

建築資訊模型在 軌道運輸工程設計之應用

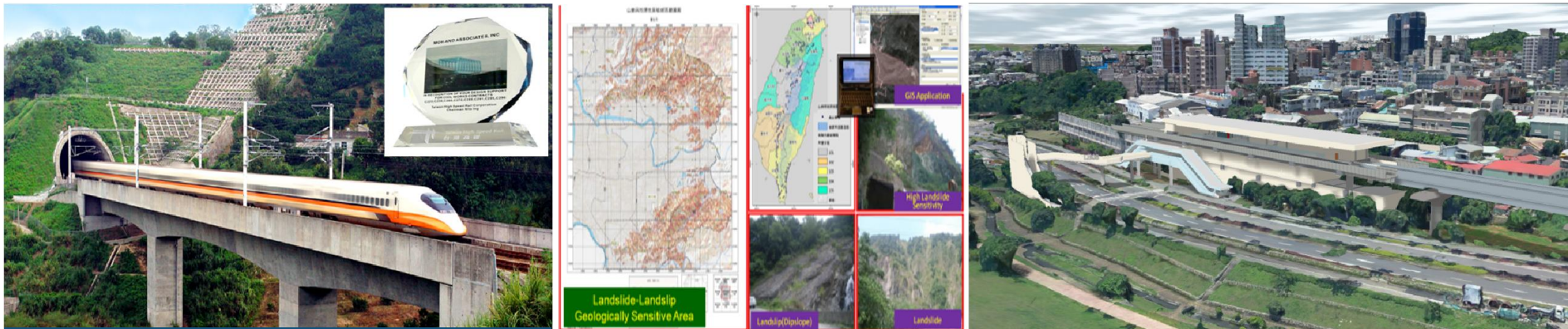


BIM MGMT. & ENGT. Integration Center

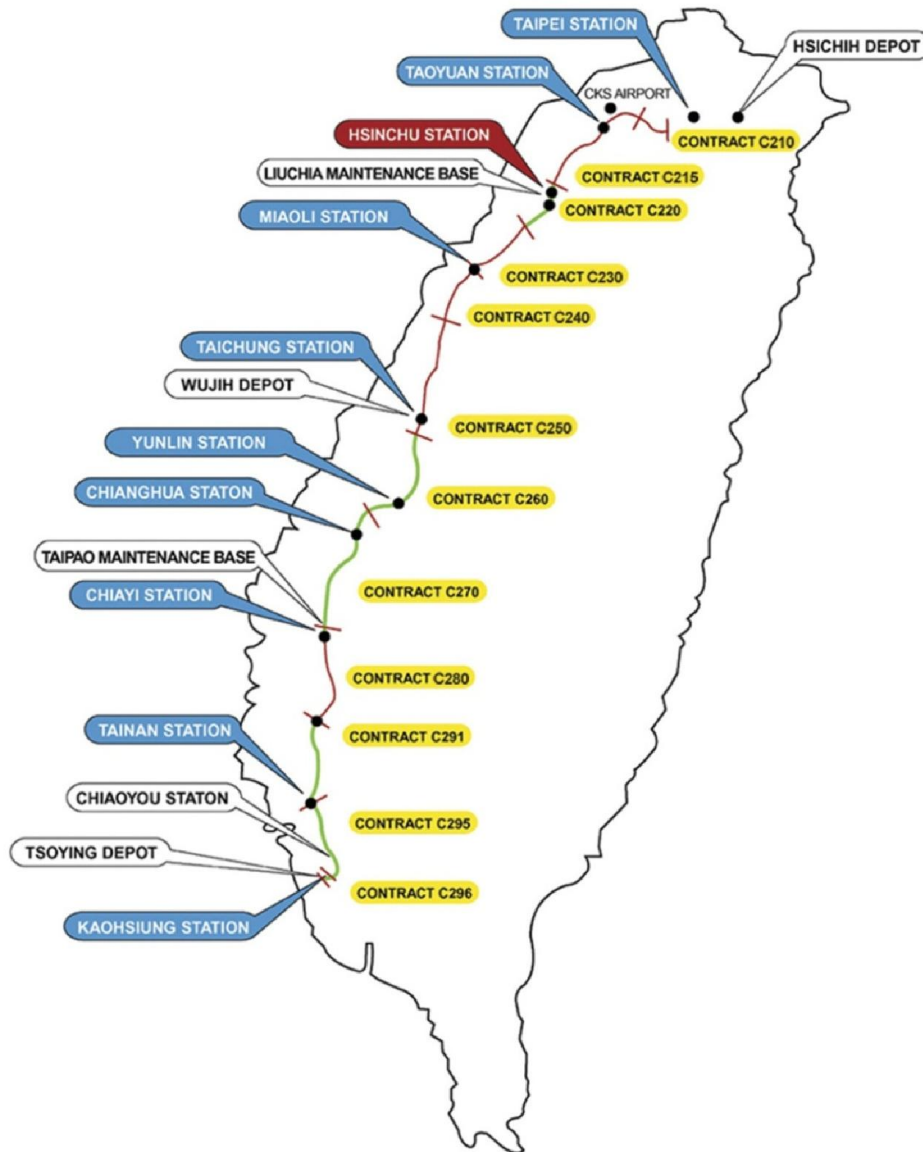
游中榮



- ❖ 學歷：中央大學應用地質研究所碩士
- ❖ 經歷：亞新公司大地工程及資訊部技術經理
中華民國大地工程技師公會理事
- ❖ 現職：亞新公司BIM中心經理
- ❖ 專長項目：大地工程、工程地質、地理資訊系統
MCSE、MCDBA



Taiwan High Speed Rail



Scope of Services:

For Government

- Feasibility Study and Preliminary Design

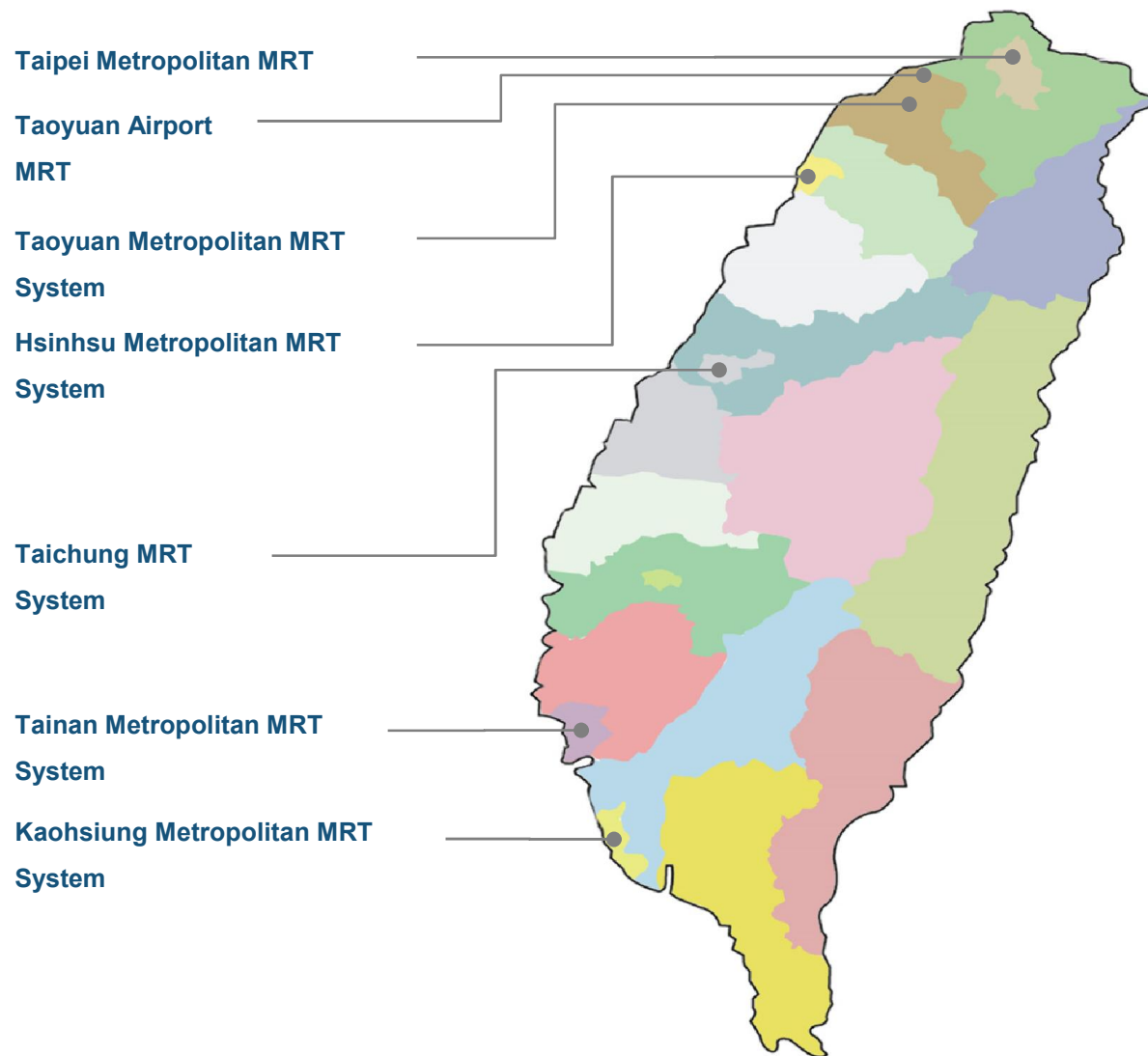
For Investors and Contractors

- Tender Document Preparation: C215, C290, Yunling Station
- Detailed Design: C220, C230, C240, C250, C280, C291, C295, C296, Depot D250
- Contractor's Independent Checking Engineer (CICE): C260, C270, depot D250, Hsinchu station

Others

- Interfacing management, land acquisition, vibration mitigation, environmental monitoring Inspection & maintenance program consultancy

MRT System-Taiwan



Taipei Metropolitan MRT System

- Planning & detailed design, risk management, construction supervision

Taoyuan Airport MRT

- BOT Investment Consultant

Taoyuan Metropolitan MRT System

- PCM & construction supervision

Hsinhsu Metropolitan MRT System

- Planning

Taichung MRT System

- General Consultant(phase1~phase3)

Tainan Metropolitan MRT System

- Feasibility Study and Privatization Study

Kaohsiung Metropolitan MRT System

- General consultant & detailed design

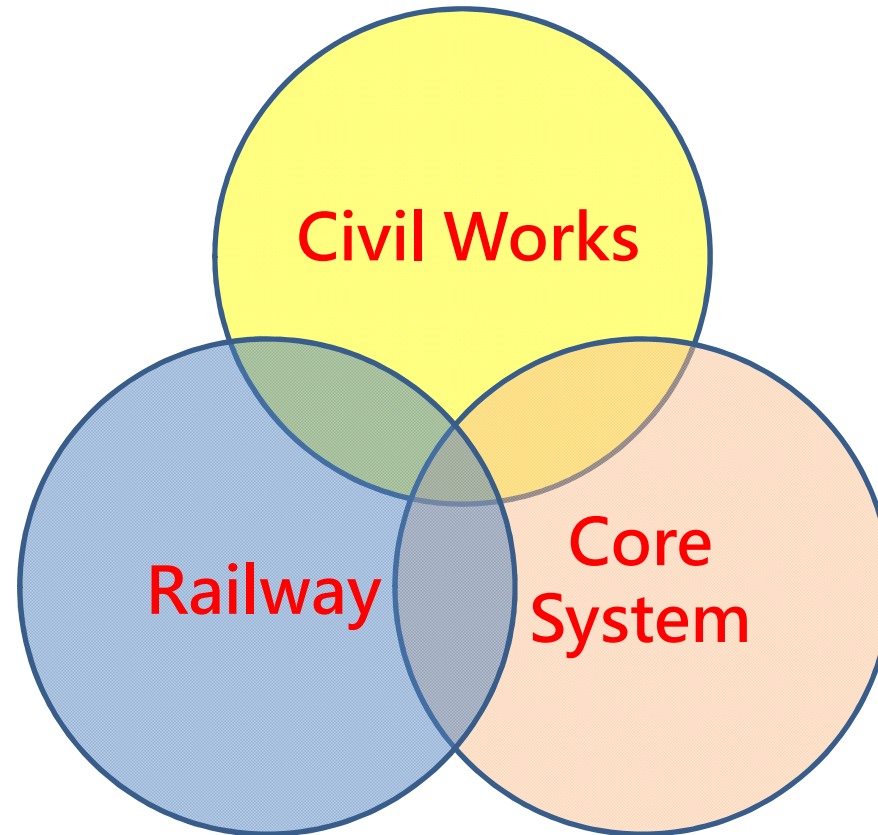
Taipei MRT System- Detailed Design & Construction Supervision



MAA has participated in over 60% of Taipei MRT civil engineering design and consultancy

RailWay Systems

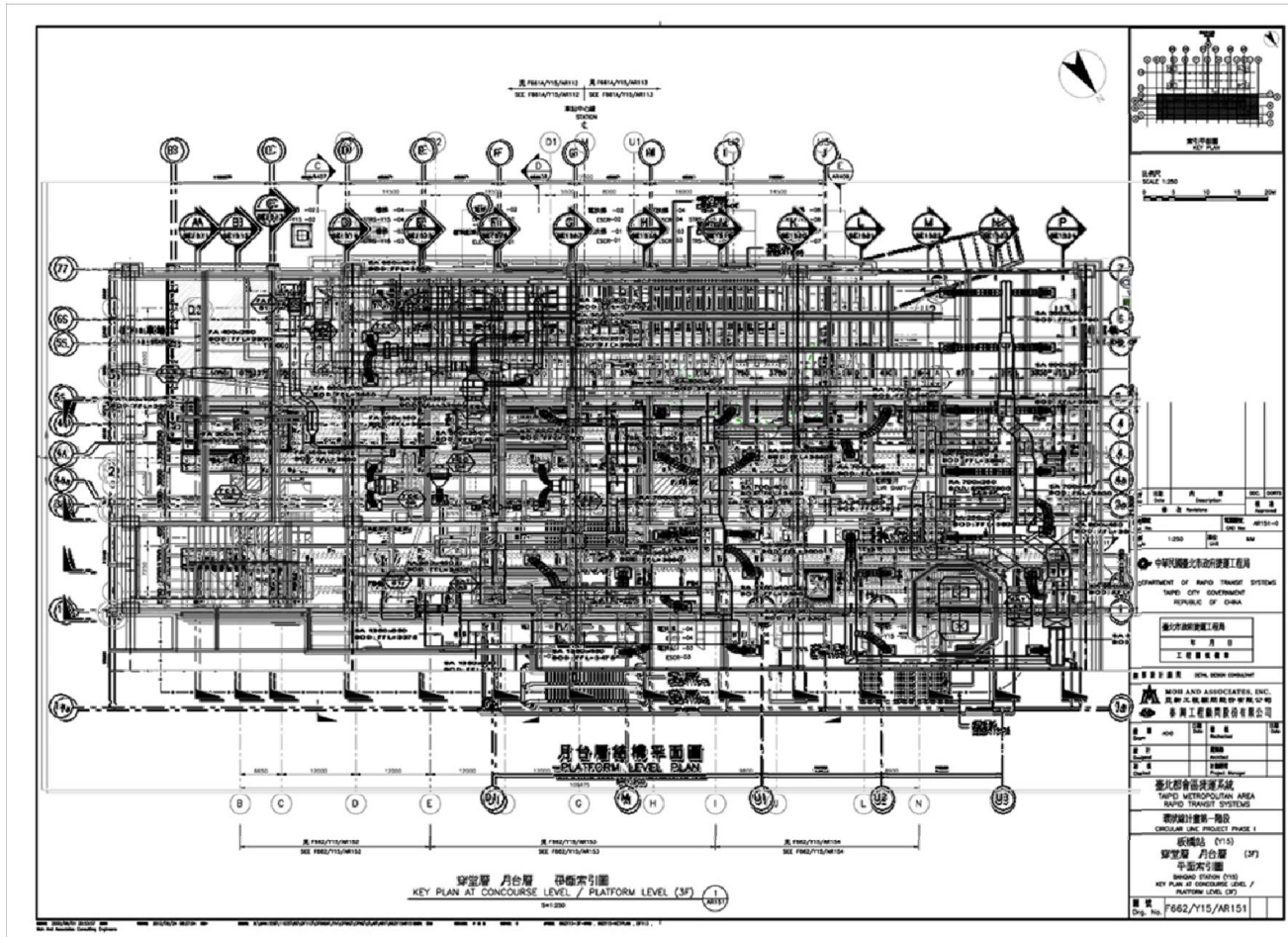
- Architecture
- Structure
- Civil Works
- Underground Facilities
- MEP
- Tracks
- Electrification
- Power Supply
- Communication
- Signaling
- Station facilities
- Depots
- Rolling Stocks



Why BIM?

Information Management

Architecture
Structure
E&M



Design Integration

- 3D visualization of design
- Design synchronization on a same model

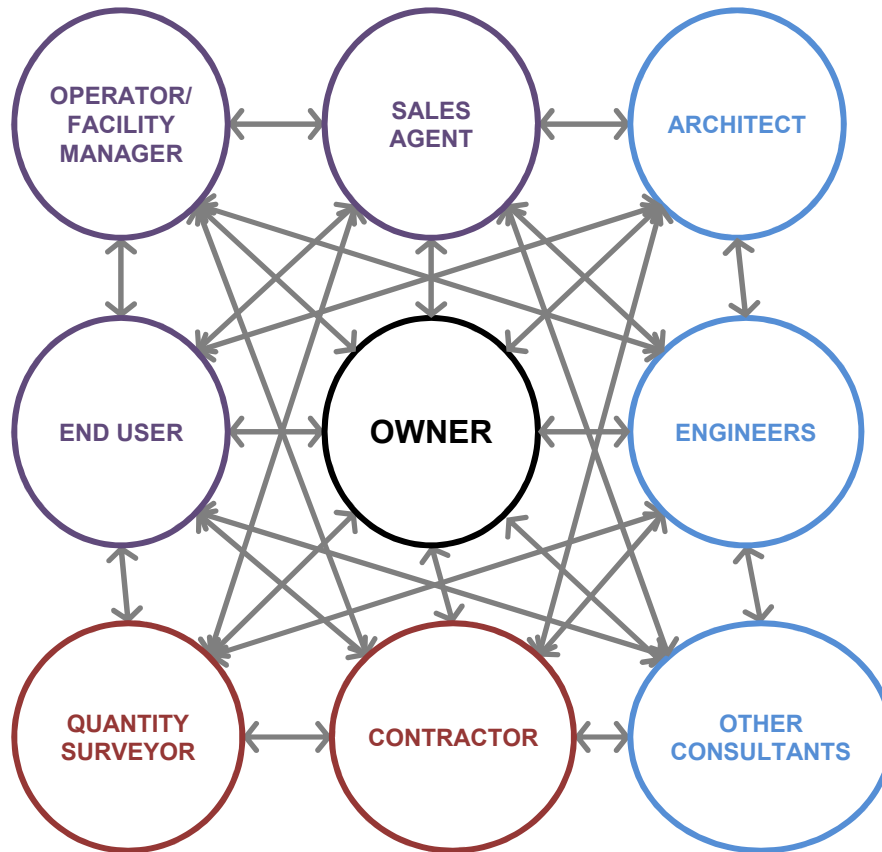
Why BIM?

Information Management

Design
Construction
Operation/Maintenance

Team Management

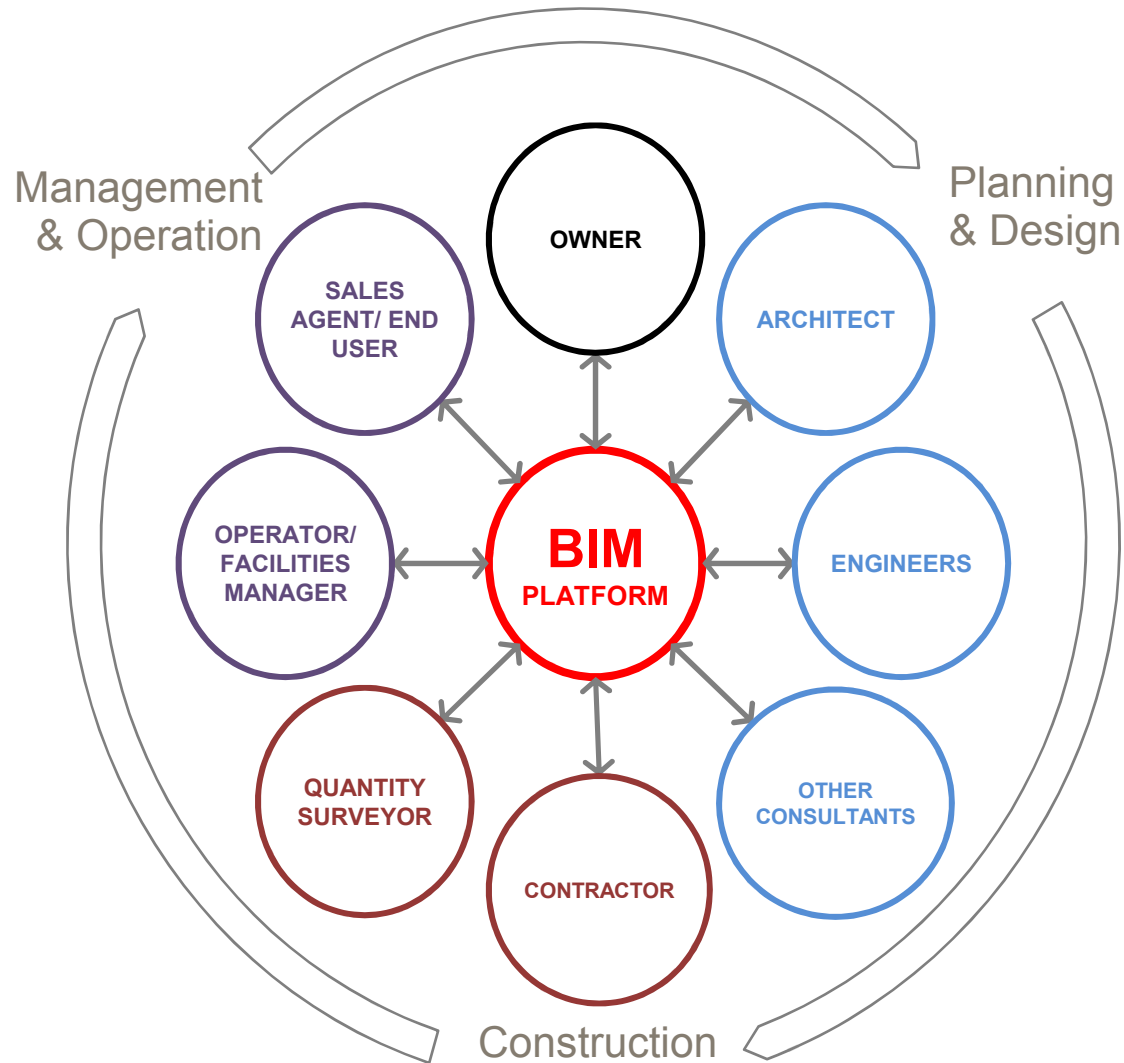
Communication is high
cost and time consuming



Why BIM?

Information Management

Communication Platform



Working Platform

3D model is used as communication interface for client, architect, engineer, and contractor to solve issues more efficiently.

Why BIM?

Information Management



Communication Platform

Seamless Integration

High Efficient Data Synchronization

BIM serves not only a 3D model but also acts as an information management platform. Data with different formats can be synchronized and exchanged through the platform.

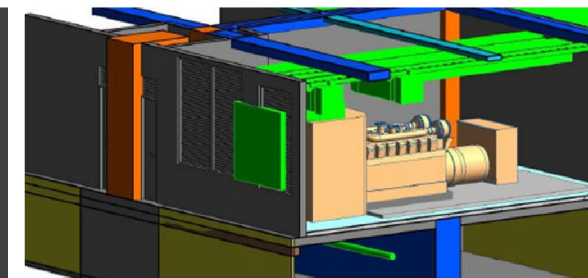
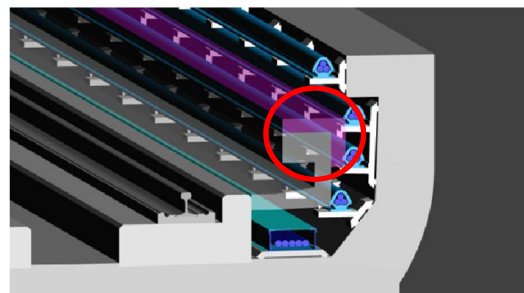
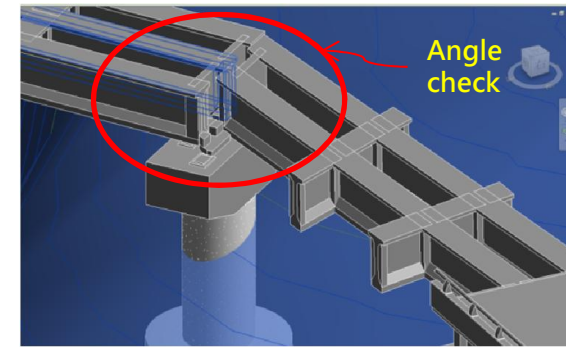
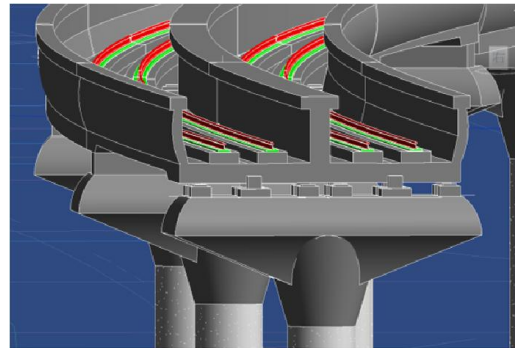
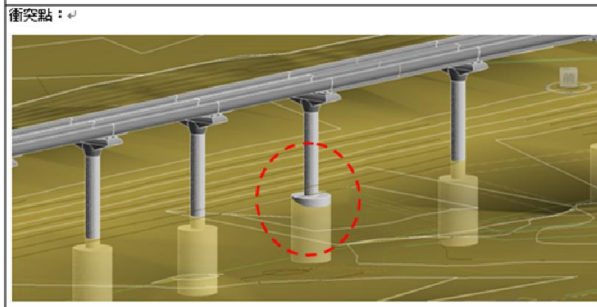
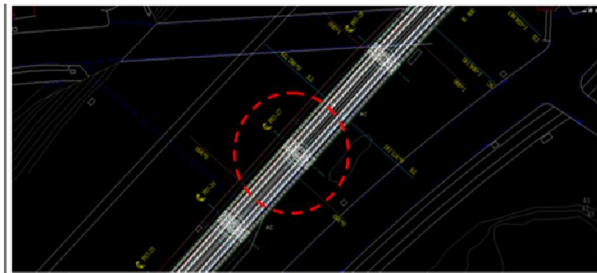
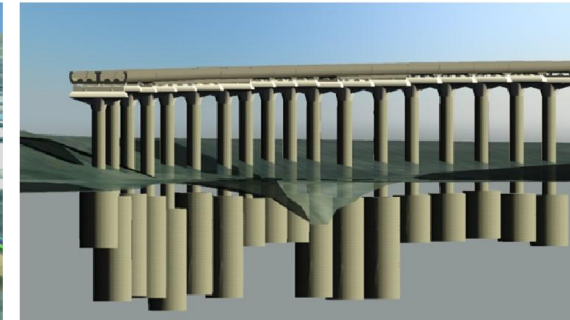
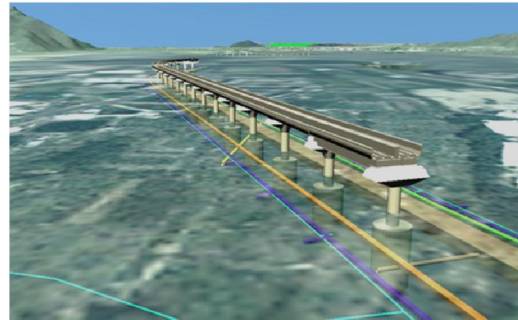
BIM on Rail Engineering Design



BIM Applications

Planning & Design

- Railway alignment & visualization
- Utility conflict detection
- Design facilitation
- Design check
- Clash detection
- 3D CSD/SEM
- Quantity take-off
- 4D construction scheduling
- Integrated construction management



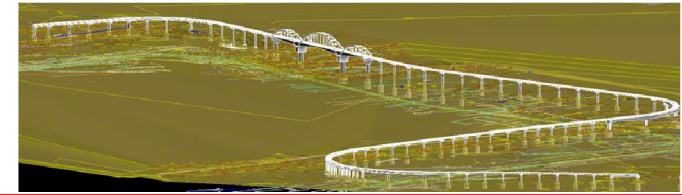
Alignment/Planning

- BIM + DEM + 3D GIS + 3D Model
- Existing Condition
- Master Planning
- Cost Estimating
- Phase Planning / Scheduling

