ION Orchard – Engineering Challenges





Penta-Ocean Construction Co Ltd

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1. Project Brief and Scope of Works



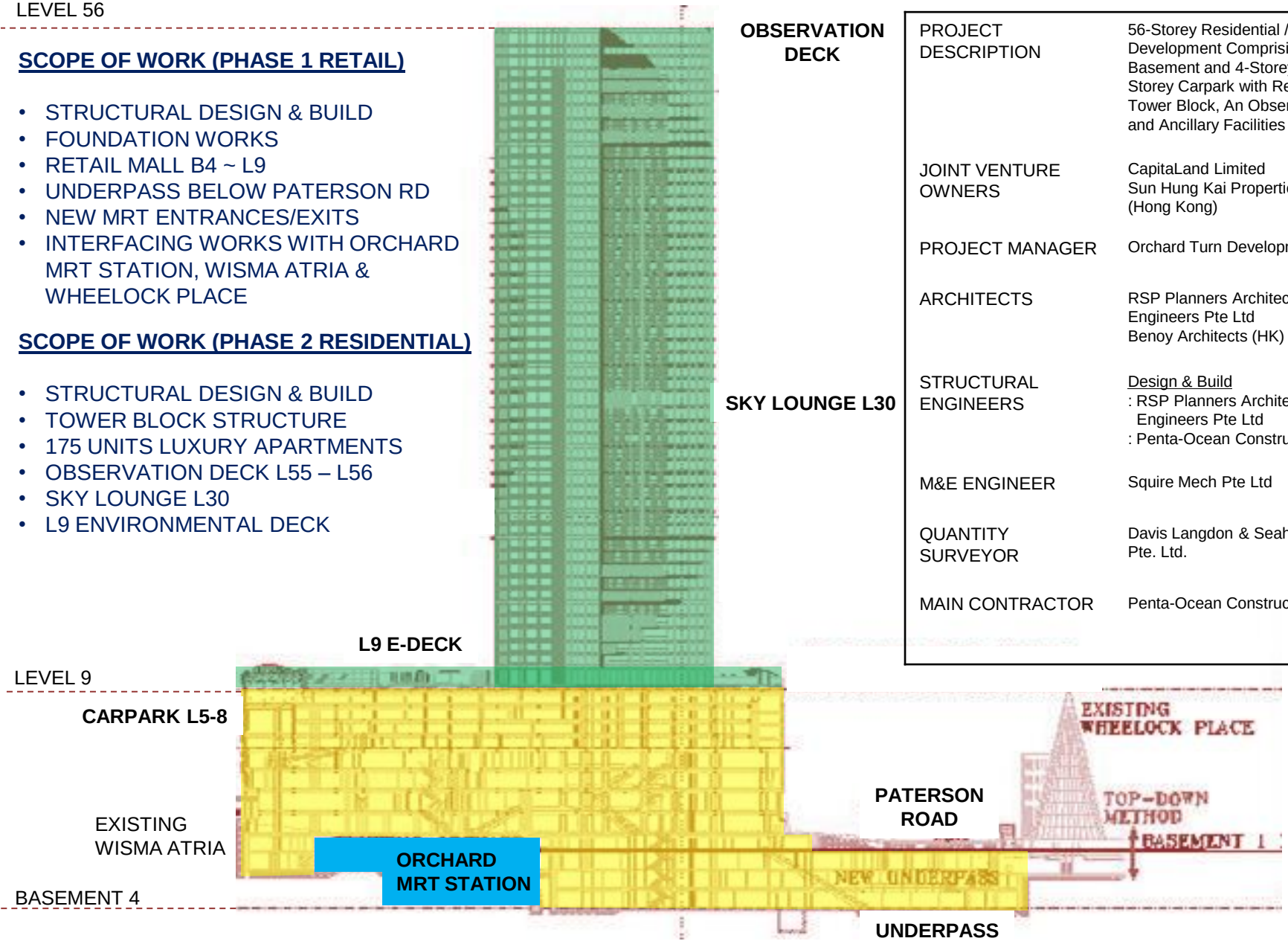
1. Project Brief and Scope of Works

SCOPE OF WORK (PHASE 1 RETAIL)

- STRUCTURAL DESIGN & BUILD
- FOUNDATION WORKS
- RETAIL MALL B4 ~ L9
- UNDERPASS BELOW PATERSON RD
- NEW MRT ENTRANCES/EXITS
- INTERFACING WORKS WITH ORCHARD MRT STATION, WISMA ATRIA & WHEELOCK PLACE

SCOPE OF WORK (PHASE 2 RESIDENTIAL)

- STRUCTURAL DESIGN & BUILD
- TOWER BLOCK STRUCTURE
- 175 UNITS LUXURY APARTMENTS
- OBSERVATION DECK L55 – L56
- SKY LOUNGE L30
- L9 ENVIRONMENTAL DECK

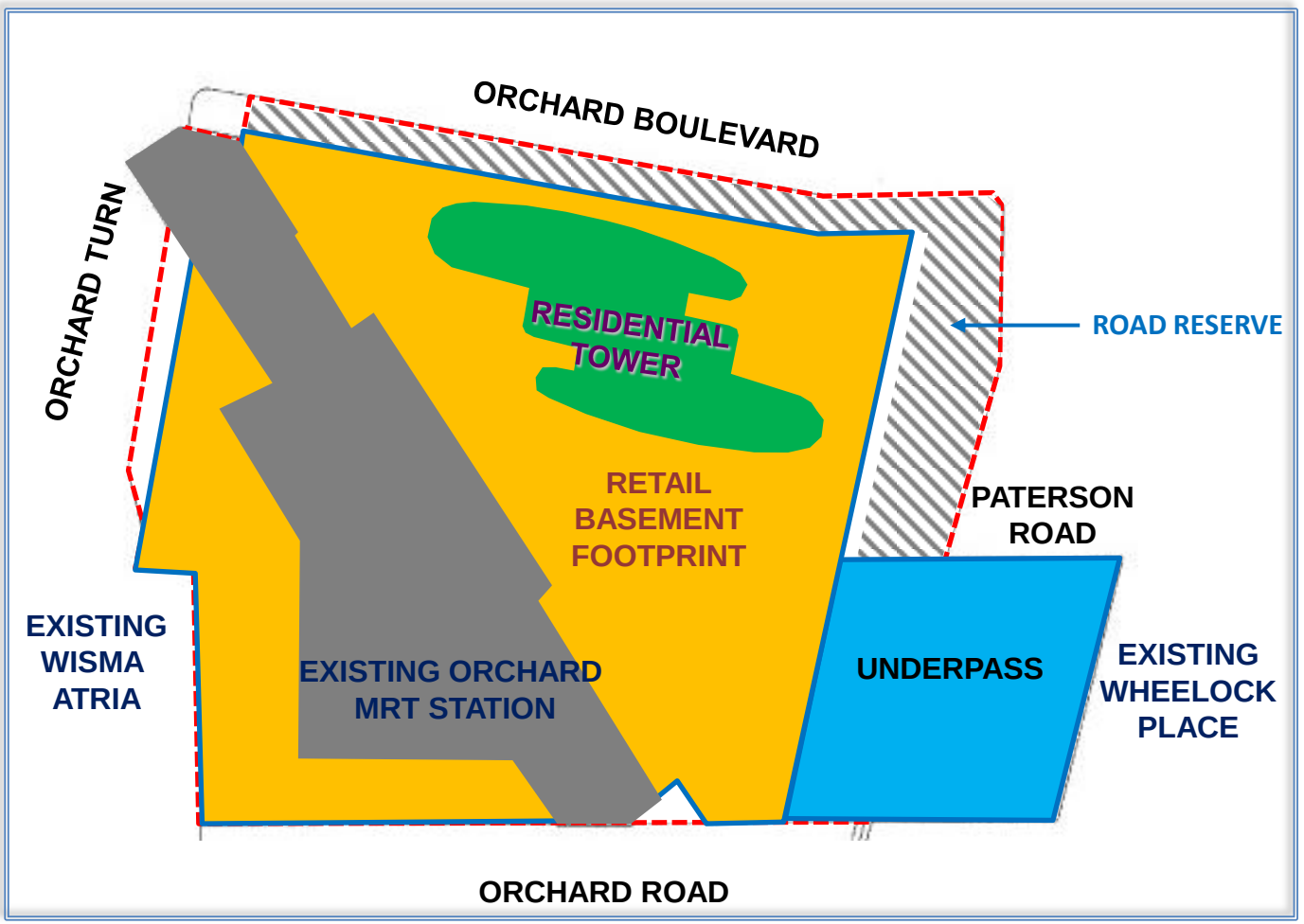


PROJECT DESCRIPTION	56-Storey Residential / Commercial Development Comprising 4-Basement and 4-Storey Retail, 4-Storey Carpark with Residential Tower Block, An Observation Deck and Ancillary Facilities
JOINT VENTURE OWNERS	CapitaLand Limited Sun Hung Kai Properties Limited (Hong Kong)
PROJECT MANAGER	Orchard Turn Developments Pte Ltd
ARCHITECTS	RSP Planners Architects and Engineers Pte Ltd Benoy Architects (HK)
STRUCTURAL ENGINEERS	Design & Build : RSP Planners Architects and Engineers Pte Ltd : Penta-Ocean Construction Co Ltd
M&E ENGINEER	Squire Mech Pte Ltd
QUANTITY SURVEYOR	Davis Langdon & Seah Singapore Pte. Ltd.
MAIN CONTRACTOR	Penta-Ocean Construction Co., Ltd.

2. Site Complexities and Challenges

CONSTRAINTS :

- ❖ SITE BOUNDED BY MAJOR ROADS
- ❖ CONSTRUCTION IS TO THE LIMIT OF PROJECT BOUNDARY
- ❖ BUILDING ABOVE & BESIDE EXISTING LIVE MRT STATION
- ❖ CONSTRUCT UNDERPASS BELOW EXISTING PATERSON ROAD
- ❖ HIGH RISE CONSTRUCTION (56 Storeys, 218m)



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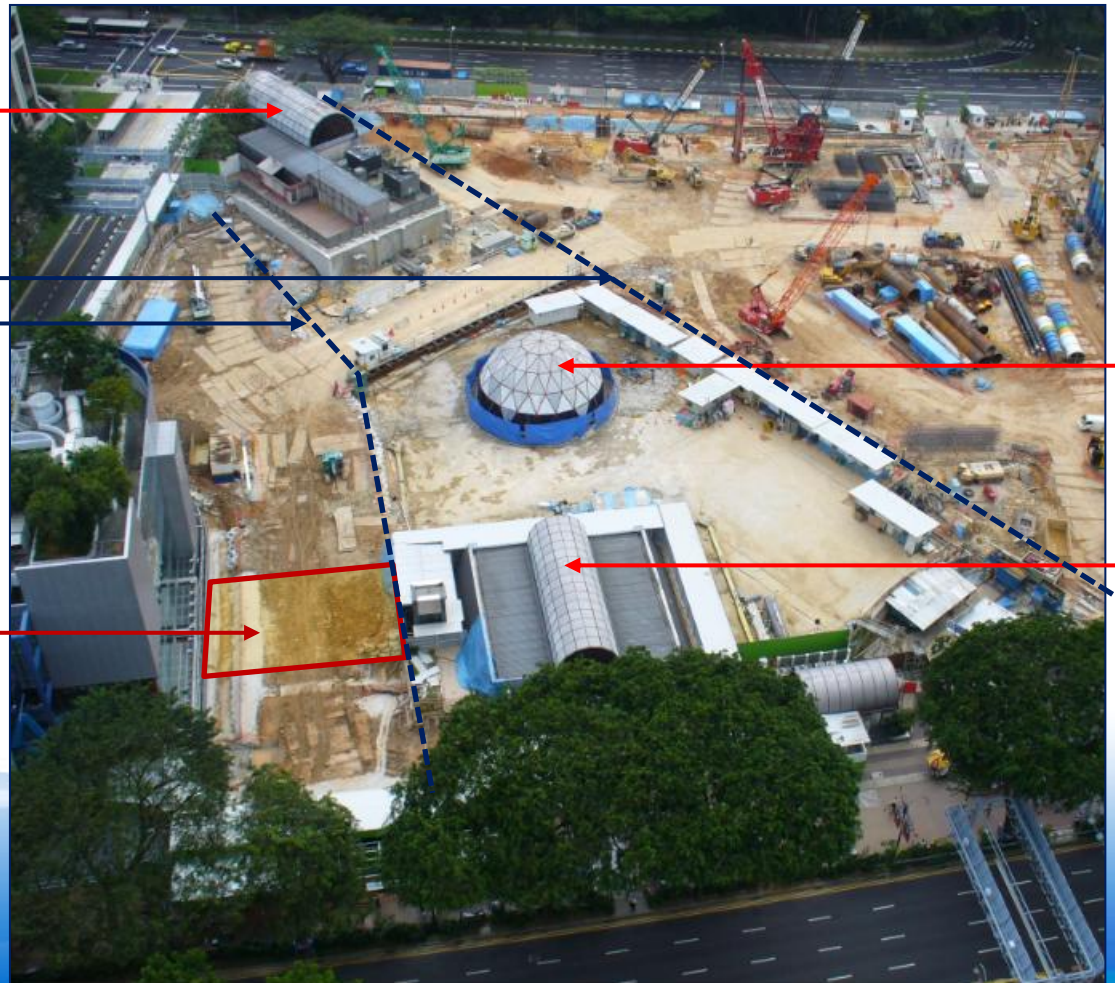
2. Site Complexities and Challenges

- EXISTING STRUCTURES ABOVE MRT
- LOADING CONSTRAINTS ON MRT
- MINIMAL MOVEMENT / DISRUPTION TO MRT
- REMOVAL OF EXISTING SUBWAY CONNECTING WISMA ATRIA & MRT STATION @ B2



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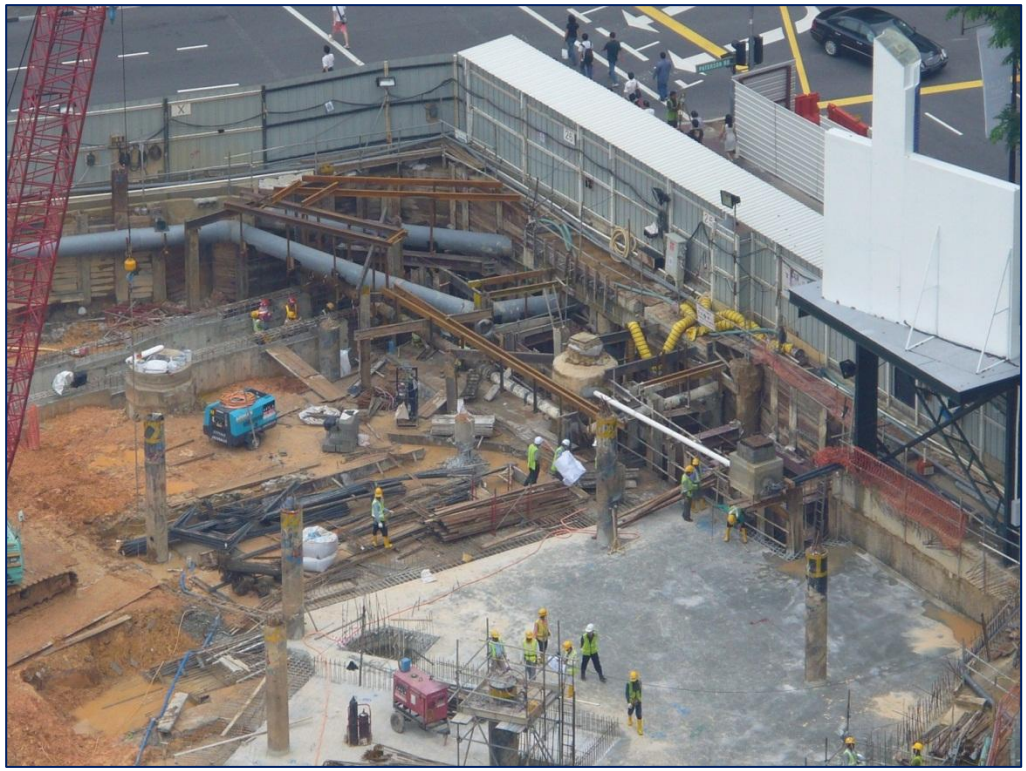
2. Site Complexities and Challenges

- EXISTING SERVICES (LIVE HIGH VOLTAGE CABLES, WATER PIPES, SEWER ETC.)
- EXISTING MRT SOIL NAILS





2. Site Complexities and Challenges

- **PUBLIC & WORKERS' SAFETY FROM FALLING OBJECTS & FALLING FROM HEIGHT**





2. Site Complexities and Challenges

OTHER CONSTRAINTS :

- DIFFICULT SOIL CONDITIONS – VARYING SOIL STRATA
- UNDULATING TERRAIN – 8m DIFFERENCE
- PRESENCE OF BOULDERS
- PRESENCE OF MARINE CLAY
- HIGH WATER TABLE
- MAINTAINING TRAFFIC LANES / MINIMISING TRAFFIC INCONVENIENCES ALONG PATERSON ROAD DURING UNDERPASS CONSTRUCTION



2. Site Complexities and Challenges

CONSTRAINTS / CHALLENGES :

TIME IMPACT

BASEMENT / PODIUM CONSTRUCTION

POSSIBLE IMPACT

RESIDENTIAL TOWER CONSTRUCTION

CONSIDERATIONS

CONSIDERATIONS

3. Design & Construction Strategies

KEY CONSIDERATIONS :

- TOP PRIORITY : SAFETY OF THE PUBLIC AND SITE PERSONNEL
- ADDRESSING ALL SITE COMPLEXITIES MENTIONED ABOVE
- STRENGTH AND ROBUSTNESS OF STRUCTURAL SYSTEM
- ACCESS MANAGEMENT
- MINIMAL INCONVENIENCE TO THE PUBLIC & NEIGHBOURS
- IMPROVE PRODUCTIVITY
- CONCURRENT CONSTRUCTION
- SUSTAINABLE CONSTRUCTION

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3. Design & Construction Strategies

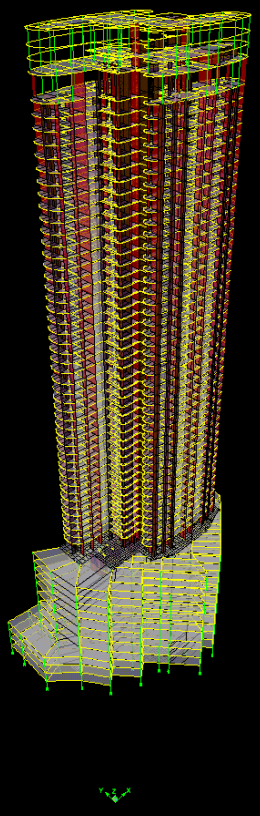
STRATEGIES :

- TOP-DOWN CONSTRUCTION FOR RETAIL AREA
- FOUNDATION : BARRETTE PILES AND BORED PILES WITH PLUNGED-IN COLUMNS
- BASEMENT PERIMETER DIAPHRAGM WALL : 800mm ~ 1000mm THICK
- SHIELD WALL TO PREVENT MRT STATION MOVEMENT
- MEGA STEEL TRUSSES SPANNING ACROSS THE MRT STRUCTURE
- STEEL STRUCTURE AND COMPOSITE METAL DECKING SYSTEM FOR PODIUM
- TOP-DOWN CONSTRUCTION FOR PATERSON RD UNDERPASS
- PRECAST ELEMENTS FOR TOWER BLOCK
- HIGH RISE TOWER SAFETY PROVISIONS
- BUILDING ENVELOPE (FACADE)



3. Design & Construction Strategies

DYNAMIC STRUCTURE ANALYSIS



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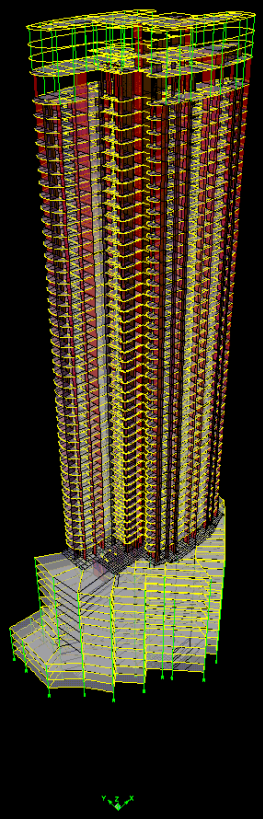

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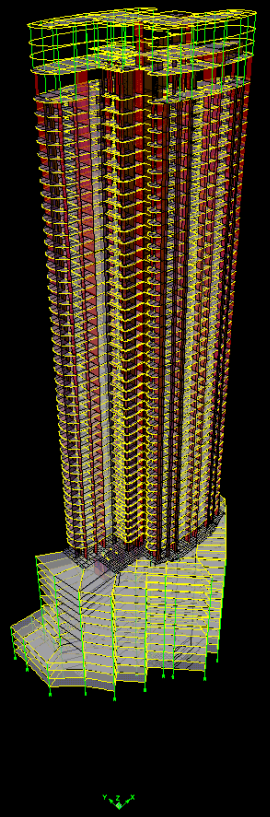
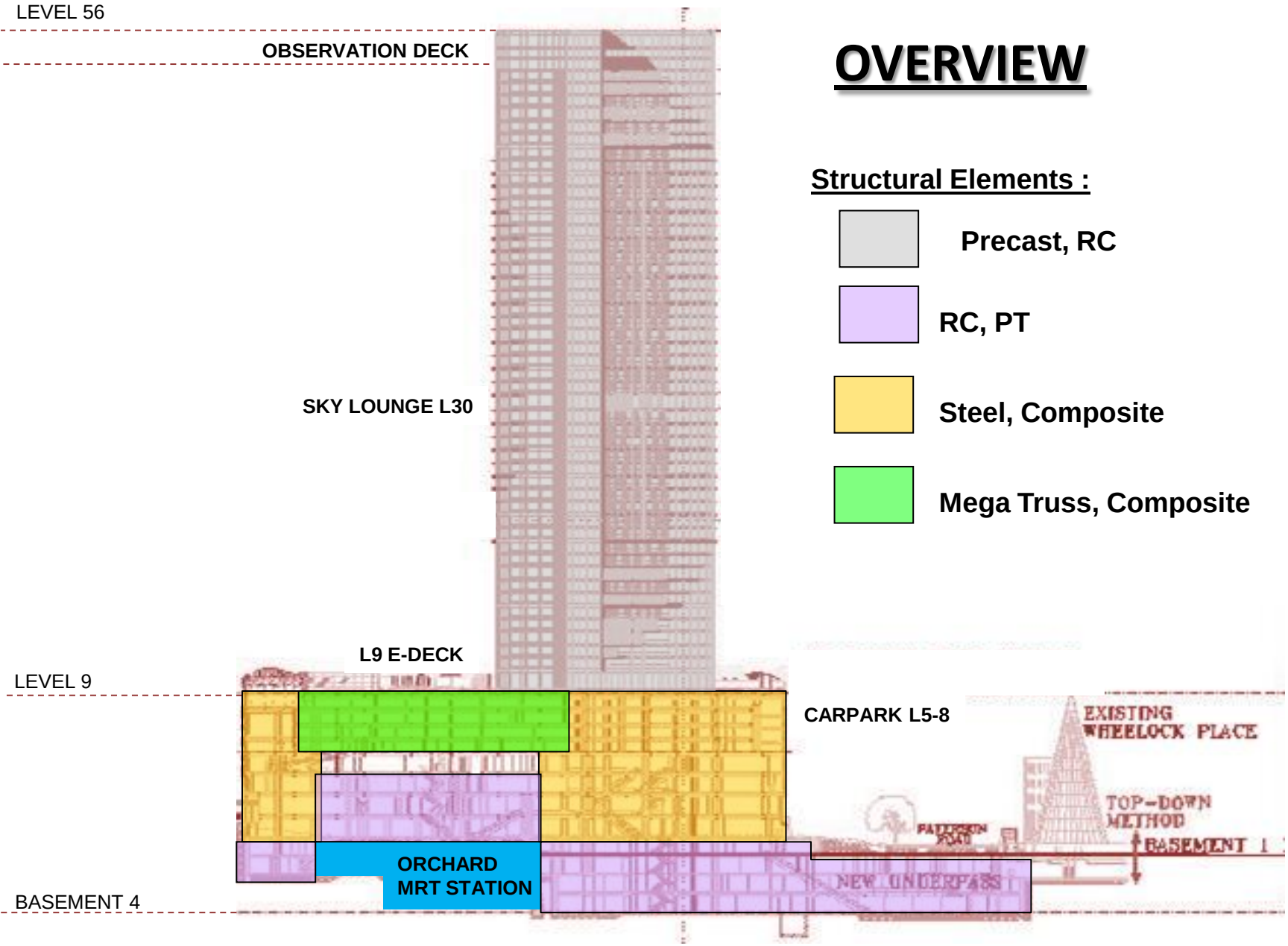


Mode 3

3. Design & Construction Strategies



OVERVIEW

Structural Elements :

- Precast, RC
- RC, PT
- Steel, Composite
- Mega Truss, Composite

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3. Design & Construction Strategies

A. TOP DOWN CONSTRUCTION SEQUENCE



A. Top Down Construction Sequence

TOP-DOWN CONSTRUCTION SEQUENCE

Why Top Down?

- Stability to MRT Box Structure
- Concurrent Construction of Retail Superstructure/Basement



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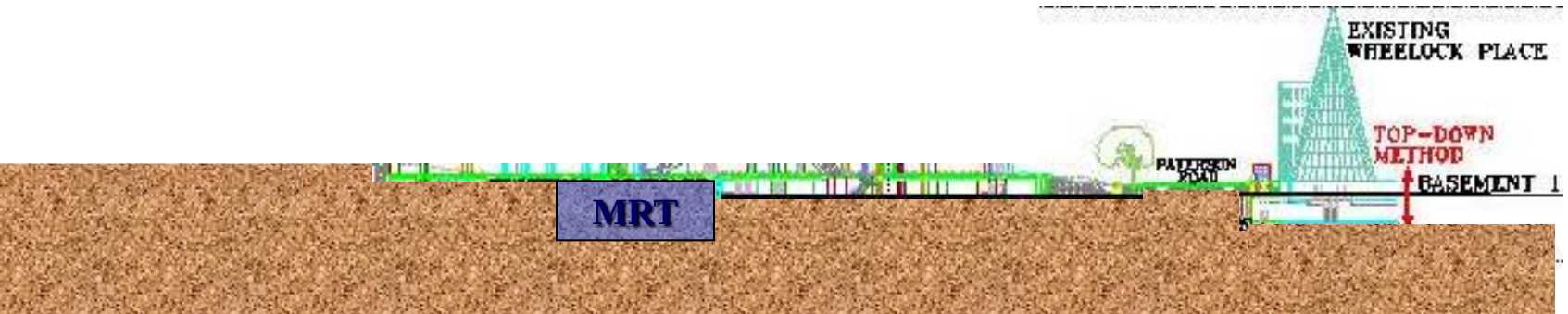
A. Top Down Construction Sequence

TOP-DOWN CONSTRUCTION SEQUENCE



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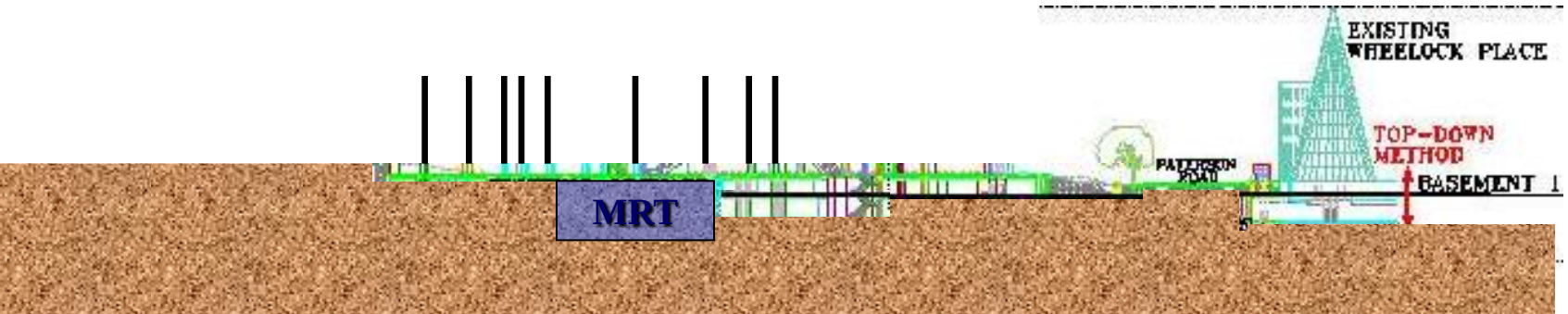

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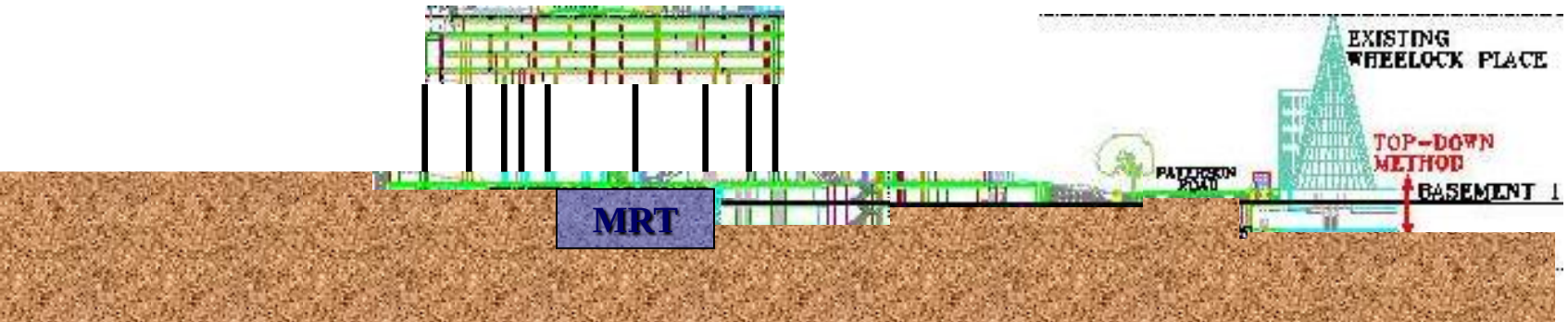

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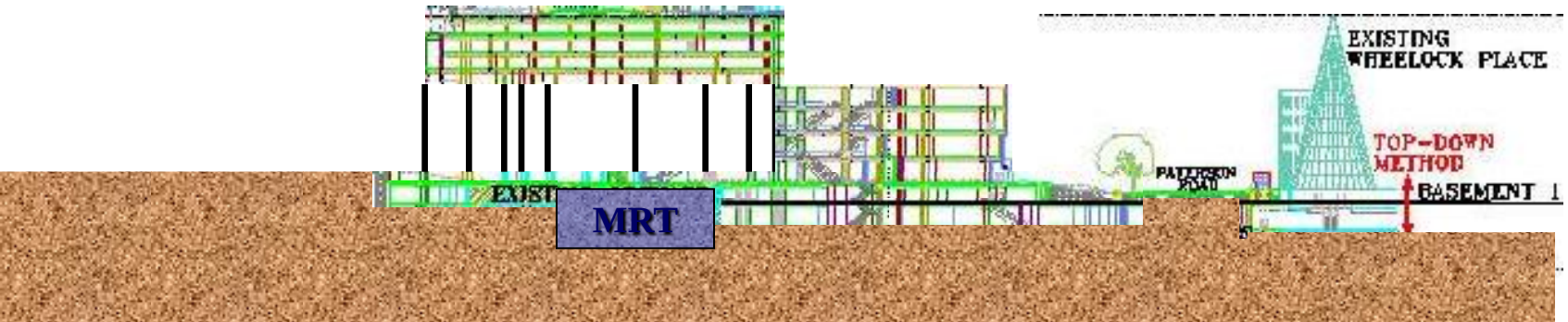

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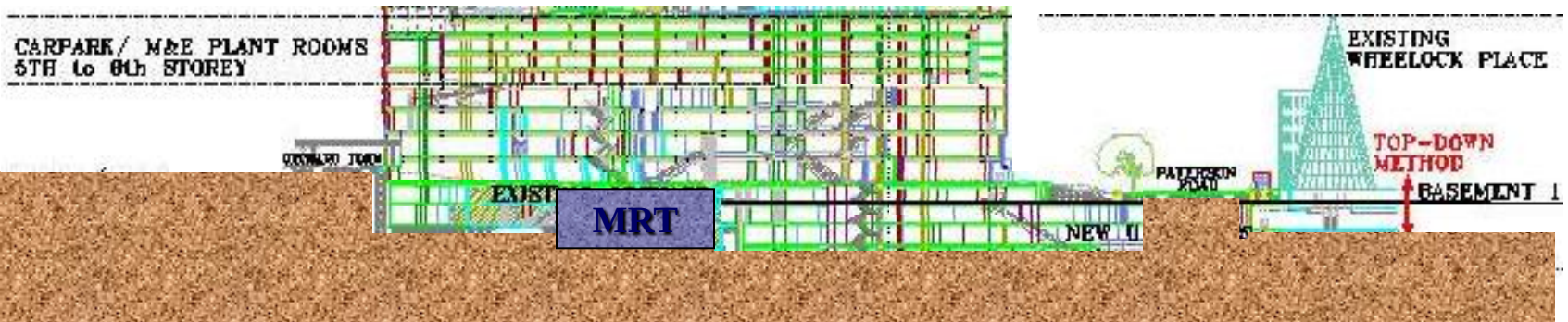

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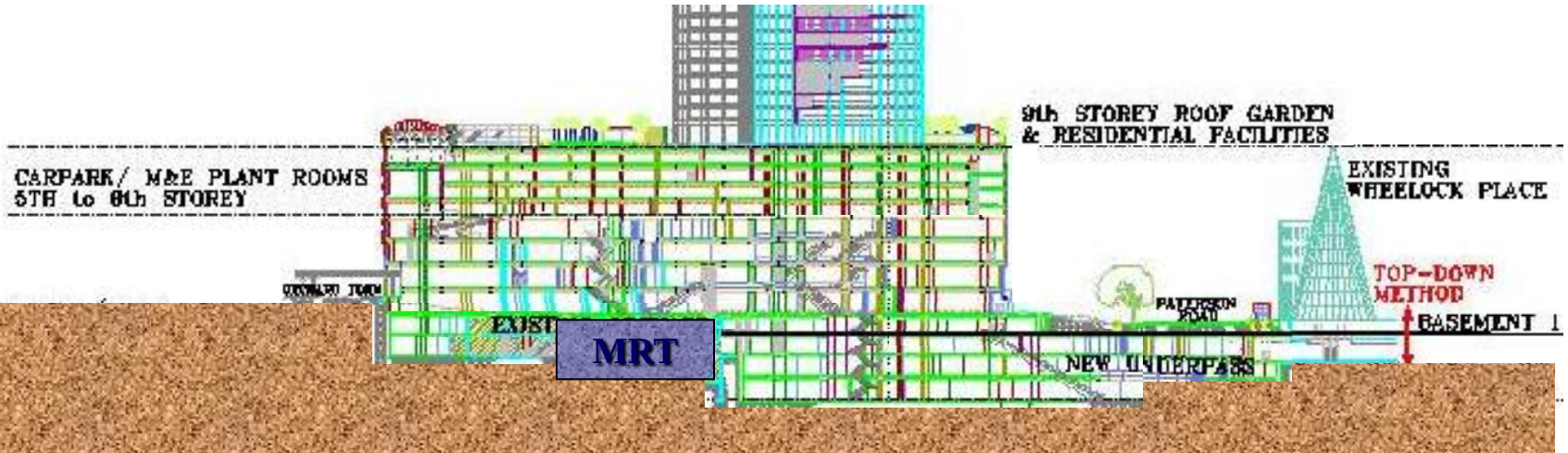

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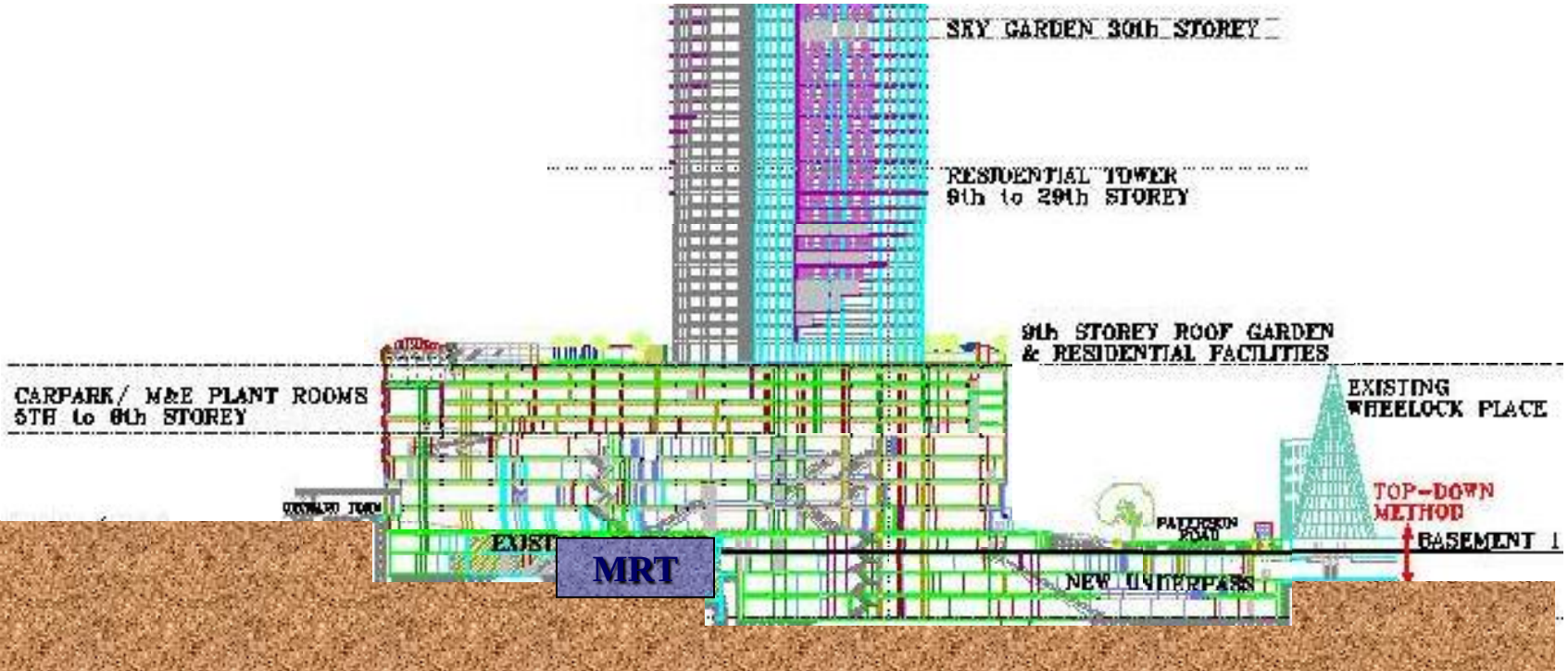

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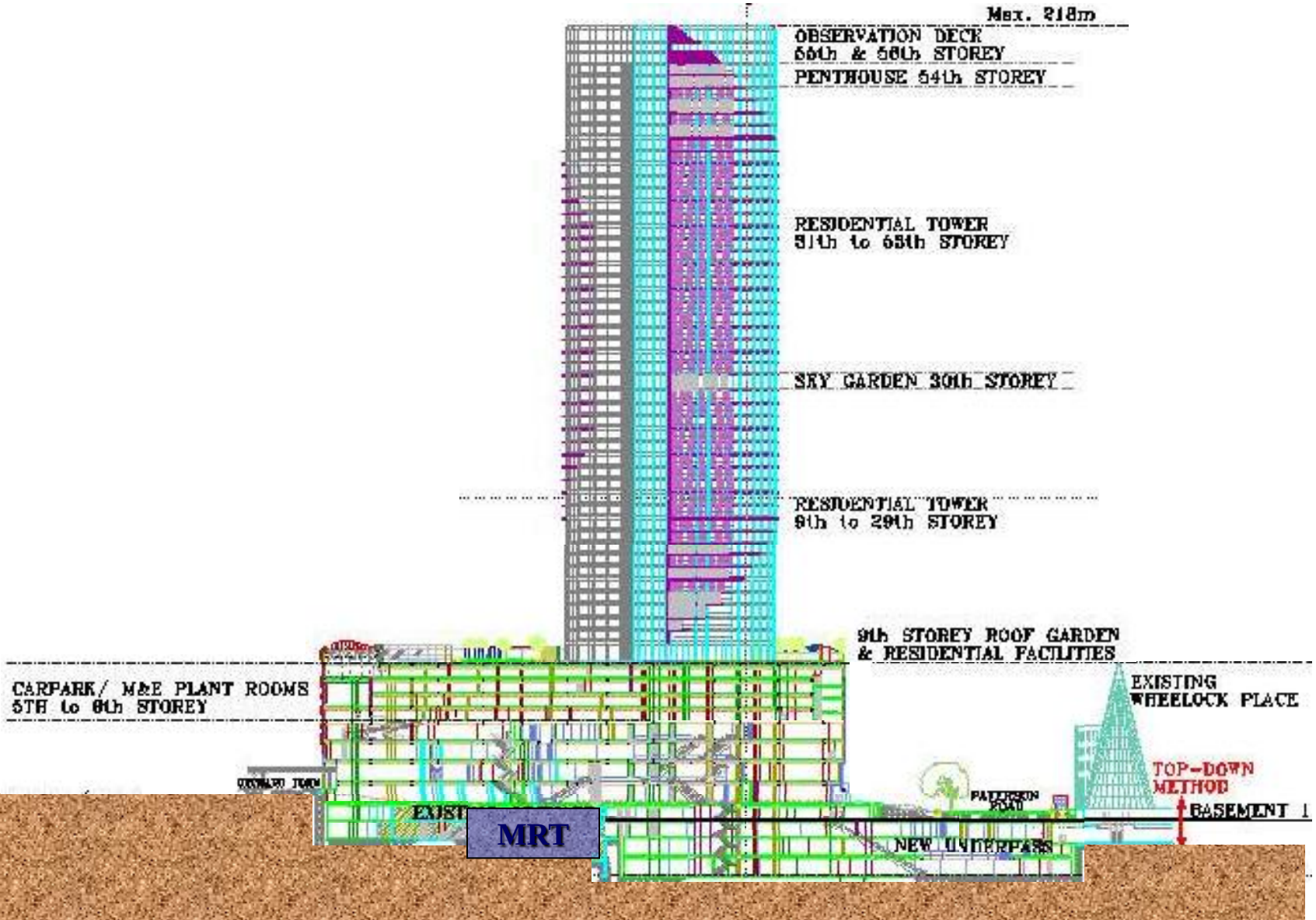


3. Design & Construction Strategies

B. SOIL NAIL / WISMA SUBWAY REMOVAL USING SUPERTOP MACHINE

B. Soil Nail / Wisma Subway Removal

Why SuperTop?

