# Chapter

# 2

# Construction Methodology

# 1. EXECUTIVE SUMMARY

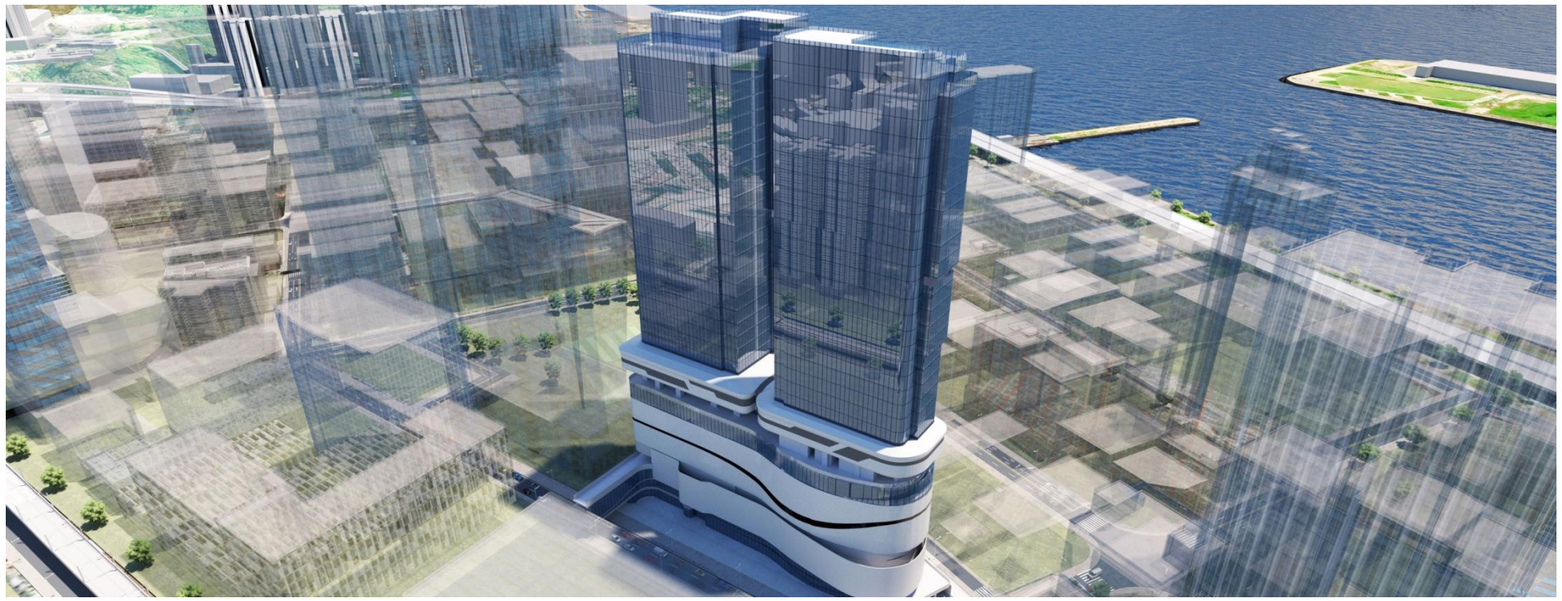
In view of KTIL240's characteristics, **Yee Fai** has established two principal philosophies:

1. Plan and execute based on **SMITH**
   - ✧ **S:** Safety Oriented
   - ✧ **M:** Mechanized Methodology
   - ✧ **I:** Innovation Driven
   - ✧ **T:** Technological Advanced
   - ✧ **H**: Humanized Approaches
2. Complete superstructure when basement is completed to enshrine the full benefit of top-down construction.

Superstructure construction shall be commenced at the soonest possible by creating diverted workfronts at G/F, B1/F and 2/F

1. G/F exclusively for the superstructure construction;
2. B1/F exclusively for the bulk excavations; and
3. B2/F exclusively for the basement construction.

Based on the principal philosophy, the followings construction methodologies are developed.



***Basement Construction***

- ✧ *Early Commencement of Tower 2 Raised Pilecap at G/F – Critical Path Shortened*
- ✧ *Early Completion of Car Ramp from G/F to B1/F – Diverted Workfront*
  - ➢ *Pipe pile strengthening is required long the car ramp (cost to be borne by the Employer )*
- ✧ *The Muck Hoist – Massive Transporting Media for Soil Excavation*
- ✧ *Modular Strutting System*
- ✧ *Alternative studded RC column head – Speed of Erection and Environmental Friendly*
- ✧ *Highly Mechanical Basement Ventilation System – 8 Air Change per hour*
- ✧ *Intelligent Monitoring System*

***Superstructure Construction***

- ✧ *Post-tensioning Transfer Plates – Cost and Time Efficient*
- ✧ *Table System Formwork for Towers*
- ✧ *Dynamic Site Logistic Planning*
- ✧ *Combination of different Scaffolding Systems*
- ✧ *Diligent Façade Installation Planning with the aid of 3D Scanning*

***Innovative M&E Team with Comprehensive Thought***

- ✧ Exploring the potential use of DfMA and modular construction method
- ✧ Early engagement of B1/F transformer to replace the deployment of diesel engines.

***Well Established Handover System***

- ✧ All materials are kept as brand new condition from installation until project completion.

Based on the above construction methodology; **Yee Fai** could substantially completed KTIL240 in 1190 calendar days – 60 days earlier than 1250 days stipulated in the Tender. We strive for the best interests for the Employer and the Project as a whole.

# 2. YEE FAI ALTERNATIVE TOP-DOWN CONSTRUCTION

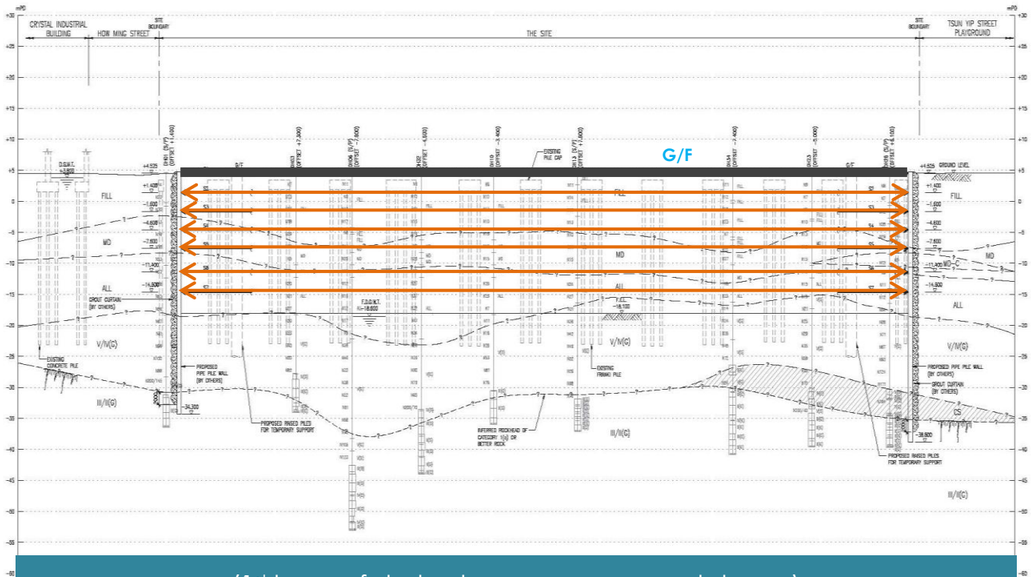
## 2.1. YEE FAI'S ALTERNATIVE ELS DESIGN

***Conforming Tender Design***

Construct G/F slab

Excavate down to final excavation levels with 7 layers of struts.

Construct B4/F, B3/F, B2/F and B1/F in a bottom-up manner



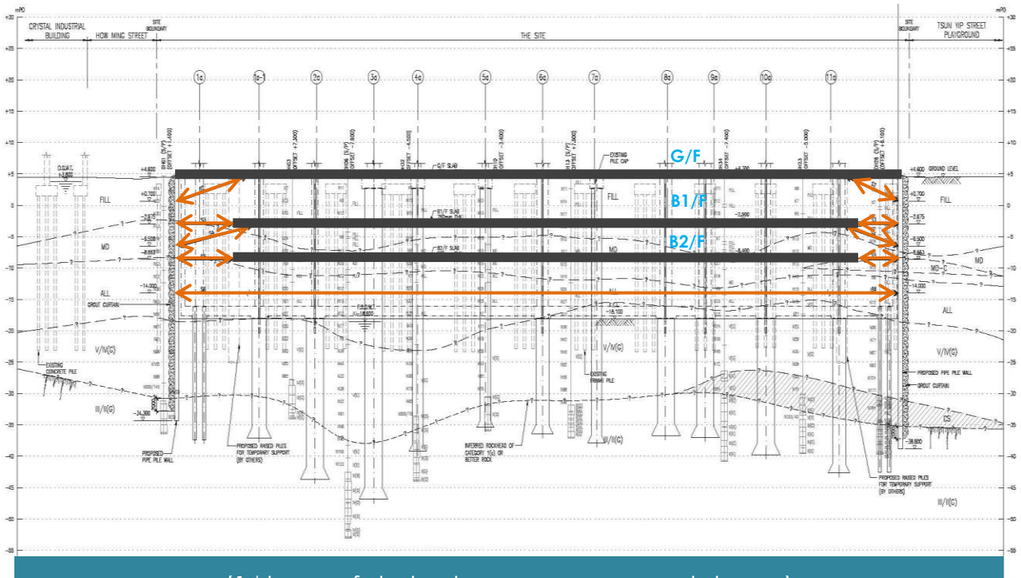

(1st layer of struts at car ramp area not shown)

***Yee Fai's Alternative Design***

Construct G/F slab

Complete B1/F and B2/F simultaneously with excavation; With B1/F and B2/F serving as propping system, excavation down to final excavation levels with 6 layers of struts.

Construct B4/F and B3/F in a bottom up manner.




(1st layer of struts at car ramp area not shown)

**Yee Fai** applies the top-down method for concurrent construction of superstructure and basement. To complete superstructure and basement at the same time, G/F shall be completed at the soonest possible to accelerate the separation of workfronts

### *Sequence of Construction*

Excavation proceeds from +4.7mPd to +2.7mPD from the West to the East, alongside with stanchions installation by crawler crane. Priority shall be given to the areas of towers' pile caps where tower cranes sit, allowing enjoyment of tower crane capacity at the earliest possible. Steel fixing, formworking an concreting would be carried out in phase in a normal manner.

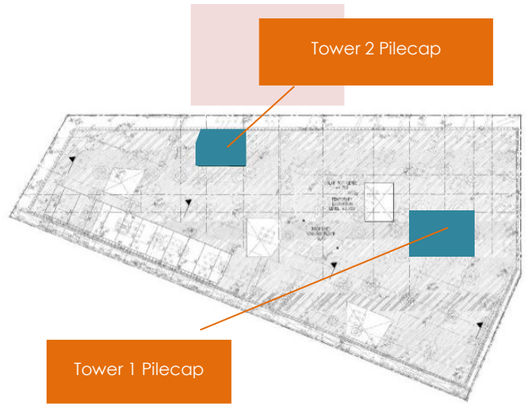
### *Alternative Construction Sequence Of Tower 2 Raised Pilecap At G/F*

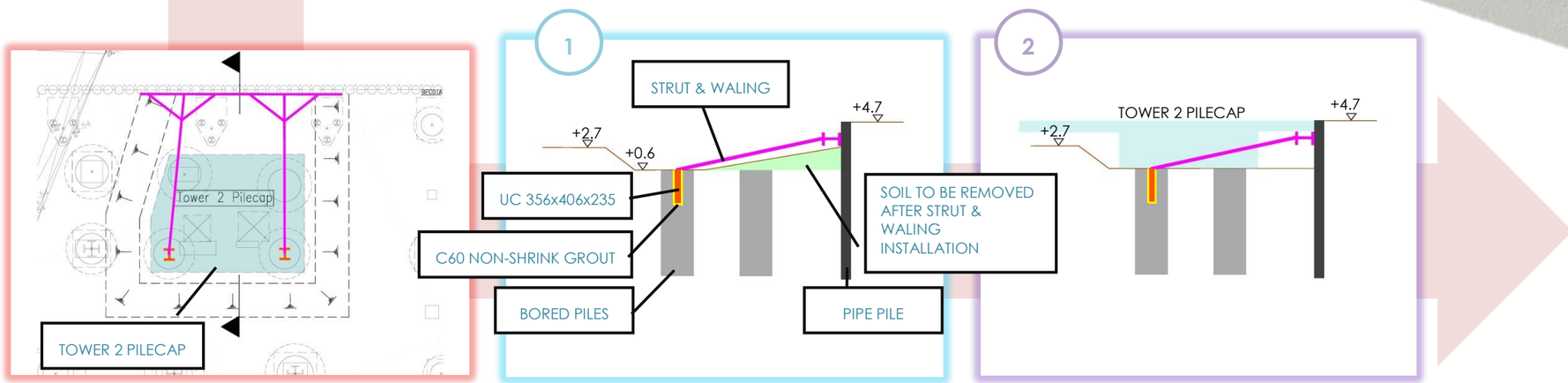
According to the Tender drawings, Tower 2 pilecap is 5.5m away from the perimeter pipe pile wall. Pilecap's bottom level is +0.7mPD, which is lower than 2nd excavation stage. It can only be constructed after completion of the whole G/F slab and 2nd layer of strut. This would jeopardize the programme of Tower 2 superstructure construction.

**Yee Fai**'s proposed alternative can enable Tower 2 pilecap to be constructed simultaneously with G/F structures, which allows fastest start of Tower 2 construction.

The can be achieved by:

- Installing structural steel sections in bored piles by coring and grouting;
- Installing strut and waling onto the steel sections and excavate the remaining soil adjacent to pipe piles.



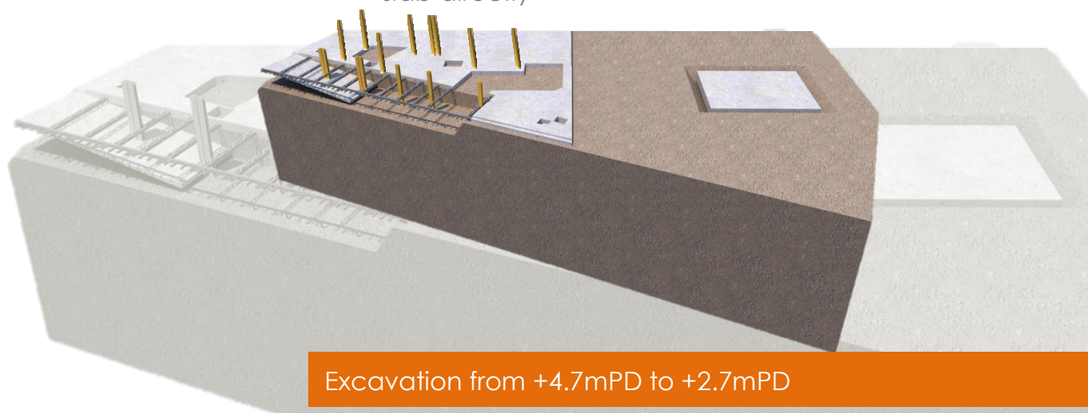




### *Early Car Ramp Construction*

Car Ramp construction could be in phase with G/F structures (Technical details to be explained in 2.2.). Early engaging the ramp from G/F to B1 can facilitate and increase the daily excavated volume.

### *Benefits to Site Logistic*

Upon the completion of the pilecaps and G/F slab, we can engage the working places for early set up of site office, logistic route for transportation, erection of plants and material storage on site. Extent of temporary steel platforms can also be saved as the plants can sit on G/F slab directly




21 nos. of steel stanchions. 6 nos., 13 nos. and 2 nos. of them are extended to G/F, 1/F and 2/F respectively. The stanchions are assembled by 80mm thick S460M high strength steel plates off site. These stanchions are installed alongside with G/F excavation to connect with the embedded port by on-site welding. Since the plates are thick, the weld volume is significant. Measures on welding will be explained in the coming paragraphs.

### *Fabrication of Steel Stanchions*

The stanchions are fabricated off site. Temperature controls are the key to success of the high-strength steel plates welding. Special attention shall be given as follows:

1) Preheat treatment
2) Inter-pass temperature
3) Postheat treatment

Automated submerged arc welding machine will be engaged.

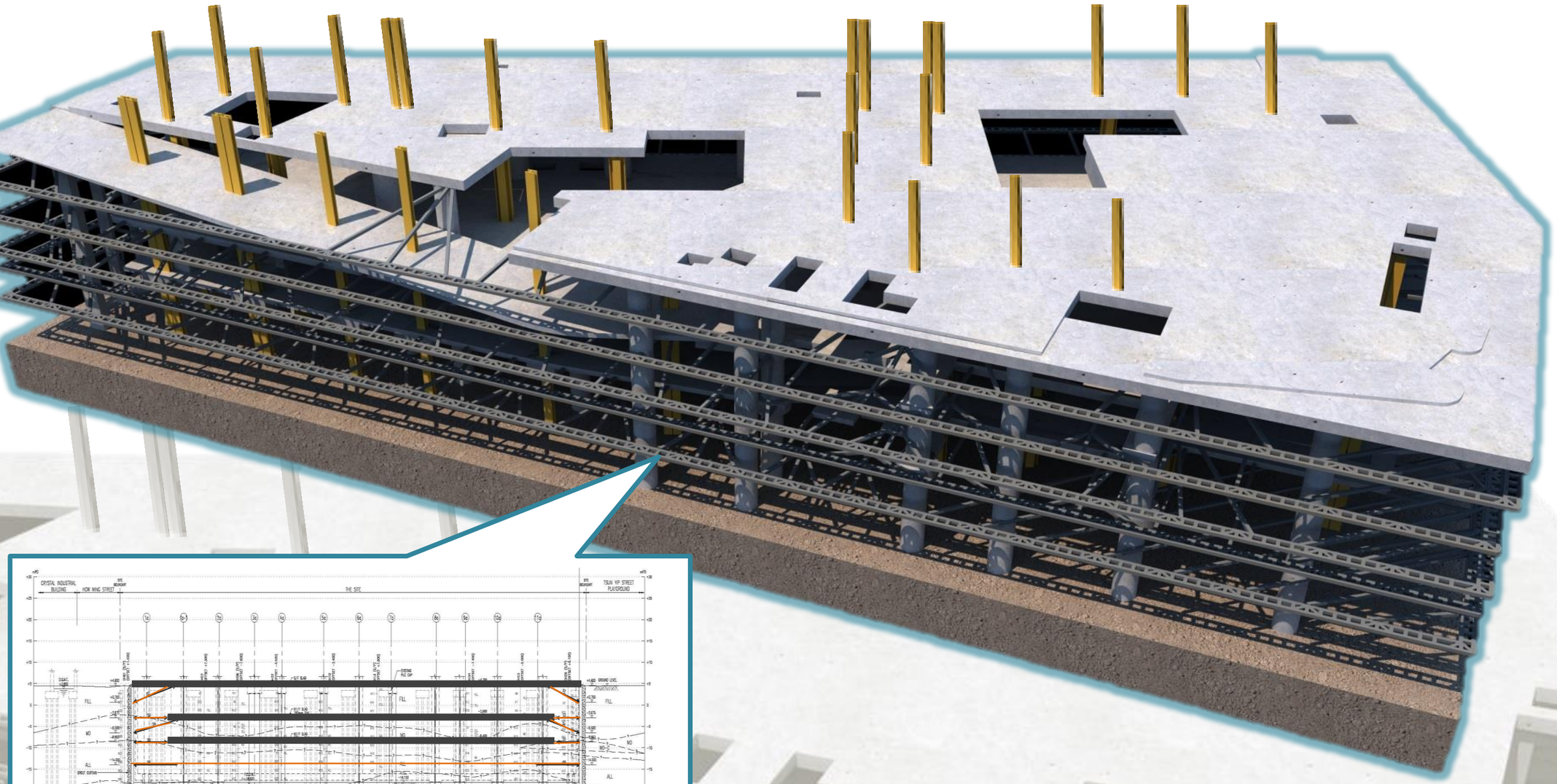
### *Single-lift Installation by Crawler Crane*

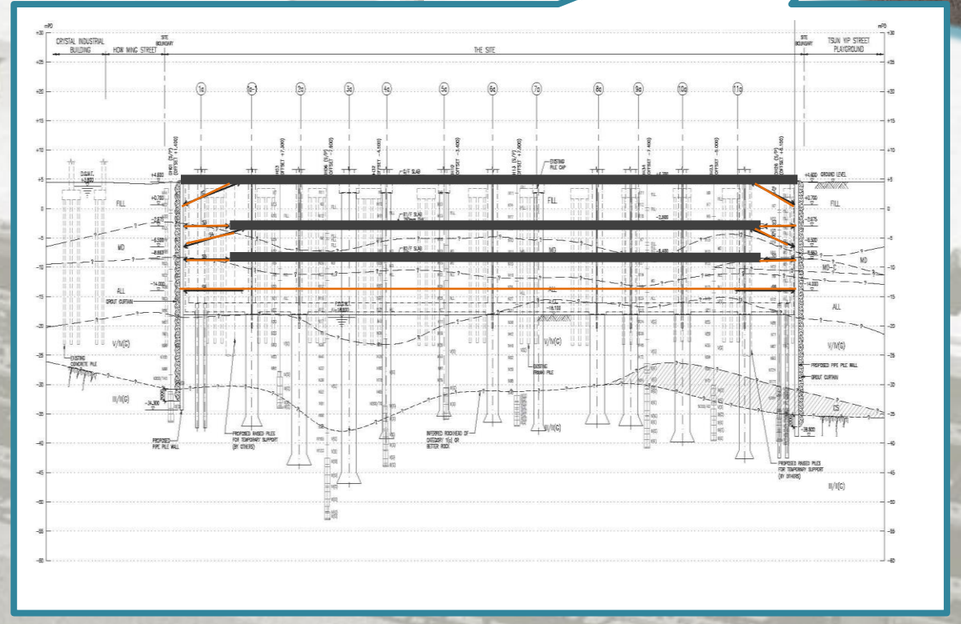
The longest and heaviest stanchion is ST01, which is 10m long and weighs 32.5T. Stanchions are installed in a single-lift manner. A crawler crane shall be deployed to erect the stanchions. Stanchions are installed alongside with the 1st layer of excavation from +4.7mPD to +2.7mPD.

