Revolutionizing Cement Plant Construction with BIM

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HOLTEC CONSULTING

(Kapil Goyal)

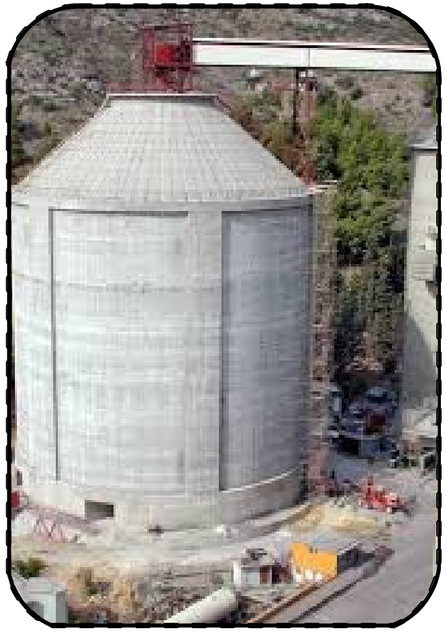
Key Insights of the webinar

- To highlight the challenges faced in cement plant construction.
- To demonstrate how BIM (Building Information Modelling) addresses these challenges through advanced digital tools.
- To showcase the advantages of BIM in improving efficiency, safety and cost-effectiveness.
- To present Holtec's expertise and experience in implementing BIM in cement industry projects.

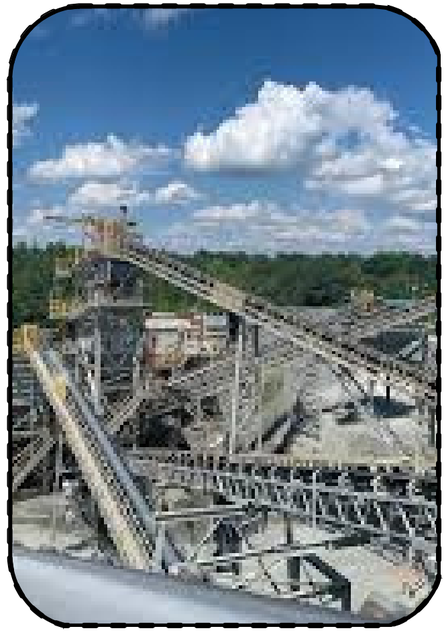
CEMENT PLANT

A HEAVY INDUSTRY

VERY HEAVY VIBRATING MACHINES



HUGE STORAGES



COMPLEX NETWORK OF MATERIAL TRANSFER SYSTEM

HUGE INTERCONNECTING DUCT NETWORKS

HUGE NETWORK OF CABLES

CEMENT PLANT

FOR SUPPORTING WE NEED

40-50 ODD NUMBERS OF SMALL AND BIG BUILDINGS

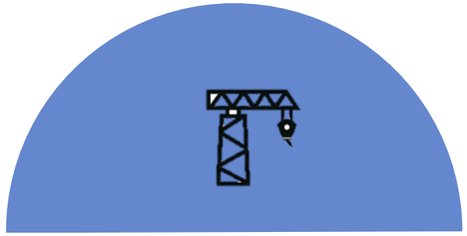
INDEPENDENT STRUCTURES TO SUPPORT DUCT , CONVEYING SYSTEMS AND CABLES

FACILITIES FOR ADMINISTRATIONS AND WORKERS

CONSTRUCTION VOLUMES

RCC CONSTRUCTION

- Typical cement plants require 80,000 and 120,000 cu m of RCC for foundational and buildings.
- Size of structure varies from small electrical load center to Preheater (26m x 36m x 150m High).
- All building are having equipment and machine supports inside.



STEEL CONSTRUCTION

- Typical cement plants require about 12,000 Metric Ton of Structural steel fabrication and erection.
- Structures are complex as these support Ducts (which are not straight) , maintenance platform and cables.

EARTHYWORK

- Depending on the land terrain there is a huge earthwork in the construction of cement plant.
- Optimization to be done.
- Access to different levels to the ensured.
- Road slopes and Drainage to be taken care.
- Erectability, operability and maintenance of machines and structures to seen.

KEY CHALLENGES IN ENGINEERING

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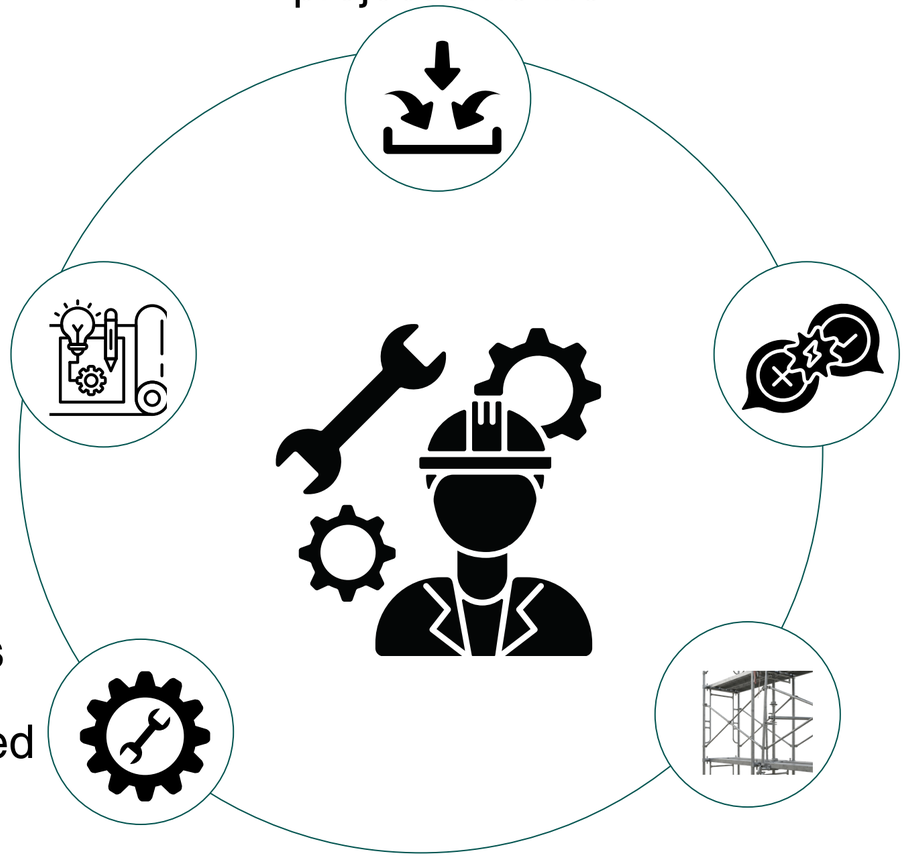
Receipt of input in phases

Improperly phased/delayed ordering of equipment impacts project timeline



Revision of Drawings

All stake holders to work on latest revision of drawings

Dimensional Clash

Mismatch between mechanical GA and civil construction drawings or with steel fabrication drawings.

Changes in building GAs

Changes due to phased / delayed procurement

Structural Fouling

Improperly conceived GA may result in fouling of ducts with equipment or with structural members

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INTRODUCTION TO BIM (BUILDING INFORMATION MODELING)

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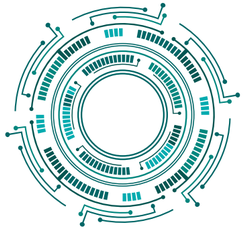
Define BIM as a digital building representation

BIM is the digital representation of the physical and functional characteristics of a building facility, serving as a comprehensive information resource.

Enable integrated project visualization & collaboration

BIM facilitates teamwork by allowing stakeholders to visualize the entire project and collaborate efficiently throughout the construction process.

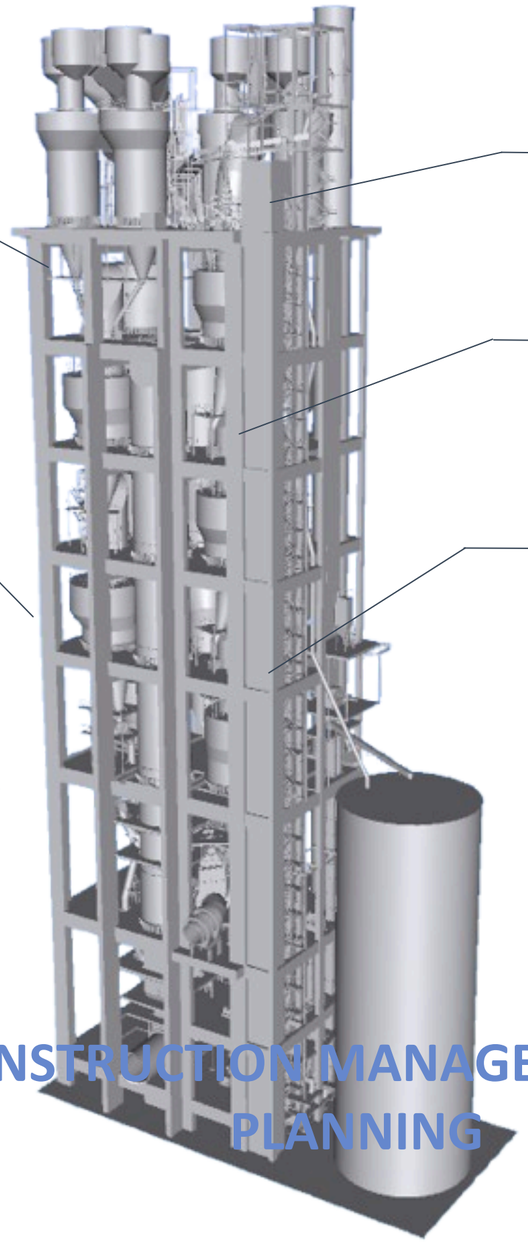
Recognize BIM as a transformative construction technology



Emerging over the last two decades, BIM is revolutionizing the construction industry by enhancing design,planning & execution phases.

