Challenging Projects List 2011

October 2011

S.N.	Project Nr.	Project Name	Criteria							
			2. Geology		3. Tunnel Alignment					
			2.1 Hard rock	2.2 Soft ground	3.1 Length	3.2 Diameter	3.3 Cover	3.4 Inclination	3.5 Radius	4. Technology
1	09-001	Shanghai Yangtze Road Tunnel China		x	x	x	x			
2	09-002	Shanghai Shangzhong Road River-crossing, China		x			x			
3	09-003	Shanghai East Fuxing Road Tunnel, China		x			x			
4	09-004	Uetliberg Railwaytunnel, Zürich, Switzerland				x				x
5	10-001	Trans-Bay Gas Pipeline, Futtsu city, Japan		x	x					
6	11-001	Galleria Sparvo, Castiglione dei Pepoli (BO), Italy				x				X
7	11-002	Dez to Ghomroud Water Conveyance Project, Long Tunnel Lot 1, Iran		xx	x					

The projects are sorted according to the red field indications

CHALLENGING PROJECTS WORLDWIDE

PROJECT Shanghai Yangtze Road Tunnel, China

Project Description

Location	Wuhaogao ~ Changxing Island, Shanghai, China
Usages of the Tunnel	River-crossing, Highway
Year of Construction Start	2004
Year of Const.Completion	2010
Actual Construction Cost	951 Mio.US$

Owner's Detail

Name	Shanghai Yangtze Tunnel & Bridge Development Co., Ltd
Address	No.999 Miaoche Road, Shanghai Jiang Yunsu
Phone	Fax: +86-21-5863 2938
E-Mail	

Technical Data

Length of Tunnel	7.4	km
Excavation diameter	15.43	m
Overburden depth	27	m Max.
	7.2	m Min.
Initial lining	Segmental Lining : sealed	
Thickness	0.65	m
Inner Dia.	13.7	m
Final lining	None	
Thickness		m
Inner Dia		m
Special Lining		
Water Pressure	5.5	bar (Max.at Crown)

TBM Parameters

Type of TBM	Soft Ground Slurry Support	
Length of TBM		m
Weight of TBM		Metric ton
Trailing Gear Length	120	m
Mucking System	Slurry circuit	

Progress Data

Mining Hours/Day		Days/Week	
Average Progress/Calendar Day			m
Average Advance/Cal.Month			m
Peak Advance/Cal.day			m
Peak Advance/Cal.Week			m
Peak Advance/Cal.Month			m

Picture 1:

Picture 2 :

CHALLENGING PROJECTS WORLDWIDE

PROJECT Shanghai Yangtze Road Tunnel, China

Project Geology

gray clayey silt, gray mucky & silty clay, gray muddy clay, gray clay, grass yellow clayey silt, gray sandy silt

Additional Project Information

Prominent Features of the Project:
1. River-crossing tunnel for highway with 6 lanes in bi-direction.
2. Largest slurry balanced shield machine(Φ15.43 m).
3. Non-stop driving distance of 7,472 m.
4. Universal ring, small key segment, oblique bolt connection.
5. High water pressure, 0.55 Mpa.
6. Synchronize the construction of road pavement and tunnel boring.
7. Eight cross passages linking two bore tunnels.

Reference Publications

Criteria for the Challenging Project List

1.	2.2.5 Soft Ground_ Applied face support pressure [≥ 5 bar]	5.5 bar
2.	3.1.2 Tunnel Length_Without intermediate access in soft soil [≥ 5 km]	7.5 km
3.	3.2.2 Tunnel Bored diameter in soft ground [≥ 15 m]	15.43 m

Tunnel excavation with very low cover about 7.2 to 27 m.