### *On Site Welding Measures*

Welding splice will be used to connect with the embedded part. **Yee Fai** proposes to use high strength plates manufactured by Thermo-Mechanical Control Process (TMCP) to improve the weldability.$CO_2$ arc welding will also be utilized for faster and better quality welding in an on-site condition. Stanchion stability prior to welding is ensured by bolting connection on temporary cleat plates.

Automated Submerged Arc Welding Machine




CRYSTAL INDUSTRIAL BUILDING
HOK MING STREET
THE SITE
TSUN YIP STREET PLAYGROUND
FILL
MD
ALL
V/M(C)
M/W(C)

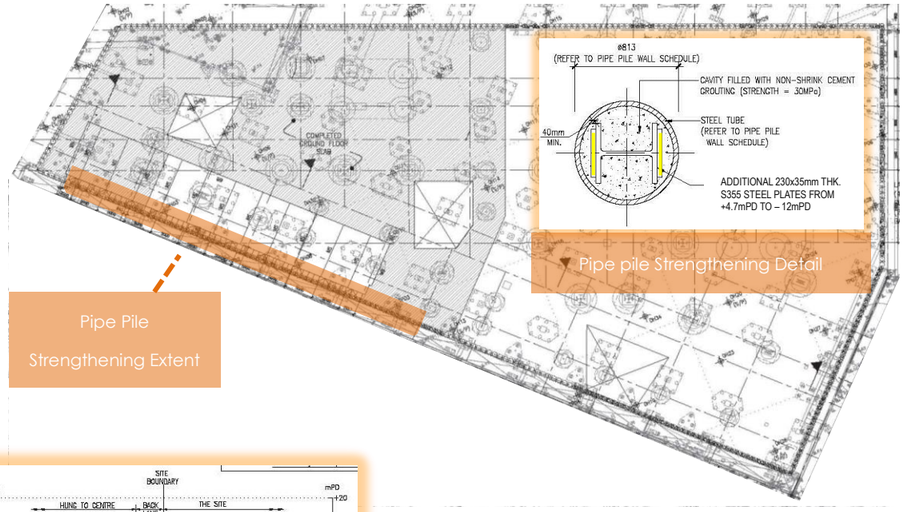
Top-down construction is essential to shorten the development programme for such a deep basement of 4 storey deep. Instead of the envisaged top-down construction in tender document, **Yee Fai** proposes to construct B1/F and B2/F floor structures to create 2 extra workfronts and separate site logistic for superstructure and basement construction.

### *Early Car Ramp Construction*

Traffic for excavation should be separated as fast as possible to free up the space for superstructure construction. Early car ramp construction enables early formation of an exclusive path for dump trucks going down to B1/F. The ramp forms a major access route for remaining volume of soil disposal. An alternative construction approach is proposed the car ramp. The car ramp can be constructed simultaneously with G/F structures, and completed prior to completion of B1/F structures.

This can be achieved by:

- Strengthening of pipe pile wall along the car camp by adding steel strengthening plates to the embedded I-section ( cost to be borne by the Employer)
- Re-design of excavation and strutting sequence as shown on the right.

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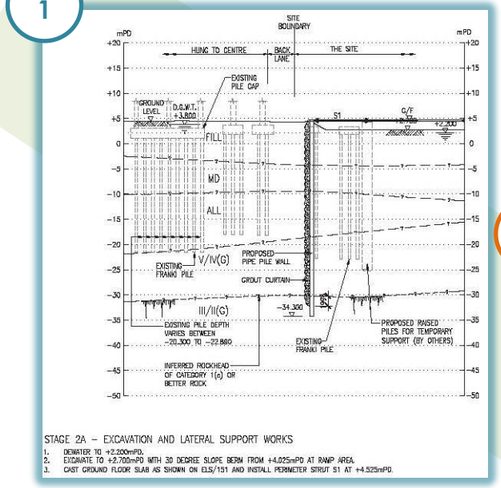


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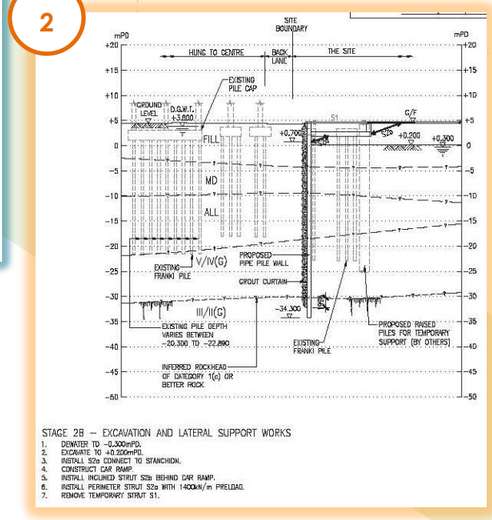


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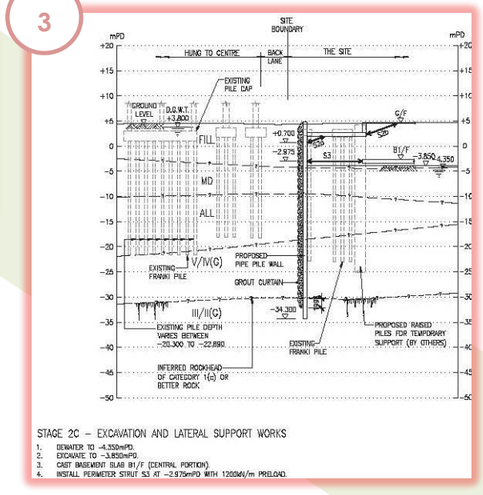




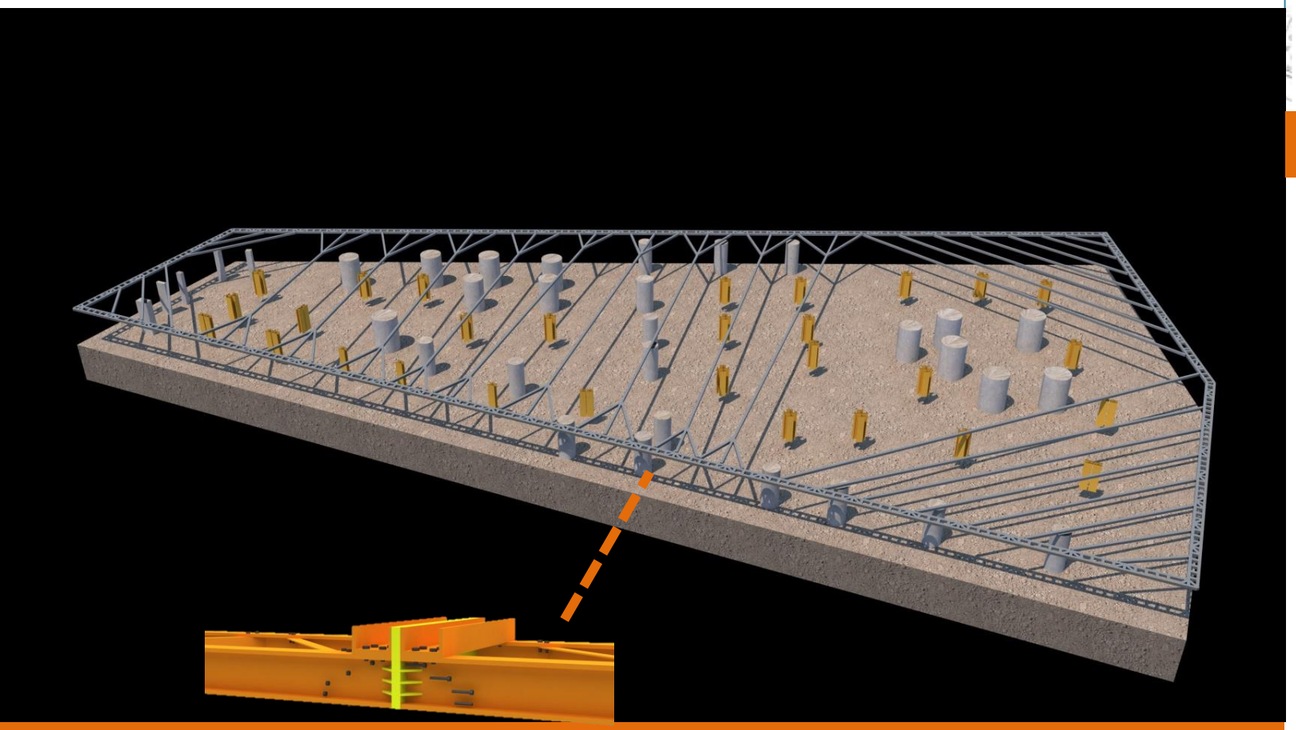
Cap Ramp

### *B1/F and B2/F Construction*

B1/F and B2/F floor are involved in the excavation works when their respective levels have been reached. The struts are propped by the floor structures. Soil disposal by dump trucks would be diverted to B1/F only (B2/F is delegated for material delivery for basement construction). G/F is free up exclusively for superstructure construction.

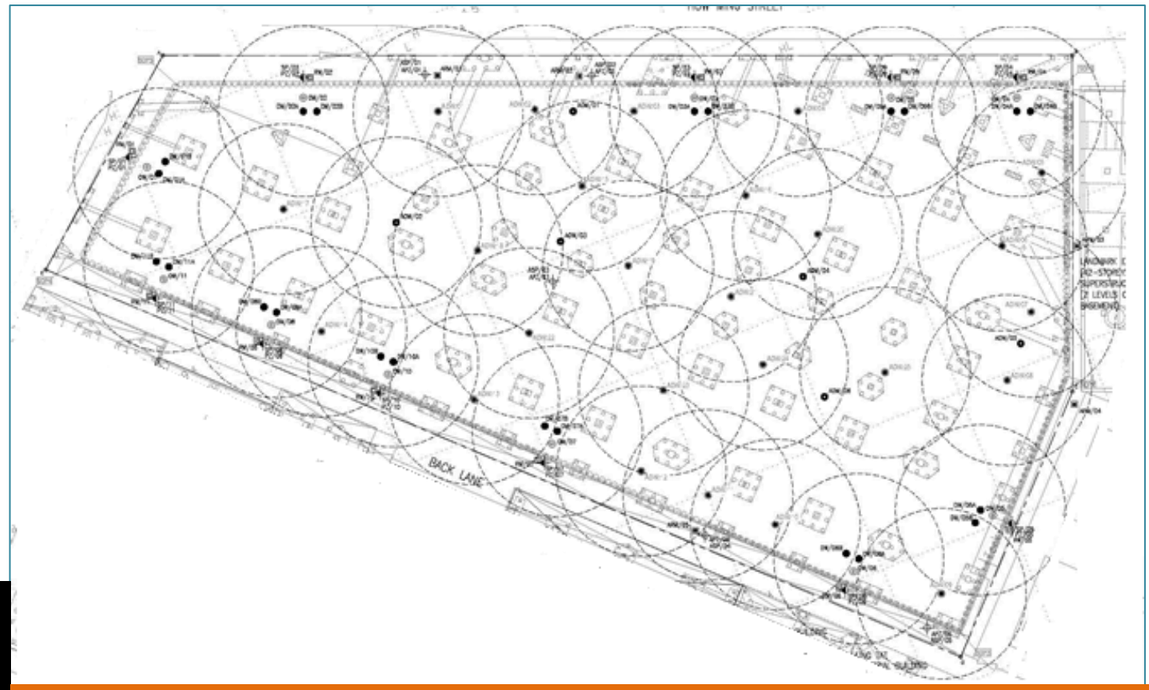
### *Modular Strutting System*

Use of modular struts minimizes on-site welding works and the associated contaminants. Modular Strutting System would be used for the remaining layer of strut installation for B3/F and B4/F excavation. Air quality and working environment in top-down construction can be substantially improved. Programme can be much shortened by using bolts and nuts connections.



Modular Strutting System

## 2.3.2. DEWATERING AND RECHARING SYSTEM




Dewatering System

### *Dewatering and Recharging System*

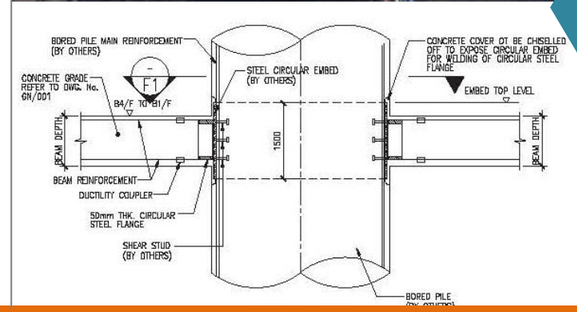
**Yee Fai** shall take over all the 22 dewatering wells (each with a submersible pump) from the previous piling contractor in good conditions. Based on our own analysis, additional dewatering wells and pumps; observation wells; standpipes/piezometers; recharge wells shall be installed to cope with the conditions when the final excavation level is reached.

A separate pipe network system shall be designed and installed around the site perimeter such that any groundwater extracted from the dewatering wells shall be used as recharging water through the recharging wells located outside the cofferdam.

## 2.3.3. ALTERNATIVE STUDED RC COLUMNS HEADS

Tender design requires substantial site welding works to connect steel flanges/ bore-pile embedded plates and reinforcement/ steel flanges. This would generate huge amount of toxic flames and gases which is not desirable for the air quality during the top-down construction. **Yee Fai**'s alternative detail only requires installation of shear studs and normal steel fixing works. Shear stud welding generates far less contaminant. This is also 5 times faster than the Tender design and hence the programme is more secured.

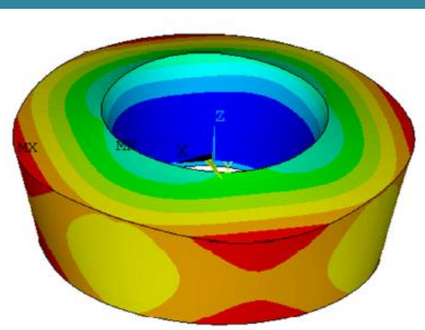
***Tender Design:***
Welding of Steel Flanges – Huge amount of flames and gases

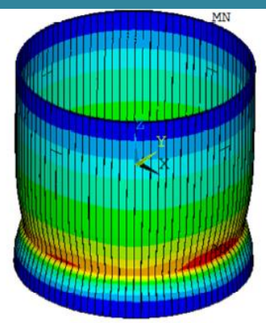



***Tender Design:***
Steel Flanges Column Heads

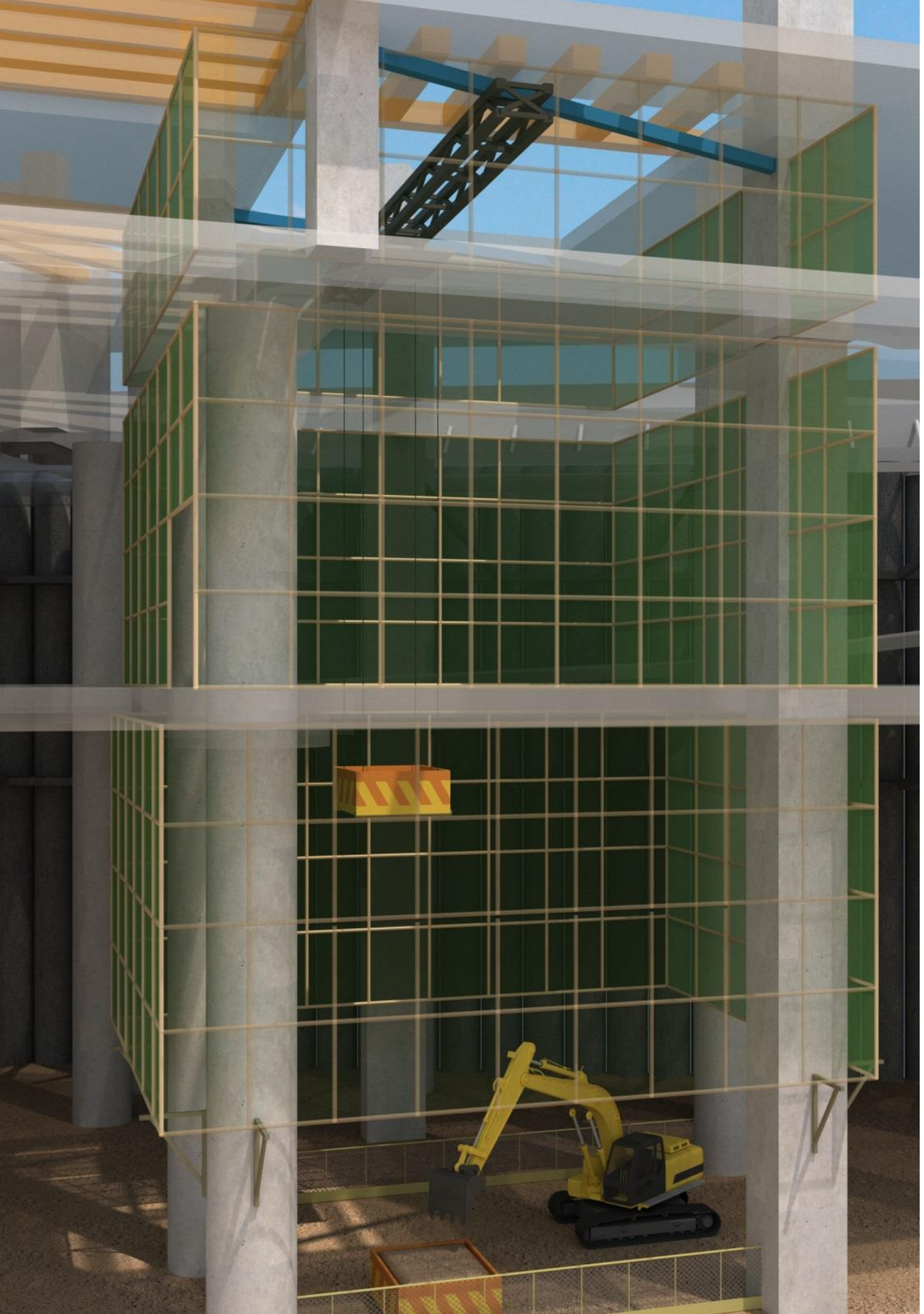
***Alternative Design:***
Welding of Shear Stud

***Alternative Design:***
Studed RC Column Heads






***Alternative Design:***
Finite Element Analysis for Studded RC Column Heads



## 2.3.4. THE MUCK HOIST

To excavate 180,000m³ of soil at KTIL240, **Yee Fai** has introduced a highly mechanical system, the Muck Hoist.

### *The Muck Hoist*

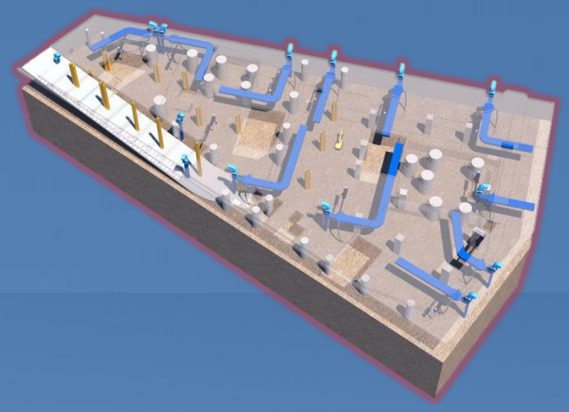
The Muck Hoist's daily output can be up to 1,800m2 /day. This is a rate which cannot be achieved by traditional method

It is also specifically designed for disposal of sticky marine deposit, which constitutes 20% of excavated materials.

