

Reference list of tunnel projects

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Project name and specification	Country	Client	Our Services	Period	Reference
Chehelkooreh underground copper mine Underground mining of a copper mine by combination of two methods of shrinkage and sub-level caving (Miami)	IR	Kavoshgaran Consultant Engineers Company	Design and analysis of support for underground spaces and definition of pillar dimensions by experimental methods, 2D by phase.2 and 3D modeling by Abaqus softwares	2016	Mr. Omid Hemmati Project Manager
Mae Ngud-Mae Kwang Water Transmission Tunnel Project (Chiang mai) of Thailand Tunnel length 11 km and int. dia. 4.20 m by D.S. TBM	TH	Terratec Company of Australia	Engineering services in: <ul style="list-style-type: none">• Segment factory design• TBM performance• Cutter consumption• Site arrangement	2014	Mr. Juan Parreno Managing Director
Azad water tunnel Tunnel length 10.8 km and int. dia. 3.00 m by EPB TBM	IR	Farab Company	Structural design of segmental lining	2014	Mr. Ahadi Engineering manager of Azad project
Western Tehran Wastewater Tunnel EPB TBM excavation, length 11 km, Final diameter 3.00 m, EPB-TBM	IR	Kayson Construction Company	Preparation of tender documents Volume estimation	2013	Mr. Minaei Technical deputy
Chamshir Water Tunnel Single Shield TBM excavation, length 7.5 km, Final diameter 4.60 m, EPB-TBM	IR	Sabir Construction Company	Detail design of segmental lining; including geometrical design (6+0) and structural design for rebar and steel fiber	2013-2014	Mr. Khosrotash Project manager

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Project name and specification	Country	Client	Our Services	Period	Reference
Qom metro Line A TBM excavation, length 2×12 km, diameter 9.40 m, EPB-TBM	IR	SCE Inst.	First and second phase design including: <ul style="list-style-type: none">• Production process definition• Detail design of general and internal layout of segment factory and its yard• Preliminary and detail design of mechanical and electrical equipments for production compressed air and steam• Preparation list and detailed technical specification for all required equipments and tools in segment factory• Preparation of organization chart and estimation of required staff• Preparation of QA-QC procedures for segment production	2012	Mr. Shamsi Project director

Berchtesgadnerstrasse 3, 5020 Salzburg – Austria

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Mob: +43-664-3634817

Email: info@anahico.com

Web: www.anahico.com

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Project name and specification	Country	Client	Our Services	Period	Reference
Azad water tunnel Tunnel length 10.8 km and int. dia. 3.00 m by EPB TBM	IR	Aban Pazhouh Consulting Company	Complete package of Planning and detail design, including: <ul style="list-style-type: none">• Geology, Engineering geology, hydrogeology studies (phase 2) considering TBM tunnelling• Method statement• TBM type selection• preparation of TBM specifications• Segmental lining design (geometrical and structural design)• Design of site installation• Design of all technical services like transport, ventilation, drainage, water supply, compressed air• Face pressure calculations• Preparation of Risk Management Plan• Backfill grouting• Monitoring plan• Segment factory design• Ground treatment by foam• Project organization chart• Detailed time plan of design and construction• Waterproofing• HSP (Health and Safety Plan)	2013	Mr. Golshan Managing director

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Project name and specification	Country	Client	Our Services	Period	Reference
Uma Oya Project in Sri Lanka 2 RCC dams, 19.2 km tunnel with internal dia. 3.5 m); D.S.TBM and D&B	SR	Farab Company	Detail design, including: <ul style="list-style-type: none">• General method statement,• Finalization of TBM specifications• D&B method statement including blast hole arrangement, support, technical services for conveyance tunnel• Design of site installation and site pavement and cradle for TBM installation in two portals• Trench design of portal (geometry and stability)• Engineering geology and geological hazards considering TBM tunnelling• Haulage system design• Disassembly detail design• Design of all technical services like transport, ventilation, drainage, water supply, compressed air• Segment factory: type selection and mould estimation• Backfill grouting• Monitoring plan• Preparation of detailed list of equipments and consumables• Geometrical design of segmental lining	2012-13	Mr. Mostajer Haghighi Head of Engeering dept.

