

Metro Tunnels

Doha Metro Gold Line Underground Tunnels

Tender Predesigns

Doha, Qatar

Project

Tender predesigns for Doha Metro Gold Line underground tunnels & cross passages

Project Budget

Total Cost: approx. € 0.5 B.

Project Schedule

Tender Design: 2012
Construction: 2013 - 2018

Project Description

14 twin bore tunnels and 1 single bore tunnel (TBM) in urban environment

Total length: approx. 40km

Cross section: 39.6m²

Effective cross section: 19.4m²

65 Pedestrian Cross Passages (NATM) in urban environment

Total length: approx. 600m

Cross section: 15.7m² - 22m²

Effective cross section: ~8.0m²

Excavation Method

- TBM tunnels: Mechanical excavation with EPB - TBM (Earth Pressure Balance - Tunnel Boring Machine)
- Cross passages: Conventional tunnelling method (NATM)

Final Lining

- Concrete C40/50 for segments (30cm thickness)
- Concrete C30/37 for cross passages

Geology

- Weathered limestone, limestone, shale, chalky limestone and interlayers of siltstone
- Karst and sink holes/cavities
- 2 aquifers (unconfined & confined), high water aggressiveness
- Overburden: 15m - 30m

Our Services

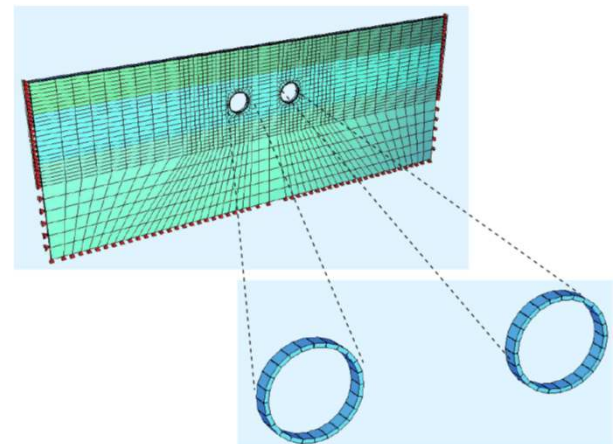
- Geotechnical & structural tender predesigns and drawings
- The designs were elaborated in common with EDR GmbH, Munich

Construction Details

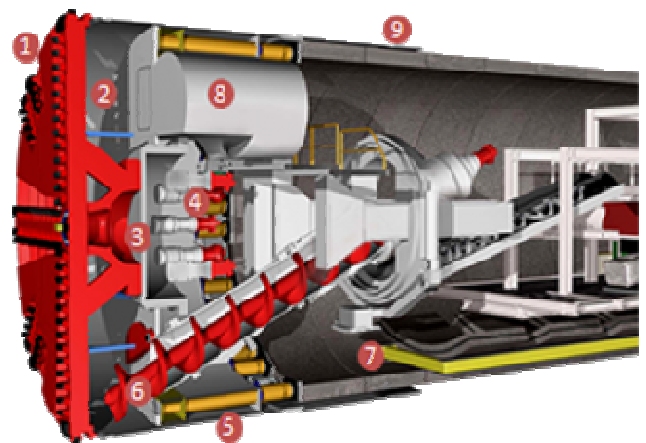
- Special grouting techniques for water isolation
- Concrete mix for 120 years durability
- Double waterproofing gasket with hydrophilic seal

Client

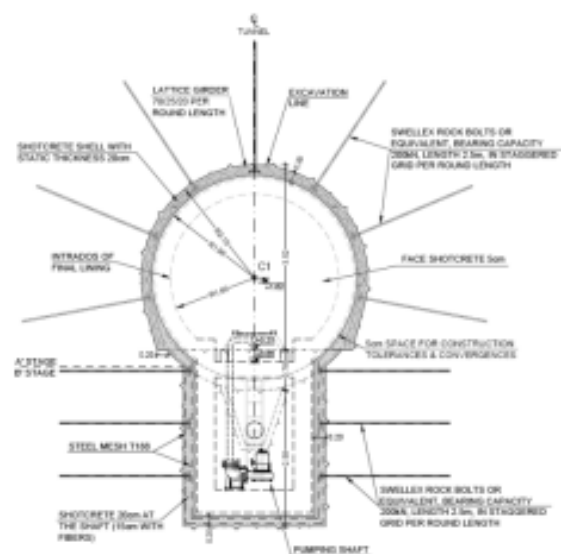
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Typical view of the FE-model and the segmental lining



Earth Pressure Balance - Tunnel Boring Machine (EPB - TBM)



Cross passage excavation geometry at pumping shaft

Metro Stations

Doha Metro Gold Line Underground Stations

Tender Predesigns

Doha, Qatar

Project

Tender predesigns for 14 UG Stations, 4 Switchboxes & 2 Emergency Exits for the Gold Line of Doha Metro

Project Budget

Total cost: approx. € 1.5 B.