Information of the Sender

Name: Dr. Bai Yun
E-Mail:
Company: China Civil Engineering Society

Sent Date: -

PROJECT Shanghai Shangzhong Road River-crossing Tunnel, China

Project Description

Location	Huaxia Road ~ Hongmei Road, Shanghai, China
Usages of the Tunnel	River-crossing, Expressway
Year of Construction Start	2004
Year of Const.Completion	2007
Actual Construction Cost	230 Mio.US$

Owner's Detail

Name	Shanghai Municipal Engineering Administration
Address	No.500 South Pudong Road, Shanghai, China
Phone	fax: +86-21-5888 6262
E-Mail	

Technical Data

Length of Tunnel	1.3	km
Excavation diameter	14.87	m
Overburden depth	33	m Max.
	8.4	m Min.
Initial lining	Segmental Lining : sealed	
Thickness	0.6	m
Inner Dia.	13.3	m
Final lining	None	
Thickness		m
Inner Dia		m
Special Lining		
Water Pressure	6	bar (Max.at Crown)

TBM Parameters

Type of TBM	Soft Ground Slurry Support	
Length of TBM	12.6	m
Weight of TBM	1900	Metric ton
Trailing Gear Length	107	m
Mucking System	Slurry circuit	

Progress Data

Mining Hours/Day	20	Days/Week	
Average Progress/Calendar Day	9	m	
Average Advance/Cal.Month	240	m	
Peak Advance/Cal.day	16	m	
Peak Advance/Cal.Week		m	
Peak Advance/Cal.Month	280	m	

Picture 1: Tunnel view

Picture 2 : Tunnel view

CHALLENGING PROJECTS WORLDWIDE

PROJECT Shanghai Shangzhong Road River-crossing Tunnel, China

Project Geology

gray muddy clay, gray silty clay, dark green silty clay, caesious~yellow sandy silt, grass yellow silty-fine sand

Additional Project Information

Prominent Features of the Project:
1. Shallow overburden, constructed by super-large slurry balanced shield (14.87m dia).
2. Double-deck road tunnel with 8 lanes in bi-direction.
3. Universal segment in staggered joint.
4. No cross passage between two bores, use stairway to link upper and lower decks in single bore instead.

Reference Publications

Criteria for the Challenging Project List

1.	2.2.5 Soft Ground_ Applied face support pressure [≥ 5 bar]	6 bar
2.	3.3.2 Cover above tunnel lining in soft ground, 10% [≤ 0.9 Dia.]	8.4 m
3.	Choose a Criteria for Challenging Project	

Information of the Sender

Name: Dr. Bai Yun
E-Mail:
Company: China Civil Engineering Society

Sent Date: -

CHALLENGING PROJECTS WORLDWIDE

PROJECT Shanghai East Fuxing Road Tunnel, China

Project Description

Location	East Fuxing Road ~ Zhangyang Road, Shanghai, China
Usages of the Tunnel	Urban Road Tunnel
Year of Construction Start	2001
Year of Const.Completion	2004
Actual Construction Cost	258 Mio.US$

Owner's Detail

Name	Shanghai Bridge Construction Administration
Address	No.848 Yun Qiao Road, Shanghai, China
Phone	Fax: +86-21-6439 2955
E-Mail	

Technical Data

Length of Tunnel	1.2	km
Excavation diameter	11.22	m
Overburden depth	28	m Max.
	8	m Min.
Initial lining	Segmental Lining : sealed	
Thickness	0.48	m
Inner Dia.	10.04	m
Final lining	None	
Thickness		m
Inner Dia		m
Special Lining		
Water Pressure	5	bar (Max.at Crown)

TBM Parameters

Type of TBM	Soft Ground Slurry Support	
Length of TBM	11.1	m
Weight of TBM	960	Metric ton
Trailing Gear Length	65	m
Mucking System	Slurry pipe	

Progress Data

Mining Hours/Day		Days/Week	
Average Progress/Calendar Day	8	m	
Average Advance/Cal.Month		m	
Peak Advance/Cal.day	13.5	m	
Peak Advance/Cal.Week		m	
Peak Advance/Cal.Month	315	m	

Picture 1: Upper Deck

Picture 2 : Lower Deck

CHALLENGING PROJECTS WORLDWIDE

PROJECT Shanghai East Fuxing Road Tunnel, China

Project Geology

gray mucky & silty clay, gray muddy clay, gray clay, gray silty clay, dark green ~grass yellow clay, grass yellow sandy silt, grass yellow silty-fine sand, gray sandy silt