WHY BUILDING INFORMATION MODELING?
KEY BENEFITS TO MEET THE CHALLENGES

A. ENHANCE COLLABORATION AMONG MULTIDISCIPLINARY TEAMS



MECHANICAL DESIGN BY SUPPLIER

CIVIL DESIGN

CIVIL CONSTRUCTION

STRUCTURAL DESIGN

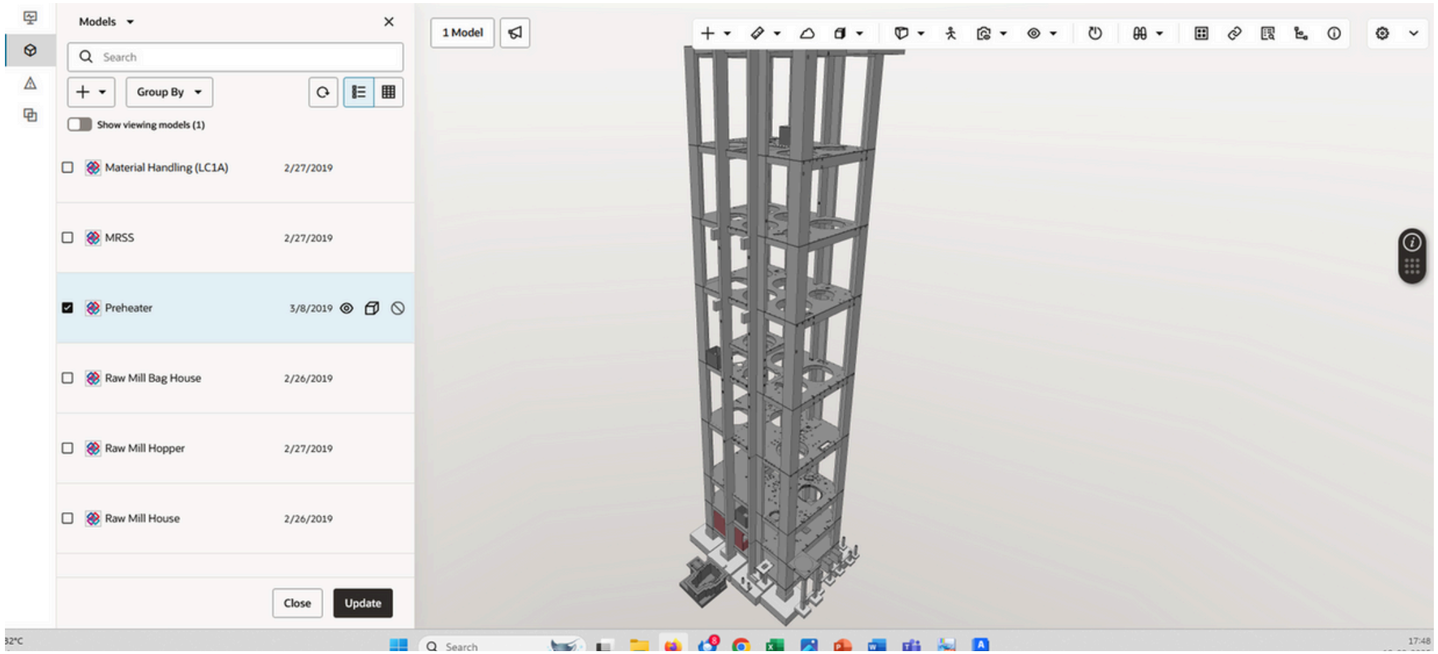
MECHENICAL ERECTION

STRUCTURAL ERECTION

CONSTRUCTION MANAGEMENT AND PLANNING

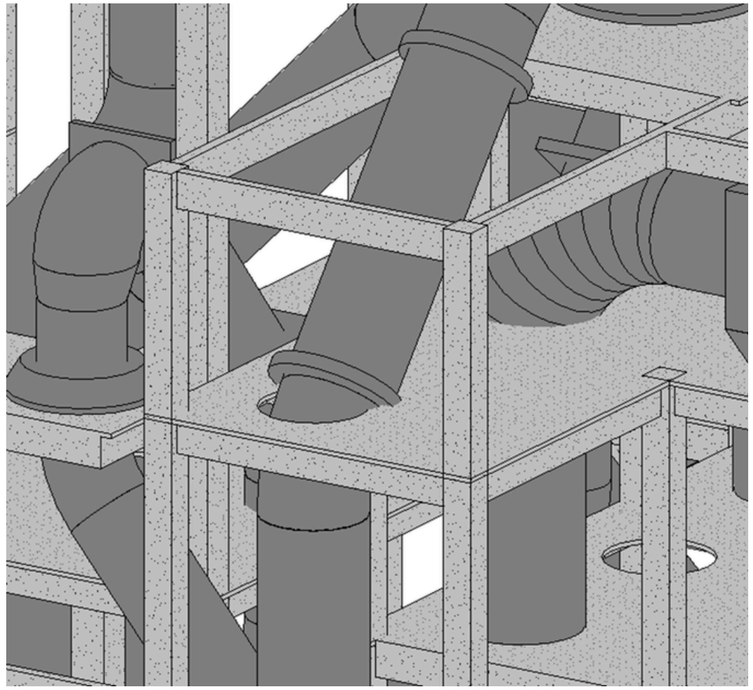
B. AVAILABILITY OF LATEST INFORMATION ON CLOUD

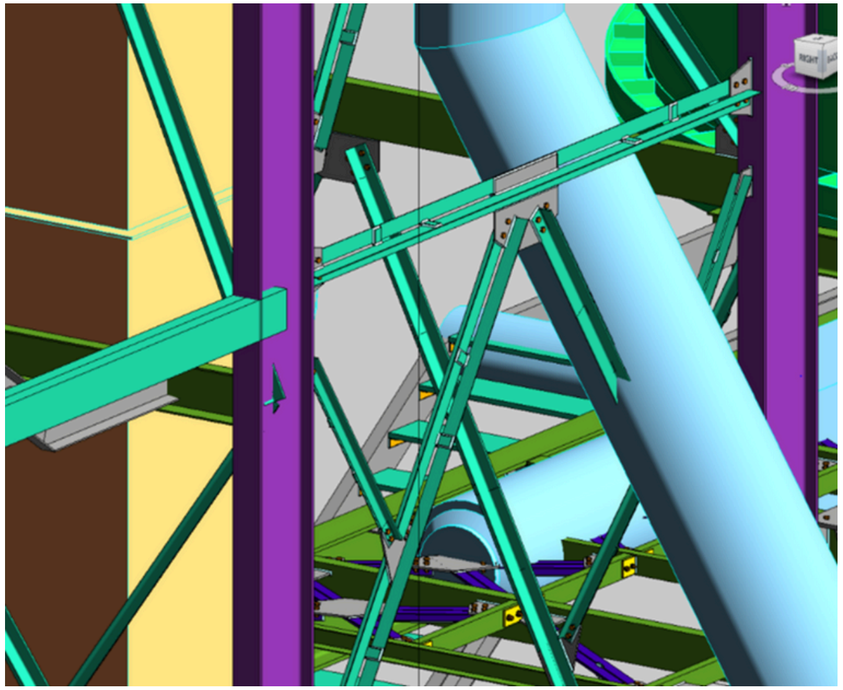
- Holtec prepared and made all the Latest models available on cloud to all the stakeholders. Cloud services for the BIM was provided by the client only for having better control over the data as an Owner
- Latest drawings and relevant data are also available on cloud to avoid any confusion at site.
- Due to phase wise availability of information, the frequent revision is confusing. This can lead to errors and mismatches . As per our experience the same is better taken care using BIM.



