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Good Practice of Planning & Design for Safety in Project Life Cycle



Fast Track Construction in HK Nowadays



Location – 18 Westlands Road, Taikoo Place, Hong Kong

Period – March 2006 to May 2008 (790 days ~ 2 Years)

Value – HK\$2,338 million

70-storey commercial building tower

2-level of basement with 4m deep raft foundation

320 m from ground

Curtain wall enclosed



“Nowadays, Construction in HK is very Fast Track !!!!”

“As a Competent Contractor, Detailed Planning for Safety, Time & Cost is very important !!!!”

See 2mins Vedio !!!!

ZERO HARM

- Zero deaths
- Zero injuries to the public
- Zero seriously disabling injuries to workforce (the 500,000)
- Zero long term harm to health
- AFR target Zero (Incident Rate)
- AFR below 0.1

These are all outcomes.

We can't manage outcomes but we can manage the risks.

To deliver the zero harm outcomes with certainty we have to eliminate the risk of them occurring.

INSPIRATION AND COMMITMENT... ...WITHOUT ALL THE ANSWERS



“I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth.”

25th May 1961



**“That’s one small step
for man, one giant leap
for mankind.”**
21st July 1969



The Safety Management Process (Swiss Cheese Method) – People make mistakes – we need several lines of defenses

Our 4 Layers of Protection

Design and Engineering

Remove the Fatal and Disabling Risks

Make it Easy to Build Safety

Materials, Plant and Equipment

The Safest System of Work

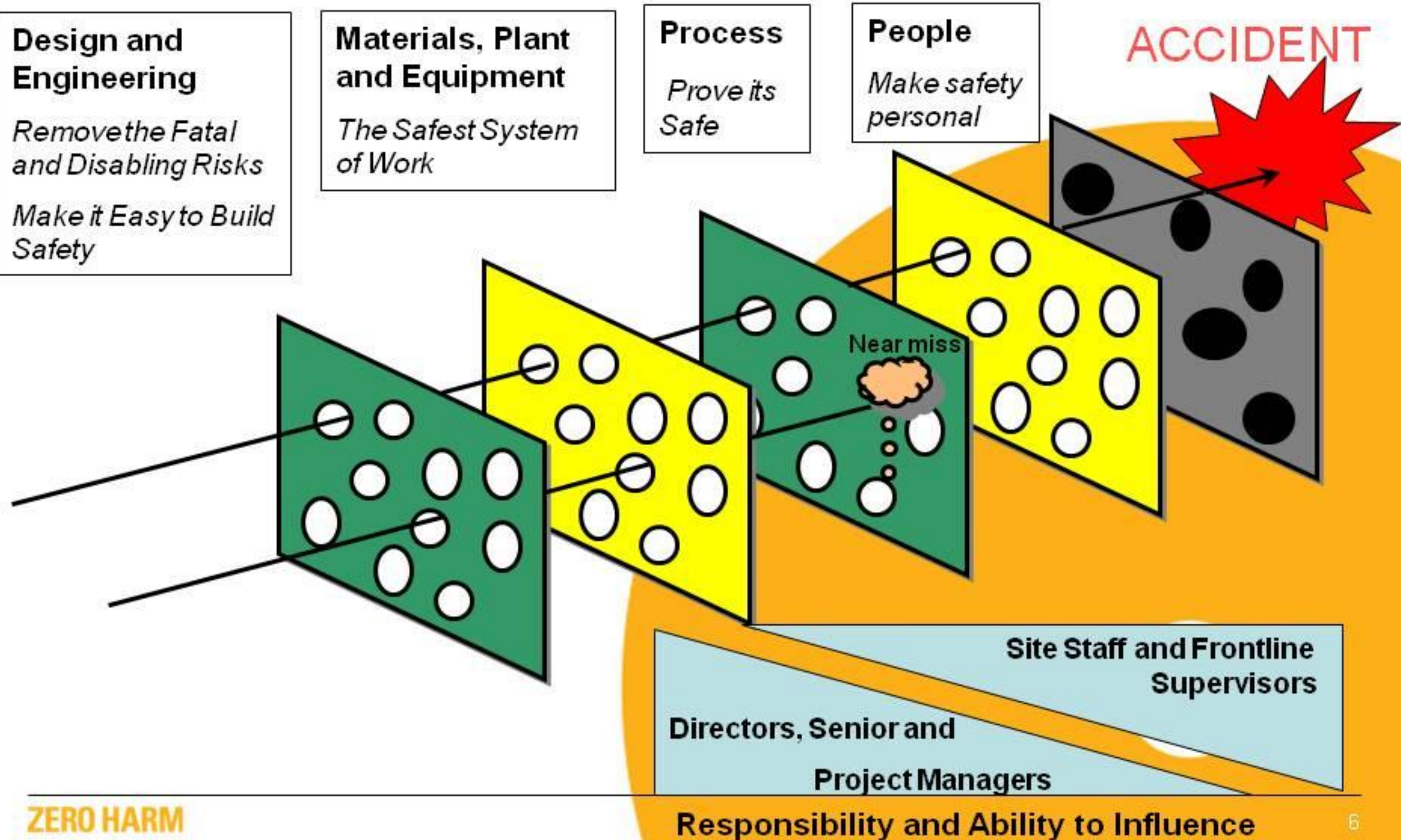
Process

Prove its Safe

People

Make safety personal

ACCIDENT



Focus on Zero Harm – The Gammon Standard



SIX POINT SAFETY FOCUS

Leadership

Care and Engagement

Near Miss and Audit

Belief in our Systems

Role of the Safety Team

Constructability

“The journey to ZERO HARM at Gammon will be through the application of the Six Point Safety Focus which is taking us to the next level of safety”

Leadership

- ◉ **Everyone is a Leader – Make Safety Personal**
- ◉ **Visible, enthusiastic and consistent engagement by all**
- ◉ **Good safety is good business**
- ◉ **Managers must ensure the system is delivering our objectives**
- ◉ **Seek and encourage opportunities for improvement**
- ◉ **Safety should be in our DNA not just a priority**

Care and Engagement

- **Managers will sponsor and live the Zero Harm culture**
- **Manages will role model “Duty of Care” at every opportunity**
- **HSE, HR and Managers to keep an open dialogue with frontline staff**
- **Business units to share best practice in SEAC and via BB website**
- **Update Gammon Academy to breed Zero Harm DNA**
- **Spread and deliver Zero Harm by proactively engaging with stakeholders**
- **Everyone to take part and support each other**

Near Miss and Audit

- ◉ **Establish an independent audit team**
- ◉ **Introduce electronic data capture and tracking**
- ◉ **Provide objective data analysis to prioritize improvements**
- ◉ **Regular performance review and update**
- ◉ **Target key issues and implement actions**
- ◉ **Develop a learning culture in support of Near Miss reports**

Belief in our Systems

- ◉ **Keep them simple but make them effective**
- ◉ **Use the system to help deliver the objectives**
- ◉ **Taskforce to simplify the paperwork**
- ◉ **Provide a simplified guide for Project Managers**
- ◉ **Managers to regularly review implementation and delivery**
- ◉ **Confirm achievements with effective audit**

