

# Buildability



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Buildability is a pre-construction exercise that assesses designs from the perspective of those that will manufacture, install components and carry out the construction works.

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In very broad terms, buildability should assess elements of the design in relation to:

- Achieving the desired final quality
- Meeting the programme requirement
- De-risking perceived problems
- Achieving optimum value for money

# The Regulatory Imperative (CDM)

**Safe to build = Safe to use**

**Regulation 9:** In the UK, designers are explicitly required to consider buildability under Regulation 9 of the Construction (Design and Management) Regulations.

## The Designer's Duty:

### Permanent Works

Designers must understand how the structure can be constructed, and how temporary works can be erected, used, and dismantled safely.

### Temporary Works

Determine if the permanent design can be altered to eliminate risks associated with temporary works (e.g., scaffolding, propping).



# The Golden Rule: Design for Sequence

*“A designer should never propose a structural system without at least one idea of how to build it... The unfortunate corollary is that if the designer has not or cannot think of a way to build it, it may be unbuildable.”*

— Bill Baker, Lead Designer of Burj Khalifa

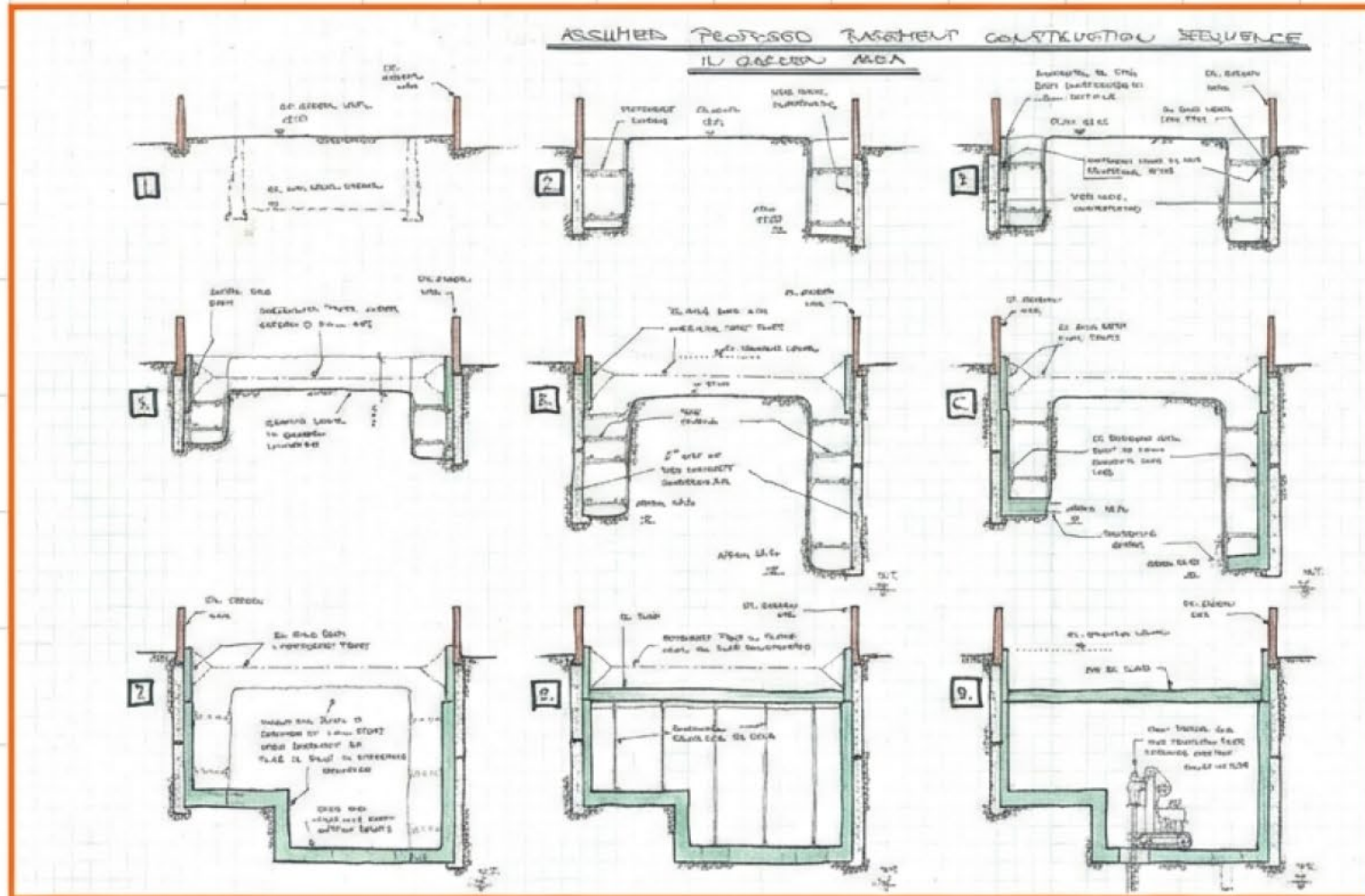
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**Core Concept:** Buildability involves a careful study of the sequence of activities that will take place both on-site and off-site. A static drawing is insufficient; the design must account for the flow of time.