C. CLASH CHECK AND FOULING

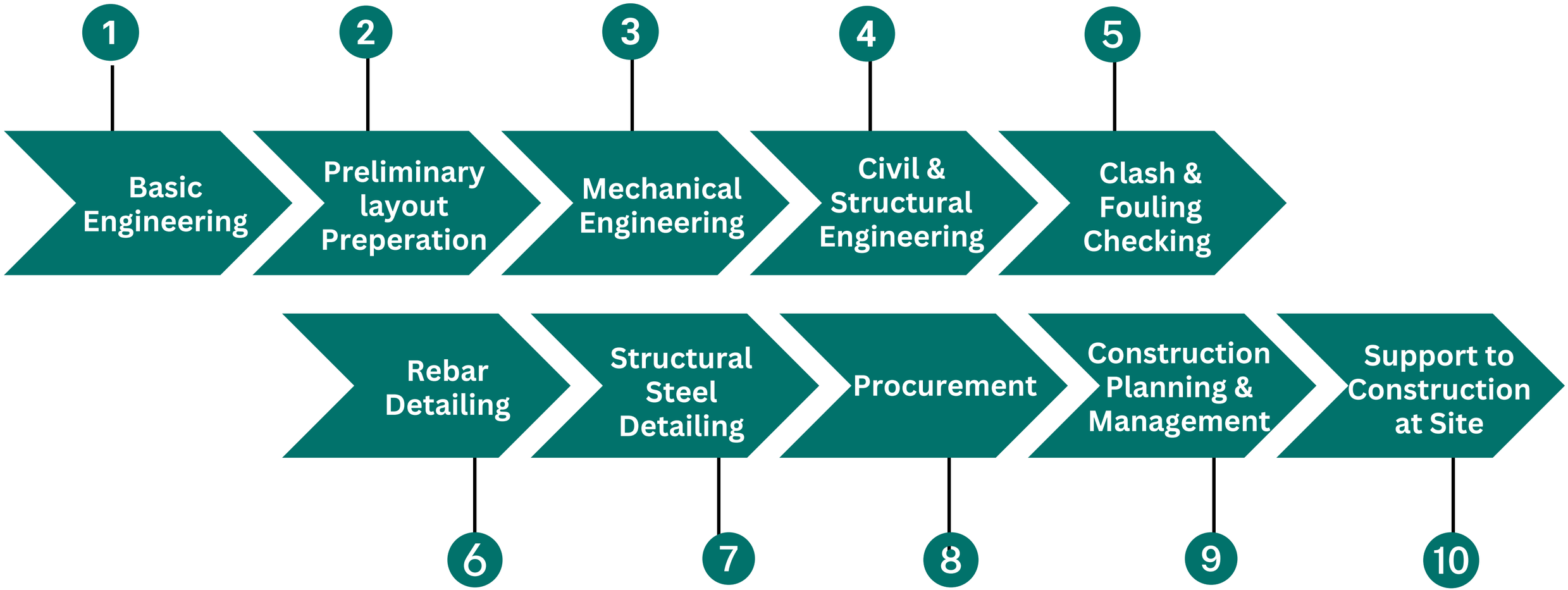
- There are different stakeholders in the construction of cement plant like mechanical supplier , civil and structural engineer and electrical engineer.
- Conventionally all of them work in their separate and isolated environment.
- Flow of information and changes is not smooth in conventional methods, hence there are chances of errors and mismatches.
- We have implemented BIM in certain disciplines and found the flow of information very smooth.
- Using tools for clash check , we could by and large remove major site problems.
- There were lesser mismatches and no clashes in the drawings .i.e between civil , structural and Mechanical.





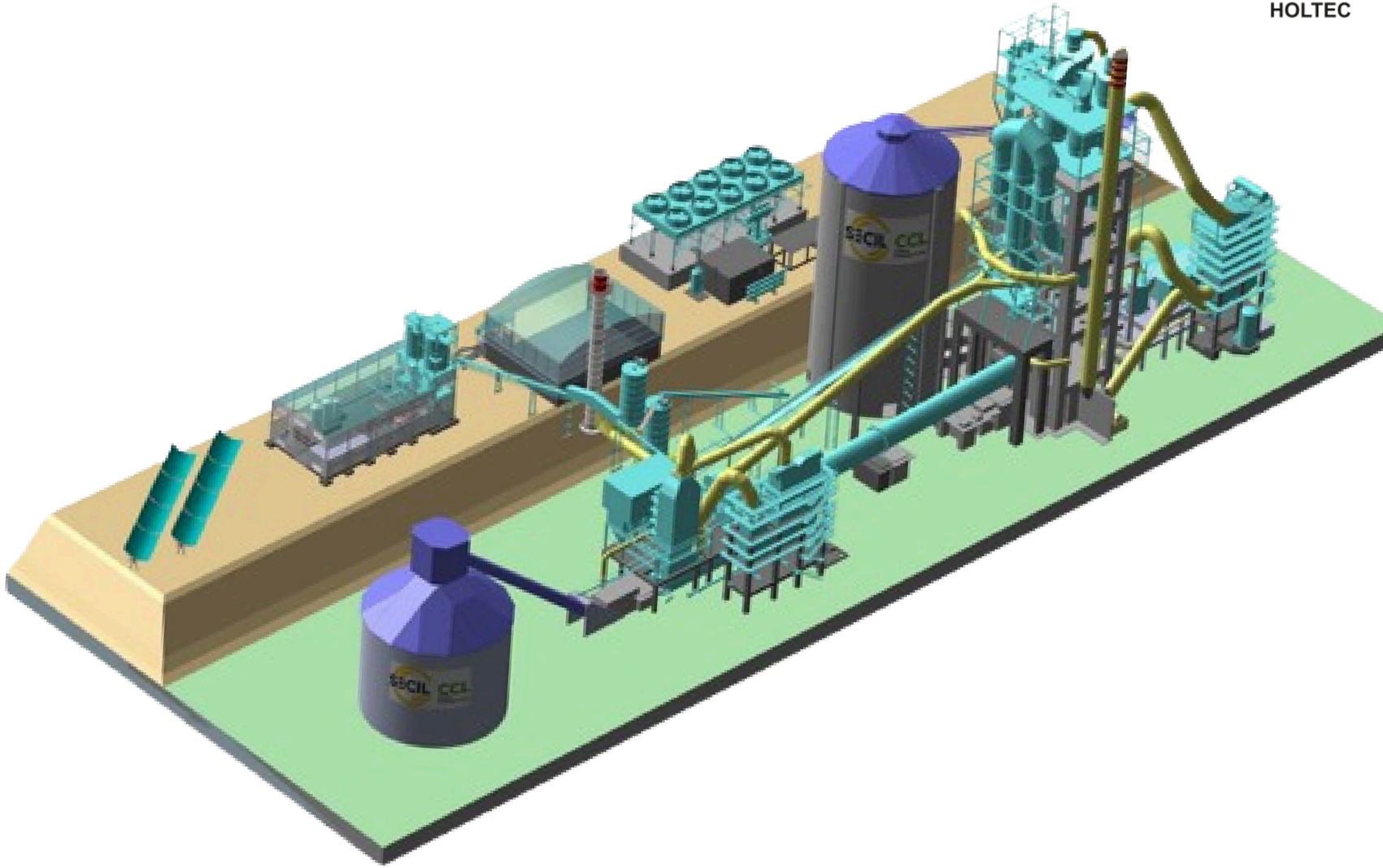
FLOW OF BIM ENGINEERING IN CEMENT PLANT

10 steps in BIM engineering in cement plant



1. BASIC ENGINEERING

- Technical concept development
- Flow sheet
- Mass flow diagram
- Preparation of tender document
- Review of tender and ordering