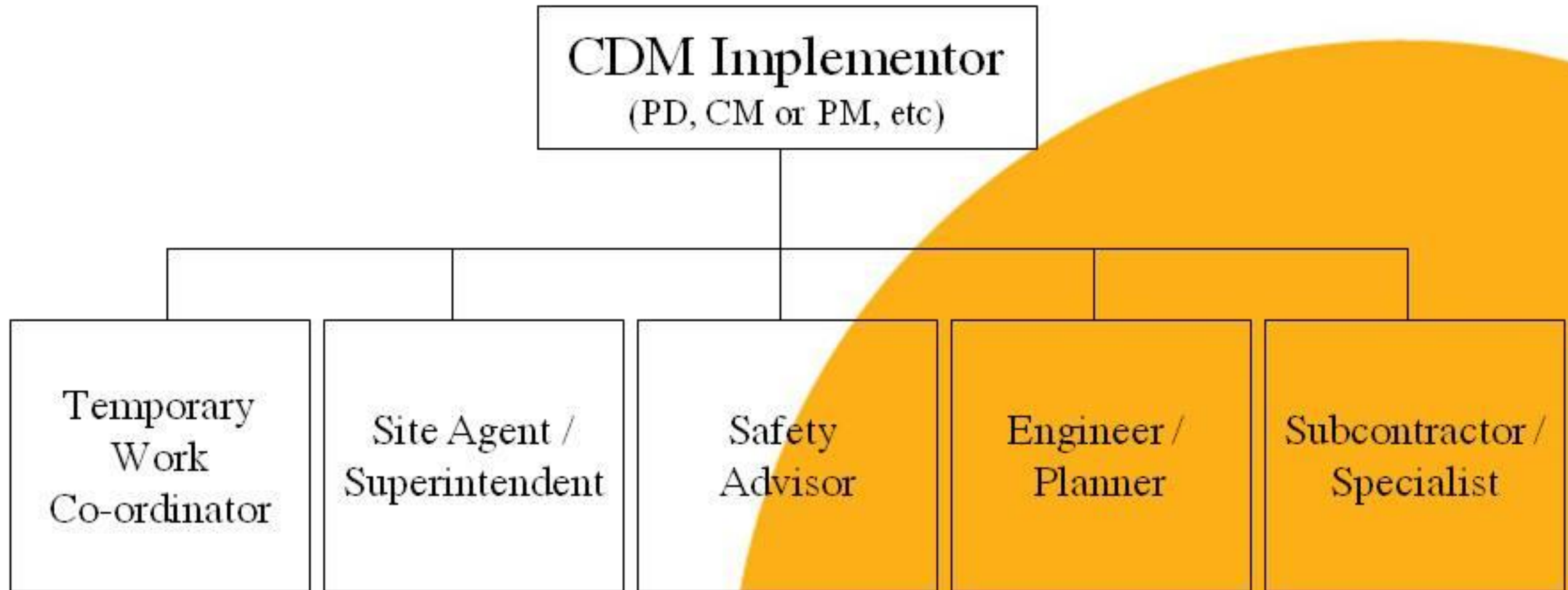
Role of the Safety Team

- ◉ To actively assist Managers to deliver Zero Harm
- ◉ Be proactive, plan ahead engage in risk identification and reduction
- ◉ Be part of the solution
- ◉ Supported by our Managers to address unsafe working and provide open, objective and consistent inspection reporting and analysis
- ◉ Proactively and enthusiastically promote safety planning and behaviour

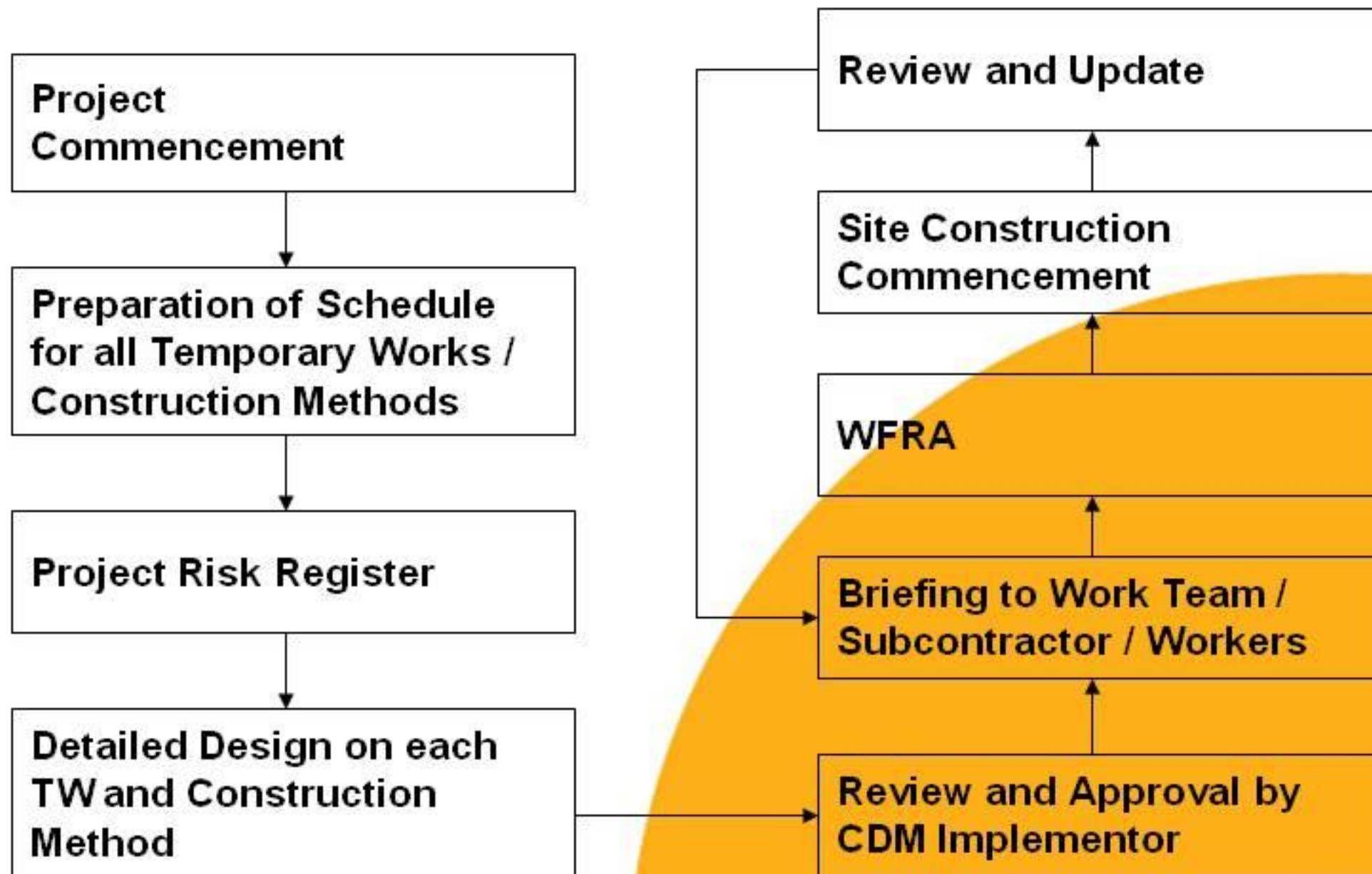
Constructability

- ◉ Engineer and specify safe systems of work
- ◉ Demonstrate how safety is built into designs and methods
- ◉ Make safety integral with efficient production
- ◉ Actively promote “Safety by Design” with Clients, Designers and Government
- ◉ Use intranet to promote and collect good practice
- ◉ Include safety from the earliest key decision stages
- ◉ Make it easy to build safely

