EMship Week - 2019

Control of Welding Deformation in Thin Plate

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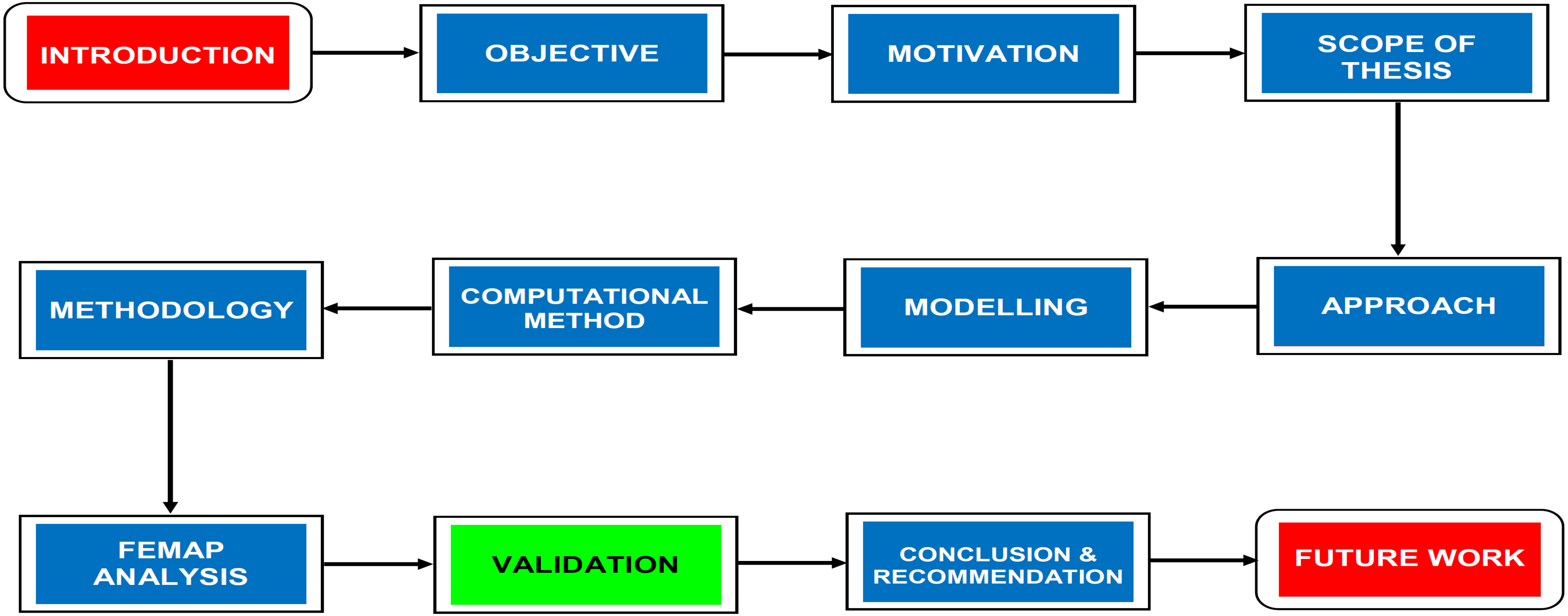
Scheme of Presentation



Introduction

1. For **7 decades** welding deformation problem still under analysis.
2. Welding deformation has a non – linear problem.
3. The Critical issue in tugs, Yachts and Ferryboats building.
4. Decrease productivity & increase production cost.

Objective

To control the welding deformation in thin plate at the time of welding process.

Motivation

- In **last year** of the shipyard, shipyard faces the deformation in the structure of tug.
- Due to the large spacing between profiles.
- By this reason, a lot of time consume to straightened the plates.

Scope of Thesis

- This thesis is performed to get the good outlook of the ferry ships and Yachts. Because of ship owner requirement.
- But at the meantime productivity of the ship is also under consider.
- That is why this thesis is performed to increase the productivity of the ship.

Approaches

There are three approaches to analyse the welding deformation in the thin plate:

