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CLIENT:

Border Roads Organisation
श्रमेण सर्वम् साध्यम

Beacon

The Chief Employer's Representative
Project BEACON
Border Roads Organization
C/O 56 APO

PROJECT:

Consultancy Services for Detailed Feasibility Study and Framing up of Phasewise proposal (DPR) for construction of two tunnels at Z-Morh and at Zojila for all weather connectivity from Srinagar to Leh in Jammu & Kashmir State

ZOJILA TUNNEL

TITLE:

Phase II: Detailed Project Report - Preliminary Tunnel Design

Volume VII: Cost Estimation

Addendum 1 – Details of Quantities (DoQ)

Prepared by:		Date:	
Checked by:		Date:	
Approved by:		Date:	

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Item No.	Description of item	Quantity	Unit
BILL 1 - CIVIL ENGINEERING MAIN TUNNEL			
SCHEDULE -A DEWATERING ARRANGEMENT			
SCHEDULE - A1 Temporary Dewatering Arrangement Tunnel			
A101	Care of water in max 3.0% drift for downward drives	1,00	lumpsum
SCHEDULE - A2 Permanent Dewatering Arrangement Tunnel			
A201	Providing and laying of PVC pipe of following diameters as main collector pipe, connection pipes, cleaning access pipes etc., as per approved drawings & Technical Specifications or as directed by Employer's Representative.		
A20101	150 mm internal diameter PVC pipe [Equation = (a*interger(b/c))]	423,00	meter
a	Mean distance between 150 mm pipe and 400 mm pipe in main tunnel cross section	3,00	meter
b	Distance bewteen manholes 400 mm pipe	100,00	meter
c	Mined tunnel length	14.083,00	meter
A20102	250 mm internal diameter PVC pipe [Equation = (a+b)*integer(d/c)]	1.528,44	meter
a	Distance between left side wall drainage and 400 mm pipe in main tunnel cross section	3,43	meter
b	Distance between right side wall drainage and 400 mm pipe in main tunnel cross section	7,41	meter
c	Distance between manholes 400 mm pipe	100,00	meter
d	Mined tunnel length	14.083,00	meter
A20103	400 mm internal diameter PVC pipe [Equation = a]	14.083,00	meter
a	Mined tunnel length	14.083,00	meter
A202	Providing and laying of perforated PVC pipe of following diameters as drainage pipes, as per approved drawings & Technical Specifications or as directed by Employer's Representative.		
A20201	150 mm internal diameter PVC pipe [Equation = a]	14.083,00	meter
a	Mined tunnel length	14.083,00	meter
A20202	250 mm internal diameter PVC pipe [Equation = 2*a]	28.166,00	meter
a	Mined tunnel length	14.083,00	meter
A203	Manufacture, supply, and placing of pre-cast concrete slot channel elements as per approved drawings for carriageway drainage [Equation = 2*a]	28.166,00	meter
a	Mined tunnel length	14.083,00	meter
A204	Providing and installing of dimpled sheets in the tunnel between primary and permanent lining as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = a*b*c]	41.140,66	sqm
a	Tunnel perimeter from main tunnel cross section	29,21	meter
b	Mined tunnel length	14.083,00	meter
c	Estimated tunnel length dimpled sheets requirement	0,10	%/100
A205	Providing, laying and fixing of Protective Felt (geotextile) with a minimum weight of 500 g/m2 for protection of the waterproofing membrane & drainage on the finished outer lining surface, including the cost of all materials, labour, equipment, etc. required for the completion of job, as per Technical Specifications or as directed by the Employer's Representative. [Equation = a*b+(c-a)*d*e]	413.689,86	sqm

Item No.	Description of item	Quantity	Unit
a	Tunnel perimeter from main tunnel cross section	29,21	sqm
b	Mined tunnel length	14.083,00	meter
c	Tunnel perimeter from main tunnel cross section lay by	31,75	sqm
d	Lay-by length	50,00	meter
e	Number of lay-bys	18,00	pcs
A206	Providing, placing, welding of 2 mm thick PVC or ECB Water Proofing Membrane including the cost of all materials, labour, equipment, etc. required for the completion of job, as per Technical Specifications or as directed by the Employer's Representative. [Equation = a*b+(c-a)*d*e]	413.689,86	sqm
a	Tunnel perimeter from main tunnel cross section	29,21	sqm
b	Mined tunnel length	14.083,00	meter
c	Tunnel perimeter from main tunnel cross section lay by	31,75	sqm
d	Lay-by length	50,00	meter
e	Number of lay-bys	18,00	pcs
A207	PVC Water stop serrated with central bulb (225mm wide, 8-11mm thick) [Equation = 2*a]	28.166,00	meter
a	Mined tunnel length	14.083,00	meter
A208	Manufacture, supply, and placing of inspection and cleaning chambers of PP or PE-HD including bell mouth, manhole cover, the cost of all materials, labour, equipment, etc. required for the completion of job as per approved detailed drawings & Technical Specifications or as directed by Employer's Representative.		
A20801	Cleaning and Inspection chamber for DN150 [Equation = integer(c/a)*b]	141,00	pcs
a	Distance between manholes	100,00	meter
b	Number of man holes per cross section	1,00	pcs
c	Mined tunnel length	14.083,00	meter
A20802	Cleaning and Inspection chamber for DN250 [Equation = integer(c/a)*b]	282,00	pcs
a	Distance between manholes	100,00	meter
b	Number of man holes per cross section	2,00	pcs
c	Mined tunnel length	14.083,00	meter
A20803	Cleaning and Inspection chamber for DN400 [Equation = integer(c/a)*b]	141,00	pcs
a	Distance between manholes	100,00	meter
b	Number of man holes per cross section	1,00	pcs
c	Mined tunnel length	14.083,00	meter
A209	Fire main [Equation = a+b+c+d]	14.200,00	meter
a	Mined tunnel length	14.083,00	meter
b	Length of cut & cover tunnel west	37,00	meter
c	Length of cut & cover tunnel east	30,00	meter
d	Estimated pipe length portal area	50,00	meter
A210	Fire hydrant [Equation = a]	132,00	pcs
a	Number of hydrant niches	132,00	pcs

Item No.	Description of item	Quantity	Unit
SCHEDULE - B UNDERGROUND EXCAVATION			
SCHEDULE - B1 Excavation			
B101	Underground excavation for tunnel in Support Category dominating the Face Area. Including all type of niches and lay-by including drilling, blasting, or other means of excavation, including widening of top heading footings, provision of surface drainage, construction ventilation, lighting arrangement during construction, temporary backfilling for traffic in tunnel, removal of the same and disposal of excavated material to muck disposal area with all lifts as per approved drawings & Technical Specifications. The quantities of excavation are determined to the design lines of excavation as per Technical Specifications. Overexcavation to the overexcavation line defined by the Technical Specifications is compensated with the unit rates.		
B10101	Excavation in Support Category A; top heading, bench, invert		
B1010101	Top Heading [Equation = a*b*c]	154.664,64	cum
a	Area of top heading excavation in cross section	56,16	sqm
b	Mined tunnel length	14.083,00	meter
c	Predicted percentage Support Category A of overall excavation	0,196	%/100
B1010102	Bench [Equation = a*b*c]	165.350,16	cum
a	Area of bench excavation in cross section	60,04	sqm
b	Mined tunnel length	14.083,00	meter
c	Predicted percentage Support Category A of overall excavation	0,196	%/100
B10102	Excavation in Support Category B; top heading, bench, invert		
B1010201	Top Heading [Equation = a*b*c]	118.752,48	cum
a	Area of top heading excavation in cross section	43,12	sqm
b	Mined tunnel length	14.083,00	meter
c	Predicted percentage Support Category B of overall excavation	0,196	%/100
B1010202	Bench [Equation = a*b*c]	166.809,78	cum
a	Area of bench excavation in cross section	60,57	sqm
b	Mined tunnel length	14.083,00	meter
c	Predicted percentage Support Category B of overall excavation	0,196	%/100
B10103	Excavation in Support Category C; top heading, bench, invert		
B1010301	Top Heading [Equation = a*b*c]	88.831,38	cum
a	Area of top heading excavation in cross section	43,48	sqm
b	Mined tunnel length	14.083,00	meter
c	Predicted percentage Support Category C of overall excavation	0,145	%/100
B1010302	Bench [Equation = a*b*c]	124.829,74	cum
a	Area of bench excavation in cross section	61,10	sqm
b	Mined tunnel length	14.083,00	meter
c	Predicted percentage Support Category C of overall excavation	0,145	%/100
B10104	Excavation in Support Category D; top heading, bench, invert		

