



Design And Quantity Estimation Of Batch Plant Structure Using Tekla Structures

Sakthivel M¹, Madhumitha B G², Jabeen A³, Swetha Sri D⁴

¹Civil/Assistant Professor, Kongunadu College of engineering and technology, Trichy, India

²Civil/Student, Kongunadu College of engineering and technology, Trichy, India

³Civil/Student, Kongunadu College of engineering and technology, Trichy, India

⁴Civil/Student, Kongunadu College of engineering and technology, Trichy, India

corresponding Author Email address: madhuguru007@gmail.com

ORCID ID: <https://orcid.org/0009-0007-7381-221X>

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Abstract— The increasing demand for RMC has made batch plant structures an essential component of modern construction projects. These structures support heavy equipment such as mixers, conveyors, silos, and aggregate storage systems, and therefore require proper structural design and accurate quantity estimation to ensure safety, stability, and economy. This project focuses on the design and quantity estimation of a batch plant structure using Tekla Structures, a Building Information Modelling (BIM) based structural detailing software. The primary objective of this study is to develop a three-dimensional model of the batch plant supporting structure and extract precise material quantities. Structural components including columns, beams, bracings, platforms, staircases, ladders and supporting frames were modelled following standard design practices. Load considerations such as dead load, live load, wind load and equipment loads were applied in accordance with relevant Indian Standard codes. Tekla Structures was used to generate detailed models, connection details, and fabrication drawings, enabling accurate visualization and clash-free modelling. Quantity take-offs were obtained directly from the BIM model, ensuring reliable estimation of steel, plates and bolts. This project demonstrates the effectiveness of BIM tools in improving accuracy, reducing manual errors, and enhancing efficiency in industrial structural design and estimation.

Keywords— Batch Plant Structure, Tekla Structures, Structural Design, Quantity Estimation, BIM, Steel Detailing, Material Take-Off.



1. Introduction

The construction industry is also rapidly growing with lots of infrastructure and urbanization. The use of Ready-Mix Concrete (RMC) has become very much popular nowadays due to the quality consistency and speed in construction. Batch plants are used to combine cement, aggregate, water and other components that make up RMC. Batch plants should be supported by structures designed to withstand dead load, live load, wind load and equipment load. This project focused on designing the structure of batch plant for construction sector using Tekla Structures.

Created a three-dimensional structural model for batch plant supporting structure using Tekla Structures software.

Designing structural elements according to standard loading conditions and Indian Standard codes. Accurate quantity take-offs were obtained for steel, plates, and bolts.

In this project, it indicates the design and quantity estimation of a batch plant structure in Tekla Structures. The batch plant structure is suitable to support heavy equipment used in RMC production like mixers, silos, conveyors or aggregate bins. A structural model in three-dimensional (3D) space is created that captures all of the main and secondary structural members. The loads like dead load, live load, wind load, and equipment load are applied as per the relevant Indian Standard codes. Detailed drawings and reality-oriented material take-off reports are produced by Tekla Structures.

1.1 Significance of Structural Design

The most significant aspect of civil engineering is structural design which plays a vital role in understanding the safety, stability, and durability of any structure. Surveying and analysing the survey data also involves providing design for structural elements to resist various loads such as dead load, live load, wind load, earthquake load etc. Yes, good structural design will not fail, and it minimizes collapse so as to save human life and property.

1.2 Role of Tekla Structures

Tekla Structures allows for the precise, detailed 3D modelling of steel and concrete structures, working off Building Information Modelling (BIM). It also provides the functionality of producing connection, assembly and fabrication drawings. It also creates an automatic material take-off report, which facilitates accurate quantity estimation. Reduce errors and make the most of work with standards through Tekla Structures – which enhance design and construction planning of industrial structure.

2. Related Work

2.1. Structural behavior of batch plant supporting structures

Authors: R. Rao and S. Kumar (2025)
vol. 15, no. 1, pp. 15–22, 2025.

2.2. Wind effects on Outdoor Structures

Authors: T. Maldonado-Martinez, M. Tesoriero, and R. Rey (2025)
Engineering Failure Analysis, vol. 156, pp. 107–114, 2025.

2.3. BIM-based cost optimization

Authors: A. Patel, R. Shah, and M. Mehta (2024)
International Journal of BIM Research
Vol.7, No.2 pp.78-85, 2024.

2.4. Fatigue stress in steel joints

Authors: P. Nair, S. Menon, and R. Iyer, (2024)
Journal of Structural Health Monitoring, Vol. 12,
no. 4, pp. 205–212, 2024.