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## Visualization: The Construction Storyboard



## The Concept:

- The best way to demonstrate that a design can be built safely is to draw the sequence.

## The Process:

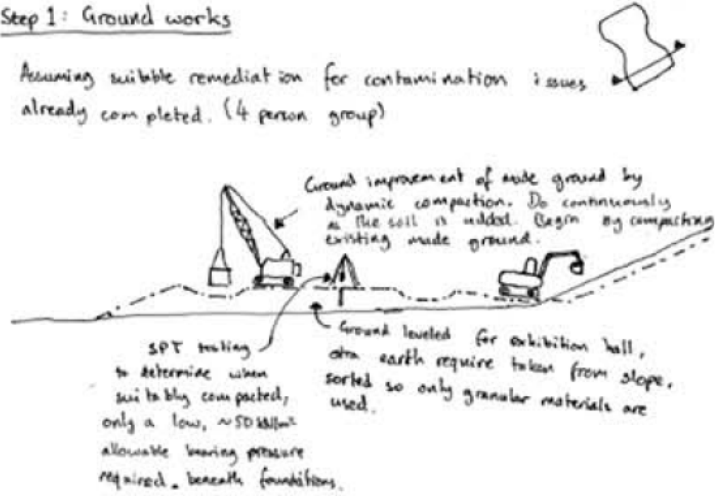
1. Outline key stages.
2. Validate structural stability at every stage.
3. Identify temporary works requirements early.

Example: A viable construction sequence showing excavation, propping, and pouring stages.

# EXHIBITION HALL CONSTRUCTION SEQUENCE

## Step 1: Ground works

Assuming suitable remediation for contamination issues already completed. (4 person group)



## In the factory (Step 1-5)

Glulam Beams assembled



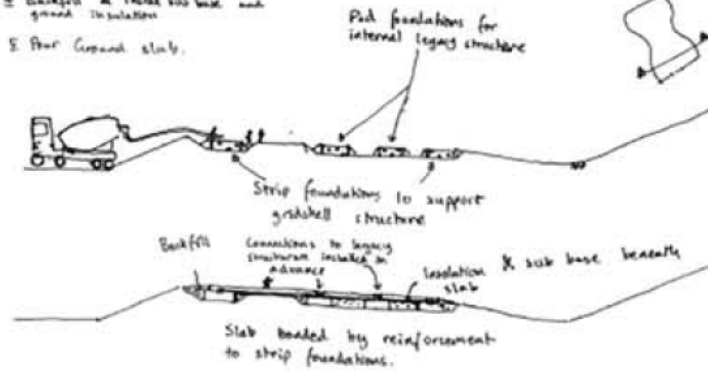
CNC laser cut connection pieces. Later welded together manually



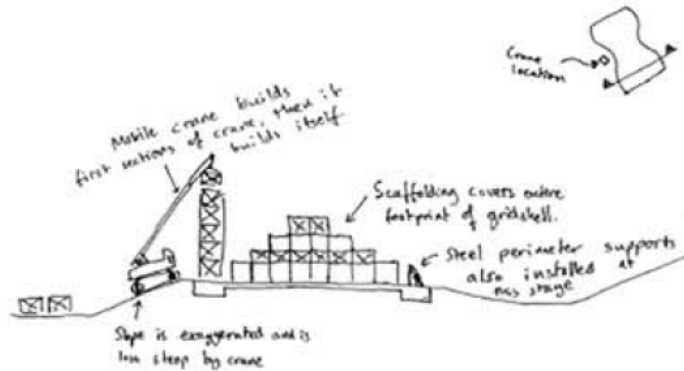
## Step 2: Foundations & Ground Slab

1. Have all excavation complete
2. Erect formwork
3. Pour foundations
4. Backfill & install sub base and ground insulation
5. Pour Ground slab.

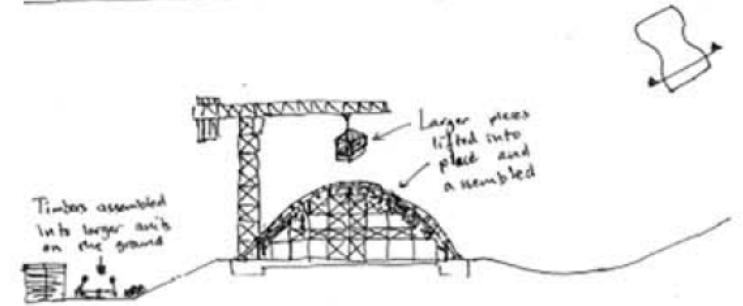
NOTE: Foundation for crane erected at this stage.



