Tel-Aviv Metro Project

Status and Challenges

Facts and Figures

The largest and most complex project ever delivered in Israel!

2034-2037
Stage A- Operation

$40-50bn
Estimated cost

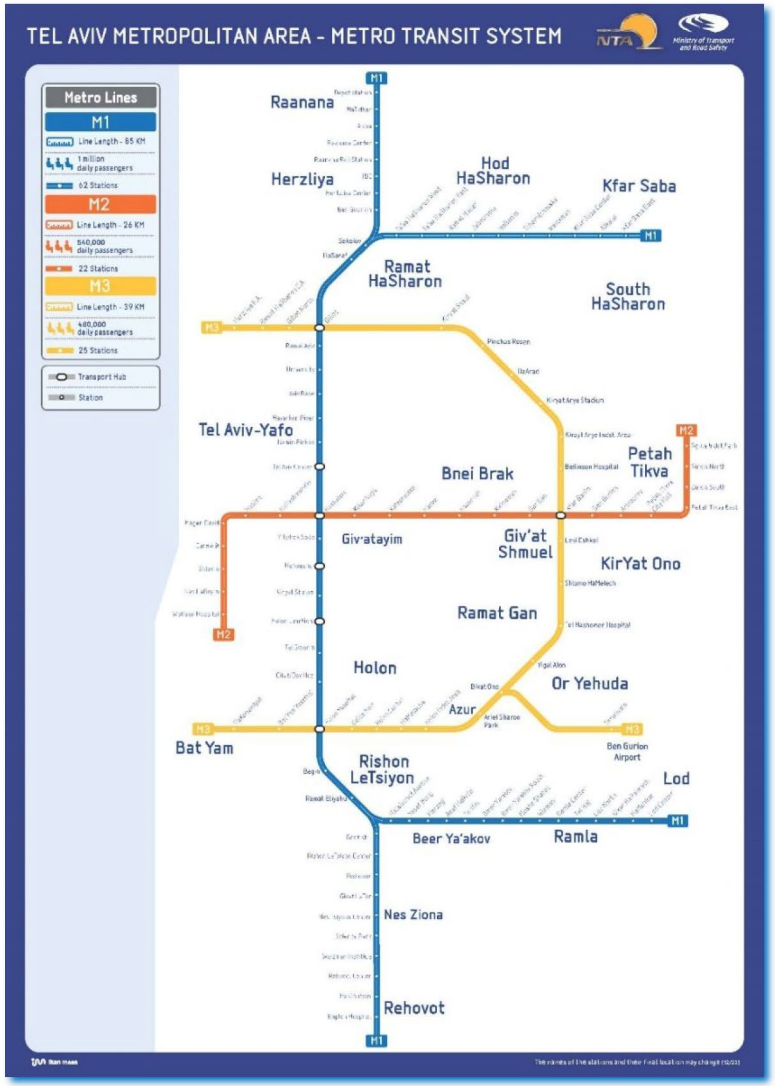
+30%
Increase use of public transport

$8.5bn
Economic benefits

2 mil
Passengers per day

General Overview

- **3** Lines (**M1**/**M2**/**M3**)
- **150** km Underground Network (double tunneling)
- **109** Stations
- **24** Municipalities
- **4** Depots
- **7** Transportation Hubs



M1 Highlights

85
km Length

62
Stations

15
Transfer Stations

14
Municipalities

2
Depots

- Academic Institutions
- Sport stadium
- Employment Centers
- Development areas
- Industrial / commercial zone
- Hospitals

M2 Highlights

25
km Length

22
Stations

8
Transfer Stations

9
Municipalities

1
Depot

- Development areas
- Academic Institutions
- Sport stadium
- Industrial / commercial zone
- Market
- Theater
- Hospitals

