Quick and efficient design of solar panel supports with CYPE Metal 3D

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INTRODUCTION

This article briefly explains how a solar panel support, complete with foundations and connections, can be easily and quickly designed using CYPE Metal 3D and CYPE Portal Frame Generator.

Solar panel supports are relatively new type of structures which due to the increasing popularity of the use of solar panels are becoming more common every day. Solar panels are often placed in open areas or on building rooftops where extreme wind velocities can be present. The open, wing shaped geometry additionally makes them very sensitive to uplift effects caused by the wind actions.

Special attention therefore needs to be dedicated to the evaluation of wind actions in the design phase.

For most structures, a structural design analysis is required in order to guarantee a safe, sustainable and cost-effective product. Hence, structural design analysis reports are sought by most assurance companies nowadays for any type of structure that needs to be insured against economical and or personal damage. For structural analysis, the expertise of a structural engineer is needed. Features such as the correct definition of loads, knowledge of mechanics and materials, connection and foundation design, etc. can be complex and therefore require the attention of qualified professionals.

Even though professional expertise is needed, engineers nowadays spend relatively little time on making manual design calculations thanks to the development of structural design orientated software.

CYPE provides secure software solutions equipped with maximum user guidance during the entire structural design process from the very start to the automatic generation of structural drawings and analysis reports. The amount of time needed for research and analysis this way is reduced to a minimum and a quick and efficient structural design is guaranteed.

International design and analysis

Since different regulations apply for different regions, load definitions, material properties and validation methods are features which need to be specified differently for each country according to the corresponding national standards. CYPE offers complete compatibility for a wide range of national standards and is completely adapted for use in the Indian market. The software, as well as the output of drawings and reports, is available in the English language and all necessary standards for structural analysis and automatic load generation are implemented in the software.

Currently, the implemented Indian standards are:

- IS 875 part 3: 1987 (wind loads)
- IS 875 part 4: 1987 (snow loads)
- IS 1893 part 1: 2002 (earthquake design)
- IS 800: 2007 (steel)
- IS 456: 2000 (concrete)

For the design of timber and aluminium structures Eurocodes EN 1995 and EN 1999 can be used.

Portal Frame generator: Software for automatic generation of loads, structural geometry and purlin design.

Portal Frame Generator is a handy design tool which can be used for automatic generation of multiple frames and loads. Dead loads, live loads, wind loads, snow loads and corresponding loadcase combinations can easily be generated according to the selected standards and the introduced geometrical and geographical properties of the structure. Wind load generation is supported for predominantly closed structures and for free-standing canopy roofs. Solar panels in general can be modelled as free-standing monopitch canopy roofs and therefore Portal Frame Generator is an ideal solution for a quick and accurate definition of wind loads.

The program provides all necessary information for the correct generation of loads and warns and prevents the user from defining invalid data; no research of the relevant codes is required. Purlin design and analysis is also supported by Portal Frame Generator.

Generated 3D geometry and 2D surface loads can be exported to Metal 3D.