Layout Plan of MRT Line



Alignment/Planning

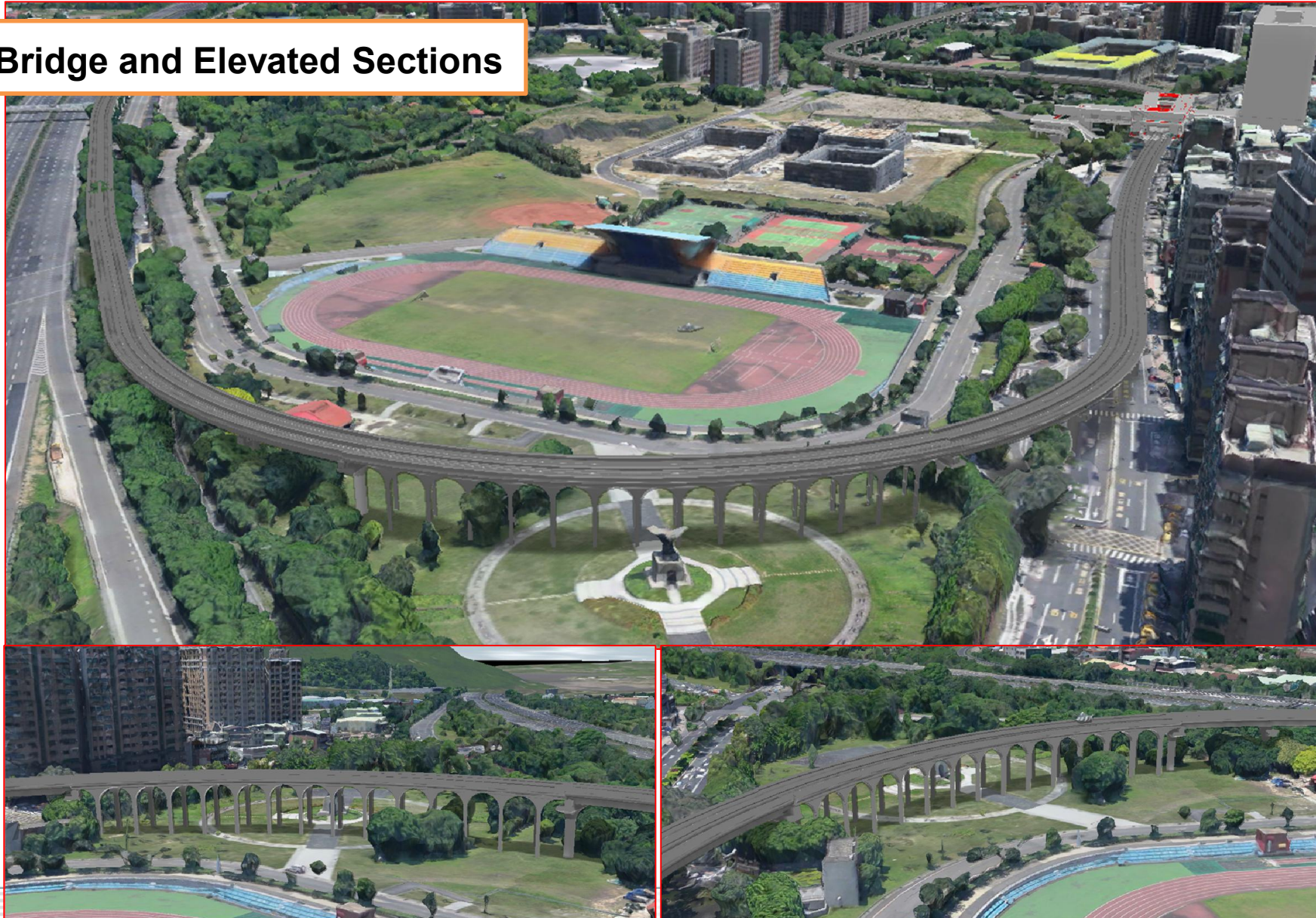


Bridge and Elevated Sections



Alignment/Planning

Bridge and Elevated Sections



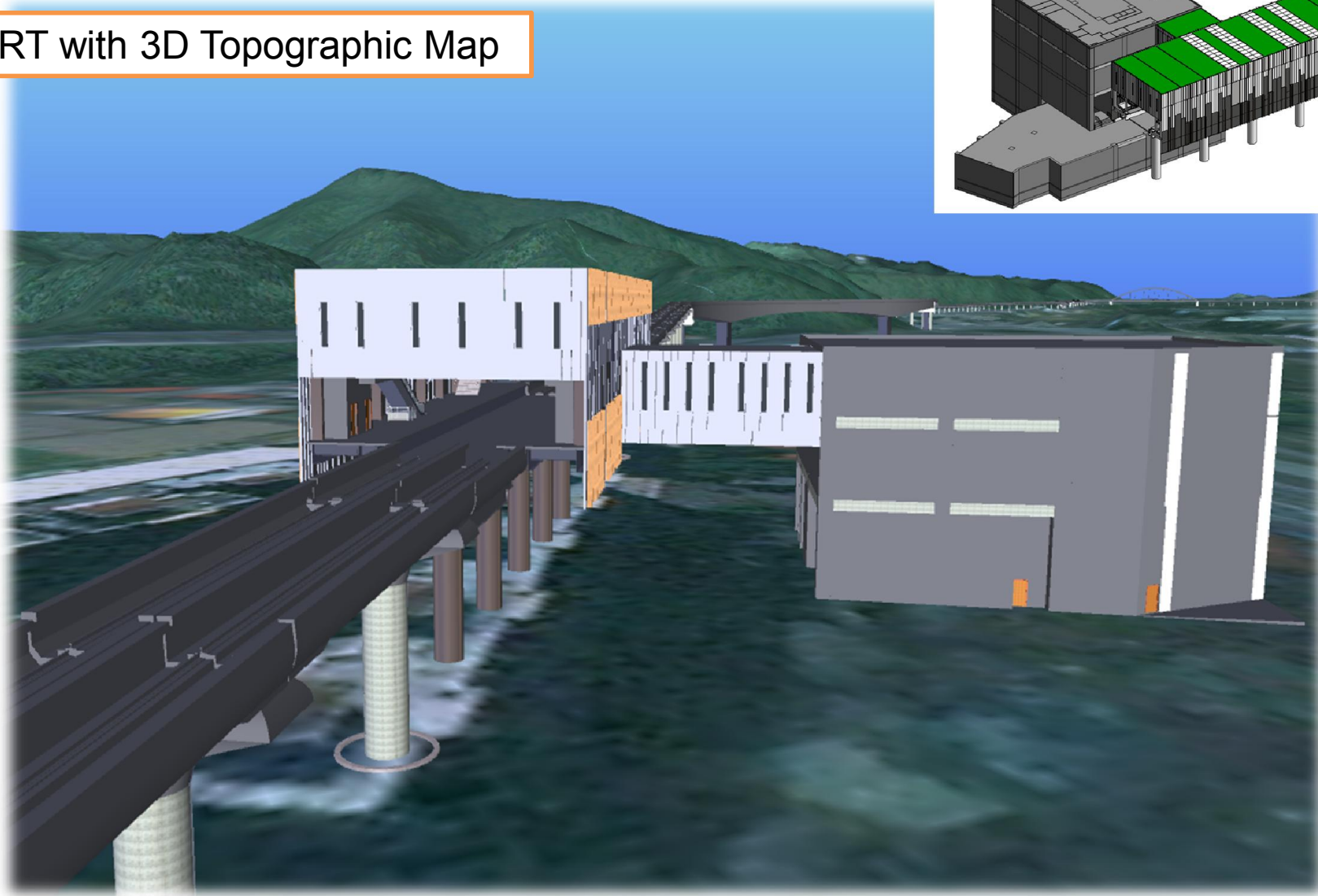
Alignment/Planning

Bridge and Elevated Sections



Alignment/Planning

MRT with 3D Topographic Map

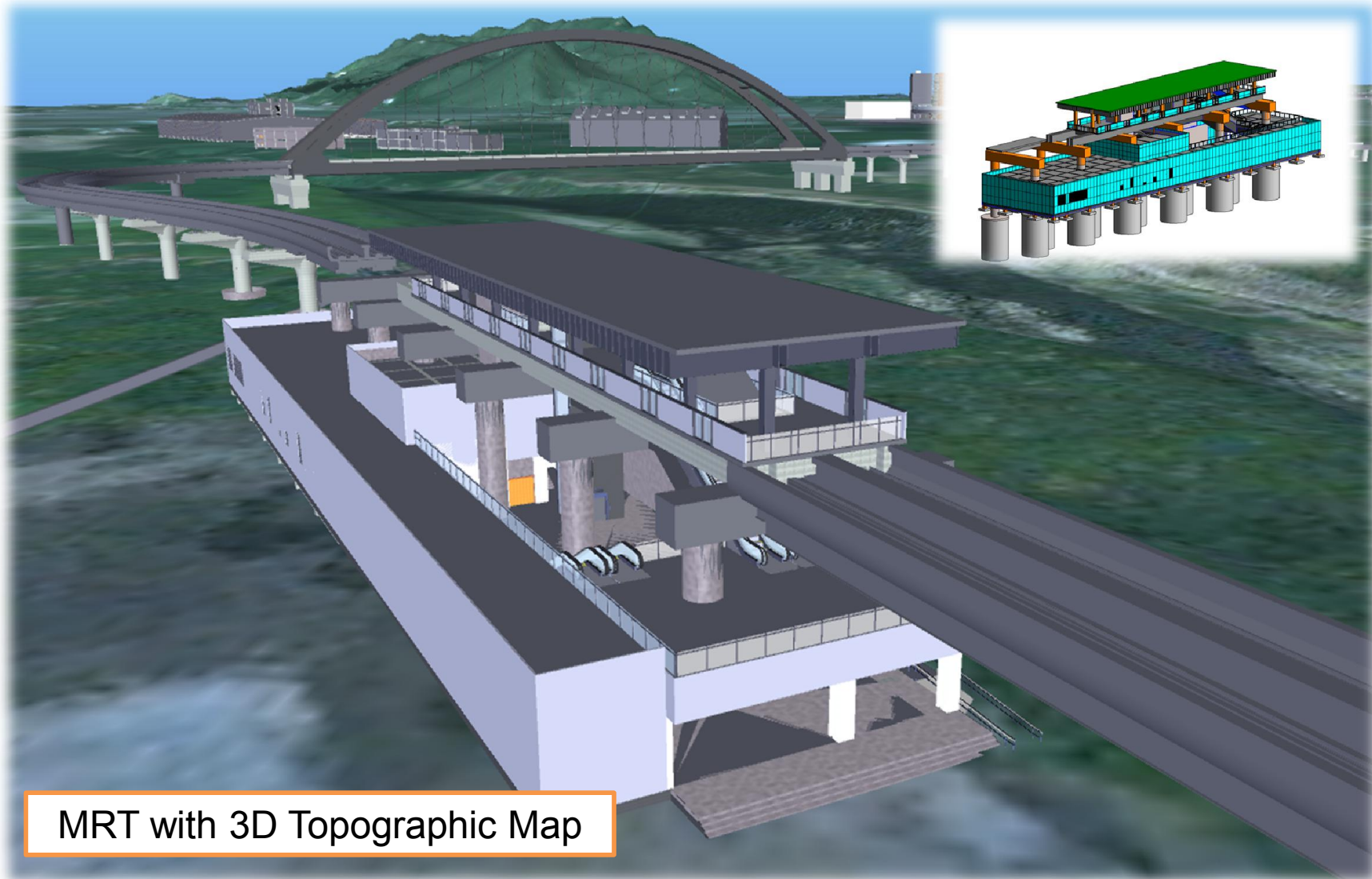


Alignment/Planning

Integrated BIM & 3D Model



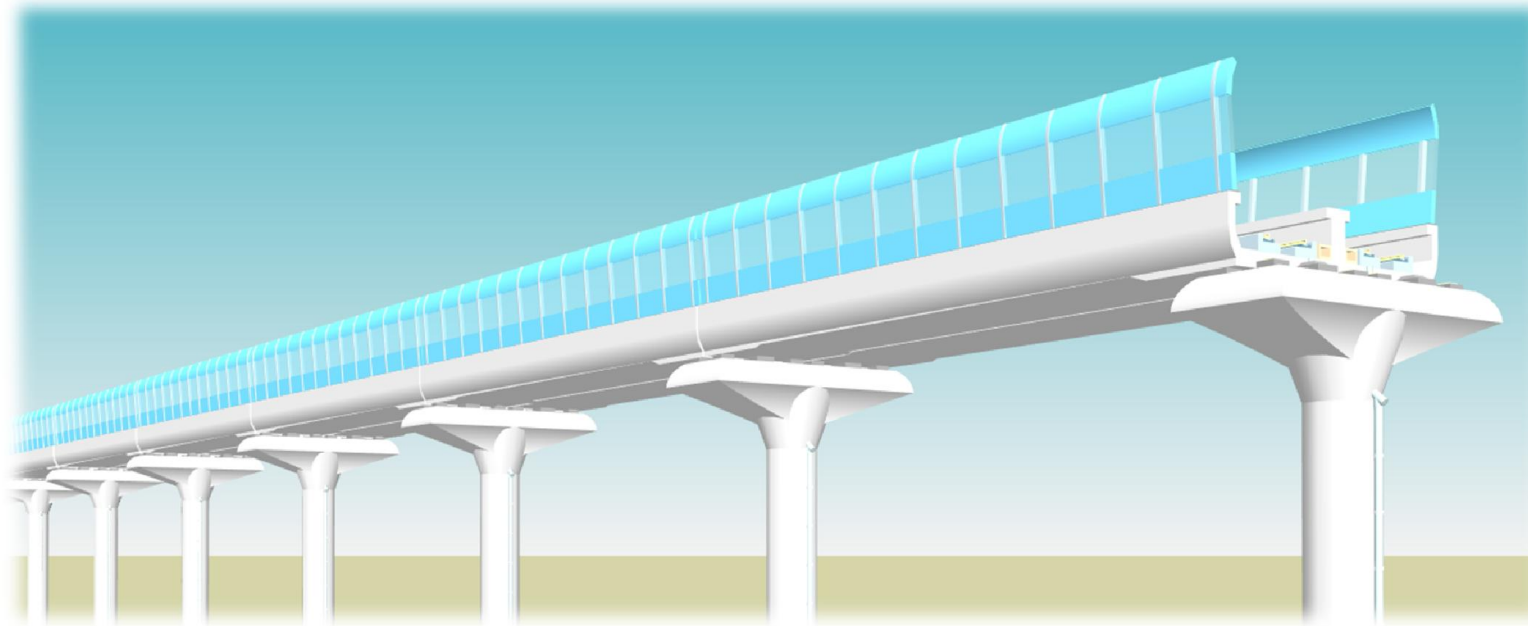
Alignment/Planning



MRT with 3D Topographic Map

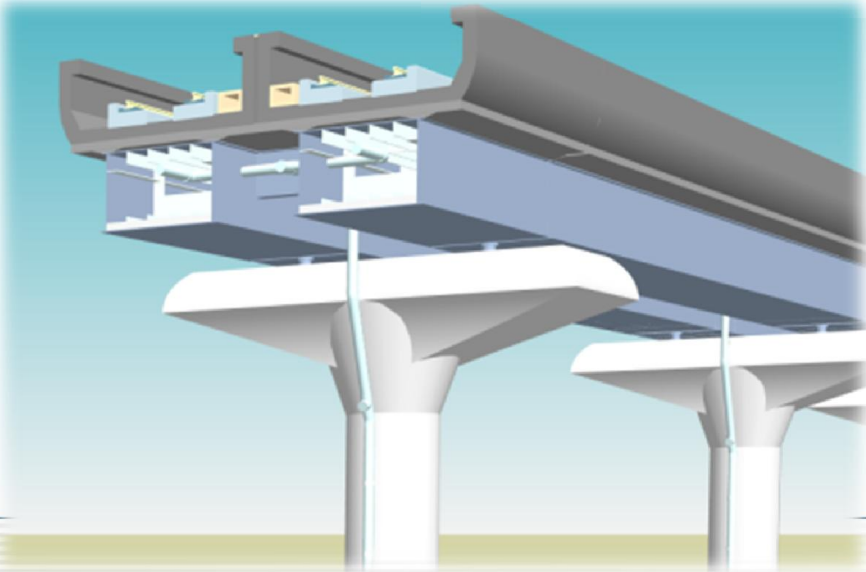
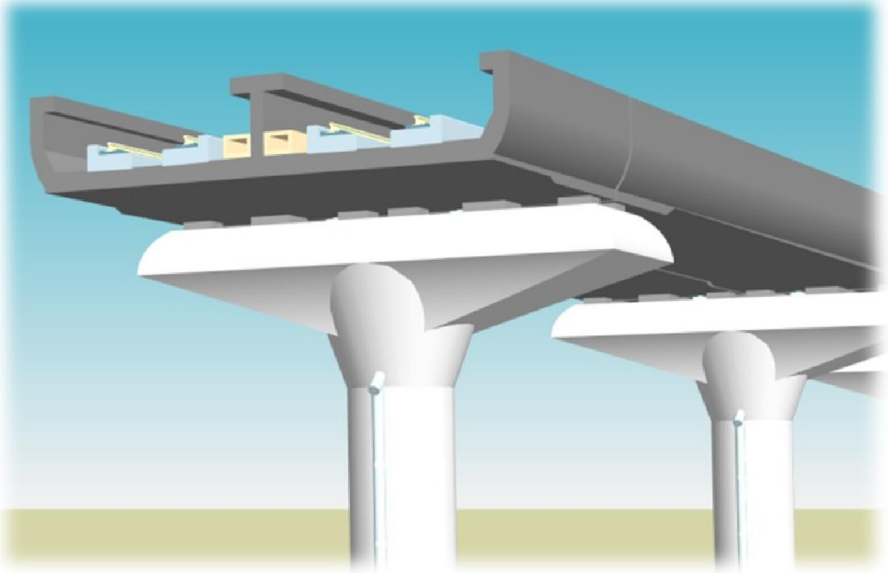
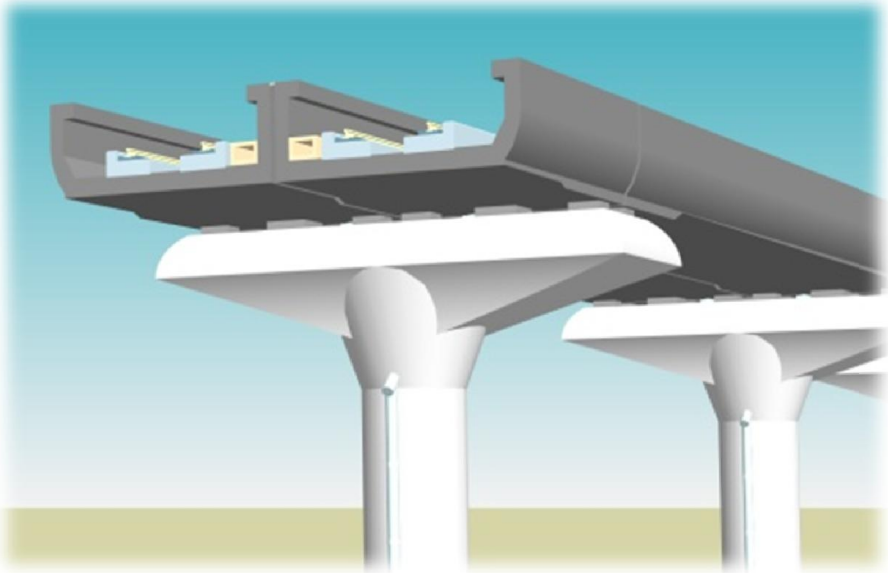
Engineering Design

- Existing Condition
- Design Modeling
- Master Planning
- Cost Estimating
- Phase Planning / Scheduling
- Site Condition
- Alignment Design
- Structure Design
- Daylight Analysis
- Green Building / Sustainability Analysis
- MEP Design
- Core System Design
- Codes / Standards Compliance
- Design Authoring
- Design Review
- 3D Coordination



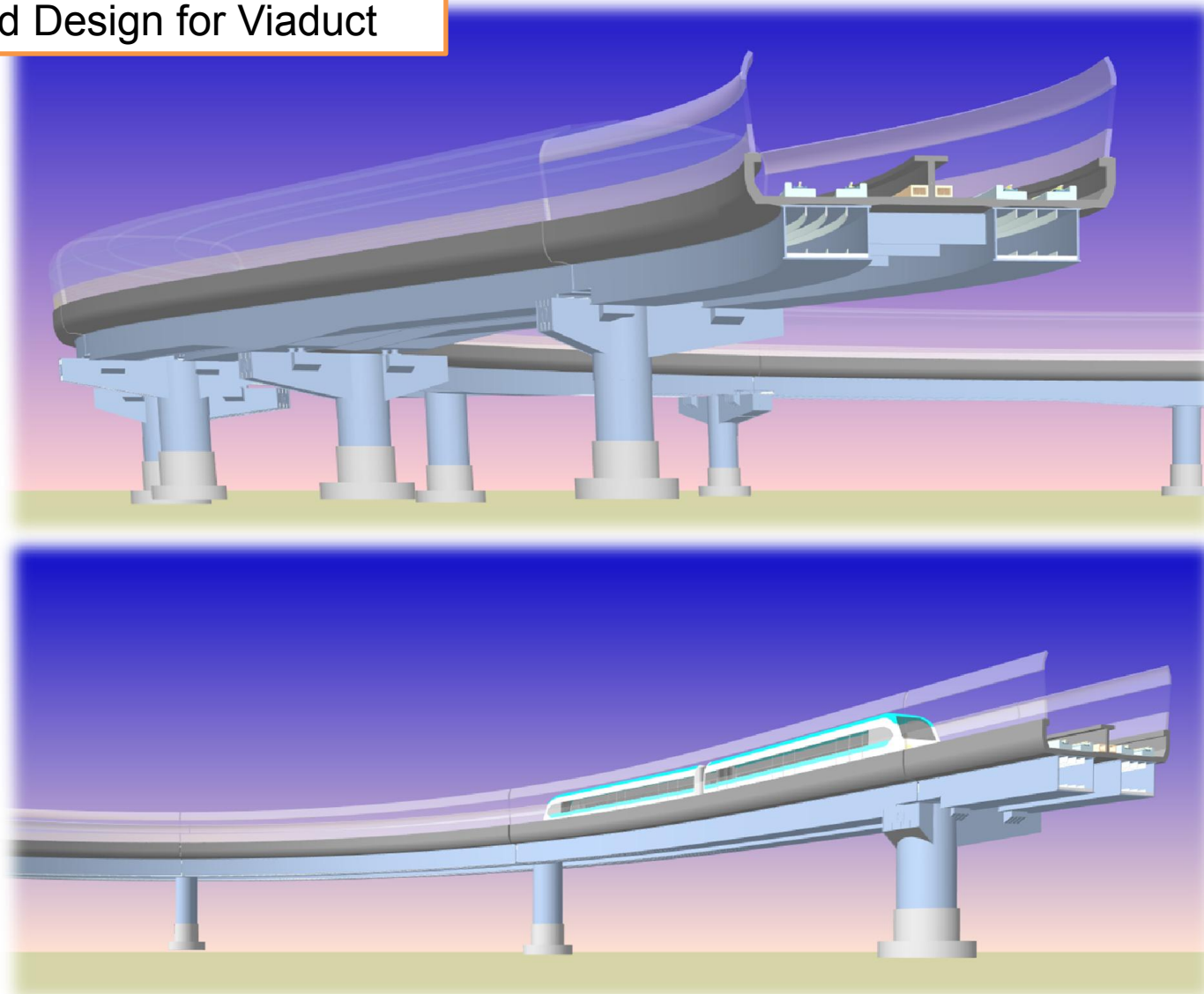
Engineering Design

Detailed Design for Viaduct

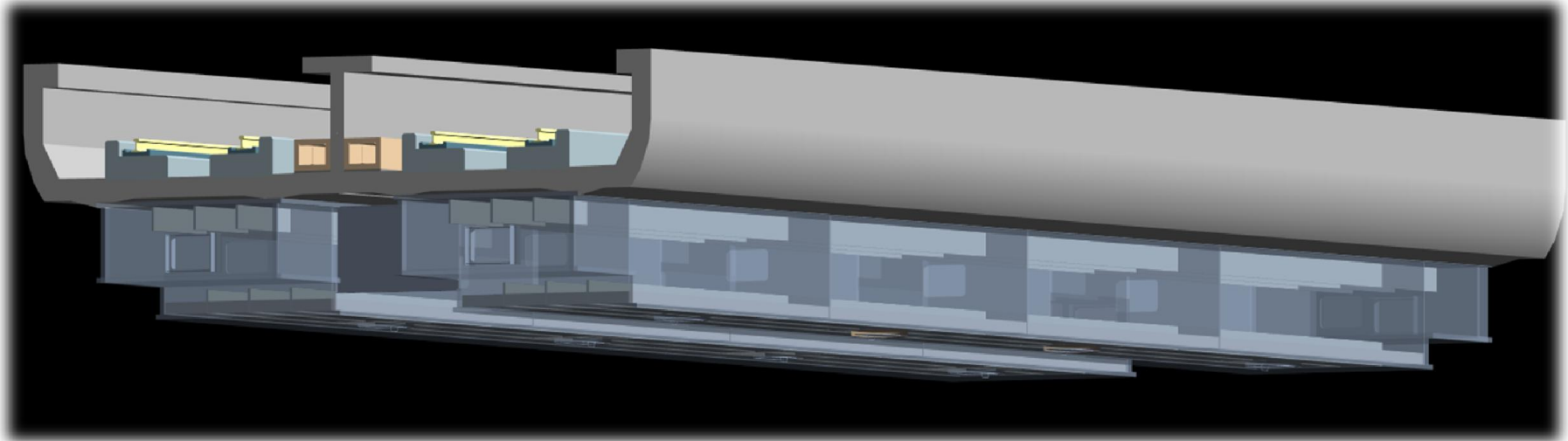
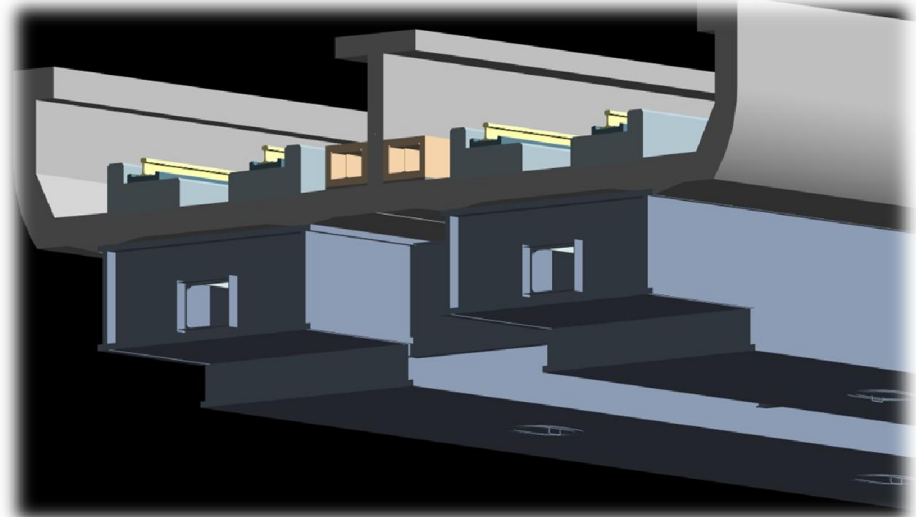
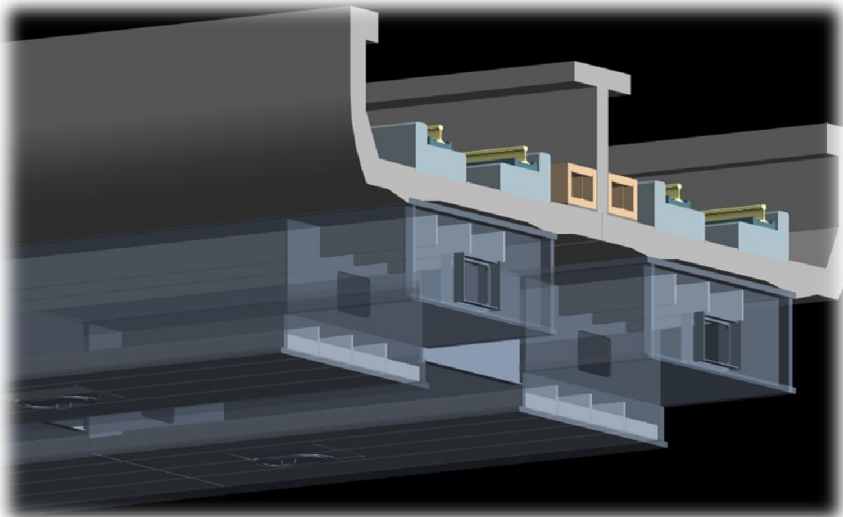


Engineering Design

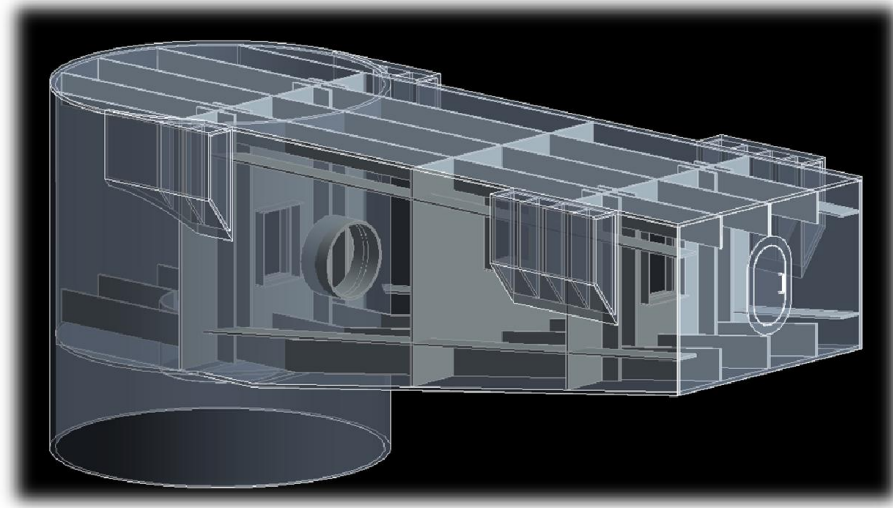
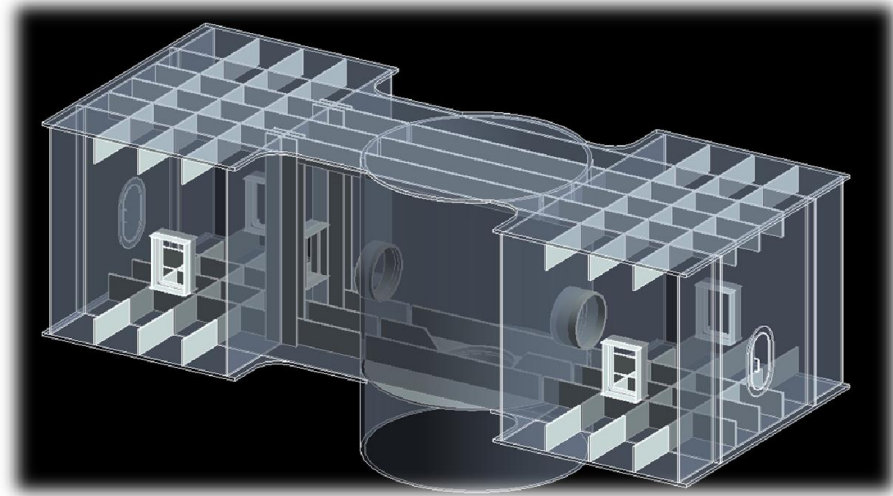
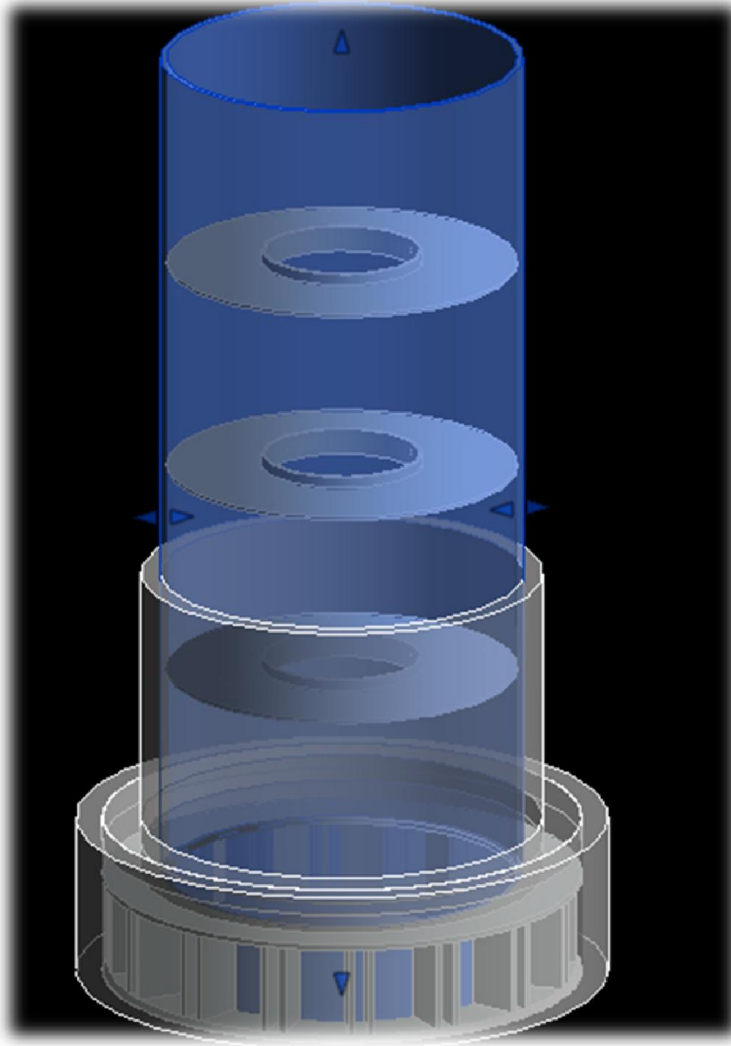
Detailed Design for Viaduct



