Summer Fellowship Report

On

Developing Osdag Section Modeller Module

Submitted by

Mohammad Azhar U Din Mir

Under the guidance of

Prof.Sidhartha Ghosh
Civil Engineering Department
IIT Bombay

Under the Mentorship of

Danish Ansari
Assistant Project Manager

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Acknowledgment

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I am grateful that I got a chance to work under Prof. Sidharth Ghosh, who took time to mentor us and monitored individual contributions as well.

Contents

Chapter 1

Introduction

1.1 Osdag Internship

Osdag internship is provided under the FOSSEE project. FOSSEE project promotes the use of FOSS (Free/Libre and Open Source Software) tools to improve quality of education in our country. FOSSEE encourages the use of FOSS tools through various activities to ensure availability of competent free software equivalent to commercial (paid) softwares.
The FOSSEE project is a part of the National Mission on Education through Infrastructure and Communication Technology(ICT), Ministry of Human Resources and Development, Government of India.
Osdag is one such open source software which comes under the FOSSEE project. Osdag internship is provided through FOSSEE project. Any UG/PG/PhD holder can apply for this internship. And the selection will be based on a screening task.

1.2 What is Osdag?

Osdag is Free/Libre and Open Source Software being developed for design of steel structures. Its source code is written in Python, 3D CAD images are developed using PythonOCC. Github is used to ensure smooth workflow between different modules and team members. It is in a path where people from around the world would be able to contribute to its development. FOSSEE's "Share alike" policy would improve the standard of the software when the source code is further modified based on the industrial and educational needs across the country.

Design and Detailing Checklist (DDCL) for different connections, members and structure designs is one of the important bi-products of this project. It would create a repository and design guide book for steel construction based on Indian Standard codes and best industry practices.

1.3 Who can use ?

Osdag is created both for educational purpose and industry professionals. As Osdag is currently funded by MHRD, Osdag team is developing software in such a way that it can be used by the students during their academics and to give them a better insight look in the subject.
Osdag can be used by anyone starting from novice to professionals. It's simple user interface makes it flexible and attractive than other software. Video tutorials are available to help get started. The video tutorials of Osdag can be accessed here.

Chapter 2

Osdag Section Modeller Creation

Osdag Section Modeller is a new feature dialog that helps design,visualize and save Sections to be further used in the Main Application.It helps the user create sections other than what are there in the IS Codes. For now the user can create 12 Built-Up Sections.The Section Modeller has 3 sections namely:

1. Define Section
2. CAD Viewer
3. Section Properties

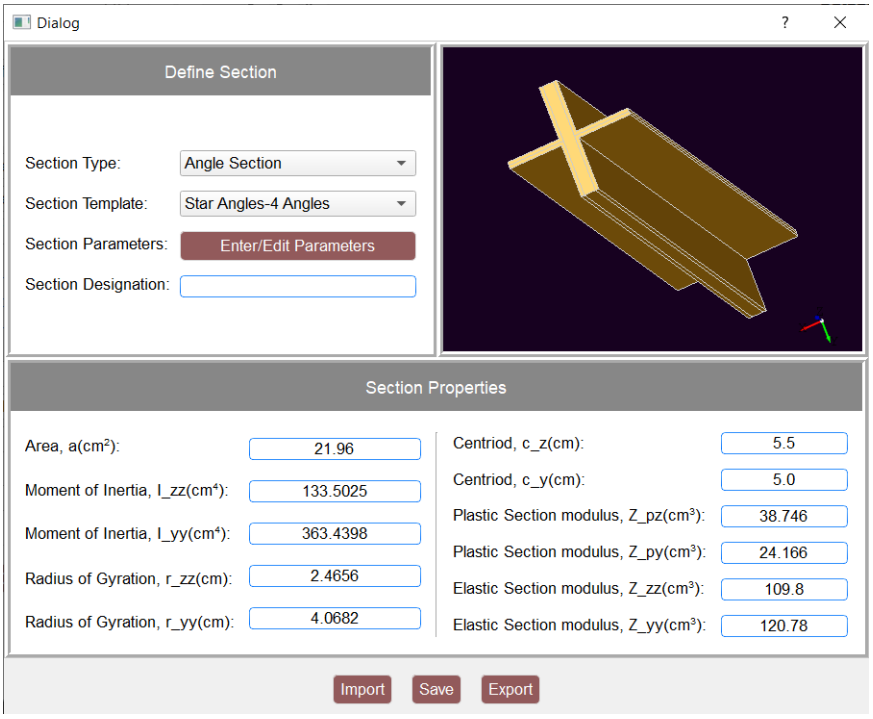


Figure 2.1: Osdag Section Modeller

2.1 Define Section with Inputs

The Define section is where the user enters/selects the required parameters.It has 4 Inputs:

1. Section Type
2. Section Template
3. Section Parameters
4. Section Designation

There are 5 Types of section out of which user can select one. On selection of a type, the Section template drop down is automatically updated with the available templates for the selected section.Next, the user show enter the Section Parameters by clicking the 'Enter/Edit Parameters' button.This opens a separate dialog which has the required parameters for the selected template. As soon as the user clicks save on the Section Parameters dialog and if the parameters are all valid, then a CAD model is created and displayed in the CAD viewer and all the Section Properties are updated and displayed in their respective text boxes.

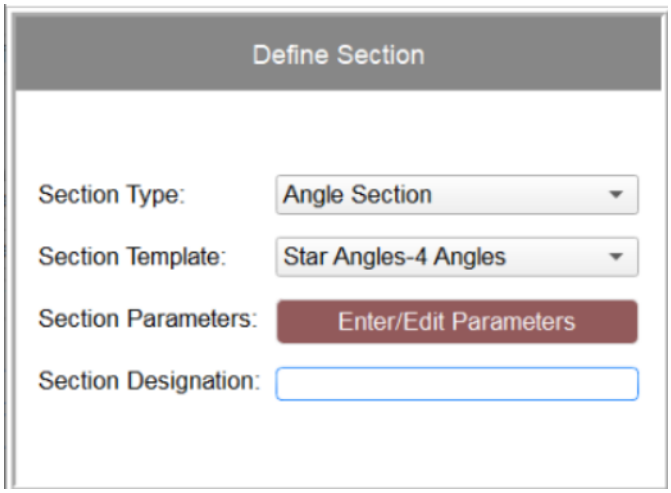


Figure 2.2: Define Section

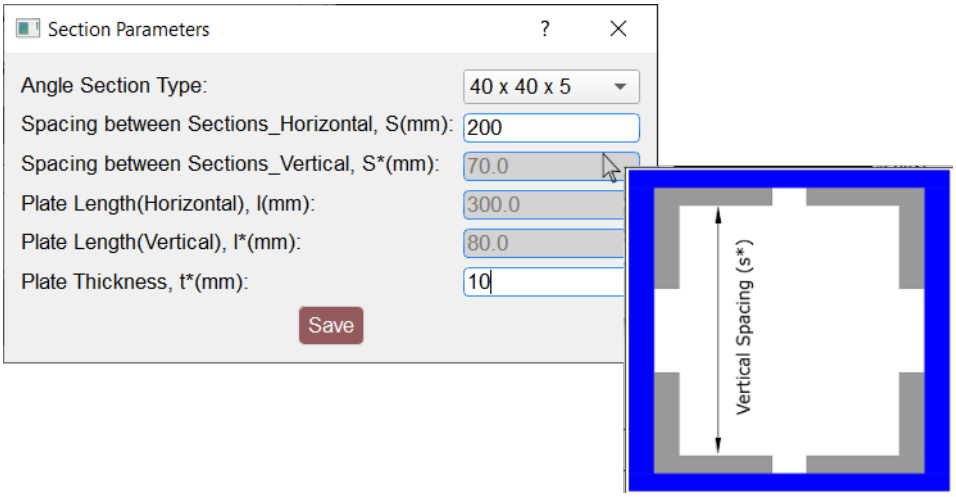


Figure 2.3: Section Parameters Dialog

2.2 Derivation of Formulas

Formulas were derived for each section property that are necessary for the design of any built-up section.These formulas were further coded in python.Coded formulas from manual calculations provided by fetching data from the user as well as the database.These formulas were then used to update the respective Section Property in the Section Properties Section.Each time a user saves the Section parameter, the Section properties are updated if the parameters entered are valid.

