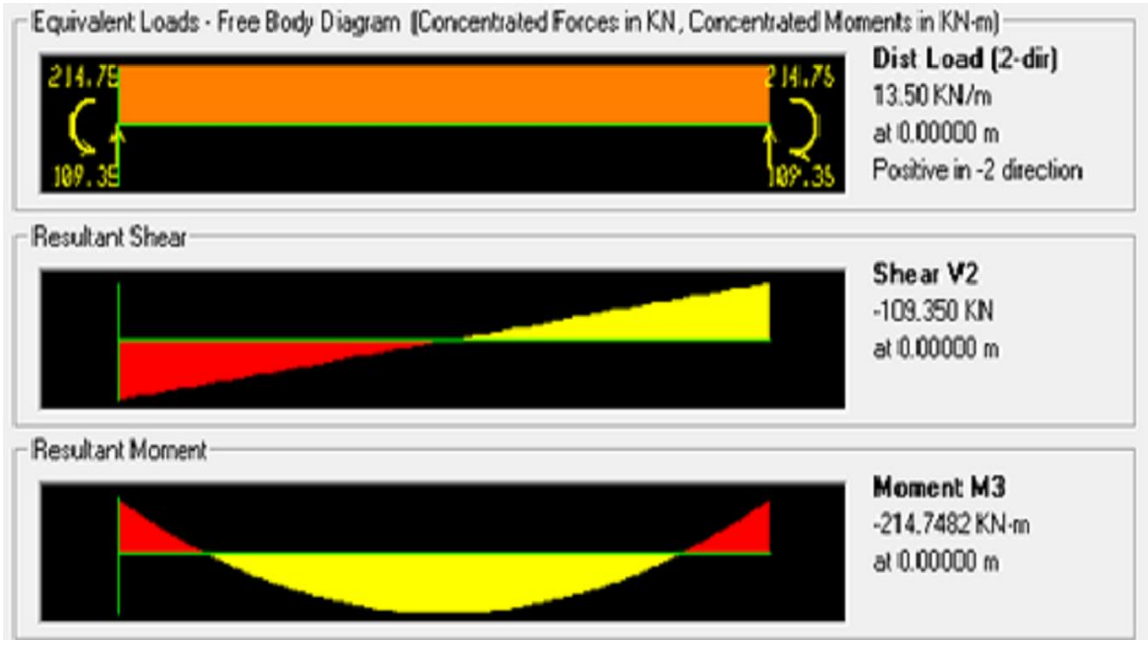

Fig 5.2 Bending Moment & Shear Force of Primary Beam at 12m Intermediate

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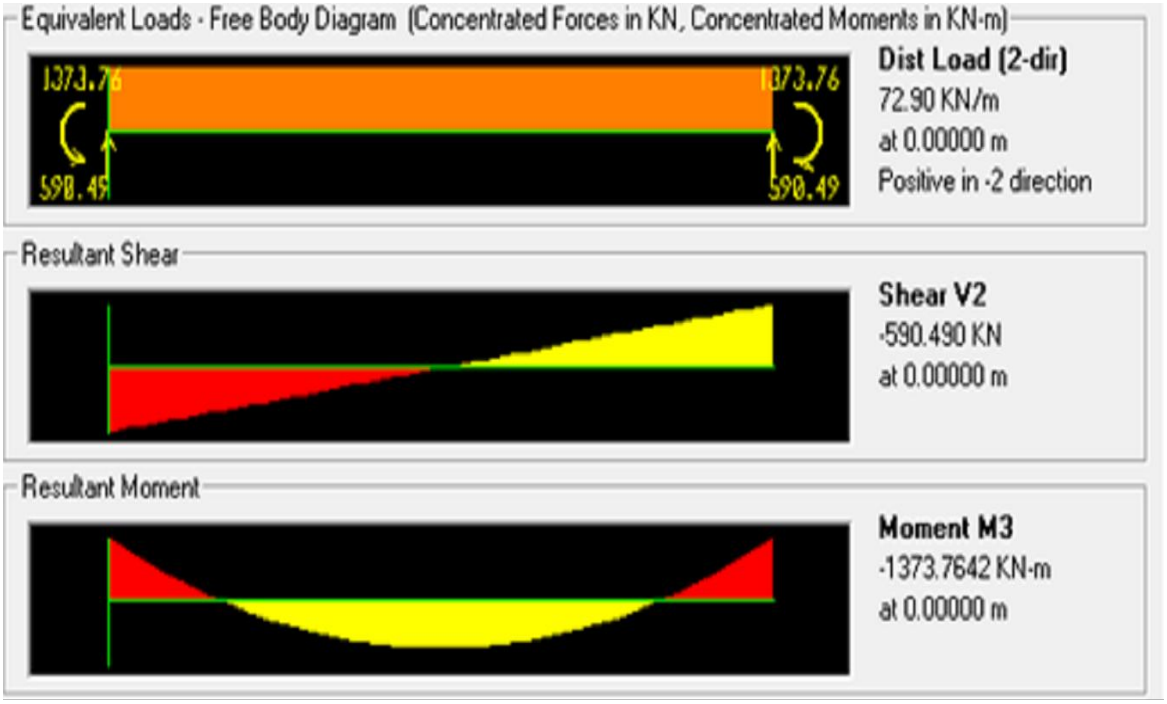