Item No.	Description of item	Quantity	Unit
B1010401	Top Heading [Equation = a*b*c]	164.818,16	cum
a	Area of top heading excavation in cross section	61,00	sqm
b	Mined tunnel length	14.083,00	meter
c	Predicted percentage Support Category D of overall excavation	0,192	%/100
B1010402	Bench & Invert [Equation = (a+b)*c*d]	217.884,20	cum
a	Area of bench excavation in cross section	58,38	sqm
b	Area of invert excavation in cross section	22,26	sqm
c	Mined tunnel length	14.083,00	meter
d	Predicted percentage Support Category D of overall excavation	0,192	%/100
B10105	Excavation in Support Category E; top heading, bench, invert		
B1010501	Top heading & temporary invert [Equation = (a+b)*c*d]	181.941,20	cum
a	Area of top heading excavation in cross section	61,82	sqm
b	Area of temporary invert excavation in cross section	29,56	sqm
c	Mined tunnel length	14.083,00	meter
d	Predicted percentage Support Category E of overall excavation	0,141	%/100
B1010502	Bench & Invert [Equation = (a+b)*c*d]	104.051,73	cum
a	Area of bench excavation in cross section	29,28	sqm
b	Area of invert excavation in cross section	22,98	sqm
c	Mined tunnel length	14.083,00	meter
d	Predicted percentage Support Category E of overall excavation	0,141	%/100
B10106	Excavation in Support Category F; top heading, bench, invert		
B1010601	Top heading & temporary invert [Equation = (a+b)*c*d]	112.478,10	cum
a	Area of top heading excavation in cross section	62,80	sqm
b	Area of temporary invert excavation in cross section	30,32	sqm
c	Mined tunnel length	14.083,00	meter
d	Predicted percentage Support Category F of overall excavation	0,086	%/100
B1010602	Bench & Invert [Equation = (a+b)*c*d]	63.607,14	cum
a	Area of bench excavation in cross section	28,98	sqm
b	Area of invert excavation in cross section	23,68	sqm
c	Mined tunnel length	14.083,00	meter
d	Predicted percentage Support Category F of overall excavation	0,086	%/100
B10107	Excavation in Support Category G; top heading, bench, invert		
B1010701	Top heading & temporary invert [Equation = (a+b)*c*d]	51.690,91	cum
a	Area of top heading excavation in cross section	62,80	sqm
b	Area of temporary invert excavation in cross section	30,32	sqm
c	Mined tunnel length	14.083,00	meter
d	Predicted percentage Support Category G of overall excavation	0,039	%/100
B1010702	Bench & Invert [Equation = (a+b)*c*d]	29.231,57	cum

Item No.	Description of item	Quantity	Unit
a	Area of bench excavation in cross section	28,98	sqm
b	Area of invert excavation in cross section	23,68	sqm
c	Mined tunnel length	14.083,00	meter
d	Predicted percentage Support Category G of overall excavation	0,039	%/100
B10108	Excavation in Support Category H; top heading, bench, invert		
B1010801	Top heading & temporary invert [Equation = (a+b)*c*d]	7.457,12	cum
a	Area of top heading excavation in cross section	67,70	sqm
b	Area of temporary invert excavation in cross section	30,42	sqm
c	Mined tunnel length	14.083,00	meter
d	Predicted percentage Support Category H of overall excavation	0,005	%/100
B1010802	Bench & Invert [Equation = (a+b)*c*d]	4.193,68	cum
a	Area of bench excavation in cross section	31,65	sqm
b	Area of invert excavation in cross section	23,53	sqm
c	Mined tunnel length	14.083,00	meter
d	Predicted percentage Support Category H of overall excavation	0,005	%/100
B102	Mucking of geological overbreak accepted by Employer's Representative as per Technical Specifications [Equation = a]	8.500,00	cum
a	Estimated geological overbreak	8.500,00	cum
B103	Additional underground excavation as directed by Employer's Representative without rock mass classification. [Equation = a]	1.250,00	cum
a	Predicted additional underground excavation	1.250,00	cum
B104	Additional payment for extra transportation of excavation material to the muck deposit area as per approved drawings & Technical Specifications. [Equation = a*b]	16.194.003,96	cum*km
a	Predicted volume of excavation material [Equation = sum(Item B101)*0,75]	1.295.520,32	cum
b	Predicted mean distance to additional deposit area	12,50	km
B105	Re-profiling of tunnel due to deformations [Equation = a]	4.850,00	cum
a	Predicted volume of re-profiling	4.850,00	cum
B106	Temporary suspension of D&B excavation [Equation = a*b*c]	151,20	wd
a	Estimated construction time	2.520,00	wd
b	Predicted suspension in percentage of construction time and face	0,01	%/100
c	Number of working faces	6,00	pcs
SCHEDULE - B2	**Drilling and Grouting**		
B201	Drilling of drainage drilling in the tunnel perimeter and face, diameter 50 mm, length 3 m to 8 m [Equation = a*b]	19.250,00	meter
a	Estimated number of drainage drillings	3.500,00	pcs
b	Average length of drainage drilling [Equation = (3+8)/2]	5,50	meter
B202	Drilling of exploratory drilling without core recovery, diameter 50 mm, length up to 20 m [Equation = a]	30,00	pcs
a	Estimated number of exploratory drillings	30,00	pcs

Item No.	Description of item	Quantity	Unit
B203	Drilling of exploratory drilling with core recovery, diameter 76 mm		
B20301	Drilling 0-10 m [Equation = a]	25,00	pcs
a	Number of estimated exploratory drillings	25,00	pcs
B20302	Drilling 10-20 m [Equation = a]	25,00	pcs
a	Number of estimated exploratory drillings	25,00	pcs
B20303	Drilling 20-30 m [Equation = a]	25,00	pcs
a	Number of estimated exploratory drillings	25,00	pcs
B204	Strata grouting as defined by the approved drawings the Technical Specifications or directed by the Employer's Representative [Equation = a]	2.600,00	cum
a	Estimated volume to be strata grouted	2.600,00	cum
SCHEDULE - C PRIMARY SUPPORT MEASURES			
SCHEDULE - C1 Bolts & Anchors			
C101	Supply, drilling and installation of frictional rock bolts (Swellex or similar) of the specified length, Fy≥ 150 KN (tunnel support) as per approved drawings & Technical Specifications or as directed by Employer's Representative. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job.		
C10101	Length 4 m [Equation = integer((a+b)*g*c+(d+e)*g*f)]	13.881,00	pcs
a	Number of bolts in Support Category A in top heading per excavation meter	1,50	pcs/meter
b	Number of bolts in Support Category A in bench per excavation meter	1,14	pcs/meter
c	Predicted percentage Support Category A of overall excavation	0,196	%/100
d	Number of bolts in Support Category B in top heading per excavation meter	1,20	pcs/meter
e	Number of bolts in Support Category B in bench heading per excavation meter	1,20	pcs/meter
f	Predicted percentage Support Category B of overall excavation	0,196	%/100
g	Mined tunnel length	14.083,00	meter
C10102	Length 6 m [Equation = integer(a*b*c)]	4.958,00	pcs
a	Number of bolts in Support Category B in top heading per excavation meter	1,800	pcs/meter
b	Predicted percentage Support Category B of overall excavation	0,196	%/100
c	Mined tunnel length	14.083,00	meter
C102	Supply, drilling, installation and grouting of grouted rock bolts (SN type) of the specified length, Fy≥ 200 KN (tunnel perimeter & face) as per approved drawings & Technical Specifications or as directed by Employer's Representative. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job.		
C10201	Length 6 m [Equation = integer((a+b)*f*c+d*f*e)]	26.267,00	pcs
a	Number of bolts in Support Category C in top heading per excavation meter	5,43	pcs/meter
b	Number of bolts in Support Category C in bench per excavation meter	1,70	pcs/meter
c	Predicted percentage Support Category C of overall excavation	0,145	%/100
d	Number of bolts in Support Category D in top heading per excavation meter	4,33	pcs/meter
e	Predicted percentage Support Category D of overall excavation	0,192	%/100