Project Schedule

Tender Design: 2012
Construction: 2013 – 2018

Project Description

14 UG Stations (including ventilation shafts):

- 13 UG stations each with: Length: ~177m / Width: ~27m / Depth: ~25m to ~45m / 4 final levels: Foundation level / Platform level / Concourse level / Roof level
- 1 UG station with: Length: ~355m / Width: ~48m / Depth: ~45m / 6 final levels: Foundation level / Platform level / Transfer level / Intermediate level / Concourse level / Roof level

15 Pedestrian/Ventilation Tunnels:

- Total length: 650m / Cross section: 73-121m² / Effective cross section: 38-60m²
- 4 Switchboxes: Length: ~120m & ~190m / Width: ~25m & ~45m / Depth: ~20m & ~28m / 2 final levels: Foundation level / Roof level
- 2 Emergency exits shafts: Length: 12m / Width: ~6m / Depth: ~28m

Construction Method

- Excavation & reinstatement (Cut & Cover) for stations, switchboxes & shafts
- Open excavation retaining structures: reinforced concrete diaphragm walls, prestressed anchors, struts for stations, switchboxes & shafts
- Stations pedestrian/ventilation tunnels: excavated with conventional means ("barrel vault" method)
- Stations/switchbox bridge structures: secant concrete piles with d: Ø100/Ø120 and l: 15m ~ 19m, prestressed anchors, precast beams, diaphragm walls with l: 16km, d: ~12m to 46m and w: 0.80m/1.00m, multi levels of anchors

Final Lining

Reinforced concrete C30/37

Geology

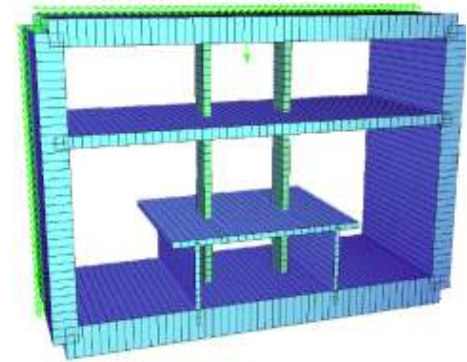
Weathered limestone, limestone, shale, chalky limestone and interlayers of siltstone, 2 aquifers (unconfined & confined), high water aggressiveness

Our Services

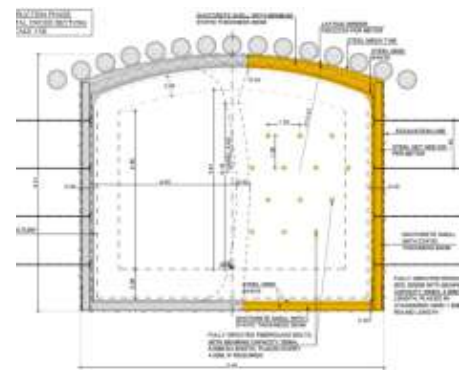
- Geotechnical & structural tender predesigns and drawings
- The designs were elaborated in common with EDR GmbH, Munich

Construction Details

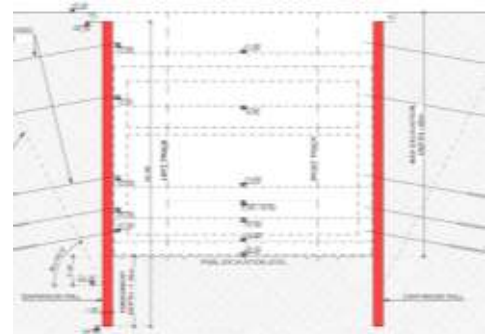
- Durability requirements for 120 years
- Special dewatering systems
- Appropriate traffic deviations



Station Structural Analysis Model



Underground tunnel construction with conventional means



Excavation & temporary support typical cross section with the application of diaphragm walls and prestressed anchors