Engineering Design

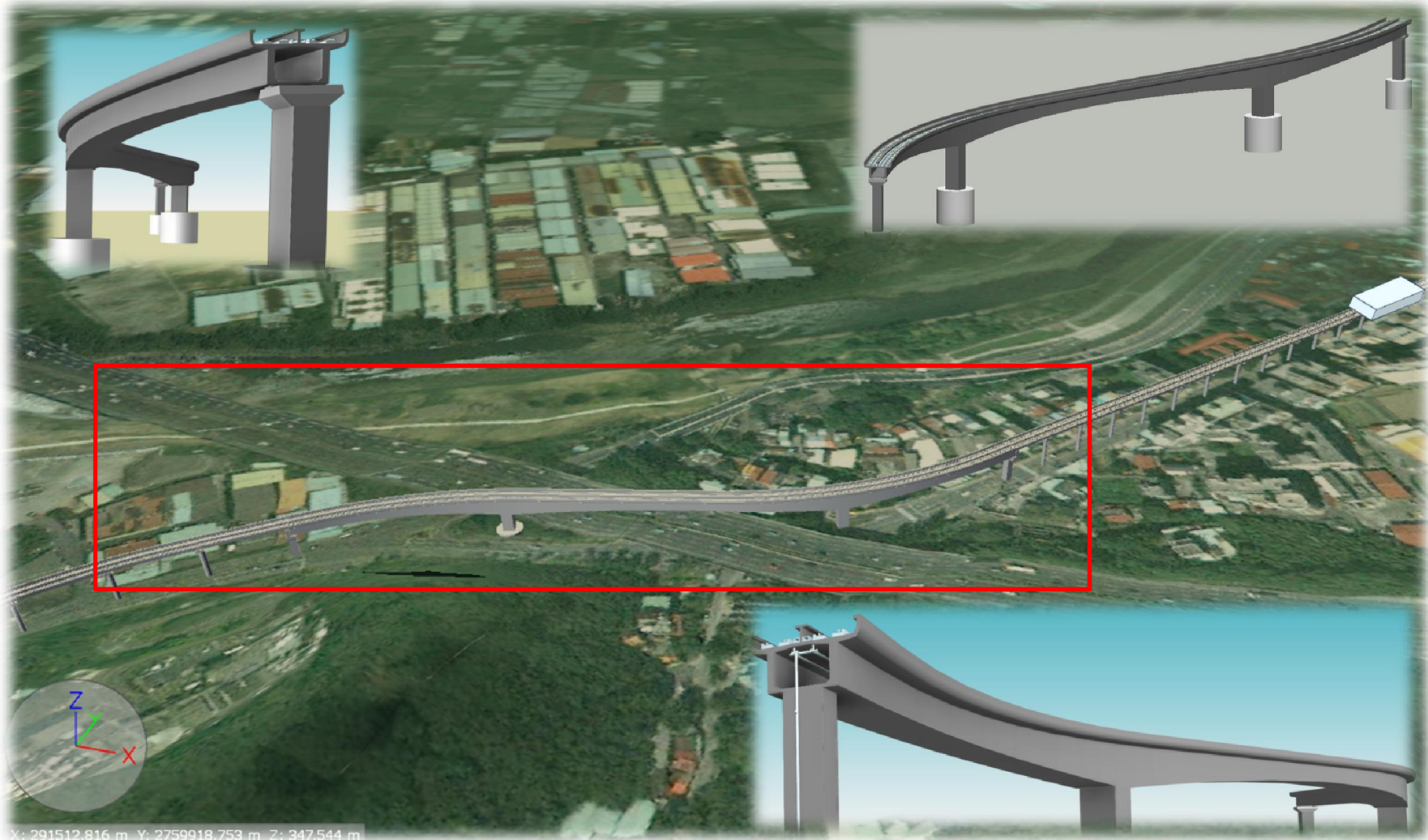


Engineering Design



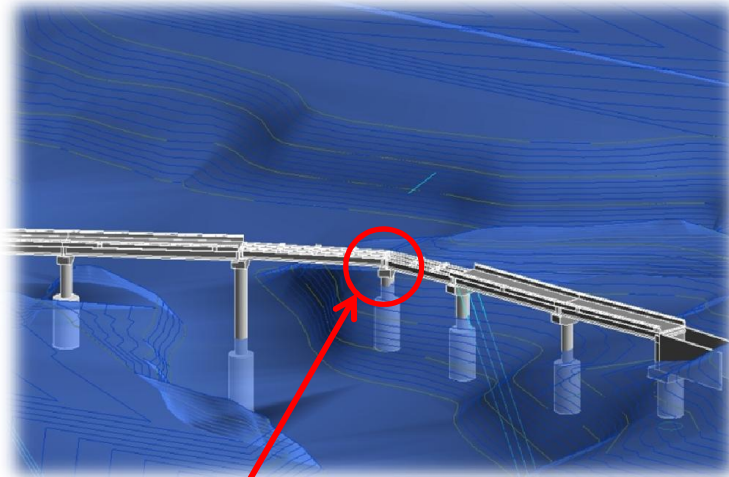
Engineering Design

Rail Overpass Simulation

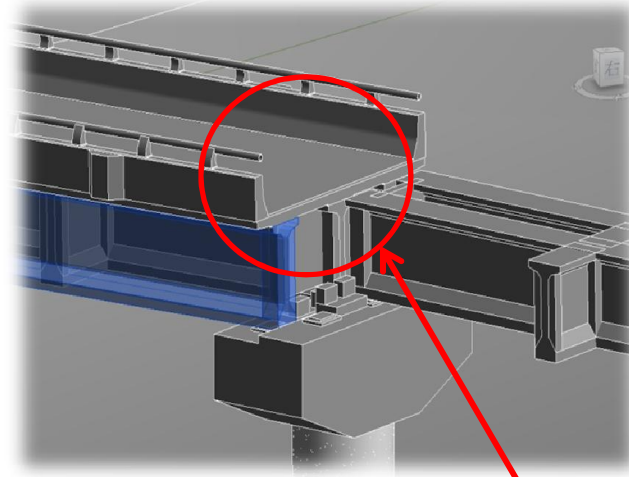


Engineering Design

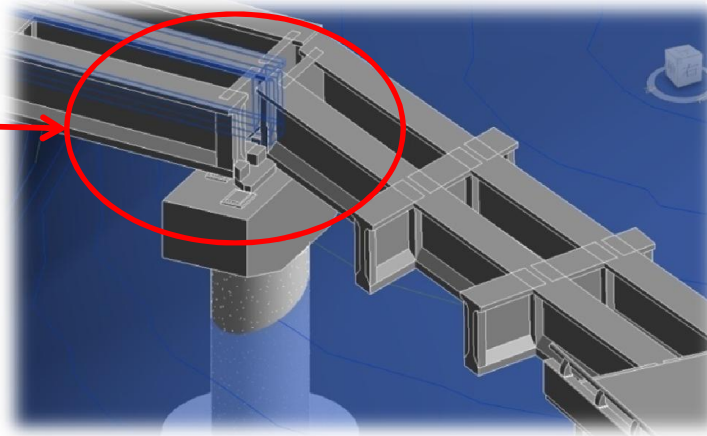
Structural Design Check



**Girder direction
change connection
angle check**

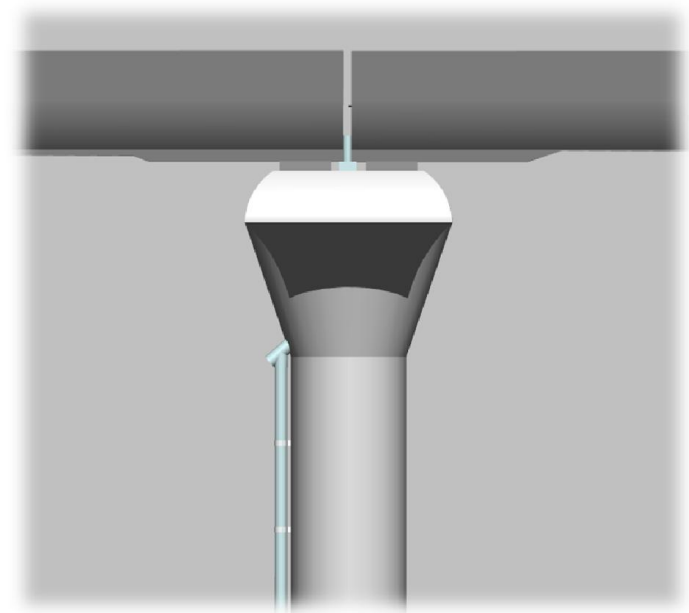
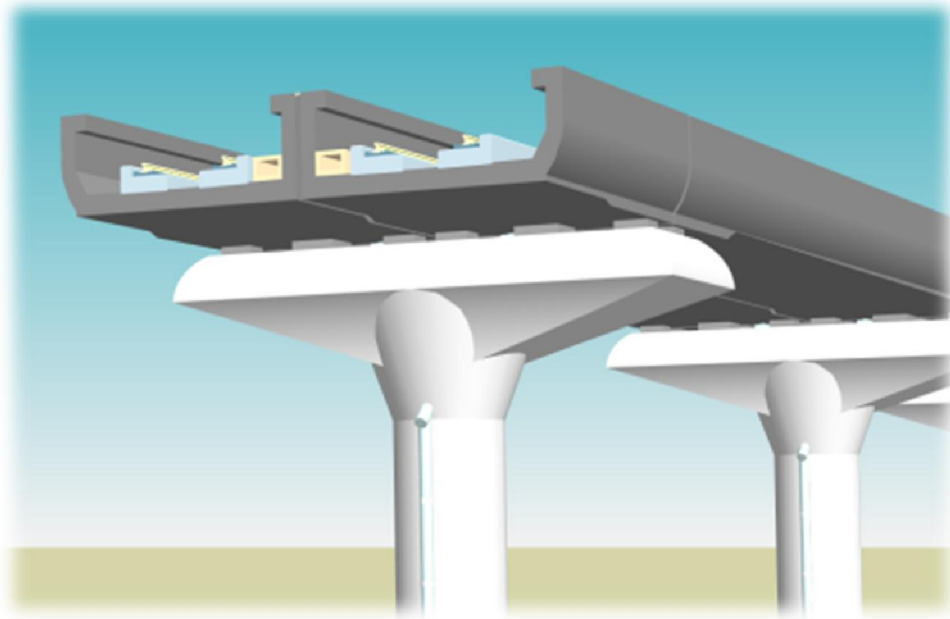


**Girder and bearing pad
elevation check**



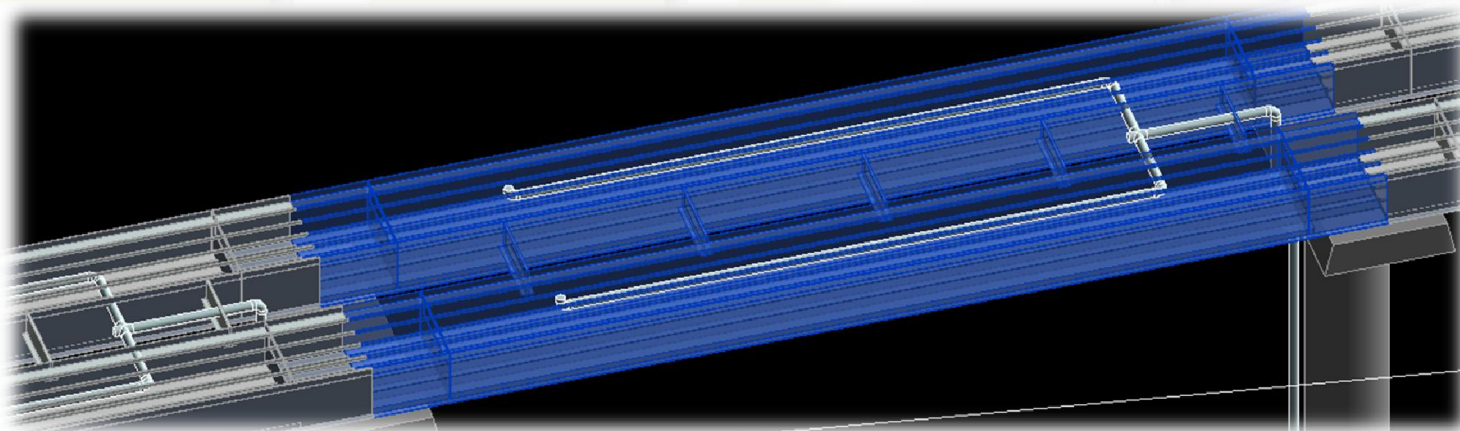
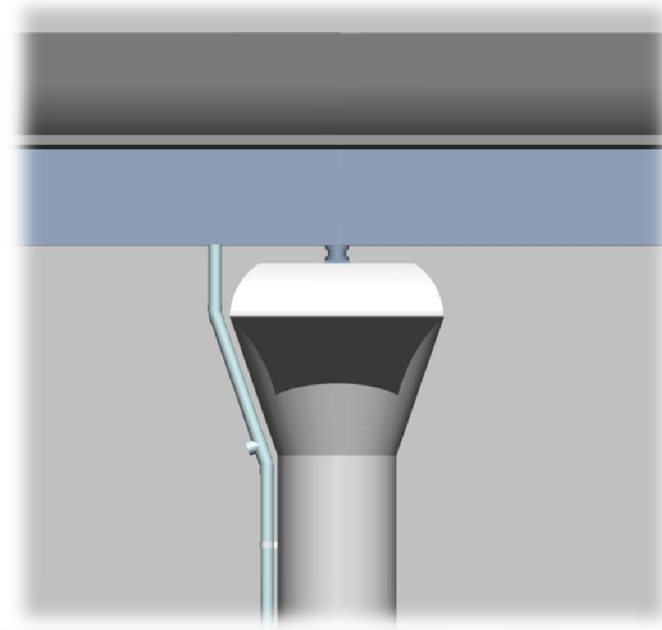
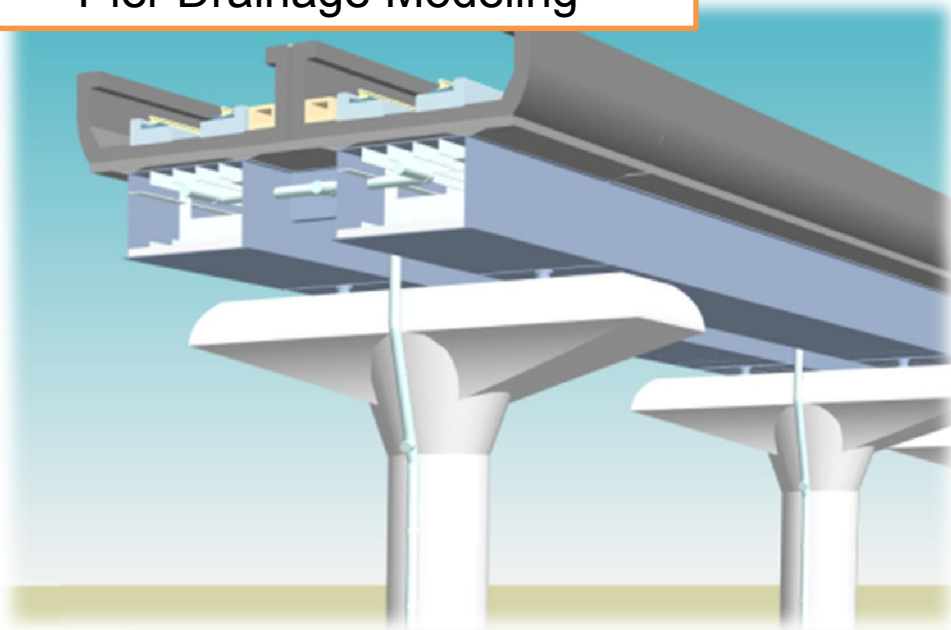
Engineering Design

Pier Drainage Modeling



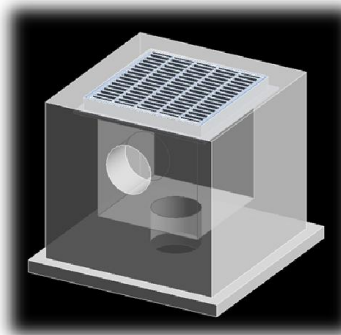
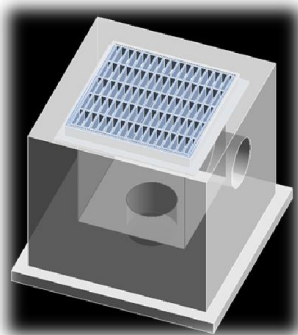
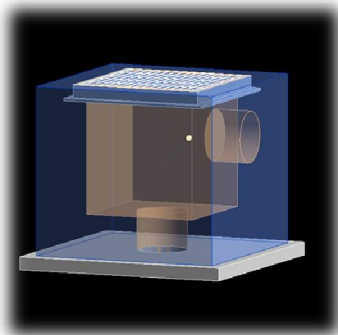
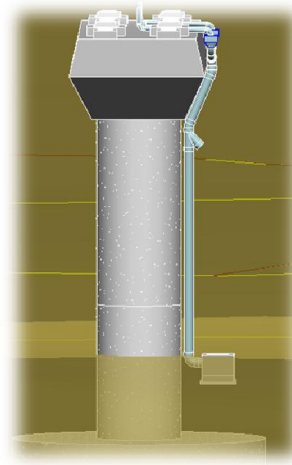
Engineering Design

Pier Drainage Modeling



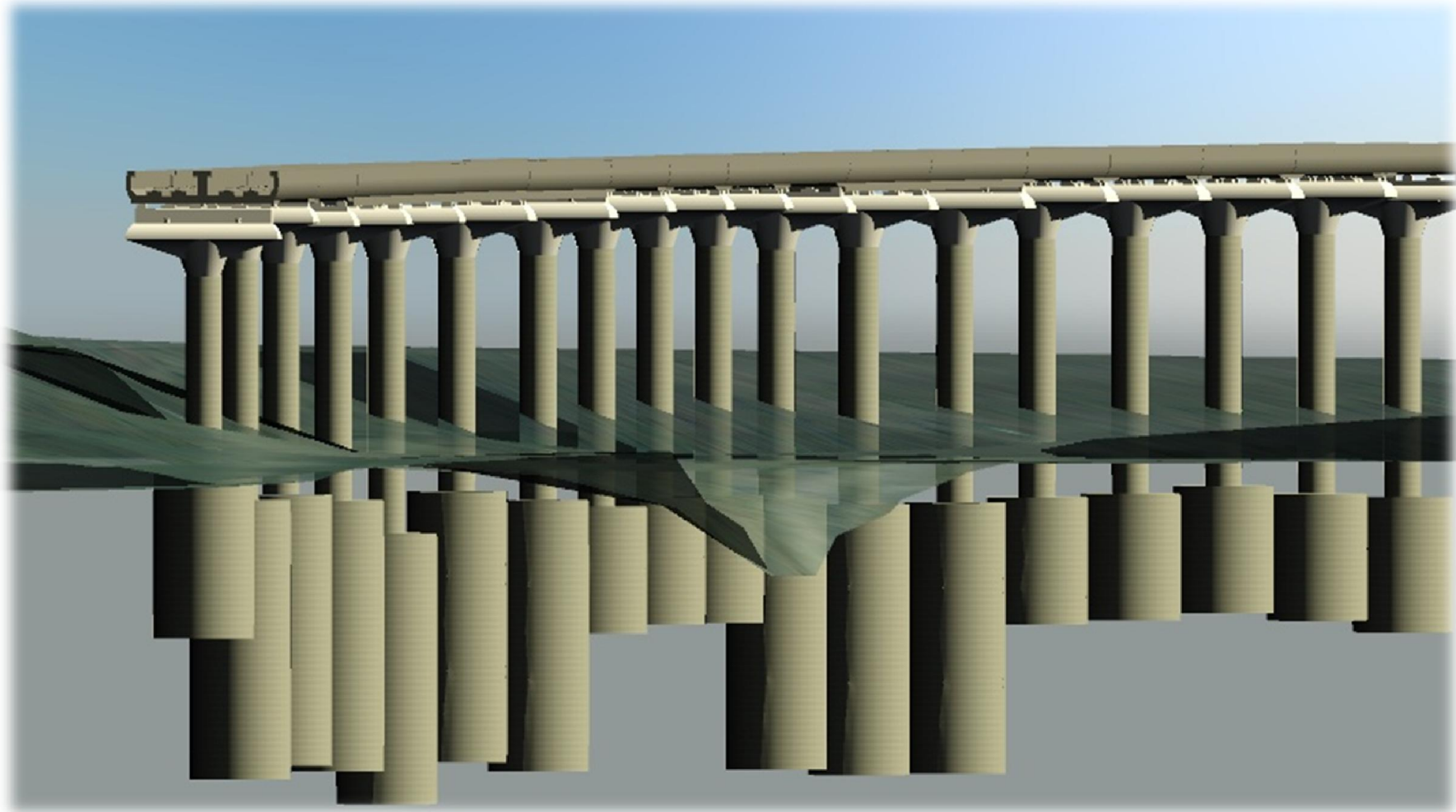
Engineering Design

Drainage Catch Pit



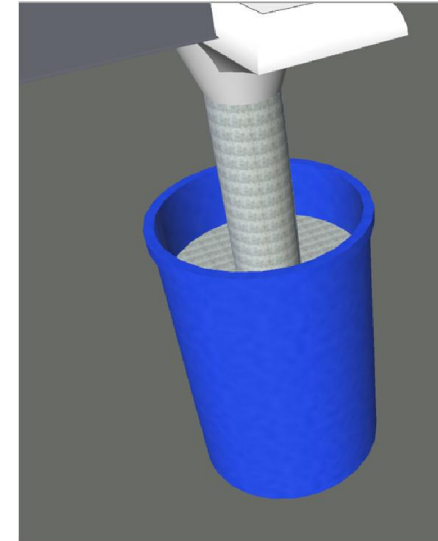
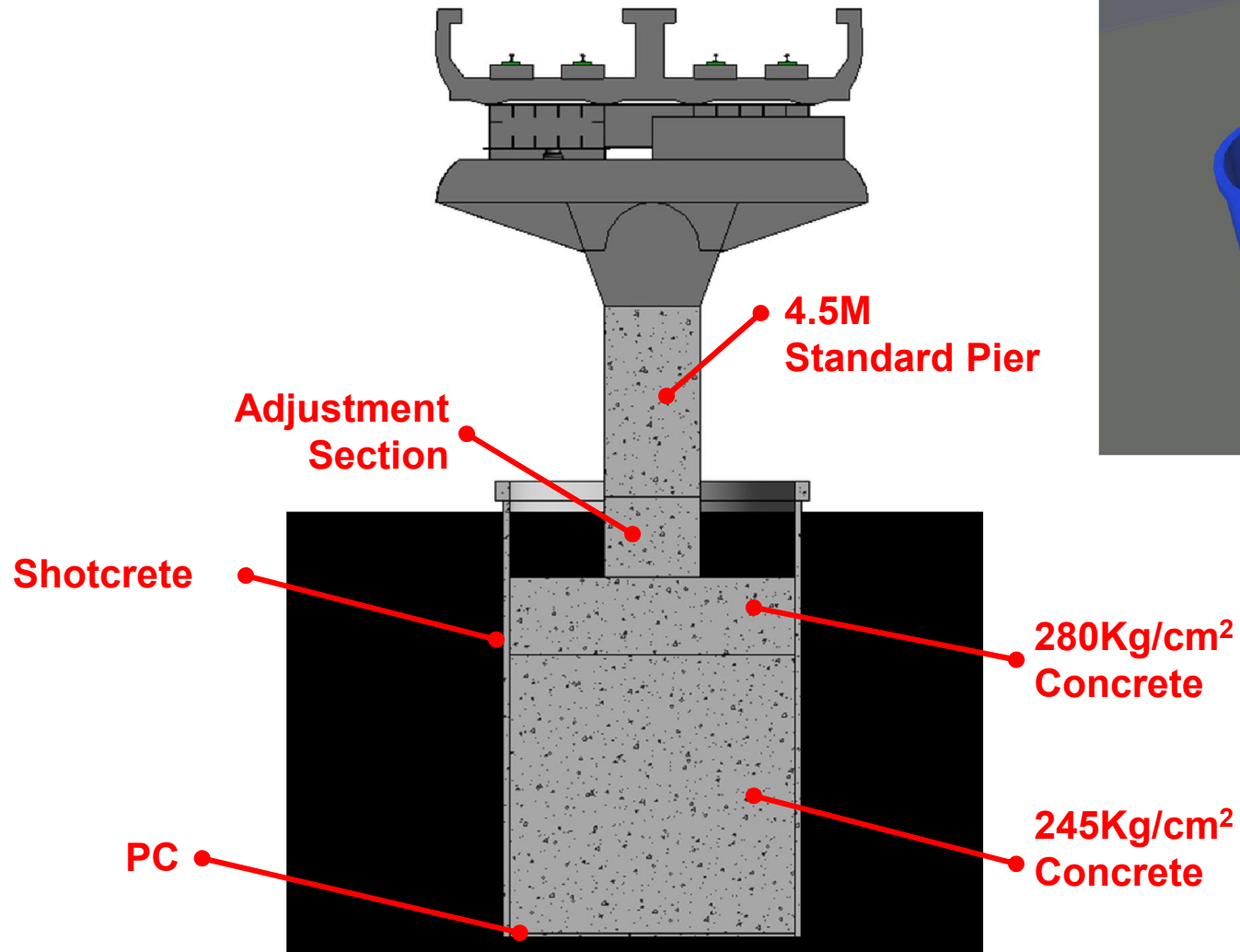
Engineering Design