2.PRELIMINARY LAYOUT PREPARATION

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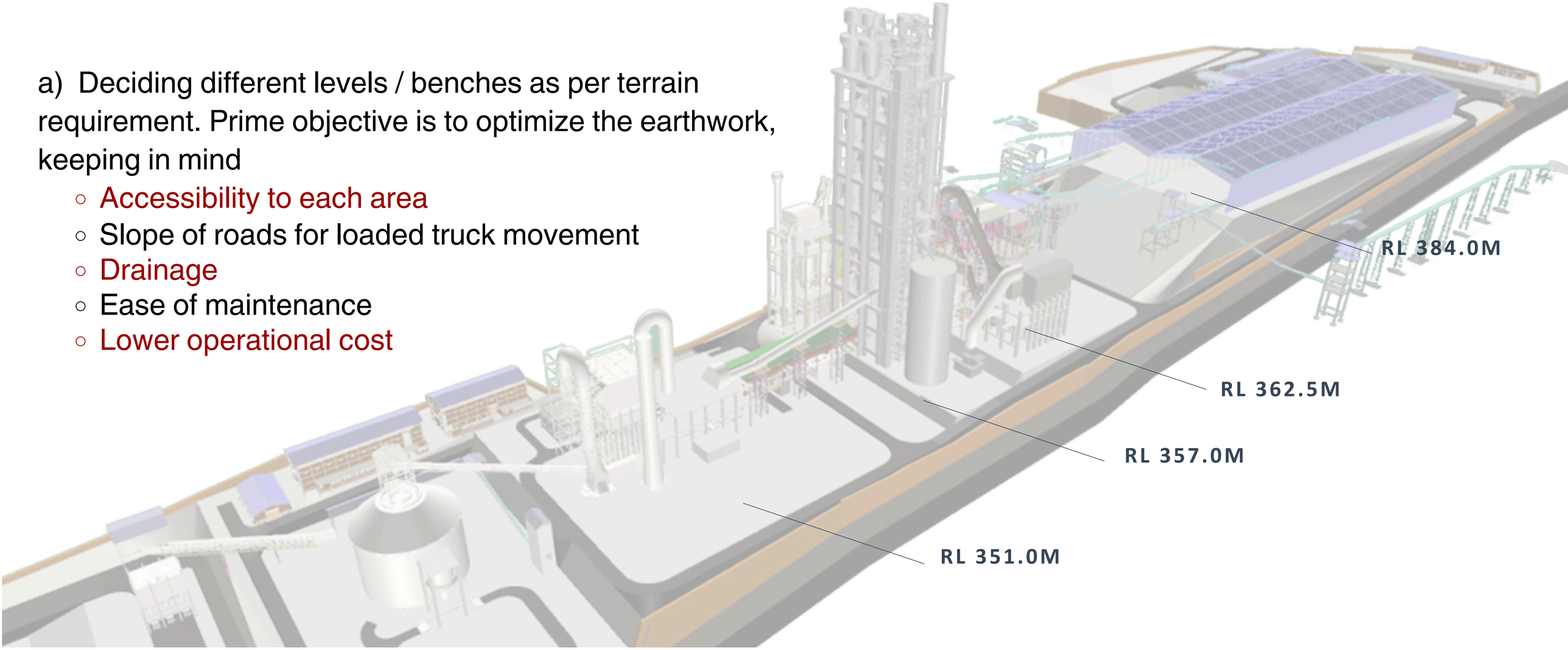
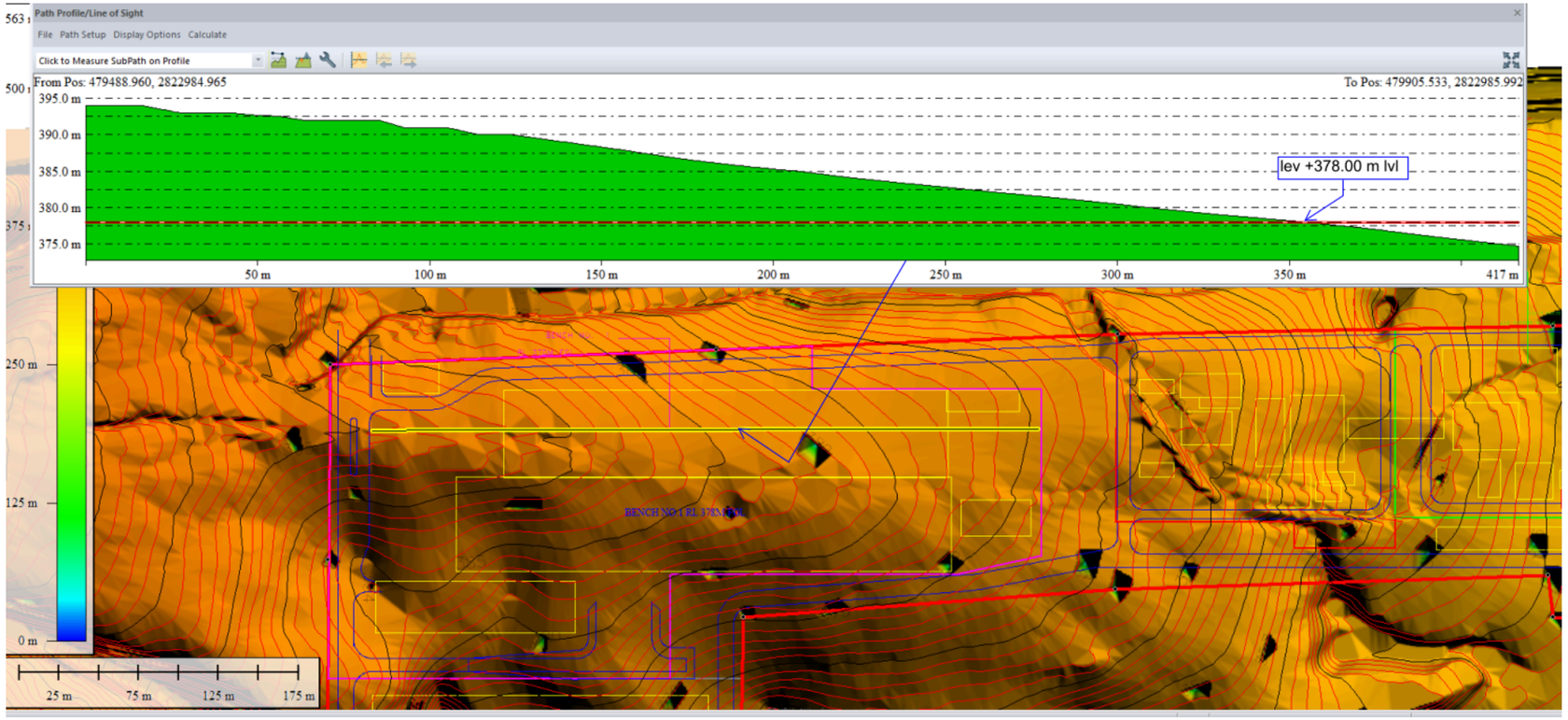
a) Deciding different levels / benches as per terrain requirement. Prime objective is to optimize the earthwork, keeping in mind

- Accessibility to each area
- Slope of roads for loaded truck movement
- Drainage
- Ease of maintenance
- Lower operational cost



2. (Contd.) PRELIMINARY LAYOUT PREPARATION

b) Detail Calculation of earthwork is done using software which shows volume of cutting and volume of filling in the selected area on adoption of certain level bench. This also tell the level of bench at which cut, and fill are balanced.



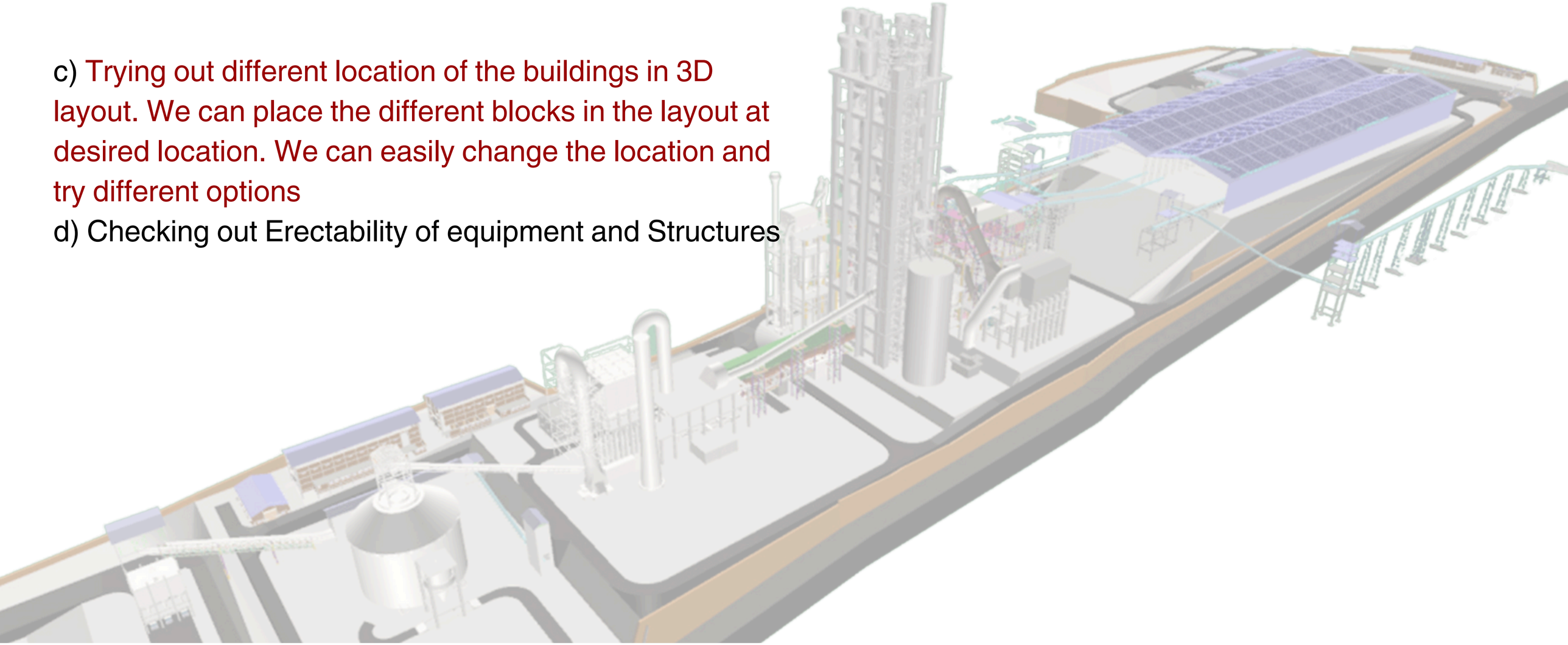
<Feature Name>	CUT_VOLUME	CUT_AREA	FILL_VOLUME	FILL_AREA	CAUT FILL BAL ELEVATION
BENCH NO.1 RL 378M FGL	430381.28 cubic meters	0.0606 sq km	143308.46 cubic meters	0.01126 sq km	381.995 m