Item No.	Description of item	Quantity	Unit
f	Mined tunnel length	14.083,00	meter
C10202	Length 9 m [Equation = integer((a+b)*m*c+(d+e)*m*f+(g+h)*m*i+(j*k)*m*l)]	61.510,00	pcs
a	Number of bolts in Support Category D in top heading per excavation meter	2,00	pcs/meter
b	Number of bolts in Support Category D in bench per excavation meter	2,00	pcs/meter
c	Predicted percentage Support Category D of overall excavation	0,192	%/100
d	Number of bolts in Support Category E in top heading per excavation meter	10,00	pcs/meter
e	Number of bolts in Support Category E in bench per excavation meter	4,00	pcs/meter
f	Predicted percentage Support Category E of overall excavation	0,141	%/100
g	Number of bolts in Support Category F in top heading per excavation meter	9,20	pcs/meter
h	Number of bolts in Support Category F in bench per excavation meter	4,00	pcs/meter
i	Predicted percentage Support Category F of overall excavation	0,086	%/100
j	Number of bolts in Support Category G in top heading per excavation meter	8,40	pcs/meter
k	Number of bolts in Support Category G in bench per excavation meter	4,00	pcs/meter
l	Predicted percentage Support Category G of overall excavation	0,039	%/100
m	Mined tunnel length	14.083,00	meter
C103	Supply, drilling, installation and grouting of self-drilling bolts of the specified length, Fy≥ 200 KN (tunnel perimeter & face) as per approved drawings & Technical Specifications or as directed by Employer's Representative. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job.		
C10301	Length 9 m [Equation = integer(a*b*d*c)]	1.520,00	pcs
a	Number of bolts in Support Category H in top heading per excavation meter	4,00	pcs/meter
b	Number of bolts in Support Category H in bench per excavation meter	5,00	pcs/meter
c	Predicted percentage Support Category H of overall excavation	0,005	%/100
d	Mined tunnel length	14.083,00	meter
C104	Supply, drilling, installation and grouting of forepoling as per approved drawings & Technical Specifications or as directed by Employer's Representative. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job.		
C10401	Grouted rock bolts (SN type) with a length of 6 m, Fy≥ 200 KN [Equation = integer(a*b+c*d+e*f+g*h+i*j)*k]	1.505.105,00	meter
a	Total length of bolts in Support Category C per excavation meter	140,58	meter/meter
b	Predicted percentage Support Category C of overall excavation	0,145	%/100
c	Total length of bolts in Support Category D per excavation meter	163,98	meter/meter
d	Predicted percentage Support Category D of overall excavation	0,192	%/100
e	Total length of bolts in Support Category E per excavation meter	206,40	meter/meter
f	Predicted percentage Support Category E of overall excavation	0,141	%/100
g	Total length of bolts in Support Category F per excavation meter	206,40	meter/meter
h	Predicted percentage Support Category F of overall excavation	0,086	%/100
i	Total length of bolts in Support Category G per excavation meter	206,40	meter/meter
j	Predicted percentage Support Category G of overall excavation	0,039	%/100

Item No.	Description of item	Quantity	Unit
k	Mined tunnel length	14.083,00	meter
C10402	Steel Pipe umbrella with a diameter of 114 mm, wall thickness of 6.5 mm and a length of 14 m [Equation = integer(a*c*b)]	5.725,00	meter
a	Total length of pipe umbrella in Support Category H per excavation meter	75,32	meter/meter
b	Predicted percentage Support Category H of overall excavation	0,005	%/100
c	Mined tunnel length	14.083,00	meter
TOTAL OF SCHEDULE - C1 Bolts & Anchors			
SCHEDULE - C2 Shotcrete, Lattice Girder, Lining Stress Controllers & Wire Mesh			
C201	Shotcreting of primary lining (tunnel, niches, caverns) with designed mix cement concrete SpC20/25(56)/II/J2/XC1/GK8 as per Technical Specifications & drawings or as directed by Employer's Representative in charge including all materials, labour, equipment, etc. required for complete job. The reinforcement is compensated separately.		
C20101	50 mm thick shotcrete lining in tunnel [Equation = (a+b)*d*c]	80.361,72	sqm
a	Perimeter of shotcrete lining in Support Category A, top heading	18,72	meter
b	Perimeter of shotcrete lining in Support Category A, bench	10,46	sqm
c	Predicted percentage Support Category A of overall excavation	0,196	%/100
d	Mined tunnel length	14.083,00	meter
C20102	100 mm thick shotcrete lining in tunnel [Equation = (a+b)*d*c]	80.471,88	sqm
a	Perimeter of shotcrete lining in Support Category B, top heading	18,78	meter
b	Perimeter of shotcrete lining in Support Category B, bench	10,44	meter
c	Predicted percentage Support Category B of overall excavation	0,196	%/100
d	Mined tunnel length	14.083,00	meter
C20103	150 mm thick shotcrete lining in tunnel [Equation = (a+b)*d*c]	59.861,07	sqm
a	Perimeter of shotcrete lining in Support Category C, top heading	18,86	meter
b	Perimeter of shotcrete lining in Support Category C, bench	10,44	meter
c	Predicted percentage Support Category C of overall excavation	0,145	%/100
d	Mined tunnel length	14.083,00	meter
C20104	200 mm thick shotcrete lining in tunnel [Equation = (a+b)*d*c]	77.059,24	sqm
a	Perimeter of shotcrete lining in Support Category D, top heading	19,28	meter
b	Perimeter of shotcrete lining in Support Category D, bench	9,24	meter
c	Predicted percentage Support Category D of overall excavation	0,192	%/100
d	Mined tunnel length	14.083,00	meter
C20105	250 mm thick shotcrete lining in tunnel [Equation = (a+b)*d*c]	56.903,91	sqm
a	Perimeter of shotcrete lining in Support Category E, top heading	19,34	meter
b	Perimeter of shotcrete lining in Support Category E, bench	9,24	meter
c	Predicted percentage Support Category E of overall excavation	0,141	%/100
d	Mined tunnel length	14.083,00	meter
C20106	300 mm thick shotcrete lining in tunnel [Equation = ((a+b)*c+(d+e)*f+(g+h)*i)*j]	52.739,92	sqm

Item No.	Description of item	Quantity	Unit
a	Perimeter of shotcrete lining in Support Category F, top heading	19,42	meter
b	Perimeter of shotcrete lining in Support Category F, bench	9,22	meter
c	Predicted percentage Support Category F of overall excavation	0,086	%/100
d	Perimeter of shotcrete lining in Support Category G, top heading	19,42	meter
e	Perimeter of shotcrete lining in Support Category G, bench	9,22	meter
f	Predicted percentage Support Category G of overall excavation	0,039	%/100
g	Perimeter of shotcrete lining in Support Category H, top heading	20,46	meter
h	Perimeter of shotcrete lining in Support Category H, bench	9,12	meter
i	Predicted percentage Support Category H of overall excavation	0,005	%/100
j	Mined tunnel length	14.083,00	meter
C202	Shotcreting of primary invert lining with designed mix cement concrete SpC20/25(56)/II/J2/XC1/GK8 as per Technical Specifications & drawings or as directed by Employer's Representative in charge including all materials, labour, equipment, etc. required for complete job. The reinforcement is compensated separately.		
C20201	200 mm thick shotcrete lining in tunnel [Equation = a*e*b+c*e*d]	65.900,83	sqm
a	Perimeter of shotcrete lining in Support Category D, invert	13,72	meter
b	Predicted percentage Support Category D of overall excavation	0,192	%/100
c	Perimeter of shotcrete lining in Support Category E, temporary invert	14,48	meter
d	Predicted percentage Support Category E of overall excavation	0,141	%/100
e	Mined tunnel length	14.083,00	meter
C20202	250 mm thick shotcrete lining in tunnel [Equation = a*i*b+c*i*d+e*i*f+g*i*h]	54.333,86	sqm
a	Perimeter of shotcrete lining in Support Category E, invert	13,80	meter
b	Predicted percentage Support Category E of overall excavation	0,141	%/100
c	Perimeter of shotcrete lining in Support Category F, temporary invert	14,60	meter
d	Predicted percentage Support Category F of overall excavation	0,086	%/100
e	Perimeter of shotcrete lining in Support Category G, temporary invert	14,60	meter
f	Predicted percentage Support Category G of overall excavation	0,039	%/100
g	Perimeter of shotcrete lining in Support Category H, temporary invert	14,71	meter
h	Predicted percentage Support Category H of overall excavation	0,005	%/100
i	Mined tunnel length	14.083,00	meter
C20203	300 mm thick shotcrete lining in tunnel [Equation = a*g*b+c*g*d+e*g*f]	25.564,15	sqm
a	Perimeter of shotcrete lining in Support Category F, invert	13,90	meter
b	Predicted percentage Support Category F of overall excavation	0,086	%/100
c	Perimeter of shotcrete lining in Support Category G, invert	13,90	meter
d	Predicted percentage Support Category G of overall excavation	0,039	%/100
e	Perimeter of shotcrete lining in Support Category H, invert	13,93	meter
f	Predicted percentage Support Category H of overall excavation	0,005	%/100
g	Mined tunnel length	14.083,00	meter

