

# “Structure Optimization of Control Panel”

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## Abstract —

*“Pre-assembled fenced in area divider board framework has a place with a specific sub-classification of Off-Site Manufacturing (OSM) development frameworks, which are regularly utilized for monetary as well as aesthetical reasons. Anyway the innovations accessible for these frameworks can possibly boost the useful and constructional advantages of panelized fronts, thus contributing for the advancement of superior machine envelopes.”*

**Keywords —** “Off-Site Manufacturing (OSM), panelized fronts, superior machine envelopes, sheet metal stamping, Die design”

## I. INTRODUCTION

Sheet framing is a critical net shape fabricating cycle of delivering an enormous assortment of customer items (kitchen sinks, sticks, cupboards, boxes, sections, and so on) And aviation parts (body boards, wing parts, and so on) Bite the dust plan in sheet metal framing, even after numerous long stretches of training, actually stays a greater amount of a craftsmanship than a science. Generally the development of a sheet metal stepping from origination through part configuration to kick the bucket plan to the last pass on give a shot has been a lethargic, wary interaction dependent on the experimentation experience and expertise of the craftsman. Welding measure after the sheet twisting is a greater amount of the expertise based work.

Pre-assembled nook divider board framework has a place with a specific sub-classification of Off-Site Manufacturing (OSM) development frameworks, which are oftentimes utilized for monetary and additionally aesthetical reasons. Anyway the advances accessible for these frameworks can possibly boost the utilitarian and constructional advantages of panelized fronts, thus contributing for the improvement of superior machine envelopes

## II. LITERATURE SURVEY

Writing for Optimization of design of Control panel was gathered from different sources. Scholastic articles, reports, and studies were gathered and examined from data sets, web searches, and Publications. The objective of this writing Review is to give a reasonable setting of the state, public, And worldwide discussion on this interaction.

The first survey is an R. Mantripragada, G. Kinzel, T. Altan, explained that A component based way to deal with model sheet metal parts during the plan and investigation measure has been pre248 R. Mantripragada et al./Journal of Materials Processing Technology 57 (1996) 241-248 sented. Highlights permit an organized portrayal of information which can oblige data about numerous parts of the plan in a typical plan. They permit the PC to catch and control the plan data and, eventually, to decide. The CAE framework created can be utilized for formability investigation and plan for assembling examination of box-type parts shaped from sheet metal. Its scope of relevance ought to be adequately enormous for a few assembling organizations to be keen on utilizing it. Additionally, the construction of the program is to such an extent that it will be not difficult to make improvements later on by evolving clear cut modules. The information based master framework gives a climate to the plan of 'hard' tooling. This climate will be utilized to help the accomplished planner to develop part models helpfully and to change another part plan into a manufacturable one. [1]

The second survey is an Xiaobing Danga, Kai Heb, FeifeiZhangb, RuxuDua, clarified that Incremental twisting is an exceptionally adaptable framing strategy. It tends to be done by utilizing more than one twisting device. A few strips can be twisted all the while, which thusly, improves shaping productivity. Two techniques can be embraced: one is unconstrained various devices twisting and the other is compelled numerous instruments bowing. The compelled methodology would essentially diminish intricacy of model. In obliged different instruments bowing technique, the direction along the primary strip is determined by least energy guideline. The direction along different strips is determined by that along the principle strip and intuitive mathematical data between strips. The obliged numerous apparatuses twisting procedure can be effectively utilized in gradual bowing. A sort of factor shape sheet metal has been framed by the

strategy. The framing activity requires just 27 minutes. The nature of definite workpiece is high. Its surface is smooth, and no punching dimple or plastic pivot shows up. [2]

Hosein Moazami Goodarzi, Souvik Pal, Douglas Down, Mohammad Esmalifalak, Ishwar K. Puri, explains that the temperature dissemination and wind stream inside an encased rack that is inside incorporated with a RMCU. Investigations uncover impacts because of latent workers, IT load thickness, IT load dissemination and cold chamber profundity that control worker setups and rack calculation. Another measurement, ASTD, is developed to evaluate RMCU execution.