Construction Design Management - CDM



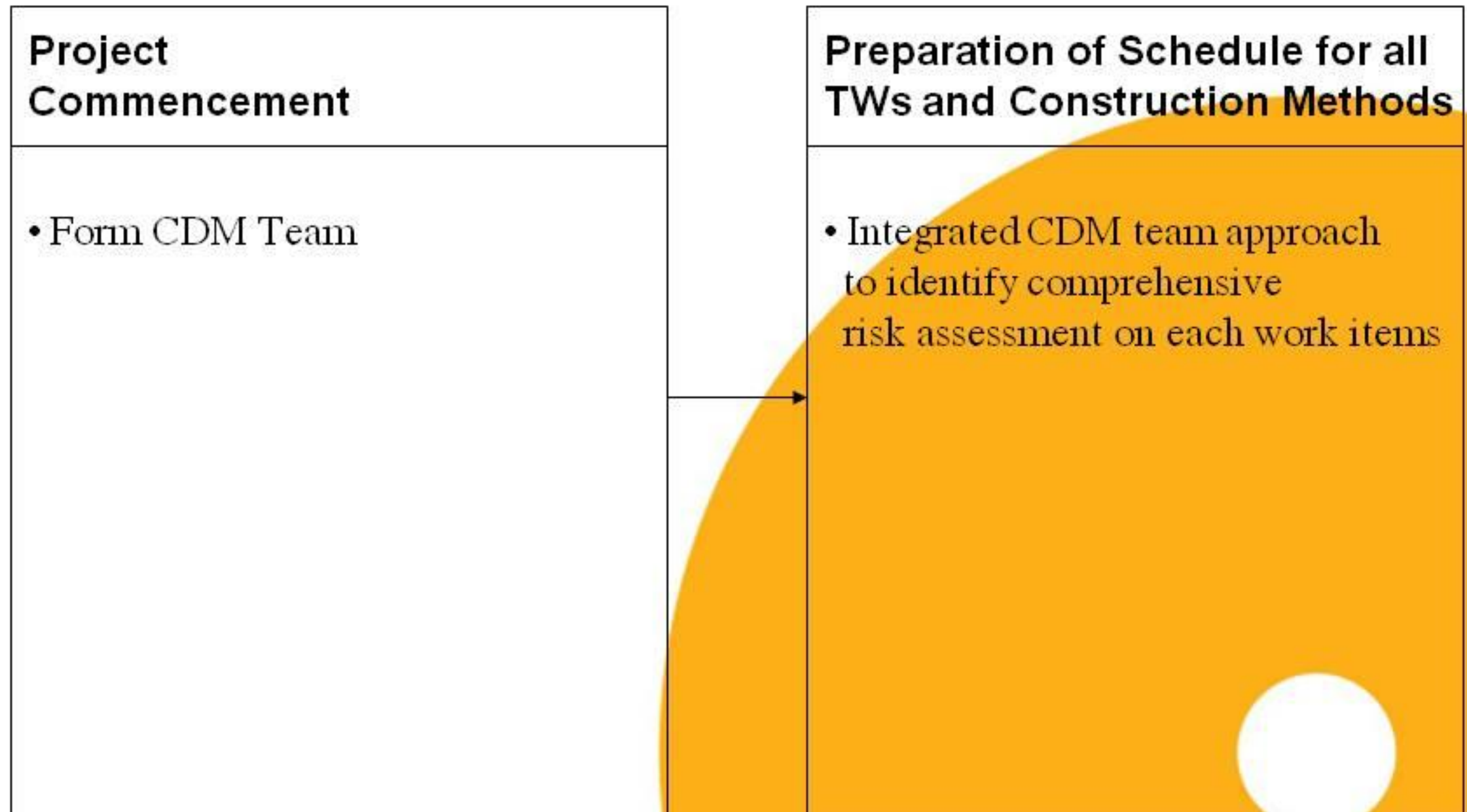
CDM Implementation Flow



CDM Added Value:

- Not only for Temporary Work Design in the Focus of Structural Check
- Need to Consider for the Whole Work Process to meet Zero Harm Target
- Integrated Team Approach to remove Risk and Hazards of all Work Faces

CDM Implementation Flow



CDM Implementation Flow

Project Risk Register

It is progressively reviewed and updated by the CDM Implementor and risk owners, recording progress of how risk is eliminated and also recording control measures to be put in place for any residual risk

Scoring Scheme for Health, Safety & Environmental Risk Assessment

HSE Impact Rating Scale

(note for cost and delivery ratings refer to QMS/13)

| IMPACT RATING Consequences | HEALTH, SAFETY & ENVIRONMENT (\$) |
|-------------------------------|---|
| 5 Very High | A fatality or fatalities, conviction, prolonged adverse effect on the environment. |
| 4 High | Serious injuries also involving the public, irreversible, life shortening health effect or disability. Potential prosecution. Medium term adverse environmental impact or complaints concerning pollution. Breach in security |
| 3 Medium | Serious injury or illness. Short-term adverse environmental impact requiring recovery actions. Isolated nuisance complaint. |
| 2 Low | Minor injury involving first aid or minor illness. Reversible health effect. Isolated environmental impact. |
| 1 Very Low | Negligible impact. |

Probability rating scale

| PROBABILITY RATING | DESCRIP-TOR | GUIDANCE |
|--------------------|-----------------------------|--|
| 5 | Very likely, almost certain | A threat or opportunity with a greater than 90% chance of occurring during the period. |
| 4 | Probable | A threat or opportunity with a 50% - 90% chance of occurring. |
| 3 | Possible | A threat or opportunity with a 10% - 50% chance of occurring. |
| 2 | Remote | A threat or opportunity with a 1% - 10% chance of occurring. |
| 1 | Improbable | A threat or opportunity that is so unlikely that it can be assumed that it will not occur. |

IMPACT / PROBABILITY MATRIX

| | | | | | |
|-----------------------|----------------------------|--------|--------|--------|--------|
| | ORANGE | RED | RED | RED | RED |
| IMPACT RATINGS 1 TO 5 | YELLOW | ORANGE | ORANGE | RED | RED |
| | YELLOW | YELLOW | YELLOW | YELLOW | YELLOW |
| | GREEN | GREEN | YELLOW | YELLOW | YELLOW |
| | GREEN | GREEN | GREEN | YELLOW | YELLOW |
| | | | | | |
| | PROBABILITY RATINGS 1 TO 5 | | | | |

RISK RATINGS

Red
- Risk unmitigated. Do not proceed.