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Project name and specification	Country	Client	Our Services	Period	Reference
Sayyad Roadway tunnel, Tehran TBM excavation, length 10 km, diameter 14.20 m, EPB-TBM	IR	Hendeseh Pars Consulting Engineers	phase 1 design reports; including: <ul style="list-style-type: none">• Method statement• TBM selection• preparation of TBM specifications• Segmental lining design (geometrical design)• Preliminary design of start and exit TBM shafts	2011	Mr. Hossein Nejad Project manager
Uma Oya Project in Sri Lanka 2 RCC dams, 19.2 km tunnel with internal dia. 3.5 m); D.S.TBM and D&B	SR	Farab Company	Supervision on 1st phase and detail design done by JV of Poyry and Mahab Ghodss Cooperation in finalization of TBM specs Assistance in inspection and delivery of 2 nd Double Shield TBM in Herrenknecht Factory	2011	Mr. Ahadi Senior engineer
Esfahan metro, Line 1: Middle section twin tunnels with length of 4.5 km and final dia. 5.9 m, EPB TBM	IR	Alamoot Construction Co.	Preparation of 4 reports on review of EPB TBMs abrasiveness problems in Esfahan metro – Line 1 : Middle Section (technical claim report);	2010	Mr. Masoudi Managing Director

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Project name and specification	Country	Client	Our Services	Period	Reference
Tehran Metro Line 3 TBM excavation, length 7 km, diameter 9.20 m, EPB-TBM	IR	Rah-Tarh Consulting Co.	Complete package of Planning and detail design, including: <ul style="list-style-type: none">• Method statement• TBM Type selection• Preparation of TBM specifications and finalization with Herrenknecht factory before manufacturing• Segmental lining design (geometrical and structural design)• Design of site installation and arrangement• Design of all technical services like transport, electricity, ventilation, drainage, water supply• Face pressure calculations• Detail design of TBM passing through already-built stations• Preparation of Risk Management Plan• Settlement prediction• Backfill grouting• Monitoring plan• Finalization of requirements for design of TBM Entrance shaft• Detail design of Segment factory	2009-2010	Mr. Gharebaghi Member of the board
Esfahan metro, Line 1: South section twin tunnels with length of 3.7 km and final dia. 6 and 8 m, Roadheader	IR	Alamoot Construction Co.	Preparation of roadheader performance report and bit consumption in Esfahan metro – Line 1 (technical claim report);	2008	Mr. Masoudi Managing Director



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Project name and specification	Country	Client	Our Services	Period	Reference
Tehran Metro Line 6 (Lots 1 and 2) Tunnel length (12+18) km and int. dia. 8.15 m EBM TBM	IR	Taha Consulting Engineers	Preparation of tender technical documents Cost estimation	2008	Mr. Nowjavan Project manager
Karimkhan Cable Tunnel length of 250 m and final dia. 2.5, Conventional method	IR	Rayab Consulting Company	Complete package of 1st phase and detail design	2006-2007	Mr. Rahbar Project manager
Tehran Shomal Freeway Project (Lot 2) twin motorway tunnels plus passages to service TU and main tunnels; D&B	IR	Taloon construction company	Preparation of tender technical documents in international tender Cost estimation	2006	Mr. Rahimian Managing director
West Water Tunnel (Lot 2); Length 26km and Dia.6.7m D.S.TBM	IR	Rahab Co.	Documentation of TBM procurement procedure 9 Volumes	2005-2006	Mr. Saadi Technical deputy

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Project name and specification	Country	Client	Our Services	Period	Reference
Golab Water tunnel Length 10km and final Dia.3.8m; D.S.TBM	IR	Scetiran Consulting Company	Complete package of Planning and Detail Design; including: <ul style="list-style-type: none">• General method statement• TBM selection• preparation of TBM specifications• Segmental lining design (geometrical and structural design)• Design of site installation and arrangement• Design of all technical services like transport, electricity, ventilation, drainage, water supply• Preliminary design of segment factory• Design of backfill grouting	2005	Mr. Agha Amiri Project manager
Aleppo Water Tunnel, Syria Length 5 km and Dia. 5.5 m S.S.TBM	SY	Sabir International Co.	Consulting in Procurement of an exiting Single Shield TBM and Segment moulds Design of a big open pit for opening of tunnel Design of site installation and arrangements Preparation of site organization chart for TBM tunnelling Complete design of segment factory	2005	Mr. Ebrahimi Managing director
West Water Conveyance Tunnel- Lot 2 Length 26km and Dia.6.7m D.S.TBM	IR	Imensazan Consulting	Design of related structures to TBM start and commissioning	2004	Mr. Taheri Project manager



