

REFERENCE LIST OF DRILLING BY RAISE BOREING MACHINE AND DIRECTIONAL STEERING TOOL Z B E 3000/4000

Project	Depth (m)	Inclination (degree)	Diameter (m)	Construction Time (Days)	Year of work	Contractor	Rock type	Divergency in Total (m)
Pressure Shaft	584	90	0,215	86	1988	OBB - Uttendorf (AUSTRIA)	Praisinit Quarz Phylit	0,99
Installation Shaft	98	90	0,215	12	1988	Gasterminal Sunsvall (SWEDEN)	Granit with Quarz	0,05
Surge Chamber	105	90	0,215	15	1989	J.V. Hintermuhr (AUSTRIA)	Phylit	0,02
Pendulum - plumb - drilling	45	90	0,31	12	1989	Kolnbreinsperre (AUSTRIA)	Gneis	0,05
	54	90	0,31	8	1989			0,02
	55	90	0,31	9	1989			0,03
Pressure Shaft	225	90	0,215	25	1990	J.V. Sungai Piah Project (MALAYSIA)	Granite	0,04
Ventilation Shaft	327	90	0,215	36	1990		Micaschist	0,45
Pressure Shaft	360	90	0,215	42	1990		Micaschist	0,3
Starcaise Shaft	42	90	0,215	18	1990	Silvretta Dam (AUSTRIA)	Concrete	0,02
	55	90	0,215	11	1990			0,28
Pressure Shaft	150	90	0,215	14	1991	J.V. Warmatsgund (GERMANY)	Dolomit	0,37
Pendulum - plumb - drilling	36	90	0,31	3	1991	SSW Salzburg (AUSTRIA)	Concrete	0,01
Ventilation Shaft	310	90	0,215	33	1991	J.V. ALMR Delemont (SWISS)	Limestone Marl	0,2
Cables/lift Upper	254	90	0,215	14	1992	Hydro-Electric S.Giacomo al Vomano (I)	Limestone and Marl	0,07
Cables/lift Lower	308	90	0,215	17	1992			0,2
Penstock Shaft Upper	308,5	90	0,215	10	1992			0,07
Penstock Shaft Lower	302,5	90	0,215	18	1992			(0,6)*-0,05 *last 12 m. only
Landfall f.Oil-Pipeline	300	19-30	0,311	45	1994	Statoil Project (NORWAY)	Granite	0,1
Pressure Shaft	225	45	0,311	7	1995	Hydro-Electric Pejo (ITALY)	Bad Schist	0,15
	250	43	0,311	7	1998			0,34
Penstock Shaft	280	90	0,311	11	1999	Hydro-Electric Susa (ITALY)	Sist	3,2

TOTAL DRILLED m. 4674

REFERENCE LIST OF PILOT HOLES VERTICAL AND INCLINED DRILLED BY RAISE BORING MACHINE WITH THE EMPLOY OF DIRECTIONAL STEERING TOOL "Z B E 3000/4000" AND "RVDS"

Project	Depth (m)	Inclin. (degree)	Dia		Drilling (Days)	Year work	Contractor	Rock type	Divergency	
			(m)	(inc)					(m)	(%)
Cables/lift Upper	254	90°	0,215	8 1/2"	14	1992	Hydro-Electric S.Giacomo al Vomano (ITALY)	Limestone and Marl *last 12 m. only	0,07	0,028%
Cables/lift Lower	308	90°	0,215	8 1/2"	17	1992			0,2	0,065%
Penstock Shaft Upper	308,5	90°	0,215	8 1/2"	10	1992			0,07	0,023%
Penstock Shaft Lower	302,5	90°	0,215	8 1/2"	18	1992			(0,6)*÷0,05	(0,2)÷0,016
Pressure Shaft upper	225	45°	0,311	12 1/4"	7	1995	Hydro-Electric Pejo (ITALY)	Bad Schist	0,15	0,067%
Pressure Shaft lower	250	43°	0,311	12 1/4"	7	1998			0,34	0,136%
Penstock Shaft	280	90°	0,311	12 1/4"	11	1999	Hydro-Electric Susa (ITALY)	Schist	3,2	1,143%
Ventilation Shaft	335	90°	0,349	13 3/4"	21	2000	ATF LOTCHBERG for BLS Alptransit AG Ferden (CH)	Gneiss	0,47	0,140%
Surge shaft	402	90°	0,349	13 3/4"	12	2001	Empr. VENDA NOVA (Portugal)	Granite	0,12	0,030%
Penstock Shaft	580	90°	0,311	12 1/4"	58	2007	Hydro- Brissogne- F.LLI RONC SRL (ITALY)	Misachist	0,18	0,031%
Penstock Shaft	220	90°	0,311	12 1/4"	17	2007	Hydro- Val Passiria - INGENIEURBURO (ITALY)	Schist	0,06	0,027%
Cables & Ventilation	170	90°	0,349	13 3/4"	23	2008	Hydro- Picote - UTE MSF - OPCA (PORTUGAL)	Granite	0,04	0,024%
Surge Chamber Shaft	70	90°	0,311	12 1/4"	12	2009	Amenagement du Rizzanese - Corse - BEC FRERES (FRANCE)	Diorite-Granodiorite	0,002	0,003%

TOTAL DRILLED m. 3705

PROJECT	Hydroelectric power plant Penstock shaft Timpagrande (CZ) ITALY Year: 1976	PURCHASER	E.N.E.L.
		CONTRACTOR	DE LIETO S.p.A.
		ROCK TYPE	DEGRADED GRANITE
WORKS DESCRIPTION			
		<p>- Sinking vertical shaft 124 m deep from Ø 2,13 m, previously reamed by Raise Boring Machine, to diameter Ø 6,50 m</p> <p style="text-align: right;">TOT. MINED ROCK cu.m. 3.900</p>	
WORKING SYSTEM			
		<ul style="list-style-type: none"> - Drilling, blasting, scaling and mucking from the top to the bottom and evacuation through Raise Borer hole by air-water lance; - Laying electro-welded net, steel centerings, rock bolts and shotcrete; - Concreting by self-lifting form 	
EQUIPEMENTS USED			
		<ul style="list-style-type: none"> - Stationary gantry crane with two winches: one for goods and one for passengers lift; - Jumbo drill rig with two booms and air rock drill; - Dry shotcreting machine. 	

PROJECT	Hydroelectric power plant - Concrete Dam Inlet sluice shaft Ridracoli (FO) - ITALY Year: 1978	PURCHASER	CONSORZIO ACQUE NERE PER PROVINCE DI FORLI' - RAVENNA
		CONTRACTOR	COGEFAR - LODIGIANI - C.M.C.
		ROCK TYPE	MARL - SANDSTONE
WORKS DESCRIPTION			
		<p>- Sinking vertical shaft 93 m deep from Ø 2,13 m, previously reamed by Raise Boring Machine, to diameter Ø 6,00 m, starting from the tunnel and cutting the raise boring hole to 10 m below the top.</p> <p style="text-align: right;">TOT. MINED ROCK cu.m. 2.051</p>	
WORKING SYSTEM			
		<ul style="list-style-type: none"> - Drilling, blasting, scaling and mucking from the top to the bottom and evacuation through Raise Borer hole by air-water lance; - Laying electro-welded net, steel centerings, rock bolts and shotcrete; 	
EQUIPEMENTS USED			
		<ul style="list-style-type: none"> - Stationary gantry crane with two winches: one for goods and one for passengers lift; - Jumbo drill rig with two booms and air rock drill. 	

PROJECT	Hydraulic plant - Dam of Hammam Meskoutine Penstock and spillway shafts Guelma - ALGERIA Year: 1982	PURCHASER	MINISTERY OF WATER
		CONTRACTOR	COGEFAR - ITALSTRADE - RECCHI
		ROCK TYPE	MARL - SANDSTONE
WORKS DESCRIPTION		<ul style="list-style-type: none"> - <u>Penstock intake</u> Sinking vertical shaft 40 m deep from Ø 2,44 m, previously reamed by Raise Boring Machine, to diameter Ø 5,00 m. - <u>Two open spillway shafts</u> Sinking inclined shafts, previously reamed to Ø 2,44 m by Raise Borer Machine, starting vertically from the top with a mean diameter of 16 m and arriving to the bottom with a diameter of 12 m and an inclination of 50° (following the shape of a horn). Mean length 70 m. <p style="text-align: right;">TOT. MINED ROCK cu.m. 19.396</p>	
WORKING SYSTEM		<ul style="list-style-type: none"> - From the top to the bottom drilling, blasting, scaling, mucking with excavator; - Laying steel centerings, electro-welded net , rock bolts and shotcrete (first lining); steel centerings, armour-plating and concreting (second lining). 	
EQUIPEMENTS USED		<ul style="list-style-type: none"> - Stationary tower jib crane, crawler air rock drill, excavator, welding machine, wet shotcreting machine. 	

PROJECT	Hydroelectric power plant Surge shafts Presenzano (CE)-ITALY Year: 1985	PURCHASER	E.N.E.L.
		CONTRACTOR	DE LIETO S.p.A.
		ROCK TYPE	LIMESTONE
WORKS DESCRIPTION			
		<p>- Sinking vertical shaft 50 m deep from Ø 2,13 m, previously reamed by Raise Boring Machine, to diameter Ø 16,00 m</p> <p style="text-align: right;">TOT. MINED ROCK cu.m. 19.750</p>	
WORKING SYSTEM			
		<p>- From the top to the bottom drilling, blasting, scaling, mucking with excavator through Raise Borer hole;</p> <p>- Laying electro-welded net, steel centerings, rock bolts and shotcreting.</p>	
EQUIPEMENTS USED			
		<p>- Overhead travelling gantry crane 14 tons capacity, 17 m rail gauge;</p> <p>- Air crawler rock drill;</p> <p>- Excavator;</p> <p>- Dry shotcreting machine.</p>	

PROJECT	Hydroelectric power plant Various shafts	PURCHASER	TANESCO
	M'tera - TANZANIA	CONTRACTOR	COGEFAR S.p.A.
	Year: 1985	ROCK TYPE	HARD GRANITE
WORKS DESCRIPTION			
<ul style="list-style-type: none"> - <u>Penstock shafts</u>: Sinking two vertical shafts 107 m deep from Ø 1,30 m, previously reamed by Raise Boring Machine, to three different diameters; from top: 1) final diameter Ø 5,80 m, length 21 m; 2) final diameter Ø 7,40 m, length 9,50 m; 3) final diameter Ø 4,00 m, length 76,5 m. TOT. MINED ROCK cu.m. 4.048 - <u>Cables, lift shaft</u>: Sinking vertical shaft 115 m deep from Ø 1,30 m, previously reamed by Raise Boring Machine, to rectangular section of 3,60 x 2,40 m. TOT. MINED ROCK cu.m. 1.588 - <u>Weeled gate shaft</u>: Sinking vertical shaft 23 m deep from two holes with diameters of Ø 1,30 m and Ø 2,44 m, previously reamed by Raise Boring Machine, to rectangular section of 13,60 x 2,60 m. TOT. MINED ROCK cu.m. 834 - <u>Draft shafts</u>: Underground sinking of two vertical shafts 33 m deep from Ø 1,30 m, previously reamed by Raise Boring Machine, to an elliptical section of 19,20 sq.m. TOT. MINED ROCK cu.m. 1.220 - <u>Surge shafts</u>: Underground sinking of two vertical shafts 15 m deep from Ø 2,44 m, previously reamed by Raise Boring Machine, to Ø 8,00 m. TOT. MINED ROCK cu.m. 1.550 - <u>Intake tunnel 1 and 2</u>: Tunnelling between two parallel shafts. TOT. MINED ROCK cu.m. 1.538 			
WORKING SYSTEM			
<ul style="list-style-type: none"> - From the top to the bottom drilling, blasting, scaling, mucking with excavator through Raise Borer hole; - Laying electro-welded net, steel centerings, rock bolts and shotcreting. 			
EQUIPEMENTS USED			
<ul style="list-style-type: none"> - Overhead travelling gantry crane 4 tons capacity, 6 m rail gauge, with two electric winches: one for goods and one for passengers lift; - Jumbo drill rig with two booms and air rock drills; - Air-crawler rock drill and truck loader. 			

PROJECT	Hydroelectric power plant Various shafts Alto Lindoso PORTUGAL Year: 1988/89	PURCHASER	ELECTRICIDADE DE PORTUGAL
		CONTRACTOR	TORNO S.p.A.
		ROCK TYPE	HARD GRANITE
WORKS DESCRIPTION			
<ul style="list-style-type: none"> - <u>Cables, lift, ventilation shaft</u> Sinking vertical shaft 335 m deep from Ø 1,80 m, previously reamed by Raise Boring Machine, to diameter Ø 7,80 m TOT. MINED ROCK cu.m. 16.200 - <u>Penstock shaft</u> Sinking vertical shaft 330 m deep from Ø 1,80 m, previously reamed by Raise Boring Machine, to diameter Ø 7,00 m TOT. MINED ROCK cu.m. 26.300 - <u>Cooling room, drainage tunnel, penstock intakes</u> Tunnelling between shafts TOT. MINED ROCK cu.m. 1.500 			
WORKING SYSTEM			
<ul style="list-style-type: none"> - From the top to the bottom drilling, blasting, scaling, mucking through Raise Borer hole by specific excavator; - Laying electro-welded net and bolts where necessary; shotcreting all surfaces. 			
EQUIPEMENTS USED			
<ul style="list-style-type: none"> - Overhead travelling gantry crane 8 tons capacity, 7 m rail gauge with two electric radio remote controlled winches: one for goods and one for personnel; - Electro-hydraulic jumbo drill rig with two independent booms and hydraulic rock drills; - Two excavators; - Standard shotcreting pump and in-shaft pump for particular addittivate shotcrete; - Electric hoist for power cable; - Containerised workshop. 			

