

Riyadh Metro Project

Tunnel Boring Machine (TBM)

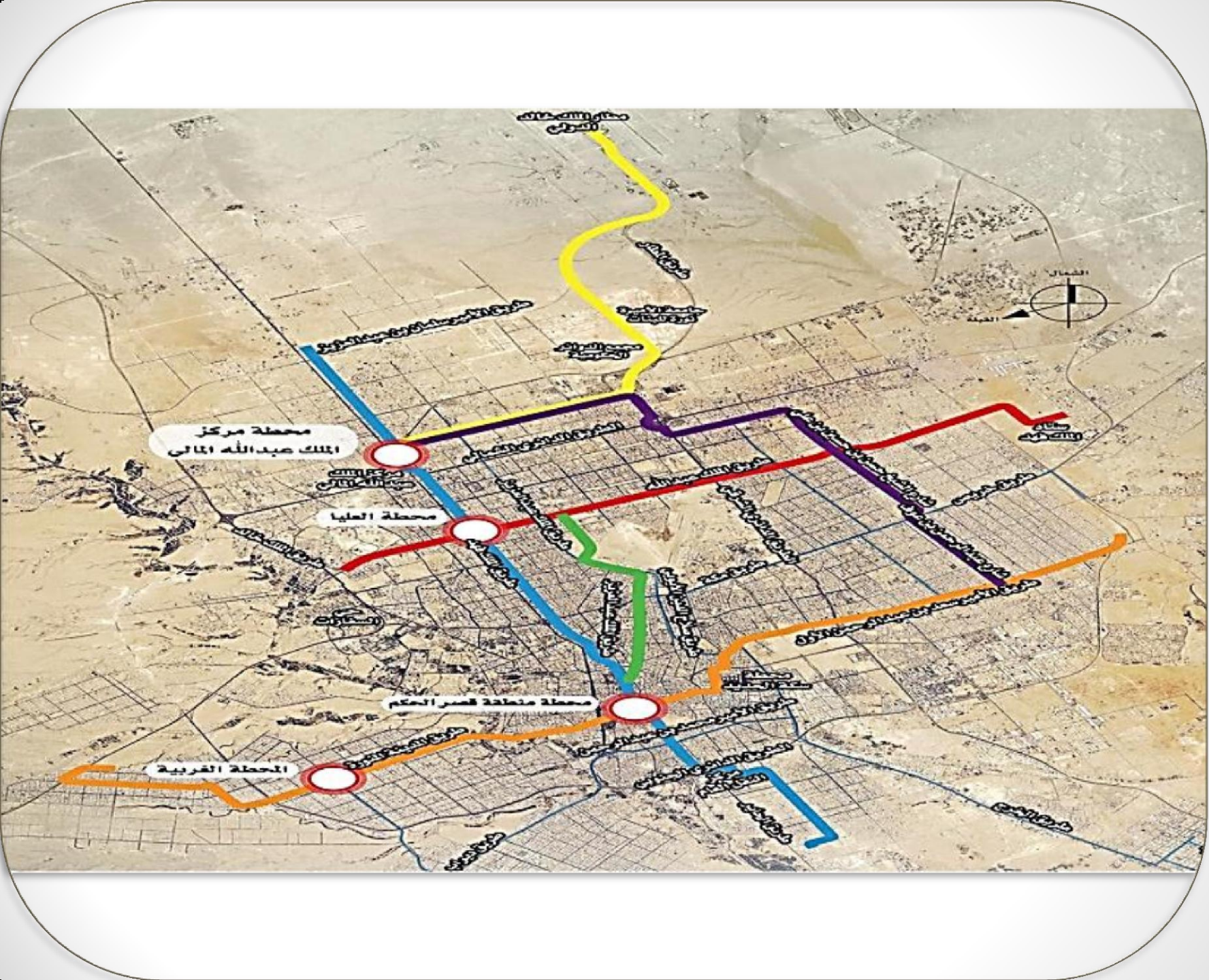
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Introduction

- Riyadh Metro Project is the present and future work experience as a new megaproject in Saudi Arabia.
- It consists of 6 lines integrated to each other by 4 Main Stations.
- A total length of 176 km linked with 85 stations



محطة مركز الملك عبد الله الثاني

محطة العليا

محطة منطقة قصر الحكم

محطة القرية



Metro Lines

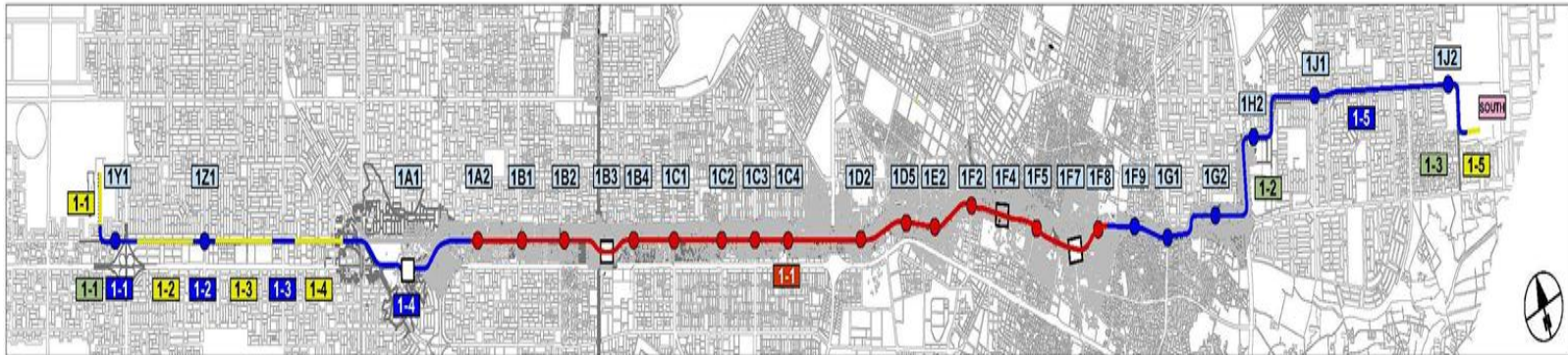
- Line 1: “Olaya Street” 38 km
- Line 2: “King Abdullah Road” 25.3 km
- Line 3: “Almadinah Road” 40.7 km
- **Line 4: “King Khalid Airport” 29.6 km**
- Line 5: “King Abdulaziz Road” 12.9 km
- Line 6: “Abdulrahman bin Awf” 30 km

Underground Trains

Length (km)	Total Length	Tunnel	At Grade	Elevated
Line 1	38	17.3	4.8	15.9
Line 2	25.3	3.3	16.6	5.4
Line 3	40.7	9.4	5.2	26.1
Line 4	29.6	5.9	6.9	16.7
Line 5	12.9	12.9	0	0
Line 6	30	8	2	19.7