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Project name and specification	Country	Client	Our Services	Period	Reference
Dam and Powerplant of Roodbar Lorestan	IR	Omran Inst.	Preparation of tender documents for underground works and access roads	2002	Mr. Moosavi Project manager
Loashan Twin Roadway Tunnels each 250 m-Conventional Method	IR	FARBAR Consulting Engineers	Complete Design of 1st & 2nd Phase	2001	Mr. Akbar Project manager
Ghomroud Water Tunnel – Lot 3&4 length 24.5 km and final dia. 3.8m; D.S.TBM	IR	Imensazan Consulting	Report about review of hazards and problems	2003	Mr. Shamsi Project manager

Headrace Tunnel UMA OYA Multipurpose Project

Banderawela, Srilanka

DYRAABA TUNNEL

Project aim

145 mil.cu. of water transfer for irrigation of dried area in S-E of Srilanka

Construction Costs

Construction Headrace TU: approx. USD 135 million

Project Schedule

Design: 2013
Construction: 2014 to now

Project Description, Construction Headrace

Headrace tunnel between Dyraaba dam to valve chamber and powerhouse shaft, circular profile

Length: 15650 m
Curve radius: Straight
Gradient: 1% and 0.2 %

Method of Excavation

Double Shield TBM \varnothing 4.30 m

Geology

Leucocratic Feldspar Gneisses, Charnockitic Gneisses, undifferentiated, Garnet Gneisses, Quartz-rich Gneisses to pure Quartzites, Marbles and Calc-Silicate Gneisses

Max. overburden: 700 m

Our Services

- Detail design, including
- General method statement, TBM selection, preparation of TBM specifications
- Design of site installation and site pavement and cradle for TBM installation in two portals
- Trench design of portal (geometry and stability)
- Engineering geology and geological hazards considering TBM tunnelling
- Haulage system design
- Disassembly detail design
- Design of all technical services like transport, ventilation, drainage, water supply, compressed air
- Segment factory: type selection and mould estimation
- Backfill grouting
- Monitoring plan
- Preparation of detailed list of equipments and consumables

Client and Contact Person

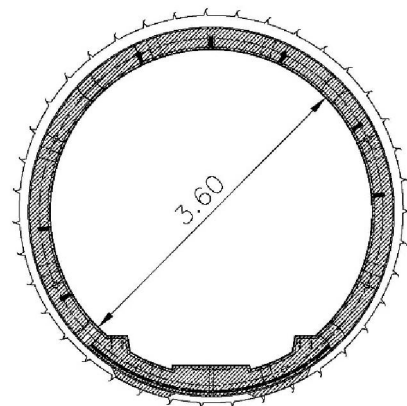
Farab Co. (Energy & Water Projects)
Mr. Mostajer Haghighi (Project Director)
Mr. Foroutan (Head of Engg. Dept.)



Project master plan



Assembly of first TBM at exit of Dyraaba headrace Tunnel



Cross-section of 4-piece honeycomb segmental lining

Water Conveyance Tunnel UMA OYA Multipurpose Project

Banderawela, Srilanka

PUHULPOLA TUNNEL

Master plan aim

145 mil.cu. of water transfer for irrigation of dried area in S-E of Srilanka

Construction Costs

Construction Conveyance TU: approx. USD 30 million

Project Schedule

Design: 2013
Construction: 2013-2016

Project Description, Construction Conveyance

Conveyance tunnel between Puhulpola and Dyraaba RCC dams, horse-shaped profile

Length: 3718 m
Curve radius: Straight
Gradient: 0.07 %

Method of Excavation

Drill & Blast \varnothing 4.50 m

Geology

Methamorphic Gneisses with different percentage of Quartz and Feldspar
Max. overburden: 250 m

Our Services

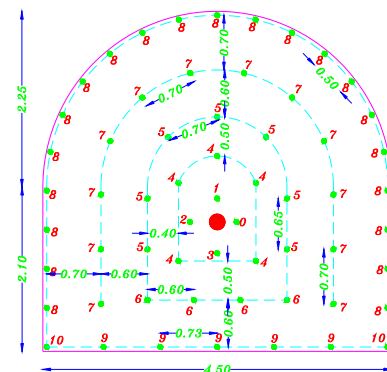
Preparation of D&B method statement
Design of blast-hole arrangement
Method of support installation
Design of technical services during execution;
including:
• Ventilation
• Water supply
• Drainage
• Compressed air supply
Preparation of equipment list
Design of ground monitoring plan