Orange
- Residual risk to be managed by specially defined controls and monitoring, proceed with caution.

Yellow
- Residual risk to be managed by standard and supplementary minor controls

Green
- Risk fully mitigated and standard controls required

(Ratings edited for CDM process)

HSEMS/02 Issue 4 Rev 2, July 2009

(Please refer to "Definitions - Risk register" for further clarification)

| No | RISK | CONSEQUENCES | REVIEW & DATE | MITIGATION STAGES & CONTROLS (Record any consequential risk in RISK column) | COST OF MITIGATION | RISK | | | OWNERSHIP (Nominee from relevant disciplines) |
|----|---|--|--------------------------------------|--|--|------|---|--------|--|
| | | | | | | I | P | I + P | |
| 1 | Working at height Falling off truss when bolting up steel sections | Injury or death to worker Loss of company image Banned from tendering | Concept Design Jan 2009 | Review and mitigation required | | 5 | 3 | Red | CF Chan |
| | | | Design March 2009 | Pre-assemble sections into frames before erection. Install permanent access platforms before erecting bracing, where scaffold access is not possible. | Minimal | 5 | 1 | Orange | CF Chan |
| | | | Construction June 2009 | Ensure adequate site supervision and riggers are suitably skilled and wear harnesses. | | 3 | 1 | Yellow | CF Chan |
| 2 | Falling objects Dropping splice plates, hand tools, nuts and bolts | Injury or death to public and workers Damage to adjacent properties Loss of company image Banned from tendering | Concept design Jan 2009 | Minimise weight of truss and number of individual small sections. Design steelwork sections to be preassembled in frames for erection in one lift | | 5 | 2 | Red | Steve Jenkins |
| | | | Pre-construction review June 2009 | Provide safety netting catch small items and reduce impact | | 2 | 2 | Green | Danny Chan |
| 3 | Structural failure Support bearings fail and truss falls off roof onto Nathan Road. Uplift restraint required during service conditions. | Injury or death to public and workers Damage to adjacent properties Loss of company image Banned from tendering | Design Jan 2009 | Ensure bearings are correctly specified and of reliable construction with higher than normal safety factors. Designer's advisory note required on design drawings that bearings must be properly maintained | Cost of bearings ~20%. Stringent inspection & maintenance required | 5 | 1 | Orange | Steve Jenkins |
| | | | Design March 2009 | Eliminate bearings and risk by casting truss supports directly into the building and design truss to accommodate thermal restraint forces. Designer to inspect supports before concreting | Cost of bearings eliminated. Additional steel minimal. | - | - | Green | Alex Fung |
| 4 | Instability during erection Frames can topple because they are unstable during erection, until bracing is installed | Injury or death to public and workers Damage to adjacent properties Loss of company image Banned from tendering | Pre-construction June 2009 | Mitigation required by August 2009 | | 5 | 3 | Red | Danny Chan |
| | | | Construction August 2009 | To prevent toppling, erect and brace centre frames first and work outwards to the ends, bracing each frame as it is erected. Site supervision to ensure workers understand and implement the method statement | Minimal | 4 | 1 | Yellow | Danny Chan |

I = Impact rating P = Probability rating Ratings: - 5 = high to 1 = low

CDM Implementation Flow

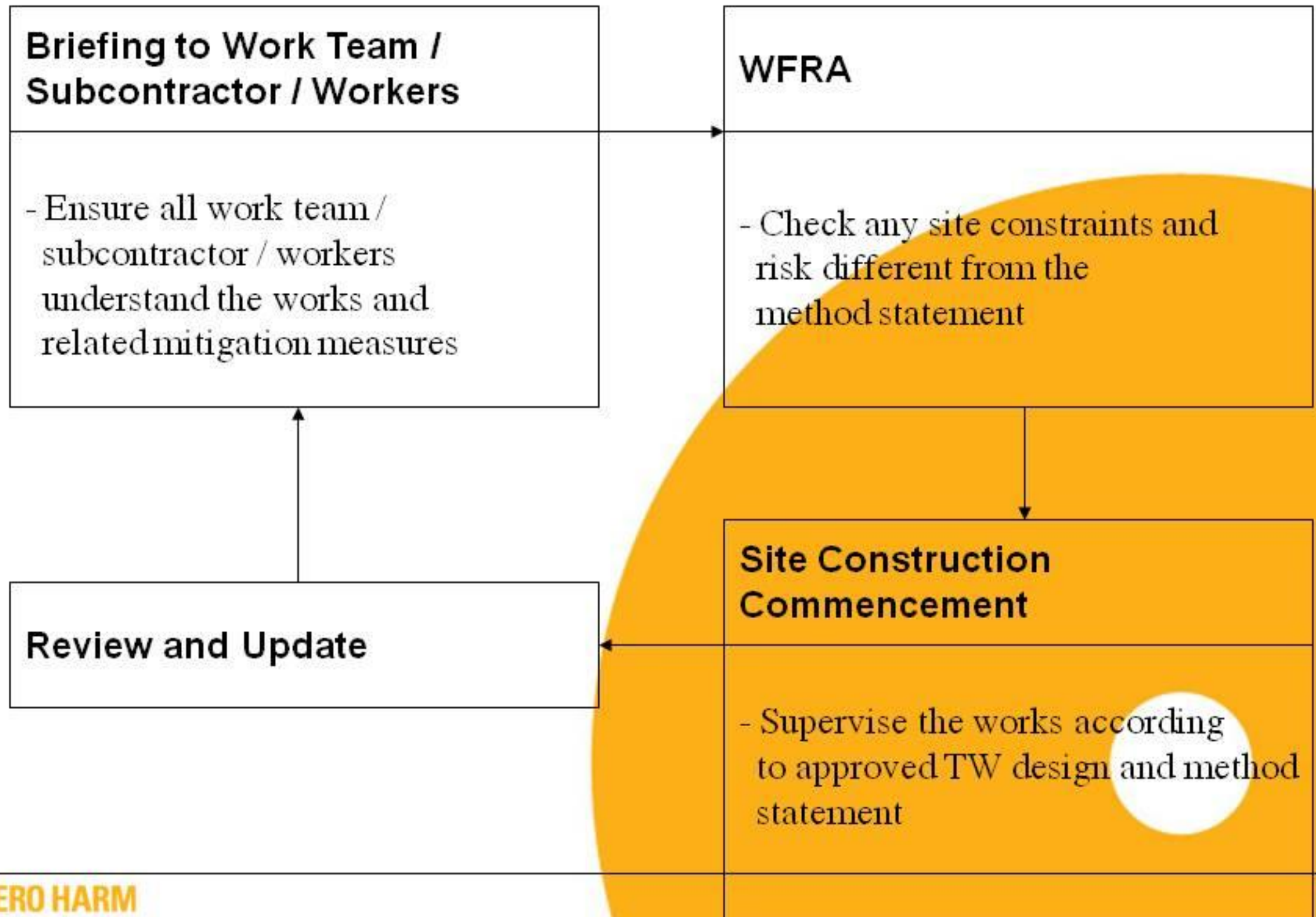
Detailed Design on each TW and Construction Method