1. Analytical Approach
2. Computational Approach
3. Experimental Approach

Approach Adopted

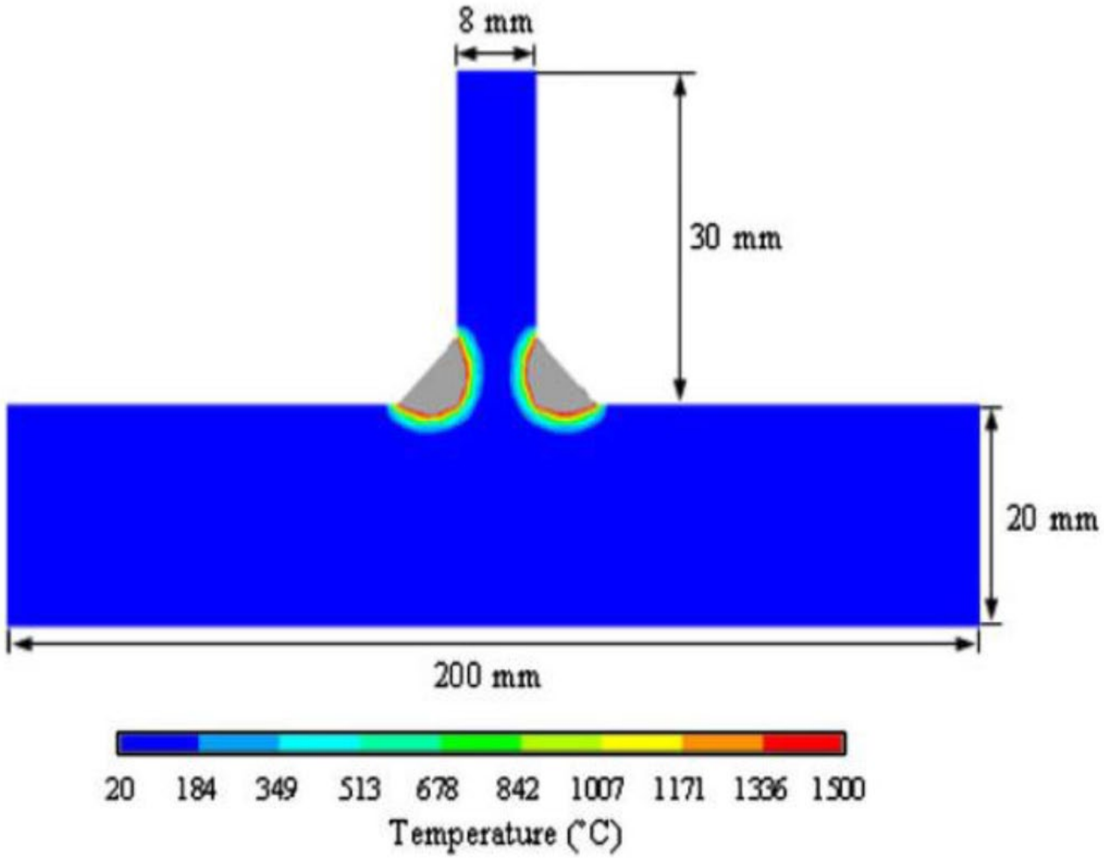
- Computational Approach.
- Productive approach other than two approaches.
- Both Thermal and Mechanical Analyses are performed.

Modelling

- In Shipyards, **Grade "A"** steel is used in thin plate.
- The model assumes to be a **temperature** dependent.
- The following properties are the dependent of temperature is given below:
    - Yield Stress
    - Elastic Modulus
    - Thermal Expansion and
    - Poisson`s ratio.

Modelling

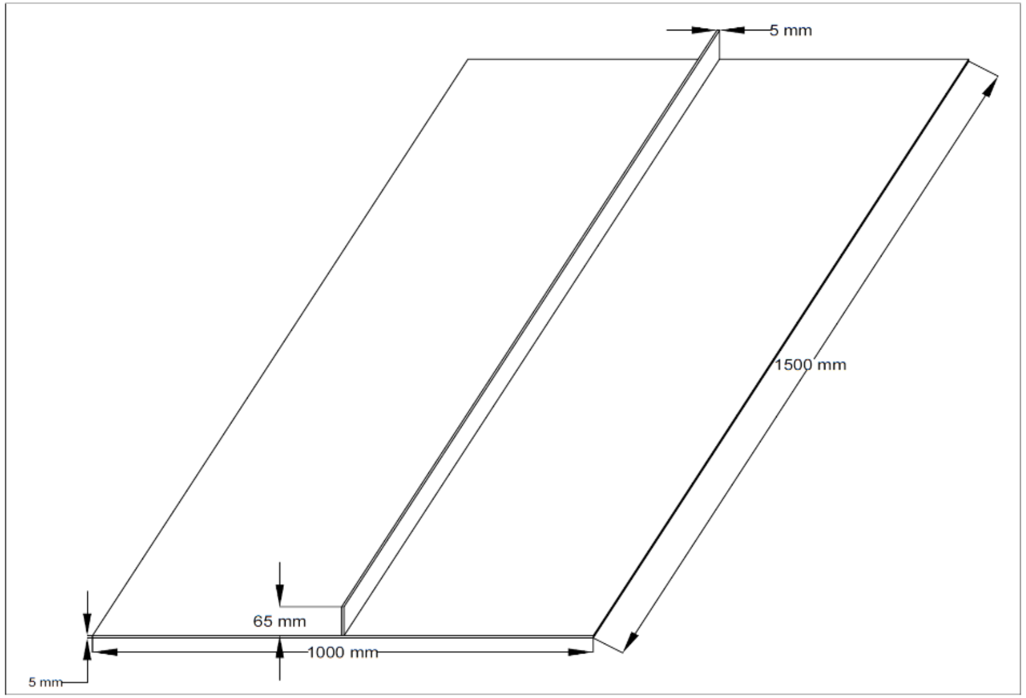
- "Barsoum et al" Model
- Maximum Temperature = 1500°C
- Minimum Temperature = 20°C