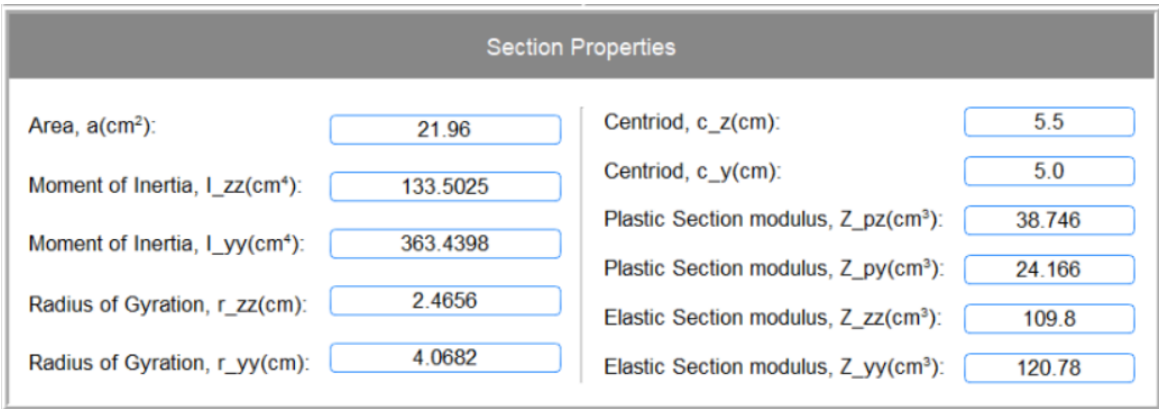


Figure 2.4: Section Properties

2.3 Development of rough CAD models for each template

CAD models were created for every template and then developed by a CAD Intern.Respective CAD model creation and display in OCC Viewer coded with input and database parameters for each model. Each time a user saves the Section parameter, respective CAD model based on parameters is created and displayed if the parameters entered are valid.

