HANOI PILOT LIGHT METRO LINE

Section Nhon - Hanoi Railway Station

# HANOI METRO

# LINE 3 PRESENTATION

## August 2013

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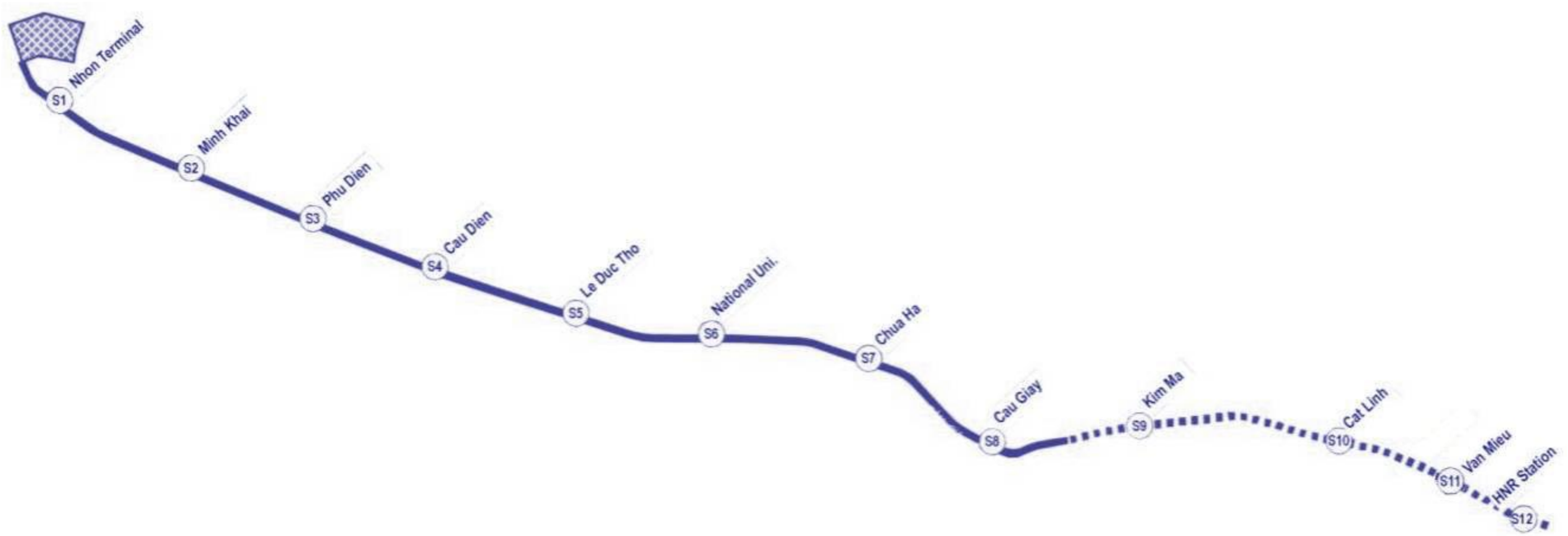
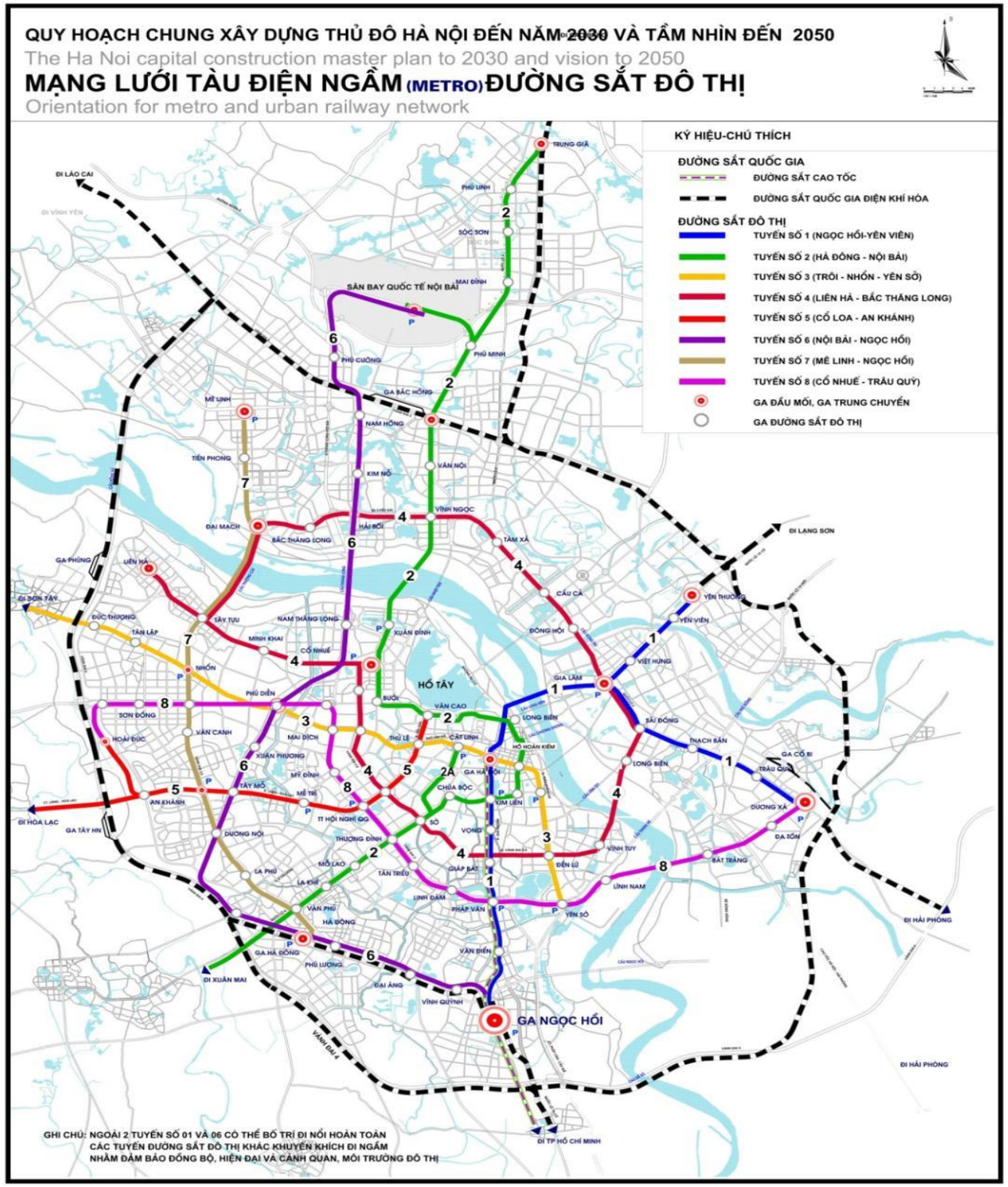
# 1. GENERAL DESCRIPTION



# Line 3 and Hanoi Metro Master Plan for 2020




**Line 1** (Ngoc Hoi – Yen Vien – Nhu Quynh): is about 38,7 km

**Line 2** (Noi Bai _ City Center – Thuong Dinh): is about 35,2 km long, which is the backbone of the current and future city areas, connecting with Hanoi – Ha Dong line which is 14 km long.

**Line 3** (Nhon - HRS - Hoang Mai): is about 21 km long. After 2020, it will be extended to Son Tay, total estimated length is 48 km.

**Line 4** (Dong Anh – Sai Dong - Vinh Tuy/Hoang Mai - Thanh Xuan - Tu Liem - Thuong Cat - Me Linh): is in the circle shape, connecting with line 1, line 2, line 3 and line 5, length of 53,1 km.

**Line 5** (South West Lake – Ngoc Khanh – Lang – Hoa Lac): length is about 34,5 km.

**Line 6** (length is about 43 Km): Noi Bai – new urban zone at the west of Ngoc Hoi. The line is connected with line 4 in Co Nhue and line 7 in Duong Noi.

**Line 7 (**length is about 35 km)**:** Me Linh – new urban zone at the west of Nhon – Van Canh – Duong Noi. The line is connected with line 4 in Dai Mach and Tay Tuu and line 6 in Duong Noi.

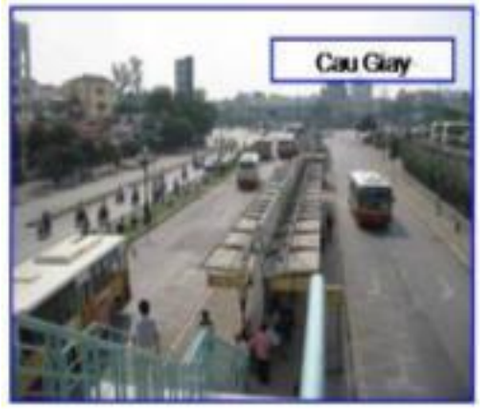
**Line 8** (length is about 28Km): Co Nhue - RR 3 – Linh Nam – Bat Trang – Duong Xa.

# Project description

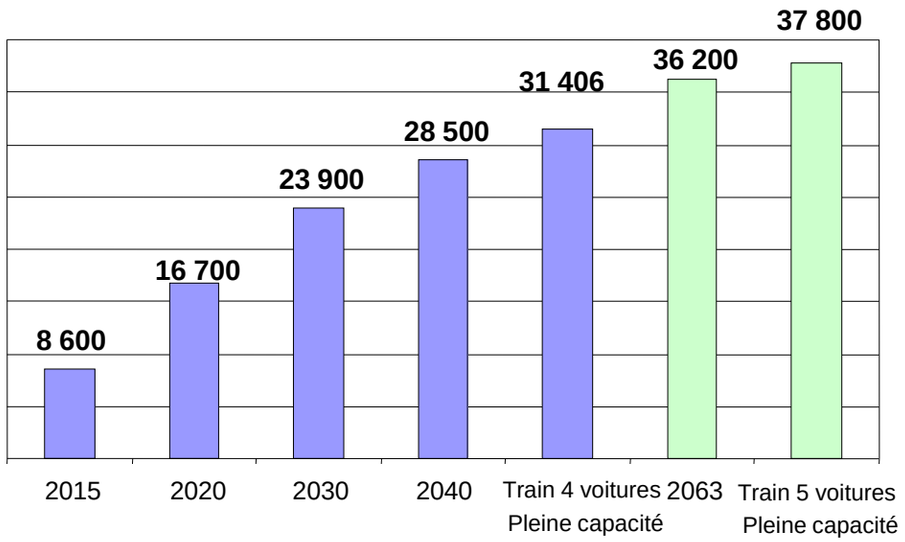
- 12 stations (Main Civil and Secondary Works)
- Viaducts and Special Bridges, about 8,5km
- Tunnels et open trench, about 4km
- 1 depot including the OCC and maintenance equipment
- 2 substations from Hanoi city for power supply
- Track and Third Rail
- Rolling Stock: 10 trains at start of operation
- Electrical & Mechanical (lifts, escalators, ventilation)
- Signalling
- Telecommunication
- Automatic Fare Collection
- Integration testing
- Training for future operation and maintenance people
- Start of operation

# Performances





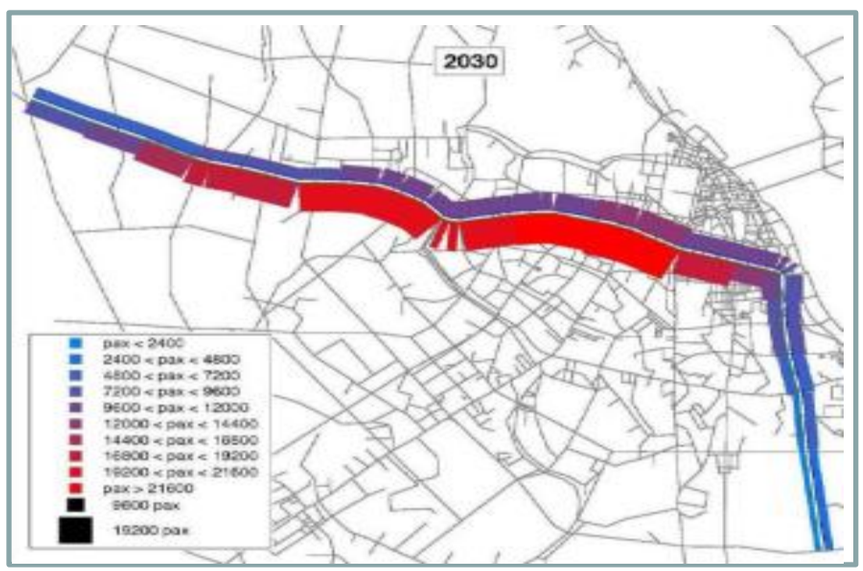





→ **Increasing number of passengers per hour per direction**

→ **Minimum headway: 105 s (train with 4 cars - full capacity)**

→ **Estimated round Trip duration: ~ 43 min 50 s**




→ **Number of passenger per train (6/m²) : 916 for 4 cars**
**1155 for 5 cars**

→ **Average operational speed: ~ 37.0 km/h**

# Tendering Plan - packages

| No | Packages | Donors |
|---|---|---|
| 1 | Elevated Section – Line | AFD (48%) and EIB (52%) |
| 2 | Elevated Section – Stations | AFD (48%) and EIB (52%) |
| 3 | Underground Section – Line and Stations | ADB (100%) |
| 4 | Depot Infrastructures | AFD (100%) |
| 5 | Depot Buildings | AFD (100%) |
| 6 | Railway System 1: Rolling Stock, Signalling, depot equipement, Telecommunication, OCC/SCADA, power supply | DGTP (100%) |
| 7 | Railway System 2: E&M | AFD (100%) |
| 8 | Railway System 3: Track | ADB (40%) and EIB (60%) |
| 9 | AFC | DGTP (100%) |