- Comply with Zero Harm Policies
- Easy to build safely
- Highlight safe working method and guideline into all working drawing/ shop drawing / method statement
- Remove fatal and disabling risk
- Plan mitigation measures to eliminate risk

Review and Approval by CDM Implementor

- PD/CM/PM to scrutinize detailed design
- Ensure safety elements and design incorporated in the TW design and construction method
- If required, further review by Lambeth / design engineer

CDM Implementation Flow



Building Information Modeling



Examples of Digital Project Implementation in China – The Beijing Olympic Stadium Project

Architect: Herzog & DeMeuron, Structural Engineer: Arup

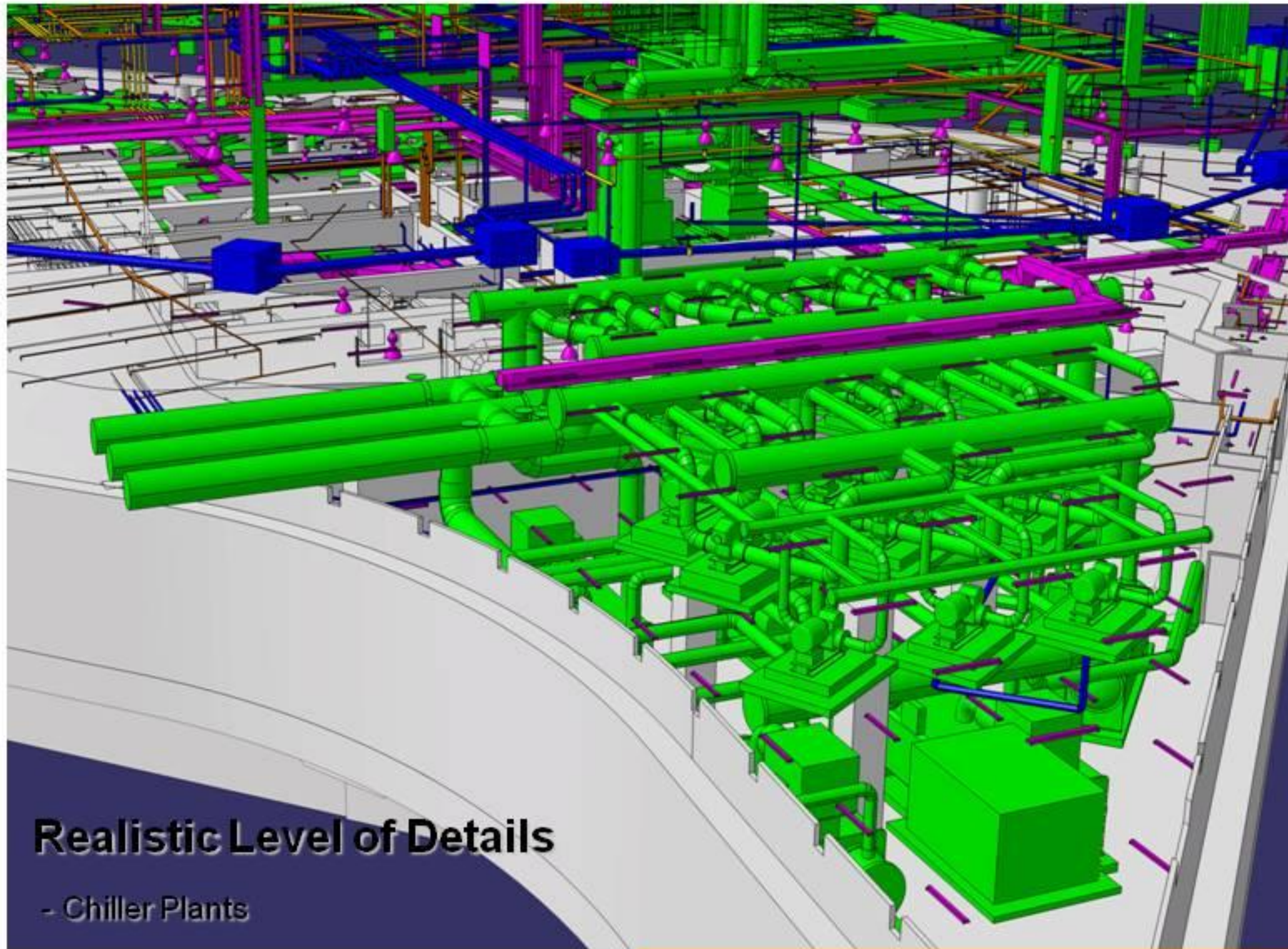
Objectives

- **Facilitate design co-ordination and planning**
- **Clash Identification prior to construction**
 - Minimize abortive works
 - Minimize waste generation
- **Handover the as-built 3D model to the Client after project completion**

Scope

- **Structural frame and slab**
- **Architectural layout and works**
- **M&E works (including Lifts and Escalators)**
- **Façade works – Curtain Wall**
- **Façade works – Glass Wall & Link Bridges**