Additional Project Information

"Prominent Features of the Project:
1. Shallow overburden, constructed by slurry balanced shield.
2. Two slurry balanced shield machines bored forward at the same direction.
3. Double-deck road tunnel with 6 lanes in bi-direction.
4. A bracket was cast together with the segment, functioning as a support of the upper level deck.
5. Bored by slurry balanced shield machine, lining ring in staggered joint.
6. A total of 4 cross-passages between the two bores."
Given mining hours (4 hr/day) is excluding the lining erection time.

Reference Publications

Criteria for the Challenging Project List

1.	2.2.5 Soft Ground_ Applied face support pressure [≥ 5 bar]	5 bar
2.	3.3.2 Cover above tunnel lining in soft ground, 10% [≤ 0.9 Dia.]	8 m
3.	Choose a Criteria for Challenging Project	

Information of the Sender

Name: Dr. Bai Yun
E-Mail:
Company: China Civil Engineering Society

Sent Date: -

CHALLENGING PROJECTS WORLDWIDE

PROJECT Uetliberg Railway Tunnel, Zürich, Switzerland

Project Description

Location	Zurich, Switzerland
Usages of the Tunnel	Road tunnel, bypass
Year of Construction Start	2001
Year of Const.Completion	2008
Actual Construction Cost	850 Mio.US$

Owner's Detail

Name	Otto Schnelli
Address	Public Works Department, Canton Zurich Walcheplatz 2, POB 8090 Zurich, Switzerland
Phone	
E-Mail	

Technical Data

Length of Tunnel	4.5	km
Excavation diameter	14.4	m
Overburden depth	320	m Max.
		m Min.
Initial lining	Special/Others	
Thickness	0.3	m
Inner Dia.		m
Final lining	In-Situ Concrete	
Thickness	0.4	m
Inner Dia	13	m
Special Lining	Swellex, nets (5-6m), shotcrete	
Water Pressure	0	bar (Max.at Crown)

TBM Parameters

Type of TBM	Special/ Others	
Length of TBM	180	m
Weight of TBM	1000	Metric ton
Trailing Gear Length	160	m
Mucking System	Conveyer Belt	

Progress Data

Mining Hours/Day	16	Days/Week	
Average Progress/Calendar Day	8.5	m	
Average Advance/Cal.Month	150	m	
Peak Advance/Cal.day	16.5	m	
Peak Advance/Cal.Week		m	
Peak Advance/Cal.Month	240	m	

Picture 1:

Picture 2 :

CHALLENGING PROJECTS WORLDWIDE

PROJECT **Uetliberg Railway Tunnel, Zürich, Switzerland**

Project Geology

molasse (sandstone / siltstone / marl, all layers flat bedded)

Additional Project Information

"Prominent Features of the Project- Advantage of ventilation through the before bored pilot tunnel (d = 5.0 m)- Only shotcrete with steelfibres and FRP rock bolts as rock support in pilot tunnel, because TBE(Tunnel Bore Extender) has to excavate this rock support later- Largest cutterhead with undercutting technique in the world- Possibility of boring a non circular profile by using three overcutters- Working against the tensile strength of the rock by using undercutting technique instead of the compressive strength- Need of 50% less energy by using undercutting technique instead of conventional TBM heading- Swellex rock bolts with nets for head protection- Rock support (Swellex) installed within 4 m behind cutterhead- In L1 5 cm of shotcrete, rest in L2- Loosening rock right above the cutterhead because of flat bedded layers of sand-, siltstone and marl; chosen rock support measures were appropriate (flexible)"
Drainage system is used in TBE-molasse section, so ground water pressure could be taken as 0 MPA.

Reference Publications

Criteria for the Challenging Project List

1.	3.2.1 Tunnel bored diameter in hard rock [≥ 14 m or ≤ 1.2 m]	14.4 m
2.	4.0 Technology_Newly developed means and methods of TBM	see below
3.	Choose a Criteria for Challenging Project	

In the Uetliberg molasse section, the tunnel was excavated using a tunnel boring machine (5.0 m diameter) followed by a tunnel bore extender (TBE) which applies undercutting techniques to widen the previously cut pilot tunnel to its full cross-section diameter of 14.20 to 14.40 m.