1. **Soil nails are T16, T25 & T32 rebars > 12m used as slope stability restraint during original construction of Orchard MRT Station.**

2. **Soil nail has to be removed to install diaphragm wall. Diaphragm wall machine cannot cut thru soil nail.**

3. **Using man-cage to lower worker to cut existing soil nail is dangerous.**

4. **The SuperTop machine uses a diamond head cutter to cut away the soil nail and Wisma subway RC structure.**

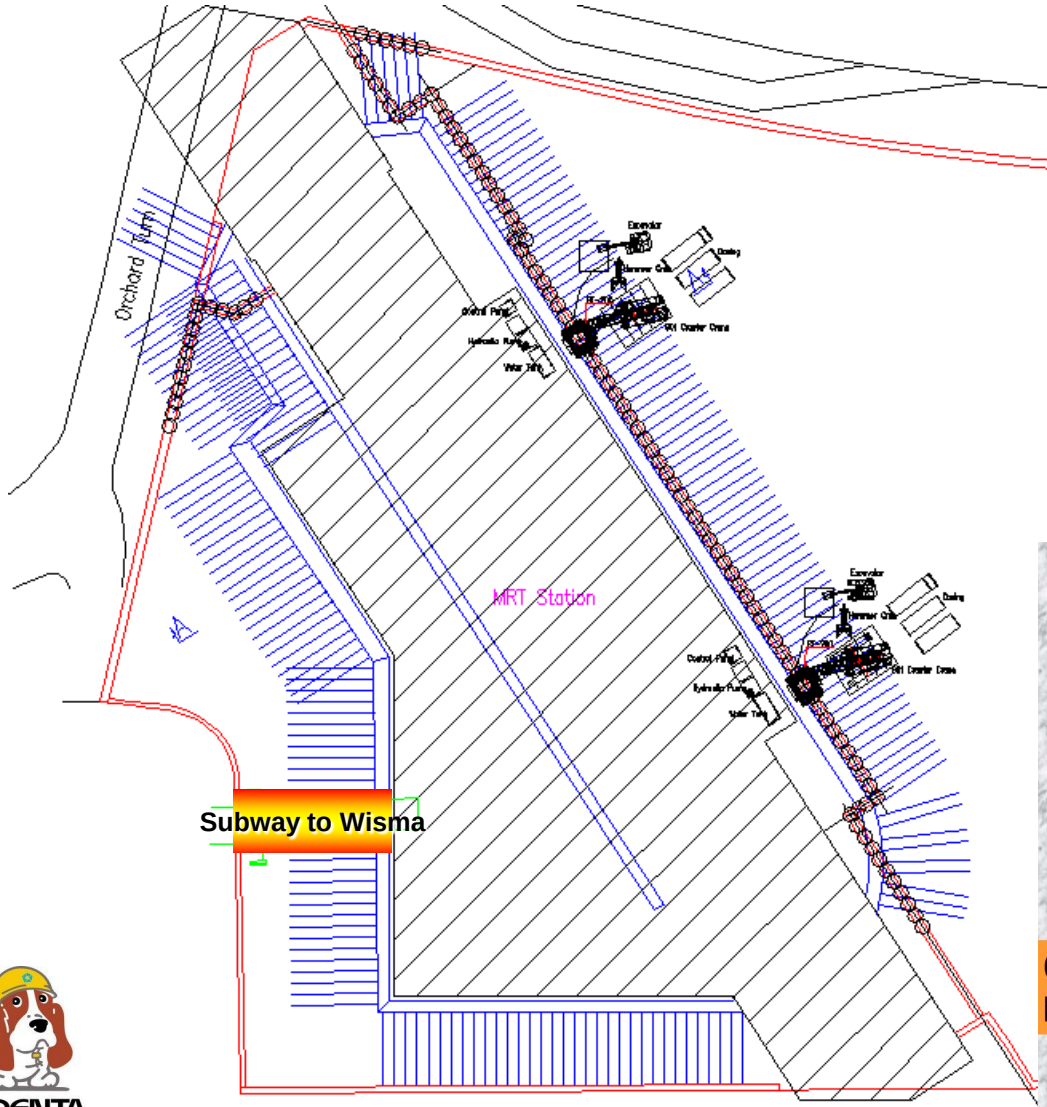
5. **Use of SuperTop minimises vibration to MRT Box Structure.**

6. **No manual cutting / hacking of Soil Nail / Wisma Subway - minimises safety risk to workers.**

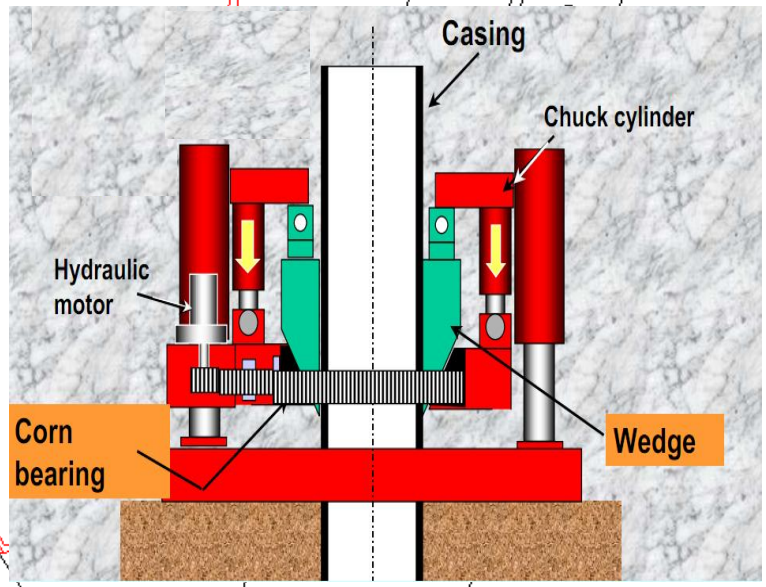
7. **Minimise noise.**

B. Soil Nail / Wisma Subway Removal

SPECIAL CASING ROTATOR EQUIPMENT WERE BROUGHT IN FROM JAPAN TO REMOVE SOIL NAILS AND THE STRUCTURE CONNECTING WISMA ATRIA & MRT STATION







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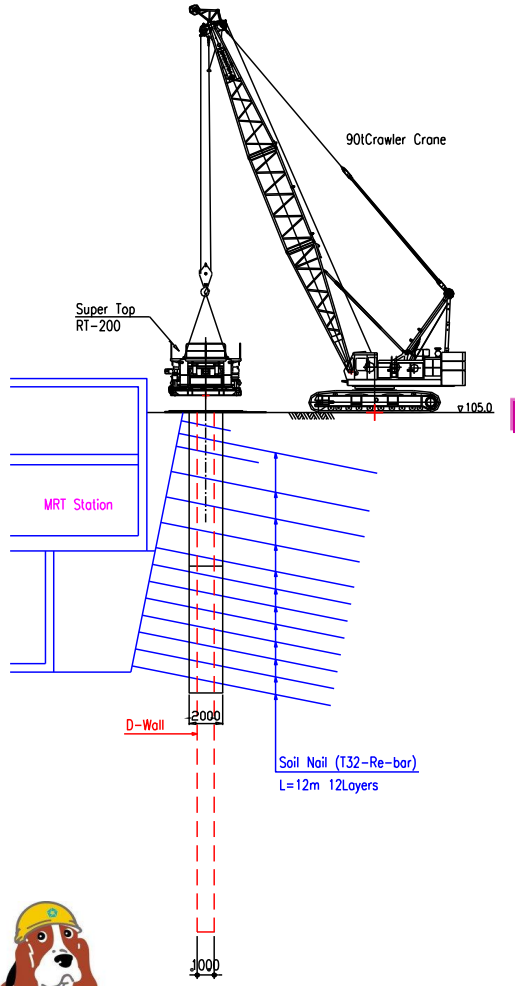
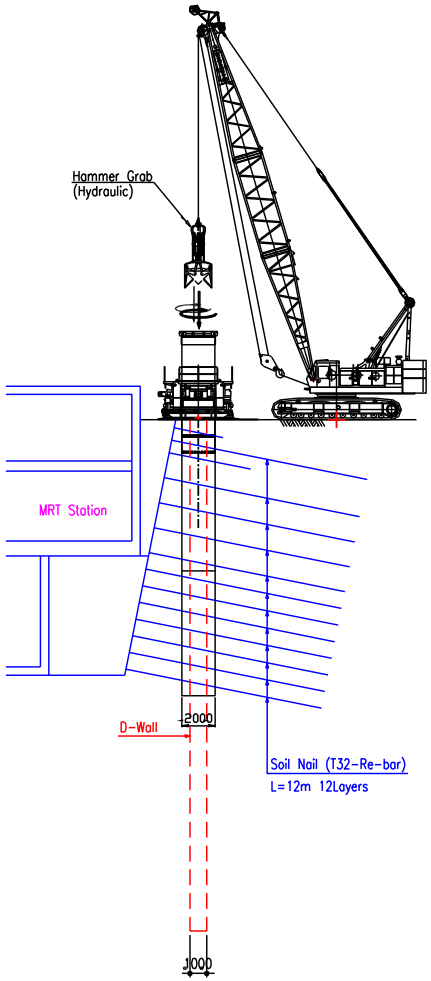
B. Soil Nail / Wisma Subway Removal

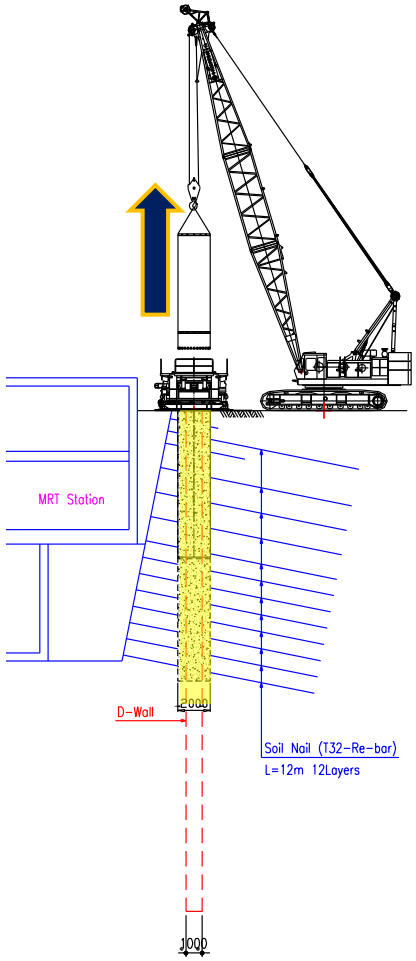
1. Setting of the Machine



2. Cut and Remove Soil Nails & Install Casing



3. Backfill with LSS & Extraction of the Casing



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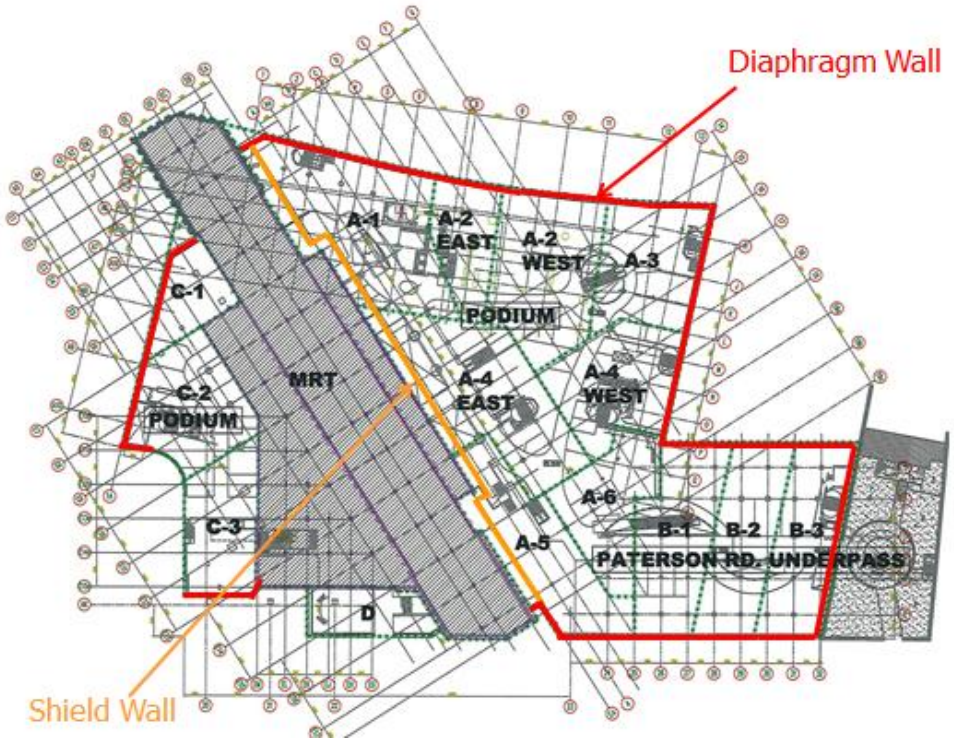
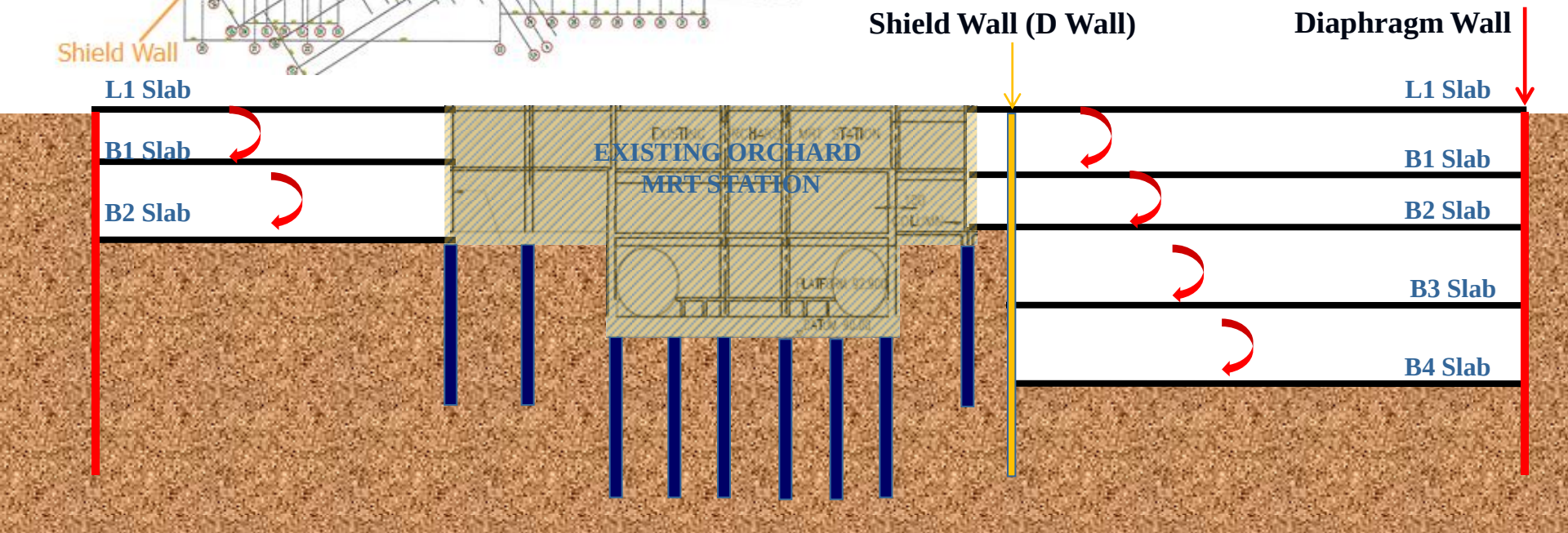
C. DIAPHRAGM WALL & BASEMENT CONSTRUCTION

C. Diaphragm Wall and Basement Construction



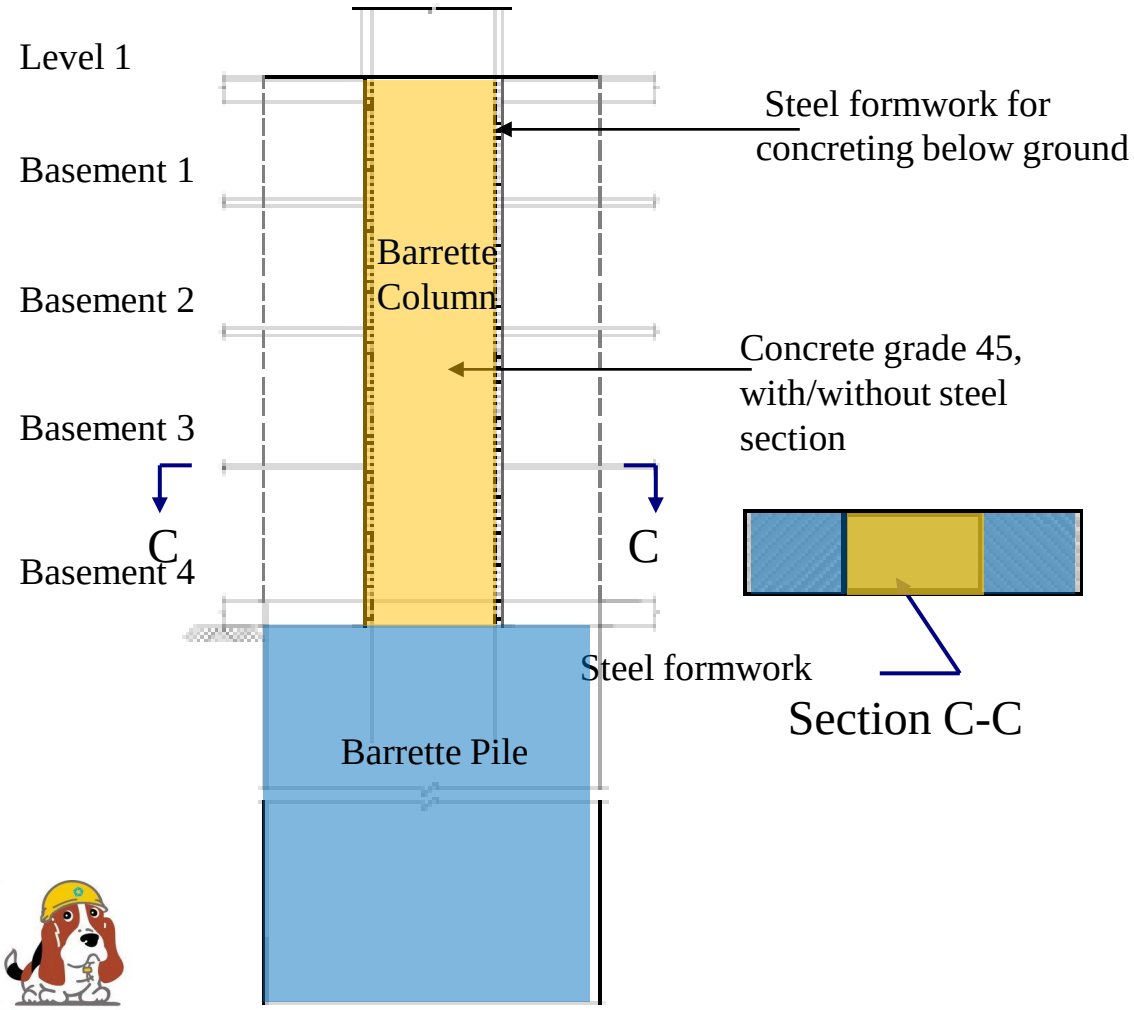
STRUT FREE BASEMENT CONSTRUCTION USING TOP DOWN METHOD

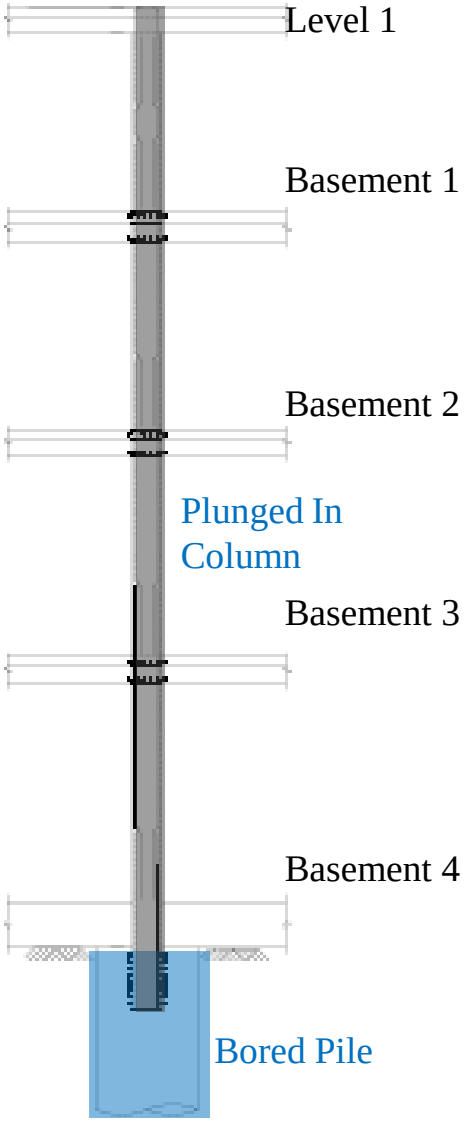


3. Design & Construction Strategies

D. BASEMENT COLUMNS

D. Basement Columns





AT MEGA COLUMNS AREA

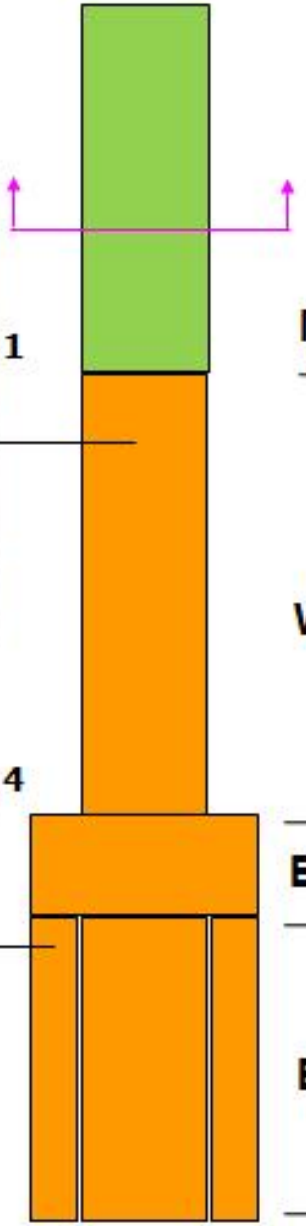
REST OF PODIUM AREA

D. Basement Columns

BARRETTE PILE









MEGA COLUMN

COLUMN CAGE
WITH METAL FORM



BARRETTE BEAM

BARRETTE CAGE



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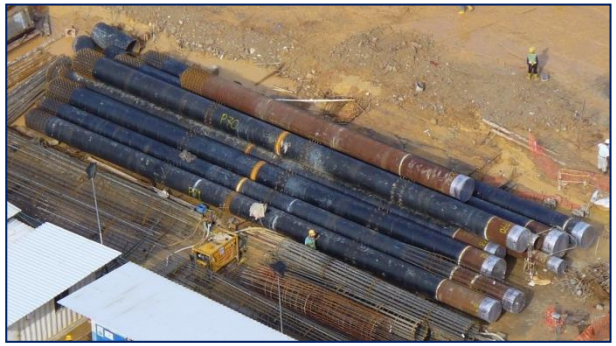
D. Basement Columns

BORED PILES WITH PLUNGED-IN COLUMNS









Plunged-In Columns

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B. Soil Nail / Wisma Subway Removal

Why Steel Pipes instead of H-Beams



1. Increased member capability
2. Reduced member size thus reducing column size.
3. Need not consider the XY axis (strong / weak axis).

How to install & secure pipe

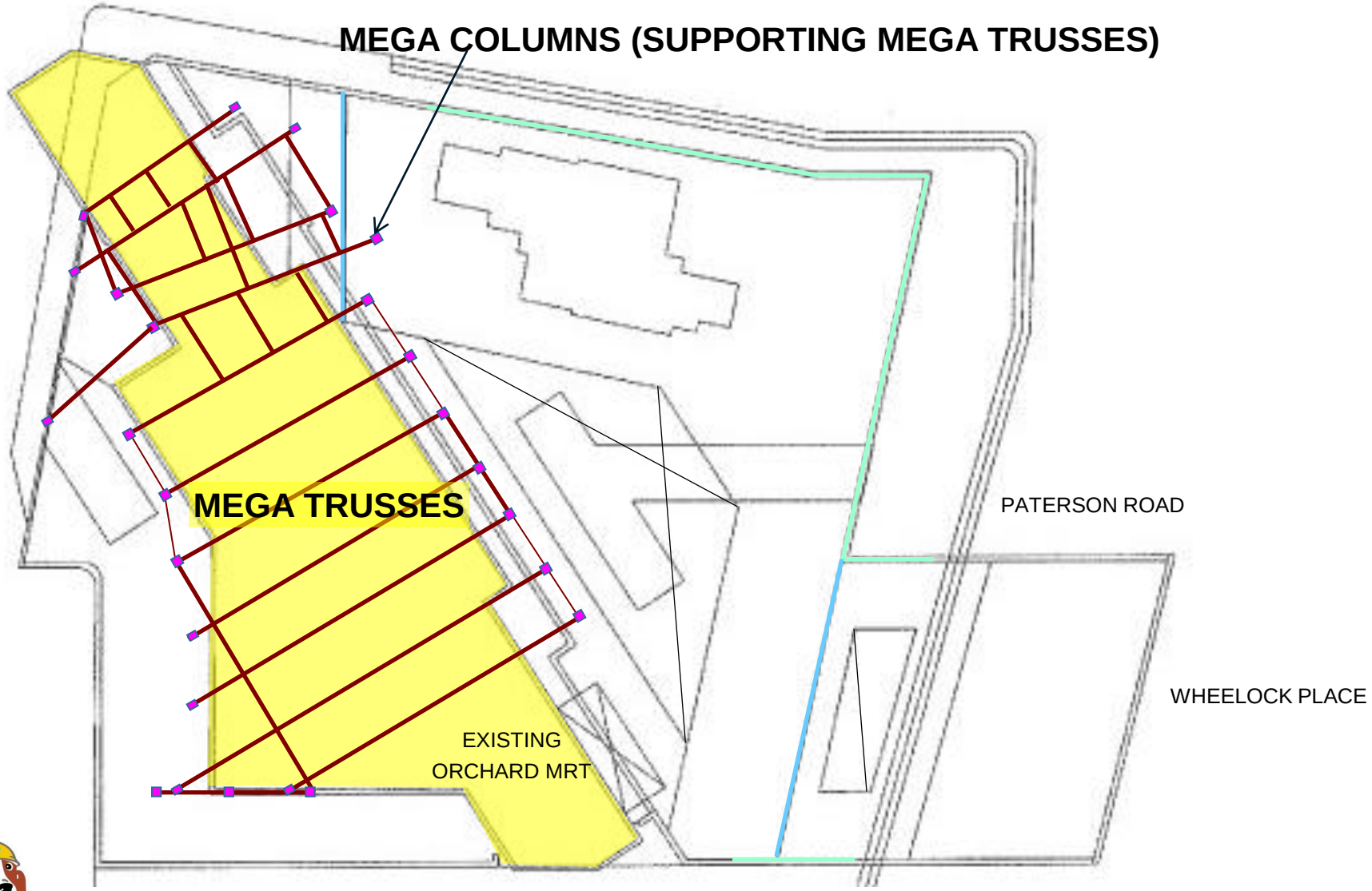


1. Place guides at steel casing.
2. Fill in water to increase weight & stability.
3. Install rebar & fill with concrete to become permanent column.

3. Design & Construction Strategies

E. MEGA TRUSSES ACROSS EXISTING MRT

E. Mega Trusses across Existing MRT



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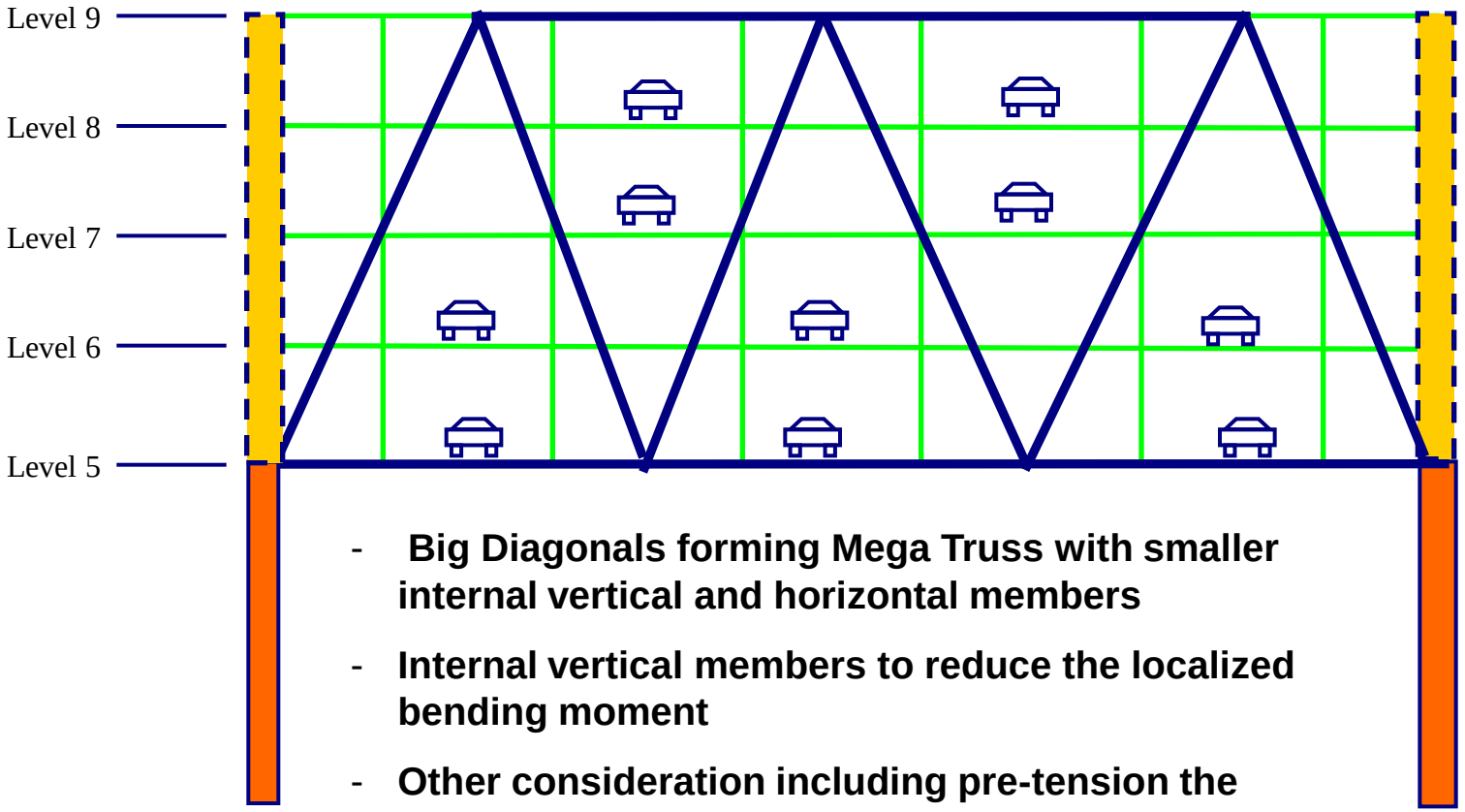
E. Mega Trusses across Existing MRT



- **Big Diagonals forming Mega Truss with smaller internal vertical and horizontal members**
- **Internal vertical members to reduce the localized bending moment**
- **Other consideration including pre-tension the bottom chords**

Mega truss Over MRT Station

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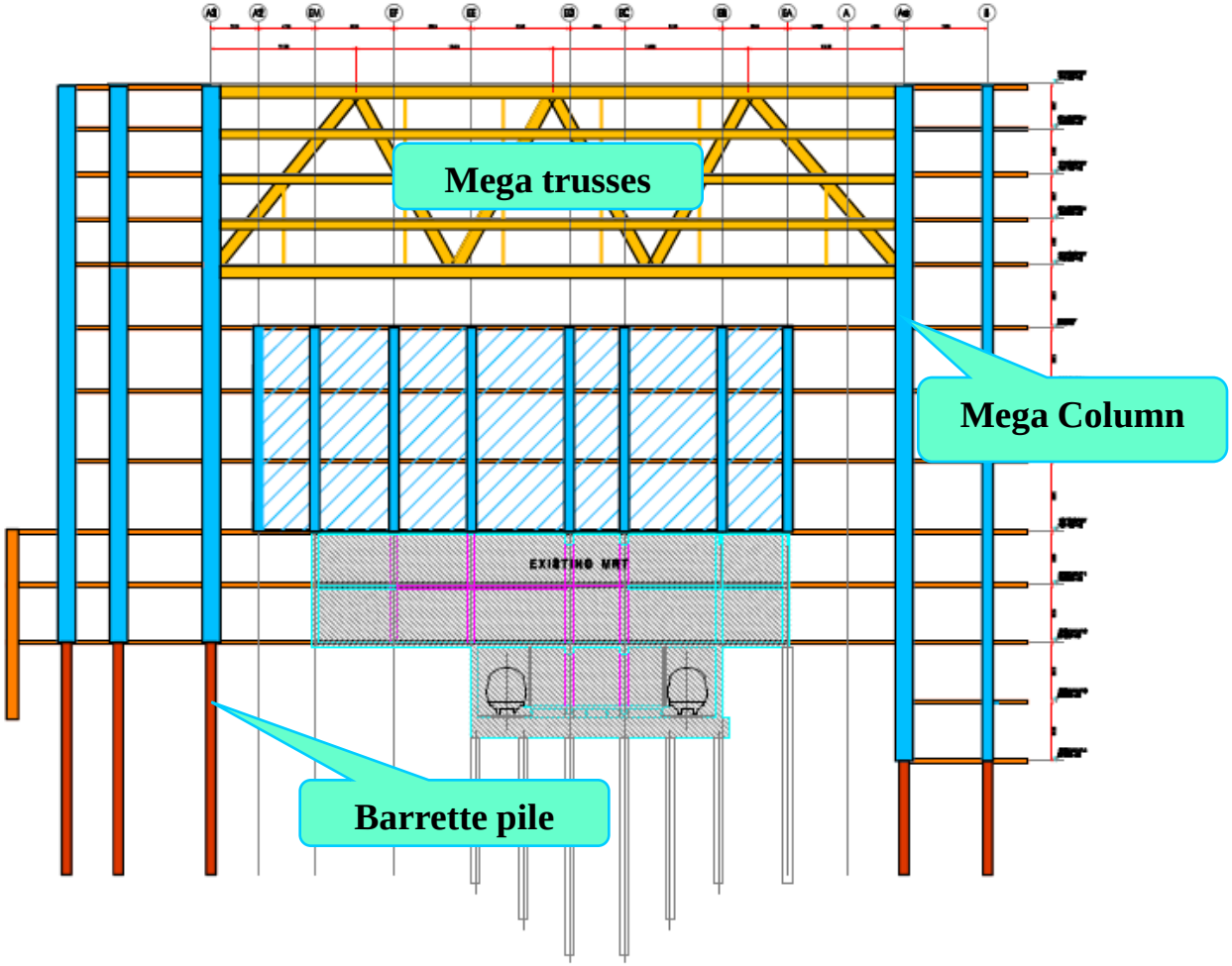
E. Mega Trusses across Existing MRT

- **Mega Trusses occupying the 5th to 9th storey i.e 15.2m deep, span over MRT station 50m ~ 75m**

- **Mega column 2m x 2m / 1.5m x 1.5m / 2.4m dia.**

- **Mega column on Barrette pile**



Mega truss Over MRT Station

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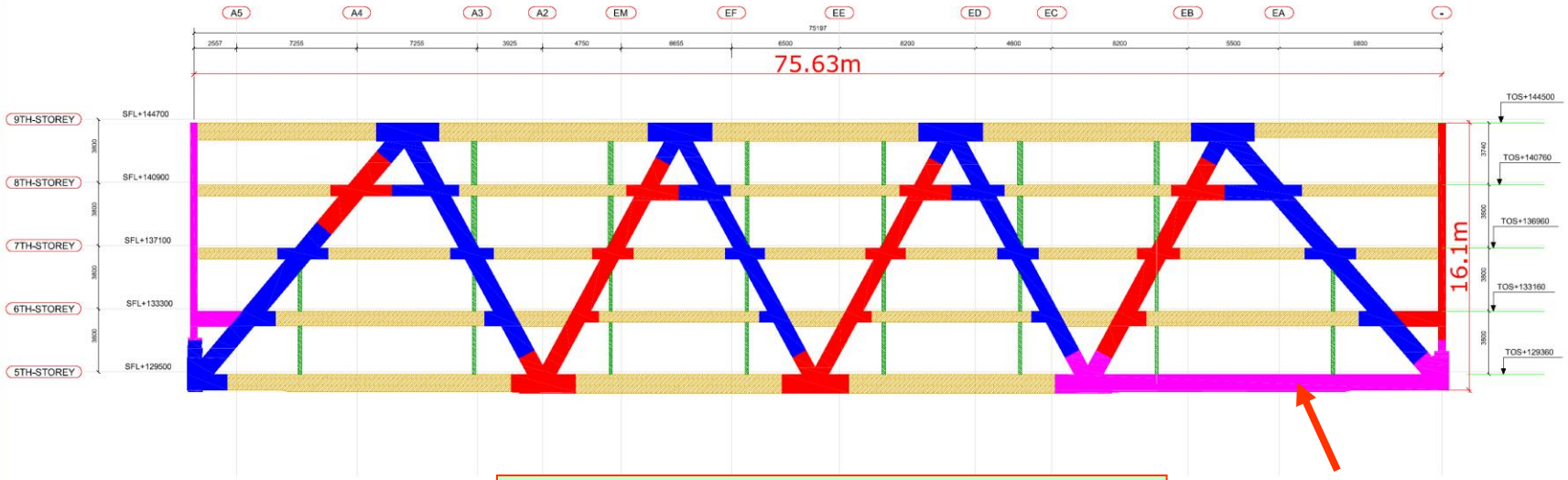

Longest & Heaviest Truss

Length : 75.63m
Weight : Approx: 508.93 T

Heaviest Segment : Approx: 60 T, 23.73m

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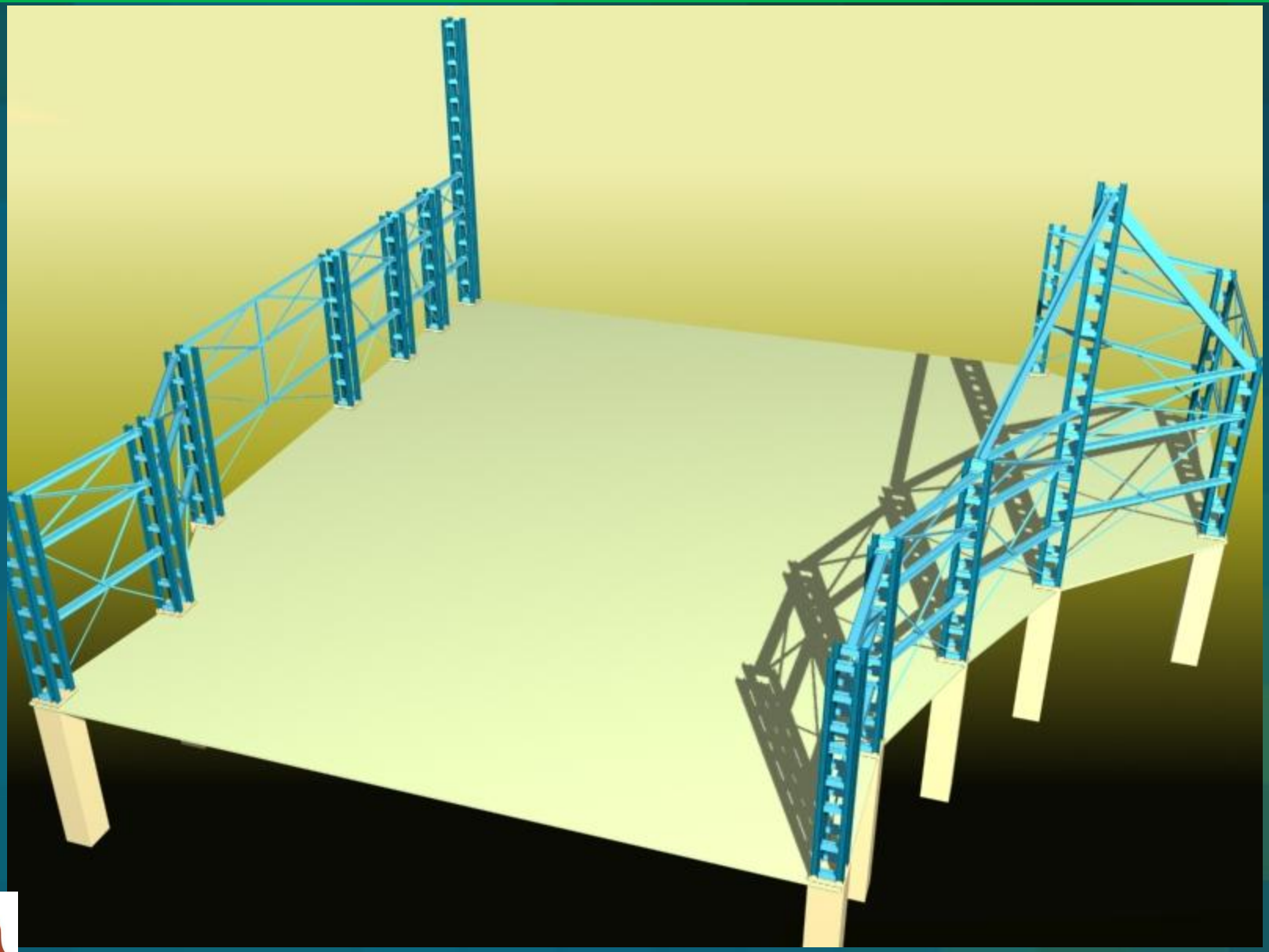
E. Mega Trusses across Existing MRT