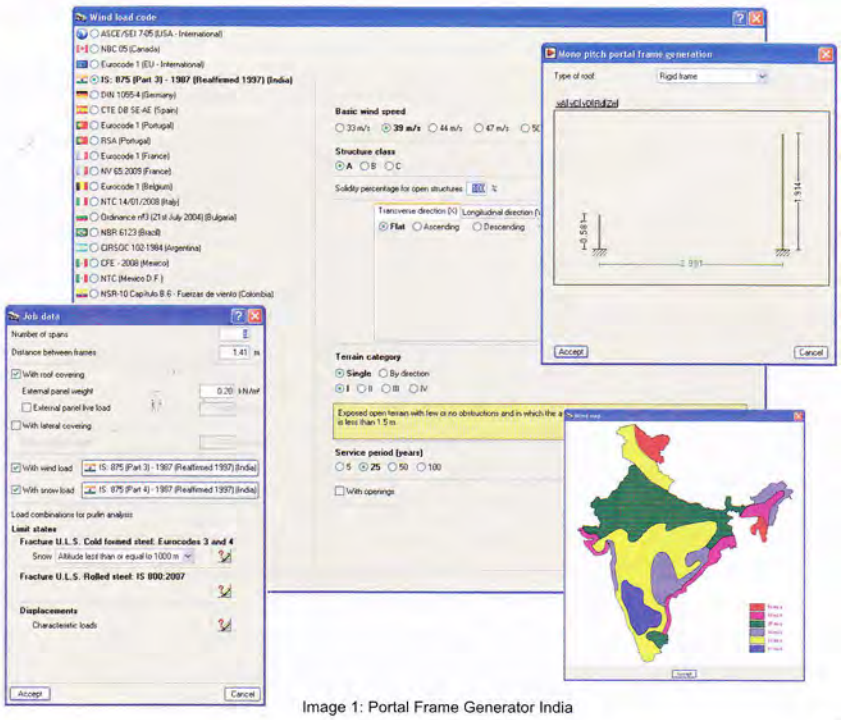


Image 1: Portal Frame Generator India

Metal 3D: Software for complete structural design and analysis of 3D Frames

Metal 3D is an excellent program for the structural design and analysis of simple and complex three-dimensional frames and a high-quality tool for fast and efficient design of solar panel supports.

Structural geometry can be defined by means of manual introduction, import of dwg/dxf drawing file format, or can be generated with Portal Frame Generator and afterwards exported to Metal 3D. Loads can be defined manually within Metal 3D or can also be generated qq Portal Frame Generator.

Data generated by Portal Frame Generator can be revised immediately after exporting the model to Metal 3D.

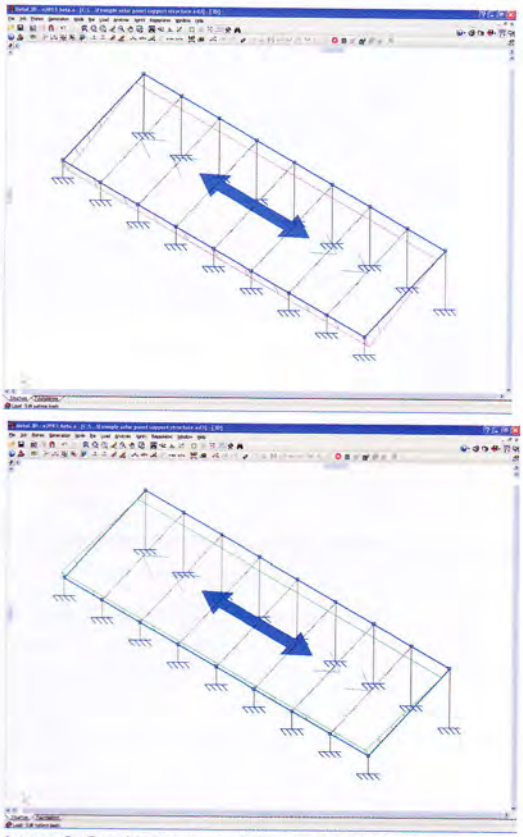
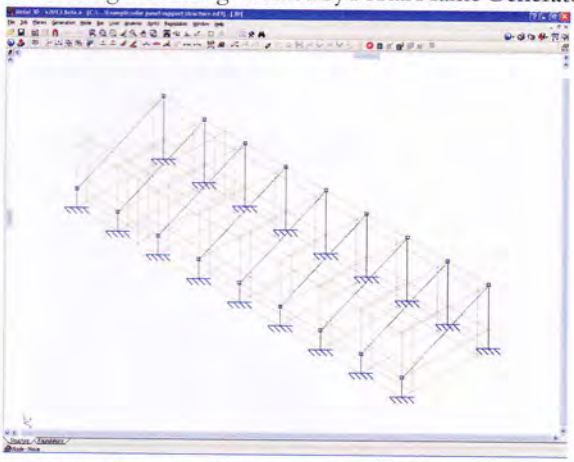


Image 2: Graphical output of generated wind loadcases

If desired, the structure can be modified (new members can be introduced, present members can be deleted) within Metal 3D without losing the loads generated by Portal Frame Generator.