2. (Contd.) PRELIMINARY LAYOUT PREPARATION

HOLTEC

c) Trying out different location of the buildings in 3D layout. We can place the different blocks in the layout at desired location. We can easily change the location and try different options

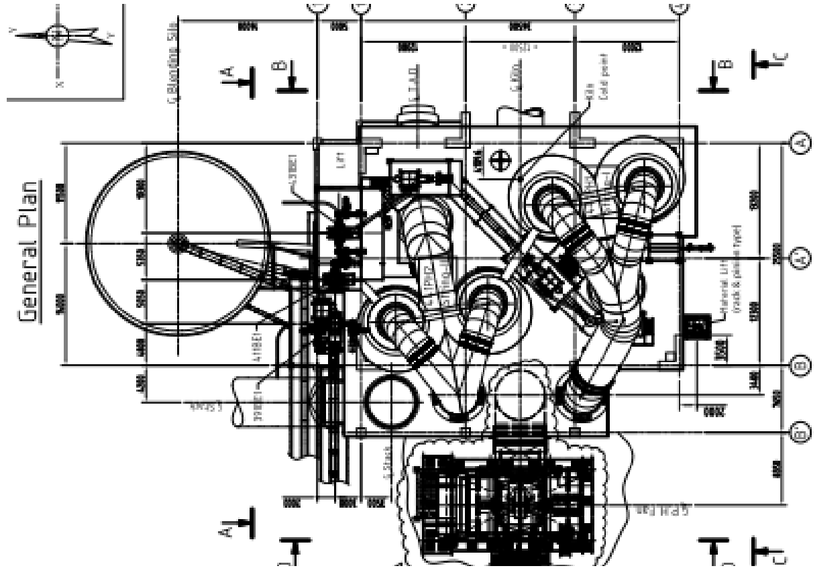
d) Checking out Erectability of equipment and Structures

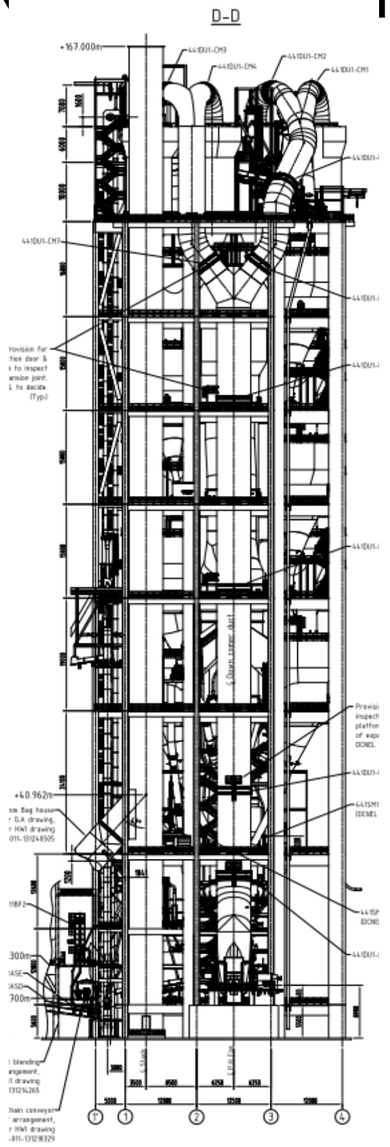


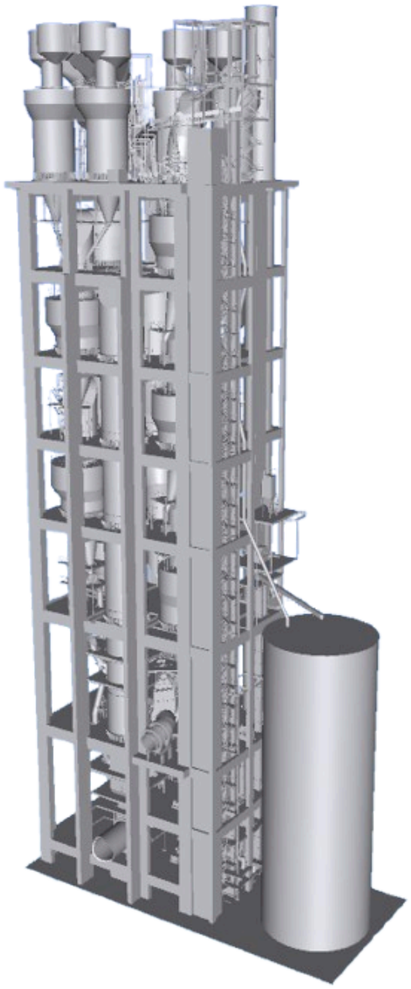
3. MECHANICAL EN

Supplier prepare mechanical engineering model

- As per process requirement
- As per layout requirement
- Following statutory rules
- As per local requirements
- As per client preference for building material
- Also calculates and provides loads on the structure required







Basic Engineering | Preliminary layout Preperation | **Mechanical Engineering** | Civil & Structural Engineering | Clash & Fouling Checking | Rebar Detailing | Structural Steel Detailing | Procurement | Construction Planning & Management | Support to Construction at Site

4. CIVIL AND STRUCTURAL ENGINEERING

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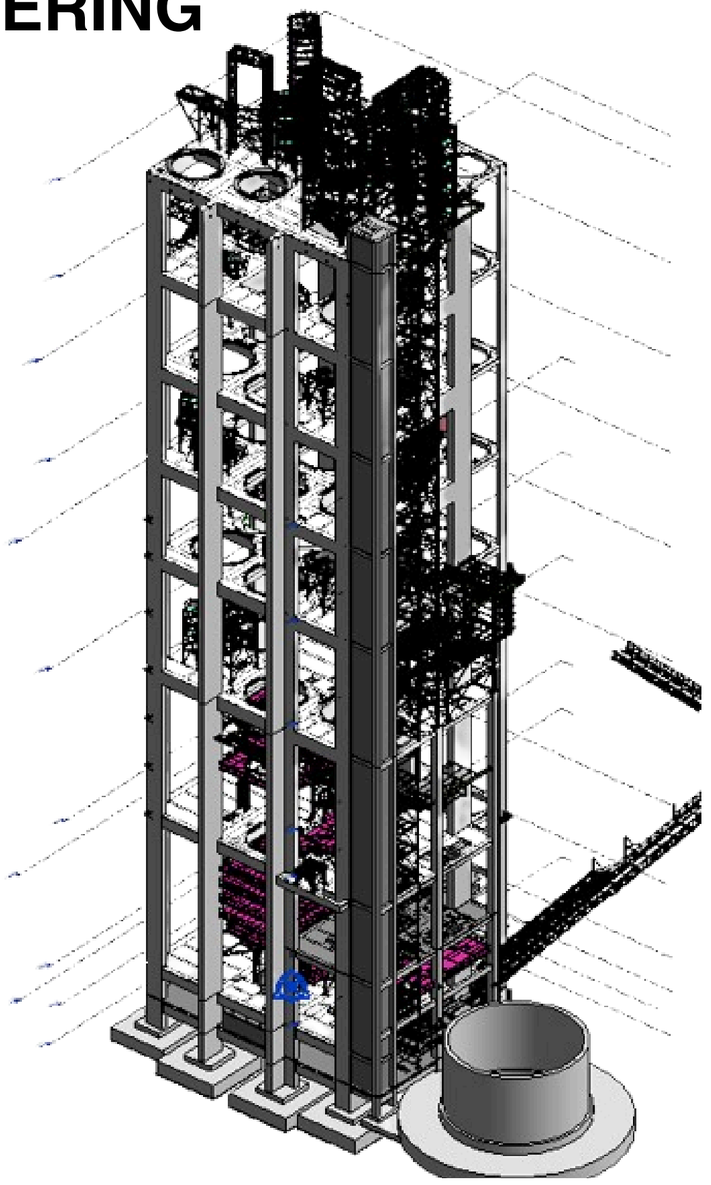
Structural consultant design the required structure and prepare civil / structural engineering model collaborating on the same mechanical model:

- Design is done taking the loads as per mech requirements.
- All other live loads are considered as per codes.
- Wind and seismic loads are taken as per location and codes applicable .
- Sizing of the members are done as per restrictions due to mechanical equipment's .
- Sufficient maintenance space is ensured.
- Constructability is to checked by the site.
- Collaborated model is shared to all stakeholders.
- Any comments from the stakeholders are discussed , mutually agreed and implemented combinedly by mechanical or civil engineer
- Any fouling and mismatches can be checked before hand and same can be rectified



5. CLASH AND FOULING CHECKING

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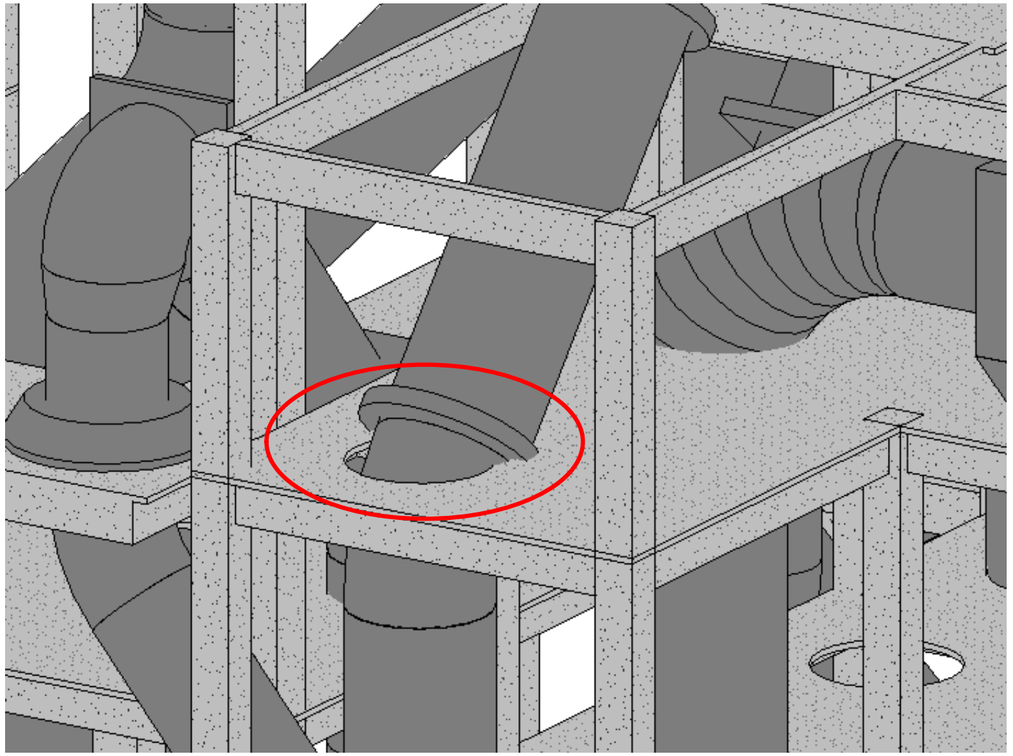
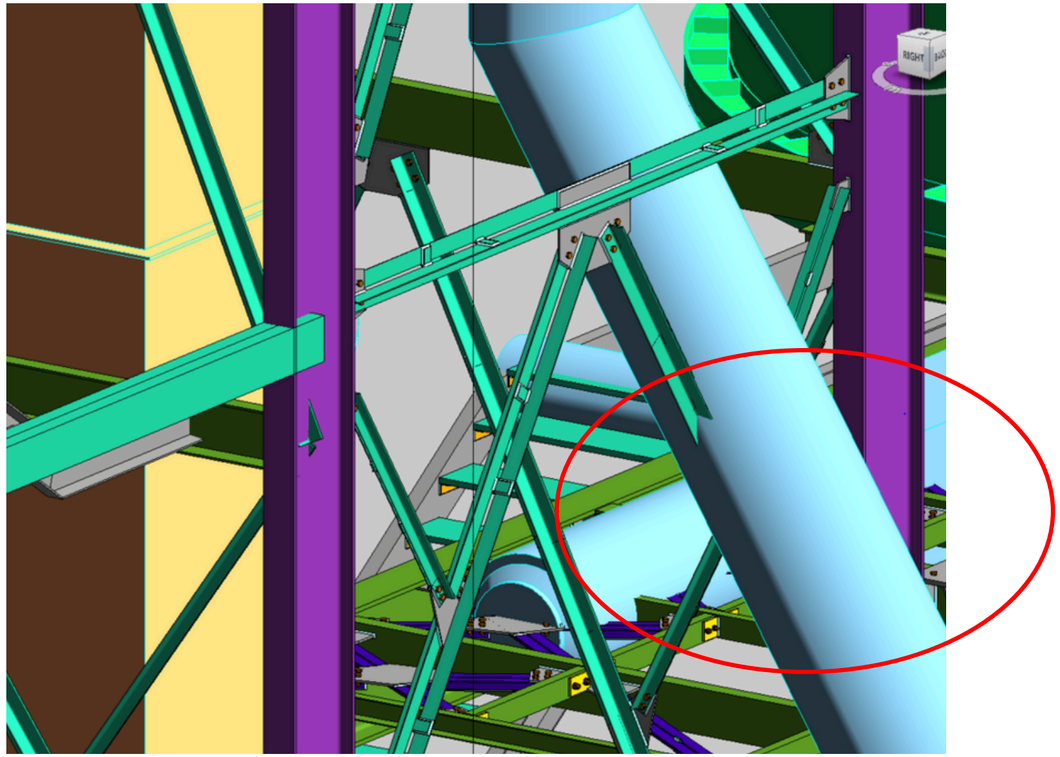
- Software has inbuilt tools to check the clashes / fouling in the integrated model.
- It checks fouling between equipment to structure and structure to structure.
- It lists and Highlight the clashes.
- Corrections can be made in the model before final detailing.



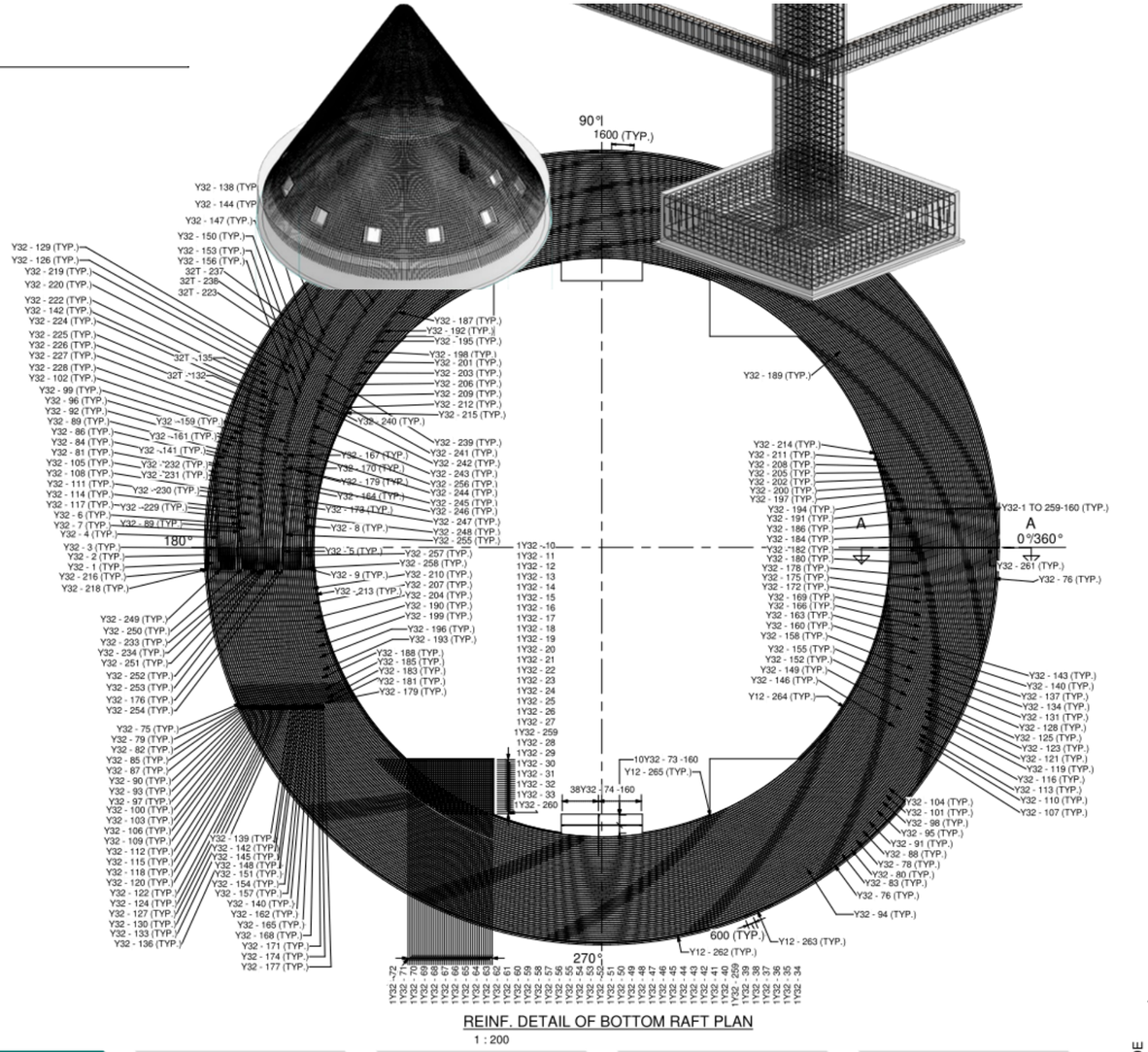


6. REBAR DETAILING

After finalization of GA model with all the stakeholders. Rebars are modeled in the Main model