Client and Contact Person

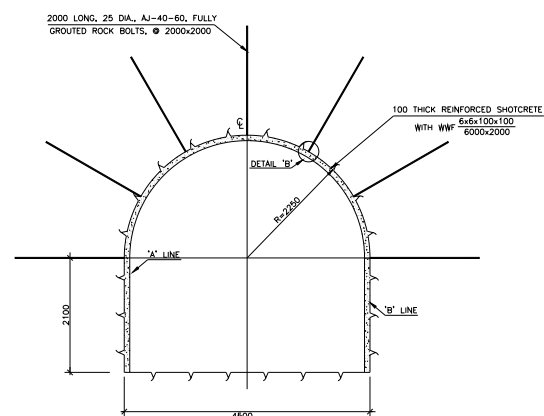
Farab Co. (Energy & Water Projects)
Mr. Mostajer Haghighi (Project Director)
Mr. Foroutan (Head of Engg. Dept.)



Project master plan



Blast-hole arrangement



One of temporary support classes

Water Conveyance Tunnel Ghorveh-Dehgolan Dam and Tunnel Project

Kurdistan, IRAN

Ghorveh-Dehgolan Tunnel – Last Lot

Project aim

The dam has an installed electricity generating capacity of 10 MW. A 175 km (109 mi) canal connecting the dam with towns of Qarveh and Dehlegan will annually supply over 0.25 cubic km (200,000 acre-ft) of water for agricultural purposes to these towns. The tunnel is the last part of this connection.

Construction Costs

Construction Azad TU: approx. USD 35 million

Project Schedule

Design: on going
Construction: 2014 to now

Project Description, Construction Headrace

Azad end tunnel will receive water from pipeline and transfer it into Ghochem dam reservoir, circular profile

Length: 10840 m
Final diameter: 3.00 m
Curve radius: Straight
Gradient: 0.1 %

Method of Excavation

EPB-Hard rock TBM \varnothing 3.70 m

Geology

75%: Sandstone, Conglomerates and Mudstones,
25%: Alternation of Andesites and Andesitic Tuffs,
Grey Argillaceous Limestines, Cretaceous Basement
Rocks

Max. overburden: 300 m

Our Services

Complete package of Planning and detail design, including: Geology, Engineering geology, hydrogeology studies (phase 2) considering TBM tunnelling Method statement, TBM selection, preparation of TBM specifications, Segmental lining design (geometrical and structural design), Design of site installation Design of all technical services like transport, ventilation, drainage, water supply, compressed air Face pressure calculations, Preparation of Risk Management Plan, Backfill grouting, Monitoring plan Segment factory detail design, Ground treatment by foam, Project organization chart, Detailed time plan of design and construction, Waterproofing, HSP (Health and Safety Plan)

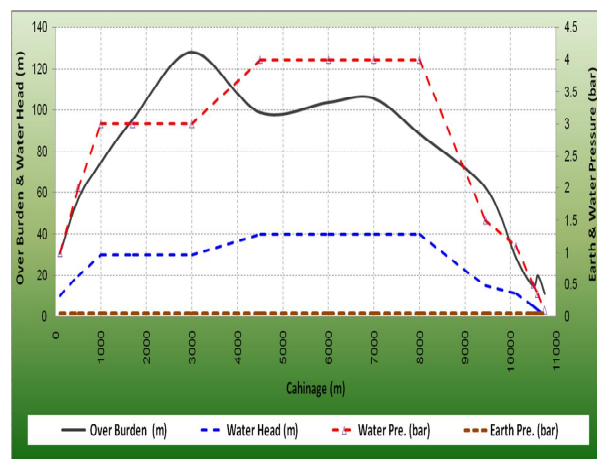
Client and Contact Person

Aban Pajooch Consulting Co.

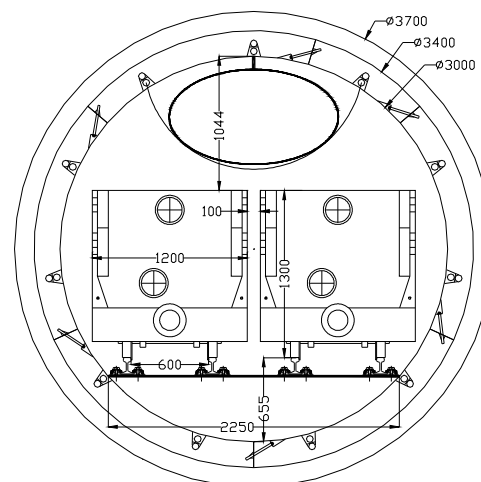
Mr. Golshan (Managing director)