- **DGTP: Direction Générale du Trésor**
- **AFD: Agence Française de Développement**
- **EIB: European Investment Bank**
- **ADB: Asian Development Bank**

# Project Organisation

Government and Vietnamese Ministres

Owner — Hanoi People Committee (HPC)

Donors — DG Trésor, AFD, EIB, ADB

Employer — Hanoi Metropolitan Railway Management Board (MRB)

Vietnamese Consultants:
(TEDI, TRICC) – Design Appraisal

Foreign Consultants:
IDOM (SPAIN): Project Management Assistant
SENER (SPAIN): Design Appraisal

Engineer — SYSTRA SA
(FR, general consultant)

Contractors

Viaducts (CP01)
DAELIM (COR) negotiations on-going

Elevated Stations (CP02)
POSCO (COR) negotiations on-going

Underground Section (CP03)
Prequalification on-going

Depot - infrastructures (CP04)
VINACONEX 2 (VN)

Depot Buildings (CP05)
HANCORP (VN)

Railway System 1 (CP06)
Prequalification on-going (FR)

Railway System 2 (CP07)
Prequalification on-going

Railway System 3 (CP08)
Prequalification not launched

AFC (CP09)
Design on going (FR)

# An Innovative Project

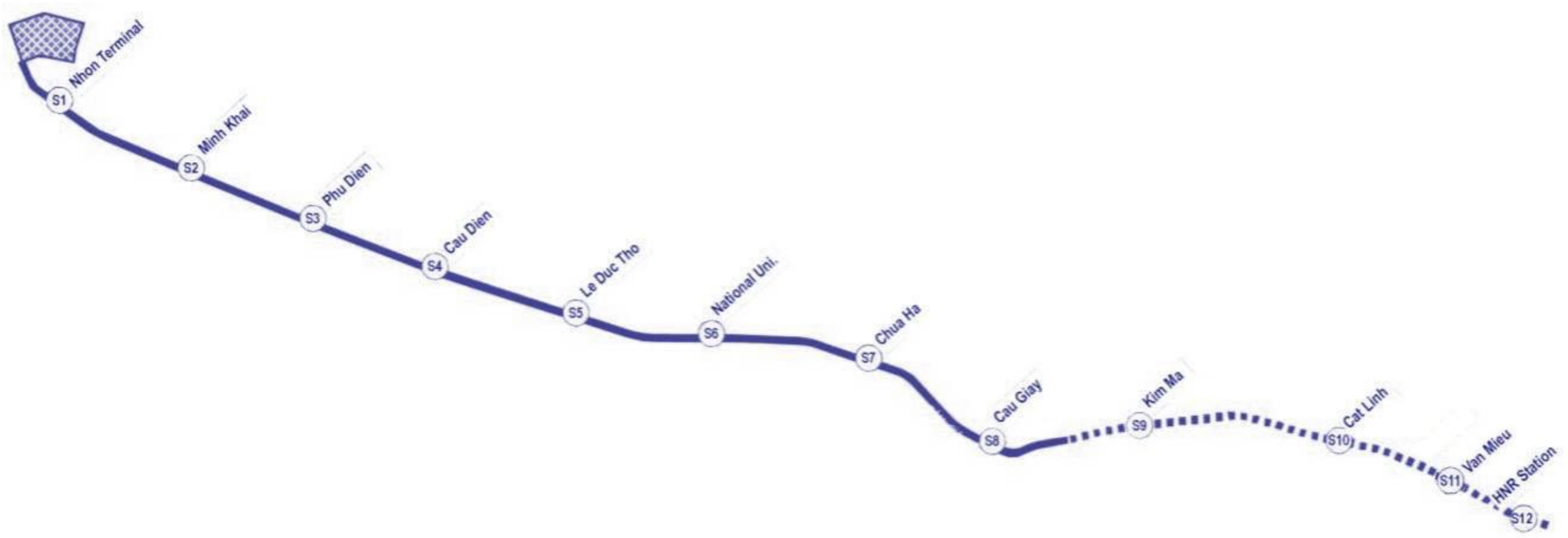
- First  Metro Line in Vietnam (Pilot Line) with numerous technical and contextuel  challenge:
  - Design life of 100years for all metro structures requiring a strict application of norms and a choice of material compliant with the technical requirements of the project
  - Laws, Norms and Vietnamese regulations to be adapted to urban railway transportation projects and to management of international projects => application of norms and forms of international contracts not well known in the country
  - First underground project built using TBM technology
  - Site clearance process difficult (expropriation and utility diversion), necessity to establish a standard framework to follow international rules with the help of ADB
  - Management of the General Working Plan based on each contract package schedule  and especially regarding packages' interfaces to minimise additional costs coming mainly from annual inflation and impacting the Total investment cost
  - Inter-connectivity and Inter-operability within the other urban transport networks (existing and future), and the urban development in the line surroundings

# Key-dates – Project Schedule

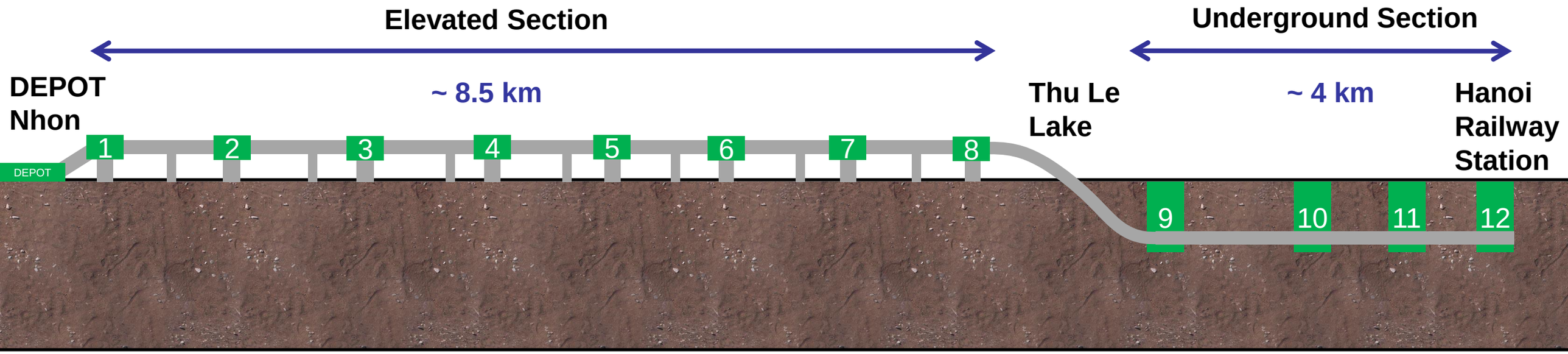
## Schedule Constraints

- 1st pre-faisability study (SYSTRA SA – FR): October 2005,
- 2nd pre-faisability study (TRICC – VN): November 2006,
- Start of project and activities for SYSTRA SA: 10/03/2008,
- Feasibility study and Basic Design approval: 27/04/2009,
- 1st Technical design approval: 24/05/2010,
- 1st Tendering Plan approval: 22/06/2010,
- Start of construction works at Depot site: 22/09/2010,
- All Master Plans approval: 26/06/2012,
- All Technical design Approvals (except AFC): 12/04/2013,
- Planned elevated section contract signature for construction: 2nd semester 2013,
- Planned underground section contract signature for construction: 1st semester 2014,
- Planned Railway System contract signature: 2014,
- Planned end of construction works: end 2017,
- Planned start of operation: in the year 2018.

# 2. ALIGNMENT

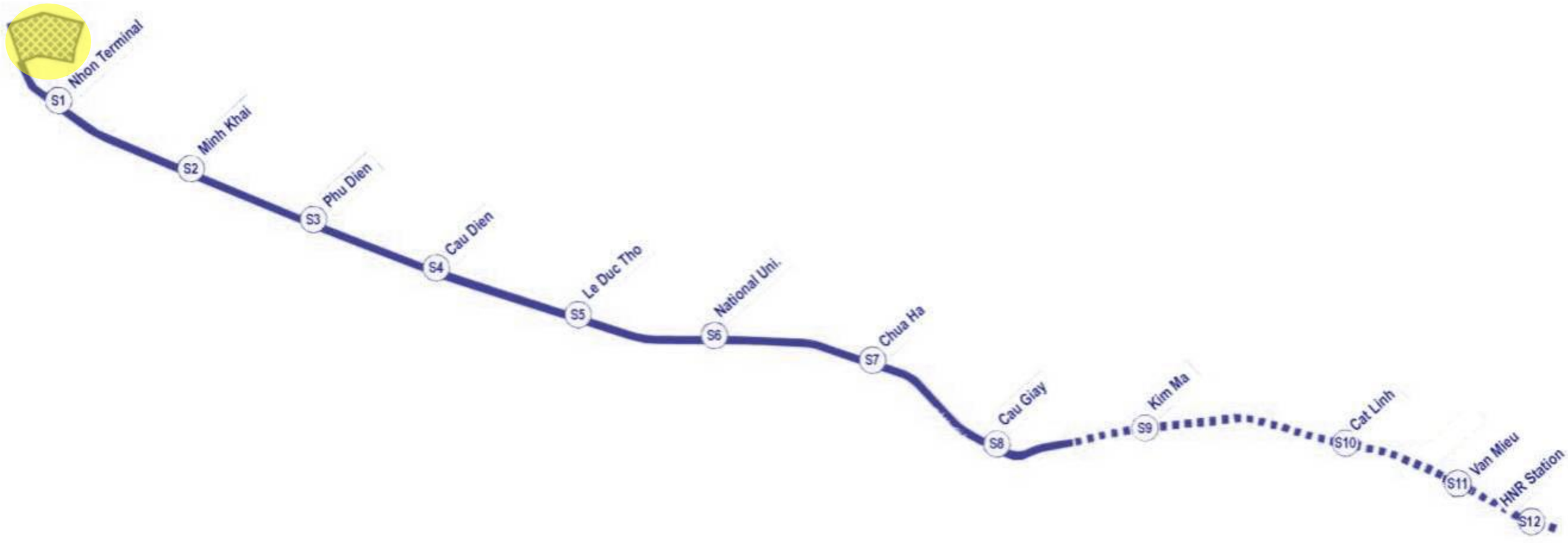

Nhon Terminal
S1
Minh Khai
S2
Phu Dien
S3
Cau Dien
S4
Le Duc Tho
S5
National Uni.
S6
Chua Ha
S7
Cau Giay
S8
Kim Ma
S9
Cat Linh
S10
Van Mieu
S11
HNR Station
S12

# Alignment and stations location




**1 DEPOT – 8 ELEVATED STATIONS – 1 TRANSITION RAMP – 4 UNDERGROUND STATIONS**

# 3. DEPOT


Nhon Terminal
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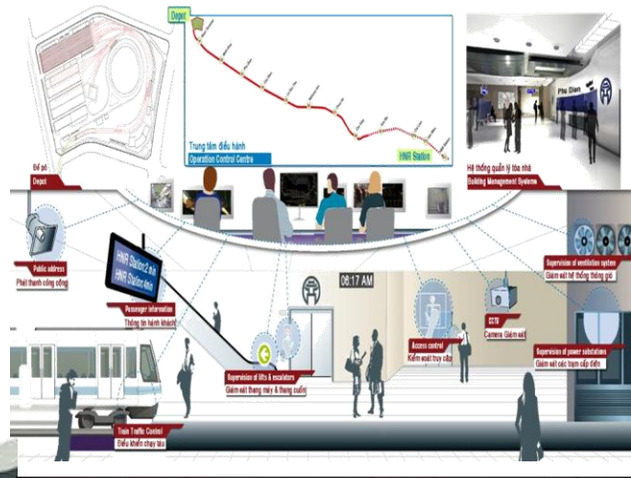
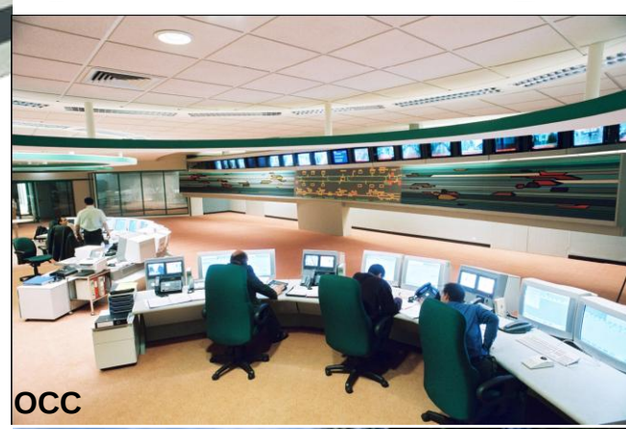
S6
Chua Ha
S7
Cau Giay
S8
Kim Ma
S9
Cat Linh
S10
Van Mieu
S11
HNR Station
S12