In this Survey we discover: (1) The measure of required cold wind stream per unit IT load in the encased rack coordinated with a RMCU is up to 50% lower than required cold wind current for customary cooling frameworks. (2) Regardless of RMCU area, there is a temperature inclination in the virus office of an encased rack. (3) The pressing factor distinction  $\sim 10$  Pa between the cold and hot chambers is an element of the worker and RMCU stream rates. (4) Passive workers act as permeable conduits put between the hot and cold chambers, permitting in reverse spillage of  $\sim 0.00377$  m<sup>3</sup>s<sup>-1</sup> of warm air from the hot chamber to the virus chamber. (5) Replacing latent workers with blanking boards gives a more uniform temperature dissemination. [3]

The fourth survey is an Takashi Kuboki a, Armad Azrie a, Yingjun Jin, explains that Incremental shaping would have the possible capacity of creating miniature underlying parts. Saotome et al. fostered an interaction called "steady framing by pounding" for creation of miniature primary suspension. Unexpectedly, gradual shaping has been utilized for framing in standard scales also. Matsubara controlled cost ways by PC mathematical control. Malhotra et al. improved formability by apparatus way streamlining. Martins et al. applied steady shaping for the creation of polymers. All the above framing uses point beating. Then again, the creators proposed gradual in-plane twisting with shifted punch for sheet metal with 2 mm thickness. The technique used line beating, which would acknowledge higher usefulness than point beating. Notwithstanding, it was not appropriate for twisting more slender sheet metals in small sizes. [4]

Thus an inventive steady in-plane bending of dainty metal sheets for assembling infinitesimal machine components. The interesting component of the interaction is that a tiltable punch having a beating face with trapezoidal profile was utilized. The beating face

empowered the punch to twist slight metal sheets in-planemanner. The toe point of the beating face of 30 degrees was the most effective among the attempted conditions in this paper. Working conditions, including space and taking care of pitch, can easily and deftly control the twisting span. Specifically, the feeding pitch, which is effortlessly changed during shaping, had the option to control the twisting heading. The in-plane twisted slim sheet items are expected to be utilized as springs, funnel shaped chambers, shrubberies and other components of miniature machines like clinical instruments.

### III. PROPOSED METHODOLOGY

The proposal methodology for implementation of the proposed system includes:

The streamlining of Control board construction will go through significant after stages. This portion clarifies the different instruments and gear that will be needed during this entire interaction

#### 1. REVERSE ENGINEERING OF CAD MODEL FROM ACTUAL MODEL

Computer aided design (Computer-supported plan) model is fundamental for age of IGES information and DXF record that will be feed to laser machine for assembling. The ordinary board structure is estimated and drafted in CAD programming. Computer aided design model then, at that point is made by the orders in Solidworks 2019 of Extrude, Cut, fillet, and mathematical choices partially plan module. Parametric age of drawings will assist with getting the measurements helpful in powers computations in static stacking conditions on a segment. [5]

#### 2. MATERIAL SELECTON

Material determination assumes a significant part. Sheet metal will be metal shaped by a mechanical cycle into dainty, level pieces. Sheet metal is one of the crucial structures utilized in metalworking and it tends to be cut and twisted into an assortment of shapes. Innumerable ordinary articles are manufactured from sheet metal. Thicknesses can differ essentially; very meager sheets are viewed as foil or leaf, and pieces thicker than 6 mm (0.25 in) are viewed as plate steel or "underlying steel."

### IV. ARCHITECTURE OF PROPOSED SYSTEM

In Figure 1, we have presented Overall Progress of Process and Structural Optimization of Control Panel to Enhance Productivity.