Item No.	Description of item	Quantity	Unit
C203	Shotcreting with designed mix cement concrete SpC20/25(56)/II/J2/XC1/GK8 of face sealing and widening of top heading footing in tunnel, as defined in the Technical Specifications including all labour, materials, cost of pins, hooks, lead, lift, handling, wastage complete with contractor's own equipment for complete job . [Equation = a*c*b]	11.742,00	cum
a	Support Category H, area of elephant foot shotcreting	1,20	sqm
b	Support Category H, area of excavation face top heading	67,70	sqm
c	Support Category H, area of excavation face temporary invert	30,42	sqm
d	Support Category H, area of excavation face bench	31,65	sqm
e	Support Category H, area of excavation face invert	23,53	sqm
f	Predicted percentage Support Category H of overall excavation	0,005	%/100
g	Mined tunnel length	14.083,00	meter
C204	Steel fibre reinforcement if required [Equation = a*(b+c)*d*f*e*g]	56,25	tonne
a	Reinforcement rate	0,002	%/100
b	Perimeter of shotcrete lining in Support Category A, top heading	18,72	meter
c	Perimeter of shotcrete lining in Support Category A, bench	10,46	meter
d	Thickness of shotcrete lining in Support Category A	0,05	meter
e	Predicted percentage Support Category A of overall excavation	0,196	%/100
f	Mined tunnel length	14.083,00	meter
g	Unit weight of steel	7,00	tonne/cum
C205	Supply and placing of 150 x 150 x 6 mm Q188 (3.01 kg/m²) welded wire fabric of Fe 500 as reinforcement in primary lining as per approved drawings & Technical Specifications or as directed by Employer's Representative. The rate shall include all labour, materials, cost of pins, hooks, lead, lift, handling, wastage complete with contractor's own equipment for complete job. [Equation = ((a+b)*c+(d+e)*f+(g+h+i)*j+(k+l+m+n)*o+(p+q+r+s)*t+(u+v+w+x)*y+(z+za+zb+zc)*zd)*ze/1000]	2.690,77	tonne
a	Support Category B, top heading	58,41	kg
b	Support Category B, bench	32,47	kg
c	Predicted percentage Support Category B of overall excavation	0,196	%/100
d	Support Category C, top heading	117,31	kg
e	Support Category C, bench	64,94	kg
f	Predicted percentage Support Category C of overall excavation	0,145	%/100
g	Support Category D, top heading	119,92	kg
h	Support Category D, bench	57,47	kg
i	Support Category D, invert	85,34	kg
j	Predicted percentage Support Category D of overall excavation	0,192	%/100
k	Support Category E, top heading	120,29	kg
l	Support Category E, temporary invert	90,07	kg
m	Support Category E, bench	57,47	kg
n	Support Category E, invert	85,84	kg

Item No.	Description of item	Quantity	Unit
o	Predicted percentage Support Category E of overall excavation	0,141	%/100
p	Support Category F, top heading	120,79	kg
q	Support Category F, temporary invert	90,81	kg
r	Support Category F, bench	57,35	kg
s	Support Category F, invert	86,46	kg
t	Predicted percentage Support Category F of overall excavation	0,086	%/100
u	Support Category G, top heading	120,79	kg
v	Support Category G, temporary invert	90,81	kg
w	Support Category G, bench	57,35	kg
x	Support Category G, invert	86,46	kg
y	Predicted percentage Support Category G of overall excavation	0,039	%/100
z	Support Category H, top heading	127,26	kg
za	Support Category H, temporary invert	91,50	kg
zb	Support Category H, bench	56,73	kg
zc	Support Category H, invert	86,64	kg
zd	Predicted percentage Support Category H of overall excavation	0,005	%/100
ze	Mined tunnel length	14.083,00	meter
C206	Supply, fabrication and erection of lattice girders and all accessories including all lead, lift, wastage, storing, drilling holes, fixing in phases etc. and installation of accessories for joining the lattice girder segments as per approved workshop drawings of contractor & Technical Specifications or as directed by Employer's Representative. The rate shall include costs of all materials, labour, equipment, welding, etc. for the complete job including additional cost for enlargement of top heading footing. [Equation = ((a+b)*c+(d+e)*f+(g+h)*i+(j+k)*l+(m+n)*o+(p+q)*r)*s/1000]	2.232,82	tonne
a	Support Category C, top heading	132,56	kg
b	Support Category C, bench	73,38	kg
c	Predicted percentage Support Category C of overall excavation	0,145	%/100
d	Support Category D, top heading	160,67	kg
e	Support Category D, bench	77,00	kg
f	Predicted percentage Support Category D of overall excavation	0,192	%/100
g	Support Category E, top heading	202,68	kg
h	Support Category E, bench	96,84	kg
i	Predicted percentage Support Category E of overall excavation	0,141	%/100
j	Support Category F, top heading	203,52	kg
k	Support Category F, bench	96,63	kg
l	Predicted percentage Support Category F of overall excavation	0,086	%/100
m	Support Category G, top heading	219,06	kg
n	Support Category G, bench	104,00	kg
o	Predicted percentage Support Category G of overall excavation	0,039	%/100

Item No.	Description of item	Quantity	Unit
p	Support Category H, top heading	288,49	kg
q	Support Category H, bench	128,59	kg
r	Predicted percentage Support Category H of overall excavation	0,005	%/100
s	Mined tunnel length	14.083,00	meter
C207	Providing and fixing yielding elements (Lining Stress Controllers - LSC or equivalent)) as per approved drawings and Technical Specifications. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job. [Equation = a*integer(c*b)]	4.640,00	pcs
a	Number of LSC per tunnel meter in Support Category F	2,00	pcs
b	Predicted percentage Support Category F of overall excavation	0,086	%/100
a	Number of LSC per tunnel meter in Support Category G	4,00	pcs
b	Predicted percentage Support Category G of overall excavation	0,039	%/100
c	Mined tunnel length	14.083,00	meter
SCHEDULE - D CONCRETE WORK			
D101	Design Mix Cement Concrete C25/30 including machine mixed, machine batched, machine vibrated, form work, etc. as per Technical Specifications & drawings or as directed by Employer's Representative. The reinforcement is compensated separately.		
D10101	Inner lining of tunnel - foundation [Equation = a*b*c]	13.184,12	cum
a	Area of foundation cross section	0,87	sqm
b	Number of foundations	2,00	pcs
c	Tunnel length with cross section type without invert	7.551,04	meter
D10102	Inner lining of tunnel - invert [Equation = a*b]	62.060,15	cum
a	Area of invert cross section	9,50	sqm
b	Tunnel length with cross section type with invert	6.531,96	meter
D10103	Inner lining of tunnel & niches - vault with radial formwork		
D1010301	with thickness of 30 cm [Equation = a*b]	68.487,93	cum
a	Concrete cross section	9,07	sqm
b	Tunnel length with cross section type without invert	7.551,04	meter
D1010302	with thickness of 40 cm [Equation = a*b]	76.907,30	sqm
a	Concrete cross section	11,77	meter
b	Tunnel length with cross section type with invert	6.531,96	meter
D10104	Inner lining tunnel ceiling and ventilation wall [Equation = (a+b)*c]	53.050,66	cum
a	Area of ceiling cross section	3,14	sqm
b	Area of ventilation wall cross section	0,63	sqm
c	Mined tunnel length	14.083,00	meter
D102	Design Mix Cement Concrete C12/15 including mechanically mixed machine mixed, machine batched, machine vibrated, form work, etc. as per Technical Specifications & drawings or as directed by Employer's Representative		
D10201	Fill concrete in tunnel [Equation = a*b+c*d]	82.955,72	cum

Item No.	Description of item	Quantity	Unit
a	Area of fill around tunnel main drainage pipe in cross section type without invert	2,37	sqm
b	Tunnel length with cross section type without invert	7.551,04	meter
c	Area of fill around tunnel main drainage pipe in cross section type with invert	9,97	sqm
d	Tunnel length with cross section type with invert	6.531,96	meter
D10202	Blinding concrete in tunnel [Equation = a*b]	3.156,33	cum
a	Area of blinding concrete (thickness 5 cm) below both foundation in cross section type without invert	0,42	sqm
b	Tunnel length with cross section type without invert	7.551,04	meter
D103	No-fines porous concrete in tunnel [Equation = a*b+c*d]	4.723,37	cum
a	Area of porous concrete around left and right side wall drainage in cross section type without invert	0,30	sqm
b	Tunnel length with cross section type without invert	7.551,04	meter
c	Area of porous concrete around left and right side wall drainage in cross section type with invert	0,37	sqm
d	Tunnel length with cross section type with invert	6.531,96	meter
D104	Reinforcement for inner lining		
D10401	Reinforcement for inner lining - foundation [Equation = a*b/1000]	988,81	tonne
a	Reinforcement rate	75,00	kg/cum
b	Total volume of foundation concrete (Item D10101)	13.184,12	cum
D10402	Reinforcement for inner lining - invert [Equation = a*b/1000]	4.654,51	tonne
a	Reinforcement rate	75,00	kg/cum
b	Total volume of invert concrete (Item D10102)	62.060,15	cum
D10403	Reinforcement for inner lining - vault	6.089,42	tonne
a	Reinforcement rate	75,00	kg/cum
b	Area of reinforced inner lining vault concrete (Item D1010302)	12,43	sqm
c	Tunnel length with cross section type with invert	6.531,96	meter
D10404	Reinforcement for inner lining tunnel ceiling and ventilation wall	3.978,80	tonne
a	Reinforcement rate	75,00	kg/cum
b	Total volume of tunnel ceiling and ventilation wall concrete (Item D10104)	53.050,66	cum
D105	Concrete tests	1,00	lump sum
SCHEDULE - E INSTRUMENTATION AND MONITORING			
E101	Supply, install, read and maintain of 3D monitoring targets (reflectors) in top heading bench and invert as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer(y*c/a)*b+integer(y*f/d)*e+integer(y*i/g)*h+integer(y*l/j)*k+integer(y*o/m)*n+integer(y*r/p)*q +integer(y*u/s)*t+integer(y*x/v)*w]	9.238,00	pcs
a	Support Category A, measurement section every	25,00	meter
b	Support Category A, reflectors per measurement section	5,00	pcs
c	Predicted percentage Support Category A of overall excavation	0,196	%/100
d	Support Category B, measurement section every	25,000	meter
e	Support Category B, reflectors per measurement section	5,000	pcs