# DEPOT

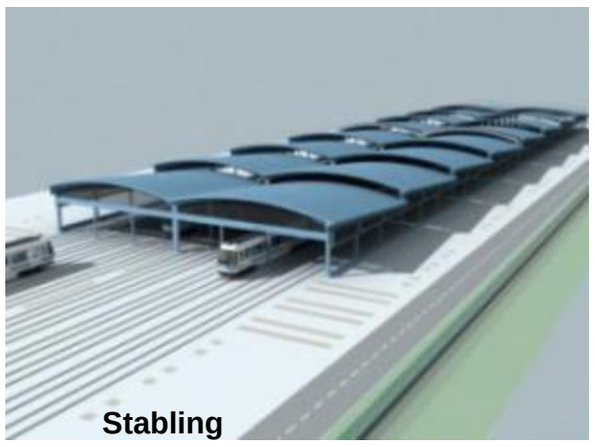
**Includes OCC, maintenance workshops, overhaul, stabling area, administrative buildings…**





OCC


OCC

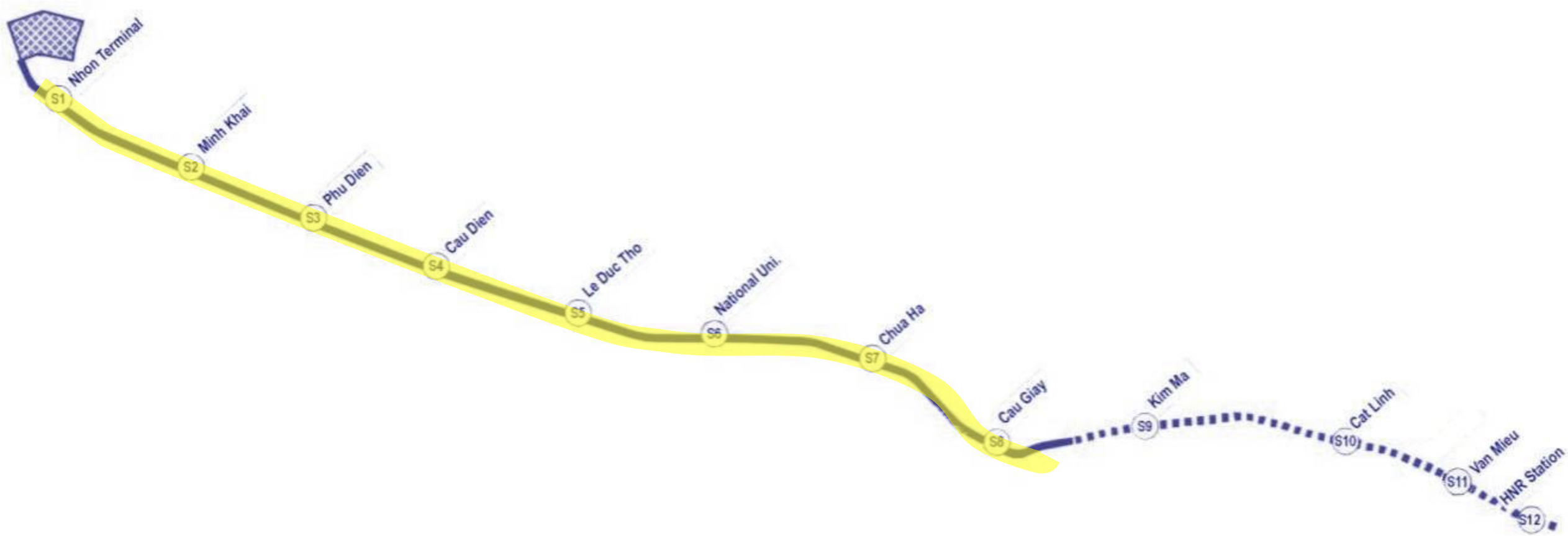

Washing Mahcine


Stabling

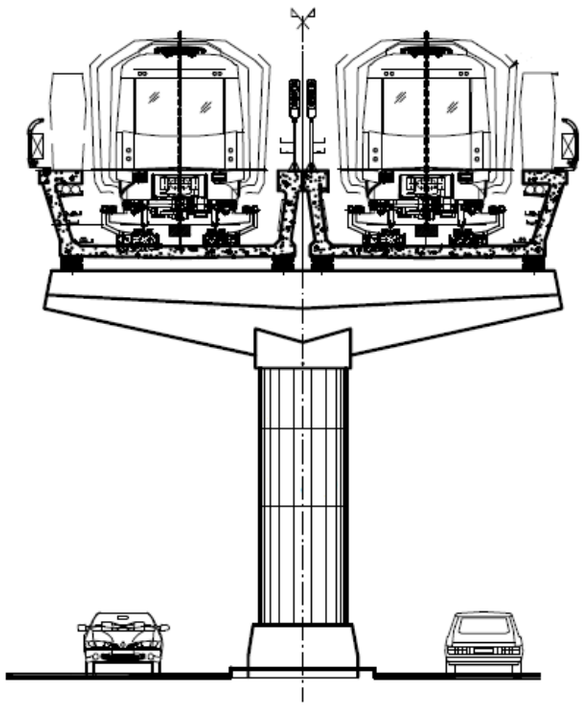

Stabling

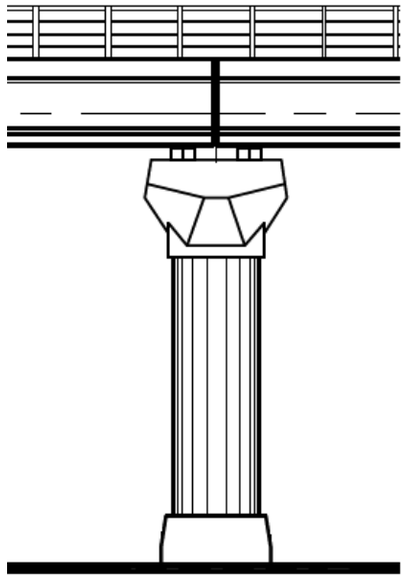

Workshop

# 4. ELEVATED SECTION – VIADUCTS AND SPECIAL BRIDGES



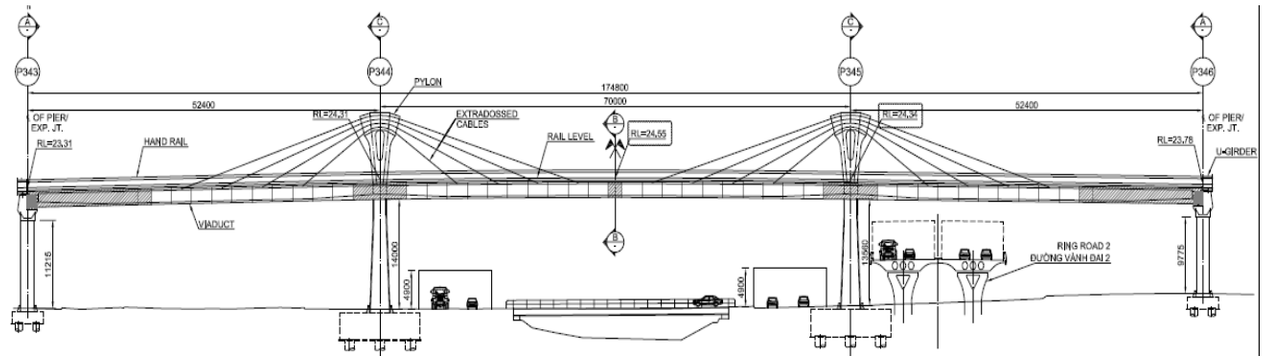
# Elevated Section – Typical Spans

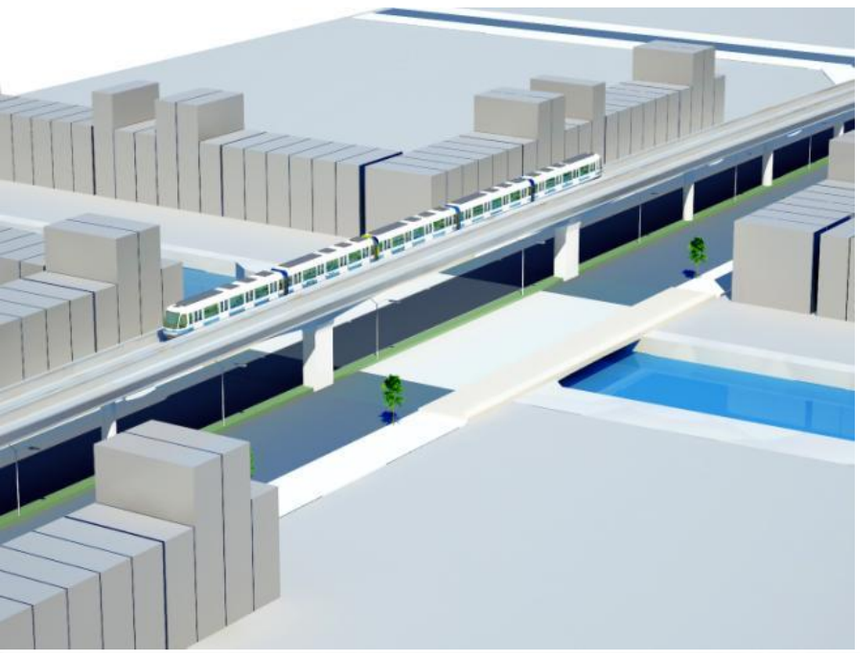




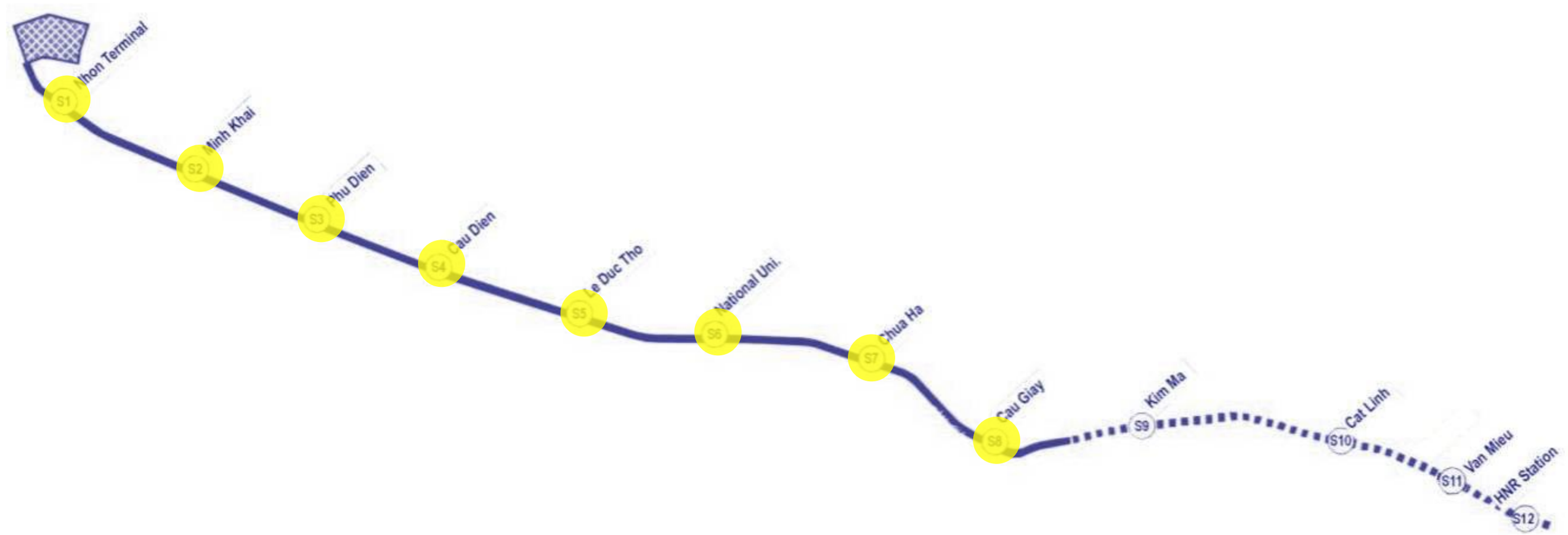
- Design and patent SYSTRA SA
- Structure having numerous advantages
  - Minimize Environmental Impact
  - System Integration
  - Minimised visual impact
  - Fast construction
  - Cost Savings