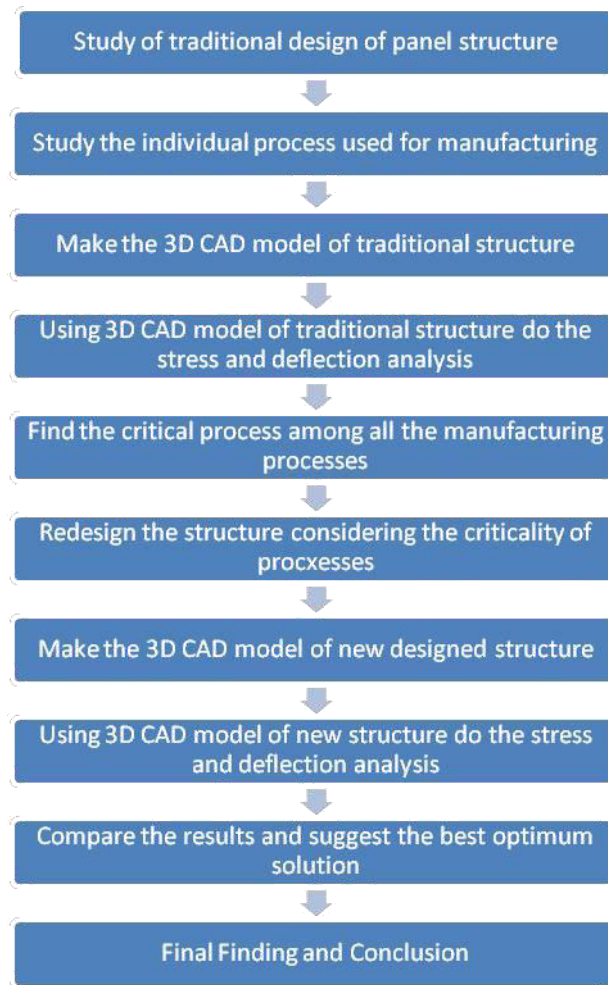


Figure 1: Architecture of Proposed System

The proposed work in this paper is there are 2 significant plan ideas as underneath, on which future work is reliant.

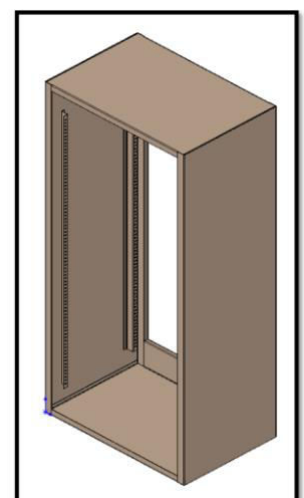
- Construction utilizing shot construction (Box type), in which standard parts are utilized. The crude material amount of level sheets will be diminished and the ability based creation would be kept away from. The construction sections can be produced in mass and side covers can be darted as and when required. The base would be manufactured to primary sections. Accordingly the power would be conveyed by sections and straightforwardly to the base.

- Construction utilizing riveting. In this kind on development the side board is bolted to structure straightforwardly. Adaptability of opening board from sideways for upkeep design is lost for this situation. Riveting diminishes vibration in board. It is unbending and should be possible utilizing pneumatic riveting firearm. Gifted work isn't needed for this situation .

### V. CAD Model of traditional Panel



Present Structure

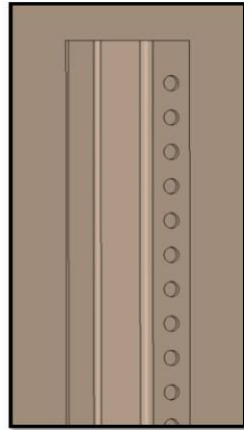


Present Structure (CAD)

Mounting Bracket is the main part of structure. It is stitch welded with the side frame. This bracket carries the load from the mounting plate to structure frame. It is the first contact with the load. Welding of bracket plays an important role. The stitch welding is done in 200mm run.



Mounting Bracket



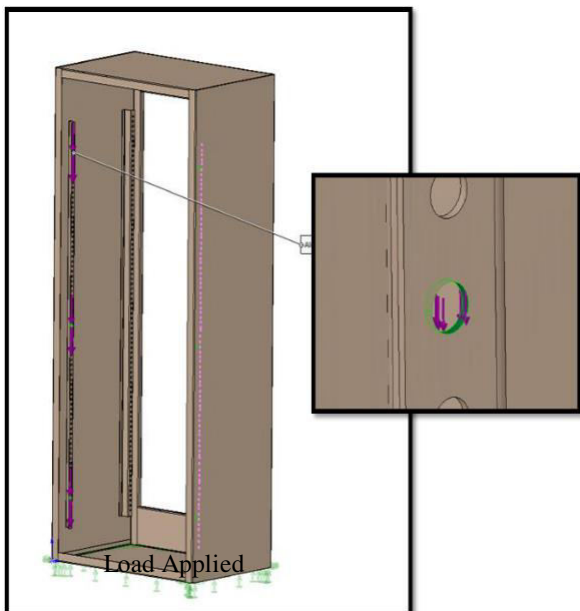
Mounting Bracket(CAD)