Line 1 has the tallest tunneling path

Line 1



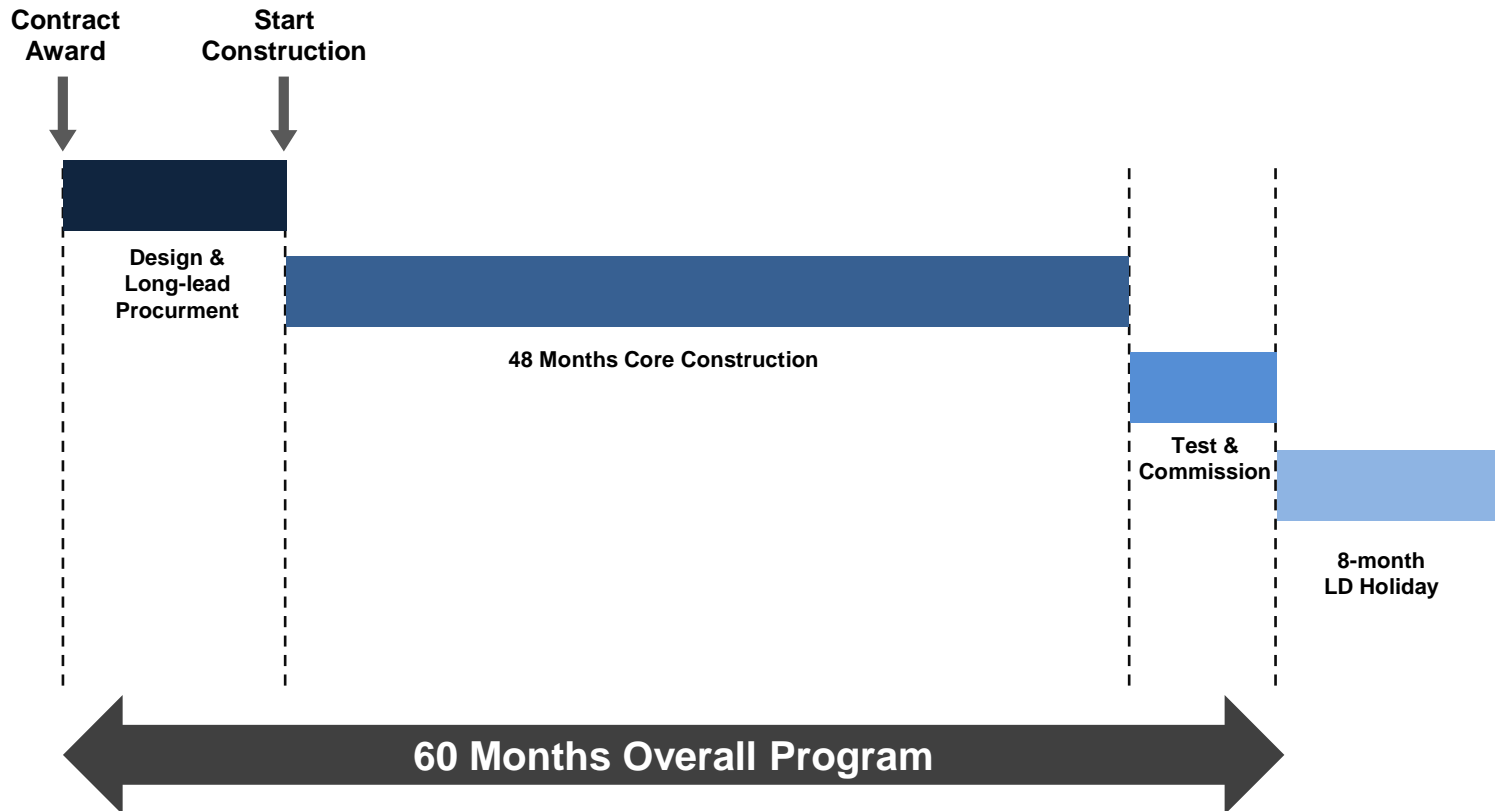
- At Grade
- Elevated
- Underground

Line 1 Contractors

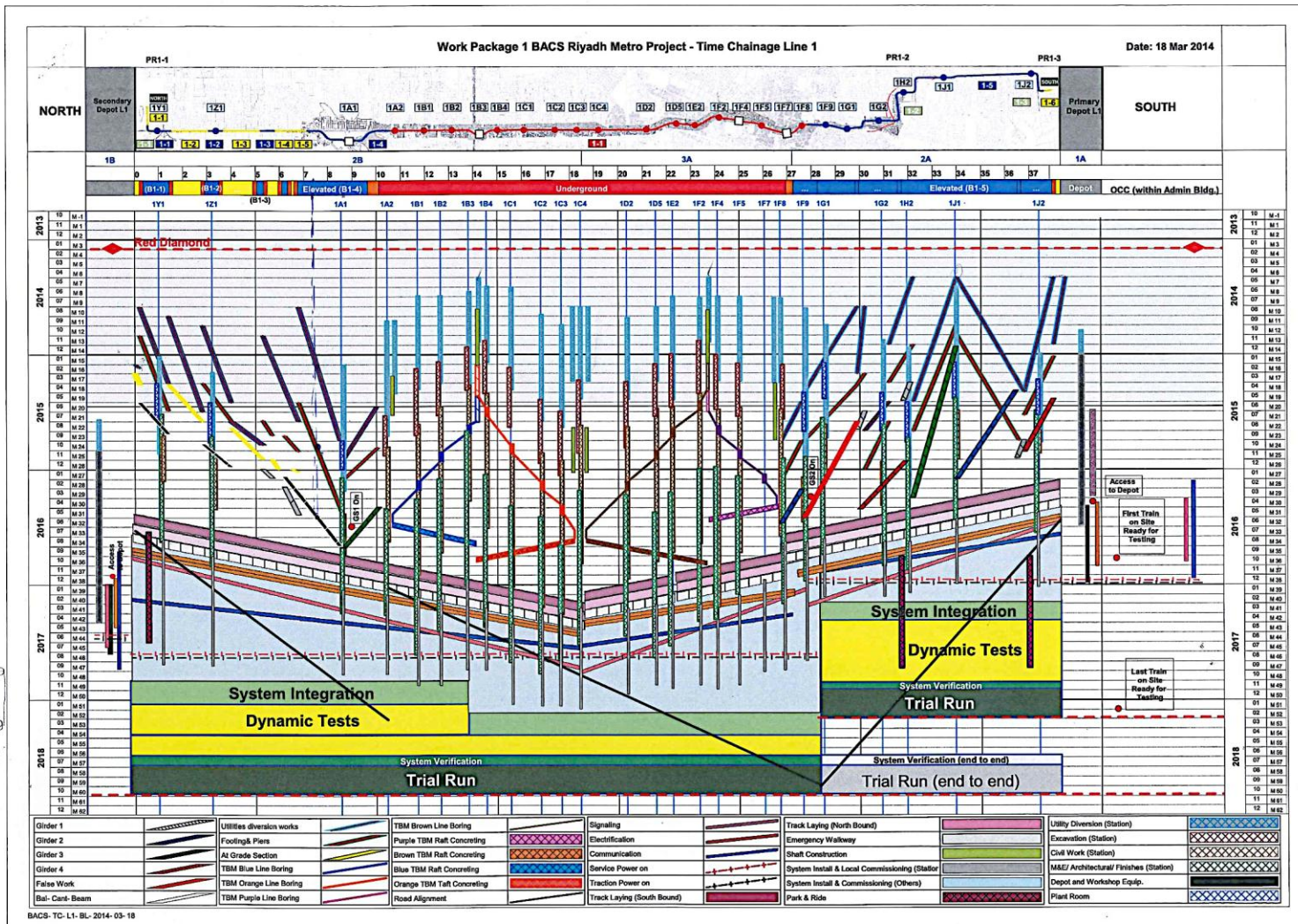
- “BACS” CONSORTIUM
 - Bechtel
 - Almabani
 - CCC
 - Siemens
- The contract is “Design and Build” contract

Project Time Schedule

OVERALL SCHEDULE



Time Chainage Diagram



Stations

- Line 1 is connecting 3 Main stations and has 22 Pick-Up stations.
- The main stations are:
 - 1- King Abdullah Financial District Station
 - 2- Olaya Station
 - 3- Qaser Al Hokm Station
- One Example of the Pick-Up stations is 1A2 “shown in figure”

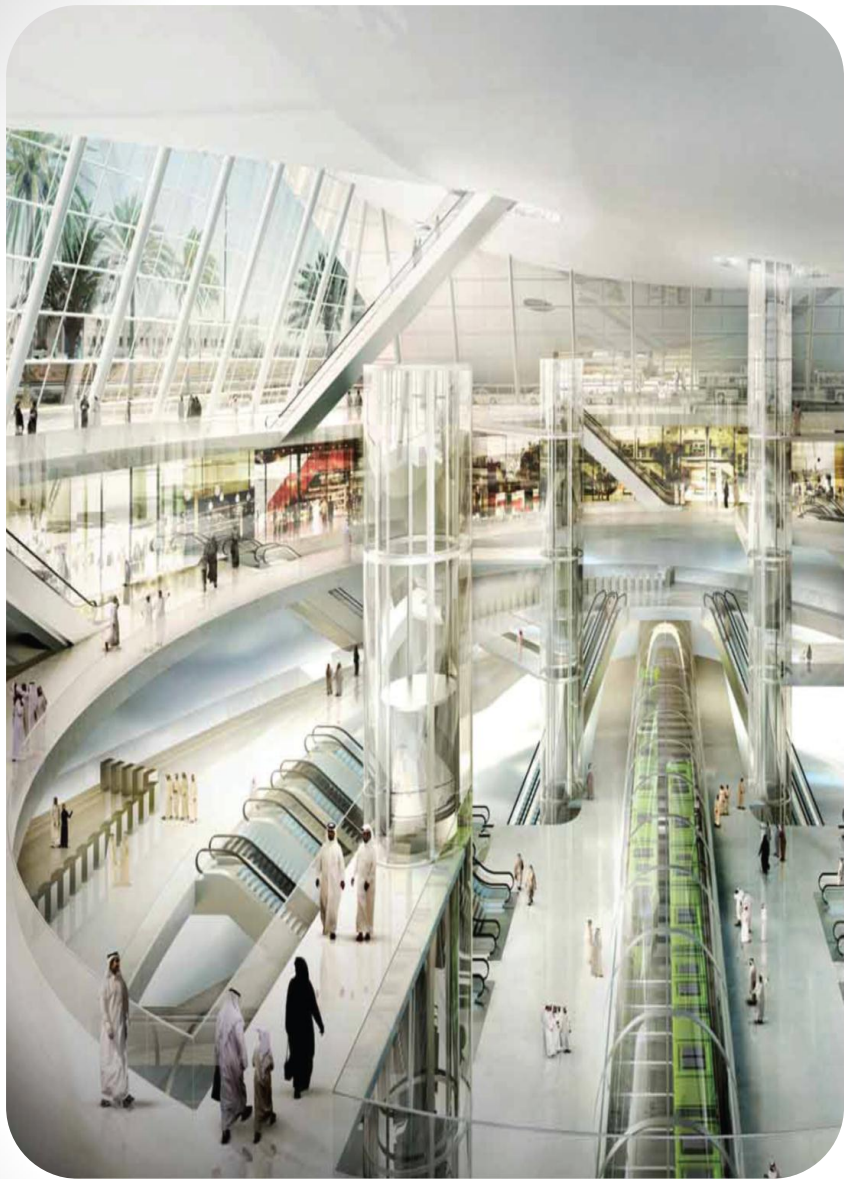
Olaya Station

○ **Location:** South of King Abdullah road at the intersection of Line 1 Olaya-Batha with Line 2 King Abdullah road.