2.5. Dynamic loads on processing plant frames

Authors: A. Verma and K. Suresh (2024)
International Journal of Structural Dynamics
12(2), pp. 18, no. 1, pp. 33–40, 2024.



3. Introduction of BIM

BIM (Building Information Modelling) is a digital tool that allows management and representation of construction project data with an integrated 3D model. BIM contains geometric, structural and material information of a construction project as opposed to 2D drawings. This improves coordination between architects, engineers and construction crew. In construction projects, BIM improves accuracy and minimizes mistakes. It also facilitates better decision-making. The industrial construction projects such as the batch plant, BIM is an important digital medium. Because of the intricate steelwork and structural details. Tekla Structures, a BIM (Building Information Modelling) software is used to develop 3D model details of structural components such as columns, beams and bracings in the deformation analysis. This helps estimate quantities. In addition, BIM provides 5D integration with project models. It is about connecting with cost information in project models. It aids in real-time cost analysis and project planning.

4. Experimental Method/Procedure/Design

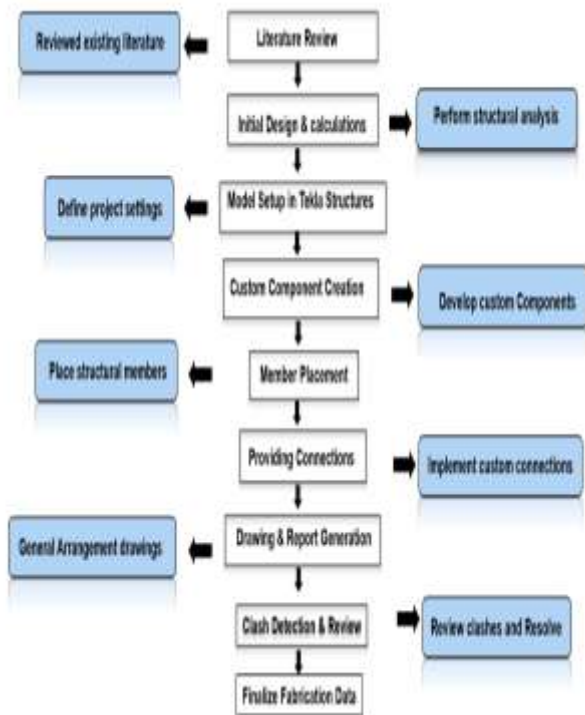


Figure 1. Flowchart

The methodology presented here is in part the same method used within Tekla Structures detailing of a structural steel project, remapping the entire process in the BIM environment. This makes sure that a valid 3D

model is generated before fabrication. The initial workflow in this tool is focusing on Initial Design & Calculations, which imports or creates information from the structural engineer based on member size, material and so many other factors. The detailer will then work through the 3D model in steps, starting with the Main Members i.e. Columns and Beams, then creating detailed components like Custom Component Creation for special connection details & Modelling Secondary Steel & Access (walkways, ladders etc). But adding the Connections, Welds and Bolts is the most important part of this entire system, since that defines how everything goes together. When the 3D model is completed, they also use the automation tools used in Drawing Generation to produce Garages/Assembly/Parts drawings. Clash Detection & Review: No geometry can be in conflict with each other; hence this is an important process of quality control that is a part of this methodology. The last of these processes is Finalize Fabrication Data.

5. Model Implementaion

5.1 3D Model

This project includes a 3D BIM model of the batch plant structure using Tekla Structures software. There is also a precise calculation of the amounts of materials used in the structure, such as steel and concrete. The benefit gained consists of better visualization and coordination on the structure, optimal use of materials for the structure, and precision in results for batch plant forming and estimation.

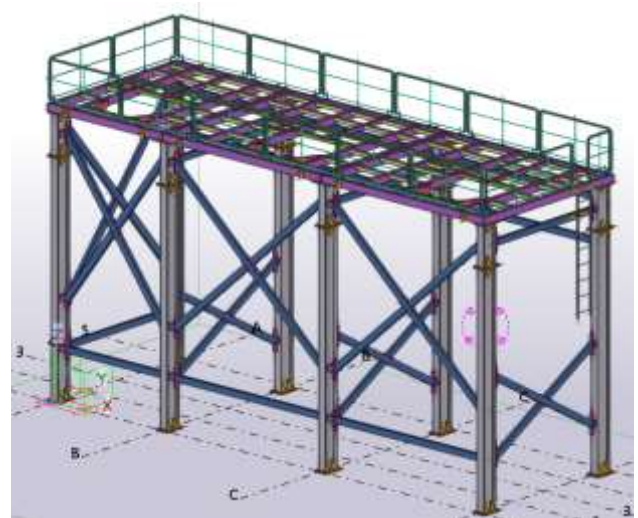


Figure 2. 3D Model



5.2 Reports generated

Assembly list generation in Tekla Structures is the process of creating a detailed report that includes all assemblies present in a structural model, such as beams, columns, and their connected components. After completing the modeling, the assemblies are numbered to assign unique identification marks, and then a report is generated using predefined templates in the software. This report typically contains information like assembly numbers, part details, quantities, material specifications, and weights. It is widely used for fabrication, material estimation, and project documentation, helping engineers and contractors organize data efficiently and reduce errors during construction.