Models

MODEL # 1

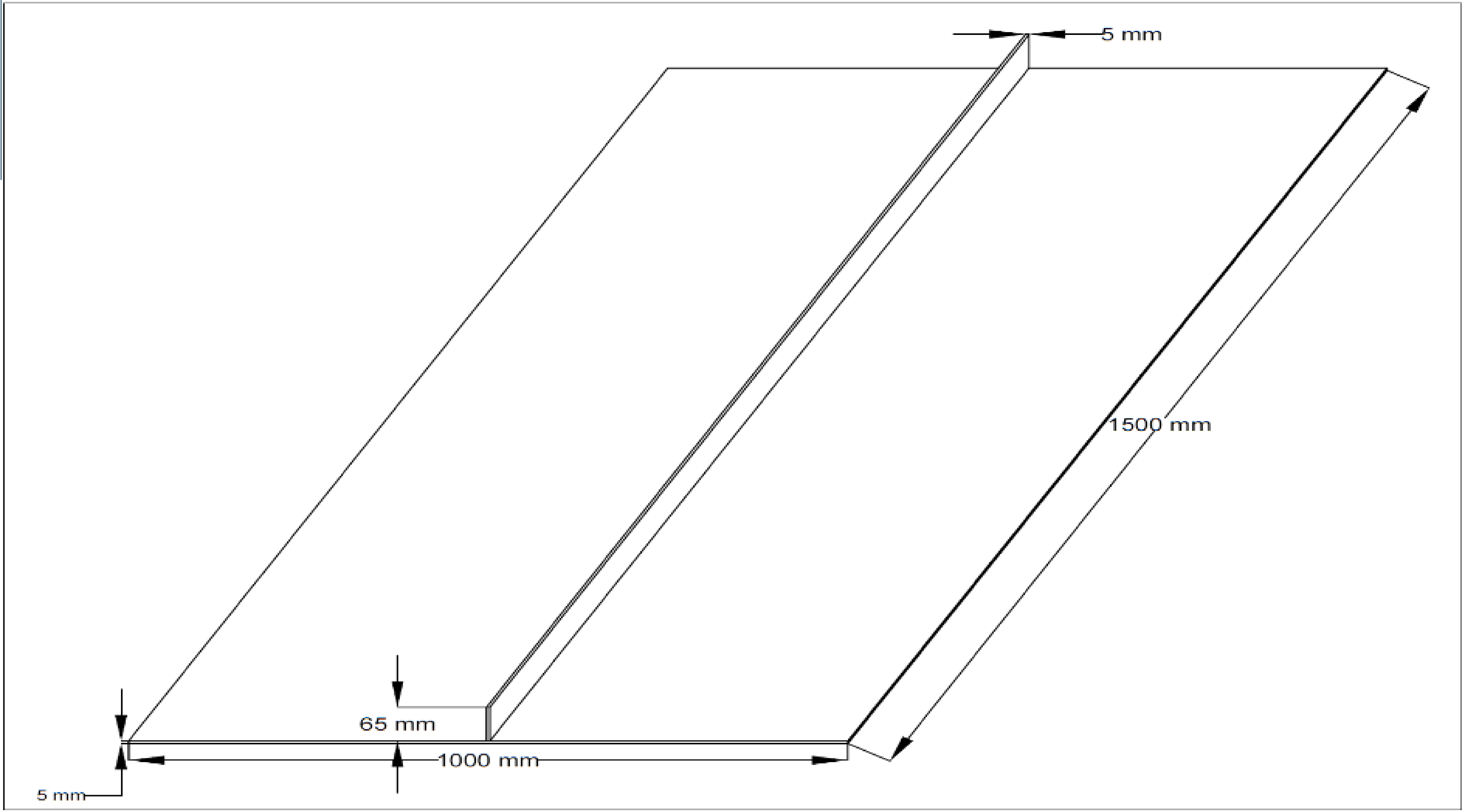
One longitudinal profile with base plate.