Item No.	Description of item	Quantity	Unit
f	Predicted percentage Support Category B of overall excavation	0,196	%/100
g	Support Category C, measurement section every	15,000	meter
h	Support Category C, reflectors per measurement section	5,000	pcs
i	Predicted percentage Support Category C of overall excavation	0,145	%/100
j	Support Category D, measurement section every	10,000	meter
k	Support Category D, reflectors per measurement section	9,000	pcs
l	Predicted percentage Support Category D of overall excavation	0,192	%/100
m	Support Category E, measurement section every	7,500	meter
n	Support Category E, reflectors per measurement section	9,000	pcs
o	Predicted percentage Support Category E of overall excavation	0,141	%/100
p	Support Category F, measurement section every	7,500	meter
q	Support Category F, reflectors per measurement section	9,000	pcs
r	Predicted percentage Support Category F of overall excavation	0,086	%/100
s	Support Category G, measurement section every	5,000	meter
t	Support Category G, reflectors per measurement section	9,000	pcs
u	Predicted percentage Support Category G of overall excavation	0,039	%/100
v	Support Category H, measurement section every	5,000	meter
w	Support Category H, reflectors per measurement section	9,000	pcs
x	Predicted percentage Support Category H of overall excavation	0,005	%/100
y	Mined tunnel length	14.083,00	meter
E102	Supply, drill, install, grout, read and maintain of borehole extensometer (four point) in the tunnel perimeter as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer(v*c/a*b)+integer(v*f/d)*e+integer(v*i/g)*h+integer(v*l/j)*k+integer(v*o/m)*n+integer(v*r/p)*q+integer(v*u/s)*t]	1.130,00	pcs
a	Support Category B, measurement section every	100,000	meter
b	Support Category B, bore hole extensiometers per measurement section	2,000	pcs
c	Predicted percentage Support Category B of overall excavation	0,196	%/100
d	Support Category C, measurement section every	60,000	meter
e	Support Category C, bore hole extensiometers per measurement section	2,000	pcs
f	Predicted percentage Support Category C of overall excavation	0,145	%/100
g	Support Category D, measurement section every	35,000	meter
h	Support Category D, bore hole extensiometers per measurement section	4,000	pcs
i	Predicted percentage Support Category D of overall excavation	0,192	%/100
j	Support Category E, measurement section every	25,000	meter
k	Support Category E, bore hole extensiometers per measurement section	4,000	pcs
l	Predicted percentage Support Category E of overall excavation	0,141	%/100
m	Support Category F, measurement section every	20,000	meter

Item No.	Description of item	Quantity	Unit
n	Support Category F, bore hole extensiometers per measurement section	4,000	pcs
o	Predicted percentage Support Category F of overall excavation	0,086	%/100
p	Support Category G, measurement section every	20,000	meter
q	Support Category G, bore hole extensiometers per measurement section	4,000	pcs
r	Predicted percentage Support Category G of overall excavation	0,039	%/100
s	Support Category H, measurement section every	20,000	meter
t	Support Category H, bore hole extensiometers per measurement section	4,000	pcs
u	Predicted percentage Support Category H of overall excavation	0,005	%/100
v	Mined tunnel length	14.083,00	meter
E103	Supply, install, read and maintain of load cells for rock bolts as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer(v*c/a*b)+integer(v*f/d)*e+integer(v*i/g)*h+integer(v*l/j)*k+integer(v*o/m)*n+integer(v*r/p)*q+integer(v*u/s)*t]	628,00	pcs
a	Support Category B, measurement section every	100,000	meter
b	Support Category B, load cells per measurement section	2,000	pcs
c	Predicted percentage Support Category B of overall excavation	0,196	%/100
d	Support Category C, measurement section every	60,000	meter
e	Support Category C, load cells per measurement section	2,000	pcs
f	Predicted percentage Support Category C of overall excavation	0,145	%/100
g	Support Category D, measurement section every	35,000	meter
h	Support Category D, load cells per measurement section	2,000	pcs
i	Predicted percentage Support Category D of overall excavation	0,192	%/100
j	Support Category E, measurement section every	25,000	meter
k	Support Category E, load cells per measurement section	2,000	pcs
l	Predicted percentage Support Category E of overall excavation	0,141	%/100
m	Support Category F, measurement section every	20,000	meter
n	Support Category F, load cells per measurement section	2,000	pcs
o	Predicted percentage Support Category F of overall excavation	0,086	%/100
p	Support Category G, measurement section every	20,000	meter
q	Support Category G, load cells per measurement section	2,000	pcs
r	Predicted percentage Support Category G of overall excavation	0,039	%/100
s	Support Category H, measurement section every	20,000	meter
t	Support Category H, load cells per measurement section	2,000	pcs
u	Predicted percentage Support Category H of overall excavation	0,005	%/100
v	Mined tunnel length	14.083,00	meter

Item No.	Description of item	Quantity	Unit
E104	Supply, install, read and maintain of strain gauges for shotcrete as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer(v*c/a*b)+integer(v*f/d)*e+integer(v*i/g)*h+integer(v*l/j)*k+integer(v*o/m)*n+integer(v*r/p)*q+integer(v*u/s)*t]	318,00	pcs
a	Support Category B, measurement section every	100,000	meter
b	Support Category B, strain gauges per measurement section	1,000	pcs
c	Predicted percentage Support Category B of overall excavation	0,196	%/100
d	Support Category C, measurement section every	60,000	meter
e	Support Category C, strain gauges per measurement section	1,000	pcs
f	Predicted percentage Support Category C of overall excavation	0,145	%/100
g	Support Category D, measurement section every	35,000	meter
h	Support Category D, strain gauges per measurement section	1,000	pcs
i	Predicted percentage Support Category D of overall excavation	0,192	%/100
j	Support Category E, measurement section every	25,000	meter
k	Support Category E, strain gauges per measurement section	1,000	pcs
l	Predicted percentage Support Category E of overall excavation	0,141	%/100
m	Support Category F, measurement section every	20,000	meter
n	Support Category F, strain gauges per measurement section	1,000	pcs
o	Predicted percentage Support Category F of overall excavation	0,086	%/100
p	Support Category G, measurement section every	20,000	meter
q	Support Category G, strain gauges per measurement section	1,000	pcs
r	Predicted percentage Support Category G of overall excavation	0,039	%/100
s	Support Category H, measurement section every	20,000	meter
t	Support Category H, strain gauges per measurement section	2,000	pcs
u	Predicted percentage Support Category H of overall excavation	0,005	%/100
v	Mined tunnel length	14.083,00	meter
E105	Supply, install, read and maintain of strain gauges for concrete as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer(v*c/a*b)+integer(v*f/d)*e+integer(v*i/g)*h+integer(v*l/j)*k+integer(v*o/m)*n+integer(v*r/p)*q+integer(v*u/s)*t]	318,00	pcs
a	Support Category B, measurement section every	100,000	meter
b	Support Category B, strain gauges per measurement section	1,000	pcs
c	Predicted percentage Support Category B of overall excavation	0,196	%/100
d	Support Category C, measurement section every	60,000	meter
e	Support Category C, strain gauges per measurement section	1,000	pcs
f	Predicted percentage Support Category C of overall excavation	0,145	%/100
g	Support Category D, measurement section every	35,000	meter
h	Support Category D, strain gauges per measurement section	1,000	pcs