Assembly	Qty.	Name	Profile	Weight [kg]
0	1	BASE PLATE	PL16*250	12.6
0	17	BRACING	RHS122X61X5	32.4
1	1	BASE PLATE	PL16*250	14.4
2	5	BASE PLATE	PL16*400	20.1
3	12	CONNECT PLATE	PL12*63	2.4
4	2	CONNECT PLATE	PL12*63	3.9
5	2	BRACE CONNECT	PL12*65	1.8
6	2	CONNECT PLATE	PL10*50	0.6
7	1	CONNECT PLATE	PL10*50	2.0
8	1	CONNECT PLATE	PL10*50	0.6
9	8	CONNECT PLATE	PL12*63	1.8
BA1	1	BEAM	RHS122X61X5	29.1
BA2	1	FLOOR BEAM	RHS145X83X5	485.8
BA3	1	FLOOR BEAM	RHS145X83X5	643.2
BA4	1	FLOOR BEAM	RHS145X83X5	628.0
CA1	1	COLUMN	HI300-15-12	4036.4

Table 1. Assembly List

Size	Qty.	Length(mm)	Area(m ²)	Weight(kg)
D33.7	15	1540	0.2	8.8
D33.7	14	2884	0.3	16.9
D33.7	14	1439	0.1	8.2
D33.7	8	320	0.0	1.8
D33.7	2	150	0.0	0.8
D33.7	2	52	0.0	0.4
D33.7	1	3484	0.4	20.4
D33.7	1	2380	0.2	13.5
D33.7	1	2380	0.2	13.5
D33.7	1	2039	0.2	11.7
D33.7	1	1913	0.2	11.2
D33.7	1	600	0.1	3.4
D33.7	1	569	0.1	3.2
D33.7	1	467	0.0	2.6
HI300-15-12	8	4616	5.2	271.8
HI300-15-12	8	800	0.9	47.1

PL10*50	48	120	0.0	0.5
PL10*50	4	150	0.0	0.6
PL10*50	4	150	0.0	0.6
PL10*117	44	200	0.0	0.9
PL10*117	20	150	0.0	0.7
PL12*63	108	400	0.1	2.4
PL12*63	8	300	0.0	1.8
PL12*65	2	300	0.0	1.
PL12*117	8	200	0.0	1.1
PL12*120	12	145	0.0	1.2
PL12*130	9	190	0.1	2.3
PL12*280	3	280	0.1	2.1
PL16*250	24	400	0.2	12.6
PL16*400	8	400	0.3	20.1
PL25*250	8	400	0.2	19.6
PLT12*65	4	300	0.0	1.8
RHS70X52.5	3	1300	0.3	11.5
RHS70X52.5	1	398	0.1	3.5
RHS70X61	6	614	0.2	5.8
RHS70X61	6	506	0.1	4.8
RHS70X61	2	741	0.2	7.0
RHS70X61	2	691	0.2	6.6
RHS70X72	12	614	0.2	6.4
RHS70X72	12	506	0.1	5.2
RHS70X72	5	741	0.2	7.7
RHS70X72	5	691	0.2	7.2

RHS70X72	5	398	0.1	4.1
RHS70X72	4	638	0.2	6.6
RHS70X72	4	588	0.2	6.1
RHS70X72	3	1522	0.4	15.8
RHS70X72	1	504	0.1	5.2
RHS70X83	3	1300	0.4	14.6
RHS122X61	24	54	0.0	0.7
RHS122X61	16	118	0.0	1.6
RHS122X61	11	116	0.0	1.6
RHS122X61	3	2893	1.0	38.3
RHS122X61	3	2893	1.0	36.4

Table 2. Material List



5.3 General Arrangement Drawings

General arrangement (GA) drawings are used for viewing the complete structure of the batch plant, which includes the layout, size, and location of the major structural components, i.e., columns, beams, bracings, platforms, staircases, etc. These drawings are useful for understanding the complete geometry of the structure.