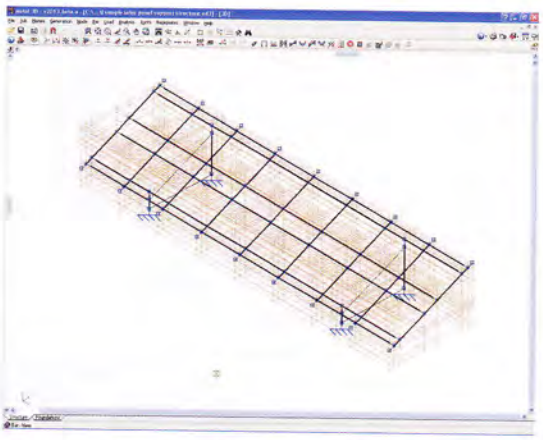


Image 3: Original and modified geometry

Generation of loadcase combinations and cross-sectional resistance checks are carried out according to the selected material standards. Different standards can be selected for materials (steel, aluminium, timber and concrete). Apart from the generated standard loadcase combinations it is also possible to add user-defined loadcases and loadcase combinations.

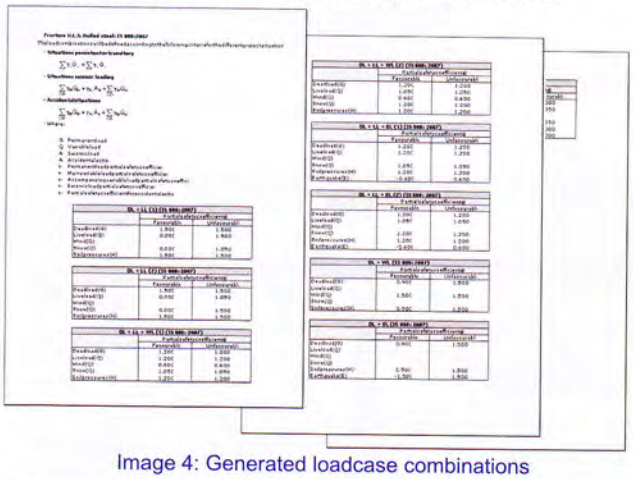


Image 4: Generated loadcase combinations

Cross-sections can be selected from the implemented cross-sectional libraries in the program or created by means of numerical or graphical input.

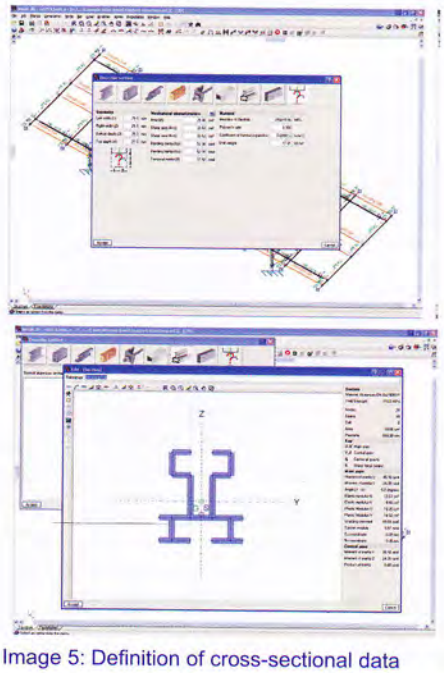


Image 5: Definition of cross-sectional data

After defining the mechanical properties of the members (supports, hinges, type of cross-sections and materials, buckling lengths, etc.) the structure can be analysed. Metal 3D is equipped with automatic member design algorithms, which can save the user valuable time in the design process.

Member checks and automatic design can be carried out for steel, aluminium and timber cross-sections for a wide range of national standards.

Analysis results (reactions, member forces, deformations, resistance checks) can be represented graphically as well as numerically in detailed analysis reports.