Item No.	Description of item	Quantity	Unit
i	Predicted percentage Support Category D of overall excavation	0,192	%/100
j	Support Category E, measurement section every	25,000	meter
k	Support Category E, strain gauges per measurement section	1,000	pcs
l	Predicted percentage Support Category E of overall excavation	0,141	%/100
m	Support Category F, measurement section every	20,000	meter
n	Support Category F, strain gauges per measurement section	1,000	pcs
o	Predicted percentage Support Category F of overall excavation	0,086	%/100
p	Support Category G, measurement section every	20,000	meter
q	Support Category G, strain gauges per measurement section	1,000	pcs
r	Predicted percentage Support Category G of overall excavation	0,039	%/100
s	Support Category H, measurement section every	20,000	meter
t	Support Category H, strain gauges per measurement section	2,000	pcs
u	Predicted percentage Support Category H of overall excavation	0,005	%/100
v	Mined tunnel length	14.083,00	meter
E106	Supply, install, read and maintain of radial pressure cells as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer(v*c/a*b)+integer(v*f/d)*e+integer(v*i/g)*h+integer(v*l/j)*k+integer(v*o/m)*n+integer(v*r/p)*q+integer(v*u/s)*t]	1.570,00	pcs
a	Support Category B, measurement section every	100,000	meter
b	Support Category B, radial pressure cells per measurement section	5,000	pcs
c	Predicted percentage Support Category B of overall excavation	0,196	%/100
d	Support Category C, measurement section every	60,000	meter
e	Support Category C, radial pressure cells per measurement section	5,000	pcs
f	Predicted percentage Support Category C of overall excavation	0,145	%/100
g	Support Category D, measurement section every	35,000	meter
h	Support Category D, radial pressure cells per measurement section	5,000	pcs
i	Predicted percentage Support Category D of overall excavation	0,192	%/100
j	Support Category E, measurement section every	25,000	meter
k	Support Category E, radial pressure cells per measurement section	5,000	pcs
l	Predicted percentage Support Category E of overall excavation	0,141	%/100
m	Support Category F, measurement section every	20,000	meter
n	Support Category F, radial pressure cells per measurement section	5,000	pcs
o	Predicted percentage Support Category F of overall excavation	0,086	%/100
p	Support Category G, measurement section every	20,000	meter
q	Support Category G, radial pressure cells per measurement section	5,000	pcs
r	Predicted percentage Support Category G of overall excavation	0,039	%/100
s	Support Category H, measurement section every	20,000	meter
t	Support Category H, radial pressure cells per measurement section	5,000	pcs

Item No.	Description of item	Quantity	Unit
u	Predicted percentage Support Category H of overall excavation	0,005	%/100
v	Mined tunnel length	14.083,00	meter
E107	Supply, install, read and maintain of tangential pressure cells as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer(v*c/a*b)+integer(v*f/d)*e+integer(v*i/g)*h+integer(v*l/j)*k+integer(v*o/m)*n+integer(v*r/p)*q+integer(v*u/s)*t]	1.570,00	pcs
a	Support Category B, measurement section every	100,000	meter
b	Support Category B, tangential pressure cells per measurement section	5,000	pcs
c	Predicted percentage Support Category B of overall excavation	0,196	%/100
d	Support Category C, measurement section every	60,000	meter
e	Support Category C, tangential pressure cells per measurement section	5,000	pcs
f	Predicted percentage Support Category C of overall excavation	0,145	%/100
g	Support Category D, measurement section every	35,000	meter
h	Support Category D, tangential pressure cells per measurement section	5,000	pcs
i	Predicted percentage Support Category D of overall excavation	0,192	%/100
j	Support Category E, measurement section every	25,000	meter
k	Support Category E, tangential pressure cells per measurement section	5,000	pcs
l	Predicted percentage Support Category E of overall excavation	0,141	%/100
m	Support Category F, measurement section every	20,000	meter
n	Support Category F, tangential pressure cells per measurement section	5,000	pcs
o	Predicted percentage Support Category F of overall excavation	0,086	%/100
p	Support Category G, measurement section every	20,000	meter
q	Support Category G, tangential pressure cells per measurement section	5,000	pcs
r	Predicted percentage Support Category G of overall excavation	0,039	%/100
s	Support Category H, measurement section every	20,000	meter
t	Support Category H, tangential pressure cells per measurement section	5,000	pcs
u	Predicted percentage Support Category H of overall excavation	0,005	%/100
v	Mined tunnel length	14.083,00	meter
E108	Supply, install, read and maintain of temperature gauges as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer(c/a*b)	282,00	pcs
a	Formwork block length	12,500	meter
b	Temperature gauge per formwork block	0,250	pcs
c	Mined tunnel length	14.083,00	meter
SCHEDULE - F PAVEMENT			
F101	Supply, preparation of material, placing, compacting of granular sub-base with a minimum thickness of 30 cm as per approved drawings & Technical Specifications. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job. [Equation = a*b*c+e*f*(d-a)]	40.708,65	cum

Item No.	Description of item	Quantity	Unit
a	Width of pavement	8,50	meter
b	Thickness of layer	0,30	meter
c	Mined tunnel length	14.083,00	meter
d	Width of pavement lay by	13,83	meter
e	Lay-by length	50,00	meter
f	Number of lay-bys	18,00	pcs
F102	Supply, mixing, placing, compacting of dry lean cement concrete base layer with a minimum thickness of 5 cm as per approved drawings & Technical Specifications. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job. [Equation = a*c+e*f*(d-a)]	124.502,50	sqm
a	Width of pavement	8,50	meter
b	Thickness of layer	0,05	meter
c	Mined tunnel length	14.083,00	meter
d	Width of pavement lay by	13,83	meter
e	Lay-by length	50,00	meter
f	Number of lay-bys	18,00	pcs
F103	Supply, mixing, placing, compacting of cement concrete pavement with a minimum thickness of 22 cm including construction of contraction joints, expansion joints, longitudinal joints, joint sealing compound, reinforcement, dowel rods and tie bars complete as per approved drawings & Technical Specifications. The rate shall include costs of all materials, labour, equipment, quality checks etc. required for the complete job. [Equation = a*b*c+e*f*(d-a)]	124.502,50	sqm
a	Width of pavement	8,50	meter
b	Thickness of layer	0,22	meter
c	Mined tunnel length	14.083,00	meter
d	Width of pavement lay by	13,83	meter
e	Lay-by length	50,00	meter
f	Number of lay-bys	18,00	pcs
F104	Manufacture, supply, and placing of pre-cast footpath elements in tunnel as per approved drawings, including application of 2 cm mastic asphalt surface. The rate shall include costs of all materials, labour, equipment, quality checks etc. required for the complete job. [Equation = a*b]	28.166,00	meter
a	Number of pre-cast elements per cross section	2,00	meter
b	Mined tunnel length	14.083,00	meter
BILL 2 - CIVIL ENGINEERING EGRESS TUNNEL			
SCHEDULE - G DEWATERING ARRANGEMENT			
SCHEDULE - G1 Temporary Dewatering Arrangement Tunnel			
G101	Care of water in max 3.0% drift for downwards drives	1,00	lump sum
SCHEDULE - G2 Permanent Dewatering Arrangement Tunnel			
G201	Providing and laying of perforated PVC pipe of following diameters as drainage pipes, as per approved drawings & Technical Specifications or as directed by Employer's Representative.		

Item No.	Description of item	Quantity	Unit
G20101	250 mm internal diameter PVC pipe [Equation = (a+c*d)*b*2]	22.583,68	meter
a	Mined egress tunnel length	14.054,00	meter
b	Predicted length of egress tunnel with inner lining and side wall drainage pipes	0,71	%/100
c	Number of cross passages	55,00	pcs
d	Length of Cross passages	35,00	meter
G20102	400 mm internal diameter PVC pipe [Equation = a+b*c]	15.979,00	meter
a	Mined egress tunnel length	14.054,00	meter
b	Number of cross passages	55,00	pcs
c	Length of Cross passages	35,00	meter
G202	Providing and installing of dimpled sheets in the tunnel between primary and permanent lining as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = a*b*c]	12.185,50	sqm
a	Tunnel perimeter from egress tunnel	17,34	meter
b	Mined egress tunnel length	14.054,00	meter
c	Estimation of tunnel length dimpled sheets required	0,050	%/100
G203	Providing and installing of strip drains in the tunnel as per approved drawings & Technical Specifications or as directed by Employer's Representative.		
G20301	Strip drain 200 mm x 25 mm [Equation = a]	1.480,00	meter
a	Estimated strip drain length	1.480,00	meter
G20302	Strip drain 200 mm x 40 mm [Equation = a]	980,00	meter
a	Estimated strip drain length	980,00	meter
G204	Providing, laying and fixing of Protective Felt (geotextile) with a minimum weight of 500 g/m^2 for protection of the waterproofing membrane & drainage on the finished outer lining surface, including the cost of all materials, labour, equipment, etc. required for the completion of job, as per Technical Specifications or as directed by the Employer's Representative. [Equation = (c+d*e)*a*b]	195.811,44	sqm
a	Tunnel perimeter from egress tunnel	17,34	meter
b	Predicted length of egress tunnel with inner lining and side wall drainage pipes	0,71	%/100
c	Mined egress tunnel length	14.054,00	meter
d	Number of cross passages	55,00	pcs
e	Length of Cross passages	35,00	meter
G205	Providing, placing, welding of 2 mm thick PVC or ECB Water Proofing Membrane including the cost of all materials, labour, equipment, etc. required for the completion of job, as per Technical Specifications or as directed by the Employer's Representative.	195.811,44	sqm
a	Tunnel perimeter from egress tunnel	17,34	meter
b	Predicted length of egress tunnel with inner lining and side wall drainage pipes	0,71	%/100
c	Mined egress tunnel length	14.054,00	meter
d	Number of cross passages	55,00	pcs
e	Length of Cross passages	35,00	meter