# 3 Special Bridges

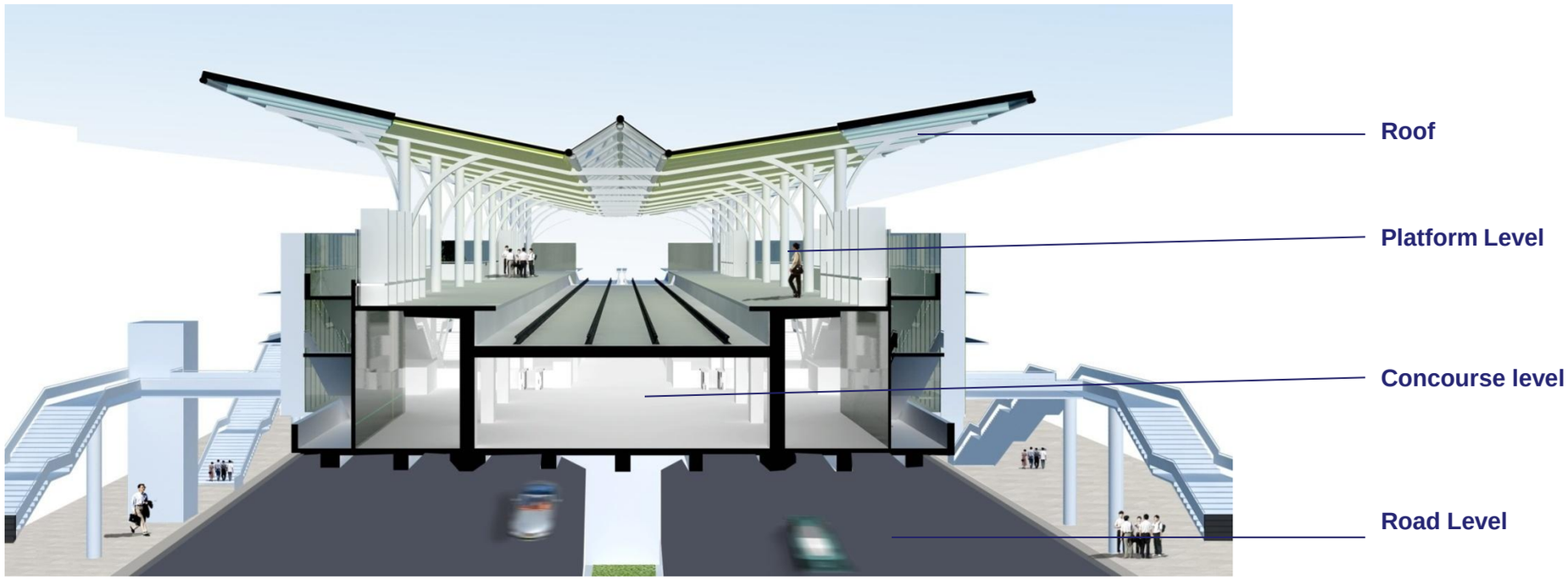


# 5. ELEVATED SECTION – ELEVATED STATIONS



# Elevated Stations – Cross section and general view





Hanoi Pilot Light Metro Line / Section Nhon – Hanoi Railway Station

# Elevated Stations – 3D views

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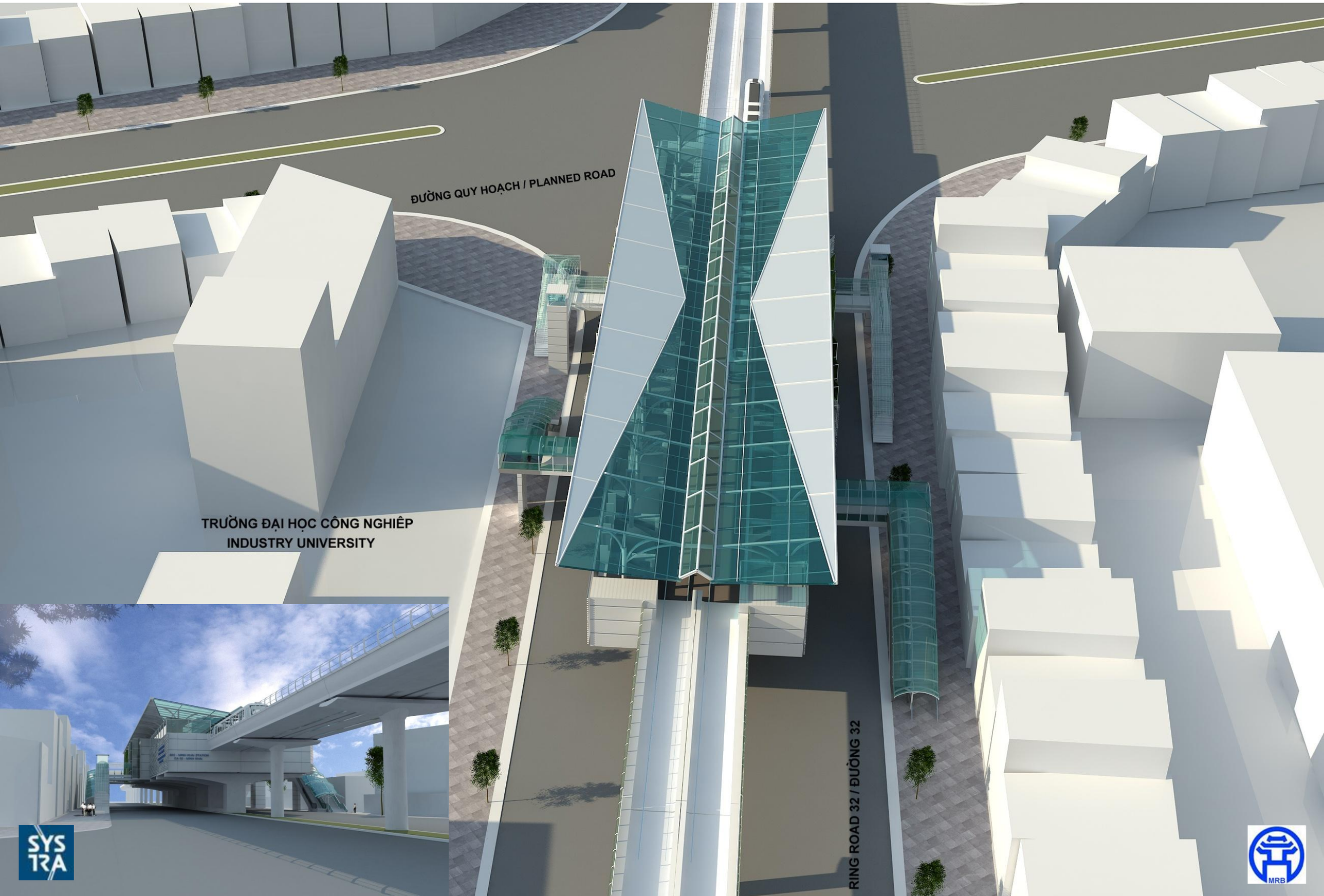
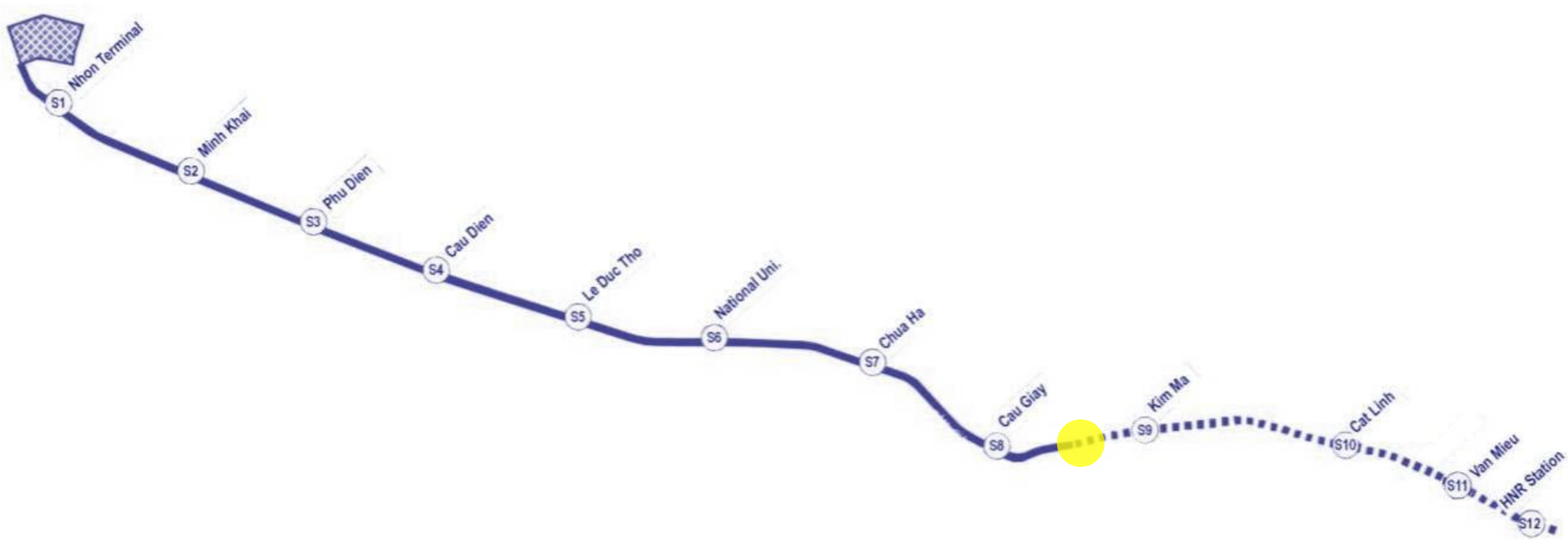


# Cau Giay Station – Interchange


## → Connection to bus terminal at Cau Giay

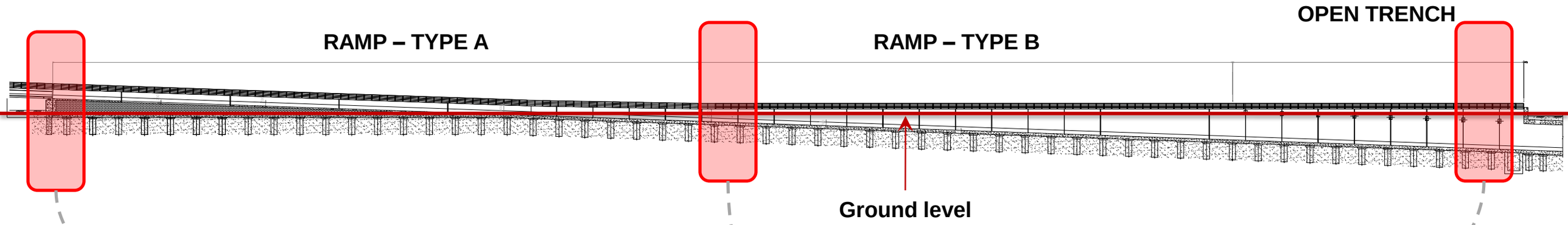

*General view of station 8*

# 6. RAMP – TRANSITION FROM ELEVATED SECTION TO UNDERGROUND SECTION

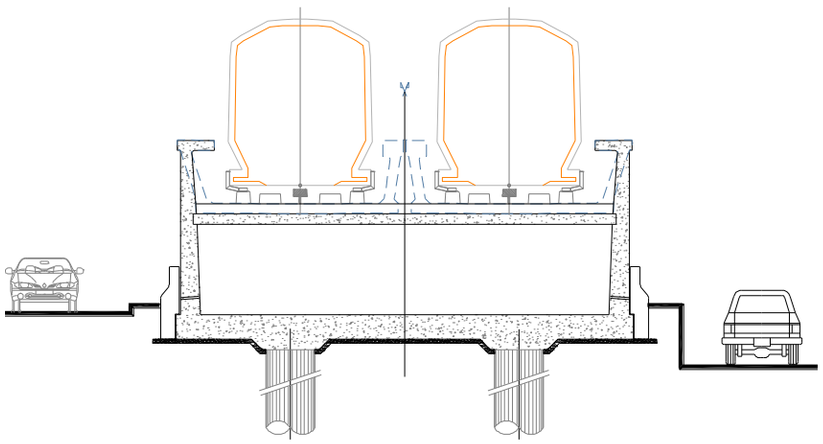


# Ramp

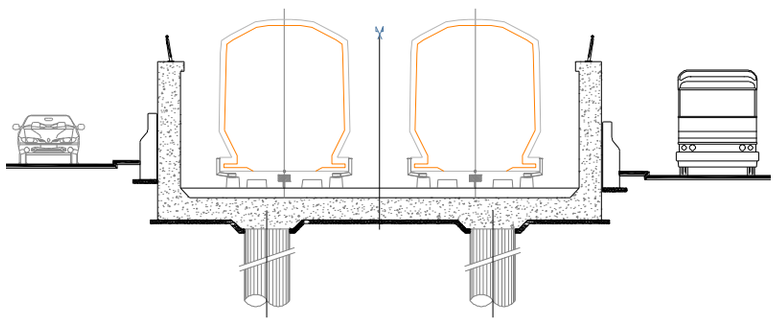
## LONGITUDINAL SECTION
### RAMP STRUCTURE