- Rebars dia and spacing provided in scale as per design requirement
- Rebar drawings are generated through software.
- Max. Bar length provided considering the availability , maneuverability and weight of each bar.
- Codal provision are followed
- BBS is Automatically extracted
- Barwise procurement details can be extracted

RAFT BOTTOM R/F.	1	32	5220	2	5210 mm	
RAFT BOTTOM R/F.	2	32	6216	2	200 mm 6200 mm	78
RAFT BOTTOM R/F.	3	32	4225	2	80 mm 4220 mm	53
RAFT BOTTOM R/F.	4	32	3246	2	50 mm 3240 mm	41
RAFT BOTTOM R/F.	5	32	3245	2	50 mm	41



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7. STRUCTURAL STEEL DETAILING

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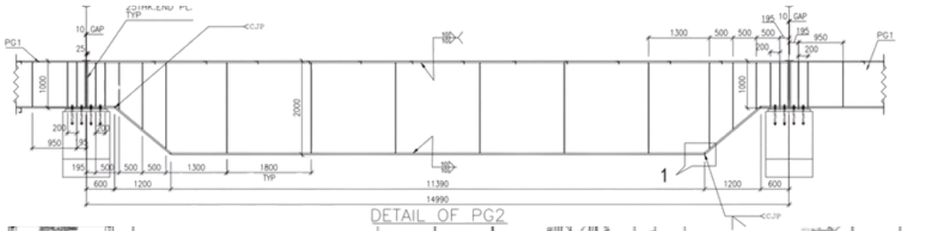
After finalization of GA model with all the stakeholders. Structural steel connections are applied in the main model.

- Erection GA is prepared.
- Shop fabrication drawings are prepared from the model.
- Drawings wise bill of material is extracted.
- Overall BOQ can be extracted.
- Bolt list can be extracted.
- If required CNC files for each piece can also be extracted if the fabrication is to be done in automize workshop.



Structural Steel Qty.	
Section	**Total Weight (Kg)**
ISMB600	1820
ISMB500	237
ISMB300	1967
ISMC150	89
ISMC100	75
ISMC75	115
ISA75X75X6	125
ISA65X65X6	1,055
PL.10	2,180
PL.12	560
pl.16	50
PL.20	5,240
PL.25	17,495
PL.32	8,036
Total (kg)	**39,044**
8% Extra for connection & stiffners plates	3,124
Grand Total (kg)	**42,168**

8. PROCUREMENT

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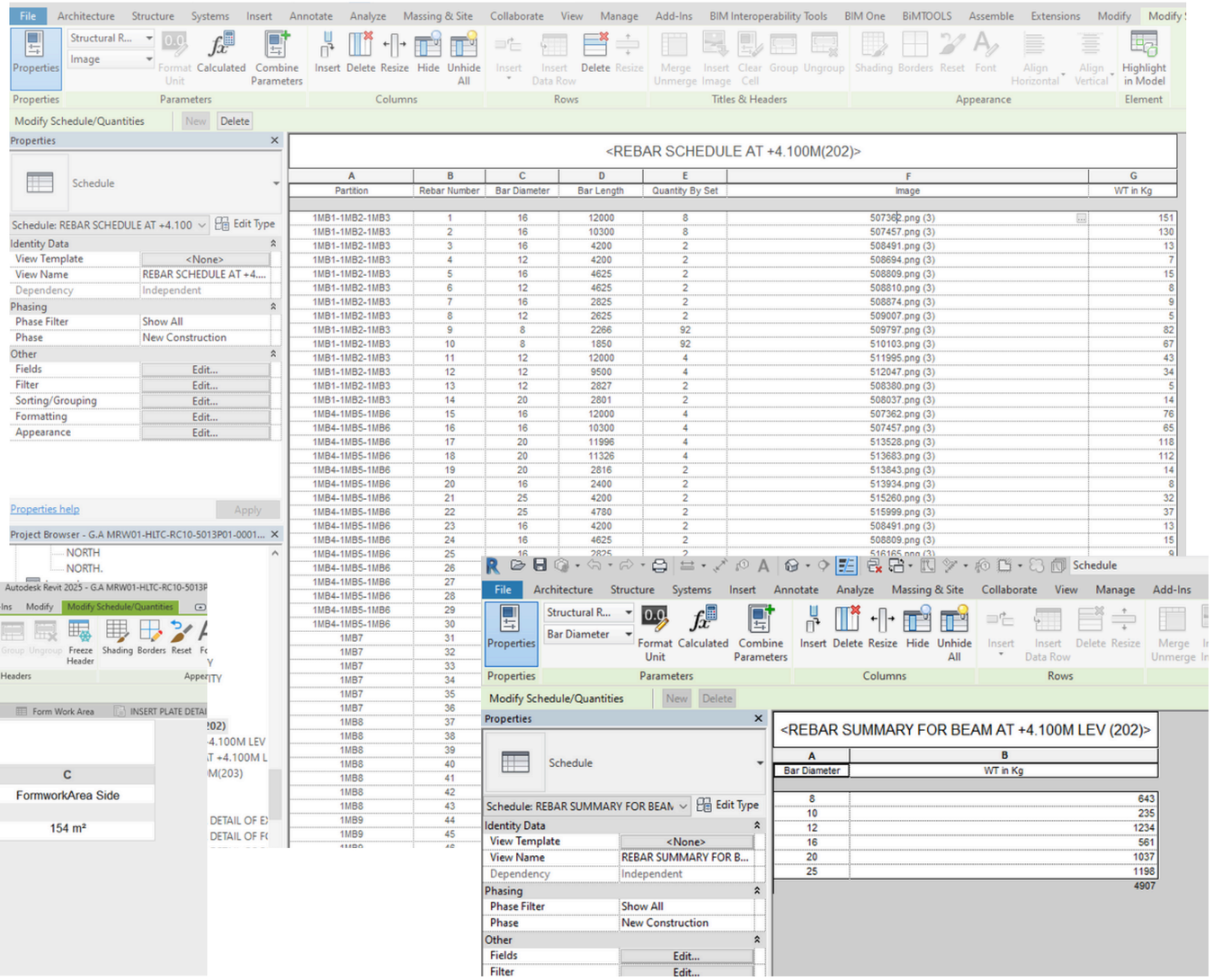
Precise Quantity Takeoff for procurement

- Automated quantity extraction with BIM models
- Improve accuracy in material estimation
- Reduce waste and cost overruns
- No interference of other agency in estimation
- BOQ for RCC (Grade wise)
- Rebar qty Dia wise
- Structural Steel Qty Member wise
- Area of Shuttering



