Solar Panel & its Design- A Research

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Abstract

The utilization of non-sustainable well spring of vitality in age of power has prompted outflow of contaminations which has caused a dangerous atmospheric deviation. The expansion in contamination has made mindfulness in broad daylight to utilize inexhaustible wellspring of vitality, for example, sun powered vitality which can be tackled without the arrival of destructive poisons to the earth. This review deals with the extracts of details regarding solar panels, it's structure design, and details. The fundamental motivation behind the investigation is to choose the auxiliary areas and associations with help the sun oriented board which are mostly stacked by wind stack. The investigation is done as per IS-875(Part III) 1987 and every one of the estimations is done physically according to code arrangements.

Keywords: sun oriented boards, solar structure design, sustainable energy.

1. Introduction

A panel designed to absorb the sun's rays as a source of energy for generating electricity or heating. Sun powered boards are gadgets that change over light into power. They are called "sun based" boards on the grounds that more often than not, the most capable wellspring of light accessible is the Sun, called Sol by space experts (Markvart & Castarier). A few researchers call them photovoltaic which implies, essentially, "light-power."Sun powered boards change over 22% of their accessible vitality into electrical power. This may not sound great, but rather it is vastly improved than most sun oriented boards. Most sunlight based boards on individuals' homes, for instance, are genuinely wasteful. Fewer than 14% of the vitality that contacts them will be changed over to power (Kapur). A sun based board is a gathering of sunlight based cells. Heaps of little sun oriented cells spread over an expansive zone can cooperate to give enough energy to be helpful. (Fanchi)

2. Model Details

Firstly we need to prepare the modal in structure analysing software i.e. Staad.pro. For this paper, a structure of 2-Panel set is prepared at 10 meter, 15 meter, 20 meter and 30 meter height from ground and the panel is set an angle of 10degree, 26degree and 37detgree. The designing of these models includes preparation of geometry, application of loads, assigning of material or say sections used for safe structure, and designing is done using optimization of structure and at last analysis is done with gives final results in terms of maximum reactions and moments for safe structure.

Dimensions for 2*2 panel set:

Length of purlins = 2 m
No. of purlins = 4
So area where wind pressure will act = 4*2 = 8 m^2

3. Load Calculation

Wind force = wind intensity * area =1.325*8=10.6 KN
Force per unit length of purlins, P = 10.6/8= 1.325kN/m

For 37^0 angle

Force in x- direction = P sin 37^0 = 1.325 sin 37 = 0.797 KN/m
Force in y- direction = P cos37^0 = 1.325 cos37 = 1.058 KN/m

Similarly, for 26 degree and 10 degree load is calculated. And applied these calculated force in Staad.pro model of 2x2 panels on purlins in that particular direction for which force has been calculated.

For dead load of plates
Mass of a single plate = 25Kg
Mass of 4 plates = 25*4 = 100 Kg

So weight of 4 panels = 100*9.8 = 980 N=.98 KN

Force per unit length of purlins due to self weight of plates
.98 /12 = 0.0816kN/m
And this will act in gravity direction i.e. y – direction.

Then applied the loads in software and designing is done.
The AutoCAD drawings are shown below.