Foundation and Elevation Check



Engineering Design

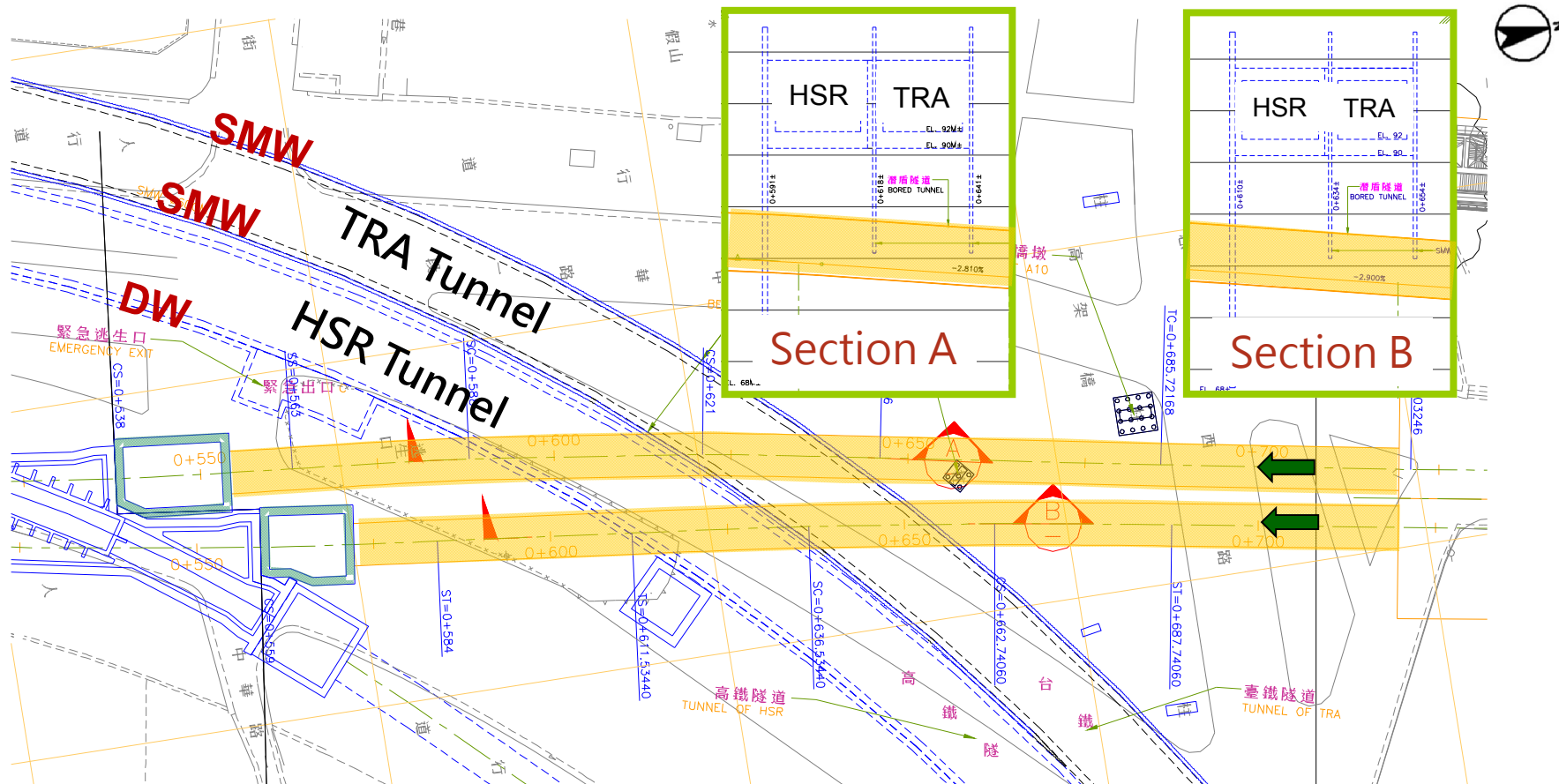
Bridge Pier Detailed Model



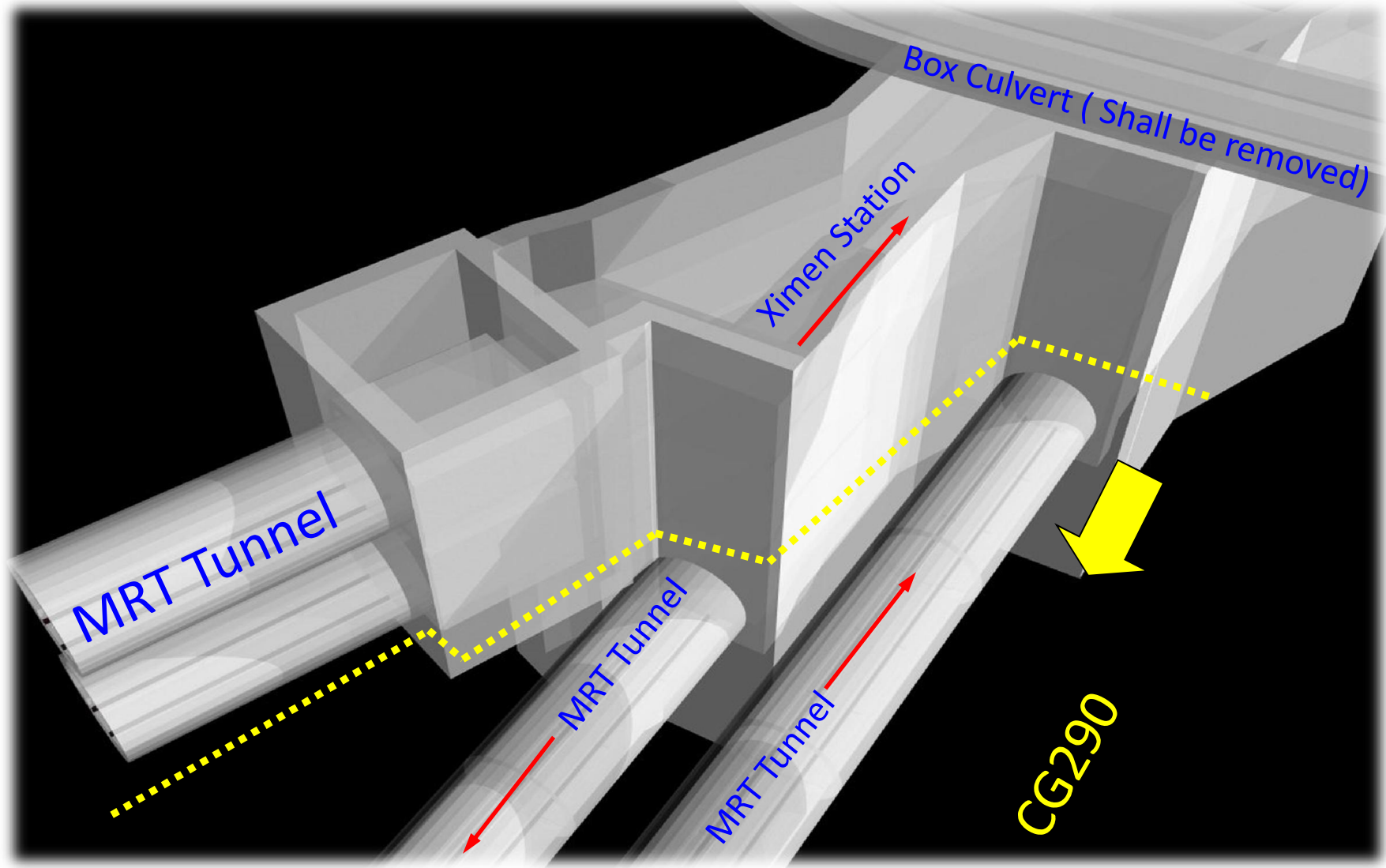
Shield Tunnel & Rail



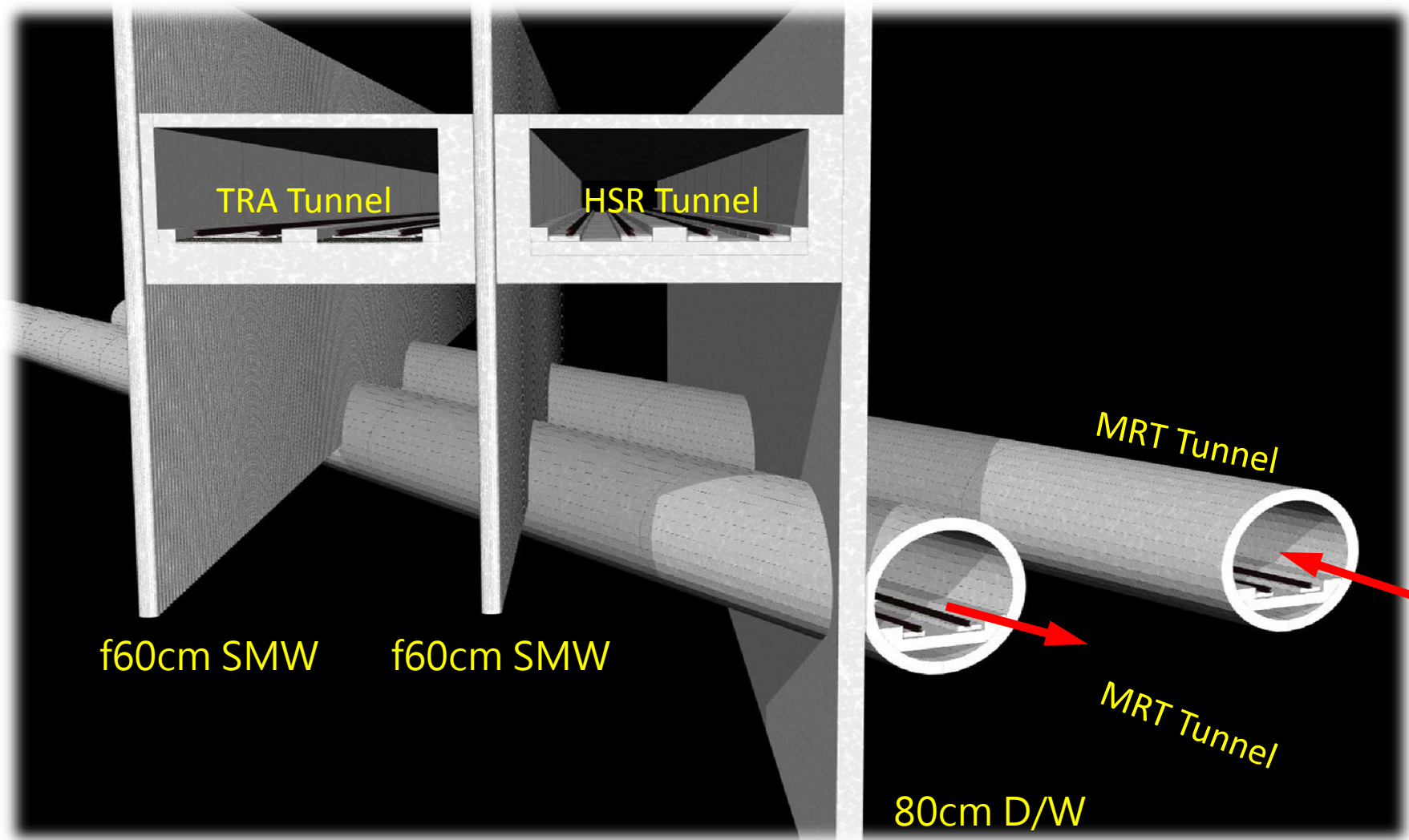
Shield Tunnel & Rail



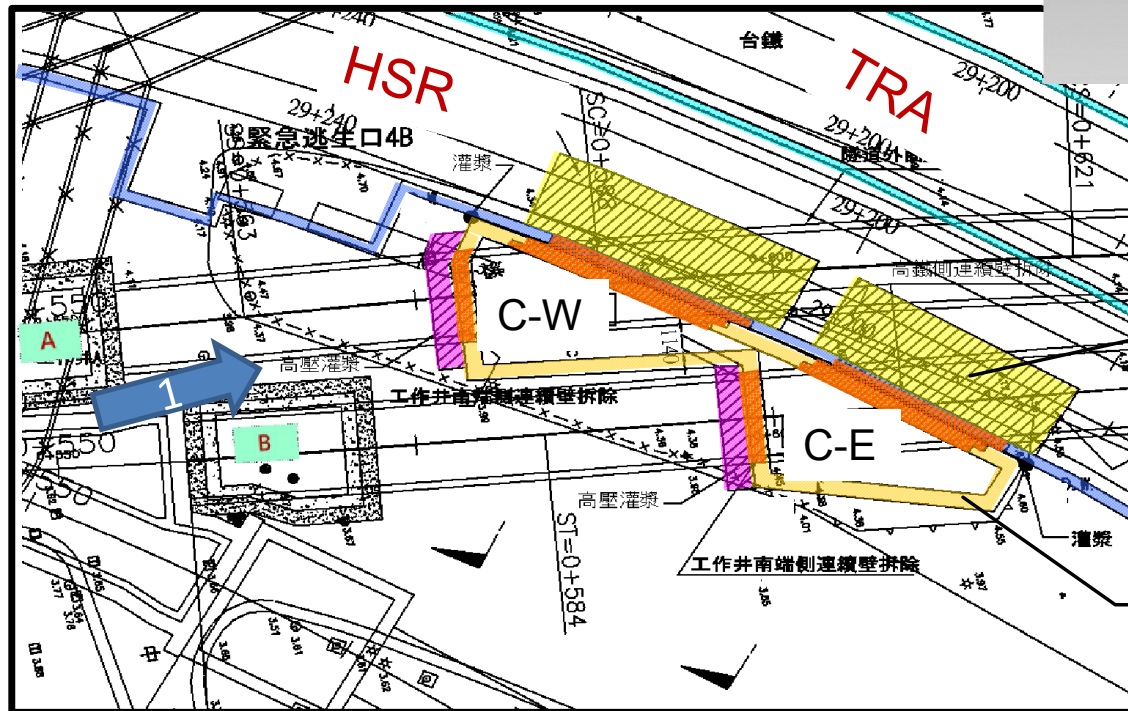
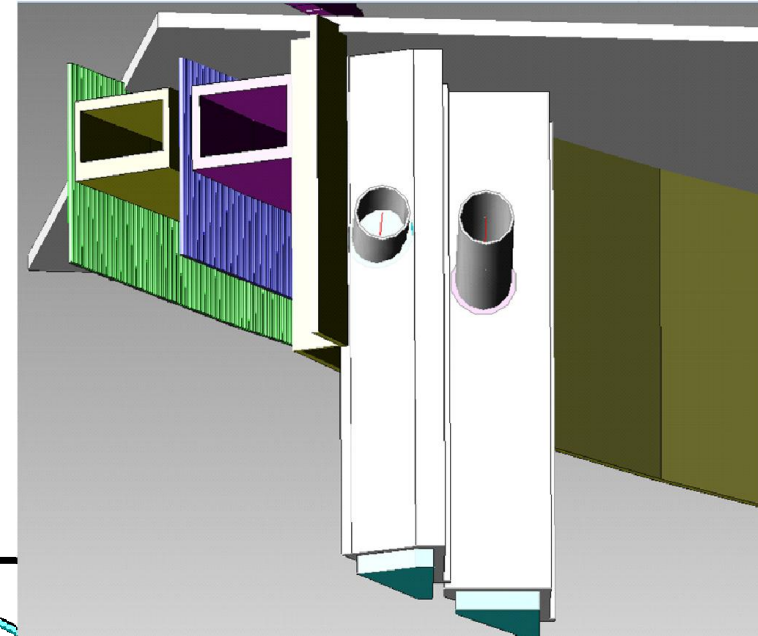
Shield Tunnel & Rail



Shield Tunnel & Rail



Shield Tunnel & Rail

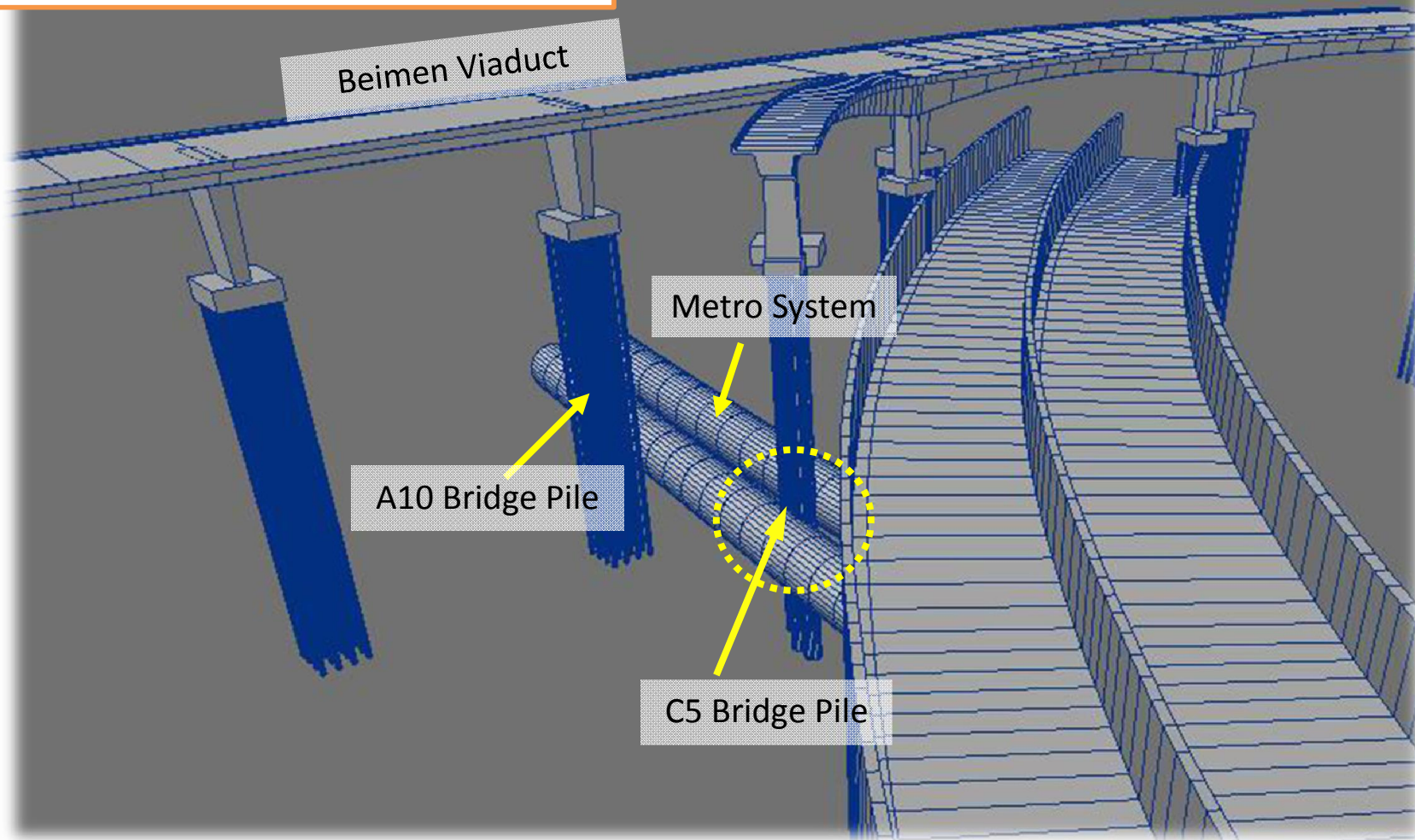


Horizontal
Ground
Improvement

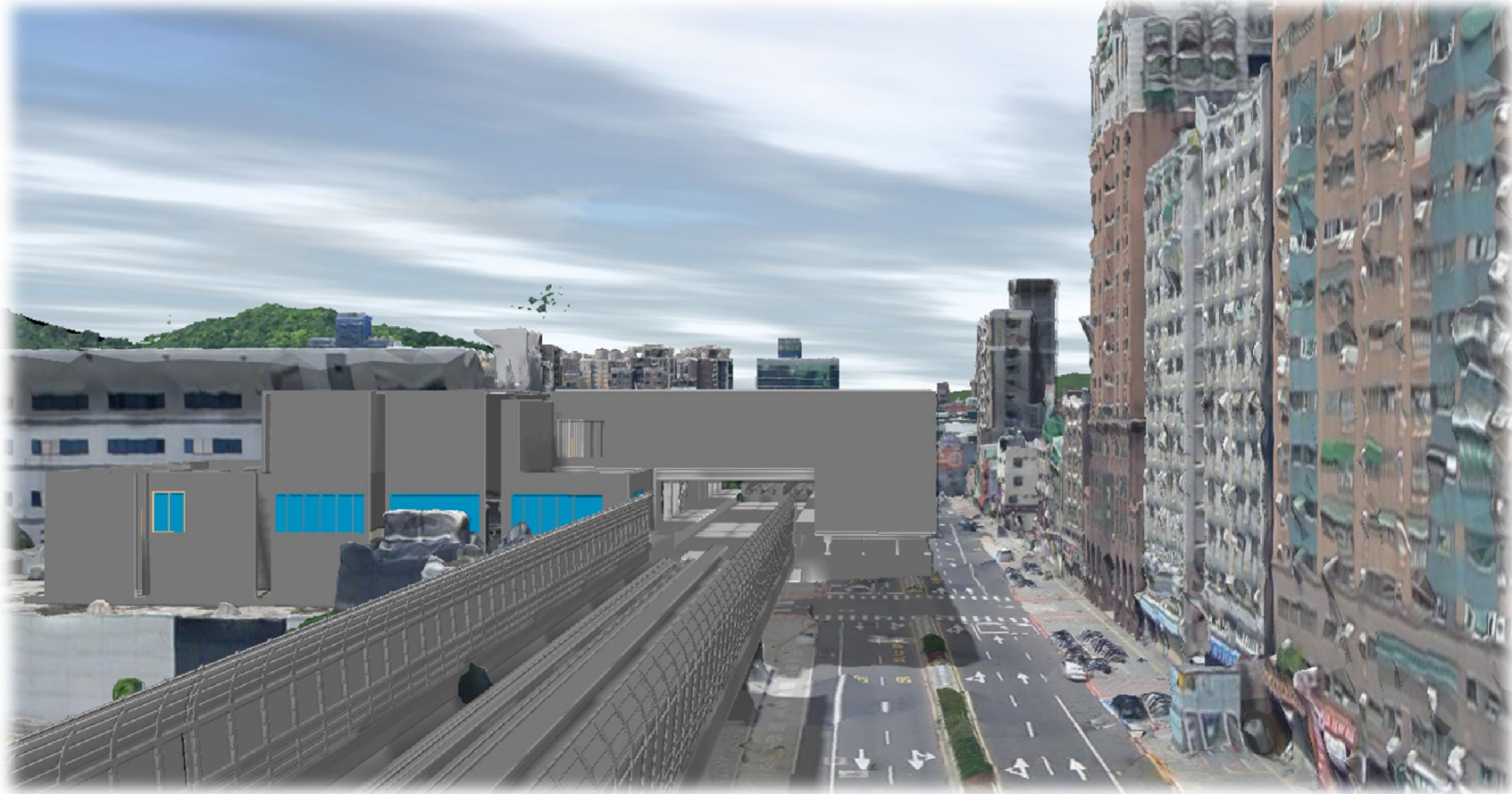
Work Shaft C-E &
C-W

Engineering Design

Clash Detection with Existing Structures

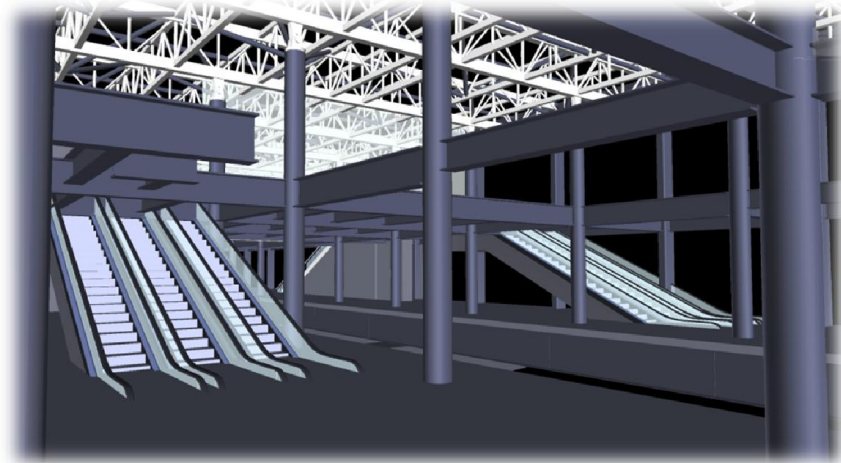
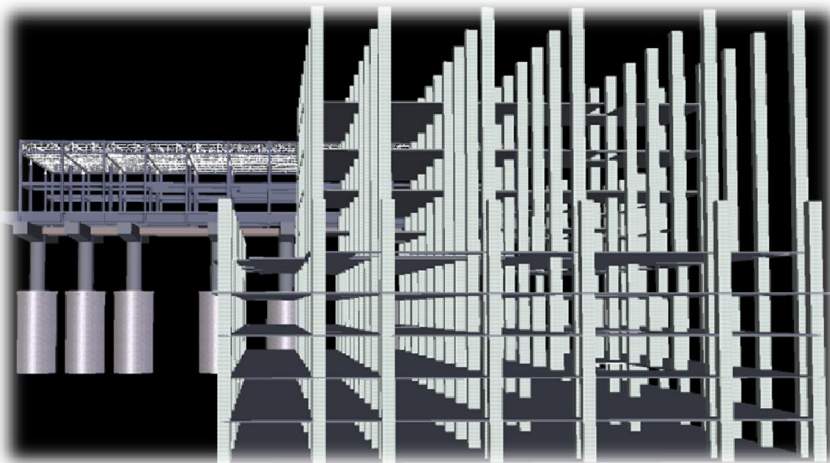
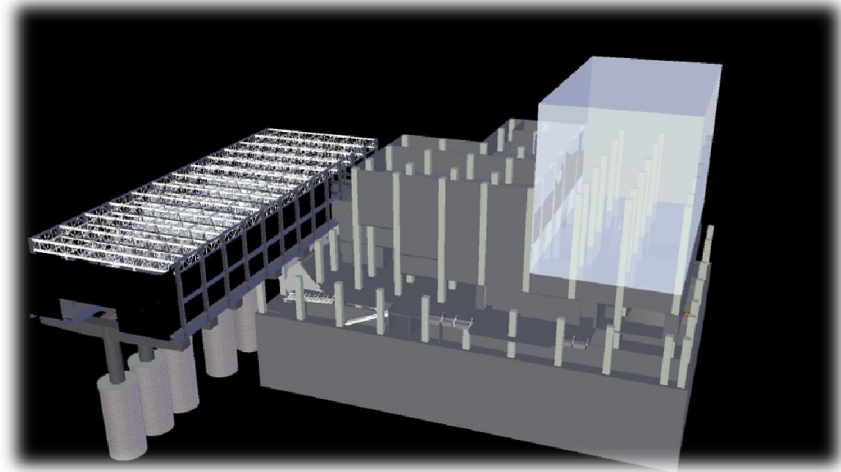
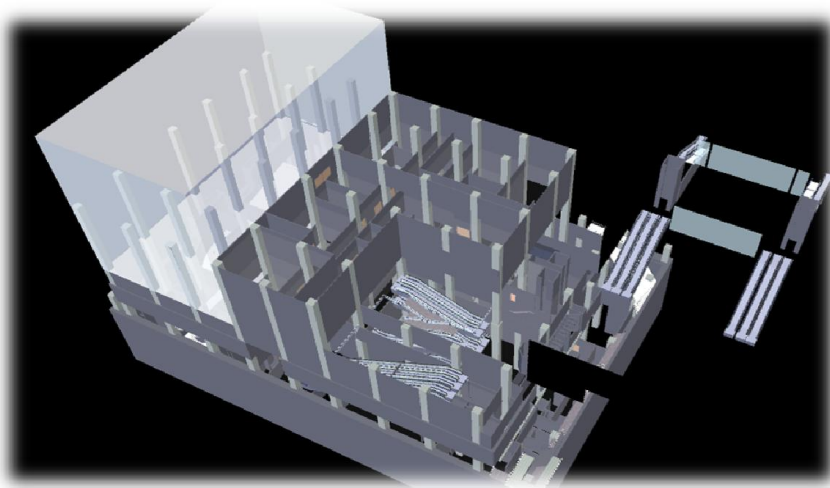


Station



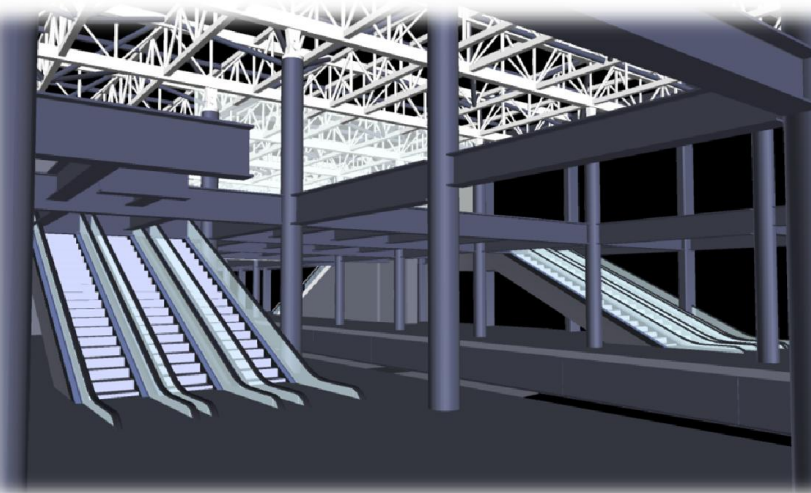
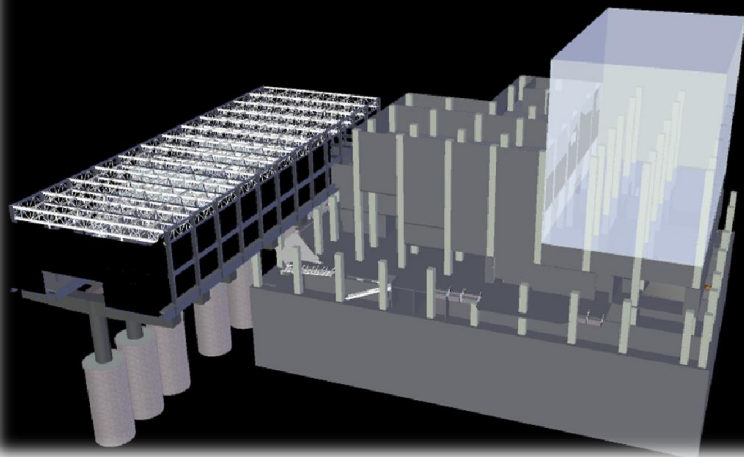
Station

MRT Station



Station

Request for Information

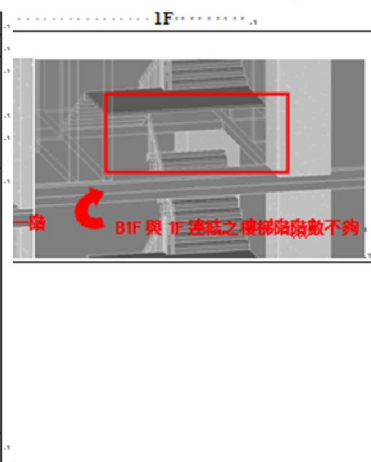


疑義清單表

項次	2	專案類型	<input checked="" type="checkbox"/> 建築 <input type="checkbox"/> 結構 <input type="checkbox"/> 機電 <input type="checkbox"/> 景觀	回覆	
位置	(C6,C7)(cd,cE)			<input type="checkbox"/> 待處理 <input type="checkbox"/> 處理中 <input type="checkbox"/> 已處理	
類型	<input type="checkbox"/> 結構問題 <input type="checkbox"/> 介面問題 <input type="checkbox"/> 碰撞衝突 <input type="checkbox"/> 法規不符 <input type="checkbox"/> 機能不足 <input type="checkbox"/> 圖說缺遺 <input type="checkbox"/> 施工性問題 <input checked="" type="checkbox"/> 其他			處理狀況說明	
圖說	LB01 平面_20161117				
問題說明	B1F 與 1F 樓梯登板數量不同無法連結?無法使其樓梯連結一起。是否有樓梯大樣圖可參考?				
衝突位置	..				

疑義清單表

項次	6	專案類型	<input checked="" type="checkbox"/> 建築 <input type="checkbox"/> 結構 <input type="checkbox"/> 機電 <input type="checkbox"/> 景觀	回覆	
位置	(c2,c3)(cK,cM)			<input type="checkbox"/> 待處理 <input type="checkbox"/> 處理中 <input type="checkbox"/> 已處理	
類型	<input checked="" type="checkbox"/> 結構問題 <input type="checkbox"/> 介面問題 <input type="checkbox"/> 碰撞衝突 <input type="checkbox"/> 法規不符 <input type="checkbox"/> 機能不足 <input type="checkbox"/> 圖說缺遺 <input type="checkbox"/> 施工性問題 <input type="checkbox"/> 其他			處理狀況說明	
圖說	LB01 平面_20161117				
問題說明	B1F 的結構柱及牆面與 1F 樓梯有衝突				
衝突位置	..				

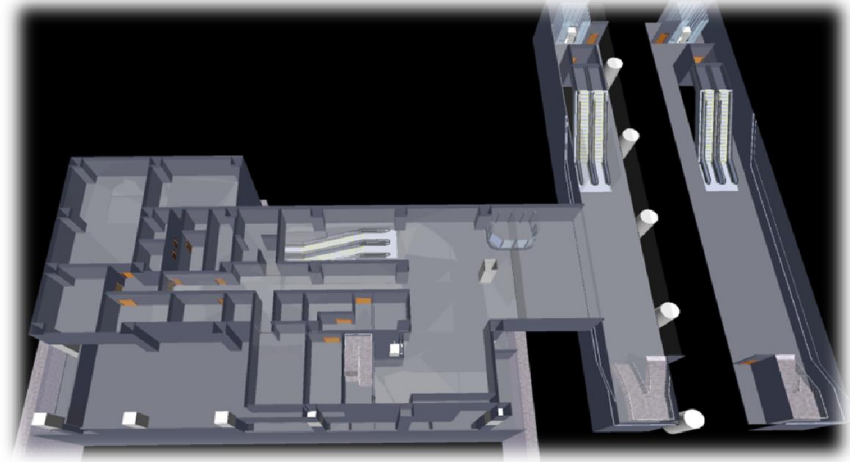
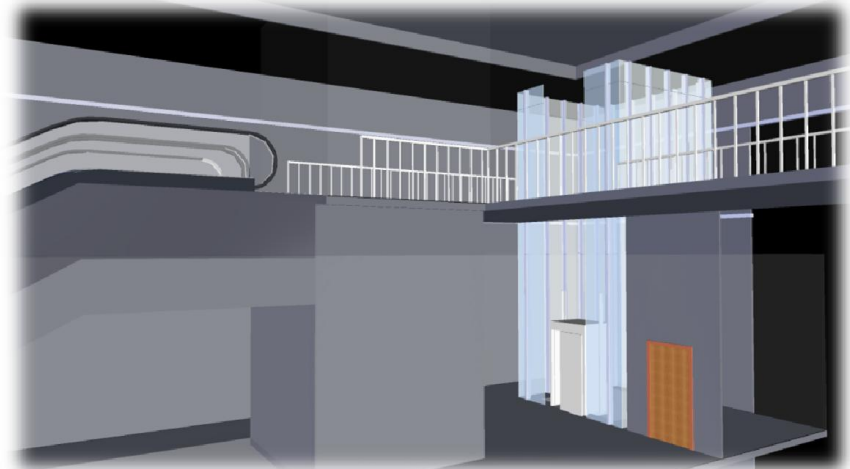
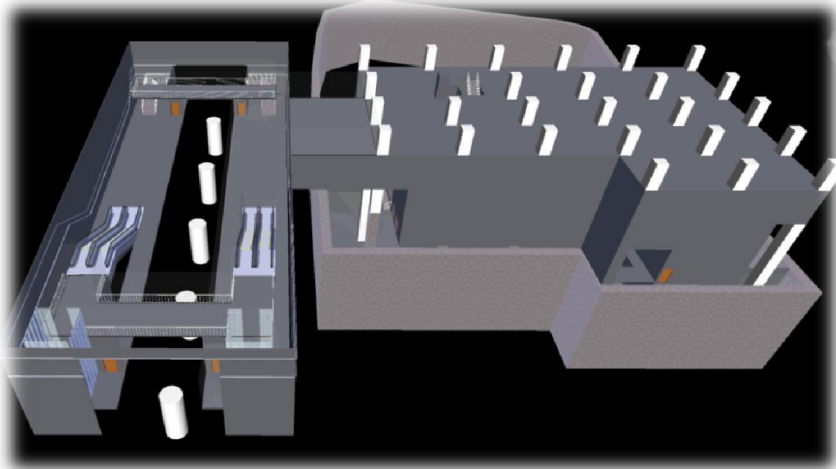