M3 Highlights

39
km Length

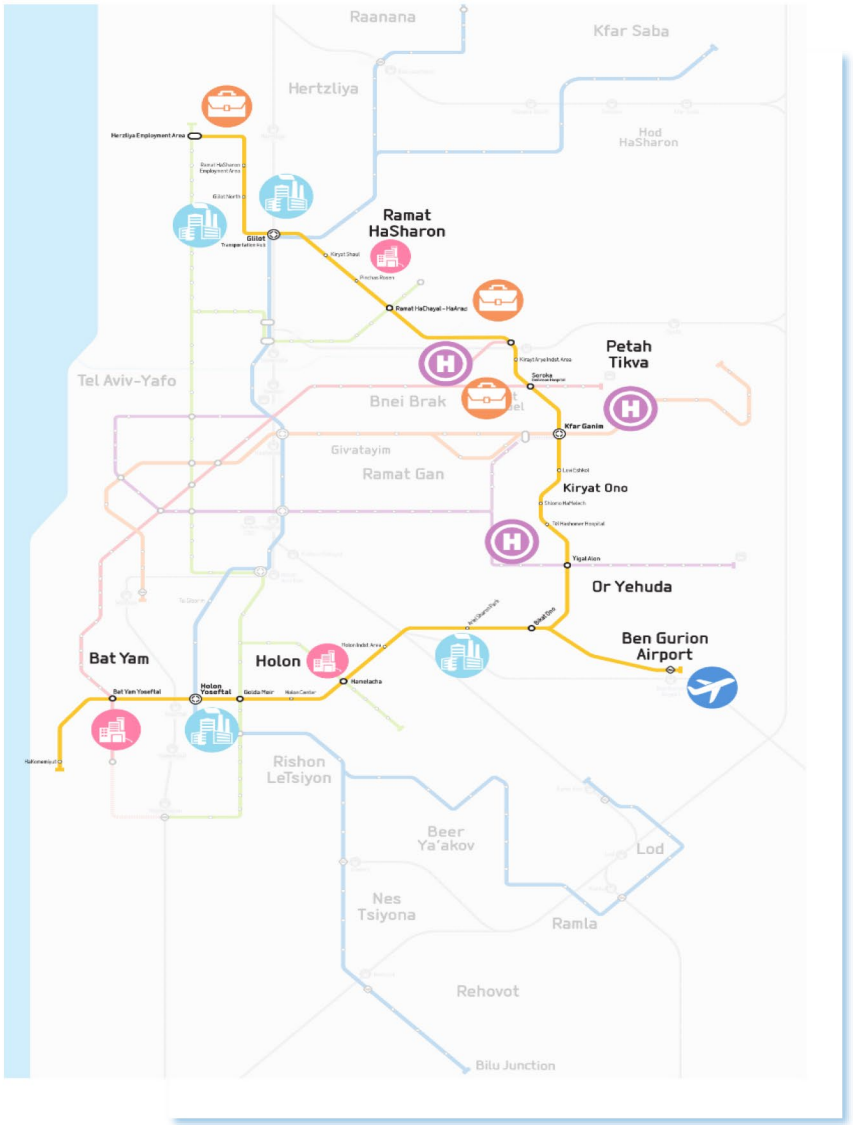
25
Stations

12
Transfer Stations

13
Municipalities

1
Depot

- Hospitals
- Development areas
- Employment Centers
- Airport
- Industrial / commercial zone



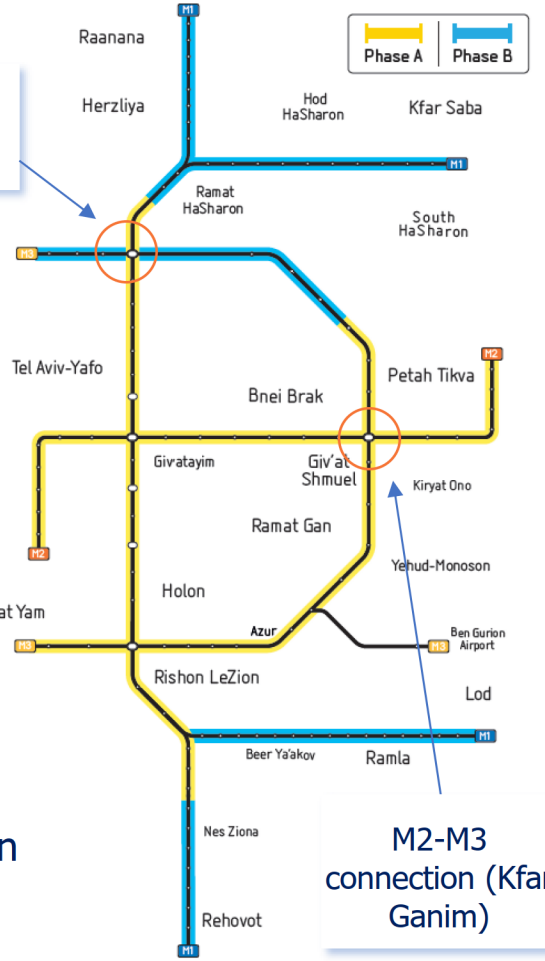
Project Staging

The Metro Project is divided into two main execution stages:

		M1	M2	M3	Total Network
Stage Execution 1	**Track Length**	28 km	26 km	24 km	**78** KM
	Stations	20	22	17	**59** Stations
	Depot	Rishonim	Sgula	Mesubim	**3** Depots
Stage Execution 2	**Track Length**	58 km	-	11 km +5 km to airport	**74** KM
	Stations	42	-	7 +1 km to airport	**50** Stations
	Depot	Ra'anana	-	-	**1** Depot
		85km	**26km**	**39km**	

Total: 150 km, 109 Stations

M1-M3 connection (Glilot)



M2-M3 connection (Kfar Ganim)

2034
Initial Operation

2037
Full Operation

Main Pillars

- **Definition:** Main technical critical programme decisions.
- **Each pillar decision considered the following aspects:** engineering, cost, time, service, operation and maintenance.

Pillar	Recommendation
Grade of Automation	GoA4 – Unattended and Driverless
Length of Platforms and vehicle	M1- train capacity of ~1012 passengers, 3.2m width, ~115m length. Design for 90 sec headway. M2- train capacity of ~860 passengers, 3.2m width, ~92m length. Design for 90 sec headway. M3- train capacity of ~860 passengers, 3.2m width, ~92m length. Design for 120 sec headway.
Electrification	1500VDC Rigid Overhead Catenary System
Tunneling	Double twin TBM, 6.5m diameter. Combination of mining method for stations- depending on location.

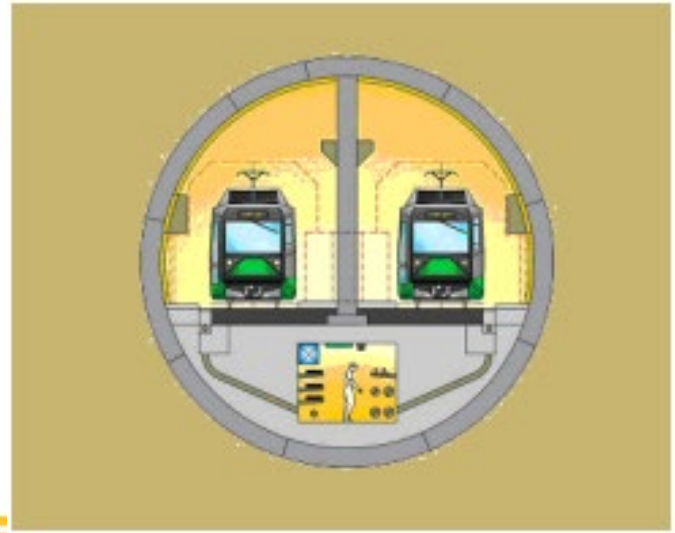
Automatic Train Control (ATC)

- Automatic Train Protection (ATP) - safety system that checks speed limits, signaling input and can emergency brake
- Automatic Train Supervision (ATS) - remote supervision of the train
- Automatic Train Operation (ATO) - system that enables trains to be operated and driven automatically