○ **Area:** 11,000 m².

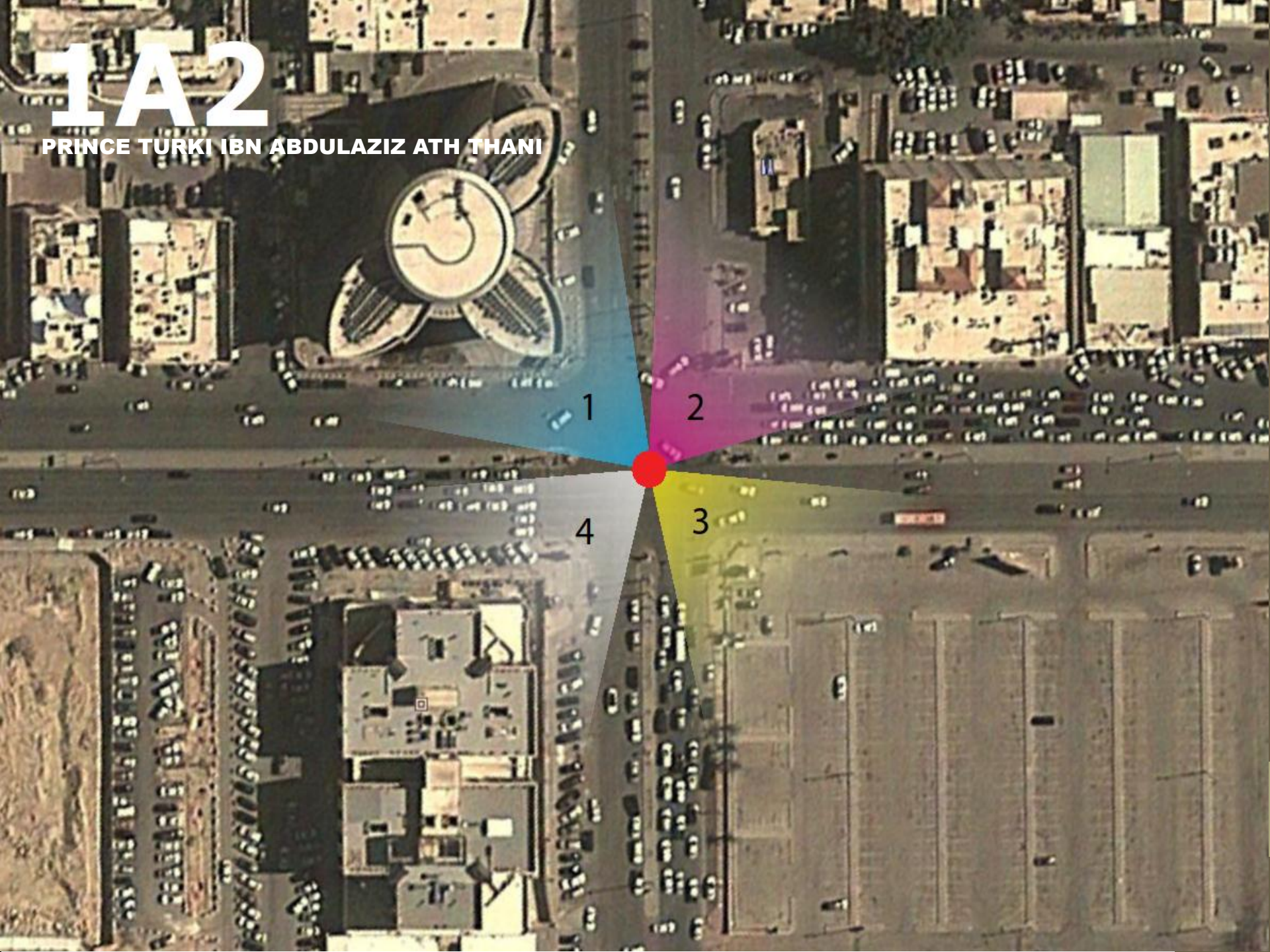
○ **Designer:** Gerber Architekten (Germany).