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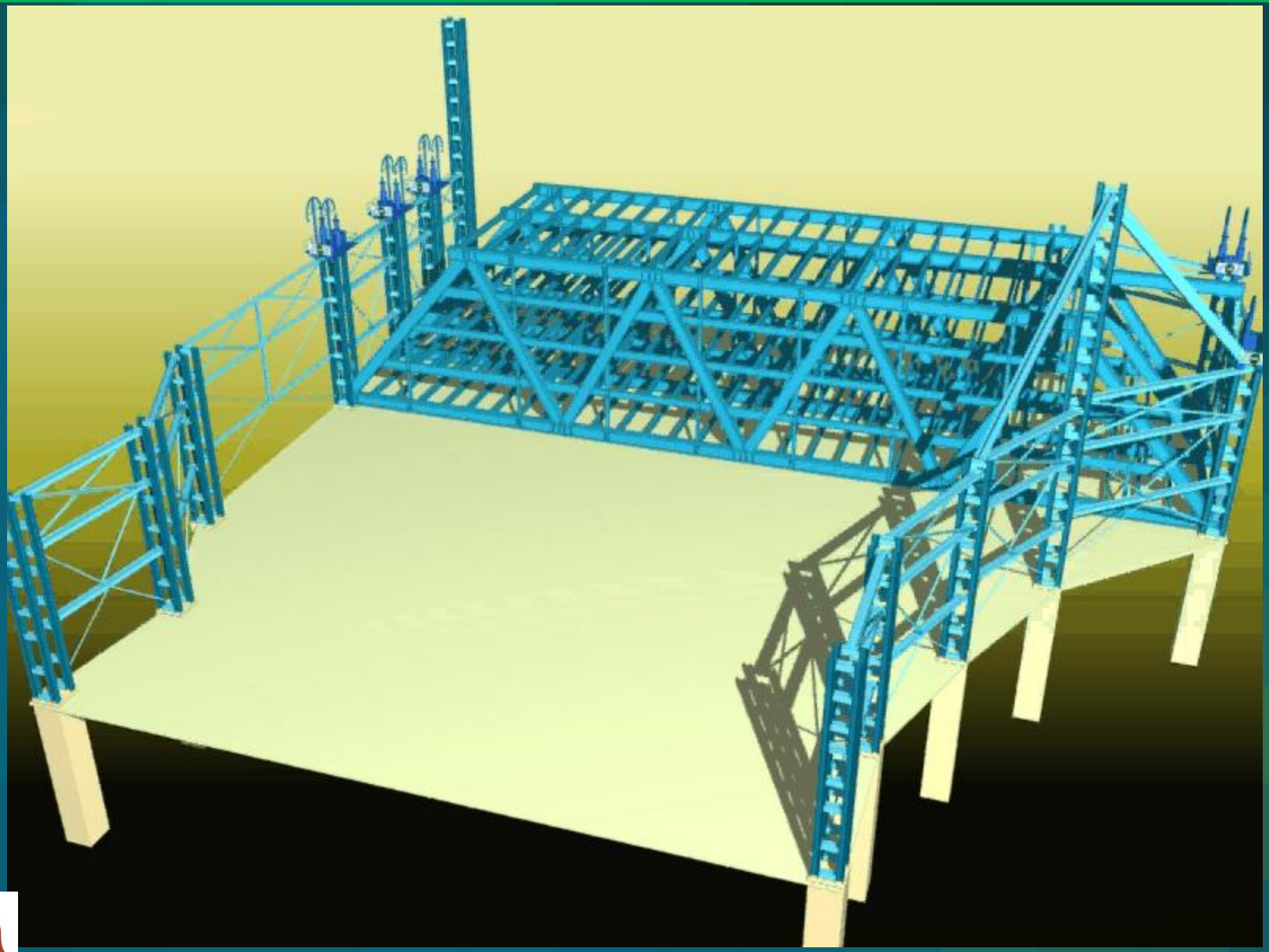

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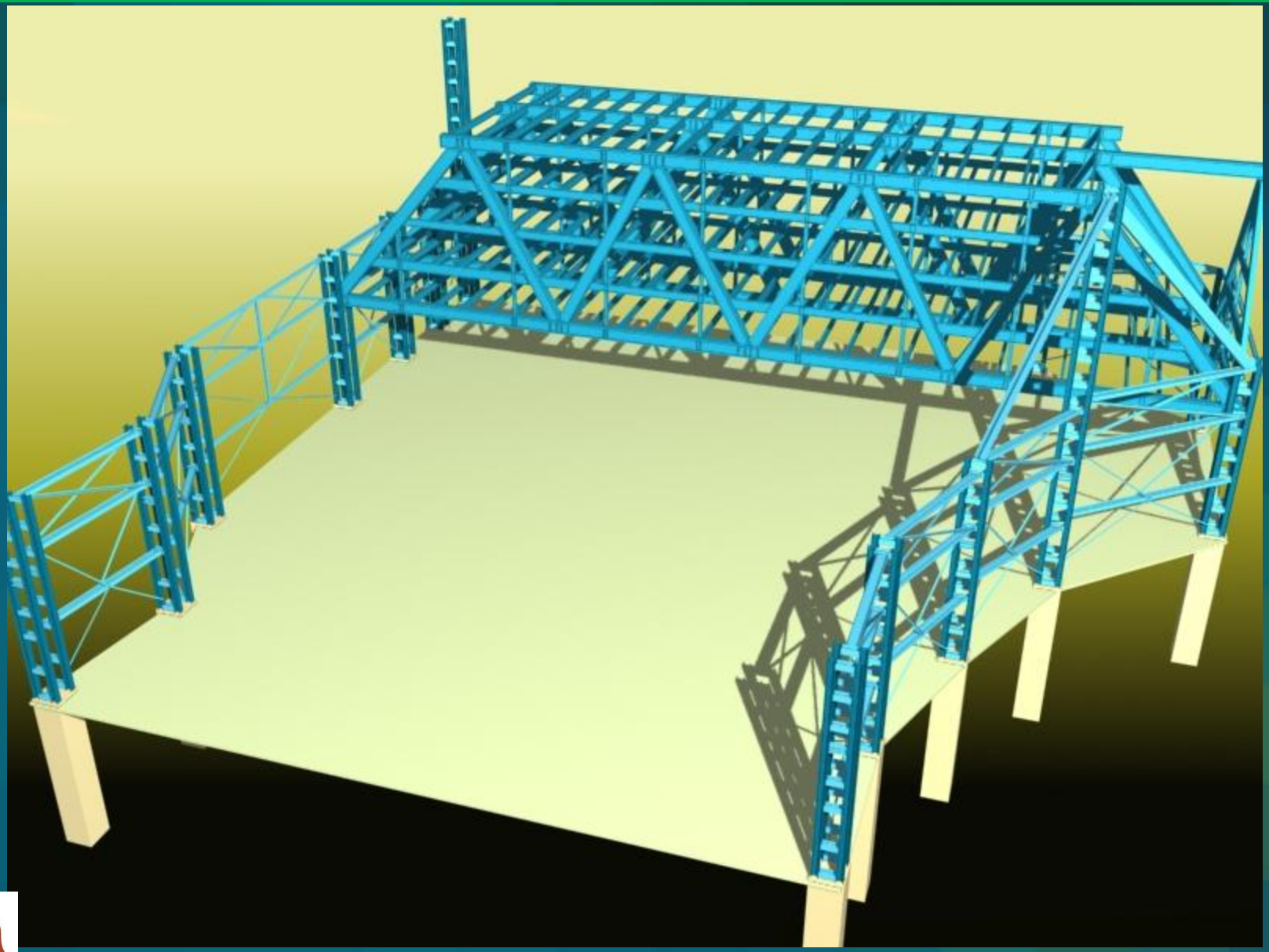

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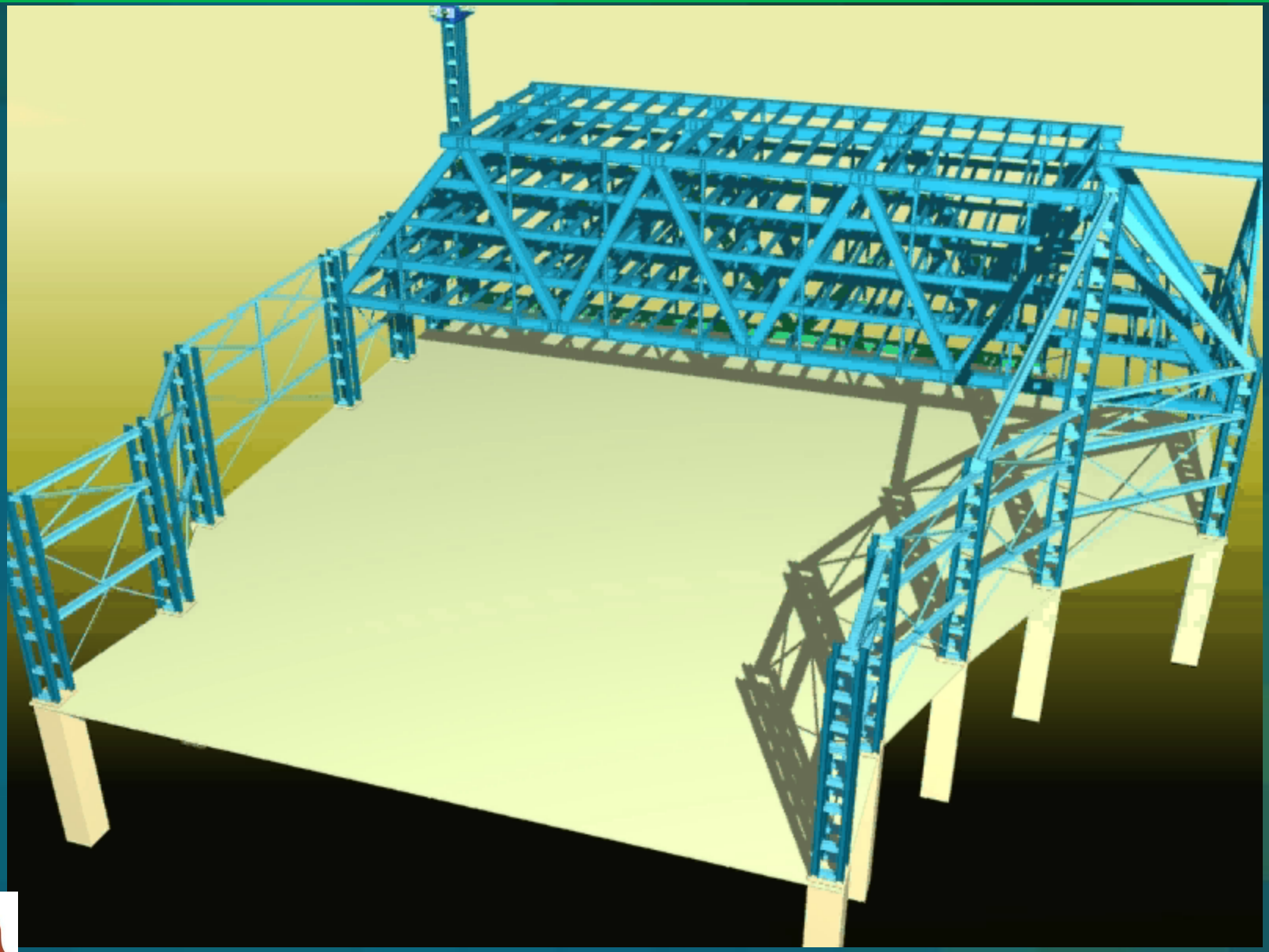

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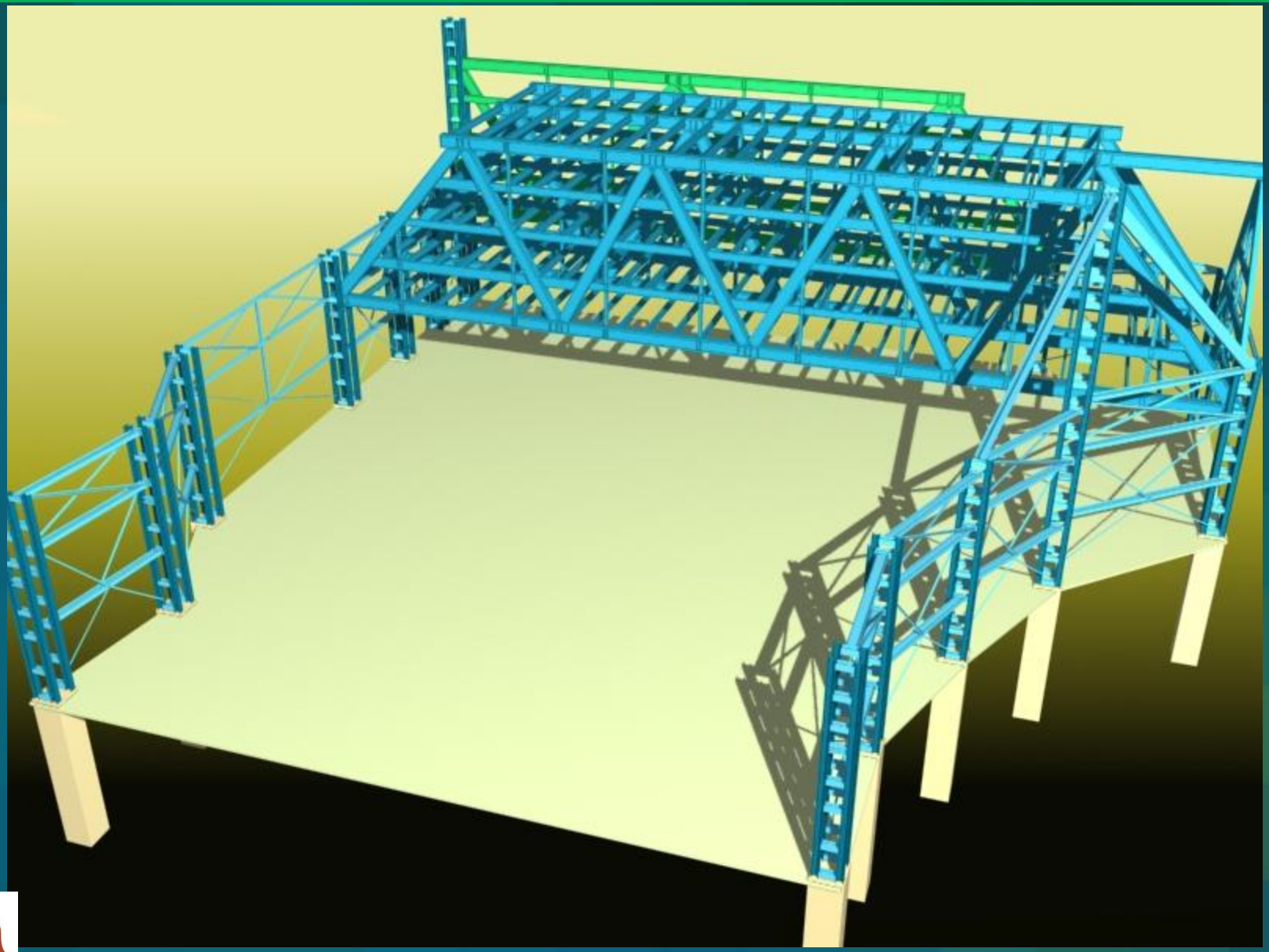

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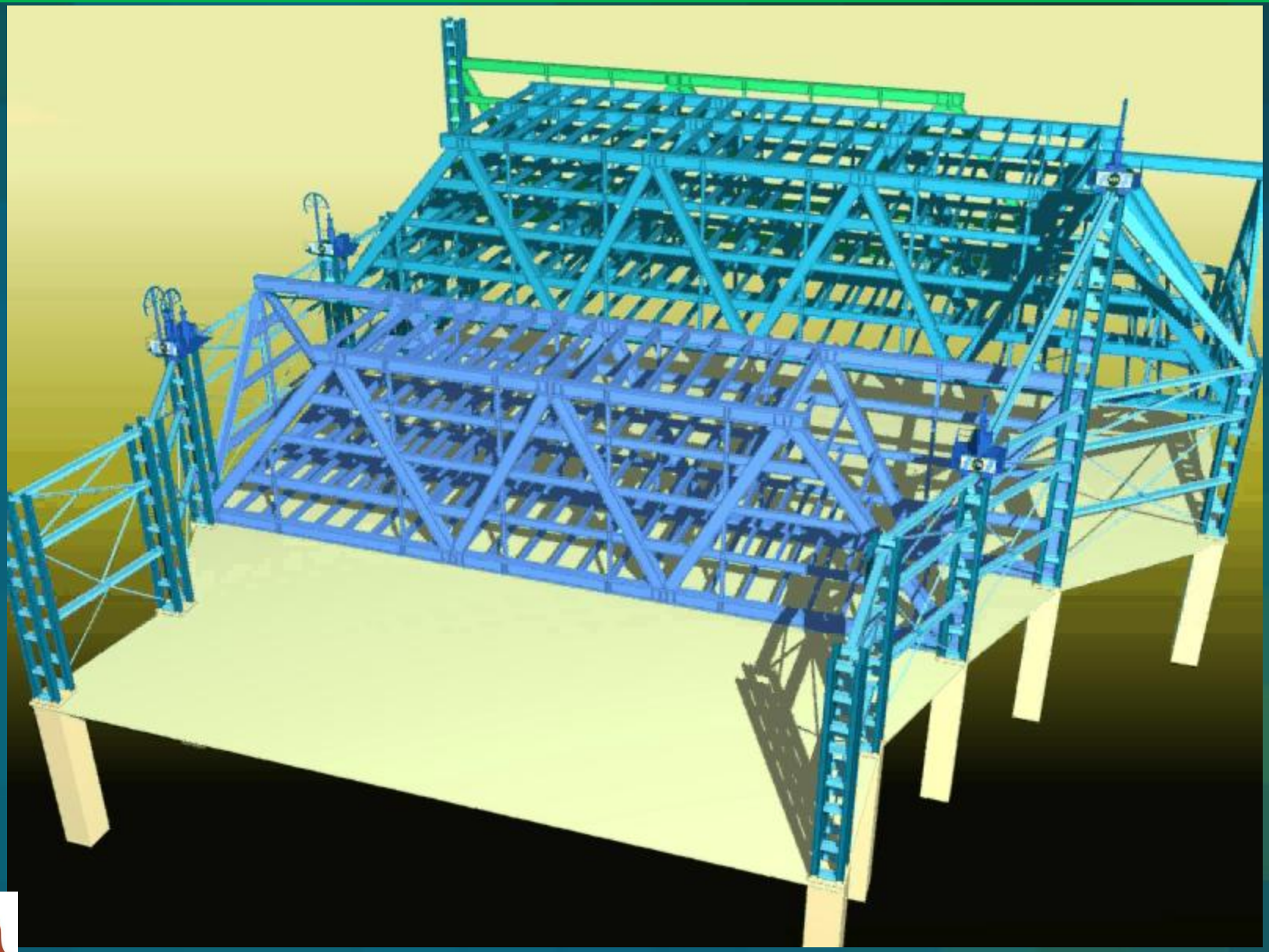

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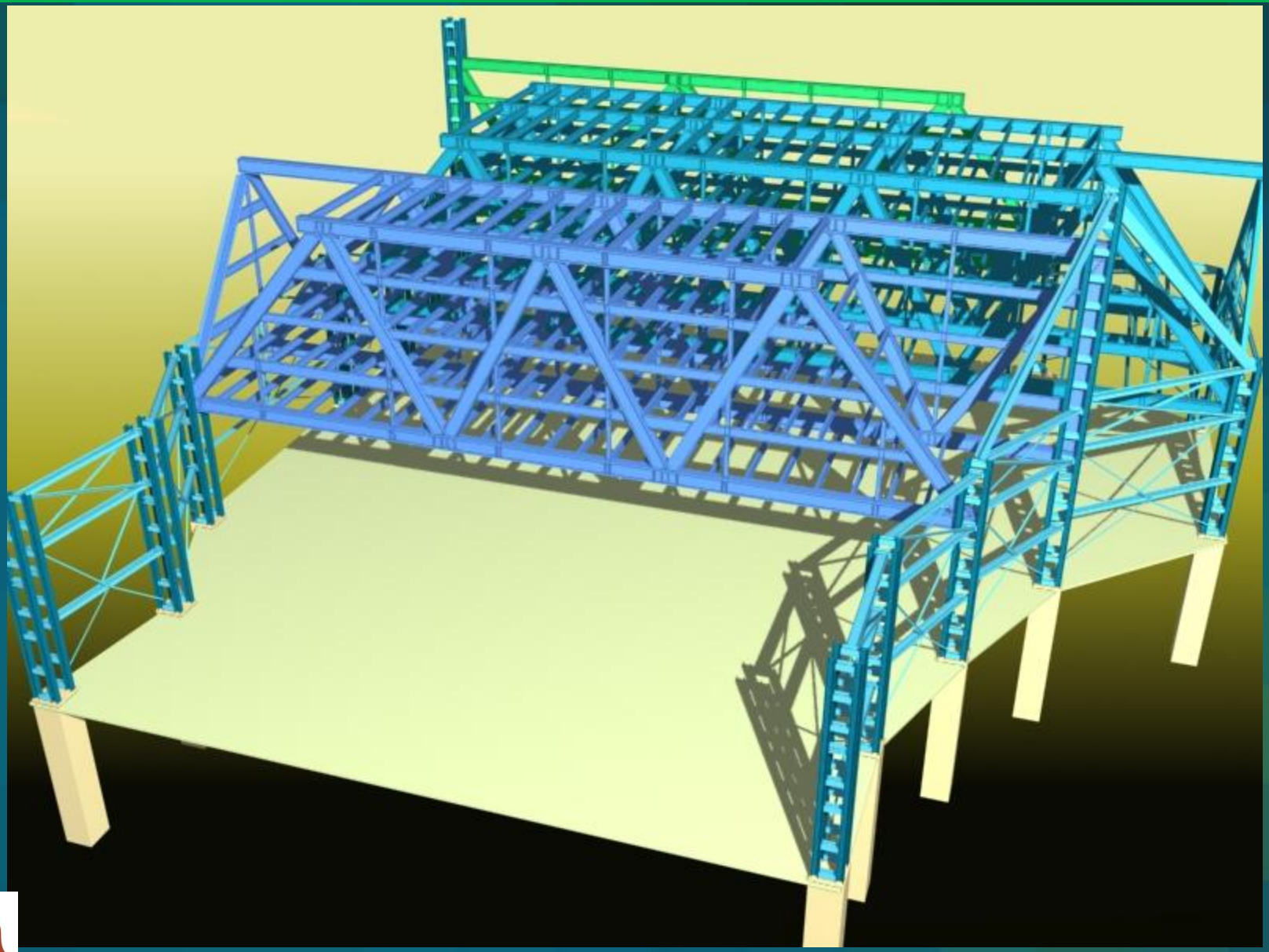

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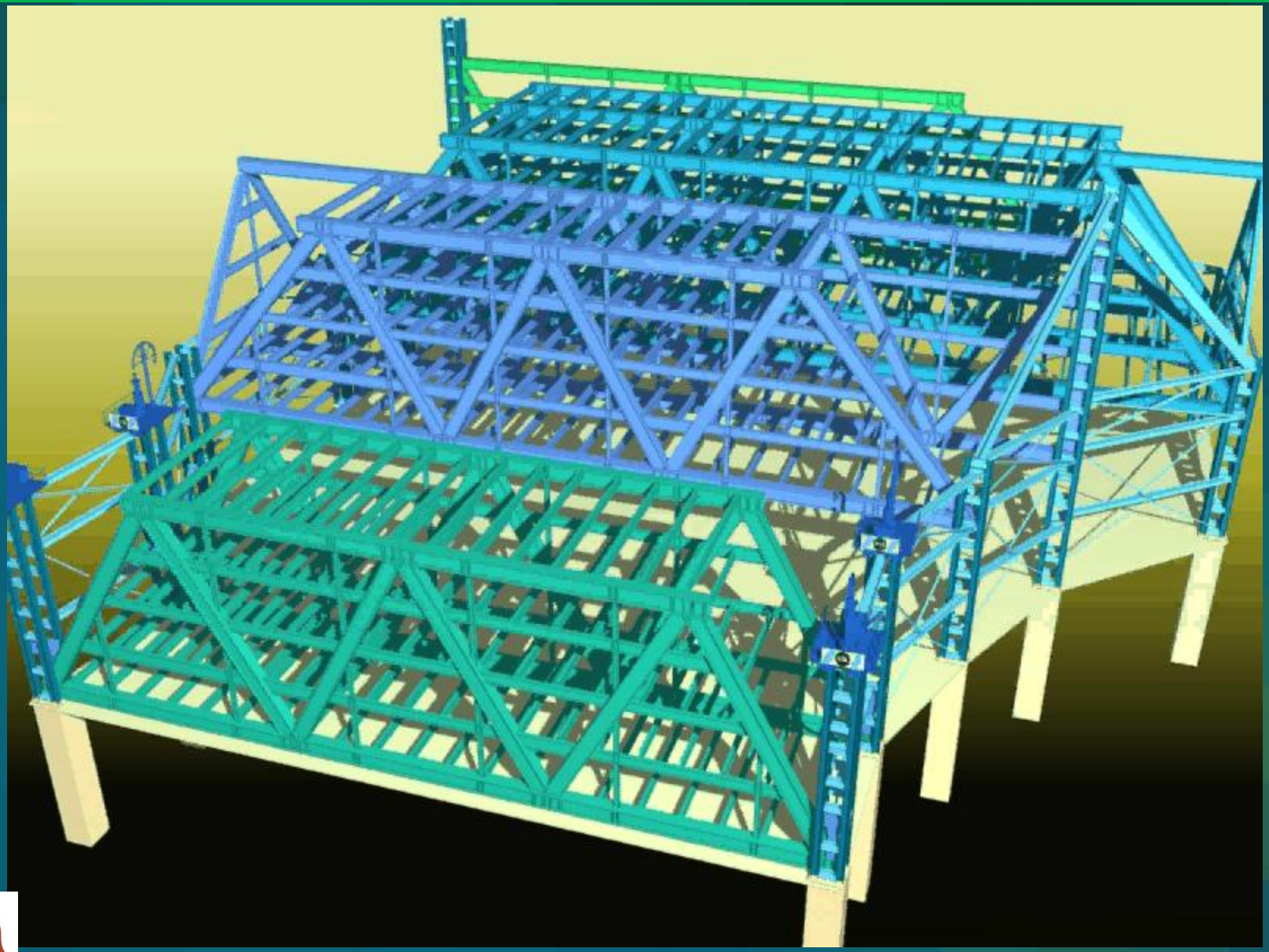

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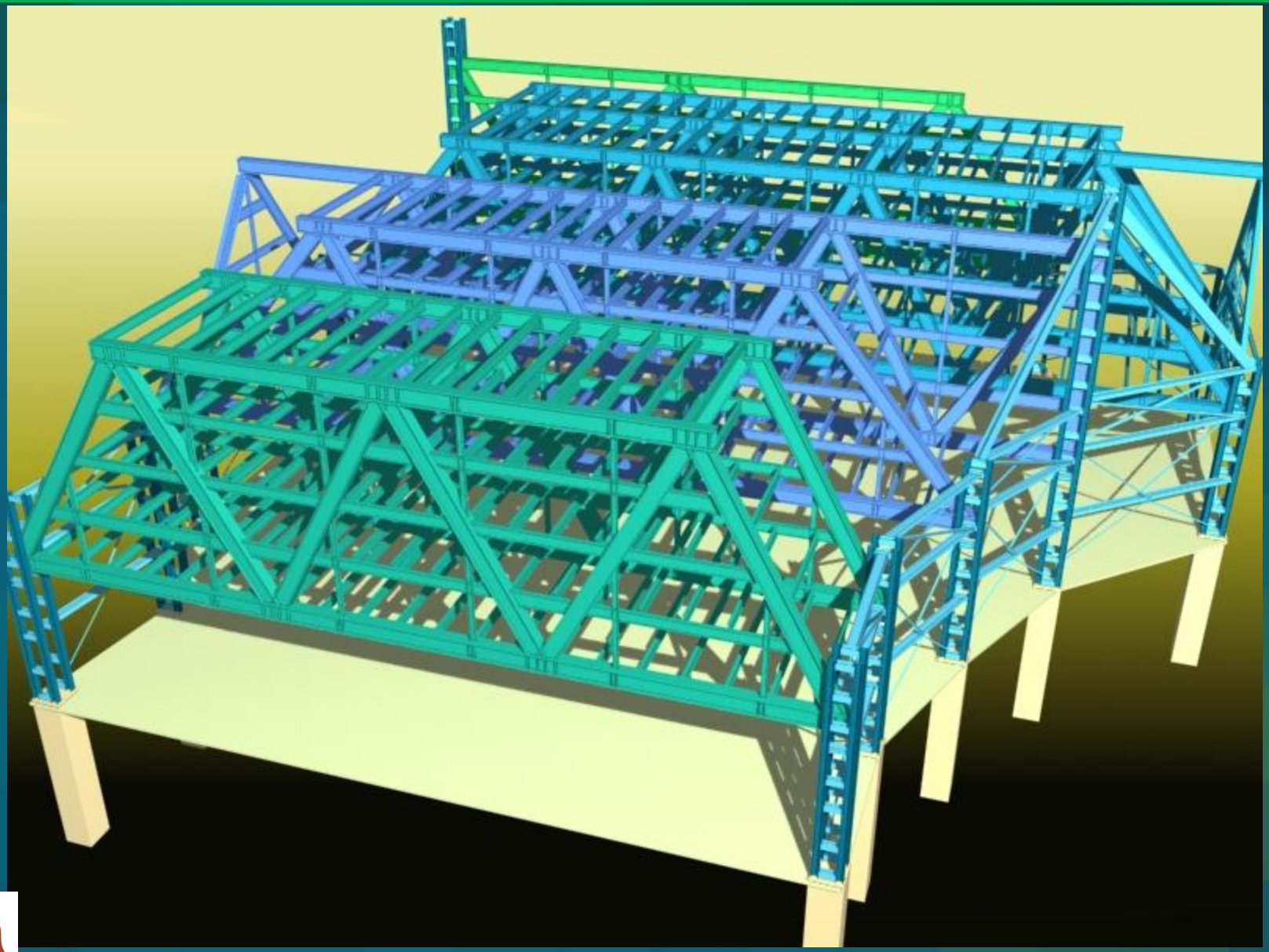
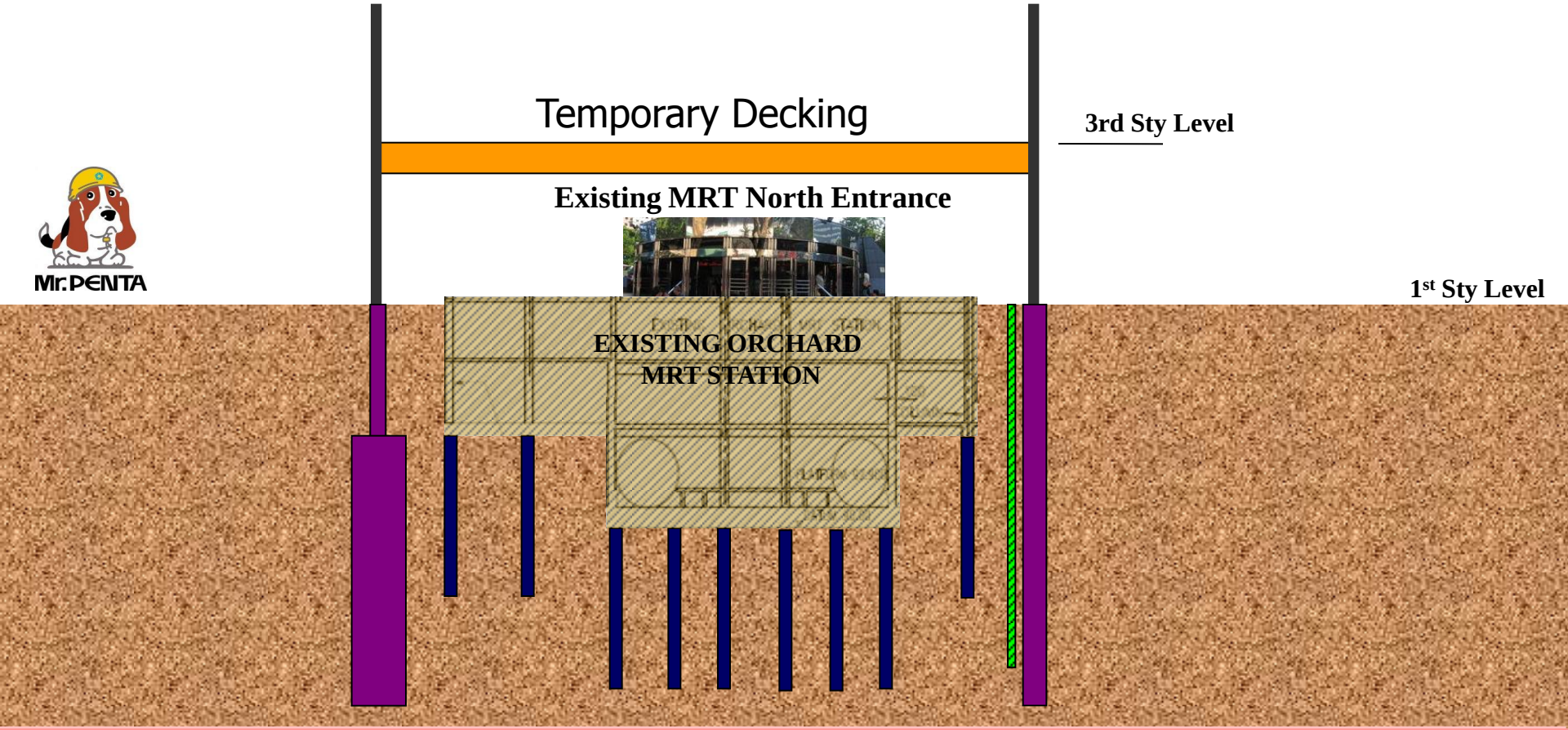


E. Mega Trusses across Existing MRT

Temporary Decking
- Public Safety
- MRT Roof Loading Constraints
- Existing MRT Entrances
- Limited Crane access



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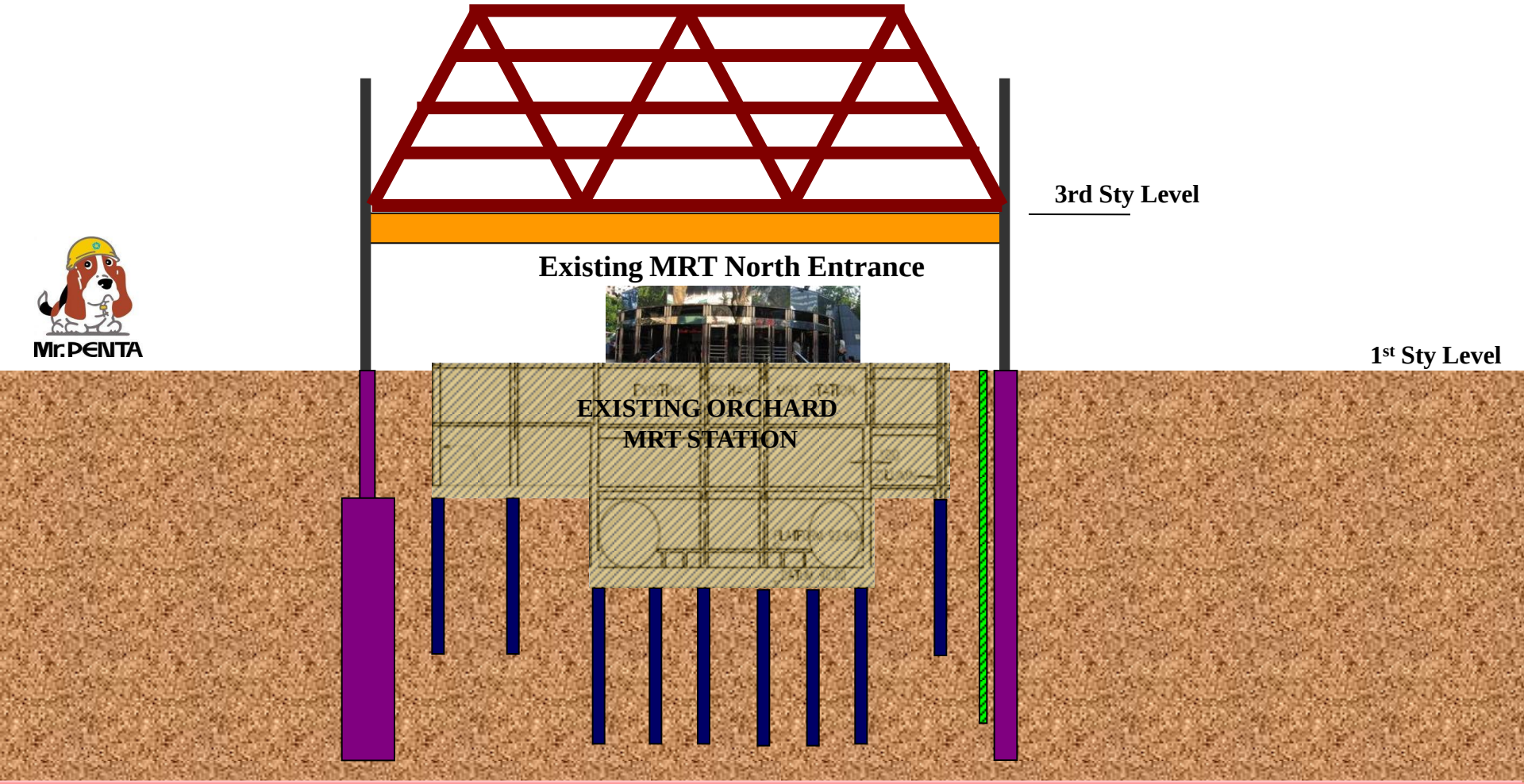
Install Mega Columns & Temporary Truss Decking