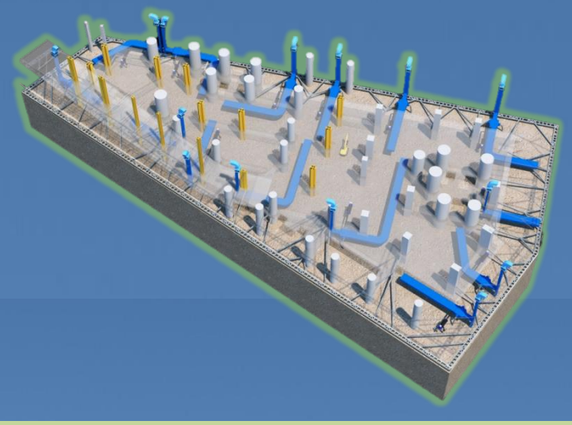
The Muck Hoist increases the rate of excavation by streamlining the vertical transportation. With the supporting frame spanning between columns at G/F – 1/F's space, the Muck Hoist can travel freely from the excavation level to dump truck level at B1/F. Each cycle takes 5 minutes. More technical details will be explained in Chapter 4.

### *Operation*

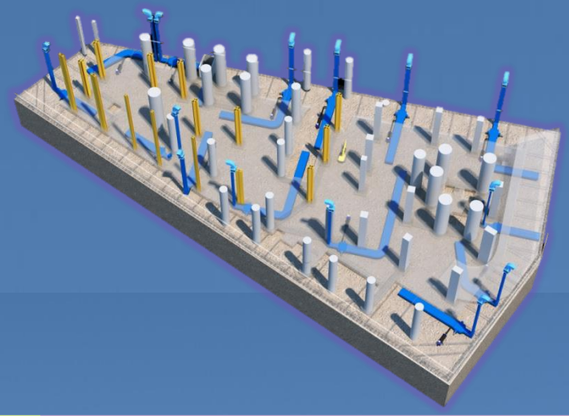
Excavator, dump trucks and the Muck Hoist work together for the excavation works. From G/F-B1/F, only excavator and dump truck will be used. For excavation below B1/F, the Muck Hoist will come into play. Firstly, the mud will be put in a container by the excavator. Then, the Muck Hoist will lift the container to B1/F and unload the mud into the dump trucks parked at B1/F. Two containers shall be provided. While one container is being lifted up, the other could continue to receive mud at the excavation level.



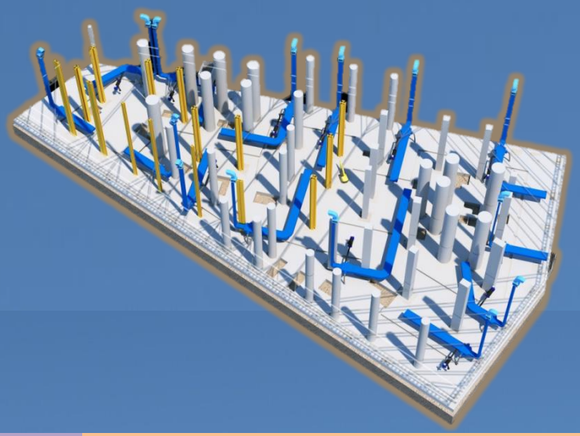
Ventilation System Arrangement for B1 Construction



Ventilation System Arrangement for B2 Construction



Ventilation System Arrangement for B3 Construction

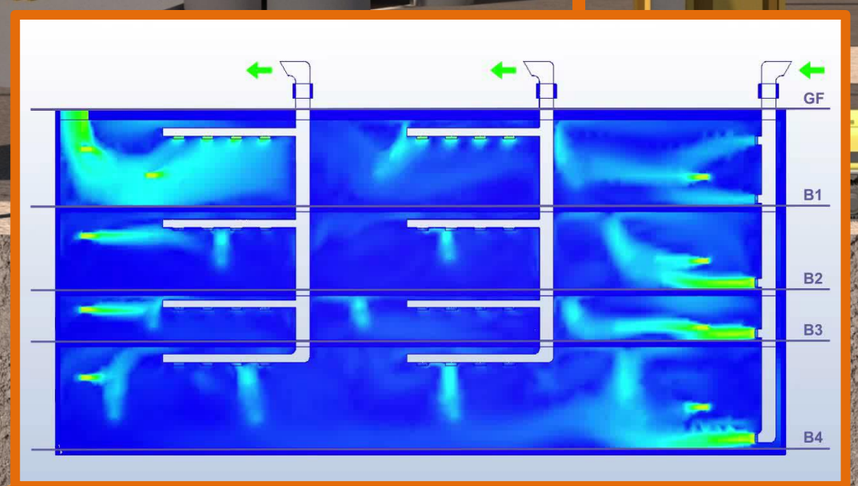


Ventilation System Arrangement for B4 Construction

15m flexible exhaust pipe

Fixed exhaust

Retractable exhaust pipe **(10m² coverage area)**




Computational Fluid Dynamics (CFD) Analysis

## 2.3.5. HIGHLY MECHANICAL VENTILATION SYSTEM

Yee Fai conducts a Computational Fluid Dynamics (CFD) analysis on highly mechanical basement ventilation system. Based on the result, 8 Air Changes per hour for basement excavation and construction can be achieved. This air change quality is even better than internal lavatories in which 5 Air Changes per hour is the minimum requirement. A 2-meter high "smoke-free" zone will be provided. Yee Fai always strive for safe and healthy working environment.

Details of the system are provided in **Chapter 4**.

## 2.3.6. INTELLIGENT MONITORING SYSTEM FOR TOP-DOWN CONSTRUCTION

Top-down construction is more like a confined space construction and poses extra threats to workers on site. **Yee Fai** will set up an intelligent monitoring system for top-down construction to monitor workers' status and working environment condition. The system will also extend to track dump truck's location and dumping volume.

***Site Workers Monitoring***

By providing smart helmet equipped with different sensors to each worker, we can have information on worker's location and personal safety data. If the worker experiences a sudden fall or physically unfit, this would make an alarm on our monitoring system and assistance could be provided to the worker at the shortest possible time.

There will also be danger zone alarming system to remind workers not to approach dangerous area.

***Environmental Condition***

Sensors are installed in the construction areas to real-time monitor temperature, humidity, noise, air quality and UV index, etc. The data is uploaded to the monitoring system, allowing the site management to make the best environmental improvement plan.

Display panel is set up in each area to display the senor data, allowing workers to consider the environmental impact in real-time.

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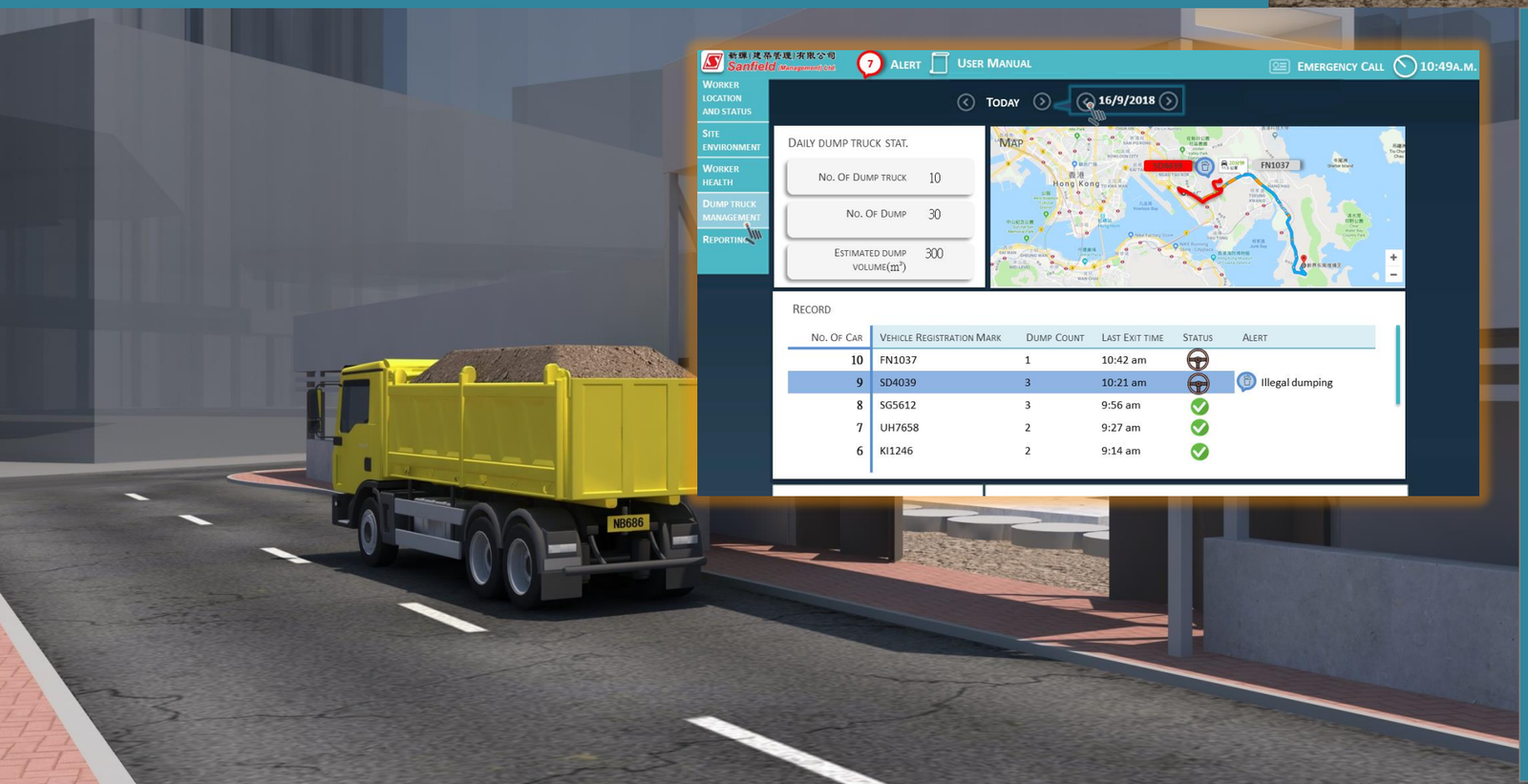



***Dump Truck's Tracking***

GPS are installed on dump trucks enabling real-time monitoring on trucks' location. Any illegal dumpling can be instantly identified.

Drivers of the dump truck shall also scan the dumping receipt onto the system. This could provide a first-hand data for progress management.

Details of the monitoring system are provided in **Chapter 4**


2.4. Towers

2.4.1. STRUCTURAL STEELWORKS (CENTRAL ATRIUM, CINEMA 8)

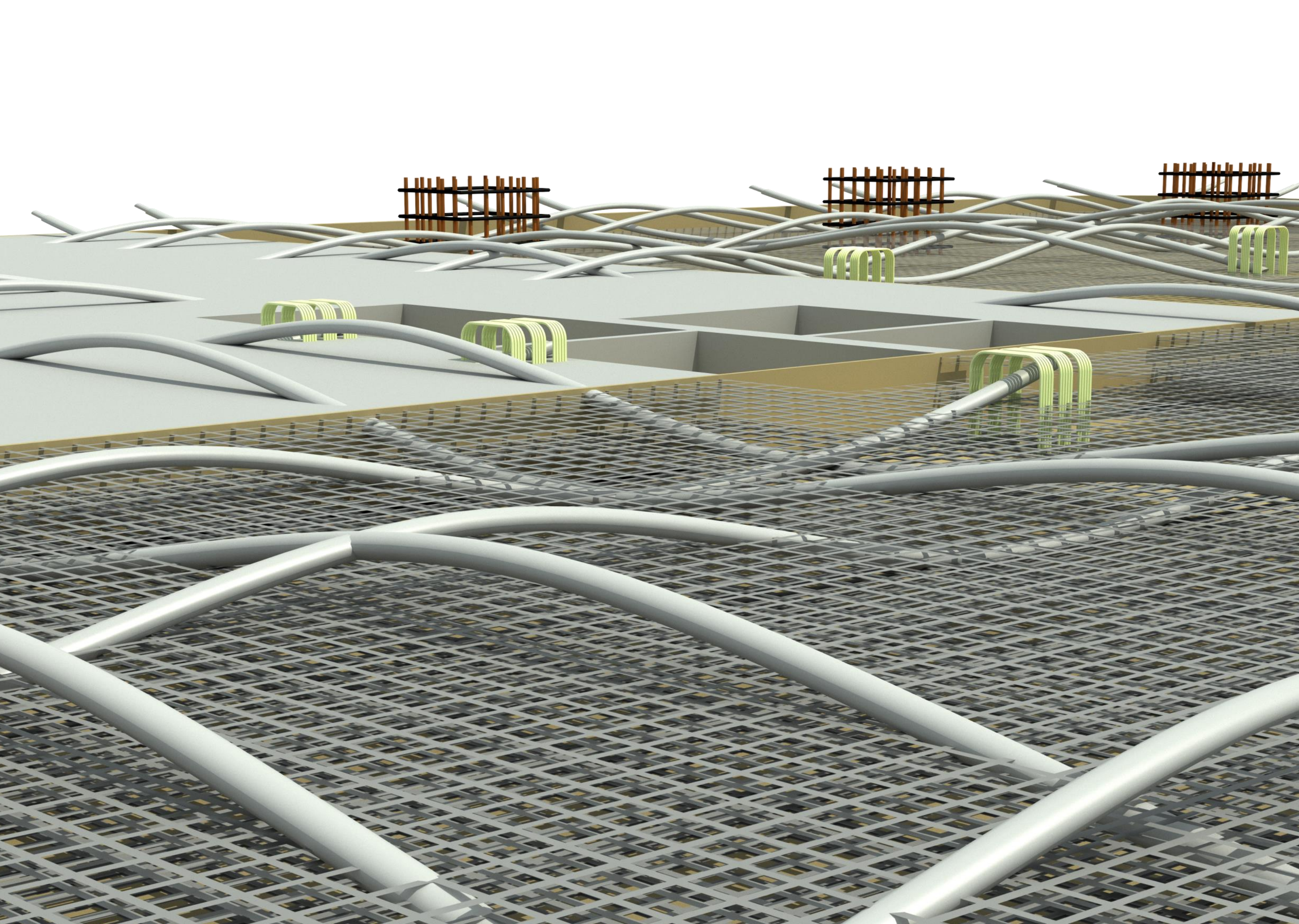
Long span and heavy steel structures are located at 3/F-9/F of Central Atrium and Roof of Cinema 8. The total tonnage is 670T. At the respective floor, there are steel members with its max. span and tonnage up to 24m and 27T respectively.

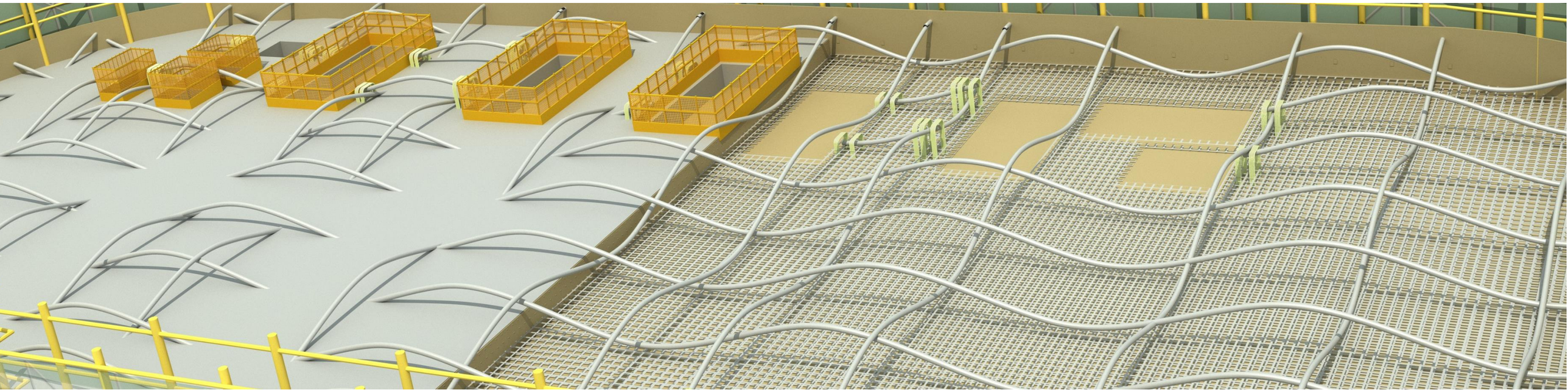
***Installation by Short-Term Tower Crane (TC(S))***

A short-term tower crane, TC(S) will be installed for erection of these heavy steel members. The steel installation would commence when 7/F is completed. It is anticipated that the structural steelworks can catch up the concrete construction cycle at 9/F. Transfer plates construction above can be secured.

To maximize the usage time, the crane would be installed at 7/F and dismantled after transfer plate construction. It is also located adjacent to the steel installation zone for maximum lifting efficiency.


T2







Post-tensioning technique is proposed to integrate with traditional reinforced concrete construction.

### *Tender method*

Normal reinforced concrete construction with 3000mm deep transfer plates for both Tower 1 and Tower 2.

### *Alternative method*

> ***Loading Assumption***
>
> Loadings are assessed by Etabs based on Tender Framings Plans, Loading Key Plans, and Code of Practice for Wind Effects in HK 2004. Yee Fai's assessed loading schedules at transfer plate level are attached in Annex E.

Post-tensioning technique is employed in transfer plates for both Tower 1 and Tower 2. Transfer plates thickness can be reduced to 2800mm. Advantages over Tender method:

i. Time saving by reduced concreting time and reinforcement fixing time. Post-tensioning techniques can reduce the transfer plate thickness and reinforcement content.
ii. Post-tensioning activities kept off the critical path. Fai's proposed design would enable the tower construction continues while stressing and grouting of tendons are being carried out.
iii. Safer construction. Bottom 800mm of transfer plates would be designed as a permanent formwork supporting the weight of the transfer plates above. De-propping and re-propping of falsework can be avoided.
iv. Increased flexibility for 11/F's functional use as transfer plates thicknesses are reduced

**Yee Fai** applies Table System Formwork at typical floors (13/F to R/F) of Tower 1 & 2 for higher efficiency and green construction. This also helps to mitigate the impacts from shortage of the skilled formwork labours in Hong Kong. One full set of formwork is allocated for each floor.

### *Table System Formwork*

The table form can be moved manually across a floor without the use of heavy equipment. It consists of an upper part and a lower part. The upper part is 1.8m high aluminum frames while the lower part is adjustable telescopic legs.

Hoisting rigs are set up at designated locations at upper floor to ascend the table form. This save the use of tower crane.

Slab edge profile is extending outward progressively at certain floors. Handset panels will be installed and fixed between the table forms at these non-typical areas.

### *Column and Core Wall System Formwork*

Lightweight aluminum handset panels will be used. The panels can be handled manually without the use of lifting equipment to achieve high efficiency.