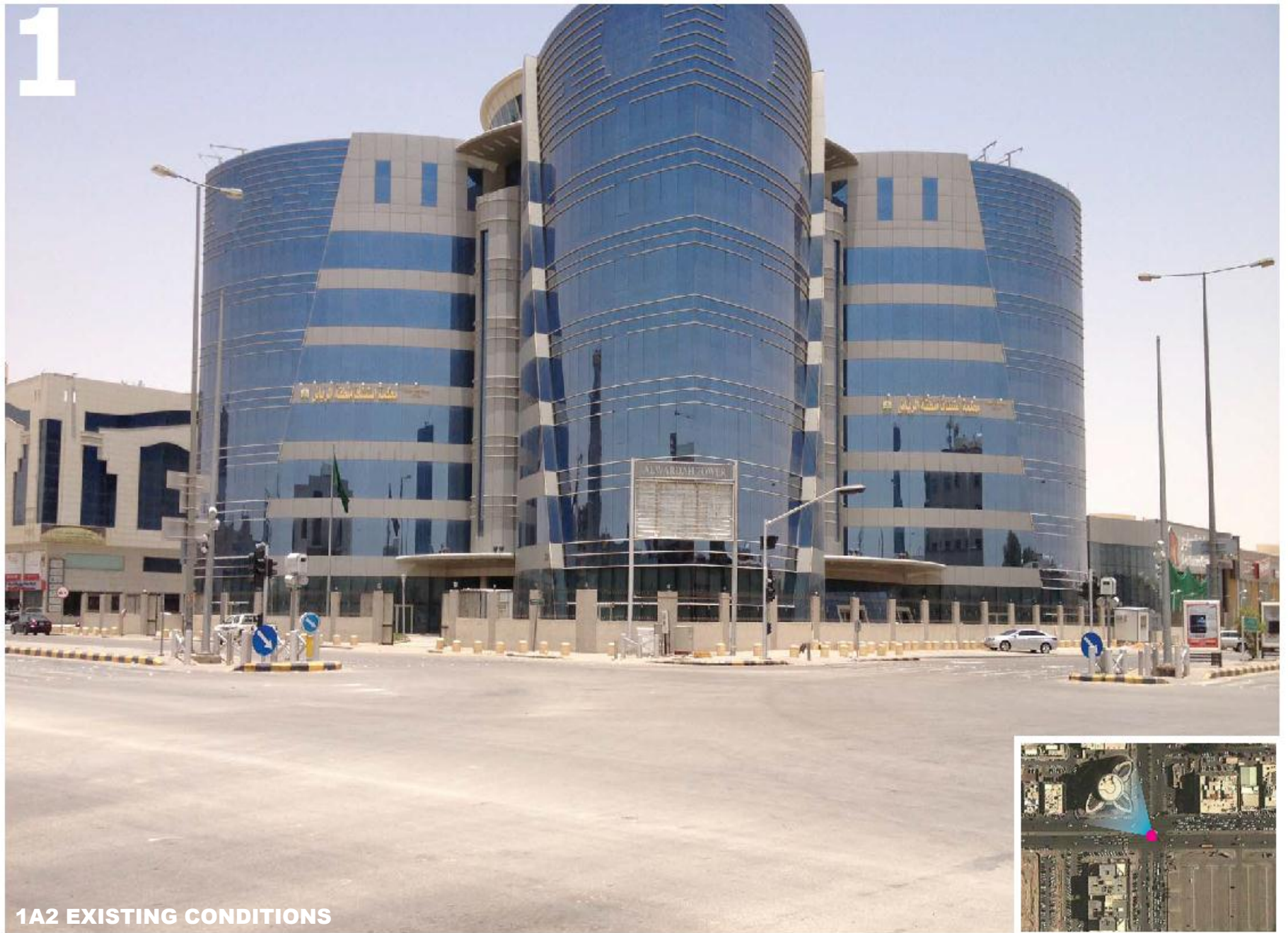


1A2

PRINCE TURKI IBN ABDULAZIZ ATH THANI



1



1A2 EXISTING CONDITIONS

2



1A2 EXISTING CONDITIONS

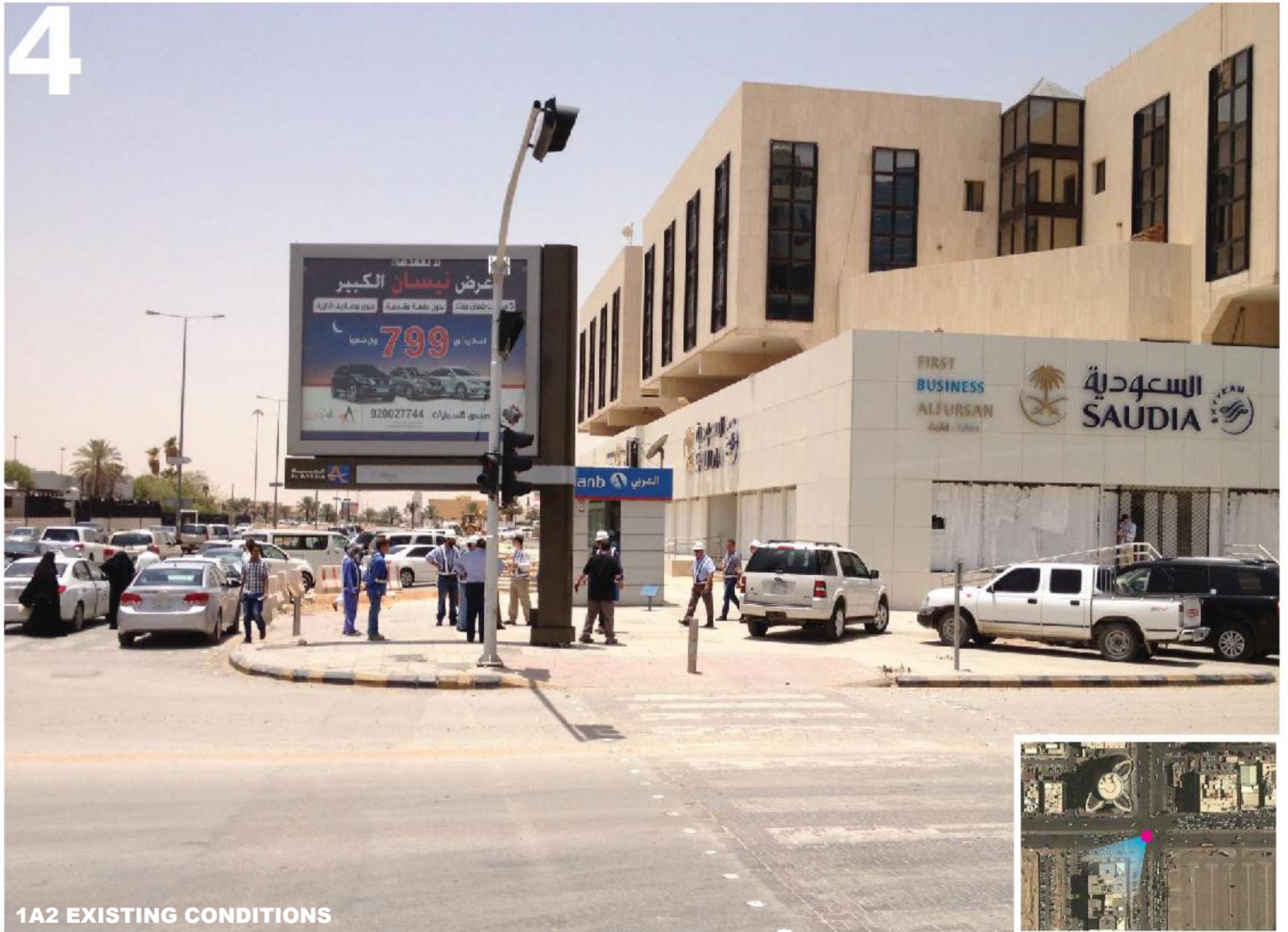
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1A2 EXISTING CONDITIONS