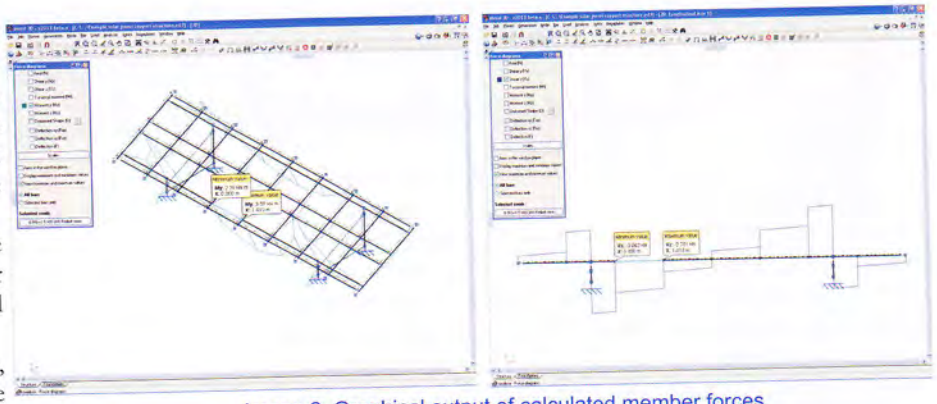


Image 6: Graphical output of calculated member forces

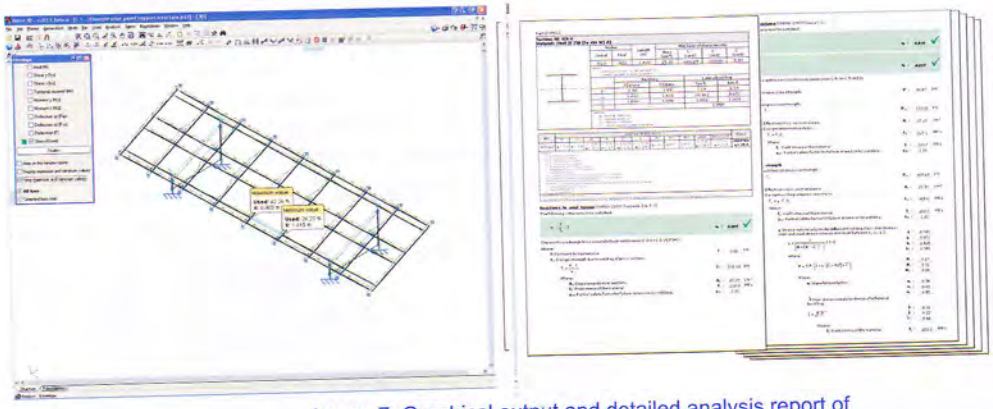


Image 7: Graphical output and detailed analysis report of member resistance checks

A special module for automatic connection design is available in Metal 3D. The most common type of bolted and welded steel joints will be generated and designed automatically by the program according to the design parameters specified by the user. Detailed calculation reports and graphical output can be generated for each designed joint.

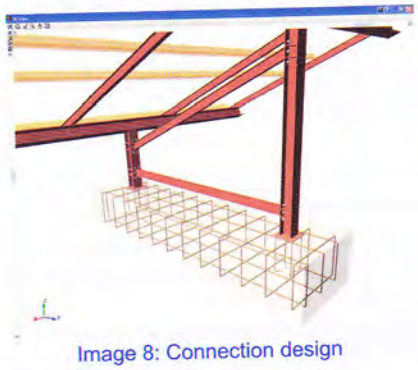


Image 8: Connection design

The whole structural design, joints included, can be exported to TEKLA® Structures, TecnoMETAL® or CIS/2 file format.