DIMENSION

Base Plate = 1000 x 1500 x 5 mm^3

Long. Profile = 65x1500x5 mm^3


5 mm
1500 mm
65 mm
1000 mm
5 mm

Models

MODEL # 2

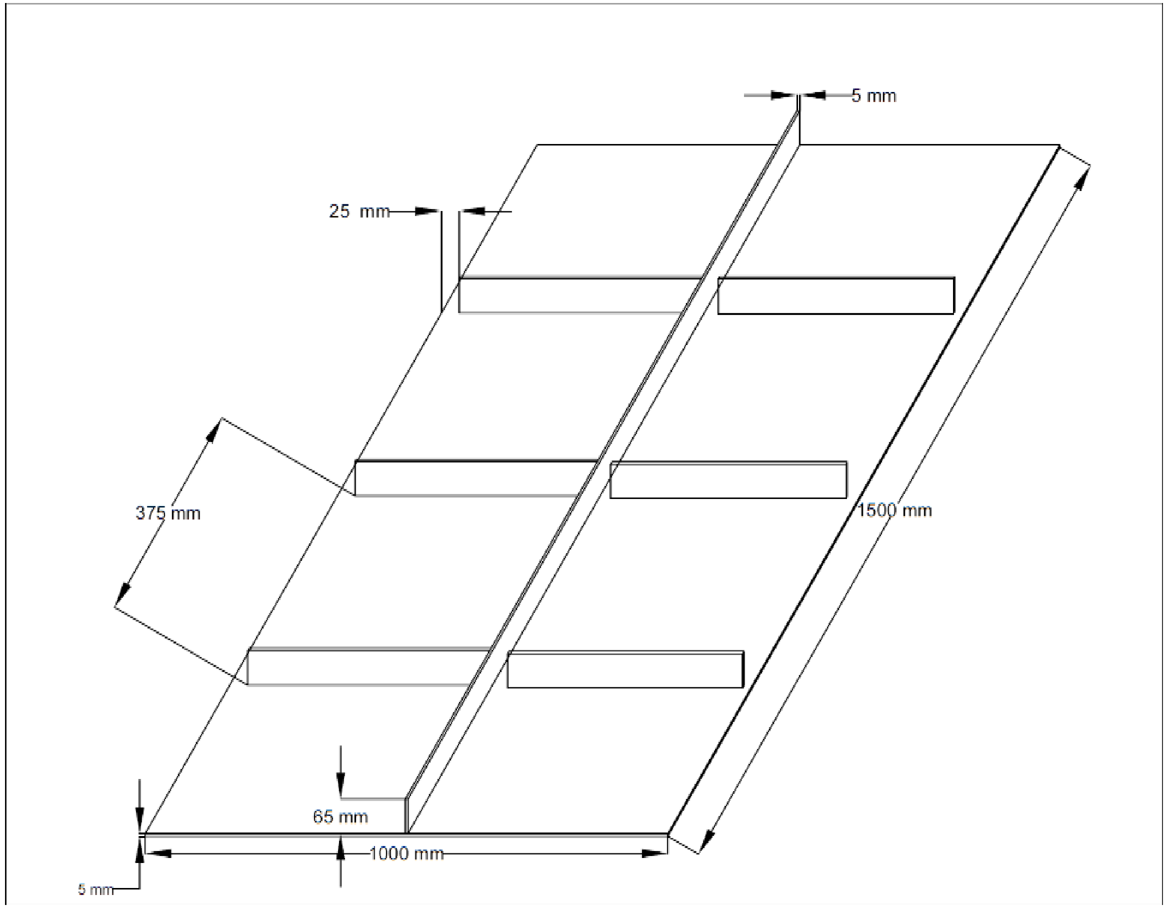
One longitudinal & three transverse profile with base plate.