PROJECT	Locarno underground by-pass road Ventilation shaft	PURCHASER	DIPARTIMENTO PUBBLICHE COSTRUZIONI TICINO
	Locarno-SWITZERLAND	CONTRACTOR	CONSORZIO GALLERIA DI LOCARNO
	Year:	ROCK TYPE	SCHIST - GNEISS
WORKS DESCRIPTION			
<ul style="list-style-type: none"> - Sinking vertical shaft 370 m deep from Ø 2,44 m, previously reamed by Raise Boring Machine, to final diameter Ø 6,60 m TOT. MINED ROCK cu.m. 11.000 			
WORKING SYSTEM			
<ul style="list-style-type: none"> - Drilling, blasting, scaling and mucking through Raise Borer hole by specific drilling machine and excavator from the top to the bottom; - Laying electro-welded net and bolts; shotcreting all surfaces; - Waterproofing the wall by plastic covering; - Final concreting by self-lifting slip form. 			
EQUIPEMENTS USED			
<ul style="list-style-type: none"> - Overhead travelling gantry crane 6+8 tons capacity, 7 m rail gauge with four hydraulic radio controlled winches: three for working platform and one for personnel; - Electro-hydraulic jumbo-platform drill rig with two independent booms and hydraulic rock drills; - Hydraulic excavator; - Shotcreting pump and equipments for wet shotcrete; - Electric hoist for in-shaft movable power cable; - Containerised workshop. 			

PROJECT	Cels Tunnel - Frejus highway Ventilation shaft	PURCHASER	S.I.T.A.F. S.p.A.
	Val di Susa (TO) - ITALY	CONTRACTOR	INC. COSTRUZIONI GENERALI S.p.A.
	Year: 1991	ROCK TYPE	SCHIST
WORKS DESCRIPTION			
<ul style="list-style-type: none"> - Sinking vertical shaft 311 m deep from Ø 2,44 m, previously reamed by Raise Boring Machine, to final diameter Ø 11,00 m TOT. MINED ROCK cu.m. 28.100 			
WORKING SYSTEM			
<ul style="list-style-type: none"> - Drilling, blasting, scaling and mucking through Raise Borer hole by specific drilling machine and excavator from the top to the bottom; - Lining the wall by steel rib and electro-welded net bolted to the rock and shotcreting all surfaces; - Final concreting by self-lifting slip form. 			
EQUIPEMENTS USED			
<ul style="list-style-type: none"> - Overhead travelling gantry crane 8 tons capacity, 7 m rail gauge with two electric radio remote controlled winches: one for goods and one for personnel; - Electro-hydraulic jumbo drill rig with one boom and hydraulic rock drill; - Two excavators; - Shotcreting pump and equipments for wet shotcrete; - Electric hoist for power cable; - Containerised workshop. 			

PROJECT	Hydroelectric Power Plant Surge and reversible machine shafts S. Giacomo al Vomano (TE) - ITALY Year: 1992/94	PURCHASER	E.N.E.L.
		CONTRACTOR	CONSORZIO S. GIACOMO
		ROCK TYPE	MARL AND LIMESTONE
WORKS DESCRIPTION			
<ul style="list-style-type: none"> - <u>Surge shaft</u> Sinking vertical shaft 95 m deep from Ø 2,44 m, previously reamed by Raise Boring Machine, to final diameter Ø 20 m for the first 70 m, then to Ø 8 m for the last 25 m. TOT. MINED ROCK cu.m. 23.250 - <u>Reversible machine shaft</u> From underground Power House, sinking vertical shaft 55 m deep from Ø 1,84 m, previously reamed by Raise Boring Machine, to final diameter Ø 16,60 m TOT. MINED ROCK cu.m. 13.680 			
WORKING SYSTEM			
<ul style="list-style-type: none"> - Drilling, blasting, scaling and mucking through Raise Borer hole by excavator from the top to the bottom; - Layering steel centerings, rock bolts, shotcreting, scaffolding and concreting. 			
EQUIPEMENTS USED			
<ul style="list-style-type: none"> - Overhead travelling gantry crane 24 tons capacity, 20 m rail gauge; - Air crawler rock drill and hydraulic jumbo with one boom; - Excavators with bucket and hydraulic hammer; - Wet shotcreting pump. 			

PROJECT	Hydroelectric Power Plant Cable/lift and penstock shafts S. Giacomo al Vomano (TE) - ITALY Year: 1992/94	PURCHASER	E.N.E.L.
		CONTRACTOR	CONSORZIO S. GIACOMO
		ROCK TYPE	MARL AND LIMESTONE
WORKS DESCRIPTION			
<ul style="list-style-type: none"> - <u>Cable/lift shaft</u> Sinking vertical shaft 610 m deep in two sections of 308+302 m from Ø 1,84 m, previously reamed by Raise Boring Machine, to final diameter Ø 5,95. TOT. MINED ROCK cu.m. 15.500 - <u>Penstock shaft</u> Sinking vertical shaft 566 m deep in two sections of 254+312 m from Ø 1,84 m, previously reamed by Raise Boring Machine, to final diameter Ø 5,95. TOT. MINED ROCK cu.m. 14.400 			
WORKING SYSTEM			
<ul style="list-style-type: none"> - Down hole reaming to final diameter; - Shotcreting and lining the wall by 14 steel panels per meter, each bolted to the rock by resined steel anchor bolts 2,5 m long. 			
EQUIPEMENTS USED			
<ul style="list-style-type: none"> - Raise Boring Machine 83 RM-DC with Ø12 7/8" drill pipes and Ø 5,95 m down reamer 370 tons heavy; - Two levels platform equipped at the upper level with drilling and bolting machine and at the lower level with shotcreting machine, travelling into the shaft by a couple of electric on-board radio controlled hoists; - Elevator for goods and personnel travelling into the shaft at variable speed 0÷60 m/min by an electro-hydraulic on-board radio controlled hoist; - Steel structures to support the equipments in shaft and to cover the shaft; - Electric hoist for electric multipolar power cable. 			

PROJECT	New development of limestone quarry	PURCHASER	CEMENTERIE SICILIANE S.p.A.
	ISOLA DELLE FEMMINE (PA) - ITALY	CONTRACTOR	CEMENTERIE SICILIANE S.p.A.
	Year: 1995	ROCK TYPE	LIMESTONE
WORKS DESCRIPTION			
		<p>- Sinking vertical shaft 50 m deep from Ø 3,68, previously reamed by Raise Boring Equipment, to final Ø 8 m.</p> <p style="text-align: right;">TOT. MINED ROCK cu.m. 2.600</p>	
WORKING SYSTEM			
		<ul style="list-style-type: none"> - Drilling and blasting, scaling, mucking through the Raise Borer hole by specific jumbo drilling machine and excavator. - Lining the wall by rock bolts and shotcreting all surfaces. 	
EQUIPEMENTS USED			
		<ul style="list-style-type: none"> - Overhead travelling gantry crane 8 tons capacity, 7 m rail gauge with four hydraulic radio remote controlled winches: one for goods and one for personnel; - Electro-hydraulic jumbo drilling machine with one boom and hydraulic rock drill; - Excavator; - Shotcreting pump for wet shotcrete; - Electric hoist for power cable; - Containerised workshop. 	

PROJECT	Hydroelectric Plant Various shafts	PURCHASER	E.N.E.L. VENEZIA
	Cogolo (TN) - ITALY	CONTRACTOR	DE LIETO S.p.A.
	Year: 1994/95	ROCK TYPE	SCHIST
WORKS DESCRIPTION			
<ul style="list-style-type: none"> - <u>Penstock shaft:</u> Lining all the length of 45° inclined shaft 225 m deep, previously reamed to Ø 2,13 m, by spraying wet premixed and poli propilene fibres reinforced concrete and then laying steel panels, each bolted to the rock. - <u>Surge shaft:</u> Lining all the length of 84 m deep vertical shaft, reamed by Raise Boring Equipment in two different size (diameter Ø 3,13 m for the upper 49 m and diameter Ø 6,12 m for the last 35 m), by spraying wet premixed and polipropilene fibres reinforced concrete and then laying steel panels, each bolted to the rock. 			
WORKING SYSTEM			
<ul style="list-style-type: none"> - From the top to the bottom laying manually steel panels to the wall from a working platform, bolting each one to the rock and spraying wet shotcrete. 			
EQUIPEMENTS USED			
<ul style="list-style-type: none"> - Radio remote controlled hydraulic hoist 6 tons lifting capacity, variable speed; - Railway steel platform; - Special platforms that allow to work in Ø 6 m shaft arriving from Ø 3 m shaft; - Wet shotcreting pump; - Hand all powered drilling machine. 			

PROJECT	Tunnel de Somport Ventilation shaft	PURCHASER	MINISTERIO DE FOMENTO
	Jaca - SPAIN	CONTRACTOR	ERSOM - UTE
	Year: 1996	ROCK TYPE	LIMESTONE - MARL
WORKS DESCRIPTION			
<ul style="list-style-type: none"> - Sinking vertical shaft 213 m deep from Ø 4,78 m, already reamed by Raise Boring Equipment, to Ø 7 m final excavation; - Waterproofing; - Final concreting. 		TOT. MINED ROCK cu.m. 4.373	
WORKING SYSTEM			
<ul style="list-style-type: none"> - Drilling, blasting, scaling, mucking through Raise Borer hole by specific drilling machine and excavator from the top to the bottom; - Lining the wall by bolting, wire net and shotcreting all surfaces; - Waterproofing the wall by plastic covering; - Final concrete lining by self-lifting slip form. 			
EQUIPEMENTS USED			
<ul style="list-style-type: none"> - Overhead travelling gantry crane, 7 m rail gauge with four hydraulic radio remote controlled winches: three for working platform with total lifting capacity of 11 tons and one for personnel lift with 6 tons capacity; - Electro-hydraulic jumbo-platform drilling rig with two independent booms and hydraulics rock drills and hydraulic excavator; - Shotcreting pump and equipments for wet shotcrete; - Electric hoist for in-shaft movable power cable; - Containerised workshop; - Self-lifting slip form. 			

PROJECT	New underground Railway Station Ventilation shafts	PURCHASER	FERROVIE DELLO STATO
	S. Remo (IM) - ITALY	CONTRACTOR	FIORONI S.p.A.
	Year: 1997	ROCK TYPE	SANDSTONE - MARL
WORKS DESCRIPTION			
		<ul style="list-style-type: none"> - Shotcreting, steel lining and bolting two vertical shafts Ø 4,07 m, 40 m and 80 m deep; - Final concrete lining. 	
WORKING SYSTEM			
		<ul style="list-style-type: none"> - From the top to the bottom shotcreting and steel lining the walls; - From the bottom to the top concreting to final diameter Ø 3,40 m. 	
EQUIPEMENTS USED			
		<ul style="list-style-type: none"> - Radio remote controlled hydraulic hoist 6 tons lifting capacity; - Hanging steel platform; - Wet shotcreting pump; - Hand drilling machine; - Self-lifting slip form. 	

PROJECT	Hydraulic plant "Chiascio" Airing hole Pianello (PG) - ITALY Year: 1997	PURCHASER	ENTE IRRIGUO UMBRO - TOSCANO
		CONTRACTOR	DE LIETO S.p.A.
		ROCK TYPE	MARL - SANDSTONE
WORKS DESCRIPTION			
<ul style="list-style-type: none"> - Lining all the length of 80 m deep vertical shaft, already reamed by Raise Boring Equipment to final size of Ø 2,44 m, by laying steel panels, bolting each one to the wall and spraying wet shotcrete. 			
WORKING SYSTEM			
<ul style="list-style-type: none"> - From the top to the bottom bolting the rock, laying the panels and spraying wet shotcrete. 			
EQUIPEMENTS USED			
<ul style="list-style-type: none"> - Radio remote controlled hydraulic hoist 6 tons lifting capacity, variable speed; - Hanging steel platform; - Special platforms that allow to work in Ø 2,44 m vertical shaft; - Wet shotcreting pump; - Hand drilling machine. 			

PROJECT	Talc Mine Ventilation and safety exit shaft Prali (TO) - ITALY Year: 1998/99	PURCHASER	LUZENAC VALCHISONE S.p.A.
		CONTRACTOR	LUZENAC VALCHISONE S.p.A.
		ROCK TYPE	QUARTZ - MICASCHIST
WORKS DESCRIPTION			
		<ul style="list-style-type: none"> - Lining all the length of vertical shaft 276 m deep, already reamed to Ø 3,05 m, by laying steel panels, each one bolted to the rock wall, shotcreting wet concrete and installing steel structure for safety exit. 	
WORKING SYSTEM			
		<ul style="list-style-type: none"> - From the top to the bottom laying manually the steel panels to the wall from a working platform, bolting each one to the rock, spraying wet shotcrete and lifting and transporting the steel structure into the shaft. 	
EQUIPEMENTS USED			
		<ul style="list-style-type: none"> - Radio remote controlled hydraulic hoist 6 ton. lifting capacity, variable speed; - Hanging steel platform; - Special platforms that allow to work in Ø 3,05 m vertical shaft; - Wet shotcreting pump; - Hand drilling machine. 	

PROJECT	Hydroelectric power plant Discharge and penstock shaft Pieve Vergonte (VB) ITALY Year: 1998/99	PURCHASER	E.N.E.L. TORINO
		CONTRACTOR	DE LIETO S.p.A.
		ROCK TYPE	GNEISS
WORKS DESCRIPTION			
<ul style="list-style-type: none"> - <u>Discharge shaft:</u> Lining all the length of 396 m deep 45° inclined shaft, already reamed by Raise Boring Equipment, to final size of Ø 3,68 m, by bolting the wall and laying wire net and spraying wet shotcrete. Installation of safety steel stairs - <u>Penstock shaft:</u> Lining all the length of 370 m deep 45° inclined shaft, already reamed by Raise Boring Equipment, to final size of Ø 3,05 m, by bolting the wall and laying wire net and spraying wet shotcrete. 			
WORKING SYSTEM			
<ul style="list-style-type: none"> - From the top to the bottom bolting the rock, laying wire net and spraying wet shotcrete. - Lifting and transporting the steel structure into the shaft. 			
EQUIPEMENTS USED			
<ul style="list-style-type: none"> - Radio remote controlled hydraulic hoist 6 tons lifting capacity, variable speed; - Railway steel platform; - Special platforms that allow to work in Ø 3,05 m and Ø 3,68 m inclined shaft; - Wet shotcreting pump; - Hand drilling machine. 			

