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DESIGNED TABULATIVE COUPLING OF RC COMPRESSION MEMBERS-A SIMULATIVE APPROACH

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I. ABSTRACT : In the present era design of any structural element would be a challenging task. Design of compression members being most challenging to decide the section is capable to withstand or bear the force applied on it. Hence design of Structural members are always designed based on number of trails and error method. While undertaking many trails, design calculations with their design checks proves a length and time consuming. Hence, in the present study efforts are put to build the stock of various design combinations of compression members by pre-assuming the sectional date and applying forces, moments on it. And suitable conclusion will be made at the end.

II. INTRODUCTION

1. COLUMN

Columns is a vertical structure member which take load from slabs and beams and transfer to ground. In reinforced concrete buildings beams, floors, and columns are cast monolithically. The columns based on slenderness ratio, their shape, and their load applied on it . Column can be used to support beams , arches or any upper part of the wall. Column is a part of wall with a bigger dimension. Column is basically fail by two types One is buckling and crushing. Column not only undergoes with various loads ,it even undergoes with 2-3 moments.

1.2 HISTORY OF COLUMN

Ashoka pillars, also known as Ashoka pillars or columns, were erected during the reign of Emperor Ashoka (c. 268–232 BCE) of the Maurya Dynasty in India. These pillars are famous for their inscriptions and the symbolic representation of the Lion Capital atop some of them. Constructing Musical Pillars. Ashoka pillars were typically made from a single piece of highly polished sandstone. The choice of sandstone provided durability and a smooth surface for inscriptions and carvings. The sandstone blocks were quarried from suitable locations, and large monolithic columns were carved from these blocks. Skilled artisans would carve and shape the monolithic sandstone block into the desired cylindrical shape. These pillars are usually quite tall and slender. The top of Ashoka pillars often features intricate and symbolic carvings. The most famous is the Lion Capital, which includes four lions sitting back-to-back, symbolizing Ashoka's commitment to non-violence and dharma. These capitals were often highly detailed and beautifully crafted.

1.3 EXAMPLES

Fig. 1 Ashoka Pillar

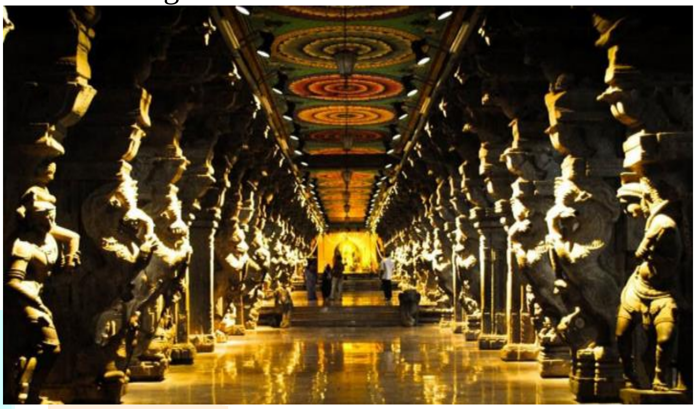


Fig. 2 Meenakshi Temple

Fig.3 Iron Pillar

Fig. 4 Musical Pillar (Hampi)

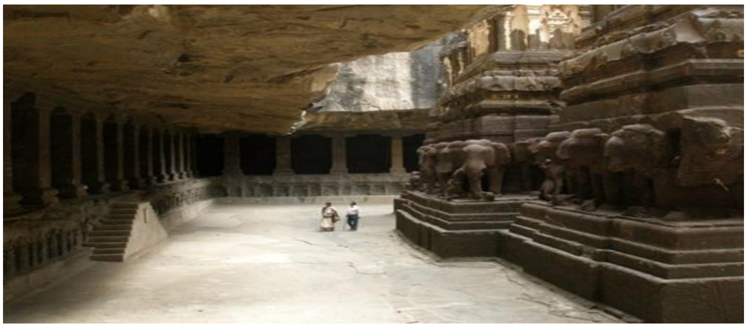


Fig. 5 Ellora Caves

Fig.6 Anti gravity pillar

1.4 METHODOLOGY

- Consider a trial section perfection column subjected to bi-axial moment with axial load.
- Assume the axial load and moment on the section.
- Design of steel reinforcement for the trail section considered.
- For the same trail section increase the axial force, moment and design of the steel reinforcement.
- After the number of iterations, a table is prepared which consists trail section, force applied, moment applied and the combination of reinforcement.
- The entire methodology is repeated for different sections and columns.