**KTIL 240**

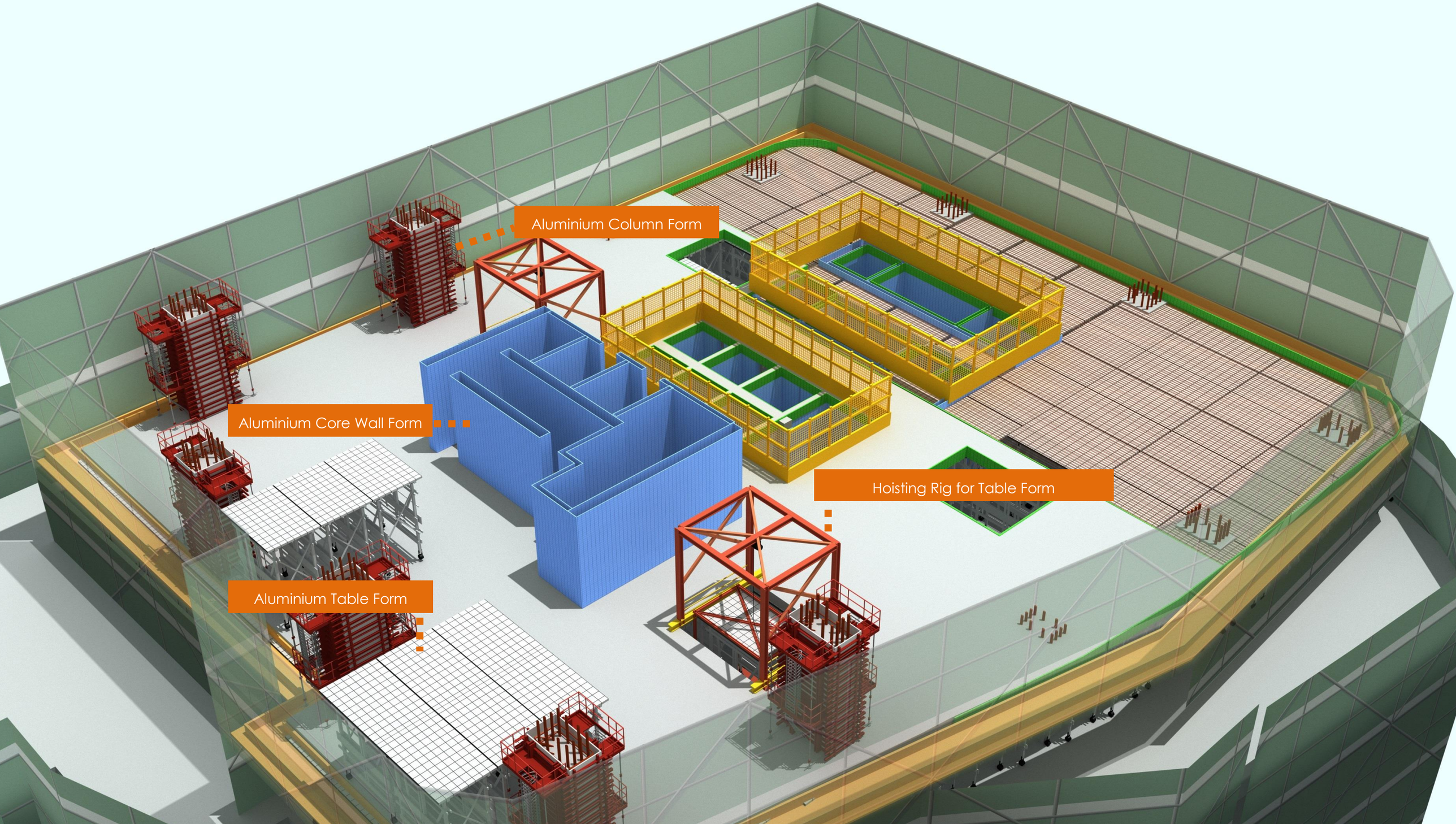
**Proposed Construction Programme for 5-days cycle (Level 12 ~ above )**

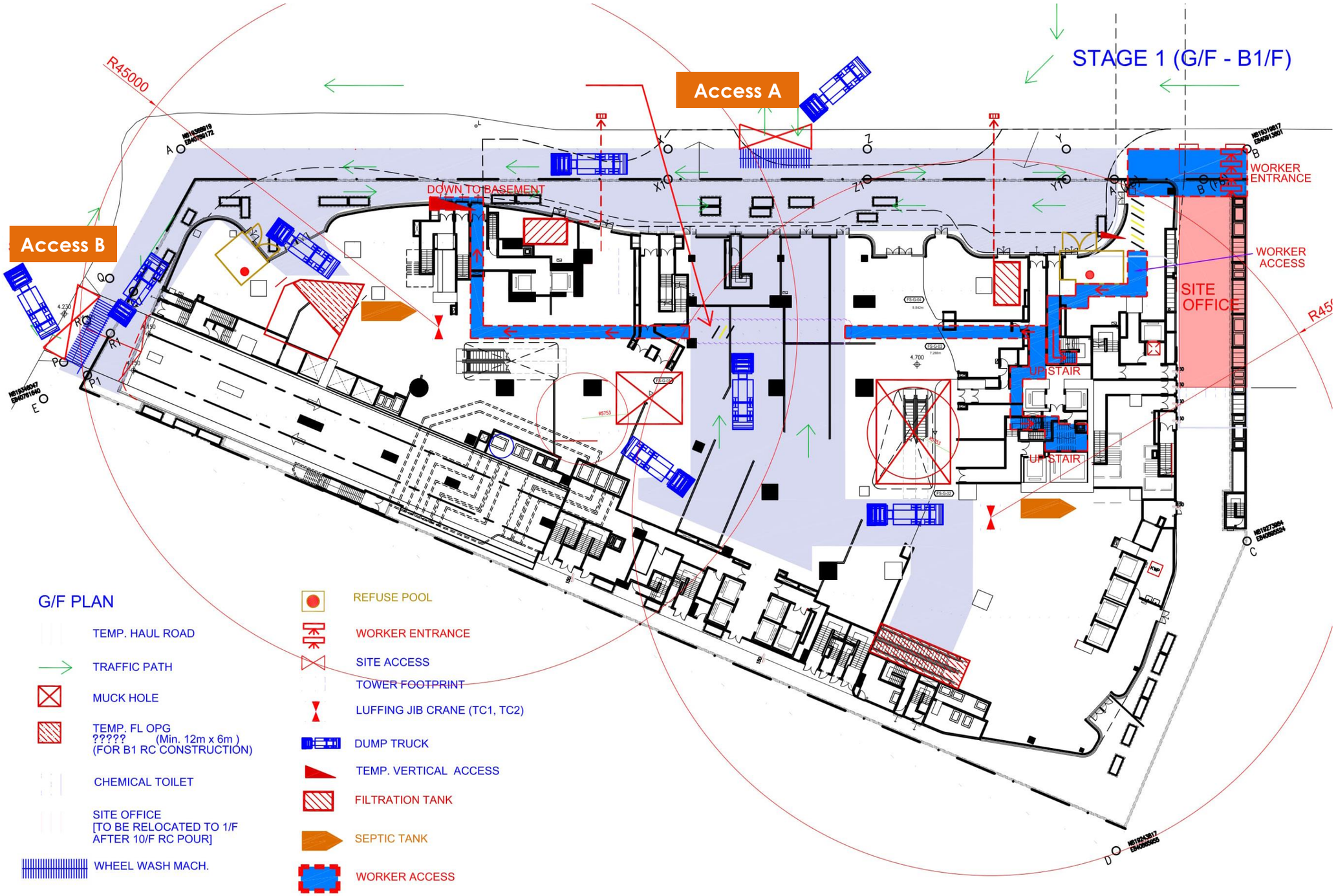
| T1 | ITEM | DESCRIPTION OF WORKS | 2020 |
|---|---|---|---|
| | | | M A M A M A M A M A M A M A M A M A M A M A M A M A M A M A M A M A M A M A M A |
| | | | 1 1 2 2 3 3 4 4 5 5 1 1 2 2 3 3 4 4 5 5 1 1 2 2 3 3 |
| Pour 1 | 1 | Re-bar fixing to column & core wall | |
| | 2 | Formwork erection to column, core wall & slab | |
| | 3 | Slab reinforcement fixing | |
| | 4 | Concreting (Wall,Column & Slab) | |
| Pour 2 | 1 | Re-bar fixing to column & core wall | |
| | 2 | Formwork erection to column, core wall & slab | |
| | 3 | Slab reinforcement fixing | |
| | 4 | Concreting (Wall,Column & Slab) | |
| Pour 3 | 1 | Re-bar fixing to column & core wall | |
| | 2 | Formwork erection to column, core wall & slab | |
| | 3 | Slab reinforcement fixing | |
| | 4 | Concreting (Wall,Column & Slab) | |

M - Morning A - Afternoon

| T2 | ITEM | DESCRIPTION OF WORKS | 2020 |
|---|---|---|---|
| | | | M A M A M A M A M A M A M A M A M A M A M A M A M A M A M A M A M A M A M A M A |
| | | | 1 1 2 2 3 3 4 4 5 5 1 1 2 2 3 3 4 4 5 5 1 1 2 2 3 3 |
| Pour 1 | 1 | Re-bar fixing to column & core wall | |
| | 2 | Formwork erection to column, core wall & slab | |
| | 3 | Slab reinforcement fixing | |
| | 4 | Concreting (Wall,Column & Slab) | |
| Pour 2 | 1 | Re-bar fixing to column & core wall | |
| | 2 | Formwork erection to column, core wall & slab | |
| | 3 | Slab reinforcement fixing | |
| | 4 | Concreting (Wall,Column & Slab) | |

M - Morning A - Afternoon


Aluminium Column Form
Aluminium Core Wall Form
Hoisting Rig for Table Form
Aluminium Table Form






One way vehicular traffic direction

# 3. SITE LAYOUT AND MAJOR TRAFFIC ROUTE

## 3.1. SITE LOGISTICS

***Philosophy of site logistics***

The following section describes each component part of our logistical planning and methodology that we consider necessary to meet the construction challenge of this project. The input and reasoning is supported by examples, diagrams and illustrations to aid understanding of our proposals and promote detailed discussion.

Developing the Project Logistical requirements has followed a clearly structured process. First, we have had to fundamentally appraise what is to be constructed and how. Then, we have addressed the key issues associated with this major project and identified the specific site constraints. Our methodology is built on that awareness and understanding.

In summary, the key logistical points to further consider, plan, and establish temporary infrastructure for include:-

- External road access and designated route; boundary conditions and restrictions, in particular the required traffic routes which are to be used by the contractors for all earth moving and other major plant and material deliveries;
- Curtain wall storage area and designated delivery routes;
- The intense building programme and an analysis of the large volumes of material entering and leaving the site;
- The fast, effective and safe simultaneous movements of large numbers of personnel, machines and heavy equipment needed throughout the construction period;
- Coordinated site office and welfare facilities that are adequate, comfortable and enhance a working environment for all personnel entering the site and joining the construction team;
- Micro management of laydown and store areas at site encompassing staged allocation of stockpile; rebar fixing areas, ABWF materials, equipment, including allocated assembly, fabrication and workshop areas;
- The installation, operation, coordination and final demobilization of the tower cranes;
- Dewatering and temporary drainage system;
- Provision and maintenance of various access routes both vehicular and pedestrian for members of the public through and adjacent to the site; and
- Protection and diversion of buried utility services within and around the site.

***General site traffic and gantries arrangement***

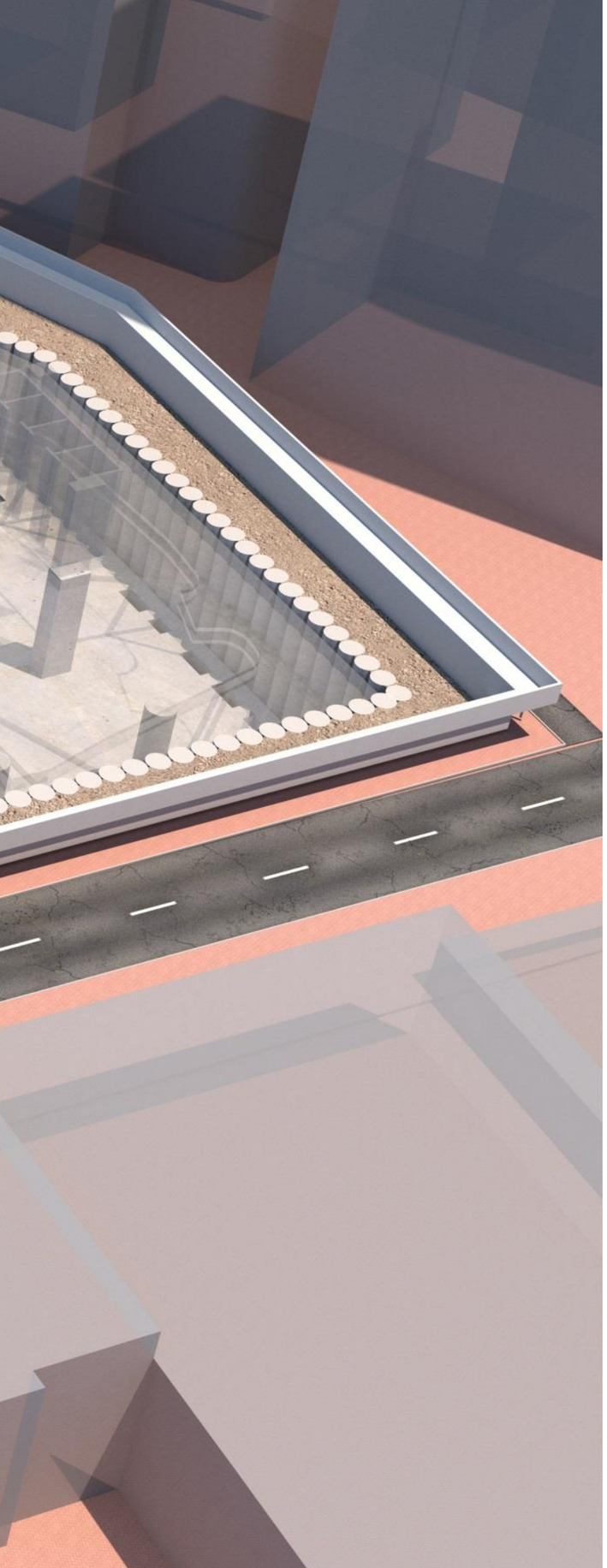
To maintain and keep the flow smoothly and continuity, two site accesses will be provided (which are facing How Ming Street). We plan to control all vehicles' movement within the site at one way direction. That means all vehicles can enter the site directly without driving in reverse. All vehicles can turn around within the site and then leave.

***One way vehicular traffic direction***

To achieve the goal, the gantries at hoarding should have sufficient width so as to ensure two trucks (either concrete or dumpling trucks) can access in or out from the site at the same time. Site access **A** is the main entrance for all vehicles for the purpose of soil and waste dumpling, concreting work, loading and unloading and material delivery etc. And, site access "B" provides the direct access road leading to all floors of basements. It provides the secondary access and mitigates the burden at access **A**. Thus, continuity of traffic flow can be maintained.

Access A

Access B





### *Gantries Arrangement*

Access **A** and Access **B** will be provided at the North and the West respectively. Both of them are linked to How Ming Street. Hoarding gantry shall be widened to ensure two trucks pass through side by side. **Yee Fai** will be responsible for the hoarding amendment after site possession. Flash light, convex mirror and LED warning sign board will be installed at each access.

### *Access A*

Access **A** provides the main route for transportation. When the trucks enter into the site, no vehicle is permitted to stay at the entrance. The trucks can only park at the designated loading and unloading area for daily façade or wet trade work.

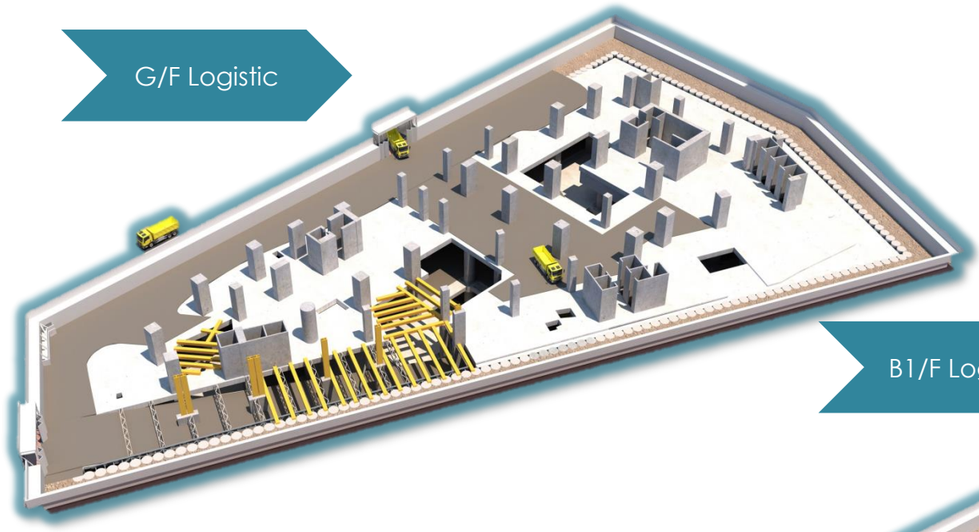
### *Access B*

Access **B** forms a major access road to basement. It is directly linking to the basement car ramp and will be mainly used for soil disposal once the car ramp is formed. It also links to Access **A** and forms an interlink access at West.

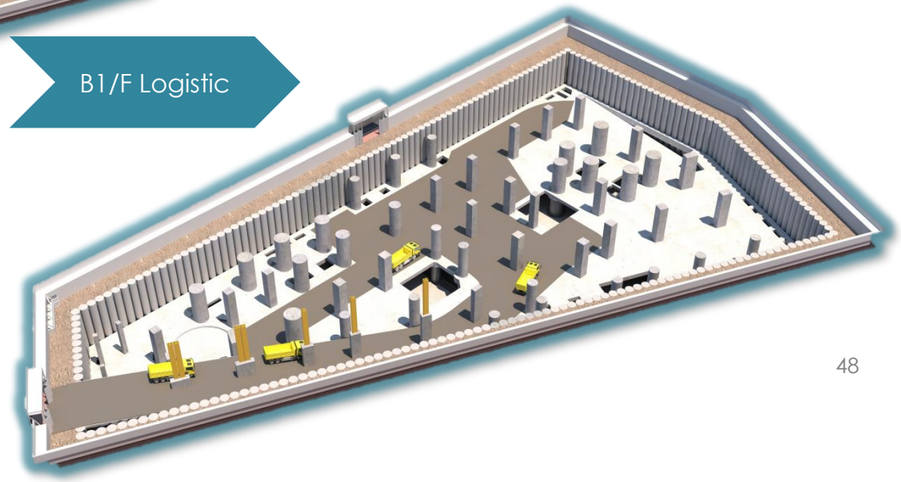
### *Secondary Route of Transportation*

To form the secondary route of transportation, some internal walls (either partition walls or RC walls) should be boxed out for temporary access to pass through. Small mobile machines such as lifting truck, 1.5 tons lorry, small bulldozer/ excavator will be used. It can enhance the degree of mobilization and machinery used on site. Materials can be delivered on point to point basic and save the manpower on double handling.

G/F Logistic



B1/F Logistic



## 3.2. PHASING ARRANGEMENT

We divide the site layout and logistics planning into the following 3 phases according to the construction programme:-

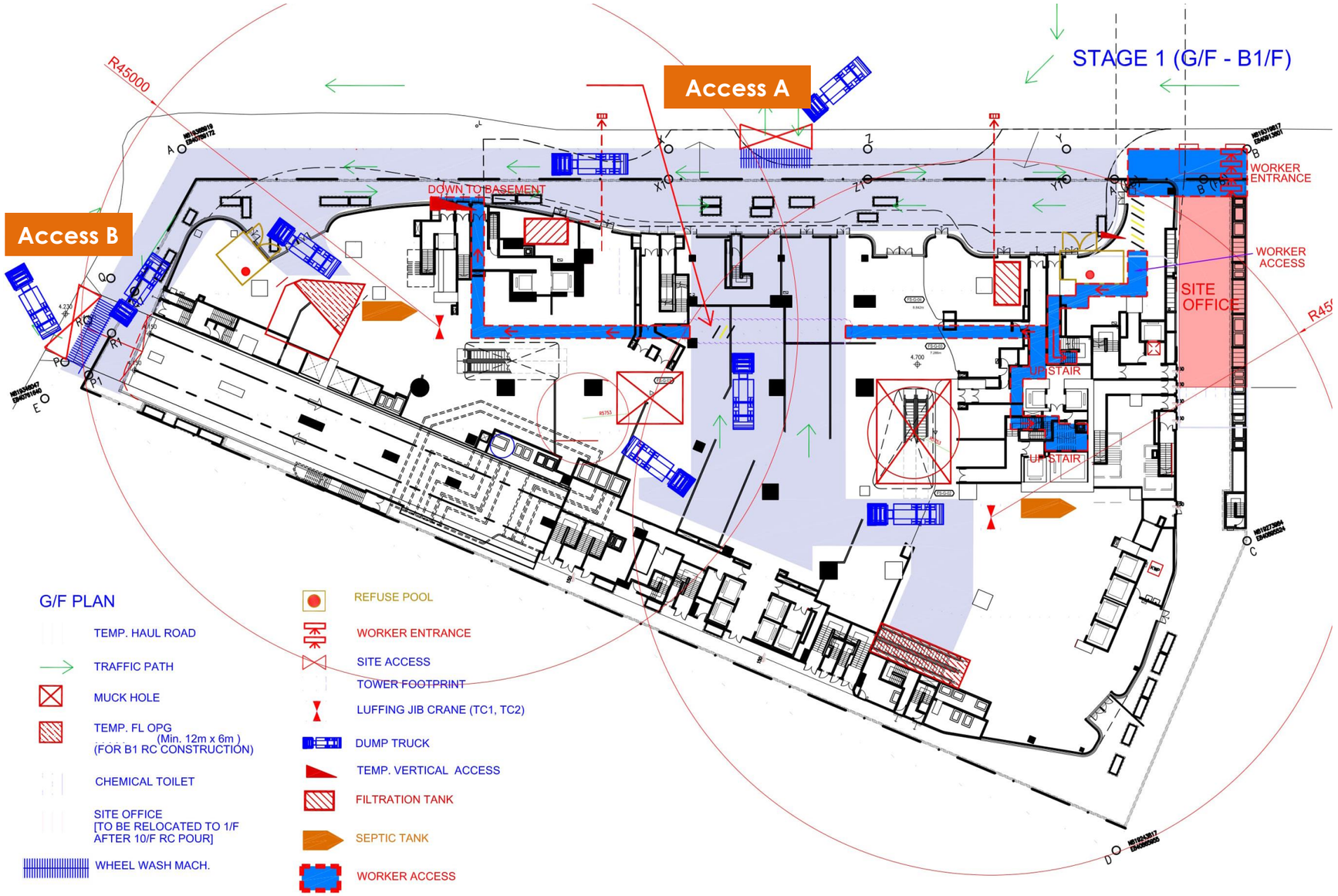
- ELS and basement construction stage.
- Superstructure construction stage.
- External façade, ABWF and M&E installation stage.