PROJECT	Railway Tunnel Bologna-Firenze "TAV" Ventilation shaft Loc. Poggiolo (BO) ITALY Year: 1999	PURCHASER	FERROVIE DELLO STATO
		CONTRACTOR	C.A.V.E.T.
		ROCK TYPE	SANDSTONE - MARL
WORKS DESCRIPTION			
		<ul style="list-style-type: none"> - Lining all the length of 55 m deep 73,8° inclined shaft, already reamed by Raise Boring Equipment, to final size of Ø 3,05 m, by laying steel panels, each bolted to the rock wall, and spraying wet shotcrete. 	
WORKING SYSTEM			
		<ul style="list-style-type: none"> - From the top to the bottom by laying manually the steel panels to the wall from a working platform, bolting each one to the rock and spraying wet shotcrete. 	
EQUIPEMENTS USED			
		<ul style="list-style-type: none"> - Radio remote controlled hydraulic hoist 6 tons lifting capacity, variable speed; - Railway steel platform; - Special platforms that allow to work in Ø 3,05 m inclined shaft; - Wet shotcreting pump; - Hand drilling machine. 	

PROJECT	Lötschberg - Basisline Ventilation shaft Goppenstein - Ferden SWITZERLAND Year: 2000	PURCHASER	B.L.S. AlpTransit AG
		CONTRACTOR	ATF - Arge Fensterstollen Ferden
		ROCK TYPE	SERITICGNEISS AND SCHIST
WORKS DESCRIPTION		<ul style="list-style-type: none"> - Sinking the upper 144 m of the shaft by drilling and blasting from Ø 2,44 to final Ø 5 m diameter; - Lining the lower 197 m Ø 4,38 m of the shaft, already reamed by Raise Boring Equipment, by bolting, laying wire net and shotcreting. <p style="text-align: right;">TOT. MINED ROCK cu.m. 4.373</p>	
WORKING SYSTEM		<ul style="list-style-type: none"> - Drilling and blasting, scaling, mucking through Raise Borer hole by specific drilling machine and excavator from the top to the bottom; - Lining the wall by bolting, wire net and shotcreting all surfaces; - Waterproofing the wall by plastic covering; - Final concreting by self-lifting slip form. 	
EQUIPEMENTS USED		<ul style="list-style-type: none"> - Overhead travelling gantry crane 30+5 tons capacity, 7 m rail gauge with four hydraulic radio remote controlled winches: three for working platform 5 tons each one and one for personnel 3 tons lifting capacity; - Electro-hydraulic jumbo-platform drilling rig with two independent booms and hydraulics rock drills and hydraulic excavator; - Shotcreting pump and equipments for wet shotcrete; - Electric hoist for in-shaft movable power cable; - Containerised workshop; - Self-lifting slip form. 	

PROJECT	Railway Tunnel Bologna-Firenze "TAV" Ventilation shaft "Vaglia Tunnel" Loc. Vaglia (FI) ITALY Year: 2000	PURCHASER	FERROVIE DELLO STATO
		CONTRACTOR	C.A.V.E.T.
		ROCK TYPE	SANDSTONE - MARL
WORKS DESCRIPTION			
		<ul style="list-style-type: none"> - Shotcreting, steel lining and bolting vertical shaft Ø 4,38 m, 160 m deep. 	
WORKING SYSTEM			
		<ul style="list-style-type: none"> - From the top to the bottom steel lining and shotcreting the walls. 	
EQUIPEMENTS USED			
		<ul style="list-style-type: none"> - Overhead travelling gantry crane 7 tons capacity, 8 m rail gauge with two electric radio remote controlled winches: one for working platform, one for lifting cab; - Hanging steel platform; - Wet shotcreting pump; - Hand drilling machine; - Containerised workshop. 	

PROJECT	Railway Tunnel Bologna-Firenze "TAV" Ventilation shaft "RATICOSA" Tunnel Loc. Castelvecchio (FI) ITALY Year: 2001	PURCHASER	FERROVIE DELLO STATO
		CONTRACTOR	C.A.V.E.T.
		ROCK TYPE	SANDSTONE - MARL
WORKS DESCRIPTION			
		<ul style="list-style-type: none"> - Shotcreting, steel lining and bolting vertical shaft Ø 3,68 m, 160 m deep. 	
WORKING SYSTEM			
		<ul style="list-style-type: none"> - From the top to the bottom steel lining and shotcreting the walls. 	
EQUIPEMENTS USED			
		<ul style="list-style-type: none"> - Overhead travelling gantry crane 7 tons capacity, 8 m rail gauge with two electric radio remote controlled winches: one for working platform, one for lifting cab; - Hanging steel platform; - Wet shotcreting pump; - Hand drilling machine; - Containerised workshop. 	

PROJECT	Conveyor Tunnel "Monte Giglio-Colle Pedrino" Interceptor Shaft Loc. Pontida (BG) ITALY Year: 2003-2004	PURCHASER	ITALCEMENTI S.P.A.
		CONTRACTOR	ITALCEMENTI S.P.A.
		ROCK TYPE	MARL-LIMESTONE
WORKS DESCRIPTION			
<ul style="list-style-type: none"> - Excavation of a vertical Blinde shaft Ø 8,00 m 55 m deep, by jet-grouting of the top gage collar shaft, excavating the first 			
WORKING SYSTEM			
<ul style="list-style-type: none"> - Jet-grouting the top 18 m gage collar of the shaft, excavating the first part by excavator, than by drilling and blasting. Lining the full surface of the wall by steel archs, wire mesch and shotcrete 			
EQUIPEMENTS USED			
<ul style="list-style-type: none"> - Overhead travelling gantry crane 30+5 tons capacity, 7 m rail gauge with four hydraulic radio remote controlled winches: three for working platform 5 tons each one and one for personnel 3 tons lifting capacity; - Skipp structure and bucket 4 mc capacity lifted by radio controlled hoist 20 ton lifting capacity - Kamo excavator - Electro-hydraulic jumbo drill-rig with two indipendent booms and hydraulics rock drills; - Shotcreting pump and equipments for wet shotcrete; - Electric hoist for in-shaft movable power cable; - Containerised workshop; 			

PROJECT	Enerpass Hydroelectric Power plant Surge Shaft S. Martino I.P. (BZ) ITALY Year: 2007	PURCHASER	ENERPASS
		CONTRACTOR	ENERPASS
		ROCK TYPE	GNEISS AND SCHIST
WORKS DESCRIPTION			
<ul style="list-style-type: none"> - Sinking the upper 42 m of the shaft by drilling and blasting from Ø 1,84 to final Ø 9,2 m diameter; - first Lining Ø 8,80 m by bolting, laying wire net and shotcreting and final - final Lining Ø 8,00 m by metallic covering sp. 10 mm and concrete C 20/25 <p style="text-align: right;">TOT. MINED ROCK cu.m. 2.800</p>			
WORKING SYSTEM			
<ul style="list-style-type: none"> - Drilling and blasting, scaling, mucking through Raise Borer hole by specific drilling machine and excavator from the top to the bottom; - Lining the wall by bolting, wire net and shotcreting all surfaces; - Final lining with steel covering and concrete behind 			
EQUIPEMENTS USED			
<ul style="list-style-type: none"> - Overhead travelling gantry crane 30+5 tons capacity, 9,5 m rail gauge with four hydraulic radio remote controlled winches: three for working platform 5 tons each one and one for personnel 3 tons lifting capacity; - Electro-hydraulic jumbo-platform drilling rig with two independent booms and hydraulics rock drills and hydraulic excavator; - Shotcreting pump and equipments for wet shotcrete; - Electric hoist for in-shaft movable power cable; - Containerised workshop; 			

PROJECT	Enerpass Hydroelectric Power plant Penstock Shaft S. Martino I.P. (BZ) ITALY Year: 2007	PURCHASER	ENERPASS
		CONTRACTOR	ENERPASS
		ROCK TYPE	GNEISS AND SCHIST
WORKS DESCRIPTION			
<ul style="list-style-type: none"> - Shotcreting, steel lining and bolting vertical shaft Ø 2,74 m, 220 m deep. - installing steel pipes ϕ 2,20 m for penstock 			
WORKING SYSTEM			
<ul style="list-style-type: none"> - From the top to the bottom steel lining and shotcreting the walls. - From the bottom to the top, installing 6,5 m long pipes and welding. 			
EQUIPEMENTS USED			
<ul style="list-style-type: none"> - Overhead travelling gantry crane 7 tons capacity, 8 m rail gauge with two electric radio remote controlled winches: one for working platform, one for lifting cab; - Hanging steel platform; - Wet shotcreting pump; - Hand drilling machine; - Containerised workshop. 			

PROJECT	Salini Costruttori - Beles Multi Purpose Project - Etiopia Penstock Shaft Beles ETIOPIA Year: 2007-2008	PURCHASER	ETHIOPIAN ELECTRIC POWER CORPORATION
		CONTRACTOR	SALINI COSTRUTTORI
		ROCK TYPE	BASALT
WORKS DESCRIPTION			
<ul style="list-style-type: none"> - Sinking the 272 m of the shaft by drilling and blasting from Ø 1,84 to final Ø 8,00 m diameter; - first Lining Ø 7,80 m by bolting, laying wire net and shotcreting and final <p style="text-align: right;">TOT. MINED ROCK cu.m. 11.300</p>			
WORKING SYSTEM			
<ul style="list-style-type: none"> - Drilling and blasting, scaling, mucking through Raise Borer hole by specific drilling machine and excavator from the top to the bottom; - Lining the wall by bolting, wire net and shotcreting all surfaces; 			
EQUIPEMENTS USED			
<ul style="list-style-type: none"> - Overhead travelling gantry crane 30+5 tons capacity, 7 m rail gauge with four hydraulic radio remote controlled winches: three for working platform 5 tons each one and one for personnel 3 tons lifting capacity; - Electro-hydraulic jumbo-platform drilling rig with two independent booms and hydraulics rock drills and hydraulic excavator; - Shotcreting pump and equipments for wet shotcrete; - Electric hoist for in-shaft movable power cable; - Containerised workshop; - Kamo Escavator; 			

PROJECT	Salini Costruttori - Beles Multi Purpose Project - Etiopia Cable Shaft Beles ETIOPIA Year: 2007-2008	PURCHASER	ETHIOPIAN ELECTRIC POWER CORPORATION
		CONTRACTOR	SALINI COSTRUTTORI
		ROCK TYPE	BASALT
WORKS DESCRIPTION			
<ul style="list-style-type: none"> - Sinking the 287 m of the shaft by drilling and blasting from Ø 1,84 to final Ø 6,80 m diameter; - first Lining Ø 6,60 m by bolting, laying wire net and shotcreting and final - Final concrete lining by self-lifting slip form. <p style="text-align: right;">TOT. MINED ROCK cu.m. 7.350</p>			
WORKING SYSTEM			
<ul style="list-style-type: none"> - Drilling and blasting, scaling, mucking through Raise Borer hole by specific drilling machine and excavator from the top to the bottom; - Lining the wall by bolting, wire net and shotcreting all surfaces; - Final concrete lining by self-lifting slip form. 			
EQUIPEMENTS USED			
<ul style="list-style-type: none"> - Overhead travelling gantry crane 30+5 tons capacity, 7 m rail gauge with four hydraulic radio remote controlled winches: three for working platform 5 tons each one and one for personnel 3 tons lifting capacity; - Electro-hydraulic jumbo-platform drilling rig with two independent booms and hydraulics rock drills and hydraulic excavator; - Shotcreting pump and equipments for wet shotcrete; - Electric hoist for in-shaft movable power cable; - Containerised workshop; - Kamo Escavator; 			

PROJECT	Galleria Vedeggio- Cassate Pozzo di Ventilazione Lugano (CH) SVIZZERA Year: 2007-2008	PURCHASER	REPUBBLICA E CANTONE TICINO, DIPARTIMENTO DEL TERRITORIO
		CONTRACTOR	CONSORZIO MARTI
		ROCK TYPE	SCHIST
WORKS DESCRIPTION			
<ul style="list-style-type: none"> - Lining the full surface of the wall by steel archs, wire mesh and shotcrete, vertical shaft Ø 4,09 m, 96 m deep. 			
WORKING SYSTEM			
<ul style="list-style-type: none"> - From the top to the bottom steel lining and shotcreting the walls. 			
EQUIPEMENTS USED			
<ul style="list-style-type: none"> - Overhead travelling gantry crane 7 tons capacity, 8 m rail gauge with two electric radio remote controlled winches: one for working platform, one for lifting cab; - Hanging steel platform; - Wet shotcreting pump; - Hand drilling machine; - Containerised workshop. 			

PROJECT	Manutenzione straordinaria Diga Val Noci	PURCHASER	MEDITERRANEA DELLE ACQUA
	Pozzo per sfioratore a calice	CONTRACTOR	MEDITERRANEA DELLE ACQUA
	Montoggio (GE) ITALIA	ROCK TYPE	DOLOMIA
Year: 2008			
WORKS DESCRIPTION			
<ul style="list-style-type: none"> - Lining the full surface of the wall by wire mesh and shotcrete, vertical shaft Ø 3,05 m, 36 m deep. - Final concrete lining by self-lifting slip form to Ø2,35 m. 			
WORKING SYSTEM			
<ul style="list-style-type: none"> - From the top to the bottom steel lining and shotcreting the walls. - Final concrete lining by self-lifting slip form to Ø2,35 m. 			
EQUIPEMENTS USED			
<ul style="list-style-type: none"> - 7 tons capacity wheel crane; - Hanging steel platform; - Wet shotcreting pump; - Hand drilling machine; - Containerised workshop. 			