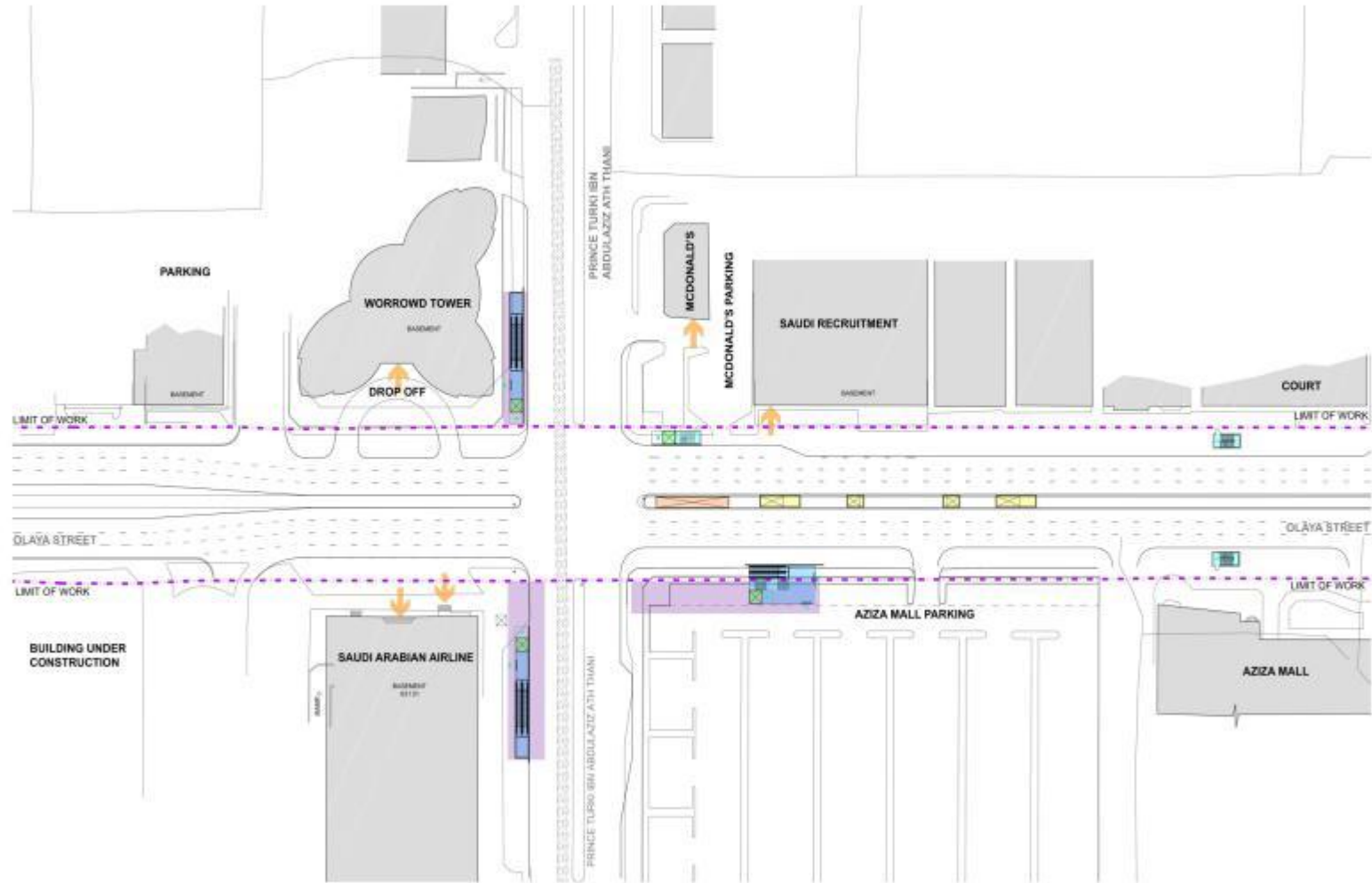


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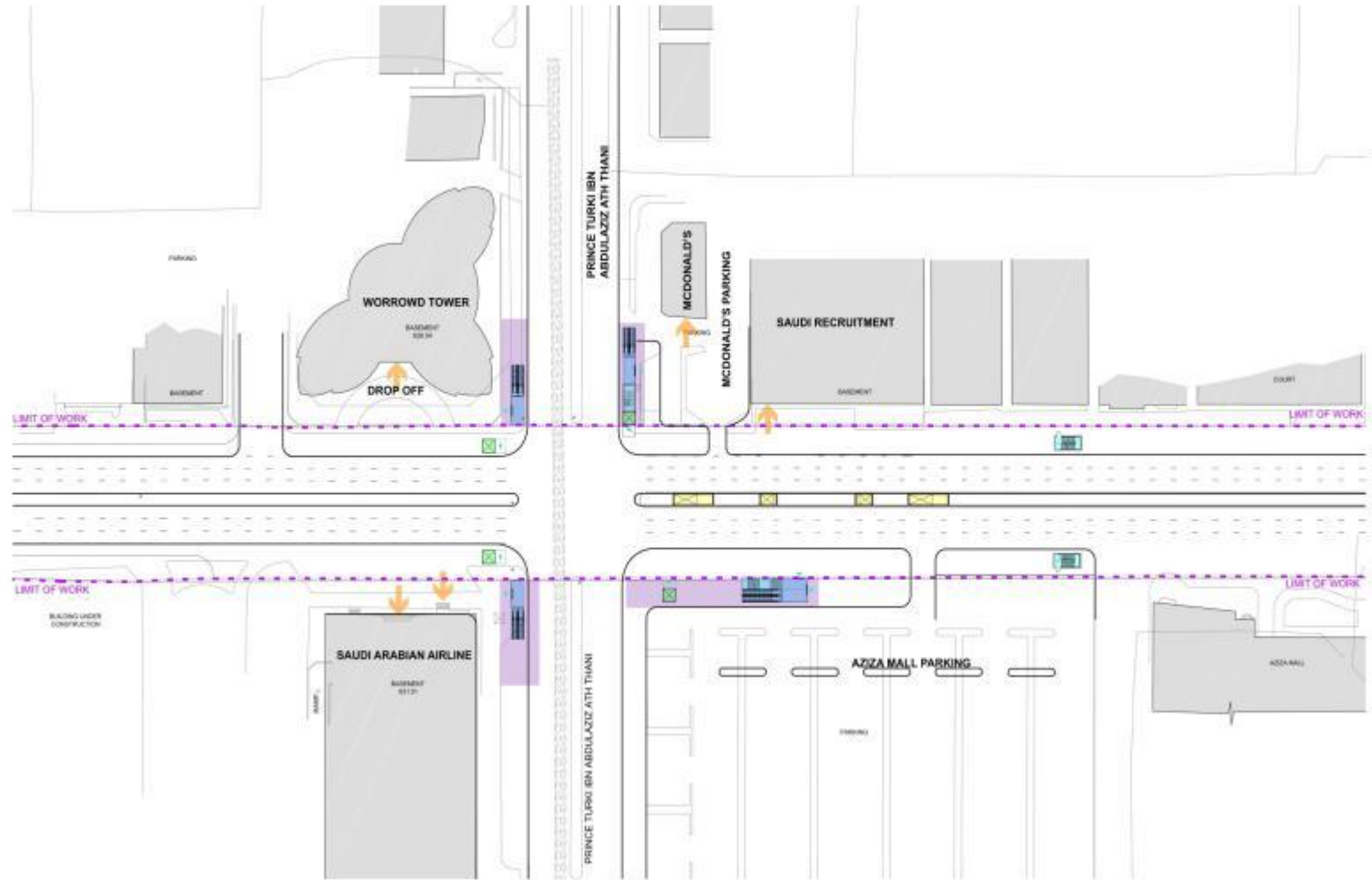