ELS and basement construction stage

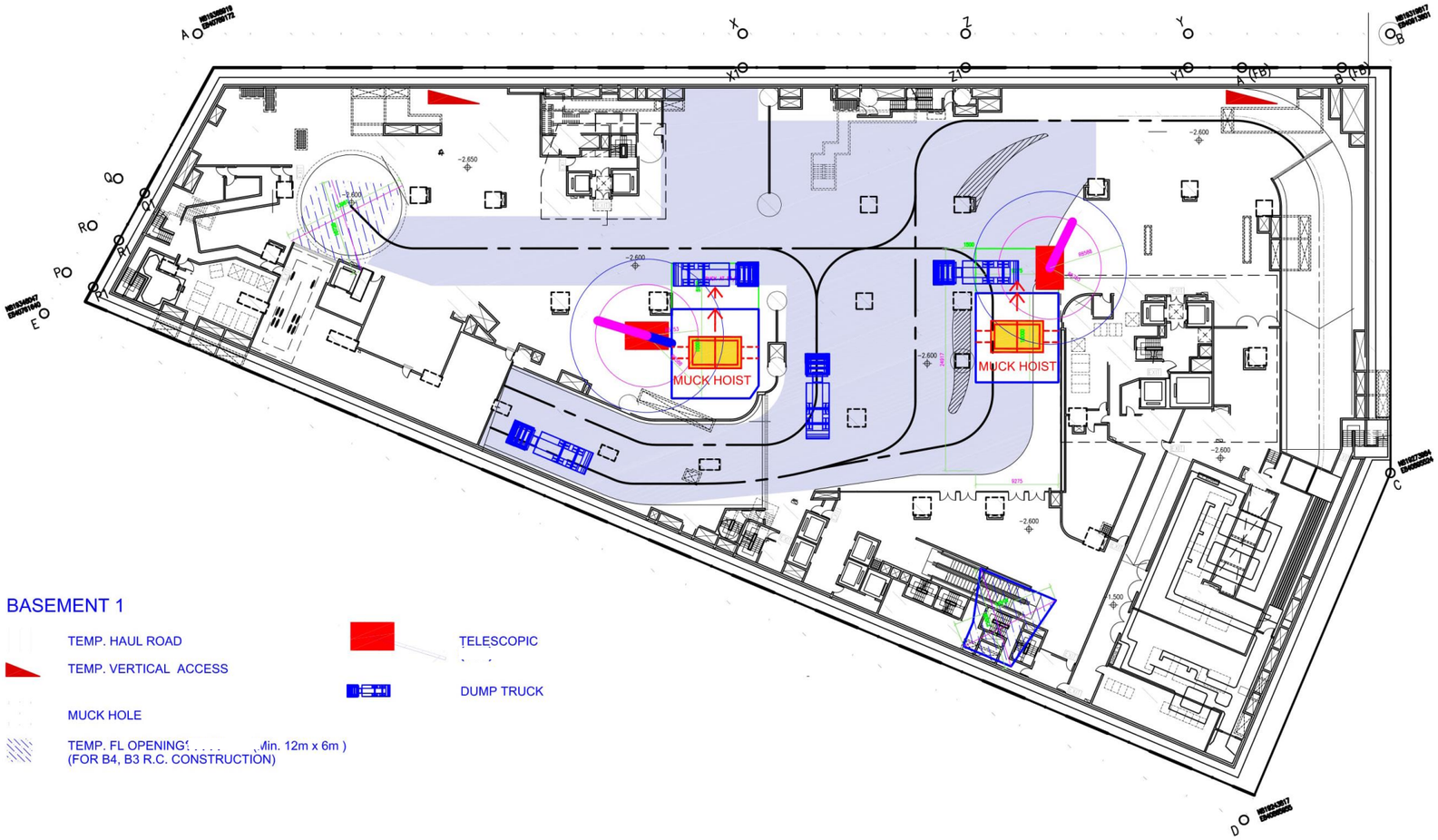
After taking site possession, the following will be established for enabling smooth commencement of construction works.

***Material Transportation*** – To commence the top down construction, G/F slab and associated pile cap would be constructed with excavation works and lateral support installation. During this stage, 2 sets of tower cranes will be erected after G/F structure completion to handle all the vertical transportation. The tower cranes will be responsible for the lifting of re-bar and formwork for the superstructure construction afterwards.

On the other hand, after B1/F car ramp structure completed, the main logistic path for excavation would be transferred to B1/F and hence raise the flexibility of the site layout on G/F to cater super-structure construction and ELS works proceed concurrently.




Initial site set up for ELS and superstructure construction




Designated logistic arrangement for ELS on B1/F

***Initial site set up for ELS and superstructure construction***

***Excavated disposal transportation*** – As the designated logistic path would be formed for ELS on B1/F, the Muck Hoist would be set up to handle the vertical transportation of excavated disposal from excavation level to B1/F dump truck for cart away.

Wet concrete transported by pump truck – At the day of concreting operation, wet concrete shall be delivered to the site by ready-mixed concrete trucks. Concrete pump trucks to be deployed for concreting works to handle the large concrete volume of superstructure construction.


Concrete pump truck

### *Reinforcement bar Storage & Bending*

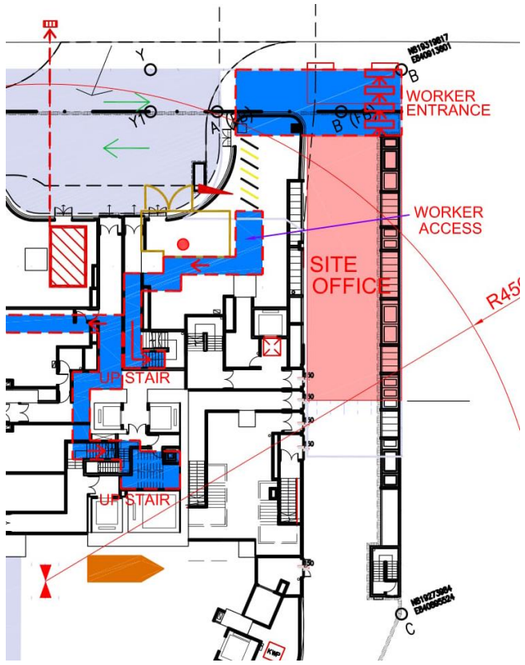
The reinforcement bar storage and bending area will be set up on site and to be relocated according to the phasing of the substructure construction works.

### *Workers access control* –

There will be only 1 ingress and egress point for all personnel getting into and leaving the site for security purpose. Workers access control point will be setup next to the site gantry. Turn stiles and computerized handkey system will be installed for workers' identification and access control.

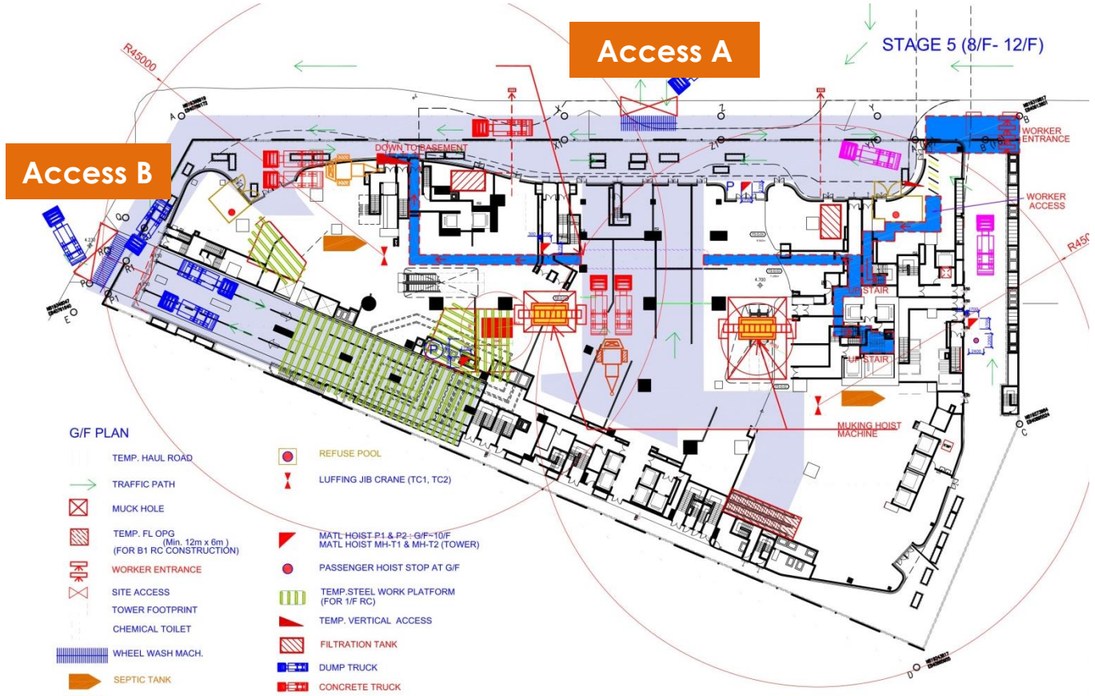

### *Site office*

Container offices will be set up closed to the personnel ingress point for direct access

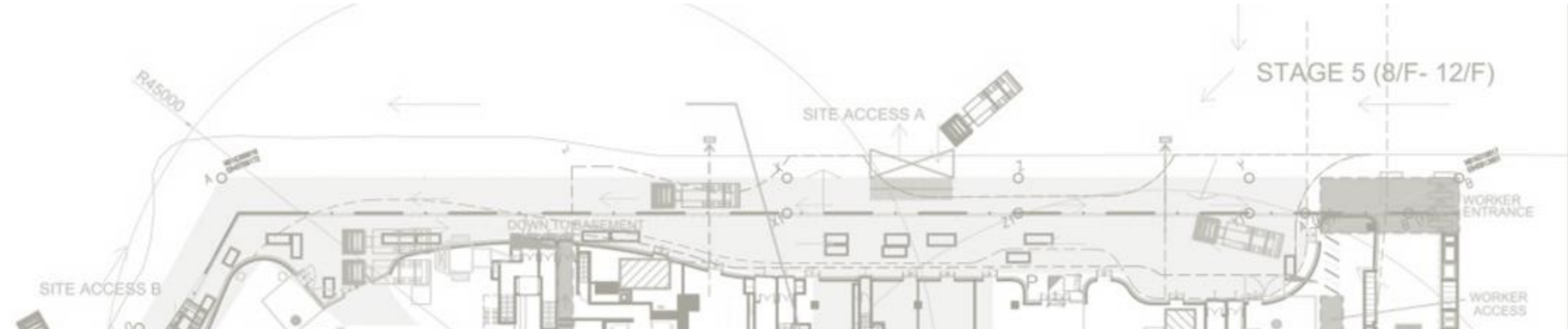



*Site office location connected with worker entrance*

Tower crane – We shall install total 3 sets of tower crane in the site establishment stage to facilitate the handling of building materials and debris. 2 sets of tower crane would be assigned to handle superstructure's construction; the remaining tower crane (TC-S) would be responsible for the heavy structural steel lifting work and assistance of installation at podium portion




Tower cranes arrangement



Temporary site facilities will basically follow the arrangement in the previous construction stage, except the following:-

Material Transportation – Each tower in this stage will be served by the dedicated tower crane to handle the large amount of construction materials during the 5 days construction cycle for typical floors.

Also, material hoists will be deployed to assist the vertical transportation. The tower crane will be mainly responsible for the lifting of re-bar and formwork. For achieving a good housekeeping plan, **Yee Fai** will designate a material storage zone at G/F for temporary material storage.

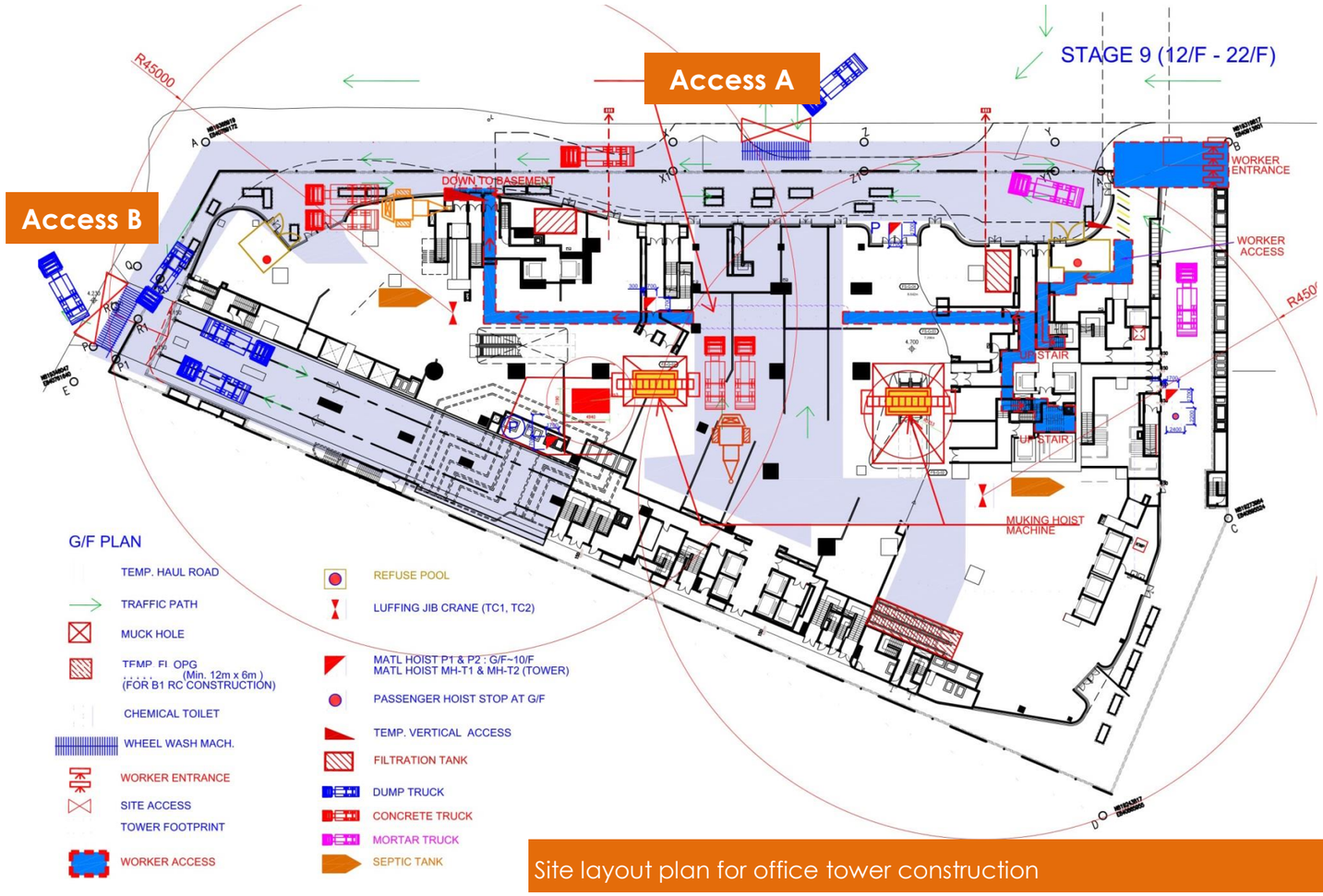
Wet concrete transport by stationary concrete pump – For office tower construction, we shall set up stationary concrete pump on the G/F for transporting wet concrete to the working floors and will be relocated to facilitate the construction cycle of different zone.


Stationary concrete pump

Construction debris removed by skips – Construction debris will be lifted up from the structural construction working floors by the cranes and skip down to the G/F open space prior to removal off site.

Passenger / Material hoist – Each tower would be deployed passenger and material hoists accessing from G/F for the transportation of worker, building materials and equipment to all floor levels. The location is selected to be away from the edges of the transfer structure

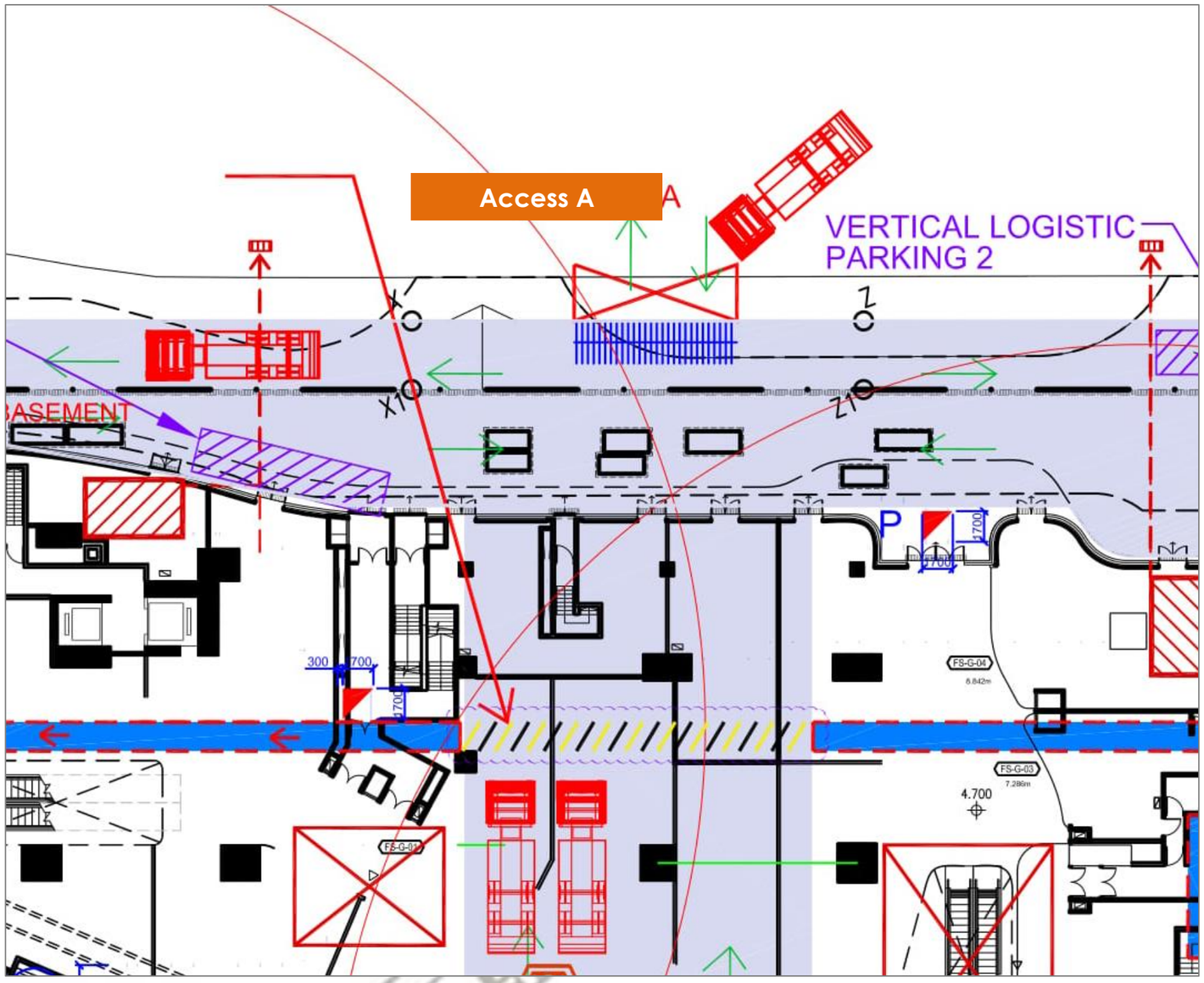
Material Hoist




Site layout plan for office tower construction

## 3.5. SITE LOGISTICS PLANNING FOR EXTERNAL FAÇADE. ABWF AND M&E INSTALLATION STAGE

Designated storage and logistic arrangement for external facade – Detailed planning has been considered to arrange a designated storage and logistic planning for large amount of curtain wall and external façade elements. It is noted there are over 4800 pieces curtain wall panel would be delivered daily and lifted to designated floor at office towers.

