

# International Journal of Innovative Research in Science, Engineering and Technology

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## Design of Semi Automatic SAW Platform

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**ABSTRACT:** Automation systems are rapidly taking the place of the human work force. One of the benefits is that this change provides the human work force with the time to spend on more creative tasks. Increased quality requirements for products and the trend to automate production processes along with increased profitability result in the use of automation in modern manufacturing. With the rapid developing of economy, India has gradually become a manufacturing giant in the world. Welding is one of the most important technologies of materials forming and processing in modern manufacturing industry. Welding is the primary connecting process in oil, gas, and grain storage tanks, boiler and condenser construction. Automated systems play an important role in achieving higher quality and productivity in a cost-effective way. The objective of this project is to reduce the time and cost required for arrangement of Submerged Arc Welding (SAW).

### I. INTRODUCTION

Shell is the main component of cylindrical jobs such as pressure vessel, boiler, petroleum storage tank, chillers etc. Shell thickness varies from 20 to 150 mm depends on inside pressure. Manual welding by Shielded Metal Arc Welding (SMAW) takes lot of time to weld such a large thick shell and it is not economical too as consumables used in this process is costlier. To overcome this problem industries started automated SAW welding which is economical as well as it reduce time for welding. But the drawback of this welding process is takes lot of time for arrangement before welding starts as it required rigid platform for smooth finish of welding. Industries used scaffolding to make temporary platform for welding. For every shell welding they made separate platform. This requires lot of time and cost. To reduce this time and cost I suggested a semi automatic platform which can be used for wide range of shell welding and it reduces the cost and time and to improve safety and productivity.

### II. EXISTING TECHNIQUE

Welding is the primary function of manufacturing industries. After rolling of shells longitudinal setup is done to ensure dimension of shell before welding. In shell setup stage tack welds of approximate length 150-200 mm is carried out so that after setup inspection it can be moved from setup station to welding station. In welding station before starting of SAW welding which is semi automatic welding process a fixture or platform is required to keep track is kept on which trolley moves. This platform is made for each and every shell depends on its length and diameter. Scaffolding is used to make such a temporary rigid platform so that it can sustain SAW trolley and workers load. It required lot of time to make platform for every shell before start of welding.



Fig-1 Existing platform for SAW welding

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## III. SUGGESTED TECHNIQUE

### a. Component

#### 3.1.1. Platform Plate

Weight acting on platform-

- The tank welder cradle includes frame and operator platform, bearing the operator and system controls, flux feed and recirculation system, welding machine, as well as welding control and wire feed unit.
- Operators-  $4 \times 65 = 260$  kg
- Welding machine with wire and flux feed unit- 150 Kg
- Recirculation system-500 Kg
- Total approximate weight on platform-910 Kg
- 1.5 Factor of safety taken for this design.

$$\frac{M}{I} = \frac{\sigma_t}{Y_t}$$

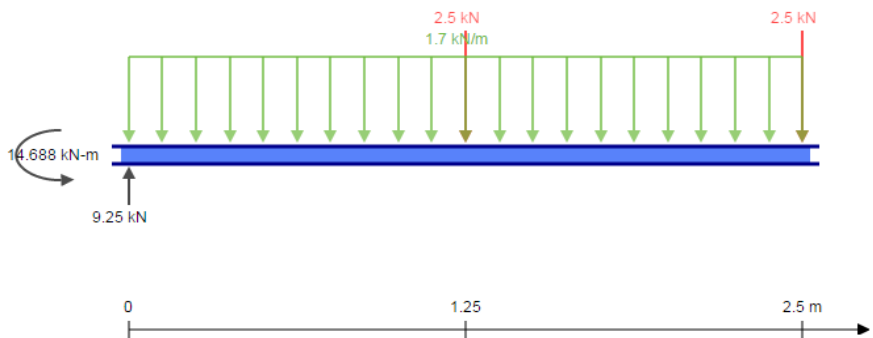
Maximum bending moment is  $6.25 \times 10^6 \text{ N} \cdot \text{mm}$

$$t = 11.57 \text{ mm} \approx 12 \text{ mm}$$

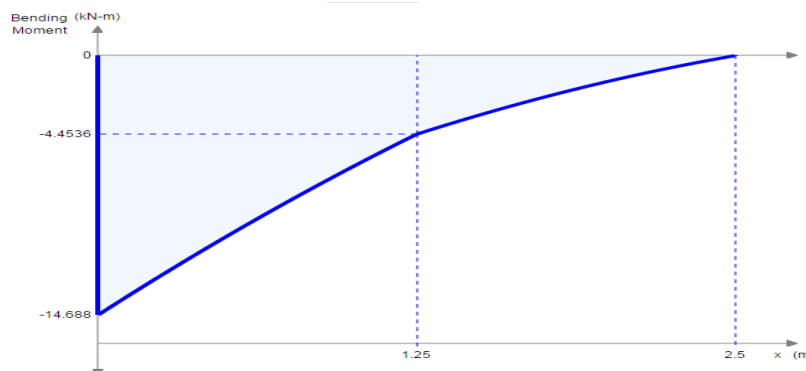
#### 3.1.2. Supporting Cantilever

Weight of plate =  $12 \times 3500 \times 25 \times 78 \times 10^{-9}$   
 = 819 Kg for 2.5 m  
 = 1607 N/m shares by each support

Weight of workers, machines, Recovery = 10,000 N  
 = 5,000 N shares by each support



**Fig-2** Shear force diagram of supporting cantilever



**Fig-3** Bending Moment diagram of supporting cantilever

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$$\frac{M}{I} = \frac{\sigma_t}{y}$$