衝突點

修正結果

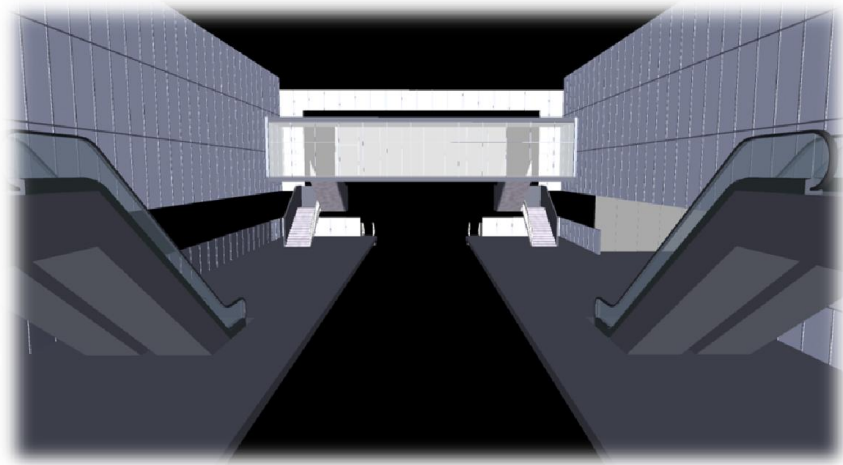
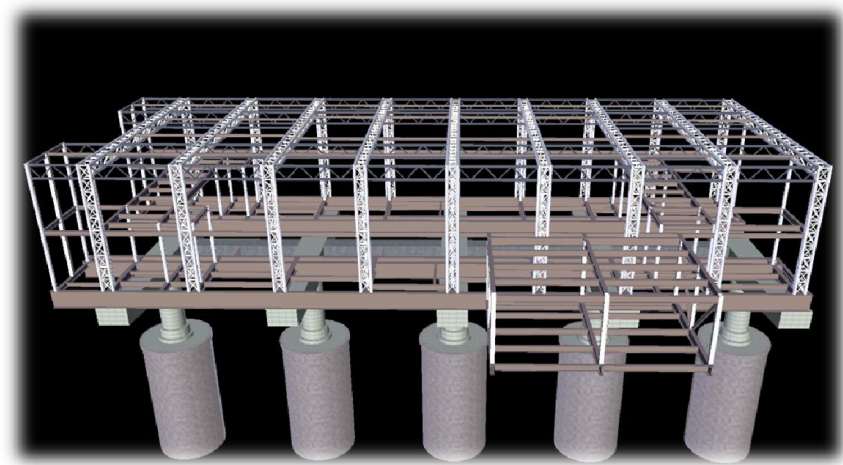
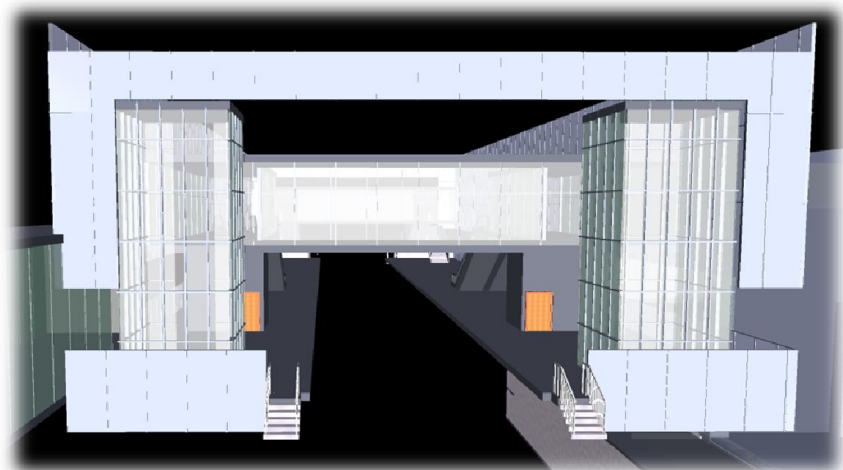
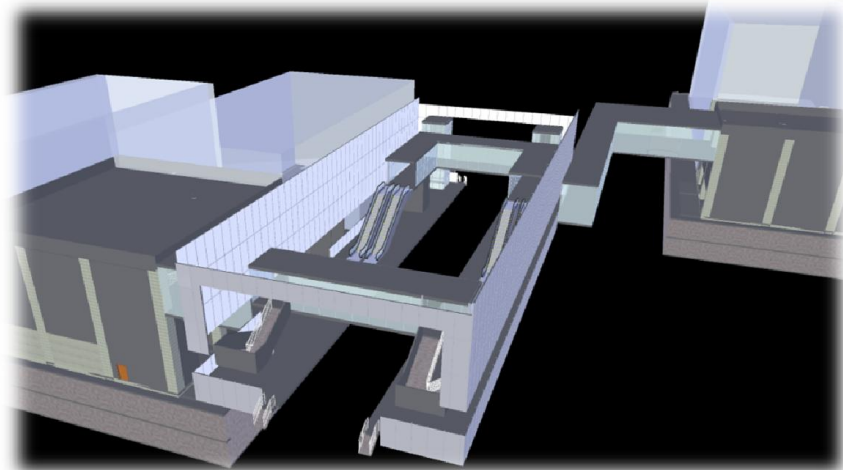
Station

MRT Station



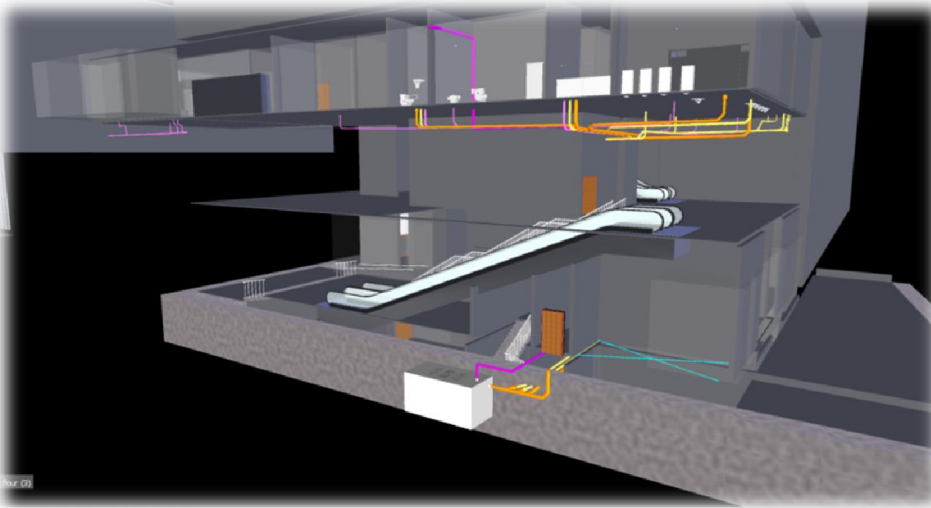
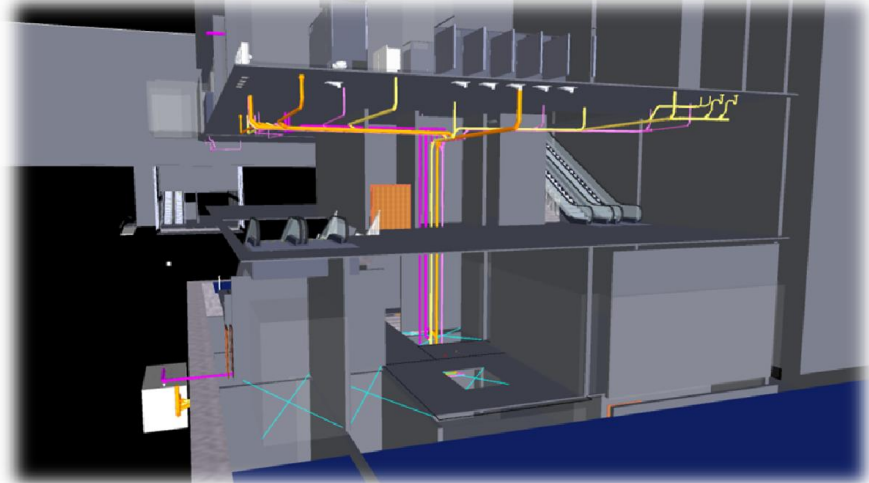
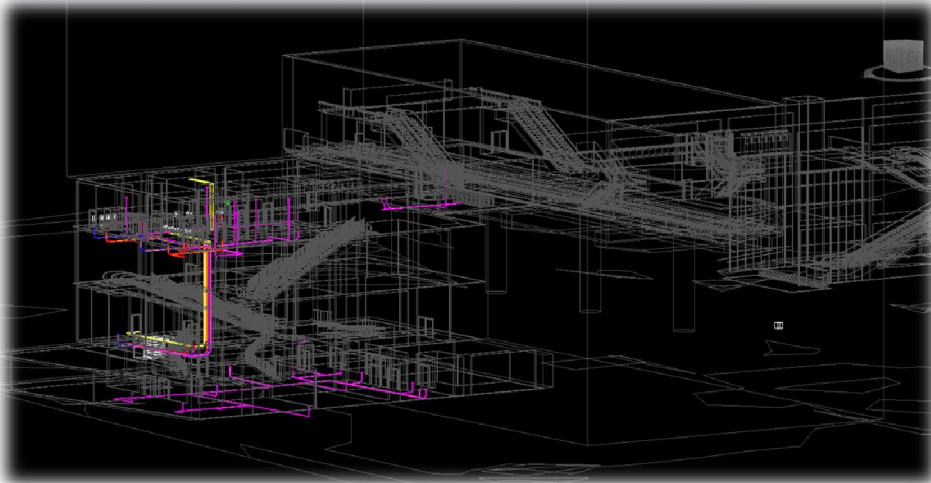
Station

MRT Station



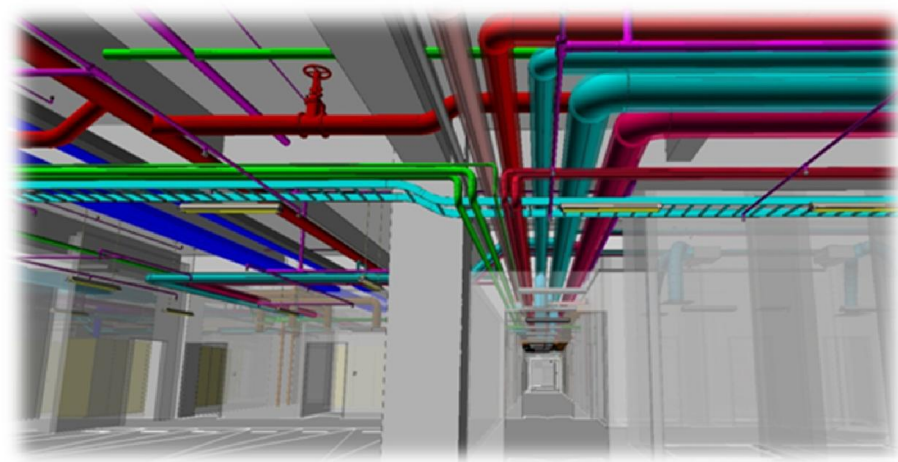
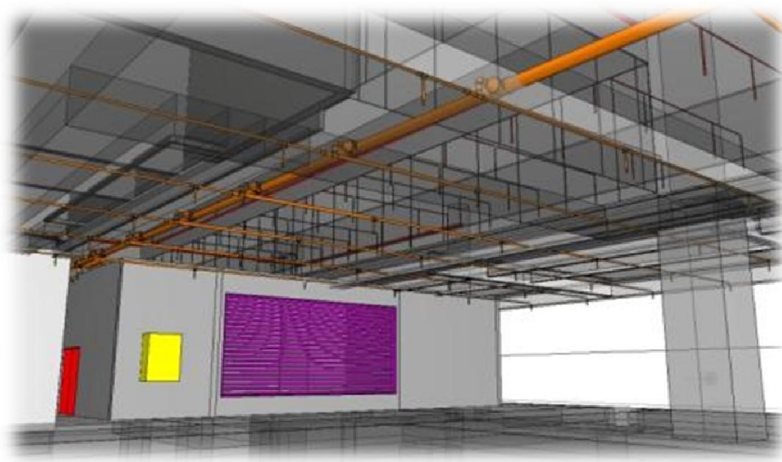
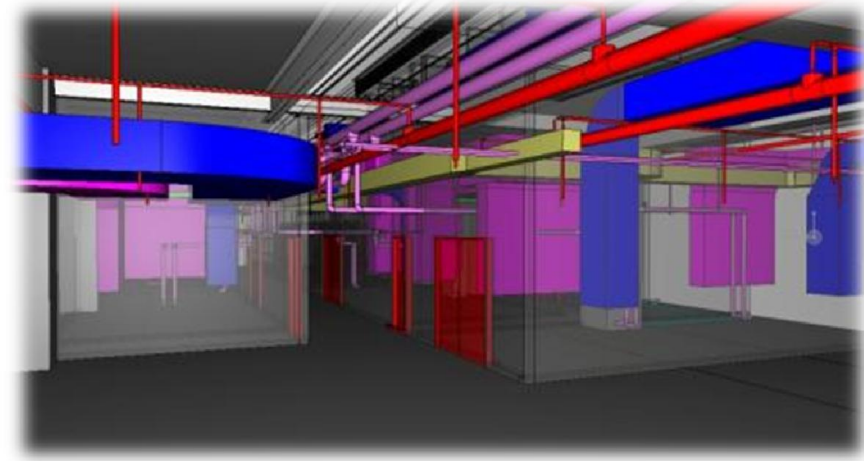
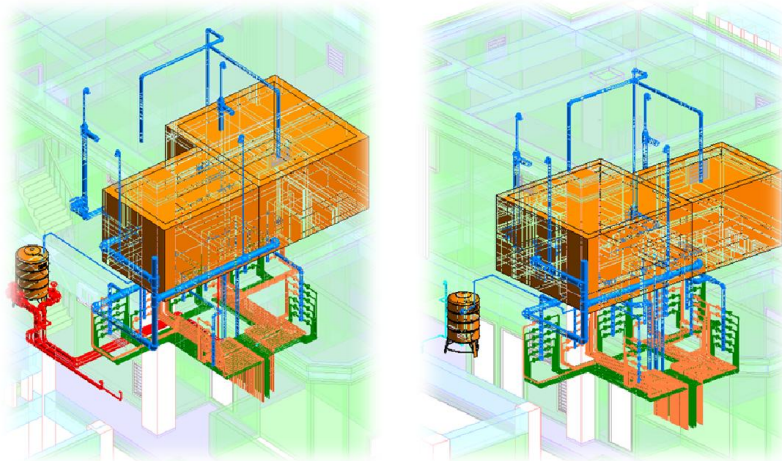
Station

MRT Station

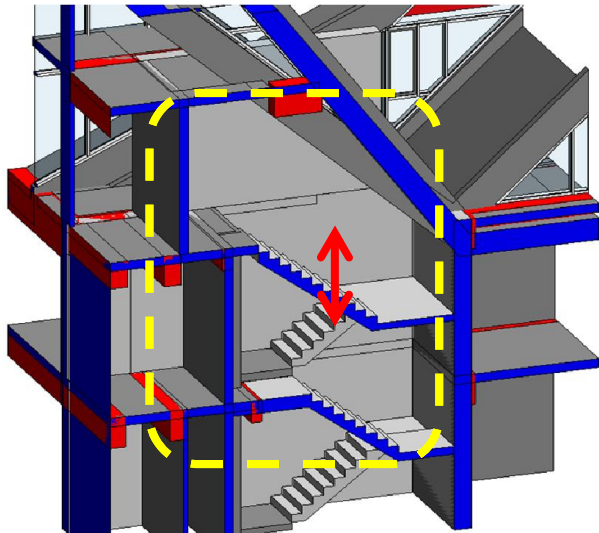


Station

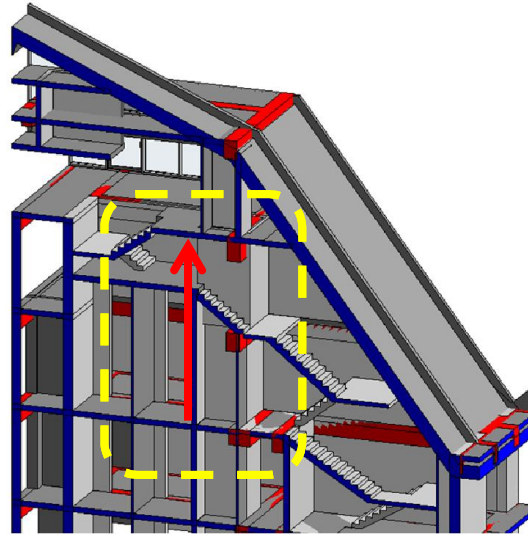
MRT Station



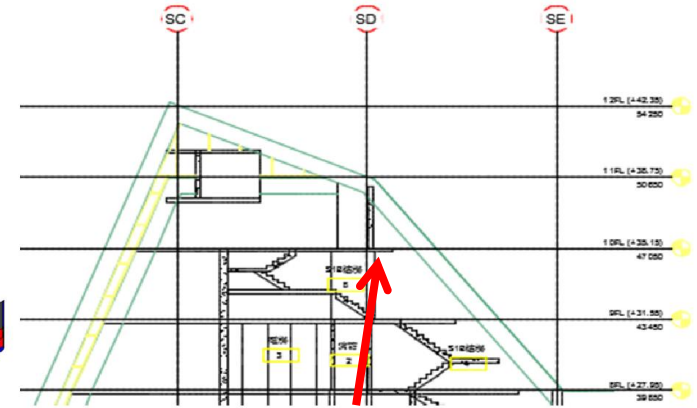
Clash Detection



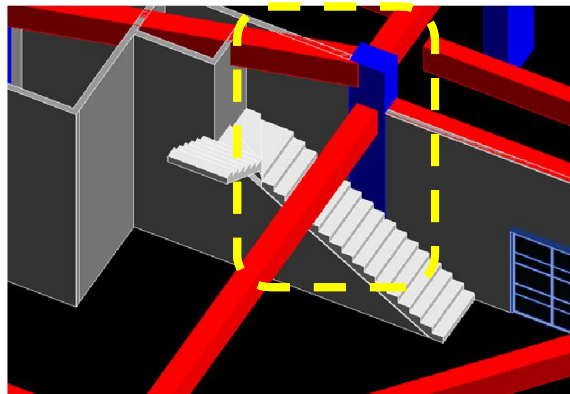
Not Enough Clearance Space



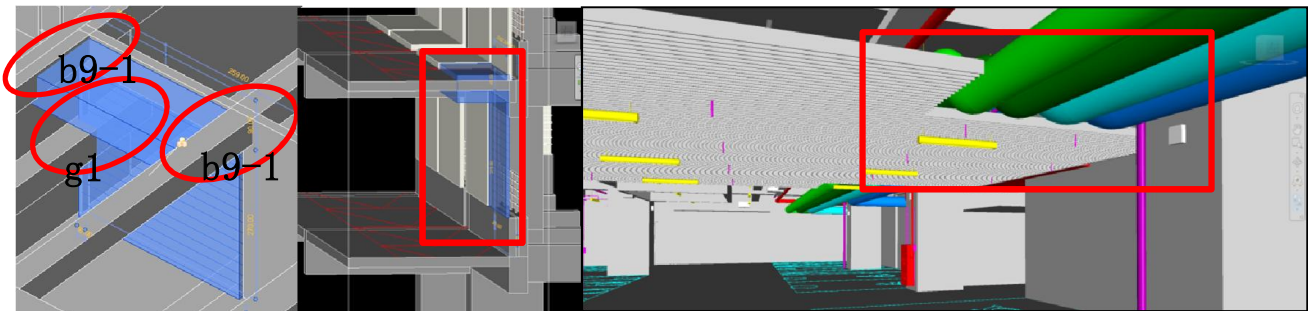
Elevation Review



BIM Elevation Call Out

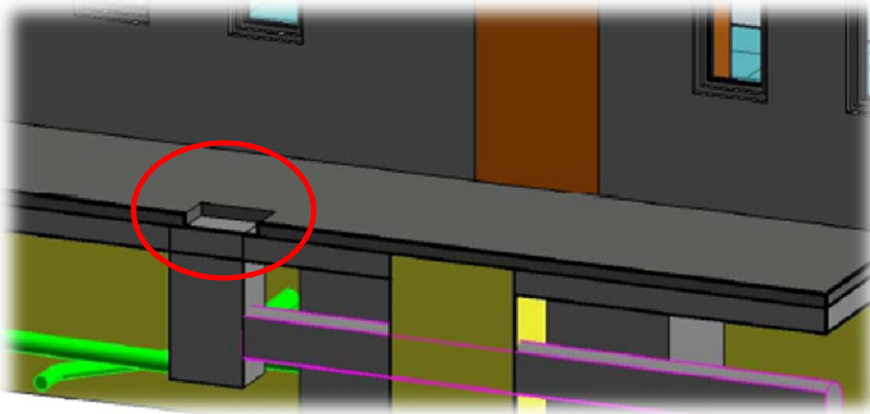


Clash Detection

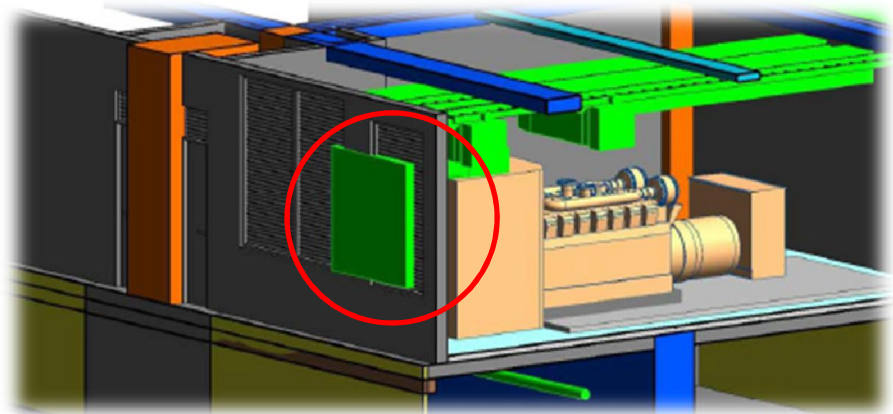


Clash Detection

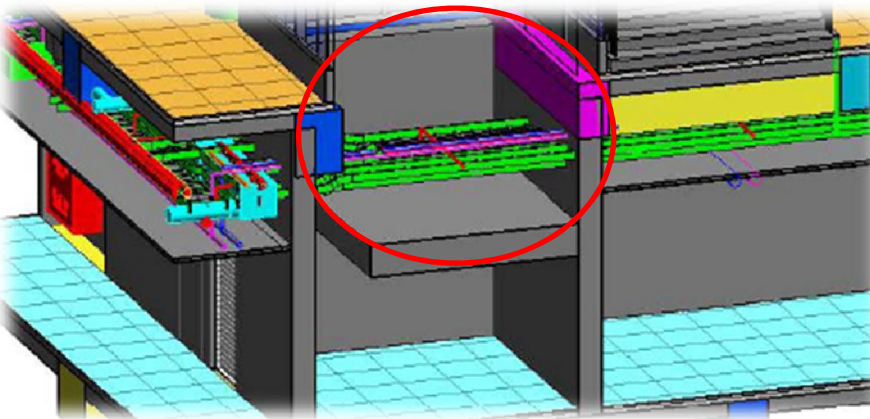
Clash Detection



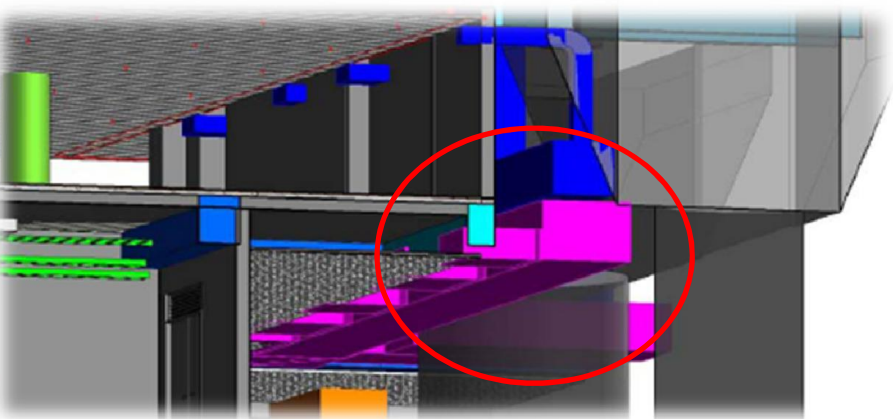
Floor Opening Clash



Louver Clash with Exhaust Duct



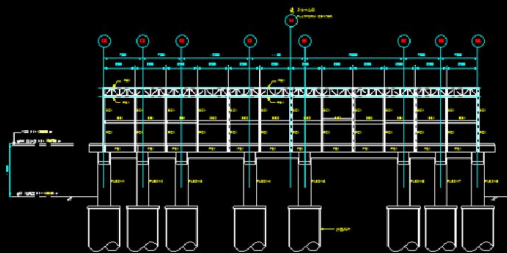
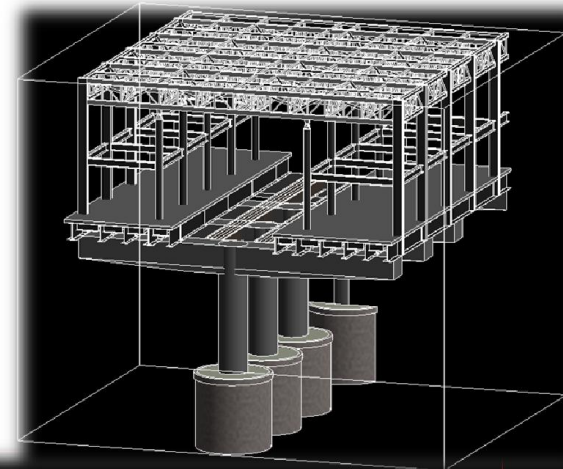
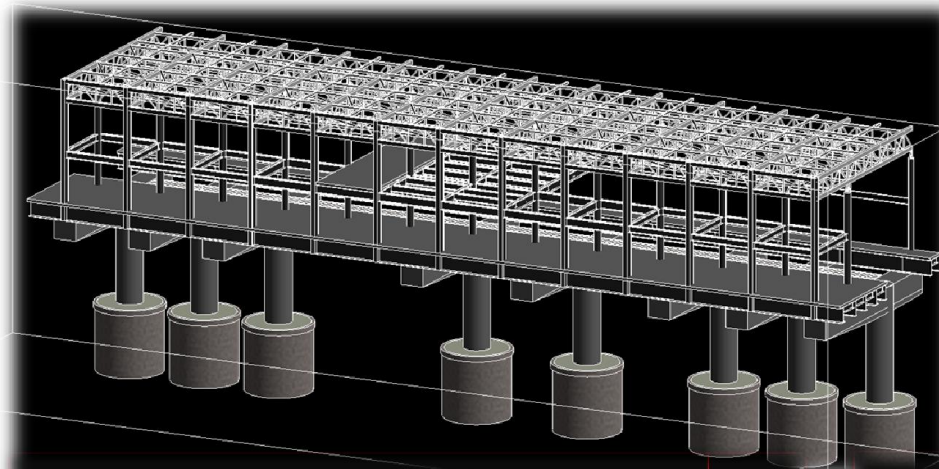
Pipe Clash with Elevator Pit



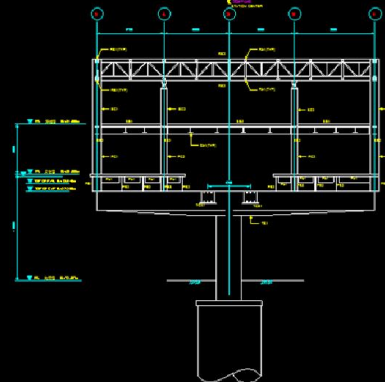
Pipe Clash with Bridge Pier

Station

Design Drawing



1:5 梁柱立位图
T. 08



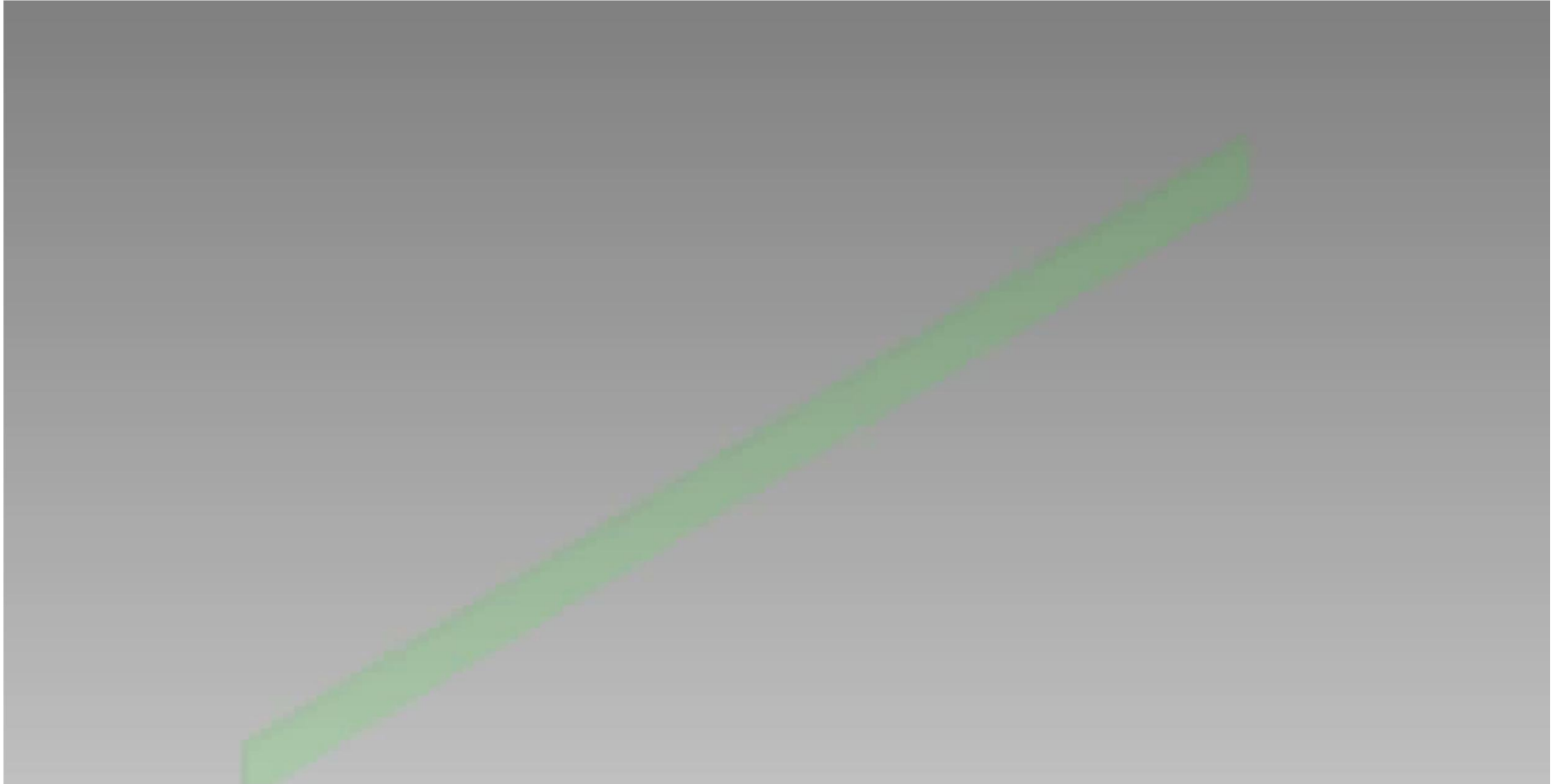
1:5 梁柱立位图
T. 08

Quantity Estimates

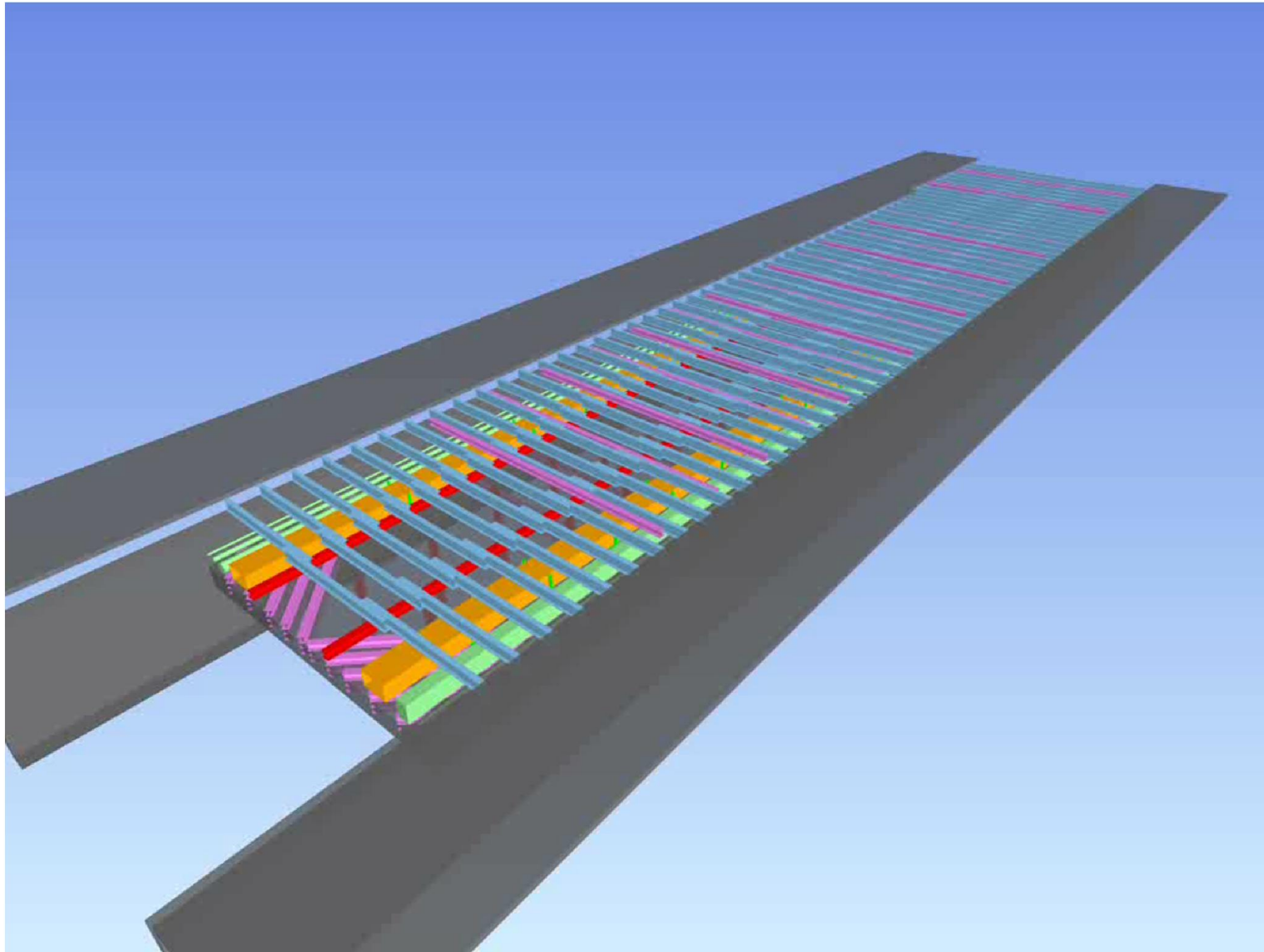
The screenshot shows the Autodesk Navisworks Manage 2012 interface. The main window displays a 3D model of a building with a balcony. The left pane shows the Selection Tree with a hierarchy of elements. The right pane shows the Properties window for a selected window element. Overlaid on the bottom of the interface is a table titled '房間材料明細表' (Room Material Detail Table).