Item No.	Description of item	Quantity	Unit
G206	PVC Water stop serrated with central bulb (225mm wide, 8-11mm thick) [Equation = a*(c+d*e)*b]	22.583,68	meter
a	Water stops per tunnel cross section	2,00	pcs
b	Predicted length of egress tunnel with inner lining and side wall drainage pipes	0,71	%/100
c	Mined egress tunnel length	14.054,00	meter
d	Number of cross passages	55,00	pcs
e	Length of Cross passages	35,00	meter
G207	Manufacture, supply, and placing of pre-cast concrete manholes including bell mouth, manhole cover, the cost of all materials, labour, equipment, etc. required for the completion of job as per approved detailed drawings & Technical Specifications or as directed by Employer's Representative.		
G20701	Cleaning and Inspection chamber for DN250 [Equation = integer(c*d/a)*b]	200,00	pcs
a	Distance between manholes	100,00	meter
b	Number of man holes per cross section	2,00	pcs
c	Mined egress tunnel length	14.054,00	meter
d	Predicted length of egress tunnel with inner lining and side wall drainage pipes	0,71	%/100
G20702	Cleaning and Inspection chamber for DN400 [Equation = integer(c*d/a)*b]	100,00	pcs
a	Distance between manholes	100,00	meter
b	Number of man holes per cross section	1,00	pcs
c	Mined egress tunnel length	14.054,00	meter
d	Predicted length of egress tunnel with inner lining and side wall drainage pipes	0,71	%/100
SCHEDULE - H UNDERGROUND EXCAVATION			
SCHEDULE - H1 Excavation			
H101	Underground excavation for tunnel in Support Category dominating the Face Area. Including all including drilling, blasting, or other means of excavation, including widening of top heading footings, provision of surface drainage, construction ventilation, lighting arrangement during construction, temporary backfilling for traffic in tunnel, removal of the same and disposal of excavated material to muck disposal area with all lifts as per approved drawings & Technical Specifications. The quantities of excavation are determined to the design lines of excavation as per Technical Specifications. Overexcavation to the overexcavation line defined by the Technical Specifications is compensated with the unit rates.		
H10101	Excavation in Support Category A; top heading, bench, invert		
H1010101	Top Heading [Equation = (b*c+d*e)*a]	105.005,98	cum
a	Area of top heading excavation in cross section	35,08	sqm
b	mined egress tunnel length	14.054,00	meter
c	Predicted percentage Support Category A of overall excavation	0,196	%/100
d	Proposed number of driveable cross passages in Support Category A	7,00	pcs
e	Length of Cross passages	35,00	meter
H10102	Excavation in Support Category B; top heading, bench, invert		
H1010201	Top Heading [Equation = (b*c+d*e)*a]	103.467,45	cum

Item No.	Description of item	Quantity	Unit
a	Area of top heading excavation in cross section	35,82	sqm
b	Mined egress tunnel length	14.054,00	meter
c	Predicted percentage Support Category B of overall excavation	0,196	%/100
d	Proposed number of driveable cross passages in Support Category B	4,00	pcs
e	Length of Cross passages	35,00	meter
H10103	Excavation in Support Category C; top heading, bench, invert		
H1010301	Top Heading [Equation = (b*c+d*e)*a]	82.708,50	cum
a	Area of top heading excavation in cross section	37,96	sqm
b	Mined egress tunnel length	14.054,00	meter
c	Predicted percentage Support Category C of overall excavation	0,145	%/100
d	Proposed number of driveable cross passages in Support Category C	4,00	pcs
e	Length of Cross passages	35,00	meter
H10104	Excavation in Support Category D; top heading, bench, invert		
H1010401	Top Heading [Equation = (b*c+d*e)*a]	187.002,77	cum
a	Area of top heading excavation in cross section	39,05	sqm
b	Mined egress tunnel length	14.054,00	meter
c	Predicted percentage Support Category D of overall excavation	0,333	%/100
d	Proposed number of driveable cross passages in Support Category D	3,00	pcs
e	Length of Cross passages	35,00	meter
H1010402	Invert [Equation = (b*c+d*e)*a]	59.192,16	cum
a	Area of invert excavation in cross section	12,36	sqm
b	Mined egress tunnel length	14.054,00	meter
c	Predicted percentage Support Category D of overall excavation	0,333	%/100
d	Proposed number of driveable cross passages in Support Category D	3,00	pcs
e	Length of Cross passages	35,00	meter
H10105	Excavation in Support Category E; top heading, bench, invert [Equation = (a+b)*c*d]		
H1010501	Top Heading [Equation = b*c*a]	70.082,07	cum
a	Area of top heading excavation in cross section	39,83	sqm
b	Mined egress tunnel length	14.054,00	meter
c	Predicted percentage Support Category E of overall excavation	0,125	%/100
H1010502	Invert [Equation = b*c*a]	22.622,82	cum
a	Area of invert excavation in cross section	12,86	sqm
b	Mined egress tunnel length	14.054,00	meter
c	Predicted percentage Support Category E of overall excavation	0,125	%/100
H10106	Excavation in Support Category F; top heading, bench, invert		
H1010601	Top Heading [Equation = b*c*a]	3.592,04	cum
a	Area of top heading excavation in cross section	47,36	sqm
b	Mined egress tunnel length	14.054,00	meter

Item No.	Description of item	Quantity	Unit
c	Predicted percentage Support Category F of overall excavation	0,005	%/100
H1010602	Invert [Equation = b*c*a]	1.031,59	cum
a	Area of invert excavation in cross section	13,60	sqm
b	Mined egress tunnel length	14.054,00	meter
c	Predicted percentage Support Category F of overall excavation	0,005	%/100
H102	Underground excavation for cross passages for pedestrian use without rock mass classification [Equation = a*b*c]	20.257,69	cum
a	Area of excavation in egress tunnel cross passage for pedestrian use	15,64	sqm
b	Length of Cross passages	35,00	meter
c	Number of cross passages pedestrian use	37,00	pcs
H103	Mucking of geological overbreak accepted by Employer's Representative as per Technical Specifications [Equation = a]	2.250,00	cum
a	Predicted geological overbreak	2.250,00	cum
H104	Additional underground excavation as directed by Employer's Representative without rock mass classification. [Equation = a]	980,00	cum
a	Predicted additional underground excavation	980,00	cum
H105	Additional payment for extra transportation of excavation material to the muck deposit area as per approved drawings & Technical Specifications. [Equation = a*b]	5.950.362,88	cum*km
a	Predicted volume of excavation material [Equation = sum(Item H101)*0,75]	476.029,03	cum
b	Predicted mean distance to additional deposit area	12,50	km
H106	Re-profiling of tunnel due to deformations [Equation = a]	1.320,00	cum
a	Predicted volume of re-profiling	1.320,00	cum
H107	Temporary suspension of D&B excavation [Equation = a*b*c]	201,60	wd
a	Estimated construction time	2.520,00	wd
b	Predicted suspension in percentage of construction time and face	0,01	%/100
c	Number of working faces	8,00	pcs
SCHEDULE - H2	**Drilling and Grouting**		
H201	Drilling of drainage drilling in the tunnel perimeter and face, diameter 50 mm, length 3 m to 8 m [Equation = a*b]	19.250,00	meter
a	Number of drainage drillings	3.500,00	pcs
b	Average length of drainage drilling [Equation = (3+8)/2]	5,50	meter
H202	Drilling of exploratory drilling without core recovery, diameter 50 mm, length up to 20 m [Equation = a*b]	225,00	meter
a	Number of exploratory drillings	15,00	pcs
b	Average length of drainage drilling	15,00	meter
H203	Drilling of exploratory drilling with core recovery, diameter 76 mm		
H20301	Drilling 0-10 m [Equation = a*b]	37,50	meter
a	Number of exploratory drillings	5,00	pcs
b	Average length of exploratory drilling	7,50	meter