PROJECT	Razel Penstock shaft Corsica France	PURCHASER	EDF
		CONTRACTOR	RAZEL
		ROCK TYPE	SCHIST
Year: 2009			
WORKS DESCRIPTION			
<ul style="list-style-type: none"> - Sinking the 70 m of the shaft by drilling and blasting from Ø 1,84 to final Ø 7,00 m diameter; - first Lining Ø 7,00 m by bolting, laying wire net and shotcreting and final <p style="text-align: right;">TOT. MINED ROCK cu.m. 2.700</p>			
WORKING SYSTEM			
<ul style="list-style-type: none"> - Drilling and blasting, scaling, mucking through Raise Borer hole by specific drilling machine and excavator from the top to the bottom; - Lining the wall by bolting, wire net and shotcreting all surfaces; 			
EQUIPEMENTS USED			
<ul style="list-style-type: none"> - Overhead travelling gantry crane 30+5 tons capacity, 7 m rail gauge with four hydraulic radio remote controlled winches: three for working platform 5 tons each one and one for personnel 3 tons lifting capacity; - Electro-hydraulic jumbo-platform drilling rig with two independent booms and hydraulics rock drills and hydraulic excavator; - Shotcreting pump and equipments for wet shotcrete; - Electric hoist for in-shaft movable power cable; - Containerised workshop; - Kamo Escavator; 			

RAISE BORING DIVISION WORKS - REFERENCES LIST

PROJECT SITE PURCHASER	YEAR	CONTRACTOR	ROCK TYPE	LENGHT (m.)	DIA. (m.)	INCLI- NATION (deg.)	DEVIA- TION (m.)	EXEC. TIME (*) (days)	R E M A R K S
Hydroelectric Power Plant TIMPAGRANDE (Catanzaro) ITALY E.N.E.L.	1976	DE LIETO S.p.A.	DEGRADED GRANITE	124	2,13	90°	0,05	14	Penstock
Oil Pipeline "Spluga" CASARGO (Como) ITALY S.N.A.M.	1977 "	SNAM PROGETTI	HARD GNEISS	84 93	1,55 1,55	60° 60°	0,3 0,25	5 10	Pipeline by-pass Varrone river
Hydroelectric Power Plant ALBI (Catanzaro) ITALY	1977 "	SICALF S.p.A.	CRACK GRANITE	59 21	2,44 2,44	90° 90°	0 0	7 (?) 4	Water Supply Shafts (?) pilot hole start to 45 m. deep into
	1978	SELI S.r.l.	with QUARTZ. BANKS	208	2,13	90°	1,2	47	Penstock Penstock
Hydroelectric Power Plant RIDRACOLI (Forli) ITALY CONSORZIO ACQUE PER LE PROV.DI FORLI' E RAVENNA	1978 "	Association COGEFAR LODIGIANI C.M.C.	MARL and SANDSTONE	93 61	2,13 1,84	90° 90°	0,06 0	8 4	Inlet Sluice Shafts
Hydroelectric Power Plant EDOLO (Brescia) ITALY E.N.E.L. Venezia	1978	CHINI & TEDESCHI	HARD SCHIST	91	2,13	90°	0	13	Surge Shaft
	1978	ICOMEC	MICASCHIST	70	2,13	90°	0	8	Surge Shaft
	1981		40	3,05	36°	0	(1) 25	Distributor Shaft 4x	
	1980		10	2,44	90°	0	(1) 2	10- (1) time for all	
	1978	FARSURA S.p.A.	MICASCHIST	321	2,13	46°	(1) 8,75	37	Penstock (1) devi a- tion for crossover in degraded schist with bedding near the bore angle (2) following by hole-opener a di- rectional hole (3) drilling by mud and hole-opener. Casing first 57 m.
	1979			313	2,13	47°	(2) 0	56	
	"			231	2,13	45°	4	32	
	"			147	2,13	48°	0,4	28	
	1980		(3)	97	1,55	47°	0	45	
	"		(3)	66	1,55	49°	0	14	
"	(3)		252	1,55	47°	1,45	46		
1981	"	80	1,55	47°	0	9			
"	"	96	1,55	47°	0	11			
Limestone Quarry SEDRINA (Bergamo) ITALY	1978	GHISALBERTI S.p.A.	LIMESTONE	145	3,68	74°	0,6	25	Rock blasted
	1987		70	3,68	74°	0	12	stocking well	
	1980	INDUSTRIALE CALCE S.p.A.	LIMESTONE	99	3,68	73°	0	27	Rock blasted stocking well
Public Passenger Lift S. Devote Sq.-MONTECARLO PUBLIC WORKS P.to MONACO	1982	MARIOTTI	JURASSIC LIMESTONE	67	2,13	90°	0	9	Elevator shaft
Municipal Water System CATANZARO - ITALY C A S M E Z	1980	DE LIETO S.p.A.	GRANITE	28	2,44	90°	0	6	Spillway Shaft
Uranium Mines VALVEDELLO (Sondrio) ITALY NOVAZZA (Bergamo) ITALY	1980	CARIBONI S.p.A.	CONGLOMERATE	185	2,44	66°	2,28	28	Elevator S haft
	1982		HARD GNEISS- IGNIMBRITE	106	2,44	73°	0,9	19	Ventilation Sh aft
	1982	SIMUR	CONGLOMERATE	80	2,44	61°	0	22	Ore mined stocking
Pyrite Mine CAMPIANO (Grosseto) ITALY S O L M I N E	1980	SOLMINE S.p.A.	SANDSTONE	78	2,44	90°	0	4	Well for waste
	1981		108	1,84	90°	0	13	Well for waste	
	"		100	3,68	90°	0	25	Elevator shaft	
	1987		184	1,05	90°	0,07	24	Cable, Compressed air	
"	241	1,05	90°	0,11	13	pumping pipeline			
Limestone Quarry CESANA B.ZA (Como) ITALY CEMENTERIA MERONE	1981	CARIBONI S.p.A.	LIMESTONE	195	2,44	67°	0,15	17	Rockblasted Stocking well
TOTAL REAMED SHAFT'S LENGHT m. 4.357									(*) from pilot hole start to reaming end only

RAISE BORING DIVISION WORKS - REFERENCES LIST

PROJECT SITE PURCHASER	YEAR	CONTRACTOR	ROCK TYPE	LENGHT (m.)	DIA. (m.)	INCLI- NATION (deg.)	DEVI- TION (m.)	EXEC. TIME (*) (days)	R E M A R K S
Mine of Mixed Sulfides MONTEPONI (Cagliari) ITALY S A M I M	1982	SAMIM S.p.A.	DOLOMITE	365	3,68	90°	(1) 0	56	Lift ventilation shaft (1) following dia.4" directional hole by hole opener dia.12-1/4"
Hydroelectric Power Plant BRAULIO (Sondrio) ITALY A.E.M. Milano	1981	GIROLA S.p.A.	LIMESTONE	166	2,13	43°	1,2	20	Penstock
Mixed Sulfides Mine FENICE CAPANNE (Grosseto) IT S A M I M	1981 " " " 1982 " 1983 1985	SAMIM S.p.A.	CHALCOPYRITE MARL CLAY with QUARTZITE CLAY FLAKED CHALCOPYRITE MARL	63 42 79 90 63 68 233	2,13 2,44 2,13 *0,38 2,13 2,13 1+1,5	60° 90° 45° 57° 58° 53° 90°	0 0 0,12 0,5 0,6 0 0	8 5 19 ° 7 17 13 11	Ore casting, ventilation and pumping wells pilot hole only, with hole-opener dia. 15"
Hydraulic Plant DAM of HAMMAM MESKOUTINE (Guelma) - ALGERIA MINISTRY OF WATER	1982 " " " " " " "	Association COGEFAR ITALSTRADE RECCHI	MARL and SANDSTONE (38) (41) (40) (33) (33) bracking nb. Pilot hole only.	40 66 24 66 11 11 11 48	2,44 2,44 2,44 2,44 2,44 2,44 2,44 2,44	90° 59° 90° 50° 90° 90° 90° 90°	0 0 0 0 0 0 0 0	7 18 6 21 7 4 3 4 5	Penstock intake Open spillway shaft Stair shaft Open spillway shaft Rescue and adit shaft Foundation plints for valves chamber
Hydroelectric Power Plant SOLARINO (Siracusa) ITALY E.N.E.L.	1984 " 1986 " " " " " " " " "	Association ASTALDI DI PENTA LODIGIANI CALDART	WHITE LIMESTONE	55 21 54 36 36 10 10 33 33 69 12 10 70	4,22 2,13 2,13 1,55 1,55 1,53 1,53 1,53 1,53 2,13 1,55 1,55 1,55	90° 90° 77° 40° 38° 90° 90° 37° 35° 90° 90° 90° 90°	0 0 0 0 0 0 0 0 0 0 0 0 0 0	7 2 5 4 4 1 1 4 7 3 2 1 4	Escape shaft Pumping station shaft Ventilation shaft Distributor shaft 1 Distributor shaft 2 Turbine shaft 1 Turbine shaft 2 Distributor shaft 3 Distributor shaft 4 Surge shaft Turbine shaft 3 Turbine shaft 4 Surge shaft
Stone Quarry for Aggregate BAGNI DI LUCCA (Pistoia) ITALY CAVE TANA	1982 "	CAVE TANA S.r.l.	LIMESTONE	37 107	0,31 3,68	40° 70°	0 0	2 18	Pumping hole rock blasted stocking well
Hydroelectric Power Plant SANTA SOFIA (Forli) ITALY E.N.E.L.	1983 "	SELI S.r.l./ CHINI & TE- DESCHI S.p.A	MARL and SANDSTONE	96 220	2,13 3,68	90° 47°	0 0	13 45	Surge shaft Penstock
Hydroelectric Power Plant VALGRISANCHE (Aosta) ITALY E.N.E.L.	1983 "	BETTI S.p.A.	HARD SCHISTS	72 96	2,44 2,44	90° 90°	(1) 1,1 0,4	11 12	Penstock (1) bedding near the bore angle
Hydraulic Plant for Water Supply SINNI river (Matera) ITALY C A S M E Z	1983 " "	LODIGIANI S.p.A.	MARL and VERY HARD QUARTZ- SANDSTONE	42 24 28	3,68 3,68 3,68	90° 90° 90°	0 0 0	11 8 7	Surge shaft
Hydraulic Plant for Water Supply Acquedotto CAMPANO - CASMEZ S.PIETRO INFINE (Caserta) ITALY	1985	COGEFAR S.p.A.	DOLOMITE	108	1,55	90°	0	13	Ventilation shaft

TOTAL REAMED SHAFT'S LENGHT m.

7.093

(*) from pilot hole start to reaming end only

RAISE BORING DIVISION WORKS - REFERENCES LIST

PROJECT SITE PURCHASER	YEAR	CONTRACTOR	ROCK TYPE	LENGHT (m.)	DIA. (m.)	INCLI- NATION (deg.)	DEVIA- TION (m.)	EXEC. TIME (*) (days)	R E M A R K S	
Hydroelectric Power Plant M'TERA - TANZANIA T A N E S C O	1985	COGEFAR S.p.A.	HARD GRANITE	105	1,34	90°	0	10	Penstock 1	
	"			107	1,34	90°	0	13	Penstock 2	
	"			115	1,34	90°	0	11	Lift, cable, shaft	
	"			207	0,27	90°	0	6	Airing hole	
	"			205	3,05	90°	0,3	50	Ventilation shaft	
	"			23	1,34	90°	0	5	Weeled gate shaft 2	
	"			23	2,44	90°	0	5	Weeled gate shaft 1	
	"			33	1,34	90°	0	8	Draft shaft 1	
	"			33	1,34	90°	0	7	Draft shaft 2	
	"			15	2,44	90°	0	4	Surge shaft 1	
"	15	2,44	90°	0	5	Surge shaft 2				
Improvement "FURORE" fiord FURORE (Napoli) ITALY C A S M E Z	1985	RECCHI S.p.A.	LIMESTONE	77	1,55/1	48°	0	19	Reaming start under- water for undersea water pipeline	
Hydroelectric Power Plant CENCENIGHE (Belluno) ITALY E.N.E.L.	1987	CALDART S.p.A.	MARL and SANDSTONE	270	2,13	57°	0	(1) 17	Penstock (1) Reaming only	
Hydroelectric Power Plant PRESENZANO (Caserta) ITALY E.N.E.L.	1985	DE LIETO S.p.A.	LIMESTONE	50	2,13	90°	0	10	Surge shaft 1	
	"			33	2,13	45°	0	6	Penstock 1	
	"			50	2,13	90°	0	10	Surge shaft 2	
	"			35	2,13	45°	0	5	Penstock 2	
Railway Tunnel PRATO ISARCO (Bolzano) ITALY FERROVIE DELLO STATO	1986	Association C.O.M.E.R.	RED PORPHYRY	37	2,44	90°	0	10	Railway ventilation shaft	
	"			37	2,44	90°	0	9		
Hydroelectric Power Plant PALAZZO II° MORMANNO (CS) IT E.N.E.L.	1987	DI PENTA SECOL	LIMESTONE	48	1,84	90°	0	5	Penstock	
Hydraulic Plant ARCICHIARO DAM (Campobasso) IT C A S M E Z	1987	COSTANZO S.p.A.	LIMESTONE	90	1,55	90°	0	8	Penstock	
Hydraulic Plant METRAMO DAM (Reggio Calabria) IT C A S M E Z	1987	RODIO S.p.A.	LIMESTONE	68	1,55	90°	0	7	Penstock	
	"			30	1,55	45°	0	5		
Hydroelectric Power Plant ALTO LINDOSO - PORTUGAL E. D. P.	1988	TORNO S.p.A.	GRANITE TWO MICAS	336	1,84	90°	2,8	40	Bus-bar shaft	
	"			324	1,84	90°	4,9	28	Penstock 1	
	"			321	1,84	90°	1,5	34	Penstock 2	
	1989			67	3,68	90°	0	11	Pumping shaft	
	"			50	2,44	90°	0	8	Surge chamber shaft	
	"			150	3,41	90°	0	25	Air discharging shaft	
Hydroelectric Power Plant MONTE REALE VALCELLINA (Pordenone) ITALY E.N.E.L.	1989	COGEFAR S.p.A.	LIMESTONE	30	2,13	90°	0	6	(67) the numbers	
	"			41	2,13	45°	0	8	(88) bracking are	
	"			30	2,13	90°	0	6	(62) the lenght of	
	"			42	2,13	45°	0	8	(86) the pilot only	
Gas pipeline PRIMOLANO (Vicenza) ITALY S.N.A.M.	1989	SICIM S.p.A.	WHITE LIMESTONE	365	1,84	76°50'	3	24	Gas Pipeline shaft	
	"			15	1,07	14°	0	5		
Limestone Quarry SEDRINA (Bergamo) ITALY	1989	GHISALBERTI S.p.A.	LIMESTONE	29	3,68	78°	0	6	Rock stocking well	
	1990			30	3,68	73°	0	6		
	"			17	3,68	90°	0	7		
	"			29	2,13	90°	0	3		
	"			28,5	2,13	90°	0	3		
	"			57,5	0,27	90°	0	2		Cables hole
	"			38	2,13	90°	0	5		
	"			15	2,13	90°	0	2		
"	92	0,27	84°	0	4	Cables hole				
TOTAL REAMED SHAFT'S LENGHT m.									(*) from pilot hole start to reaming end only	