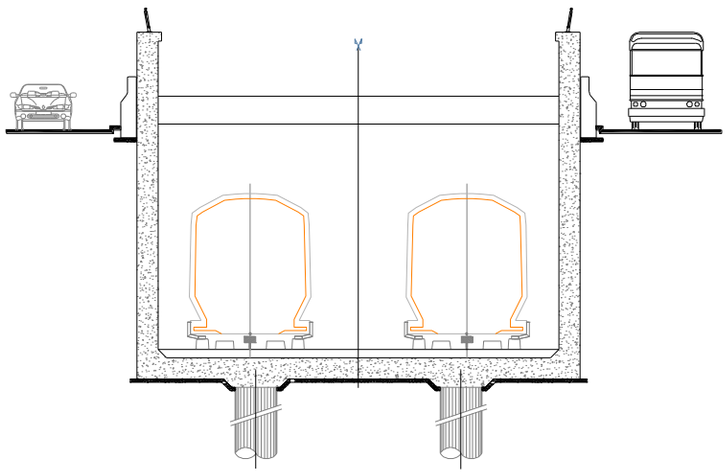

**CROSS SECTION**
**RAMP – TYPE A**



**CROSS SECTION**
**RAMP – TYPE B**

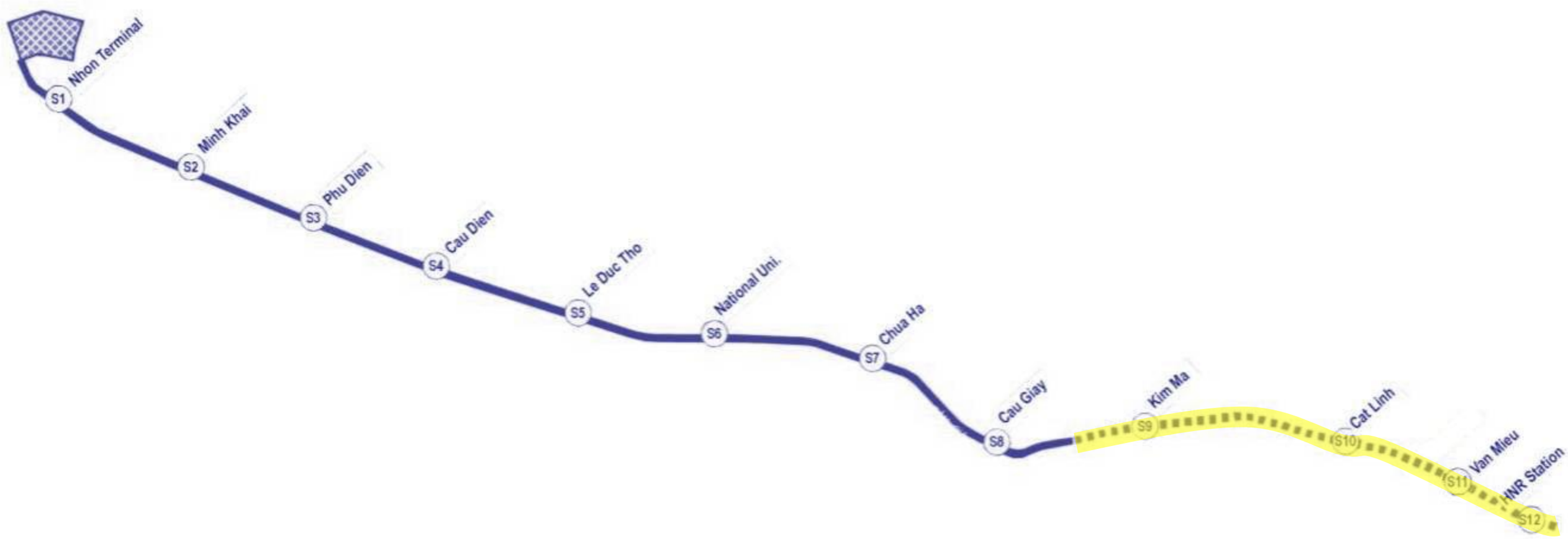


**CROSS SECTION**
**OPEN TRENCH**



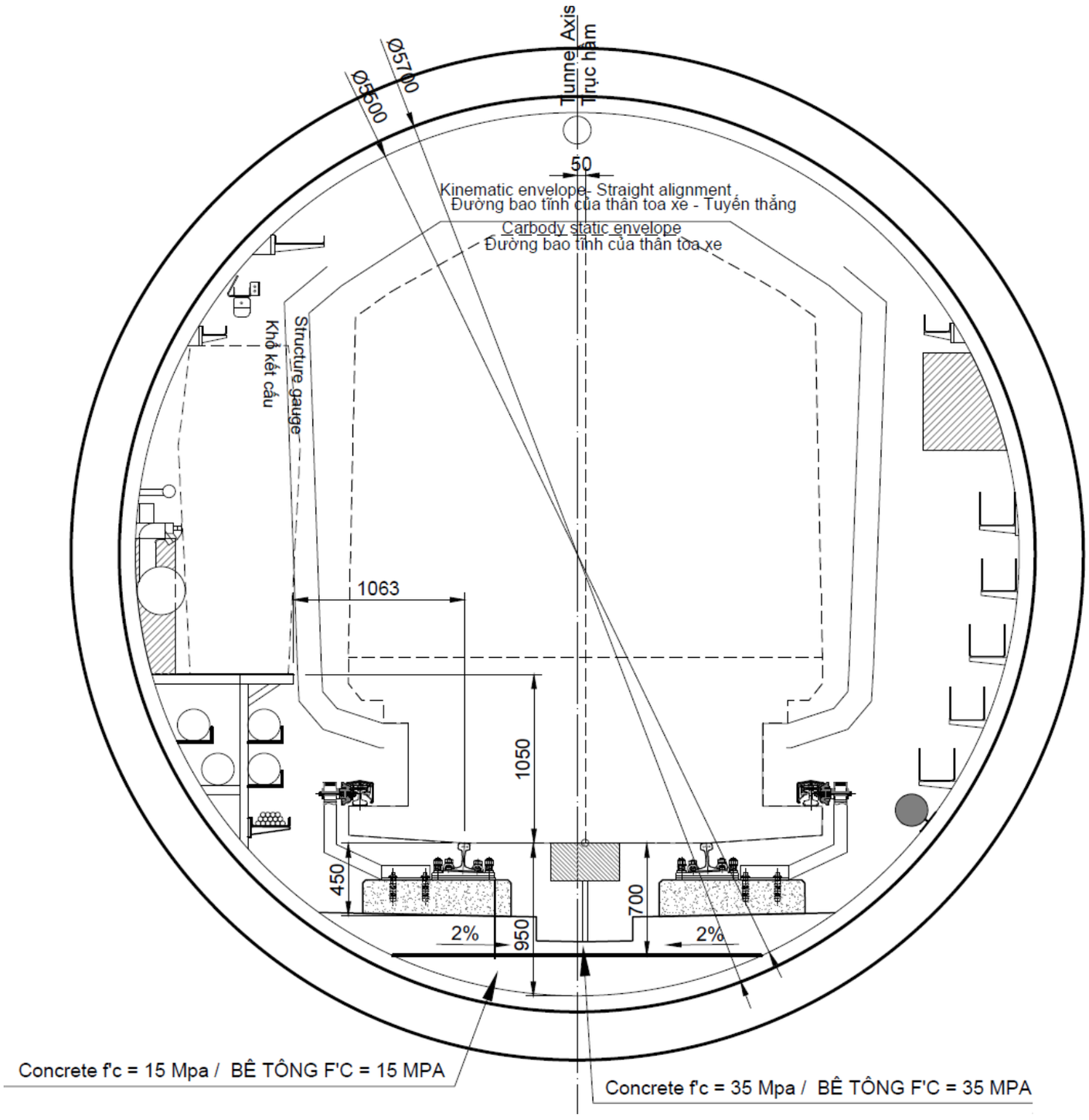
# Ramp

# 7. UNDERGROUND SECTION – TUNNELS & STATIONS



# Underground Section – TBM

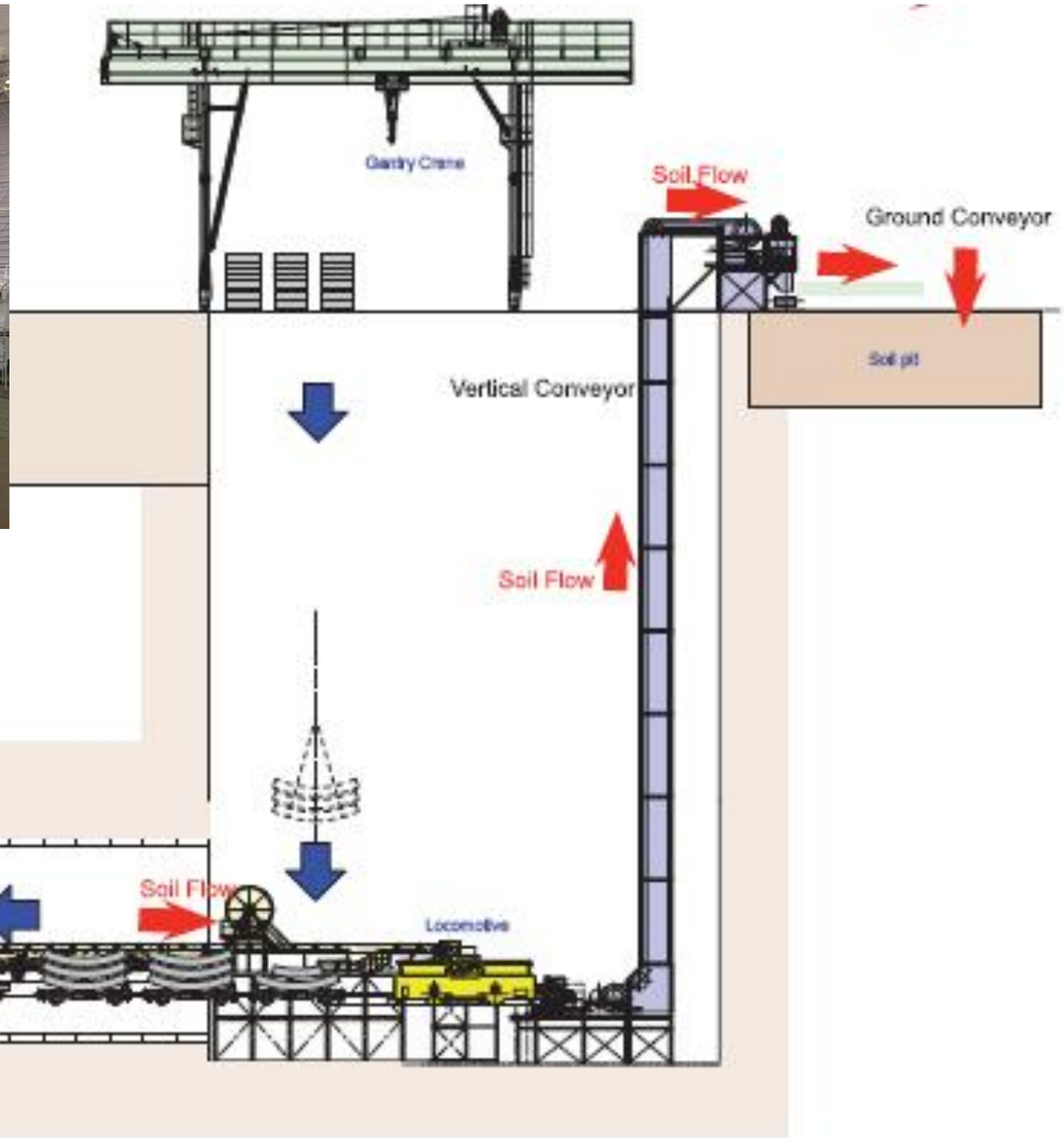
## FUNCTIONAL CROSS SECTION
### STRAIGHT ALIGNMENT