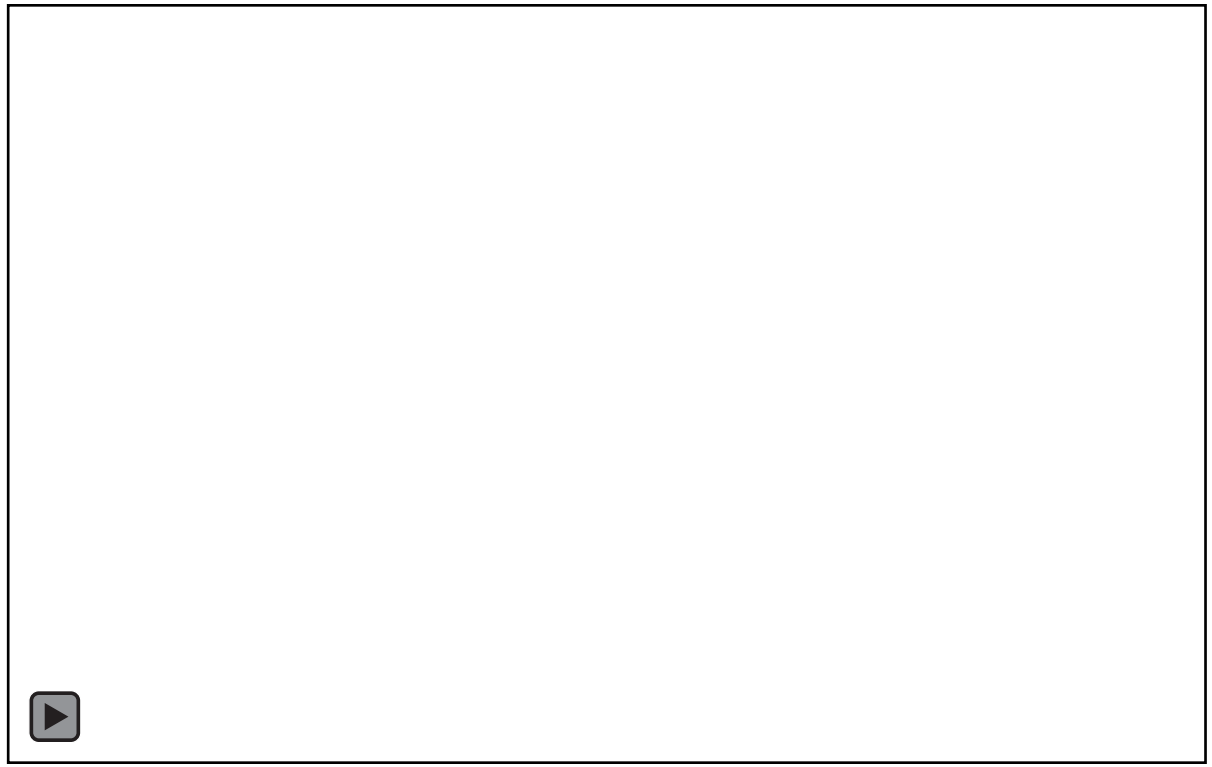
Automatic Train Operation (ATO)

Grade of automation	Train operation	Setting the train in motion	Driving and stopping the train	Opening and closing the doors	Operation in case of disruptions
0 Line of Sight	Just the driver	Driver	Driver	Driver	Driver
1 Non-automatic	ATP with a driver	Driver	Driver	Driver	Driver
2 Semi-automatic	ATP and ATO with a driver	Driver Automatic	Automatic	Driver	Driver
3* Driverless	ATP and ATO without a driver	Automatic	Automatic	Driver Attendant	Attendant
4 Unattended	ATP and ATO without a driver and attendant	Automatic	Automatic	Automatic	Automatic