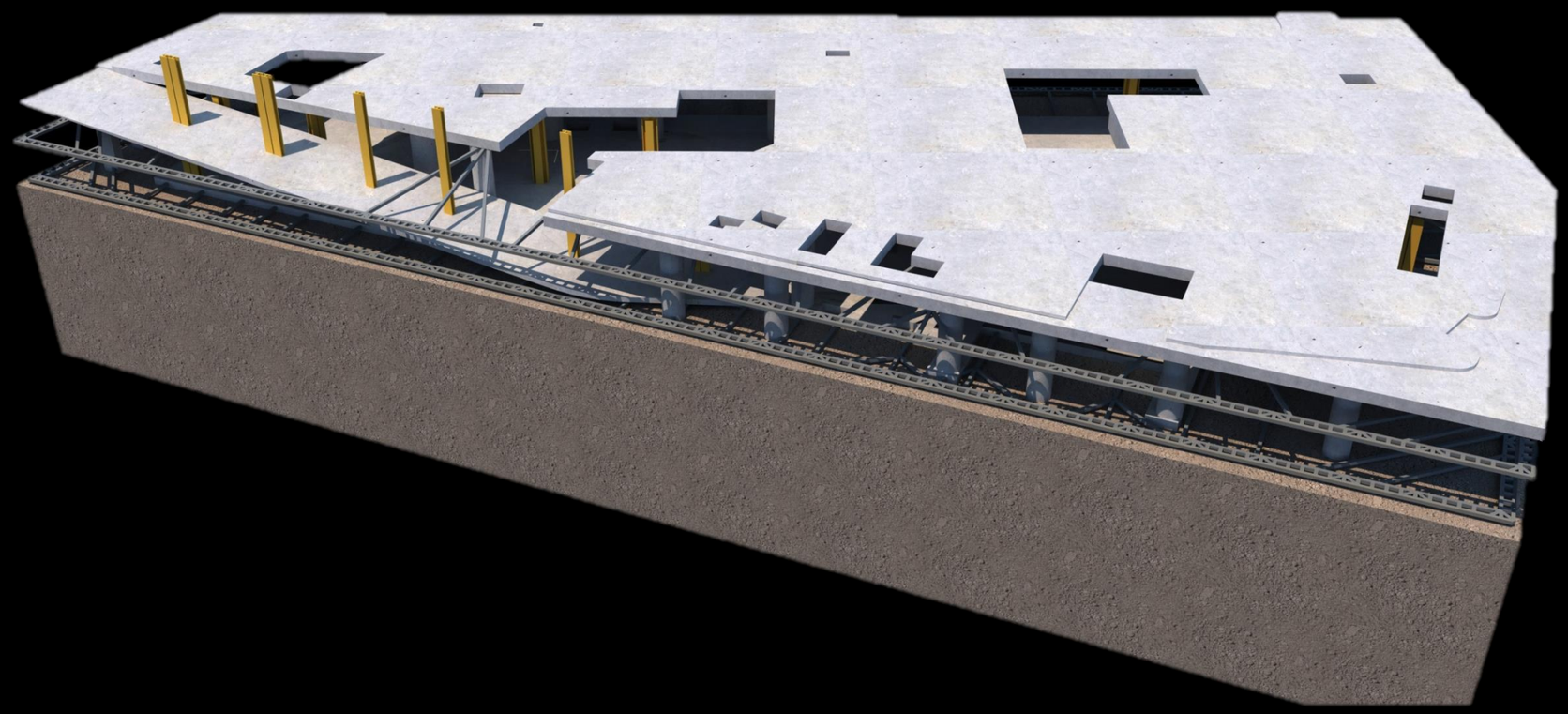



Designated façade unloading area on G/F

## 3.6. STRATEGIC PLANNING FOR SPECIAL CONSTRUCTION METHODOLOGY

To suit for top down construction, total 4 numbers of slab openings should be reserved. Two slab openings are used for soil removal and the rest are for vertical transportation (Ground floor to basements). Excavated soil should be removed through these mucking holes by the Muck Hoist and car away. As for temporary steelworks such as steel platforms for excavators and dumpling trucks to sit on temporarily and portal frame which provides a platform for upper part construction and maintain a sufficient headroom for internal lifting and access at mucking hole at G/F.

Since more than 1000$m^3$ soils should be removed daily, the Muck Hoist are installed so as to speed up and increase the efficiency for soil removal from basements to ground floor. If the Muck Hoist shut down, clamshell telescopic arm excavator, with 17m length arm to remove the soil, will then be installed. It can ensure that the soil removal work can be continuous.



# 4. FOODBRIDGE ERECTION

Since the structural steel frame of the foot bridge would be divided into four equal prefabricated components; after the delivery of those prefabricated elements, they would be further assembled into the final product on site.

Temporary traffic arrangement (TTA) would be well designed and applied to relevant government department prior the delivery of footbridge component to mitigate the nuisance to the road users and public. Following procedure would be carried out for TTA planning:-

- Early coordinate with relevant contractors of adjacent works to plan their works according to our proposed phase sequencing and target programme.
- Prepare temporary traffic arrangement (TTA) scheme detail plan for advance submission to relevant government departments (i.e. RMO, TD…etc) for approval to grant consent of temporary traffic arrangement..
- Work out the risk assessment and preventive measures to avoid occurrence of the risk identified that may affect the temporary traffic arrangement flow.
- Take prompt site supervision on any site incident that will affect the temporary traffic arrangement flow.
- Provide immediate response and emergency repair works to rectify any damages that will affect temporary traffic arrangement flow.
- Submit incident report and rectification proposal within 24 hours after the incident happened that is affecting temporary traffic

Before the installation, self-standing temporary working platform with scaffolding and protective screen would be erected on both end of the foot bridge separately by competent scaffold from bottom to top to protect the beneath pedestrian walkway after the setting up of hoarding around the footing of the scaffold. Consequently, the scaffold would be examined and checked by a competent person to ensure it could fulfill the statutory requirement.

Bearings would then be installed to provide support to the foot bridge. As the foot bridge would connect both existing building MC6 and the new building, different treatments would be proposed to two side of bearing installation separately.

For the side of new building, pockets would be prepared during the concreting stage of corbel and well-protected. The bearings would then be installed in accordance with the design movement direction and the axes; as well as set out to the alignment. Grouting, which shall be proprietary non-shrink cementations type having grade of at least 50MPa, would be followed up and applied to bottom plinth after welding works of steel works and wooden formwork fixing around the plinth. Furthermore, the thickness of the grout should be kept at 25mm and 40mm to reduce cracking. At last, the temporary fixing clamps could be released upon the achievement of 50MPa grout strength.

However, for the side of existing building, the existing corbels' cover would be chiseled according to the reference line at first to identify the existing main bar; so as to avoid the overlaying of pocket on the same position. The corbels would then be drilled by coring machine to sufficient depth to receive the pocket and the loosen materials inside and around the pocket would be removed, cleaned and covered to prevent debris accumulation before the bearings installation and followed-up grouting procedures.

The erection plan would be phased into two stages; first of all, both end-components would be installed firstly and followed up with the middle-section which would be welded properly to the previous two components, which the plan would be satisfied by setting the mobile cranes in different location to lift and install the assembled section during overnight period to minimize the disturbance and time required


SCHWERL

# 5. CASTING CONCRETE ARRANGMENT

At basements, concrete placing boom with connection of concrete pipes to various working area will be used for concreting works. And at G/F pilecaps, ground floor slab, lower level of podium and G/F landscape area, mobile concrete pump with placing jib will be used.

The mobile concrete pump will be equipped with the pump and placing jib. The jib can extend horizontally and vertically so concrete can be placed in different area. When outrigger legs are set up on the ground, the placing jib can be operated and extended up to about 20m height, so it can enhance the mobilization on site.

Tower cranes can assist to place concrete such as at parapet walls, plinths and make good the left in/ boxing out area etc. It will be used when no materials such as reinforcement bars, scaffoldings, electrical pipes etc. are being hoisted at site.

At podium, transfer plate and towers, station concrete pump with concrete placing boom will be used. At transfer plate which is 2800mm depth, method statement of the construction sequence and post-tensioning should be submitted and approved before the commencement of work.

When heavy duty falseworks have been erected and braced, formwork will be assembled at soffit and vertical sides. Then, well coordination is needed for the time to fix and place the reinforcement bars and sleeves for tendons as the works are overlapped with each other.

Concreting works will be divided into at least 3 layers (1st pour with 800mm deep, 2nd pour with 1000mm deep and 3rd pour with 1000mm deep. Since large concrete volume will be poured at each layer, tower crane will assist the concreting work by lifting the buckets to deliver the concrete repeatedly. When each layer is completed, we will roughen the construction joint/surface with high pressure water jet so as to provide the good bonding surface.

C60 concrete will be used for transfer plate structure. Cooling and curing treatment should be incorporated during and after the concreting works. After casting concrete, the concrete surface should be covered by wet hessian bags and kept wet. To carry on the next concreting work, the concrete cube test reports should be obtained so as to prove that the design strength is achieved to the design strength to either support the 2nd layer of concrete or post tensioning work.

At tower's floor, station concrete pump will be sit at G/F atrium. When concrete trucks enter sites through Access "A" & "B", concrete will be pumped through the concrete pipes to each floor. Concrete placing booms with jib are installed at floor and place the concrete to the area where it can cover. As the longest distance at typical floor at Tower 1 & 2 is about 49m and 53m respectively, one concrete placing boom cannot serve all the area. As a result, concreting works will be divided into three zones (Tower 1) and two zones (Tower 2).

- Tower 1 will install 3 nos of concrete placing boom posts with 1 nos placing jib.
- Tower 2 will install 2 nos of concrete placing boom posts with 1 nos placing jib.
- When Area 1 is casted, the jib at placing boom will be dismantled and fixed to the other boom for Area 2 concreting work. Upon completion one floor r.c. structure, the concrete placing booms will be raised and lifted up so as to serve the upper floor.

Summary of the use of Machinery for concreting works as below:

| Locations | Machinery 1 | Machinery 2 | Machinery 3 |
|---|---|---|---|
| **Basements (B1/F to B4/F)** | Station concrete pump + concrete pipes | | |
| **Podium (Lower level)** | Mobile concrete pump (with placing jib) | | Tower cranes |
| **Podium (Higher level)** | Station concrete pump + concrete pipes | Concrete placing boom (with placing jib) | Tower cranes |
| **Transfer Plate (at 12/F)** | Station concrete pump + concrete pipes | Concrete placing boom (with placing jib) | Tower cranes |
| **Towers (Typical floors)** | Station concrete pump + concrete pipes | Concrete placing boom (with placing jib) | |
| **Roof to Top roof** | Station concrete pump + concrete pipes | Concrete placing boom (with placing jib) | Tower cranes |
| **G/F Landscape area** | Mobile concrete pump (with placing jib) | | Tower cranes |

# 6. FAÇADE WORKS

### *Design*

The façade of KTIL240 incorporates panels with different profiles and indentation as a stylish feature to form a stunning design to outweigh all building envelope in this area

### *Tower*

By making use of the combination of curtain wall, glass wall and glass balustrade systems into 4800 numbers of panels and divides them into 3 major zones, these zones create an intriguing layer that animates the glass envelope.

### *Podium*

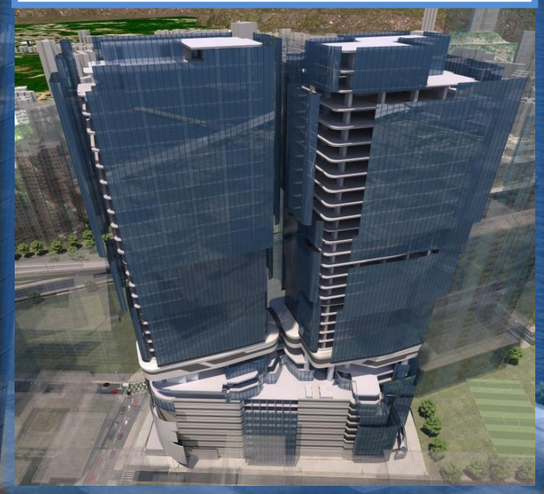
As part of the dynamic concept, different types of materials make up the façade with glasses and metal parts are positioned at different plane to give a sense of greater depth to the facade, it includes:

- Glass Curtain Wall; (Stick System) Glass Type: IGU, Low Iron IGU at (G/F to 1/F)
- Aluminum Curtain Wall -With decoration panels
- Glass Balustrade -Glass Type: Laminated Glass
- Canopy Metal Fins (1/F)
- Metal Architectural Feature -Ribbon Stripe
- Metal cladding -Slope Profile
- LED Screen / Mesh
- Green Wall
- Metal Louvres

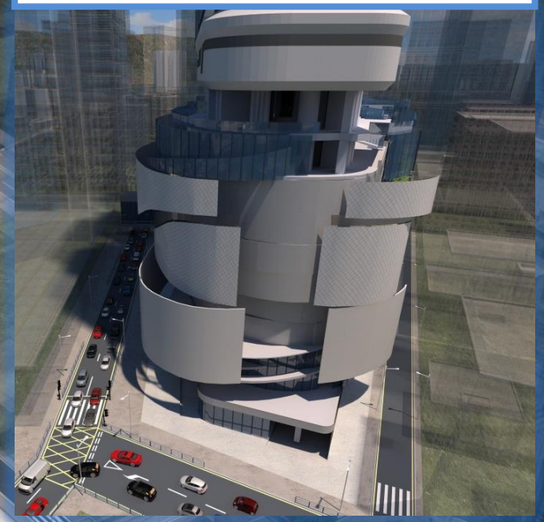
### *Partnering with NDSC*

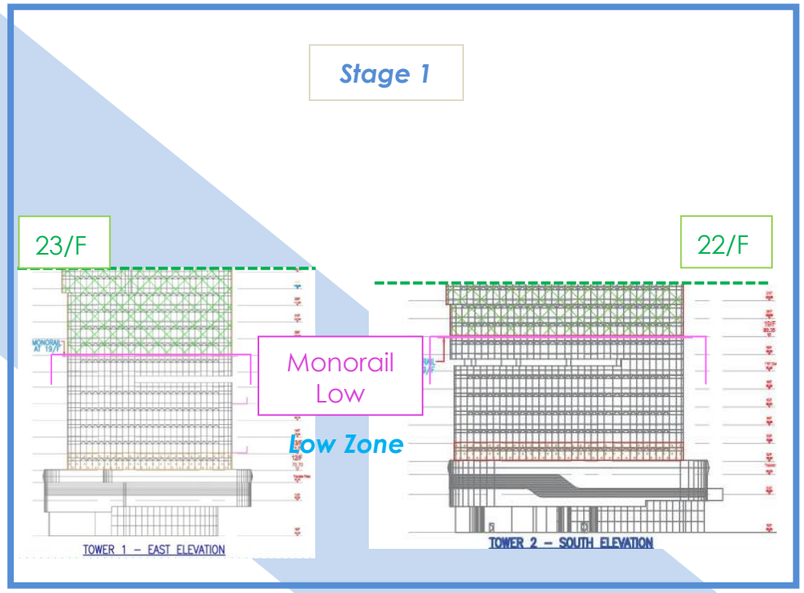
In order to install these geometrical stunning façade on to the irregular-shaped building structure, it cannot be executed in a controlled environment without the active involvement of a management team from the Main Contractor side. Yee Fai designates a façade management team to work with the Employer from procurement to completion stages.

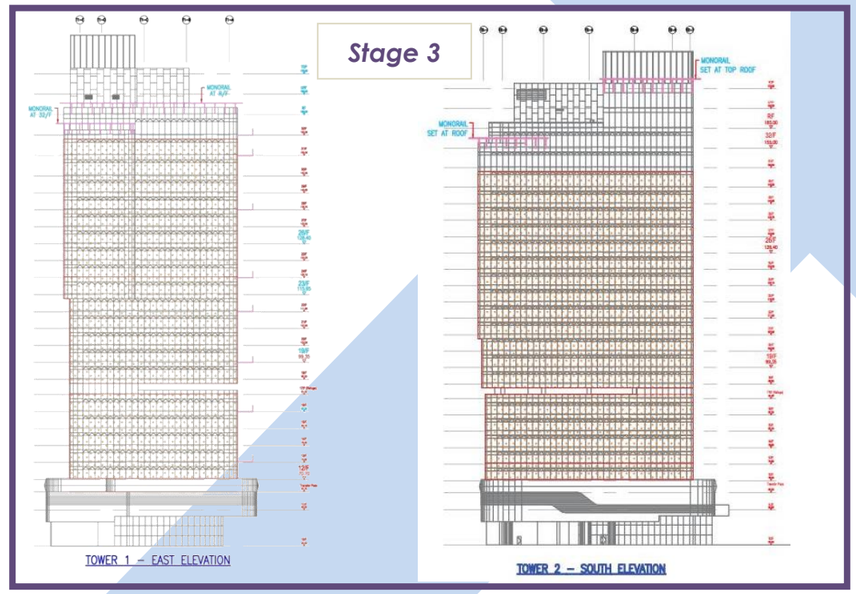
Cascading Tower Curtain Wall System



Intriguing Podium Envelop Dressed with Multi-Elements



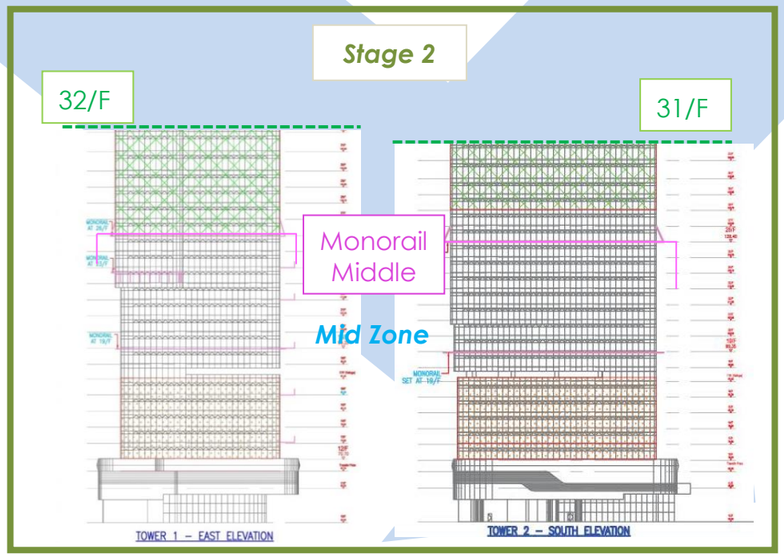


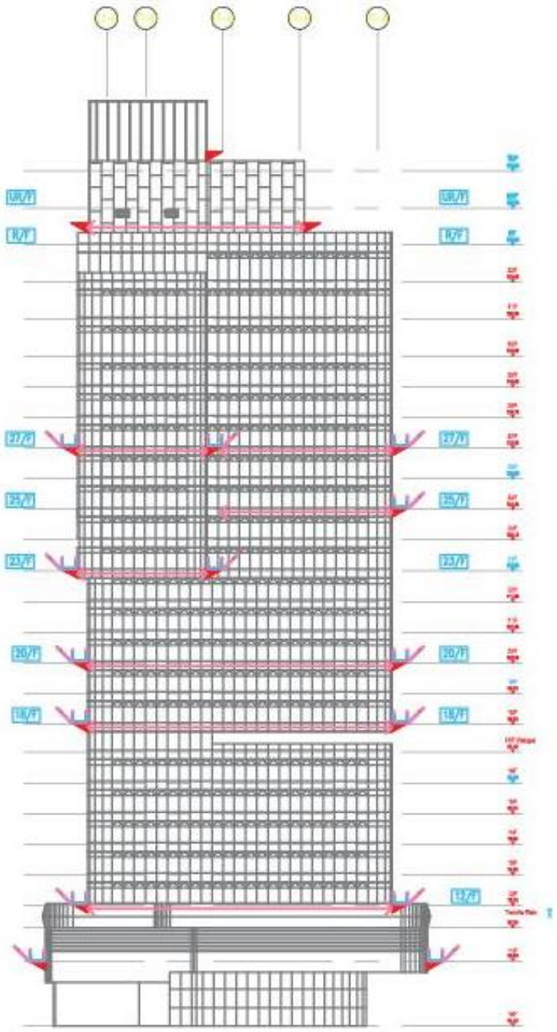

***Scaffolding Demolition and NDSC Curtain Wall Installation Interfacing Arrangement***

There are 2 nos., 22 floors office building with over 4800 pieces curtain wall panel to be encountered and installed. In general, the office tower would be divided into 3 zones (Low, Middle and High zone) to allow commencement of curtain wall panel installation during different stages of R.C. construction.