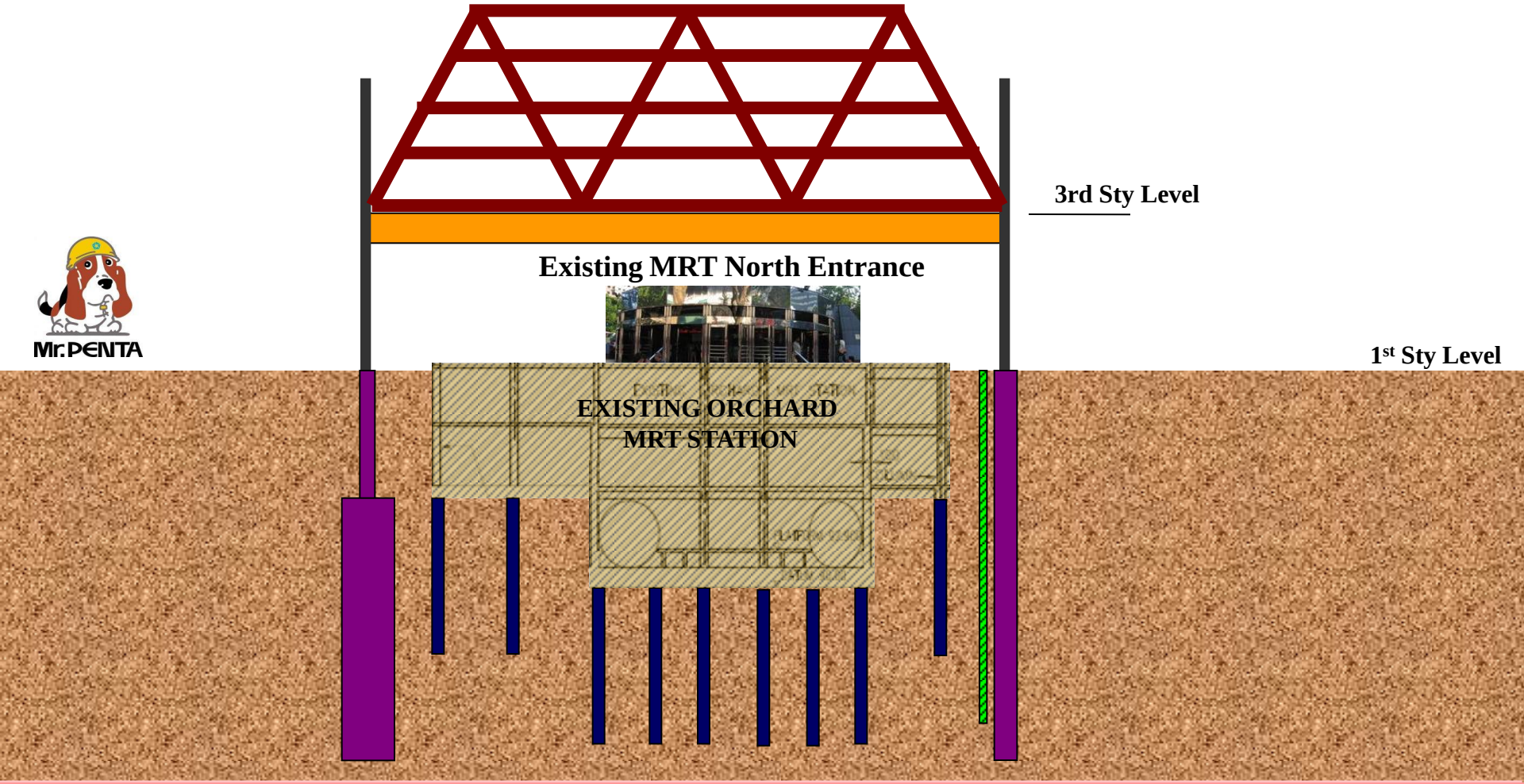
E. Mega Trusses across Existing MRT



Mr.PENTA

Assemble Mega Trusses on Temporary Deck

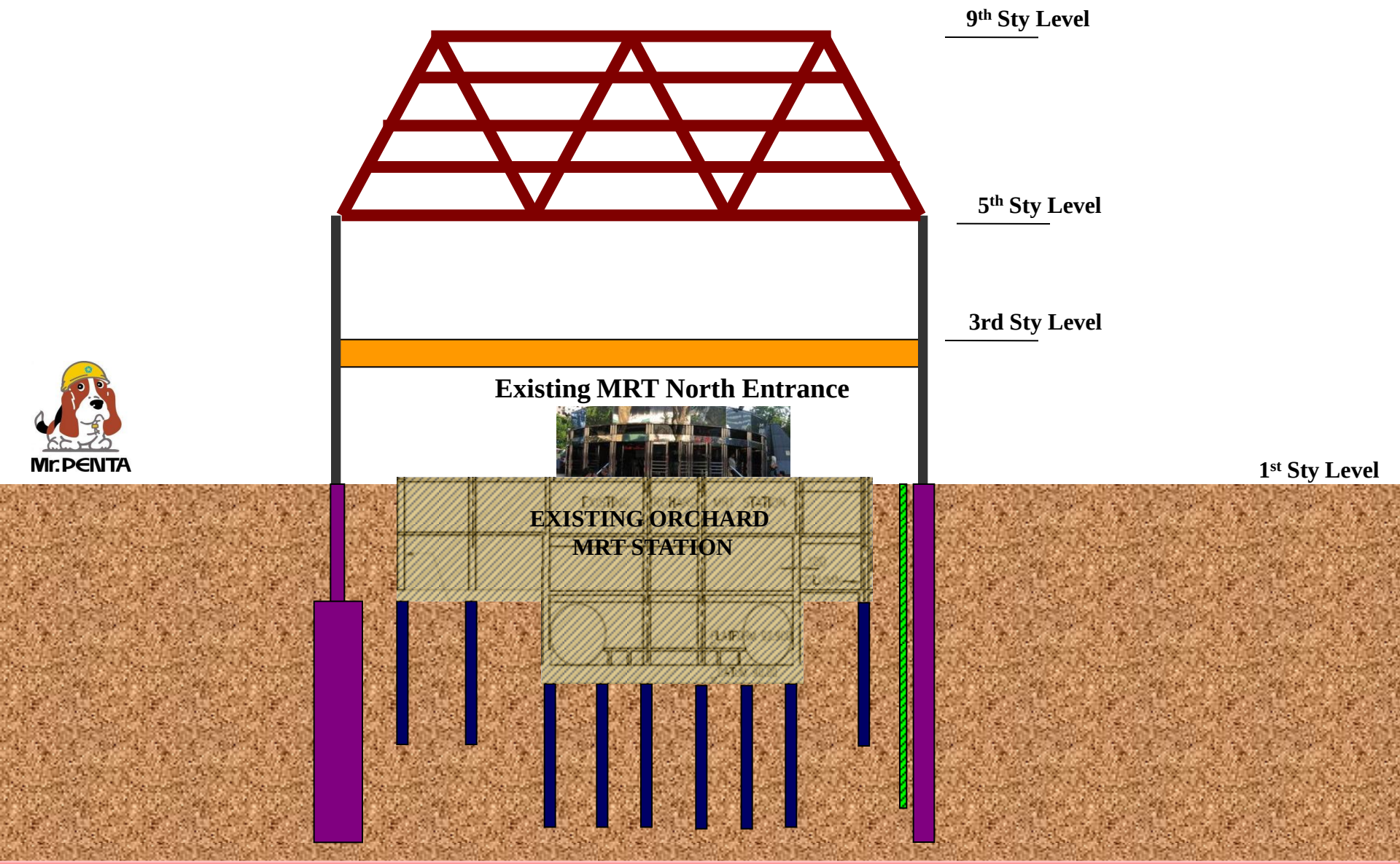
E. Mega Trusses across Existing MRT



Mr.PENTA

Jack Up Mega Trusses to Final Position

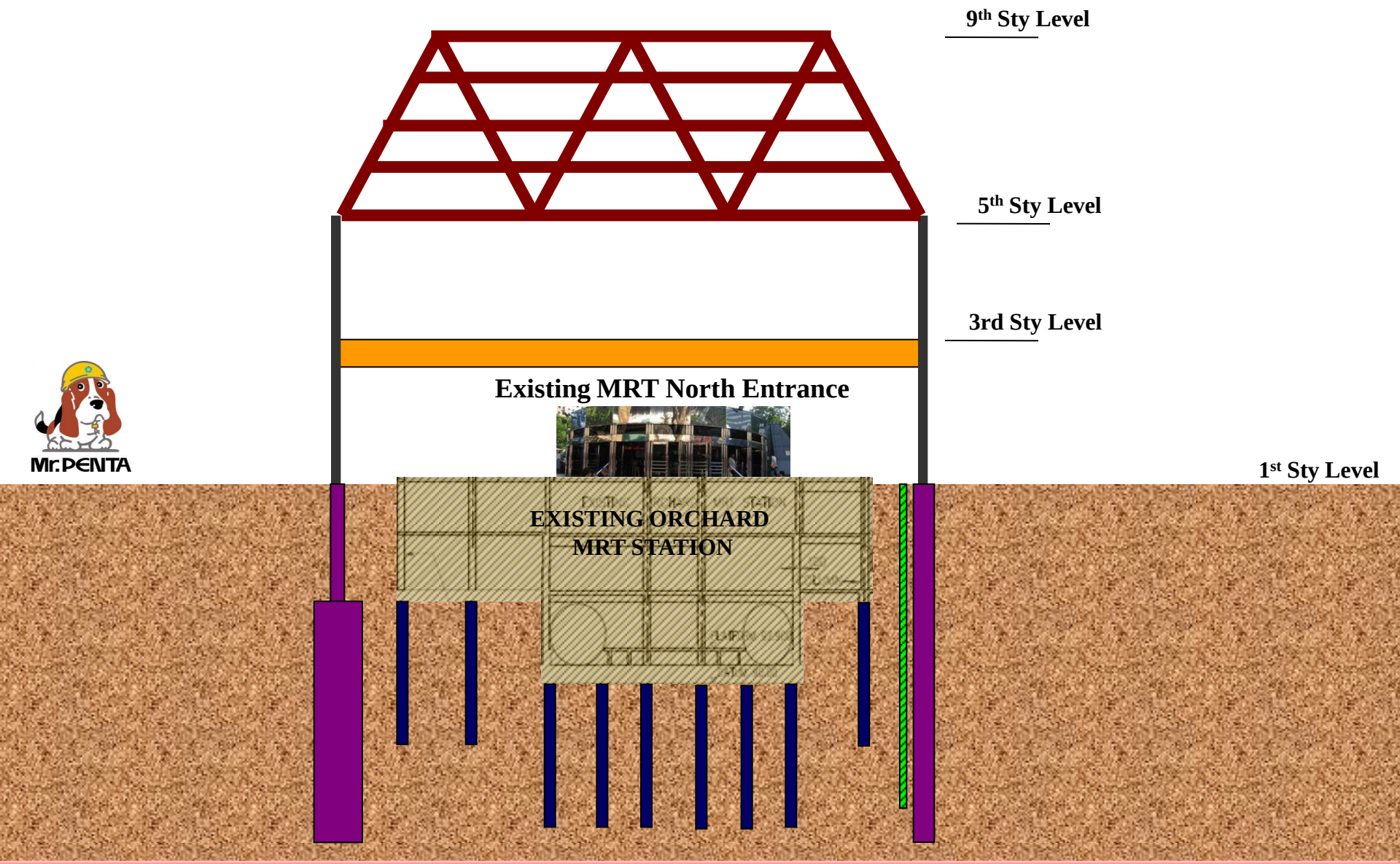
E. Mega Trusses across Existing MRT



Mr.PENTA

Jack up Mega Trusses to Final Position

E. Mega Trusses across Existing MRT



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Construct Bondek Slab on Mega Truss & Remove Temporary Decking

E. Mega Trusses across Existing MRT

CONSTRUCTION OF MEGA COLUMNS





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E. Mega Trusses across Existing MRT

ERECTION OF TEMPORARY DECKING FOR MEGA TRUSS



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E. Mega Trusses across Existing MRT

TEMPORARY COLUMN SUPPORTS FOR MEGA TRUSS ERECTION



Mr.PENTA

E. Mega Trusses across Existing MRT

MEGA TRUSS ASSEMBLY IN PROGRESS



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E. Mega Trusses across Existing MRT

MEGA TRUSS BEFORE JACKING UP



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E. Mega Trusses across Existing MRT

MEGA TRUSS BEFORE JACKING UP



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E. Mega Trusses across Existing MRT

MEGA TRUSS AFTER JACKING UP



Mr.PENTA

E. Mega Trusses across Existing MRT

MEGA TRUSS AFTER JACKING UP



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E. Mega Trusses across Existing MRT

INSTALLATION OF FLOOR BEAMS



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E. Mega Trusses across Existing MRT

BONDEK INSTALLATION IN PROGRESS



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E. Mega Trusses across Existing MRT

SLAB CAST ON BONDEK

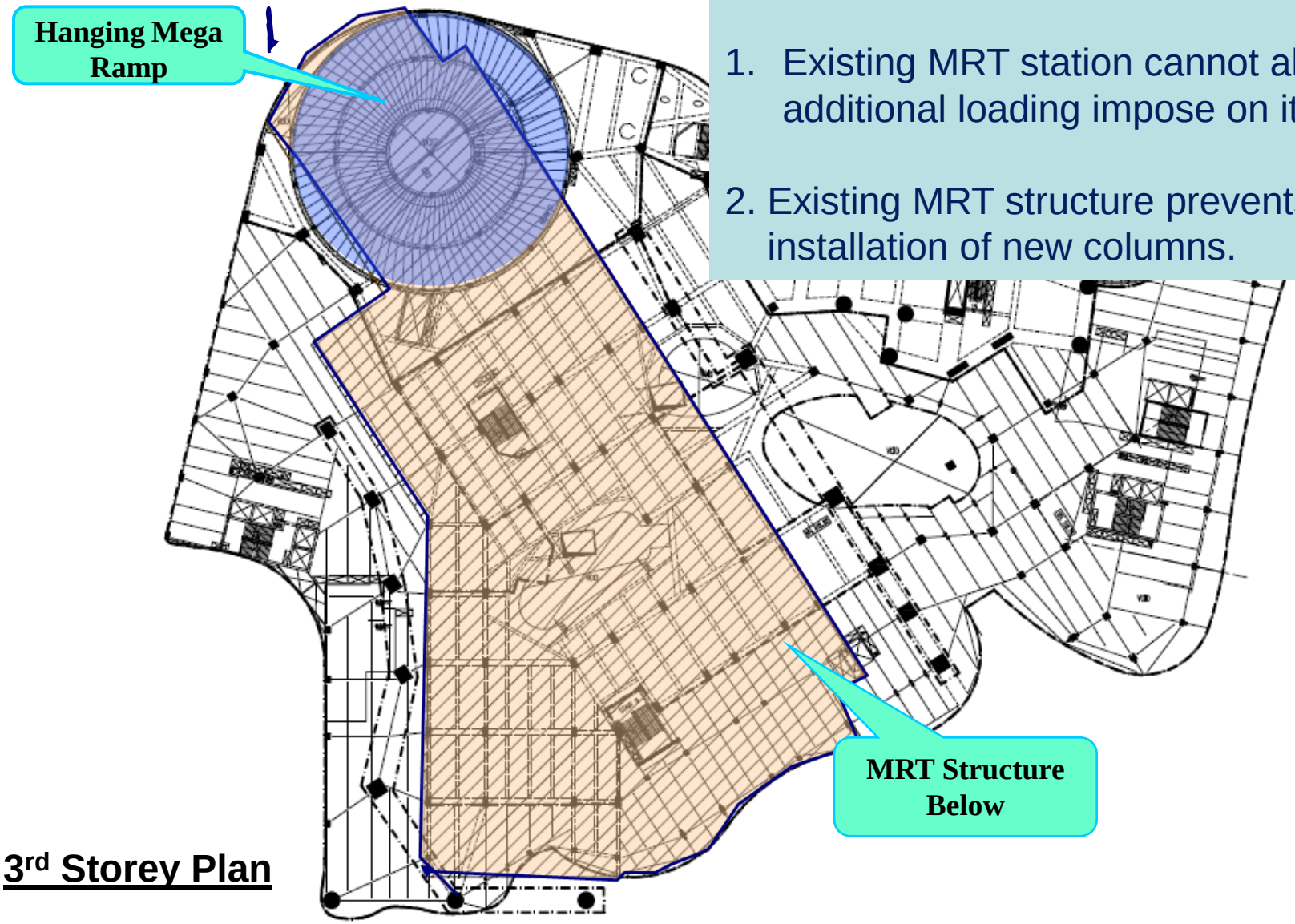


Mr.PENTA

3. Design & Construction Strategies

F. HANGING MEGA RAMP

F. Hanging Mega Ramp



3rd Storey Plan

Why Hanging Mega Ramp

1. Existing MRT station cannot allow any additional loading impose on it.

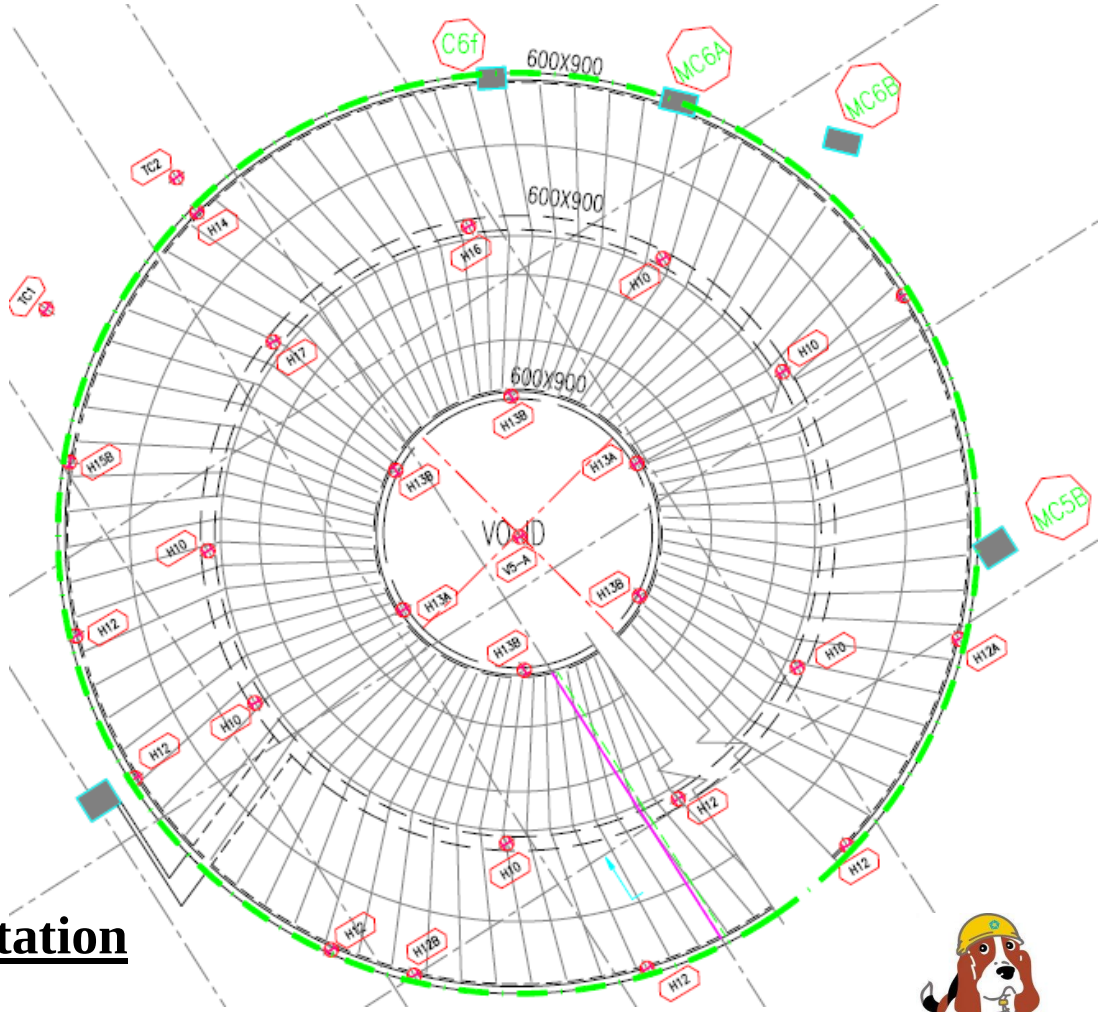
2. Existing MRT structure prevents installation of new columns.

Mr.PENTA

F. Hanging Mega Ramp

Mega Ramp over MRT Station

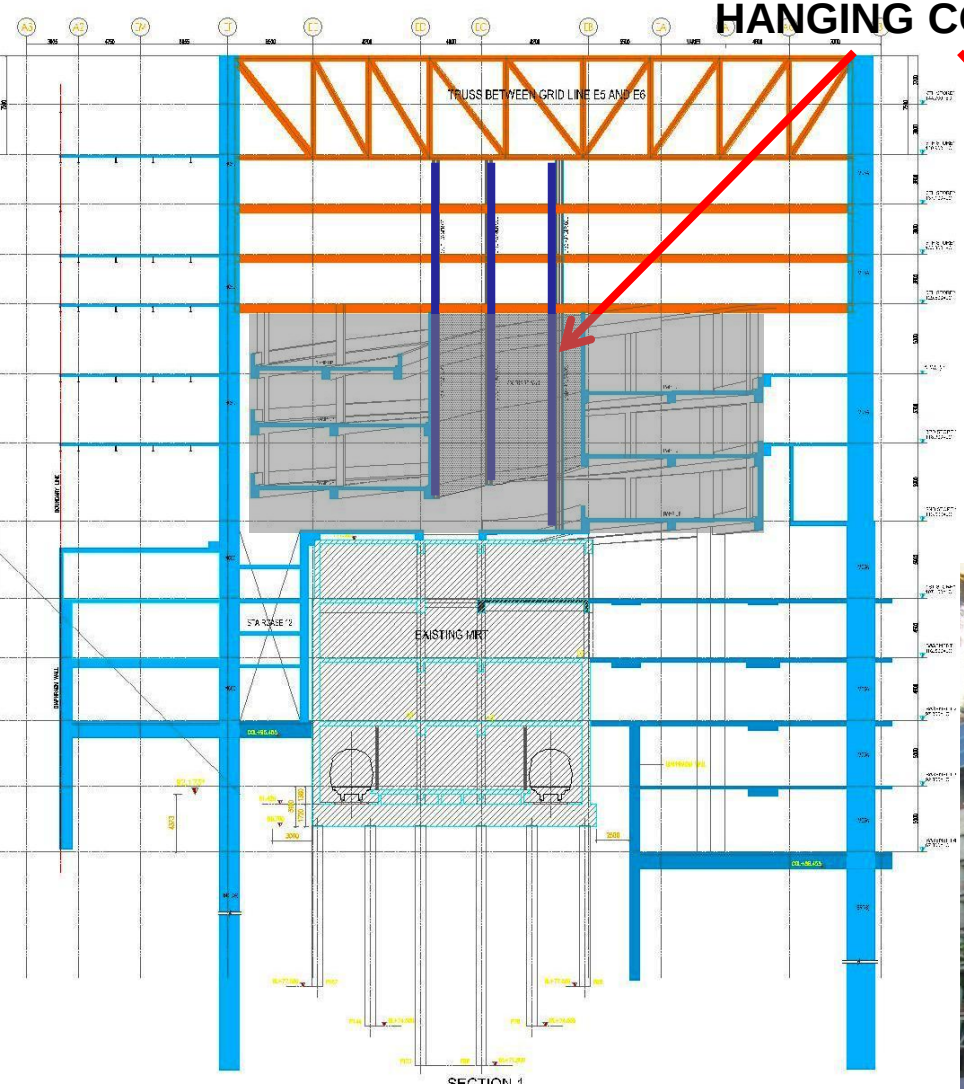
- **Mega Ramp 39m in Diameter to Support Service Vehicle of 15 KN/m2**
- **Ramp Slab 300mm thick**
- **Ramp Beam 250 x 750/900mm Deep to Support the Ramp Slab**
- **Hanger UC 356 mm deep**
- **8.3 m Deep Trusses, span 40m-45m**



Ramp Mega Truss over MRT Station

Mr.PENTA

F. Hanging Mega Ramp



HANGING COLUMNS





HANGING COLUMNS FROM MEGA TRUSS FOR MEGA RAMP CONSTRUCTION

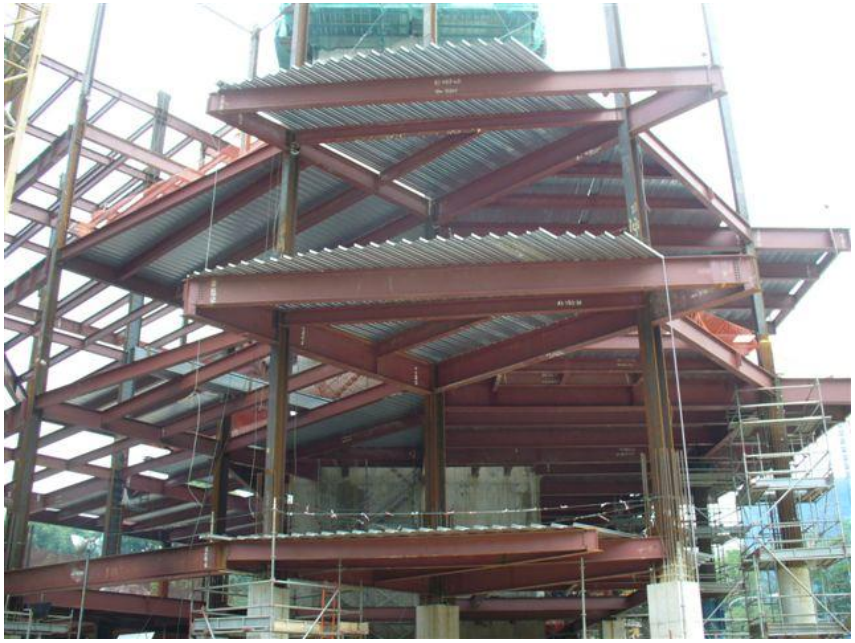
Mr.PENTA

3. Design & Construction Strategies

G. PODIUM STEEL STRUCTURE

G. Podium Steel Structure



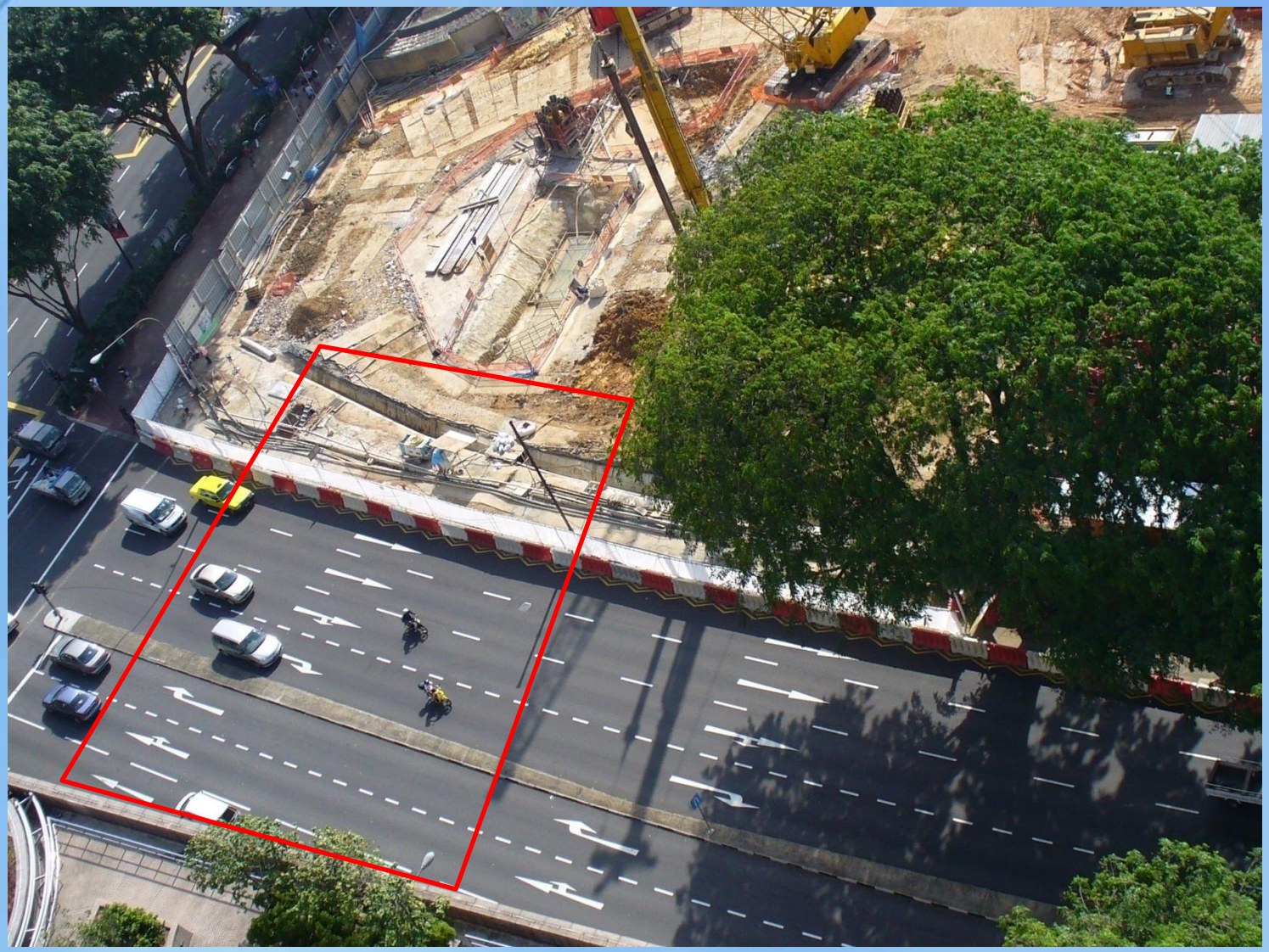




3. Design & Construction Strategies

H. UNDERPASS TO WHEELOCK PLACE

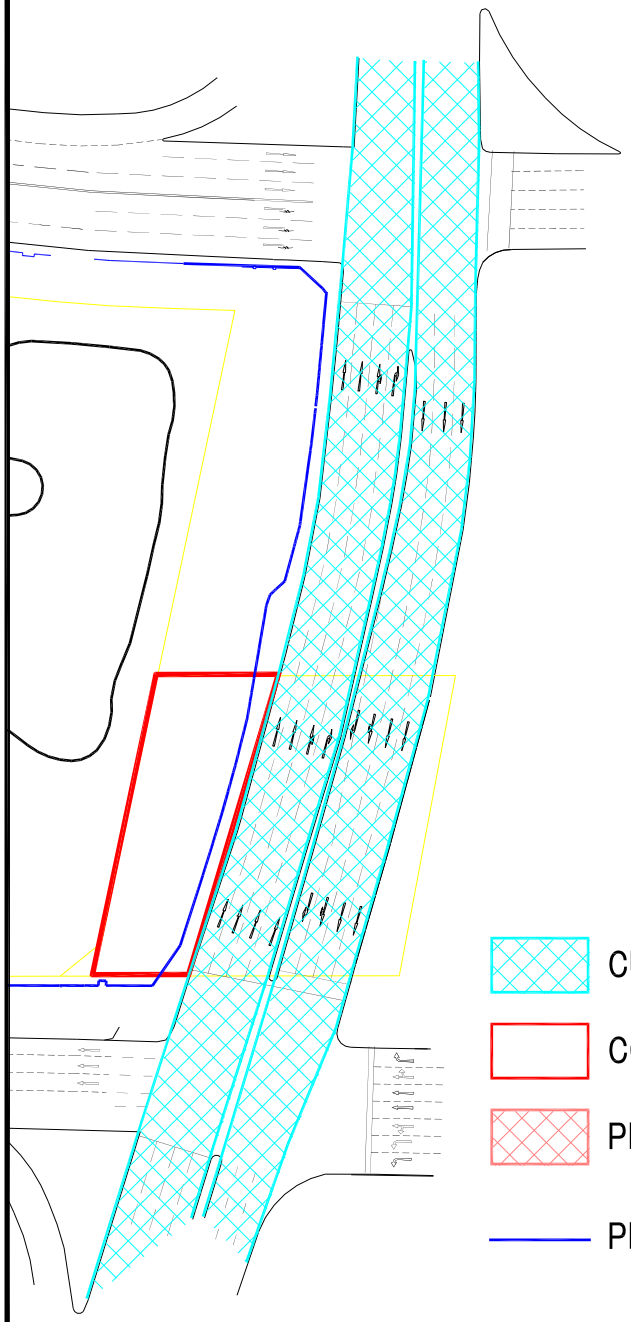
H. Underpass to Wheelock Place



ION ORCHARD

SEQUENCE OF ROAD DIVERSION

Sequence of Road Diversion



Stage-1 Structure works.

Site clearance & Trial holes.
Foundation works.
- Diaphragm wall
- Bored piles

Shoring works (for excavation)
Services diversion & temporary support.
- Drainage
- Sewer line
- Water supply pipe

Excavation works.
RC works.(Basement 1 structure)
Water proof work.
Shoring works.(for road construction)
Back fill & road construction works.

CURRENT ROAD

CONSTRUCTION AREA

PROPOSAL ROAD

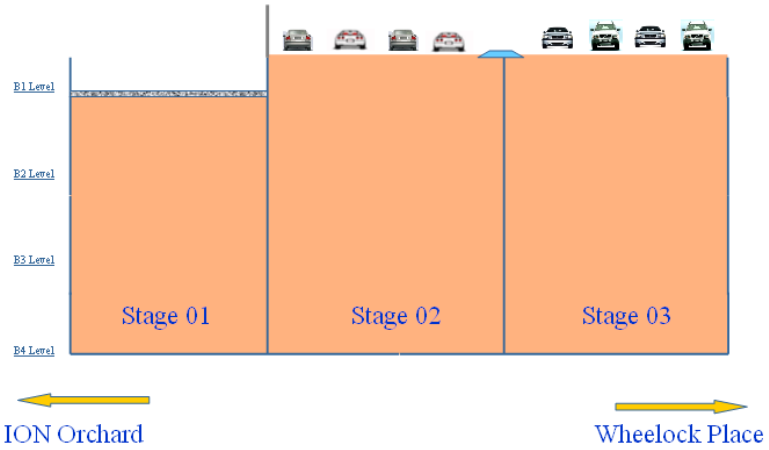
PROJECT HOARDING

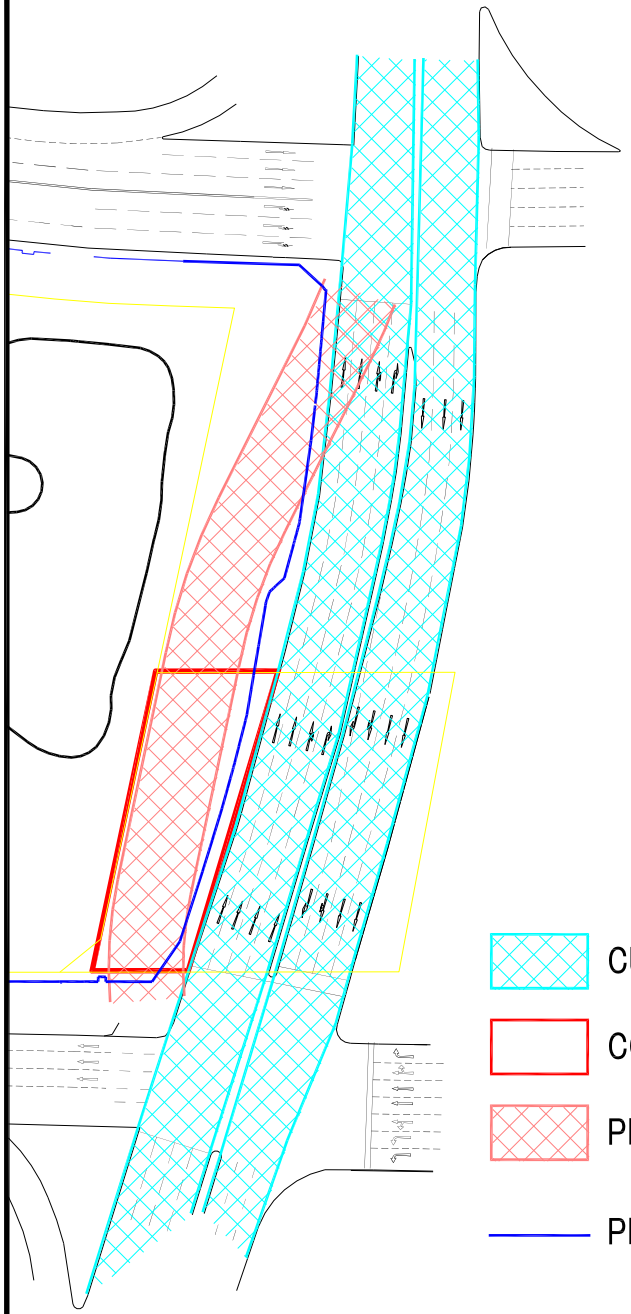
Sequence of Road Diversion

Stage-1 Road diversion work

Construct proposal road.
Project hoarding diversion.

1st Road diversion.





CURRENT ROAD

CONSTRUCTION AREA

PROPOSAL ROAD

PROJECT HOARDING

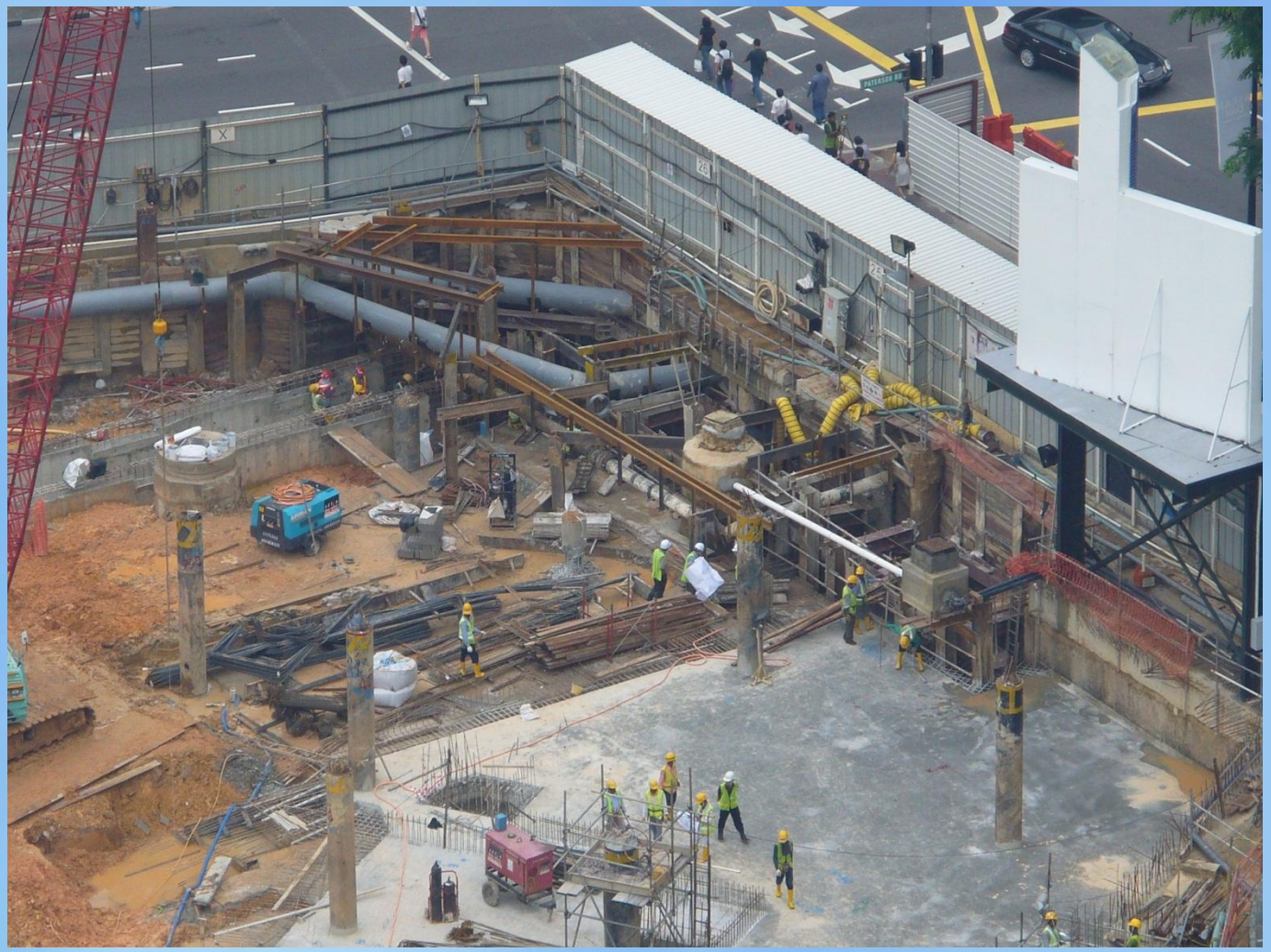
STAGE 1 - OVERVIEW



STAGE 1 – EXCAVATION & RC WORKS



STAGE 1 – UTILITIES SUPPORT WORK



STAGE 1 – RC WORK



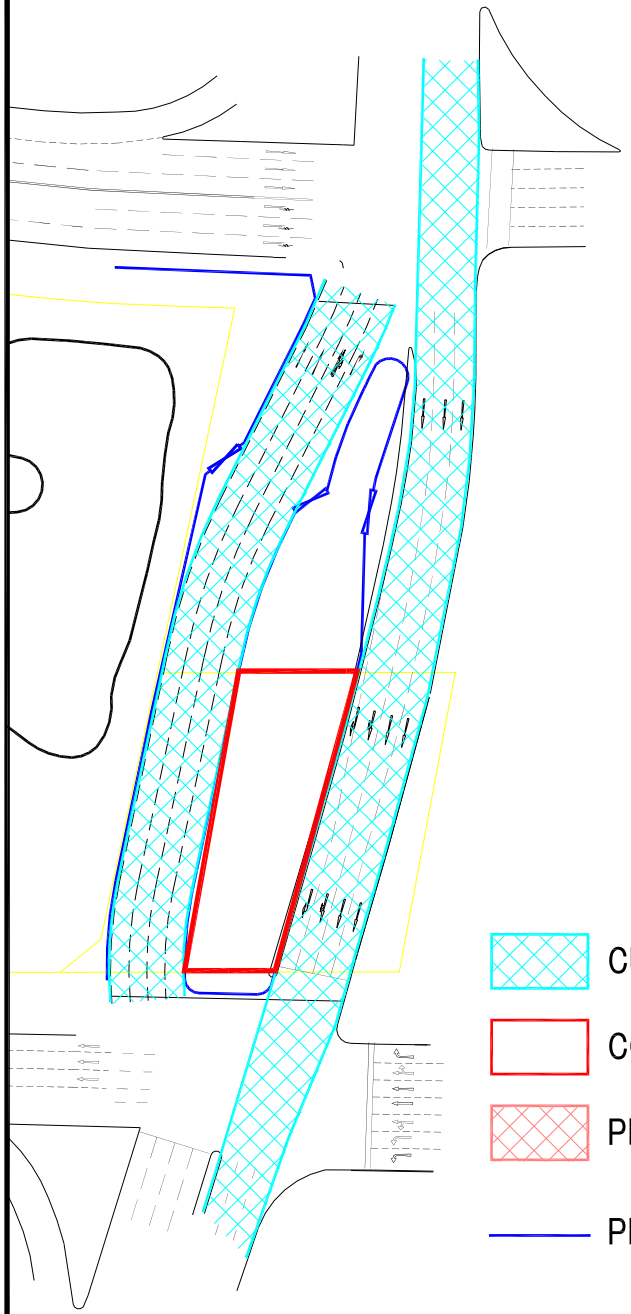
STAGE 1 – DECKING WORK



STAGE 1 – BACKFILL



Sequence of Road Diversion



Stage-2 Structure works.

Site clearance & Trial holes.
Foundation works.
- Diaphragm wall
- Bored piles

Shoring works (for excavation)
Temporary decking work.
Excavation works.
RC works.(Basement 1 structure)
Water proof work.
Shoring works.(for road construction)
Back fill & remove decking works.

CURRENT ROAD

CONSTRUCTION AREA

PROPOSAL ROAD

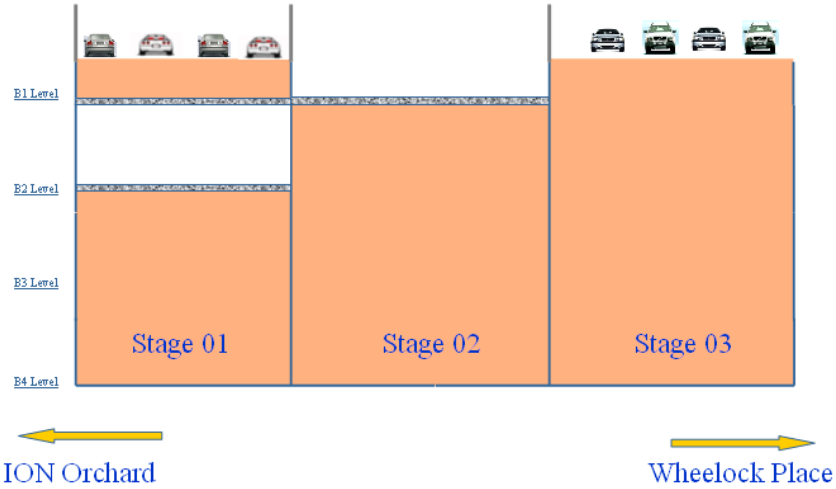
PROJECT HOARDING

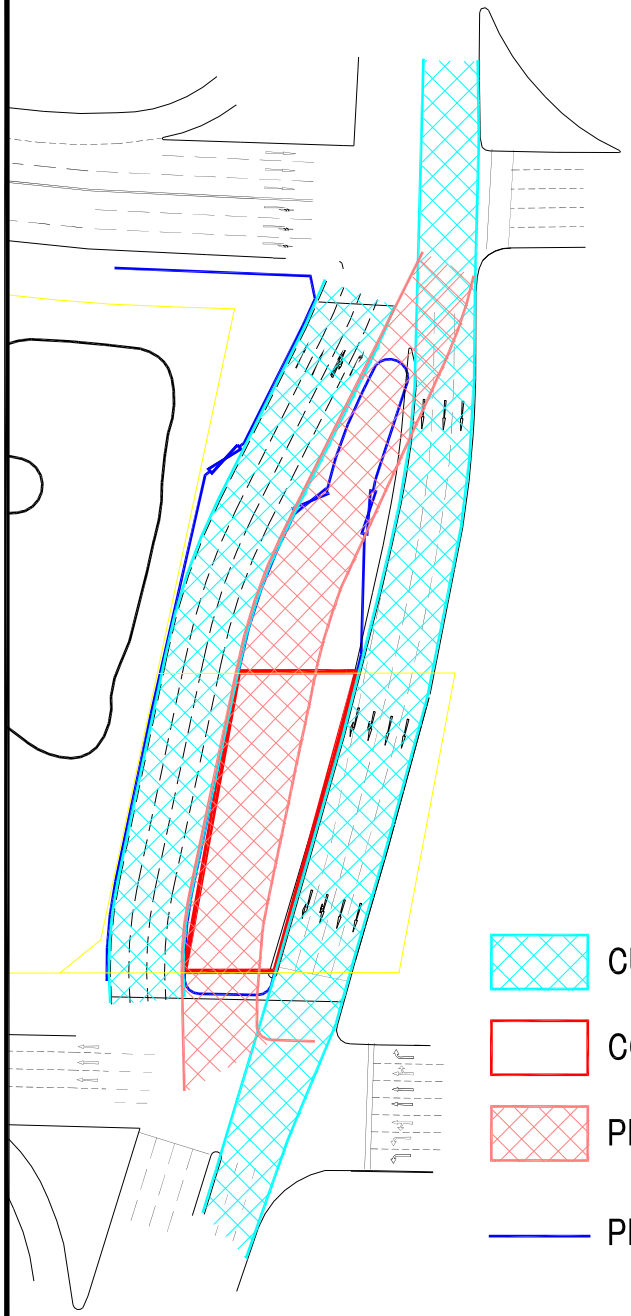
Sequence of Road Diversion

Stage-2 Road diversion work

Construct proposal road.
Project hoarding diversion.