10.906

RAISE BORING DIVISION WORKS - REFERENCES LIST

PROJECT SITE PURCHASER	YEAR	CONTRACTOR	ROCK TYPE	LENGHT (m.)	DIA. (m.)	INCLI- NATION (deg.)	DEVIA- TION (m.)	EXEC. TIME (*) (days)	R E M A R K S	
Hydraulic Pumping Plant S. STEFANO (Napoli) ITALY MUNICIPAL WATER SYSTEM	1989	ITALO DELLA MORTE S.p.A.	POZZULANA and TUFT	94	3,05	90°	0	10	Pumping shaft	
Storage tank BEER - SHEVA	1989	Ing.Nino FERRARI S.p.A.	WHITE LIMESTONE	51	3,41	90°	0	7	Ventilation shaft	
Lift shaft AMALFI (Salerno) ITALY GRAND HOTEL EXCELSIOR	1990	GRAND HOTEL EXCELSIOR	LIMESTONE	66	3,05	90°	0,05	16	Lift for beach	
Rock-fill Quarry CARPANE' (Vicenza) ITALY GRANUL.DOLOM.PEROGLIO SRL	1990	GRANUL.DOLOM. PEROGLIO S.r.l.	LIMESTONE	224	3,68	90°	0	38	Rock stocking well	
Hydraulic Plant METRAMO DAM (Reggio Calabria) IT C A S M E Z	1990	Joint Vent. FE.LO.VI.	GRANITE	50	1,55	90°	0	5	Inlet sluice shaft	
Gas Pipe Line S.SALVO-VASTOGIRARDI CARUNCHIO, COLLE D'ALBERO MONTE S.NICOLA (Chieti) ITALY S.N.A.M.	1991 " "	SAIPEM ITALIANA S.p.A.	LIMESTONE	61 45,5 64,5	1,55 1,55 1,84	3,5° 42° 39,5°	0,024 0 0	4 3 5	Pipe line tunnel Pipe line shaft Pipe line shaft	
Hydraulic Plant VODO (Belluno) ITALY E.N.E.L.	1990	PICCIN S.p.A.	MARL and SANDSTONE	25	2,13	90°	0	5	Service shaft	
Channel Tunnel Manche DOVER (Kent) ENGLAND TRANSMANCHE-LINK	1991	T M L	CHALK	109	1,55	90°	0	8	Ventilation shaft	
Hydraulic Plant DAM OF BLUFI (Palermo) ITALY REGIONE SICILIA	1991	ASTALDI	SOFT MARL	54	1,84	90°	0	3	Surge shaft	
Frejus Highway VAL DI SUSÀ (Torino) ITALY C.A.F.	1991 " 1992	CONSORZIO AUTOSTRADA FREJUS	HARD SCHIST	149 311 [108]	2,44 2,44	90° 90°	0 18 (1) [4]	12 20 [8]	(1) deviation for crossover in degraded schist with bedding near the bore angle	
Hydroelectric Power Station RIVA DEL GARDA (Trento) ITALY E.N.E.L.	1989 1991 "	DEL FAVERO S.p.A.	LIMESTONE	20 39 42	2,13 2,13 2,13	90° 90° 90°	0 0 0	5 4 6	Service shaft Blasting-rock well Surge shaft	
Hydroelectric Power Plant S.GIACOMO AL VOMANO (Teramo) IT E.N.E.L.	1990 1991 " " " " " 1992 1993 1993 1994	Joint Vent. S.GIACOMO " " " " " " " "	MARL and LIMESTONE	95 253 310 309 307 23 44 253 310 309 307 36	2,44 1,84 1,84 1,84 1,84 1,84 1,84 5,95 5,95 5,95 5,95 3,05	90° 90° 90° 90° 90° 70° 90° 90° 90° 90° 90° 90°	0 0 0 0 0 0 0 0 0 0 0 0,06	10 15+8+5 9+3+13 11+6+14 16+5+16 3 4 4	Surge shaft Penstock shaft (DDS) " Cable lift shaft (DDS) " Service shaft Reversible machine s. Sinking shafts by DOWN HOLE REAMER	
Hydraulic Plant VAL D'ULTIMO DAM (Bolzano) IT E.N.E.L.	1992	P.A.C.	SCHIST	60	1,53	90°	0	5	Inlet Sluice Shaft	
Shaft for Building MONTECARLO - P.to MONACO	1992	ITALCAVE S.p.A.	LIMESTONE	26	3,41	90°	0	6	Building foundation shaft	
Improvement "Furore" Fiord AMALFI (Salerno) ITALY C A S M E Z	1992 1994	RECCHI S.p.A.	LIMESTONE	246 110	1,34 1,34	90° 90°	0,9 0,4	35 28	Water pipe line	
TOTAL REAMED SHAFT'S LENGHT m.									15.309	(*) from pilot hole start to reaming end only

RAISE BORING DIVISION WORKS - REFERENCES LIST

PROJECT SITE PURCHASER	YEAR	CONTRACTOR	ROCK TYPE	LENGHT (m.)	DIA. (m.)	INCLI- NATION (deg.)	DEVIA- TION (m.)	EXEC. TIME (*) (days)	REMARKS
Hydroelectric Power Plant BERKE DAM PROJECT - TURCHIA CUKUROVA ELECTRIK A.S.	1993	ITALSTRADE S.p.A.	LIMESTONE	84	2,44	90°	0	7	Surge shaft
	"			118,5	1,84	90°	0	7	Penstock shaft 1
	"			122	1,84	90°	0	6	Penstock shaft 2
	"			121,5	1,84	90°	0	8	Penstock shaft 3
	1994			55,5	1,84	90°	0	4	Spillway shaft
	"			54	0,27	90°	0,15	3	Pendulum shaft
	"			55	0,27	90°	0,12	3	Pendulum shaft
"	29	0,27	90°	0	2	Pendulum shaft			
"	55	0,27	90°	0	3	Pendulum shaft			
Gas Pipe Line ARMA DI TAGGIA (Imperia) ITALY S.N.A.M.	1993	SALCIS	LIMESTONE	43	1,00	28°	0	4	Gas pipeline
Limestone Quarry SEDRINA (Bergamo) ITALY	1993	GHISALBERTI S.p.A.	LIMESTONE	93	3,68	75°	0	12	Rock stocking well
	1994			94	3,68	84°	0	8	
	"			36	0,27	77,5°	0	2	Cable hole
Limestone Quarry ISOLA DELLE FEMMINE (Palermo) IT ITALCEMENTI INGEGNERIA	1994	CEMENTERIE ITALIANE S.p.A.	LIMESTONE	125	1,00	90°	0	9	Cable shaft
	"			130	3,68	90°	0	16	Rock stocking well
	"			110	3,68	90°	0	9	"
	"			209	1,00	90°	0	14	Cable shaft
	1995			117,5	1,00	90°	0	8	Cable shaft
"	202,8	3,68	90°	0	23	Rock stocking well			
Hydroelectric Plant COGOLO (Trento) ITALY E.N.E.L.	1994	DE LIETO S.p.A.	SCHIST	47	2,13	15,5°	0,5	7	Surge chamber shaft
	"			49	3,13	90°	0	7	"
	"			35	6,12	90°	0	5	"
	1995			225	2,13	45°	0,15	18	With D.D.S.
Gas Pipe Line VALLE MONDA (Rieti) ITALY S.N.A.M.	1994	SICIM S.p.A.	LIMESTONE	185	2,44	45°	3	12	Gas pipe line
Metro de Bilbao BILBAO - SPAIN	1994	AGROMAN	MARL	38,5	5,10	90°	0	7	Lifts and ventilation
	"			48,5	5,10	90°	0	7	underground station
	"			49,5	5,10	90°	0	7	shafts
	"			49	5,10	90°	0	7	
Hydraulic Plant TERMINI IMERESE (Palermo) ITALY	1994	J.V. S.LEONARDO	LIMESTONE	54	2,13	90°	0	6	
Gas Pipe Line MADDALONI (Caserta) ITALY S.N.A.M.	1995	GHIZZONI S.p.A.	LIMESTONE	57,5	1,55	41°	0	5	By pass
Surge chamber shaft CLEUSON DIXANCE (Sion) CH J.V. LED (Losinger SA)	1995	Consortium LED	MICASCHIST	191,4	1,83	90°	1,5	12	Surge chamber shaft
	"			184,9	1,83	90°	0,6	9	
Gas Pipe Line FAEDO (Trento) ITALY S.N.A.M.	1995	SALCIS S.p.A.	LIMESTONE	228,7	1,83	71°	1,6	11	Pipe line shaft
Hydroelectric Plant RICOBAYO (Zamora) SPAIN IBERDROLA S.A.	1996	FERROVIAL	GRANITE	24	2,44	90°	0	3	Gate shaft
	"			25	2,44	90°	0	3	
	"			76	2,44	45°	0	8	Penstock shaft
	"			96,5	4,07	90°	0	10	Cable shaft
"	92	4,07	90°	0	10	Lift shaft			
GAS PIPE LINE MARRADI (Firenze) ITALY S.N.A.M.	1996	A.T.I. SICIM UNIONE	MARL SANDSTONE	83	1,80	4,11°	0,3	9	Pipe line shafts
	"			114	1,80	7,23°	0,2	12	
	"			148	1,80	3,26°	0,15	13	
	"			113	1,80	8,5°	0,25	8	
"	106	1,80	9,2°	0,2	9				
TOTAL REAMED SHAFT'S LENGHT m.									(*) from pilot hole start to reaming end only
19.484									

RAISE BORING DIVISION WORKS - REFERENCES LIST

PROJECT SITE PURCHASER	YEAR	CONTRACTOR	ROCK TYPE	LENGHT (m.)	DIA. (m.)	INCLI- NATION (deg.)	DEVIA- TION (m.)	EXEC. TIME (*) (days)	REMARKS
Hydroelectric Plant DOMEÑO (Valencia) - A361SPAIN IBERDROLA S.A.	1996	CUBIERTAS S.A.	LIMESTONE	138,7	3,41	60°	1,7	10	Penstock shaft
Limestone Quarry CIVIDATE CAMUNO (Brescia) IT	1996	VERALDI	LIMESTONE	76,5	3,05	73°	0	9	Rock stocking well
Tunnel ventilation shaft SOMPORT (Jaca) SPAIN ERSOM UTE	1996	ENTRECANALES Y TAVORA	LIMESTONE MARL	213	6,12/ 4,78	90°	3	31	Change the reamer after first 60 m. for broken rock
OIL PIPE LINE QUINCINETTO (Aosta) ITALY S.N.A.M.	1996	TRE COLLI S.p.A.	GNEIS	126	1,00	0,67°	0,2	14	Pipe line shaft
Hydroelectric Plant BARCIS (Pordenone) ITALY ENEL VENEZIA	1996	SELI S.p.A.	WHITE LIMESTONE	15	3,05	90°	0	3	Shaft for sinkin g
Limestone Quarry SEDRINA (Bergamo) ITALY	1996 1997 " "	GHISALBERTI S.p.A.	LIMESTONE	140 19 29 30	4,50 3,68 3,05 3,05	16° 90° 90° 90°	0 0 0 0	19 5 6 5	Conveiors shaft Rock stocking well Rock stocking well
Hydroelectric Plant MONCION - REP.DOMINICANA	1997 " "	AGROMAN S.A.	MARL AND SANDSTONE	90 97	5,45 4,07/ 2,44	90° 90°	0,5 0,6	13 11	Gate shaft Surge chamber shaft
Limestone Quarry LAVAGNA (Genova) ITALY SOC. FRANTOIO del TIGULLIO	1997	SOC. FRANTOIO TIGULLIO	LIMESTONE	85	3,72	75°	0,2	15	Rock stocking we ll
Calcium Quarry VIPITENO (Bolzano) ITALY OMYA S.p.A.	1997 " "	OMYA S.p.A.	CALCIUM	33 36,5 36,5	2,44 2,44 2,44	90° 90° 90°	0 0 0	5 5 5	Rock stocking well
T.G.V. MARSEILLE - FRANCE S.N.C.F.	1997	CAMPENON BERNARD	LIMESTONE	90	2,44	90°	0	10	Ventilation shaft
Undgrd. Railway station SAN REMO (Imperia) ITALY FF.SS. - ITALY	1997 " 1998 " " "	FIORONI S.p.A.	SANDSTONE/ MARL	40 80 81,8 83,3 81,8 81,8	4,07 4,07 0,31 0,31 0,31 0,31	90° 90° 68,5° 70° 68° 70°	0 0 0,15 0,07 0,05 0,02	4 6 2 2 2 2	Ventilation shafts Water & cables pipelines " " "
Hydraulic Project "Chiascio" PIANELLO (Perugia) ITALY ENTE IRRIGUO UMBRO-TOSCANO	1997	DE LIETO S.p.A.	MARL & SANDSTONE	80	2,44	90°	0,05	8	Airing hole
Hydroelectric Plant COGOLO (Trento) ITALY E.N.E.L. Venezia	1997 1998	QUADRIO & CURZIO S.p.A.	SCHIST	245 248	0,28 1,30	40° 43°	4 0,35	5 6,5+4+13	Inspection hole Piloting by DDS
Limestone Quarry SEDRINA (Bergamo) ITALY	1998	GHISALBERTI S.p.A.	LIMESTONE	95	3,05	90°	0	13	Stocking shaft
Calcium Mine VIPITENO (Bolzano) ITALY OMYA S.p.A.	1998 " "	OMYA S.p.A.	CALCIUM	12 14 12	3,05 3,05 3,05	90° 90° 90°	0 0 0	3 4 3	Rock stocking well
OIL PIPE LINE SAN RHEMY (Aosta) ITALY S.N.A.M.	1998	TRE COLLI S.p.A.	MICASCHIST	247	1,06	48°	2,5	20	Pipe line shaft
Hydroelectric Power Plant PIEVE VERGONTE (Verbania) IT E.N.E.L. Torino	1998 1999 "	DE LIETO S.p.A.	GNEISS	396 370 20	3,68 3,05 3,05	45° 45° 31°	9,19 12,02 0	41 35 8	Discharge shaft Penstock shaft Penstock shaft
TOTAL REAMED SHAFT'S LENGHT m.									22.927
									(*) from pilot hole start to reaming end only

