STUDY & DESIGN ANALYSIS ON GIRDER OF EOT CRANE

K B Sushma[1], Ankur Malviya[2]
[1]P.G. Student, [2]Assistant Professor
[1,2]Department of Mechanical Engineering, CCET Bhilai, Chhattisgarh, India.

Abstract

The purpose of the present work is to avoid crack propagation in the crane girder by decreasing the stress concentration factor. To decrease the stress concentration factor, design of crane girder is slightly modified by providing fillets at the sharp edges. Also, a load analysis is performed on E.O.T crane girder in order to find out the safe load bearing capacity of girder. In order to perform analysis a 3D-CAD model of crane girder is made in SOLIDWORKS® on the basis of design specifications paper.

Keywords: *EOT (Electric Overhead Travelling), RSM (Rail and Structural Mill), Girder, Analysis, etc*.

I. INTRODUCTION

Material handling plays a vital role in any manufacturing system and the material handling industry is dynamically, actively, and competitively run. An E.O.T crane which stand Electric Overhead Travelling crane is used for moving the maximum specified at specified place. Generally overhead crane composed of lifting trolley, crane moving system & metal structure. A crane is a mechanical lifting device equipped with a rope drum, wire rope and rope sheaves that are used both to lift and lower metals vertically and to move it horizontally. The overhead Cranes handle and move the heavy loads from one place to another. This is most common type of overhead crane, found in most factories. It serves as large floor surface area within its own travelling than any other permanent type hoisting arrangement. These cranes are commonly used in the transportation industry, in the construction industry and in the manufacturing industry. Electric overhead travelling cranes are widely used in many industries for lifting the safe working load.

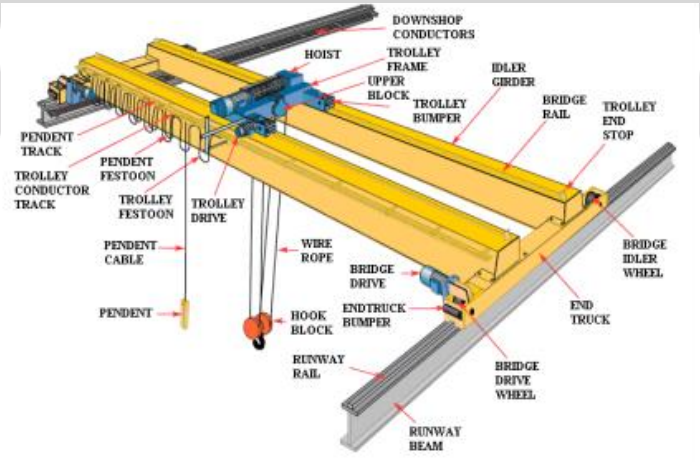

Fig 1. Basic Components of Overhead Crane

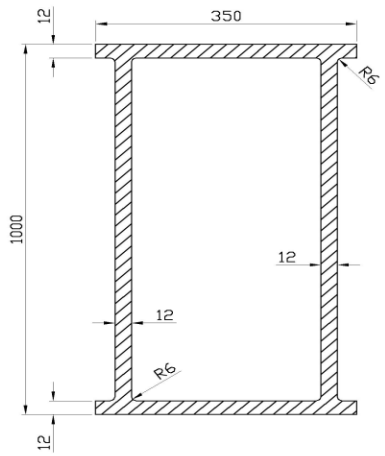

Fig 2. Typical modified section of box girder

Table 1 – Design Considerations for E.O.T Crane Notations Used

S.NO	Parameters	Values
1	Type of crane	Double girder type
2	Capacity	10 ton
3	Span	20 m
4	Trolley weight	2.5 ton
5	Hook approach	1.5 m
6	Location	Indoor(in sub store)
7	Crane weight	12 ton
8	Trolley wheel center to center	2 m
9	Lifting Height of Crane	15 m
10	Impact factor	1.32
11	Duty factor	1.06

Manual calculation [1]

- W_d=1.5 x 10000=15000Kg=147.150KN
- W_t=0.25 x W_d=3750 Kg=37KN
- W_{cr}=0.75 x W_d=11250Kg=110KN
- W_{wm}=1.07 x$(\frac{Wt+Wd}{4})$

$= 1.07 \text{ x}(\frac{147.150+37}{4})$

=49.26 KN per wheel

- $M_1 = \Psi \frac{(Wd+Wt)x\{S-Tc/2\}2}{8\times S}$

$=\frac{1.2 \text{ x } (147.150+37)x\ (20000-1000)^2}{8\times 20000}$

=498586.125 KN-mm

- M_2 = 0.25 x M1 = 124646.53 KN-mm
- Wg = (Wcr-Wt) -2 x We
  = (110-37) -2 x (11.772)