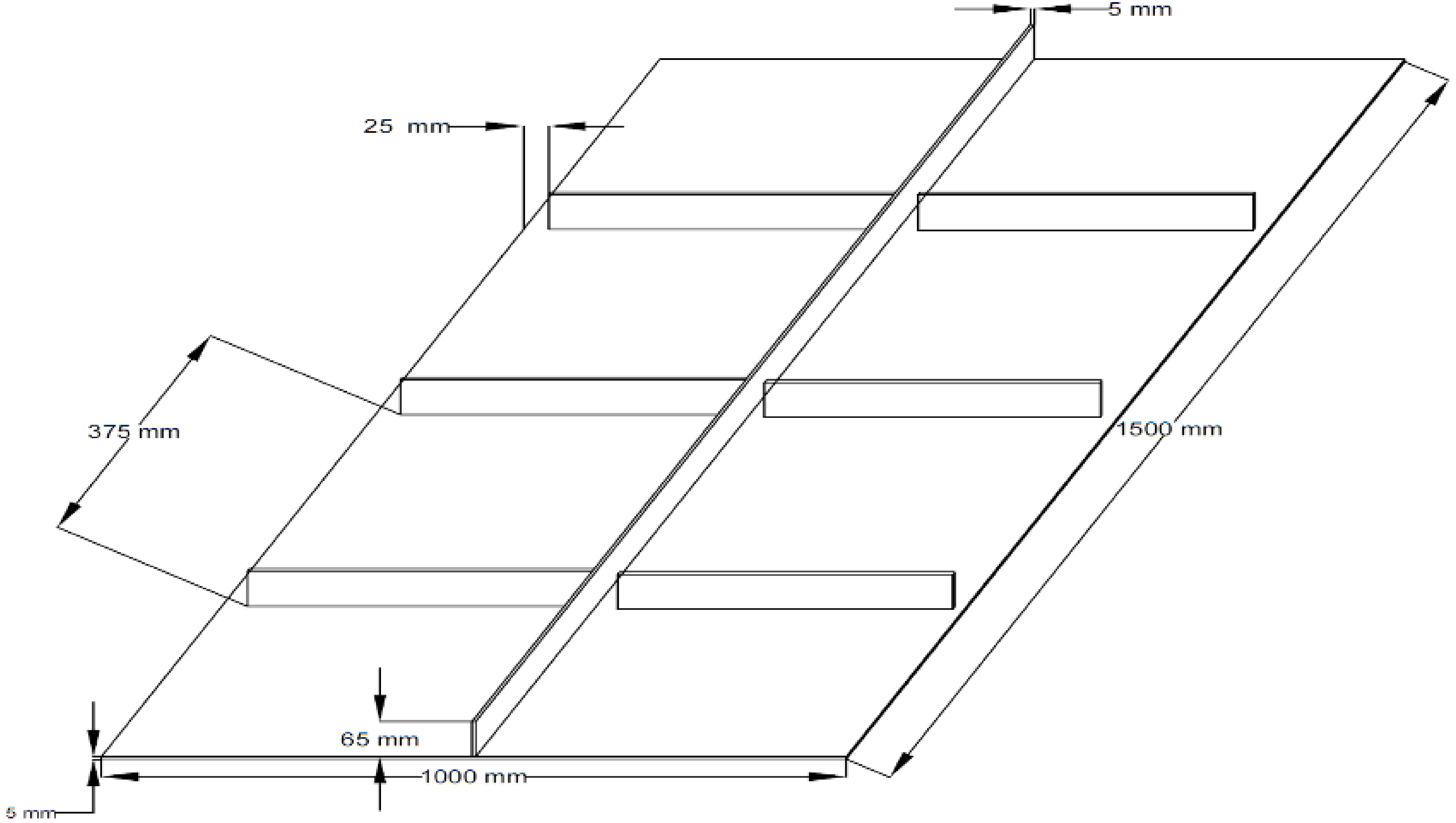
DIMENSION

Base Plate = 1000 x 1500 x 5 mm^3

Long. Profile = 65x1500x5 mm^3

Trans. Profile = 50x450x5 mm^3

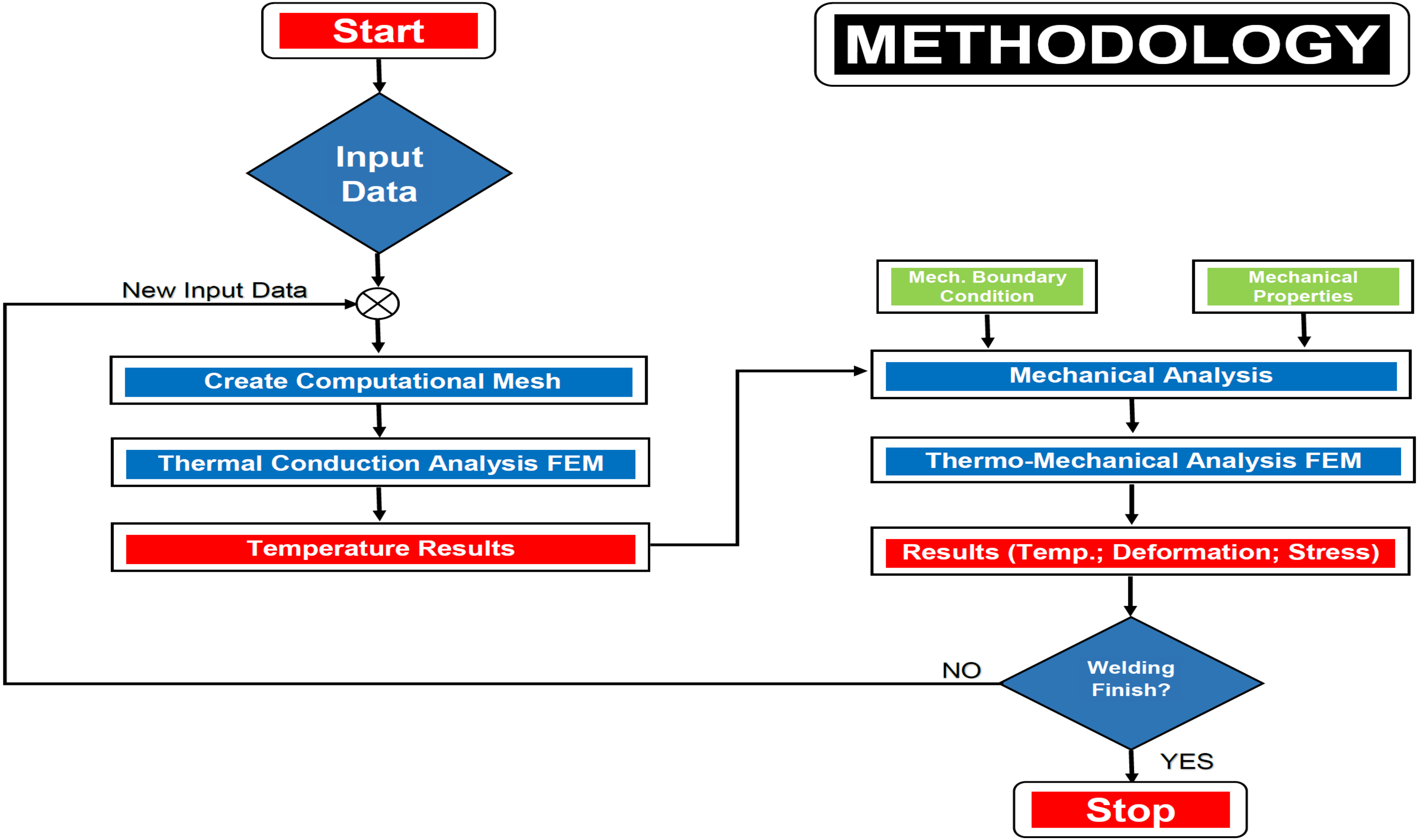



5 mm
25 mm
375 mm
1500 mm
65 mm
1000 mm
5 mm

Computational Method

1. Software – FEMAP.
2. Fillet weld is analyzed.