RAISE BORING DIVISION WORKS - REFERENCES LIST

PROJECT SITE PURCHASER	YEAR	CONTRACTOR	ROCK TYPE	LENGHT (m.)	DIA. (m.)	INCLI- NATION (deg.)	DEVIA- TION (m.)	EXECUT. TIME (*) (days)	REMARKS	
Talc Mine PRALI (Torino) ITALY LUZENAC - VALCHISONE S.p.A.	1998 1999	LUZENAC VALCHISONE S.p.A.	QUARTZ MICASCHIST	276	3,05	90°	1,35	49	Ventilation and safety exite shaft	
Villa Germania Project BOLZANO - ITALY WIPPTALER BAU AG	1998	WIPPTALER BAU AG	PORPHIRY	87	4,50	38°	0,36	16	Private rack-lift sha ft	
Minas Aguas Tenidas VALDELAMUSA (Huelva) SPAIN INSERSA	1998	INSERSA	SLATE & SANDSTONE	277	2,44	84,5°	4,2	21	Ventilation sh aft	
Railway tunnel FI-PI FIRENZE SIGNA - ITALY VIENNE COSTRUZIONI S.r.l.	1998	VIENNE COSTRUZIONI S.r.l.	SILT ROCK & SANDSTONE	73	2,44	90°	0,12	7	Ventilation s haft	
Limestone Mine TAVERNOLA (Bergamo) ITALY LAFARGE - ADRIASEBINA	1999	LAFARGE ADRIASEBINA	LIMESTONE	64	0,66	37,6°	0,1	9	Pipe line shaft	
Minas Aguas Tenidas VALDELAMUSA (Huelva) SPAIN INSERSA	1999	INSERSA	SLATE & SANDSTONE	72,5	2,44	84,5	0	6	Ventilation shaft	
Limestone Quarry TEPETZINGO - MEXICO Cementos MOCTEZUMA S.A.	1999	Cementos MOCTEZUMA S.A.	LIMESTONE	140	4,73	76°	0,3	15	Rock stocking well	
Metro de Bilbao BARAKALDO - SPAIN U.T.E. ANSIO	1999	AGROMAN	MARL	180,71 (n.12)	3,68	90°	0	45	Lifts and ventilation underground station shafts	
Gas Pipeline DN 48" VAL FORMAZZA-CRODO (VB) IT S.N.A.M.	1999	BONATTI S.p.A.	GRANITE	77 133,5 80 123,5 77 146,5 84 210	1,84 1,84 1,84 1,84 1,84 1,84 1,84	0,40° 0,43° 5,96° 1,15° 26,56° 16,17° 3,75° 0,43°	0,15 3 0,08 1,3 0,06 8,4 0,16 0 + DDS	12 18 11 28 17 21 17 48	Pipe line shaft	
Calcium Mine VIPITENO (Bolzano) ITALY OMYA S.p.A.	1999 2000	OMYA S.p.A.	CALCIUM	204 154	2,44 2,44	49,5° 64°	0 0	16 14	Ventilation sh aft Ventilation shaft	
Railway Tunnel BO-FI Loc. POGGIOLO (Bologna) ITALY C.A.V.E.T.	1999	C.A.V.E.T.	MARL & SANDSTONE	55	3,05	73,8°	0	6	Ventilation shaft	
Hydroelectric Power Plant SUSA (Torino) ITALY AEM - TORINO	1999 2000 " 2002	PONT VENTOUX S.c.r.l.	SCHIST	280 22 12,5 66	3,82 1,55 1,55 3,05	90° 23° 50° 90°	3,2 0 0 0	18 (#) 4 3 9	Penstock shaft (#) Not considered drilling piloting time by DDS cable shaft cable shaft Ventilation shaft	
Limestone Quarry Cava MA.CO - LUCCA (ITALY) UNICEM S.p.A.	1999	UNICEM S.p.A.	FLYSH	117	3,68	64°	0	15	Rock stocking we ll	
Sewerage Esine-Breno BRENO (Brescia) ITALY GIUDICI S.p.A.	1999	GIUDICI S.p.A.	LIMESTONE	80 80	1,06 1,06	0,25° 0,34°	0,05 0,5	19 8	Sewerag e shaft	
Submarine DC Power lines OTRANTO (Lecce) ITALY E.N.E.L.	1999	PIRELLI S.p.A.	LIMESTONE	65 30 39 96	0,28 0,28 0,38 0,28	2,5° 2,5° 2,5° 2,5°	0,3 0,2 0,2 0,5	1 1 2 2	Cables holes	
TOTAL REAMED SHAFT'S LENGHT m.									26.329	(*) from pilot hole start to reaming end only

RAISE BORING DIVISION WORKS - REFERENCES LIST

PROJECT SITE PURCHASER	YEAR	CONTRACTOR	ROCK TYPE	LENGHT (m.)	DIA. (m.)	INCLI- NATION (deg.)	DEVI- ATION (m.)	EXECUT. TIME (*) (days)	REMARKS
Acqueduct "Astico" THIENE (Vicenza) ITALY IRCES S.r.l.	1999	IRCES S.r.l.	DOLOMITE	113	0,28	23,2	0,1	3	Water pipeline shafts
	2000			114	1,06	24°	0,07	14	
	"			140	2,13	13,6°	0,95	22	
Gas Pipeline DN 750 Calco - Piantedo CALOLZIOCORTE (I) S.N.A.M.	2000	GHIZZONI S.p.A.	MARL & SANDST.	154	1,32	20,70°	1,5	12 (#)	Pipe line shaft (#) Not considered drilling piloting time by DDS
Limestone Quarry MADDALENI SESTO A MORIANO (Lucca) ITALY BUZZI Group	2000	BUZZI S.p.A.	LIMESTONE	104	3,68	75°	0	16	Rock stocking well
RIO NARCEA GOLD MINE BELMONTE DE MIRANDA Asturias - SPAIN	2000	UTE - INCE	GNEISS	113	1,84	90°	0,5	12	Ventilation shaft
	2001			91	1,84	90°	0,2	12	
				90	1,84	90°			
Lötschberg - Basisline Fystertellä Shaft-GOPPENSTEIN(CH) BLS AlpTransit AG	2000	ATF Fensterstollen Ferden	GNEISS	335	4,38	90°	0,47	43 (#)	Ventilation shaft (#) Last upper 140 ml. by drilling & blasting
Railway Tunnel BO-FI Loc. VAGLIA (Firenze) ITALY C.A.V.E.T.	2000	C.A.V.E.T.	MARL & SANDSTONE	160	4,38	90°	1,1	15	Ventilation shaft
Hydroelectric Power Plant PIEVE VERGONTE (Verbania) IT E.N.E.L. Torino	2000	DE LIETO S.p.A.	GNEISS	60	1,55	45°	0,2	13	Penstock shaft
Sewerage Gressoney I T. - S.J. GRESSONEY LA TRINITE' (Aosta) IT Regione Autonoma Val d'Aosta	2000	ISAF S.r.l.	CALC SCHIST	130	1,84	0,65°	1,2	17	Sewerage By pass
Gas Pipeline DN 42" Bernalda - Br. MASSAFRA (Taranto) ITALY S.N.A.M.	2000	NACAP	TUFF	73,6	1,84	30,57°	1,6	18	Pipe line shaft
Ventilation Power House Città di LECCO - ITALY Provincia di Lecco	2000	VIENNE COSTRUZIONI	MARL	25,6	2,44	90°	0	5	Rock stocking well
Graver Plant MONTEVALERIO (Livorno) ITALY SALES S.a.s	2000	SALES S.a.s	LIMESTONE	60	4,38	75°	0,3	9	Rock stocking well
National Way Ventilation shafts NATURNO (Bolzano) ITALY Provincia Autonoma di Bolzano	2001	PIZZAROTTI S.p.A.	GNEISS	31,5	2,44	90°	0	7	Ventilation shaft
				30,6	2,44	90°	0	5	Ventilation shaft
New transit Custom Italy - CH Dogana di ORIA (Como) ITALY A.N.A.S.	2001	Cossi S.p.A.	LIMESTONE	25	1,84	90°	0	6	Ventilation shaft
Calcium Mine TAMBRE D'ALPAGO (Belluno) IT I.M.A. S.r.l.	2001	I.M.A. S.r.l.	CALCIUM	70	3,05	75°	0	9	Rock stocking well
Gas Pipeline DN 500 BZ-Brix-Brun PRATO ISARCO (Bolzano) ITALY	2001	TRE COLLI S.p.A.	PORPHIRY	38	1,06	2,3°	0	7	Pipeline shaft Pipelinet by (#) MWD Directional Drilling
				318	1,06	2,3°	6,3 (#)	27	
Gas Pipeline DN 750 CALESTANO (Parma) ITALY S.N.A.M.	2001	SICIM S.p.A.	MARL	186	1,55	52,77°	0,80	18	Pipeline shaft
Pumping Station Imp. Sollev. del Flumendosa (Cagliari) ITALY E.A.F.	2001	IMPREGILO S.p.A.	SCHIST	24,5	3,05	90°	0	4	Pumping shafts
				25	2,74			3	
				25	2,74			5	
				24,5	2,74			4	
				25	2,74			4	
TOTAL REAMED SHAFT'S LENGHT m.									
28.916									
(*) from pilot hole start to reaming end only									

RAISE BORING DIVISION WORKS - REFERENCES LIST

PROJECT SITE PURCHASER	YEAR	CONTRACTOR	ROCK TYPE	LENGHT (m.)	DIA. (m.)	INCLI- NATION (deg.)	DEVIA- TION (m.)	EXECUT. TIME (*) (days)	R E M A R K S
Hydroelectric Power plant RUIVAES (Braga) PORTUGAL CPPE S.A.	2001	SOMAGUE-MSF- MOTA	GRANITE	402	4,50	90°	0,13	51	Upper surge chamber shaft
	2002	SOMAGUE-MSF- MOTA	GRANITE	53,8	5,76	90°	0	20	Lower surge chamber shaft
Railway Tunnel BO-FI LOC. RATICOSA (Firenze) ITALY C.A.V.E.T.	2001	C.A.V.E.T.	MARL/LIMESONE	154 150	0,31 3,68	90° 90°	0,15	5 13	Gas detecting shaft Ventilat ion shaft
Limestone Quarry MOLAZZANA (Lucca) ITALY FASSA S.p.A.	2001	FASSA S.p.A.	LIMESTONE	90	3,68	70°	0,17	17	Rock stocki ng well
River Divertion VIGANELLO - LUGANO - CH VIGANELLO MUNICIPALITY	2002	FLAVIO RIVA SA	MICASHIST	62,5	1,06	23°	0	11	River dive rtion shaft
Limestone Quarry TETTI BAVA (Cuneo) ITALY FASSA S.p.A.	2002	FASSA S.p.A.	LIMESTONE	104	3,68	70°	0	21	Rock stocking well
Carbonate Quarry COSTIOLO (Bergamo) ITALY	2002	UNICALCE S.p.A.	CALCIUM CARBONATE	105	3,05	90°	0	15	Rock stocki ng well
<i>Commessa 2002/01</i> Oil Pipeline DN 400 GIGNOD (Aosta)- ITALY Snam	2002	TRE COLLI S.p.A.	PORPHIRY	44,5	1,06	90°	0	4	Oil pipe line shaft
<i>Commessa 2002/03</i> Limestone Quarry "NAFARRONDO" BILBAO - SPAGNA	2002	NORTUNEL	LIMESTONE	160	4,38	73°	0,8	20	Rock stocking w ell
<i>Commessa 2002/06</i> Sewerage Plant PESCHICI (Foggia) ITALY PESCHICI MUNICIPALITY	2002	LMD	SOFT LIMESTONE	75	0,66	45°	0,3	4	Discharging hole
<i>Commessa 2002/04</i> Submerse water pipeline PUNTA BACOLI (Napoli) ITALY ACQUEDOTTO CAMPANO	2002	RESEARCH SRL	LIMESTONE	41,5	0,77	23°	0	2	Water's subma rine pipeline
<i>Commessa 2002/02</i> Limestone Quarry S.ROSALIA (Caserta) ITALY CEMENTI MOCCIA	2002	CEMENTI MOCCIA	WHITE LIMESTONE	105	3,68	75°	0	12	Rock stocking well
Gas pipeline DN750 CALESTANO (Parma) ITALY Snam	2002	SICIM	MARL & LIMESTONE	183	1,55	52,77°	1,2	19	Gas pipe line s shaft
<i>Commessa 2002/12</i> Sewerage Plant TREMOSINE sul Garda (Brescia) IT CONSORZIO GARDA UNO	2002	J oint Venture I.C.B. Srl -	LIMESTONE	147 20	0,66 0,66	75,4° 81°	0,2 unap.	11 2	Drein Trunk line shafts
<i>Commessa 2002/07</i> River Preit diversion CANOSIO (Cuneo) ITALY CONDOTTE S.p.A.	2002	IDREG PIEMONTE	LIMESTONE	421	2,13	5,4°	7	49*	Tunnel for Hydro pipeline
<i>Commessa 2002/10</i> Mina de Boinas & Carles RIO NARCEA GOLD MINE ASTURIAS - SPAIN	2002	INSERSA S.A.	GRANITE	98 140	1,84 2,44	82°	unap. unap.	18 26	Ventilation shafts
TOTAL REAMED SHAFT'S LENGHT m.									(*) from pilot hole start to reaming end only
31.472									