2nd Road diversion.





CURRENT ROAD

CONSTRUCTION AREA

PROPOSAL ROAD

PROJECT HOARDING

STAGE 2 – OVERVIEW



STAGE 2 – PILING



STAGE 2 – DECKING WORKS



STAGE 2 – CONSTRUCT DRAIN & BACKFILL



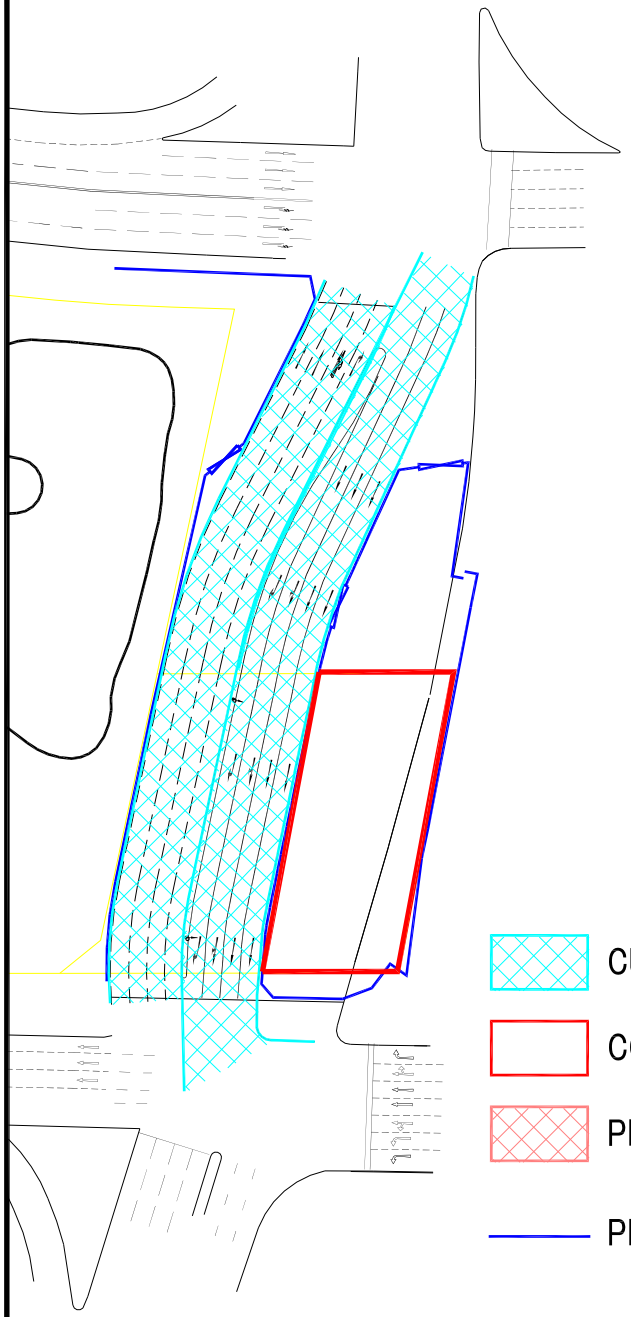
Sequence of Road Diversion

Stage-3 Structure works.

Site clearance & Trial holes.
Services diversion & temporary support.
- Drainage

Foundation works.
- Diaphragm wall
- Bored piles

Shoring works (for excavation)
Temporary decking work.
Excavation works.
Install temporary support for Telecom lines.
RC works.(Basement 1 structure)
Water proof work.
Back fill & remove decking works.



CURRENT ROAD

CONSTRUCTION AREA

PROPOSAL ROAD

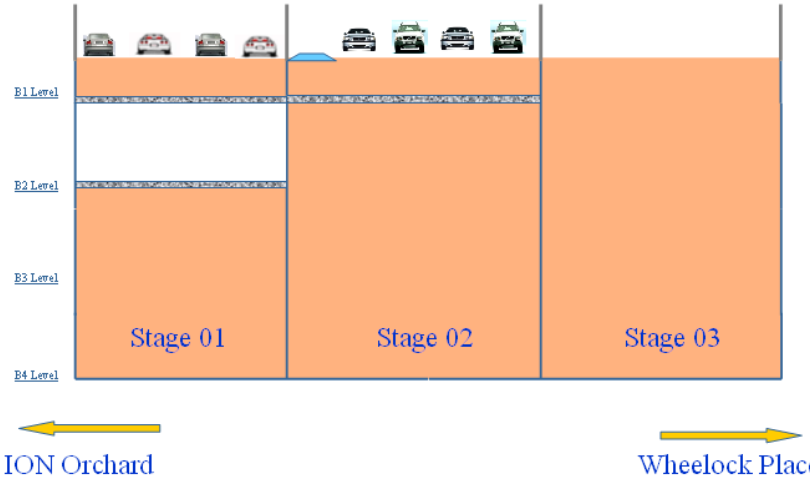
PROJECT HOARDING

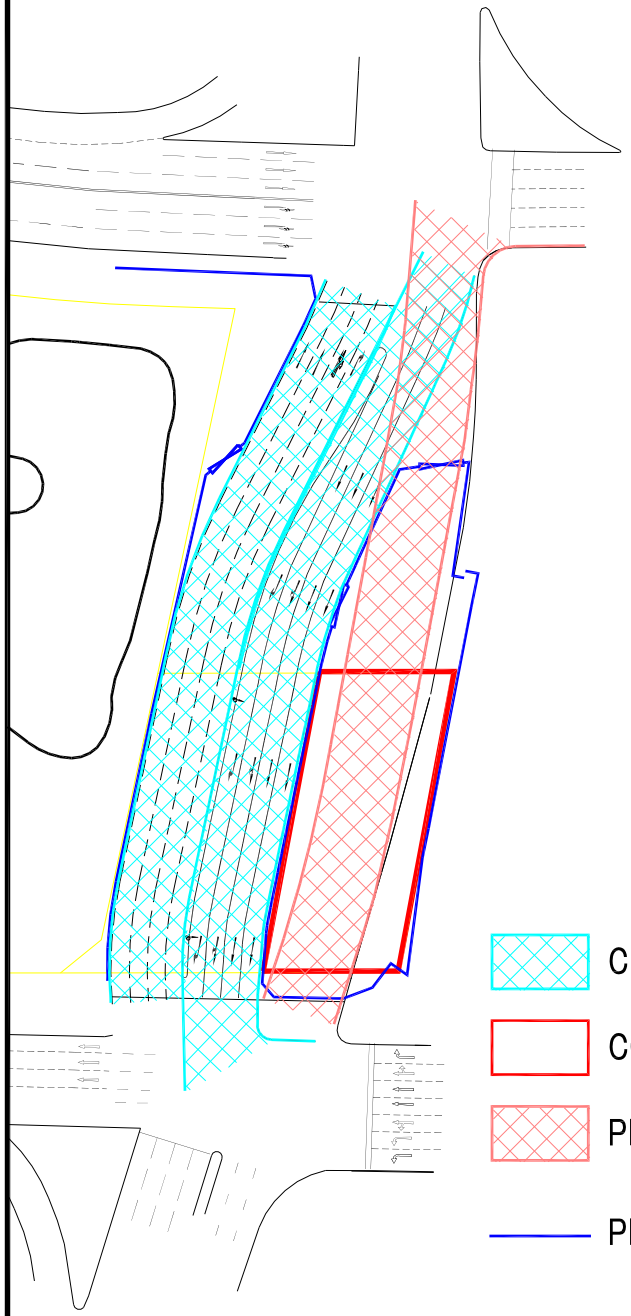
Sequence of Road Diversion

Stage-3 Road diversion work

Construct proposal road.
Project hoarding diversion.

3rd Road diversion.





CURRENT ROAD

CONSTRUCTION AREA

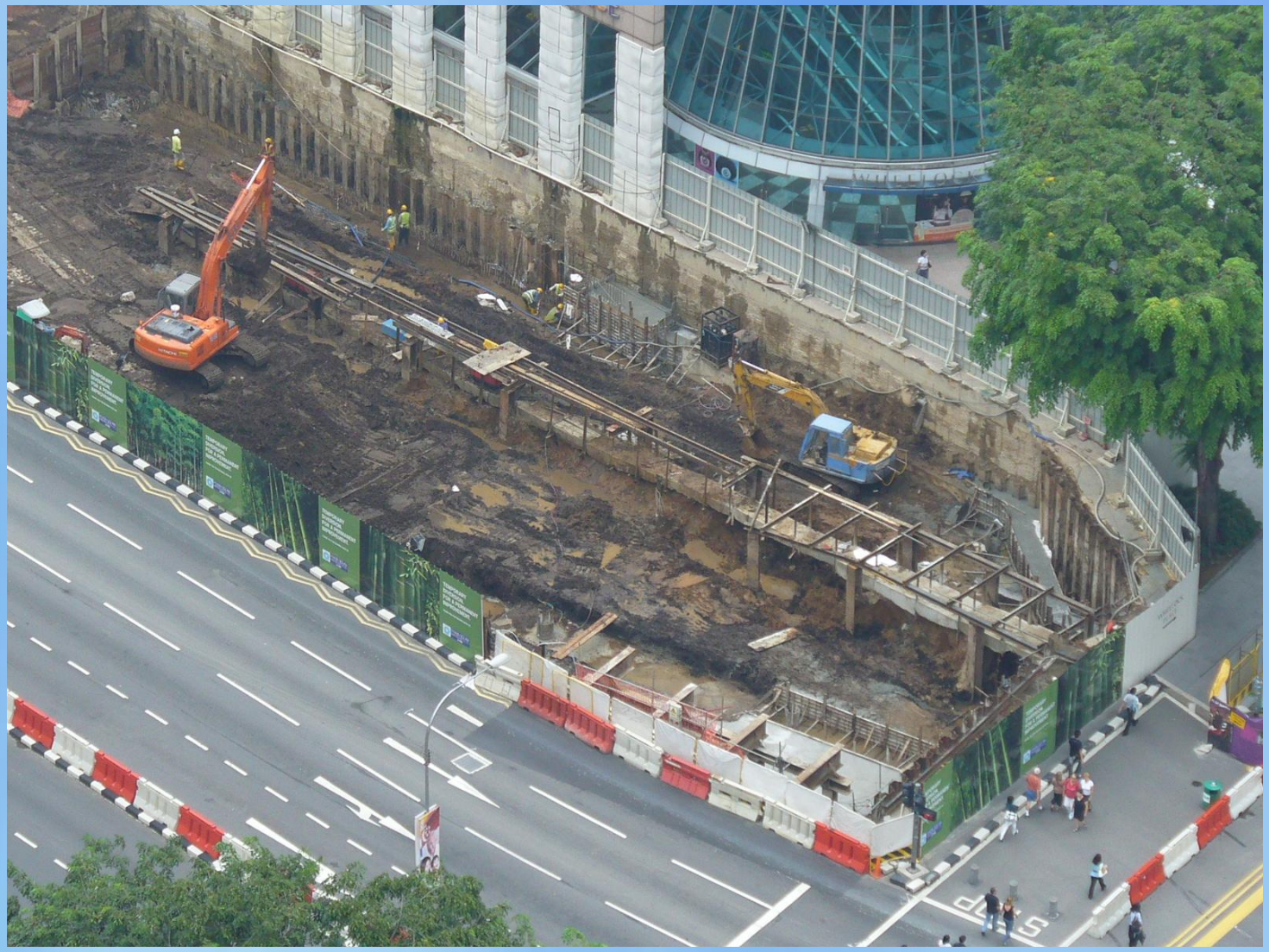
PROPOSAL ROAD

PROJECT HOARDING

STAGE 3 – PILING



STAGE 3 – EXCAVATION & TEL. SUPPORT



STAGE 3 – BACKFILL



STAGE 3 – RC WORKS

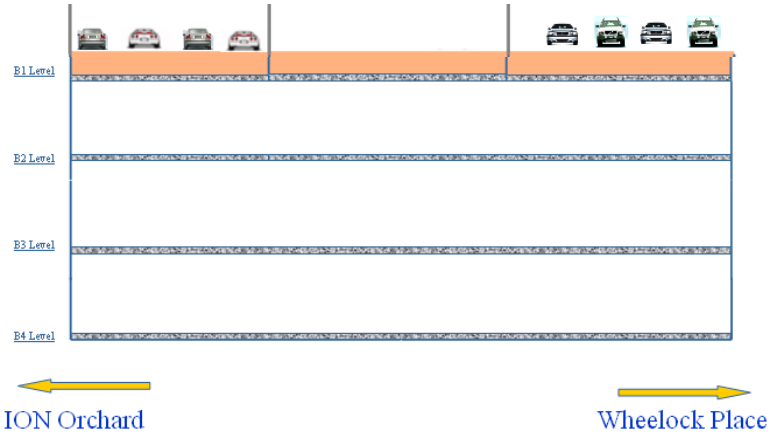


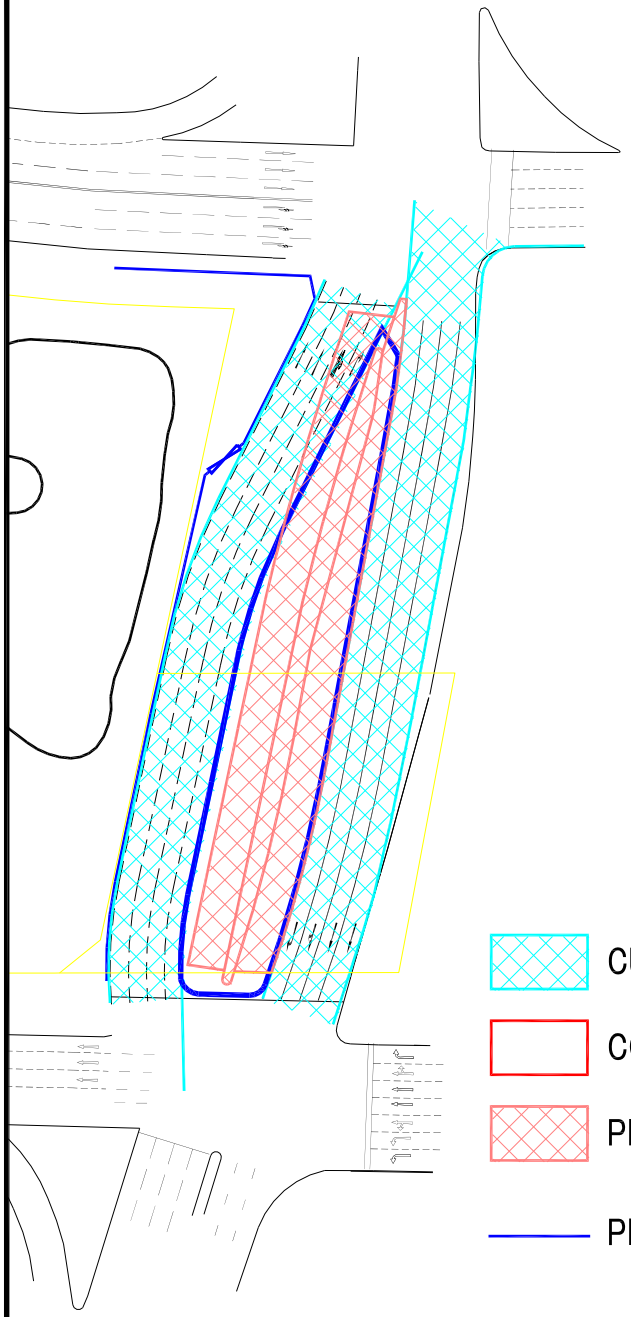
Sequence of Road Diversion

Stage-4 Road diversion work

Construct medial strip.
Construct proposal road.
Project hoarding diversion.

4th Road diversion.





CURRENT ROAD

CONSTRUCTION AREA

PROPOSAL ROAD

PROJECT HOARDING

STAGE 4 – OVERVIEW

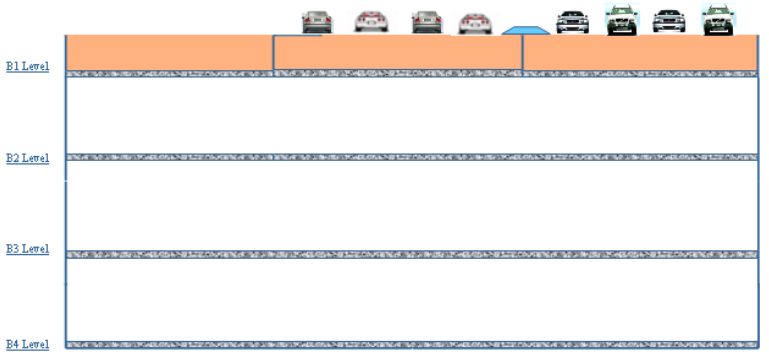


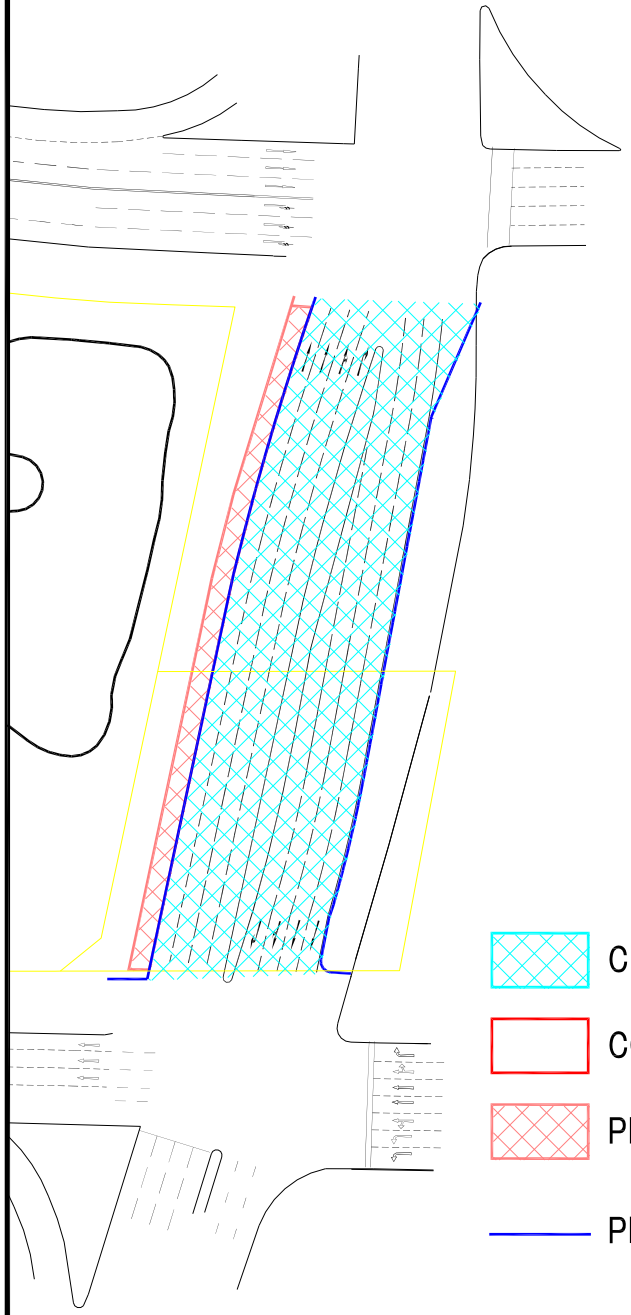
Sequence of Road Diversion

Stage-5 Road diversion work

Construct road edge.
Construct proposal road.
Project hoarding diversion.

5h Road diversion.





CURRENT ROAD

CONSTRUCTION AREA

PROPOSAL ROAD

PROJECT HOARDING

STAGE 5 – OVERVIEW

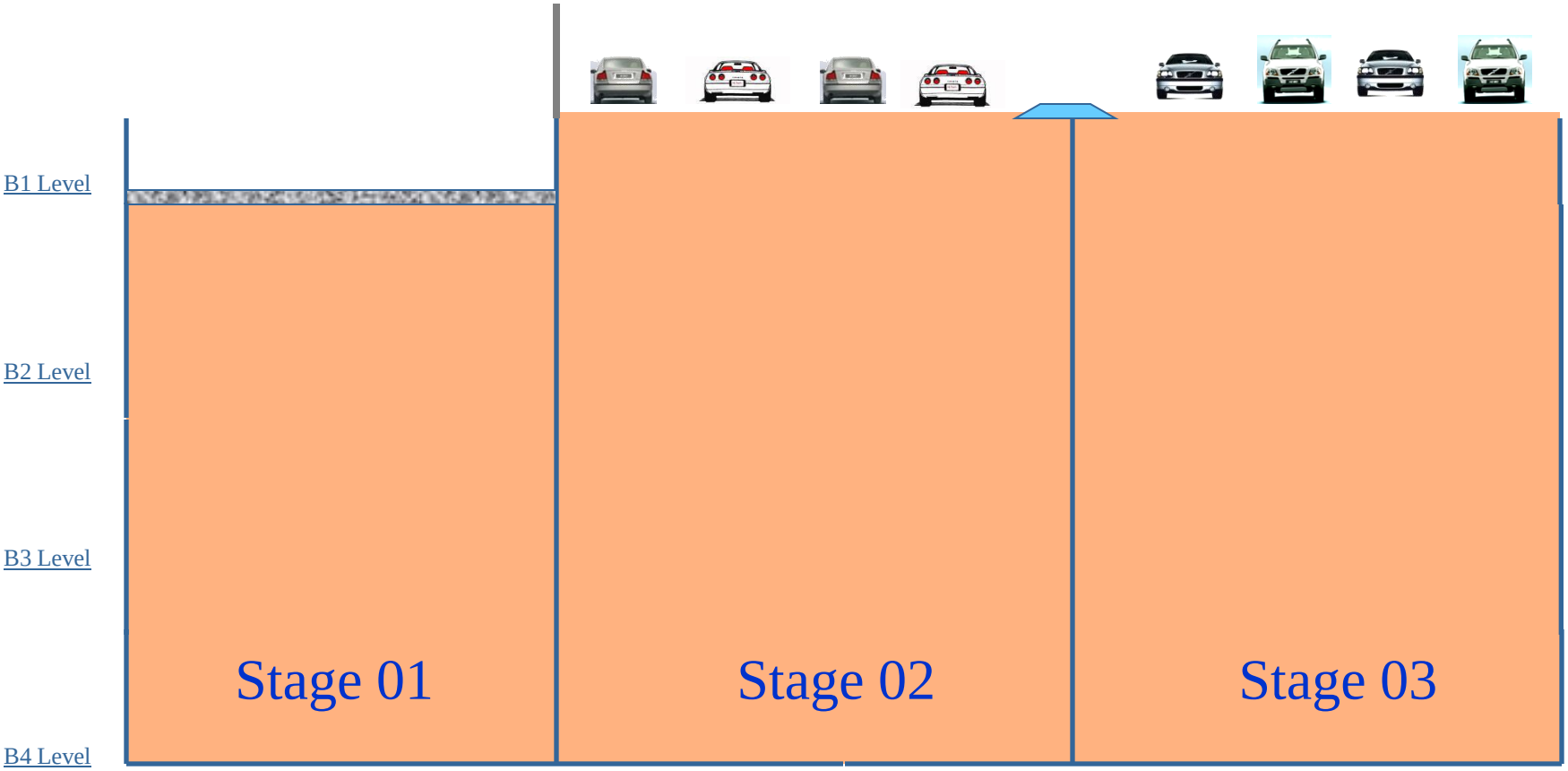


ION ORCHARD

SECTION VIEW SHOWING CONSTRUCTION SEQUENCE

UNDERPASS CONSTRUCTION SEQUENCE

Construct Underpass Roof Slab at Stage 01

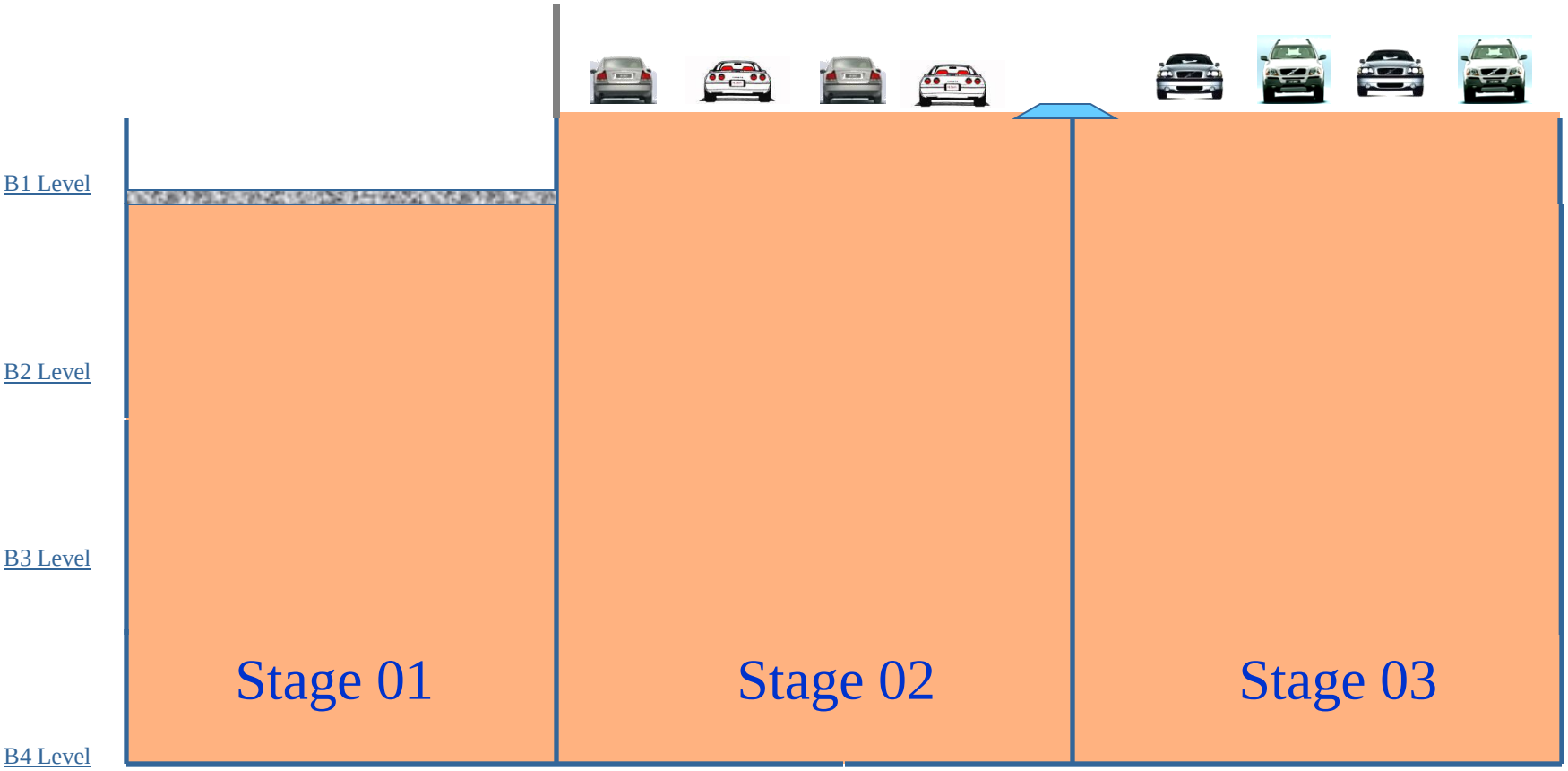


ION Orchard

Wheelock Place

UNDERPASS CONSTRUCTION SEQUENCE

Backfill and Construct Road for 1st Diversion

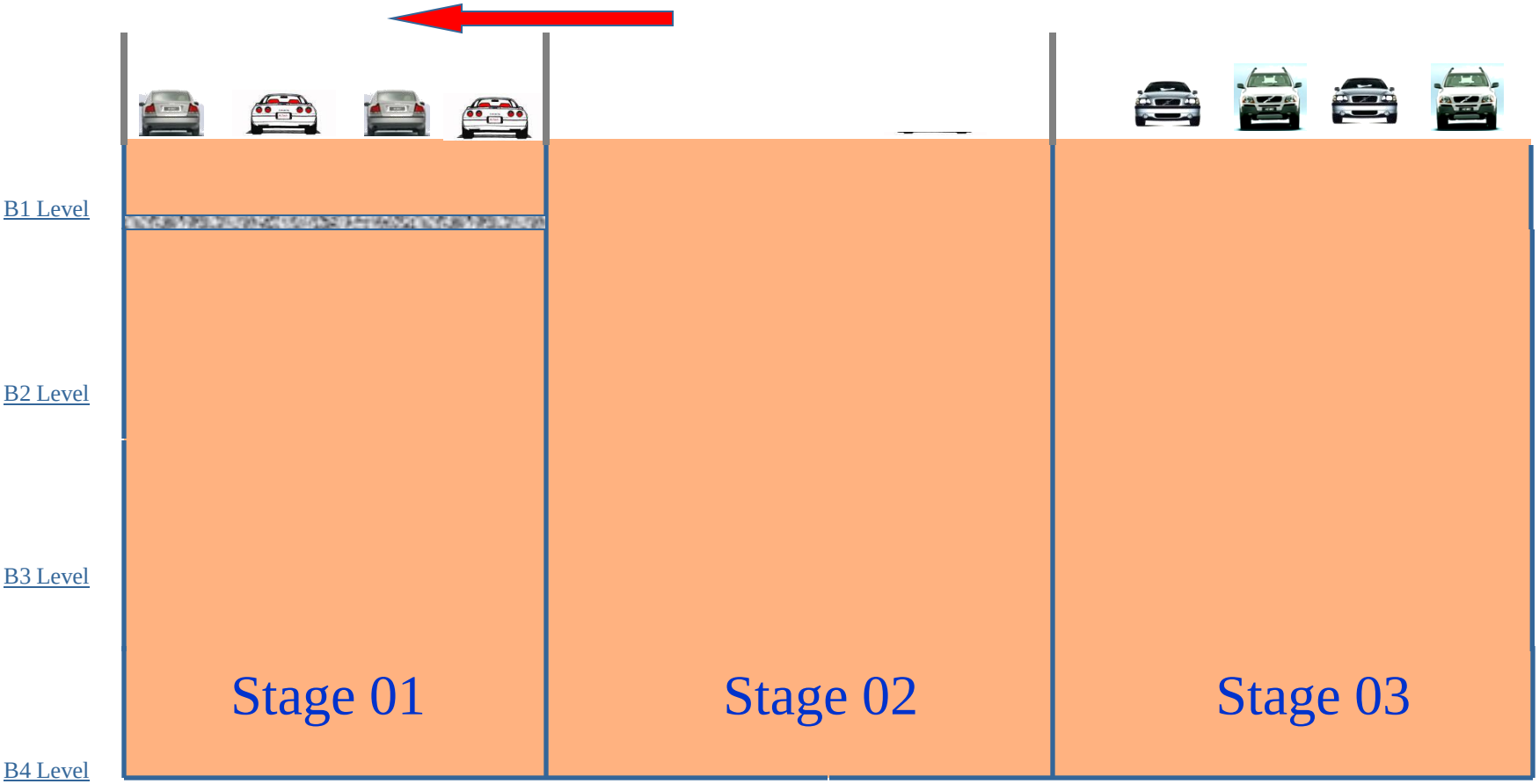


ION Orchard

Wheelock Place

UNDERPASS CONSTRUCTION SEQUENCE

1st Road Diversion

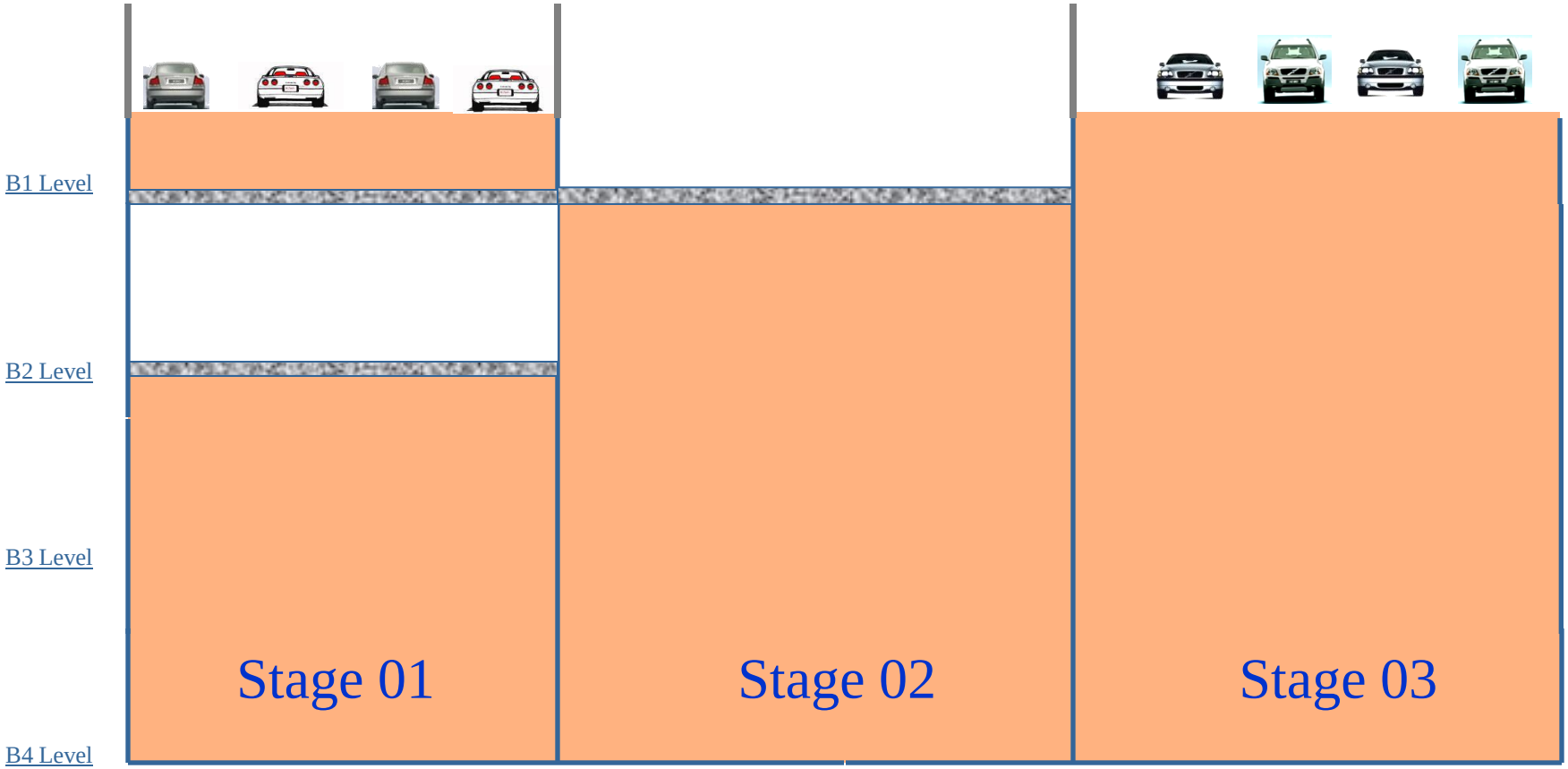


ION Orchard

Wheelock Place

UNDERPASS CONSTRUCTION SEQUENCE

Construct Underpass Roof Slab at Stage 02 & Commence B2 Construction

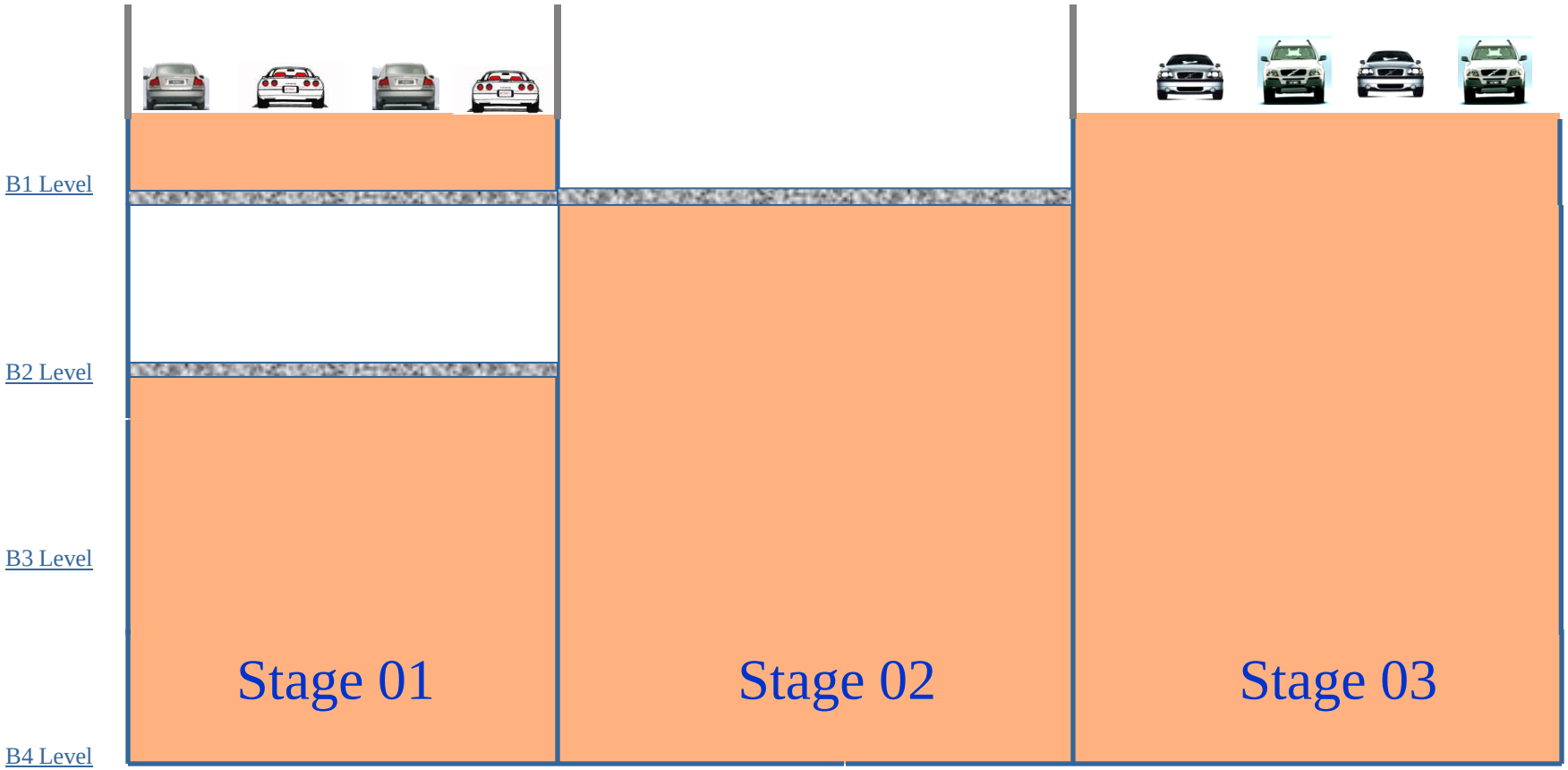


ION Orchard

Wheelock Place

UNDERPASS CONSTRUCTION SEQUENCE

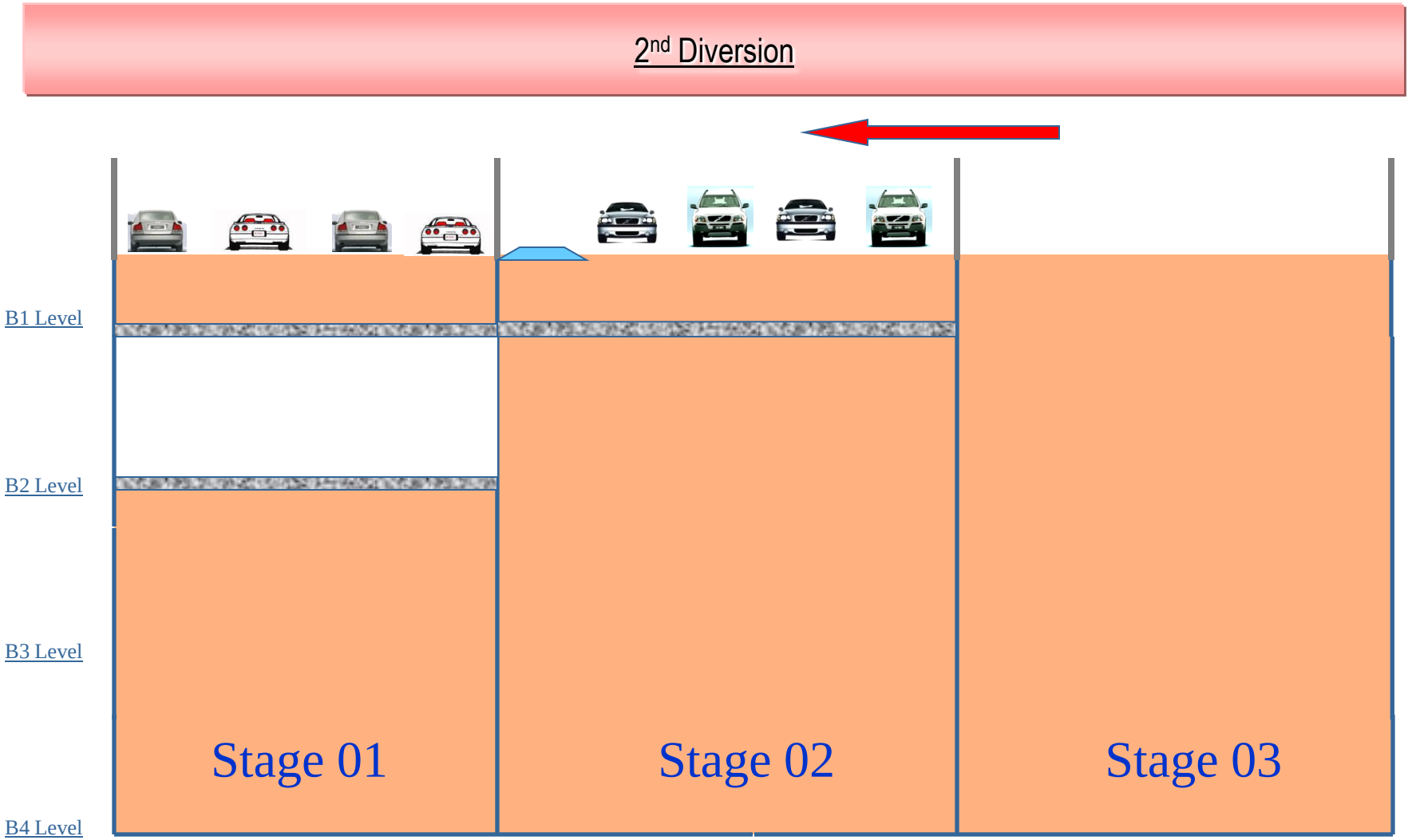
Backfill & Make Good Road for 2nd Diversion