Information of the Sender

Name	Groupe Specialise pour les Travaux Souterrains
E-Mail	
Company	
Sent Date	-

CHALLENGING PROJECTS WORLDWIDE

PROJECT Trans-Bay Gas Pipeline, Futtsu city, Japan

Project Description

Location	Futtsu city , Japan
Usages of the Tunnel	Gas Pipeline
Year of Construction Start	2003
Year of Const.Completion	2007
Actual Construction Cost	Mio.US$

Owner's Detail

Name	Tokyo Electric Power Company, Inc. (TEPCO)
Address	1-3,Uchisaiwai-cho,1-choume, Chiyoda-ku,Tokyo, 100-8560 ,Japan
Phone	Fax (+81)-3-4216-4369
E-Mail	

Technical Data

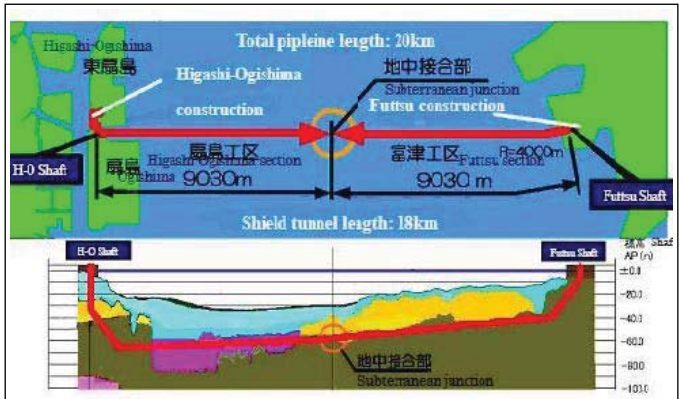
Length of Tunnel	18	km
Excavation diameter	3.62	m
Overburden depth	63.9	m Max.
		m Min.
Initial lining	Segmental Lining : sealed	
Thickness	0.22	m
Inner Dia.	3	m
Final lining	None	
Thickness		m
Inner Dia		m
Special Lining		
Water Pressure	7	bar (Max.at Crown)

TBM Parameters

Type of TBM	Soft Ground Slurry Support	
Length of TBM	12.2	m
Weight of TBM	210	Metric ton
Trailing Gear Length	230	m
Mucking System	Slurry Circuit	

Progress Data

Mining Hours/Day		Days/Week	
Average Progress/Calendar Day	28	m	
Average Advance/Cal.Month	604.9	m	
Peak Advance/Cal.day	48	m	
Peak Advance/Cal.Week		m	
Peak Advance/Cal.Month	830.4	m	



Picture 1: Overview & cross-section of pipeline route

Picture 2 : Tunnel view

CHALLENGING PROJECTS WORLDWIDE

PROJECT Trans-Bay Gas Pipeline, Futtsu city, Japan

Project Geology

The geology is governed by stiff silty and sand mixture, nanagouti jayer diluvium (simousa layer).
Tunnel section has maximum overburden of 35 m from sea bed.

Additional Project Information

In Trans-Bay gas line project, 20 km long tunnel will be constructed under Tokyo Bay. This gas line connects the terminals of Futtsu thermal power stations in Futtsu, Chiba to Higashi-Ogishima Thermal Power Station in Kawasaki. It establish a gas network linking five LNG thermal power stations of Chiba region with three LNG thermal power stations of Kanagawa region, which will improve the reliability of LNG supply.
Excavation is performed from both ends (Futtsu and Higashi-Ogishima) and tunnel will meet under central Tokyo Bay. Length of tunnel (9.03 km) is one of the prominent feature. It is constructed without replacing cutter bit or any other parts.
Use of one-pass boltless joint segments (called, Quick Block Segment) and precast RC slab for invert has resulted short assembly time and better performance rate (> 500 m/month). Direct docking tunnel method is used to connect two alignment under high water pressure (6 bar). Precise tunnel shaft survey and horizontal bore probing (as close as 50 m) help to achieve millimeter precision in aligning shield machines.