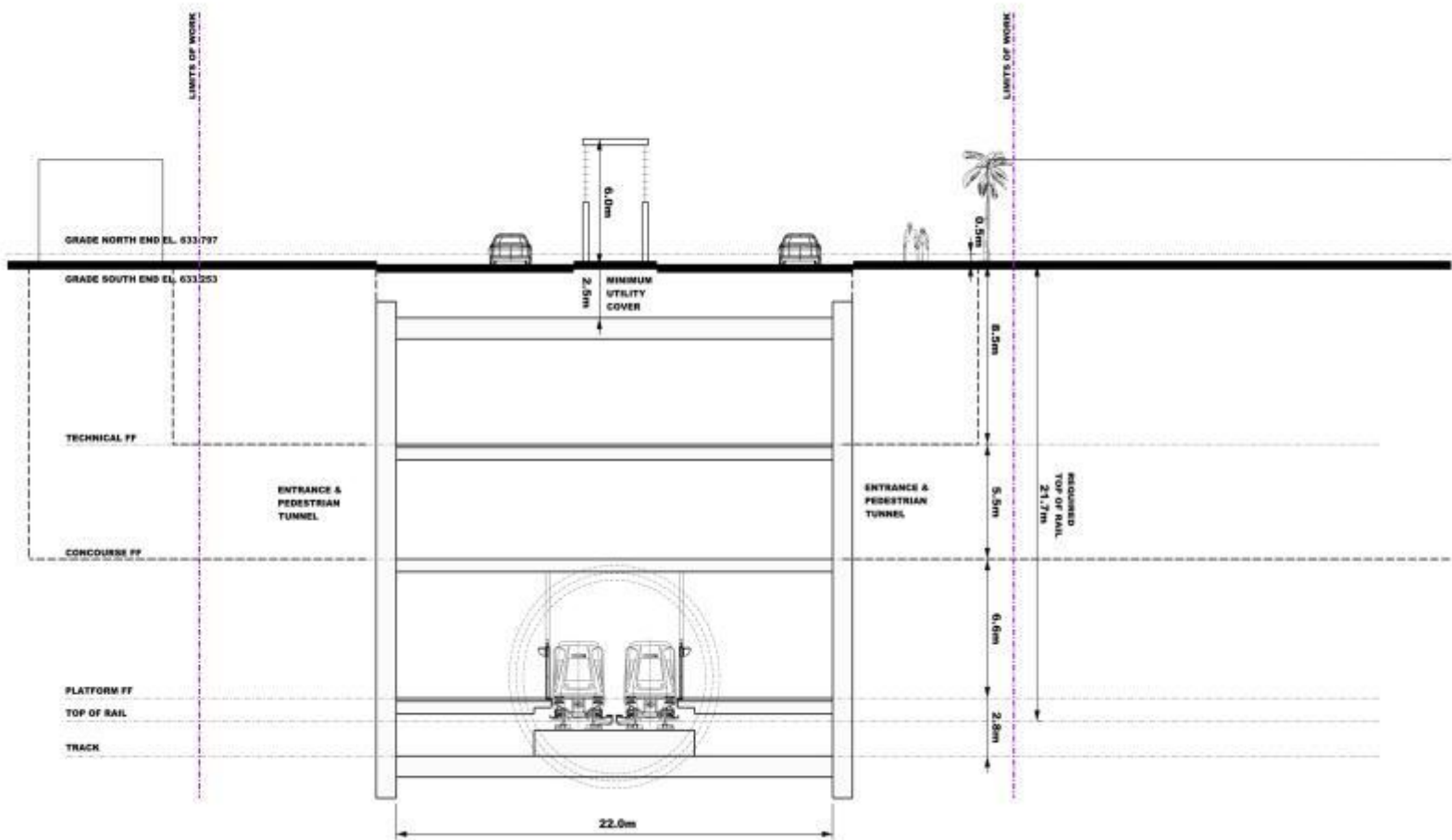
1A2 EXISTING CONDITIONS

1A2 DEEP UNDERGROUND STATION-OPTION 1



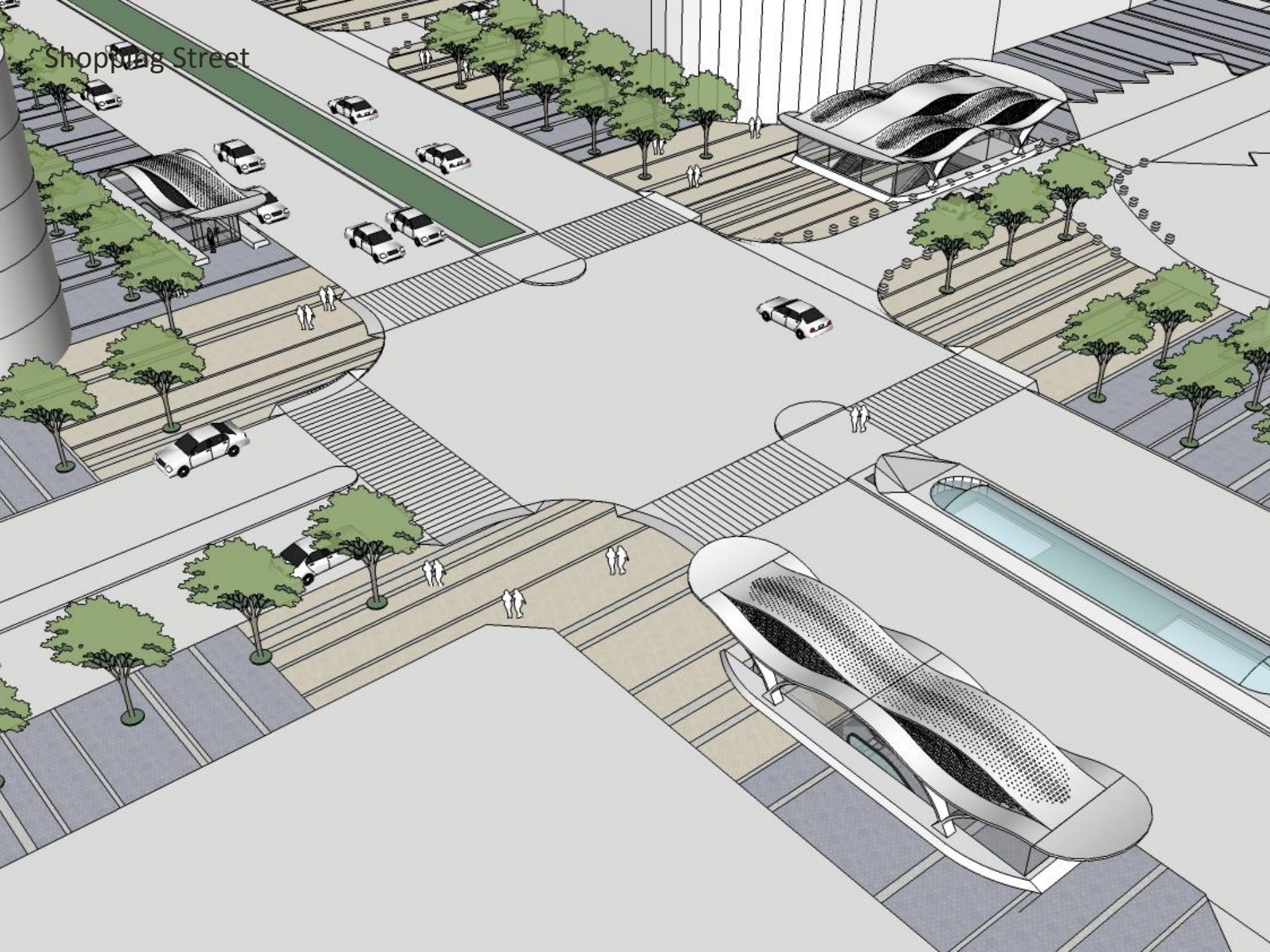
1A2 DEEP UNDERGROUND STATION OPTION 2



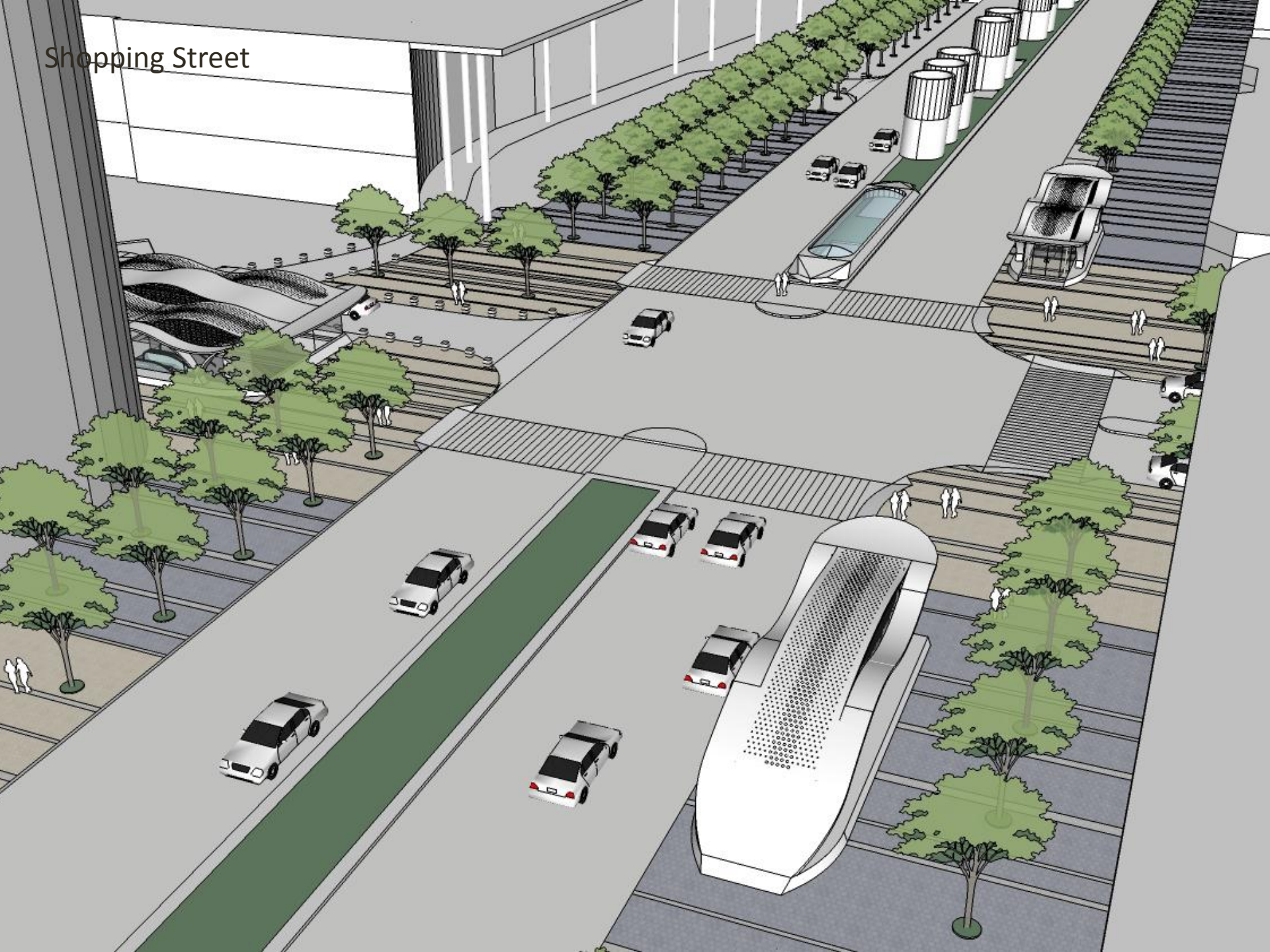


1 TRANSVERSE SECTION
 1:100

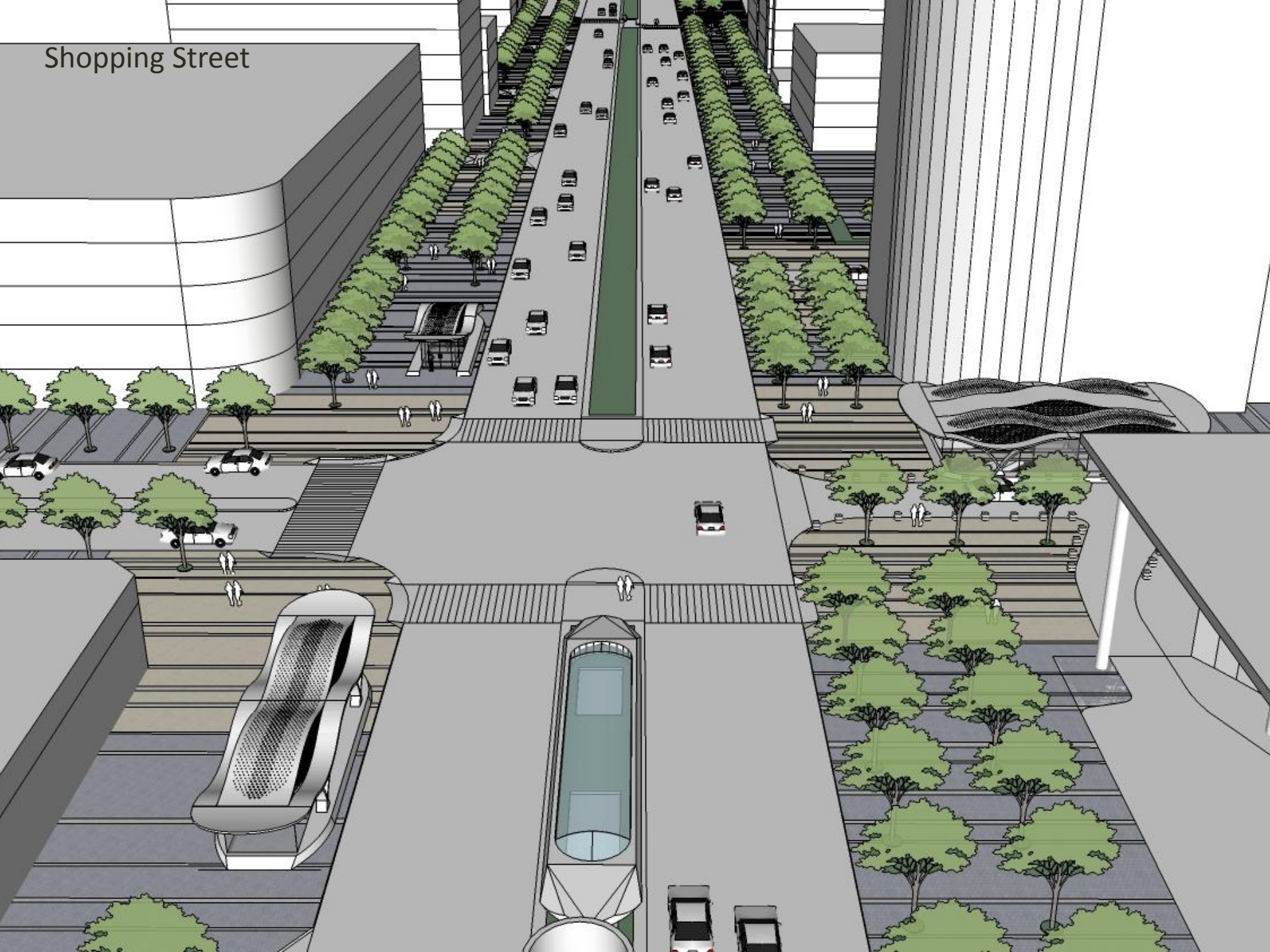
Shopping Street



Shopping Street



Shopping Street



Shopping Street



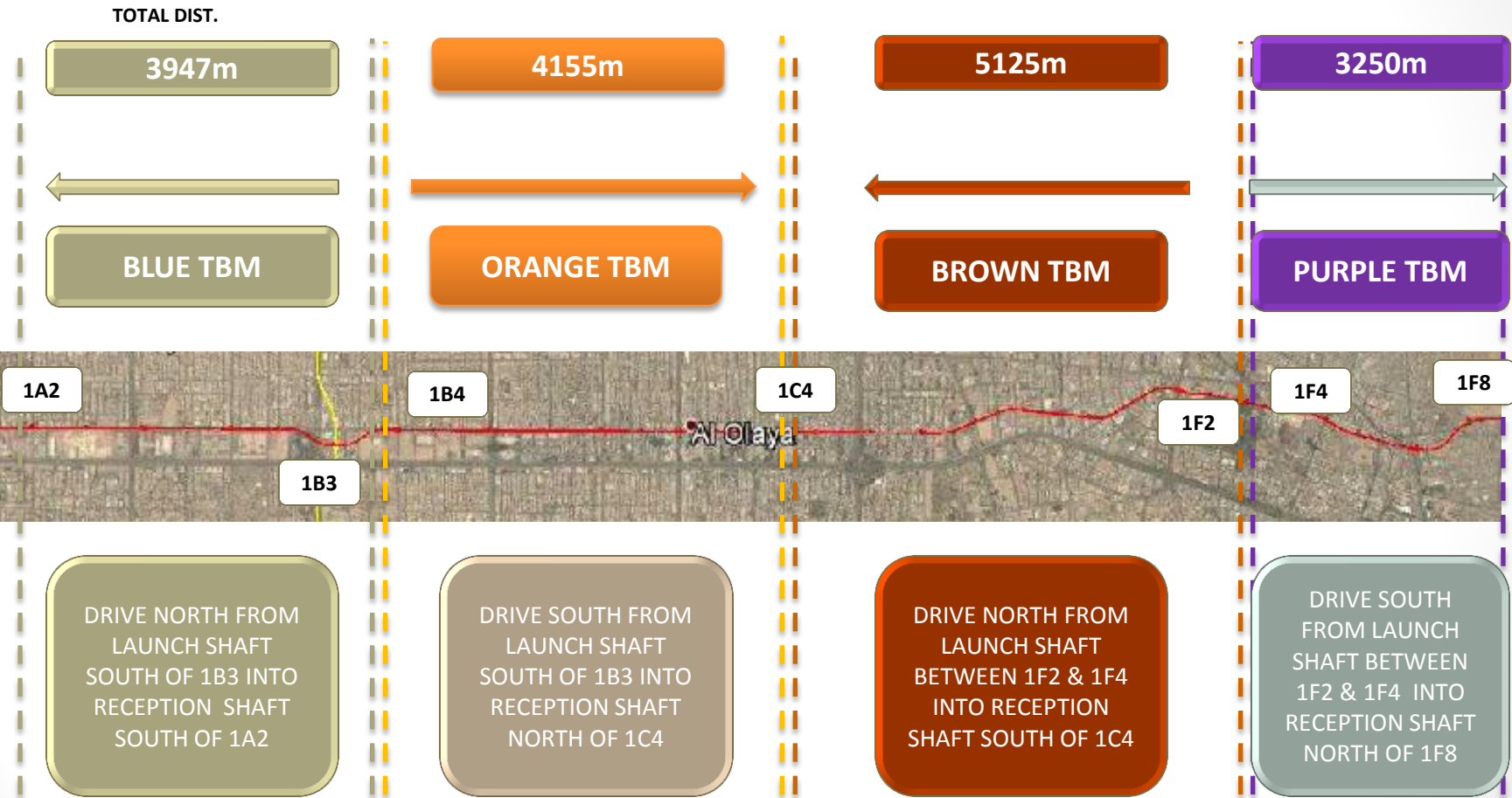
Shopping Street



Shopping Street

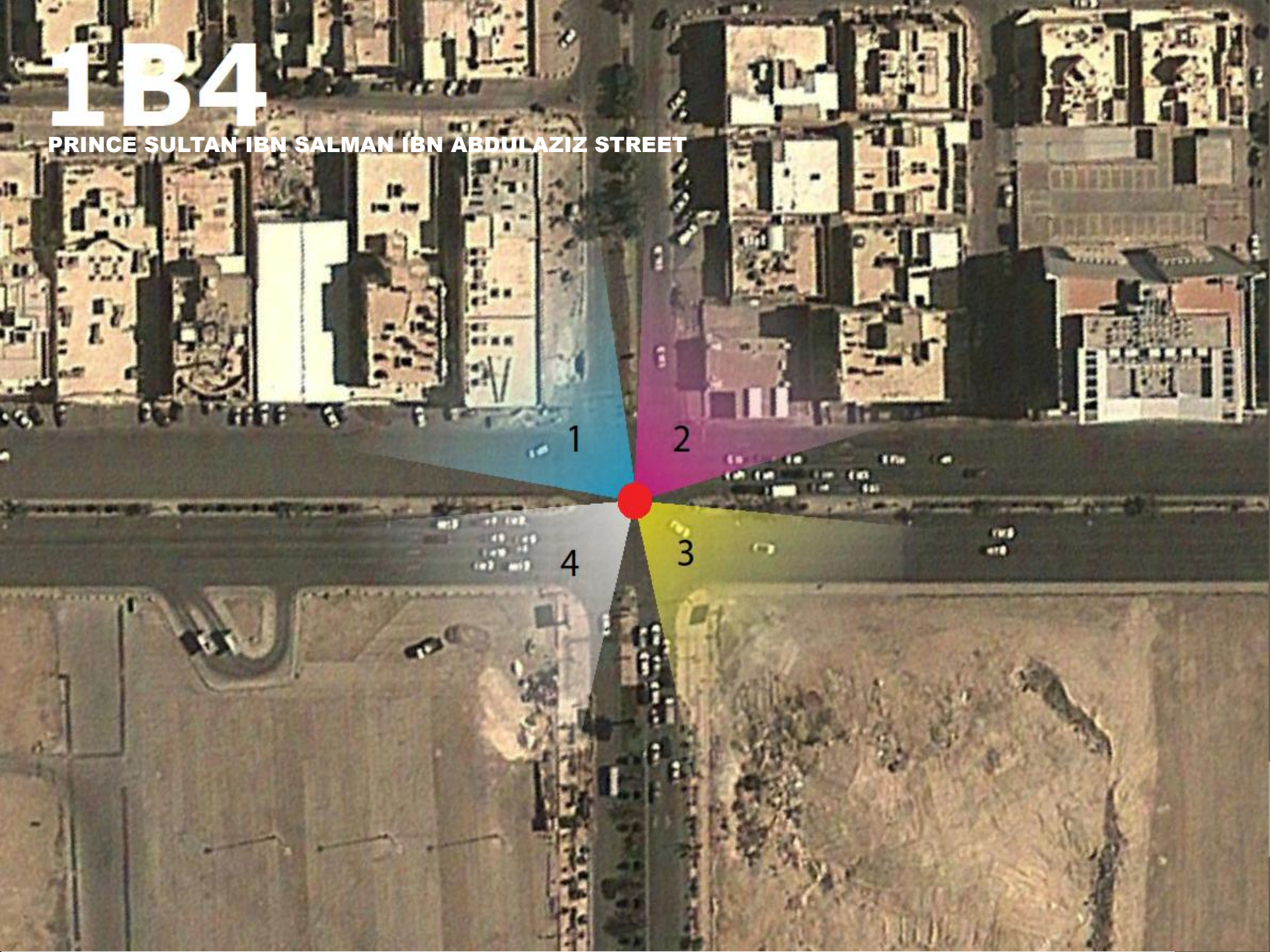


TBM Launching Shafts



1B4

PRINCE SULTAN IBN SALMAN IBN ABDULAZIZ STREET



1



1B4 EXISTING CONDITIONS

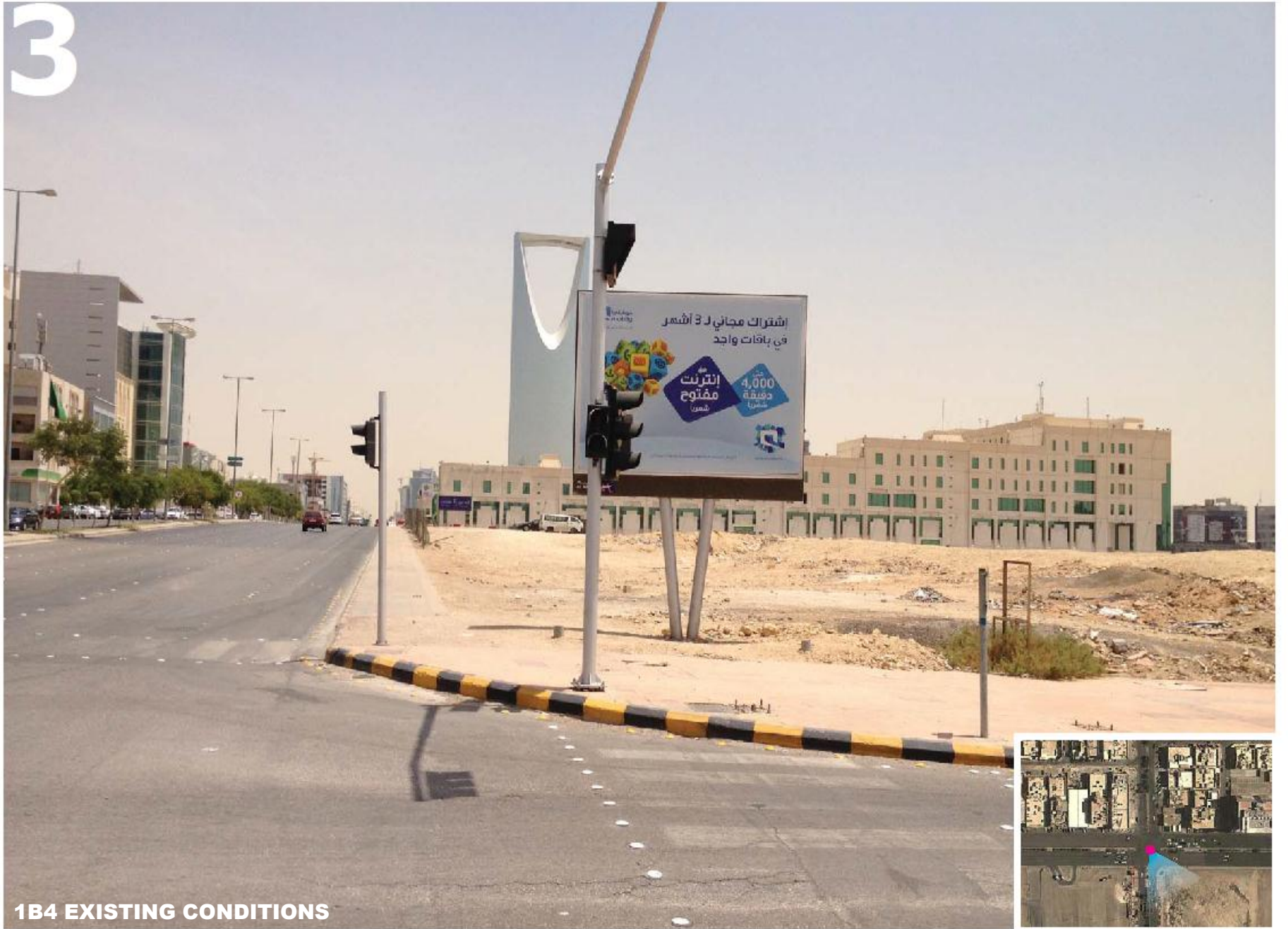
2



1B4 EXISTING CONDITIONS



3