RAISE BORING DIVISION WORKS - REFERENCES LIST

PROJECT SITE PURCHASER	YEAR	CONTRACTOR	ROCK TYPE	LENGHT (m.)	DIA. (m.)	INCLI- NATION (deg.)	DEVI- ATION (m.)	EXECUT. TIME (*) (days)	R E M A R K S
Comessa 2002/09 Limestone Quarry CEMENTO MOCTEZUMA, STAB. CERRITOS - MEXICO	2002	CEMENTOS MOCTEZUMA	LIMESTONE	85	4,38	75°	unap.	12	Rock stocking well
Comessa 2002/11 Rivers Diversion RIO LUPO E RIO ARCHETTI Genova Municipality - ITALY	2002	COSSI S.p.A.	SHIST	41 33	1,84 1,84	85° 85°	unap. unap.	5 4	River's divers ion shafts
Comessa 2003/01 Basalt Quarry OFITAS DE RIGOITA EN ERRIGOITI - SPAIN	2003	IDOM	BASALT	140	4,09	70°	2,35	16	Rock stocking well
Comessa 2003/02 Underground station METRO SESTAO Bilbao - SPAIN	2003	UTE METRO SESTAO	MARL	9,38 9,38 11 11	3,68	90°	unap.	5 5 3 5	Ventilation shaft
Comessa 2003/09 Railway ventilation shafts Proyecto Euskotren Ute Variante Sur - S.Sebastian (E)	2003	ALTUNA Y URIA S.A.	SANDSTONE MARL	42 25	5,10 5,10	90°	unap.	11	Ventilation shaft
Comessa 2003/07 PERFORACION ORIZONTAL COLECTOR Ambles Avila - SPAIN	2003	DRAGADOS	GRANITE	50 25	1,06 1,06	3%	unap.	9 5	Sewage tunnel
Comessa 2003/06 Gas pipeline DN750 GRAVAGNA Snam, Pontremoli-Parma	2003	SICIM	MARL & LIMESTONE	188	1,32	28,17°	18	27	Gas pipe line shaft
Comessa 2003/03 National way Ventilation Shaft S.GIACOMO Bronzolo (BZ)	2003	SOC. ITALIANA PER CONDOTTE D'ACQUA	QURTZ- PORPHIRY ROCK	205	4,38	90°	1,8	29	Ventilation shaft
Comessa 2003/11 POZOS DE ASCENSORES Estacion RENFE de la Peña BILBAO - SPAIN	2003	TECSA S.A.	LUTITAS GRISES	14 17	3,68 3,68	90° 90°	unap. unap.	4 4	Lifting shafts
Comessa 2003/12 Ventilation Shaft Kristallina Mine - Racines (BZ) OMYA	2003	OMYA	CALCIUM	186	2,44	55°	unap.	18	Rock stocking well
Comessa 2003/16 Gas Pipeline by-pass National Way S.S. 45 (GE) Snam	2003	TRE COLLI Spa	LIMESTONE	18	1,06	45°	0	4	Gas pipe line shaft
Comessa 2003/18 Limestone Quarry ROASCHIA (CN)	2003	BUZZI UNICEM SPA	LIMESTONE	135,34	4,09	65°	unap.	16	Rock stocking well shaft
Comessa 2003/17 MINA DE BELMONTE Rio Narcea Gold Mine Oviedo (E)	2003 2004 2004	INSERSA S.A.	GRANITE	296,8 99,03 79,36	2,74 1,52 2,44	81° 69° 73,5°	unap. unap. unap.	60 15 16	Ventilation shafts Cables shaft Rock stocking well shaft Cables shaft
Comessa 2003/05 Hydro Pumping Project JÚCAR – VINALOPÓ PROJECT Valencia - SPAIN	2004	UTE Jucan Vinalopò	LIMESTONE DOLOMITE	100,5 198,75	2,44 2,44	90° 90	0,15 0,42	9 16	Pumping shafts Pumping shafts

TOTAL REAMED SHAFT'S LENGHT m.

33.492

(*) from pilot hole start
to reaming end only

RAISE BORING DIVISION WORKS - REFERENCES LIST

PROJECT SITE PURCHASER	YEAR	CONTRACTOR	ROCK TYPE	LENGHT (m.)	DIA. (m.)	INCLI- NATION (deg.)	DEVI- ATION (m.)	EXECUT. TIME (*) (days)	R E M A R K S
Comessa 2003/15 Discharging Shaft ISOLA DI CAPRI Municipality of Capri (NA)	2004	MARINO LAVORI SpA	LIMESTONE	56,5	1,06	55°	unap.	5	Water's submarine pipeline
Comessa 2003/10 Hydro Pumping Project BASSO FLUMENDOSA ENTE AUTONOMO FLUMENDOSA	2004	IGECO	PORPHIRY	67 67	3,08	90°	unap.	11 8	Surges chamber shafts
Comessa 2004/01 Sewerage Pipeline CONSORZIO GARDA UNO Moniga del Garda (BS)	2004	I.C.B. srl	LIMESTONE	48	1,06	18,7°	unap.	9	Discharging shaft
Comessa 2004/02 VERMA Gate Shaft Premadio Power Plant A.E.M. Spa	2004	SELI Spa	METAPHILLITICS ROCS	26 17,68	2,13	90°	0,8	4 5	Penstok shaft
Comessa 2004/03 Hydroelectric Project S.Giacomo di Fraele (SO) A.E.M. Spa	2004	COSSI Costruzioni Spa	LIMESTONE	39	2,13	90°	unap.	4	Adit shaft
Comessa 2004/04 Hydroelectric Project Porlezza (CO) Elettrowatt	2004	MOLINA COSTRUZIONI	LIMESTONE	112,5	1,05	57°12'	unap.	8	Penstok shaft
Comessa 2004/05 Carbonate Quarry COSTIOLO (BG) - Italy	2004	UNICALCE S.p.A.	LIMESTONE	95	5,46	75°	0,4	18	Rock stocking well shaft
Comessa 2004/07 Limestone Quarry SO.GE.MA. Riofreddo (Roma)	2004	SO.GE.MA.	LIMESTONE	87	3,68	75°	unap.	8	Rock stocking well shaft
Comessa 2004/08 Ventilation Shaft of Perama. Schistos, near Piraeus - Grece	2004	THEMELI S.A	LIMESTONE	188	1,06	90°	1,5	8	Railway tunnel safety chamber
Comessa 2002/08 Ventilation shafts "MENTA" Dam - Cardeto (RC) Italy REG. CALABRIA Ass. LL.PP	2004	SELI Spa	GNEISS/ SCHIST	70	1,32	90°	0,15	7	Gate shaft
Comessa 2004/09 Railway Tunel BO-FI Vent. Tunel Pianoro (BO) Italy C.A.V.E.T.	2004	C.A.V.E.T.	SILTOSE MARLS	38	4,09	90°	0,15	6	Ventilation of interconnection tunnels
Comessa 2004/12 Underground station METRO BILBAO: Linea Sestao - Portugalete - Spain	2004 2005	UTE METRO PORTUGALETE	CAYULEA	13,6 14,8 15,4 15,3 21 21 16,5 11 11 11	3,68	90°	unap. unap. unap. unap. unap. unap. unap. unap. unap. unap.	5 5 5 6 7 6 9 4 6 5	Lifting shaft ventilation shaft

TOTAL REAMED SHAFT'S LENGHT m.

34.554

(*) from pilot hole start
to reaming end only

RAISE BORING DIVISION WORKS - REFERENCES LIST

PROJECT SITE PURCHASER	YEAR	CONTRACTOR	ROCK TYPE	LENGHT (m.)	DIA. (m.)	INCLI- NATION (deg.)	DEVI- ATION (m.)	EXECUT. TIME (*) (days)	R E M A R K S
Comessa 2004/13 Limestone Quarry Cori (LT) - ITALY	2004	E.P.L.E.S.	LIMESTONE	159	3,68	69,3°	unap.	21	Rock stocking well shaft
Comessa 2005/01 Level Connections Mines "Kristallina & Pratone" Vipiteno (BZ) - ITALY	2005	O M Y A SPA	CRYSTALLINE MARBLE	57,50 12,00 32,50 23,20 225 225 216,40	4,38 1,55 1,55 4,38 0,275 1,55 2,13	90° 70° 90° 61° 85° 85° 85°	unap. unap. unap. unap. 3,2 5,88 2,20	10 4 4 5 5 21 18	Rock stocking well shaft // // // // // // Ventilation shaft
Comessa 2005/03 Cementary Plant Brembilla (BG) - ITALY	2005	UNICALCE SPA	LIMESTONE	30,45 20,26	3,68 3,68	90°	unap.	10	Rock stocking well shaft
Comessa 2005/04 Limestone Quarry Caneva (PN) - ITALY	2005	C P S Srl	LIMESTONE	64	4,08	70°	unap.	9	Rock stocking well shaft
Comessa 2005/05 Miniera Ca' Bianca Tavernola (BG) - Italy	2005	LAFARGE ADRIASEBINA	LIMESTONE	29	3,05	90°	unap.	8	Dropping shaft
Comessa 2005/06 Alaiz Quarry Pamplona - Spain	2005	ALAIZ S.A.	LIMESTONE	210	4,74	70°	unap.	32	Rock stocking well shaft
Comessa 2005/07 Tunnel Vomp Terfens VOMPERBACH - Austria	2005	ARGE TUNNEL VOMP-TERFENS	DOLOMITE	107	1,55	90°	unap.	8	Ventilation shaft
Comessa 2005/08 Quarry "Monfranco" Roaschia (CN) - Italy	2005	BUZZI UNICEM Spa	LIMESTONE	83	4,09	70°	unap.	11	Rock stocking well shaft
Comessa 2005/09 Rainfalls shaft Monte di Procida (NA) - Italy	2005	Euro Co.Ge.I. S.r.l.	POZZOLANA	40	0,66	62,63°	unap.	5	Rain water draining shft
Comessa 2005/10 Mine de "La Perelle" St.Laurent de Pont - Grenoble (F)	2005	CIMENT VICAT	LIMESTONE	189	2,44	45°50°	unap.	19	Rock stocking well shaft
Comessa 2005/12 Impianto idroelettrico Torrente Clavalitè, FENIS (AO)	2005	B.G.F. Srl	CALCSCHIST	458	1,84	45°	8mt	37	Penstok shaft
Comessa 2005/14 Cementary Plant Brembilla (BG) - ITALY	2005	UNICALCE SPA	LIMESTONE	52	pil 11"	45°	unap.	3	Cables' Hole
Comessa 2005/15 Variante di Valico Pozzi di areazione	2005	TODINI (ex Rialto)	SILTOSE MARLS	76	1,06	0,9°	delete work		Conne ction hole between to tunnels
Comessa 2005/16 Underground Garage VILLA LINDA (BG) - ITALY	2005	LAMA IMMOBILIARE	FLYSH	9,87 17,53 14,27 13	1,84 1,84 1,84 3,68	90° 90° 90° 90°	0	10 8 8 13	Emergency exit shaft Ventilation shaft // //
Comessa 2006/02 Hydro Power Plant BRISOGNE (AO) - ITALY	2007	F.LLI RONC SRL	MICASCHIST	580	1,84	90°	0,18	58	Penstok shaft by RVDS
Comessa 2006/03 Ciordia Quarry Pamplona - Spain	2005	LAZARO ECHEVARRIA S.A.	LIMESTONE	118	4,07	70°	unap.	12	Rock stocking well shaft //
Comessa 2006/04 Malegno sewerage Brescia - ITALY	2006	F.LLI FURLONI SRL	LIMESTONE	29	1,06	40°	unap.	4	Sewerage shaft //

TOTAL REAMED SHAFT'S LENGHT m.

37.644

(*) from pilot hole start
to reaming end only

RAISE BORING DIVISION WORKS - REFERENCES LIST

PROJECT SITE PURCHASER	YEAR	CONTRACTOR	ROCK TYPE	LENGHT (m.)	DIA. (m.)	INCLI- NATION (deg.)	DEVI- TION (m.)	EXECUT. TIME (*) (days)	R E M A R K S	
Comessa 2006/05 Cementary Plant Cava Costiolo (BG) - ITALY	2006	UNICALCE SPA	LIMESTONE	109	3,05	90°	unap.	14	Slot shaft	
Comessa 2006/06 Sewer tratement plant Como lake - Colonno - ITALY	2006	F.lli BIACCHI S.a.S	LIMESTONE	20	1,55	0°	unap.	16	Submerged shaft for pipes line.	
Comessa 2006/07 Bilbao Metropolitan SANTURZI Station	2006 2007	UTE METRO SANTURZI	(2p.)	23,63	3,68	90°	unap.	7	Lifting shaft ventilation shaft	
			(2p.)	23,63	//	//	unap.	7		
				22,00	//	//	unap.	7		
			(2p.)	22,00	//	//	unap.	5		
			(2p.)	19,08	//	//	unap.	5		
			(2p.)	25,60	//	//	unap.	5		
Comessa 2006/08 Apario Quarry Lemona - Bizkaia (E)	2006	CEMENTOS LEMONA	LIMESTONE	154,2 60	4,38 2,44	72°	unap. unap.	22 7	Rock Stocking	
Comessa 2006/09 Connection tunnel Domodossola - ITALY	2006	S.ANDREA- DESENO SRL	GRANITE	670	0,66	4°	unap.	59	Pilot hole by motor + MWD	
Comessa 2006/10 New Penstock conduct ENEL - Usseglio (TO) - ITALY	2006	BETTI Spa	METAMORFICS BASALT	264	3,68	45°	unap.	32		
Comessa 2006/13 Beles Multipurpose Project Ethiopia	2006	SALINI Spa	ALTERNATED	81	1,84	90°	unap.	5	Surge shaft	
			BASALT AND	262	1,84	90°	1,40	18	Pensctock shaft	
			TUFF ROCKS	277	1,84	90°	unap.	33	Cables shaft	
Comessa 2006/14 Tunnel de San Pedro Colmenar Viejo - Madrid (E)	2006	UTE SAN PEDRO	ORTOGNEISS	120	3,05	90°	0,07	11	Ventilation Shaft	
Comessa 2006/15 Val Noci Dam Genova - ITALY	2008	GENOVA ACQUE	LIMESTONE	38	3,05	90°	unap.	9	Spillway shaft	
Comessa 2006/16 Hydroelectric Project Val Passiria - ITALY	2007	INGENIEURBURO	SCHIST	220	2,74	90°	0,06	17	Penstock Shaft by RVDS	
				50	1,84	90°	unap.	8	Surge Shaft	
Comessa 2006/17 Estacion Renfe - Miribilla Bilbao (E)	2006	UTE ESTACION MIRIBILLA	HARD	35	3,5	90°	unap.	10	Ventilation Shaft	
			MARL	29	6,12	90°	unap.	12	Escape Shaft	
Comessa 2006/18 Système de production eau pot. Commun.té d'Annency - FRANCE	2006	CAMPENON BERNARD	LIMESTONE	65	3,05	40°	unap.	9		
Comessa 2007/02 Cementary Plant Brembilla (BG) - ITALY	2007	UNICALCE SPA	LIMESTONE	95	pil 11"	90°	unap.	5	Pilot hole	
	2008			24,45	3,05	90	unap.	5		
	2008			89	3,05	90°	unap.			
				89	3,05	90°	unap.			
Comessa 2007/03 Cantera de Salinas Astrurias (E)	2007	CANTERAS ARROJO	CONGLOMERATE	55	2,13	72°	unap.	7	Inclinated shaft	
Comessa 2007/04 Galleria Vedeggio-Casarate LUGANO - SWISS	2007	Consorzio MARTI c/o Mancini & Marti SA	SCHIST	96	4,09	90°	unap.	9	Ventilation Shaft	
Comessa 2007/05 Rio Laque Quarry S. Saverino Marche (MC) - ITALY	2007	UNIONCAVE SRL	LIMESTONE	130	3,68	72°	unap.	20	Rock stocking well shaft	
TOTAL REAMED SHAFT'S LENGHT m.									40.813	(*) from pilot hole start to reaming end only