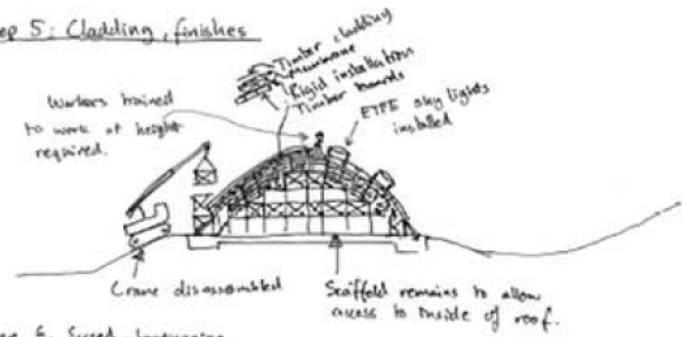
## Step 3: Erect Crane & temporary scaffolding



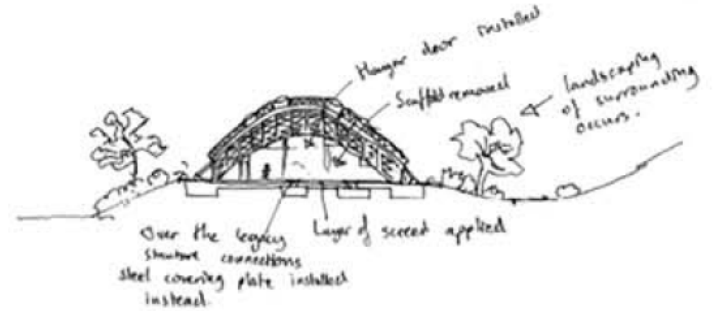
## Step 4: Assemble shell (Primary structure)



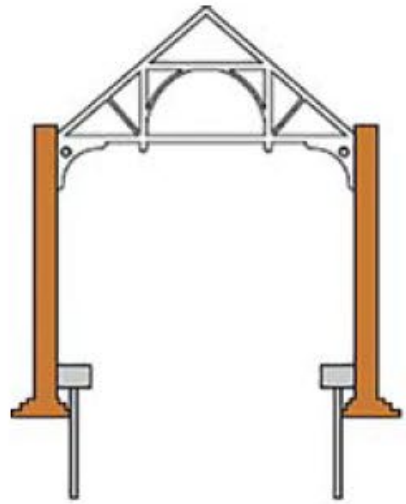
## Step 5: Cladding, finishes



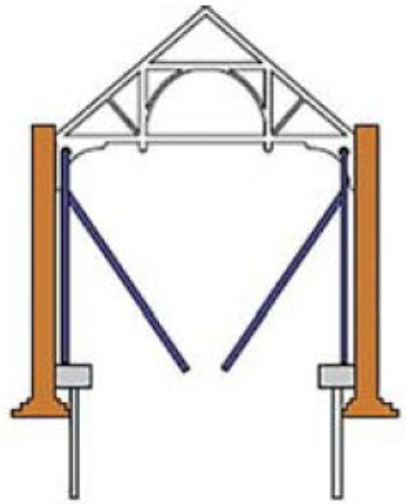
## Step 6: Sited, landscaping



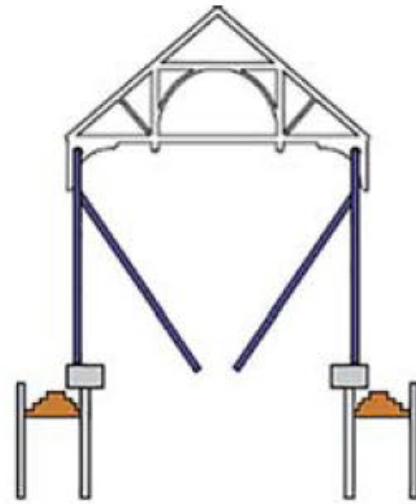




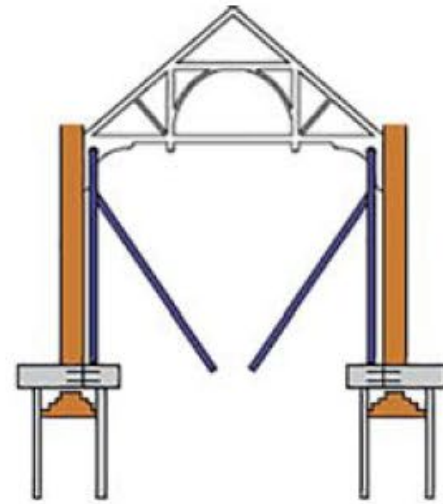
a) Mini piles installed internally and capping beams cast.