1B4 EXISTING CONDITIONS

4



1B4 EXISTING CONDITIONS

TBM General Information

- The excavation depth in Line 1 starts from 11 m and reaches a maximum of 36 m depth at the segment between (1B1-1B2).
- Design life of TBM Bored tunnel is 100 years.
- Design fire resistance is 3 hours.

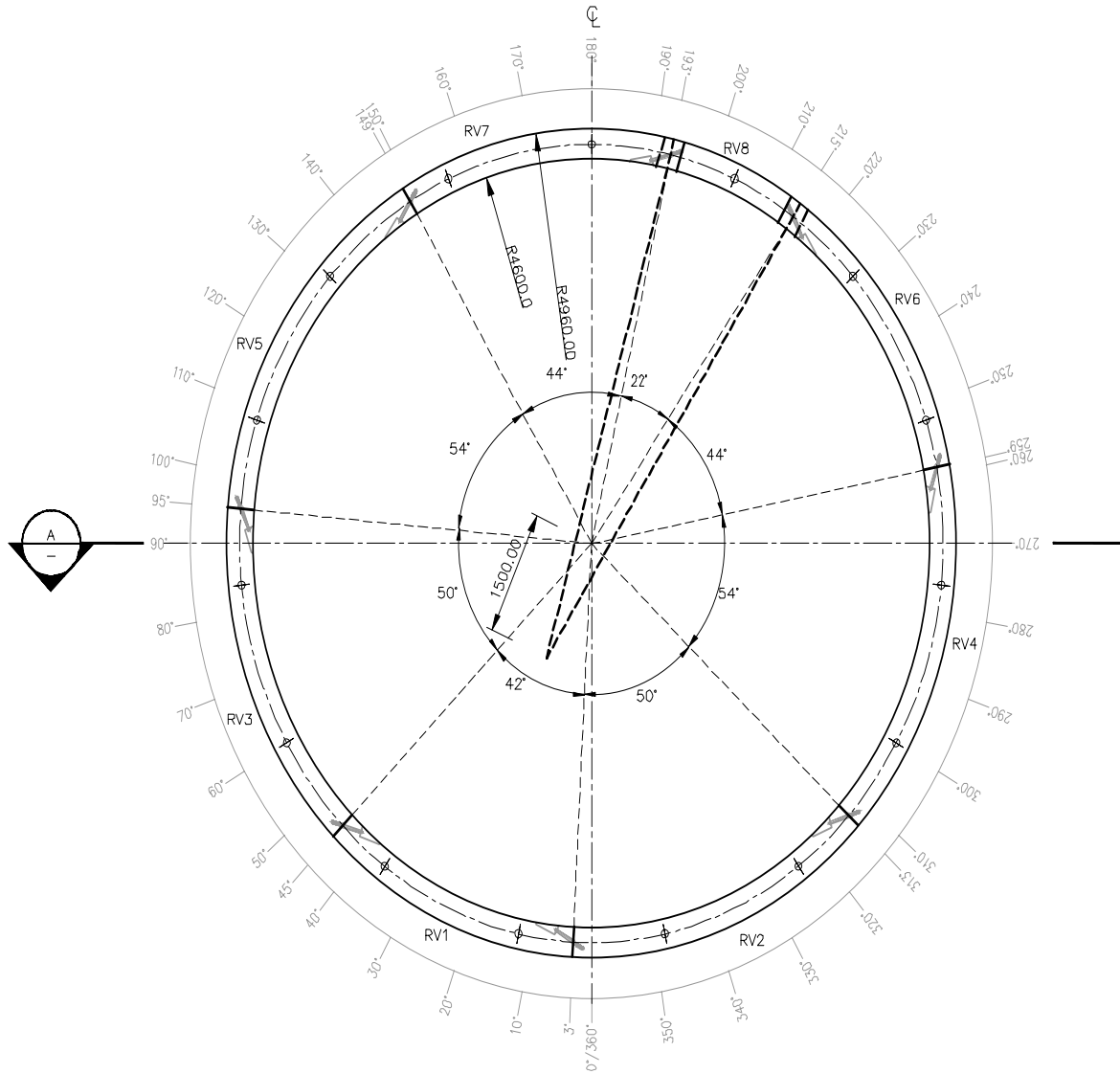
Geotechnical Design Consideration

- In almost half of the route of Line 1 competent limestone with limited weathering and without groundwater table is expected.
- From station “1F2” to “1F4” in line 1, TBM cross a silty clayey sand layer.
- Typically settlements over the tunnel (0-10mm).
- Some areas of greater predicted settlement (10-30mm) in the southern section of the Line 1 tunnel, near Station “1F2”.