ION Orchard

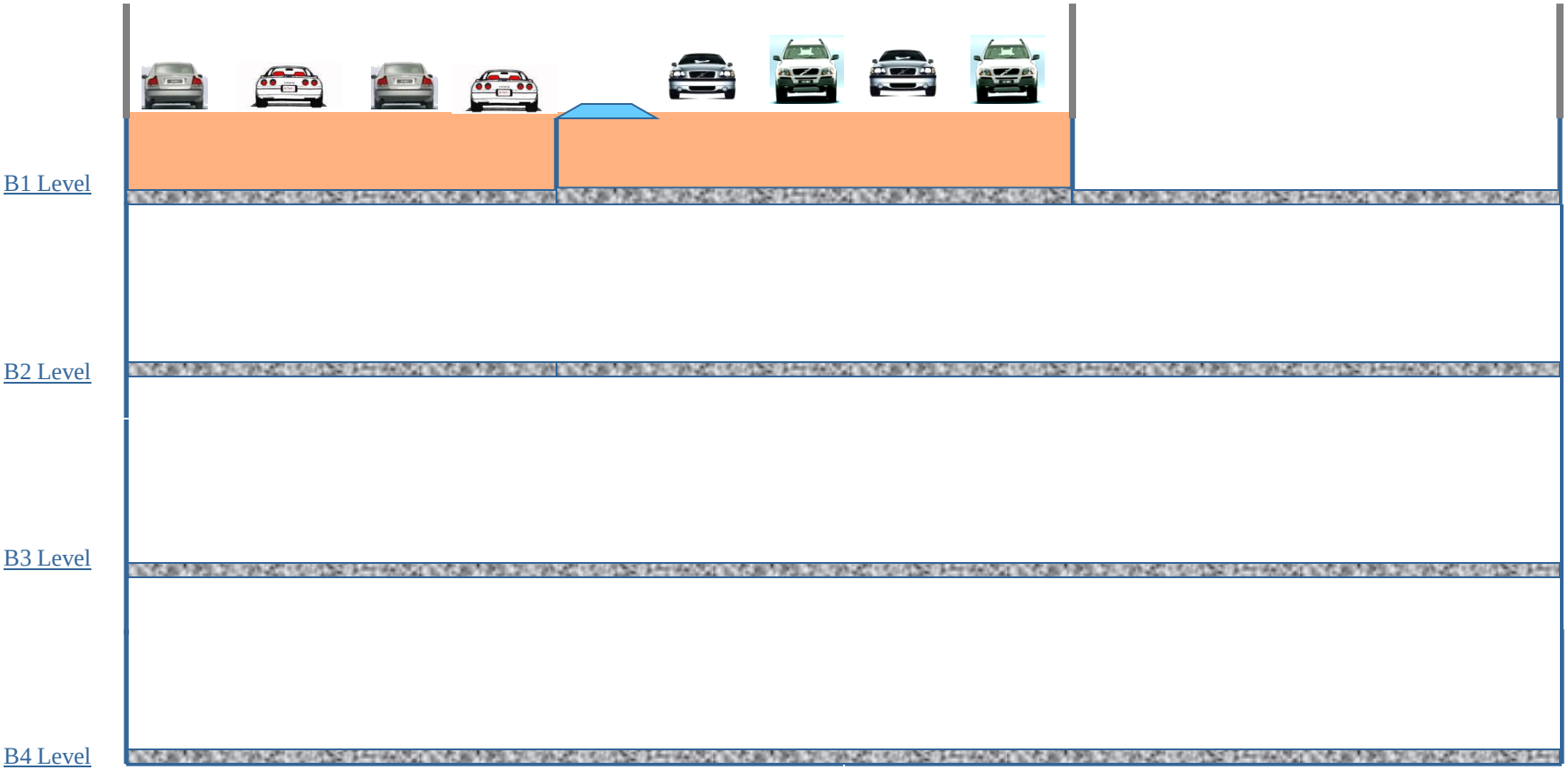
Wheelock Place

UNDERPASS CONSTRUCTION SEQUENCE



UNDERPASS CONSTRUCTION SEQUENCE

Construct Balanced Underpass Roof Slab and Continue Basement Construction



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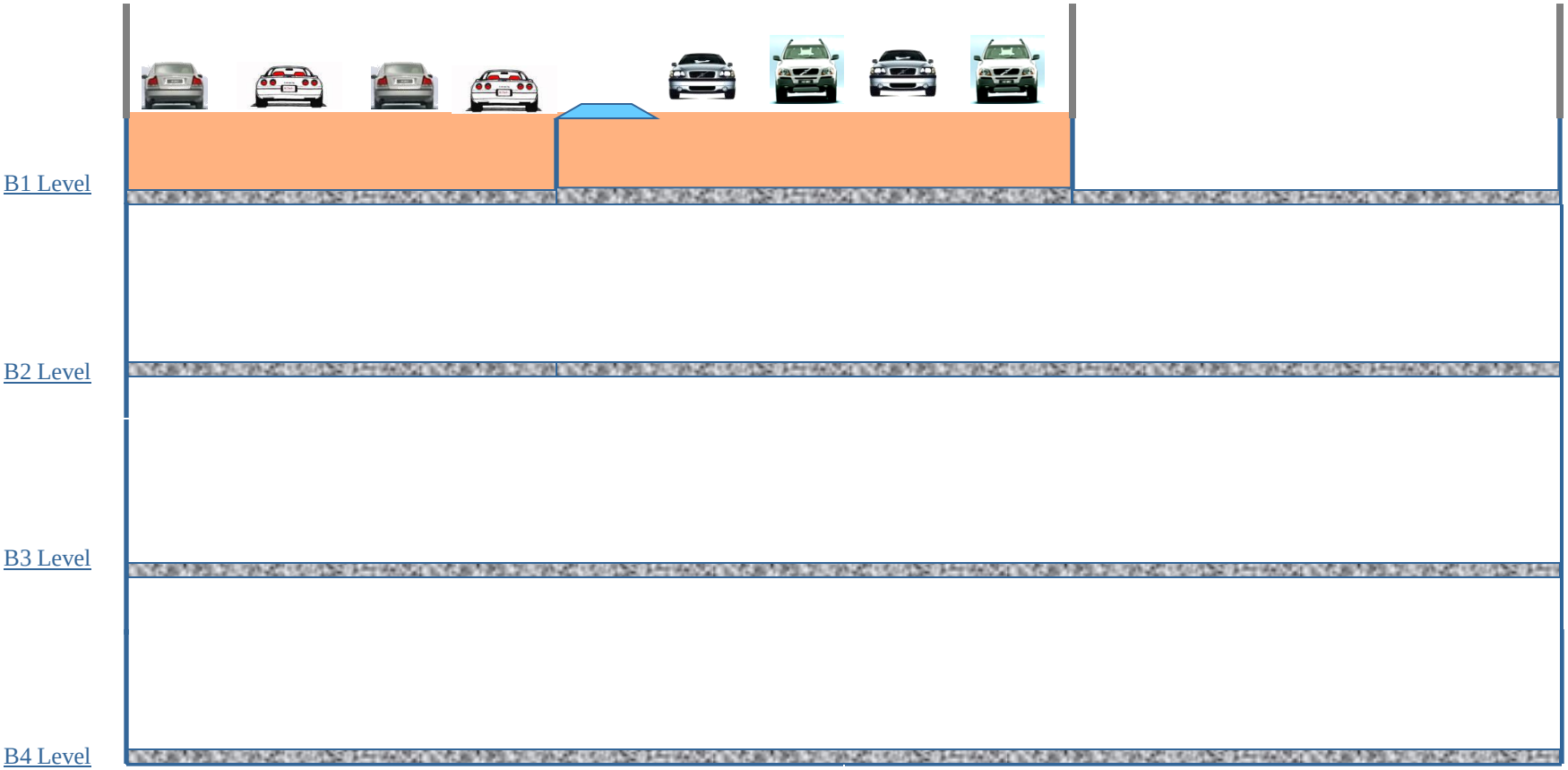
Wheelock Place

UNDERPASS CONSTRUCTION SEQUENCE

Backfill & Make Good Road



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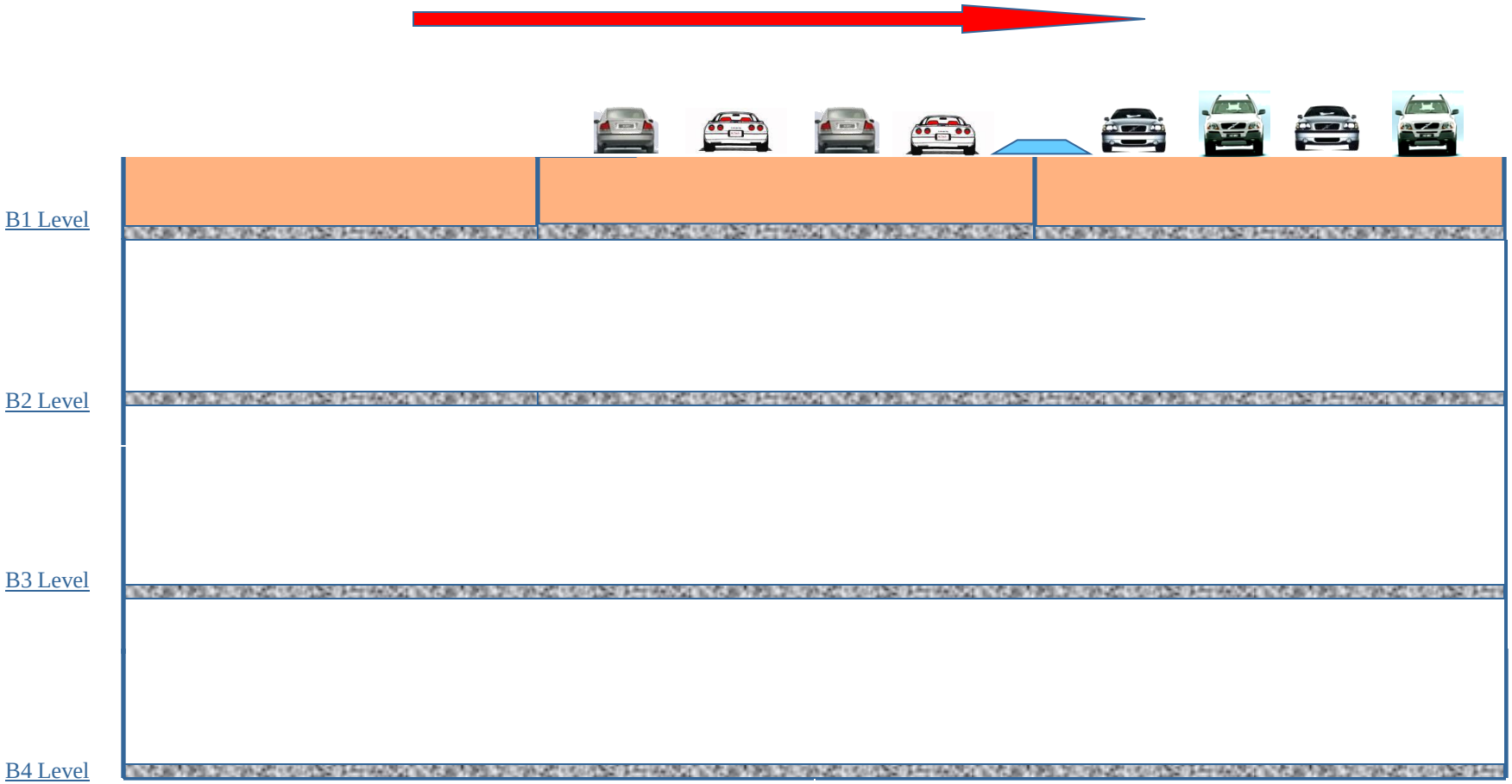
Wheelock Place

UNDERPASS CONSTRUCTION SEQUENCE

3rd Road Diversion for Centre Median Works before Finally Reverting Traffic back to Original



ION Orchard

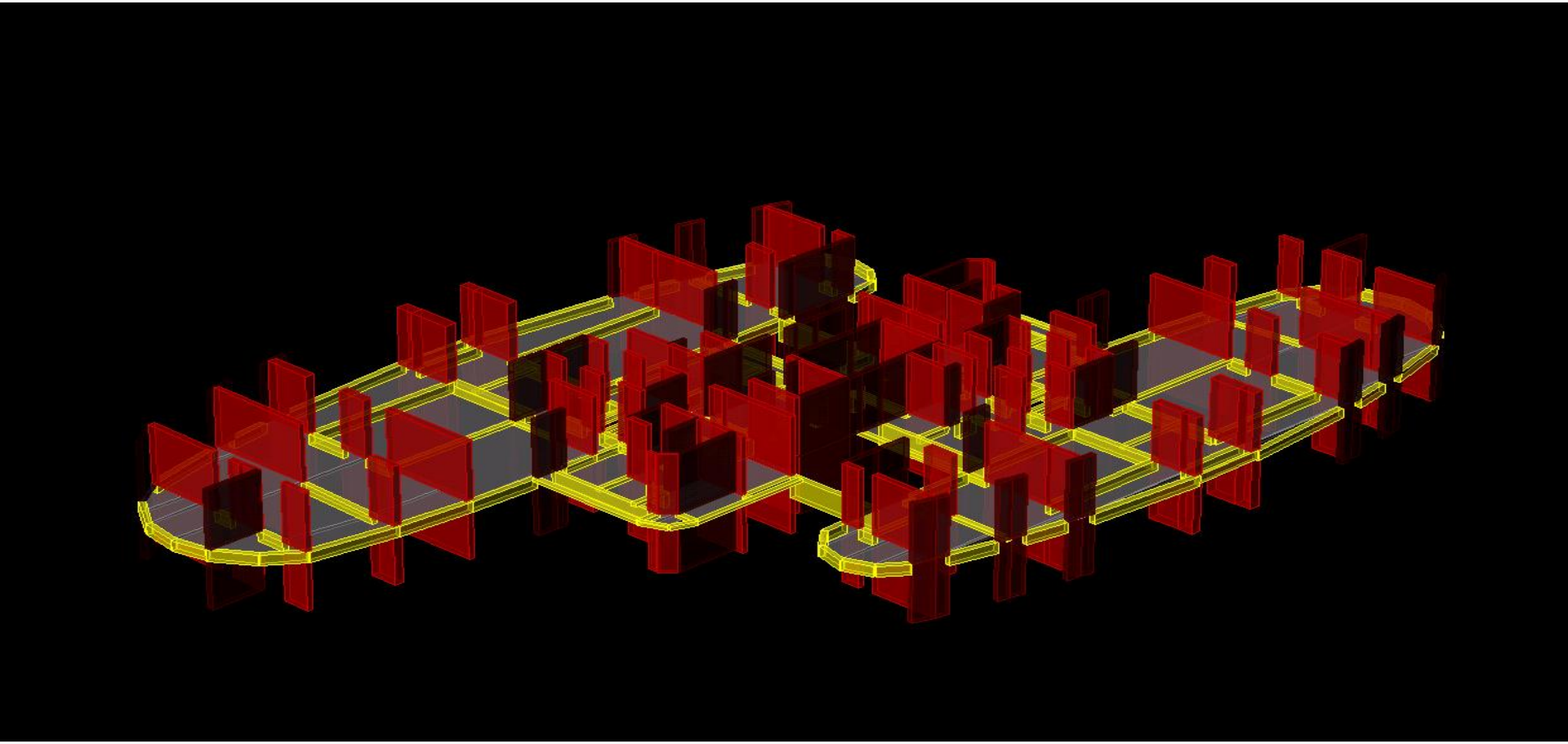
Wheelock Place

3. Design & Construction Strategies

J. PRECAST ELEMENTS FOR TOWER BLOCK

J. Precast Elements for Tower Block

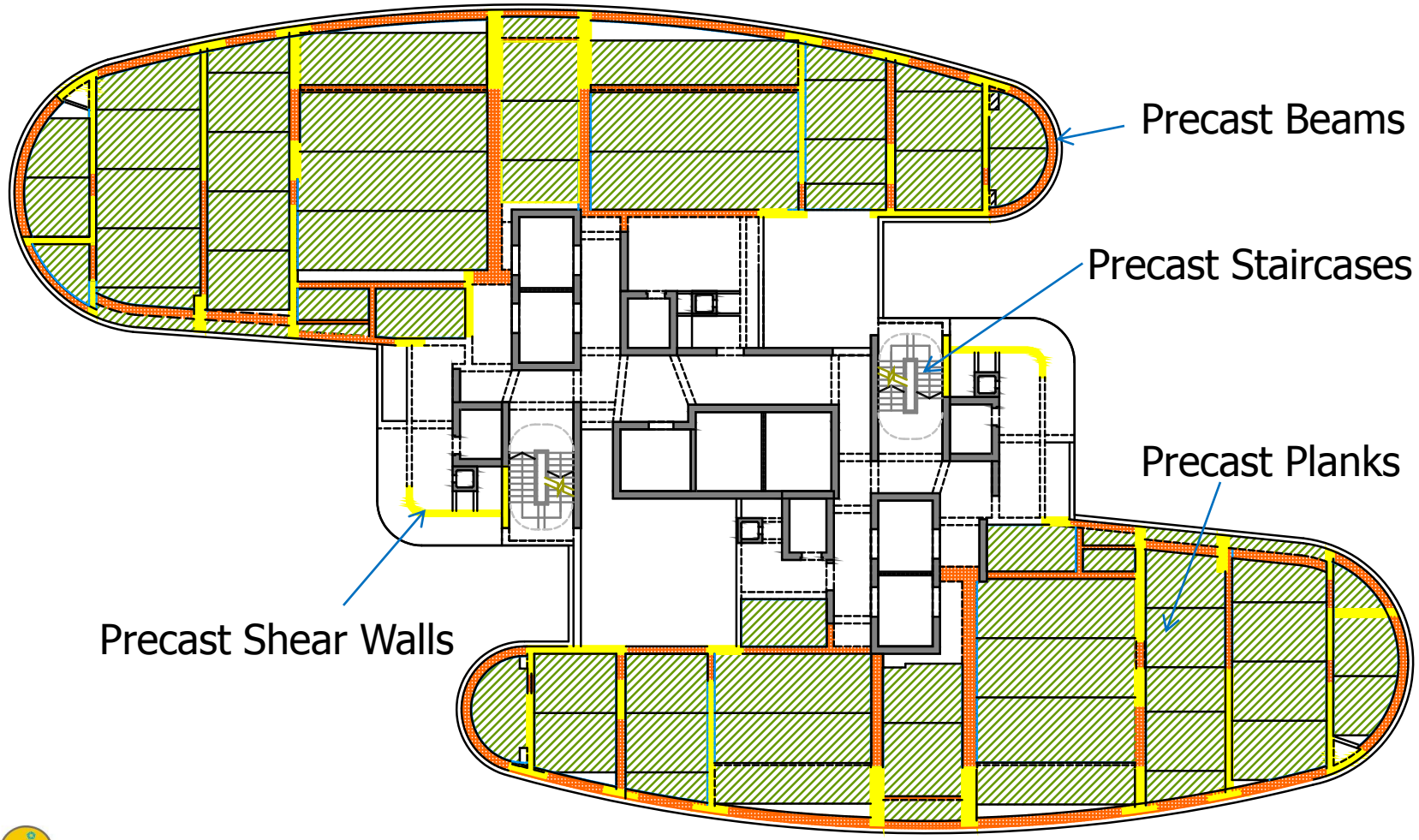
RESIDENTIAL TOWER



TYPICAL FLOOR MODEL (LEVEL 9 & ABOVE)

J. Precast Elements for Tower Block

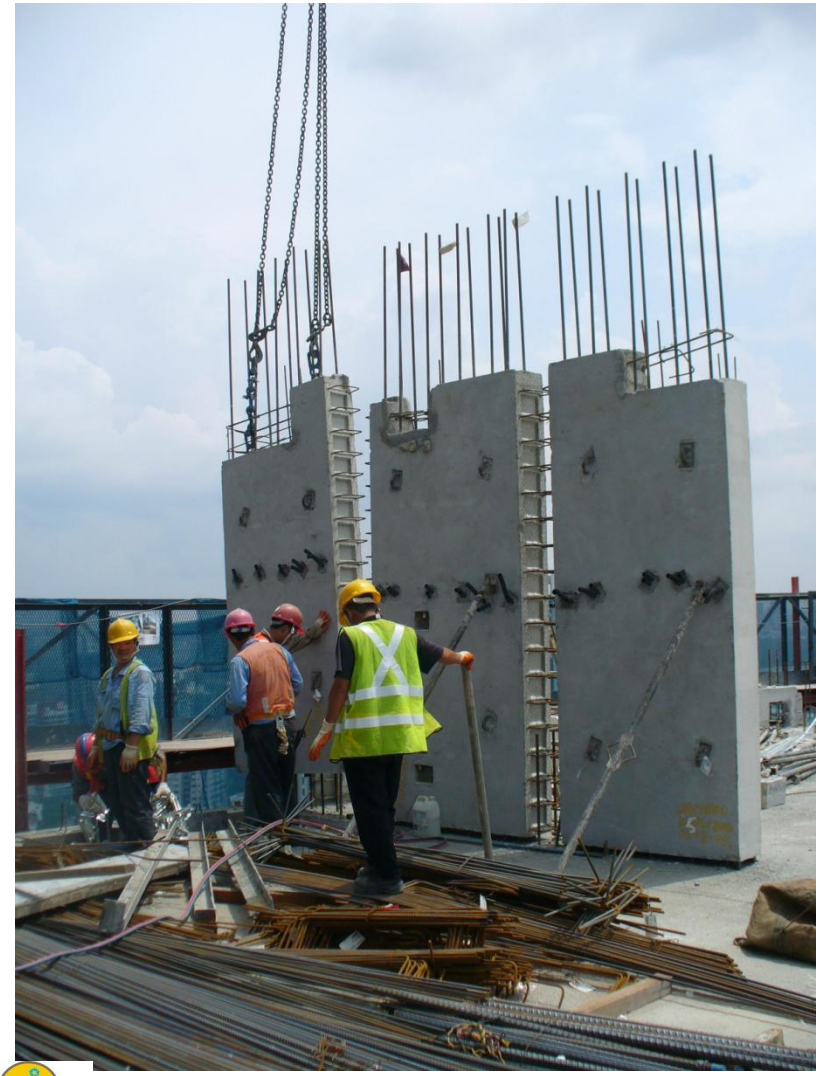
Cycle time per floor : 5-days to 7-days



TYPICAL FLOOR PRECAST LAYOUT PLAN (LEVEL 9 & ABOVE)

Mr.PENTA

J. Precast Elements for Tower Block





Precast Shear Wall Installation In Progress

J. Precast Elements for Tower Block





Mr.PENTA

Precast Shear Walls and Precast Beams

J. Precast Elements for Tower Block





Precast Plank Installation

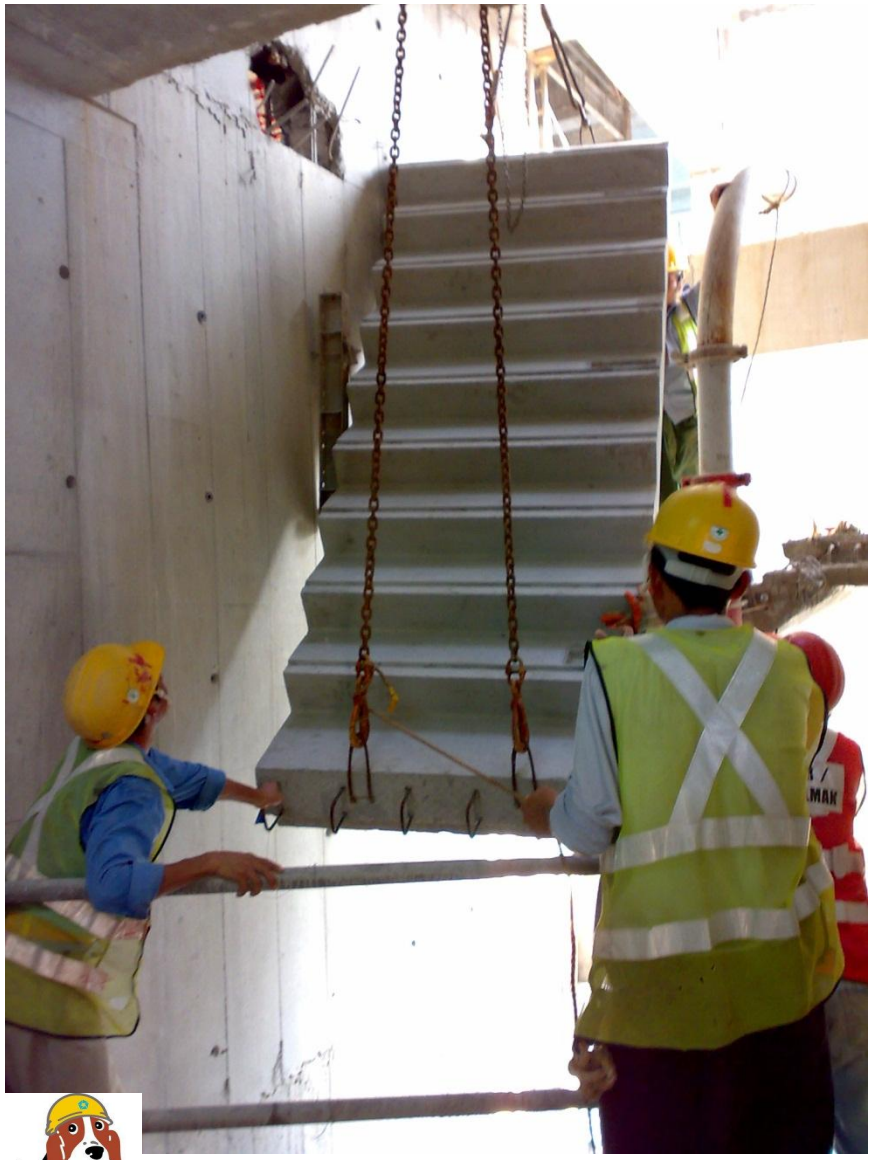
J. Precast Elements for Tower Block



Topping concrete on Precast Planks

Mr.PENTA

J. Precast Elements for Tower Block





Precast Staircase

J. Precast Elements for Tower Block

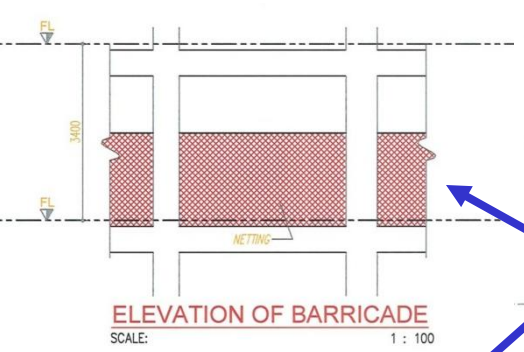


Overall View of Precast Installation

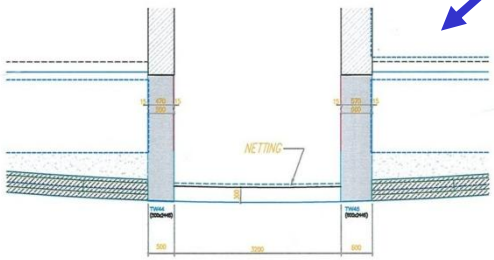
3. Design & Construction Strategies

K. HIGH RISE TOWER SAFETY PROVISIONS

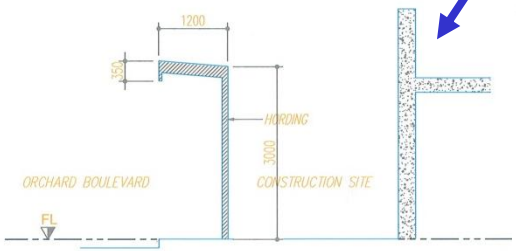
K. High Rise Tower Safety Provisions



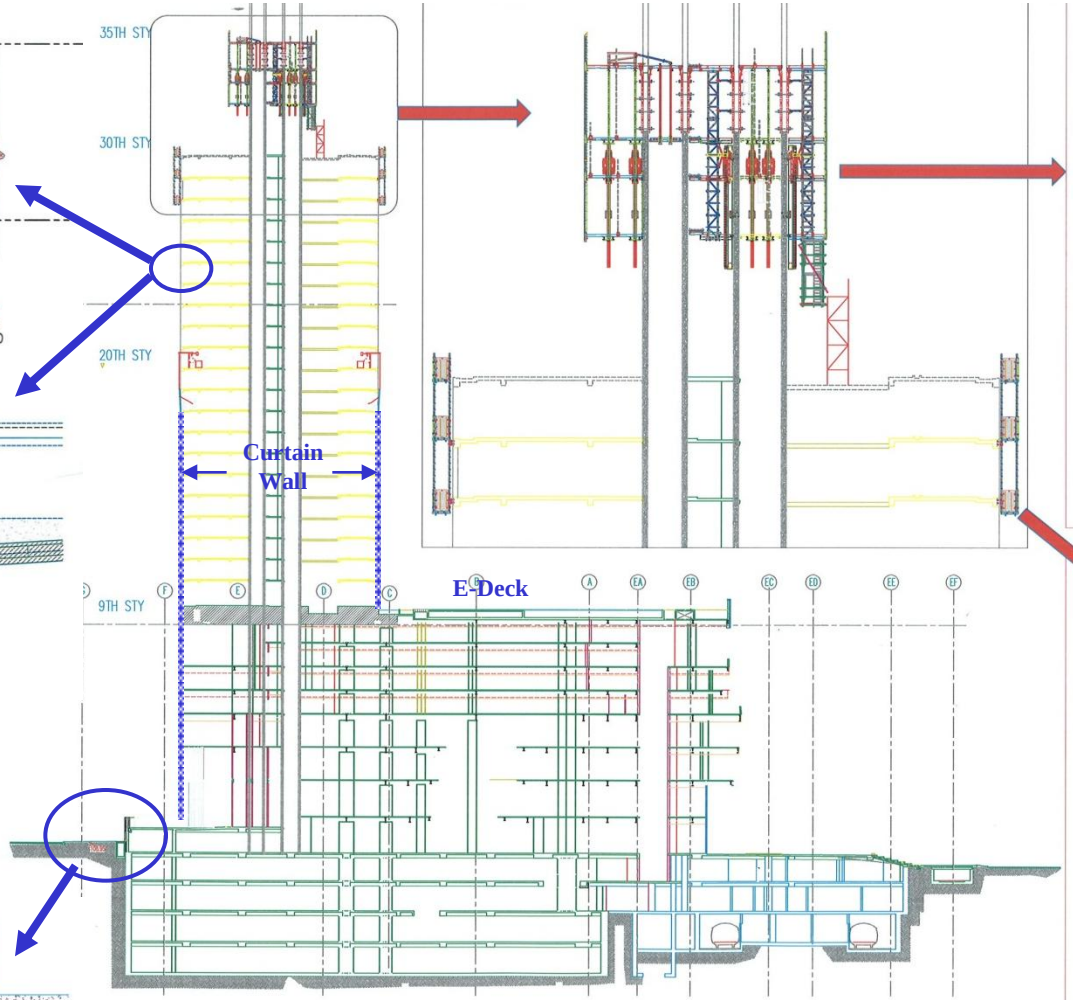
ELEVATION OF BARRICADE
SCALE: 1 : 100

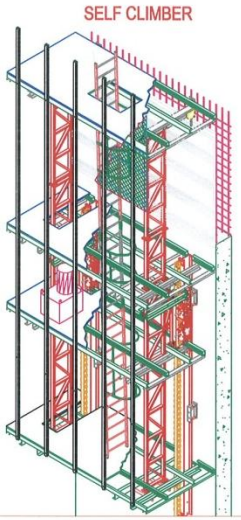


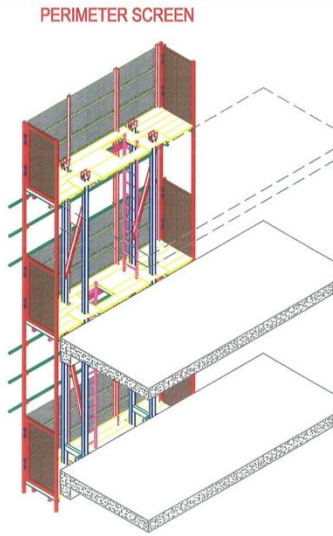
PLAN OF BARRICADE
SCALE: 1 : 100



COVERED WALKWAY
SCALE: 1 : 100



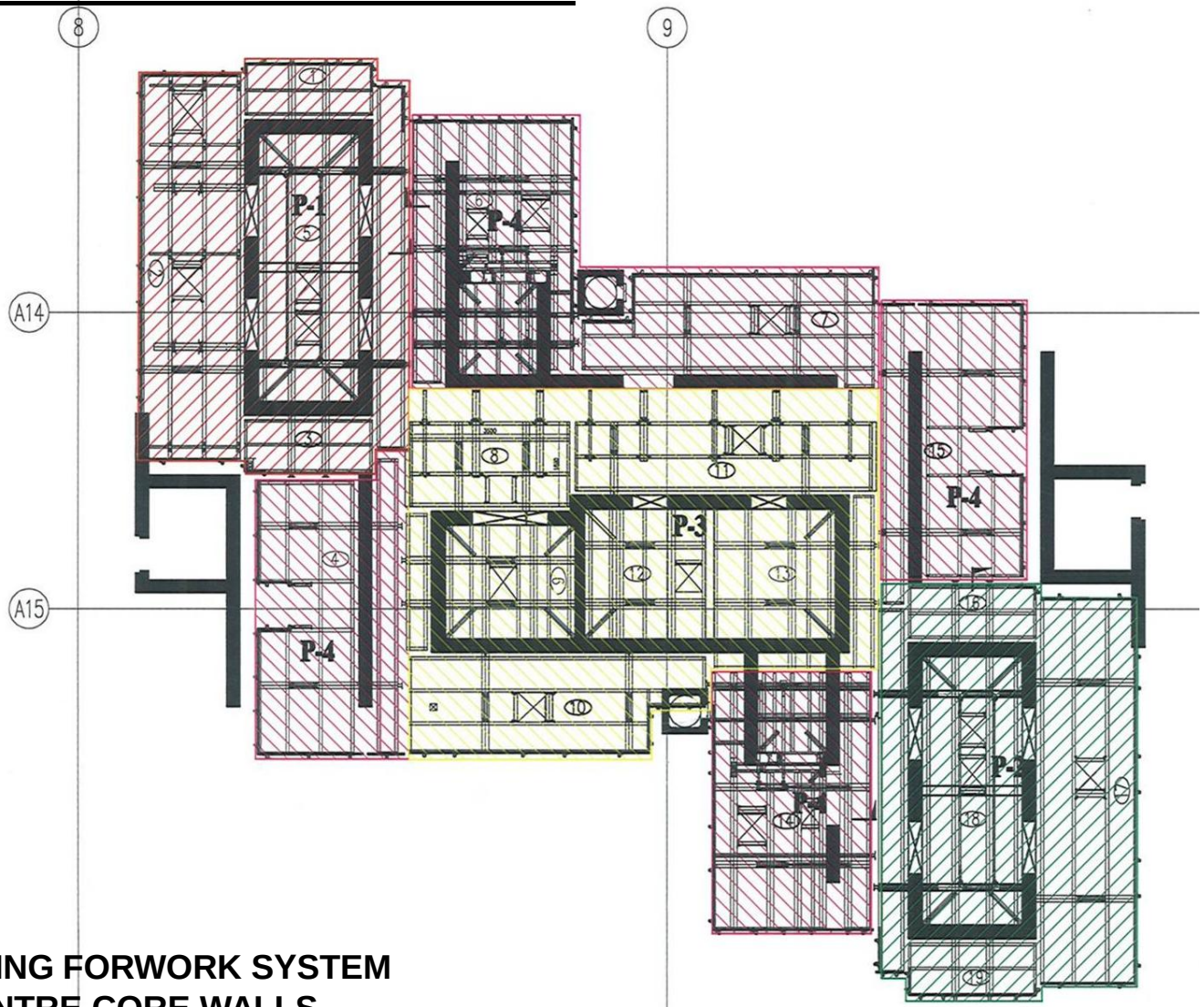




Mr.PENTA

K. High Rise Tower Safety Provisions

SELF-CLIMBING FORMWORK SYSTEM

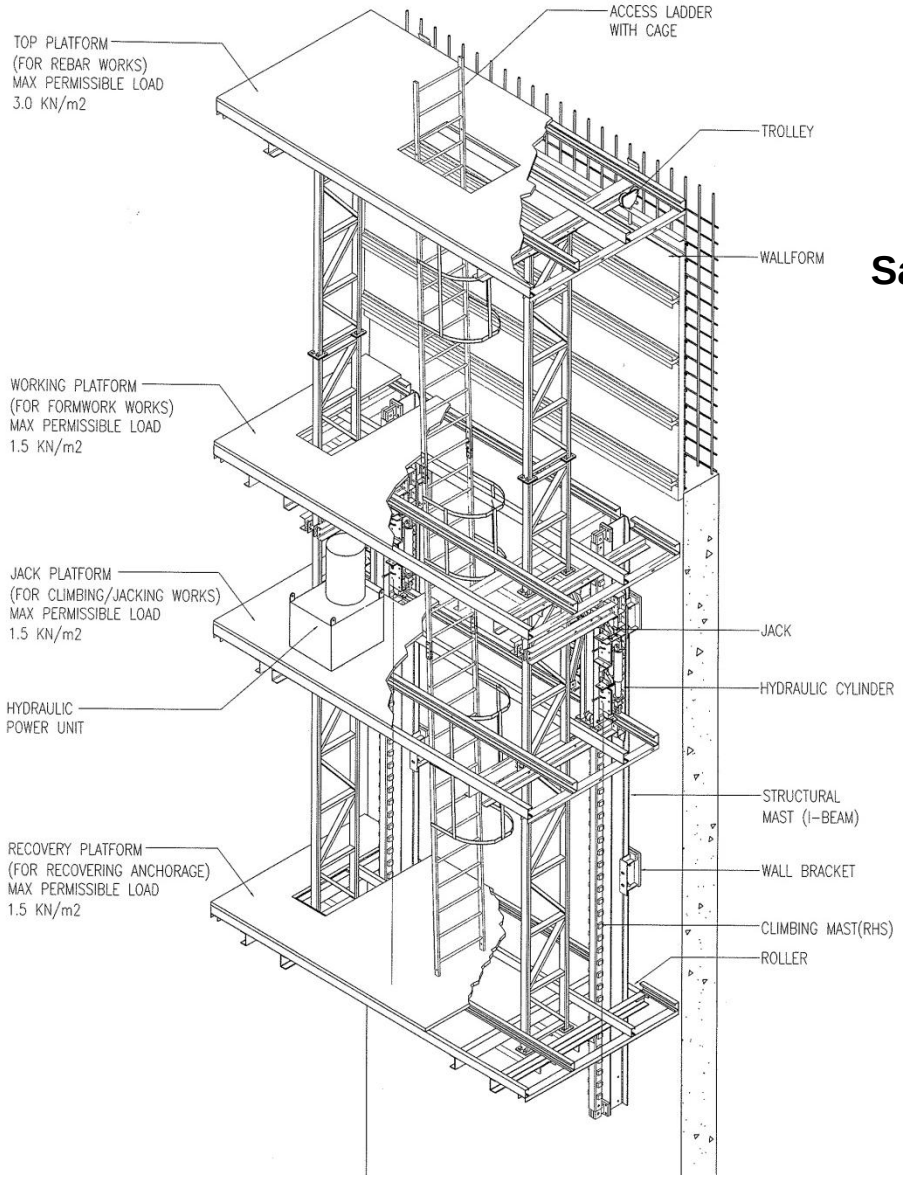


SELF-CLIMBING FORWORK SYSTEM
FOR CENTRE CORE WALLS

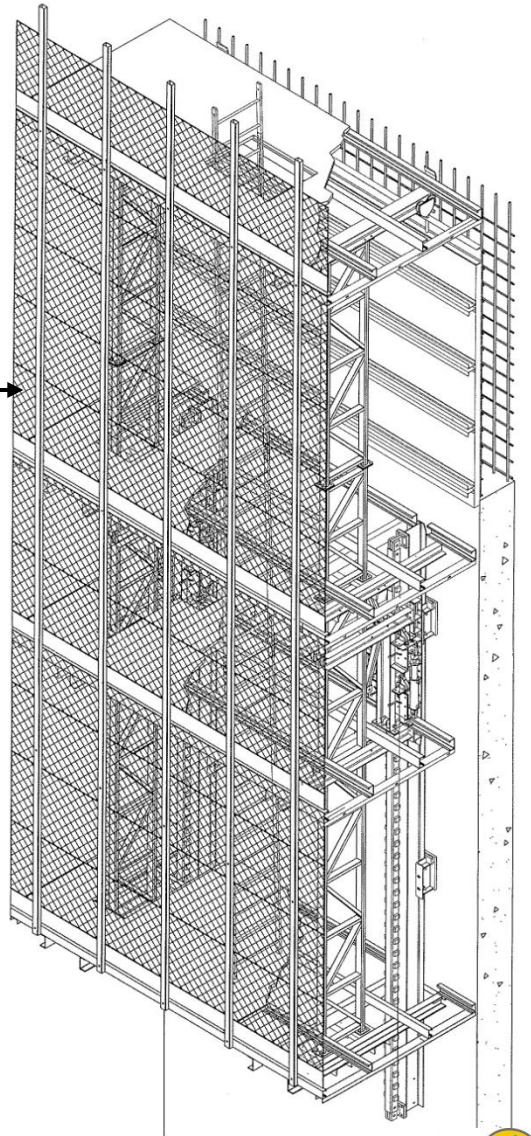
Mr.PENTA

K. High Rise Tower Safety Provisions

SELF-CLIMBING FORMWORK SYSTEM



Safety Screen →

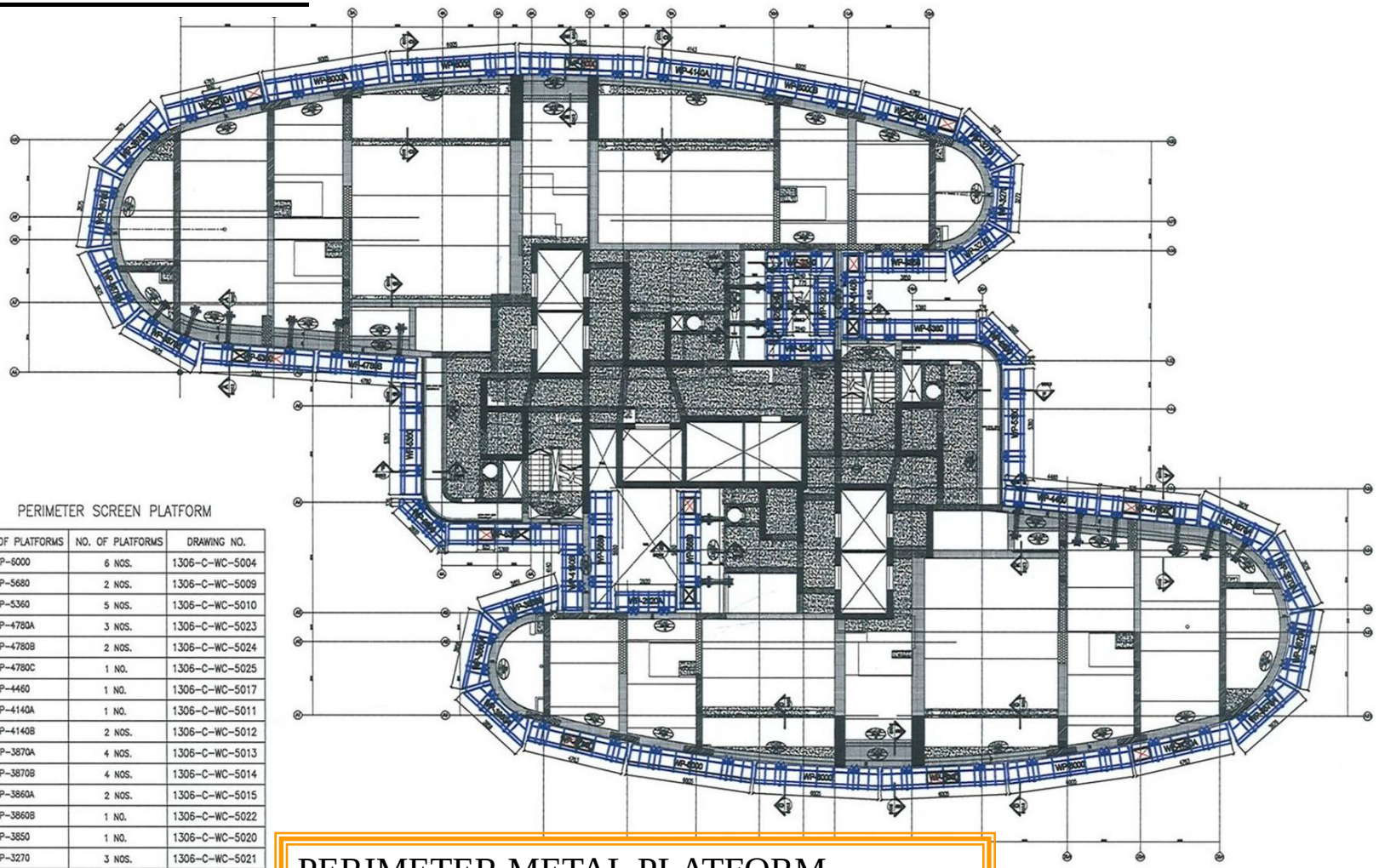


3D VIEW OF SYSTEM

Mr.PENTA

K. High Rise Tower Safety Provisions

PERIMETER SCREEN



PERIMETER SCREEN PLATFORM

TYPE OF PLATFORMS	NO. OF PLATFORMS	DRAWING NO.
WP-6000	6 NOS.	1306-C-WC-5004
WP-5680	2 NOS.	1306-C-WC-5009
WP-5360	5 NOS.	1306-C-WC-5010
WP-4780A	3 NOS.	1306-C-WC-5023
WP-4780B	2 NOS.	1306-C-WC-5024
WP-4780C	1 NO.	1306-C-WC-5025
WP-4460	1 NO.	1306-C-WC-5017
WP-4140A	1 NO.	1306-C-WC-5011
WP-4140B	2 NOS.	1306-C-WC-5012
WP-3870A	4 NOS.	1306-C-WC-5013
WP-3870B	4 NOS.	1306-C-WC-5014
WP-3860A	2 NOS.	1306-C-WC-5015
WP-3860B	1 NO.	1306-C-WC-5022
WP-3850	1 NO.	1306-C-WC-5020
WP-3270	3 NOS.	1306-C-WC-5021
WP-3240	2 NOS.	1306-C-WC-5019
WP-2920	2 NOS.	1306-C-WC-5018
WP-2600	2 NOS.	1306-C-WC-5026
WP-6000A	1 NO.	1306-C-WC-5028
WP-2920A	1 NO.	1306-C-WC-5029
WP-6000B	1 NO.	1306-C-WC-5030
TOTAL	= 47 NOS.	