Types of tunnels



Tunnel Boring Machines

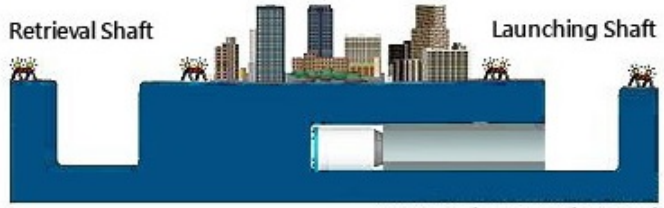


Speed of boring:100-200 meters per week
Power Consumption: 3-4 MW per machine

Tunnel Boring Machines

1. Excavate launching shaft and retrieval shaft

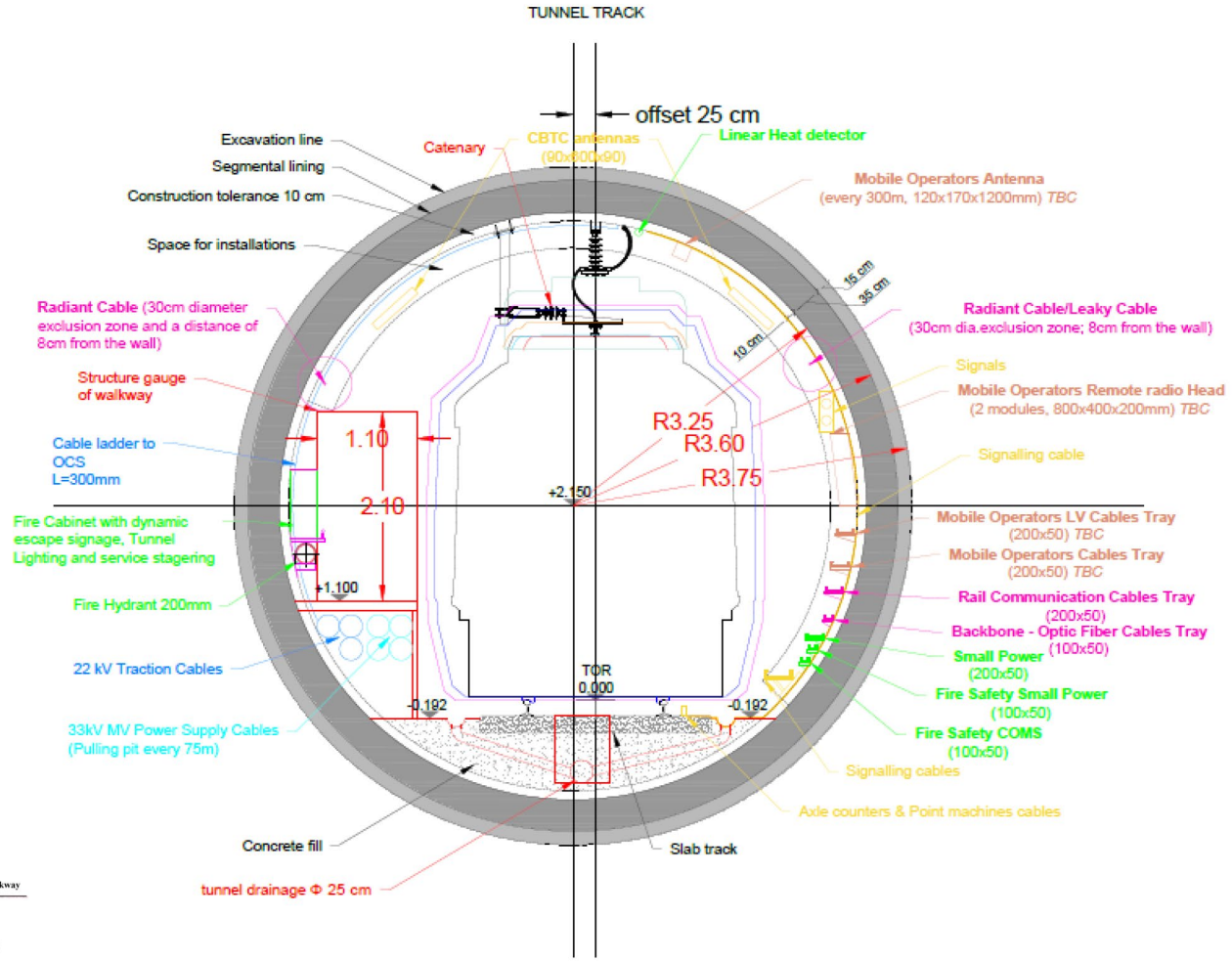
2. Assemble the TBM at the launching shaft

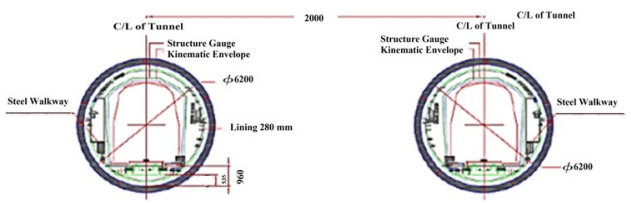


3. Cut and excavate the tunnel

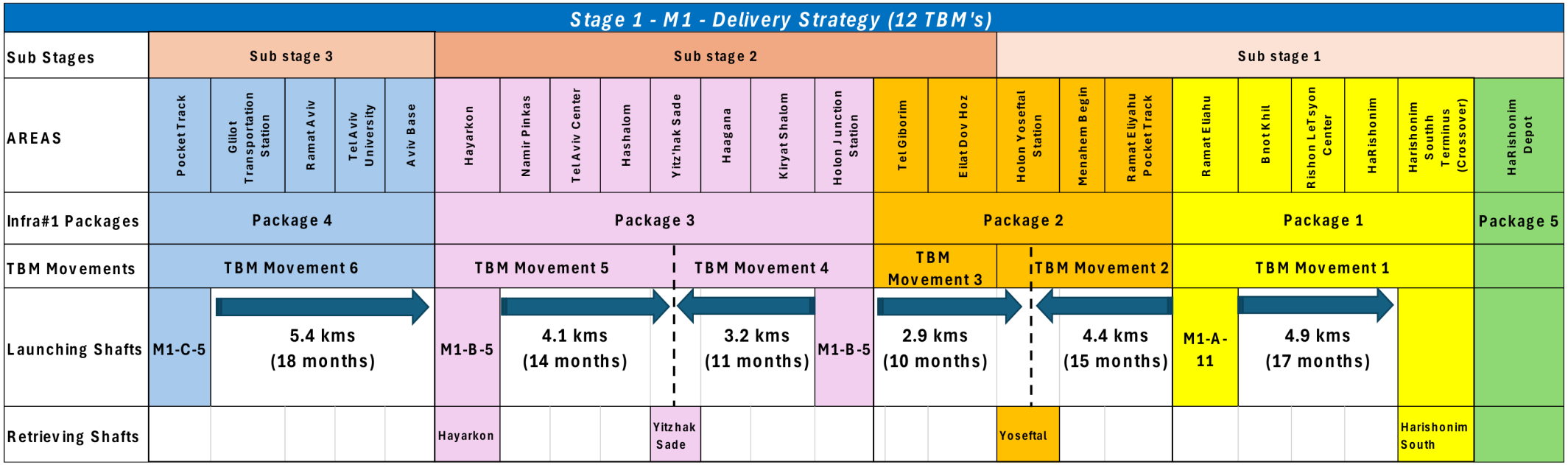
4. TBM arrives in the retrieval shaft to be dismantled for transportation