**VI. Load Applied**

The GI sheet is mounted on the frame in new design. Thus the load is not transmitted on the side cover. The GI sheet is bolted on the frame with M8 bolts, there are total 6 bolts used, 3 on each side. We have applied load accordingly.

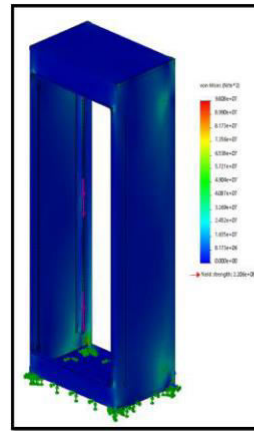
1	2	3
	Total Load (N)	Load on Each Hole (N)
4 Condition 1	5 10000	6 1667
7 Condition 2	8 15000	9 2500

Load Applied on New Structure

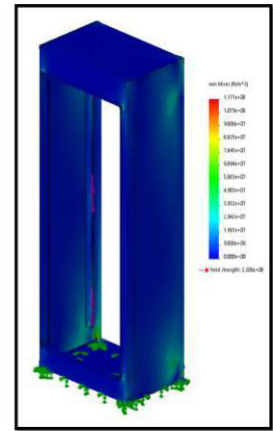


**VII. Analysis Result**

**1. Stress Analysis Results**

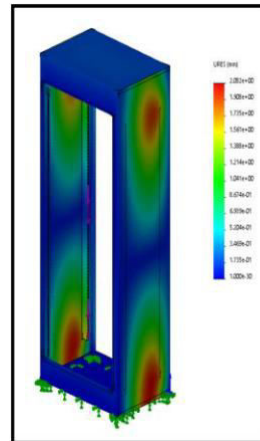


Stress Analysis (Cond. 1)

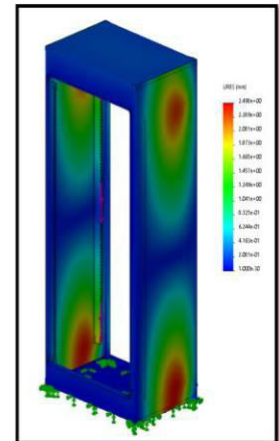


Stress Analysis (Cond. 2)

**2. Displacement Analysis Results**



Disp. Analysis (Cond. 1)



Disp. Analysis (Cond. 2)

**Result and discussion**

From the analysis we found out the traditional structure can withstand the load which we have applied. The maximum stress which material can bear is the yield strength which is about  $2.20594 \times 10^8 \text{ N/m}^2$ . The factor of safety we have obtained for load condition 2 which is maximum load is almost 2. Thus we can say the stress generated is within the limits.

The displacement analysis shows that the the maximum deformation which took place in the structure is at the bottom at the welding between the base sheet and the side sheet. The value of deformation is 2.5mm. Table 3.5 shows the analysis result for both the loading conditions.

From the result we can say that we have very narrow scope to reduce the stresses and the deflection. As the

tradition panel is very functional from past many years we have great challenge in designing new model of control panel. The new design must withstand these same loading conditions and should perform better.