名稱	編號	高程	周長	面積	體積	未設邊界的高度	牆面積	牆面塗層	天花板面積	天花板塗層	地坪面積
±0-GL1 EL+80.3											
C樓梯	B109K	±0-GL1 EL+80.3	2028	23 m ²	95.03 m ³	420	85 m ²	牆面1:3水泥砂漿粉光刷水泥漆或輕隔間批土磨平刷水泥漆(一底二度)局部牆面貼外牆材質	23 m ²	明架岩棉板天花	23 m ²
D樓梯	B116K	±0-GL1 EL+80.3	2400	26 m ²	106.88 m ³	420	101 m ²	牆面1:3水泥砂漿粉光刷水泥漆或輕隔間批土磨平刷水泥漆(一底二度)局部牆面貼外牆材質	26 m ²	明架岩棉板天花	26 m ²
E樓梯	B121K	±0-GL1 EL+80.3	2370	29 m ²	115.97 m ³	405	96 m ²	牆面1:3水泥砂漿粉光刷水泥漆或輕隔間批土磨平刷水泥漆(一底二度)局部牆面貼外牆材質	29 m ²	明架岩棉板天花	29 m ²
休息室	B123B	±0-GL1 EL+80.3	1259	10 m ²	26.15 m ³	270	34 m ²		10 m ²		10 m ²
前室	B126B	±0-GL1 EL+80.3	887	5 m ²	12.96 m ³	270	24 m ²		5 m ²		5 m ²
前室	B125B	±0-GL1 EL+80.3	1253	10 m ²	26.18 m ³	270	34 m ²		10 m ²		10 m ²
國際會議室	B124C	±0-GL1 EL+80.3	7767	342 m ²	1436.19 m ³	450	350 m ²	貼吸音布或複合式吸音材或實木皮	342 m ²	平頂輕鋼架6mmTH矽酸鈣板天花刷乳膠漆	342 m ²
女廁	B112M1	±0-GL1 EL+80.3	3286	29 m ²	78.08 m ³	270	89 m ²	牆面貼30X30cm石英磚(台灣120cmH刷防水材)	29 m ²	2x2明架複合式矽酸鈣板天花6mmTH或輕鋼架複合式矽酸鈣板天花6mmTH刷乳膠漆(一底二度)	29 m ²

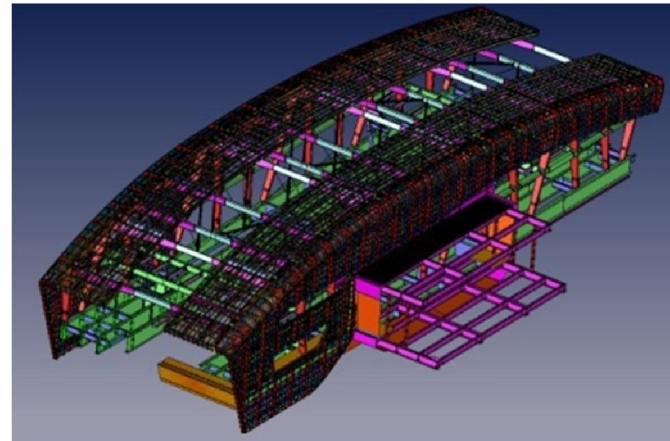
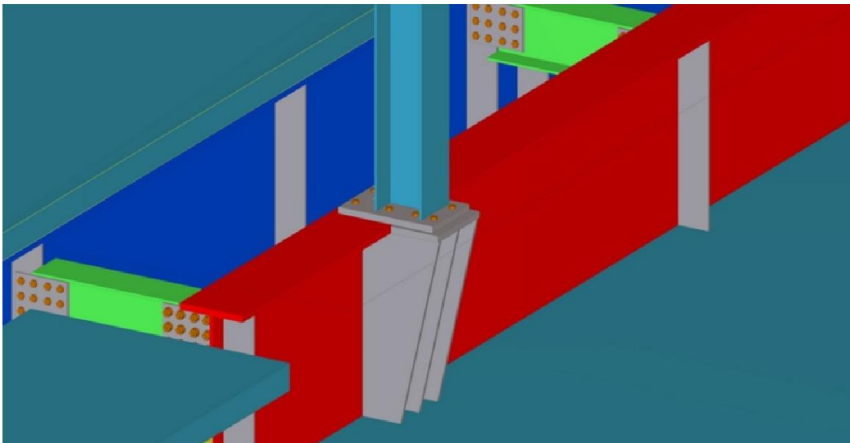
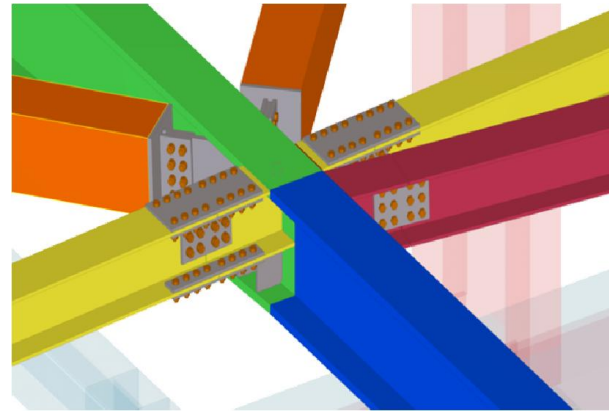
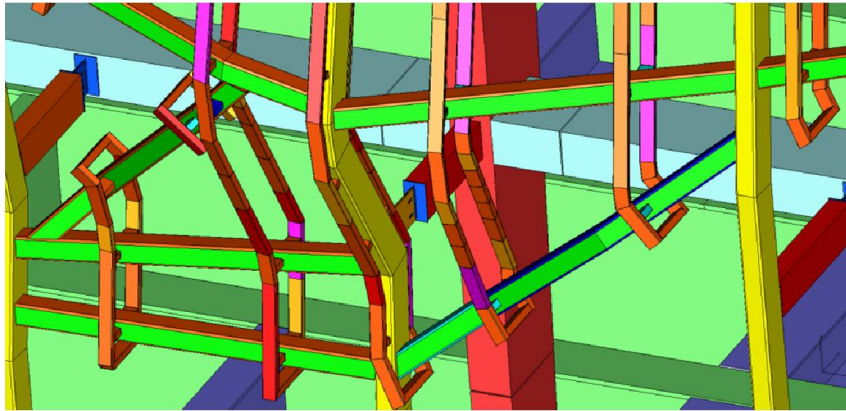
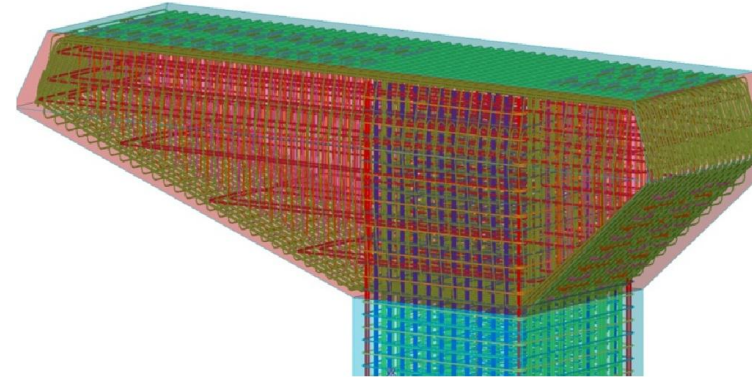
Strutting systems