Client

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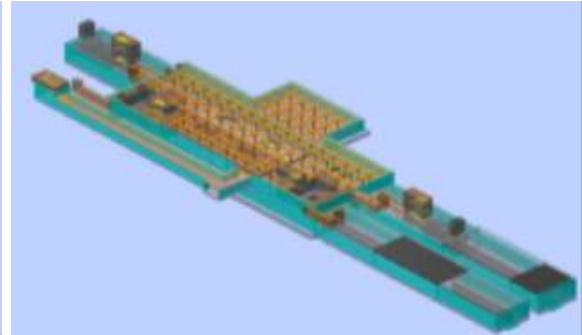
Metro Stations

Doha Metro Major ("FLAGSHIP") UG Stations Tender Predesigns

Doha, Qatar



Mshaireb Station Analysis Model



Education City Station Analysis Model

Project

Mshaireb UG Metro Station & Education City UG Metro Station in Doha city

Construction Budget

Total Cost: approx. € 1 B.

Project Schedule

Tender Design: 2012
Construction: 2013 – 2018

Project Description

Mshaireb UG Station

(major interchange station in the centre of Doha City)

Length: 177m (Main Station)

Width: ~33m (Main Station)

Depth: ~38m

6 final levels: Foundation level/2 Platform levels /Intermediate level/Concourse level/Roof level

Passenger tunnel of ~275m long

Education City UG Station (dual operation Station)

Length: ~177m (Main Station)

Width: ~65m

Depth: ~23m

4 final levels: Foundation level/Platform level/ Concourse level/Roof level

2 switchboxes of 25m span and 81m and 155m long

Passenger tunnel 145m long

Construction Method

- Excavation & Reinstatement (Cut & Cover)
- Open excavation retaining structures: reinforced concrete diaphragm walls, prestressed anchors, struts, precast beams
- Mshaireb Station: Pedestrian tunnel excavated with conventional means / Temporary steel bridge / Bridge

Final Lining

Reinforced concrete C30/37

Geology

Weathered limestone, limestone, shale, chalky limestone

and interlayers of siltstone, 2 aquifers (unconfined & confined)

High water aggressiveness

Our Services

- Geotechnical & structural tender predesigns and drawings
- The designs were elaborated in common with the EDR GmbH, Munich

Construction Details

- 120 years durability
- Special dewatering systems
- Diaphragm walls l: 1.5m d: ~14m to 28m and w: 0.64/0.80
- Multi levels of anchors
- Appropriate traffic deviations

Client

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Doha Metro Green Line Extension Tender Predesigns

Doha, Qatar

Project

Tender predesigns for Doha Metro Green Line Extension Tender. Tender predesigns metro stations, cut & cover ramps and tunnels (TBM & NATM)

Project Schedule

Tender Design: 2017
Construction: 2018 – 2022

Project Description

5UG Stations and 1 Emergency Exit (Al Hilal Junction Station, Nuaija Station, Al Wadi Station & Switchbox, Emergency Exit (Al Wadi), Bu Hamour Station, Leawaina Station), Subways and Cross Passages in urban environment :

- 5 UG stations with:
Length: ~200m / Width: ~30m / Depth: ~27m – 47 m /
5 final levels: Base / Platform / Concourse / Technical / Roof
- 1 twin bore tunnel (TBM)
Length approx. $7,5 \times 2 = 15\text{km}$, Cross section approx. 40 m^2
- 4 subways (NATM)
Total length approx. 248m, Cross section: 100 m^2
- 16 cross passages (NATM)
Total length approx. 160m, Cross section: 18 m^2

Construction Method

Excavation & reinstatement (Cut & Cover)
TBM tunnels: Mechanical Excavation with EPB – TBM (Earth Pressure Balance – Tunnel Boring Machine)
Subways & Cross passages: Conventional tunnelling method (NATM)

Final Lining

Reinforced concrete C50/60 TBM tunnels
Reinforced concrete C40/50 for stations and cross passages
Reinforced concrete C30/37 for NATM tunnels

Geology

Weathered limestone, limestone, shale, chalky limestone and interlayers of siltstone,
2 aquifers (unconfined & confined) - high water aggressiveness