RAISE BORING DIVISION WORKS - REFERENCES LIST

PROJECT SITE PURCHASER	YEAR	CONTRACTOR	ROCK TYPE	LENGHT (m.)	DIA. (m.)	INCLI- NATION (deg.)	DEVI- TION (m.)	EXECUT. TIME (*) (days)	R E M A R K S
Commissa 2007/06 Costiolo Quarry Brembilla (BG) - ITALY	2007	UNICALCE SpA	LIMESTONE	107	3,05	90°	unap.	17	Rock stocking well shaft
Commissa 2007/07 Limestone Quarry Cava di Roccavione (CN)	2007	PREVE COSTRUZIONI SPA	LIMESTONE	110	3,68	90°	unap.	18	Rock stocking well shaft
Commissa 2007/08 Limestone Quarry Vipiteno (BZ) - ITALY	2007	OMYA	LIMESTONE	180	2,4	90°	not detected	14	Ventilation
Commissa 2007/09 Hydroelectric Plant Pontebba- (UD) ITALY	2007	IDROELETTRICA del PRAMOLLO Srl	DOLOMITIE	104	1,06	36,3°	unap.	15	Sub-horizontal drilling
Commissa 2007/10 Limestone quarry TAIWAN	2008	LUCKY CEMENT	LIMESTONE	384	4,09	90°	0,60	60	Rock stocking well shaft
Commissa 2007/11 HUNOSA Coal Mine Mieres - Asturias	2008	PROMINOR 2003	MARL	78	3,68	90°	unap.	34	Rock stocking well shaft
Commissa 2008/01 Limestone Quarry Carpene di S. Nazario (VI) ITALY	2008	GRANULATI DOLOMITICI PEROGLIO	LIMESTONE	190	3,41	72°	unap.	20	Rock stocking well shaft
Commissa 2008/02 Limestone Quarry Gavardo (BS) ITALY	2008	FASSA SpA	LIMESTONE	110	3,68	70°	unap.	13	Rock stocking well shaft
Commissa 2008/03 Hydroelectric Plant Picote - Portugal	2008	UTE MSF - OPCA	GRANITE	170	5,1	90°	0,04	23	Cables & Ventilation Shaft by RVDS
Commissa 2008/04 Veracruz Quarry Mexico	2008	CEMENTOS MOCTEZUMA	LIMESTONE	130	4,38	70°	0,01	13	Rock stocking well shaft
Commissa 2008/06 Tapovan H.E. Project India	2008	PATEL ENGINEERING LTD	QUARTZ, MICA, GNEISSES	145	2,13	90°	1,8	11	Surge Chamber Shaft
Commissa 2008/09 Limestone Quarry Palazzago (BG) - ITALY	2008	ITALCEMENTI SPA	LIMESTONE	180	4,09	75°	1,80	25	Rock stocking well shaft
Commissa 2008/12 Nukazgan Mine Kazakhstan	2008	HERRENKNECHT AG	GRANODIORITE QUARTZDIORITE	144,36 279,59	4,50 4,5	90° 90°	1,4 2,1	18 46	Ventilation shaft Ventilation shaft
Commissa 2008/14 Loaharinag Pala H.E. Project India	2008	PATEL ENGINEERING LTD	AUGEN GNEISSES, QUARTZ MICA GNEISSES	123	2,13	90°	2,5		Surge Chamber Shaft
Commissa 2009/01 F.lli Negro Snc Chiampo (Vi)	2009	F.LLI NEGRO SNC	LIMESTONE	130	3,09				Rock stocking well shaft
Commissa 2009/02 EWR Energie AG Schattenhalb Meiringen - CH	2009	THYSSEN SCHACHTBAU GMBH	CLAY SCHIST SANDSTONE LIMESTONE	280	3,05	52°54°	-15,76 down -3,12 left	35	Penstock Shaft
Commissa 2009/03 Socarl Quarry (chez SBCT) Lourdes - France	2009	SOCARL (chez SBCT)	LIMESTONE	153	1,84	80,5°	1,5	17	Rock stocking well shaft
Commissa 2009/04 Pan Asia Corporation Taiwan	2009	PAN ASIA CORPORATION	SLAB ROCK	107	1,55	47°	2,3 right	9	Penstock Shaft
TOTAL REAMED SHAFT'S LENGHT m.									(*) from pilot hole start to reaming end only
									43.918

RAISE BORING DIVISION WORKS - REFERENCES LIST

PROJECT SITE PURCHASER	YEAR	CONTRACTOR	ROCK TYPE	LENGHT (m.)	DIA. (m.)	INCLI- NATION (deg.)	DEVIA- TION (m.)	EXECUT. TIME (*) (days)	R E M A R K S
<i>Commessa 2009/05</i> Aménagement du Rizzanese Corse - France	2009	BEC FRERES SA	DIORITE, GRANODIORITE	70	2,44	90°	0,002	12	Surge Chamber Shaft Shaft by RVDS
<i>Commessa 2009/08</i> Mina Farallon Negro Argentine	2009	PANEDILE ARGENTINA SAICFeI	MONZONITE	280+280	1,55	65°-70°	in execution		Ventilation shaft
TOTAL REAMED SHAFT'S LENGHT m.									
				43.988					(*) from pilot hole start to reaming end only

LAVORI IN GALLERIA (TUNNELING WORKS) - REFERENCES LIST							
PROJECT SITE PURCHASER	YEAR	CONTRACTOR	ROCK TYPE	LENGHT (m.)	SEZ. (m2.)	INCLINATION	REMARKS
Calcium Mine VIPITENO (BZ) - ITALY	1998	OMYA S.p.A.	CALCIUM	1000	40	incl. 1,5%	
Limestone Quarry MOLAZZANA (LU) - ITALY	2001	FASSA S.p.A.	LIMESTONE	53 24	28,6 92	12% 3%	
Pumping Station Imp. Sollev. del Flumendosa Cagliari - ITALY - E.A.F.	2001	IMPREGILO S.p.A.	SCHIST	125	9,5	4%	
<i>Commessa 2002/01</i> S.N.A.M. - Oil Pipeline DN 400 GIGNOD (AO) - ITALY	2002	TRE COLLI S.p.A.	PORPHIRY	36,4	9,7	1%	
<i>Carbonate Quarry</i> CAVA COSTIOLO (BG) - ITALY	2002	UNICALCE S.p.A.	CALCIUM CARBONATE	600 / anno	18	horizontal	in execution
Gas Pipeline DN 750 CALESTANO (PR) - ITALY S.N.A.M.	2002	SICIM S.p.A.	MARL	286 6	10 26	10%	
Limestone Quarry TETTI BAVA (CN) - ITALY (subappalto)	2002	FASSA S.p.A.	LIMESTONE	221 25	28,6 92	6%	
<i>Commessa 2002/02</i> Limestone Quarry CAVA MOCCIA - S.ROSALIA (CE) - ITALY	2002	CEMENTI MOCCIA	LIMESTONE	160 15	33 225	2%	
<i>Commessa 2002/09</i> Limestone Quarry CEMENTO MOCTEZUMA, Stab. Di Cerritos - MEXICO	2002	BUZZI UNICEM	LIMESTONE	280	30	horizontal	
<i>Commessa 2003/06</i> Gas pipeline DN750 POZZO GRAVAGNA GRAVAGNA (MS) - ITALY	2003	SICIM	MARL	32	10	5%	
<i>Commessa 2003/04</i> Tunnel for funicular cablecar RUACIA-PRAMAURON VAL GARDENA (BZ) - ITALY	2003	GHERDÉINA RONDA GmbH	DIFFERENT SOILS AND ROCKS	1067 150	30mq 50mq	5-16%	
<i>Commessa 2003/13</i> Real Cava Marmorera VALDIERI (CN) - ITALY	2003	CARBOCALCIO CUNESE Spa	CALCIUM	140 500	25/30mq 60/70mq	7% 10%	
<i>Commessa 2003/18</i> Quarry ROASCHIA CUNEO - ITALY	2003	BUZZI UNICEM SPA	LIMESTONE	15	90 m2	0%	
<i>Commessa 2003/19</i> Underground Quarry MONCALVO (AT) - ITALY	2003	FASSA SRL	LIMESTONE	40	27,5 m	0%	
<i>Commessa 2004/06</i> Underground Quarry MONFORTE D'ALBA (CN)-ITALY	2004	Azienda Agricola ELIO GRASSO	MARL AND TUFO	99	36	0%	
<i>Commessa 2004/07</i> Limestone Quarry "SO.GE.MA." RIOFREDDO (Roma) - ITALY	2004	SO.GE.MA.	LIMESTONE	150	32	2-3%	

LAVORI IN GALLERIA (TUNNELING WORKS) - REFERENCES LIST

PROJECT SITE PURCHASER	YEAR	CONTRACTOR	ROCK TYPE	LENGHT (m.)	SEZ. (m2.)	INCLINATION	REMARKS
Comessa 2004/07 Limestone Quarry "SO.GE.MA." RIOFREDDO (Roma) - ITALY	2004	SO.GE.MA.	LIMESTONE	150	32	2-3%	
Comessa 2004/11 Underground Garage VILLA LINDA (BG) - ITALY	2004	LAMA IMMOBILIARE	FLICH	28,5	145	0%	
Comessa 2004/13 Limestone Quarry CORI (LT) - ITALY	2004	E.P.L.E.S.	LIMESTONE	80	32	2-4%	
Comessa 2004/10 MOSO IN PASSIRIA Bolzano - ITALY	2004	EUM.Gen.m.b.h.	GRAVEL & SAND	170	16	0%	
Comessa 2005/02 Quarry ROASCHIA ROASCHIA (CN) - ITALY	2005	BUZZI UNICEM SPA	LIMESTONE	30	40	0%	
Comessa 2005/03 Cemetery Plant Brembilla (BG) - ITALY	2005	UNICALCE SPA	LIMESTONE	51 18	36 27	0%	
Comessa 2005/04 Limestone Quarry Caneva (PN) - ITALY	2005	C P S Srl	LIMESTONE	300	30	0%	camerone 3000mq
Comessa 2005/08 Quarry ROASCHIA ROASCHIA (CN) - ITALY	2005	BUZZI UNICEM SPA	LIMESTONE galleria // camerone	180 30 45	35 20 290	0%	
Comessa 2005/11 Underground Garage VILLA PICRI (BG) - ITALY	2005	PICRI SRL	LIMESTONE	12,15	33	0%	
Comessa 2005/13 Cemetery Plant Brembilla (BG) - ITALY	2005	UNICALCE SPA	LIMESTONE	180 100 100	39,27 23,44 //	downhill 8-10% climb 14-15% climb 1-2%	
Comessa 2006/01 Limestone Quarry Cava 'Martina' (BG) - ITALY	2006	NICEM SRL	DOLOMITE	80	70	0	
Comessa 2006/11 Veruca Fall Meran - ITALY	2006	PROVINCIA DI BOLZANO	PORFIRY	155	10	1%	
Comessa 2006/12 Limestone Quarry Vipiteno (BZ) - ITALY	2006	OMYA	LIMESTONE	xxx	66 53 14,24	8÷10% 8÷10% 8÷10%	
Comessa 2006/15 Val Noci Dam Val Noci (GE) - ITALY	2006	MEDITERRANEA DELLE ACQUE	DOLOMITE	40	3,5X3,5	1%	
Comessa 2006/16 Centrale idroelettrica Val Passiria - ITALY	2006	ENERPASS	GNEISS	700	4X4,5	10%	
Comessa 2007/01 Limestone Quarry Cava 'Valdieri' (CN) - ITALY	2007	CARBONALCIO CUNEESE SPA	CALCIUM	270	32	2%	
Comessa 2007/08 Limestone Quarry Vipiteno (BZ) - ITALY	2007	OMYA	LIMESTONE	300	48	0%	
Comessa 2008/01 Limestone Quarry Carpanè di S. Nazario (VI) - ITALY	2008	GRANULATI DOLOMITICI PEROGGIO	LIMESTONE	210	30 250	10%	
Comessa 2008/02 Limestone Quarry Gavardo (BS) - ITALY	2008	FASSA SPA	LIMESTONE	103 30	36 200	0% 0%	

LAVORI IN GALLERIA (TUNNELING WORKS) - REFERENCES LIST							
Commissa 2008/04 Limestone Quarry Veracruz - MESSICO	2008 2009 2009 2009	CEMENTOS MOCTEZUMA (BUZZI UNICEM)	LIMESTONE LIMESTONE LIMESTONE LIMESTONE	650 50 1600 707	36 250 16 16	3% 3% -7% -18%	
Commissa 2008/08 Limestone Quarry Casazza (BS) - ITALY	2008	NICEM	LIMESTONE	1000 mt/year	70 30 20	different kind	
Commissa 2008/09 Limestone Quarry Palazzago (BG) - ITALY	2008	ITALCEMENTI SPA	LIMESTONE	223 60	30 300	7% 0%	
Commissa 2008/10 Tunnel SS 12 Bronzolo - Bolzano Bolzano - ITALY	2008	OBEROSLER CAV. PIETRO SPA	PORPHYRY	275		vertical shaft	Scheduled Winter 2010
Commissa 2008/11 Hydroelectric Power Corvara Corvara di Moso I.P. (BZ) - ITALY	2008	AZIENDA ELETTRICA CORVARA	MICASCHIST	1006 65	28 70	18% 18%	in execution
Commissa 2008/13 Pedestrian access + Lift shaft Gargnano (Bs)	2008	Mr TESTA Mr BERNASSOLA	CLAYEY MARLS	20 8	5,88 4,37	0% 0%	
Commissa 2009/01 Quarry "Corati" Chiampo (VI) - ITALY	2009	F.LLI NEGRO SNC	LIMESTONE	224	25	12%	
Commissa 2009/06 Quarry "Colle Pedrino" Palazzago (BG) - ITALY	2009	ITALCEMENTI SPA	LIMESTONE	240		7%	in execution
TOTAL EXECUTED LENGHT m.				14.515			