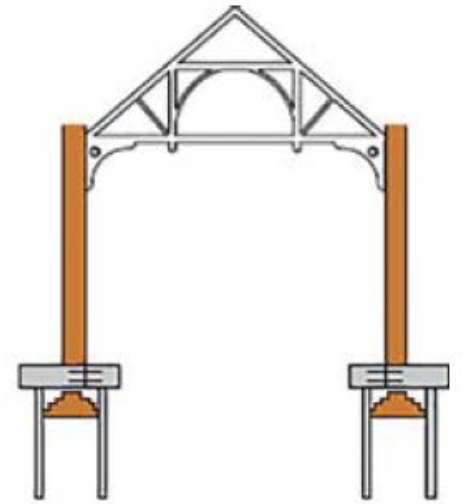
b) Temporary supports installed.



c) Perimeter walls demolished and mini piles installed externally.



d) Capping beams cast and perimeter wall rebuilt.



e) Temporary supports removed.





# Principles of Buildability

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- Avoiding unnecessary intricacies (e.g., curved walls, irregular shapes) unless functionally required.
- Using modular and repetitive elements for easier assembly and faster completion.



# Principles of Buildability

## Use of Standard Components



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- Reduces the need for custom fabrication, saving time and reducing errors.
- Enhances compatibility between components, leading to better quality control.



# Principles of Buildability

## Material Selection



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- Prioritising readily available materials to prevent project delays.
- Considering durability, workability, and environmental impact.



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- Selecting efficient construction techniques that reduce labour, time, and material waste.
- Using prefabrication and modular construction to enhance efficiency.
- Implementing Lean Construction principles to streamline processes and eliminate inefficiencies



# Principles of Buildability

## Integration of Trades



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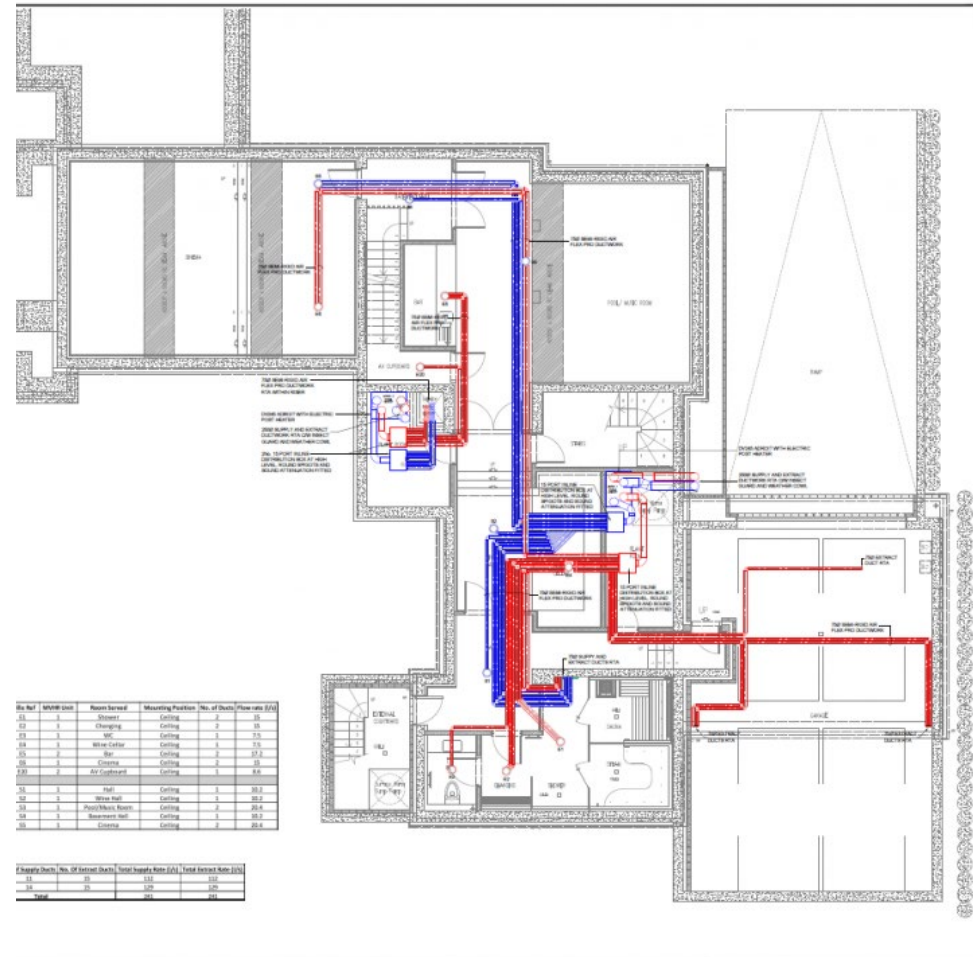
- Ensuring smooth coordination between different trades (e.g., electrical, plumbing, structural works).