Our Services

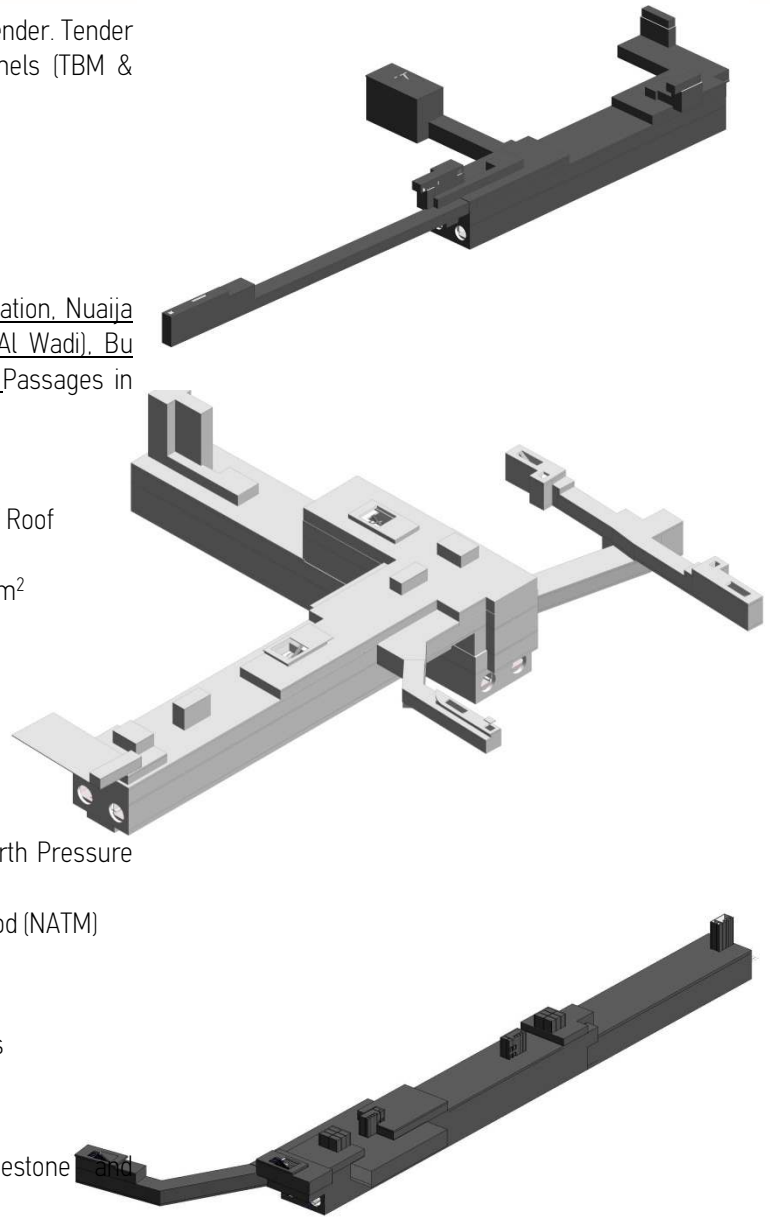
- Geotechnical and structural tender predesigns and drawings
- BIM/Revit modeling for calculation of BoQs

Construction Details

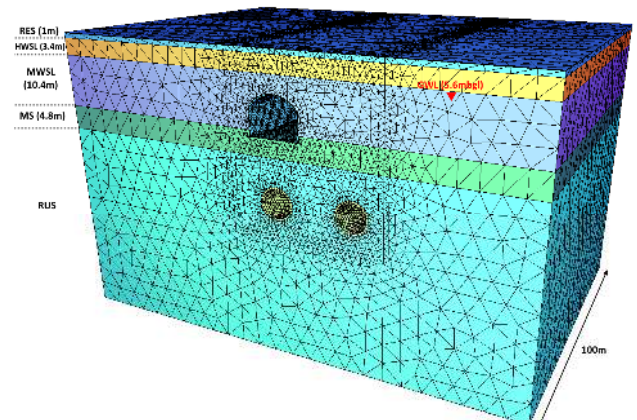
- Durability requirements for 120 years
- Special dewatering systems
- Appropriate traffic deviations
- Shoulder pile wall with anchors

Client

ALYSJ JV
(AKTOR - L&T - YAPI MERKEZI – STFA – AL JABER JOINT VENTURE)



Structural Analysis Model (BIM/Revit)



3D elasto-plastic finite element model

Doha Metro Red Line Underground Tender Predesigns

Doha, Qatar

Project

Tender predesigns for Doha Metro Red Line North Extension Tender. Tender predesigns for Al Khor metro Station, Al Khor Stabling Yard, 10 Intermediate Traction Power and Structure power Supply building (ITPS / SPS), 39 emergency exits facilities and at grade section

Project Schedule

Tender Design: 2018
Construction: 2019 – 2022

Project Description

1 Metro Station, 1 Stabling Yard, 10 ITPS/SPS Buildings, 39 Emergency Exit Facilities, and at grade section in urban environment:

- Al Khor station:
Length: ~135m / Width: ~35m / Depth: ~15m/
4 final levels: Base / Platform / Technical / Roof
- Al Khor Stabling Yard:
Length: ~200m / Width: ~30m / Depth: ~15m
3 final levels: Base / Platform / Roof
- 39 Emergency Exit Facilities:
Total length approx. 160m
Cross section: 18 m²
- 10 Intermediate Traction Power and Structure power Supply building (ITPS / SPS):
Length: ~80m / Width: ~7m
final level: at Grade
- At grade section:
Length approx. 25m
Cross section approx. 40 m²

Construction Method

Excavation & reinstatement (Cut & Cover)

Final Lining

Reinforced concrete C40/50 for stations and stabling yard

Geology

Superficial deposits or unconsolidated overburden. Simsima limestone (upper Dammam Formation). Midra Shale (lower Dammam Formation) and Rus Formation limestone and gypsum.

2 aquifers (unconfined & confined) - high water aggressiveness

Our Services

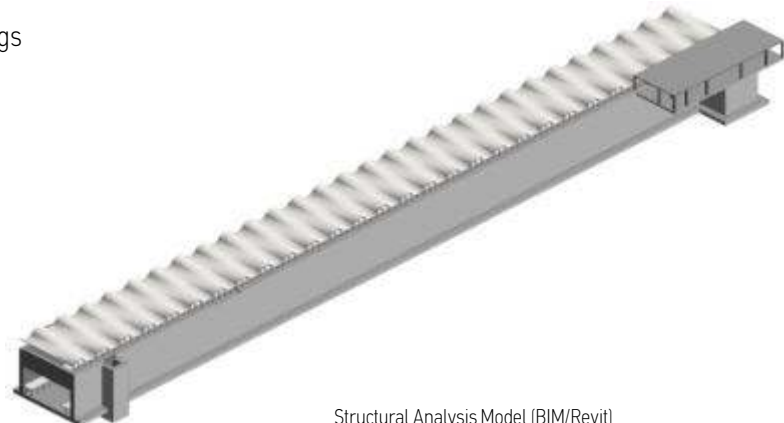
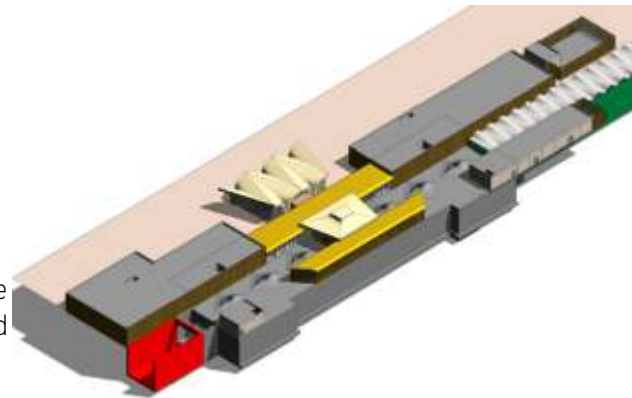
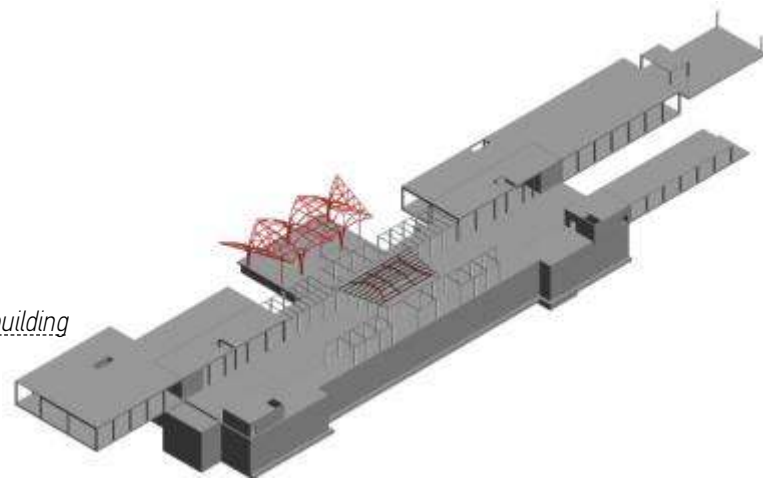
- Geotechnical and structural tender predesigns and drawings
- BIM/Revit modeling for calculation of BoQs

Construction Details

- Durability requirements for 120 years
- Special dewatering systems
- Appropriate traffic deviations

Client

AKTOR S.A. – COMO W.L.L. Joint Venture



Structural Analysis Model (BIM/Revit)