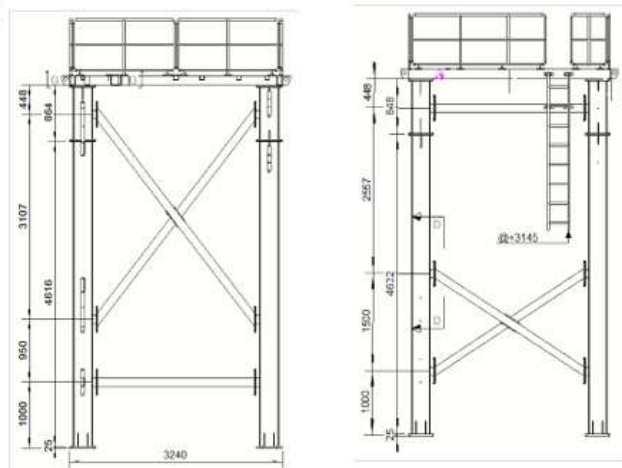
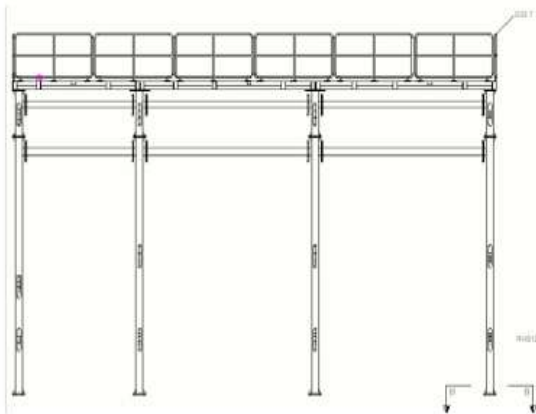
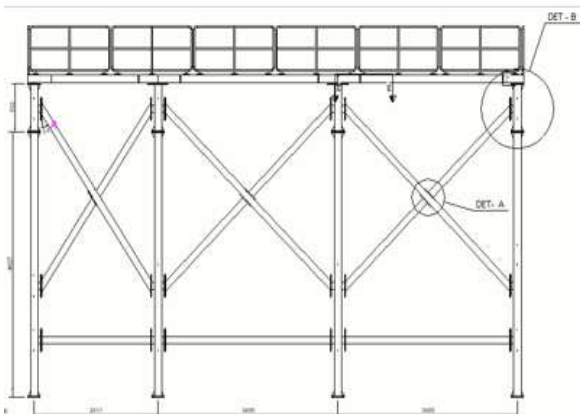


Figure 3. View at Gable End



(a)



(b)

Figure 4. View at Longitudinal View

6. Conclusion and Future Scope

The Project on Design and Quantity Estimation of Batch Plant Structure using Tekla Structures has successfully proven a great impact of Building Information Modelling (BIM) in the context of 21st Century Structural Engineering & Industrial Construction. Using Tekla Structures, it is now possible to generate an accurate detailed 3D model of the structure of the batch plant that encompasses all significant elements of the structure including columns, beams, bracings, base plates, platforms, hand railings etc.

This made sure that the amount of weight fitted to steel material, concrete volume material, bolts written in the building system was calculated accurately through BIM integration with quantity estimation; hence reducing human calculation errors and minimizes wastage of raw materials. Furthermore, the study highlighted how 5D BIM could help integrate cost information with structure to facilitate budgeting and optimization in structural analysis during construction.

Data Availability

No datasets were generated or analysed during the current study.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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Authors' Contributions

Author 2 conceived and designed the study. Author 2 collected and analysed the data. Author 1 wrote and reviewed the manuscript. All authors read and approved the final version of the manuscript.



Acknowledgements

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7. Trimble Solutions Corporation (2024) – Tekla Structures User Assistance This official guide provides practical instructions on modeling, detailing, and estimation within Tekla. It is highly relevant for learning baseplate connections, seating plate arrangements, and the use of custom components.
8. IS 800:2007 – General Construction in Steel This Indian Standard code governs the design of steel structures, covering limit state and working stress methods. For LED billboards, it helps in selecting safe columns, beams, and bracing sections.
9. IS 875 (Part 3): 2015 – Wind Loads on Buildings and Structures Since billboards face significant wind pressure, this code is crucial for load calculation and structural stability. It defines design wind speed, terrain categories, and pressure coefficients.
10. IS 456:2000 – Plain and Reinforced Concrete This standard ensures safe design of the billboard foundation and anchor bolt embedment in reinforced concrete bases.