

RESEARCH ARTICLE



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FINITE ELEMENT ANALYSIS OF MOMENT RESISTING BASES OF STEEL COLUMN

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ABSTRACT

For Structural analysis mathematical formulations are done. Structural analysis is based on boundary conditions. These boundary conditions should be assumed. Support conditions are the main important part. All the moments, displacements and structural stability based on support conditions. Column base plate behaviour affects the stability and behaviour of all structure. Fundamental parts of a steel structure formed by Steel Column Base plates. From literature, it is seen that, There are not any attention. For analysis purpose ABAQUS software is used. ABAQUS software is mainly used for analysis purpose. By using both codes i.e. IS:800-2007, AISC code & Manually. By using this software validation is done. Also there is a comparison between two methods with parameters of Moment Resisting Bases of Steel Column.

Keywords— Analysis method Finite element method, pressure load, design method, moment resisting bases, anchor rod, ABAQUS v 6.10.

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INTRODUCTION

Each and every structure is required to design. For designing of this structure the most important thing required is boundary conditions. Boundary conditions should be assumed & mathematical formulation depends on this. There are two types of behaviors of structures such as actual and predicted. This all depends on design accuracy assumption & structural detailing of each part of structural component. There are moment distribution, forces, displacements and all over stability of structure. Which depend on support conditions & column base behaviour. Behaviour of column mostly affects the behaviour of structure. Hence, steel column base

plays a important role in the fundamental components of a structure.

In past two decades, theoretical & experimental research has been done. Various modern codes gives frequent information to users about the real behavior of column base plates that to moment resisting gusseted column bases.

Following are types of Moment Resisting Steel Column Base Plates

1. Exposed column base plates
2. Embedded column base plates

Again Exposed column bases classified as According to

1. Base Plate Behaviour (Rigid, Flexible, Semi-rigid)

2.Amount of Restraint Provided(Fixed, partially restrained, pinned)

3.The concrete Failure Mode(Low,Medium,High)

4.Energy dissipation capacity

A. Applications of Moment Resisting Bases Of Steel Column

1.It is used in US steel construction.

2.It takes the load coming from column.

3.It is used in large construction industries.

4.Mostly it is used in case of large factory sheds where only steel frame is used.

II.LITERATURE REVIEW

Jayprakash P.Shaha and Dr.M.R.Shiyekar, "Extended end plate connections in special Moment Frame Sonyclowe"[9]

- This paper gives information about transferring of bending moments,shear forces and axial forces.
- IS:800-2007 gives design recommendations of limit state design.
- AISC gives provisions for end plate thickness which is on the basis of yield line theory.
- Such type of provision not included in revised IS:800-2007 specification.

E.S.Kameshki, "Comparision of BS 5950 and AISC-LRFD codes of practice"[5]

- In the comparision of BS-5950 and part 1 structural used for steelwork and AISC.
- There is consideration of dead and imposed gravity loads.
- There is a comparision of designs of various members depends on BS-5950 with those depends on AISC-LRFD and also gives more economical design for most types of members.
- From this paper,it is conclude that AISC gives more economical design than BS-5950.

James M.Fisher and Lawrence A.Kloiber,"Base Plate and Anchor Rod Design"[8]

- This paper refers the details of designing of base plate and anchor rod.
- It provides guidelines for engineers and fabricators to design,detail and specify column base-plate and anchor rod connections for avoiding common fabrication and erection problems.

Richard M.Drake and Sharon J.Elkin, "Beam Column Base Plate Design"[12]

- Equations of Static equilibrium and LRFD specification is directly used in a consistent manner for design of beam-column base plates and anchor rods along with factored loads.
- An AISC method was used for comparison of results with a problem.

▪ Factored loads are used for designing of steel structure,base plate and anchor rods.

M.Krishnamoorthy,D.Tensing, "Design of Compression Members Based on IS:800-2007 and IS:800-1984-Comparison,"[10]

- This paper focuses on detailed designing of compression members.
- Typical problem study is done by using allowable stress design methods,limit state method and Comparative studies done.
- There is a study of behaviour of steel sections with respect to load carrying capacity.