# Principles of Buildability

## Integration of Trades

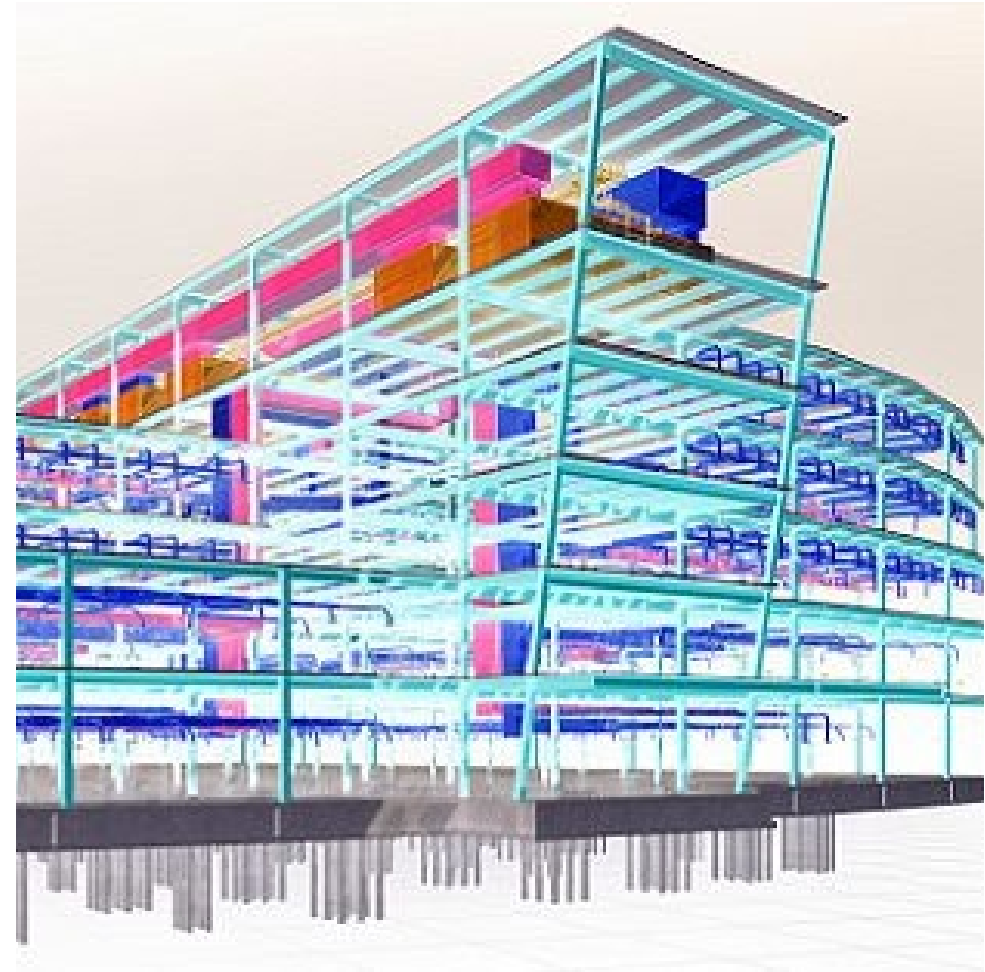
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# Principles of Buildability

## Integration of Trades

- Ensuring smooth coordination between different trades (e.g., electrical, plumbing, structural works).
- Designing with buildability in mind to prevent clashes between trades during construction.
- Utilising Building Information Modelling (BIM) to plan work sequences effectively.



# Factors affecting Buildability

## Design Complexity

The more complex a design, the harder it is to construct efficiently.

Straight walls vs. curved walls: Straight walls are easier and faster to build than curved or irregularly shaped walls.

Number of unique components: Custom or non-standard elements increase cost and construction time.

# Factors affecting Buildability

## Site Constraints

The location and physical characteristics of a construction site impact buildability.

Topography: Uneven or sloped land requires additional groundwork and may limit construction methods.

# Factors affecting Buildability

## Material Availability

The choice of materials depends on local availability, cost, and sustainability.

Locally sourced materials are more affordable and reduce transport-related delays and carbon footprint.

Imported materials can offer better quality but may introduce delays, higher costs, and supply chain risks.

# Factors affecting Buildability

## Construction Technology

Advances in construction technology improve efficiency and reduce reliance on manual labour.

Prefabrication & Modular Construction: Speeds up construction by assembling components off-site.