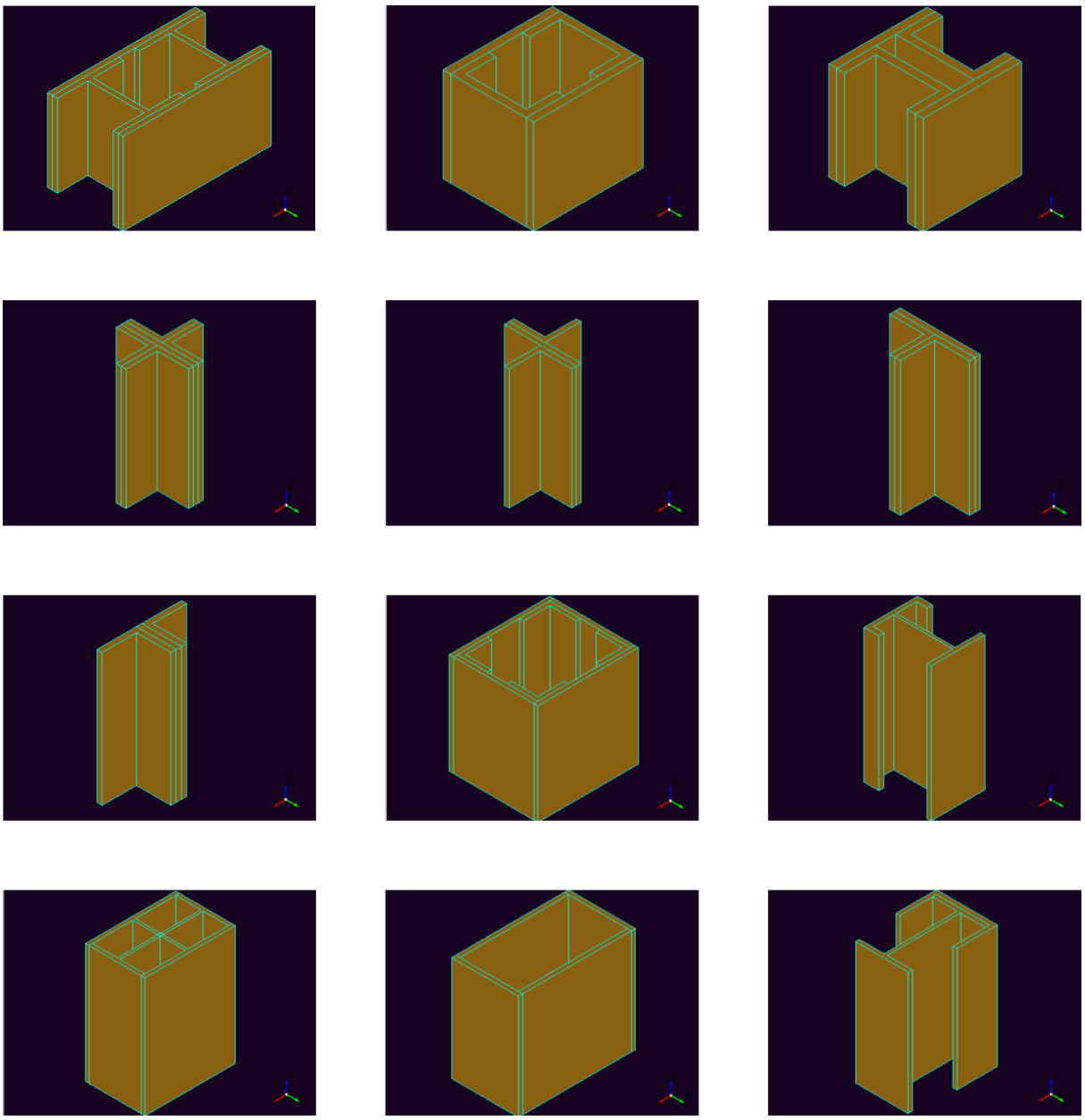


Figure 2.5: CAD Model Examples

2.4 Development of 2D Drawings

2D drawings will help identify the user all the input parameters that the user needs to feed in order to design the built-up section.

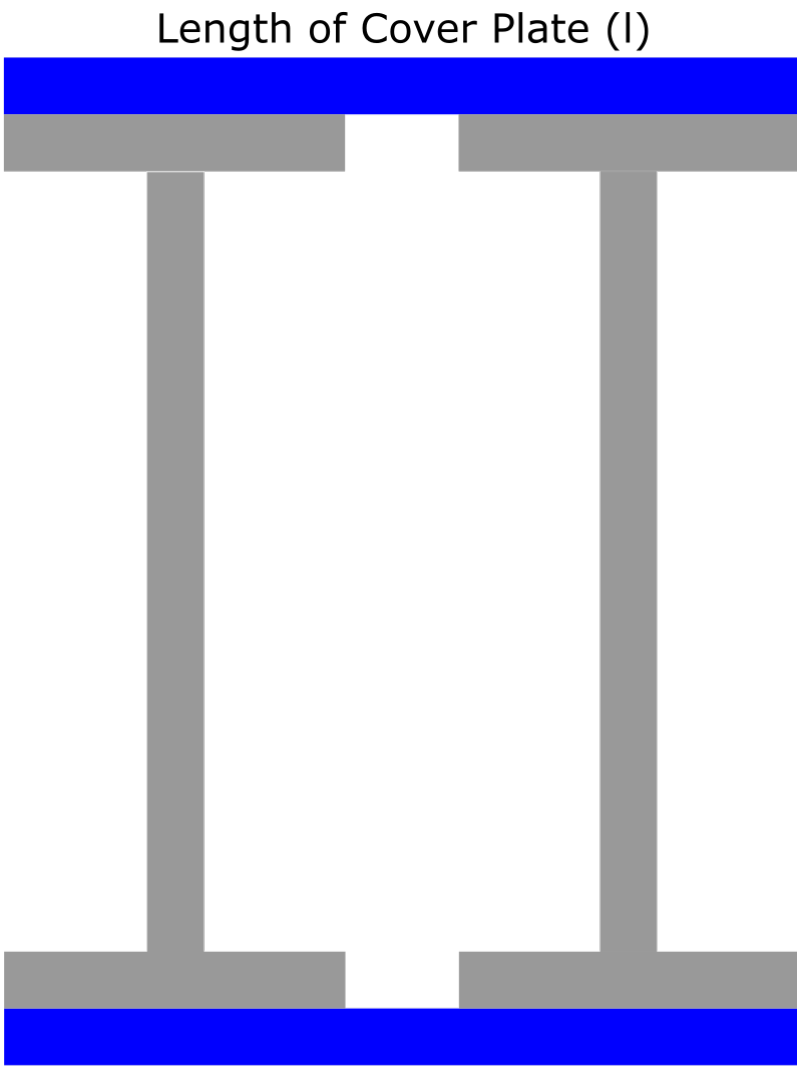
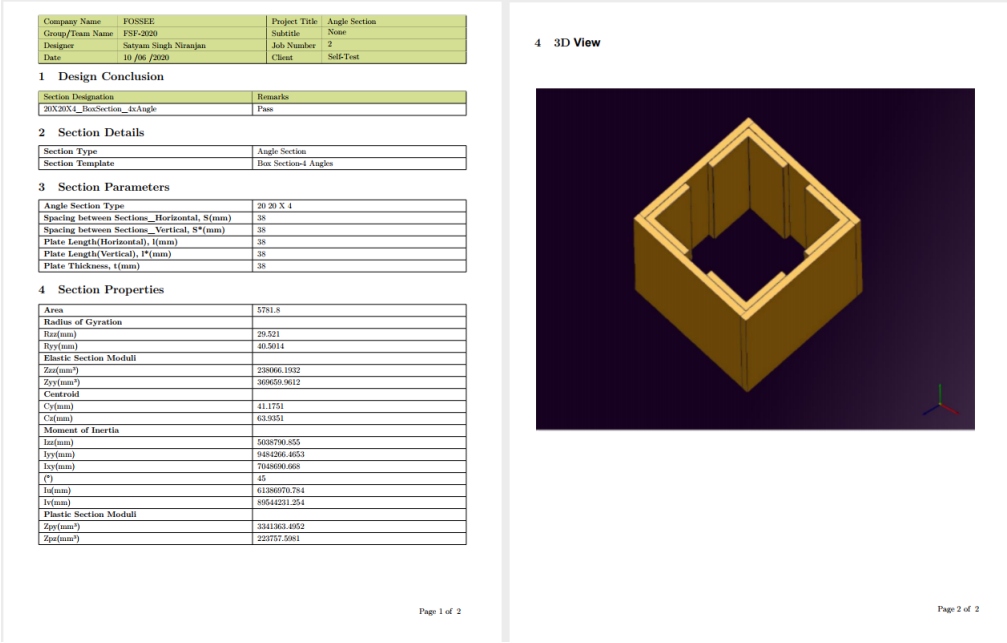


