Design of Stand for Tarpedo Car Reloading Pit

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Abstract— **This work deals with the all the departments in steel plant steel melting shop(SMS) is one of the main department In purifying the steel. Molten pig iron(some times referred as "hot metal") received from a blast furnace through open ladle(150T capacity) or torpedo ladle(300T capacity) is stored in "mixer" of capacity(1300T capacity). The hot metal in open ladle can be directly poured into the mixer, where as the hot metal in the Tarpedo ladle has to be emptied into 2 No's of open ladles. This method is called reloading of Tarpedo ladle and this is in done in a pit (of side 7m x6m x5.85m depth) with vertical stand on either side of the open ladle in taken out from the pit and charged into mixer.**

I. INTRODUCTION

Molten pig iron(some times referred as "hot metal" received from a blast furnace through open ladle which is having the capacity of 150 tonnes or torpedo ladle which is having the capacity of 300 tonnes is stored in "MIXER" Of capacity 1300 tonnes.

The hot metal in the open ladle can be directly poured into the mixer, where as the hot metal in the torpedo ladle has to be emptied into two numbers of open ladles. This method is called reloading of torpedo ladle and this Is done in a pit which is having the size of 7m x 6m x 5.85m depth with two vertical stands on either side of the open ladle. Then the open ladle is taken out from the pit and changed into mixer.

Recently, one of the ladle got damaged and hot metal flown into the pit, which not only damage to the stands inside the pit but also about 600mm height of hot metal was solidified in the pit.

A thorough study to remove the solidified hot metal reveals that, it requires so much time and money to clear it and erecting the new stands. Since the operation of the SMS will be hampered, it is decided that an emergency stand has to be made and put it in operation as soon as possible

Fig:1 The process of pouring hotmetal in tarpedo car reloading pit

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Fig 2 The process of pouring a hot metal by lifting it with the help of heavy cranes

II. DESCRIPTION OF FACILITIES

Fig3 Lifting of tarpedo car with the help of cranes

III. TARPEDO CAR RELOADING PIT

The hot metal in the open ladle can be directly poured into the mixer, where as the hot metal in the torpedo ladle has to be emptied into two numbers of open ladles. This method is called reloading of torpedo ladle and this Is done in a pit which is having the size of 7m x 6m x 5.85m depth with two vertical stands on either side of the open ladle. Then the open ladle is takenout from the pit and changed into mixer.

DESIGN DATA FORMULAE:

Compressive stress=load/area

Shear stress =shear force/area

Bending stress=maximum bending moment / section modulus

Where,

Section modulus=bd2 / 6

Factor of safety= maximum allowable stress / actual stress

DESIGN DATA CALCULATIONS

PIT CALCULATIONS:

The six beams of the stand consists of one side is fixed and the other is having the load of 200Tonnes

But on each beam=200T / 6=33.3T

The load on each beam is 33.3T

load =33.3T

=33.3x1000 kg

=33300 kg

=33300x9.81 N

= 326673 N

STRESSES:

1. **Compressive stress**= load/ area

=load / (lxb)

= 326673/(6X320)

=170.14N/mm^2

Factor of safety = 410/170.14=2.40

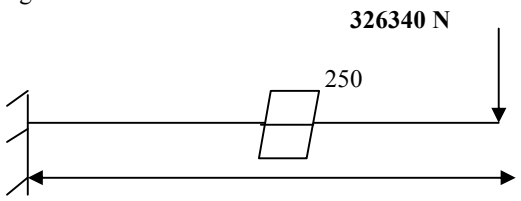
2. bending stress

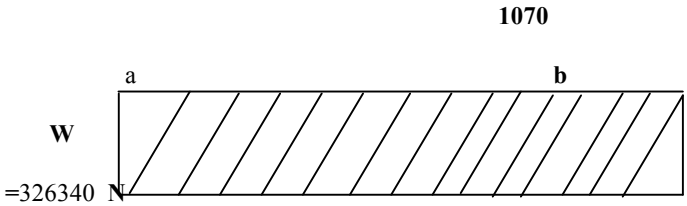
The six beams of the stand consists of one side is fixed and the other is having the load of 200Tonnes