Automation & Robotics: Increases precision, reduces labour-intensive tasks

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# Strategy for Improvement: Early Collaboration



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## Method:

Early Contractor Involvement (ECI)

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## Action:

Engaging contractors during the design phase to provide practical insights on constructability.

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## Benefits:

- Identifies design issues and material constraints early.
- Clarifies cost implications.
- Improves collaboration between designers, engineers, and builders.

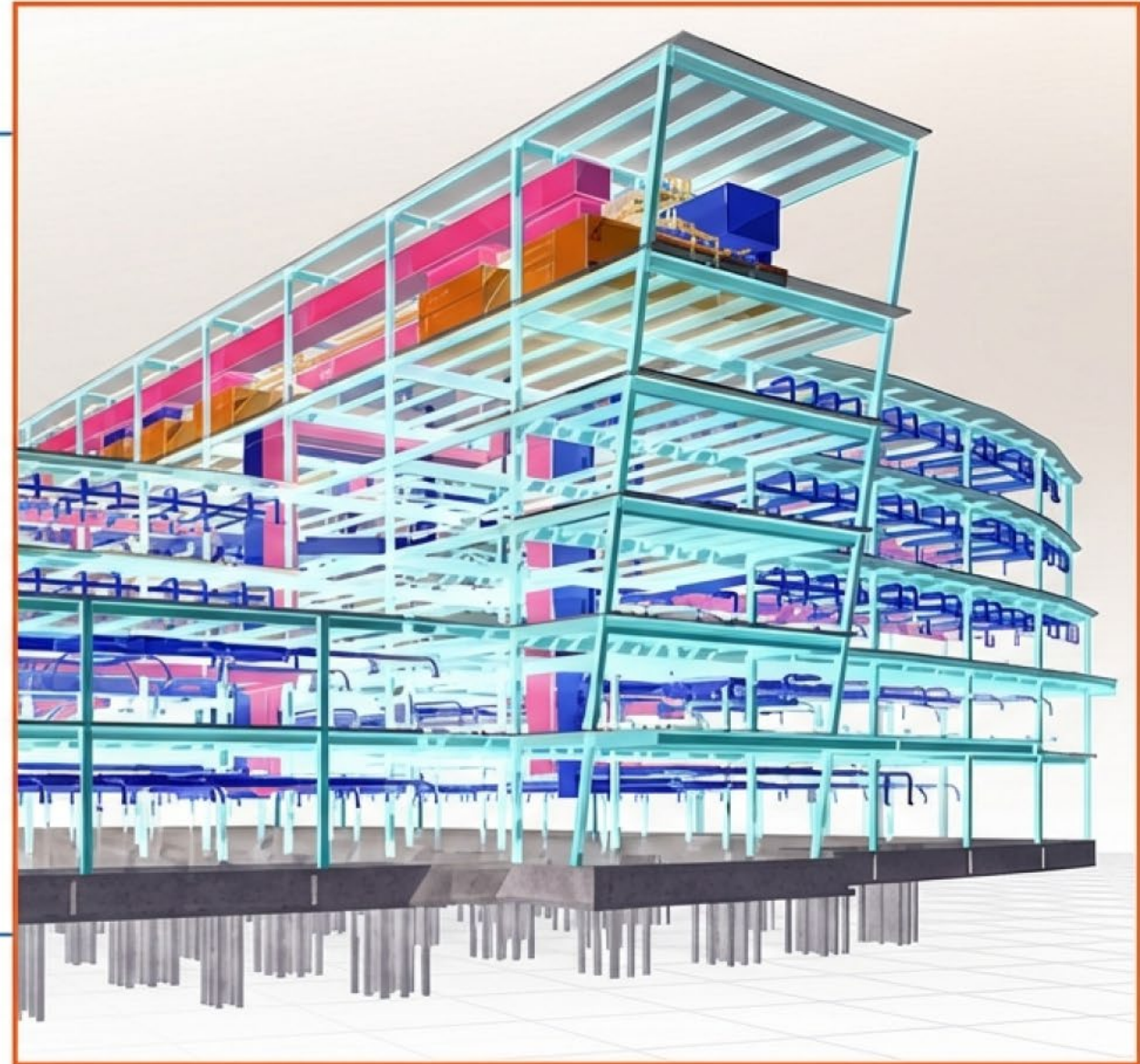
# Strategy for Improvement: Digital Verification (BIM)

## Method: Building Information Modelling (BIM)

**Core Function:** A digital 3D model that integrates architectural, structural, and MEP designs to “build it twice”.

### Key Capabilities:

- **Clash Detection:** Automatically identifies conflicts (e.g., ductwork colliding with beams).
- **Planning:** Enhances material scheduling and cost estimation.
- **Sequencing:** Allows the team to rehearse the build digitally.