Reference Publications

Criteria for the Challenging Project List

1.	3.1.2 Tunnel Length_Without intermediate access in soft soil [≥ 5 km]	9.03 km
2.	2.2.5 Soft Ground_ Applied face support pressure [≥ 5 bar]	7.0 bar
3.	Choose a Criteria for Challenging Project	

Information of the Sender

Name: Satoru Kawauchi
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Company: OBAYASHI CORPORATION
Overseas Business Division

Sent Date: November 9, 2009

CHALLENGING PROJECTS WORLDWIDE

PROJECT Galleria Sparvo, Castiglione dei Pepoli (BO), Italy

Project Description

Location	Galleria Sparvo 40035 Castiglione dei Pepoli (BO)
Usages of the Tunnel	Highway
Year of Construction Start	2011
Year of Const.Completion	2013
Estimated Construction Cost	Mio.US$

Owner's Detail

Name	Autostrade Per l'Italia
Address	via Bergamini 50 00159 Roma Italy
Phone	
E-Mail	

Technical Data

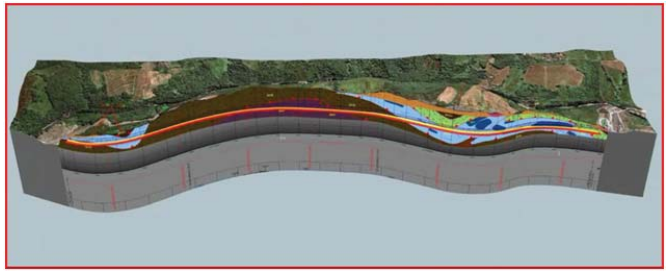
Length of Tunnel	4.9	km
Excavation diameter	15.61	m
Overburden depth	116	m Max.
	7.5	m Min.
Initial lining	Segmental Lining : sealed	
Thickness	0.7	m
Inner Dia.	13.6	m
Final lining	None	
Thickness		m
Inner Dia		m
Special Lining		
Water Pressure	0	bar (Max.at Crown)

TBM Parameters

Type of TBM	Soft Ground EPB Support	
Length of TBM	120	m
Weight of TBM	4500	Metric ton
Trailing Gear Length	107	m
Mucking System	Belt Conveyor	

Progress Data

Mining Hours/Day	24	Days/Week	7
Average Progress/Calendar Day			m
Average Advance/Cal.Month			m
Peak Advance/Cal.day			m
Peak Advance/Cal.Week			m
Peak Advance/Cal.Month			m



Picture 1: Tunnel alignment and geology

Picture 2 : TBM Assembling Area

CHALLENGING PROJECTS WORLDWIDE

PROJECT Galleria Sparvo, Castiglione dei Pepoli (BO), Italy

Project Geology

The tunnel develops inside mountainside interested by various not-active slopes linked together and local active slope of big entity (Sparvo's Slope). The rocky layer never show on the surface because of the detritic layers. The tunnel start in a low leaning mountainside with detritic layer upon the main clay substrate (Argille a Palombini). The tunnell will progress until the sandstone Scabiazza type and heavly fractured Monghidoro sandstone. It follw up inside claysh poligenic conglomerate layer before to come back to the Scabiazza sandstone; after will develop in the main clay substrate caracterized by important Ophiolitic boulders. The tunnel will end in the Monte Venere sandstone and the covering detritic layer.

Additional Project Information

A huge presence in Methane into the geological formation is espected so special technical solution have been applied to the TBM in order to keep the potential incoming methane flow under control and assure Methane-Free zone along the TBM where the personnel is working. Detailed procedures based on Risk Matrix Effect and Risk Analisys have been studied and planned. The excavated tunnel will be managed according to the special regulation of the safety into gassy tunnels well known in Italy and usally applied in case of traditional excavation method.