Tunnel Cross Section



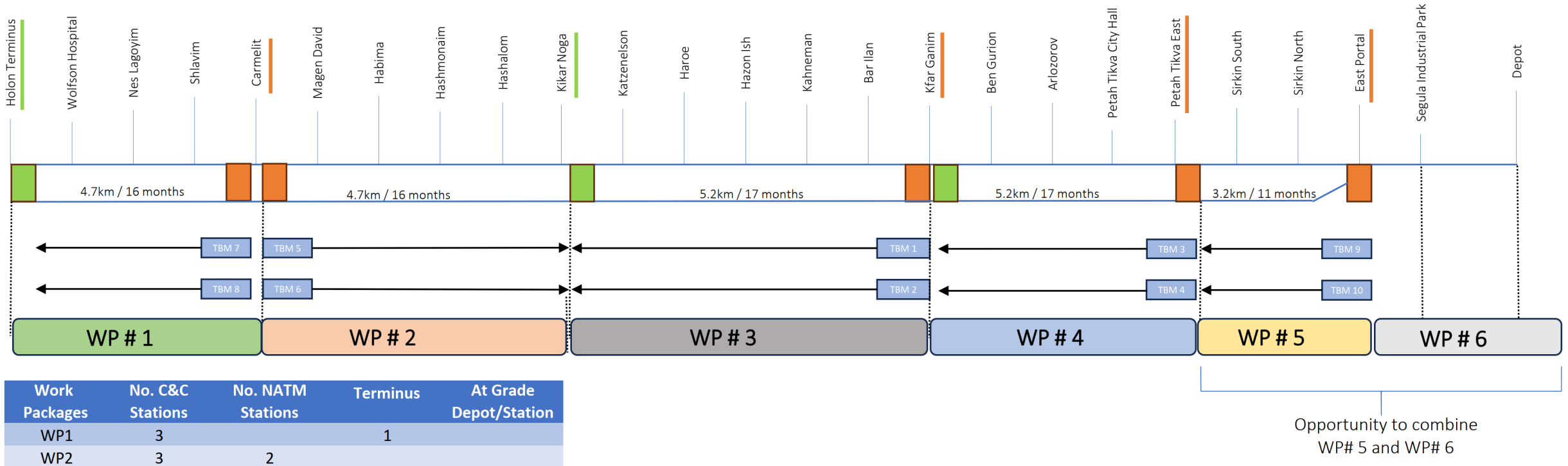


Work Packages Infra 1 Line M1 (12 TBMs)



Work Packages	No. C&C Stations	Terminus	Depot
Package 1	4	1	
Package2	4		
Package3	8		
Package4	4	1	
Package5			1
Total	**20**	**2**	**1**

Work Packages Infra 1 Line M2 (10 TBMs)



Work Packages	No. C&C Stations	No. NATM Stations	Terminus	At Grade Depot/Station
WP1	3		1	
WP2	3	2		
WP3	1	4		
WP4	2	2		
WP*5	2			
WP6				1
Total	**11**	**8**	**1**	**1**

*Including East Portal

Launch Site

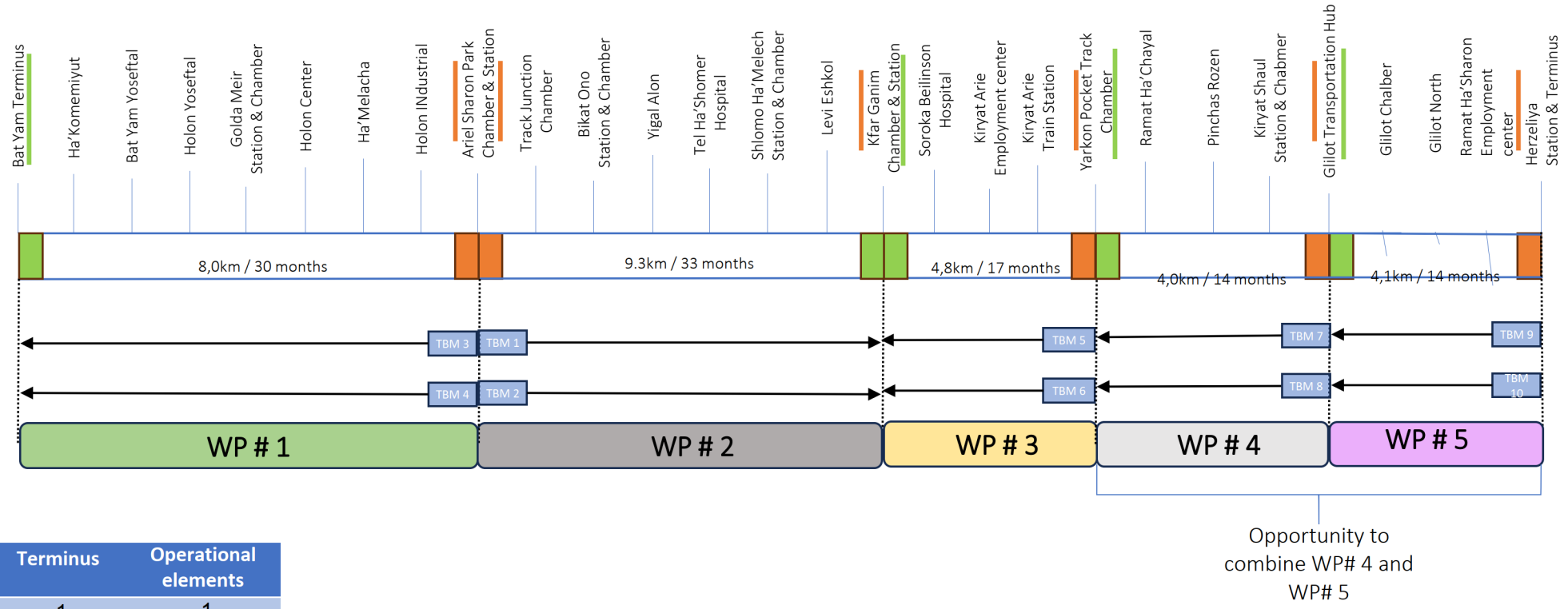
TBM Reception

TBM drive

TBM

TBM

Work Packages Infra 1 Line M3 (10 TBMs)



Work Packages	No. C&C Stations	Terminus	Operational elements
WP1	7	1	1
WP2	6		5
WP3	4		1
WP4	4		1
WP5	3	1	1
Total	**24**	**2**	**9**