# Strategy for Improvement: Modern Methods (MMC)



## Method 1: Prefabrication & Modular

Assembling components off-site in controlled environments. Reduces on-site labor, waste, and time while improving quality control.

## Method 2: Lean Construction

Focuses on eliminating waste (time, materials, labor).

- **Just-in-Time Delivery:** Optimizing workflows to prevent site clutter.
- **Automation:** Utilizing robotics for precision.

# Improving Buildability

## Lean Construction Techniques

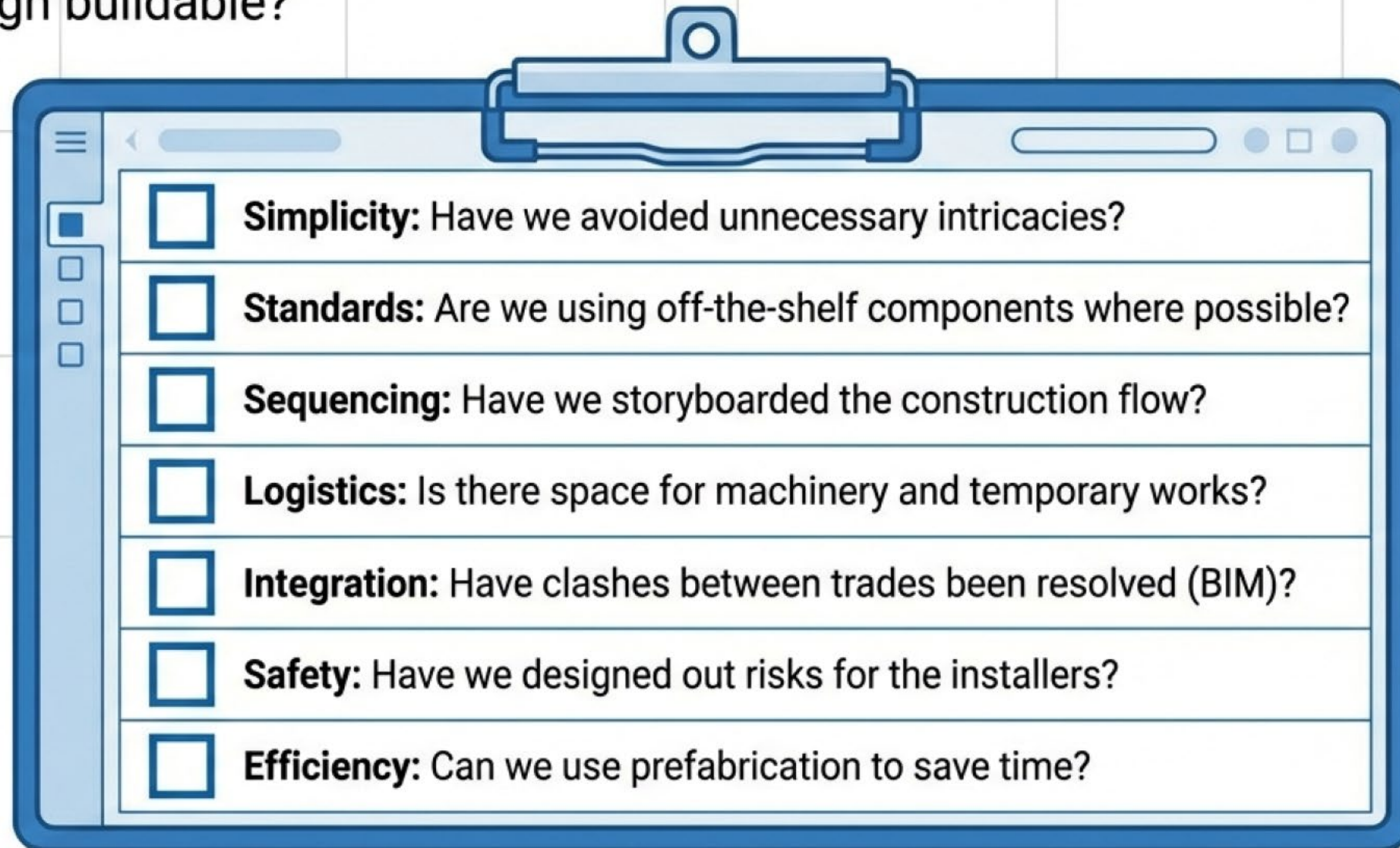
Lean construction aims to eliminate waste (materials, time, labour) and improve efficiency.

Focusses on continuous improvement, just-in-time delivery, and optimising workflows.