PERIMETER METAL PLATFORM SCREEN AT PRECAST/RC STRUCTURAL WORK TO PROTECT 3 FLOORS

OPENING OF MIDDLE PLATFORM

OPENING OF TOP PLATFORM

Mr.PENTA

K. High Rise Tower Safety Provisions

SELF-CLIMBER & PERIMETER SCREEN



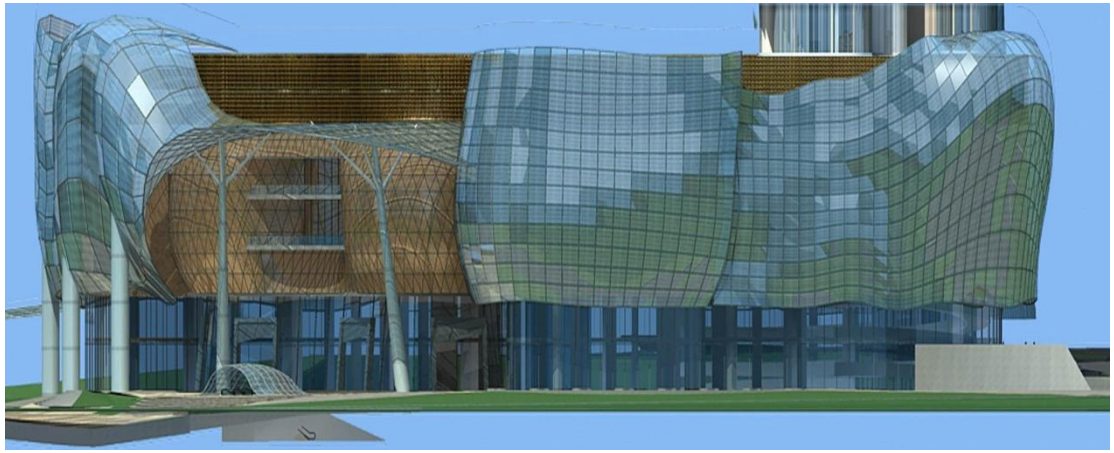


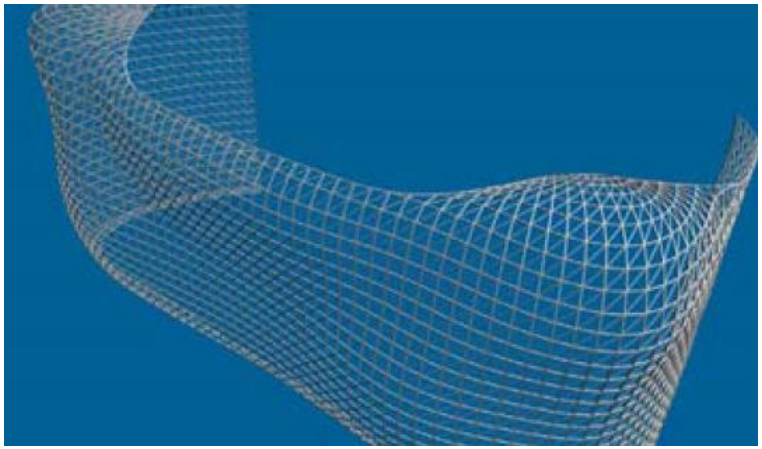
Mr.PENTA

3. Design & Construction Strategies

L. MAIN CANOPY & FACADE

L. Main Canopy & Façade

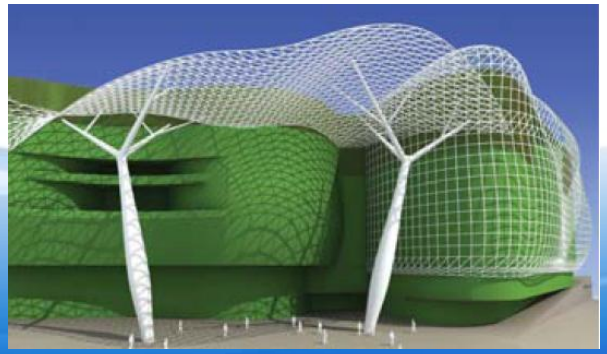


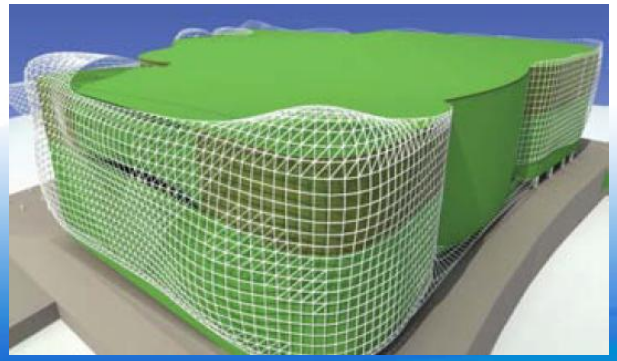


Singapore's first monocoque facade and canopy structure.

Thru detailed 3D modelling, the structure's geometry was able to be defined enabling single-shell construction technique.

The facade provides support to the overall structure, and without the need for internal support structures.





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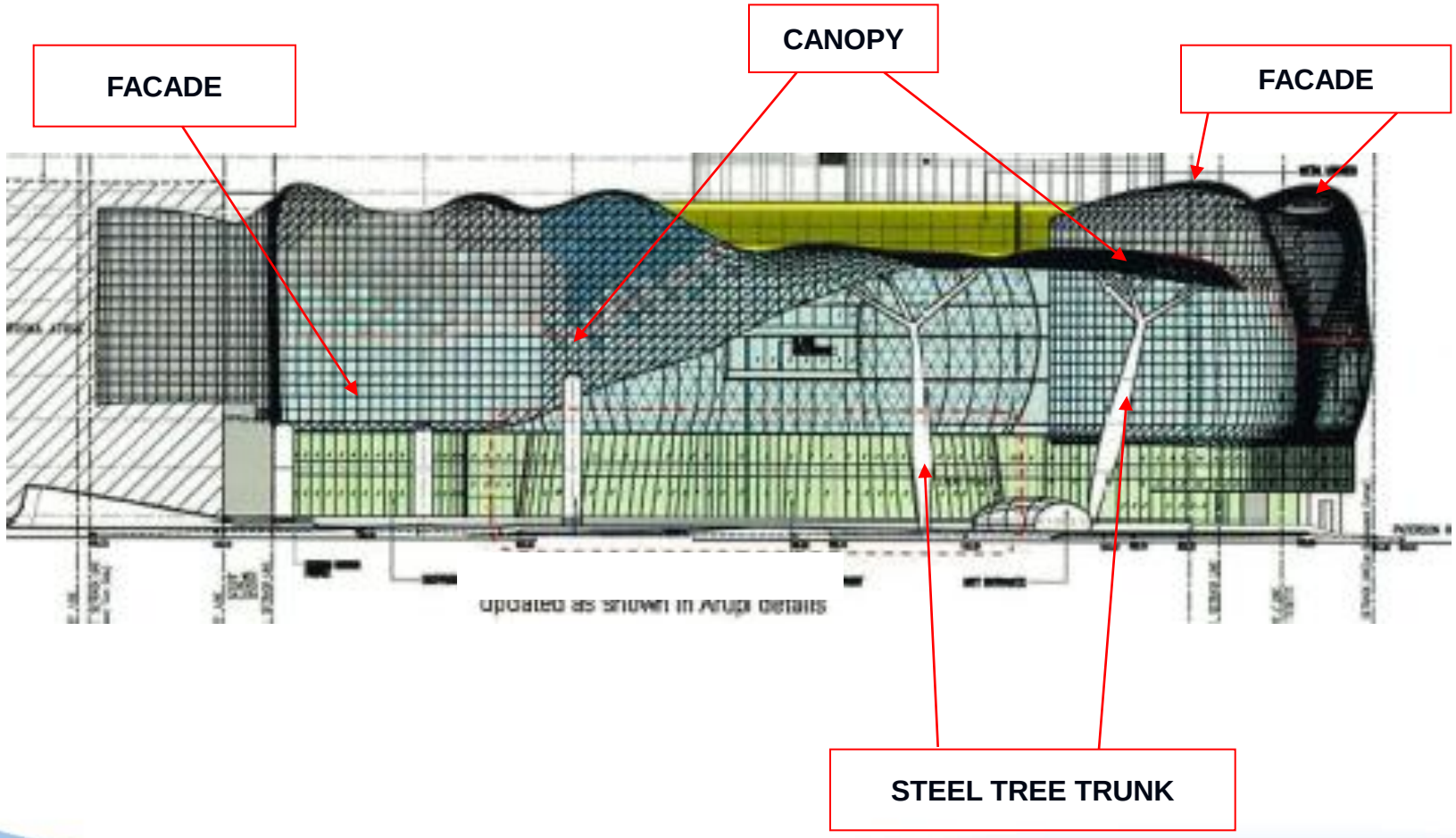
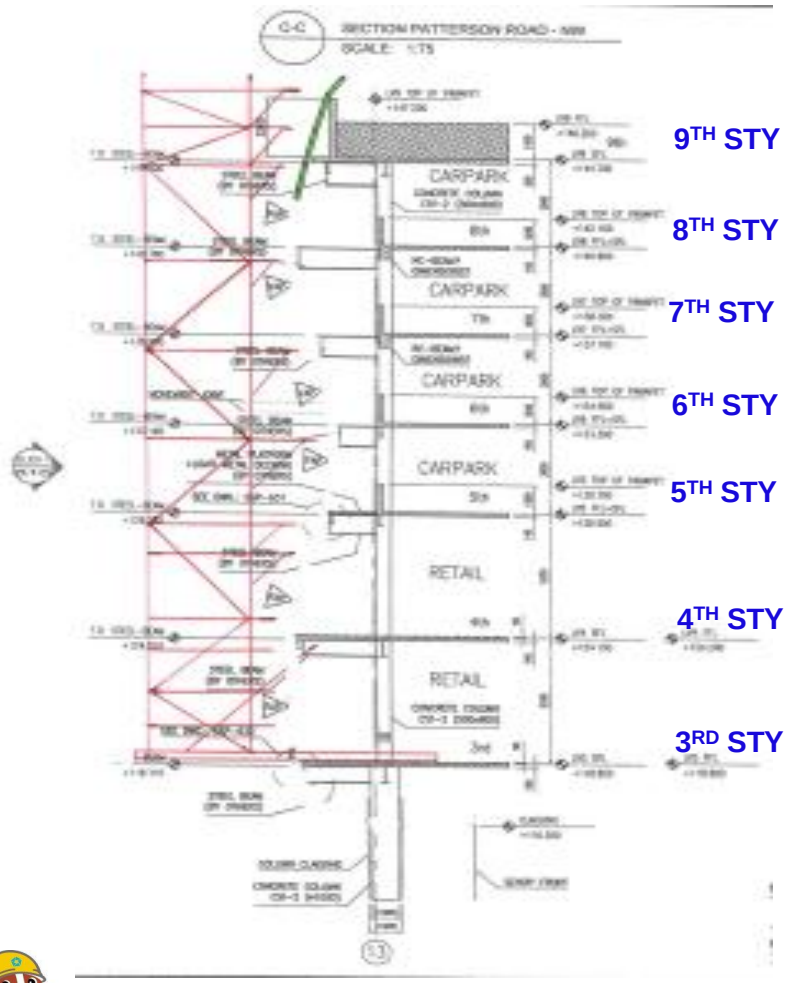
L. Main Canopy & Façade



L. Main Canopy & Façade

TYPICAL FACADE INSTALLATION





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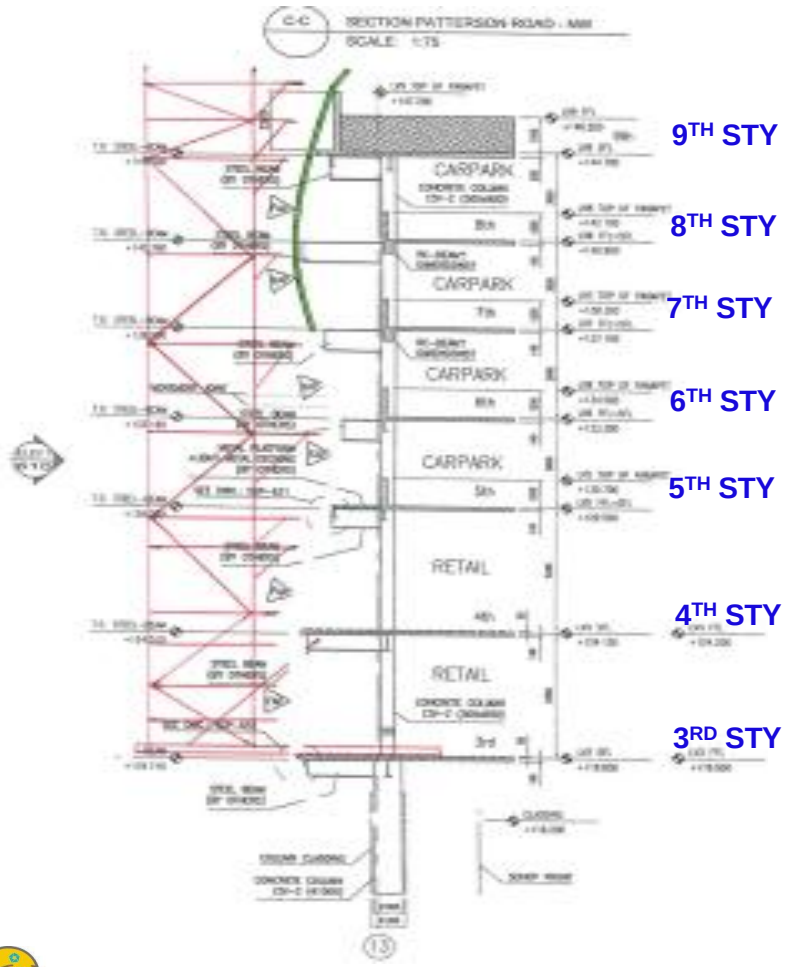
L. Main Canopy & Façade

TYPICAL FACADE INSTALLATION

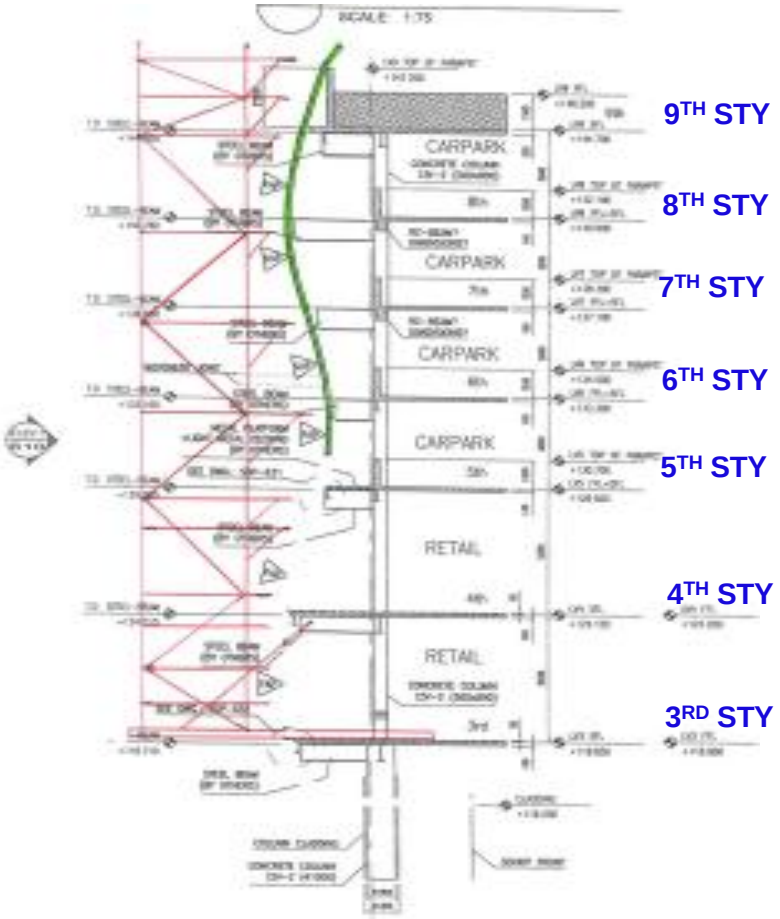




Mr.PENTA

L. Main Canopy & Façade

TYPICAL FACADE INSTALLATION





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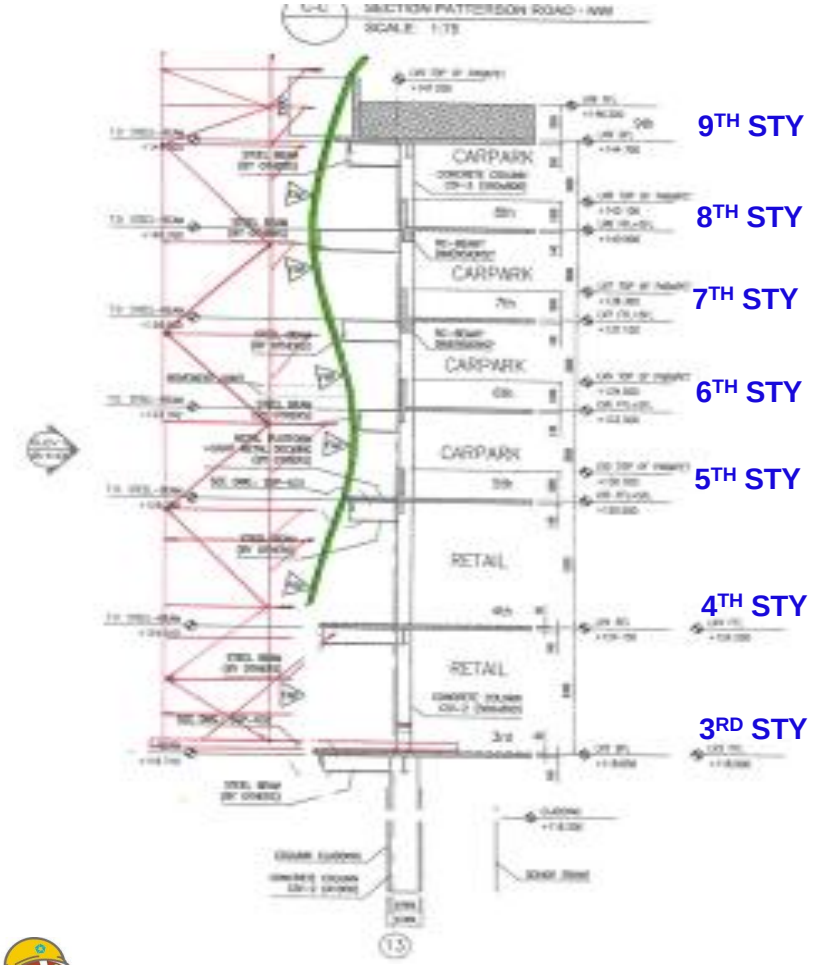
L. Main Canopy & Façade

TYPICAL FACADE INSTALLATION

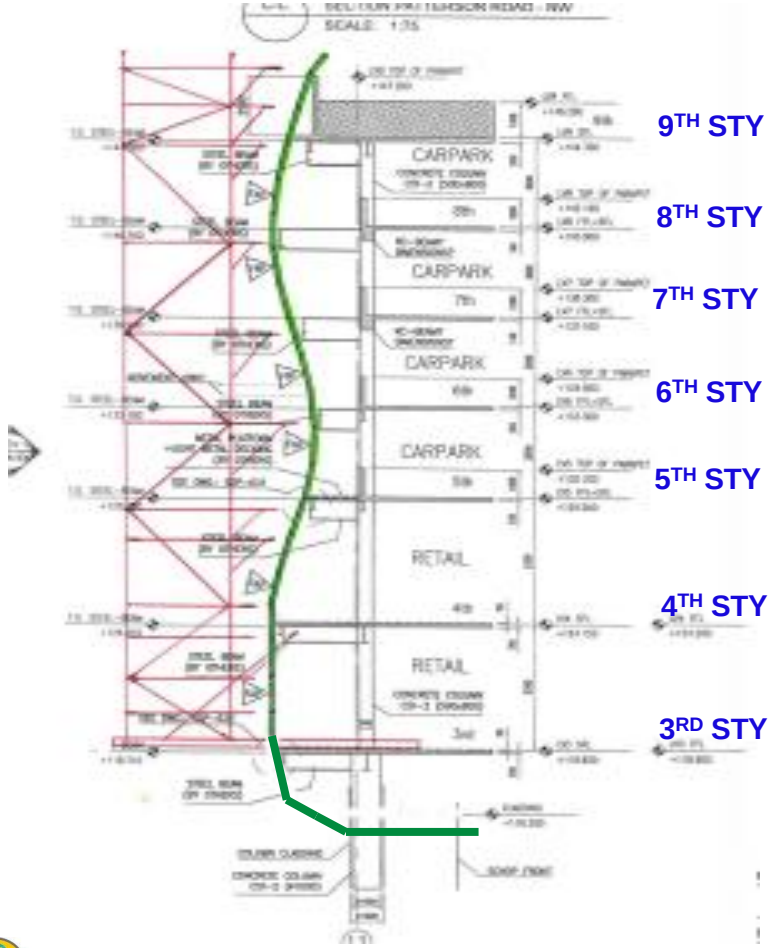


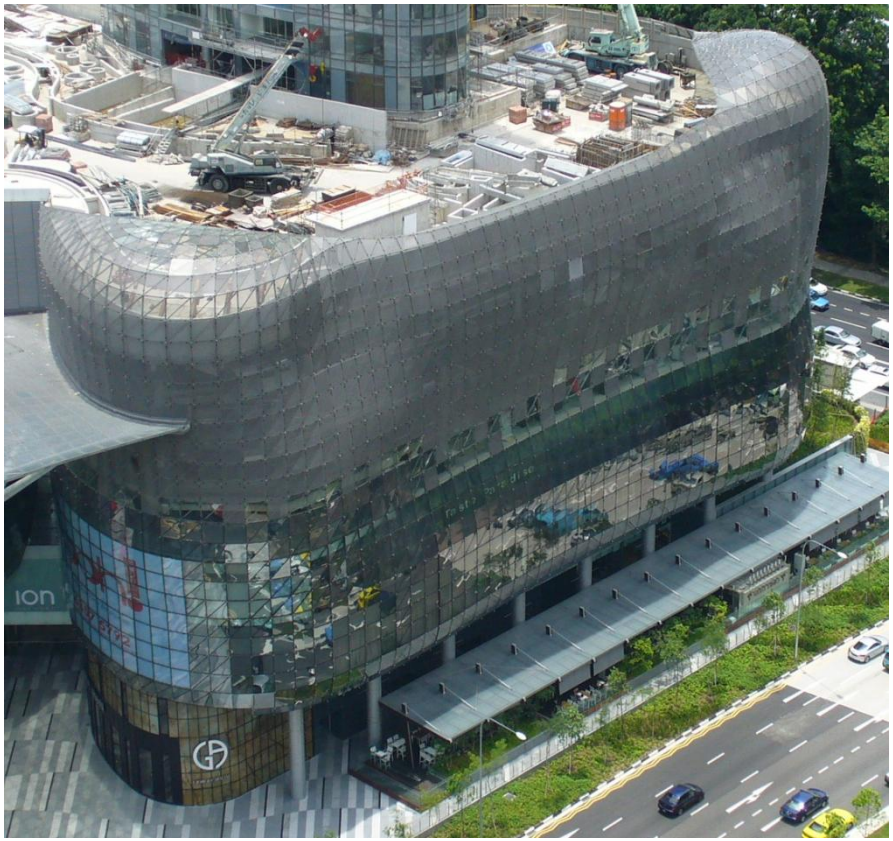


Mr.PENTA

L. Main Canopy & Façade

TYPICAL FACADE INSTALLATION





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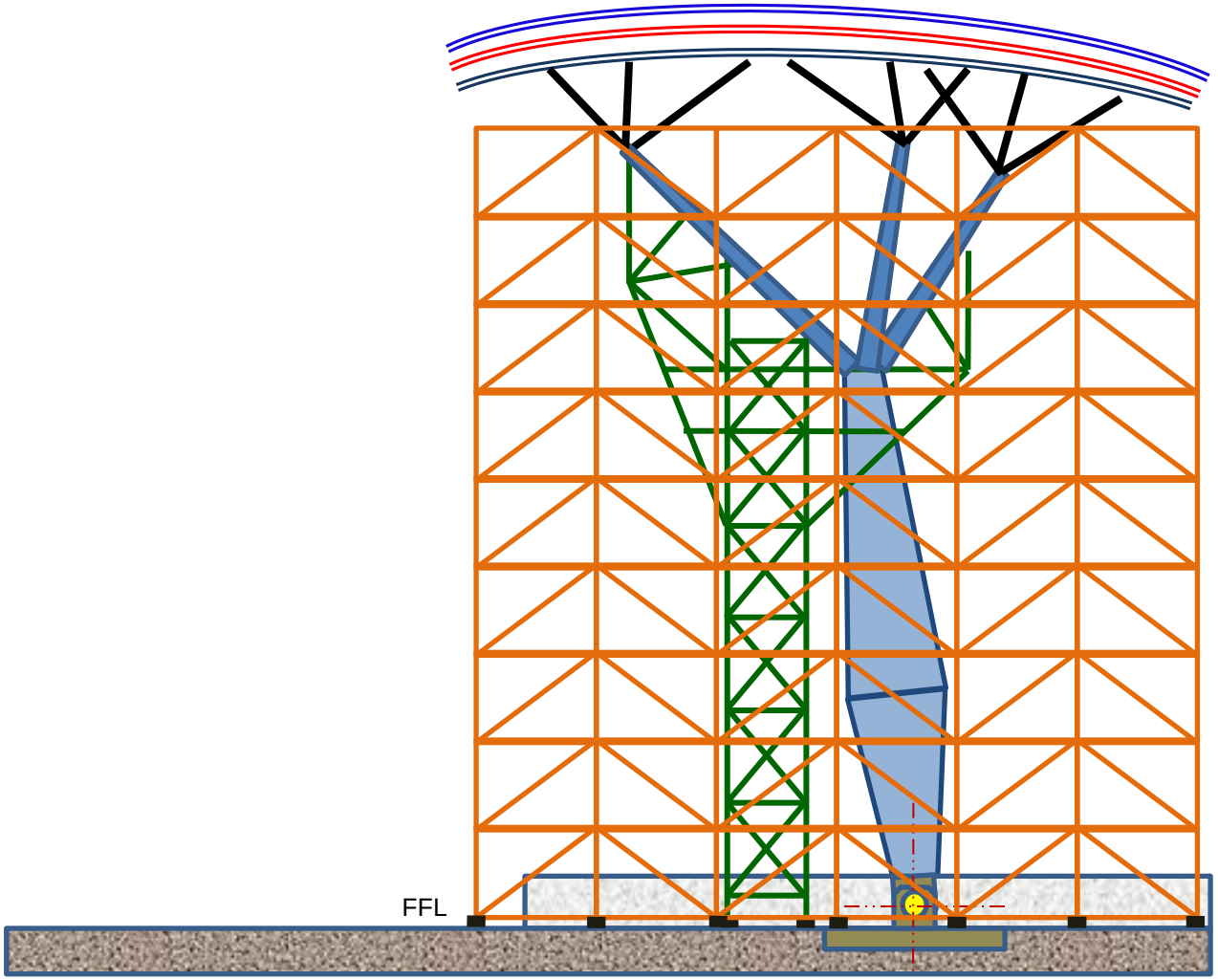
L. Main Canopy & Façade

MAIN CANOPY



SECTION OF CANOPY

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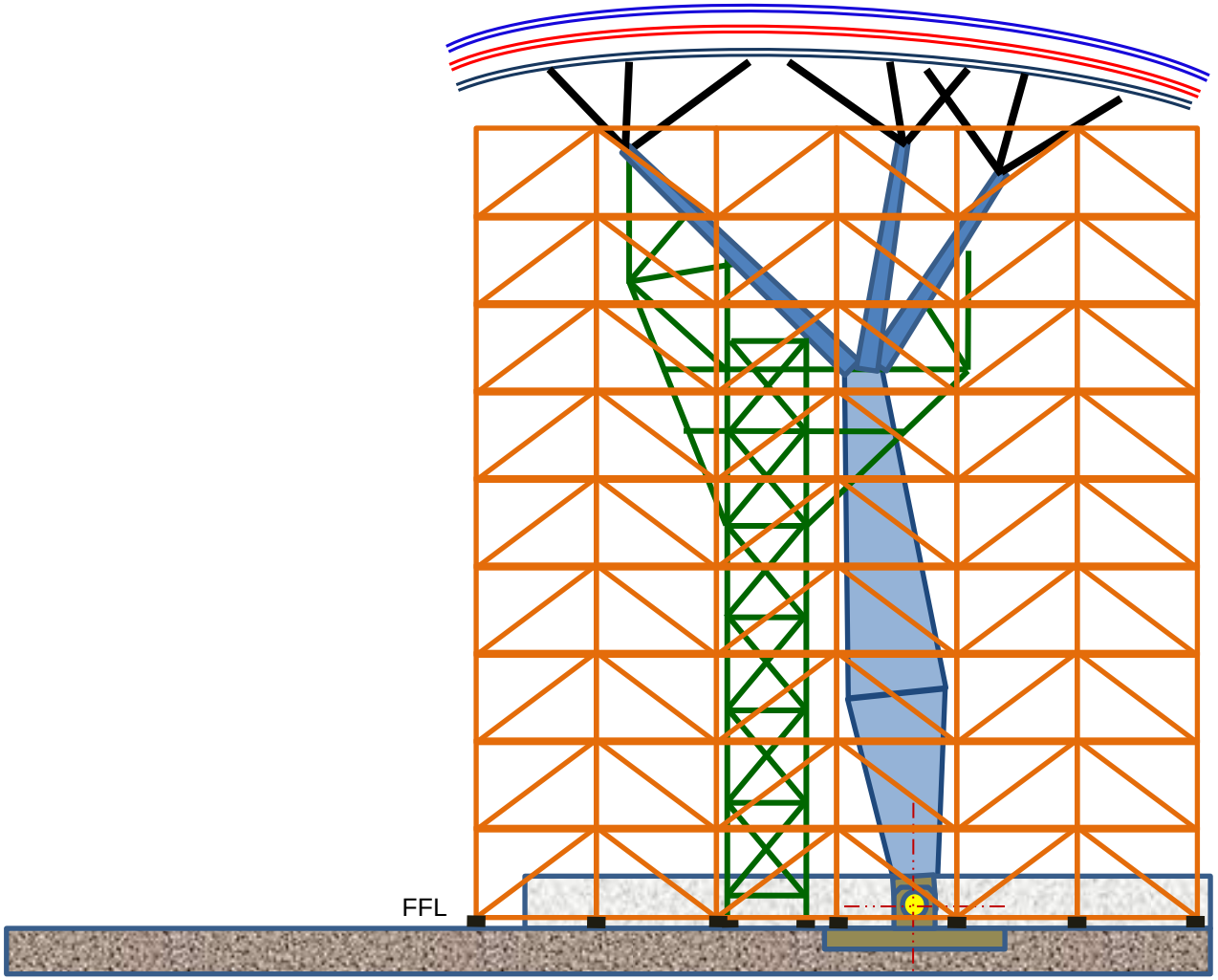
L. Main Canopy & Façade

MAIN CANOPY



SECTION OF CANOPY

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L. Main Canopy & Façade



STEEL TREE TRUNKS INSTALLATION

STEEL BRANCHES INSTALLATION



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L. Main Canopy & Façade



CANOPY STEEL FRAMES INSTALLATION

CANOPY GLASS INSTALLATION



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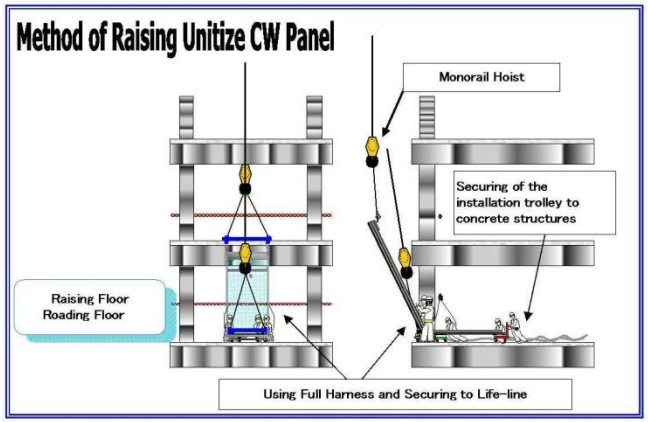
L. Main Canopy & Façade

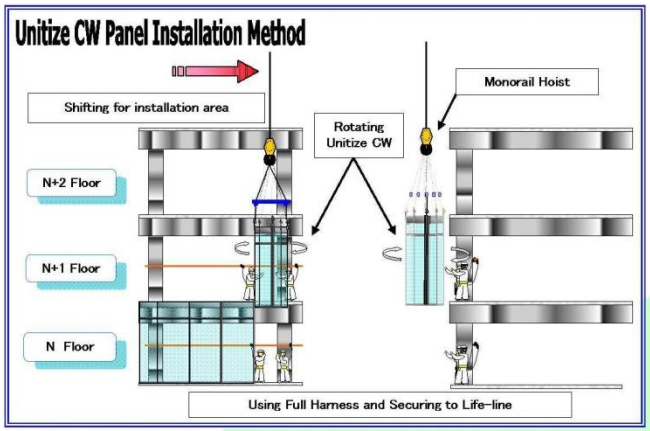


Mr.PENTA

COMPLETED VIEW OF MAIN CANOPY & FACADE FOR RETAIL

L. Residential Tower Façade



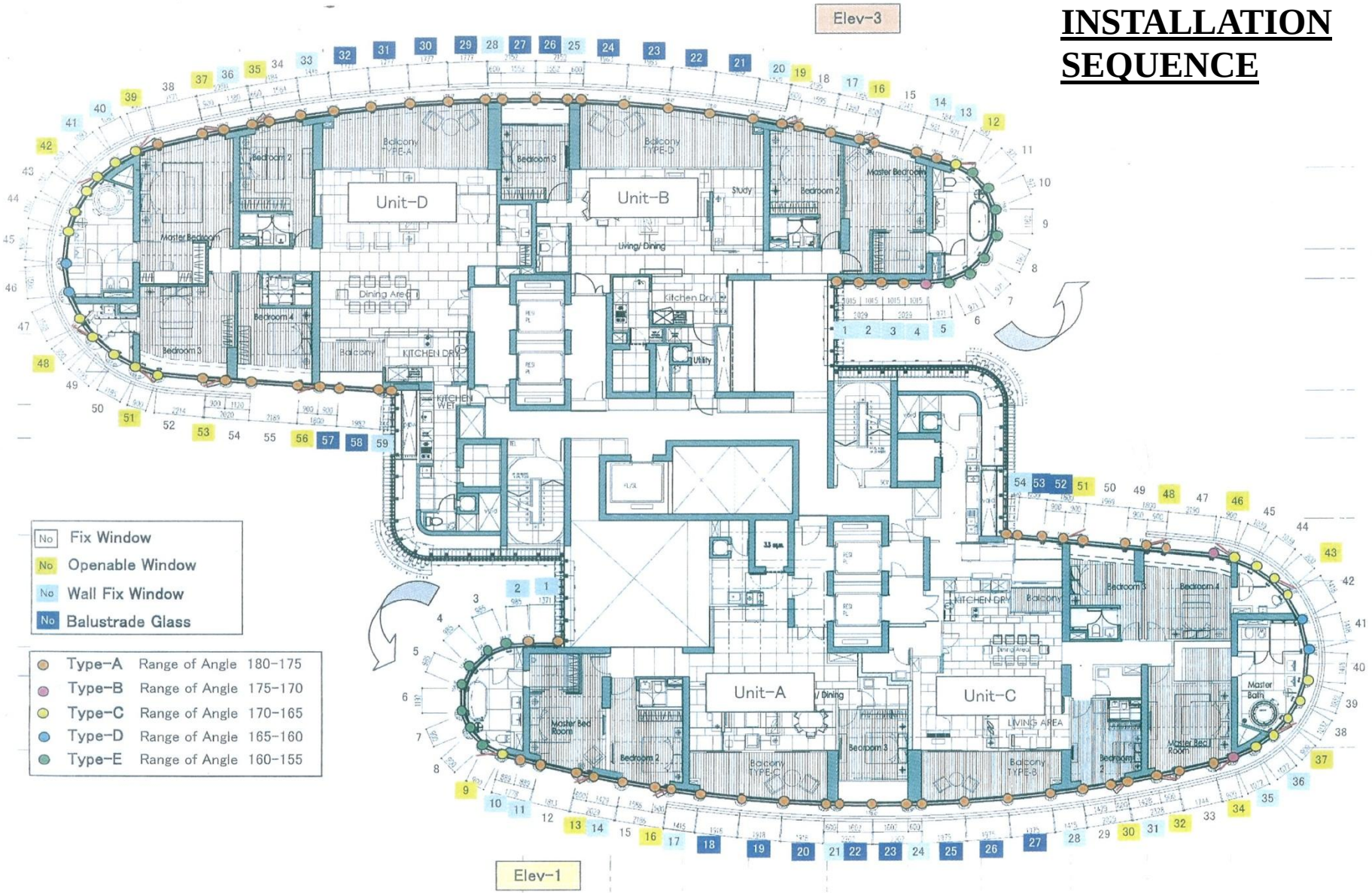


Steel pallets for CW panels storage
Typically base 3500mm x 1000mm
Panel Height varies, average = 1500 kgs