Fig 5.3 Bending Moment & Shear Force of Primary Beam at 7.5m Outer

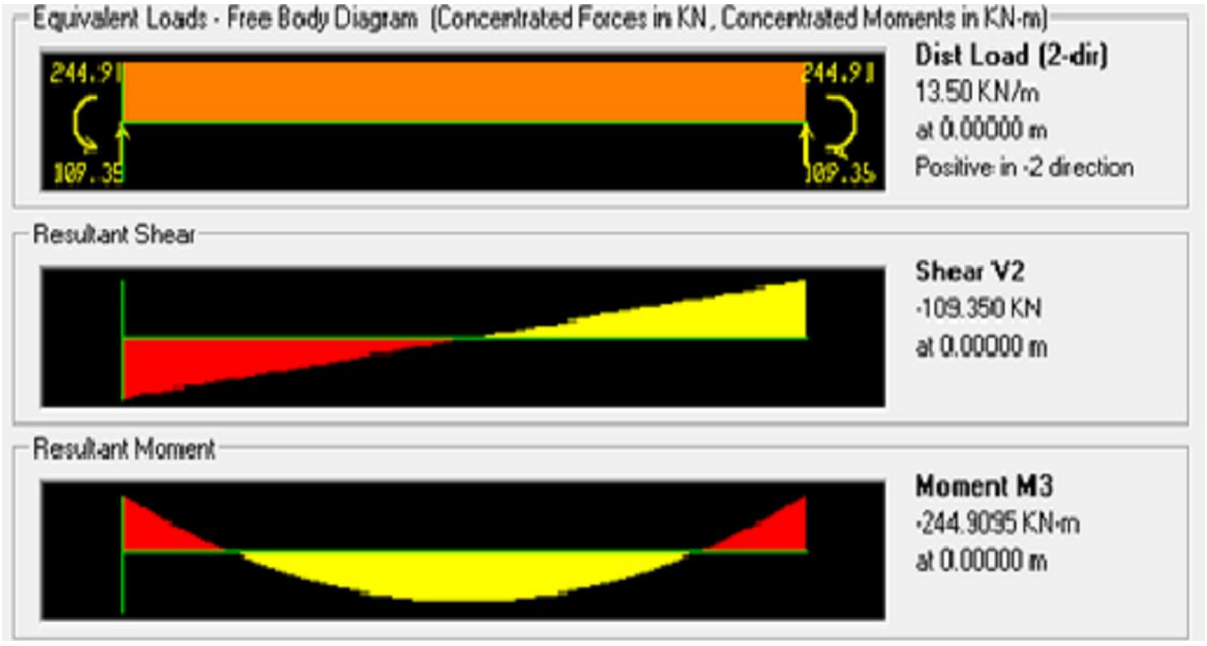

Fig 5.4 Bending Moment & Shear Force of Primary Beam at 7.5m Intermediate

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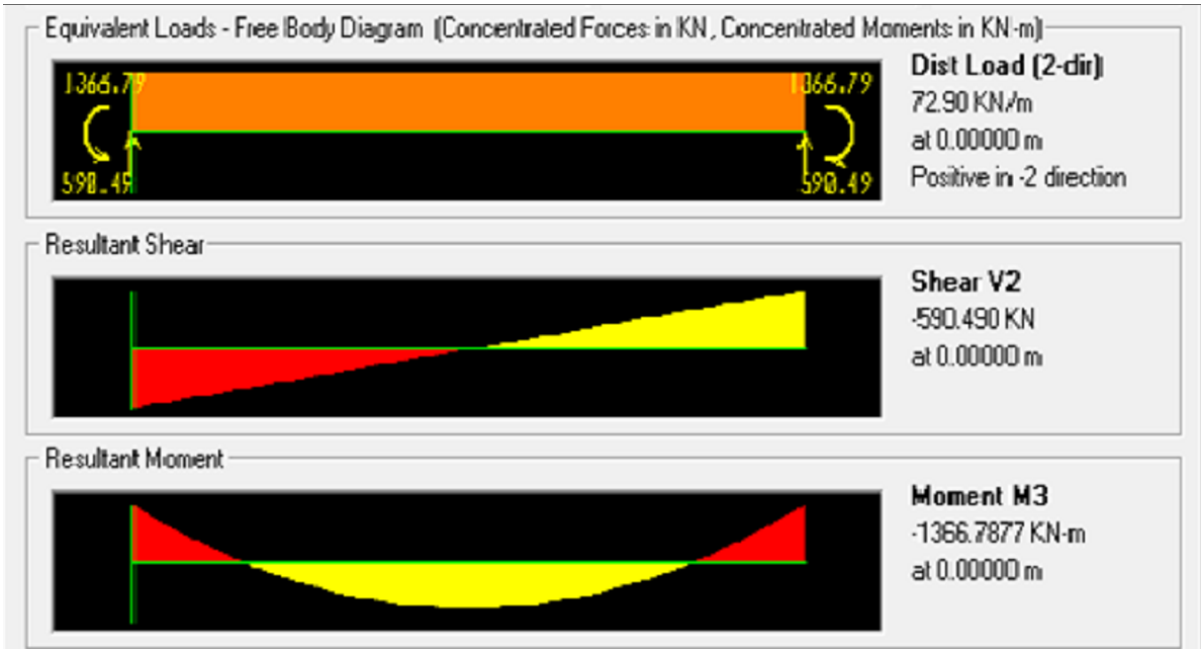