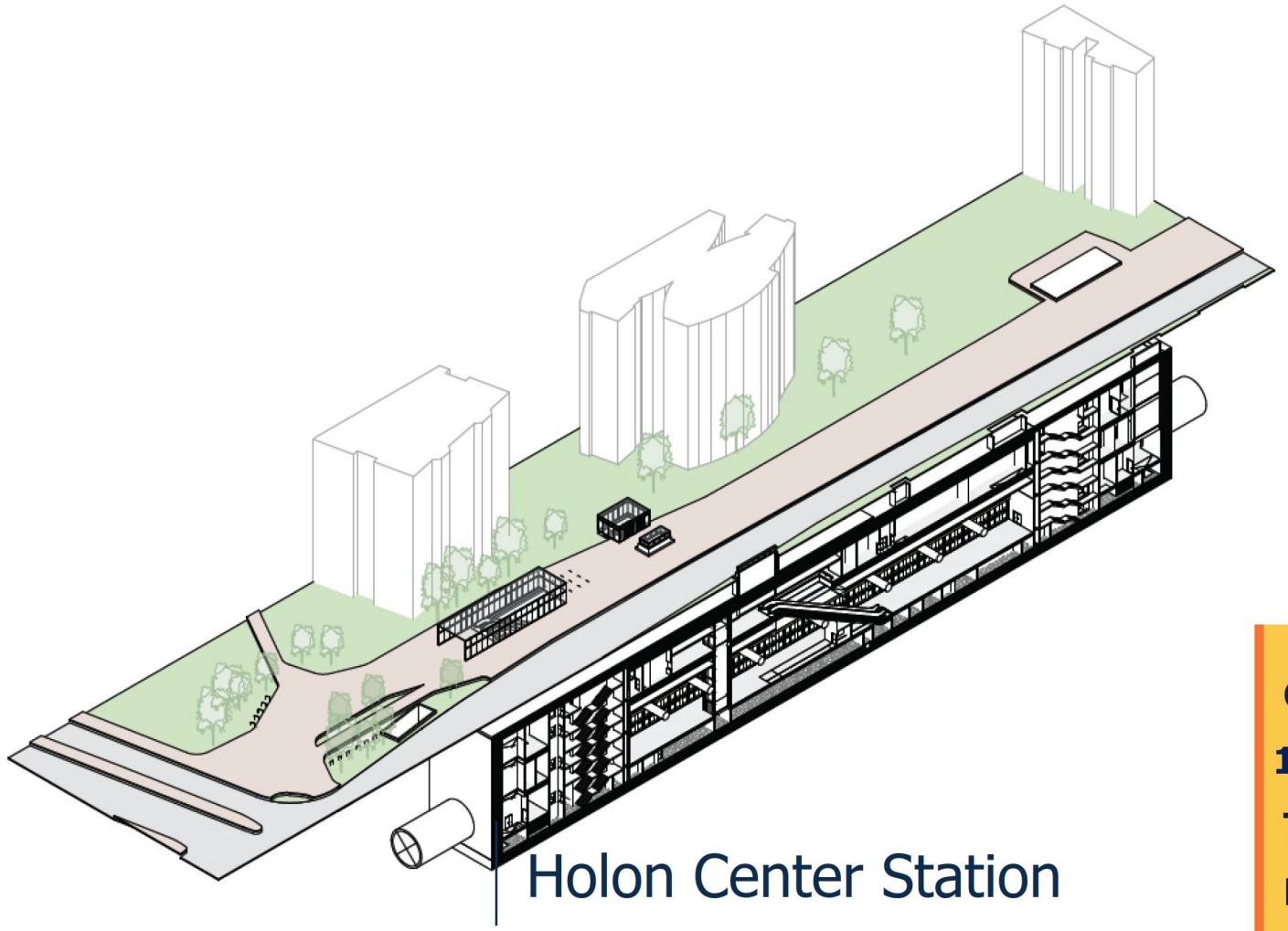
Launch Site

TBM Reception

TBM drive

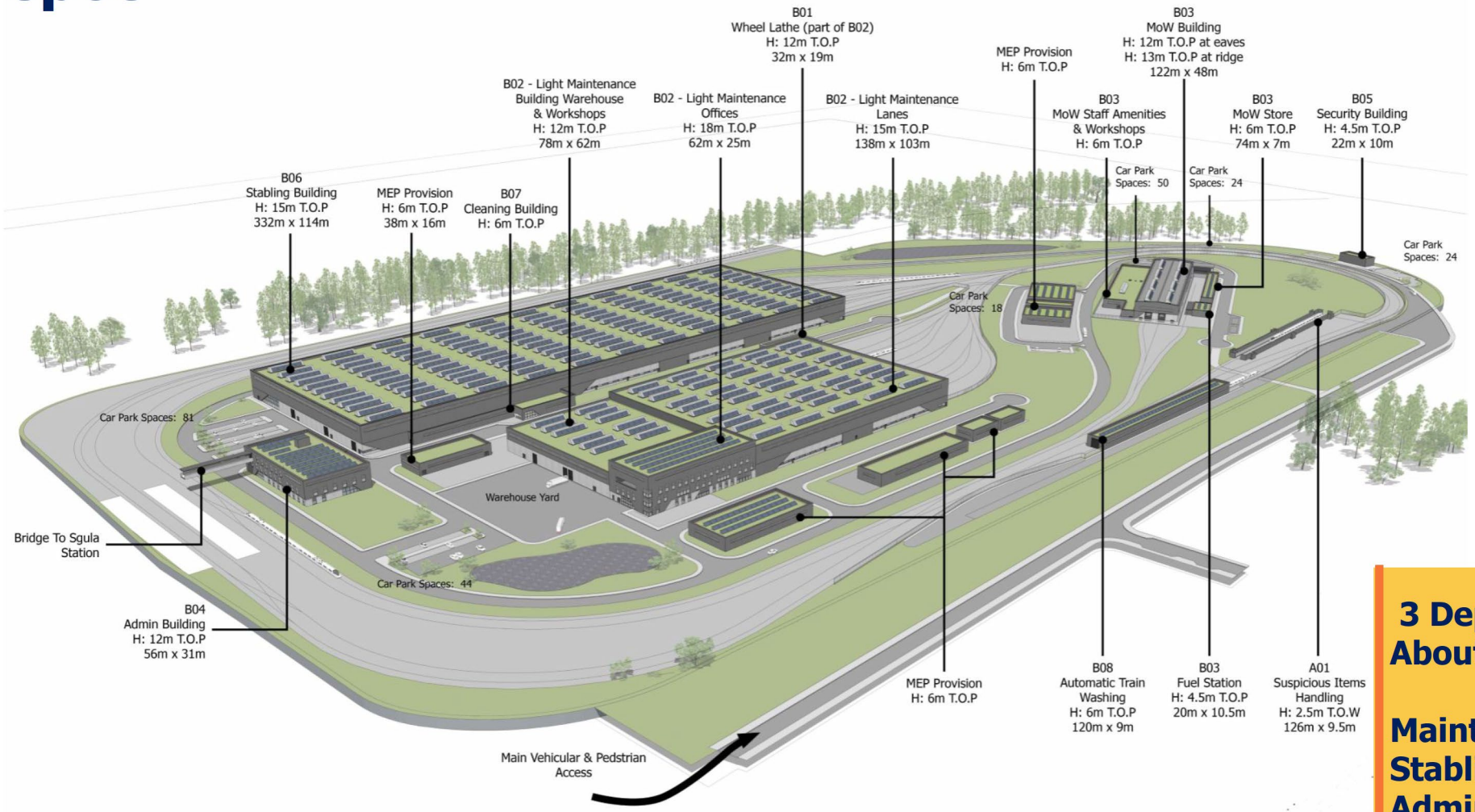
TBM

Cut & Cover 3 Levels Floor Stations



- C&C 3 levels floor