Due to high risk of sqeezing effect the TBM have been designed with specific conicity and overcutting.For the same reason the TBM has been equipped with high level of thrust force and deviced to guarantee shield lubrication.

Reference Publications

Criteria for the Challenging Project List

1.	3.2.2 Tunnel bored diameter in soft ground [≥ 15 m]	15.615 m
2.	4.0 Technology_Newly developed means and methods of TBM	See below
3.	Choose a criteria for challenging project	

Special solution to reduce the risk of potential explosive atmosfere have been applid. It has been considered also the risk related to a little squeezing behaviour of the rock that in combination with the large diameter became an important task to be managed.

Information of the Sender

Name: Maurizio Marchionni

E-Mail: maurizio.marchionni@pavimental.autostrade.it

Company: Spea - Ingegneria Europea S.p.A.
Via Girolamo Vida, 11
20127 Milano - Italy

Sent Date: May 12, 2011

CHALLENGING PROJECTS WORLDWIDE

PROJECT Dez to Ghomroud Water Conveyance Project, Long Tunnel Lot 1, Iran

Project Description

Location	Southwest Aligodarz City lorestan Province , IRAN
Usages of the Tunnel	Water Conveyance
Year of Construction Start	2006
Year of Const.Completion	2011
Actual Construction Cost	100 Mio.US$

Owner's Detail

Name	Mahabghodss Consulting Engineers
Address	#16 Takharestan St., Vahid Dastgerdy Ave.Tehran,IRAN Post code 1918781185
Phone	+98 21 22902454
E-Mail	Ghomroud 3310@yahoo.com

Technical Data

Length of Tunnel	11.3	km
Excavation diameter	4.7	m
Overburden depth	200	m Max.
	50	m Min.
Initial lining	Segmental Lining : sealed	
Thickness	0.3	m
Inner Dia.	3.8	m
Final lining	None	
Thickness		m
Inner Dia		m
Special Lining		
Water Pressure	5	bar (Max.at Crown)

TBM Parameters

Type of TBM	Soft Ground EPB Support	
Length of TBM	13	m
Weight of TBM	300	Metric ton
Trailing Gear Length	120	m
Mucking System	Rolling Stuck	

Progress Data

Mining Hours/Day	8	Days/Week	6
Average Progress/Calendar Day	7.5	m	
Average Advance/Cal.Month	220	m	
Peak Advance/Cal.day	26	m	
Peak Advance/Cal.Week	110	m	
Peak Advance/Cal.Month	401	m	

Picture 1: EPB TBM for lot 1

Picture 2 : lot1 tunnel lining

PROJECT Dez to Ghomroud Water Conveyance Project, Long Tunnel Lot 1, Iran

Project Geology

Fine and course alluvium, Alternation of schist& slate metavolcanic and quartz

Additional Project Information

Anouj Water Conveyance Long Tunnel Lots 1 is a part of Dez to Ghomroud Water Conveyance Project that transfers water from upper DEZ watershed to the central plain in IRAN. As the main part of tunnel compose the fine & course alluviums, EPB-TBM has been used.

Reference Publications

Several papers in national work shops about the mechanized tunneling with TBM have been presented
1. Dewatering in mechanized tunneling with negative slope, case study Anouj Water Conveyance Long Tunnel Lot 1
2. Investigating the EPB -TBM performance, case study Anouj Water Conveyance Long Tunnel Lot 1
3. Contact grouting in soft ground

Criteria for the Challenging Project List

1.	3.1.2 Tunnel length_Without intermediate access in soft soil [≥ 5 km]	11 km
2.	2.2.2 Soft ground_Water permeability_EPB [K ≥ 10-3 m/s]	10-3 m/s
3.	2.2.5 Soft ground_ Applied face support pressure [≥ 5 bar]	5 bar

Use several water collection sumps and dewatering pump system
Sealing the segment lining with high pressure gaskets and contact grouting with bentonite- cement mortar synchronized with boring

Information of the Sender

Name: Khosravi Hassan
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Company: Mahabghodss Consulting Engineers

Sent Date: May 14, 2011