Tunnel Boring Machines	unshielded tunnel boring machines jacket (Cripper TBM)			Double Shield Machine (DSM)			Shield Machine with full-face and without support (SM-V1)			Shield Machine with full-face and compressed air application (SM-V3)			Shield Machine with full-face and fluid support (SM-V4)			Shield Machine with full-face and earth pressure balance support (SM-V5)		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Weight	0.75	0.24	0.00	0.75	0.24	0.00	0.75	0.24	0.00	0.75	0.24	0.00	0.75	0.24	0.00	0.75	0.24	0.00
UCS (MPa)	-	+	0	0	+	0	0	+	0	0	0	0	0	0	0	0	0	0
RQD (%)	0	+	0	0	+	0	0	+	0	0	0	0	0	0	0	0	0	0
RMR	-	0	-	+	+	+	+	+	+	0	0	0	0	0	0	0	0	0
Water inflow per 10 m tunnel [l/min]	+	0	0	+	0	0	+	0	0	0	0	0	0	0	0	0	0	0
Abrasiveness (CAI)	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+
Swelling behaviour	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+	0	+	+
Supporting pressure [bar]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UCS (MPa)	0	1	0.5	0.5	1	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
RQD (%)	0.5	1	0	0.5	1	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	1
RMR	0	0.5	0	1	1	1	1	1	1	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Water inflow per 10 m tunnel [l/min]	1	0.5	0.5	1	0.5	0.5	1	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Abrasiveness (CAI)	1	0.5	1	1	0.5	1	1	0.5	1	0.5	0.5	1	0.5	0.5	1	0.5	0.5	1
Swelling behaviour	0.5	1	1	0.5	1	1	0.5	1	1	0.5	1	1	1	1	0.5	1	1	1
Supporting pressure [bar]	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
Total	0.441			0.649			0.649			0.632			0.625			0.658		

TBM type selection by DAUB, 2010



Summary of face pressure calculations



Control of clearance for rolling stock and duct in switch area

Water Diversion Tunnel CHAMSHIR Project

Kohgiluyeh-boyerahmad, IRAN

Project aim

Providing water for irrigation of about 110 thousand hectares of lands, flow control and regulation of yearly 1.8 billion cubic meters, as well as generation of 482 gw/hr hydro energy

Construction Costs

Construction Headrace TU: approx. USD 300 million

Project Schedule

Design: 2013
Construction: 2013 - 2017

Project Description, Construction Headrace

Water transfer from a regulating dam to powerhouse, circular profile

Length: 7465 m
Curve radius: Straight
Gradient: 0.065 %

Method of Excavation

Single Shield TBM \varnothing 5.30 m

Geology

Carbonate sandstone, silty marl, claystone, siltstone, conglomerate
Max. overburden: 180 m

Our Services

Detail design of new segmental lining for refurbished Herrenknecht TBM; including:

- Segmental type selection (Rhomboidal – 6+0)
- Preparation of detailed geometrical design drawings
- Finalization of geometry with mould supplier
- Tunnel stability analysis and calculation of loads and load combination
- Structural design and analysis and preparation of rebar drawings
- Design of segmental lining based on steel fiber solution

Client and Contact Person

Sabir Co. (General Contractor for Infrastructure Projects)

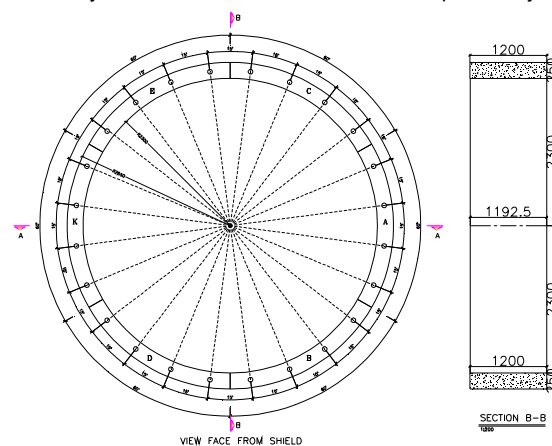
Mr. M. Khosrotash (Project Manager)