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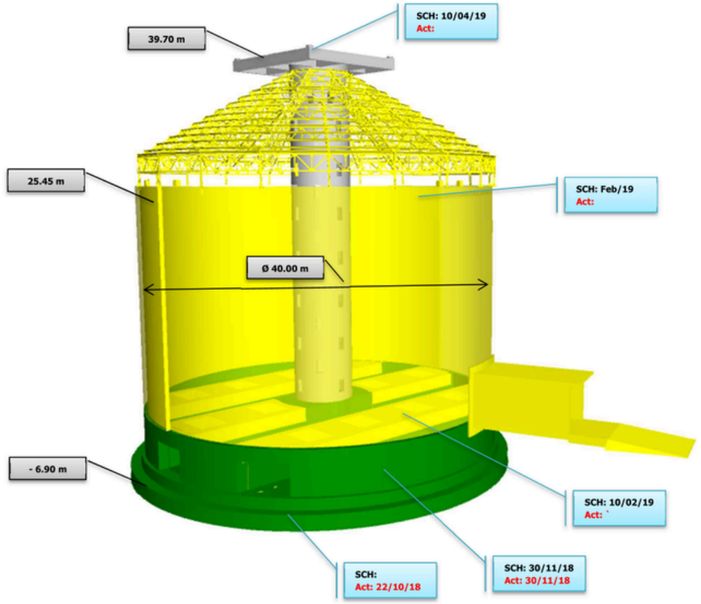
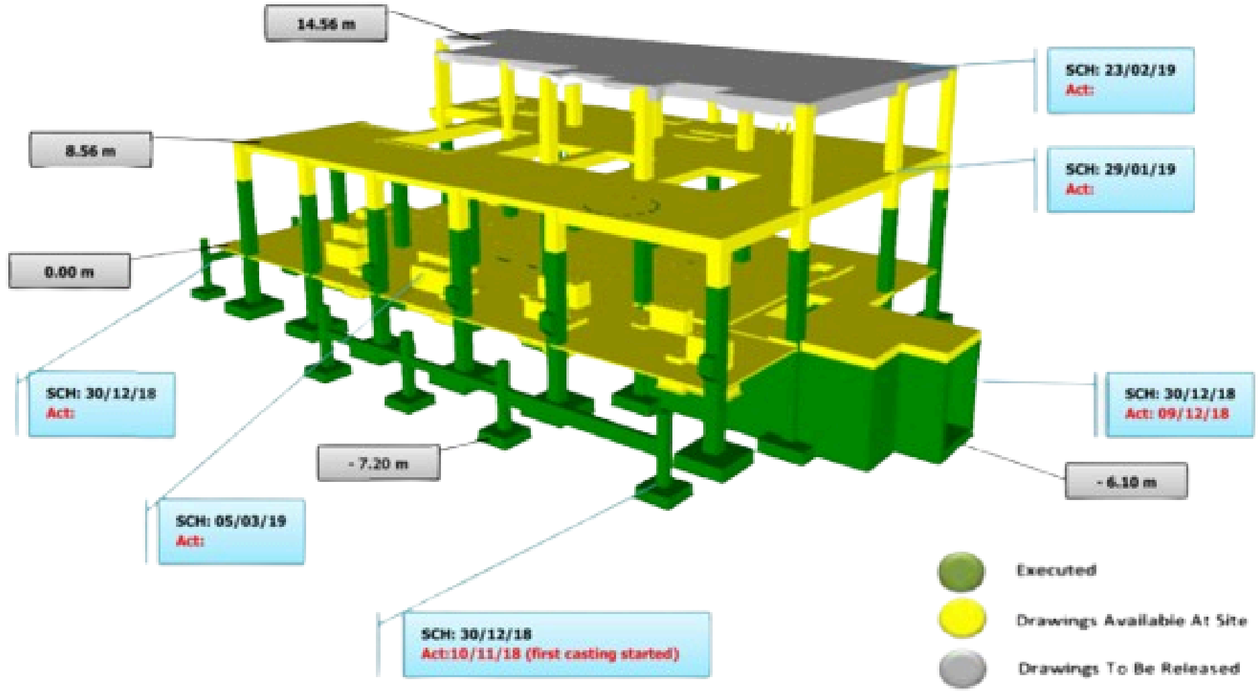
9. CONSTRUCTION PLANNING AND MANAGEMENT

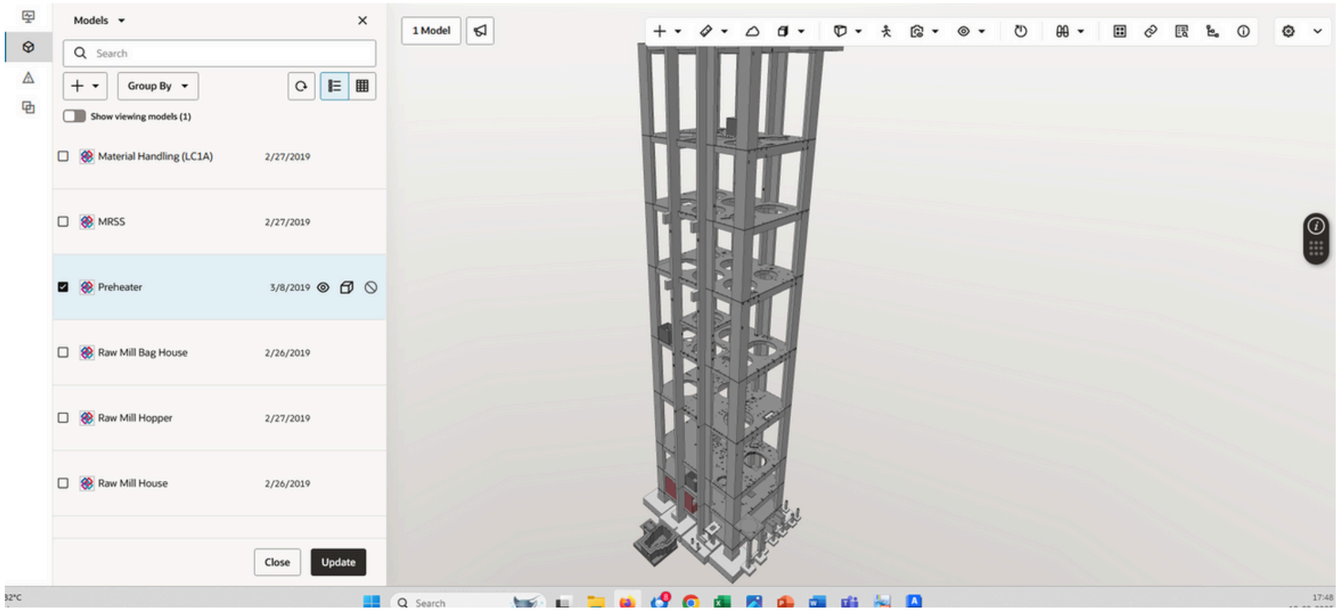
- Project planning can be done phase wise using 3 D models
- Timeline can be attached to each phase during planning
- This adds 4th Dimension i.e. Time in addition to 3-D (X,Y & Z)
- Project monitoring can be done following the planning





10. SUPPORT TO CONSTRUCTION AT SITE

- All synchronized models can be made available on cloud
- Site can access the cloud models and associated drawings on devices like laptop , TAB and Mobile using suitable applications
- Site can review the models and suggest suitable correction if required
- BOQ are also available in the model



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SITUATION TODAY & ACTION PLAN

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Situation Today

- BIM adoption in cement projects still limited
- Not all stakeholders are actively participating
- Shortage of skilled BIM professionals
- Customers hesitant due to higher initial costs and marginal increase in engineering time

Action Plan

- Encourage more investment in BIM for long-term benefits
- Train in-house teams and consultants for BIM applications
- Promote research for automation and AI integration in BIM
- Establish protocols for better collaboration and model sharing

HOLTEC's Experience in BIM Implementation

Holtec has integrated BIM methodologies across certain project implementations

Achievements:

- We have implemented the BIM in many projects to some extent .
- Cut / fill volumes were calculated using software and levels were decided.
- Civil engineering & Structural Steel models were prepared using 2-D mechanical supplier drawings.
- All Civil and Structural GA were prepared through the BIM models only.
- Detailed BBS and fabrication drawings were prepared.
- BOQ were extracted from the same models and were accurate.
- All payments for bar bending and RCC at site were made through the BOQ from BIM.
- Models were uploaded on cloud.
- Models were used later for further modification.
- Models were used to report the status of engineering and construction activities.

STRATEGIC RECOMMENDATIONS FOR BIM IMPLEMENTATION

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Adopt BIM early in design phases

Implement BIM from the initial project stage to enhance planning accuracy and design coordination, reducing revisions and improve project outcomes.

Establish collaboration protocols among teams

Define clear communication and workflow processes between mechanical, civil and electrical teams to ensure seamless integration and minimize conflicts.

Invest in BIM training and technology

Provide comprehensive training to staff and upgrade technology infrastructure to maximize BIM capabilities and support efficient project execution.

Use BIM for continuous construction monitoring

Leverage BIM tools, for real-time tracking and decision support, throughout the construction phase to enhance quality control and schedule adherence.

BIM automization and AI

Bim Processes to be automized to reduce timing of repeated process. This will reduce the time of engineering and increase efficiency.

Conclusion

- Cement plant construction requires **modern solutions** to overcome delays, errors and inefficiencies of traditional methods.
- **BIM provides a powerful framework** to integrate design, engineering, procurement and construction into one collaborative platform.
- With BIM, companies can achieve better planning, **accurate cost control, early clash detection and improved safety.**
- To fully realize these benefits, the industry should **embrace BIM, invest in training and encourage active stakeholders' participation.**
- **Holtec**, with its proven expertise, is ready to **support clients in this transition**, ensuring faster, **smarter and more sustainable** project execution.

T H A N K Y O U

Holtec Consulting Pvt Ltd

Holtec Centre
A Block, Sushant Lok-I, Gurgaon, India

info@holtecnet.com

+91 124 4047900

www.holtecnet.com