Fig 5.5 Bending Moment & Shear Force of Primary Beam at 3m Outer

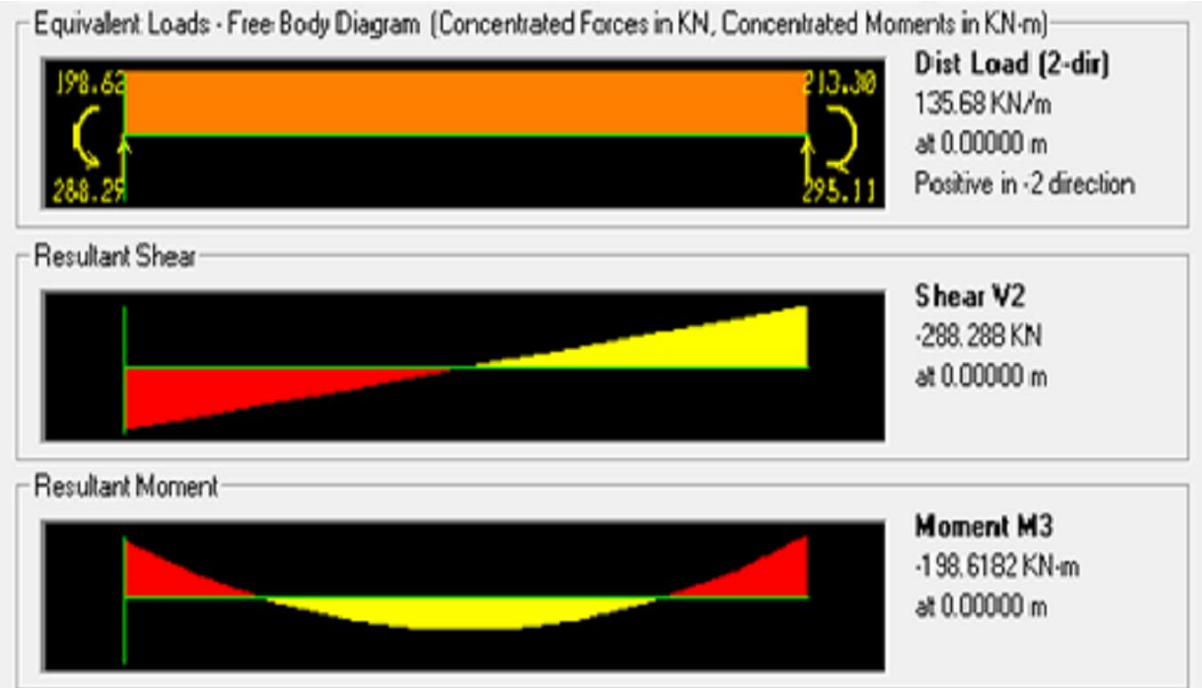

Fig 5.6 Bending Moment & Shear Force of Secondary Beam at 7.5m Outer

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Table 5.2 Costs of RCC and PSC Beams