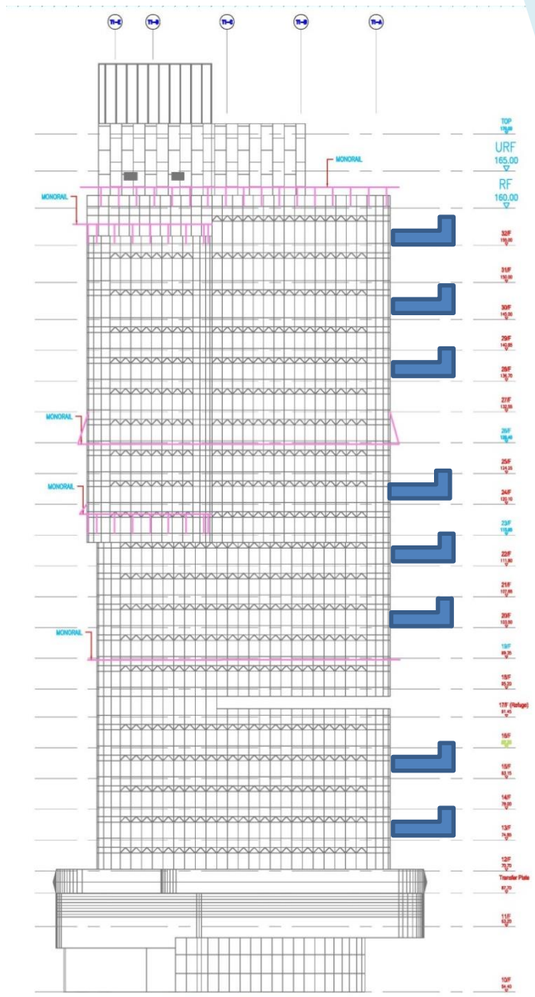
Partially scaffolding removal, catch fan erection, loading platform and temporary monorail installation would be proceeded to cater unitized panel installation.



## External Scaffolding Arrangement




## Site facilities Arrangement




| Monorail System for C.W. | | | | | | Stage |
|---|---|---|---|---|---|---|
| Layer | Floor | Type | Coverage | RC Structure Status | Remarks | |
| 1st Layer | 18/F-19/F | Beam Mounted | 12/F - 16/F | Up to 23/F | N/A | Low Zone |
| 2nd Layer | 23/F | Floor Mounted | 22/F-18/F | Up to 32/F | N/A | Mid Zone |
| 3rd Layer | 26/F - 27/F | Beam Mounted | 25/F-17/F | Up to 32/F | N/A | |
| 4th Layer | 32/F | Floor Mounted | 31/F-26/F | RC Structure Completed | N/A | High Zone |
| 5th Layer | R/F | Floor Mounted | 32/F | RC Structure Completed | N/A | |
| 6th Layer | Top Roof | Floor Mounted | TR/F-26/F | RC Structure Completed | N/A | |

*T1 Scaffolding arrangement*

*Loading Platform at each 2 Floor*

**Legend**

- Super deck (By NDSC's)
- Monorail (By NDSC's)
- Catch fan

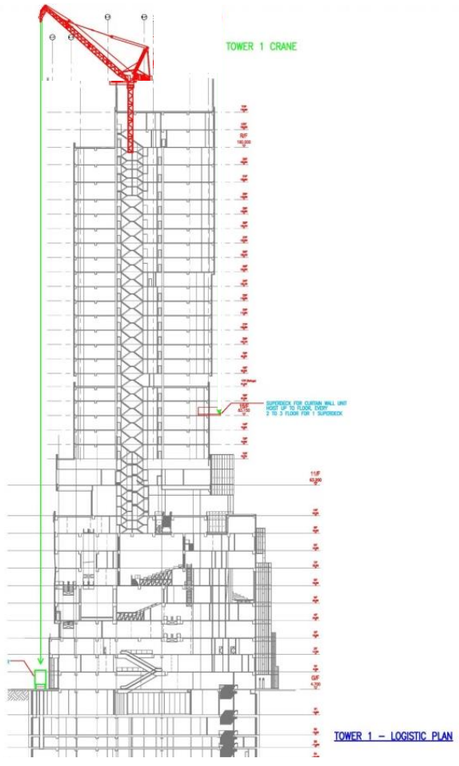
*Planning Location & Details of Monorail*
*18/F, 23/F, 26/F, 32/F R/F (By NDSC's Scope)*

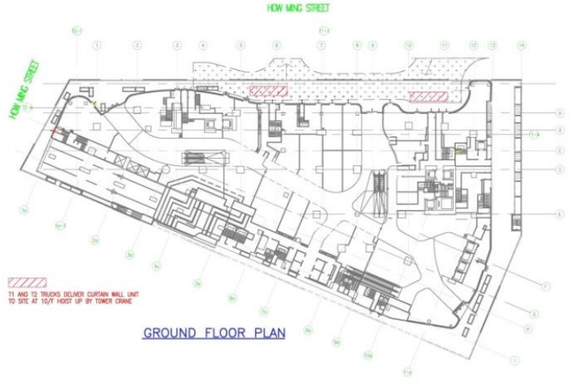
*Superdeck*

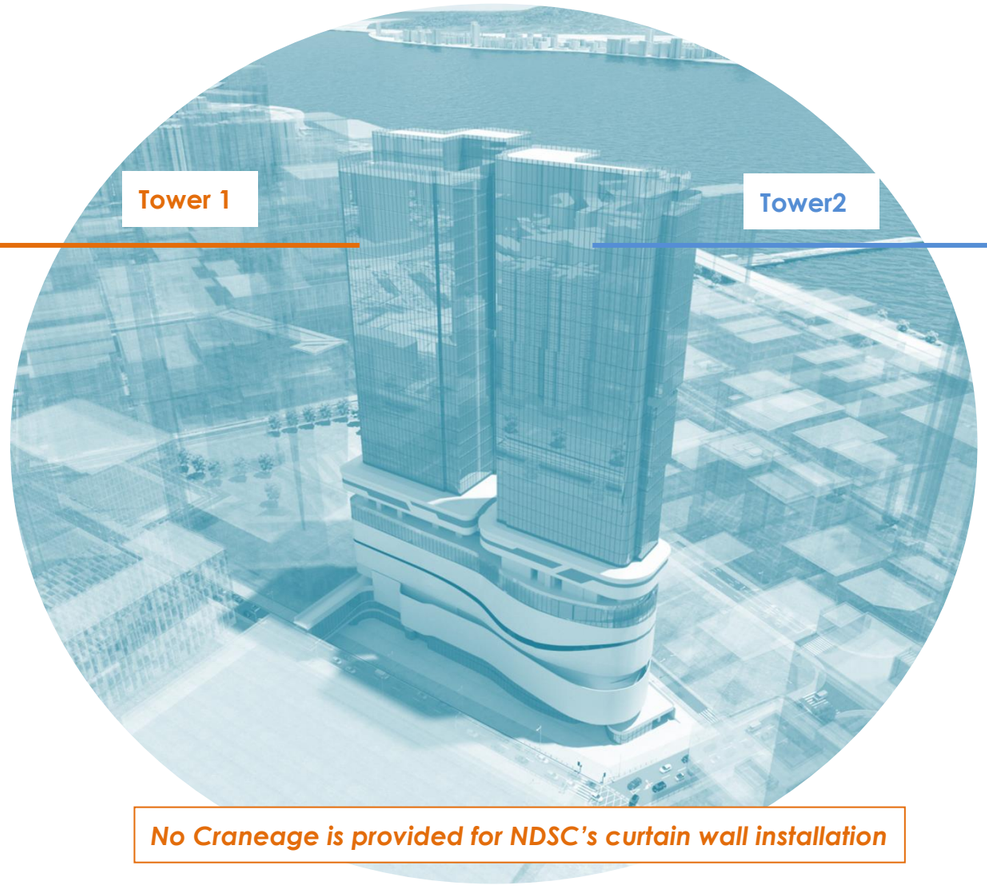
*Monorail System*

## *Logistics Arrangement for Towers*

Tower crane lifts pallets directly from truck using soft sling on to the super deck and to be distributed to designated storage at every 2 floors to suit installation sequence.

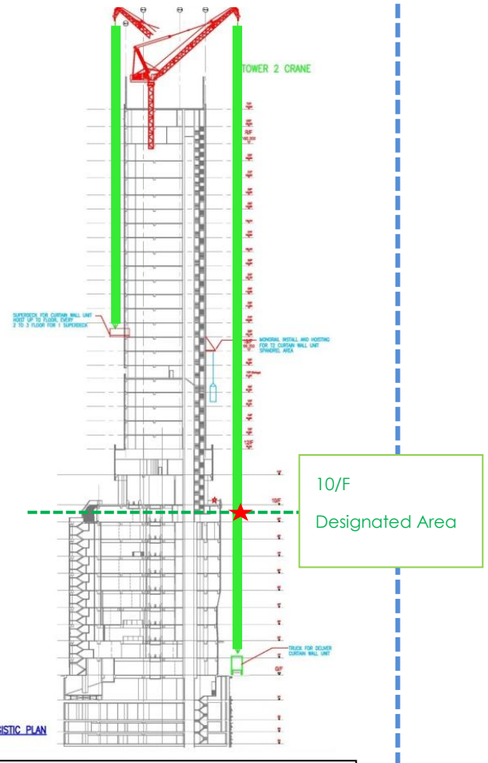


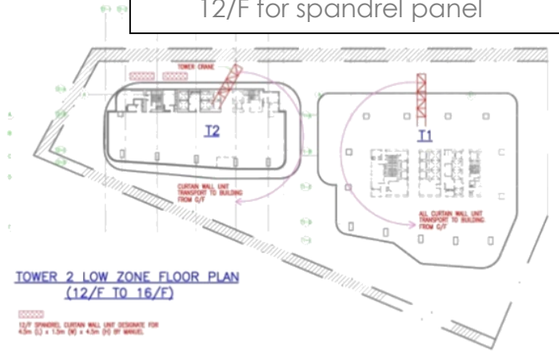

***No Craneage is provided for NDSC's curtain wall installation***

- Tower 2 has one face occupied by solid reinforced concrete walls. Extra areas to be allowed for Tower 2 façade installation




- Designated area at 10/F allow for panel temporary storage


- Allow designated area on 12/F for spandrel panel



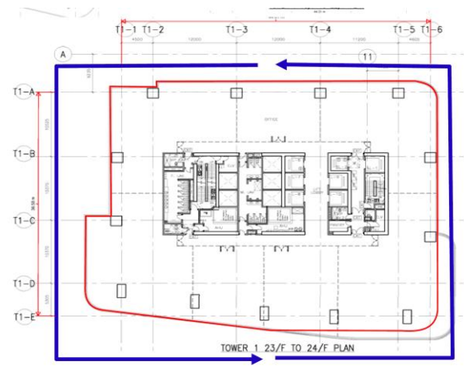
### *Tower curtain wall installation arrangement*

There are 2 nos. 21 floors office building with over 4800 pieces curtain wall panel to be encountered and installed, detailed planning on zoning, sequence and work force shall be considered to provide a smooth site progress.

In general, the office tower is scheduled into 3 zone (Low, Mid and High Zone) to allow commencement of curtain wall panel installation during different stages of RC construction. Partially scaffolding removal, catch fan erection, loading platform and temporary monorail installation would be proceeded to cater unitized panel installation.

In addition, precious planning of work force anticipated to be deployed in tower curtain wall installation, 2 gangs of work force would be planned for tower panel installation as following direction,

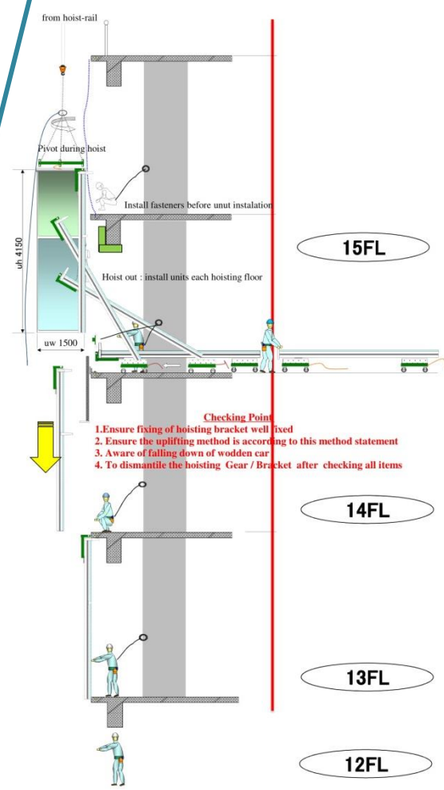
### *Two Workfronts to be adopted*



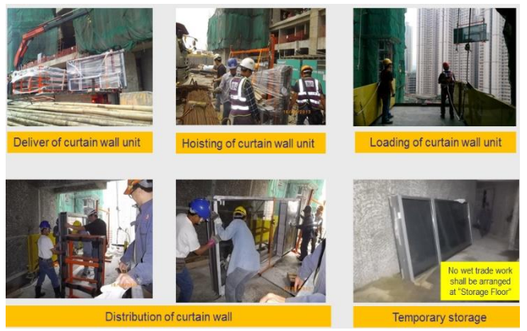

Tower 1

Tower 2

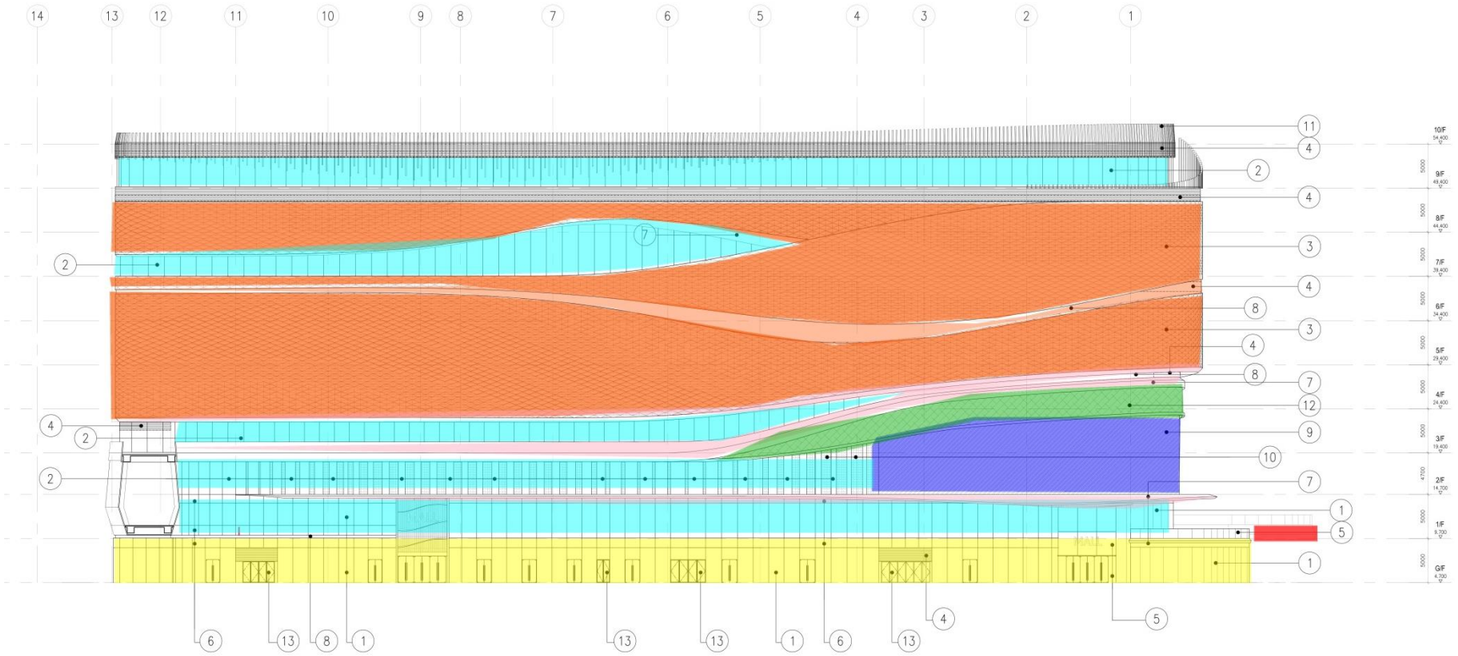
### *Monorail with temporary gondola for panel installation*