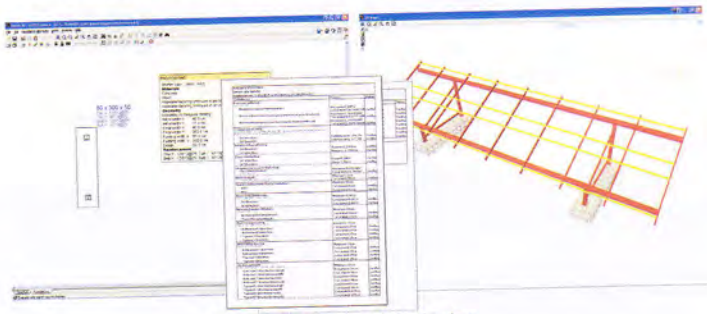
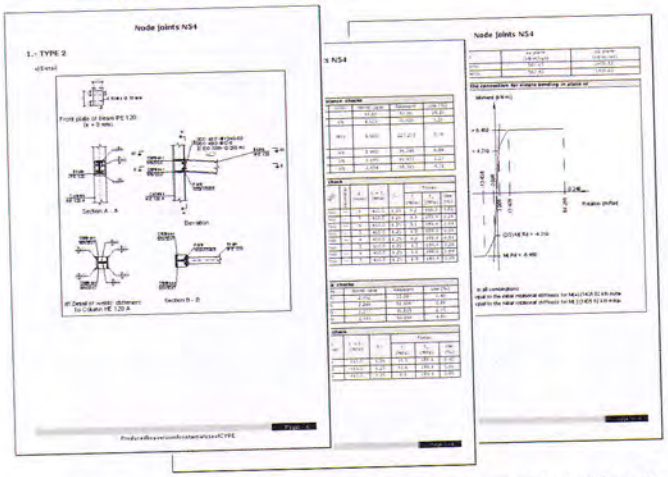


Image 9: Foundation design



A solution for automatic foundation design also is provided within the program. Metal 3D calculates the most appropriate dimensions for the foundation elements, including their reinforcements. Generated data can easily be modified and verified. For each foundation element an analysis report can be generated.

When the design process has finished, drawings of the complete model (structure, foundation and joints) can be generated for plotting or exporting to AutoCAD® file formats (dwg, dxf).

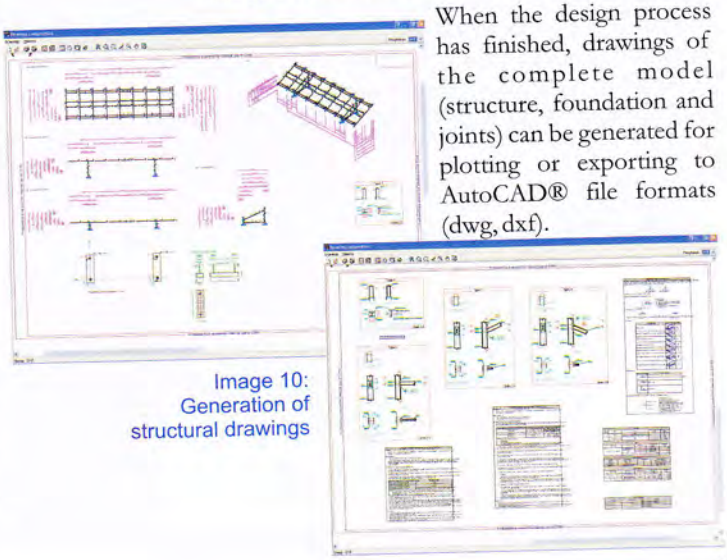


Image 10: Generation of structural drawings

Structures generated and analysed with Metal 3D can be exported completely with loads to CYPECAD for integration with reinforced concrete buildings.

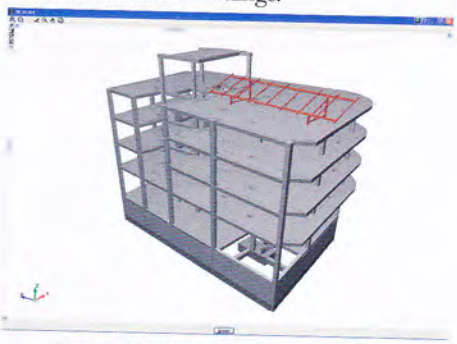


Image 11: Exportation to CYPECAD

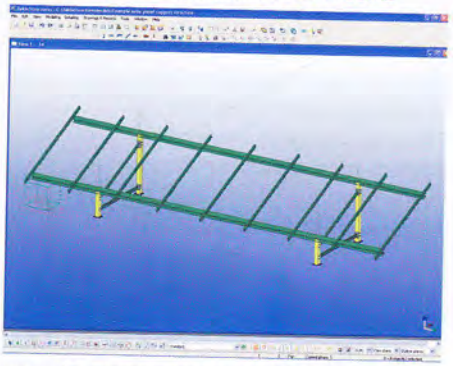


Image 12: Exportation to TEKLA® STRUCTURES

A detailed take off list can be generated for the structural members (beams, columns, etc.), joints (plates, welds, bolts) and foundation elements (concrete, reinforcements).