1.5 PROCEDURE FOR DESIGN OF CENTRALLY LOADED SHORT COLUMN

Step 1: Compute the factored load on the column.
Step 2: Choose a suitable size of the column, depending on the size of the beam that has to be placed on it and the architectural requirements.

- Usually, beam are accommodated inside the column.
- Check also the minimum eccentricity.

Step 3: Determine the effective length and slenderness ratio.

- Less than 12, consider as short column.
- More then 12, designed as long column.

Step 4: Compute the area of longitudinal steel required by

- Pu = 0.4 fck Ac + 0.67 fy Asc

1.6 COLUMN INTERACTION DIAGRAM

A column subjected to varying magnitude of P and M will act with its neutral axis at varying points as described now.

Case 1: When P = Pu and M = 0 (axial load only)
In this case it acts as a column. The strain distribution across the section is uniform. Its ultimate load Pu reached when the compression strain reaches the failure strain of $\epsilon c = 0.002$. The corresponding stresses in concrete and steel can be calculated by equilibrium equation, Pu can be calculated as.

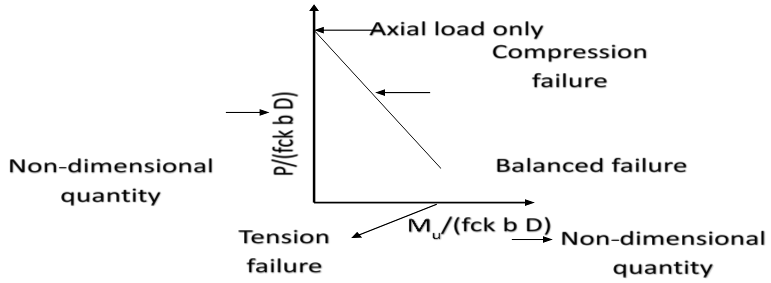
Pu = (Ac* Stress in concrete) + As * Stress in steel

Case 2: When P = 0, M = Mu (Moment only)
In this case the member acts as a pure beam. The failure moment is the ultimate moment in pure bending. The ultimate moment Mu was calculated basis of the assumption that failure reaches when $\epsilon c = 0.0035$.

C = T

Case 3: When an eccentrically loaded column is subjected to P and M, for every there is a particular value of M which will cause failure. Thus, there will infinite combinations of Pu and Mu which can be safely act together for a given RC section. The perpendicular value of Mu for a given value of Pu can be found only by trial and error and the work is quite tides. It will be more convenient especially for routine design to construct a curve showing the Pu, Mu combinations. Such a curve showing the limiting values of Pu and Mu is called P-M interaction curve. This can be made non- dimensional. Thus, the interaction curve gives the strength envelopes for the reinforced concrete section subjected to combination of direct loads and bending moment (P & M).

- Points outside these diagrams represents failure of column.
- Combinations on or inside the diagram are safe.



- Thus, the interaction curve gives the strength of the reinforced concrete section subjected to combination of direct loads and bending moment (P & M).
- Points outside these diagrams represents failure of column.
- Combinations on or inside the diagram are safe.