Figure 2.6: 2D Drawings Examples

2.5 Design of LaTex Report

The design of the report that will be created after the end of a successful design.This repoet can be then saved/exported by the user.The Import feature helps import previously saved Sections from the location of choice in the system.
The Export feature allows the creation of a LaTex formatted Design report of the Designed Section.
The Save feature helps save Designed Sections into .osm file to be used further in the Application or the Modeller itself.



Company Name	FOSSEE	Project Title	Angle Section
Group/Team Name	FSF-2020	Subtitle	None
Designer	Satyam Singh Niranjan	Job Number	2
Date	10 /06 /2020	Client	Self-Test

1 Design Conclusion

Section Designation	Remarks
20X20X4_BoxSection_4xAngle	Pass

2 Section Details

Section Type	Angle Section
Section Template	Box Section-4 Angles

3 Section Parameters

Angle Section Type	20 20 X 4
Spacing between Sections_Horizontal, S(mm)	38
Spacing between Sections_Vertical, S*(mm)	38
Plate Length(Horizontal), l(mm)	38
Plate Length(Vertical), l*(mm)	38
Plate Thickness, t(mm)	38

4 Section Properties

Area	5781.8
Radius of Gyration	
Rzz(mm)	29.521
Ryy(mm)	40.5014
Elastic Section Moduli	
Zzz(mm³)	238066.1932
Zyy(mm³)	369659.9612
Centroid	
Cy(mm)	41.1751
Cz(mm)	63.9351
Moment of Inertia	
Izz(mm)	5038790.855
Iyy(mm)	9484266.4653
Ixy(mm)	7048690.668
(°)	45
Iu(mm)	61386970.784
Iv(mm)	89544231.254
Plastic Section Moduli	
Zpy(mm³)	3341363.4952
Zpz(mm³)	223757.5981

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4 3D View

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Figure 2.7: Design Report

```
{'Section_Designation': '2AnglesOppSide',
 'Section_Parameters': {'parameterText_1': ['Angle Section Type',
                                            '65 x 65 x 8'],
                        'parameterText_6': ['Gusset Plate Length, l(mm)',
                                            '65.0'],
                        'parameterText_7': ['Gusset Plate Thickness, t*(mm)',
                                            '10']},
 'Section_Properties': {'A': '26.2',
                        'Cy': '4.2489',
                        'Cz': '7.0',
                        'Iyy': '191.3713',
                        'Izz': '381.1444',
                        'Ryy': '2.7026',
                        'Rzz': '3.8141',
                        'Zpy': '49.158',
                        'Zpz': '36.1978',
                        'Zyy': '183.4',
                        'Zzz': '85.15'},
 'Section_Template': 4,
 'Section_Type': 3}
```


Figure 2.8: Saved Section