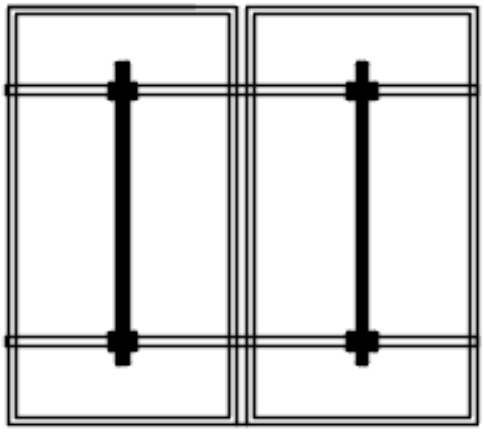

Figure 1 The 2*2 set of panel

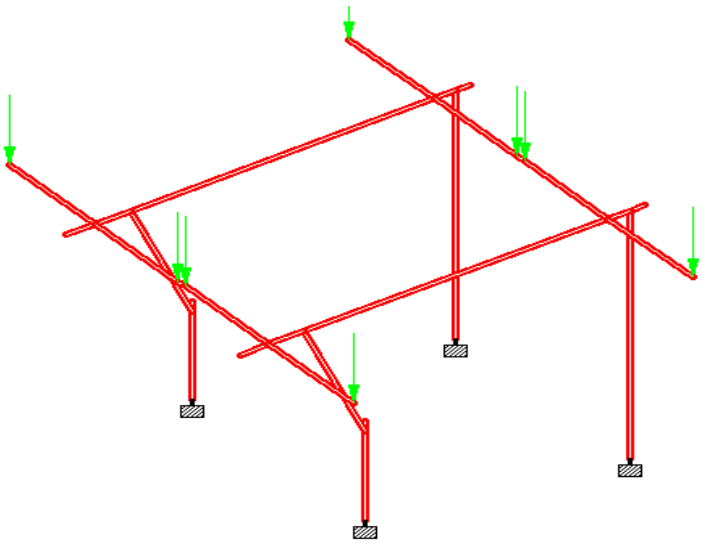

Figure 2 Staad.pro image of Solar Structure with nodal loads

4. Results

The results we got from the designing of solar panels are in terms of reactions at various heights and various angles as below. These reactions are the maximum reactions which we get on analysing the design of panels set. These reactions further can be used as maximum loads which can be applied on design of base structures for particular sites. In table-1 it is mentioned all reactions as wells as amount of steel at various heights and angle. These reactions can be generated similarly for 3-panel, 4-panel and 5-panel sets.
Table-2 contains the nomenclature of all the terms used in table-1.

Table 1 Reactions For 2 Panels

REACTIONS FOR 2 PANELS									
ANGLE	HEIGHT	Rdl	Rll	Ruh	Ruv	Rdh	Rdv	Mz	SW
10	10	0.247	0.844	0.509	-1.589	-0.195	0.608	-0.153	0.346
10	15	0.245	0.844	0.548	-1.724	-0.215	0.662	-0.153	0.34
10	20	0.245	0.844	0.596	-1.863	-0.234	0.715	-0.153	0.34
10	30	0.245	0.844	0.616	-1.928	-0.243	0.742	-0.153	0.34
26	10	0.227	0.815	1.568	-1.477	-0.89	0.888	-0.501	0.317
26	15	0.227	0.815	1.724	-1.596	-0.99	0.951	-0.555	0.317
26	20	0.241	0.815	1.843	-1.688	-1.046	1.404	-0.596	0.367
26	30	0.241	0.815	1.907	-2.473	-1.082	1.455	-0.609	0.367
37	10	0.228	0.798	2.339	-2.415	-1.561	1.613	-0.625	0.351
37	15	0.228	0.798	2.546	-2.628	-1.696	1.751	-0.702	0.351
37	20	0.228	0.798	2.749	-2.84	-1.831	1.892	-0.758	0.351
37	30	0.228	0.798	2.774	-2.915	-1.899	1.962	-0.761	0.317

Table 2 Nomenclature

Rdl=Maximum Reactions due to dead load.
Rll= Maximum Reactions due to live load.
Ruh=Maximum horizontal reaction due to upward wind force.
Ruv=Maximum vertical reaction due to upward wind force.
Rdh=Maximum horizontal reaction due to downward wind force.
Rdv=Maximum vertical reaction due to downward wind force.
Mz=Maximum moment in Z axis.
S w=Weight of steel.

5. Scope of Work

Extricating vitality from sunlight solar panel is of current enthusiasm because of a worldwide endeavour to diminish the utilization of constrained assets, for example, oil and gas, and increment the utilization of sustainable assets; sun powered water and twist vitality among others. It will likewise incorporate a survey of the improvement procedure of sunlight based boards and their item details thinking about structure, quality, materials, proficiency and cost. To get a comprehension of the item acknowledgment procedure of sun oriented boards there will initially be a general examination of sun powered boards travel from thought to an entire item. For a more nitty gritty perspective of the procedure a contextual investigation will be made at a maker of sunlight based boards. As a last advance of the task there will be a correlation of solar panels made by various makers.

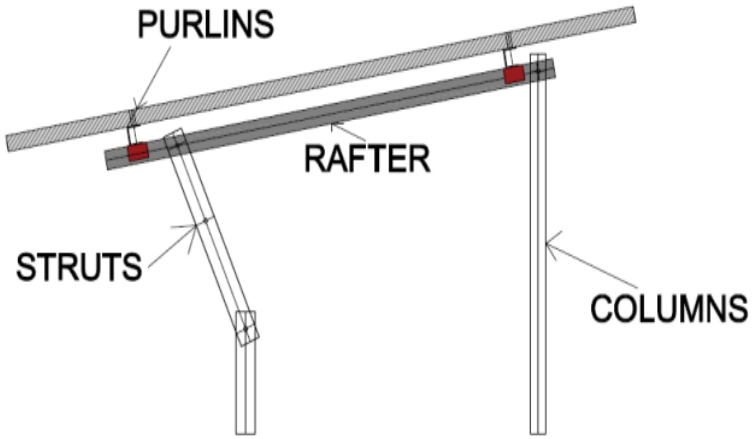

Figure 3 Solar Members

6. Conclusion

Final design of members (purlins, rafters, struts and columns) for construction purpose of panels on sites has been obtained after analysing it by manually as well as by software. Because wind load is critical here, so special consideration taken for this force, so the structure will be stable properly for many years at its location. We have studied the whole process of how the force works on panels and which load is critical for panels design and found out the economic section for given location, condition and given arrangement. After getting all these results for the sections, these member sections are ordered for the further work to perform on sites.

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