Strutting systems

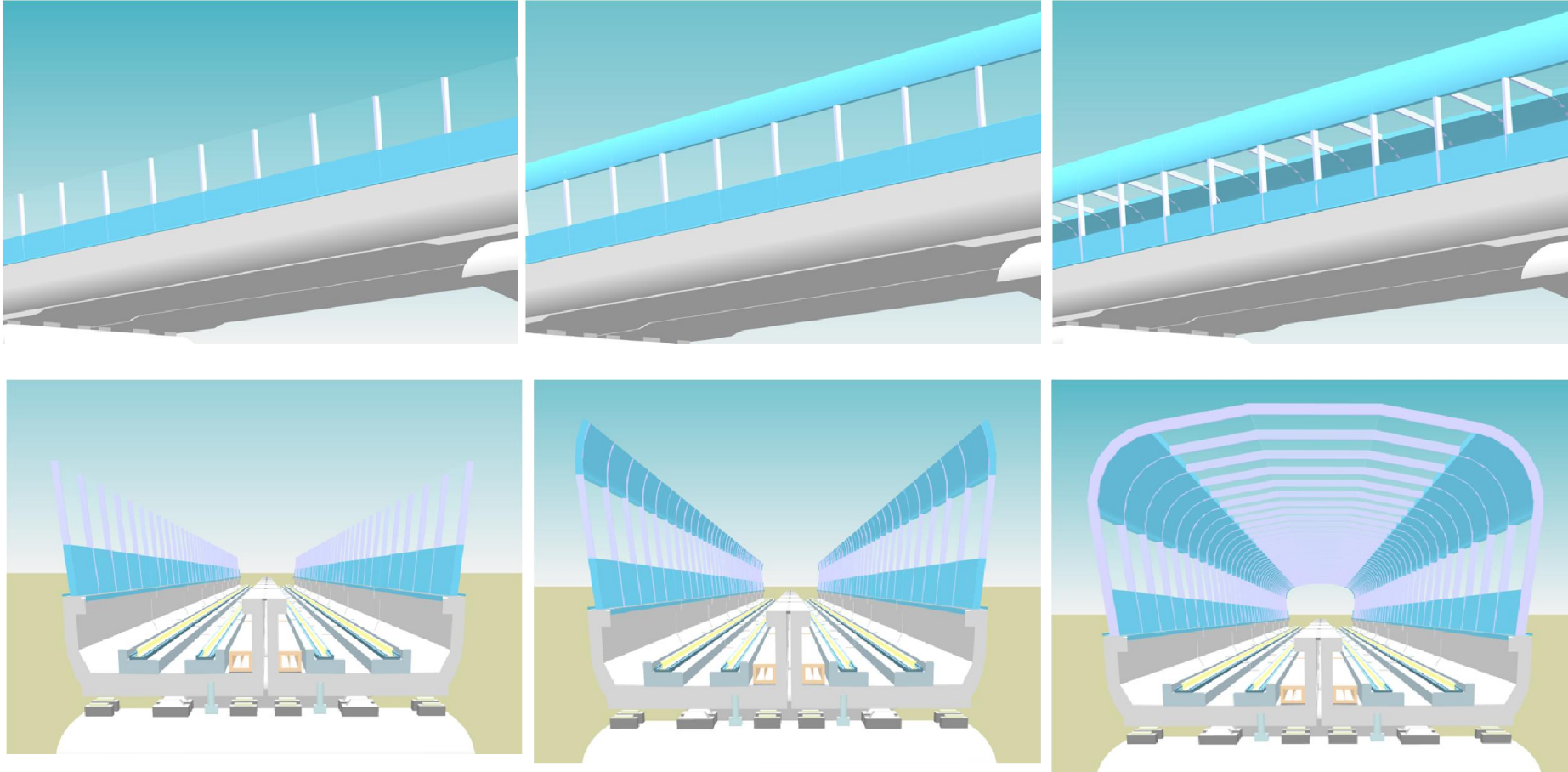


Construction Details



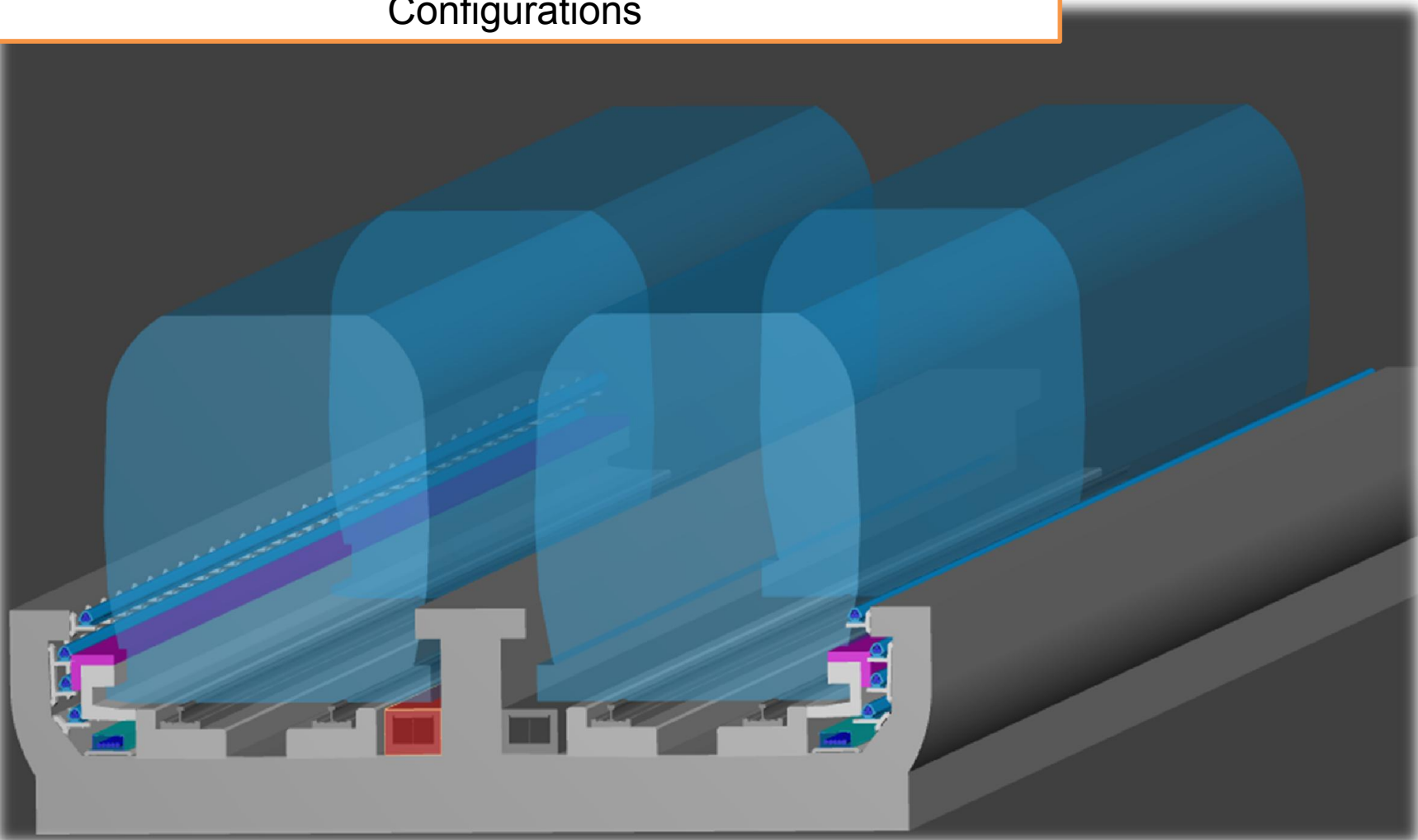
Rail Track

Detailed Track Cross-Section



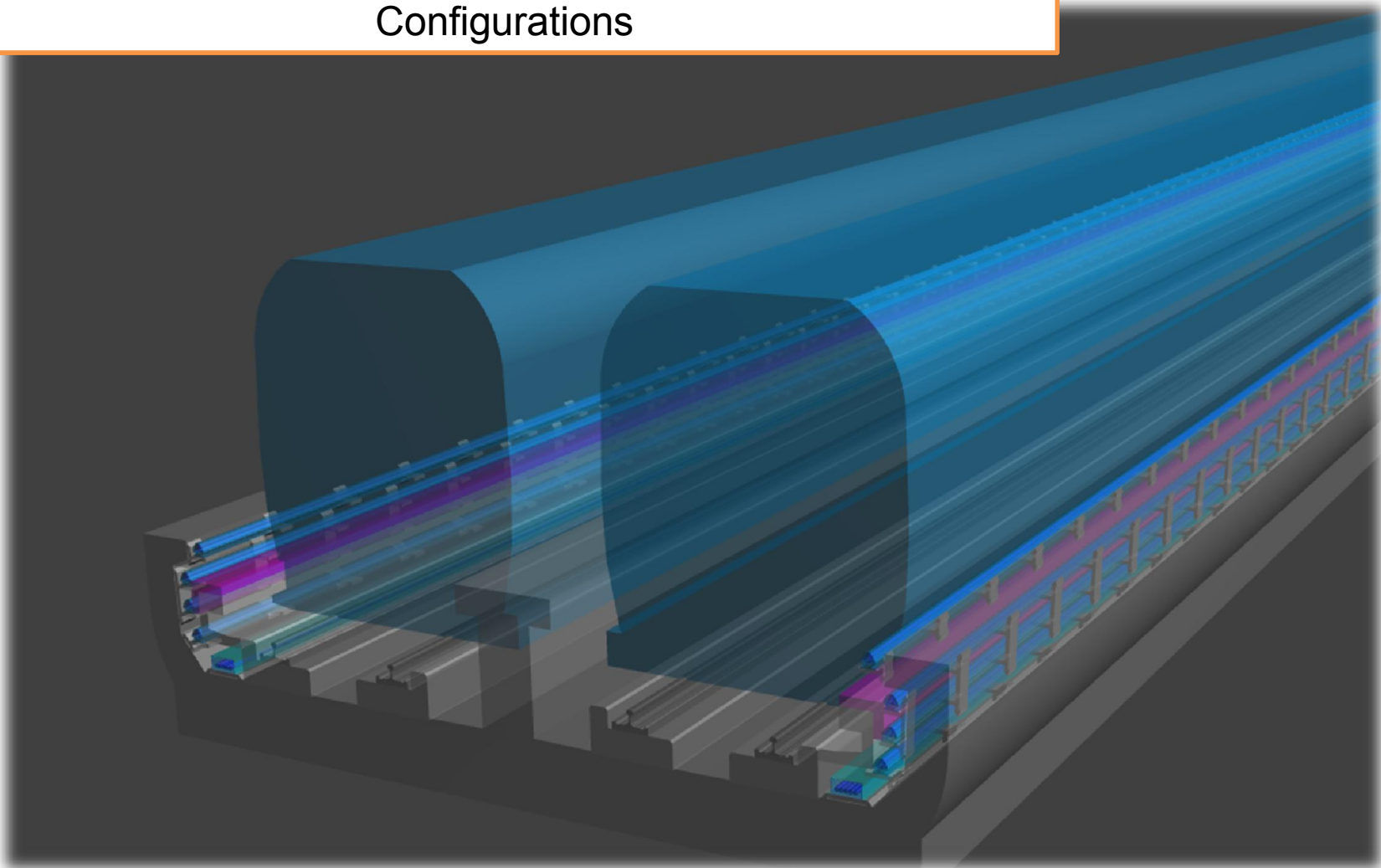
Rail Track

Evaluating Elevated Track Cross Section for Space Configurations



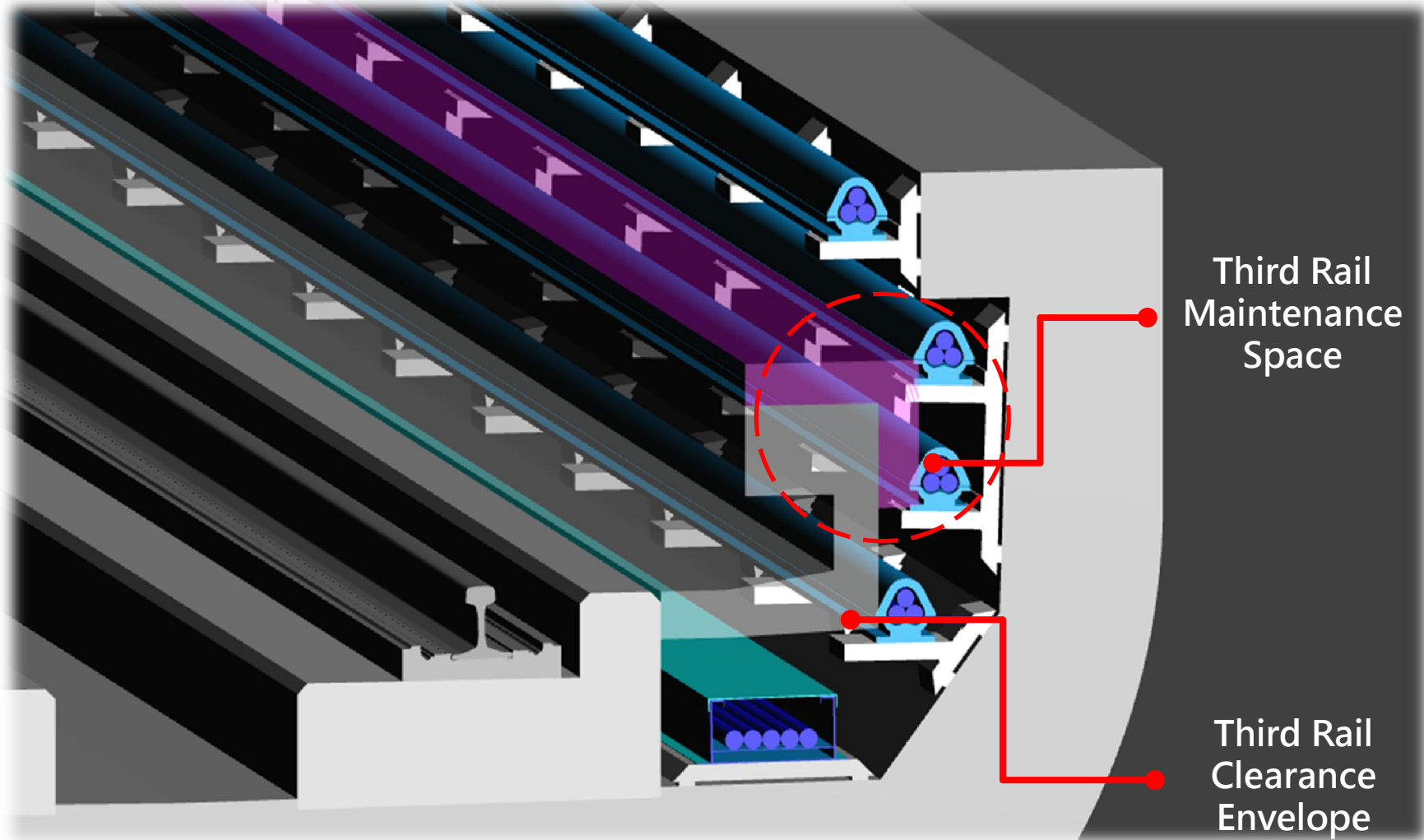
Rail Track

Evaluating Elevated Track Cross Section for Space Configurations



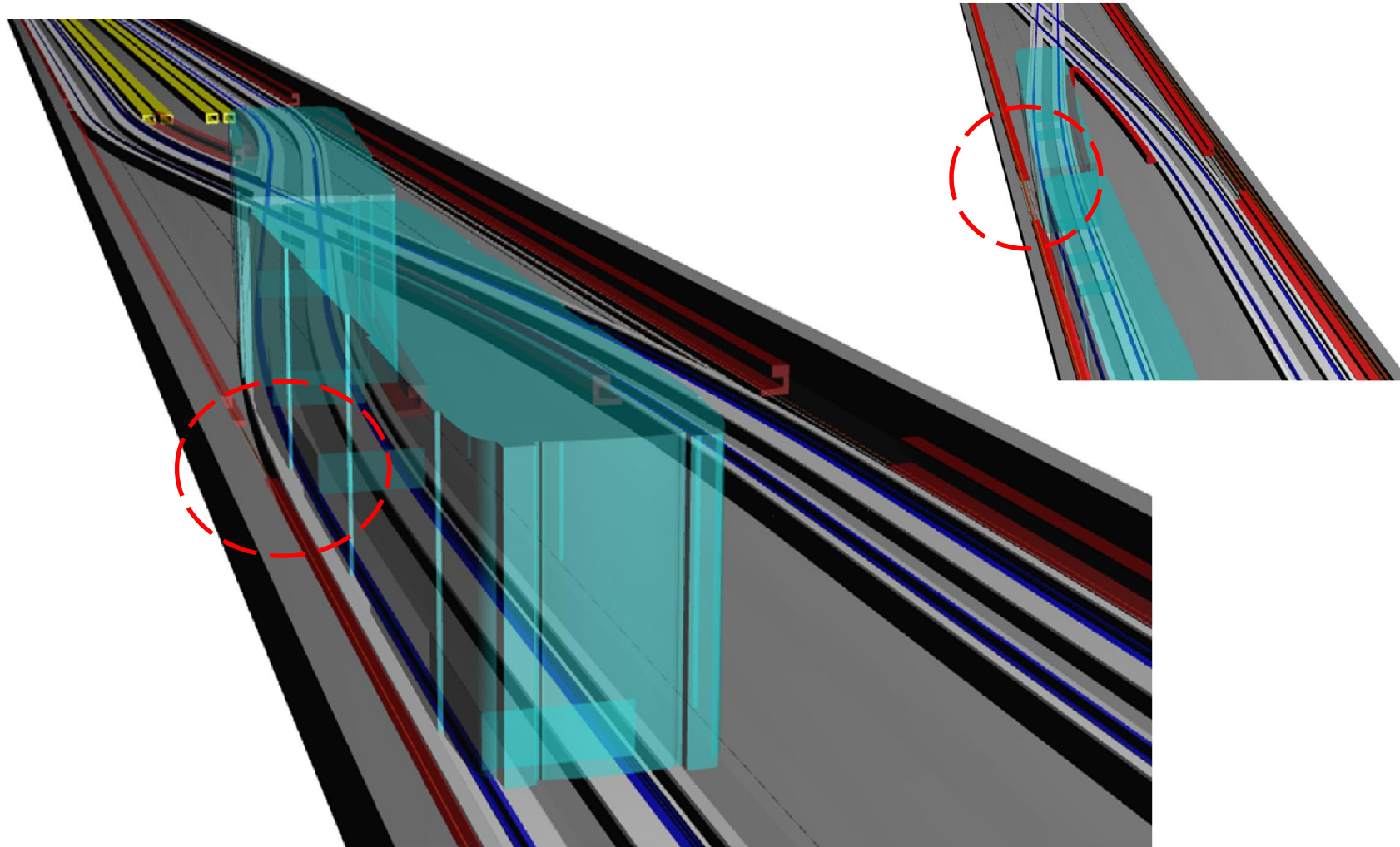
Rail Track

Maintenance Space Analysis



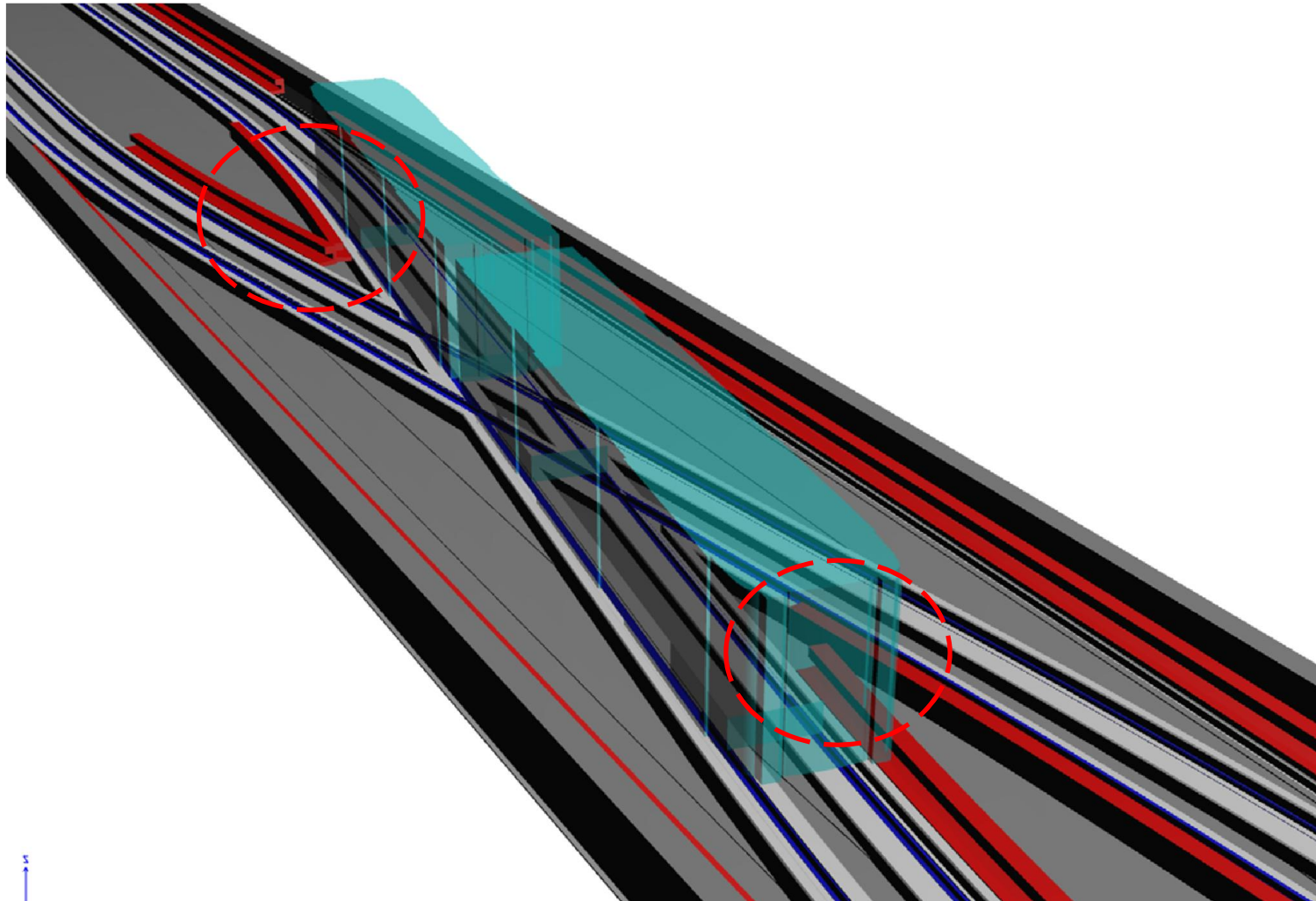
Rail Track

Diamond Crossing - Third Rail Clearance Simulation



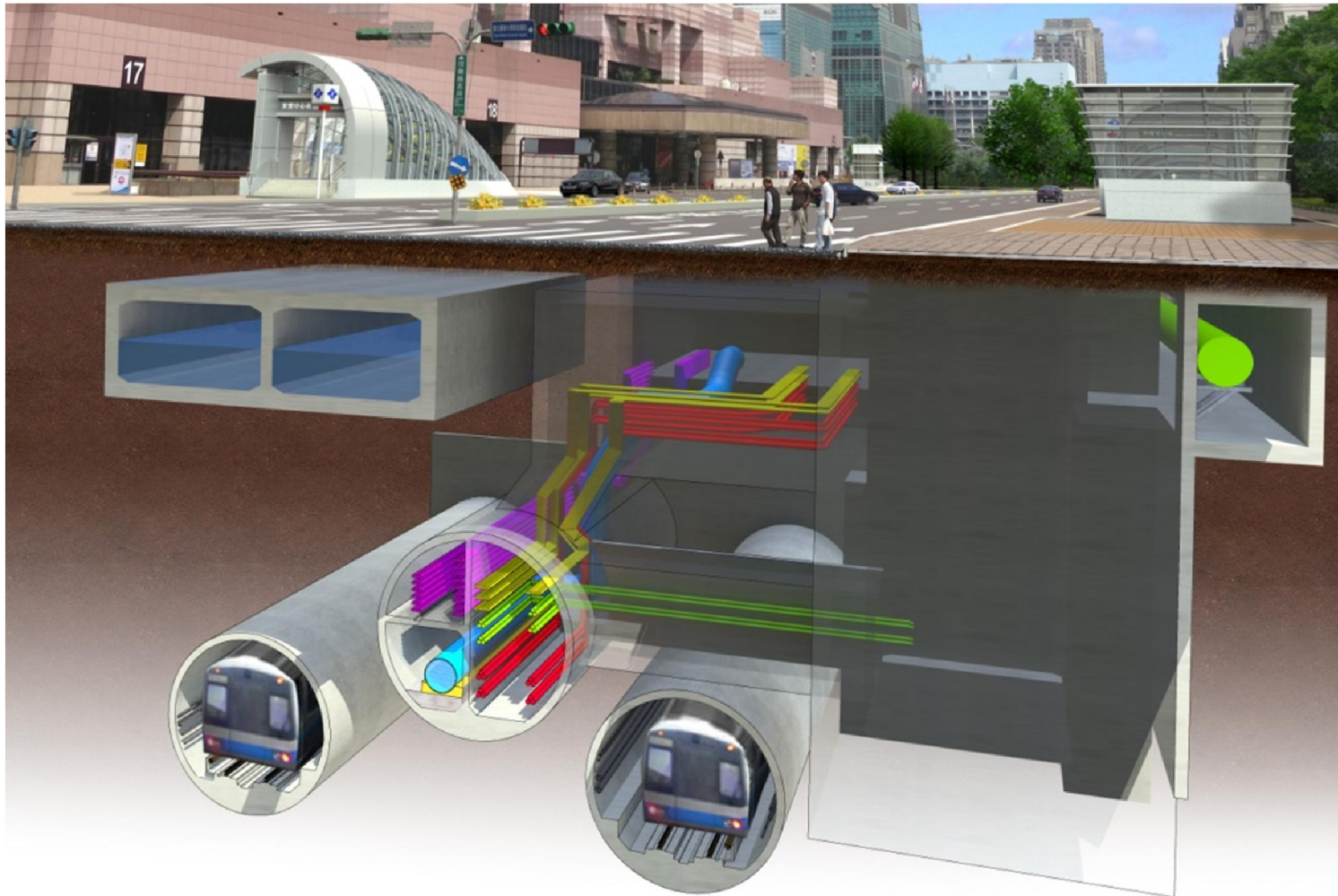
Rail Track

Diamond Crossing - Third Rail Clearance Simulation

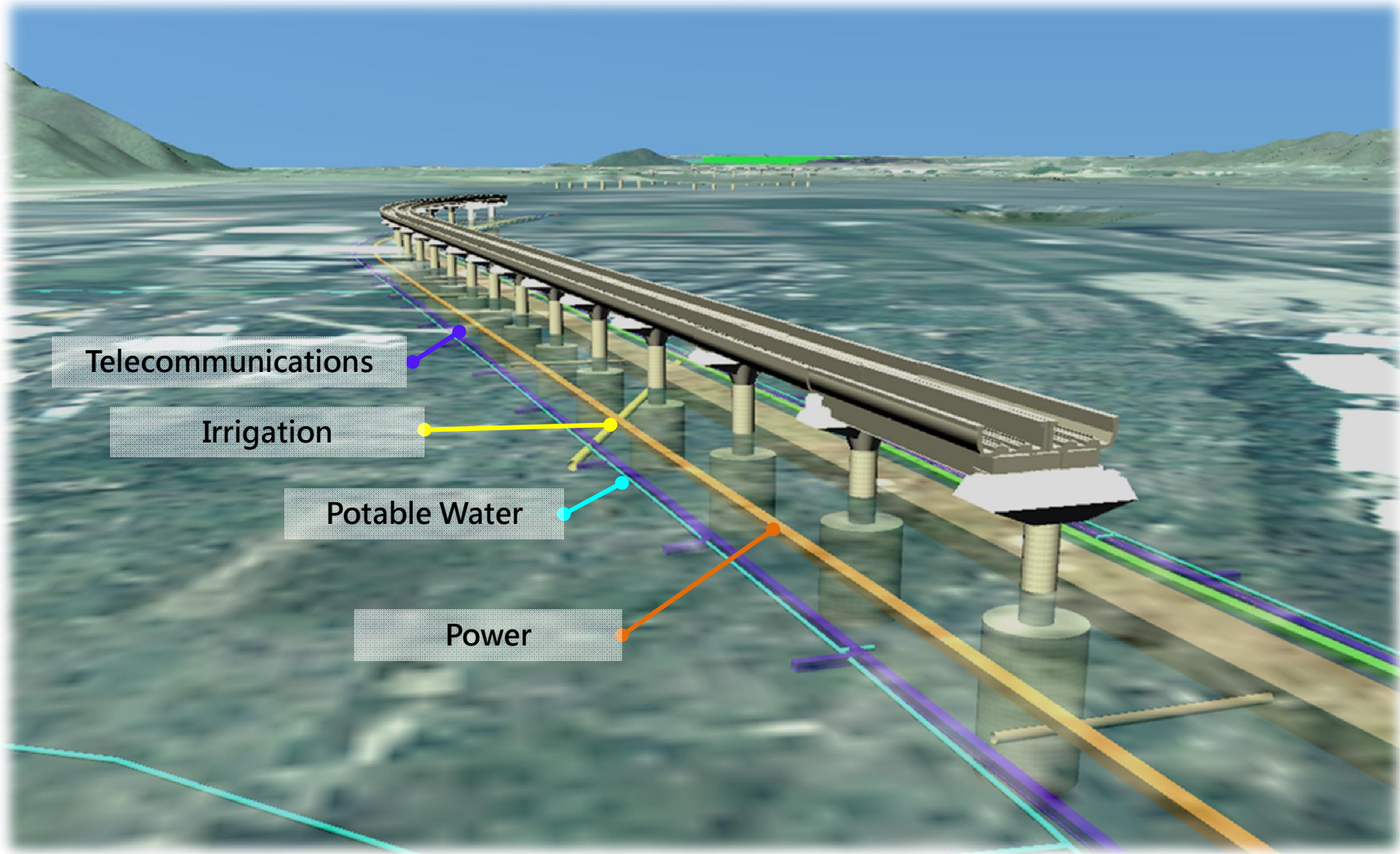


Common Duct & Rail

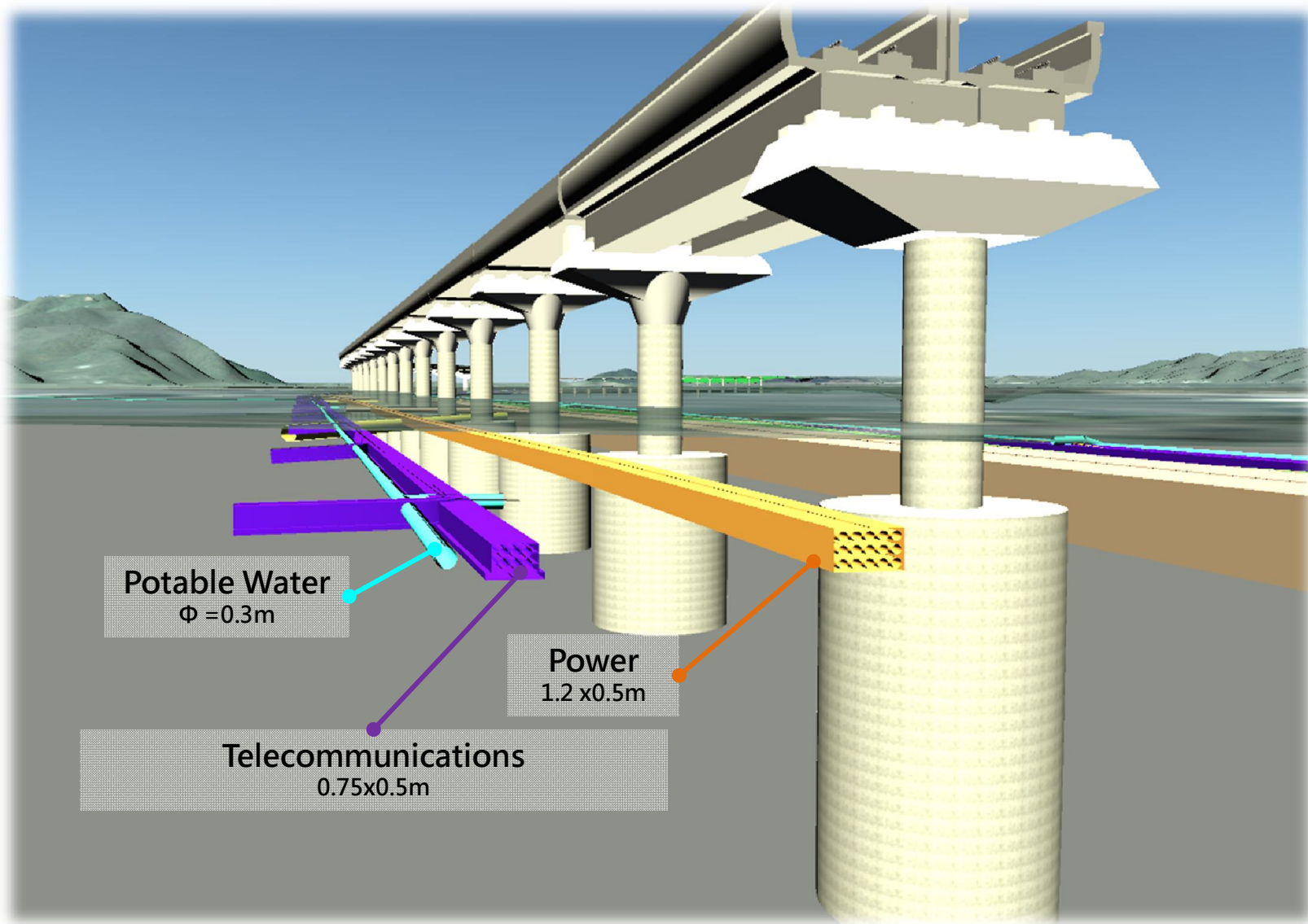
Common Duct & Rail Simulation



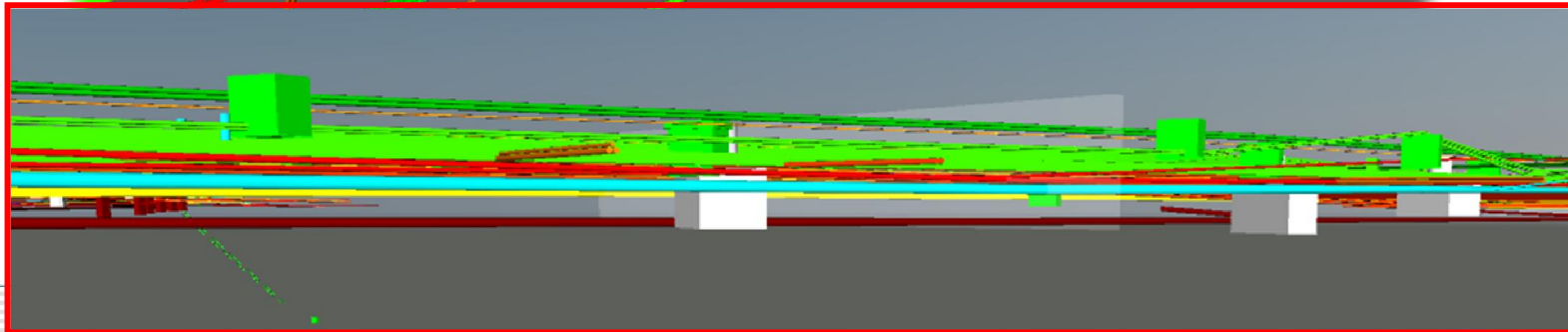
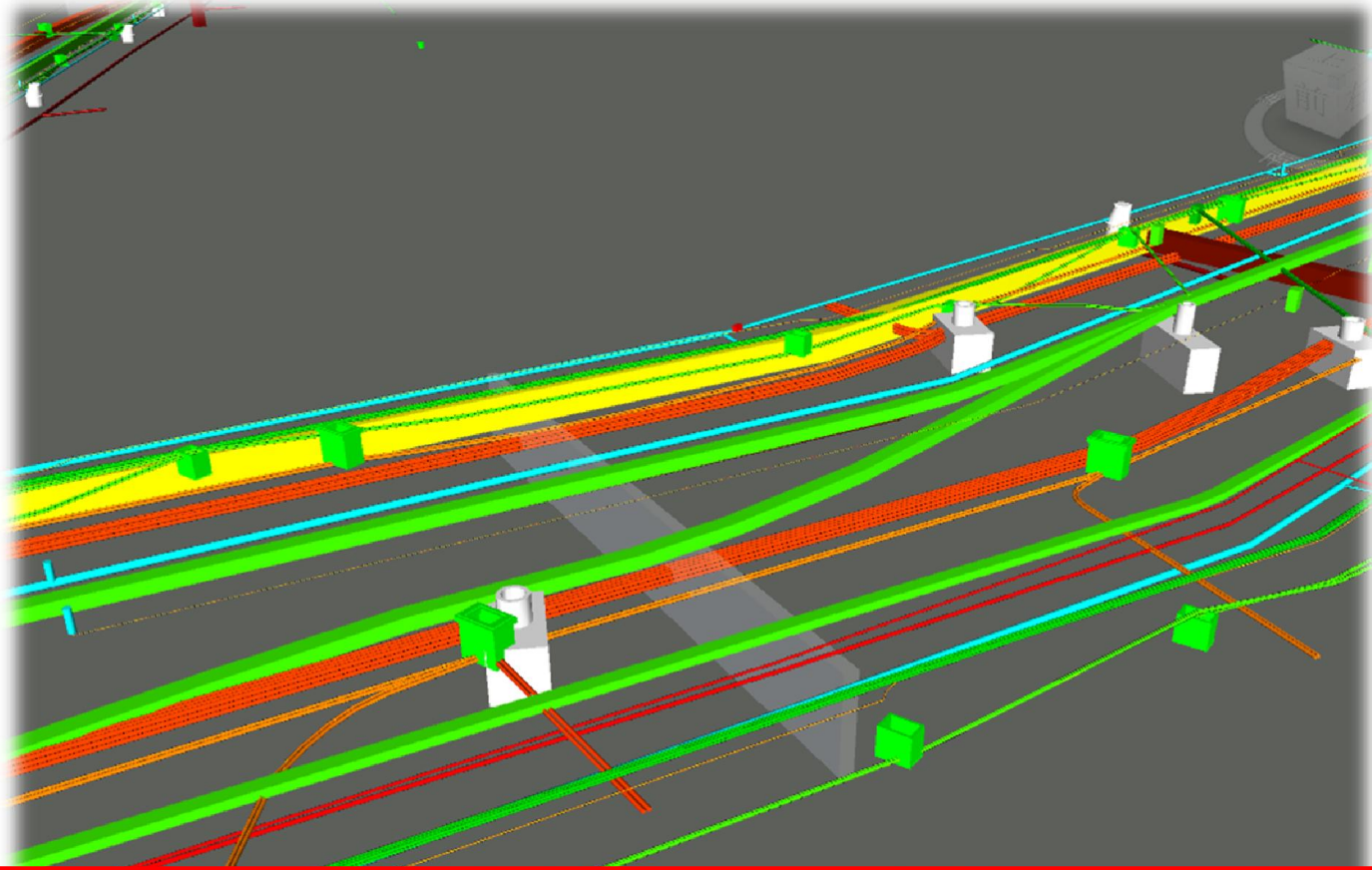
Underground Utilities



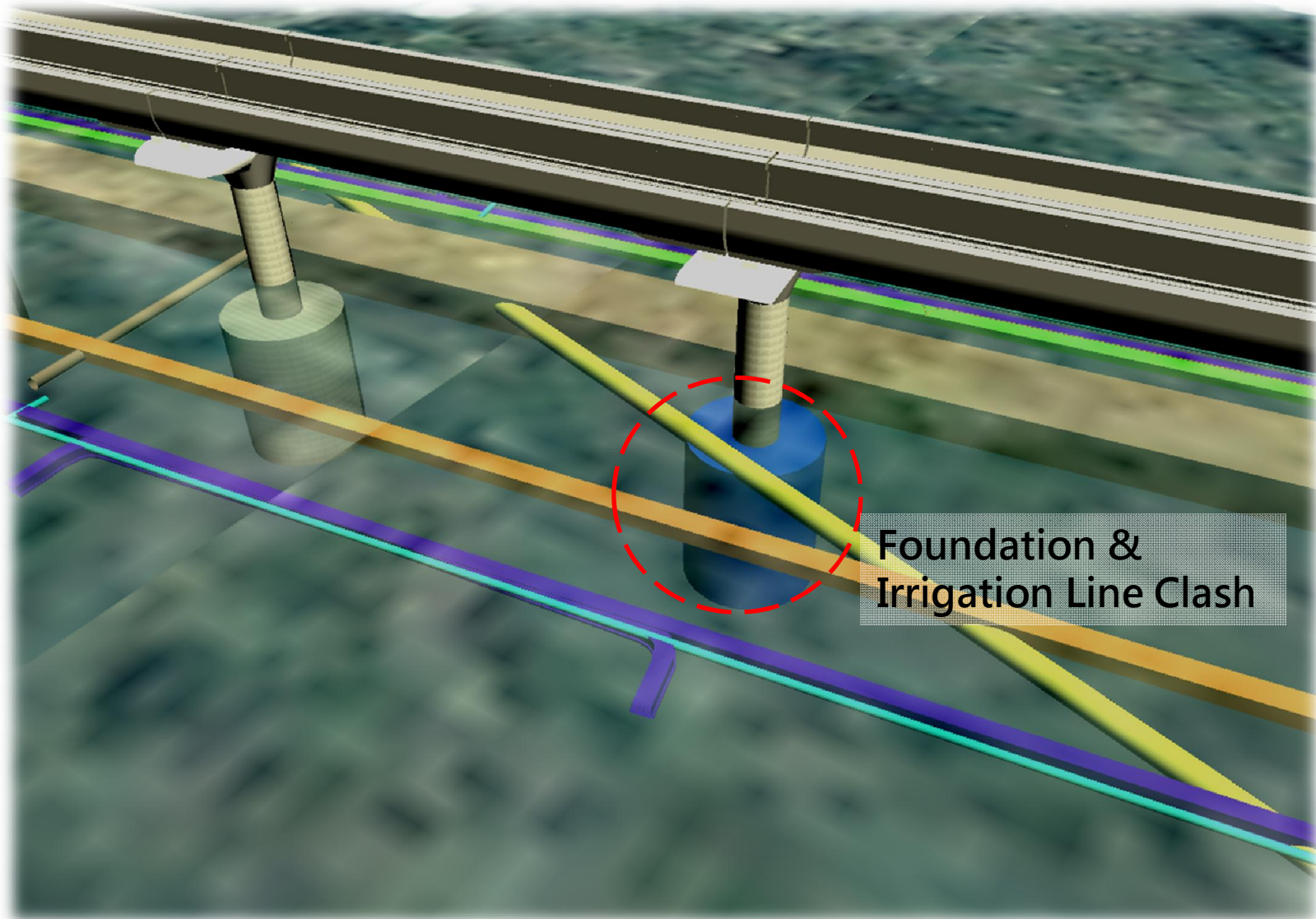
Underground Utilities



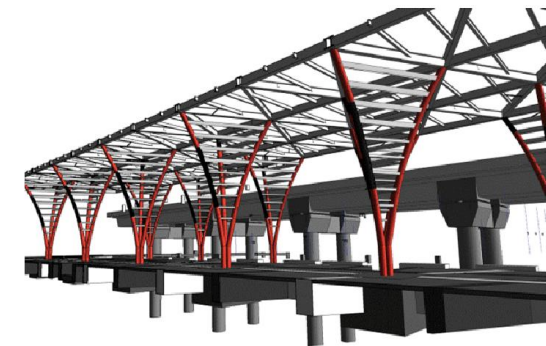
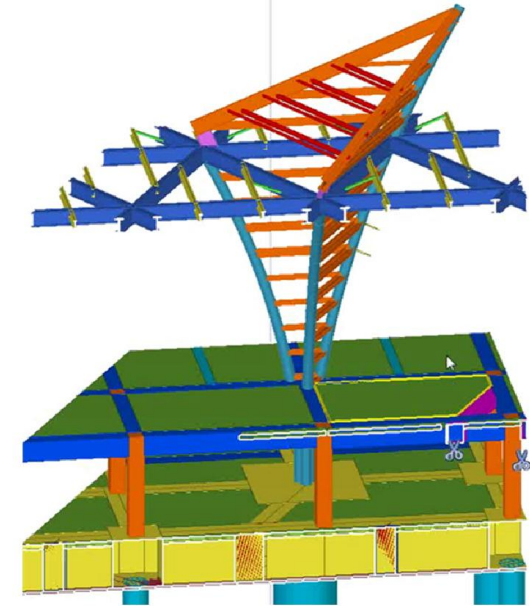
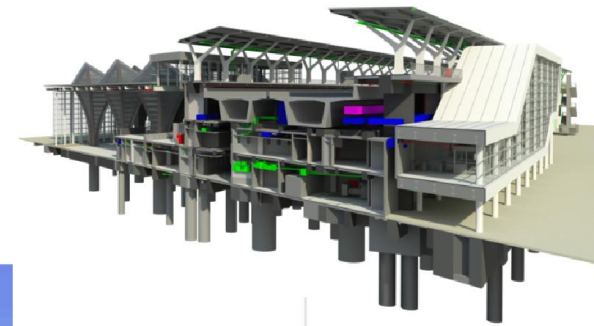
Underground Utilities



Underground Utilities



Virtual Construction



AM/FM

Properties

Model 1190C4F1
Model 1190C4F 2

Mechanical Equipmen Edit Type

Level Level B1

Host Level : Level B1

Offset 0.0

Moves With Ne...

Text

進水溫度 -5.6

能量 完全凍結式

總熱 2500

用途 空調儲冷

潛熱 2000

流體類型 25%乙二醇

污垢係數 8

水壓降 25

房間編號 B041

廠牌 CALMAC

單位時間/釋冰... 250

出水溫度 -2.5

代號 IB-5

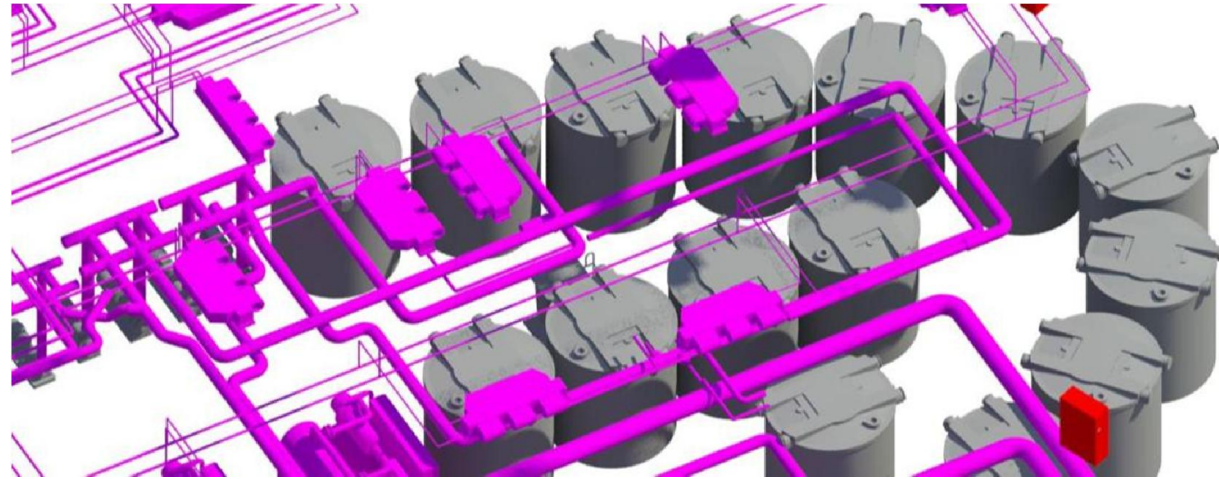
Electrical - Loads

Panel

Circuit Number

Mechanical

System Classifi...



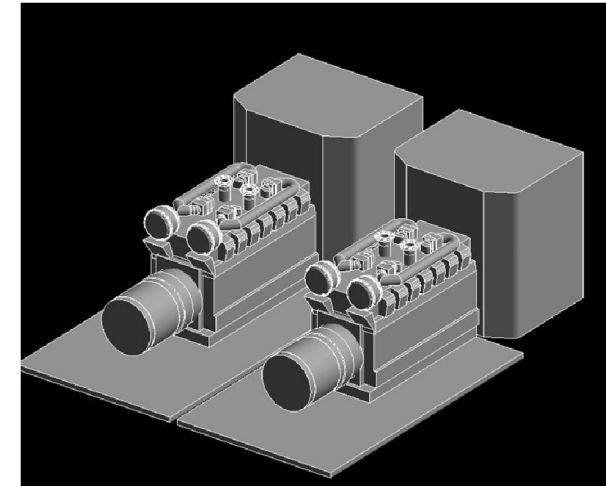
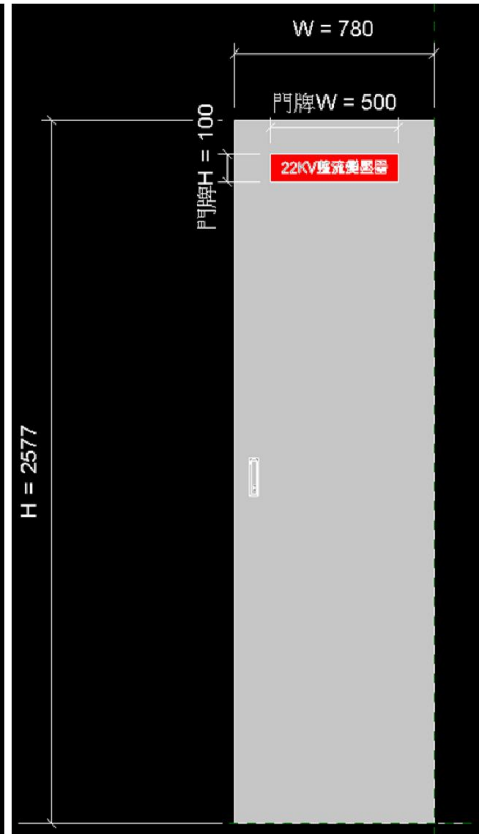
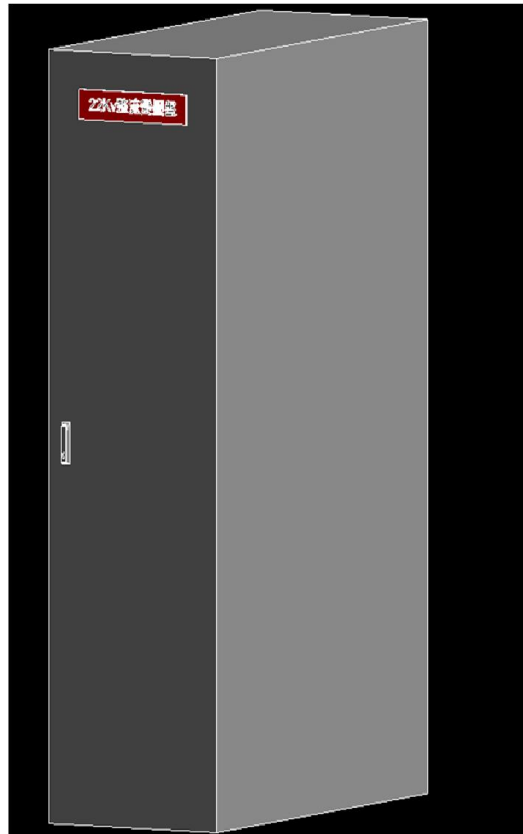
設備代號	用途	區域	樓層	房間編號	型式	容量		流體類型	儲冰				
						總熱	潛熱		進水溫度	出水溫度	流量	水壓降	製冰時間
單位						RT-HR (Min.)	RT-HR (Min.)	°C	°C	LPM	kPa (MAX.)	HR	
IB-1~15	空調儲冷	一區	B1F	B041	完全凍結式	2500	2000	25%乙二醇	-5.6	-2.5	3900	70	9

設備代號	流體類型	釋冰							廠牌
		進水溫度	出水溫度	流量	單位時間釋冰能力	最大釋冰能力	水壓降	釋冰時間	
單位		°C	°C	LPM	RT/HR	RT/HR	kPa (MAX.)	HR	
IB-1~15	25%乙二醇	11.33	3	1592	250	300	25	8	CALMAC

AM/FM

MEP assets database

盤體編號 CUBICLE & PANEL ID NO.	盤體編碼 CUBICLE & PANEL CODING.	盤體名稱 CUBICLE & PANEL DESCRIPTION	盤體尺寸 CUBICLE & PANEL DIMENSION			設備重量 EQUIPMENT WEIGHT (KG)	機房名稱 ROOM NAME
			寬(W) (mm)	深(D) (mm)	高(H) (mm)		
1. 動力發電設備清單 PPSS EQUIPMENT LIST							
①	xxP-T	22kV 整流變壓器 22KV RECTIFIER TRANSFORMER CUBICLE	780	1800	2577	3300	牽引動力變電站 PPSS



性質

22kV 整流變壓器
22kV 整流變壓器
780W*1800D*2577H

電氣設備 (1) 編輯類型

文字

NAME 22kV 整流變壓器

電機工程

明細表頁首註釋

明細表頁頁註釋

電氣 - 負載

總連接 0.00 VA
總預估需求 0.00 VA
總需求率 100.00000%
總連接電流 不計算
總預估需求電流 不計算
表面負載相位 A 0.00 VA
表面負載相位 B 0.00 VA
表面負載相位 C 0.00 VA
電流相位 A
電流相位 B
電流相位 C

識別資料

影像
備註 編碼xxP-T
權註 1
階段
建立階段 新營造
拆除階段 無
一般
外箱型式
安裝型式
配電盤名稱 22kV 整流變壓器
位置

類型性質

高程度: 前 - 22kV 整流變壓器

族群(F): 22kV 整流變壓器 載入(L)...