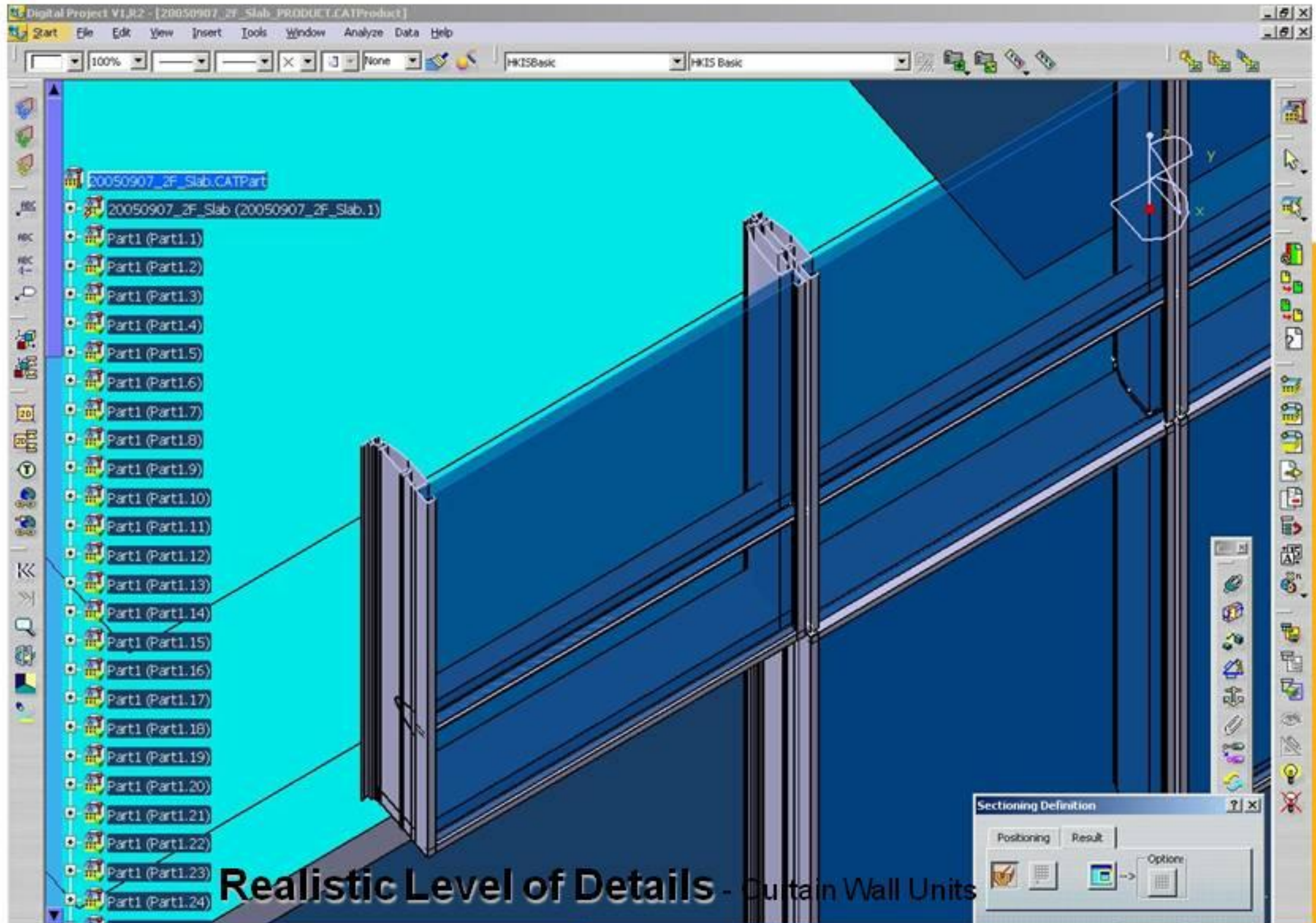
Use of 3D Model for Construction



Realistic Level of Details

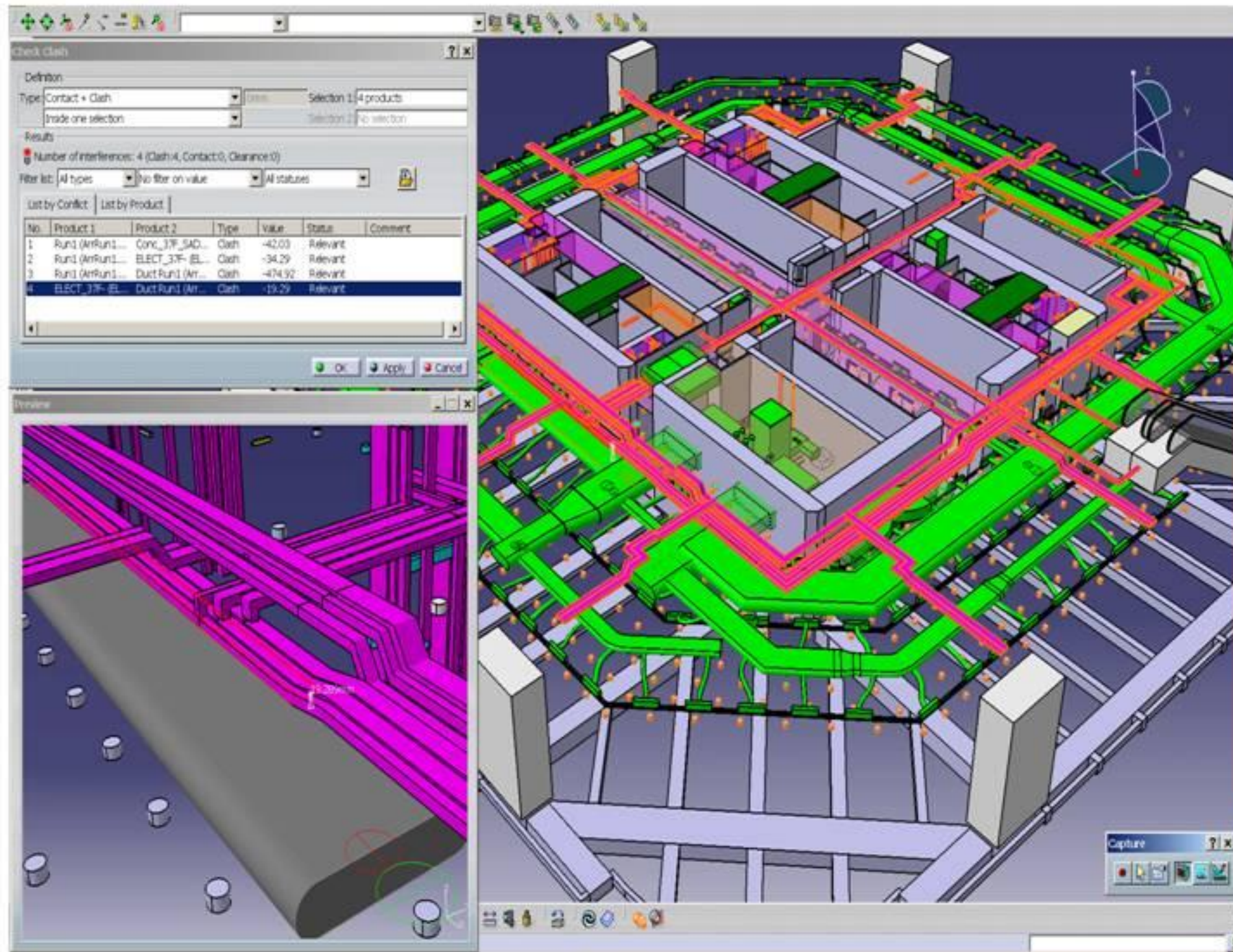
- Chiller Plants

Use of 3D Model for Construction



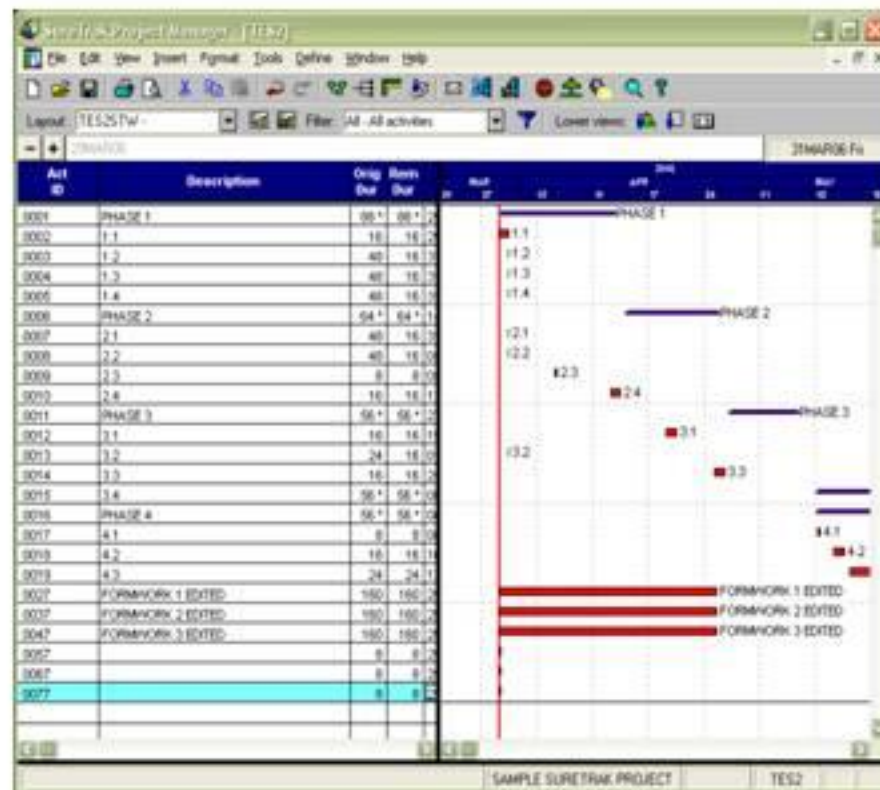
Realistic Level of Details - Curtain Wall Units