3. Analysis to measure the thermal load and total deformation for TEP – FEM.

METHODOLOGY



FEMAP Analysis

- FEMAP Software
- 10 Case Studies are analysed.
- After 10 case studies, Model # 2 give the good result.

FEMAP Result

CASE STUDY # 1

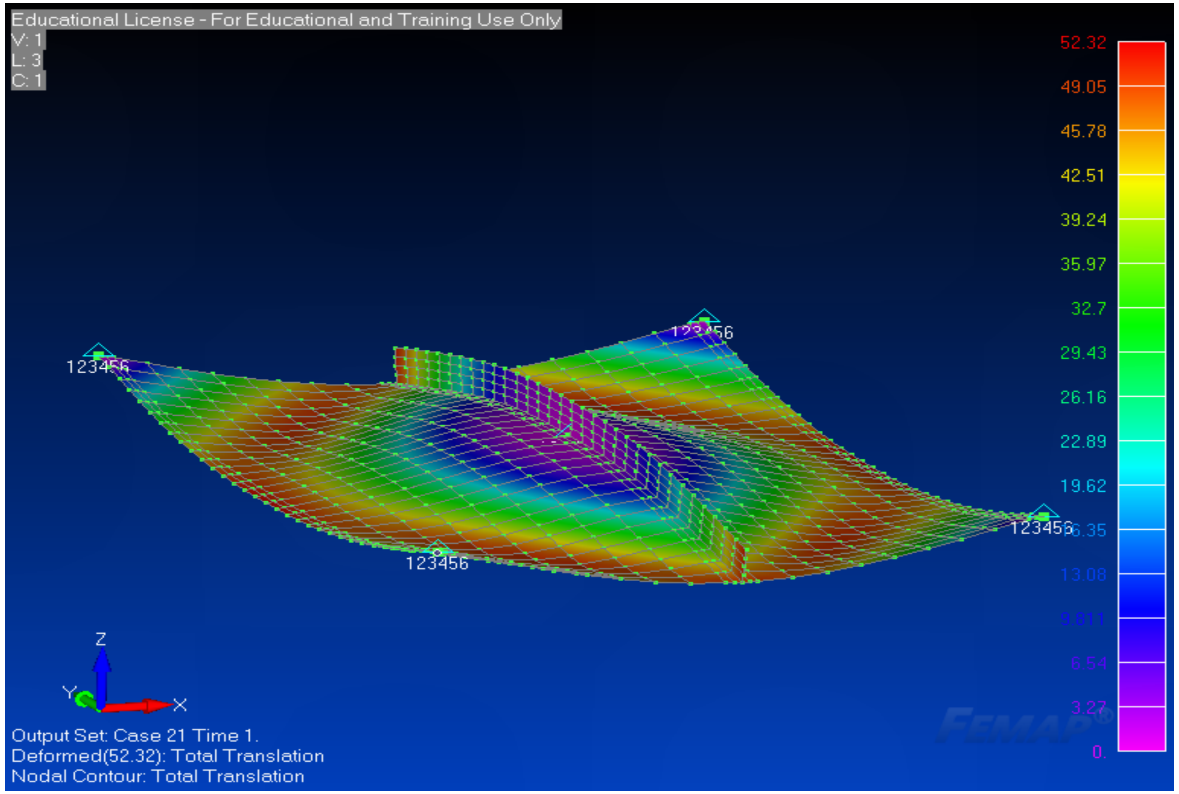
Fillet Joint Weld by continuous welding with Longitudinal member.