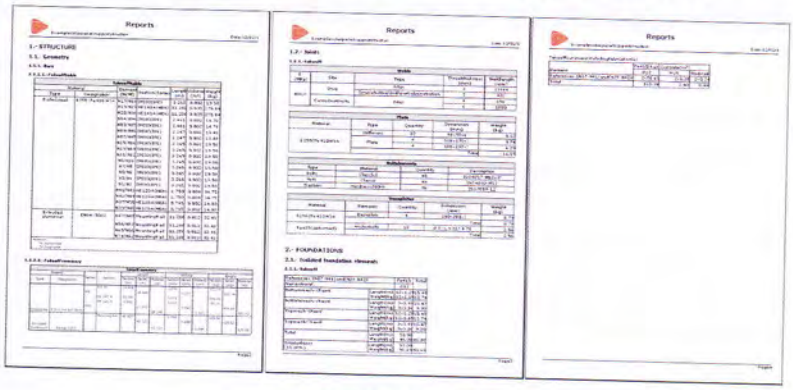


Image 13: Take off list

Summary

CYPE provides easy, understandable, intuitive software which allows for fast and efficient design and analysis of structures.
All programs are adapted to the national standards for many countries, including the Indian standards.
CYPE software increases productivity and offers efficient and secure structural design solutions.

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Continued from Page 27

Thus, by 2022 there will be huge demand of 47 million workforce needed in construction industry alone.

By the year 2022, India is aiming to build 700 million globally employable workforces, comprising 200 million university graduates and **500 million vocationally skilled people.**

Population Vs Education Analysis:

1. Indian Population @ 2022 would be 1,300 million people
2. **Employable Population (age 18-58 years): 780 million**
   Population with access to education / facilities - 200 million
   Population with limited access to education / facilities - 500 million
   No access for education - 80 million

As stated above, we can understand to cater the need of 500 million people, we have to think of opening more Skill Developmental Institutions in our country.

Financial Assistance for Skill Development

To start any business, the investment is the basic criteria. The following are the points can be considered for financial assistance:

1) Submit a proposal to the National Skill Development Corporation
2) Approaching Govt. for financial aid
3) Inviting few of social organizations to join on partnership
4) Approaching Private/Public sector for partnership investment
5) Availing Bank Loan

- China has nearly 500,000 senior higher secondary vocational schools, whereas we have about 5100 ITI's and 6000 VET schools in all over India.
- Countries current labour force in the age group of 20-24 yrs, undergone formal vocational training are:
- (a) India - 5 % (b) Mexico - 28 % c) Most industrialized nations - 60 to 80 % (d) Korea - 96 %.
- To boost Vocational Education and Skill Development, Prime Minister in his Independence Day address, stated to open:
  (a) 1600 new ITI's and Polytechnics (b) 50,000 new Skill Development Centers in India
- It would enable 1 crore students to get Vocational training in every year.

Conclusion

From the above details, the following are the conclusion:

1) The present skill level cannot compete with the growing trend.
2) The total need for skilled workforce for construction industry alone is 47 Million by 2022.
3) Introducing new Skill Development Training Centers are the only way to create a skilled workforce for the nation's development.
4) Skill Development Training brings reduction of material wastage in all the industries.
5) Skill Development Training leads high quality standards/increased production at work places.
6) Skill Development Training avoids rework in work places.
7) Skill Development Training assures safe working environment at work places.
8) Workers' social and economical position improves.
9) Proper recognition to the worker in all industries can be ensured.

Due to the above measurements, we will definitely feel a drastic financial growth in the country.

"Training is expensive & without Training it is more expensive"

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