Sl.No	Amount of RCC (INR)	Amount of PSC (INR)
1	50268.312	47111.661
2	39598.344	32949.686
3	68694.12	52666.236
4	39598.344	31496.936
5	72530.8344	52666.236
6	21178.008	6184.007
Total	291867.9624	223074.762

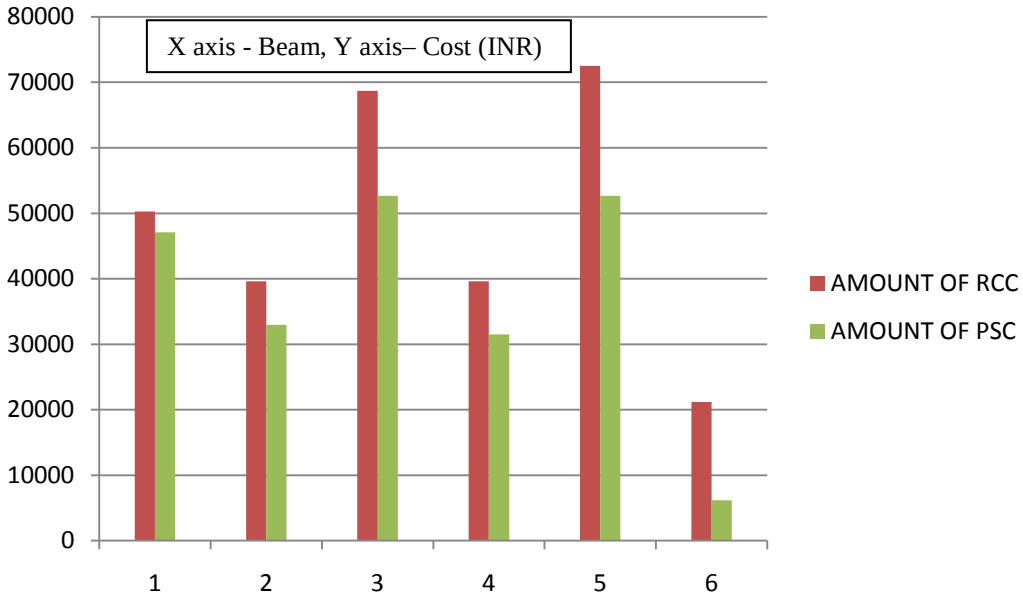

Fig 5.7 Cost Comparison of RCC and PSC

VI CONCLUSION

Based on bending moments and shear force from SAP 2000. The beams of the function hall are designed (RCC & PSC). The cost comparison of RCC & PSC is carried out, and it is evident that cost of construction of PSC is economical as compare to RCC for different spans (Fig 5.7).

REFERENCES

[1] A.R.Mundhada, Mohammad Shahezad "Economic Of Continuous R.C.C. Beams Vis-À-Vis Continuous Pre Stressed Concrete Beams" International Journal of Scientific & Engineering Research , Volume 3, Issue 7, July 2012.
[2] Vaidhav G Tejani, Hitesh K Dhameliya, Jasmin Gadhiya "Review for Study of Prestressing System for All Structural Element" International Journal of Scientific Research in Science, Engineering & Technology, Volume 1, Issue 6, 2015

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[3] Amlan K Sengupta and Prof. Devdas Menon "Prestressed Concrete Structures" NPTEL.
[4] Anupam Sharma and suresh singh kushwah "Comparative Analysis Of Reinforcement And Pre-stressed Concrete Beam" International Journal of Current Engineering and Technology Volume 5, No 4, July 2015
[5] Ankit Sahu, Prof.Anubhav Rai, Prof.Y.K.Bajpai." Cost Comparision between RCC & Post tensioned Prestressed beam Spanning 26m" International Journal of Computational Engineering Research , Volume 4, Issue 6, June 2014.
[6] Code:IS875 part 2
[7] Code:IS456-2000
[8] Code: IS1343: 1980