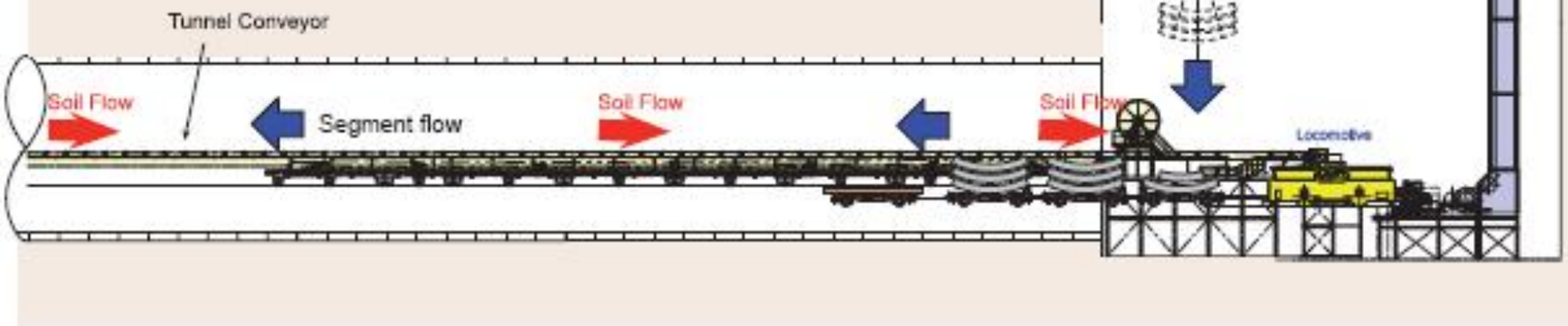


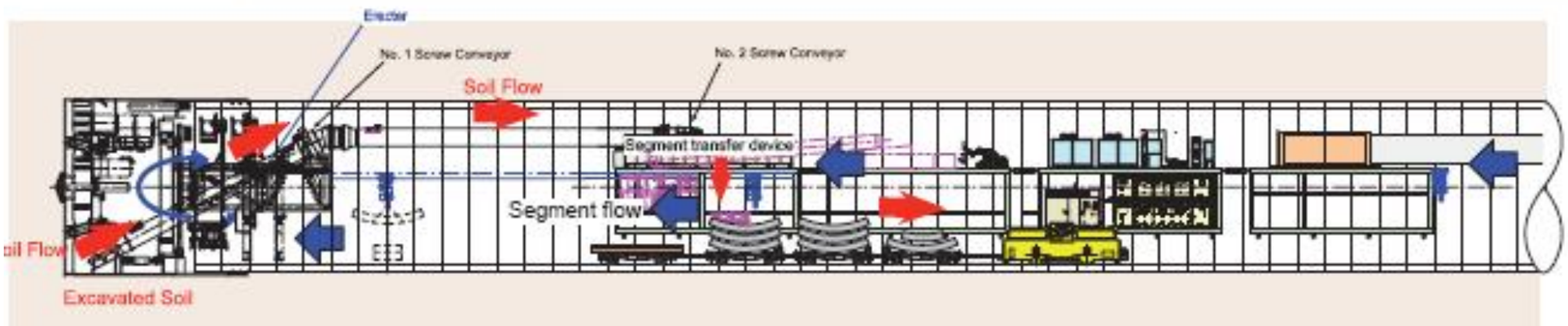

## MAIN CARACTERISTICS OF TUNNEL

| | |
|---|---|
| **Long. Tunnel** | About 4 km |
| **Method of construction** | TBM |
| **Type of tunnel** | Bi-tube at same level |
| **Diameter of tunnel** | 6300 mm |
| **Distance between both tubes** | About 16m (variable) |
| **Depth of tunnel** | Variable<br>From -15 to -30 m |