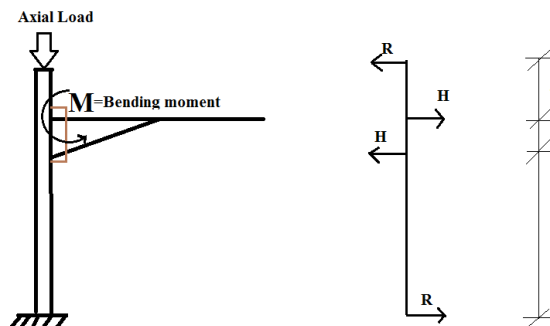
$$\frac{I}{y} = \frac{M}{\sigma}$$

$$Z = \frac{14.688 \times 10^6}{112}$$

$$= 131.14 \times 10^3 \text{ mm}^3$$

ISLB 200 (Z=169.7 cm<sup>3</sup>) I section rolled steel beam is used.

### 3.1.3. Column



**Fig-4** Loading diagram of Eccentric loading column

$$\therefore \text{Bending moment at B is} = -R \cdot a$$

$$= -\frac{M}{L} a$$

$$\text{Bending moment at C is} = R \cdot c$$

$$= \frac{M}{L} c$$

Maximum Design moment=Max(Max +ve BM, Max -ve BM)

$$\text{Design axial Load} = 5000+12000$$

$$= 17 \times 10^3 \text{ N}$$

Allowable axial compressive stress,

$$\sigma_{ac} = 70 \text{ N/mm}^2$$

$$\text{Area, } A = \frac{17 \times 10^3}{70} = 242.85 \text{ mm}^2$$

$$\text{Eq Area} = 2 \times 242.85 = 585.7 \text{ mm}^2$$

From I. S. Handbook No. 1 select a suitable section furnishing cross section area next to the value calculated above. Provide ISHB 150 @ 27.1 N/m.

$$\frac{\sigma_{ac \text{ cal}}}{\sigma_{ac}} = \frac{C_{mx} \cdot \sigma_{bcx \text{ cal}}}{\left\{ 1 - \frac{\sigma_{ac \text{ cal}}}{0.60 f_{ccx}} \right\} \sigma_{bcx}} \leq 1$$

Where,

$\sigma_{ac \text{ cal}}$  = calculated average axial compressive stress

$\sigma_{ac}$  = permissible axial compressive stress

$\sigma_{bc \text{ cal}}$  = maximum bending compressive stress taking into account the additional moment due to axial load interacting with deflections

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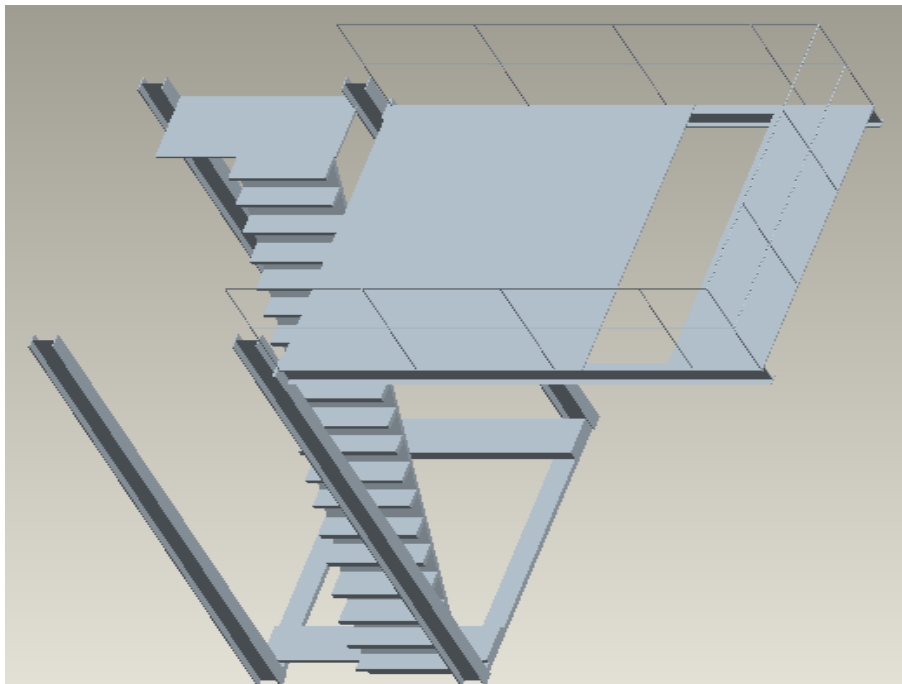
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$\sigma_{ac}$  = calculated average axial compressive stress  
<sub>cal</sub>

$\sigma_{bcx}$  = permissible bending compressive stress about major axis.

$\sigma_{bcx}$  = calculated bending compressive stress due to bending moment about major axis.  
<sub>cal</sub>

## b. Working Principle



**Fig-5** Proposed design of SAW platform

First step is to keep shell on tank rotator and then place the platform such a way that the gap provided on platform is above the shell seam. The cantilever type structure which is act as a support for SAW trolley, track, flux recovery machine and welder. The gap is provided on support to adjust track depending on the position of shell. Track must be parallel to the seam of shell. Height of cantilever support is adjusted by keeping gap of 50-60 mm from shell. Adjustment is done using EOT crane no separate drive mechanism is used to adjust height of cantilever. After setting it at required it should locked using pin slot mechanism. It will reduce the time required for arrangement for SAW welding.

## IV. CONCLUSION

New platform will results in quick adjustment, quality improvement, reduction in manpower requirement, improvement in production flexibility. It is safer than existing platform. It reduces the overall cost of production and improves productivity.

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