Chamshir dam location



Assembly of Herrenknecht Model S-124 in its previous job



Cross-section of 6+0 Rhomboidal segmental lining

Metro Tunnel TEHRAN LINE 3 – LOT 4 Project

Tehran, IRAN

Project description

Line 3: Azadegan depot (South) to Ozgol (North), Total Length (km): 35.5, Tunnel length (km): 24, No. of stations: 30 (underground: 23), No. of trains: 20 trains each 8 wagons, No. of power stations: 2, No. of depot: 2

Construction Costs

Total cost of the line: approx. USD 1'027 million

Project Schedule

Design: from 2009
Construction: 2009-2012

Project Description, Construction Lot 4

Javadieh Station to Nofel Lechateu Shaft, circular profile, Single tube-Double track tunnel

Length: 7000 m
Inner diameter of segmental lining: 8.15 m
Outer diameter: 8.85 m

Method of Excavation

EPB TBM (Herrenknecht) ø 9.19 m
Simultaneous installation of final slab by TBM
Mucking system: Belt conveyor (H+E) + Multi Service Vehicle (MSV made by Technimetal)

Geology

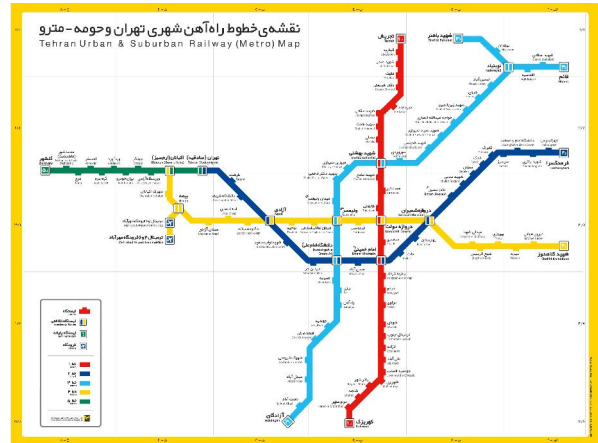
Silt, clay, sand and gravel
Max. overburden: 30 m

Our Services

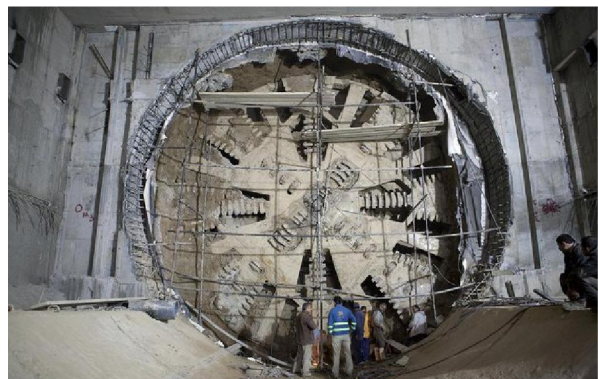
Complete package of Planning and detail design, including:
Method statement, TBM selection, preparation of TBM specifications
Segmental lining design (geometrical and structural design)
Design of site installation
Design of all technical services like transport, electricity, ventilation, drainage, water supply
Face pressure calculations
TBM passing through already-built station
Preparation of Risk Management Plan
Settlement prediction
Backfill grouting
Monitoring plan
TBM Entrance shaft
Segment factory
Site arrangement

Client and Contact Person

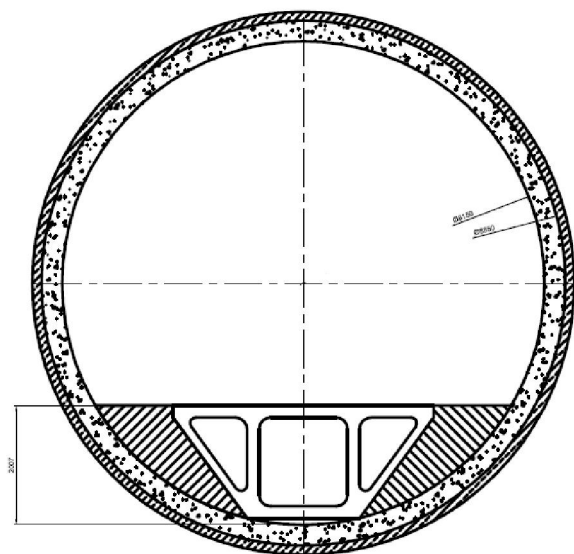
Rah-Tarh Consulting Co.
Mr. Gharebaghi (Member of the board)



Tehran Urban Railway Map – Line 3 shown by light blue



The last breakthrough of the machine



8+1key segment erection+Backfilling+Final slab installation+
Side filling all done by TBM

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