But on each beam=200T / 6=33.3T

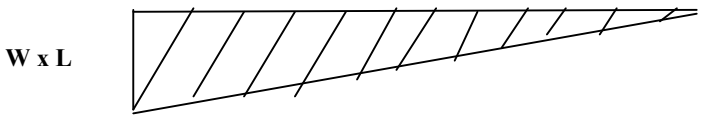
The load on each beam is 33.3T

The beam looks as a cantilever as the shear force and bending moment diagram is as follows





shear force diagram



=349183800 N-MM

bending moment diagram

section modulus (z) = bd2 /6

=250x320^2/6

=4266666.667

Maximum bending moment = w x l

=349183800 N-MM

Bending stress = Mmax / Z

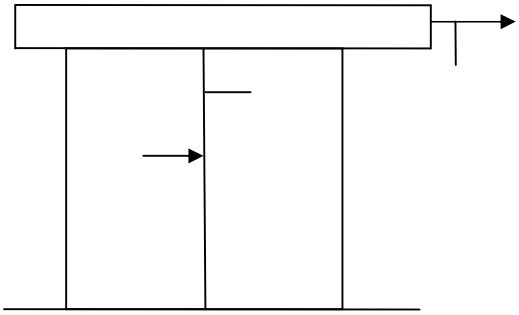
=349183800/ 4266666.67

=81.83 N/MM2

Factor of safety=81.83/410

=5.009

3. **shear stress** = 100T



(t) = shear force / area

=326340/(320x6)

=169.9 N/MM^2

Factor of safety =410/169.9

=2.41

4. Shear stress for welding section:

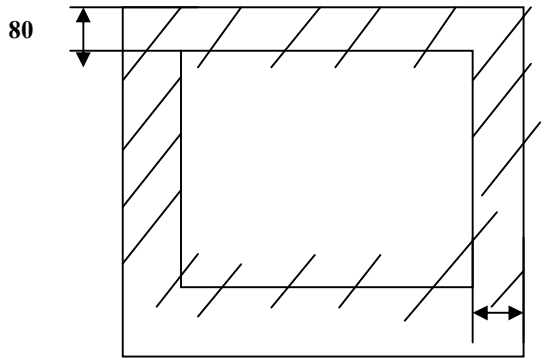


Fig : Foot diagram of welding section

Shear area of welding section = (320x250)-(160x90)

=65600 mm^2

Shear stresss =shear force/area

=326340/65600

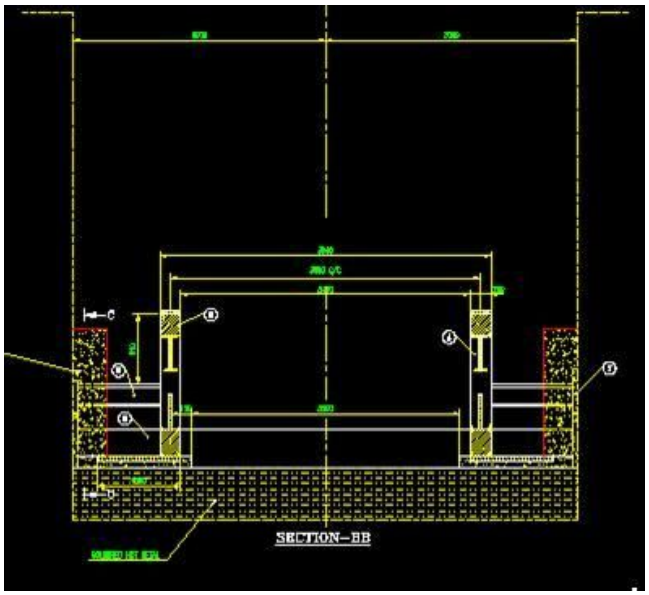
=4.97 N/mm^2

Factor of safety =410/4.97

=82.41

This figure shows the 2D view of total section of stand, used to hold tarpedo car reloading pit

This figure shows the 2D view of section –AA(top view) of stand, used to hold tarpedo car reloading pit



This figure shows the 2D view of section -BB(front view) of stand, used to hold tarpedo car reloading pit

IV. SUGGESTIONS/PRECAUTIONS

1. if any structural found to be bend or damaged, it should be replaced immediately for avoid further damage.
2. The ladle should be properly placed on the horizontal blooms. A side ways jerk may damage the three vertical posts or its welding.
3. The p.c.c should be periodically checked and maintained properly for the rigidly of the stand

ADVANTAGES

1. Used the freely available items in the plant
2. Simple for design and fabrication
3. Stand can be fabricated out side the pit, which will not intercept the cleaning by or civil foundation work inside the pit
4. Less time required, since it does not involve any external agency
5. Cheaper compared to normally used castable stand
6. More rigid than the older or previous stand
7. No other alternative since the hotmetal was solidified for about 600mm height.

CONCLUSION

A thorough study to remove the solidified hot metal reveals that it requires so much time and money to clear it for erection the new stand. Since the operation of the SMS will be hampered, it in decided that an emergency stand has to be made and put in operation as soon as possible.

Finally our project team has studied the problem and schematic drawing was got approved by the plant design and SMS department and done all the necessary calculation and found minimum factory of safety of the new stand is five. The stand was immediately fabricated and put it operation which in success.

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