Use of 3D Model for Construction

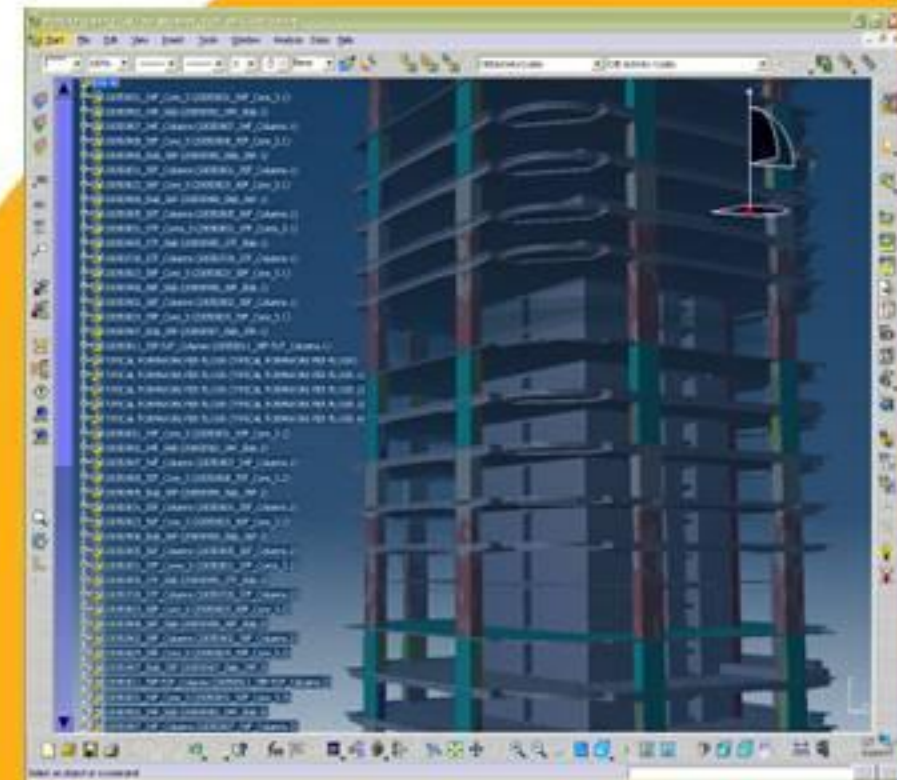


Linking to Primavera for Progress Monitoring

Data exchanging between Primavera and Digital Project



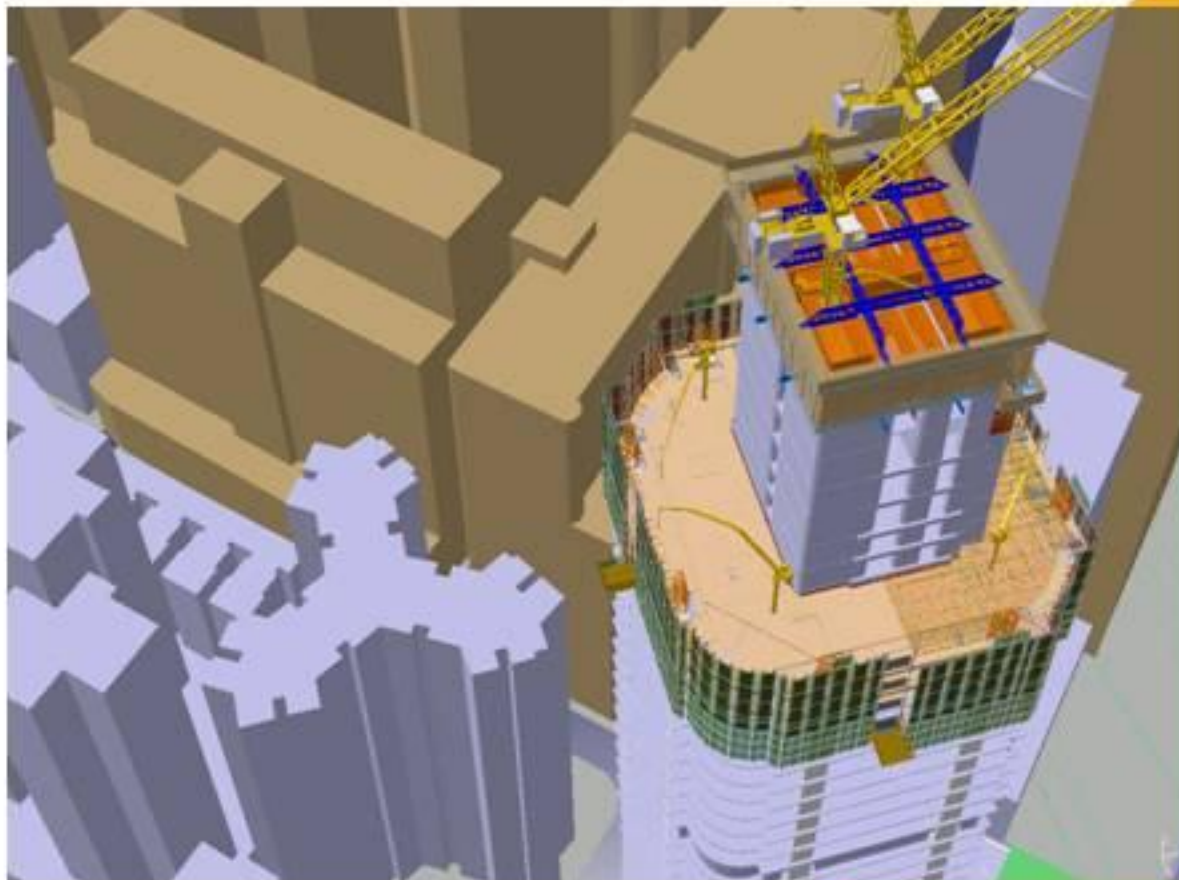
Primavera



Digital Project

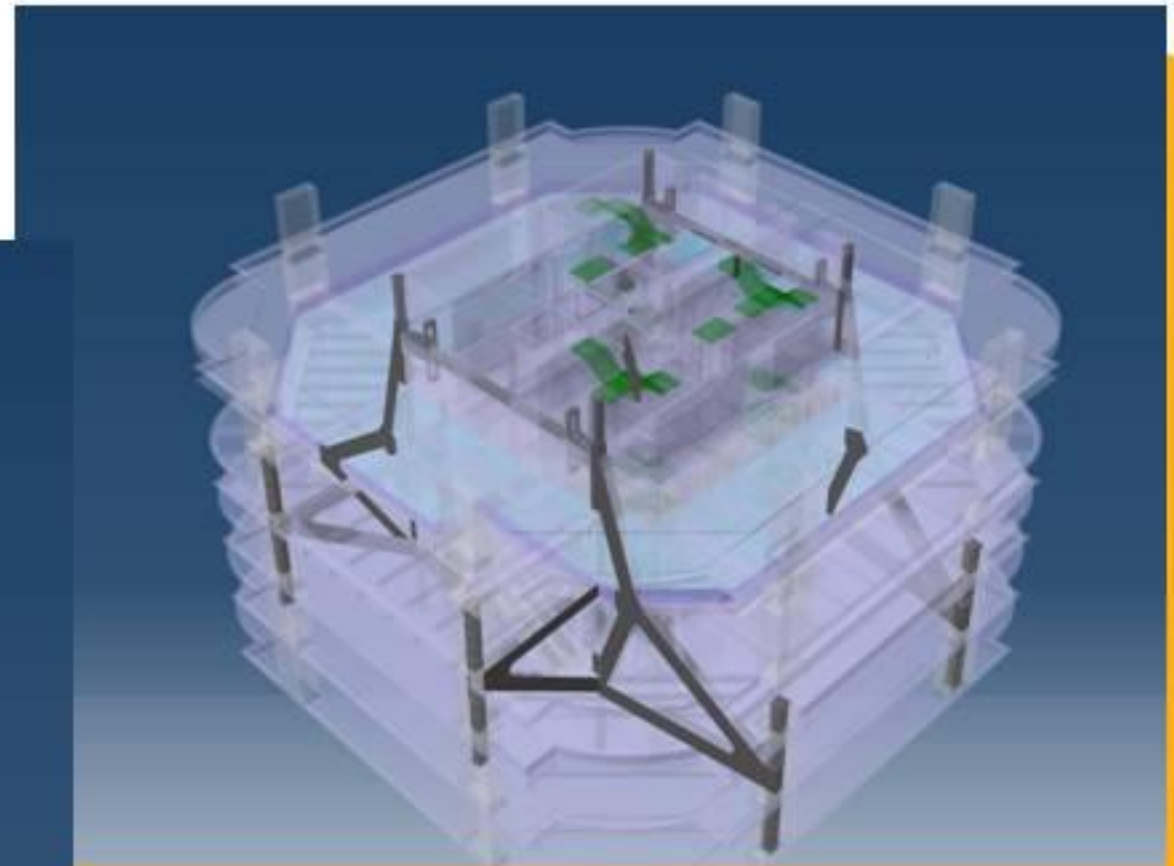
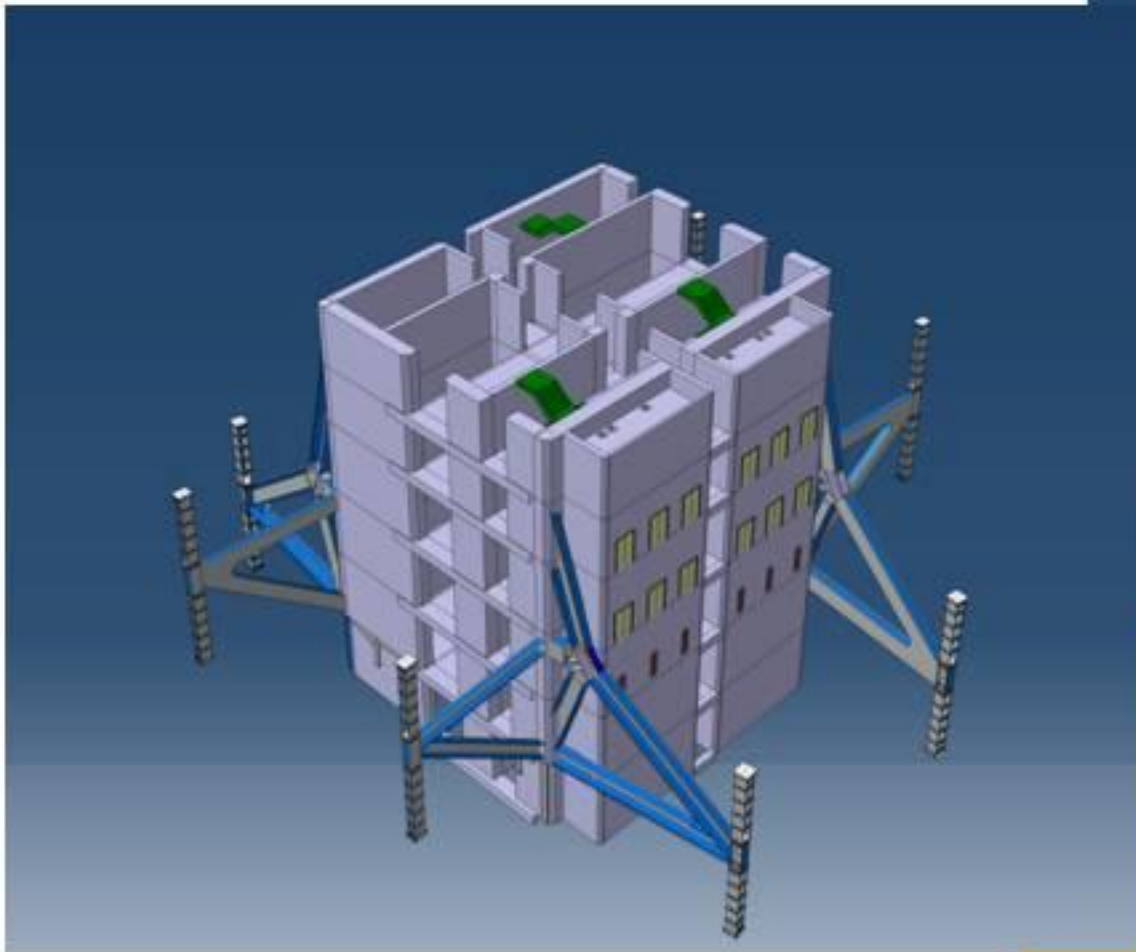
Virtual Prototyping (4D Model)

- Detail study on the critical process
 - 4-day floor cycle
 - Outrigger construction
- To partner with PolyU to carry out the simulation exercise



Virtual Prototyping (4D Model)

- Outrigger Construction



Conclusion and Further Development

- **Zero Harm**
- **Swiss Cheese**
- **CDM _ Construction Design Management**
- **BIM _ Building Information Modelling**

Thank you !!

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