TABLE 1 (COLUMN SUBJECTED TO AXIAL LOAD)

SL. NO	SECTION SIZE (MM)	FORCE APPLIED (KN)	F_{CK} (N/mm)	F_Y (N/mm)	A_{SC} (mm)	NO. OF BARS
01.	550×550	2500	20	500	2420	#7-20mm
		3000	20	500	1774	#6-20mm
		3500	20	500	3302.75	#10-20mm
		4000	20	500	4831.80	#15-20mm
		4500	20	500	6360.85	#20-20mm
		5000	20	500	7889.90	#25-20mm

TABLE 2 (COLUMN SUBJECTED TO AXIAL LOAD)

SL. NO	SECTION SIZE (MM)	FORCE APPLIED (KN)	F_{CK} (N/mm)	F_Y (N/mm)	A_{SC} (mm)	NO. OF BARS
02.	460x460	2500	20	500	2409.55	#8-20mm
		3000	20	500	3902.0	#12-20mm
		3500	20	500	5394.62	#17-20mm
		4000	20	500	6887.1	#22-20mm
		4500	20	500	8379.7	#26-20mm

UNIAXIAL LOAD WITH MOMENT:

Uniaxial bending refers to a loading condition in which the structural member experiences bending along a single axis. In this case, the member is subjected to bending moments in one plane .For example, a simply supported beam subjected to a vertical load creates bending moments that act in a single direction, causing the beam to deflect primarily in that direction. Uniaxial bending is commonly encountered in beams or slabs subjected to concentrated loads or loads applied in one direction.

TABLE 1 (COLUMN SUBJECTED TO UNIAXIAL LOAD)

SL. NO	SECTION SIZE (MM)	LOAD APPLIED (KN)	MOMENT APPLIED (KN-m)	F_{CK} (N/mm)	F_Y (N/mm)	A_{SC} (mm)	NO. OF BARS
01.	350×350	1000	230	25	415	4900	#10-25mm
		800	230	25	415	4287.5	#9-25mm
		600	230	25	415	3675	#8-25mm
		400	230	25	415	3062.5	#7-25mm

TABLE 2 (COLUMN SUBJECTED TO UNIAXIAL LOAD)

SL. NO	SECTION SIZE (MM)	FORCE APPLIED (KN)	MOMENT APPLIED (KN-m)	F_{CK} (N/mm)	F_Y (N/mm)	A_{SC} (mm)	NO. OF BARS
02.	400×400	800	250	25	415	2300	#7-25mm
		1000	250	25	415	4000	#8-25mm
		1500	250	25	415	4800	#10-25mm
		1700	250	25	415	6400	#13-25mm

BIAXIAL BENDING:

Biaxial bending, on the other hand, occurs when the structural member experiences bending moments along two perpendicular axes.
It involves the simultaneous bending of a member about two different axes. This type of loading is common in structural elements such as columns, these columns are subjected to axial loads and moments in two orthogonal directions. Biaxial bending can also occur in slabs or walls subjected to loads applied in different directions.

TABLE 1 (COLUMN SUBJECTED TO BIAXIAL LOAD)

SL. NO	SECTION SIZE	FORCE APPLIED (N/mm^2)	Mux KN-M	Muy KN-M	Fck (N/mm^2)	Fy (N/mm^2)	% OF STEEL	NO. OF BARS	Asc mm^2
01.	400x400	1000	190	110	25	15	3.25	#8-30dia	5200
		1300	190	110	25	415	3.5	#8-30dia	5887
		1600	190	110	25	415	3.75	#8-30dia	6000
		1700	190	110	25	415	4	#8-30dia	6400

CONCLUSION:

Designing of economical section of column subjected to axial, uniaxial and biaxial load with or without moment is achieved.
With the help of PM interaction curve for a particular section is obtained and achieved.
After the many trial sections on axial, uniaxial and biaxial with applied moments and combination of reinforcement.
After so many trails many checks were undergone and there reinforcement arranged in tabulative form for future reference.

FUTURE SCOPE:

• The outcome of results will help structural designers where there will be lot of steps to do in the design of column.
• The designed table overcomes repetitive design of column.
• The table will produce a quick designed sections for various axial loads with moments.

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