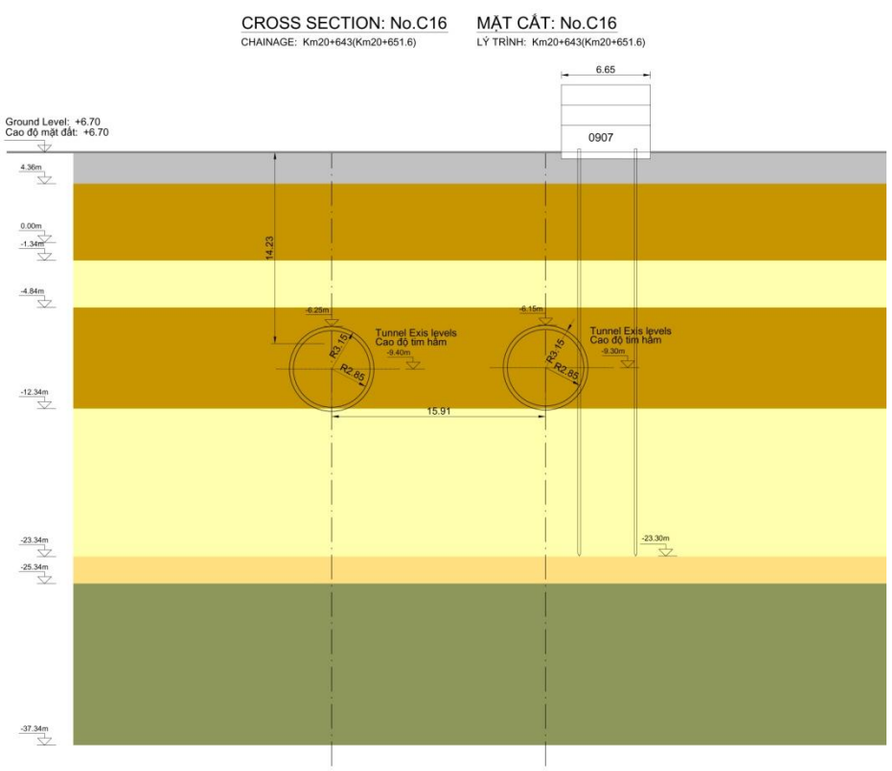
# Underground Section – TBM

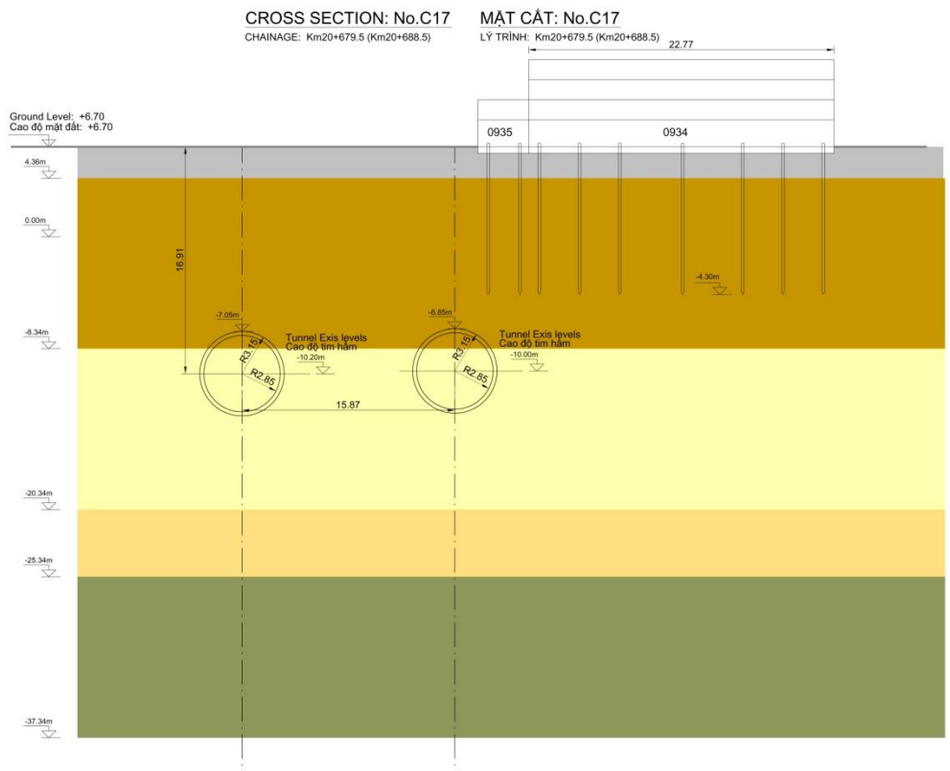


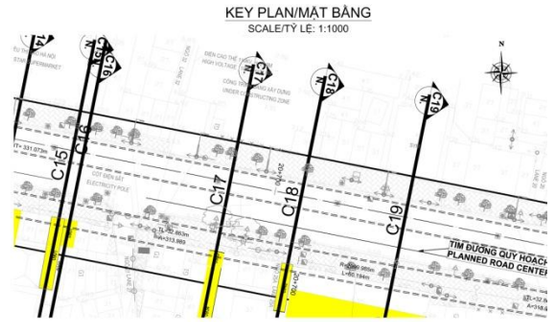



# Cross Section of tunnel under Cat Linh Street

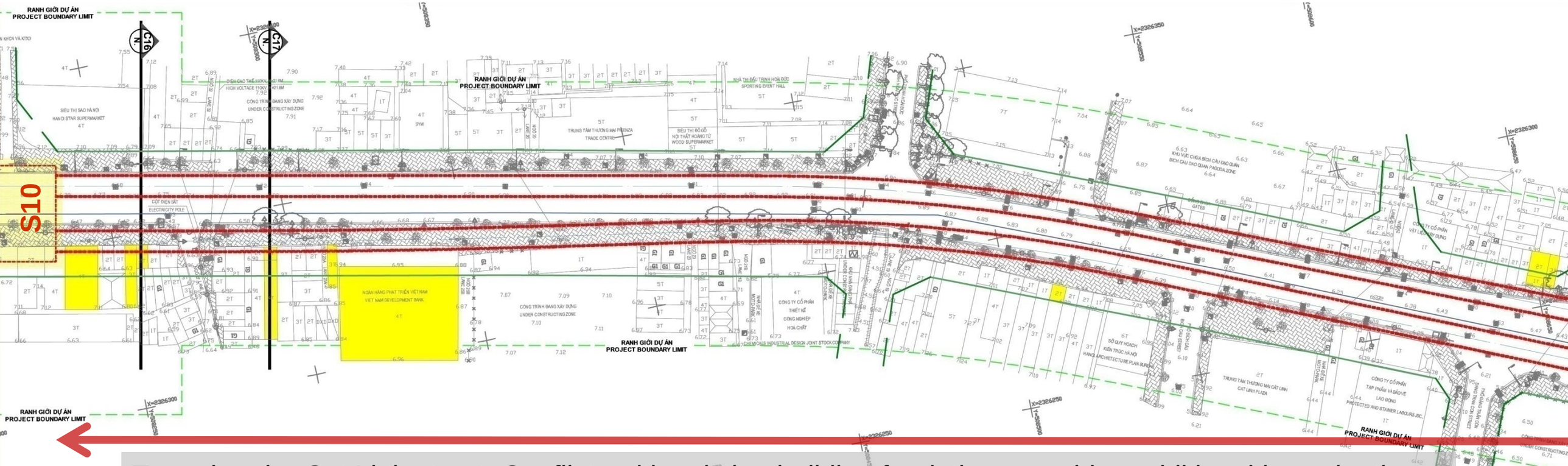


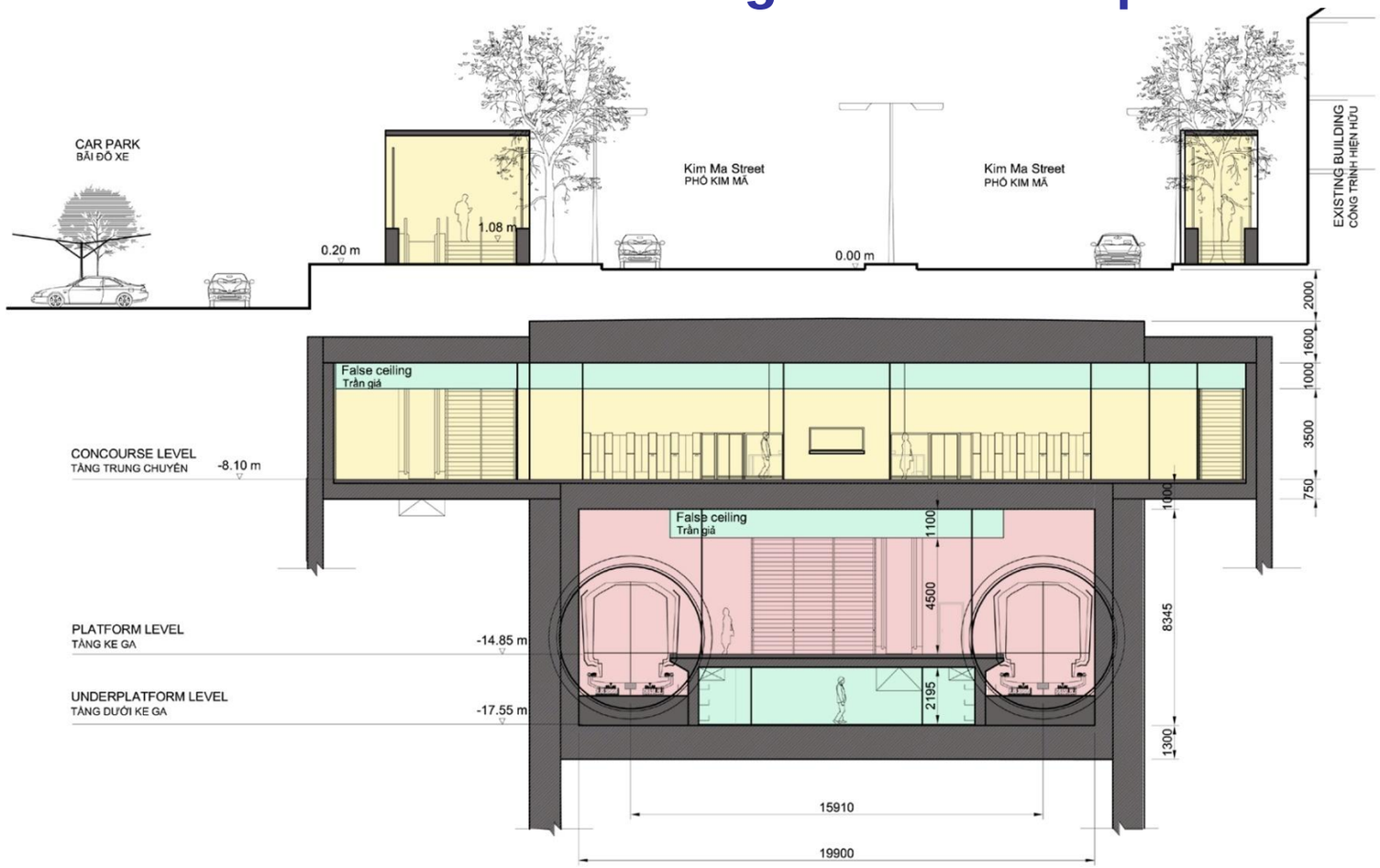

GEOTECHNICAL LEGEND
CHÚ THÍCH VỀ ĐỊA CHẤT

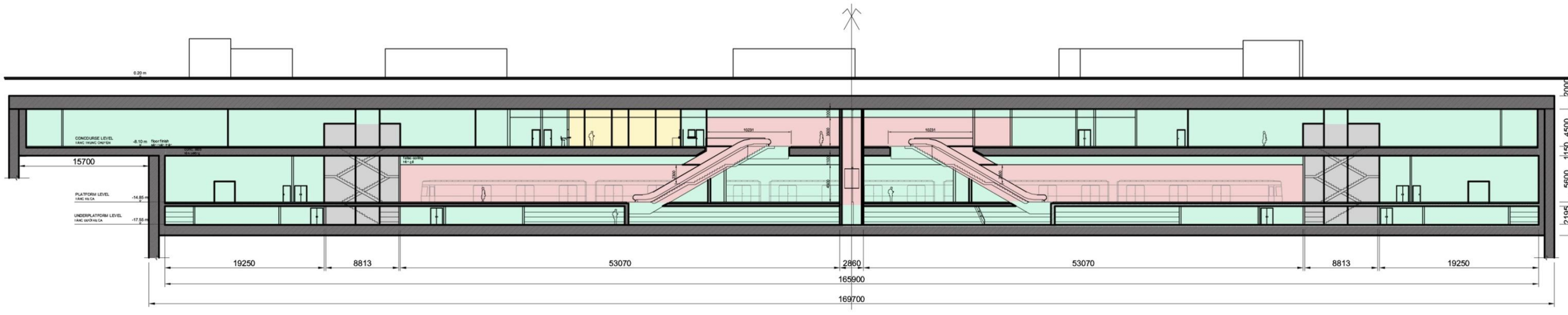
- Backfill - Anthropic soil
  ĐẮP ĐẤT - đất nhân tạo
- GU1_s : Firm to stiff Lean clay (CL)
  GU1_s : Sét nghèo chặt đến cứng (CL)
- GU2 : Silt (ML)
  GU2 : Bùn (ML)
- GU3 & 4 : Fat and Elastic clay (CH-MH) + Organic matter
  GU3 & 4 : Sét béo và đàn hồi (CH-MH) + Thành phần hữu cơ
- GU5_a : Silty and clayey sand (SC-SM-SP) Medium dense to dense; Nspt < 30
  GU5_a : Cát bột và cát sét (SC-SM-SP) Chặt vừa đến chặt; Nspt < 30
- GU5_b : Silty and clayey sand (SC-SM-SW) Dense to very dense; Nspt > 30
  GU5_b : Cát bột và cát sét (SC-SM-SW) Chặt đến rất chặt; Nspt > 30
- GU1_d : Stiff to very stiff lean clay
  GU1_d: Sét nghèo cứng đến rất cứng
- GU7 & 8 : Gravel and Coarse sand with gravel (GM-GP-GM-GC) Very dense
  GU7 & 8: Sỏi và cát hạt to với cuội (GM-GP-GM-GC) Rất chặt
- Sandstone : Substratum
  Đá cát kết : tầng nền




Tunnel under Cat Linh street: Conflicts with existing building fondations requiring additional investigations