Prevention of CW Floor Bracket from Falling

Typical Floor Crane

L. Residential Tower Façade



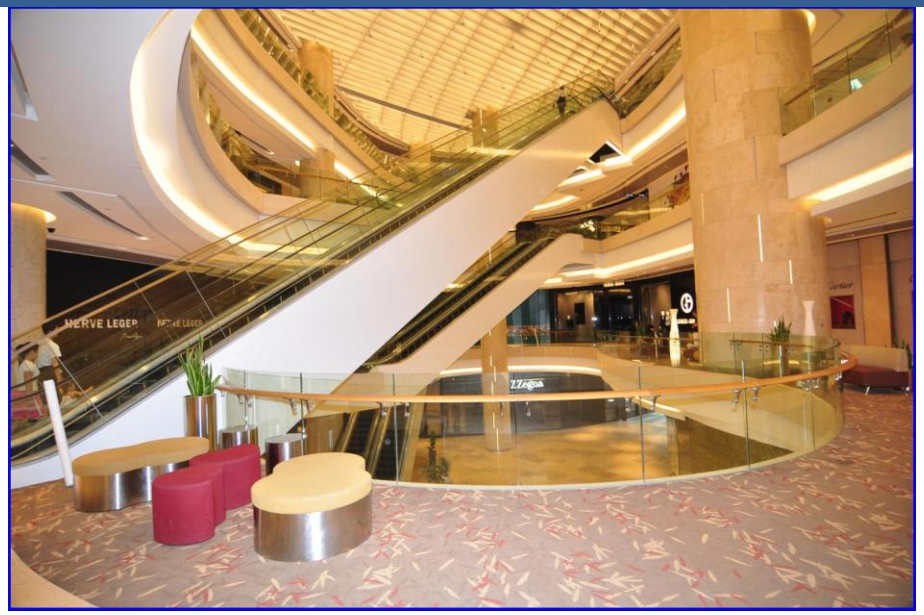
L. Residential Tower Façade



4. Finishes – ION Orchard



4. Finishes – Mall Interior



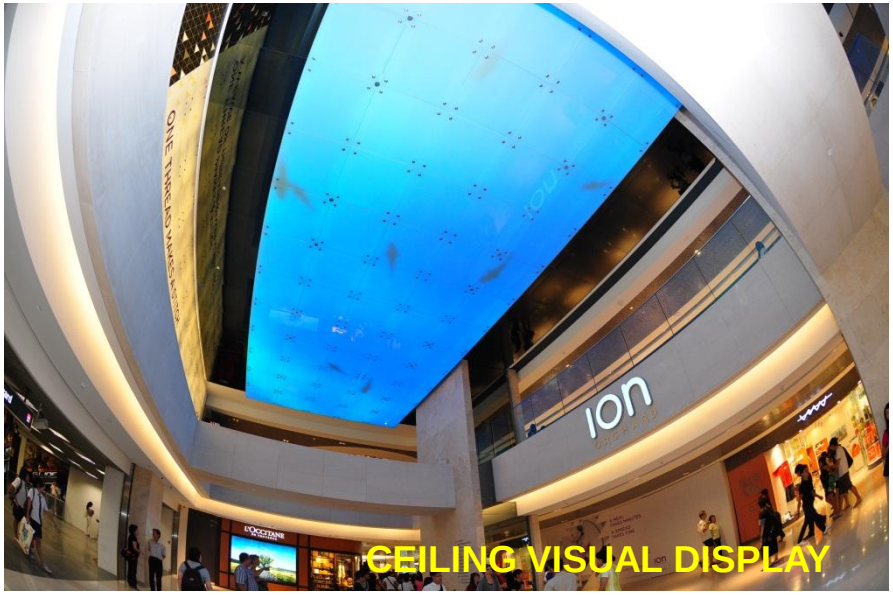
ION ORCHARD LEVEL 2



BLADE CEILING LEVEL 4



INTERFACE WITH MRT



CEILING VISUAL DISPLAY

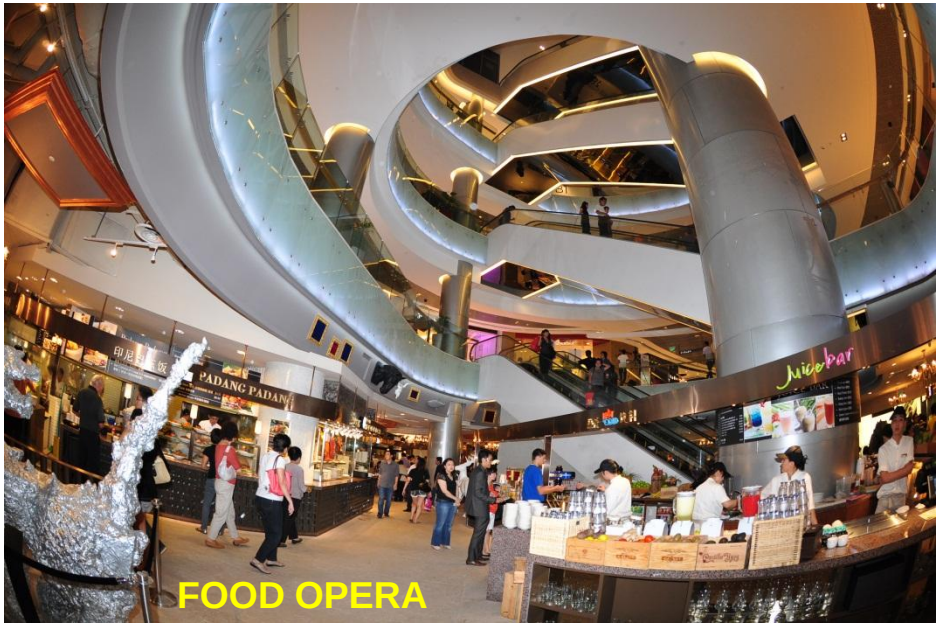
4. Finishes – Mall Interior



B4 ATRIUM BELOW PATERSON ROAD



ESCALATOR TO ION FOOD HALL





TYPICAL FEMALE TOILET

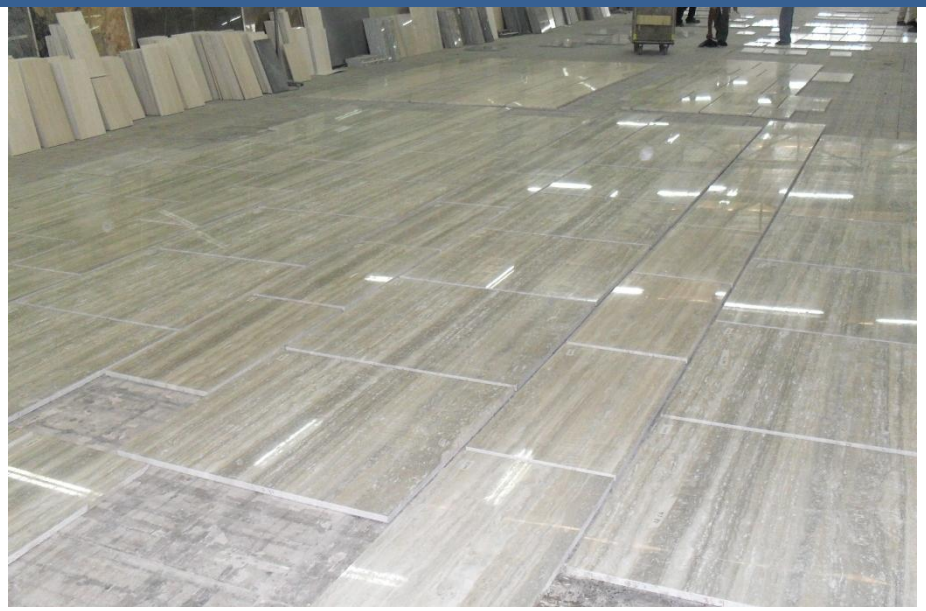
4. Finishes – Stones

FIORE DE PESCO (BOOK MATCH)





4. Finishes – Stones



SILVER TRAVERTINE (VEIN MATCH)



POTORO GOLD (VEIN MATCH)





4. Finishes – Residential Units



LIVING ROOM / BALCONY



DRY KITCHEN / DINING AREA



TYPICAL BEDROOM



WET KITCHEN / UTILITY

4. Finishes – Penthouse



LIVING ROOM / BALCONY



DRY KITCHEN





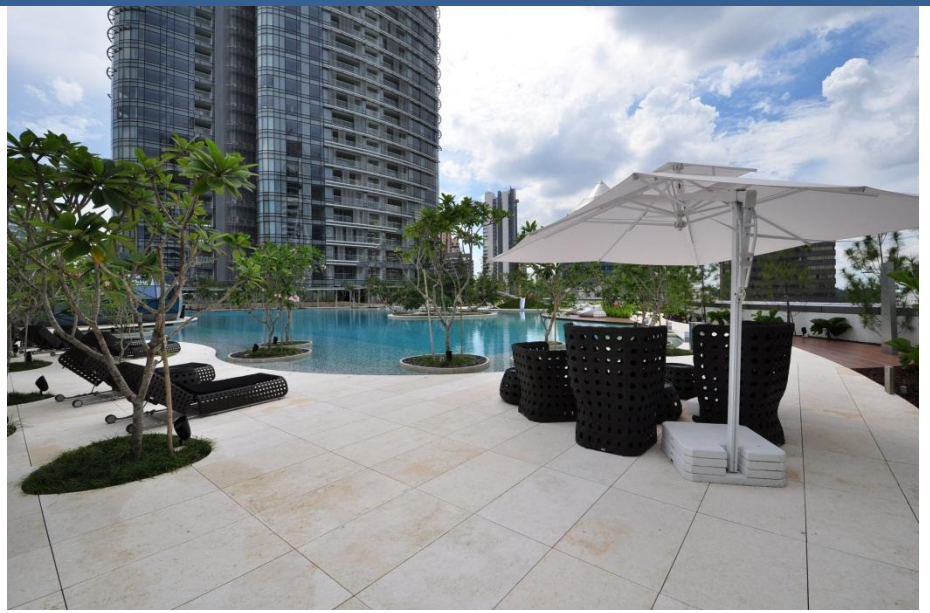
4. Finishes – Environmental Deck (Club House)



4. Finishes – Environmental Deck (Club House)

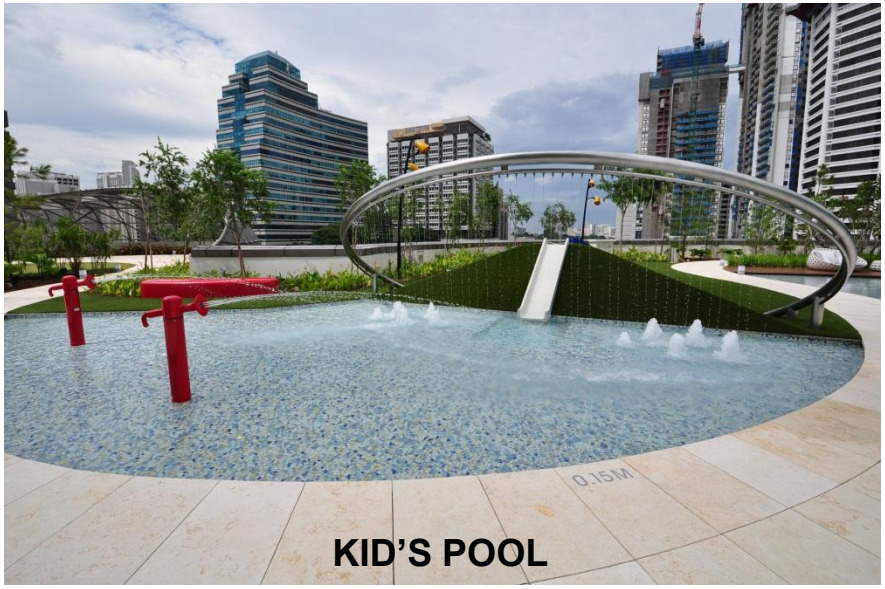


RESIDENT'S WELCOME CENTRE



SWIMMING POOL AREA

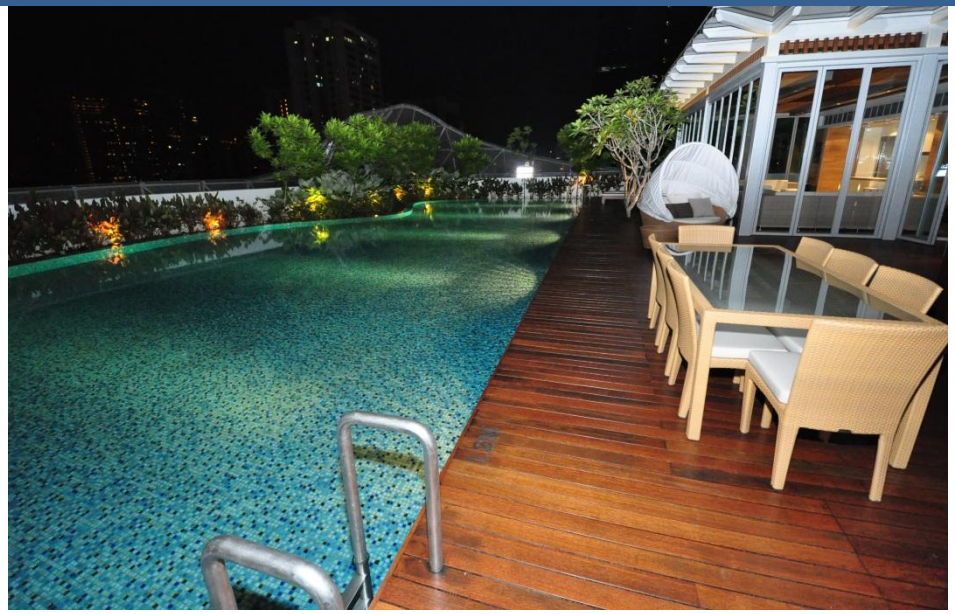




4. Finishes – Environmental Deck (Club House)



THE PARTY HOUSE

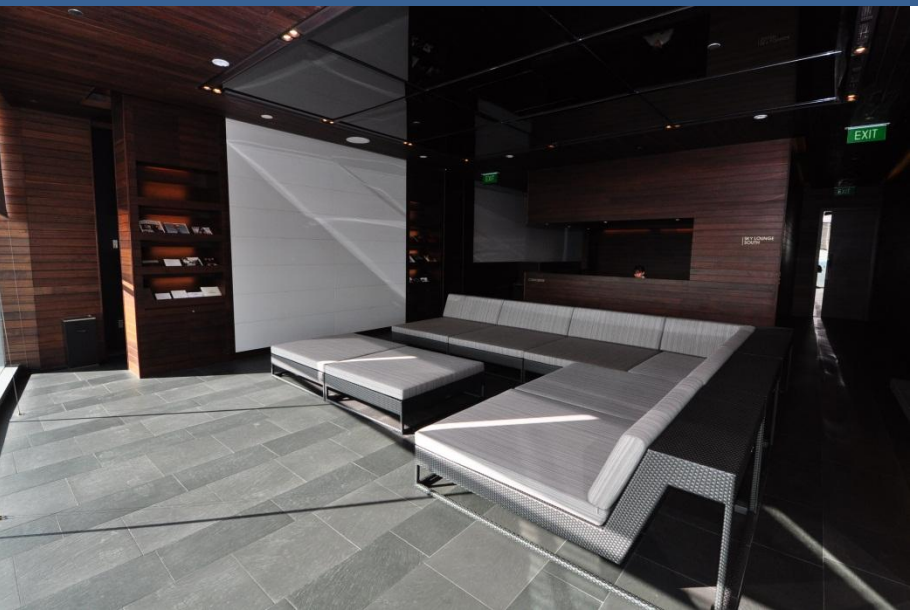


PRIVATE PARTY POOL

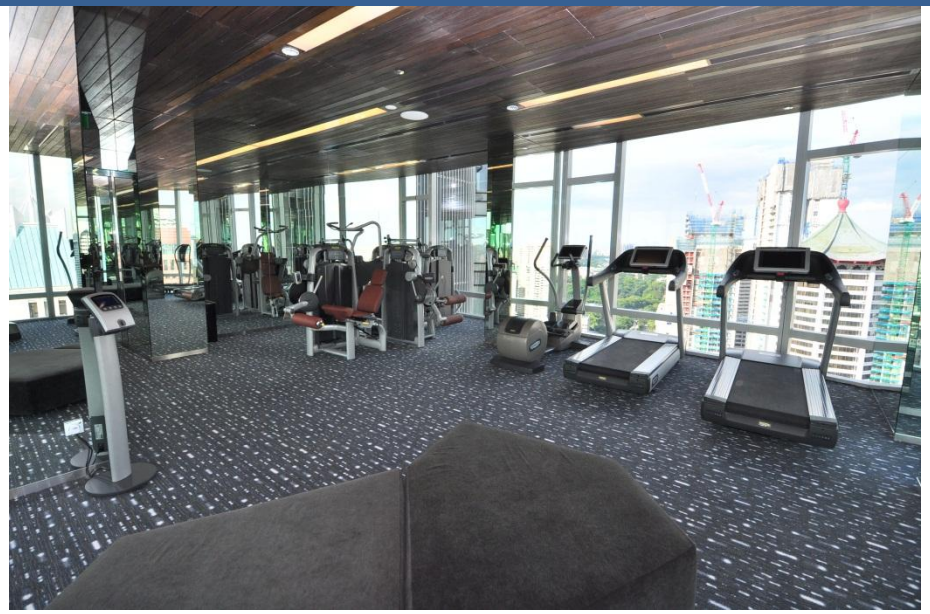




4. Finishes – Sky Lounge @ L30

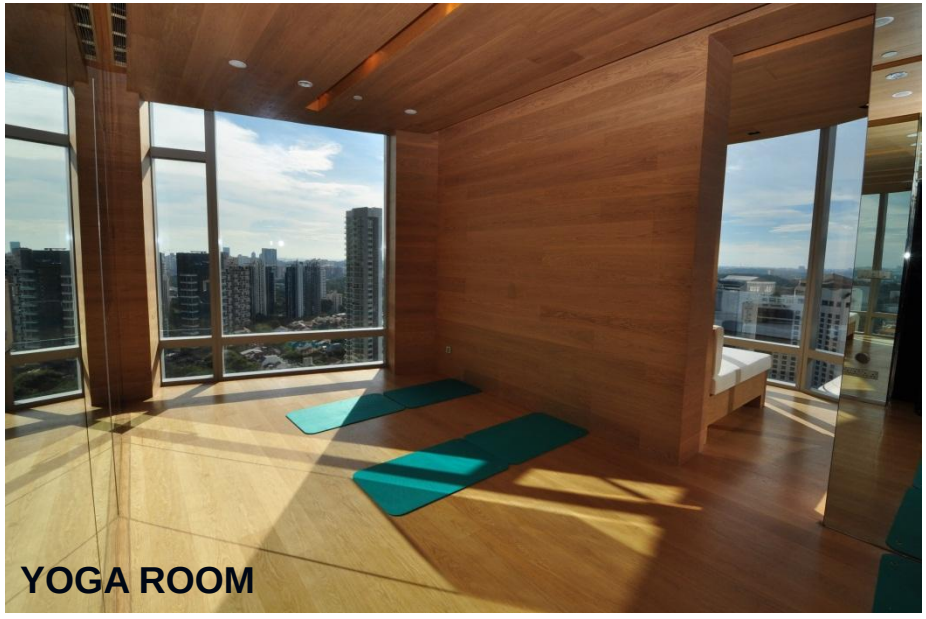


SOUTH SKY LOUNGE



GYM ROOM





4. Finishes – ION Sky @ L55 & L56



LOBBY



SALT GRILL

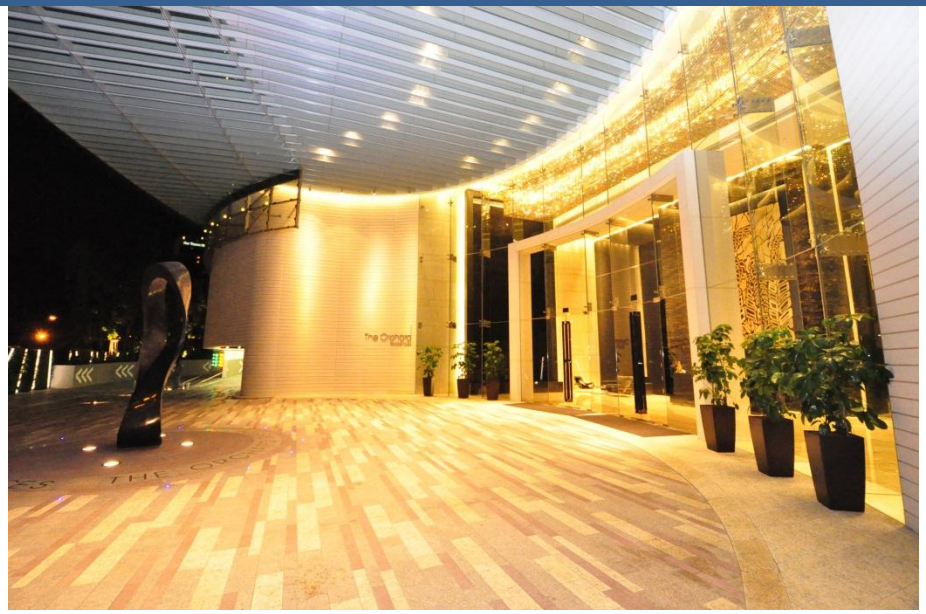


OBSERVATION DECK

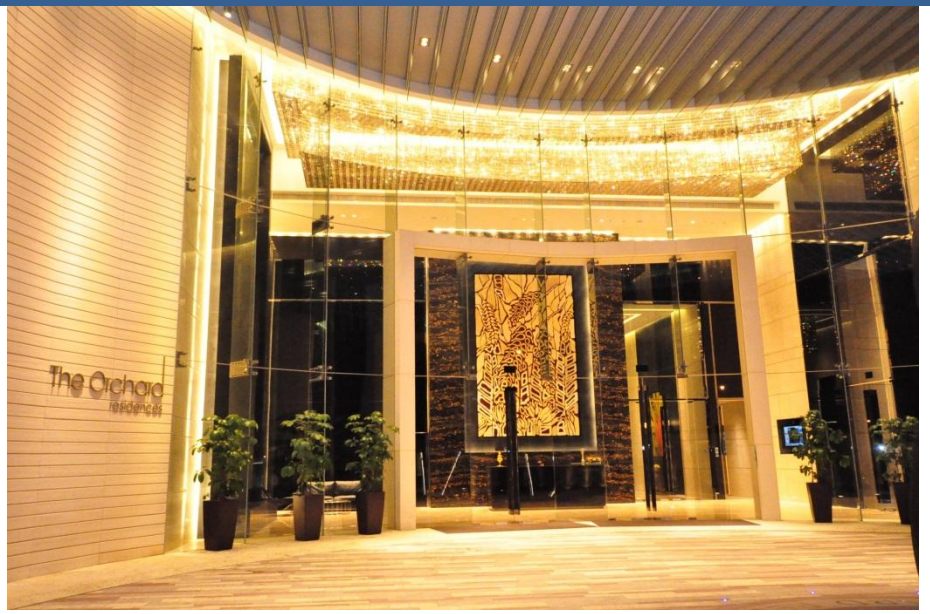


STATE OF THE ART TELESCOPE

4. Finishes – Other Common Areas



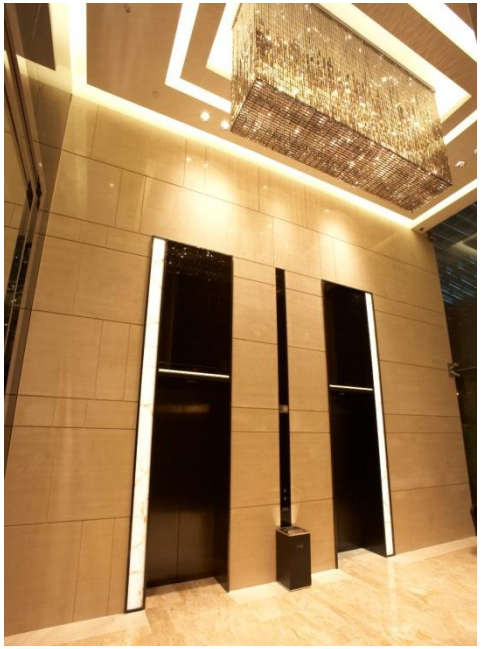
2ND STY DROP OFF AREA



2ND STY MAIN ENTRANCE



2ND STY CONCIERGE

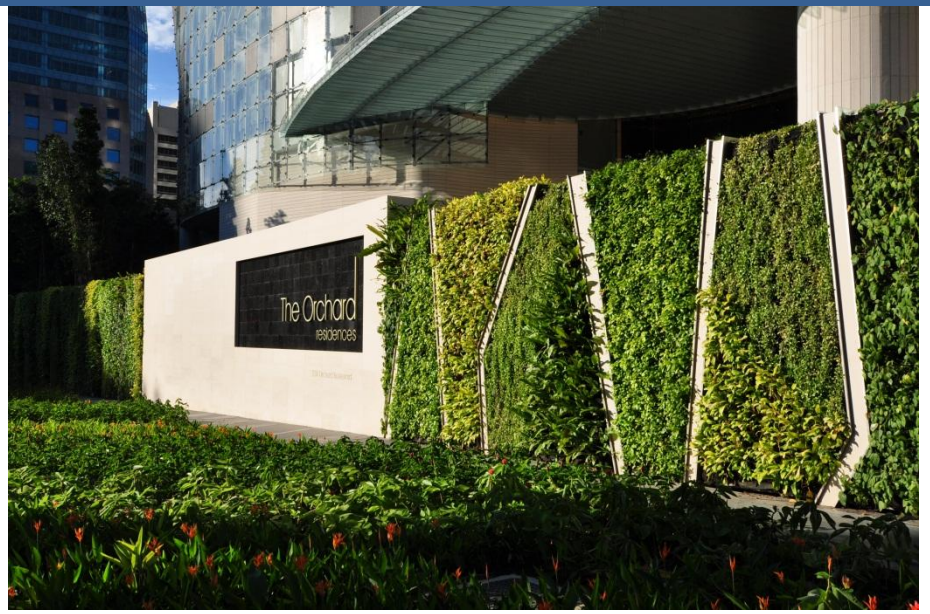


2ND STY LIFT LOBBY

4. Finishes – Other Common Areas



ENTRANCE TO CARPARK



GREEN WALL



MAIL ROOM

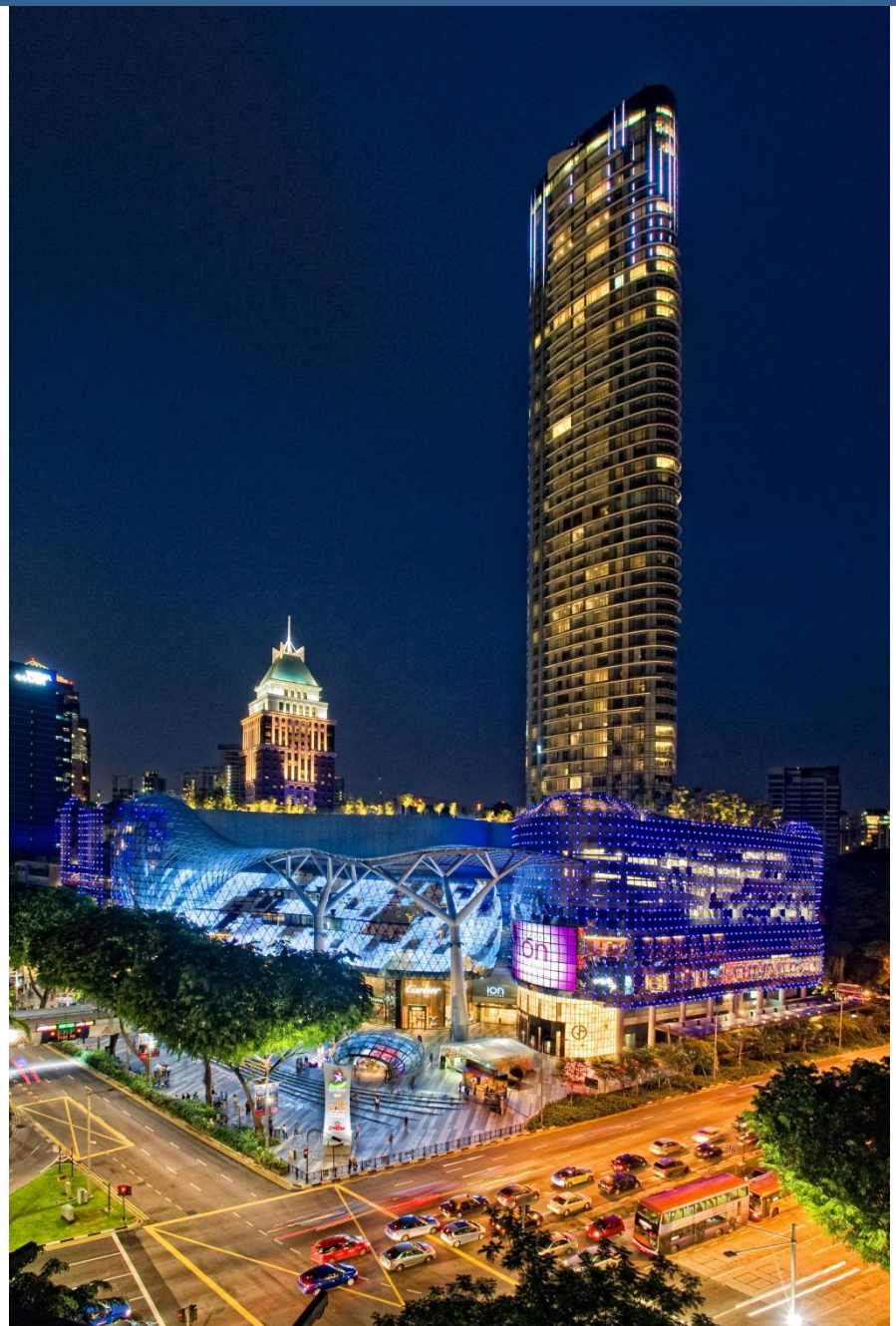


VIEW FROM SCOTTS ROAD

4. Finishes



CANOPY FRONTING
ORCHARD BOULEVARD



5. Progress Slides

PROGRESS SLIDES

5. Progress Slides



VIEW FROM SHAW HOUSE

5. Progress Slides



VIEW FROM SHAW HOUSE

5. Progress Slides



VIEW FROM SHAW HOUSE

5. Progress Slides



VIEW FROM SHAW HOUSE

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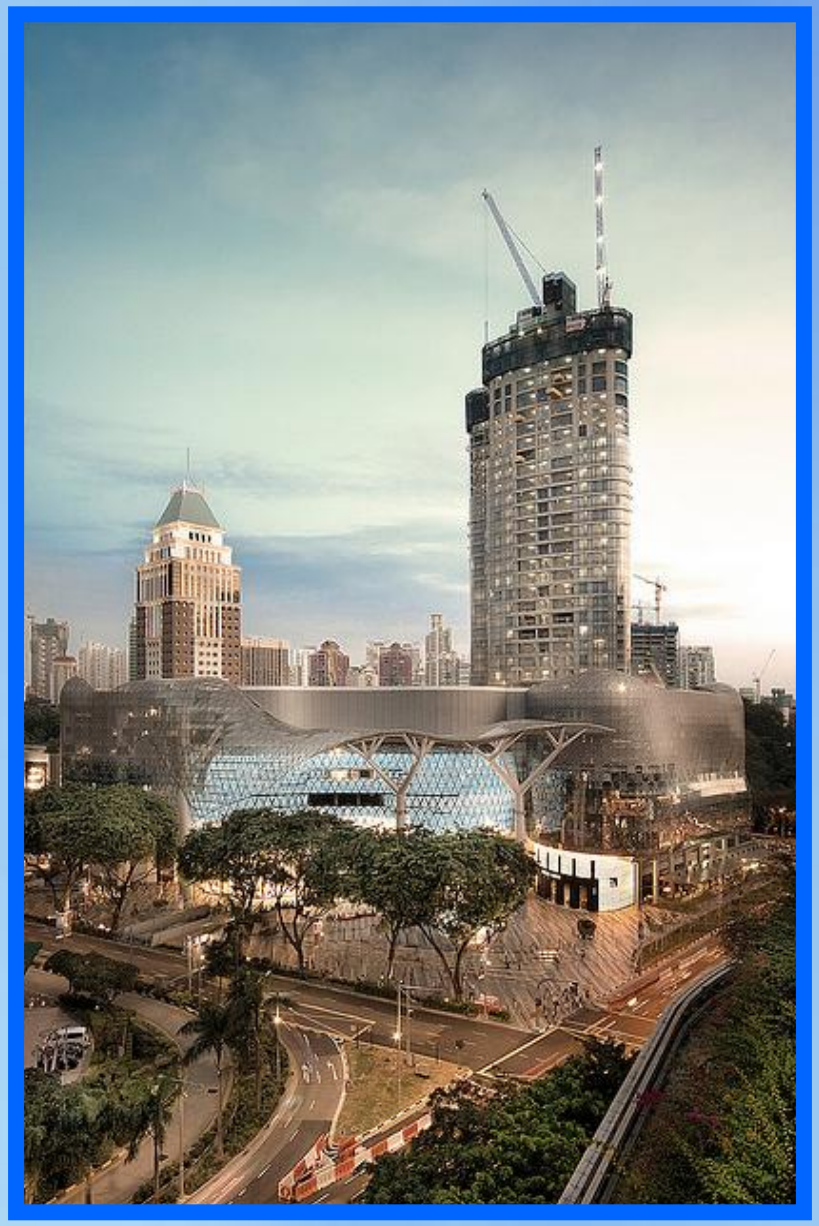
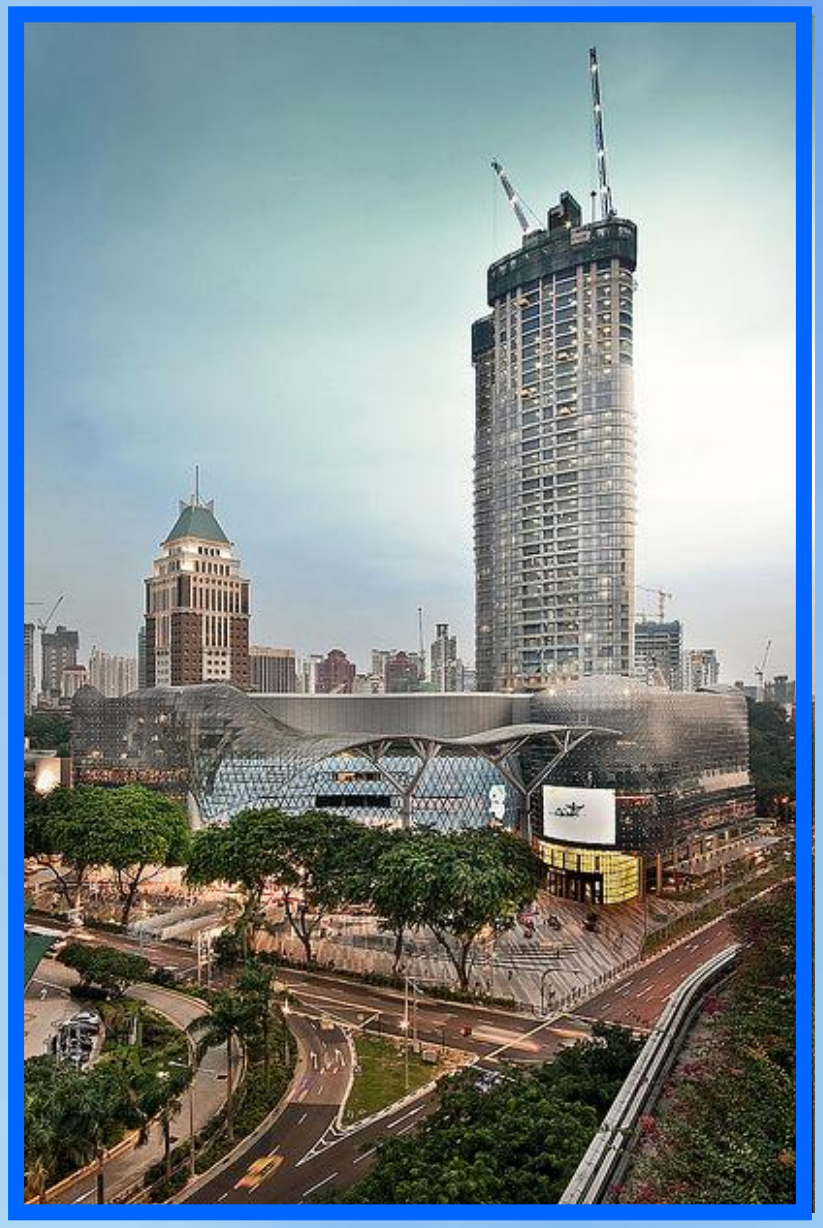
VIEW FROM SHAW HOUSE

5. Progress Slides



VIEW FROM SHAW HOUSE

5. Progress Slides



VIEW FROM SHAW HOUSE

5. Progress Slides



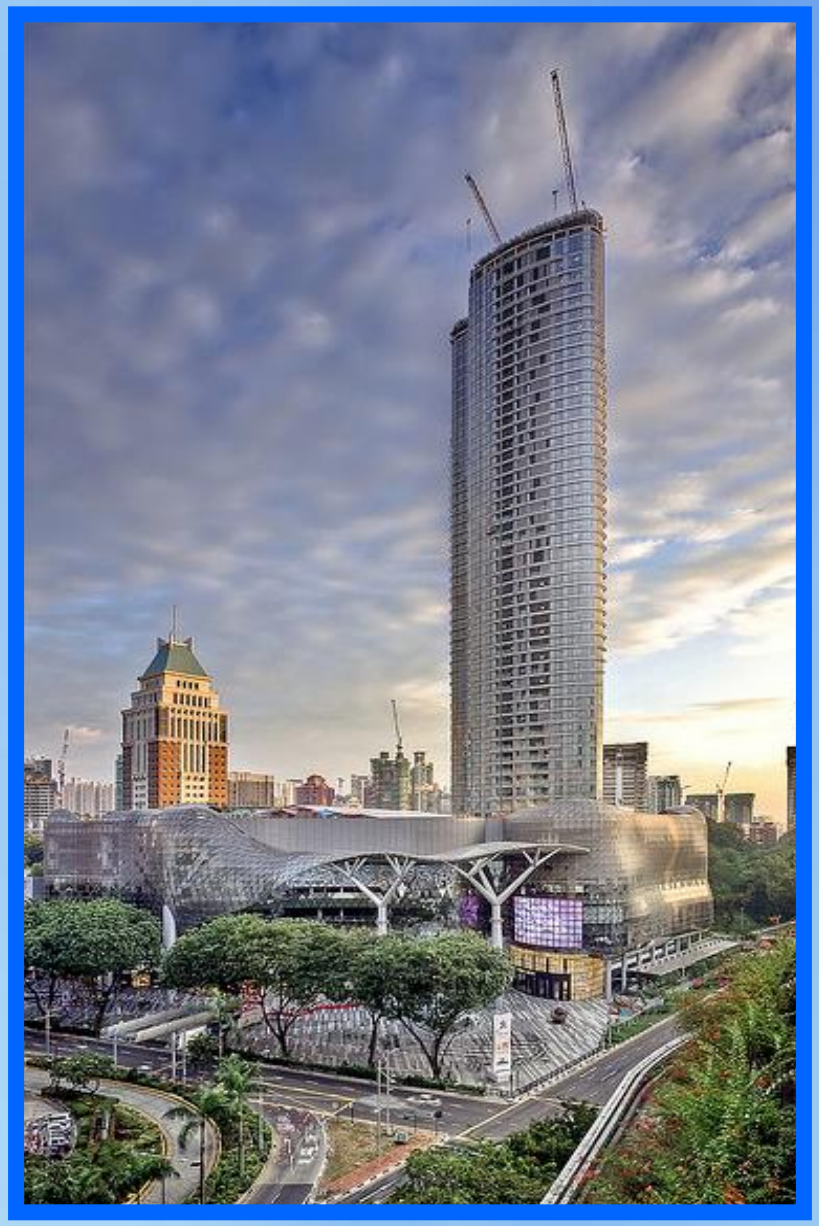
VIEW FROM SHAW HOUSE

5. Progress Slides



VIEW FROM SHAW HOUSE

5. Progress Slides



VIEW FROM SHAW HOUSE

5. Progress Slides



VIEW FROM SHAW HOUSE

6. Awards for ION Orchard

- MAPIC 2006 : Best Retail Development over 20,000m2 and Best Architectural Entry
- BCA Green Mark Gold Award 2007
- Gold Award at ICSC Asia 2008 for Business to Business
- MIPIM Asia 2009 Awards : Best Shopping Centre Asia
- SSSS Steel Design Awards 2009 : Winner for Industrial and Commercial Structures Category
- Quality Building Award 2010 : Certificate of Grand Award for Project Outside Hong Kong Category
- Global Retail and Leisure International Awards 2010 : International Retail and Leisure Destination of the Year
- BCA Design and Engineering Safety Excellence Award 2011
- BCA Construction Excellence Award 2012 (Commercial / Mixed Development)



BCA AWARDS 2012

Recognising Excellence in the Built Environment

CONSTRUCTION EXCELLENCE AWARD

Commercial / Mixed Development Buildings

AWARD

presented to

PENTA-OCEAN CONSTRUCTION CO., LTD.

as the Builder for

Ion Orchard

CHAIRMAN
Building and Construction Authority

CHAIRMAN
Assessment Committee
Construction Excellence Awards

24 May 2012

Building and Construction Authority

6. Awards for The Orchard Residences

- **MAPIC 2006 : Best Retail Development over 20,000m2 and Best Architectural Entry**
- **BCA Green Mark Gold Award 2007**
- **BCA Design and Engineering Safety Excellence Award 2011**
- **LIAS Award 2011 – Gold Award and Best of Category for "Residential" Implementation (Landscape Industry Association (Singapore))**
- **BCA Construction Excellence Award 2012 (Residential Buildings above S$1,500/m2)**



BCA AWARDS 2012

Recognising Excellence in the Built Environment

CONSTRUCTION EXCELLENCE AWARD

Residential Buildings (S$1,500/m² & Above)

AWARD

presented to

PENTA-OCEAN CONSTRUCTION CO., LTD.

as the Builder for

The Orchard Residences

CHAIRMAN
Building and Construction Authority

CHAIRMAN
Assessment Committee
Construction Excellence Awards

24 May 2012

Building and Construction Authority



Mr. PENTA