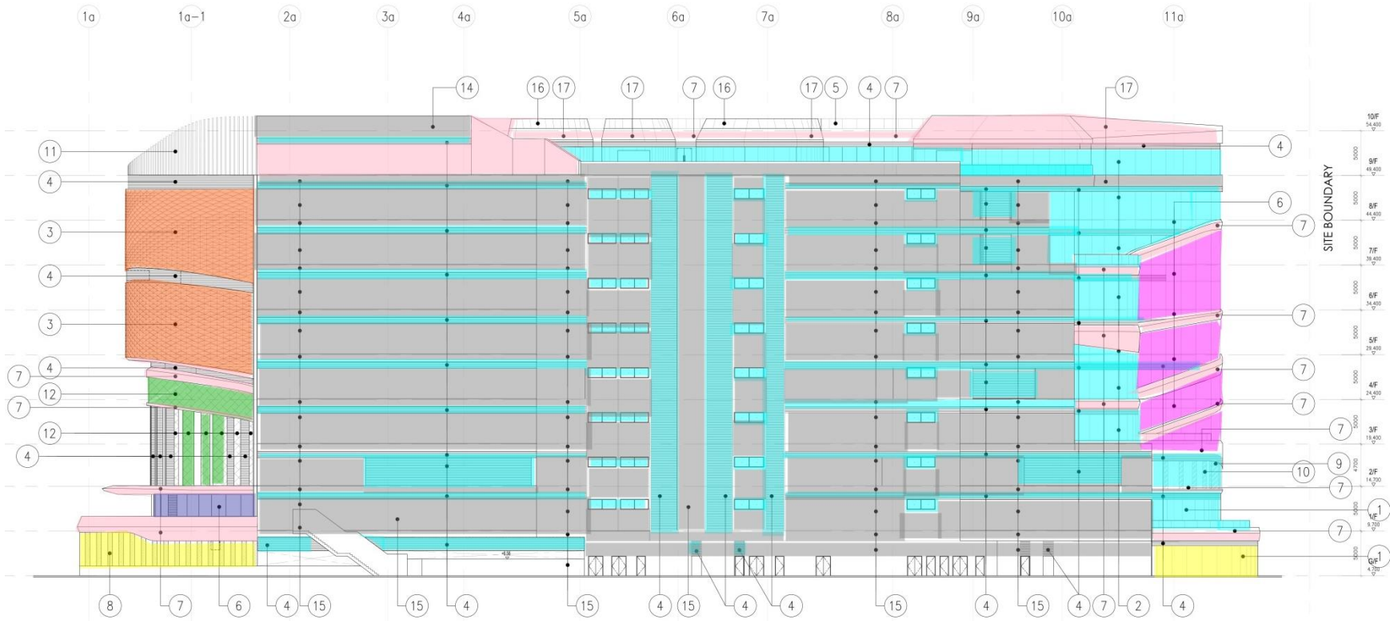




# *Early Start at Half-way Completion of Podium RC Structures*

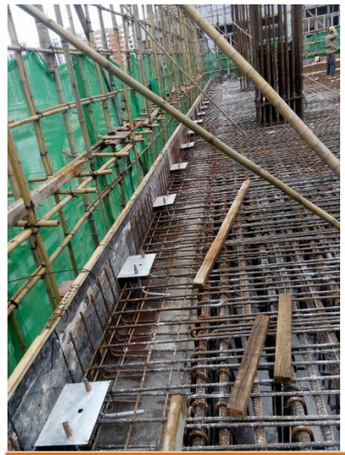


PODIUM ELEVATION - P-E1




PODIUM ELEVATION - P-E3

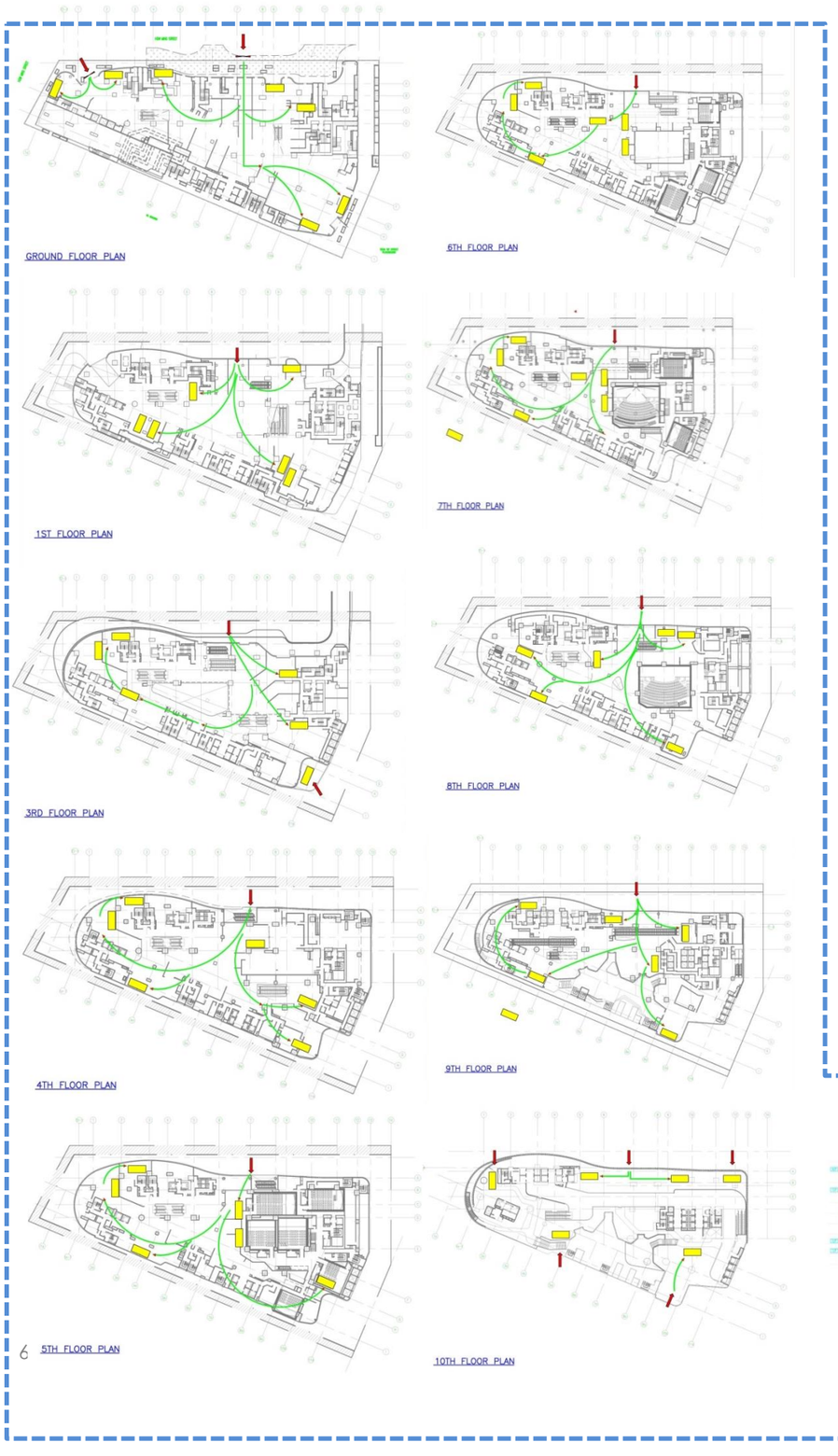
Early Start



*Casting Embedment (5/2019)*

*Installation of Sub-frame(1/2020)*

## *Logistics Arrangement for Podium*





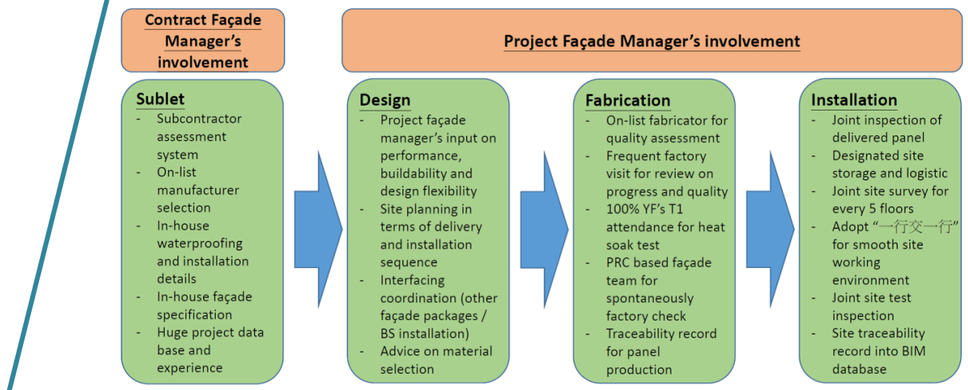
Access

- Tower crane/ mobile crane lift material directly from on to the superdeck and to be distributed to designated storage to each floor to suit installation sequence.

h

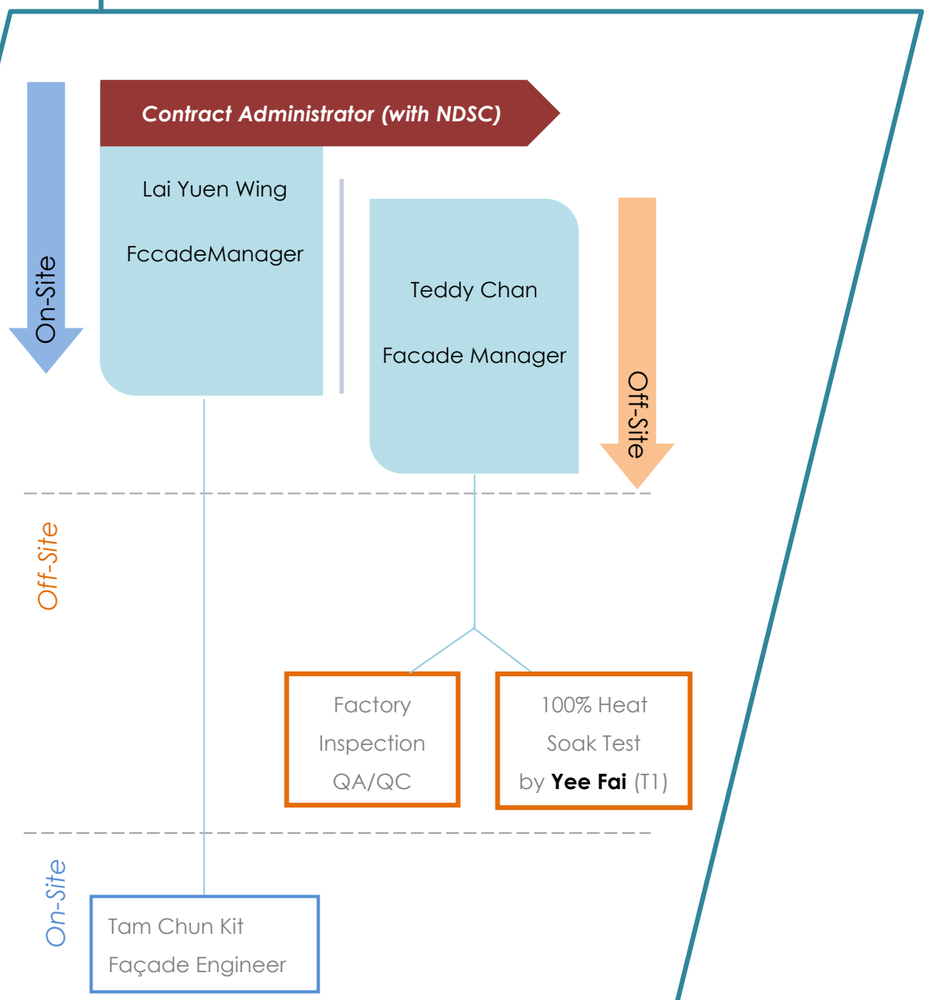
## *Façade Management Team*

### *Flow Chart of Façade Team's involvement*



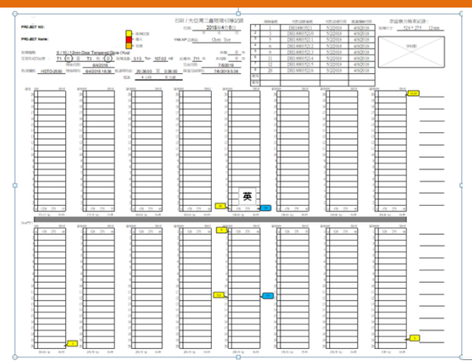

**Yee Fai** assigns two Façade Managers for both offsite & on site management.

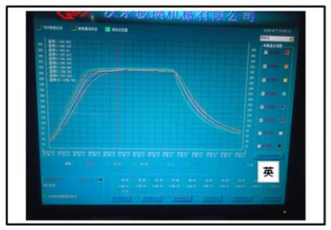
- Off site procurement and quality control for production & fabrication.
- On Site Contract Administration & site quality at different stages, aims at applying their expertise for all the risks prediction and solution to smoothen the progress.

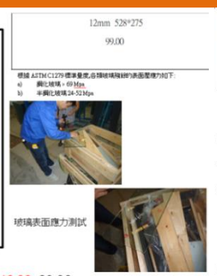



*Façade Team O-Chart*

## Quality control supervision for Heat Soak Process (100%by In-House T1)



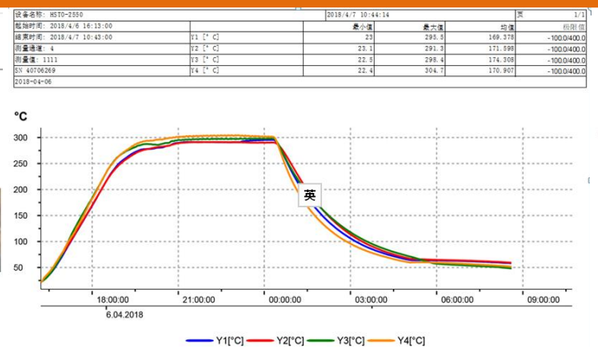


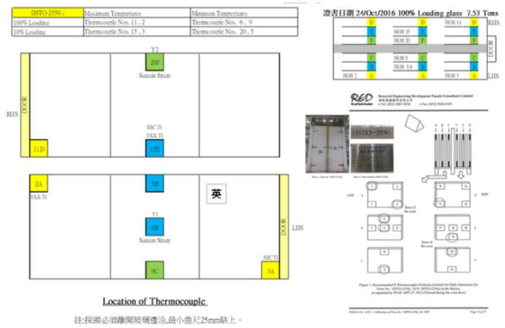


Heating period : 6/Apr/2018 16:36~20:36

Holding period (280℃ to 300℃): 6/Apr/2018 20:36~00:36

Cooling period : 7/Apr/2018 00:36~05:36



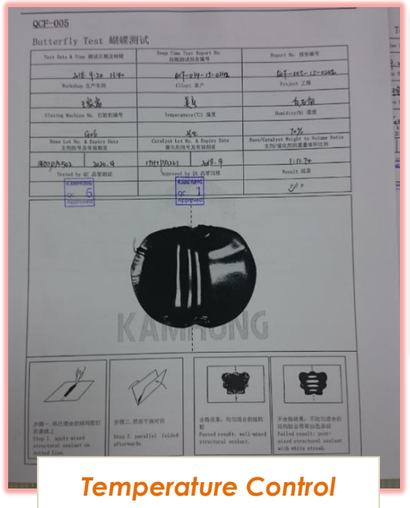

## Quality Control & Logbook System of Structural sealant

QUALITY ASSURANCE - LOGBOOK

| BATCH # | QUALITY ASSURANCE TEST | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DATE & START TIME | BASE/ CATALYST | BUTTERFLY | SNAP TIME | COLOR CHECK | ADHESION | *GLAZED UNIT LOCATION | OPERATOR SIGNATURE | COMMENTS |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

*NOTE: In the GLAZED UNIT LOCATION column, indicate the unit # and its location on the elevation drawing.

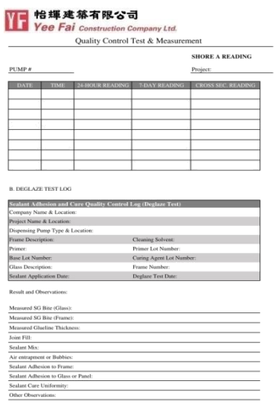
Quality Assurance – Logbook for SSG



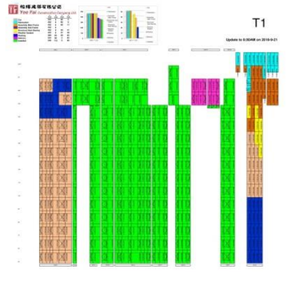

Temperature Control

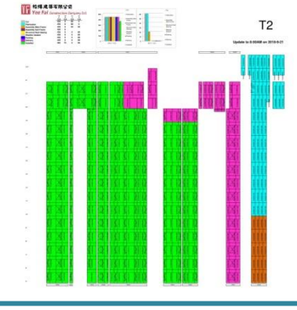

Butterfly Test

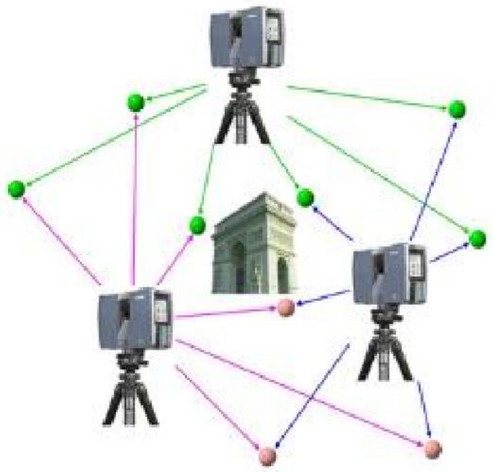
## Testing & Measurement


## SSG production Record each CW unit





**Yee Fai** deploys 3D Scan-to-BIM technology at podium level at both production and as-built checking stages.

**Production Stage:** upon the completion of RC structure of specific floors, it's as-built condition in point cloud format will be passed to NDSC for production use.

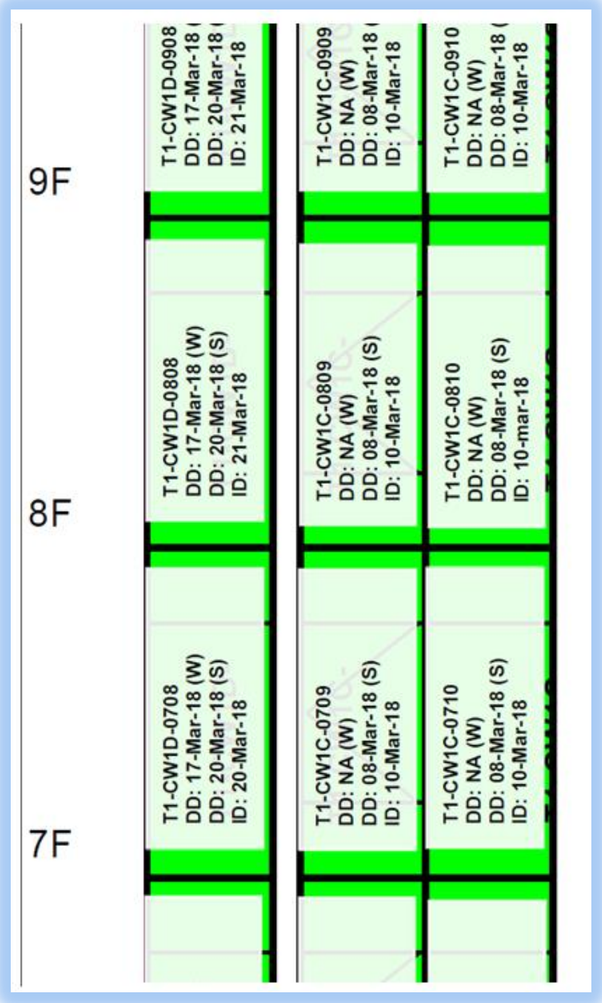
**As-built checking:** we use the same technology to check the as-built data of the completed façade, compare it with BIM model, and convert it to become the as-built record for the development

***Advantages***

- Reducing errors
- Ensuring the accuracy and efficiency of production works
- Improving installation efficiency.

## *Identity Record (Recommend)*

**Yee Fai**, makes use of previous experience to work with the NDSC to build up a comprehensive identity record to chase even the batch of structural sealant at specific glass panel as to ensure single piece of material being used with identity mark.

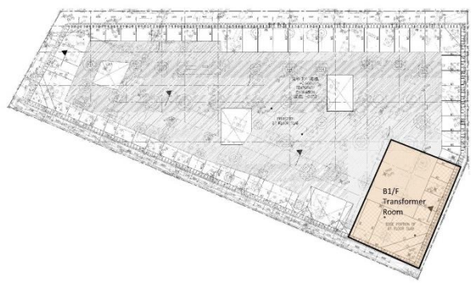



# 7. TRANSFORMER ROOM ARRANGMENT

| TX Room No. | Floor | Name of TX Room | Tower |
|---|---|---|---|
| 1 | B1/F | TX Room 1 | - |
| 2 | B1/F | TX Room 2 | - |
| 3 | 11/F | TX Room 1 | Tower 1 |
| 4 | 11/F | TX Room 2 | Tower 1 |
| 5 | 11/F | TX Room 3 | Tower 1 |
| 6 | 11/F | TX Room 4 | Tower 2 |

Total 7 nos. of Transformer Room will be constructed in KTIL240, the summary as below:

ransporting the transformer to 11/F transformer room, one lift will be installed at Tower 1 to carry the transformer from B1/F. An open bridge will also be constructed between Tower 1 and Tower 2 at 11/F to carry the transformer. Essential power shall be supplied for transformer lift in case of normal power supply failure.




### *Early Completion of B1/F Transformer Room*

Excavation sequence is tailored made to allow early completion of B1/F transformer room in 17 months after site possession. Early energization of permanent power saves the use of diesel generators. More stable power supply and better air quality, particularly in a top-down environment, will be ensured. This is beneficial to the remaining construction period and the T&C of relevant system.

Alternative excavation sequence:

1. B1/F to be constructed
2. Struts are positioned to coincide with B1/F.
3. On completion of strut preloading, the B1/F floor structures at the transformer room area shall be casted.
4. Inclined struts locate at high zone of the transformer room area will be removed and the transformer room area is ready for finishing and installation works.

# 8. M&E INSTALLATION

## 8.1. DfMA (DESIGN FOR MANUFACTURE AND ASSEMBLY)


In order to provide an effective construction technique in terms of quality, time, cost, productivity and safety, DfMA and modular construction will be promoted for M&E installation:

### Advantage

#### *Safety*

- ✧ Minimize hot work on site
- ✧ Controllable high level works
- ✧ Better house keeping

#### *Quality Control*

- ✧ Controllable Work Sequence
- ✧ Test at Factory prior to Delivery
- ✧ Standardized workmanship
- ✧ Proprietary Product Standard
- ✧ Early coordination in congested space
- ✧ Higher quality and sustainability
- ✧ Increased reliability

#### *Time and Cost Control*

- ✧ Reduce manufacturing and assembly cost
- ✧ Short assembly time on-site
- ✧ Off-site fabrication parallel with builder's work
- ✧ Tackle with the shortage of welders and specific nature of workers in market

## 8.2. M&E PACKAGING CONTRACT

**Yee Fai** provides "One-Stop" solution on M&E Installation. M&E packaging contract will be arranged, if necessary.

### *Advantage*

- ✧ Sharing of site resources such as plant materials and labours
- ✧ Better coordination for site construction
- ✧ Less project management input from Employer
- ✧ Benefits of Contractors' expertise on buildable modularization
- ✧ Fully professional team

# 9. PROTECTION METHOD TO COMPLETED FINISHING WORK

To ensure the quality of KTIL240 is delivered, it is essential that the completed finishing works receive proper protection after installation. Sufficient protection should be implemented to prevent any damage from the time of installation until project completion with pursuant to the Preliminaries Clause 4.29, "The Contractor shall make provision for protecting all work and materials from damage, weather, carelessness, negligence, etc. and shall provide all casings or coverings for the protection of any work or material as necessary.

Even with the protective measures in place, vigilance is still required to prevent damage to the finished works. The works will be carefully planned and sequenced with stringent supervision of the sub-contractors, to manage both progress and quality of the finishing trades.

The project team will develop a detailed fitting out programme and procurement programme in coordination with parties involved. Material delivery and site installation works will be monitored against the approved programmes, and any slippage will be immediately identified and suitable measures to catch up the delay implemented.

As the installation of the finishing works proceeds, the installation of protection will follow. The area of finishes that need to be protected will be identified. Where possible areas will be secured and any unauthorized access will be prohibited. Traffic over the finished floor installation will be restricted.

No protective coverings will be laid or applied which will in any way inhibit the later fixing of floor / wall finishes. Regular cleaning will be carried out as required to prevent dirt, grit or other contaminants from becoming ingrained into the finished surface.

Where finishing works are undertaken by Nominated Sub-Contractors, the site supervisory staff will ensure that the nominated contractors still provide as a minimum the protective measures as highlighted.

Protection work will be carried out for the following completed finished work.

| ***Finishing Works*** | ***Protection Method*** |
|---|---|
| *Sanitary Fittings* | *Wrap sanitary fittings in protective crating with carton cardboard and/or protective plastic tape.* |
| *Doorsets and Ironmongery:* | *Cover the doorset surfaces with polythene sheeting, and wrap hinges, door closers and locksets by using foam rubber and/or protective plastic tape.* |
| *Wooden and marble works* | *Cover the surfaces with polythene sheeting and/or protective plastic tape.* |
| *Tiling* | *To cover corner tiles by softwood strip/ polythene sheeting/ bump strips as necessary* |
| *Glass Cladding / Balustrade* | *Retain plastic covers to protect faces from scratching. Place bubble wrap and plywood protection to low level areas susceptible to damage.* |
| *Curtain wall Glass Wall and aluminium works* | *Retain plastic covers to protect glazing faces from scratching.* *Retain plastic covers and place bubble wrap and plywood protection to low-level panels in locations susceptible to damage* |