# Stations 9 to 11 – Functional Arrangement Principle



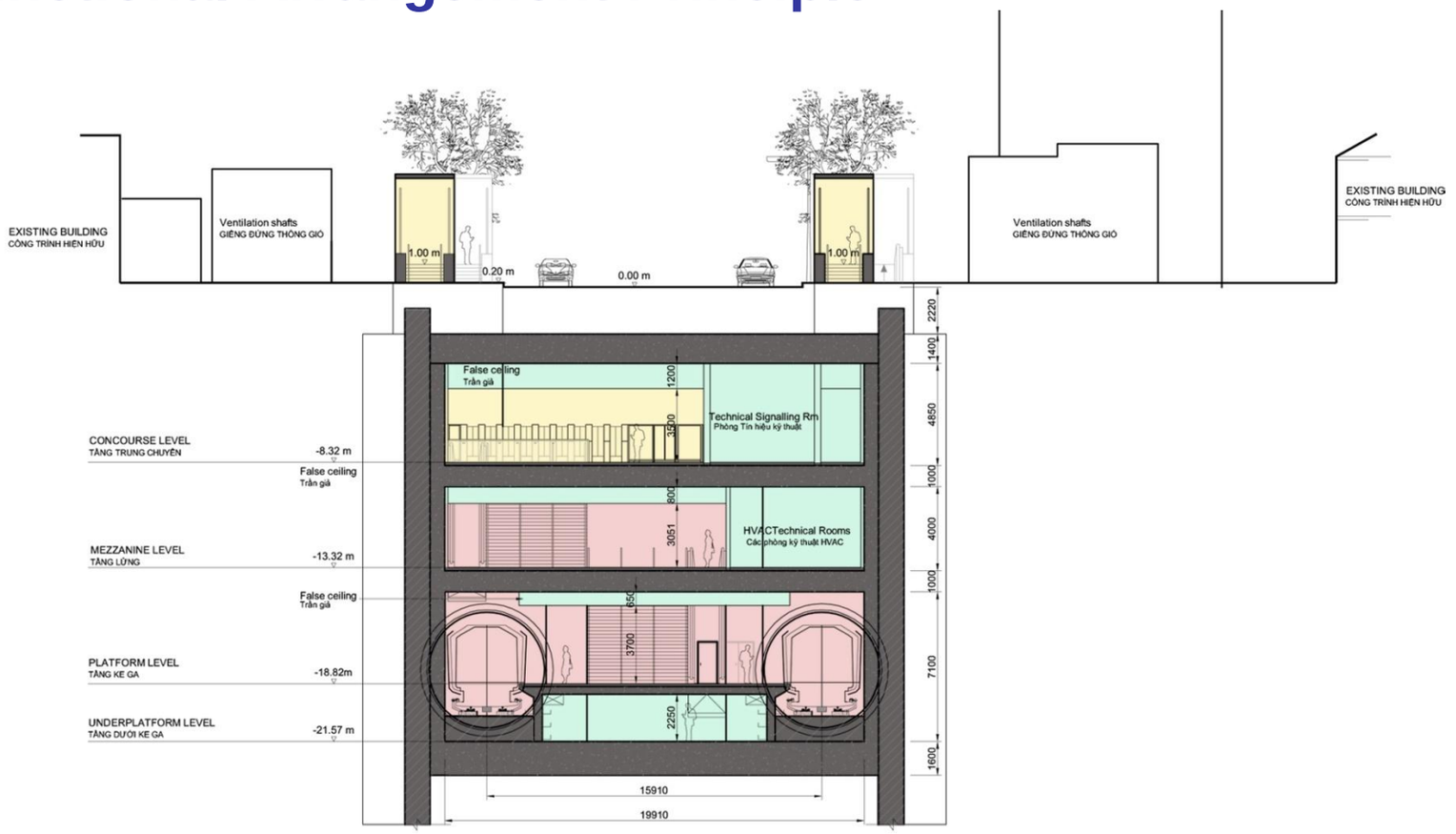



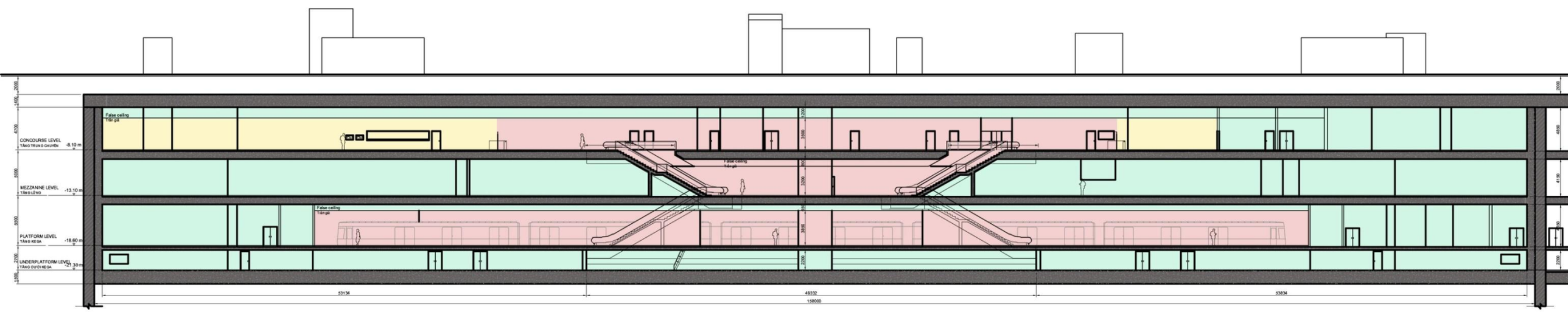

UNPAID AREA
KHU VỰC CHƯA TRẢ TIỀN

PAID AREA
KHU VỰC CHƯA ĐÃ TRẢ TIỀN

TECHNICAL AND OPERATIONAL AREAS
KHU VỰC KỸ THUẬT VÀ VẬN HÀNH

# Station 12 – Functional Arrangement Principle




UNPAID AREA
KHU VỰC CHƯA TRẢ TIỀN

PAID AREA
KHU VỰC CHƯA ĐÃ TRẢ TIỀN

TECHNICAL AND OPERATIONAL AREAS
KHU VỰC KỸ THUẬT VÀ VẬN HÀNH

# Underground Stations – 3D Views


Large entrance of station

Ventilation shafts

# Underground Stations – 3D Views

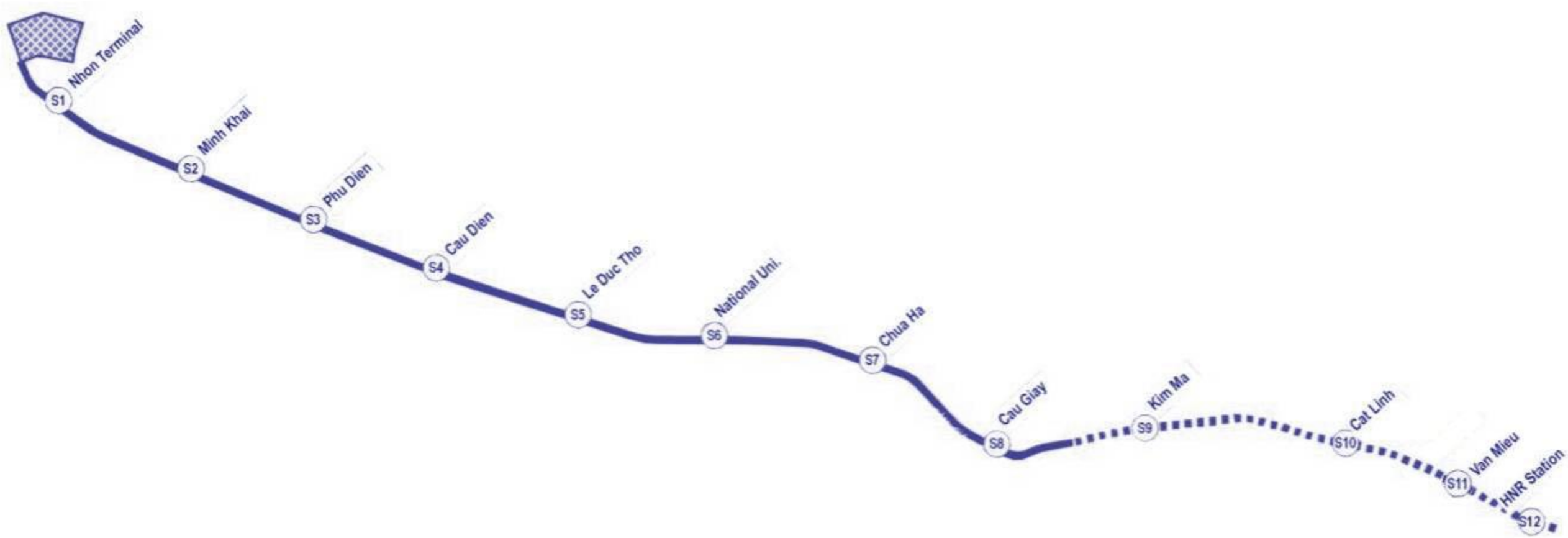

Typical Station entrance

# Underground Stations – 3D View

Concourse Level


Platform Level

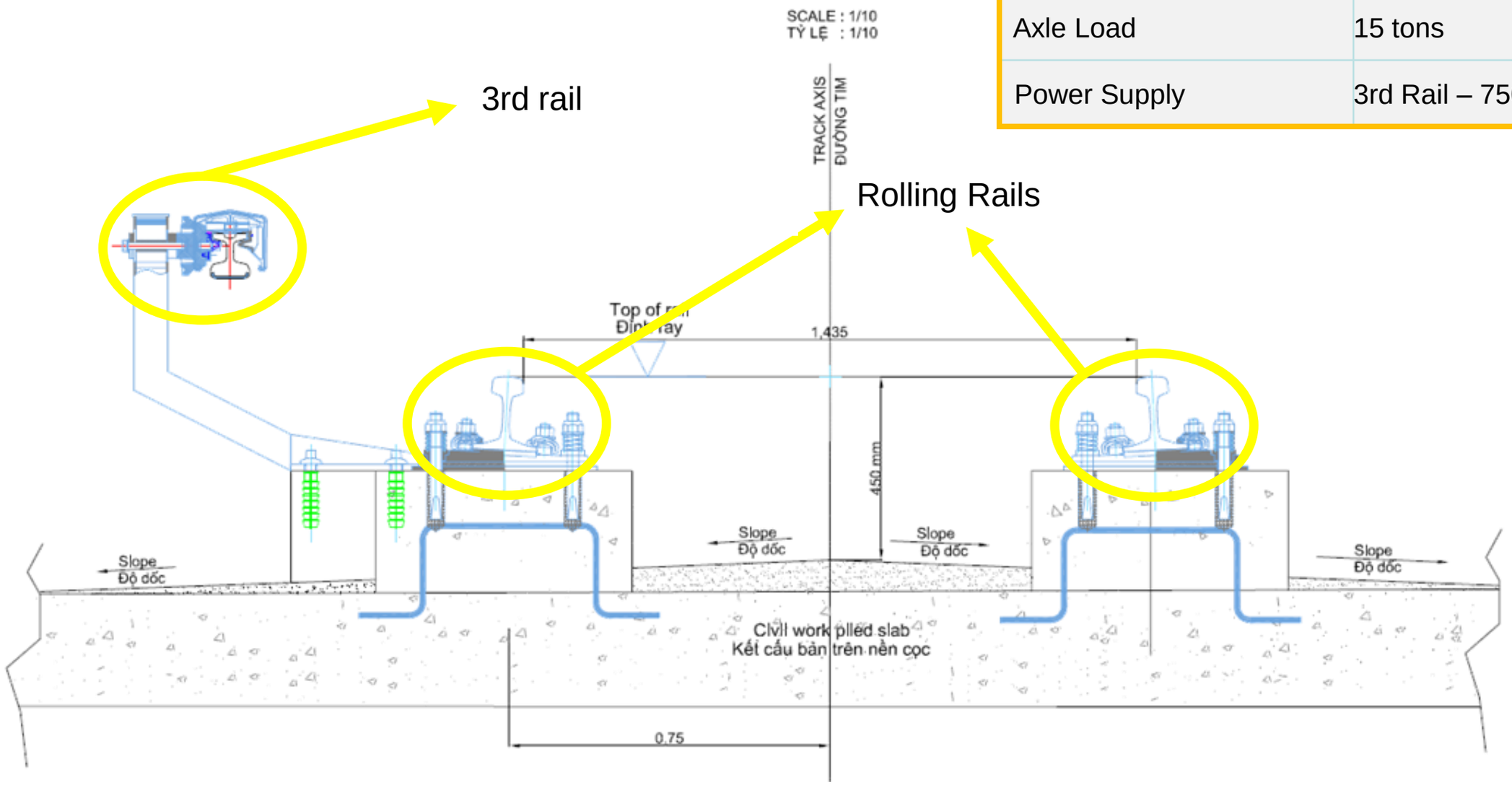
# 8. Railway Systems for Metro



# Track

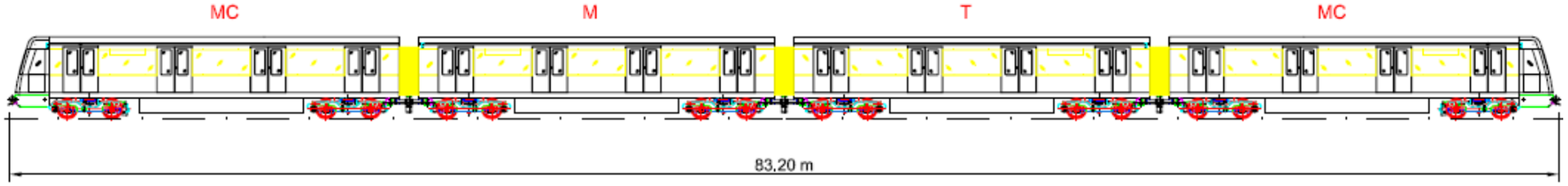
**Track Characteristics**

| Slab Track (Depot and Main Line) | |
|---|---|
| Gauge | 1435mm (standard gauge) |
| Design Speed | 90 km/h |
| Maximum Train Speed | 80 km/h |
| Axle Load | 15 tons |
| Power Supply | 3rd Rail – 750Vdc |



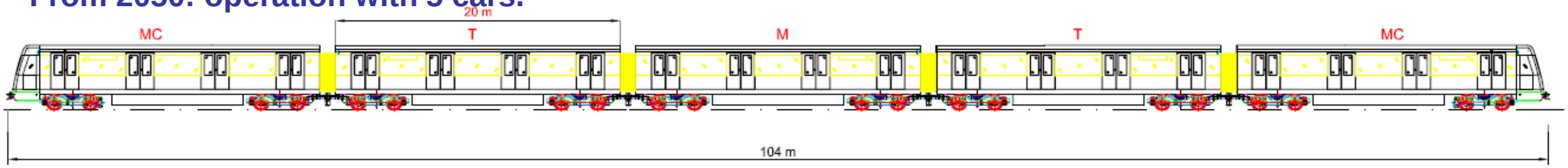
# Train Consist

## From 2015 to about 2050: operation with 4 cars.

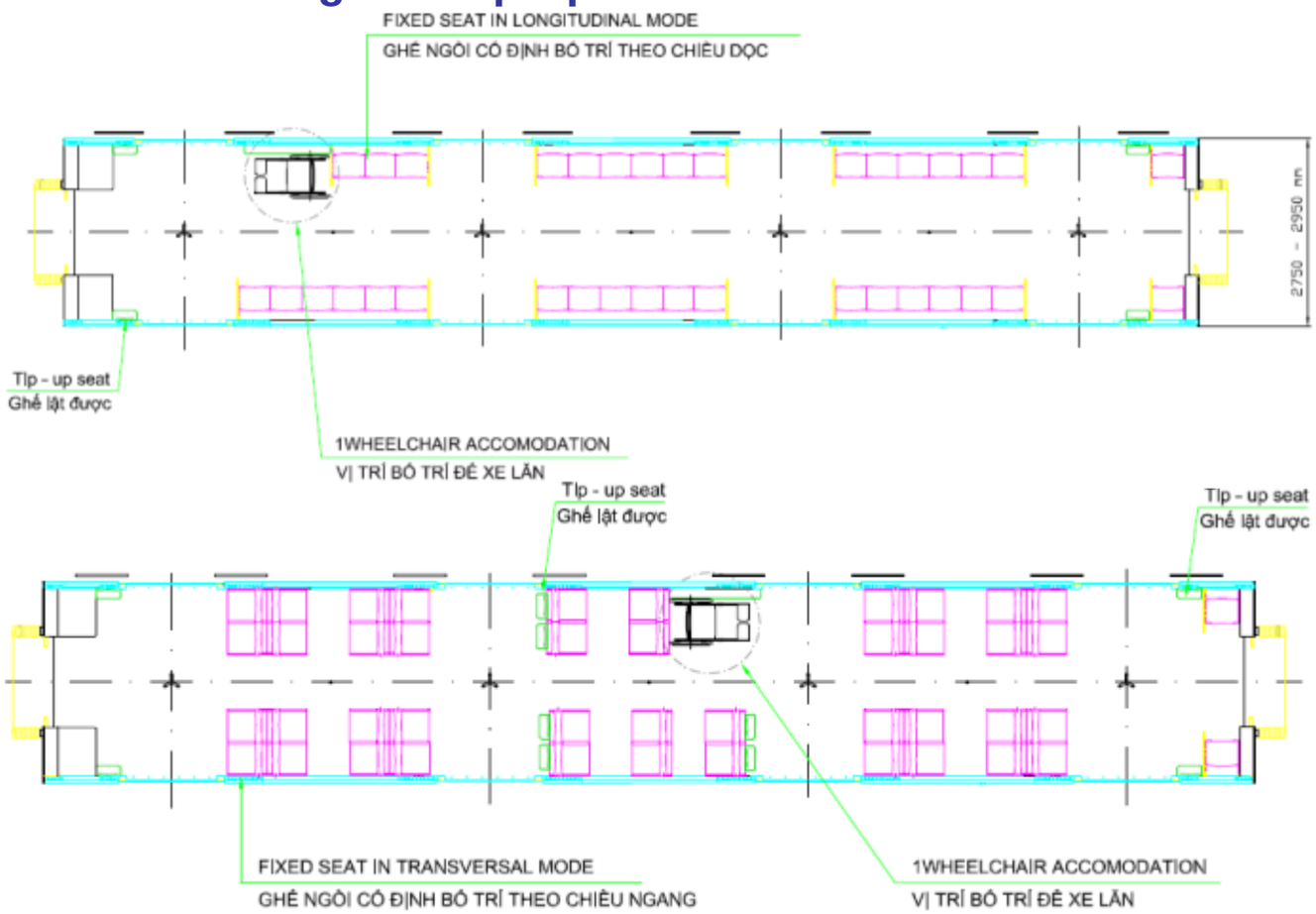



M: MOTOR CAR \ TOA ĐỘNG LỰC
T: TRAILER CAR \ TOA KÉO THEO
MC: MOTOR CAR WITH CAB \ TOA ĐỘNG LỰC CÓ CABIN LÁI

## From 2050: operation with 5 cars.




## Interior arrangement proposal





4- car train illustration

### Rolling Stock Characteristics

| | 4-cars | 5-cars |
|---|---|---|
| **Length** | < 83.20 m | < 104 m |
| **Width** | 2.75 m < train width < 2.95 m | |
| **Passenger Capacity** | 916 (6p/m$^2$) | 1155 (6p/m$^2$) |
| **Maximum operation speed** | 80 km/h | 80 km/h |

# THANK YOU FOR YOUR ATTENTION