	Total Load (N)	Maximum Stress (N/m <sup>2</sup> )	Maximum Displacement (mm)
Condition 1	10000	9.8x10 <sup>7</sup>	2.08
Condition 2	15000	1.17x10 <sup>8</sup>	2.49

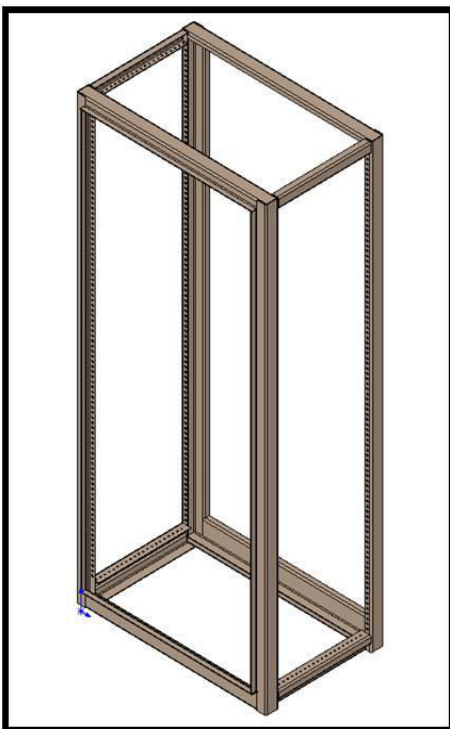
Analysis results of traditional structure

**VIII. Structure Description of New Design**

New designed structure is made of two main parts, the frame is made using 3mm sheet metal. The side covers are bolted to frame, thus the thickness of cover is 0.8mm or 1.2mm. Sheet metal is laser cut using laser cutting machine. Then the punching is done where ever required. Bending of individual part is done using bending machine. Individual part is manually checked for flatness. Then fabrication process starts which consists of welding grinding and finishing.

**CAD Model of New Designed Panel**

3D Model of new designed structure. We have kept the overall outer dimension similar to the traditional structure



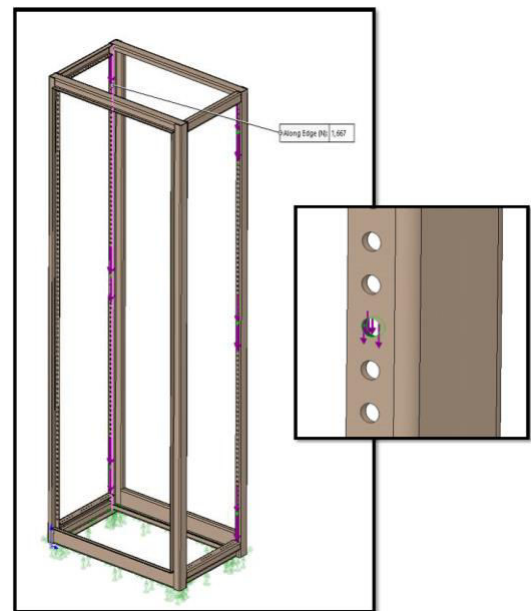
Designed Structure

**Load Applied**

The GI sheet is mounted on the frame in new design. Thus the load is not transmitted on the side cover. The GI sheet is bolted on the frame with M8 bolts, there are total 6 bolts used, 3 on each side. We have applied load accordingly.

	Total Load (N)	Load on Each Hole (N)
Condition 1	10000	1667
Condition 2	15000	2500