- 16 Stations
- TOR – about 25m
- Platform length- 92/115m

Depot



3 Depots
About 300,000 m^2 each

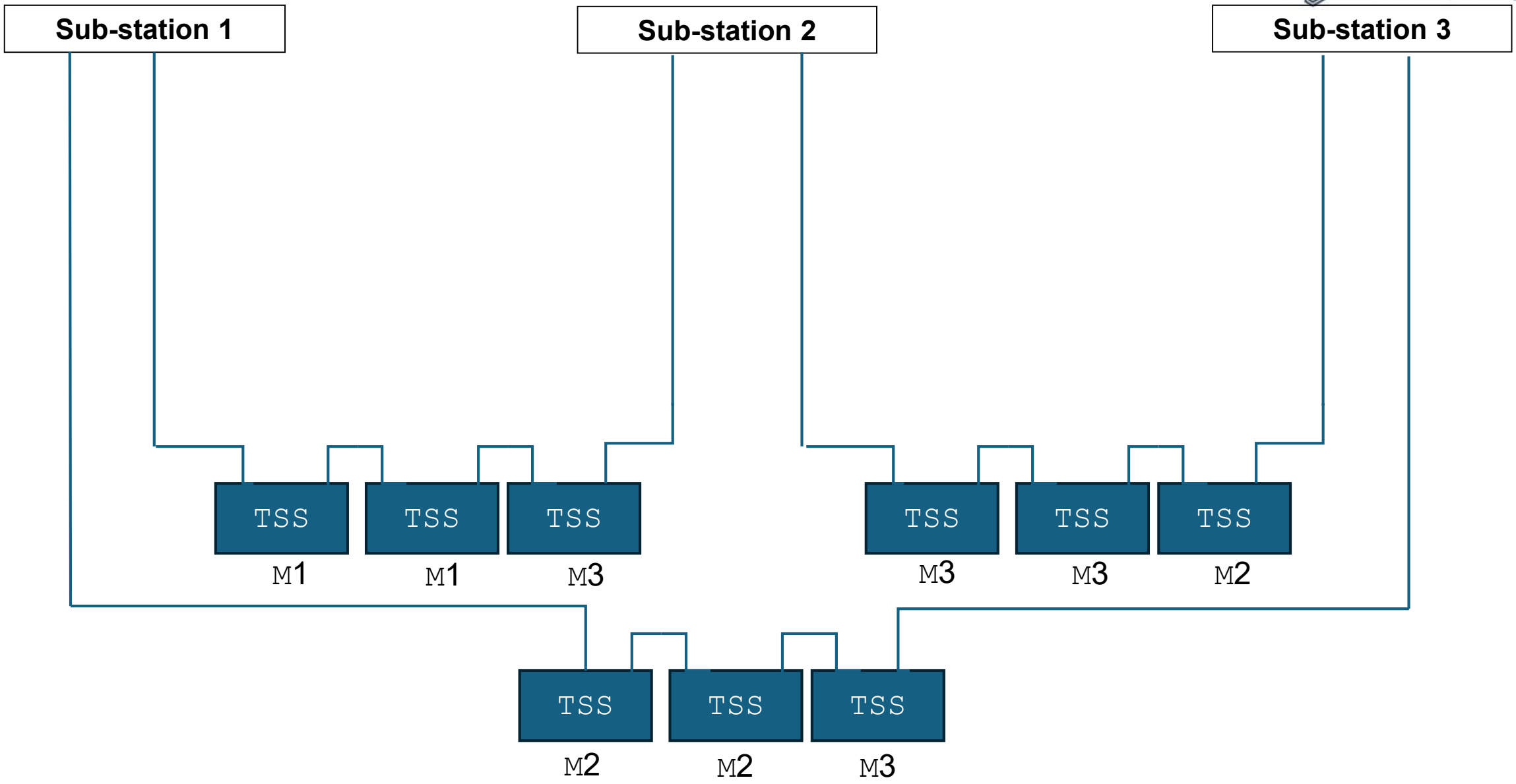
Maintenance workshops
Stabling area
Admin buildings