E.S.Kameshki, "Comparision of BS 5950 and AISC-LRFD codes of practice"[5]

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Jacinda Collins,P.E. and Thomas J.schlaflly,"A review of the concepts behind anchoring columns,as further explained in AISC Steel Design Guide 1,"[7]

- This paper gives the tolerances for anchor rod placement which is used for proper positioning of base plate on anchor rod.
- It allowed to give recommended hole size for anchor rod.Column bases are used for designing of compressive axial loads.

III. METHODOLOGY

Following are the stages for the completion of objectives.

Stage 1

1) Define Objective and Scope for Work.

Stage 2

1) Detailed Study of Moment Resisting Steel Column Bases.

Stage 3

1) Comparative study of parameters of Moment Resisting Steel Column Base Plates by using IS: 800-2007 Code and AISC (American Institute Of Steel Construction) Code & by using software.

IV.CASE STUDY

Following is the case study for Moment Resisting Column Base Plates:-

Problem Details :- In this problem ,I-section connected to the base plate by using angle cleats. The base plate thickness is 18mm.

Table No 1 :- Detailed Information of Problem

Sr No	Parameters	Parameter Details
1	Concrete Pedestal Size	1600mmx1450mmx600mm
2	Base Plate Size	400mmx250mmx18mm
3	Grade Of Concrete	25 N/mm ²
4	Load	900KN
5	Bearing Capacity Of Soil	500KN/m ²
6	Steel Column	ISMB 300
7	Boundary Conditions For Pedestal	Fixed

V.ABAQUS SOFTWARE DETAILS,RESULTS:

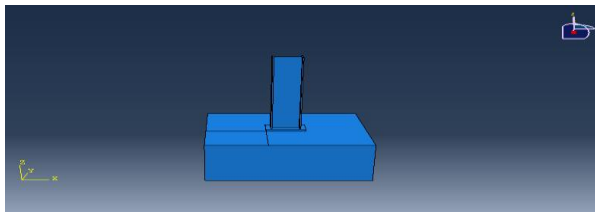


Fig. No 1:- Model diagram of the Problem.

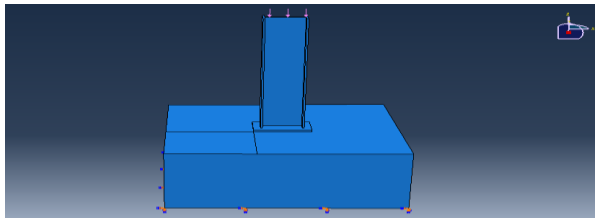


Fig. No 2:- Boundary condition diagram of the Problem.

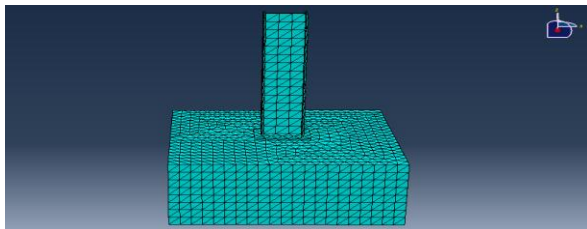


Fig. No 3:- Meshing diagram of the Problem.

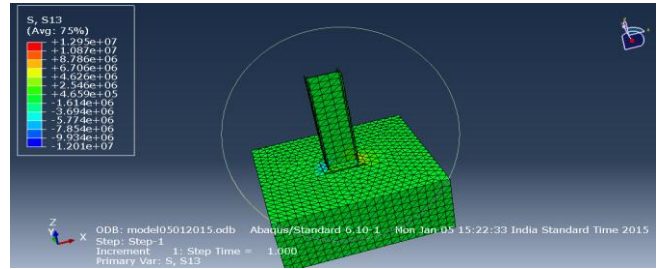


Fig. No 4:- Bending Pressure diagram of the Problem

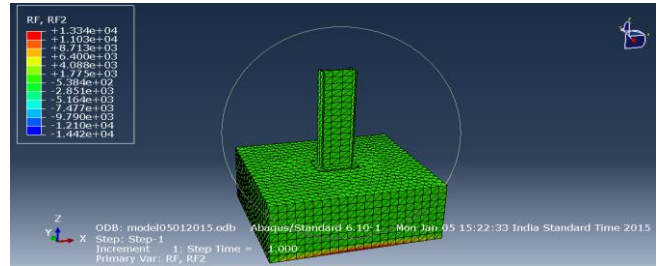


Fig.No 5 :- Bending Moment diagram of the Problem.