**Load Applied on New Structure**

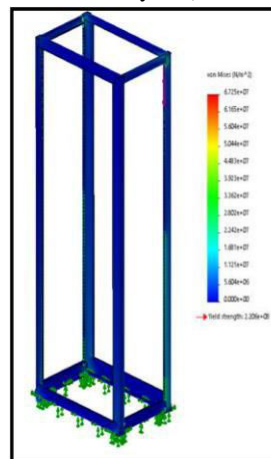


Load Applied

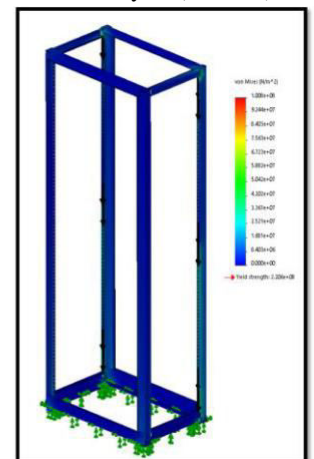
**IX. Analysis Result**

**1. Stress Analysis Results**

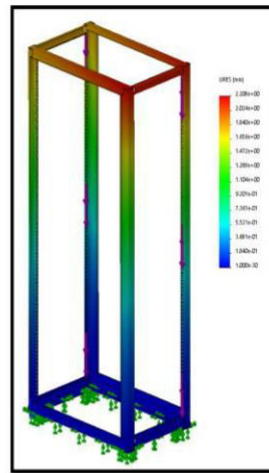
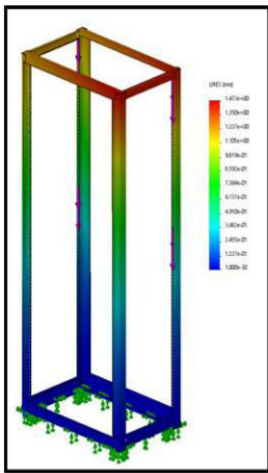
Stress Analysis (Cond. 1)



Stress Analysis (Cond. 2)

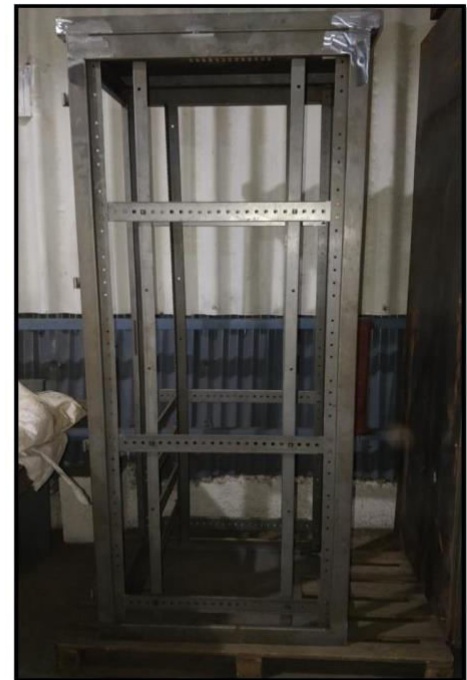


**2. Displacement Analysis Results**



Disp. Analysis (Cond. 1)

Disp. Analysis (Cond. 2)



New Fabricated Panel

	Total Load (N)	Maximum Stress (N/m <sup>2</sup> )	Maximum Displacement (mm)
Condition 1	10000	6.72x10 <sup>7</sup>	1.47
Condition 2	15000	1.08x10 <sup>8</sup>	2.2

Analysis Results of New Structures

**X. RESULT AND DISCUSSION**

From the analysis result of the new designed structure we can say that it has increased strength of the panel. The overall stresses generated are less than the traditional panel. The deformation observed is also less than the traditional panel. To compare both the result we can refer the following tables 6.1 & 6.2. We can see the deflection for condition 1 that is at 10000N load the deflection in new panel is much less than the traditional design. Also the stresses generated are less. Condition 1 is the most used condition. Thus we can say that the new designed panel will give better performance in load carrying capacity and also it will be more durable.

	Total Load (N)	Maximum Stress (N/m <sup>2</sup> )	Maximum Displacement (mm)
Condition 1	10000	9.8x10 <sup>7</sup>	2.08
Condition 2	15000	1.17x10 <sup>8</sup>	2.49

Analysis results of traditional structure

	Total Load (N)	Maximum Stress (N/m <sup>2</sup> )	Maximum Displacement (mm)
Condition 1	10000	6.72x10 <sup>7</sup>	1.47
Condition 2	15000	1.08x10 <sup>8</sup>	2.2

Analysis Results of New Structures



New Fabricated Panel with side guards

**XI. EXPECTED RESULTS**

- To propose least two plan arrangements utilizing present day strategies
- To do pressure investigation of conventional design and the new evolved structure

- To do pressure examination of customary design and the new evolved structure
- To increment the efficiency
- To decline the general lead season of assembling

### **XII.Conclusion**

In this project we concluded that the huge quantities of control board structures are made in a year. Roughly 850-1000 Panels are made yearly. The board configuration utilized as of now is a conventional plan which comprises of complete utilization of sheet metal creation. The nature of board relies upon the work expertise in twisting and welding. Consequence of this interaction will be Minimize the quantity of cycle likewise it will Minimize the time include in material taking care of starting with one sound then onto the next with Minimize the general time needed for board building.

### **XIII.References**

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