類型(T): 22kV 整流變壓器 780W*1800D*2577H 複製(D)...

更名(R)...

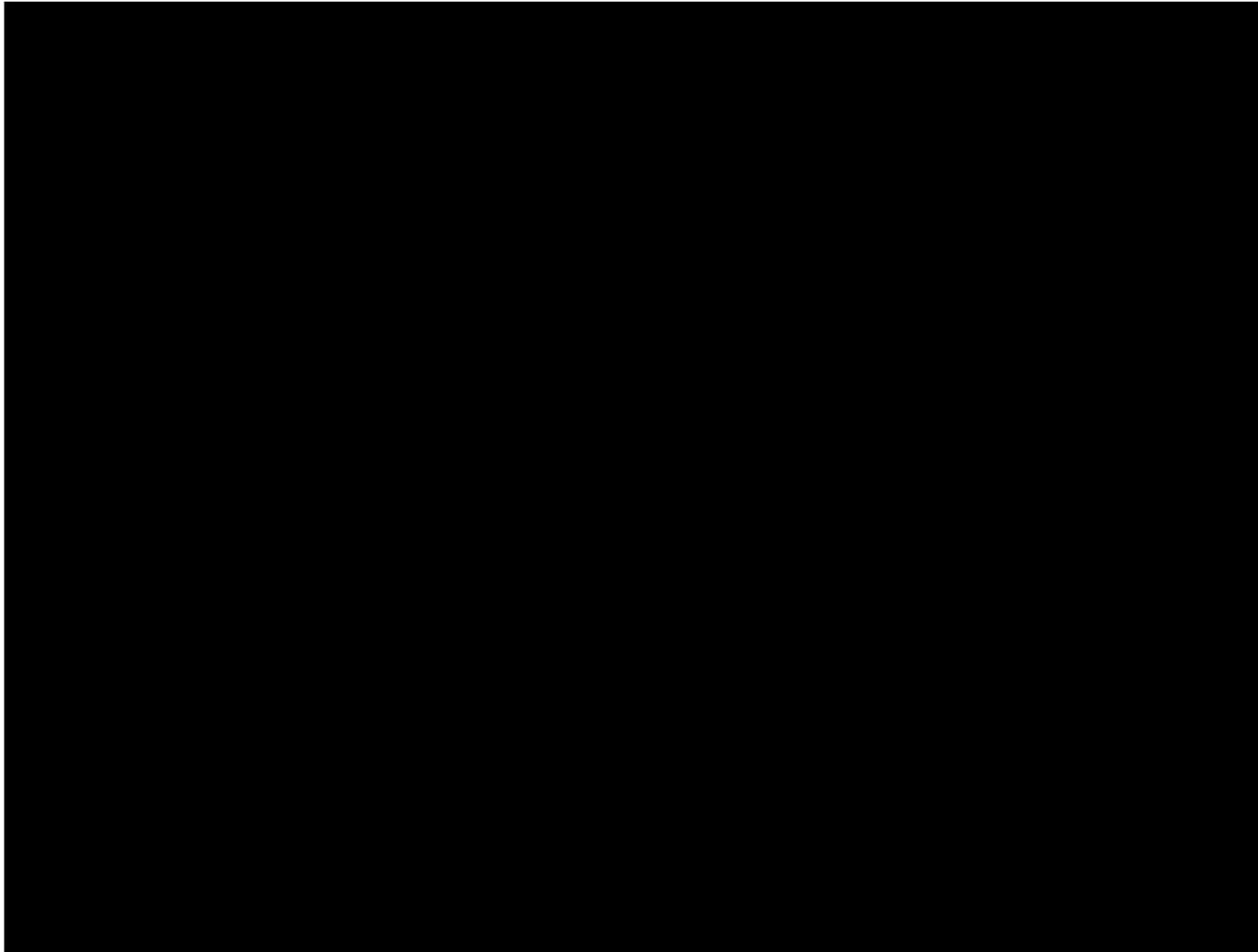
類型參數

參數	值
電氣	
電壓	
互符	
尺寸	
D	1800.0
H	2577.0
W	780.0
門牌H	100.0
門牌W	500.0
識別資料	
類型影像	
關鍵註記	
權註	
製造商	
類型備註	
URL	

<< 預覽(P) 確定 取消 套用

Visualization

Environmental Visualization





Integrated Solutions For Global Impact

MAA GROUP

Thank You

Visualization

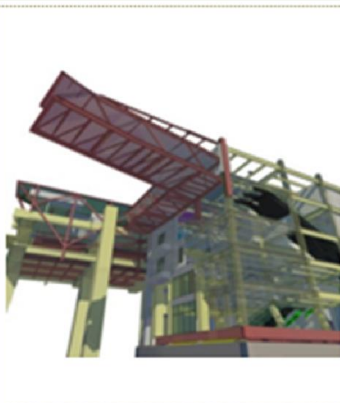
Station Visualization



BIM Awards

臺北環狀線
第一階段工程

優勝

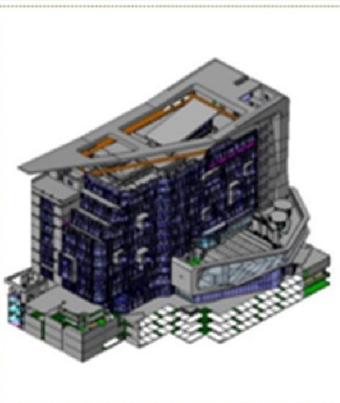


100年 優勝
BIM技術優良獎評選



新北市
立圖書館

佳獎

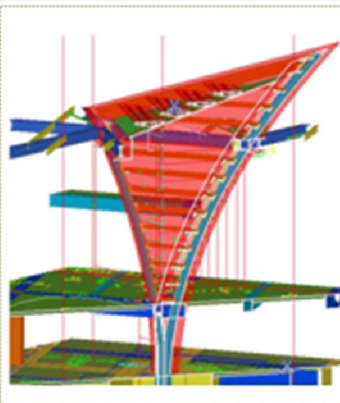


102年 佳獎
BIM技術優良獎評選



彰化
高鐵站

優勝 Winning

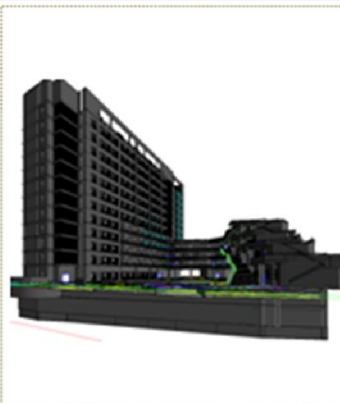


102年 優勝
BIM技術優良獎評選



成大
生科大樓

優勝

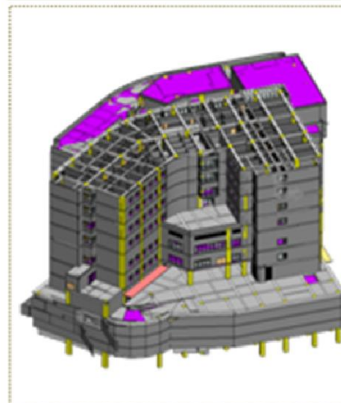


102年 優勝
BIM技術優良獎評選



三重
急重症醫院

優勝

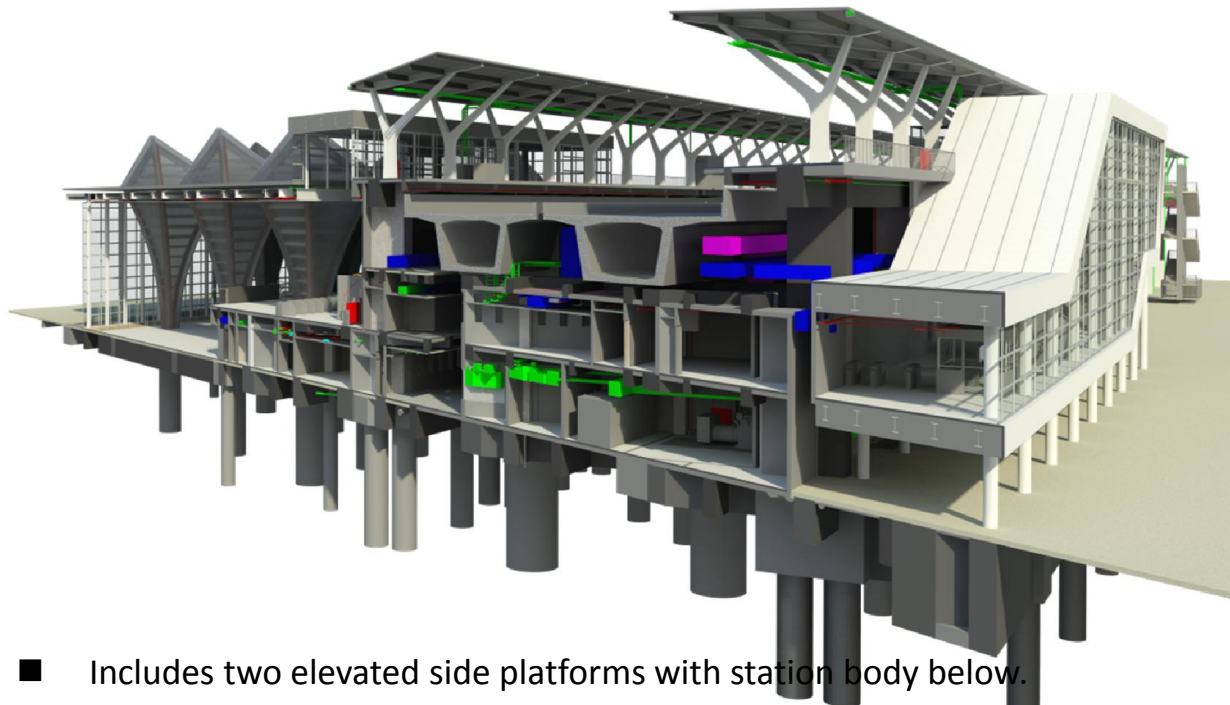


104年 優勝
BIM技術優良獎評選

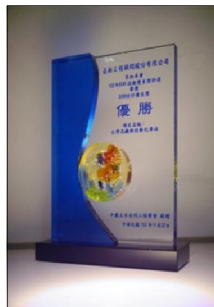


RAIL BIM EXPERIENCE

CHANGHUA STATION PROJECT TAIWAN HIGH SPEED RAIL



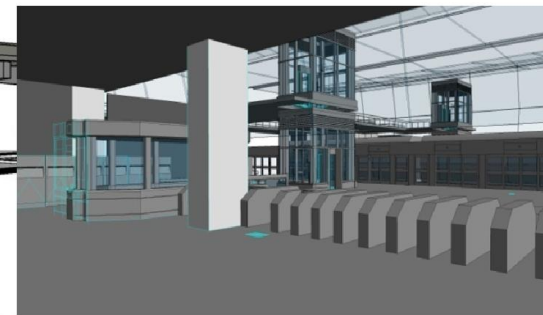
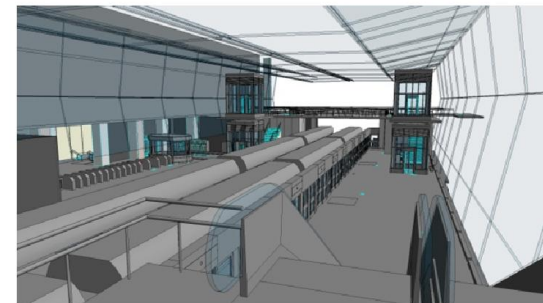
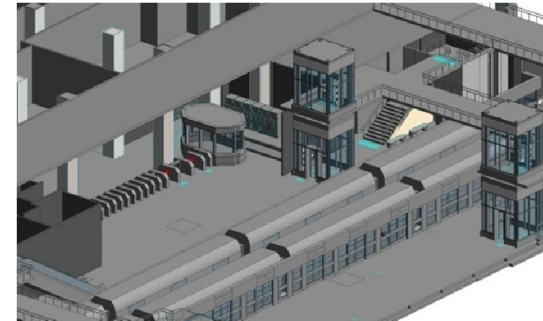
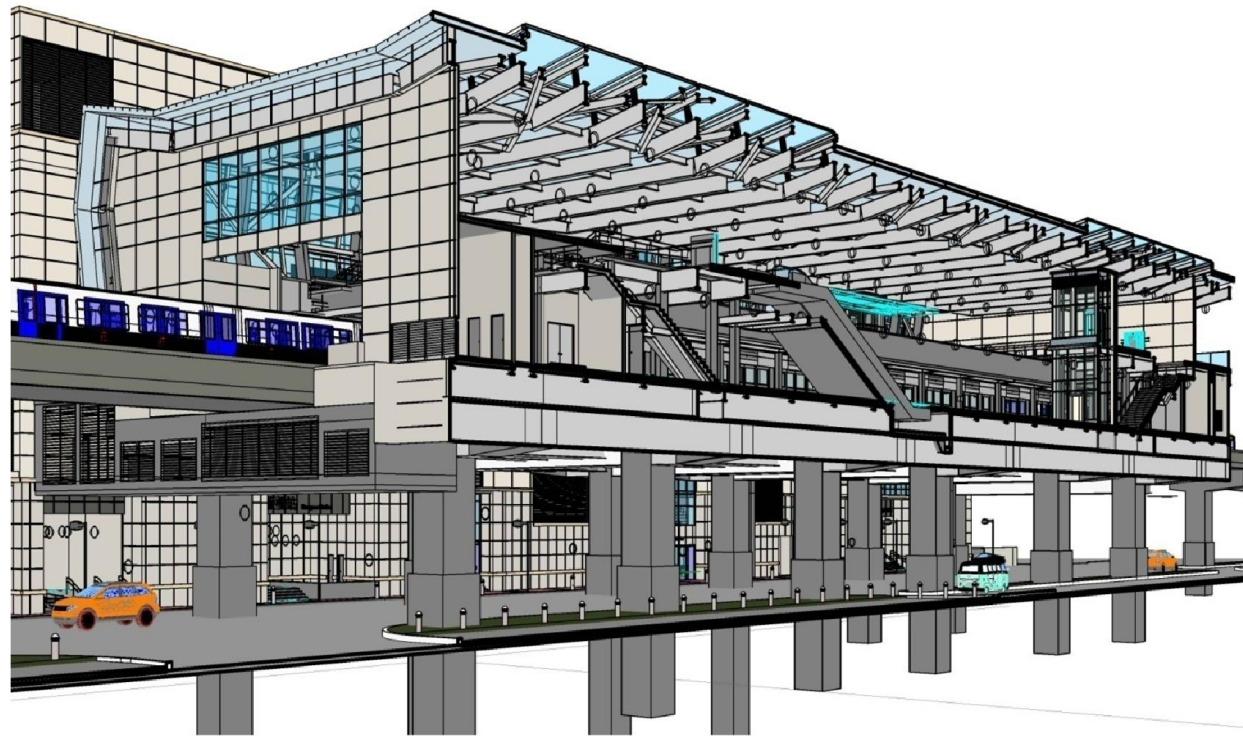
Winners



- Includes two elevated side platforms with station body below.
- BIM Integration and Management Services for the whole station.
- Leading to **20%** cost savings for the client.
- Awards:
 - Autodesk BIM Awards 2015(Hong Kong, Macau and Taiwan)
 - Chinese Institute of Civil and Hydraulic Engineering BIM Awards 2013

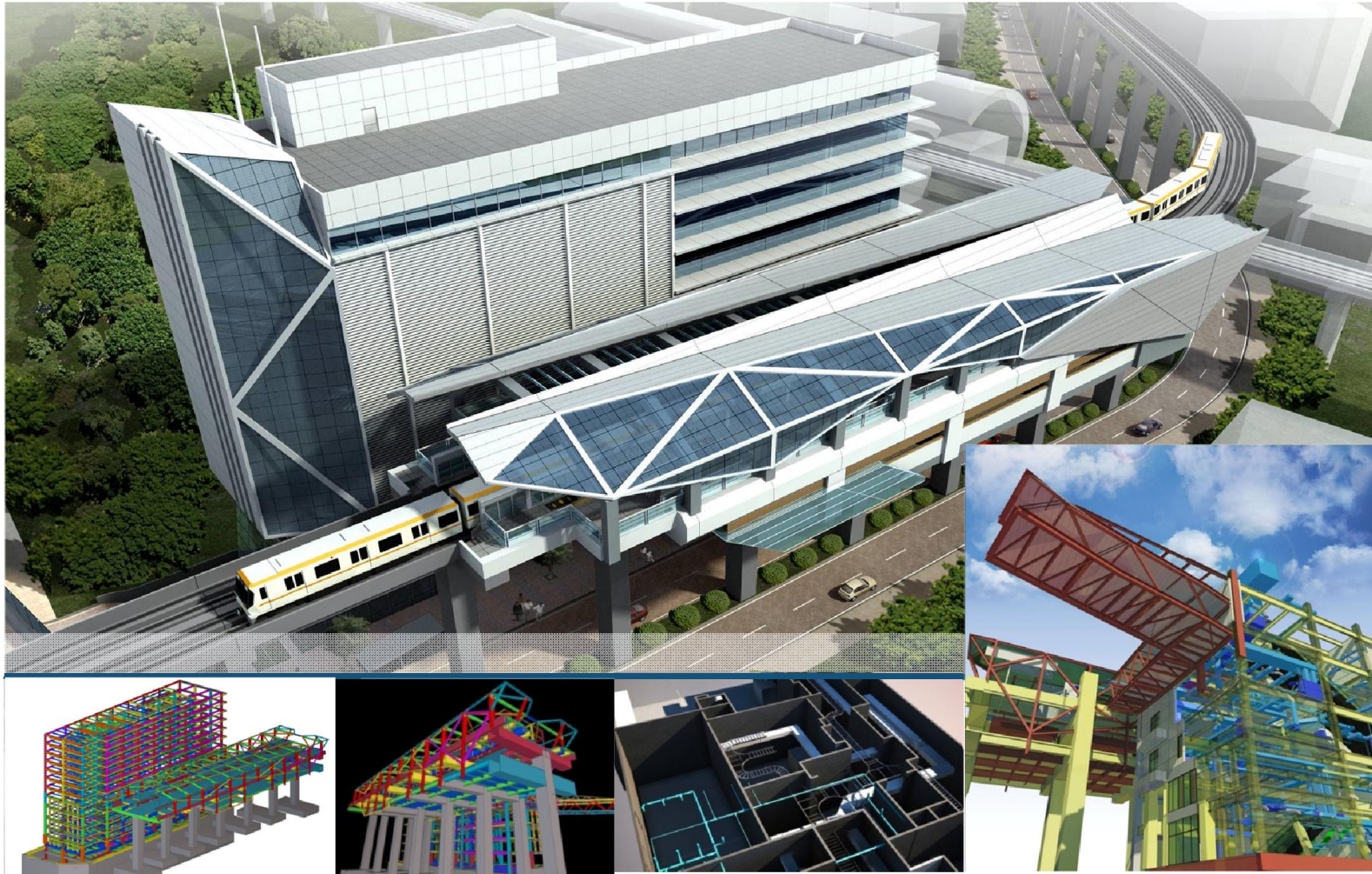
RAIL BIM EXPERIENCE

CIRCLE LINE Y15 STATION-- TAIPEI MRT



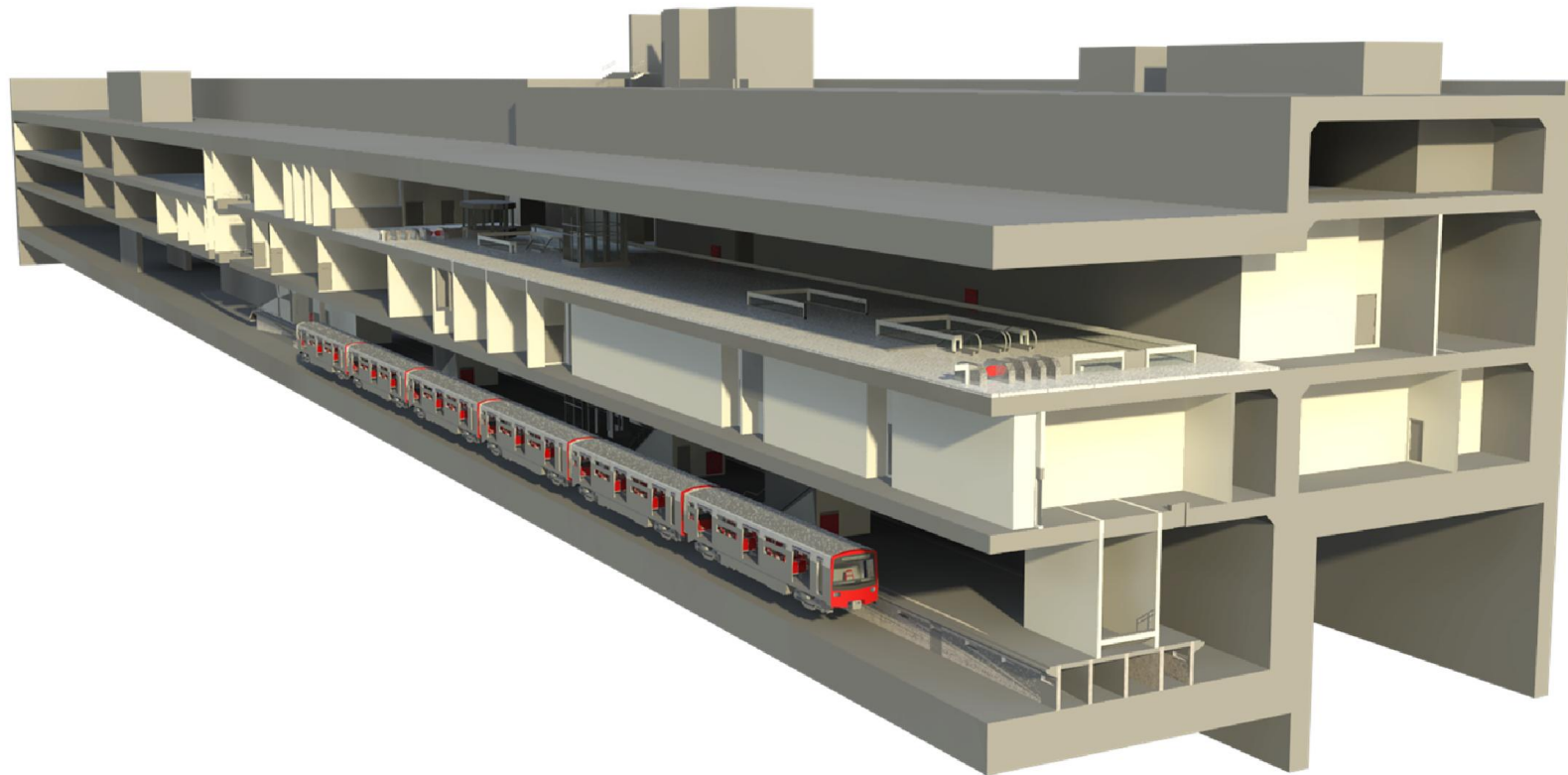
RAIL BIM EXPERIENCE

CIRCLE LINE Y19 STATION-- TAIPEI MRT



RAIL BIM EXPERIENCE

XIN YI LINE EXTENSION PROJECT --TAIPEI MRT

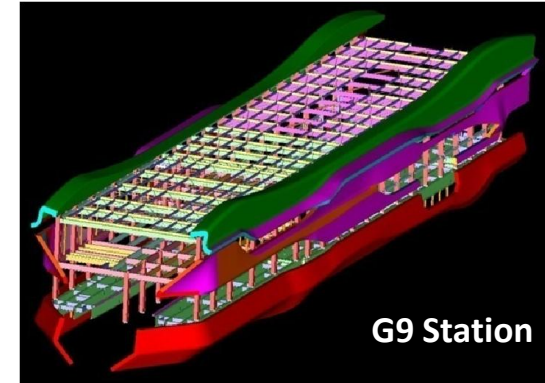
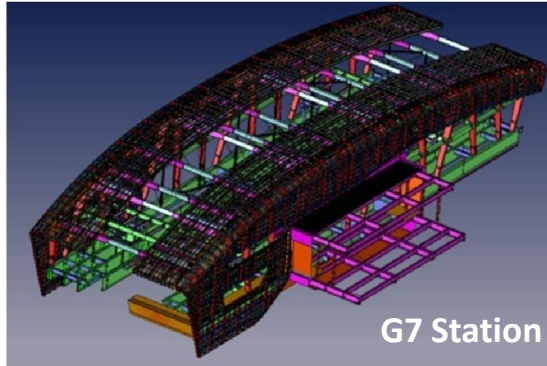
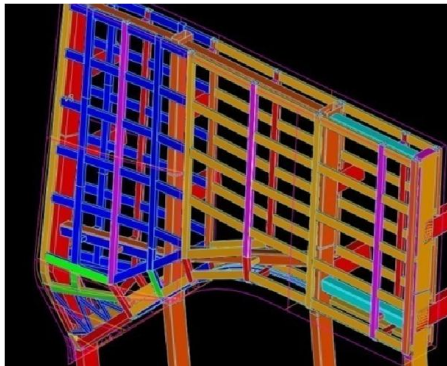
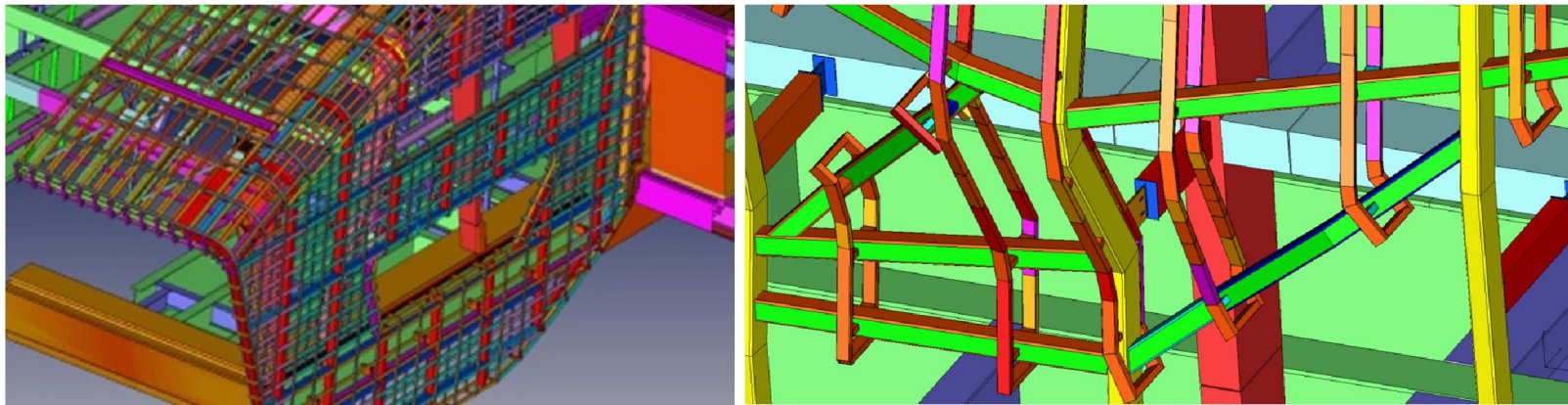


- Two underground stations (named R04 and R03), two sections of shield tunnel.
- Detailed engineering design, including civil, architecture and MEP.
- Provided BIM services for the structure and MEP.

RAIL BIM EXPERIENCE

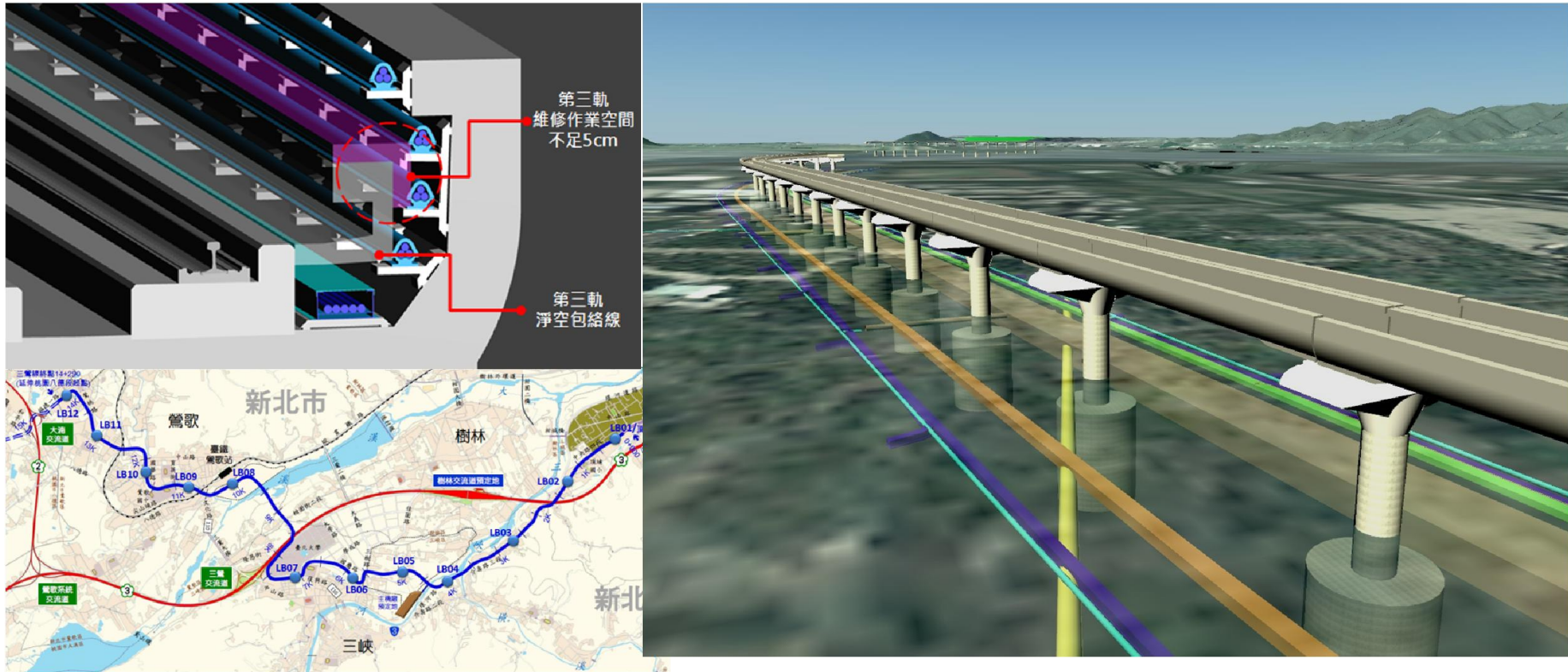
G7/G9 RAIL STATIONS-TAICHUNG MRT

- 3D BIM facade model
- BIM based facade shop drawings
- 3D BIM geometric and curvature rationalization analysis



RAIL BIM EXPERIENCE

SANYIN LINE PROJECT -- TAIPEI MRT



- Totally 14.29 km long MRT system, includes 12 stations and 1 depot.
- Detailed engineering design, including civil, architecture and MEP.
- Provided BIM services for design, construction and maintenance periods.