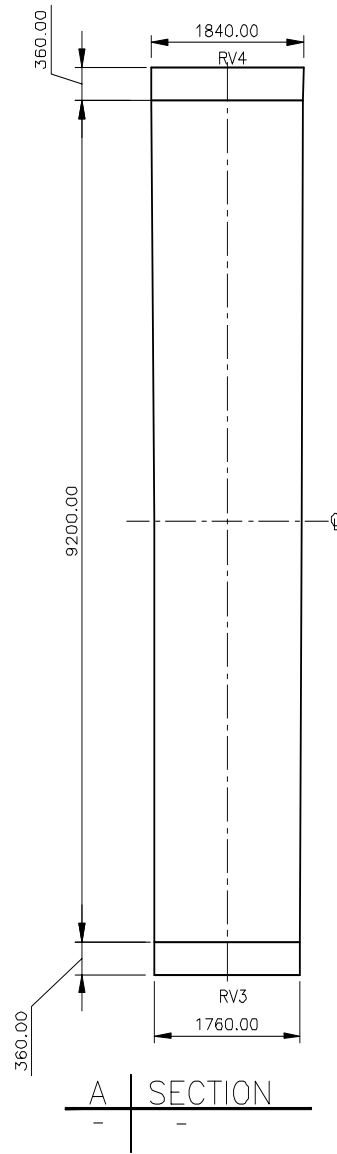
Geometry of TBM

- The tunnel internal diameter is 9.0m
- This diameter is further increased by 0.2 meter to accommodate TBM construction tolerance as required.
- The proposed TBM final lining is precast segments of 360mm thick.

Lining Thickness (mm)	360
Internal diameter (mm)	9200
External diameter (mm)	9920



ELEVATION OF RING ON RING AXES



A SECTION

Soil Excavation Quantity

- In a simple calculation, we can assume the quantity of soil to be excavated.
- Area of tunneling= 77.29 m^2
- Tunneling Length= 17.3 km
- Soil Volume= $17300 * 77.29 = 1337117 \text{ m}^3$

Thank you