=62KN

- $M_3 = \frac{Wg \text{ x } S}{8}$

$=1.1 \text{ x}\frac{62 \text{ x } 20000}{8}$

=170.5 KN-mm

- $M_{max} = M_1+M_2+M_3$
  =623403.15 KN-mm

- $Z = (\frac{Ix-x}{500}) = (\frac{3909430000}{500}) = 7818860 \text{ mm}^3$

- $\sigma_b = \frac{Mmax}{Z} = \frac{623403150}{7818860} = 79.73 \text{N/mm}^2$

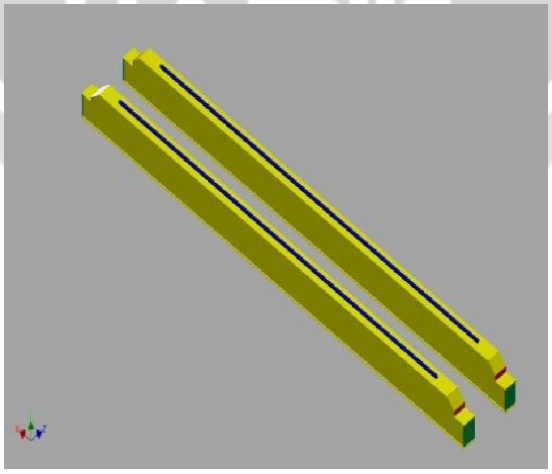

Fig 3. E.O.T Crane Girder

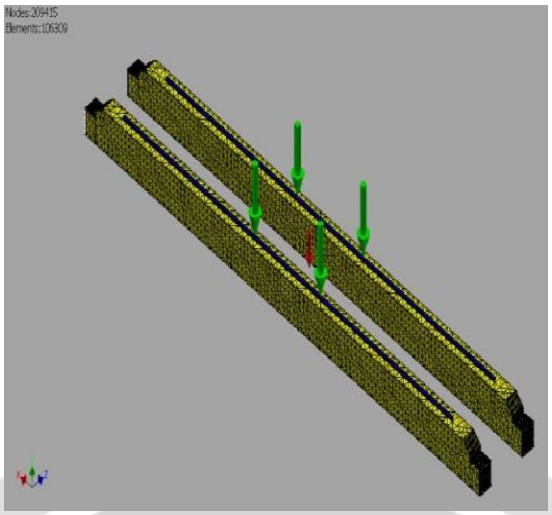

Fig 4. Load applied on crane runway girder

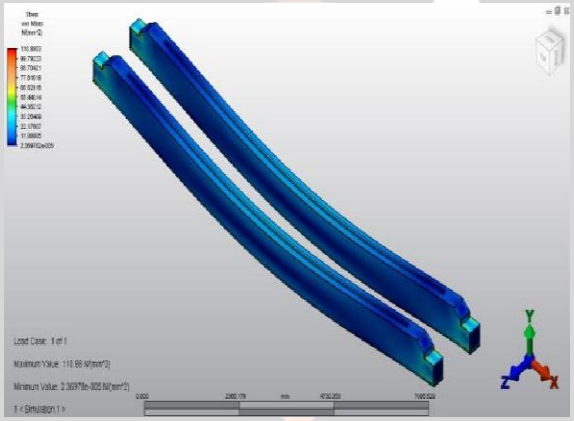

Fig 5. Von-misses stress report of crane girder

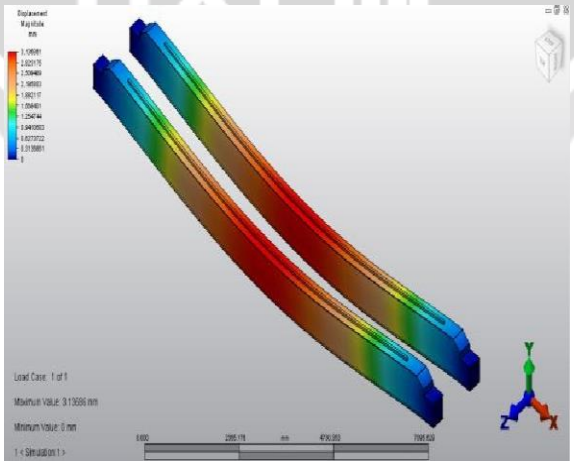

Fig 6. Equivalent stress report of crane girder

II. CONCLUSION & FUTURE SCOPE

From the above comparison between the allowable parameters of Indian Standard codes and the results of finite element analysis of re-designed box girder, it is clearly seen that the maximum stress & displacement which is obtained from the Finite Element Analysis are within the allowable limit of the Indian standard codes. The safety factor is also higher on the permissible value against the Indian standard codes (IS: 3177;807).

The future scope of the current work is that Weight Optimization of Crane Girder can be done by changing the cross section of I-beam and various advanced optimization techniques can be implemented

REFRENCES

[1] Abhinay Suratkar and Vishal Shukla, "3D Modeling and finite element analysis of EOT crane", International Journal of mechanical and production ISSN: 23202092, Volume-1, Issue 2, and Aug 2013.

[2] Patel P. and Nirav K, "Design and analysis of major components of 120 Tones capacity of EOT crane", IJEDR 2014, ISSN: 2321-9939, Volume-2, Issue 2.

[3] Patel Khalidur feasi, Deepali Bharti, "Finite Element Analysis Of 450T EOT Crane Box Girder", International Journal of Advance Engineering and Research Development Volume 2, Issue 11, November -2015.

[4] "Manual under Slung crane package and associated Works", Engineering Projects (India) Limited, Vol-2B.

[5] Omkar K. Sakurikar, D.V. Kushare, "Review of Overhead Crane and Analysis of Components Depending on Span" (IRJET) e-ISSN: 2395 -0056 Volume: 03 Issue: 05 May-2016.

[6] Patel Khalidur feasi, Deepali Bharti, "Finite Element Analysis Of 450T EOT Crane Box Girder", International Journal of Advance Engineering and Research Development Volume 2,Issue 11, November -2015.

[7] Crane Classification, Part-1, IS: 13834-1994.