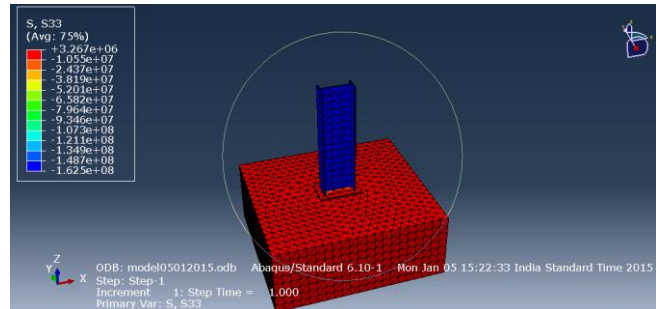


Fig.No 6:- Bending Stress diagram of the Problem.

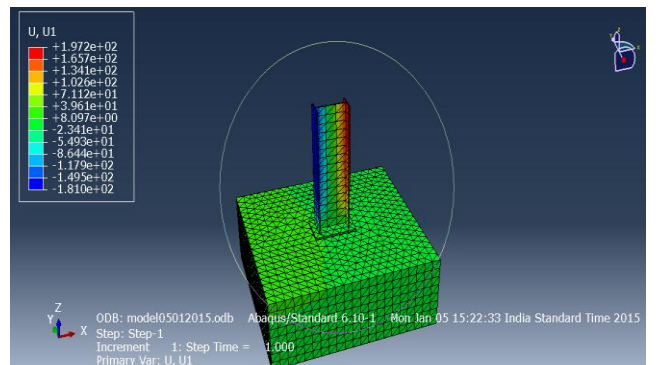


Fig.No 7:- Direct Stress diagram of the Problem.

VI. RESULTS AND DISCUSSIONS:-

A.Comparison of different parameters of Moment Resisting Bases of Steel Column

Table No 2 :- Comparison of different parameters of Moment Resisting Bases of Steel Column

Sr No	Parameters	By IS:800-2007 code	By AISC Code
1	Design about Stre	There is no any consideration about design	1.In case of column and base plate connection. As

length strength column is directly regarding Moment Resisting Bases connected to the base plate. These columns capable of distributing compressive forces in compressed parts of column over a bearing area. Hence Bearing Pressure on foundation does not exceed design strength of joint.

2. This design strength determined by considering material properties and dimensions of grout and concrete foundation.

2. Bearing There is no any linearly varying pressure distribution of pressure in detail.

Nominal bearing pressure between base plate and the support below may be determined on the basis of linearly varying distribution of pressure.

B. Comparison of Literature Results with Software Results

Table No 3:- Comparison of Literature Results with Software Results (Reference:- Limit State Design of Structural Steel By M.R. Shiyekar, Second Edition)

Sr No	Parameters	Results from literature	Results from Software	% Error
1	Bending Pressure	11.25	12.950	13.127%
2	Bending Moment	14787.5	13340.0	9.7887%
3	Bending Stress	3	3.267	8.173%
4	Direct Stress	9	8.097	10.033%

VII. CONCLUSIONS:-

1. The results obtained from finite element analysis agree with the ABAQUS & literature
2. Avg.% error for ABAQUS software with literature are 13.127% ,9.887% ,8.173% and 10.033% for problem respectively for Bearing pressure, bending moment, bending stress and direct stress parameters resp.

Here comparison of bearing capacity of concrete, friction coefficient and design strength. etc parameters of Moment Resisting Steel Column Base Plates by comparing with IS: 800-2007 and AISC (American Institute Of Steel Construction) Code.

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