CONDITION

Constraints = Fixed from the corners and centre of the base plate.

No. of Nodes = 957

No. of Elements = 896



Total Deformation = 52.32 mm

FEMAP Result

CASE STUDY # 2

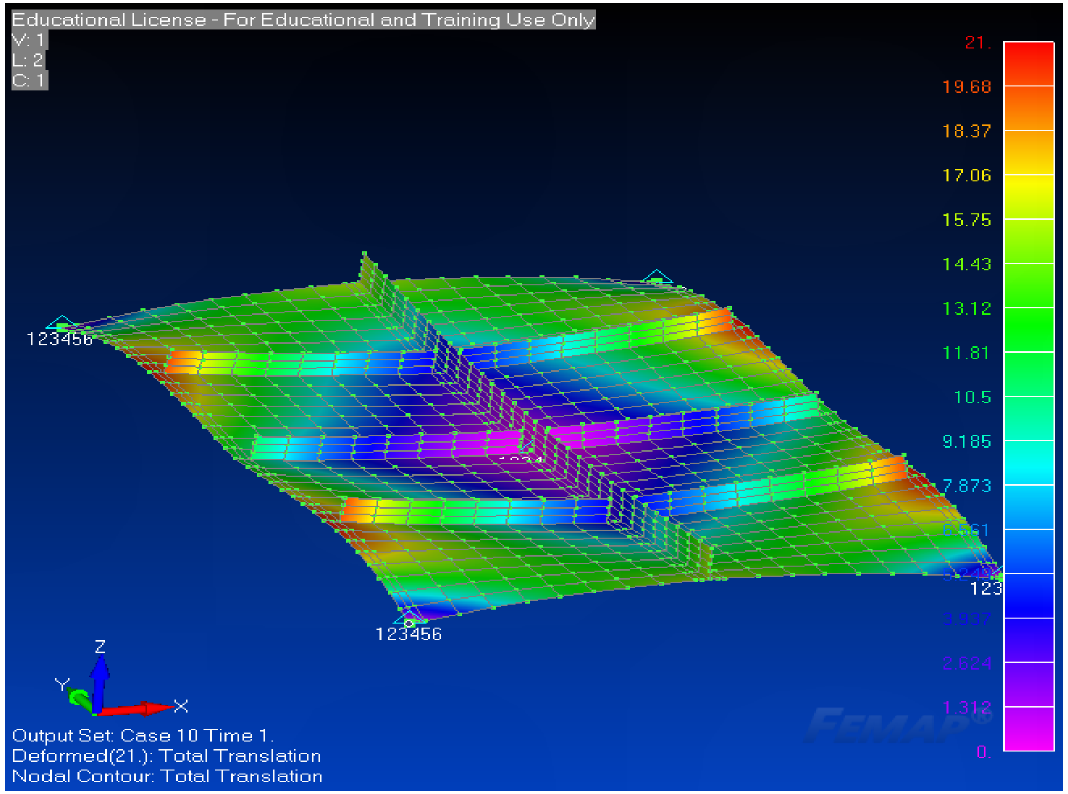
Fillet Joint Weld by continuous welding with Longitudinal member & six transverse members.

CONDITION

Constraints = Fixed from the corners and centre of the base plate.

No. of Nodes = 1119.

No. of Elements = 1040.