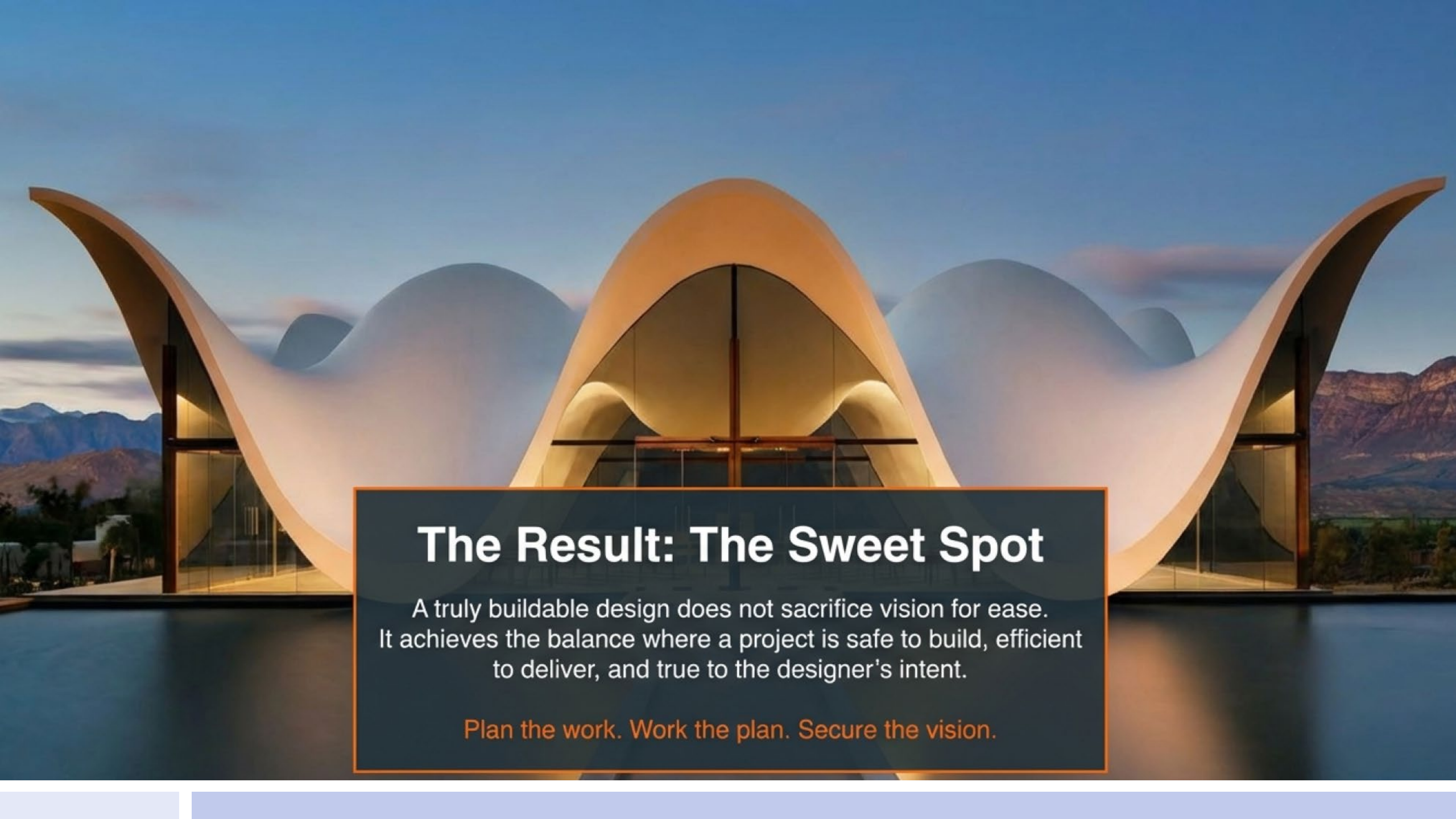
Reduces unnecessary movements, delays, and material excess, making the process more efficient.

# The Practitioner's Checklist

Is your design buildable?



|                          |                                                                         |
|--------------------------|-------------------------------------------------------------------------|
| <input type="checkbox"/> | <b>Simplicity:</b> Have we avoided unnecessary intricacies?             |
| <input type="checkbox"/> | <b>Standards:</b> Are we using off-the-shelf components where possible? |
| <input type="checkbox"/> | <b>Sequencing:</b> Have we storyboarded the construction flow?          |
| <input type="checkbox"/> | <b>Logistics:</b> Is there space for machinery and temporary works?     |
| <input type="checkbox"/> | <b>Integration:</b> Have clashes between trades been resolved (BIM)?    |
| <input type="checkbox"/> | <b>Safety:</b> Have we designed out risks for the installers?           |
| <input type="checkbox"/> | <b>Efficiency:</b> Can we use prefabrication to save time?              |



## The Result: The Sweet Spot

A truly buildable design does not sacrifice vision for ease. It achieves the balance where a project is safe to build, efficient to deliver, and true to the designer's intent.

Plan the work. Work the plan. Secure the vision.