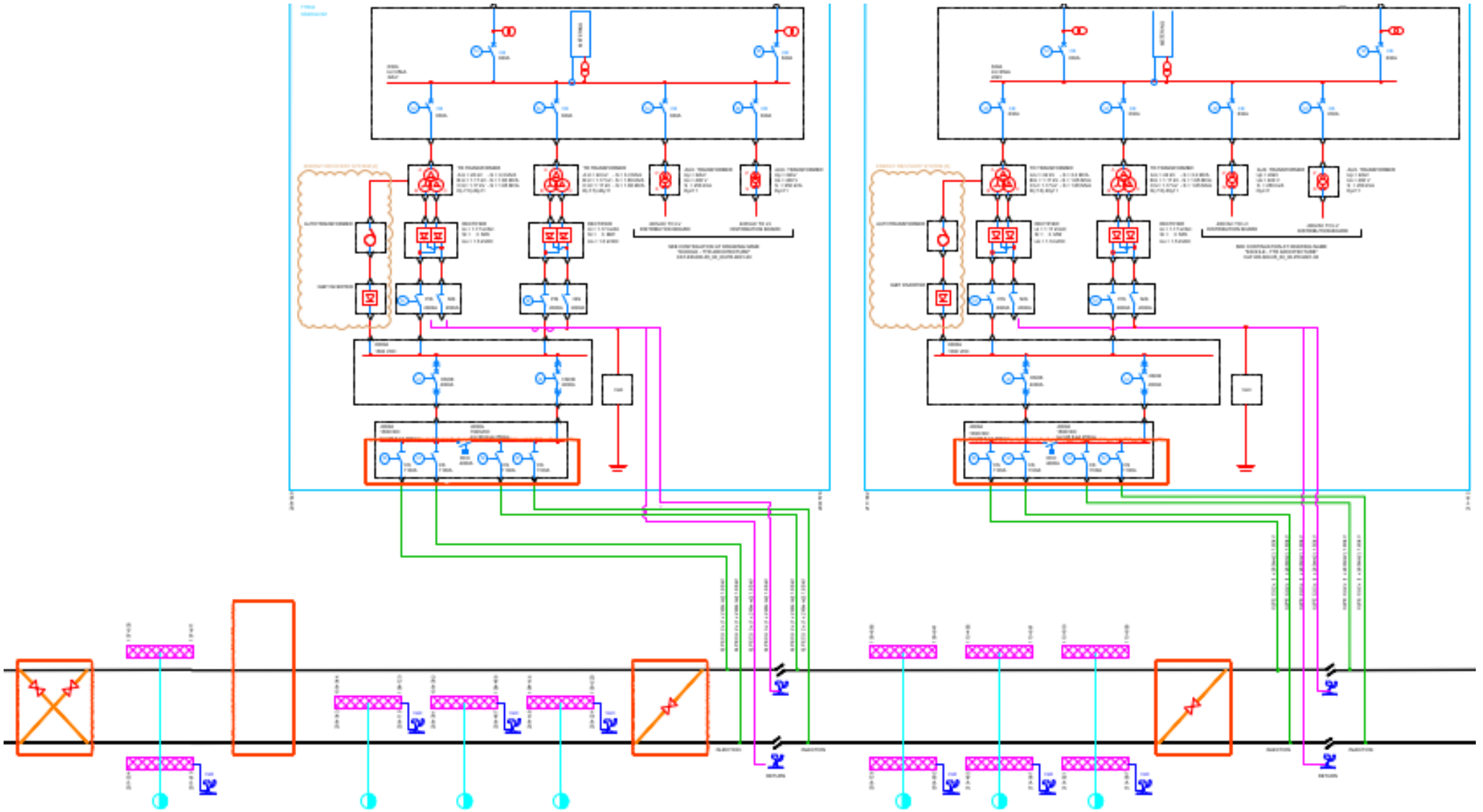
Power Consumption of the Met

- 300 MW – peak load
- 7 substations 161/33 kV
- Each substation 2x90 MVA transformers
- NOGA request to allocate additional space for up-to 4 transformers
- 2-4 incoming 161 kV overhead/underground lines

Construction of the Sub-stations

- 2025 - Tender
- 2029 – Energization
- Power supply for the needs of test runs and auxiliaries already at 2031


Sub-station 1
Sub-station 2
Sub-station 3
TSS
TSS
TSS
M1
M1
M3
TSS
TSS
TSS
M3
M3
M2
TSS
TSS
TSS
M2
M2
M3

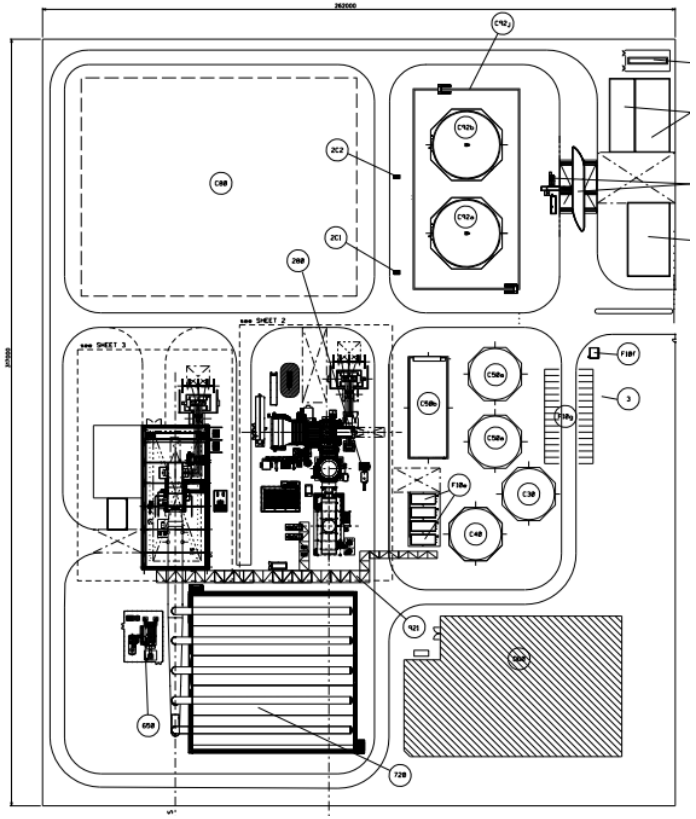


Redundancy

- Internal redundancy @ sub-station level
  - 2 transformers
  - Bus-tie between MV switchgears
- 33 kV loops between sub-stations
- Redundant AC/DC converters
- DC redundant power supply

Power Station

- Power supply in the case of Black-out or in case of major faults in the HV grid
- 300x200 m plot
- 90-120 MW constant load
- Peak shaving by grid or reduced operation in case of failure
- Statutory Process - tender



Thank You