Total Deformation = 21 mm

Fillet Joint Weld – Transverse Platting Method

- Reduction of welding deformation in the thin plate up to **60%.**

- Analysis is done in both welding condition:
    - Tack
    - Continuous

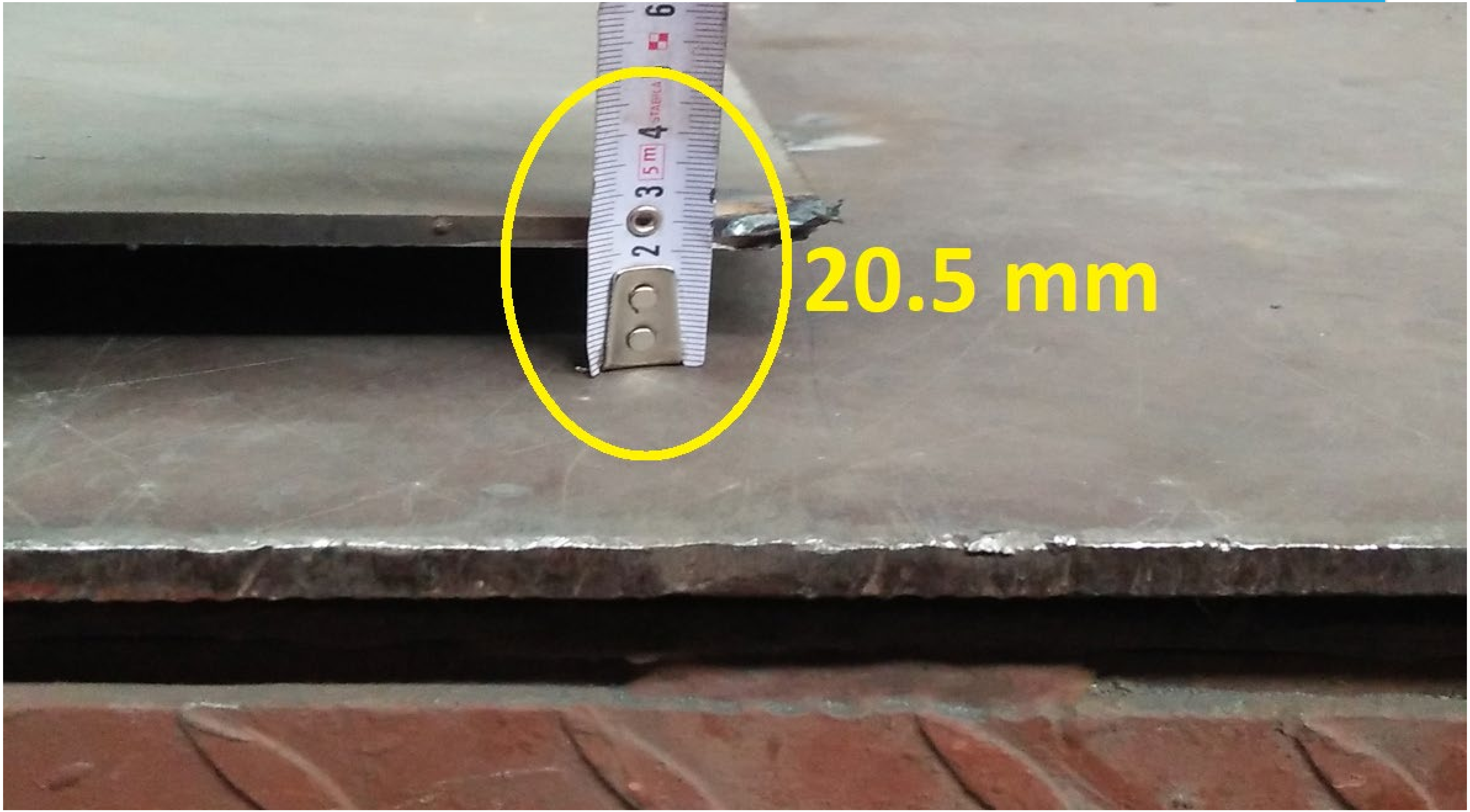
- After this analysis - transverse Platting method.

Validation

- The experimental analysis result is **20.5 mm**.

- The error between both the analysis is **2.5%.**

- Both the analysis are validated.


20.5 mm

Conclusion

- During Welding Process this method is applicable.
- More productive than other methods.
- Productivity of thin plate just in Bulkhead w.r.t time and labour cost is **12 – 14%.**

Recommendation

The following methods can be analysed in future in the shipyard:

1. Clamping Method
2. Welding Procedure Specification (W.P.S)
3. Different Welding Sequence
4. Inductive Faring Method

Future Work

1. For Large and Complex Structure
2. Clamping System
3. Reinforcement Methods
4. Inductive Fairing Method
5. Low Transformation Temperature (LTT) Filler Wires
6. Virtual System

Emship Week – 2019

THANK YOU FOR YOUR ATTENTION !!