Item No.	Description of item	Quantity	Unit
H20302	Drilling 10-20 m [Equation = a*b]	75,00	meter
a	Number of exploratory drillings	5,00	pcs
b	Average length of exploratory drilling	15,00	meter
H20303	Drilling 20-30 m [Equation = a*b]	125,00	meter
a	Number of exploratory drillings	5,00	pcs
b	Average length of exploratory drilling	25,00	meter
H204	Strata grouting as defined by the approved drawings the Technical Specifications or directed by the Employer's Representative [Equation = a]	890,00	cum
a	Estimated volume to be strata grouted	890,00	cum
SCHEDULE - I PRIMARY & FINAL SUPPORT MEASURES			
SCHEDULE - I1 Bolts & Anchors			
I101	Supply, drilling and installation of frictional rock bolts (Swellex or similar) of the specified length, Fy≥ 150 KN (tunnel support) as per approved drawings & Technical Specifications or as directed by Employer's Representative. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job.		
I10101	Length 3 m [Equation = integer(a*b*c+d*e*a+f*e*g)]	6.776,00	pcs
a	Number of bolts in Support Category A in top heading per excavation meter	1,29	pcs/meter
b	Mined egress tunnel length	14.054,00	meter
c	Predicted percentage Support Category A of overall excavation	0,196	%/100
d	Proposed number of cross passages in Support Category A	7,00	pcs
e	Length of Cross passages	35,00	meter
f	Number of cross passages pedestrian use	37,00	pcs
g	Number of bolts in cross passage pedestrian use per excavation meter	2,25	pcs/meter
I10102	Length 4 m [Equation = integer(a*b*c+d*e*a)]	8.665,00	pcs
a	Number of bolts in Support Category B in top heading per excavation meter	3,00	pcs/meter
b	Mined egress tunnel length	14.054,00	meter
c	Predicted percentage Support Category B of overall excavation	0,196	%/100
d	Proposed number of cross passages in Support Category B	4,00	pcs
e	Length of Cross passages	35,00	meter
I102	Supply, drilling, installation and grouting of grouted rock bolts (SN type) of the specified length, Fy≥ 200 KN (tunnel perimeter & face) as per approved drawings & Technical Specifications or as directed by Employer's Representative. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job.		
I10201	Length 4 m [Equation = integer(a*b*c+d*e*a+f*b*h+g*e*f)]	19.433,00	pcs
a	Number of bolts in Support Category C in top heading per excavation meter	4,29	pcs/meter
b	Mined egress tunnel length	14.054,00	meter
c	Predicted percentage Support Category C of overall excavation	0,145	%/100
d	Proposed number of cross passages in Support Category C	4,00	pcs

Item No.	Description of item	Quantity	Unit
e	Length of Cross passages	35,00	meter
f	Number of bolts in Support Category D in top heading per excavation meter	3,60	pcs/meter
g	Proposed number of cross passages in Support Category D	3,00	pcs
h	Predicted percentage Support Category D of overall excavation	0,192	%/100
I10202	Length 6 m [Equation = integer(a*g*b+c*g*d+e*g*f)]	37.744,00	pcs
a	Number of bolts in Support Category D in top heading per excavation meter	4,80	pcs/meter
b	Predicted percentage Support Category D of overall excavation	0,333	%/100
c	Number of bolts in Support Category E in top heading per excavation meter	8,40	pcs/meter
d	Predicted percentage Support Category E of overall excavation	0,125	%/100
e	Number of bolts in Support Category F in top heading per excavation meter	6,40	pcs/meter
f	Predicted percentage Support Category F of overall excavation	0,005	%/100
g	Mined egress tunnel length	14.054,00	meter
I104	Supply, drilling, installation and grouting of forepoling as per approved drawings & Technical Specifications or as directed by Employer's Representative. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job.		
I10401	Grouted rock bolts (SN type) with a length of 4 m, Fy≥ 200 KN [Equation = integer(a*j*b+c*d*a+e*j*f+d*g*e+h*i*j)]	544.588,00	meter
a	Total length of bolts in Support Category C per excavation meter	48,00	meter/meter
b	Predicted percentage Support Category C of overall excavation	0,145	%/100
c	Proposed number of cross passages in Support Category C	4,00	pcs
d	Length of Cross passages	35,00	meter
e	Total length of bolts in Support Category D per excavation meter	67,200	meter/meter
f	Predicted percentage Support Category D of overall excavation	0,333	%/100
g	Proposed number of cross passages in Support Category D	3,00	pcs
h	Total length of bolts in Support Category E per excavation meter	67,200	meter/meter
i	Predicted percentage Support Category E of overall excavation	0,125	%/100
j	Mined egress tunnel length	14.054,00	meter
I10402	Steel Pipe umbrella with a diameter of 114 mm, wall thickness of 6.5 mm and a length of 12 m [Equation = integer(a*c*b)]	2.394,00	meter
a	Total length of pipe umbrella in Support Category F per excavation meter	31,56	meter/meter
b	Predicted percentage Support Category F of overall excavation	0,005	%/100
c	Mined egress tunnel length	14.054,00	meter
SCHEDULE - I2	**Shotcrete, Lattice Girder, Lining Stress Controllers & Wire Mesh**		
I201	Shotcreting of primary lining (tunnel, niches, caverns) with designed mix cement concrete SpC20/25(56)/II/J2/XC1/GK8 as per Technical Specifications & drawings or as directed by Employer's Representative in charge including all materials, labour, equipment, etc. required for complete job. The reinforcement is compensated separately.		
I20101	50 mm thick shotcrete lining in tunnel [Equation = (a+b)*d*c]	42.156,07	sqm

Item No.	Description of item	Quantity	Unit
a	Perimeter of shotcrete lining in Support Category A, top heading	15,34	meter
b	Perimeter of shotcrete lining in Support Category A, bench	-	meter
c	Predicted percentage Support Category A of overall excavation	0,196	%/100
d	Mined egress tunnel length	14.054,00	meter
I20102	100 mm thick shotcrete lining in tunnel [Equation = (a+b)*d*c]	42.372,09	sqm
a	Perimeter of shotcrete lining in Support Category B, top heading	15,42	meter
b	Perimeter of shotcrete lining in Support Category B, bench	-	meter
c	Predicted percentage Support Category B of overall excavation	0,196	%/100
d	Mined egress tunnel length	14.054,00	meter
I20103	150 mm thick shotcrete lining in tunnel [Equation = (a+b)*d*c]	32.050,45	sqm
a	Perimeter of shotcrete lining in Support Category C, top heading	15,72	meter
b	Perimeter of shotcrete lining in Support Category C, bench	-	meter
c	Predicted percentage Support Category C of overall excavation	0,145	%/100
d	Mined egress tunnel length	14.054,00	meter
I20104	200 mm thick shotcrete lining in tunnel [Equation = a*c*b]	74.406,60	sqm
a	Perimeter of shotcrete lining in Support Category D, top heading	15,89	meter
b	Predicted percentage Support Category D of overall excavation	0,333	%/100
c	Mined egress tunnel length	14.054,00	meter
I20105	250 mm thick shotcrete lining in tunnel [Equation = a*e*b+c*e*d]	29.402,98	sqm
a	Perimeter of shotcrete lining in Support Category E, top heading	15,97	meter
b	Predicted percentage Support Category E of overall excavation	0,125	%/100
c	Perimeter of shotcrete lining in Support Category F, top heading	17,31	meter
d	Predicted percentage Support Category F of overall excavation	0,005	%/100
e	Mined egress tunnel length	14.054,00	meter
I202	Shotcreting of primary invert lining with designed mix cement concrete SpC20/25(56)/II/J2/XC1/GK8 as per Technical Specifications & drawings or as directed by Employer's Representative in charge including all materials, labour, equipment, etc. required for complete job. The reinforcement is compensated separately.		
I20201	200 mm thick shotcrete lining in tunnel [Equation = a*c*b]	42.990,94	sqm
a	Perimeter of shotcrete lining in Support Category D, invert	9,18	meter
b	Predicted percentage Support Category D of overall excavation	0,333	%/100
c	Mined egress tunnel length	14.054,00	meter
I20202	250 mm thick shotcrete lining in tunnel [Equation = a*e*b+c*e*d]	23.364,07	sqm
a	Perimeter of shotcrete lining in Support Category E, invert	12,86	meter
b	Predicted percentage Support Category E of overall excavation	0,125	%/100
c	Perimeter of shotcrete lining in Support Category F, invert	9,77	meter
d	Predicted percentage Support Category F of overall excavation	0,005	%/100
e	Mined egress tunnel length	14.054,00	meter

Item No.	Description of item	Quantity	Unit
I203	Shotcreting of permanent lining with designed mix cement concrete SpC20/25(56)/II/J2/XC3/GK8 as per Technical Specifications & drawings or as directed by Employer's Representative in charge including all materials, labour, equipment, etc. required for complete job. The reinforcement is compensated separately.		
I20301	100 mm thick shotcrete lining in tunnel [Equation = a*b*c]	63.568,85	sqm
a	Perimeter of shotcrete lining	15,42	sqm
b	Predicted percentage of length of tunnel with shotcrete inner lining	0,29	%/100
c	Mined egress tunnel length	14.054,00	meter
I204	Shotcreting with designed mix cement concrete SpC20/25(56)/II/J2/XC1/GK8 of face sealing, filling of cavities, unavoidable and geological overbreak approved by the Employer's Representative as defined in the Technical Specifications and widening of top heading footing in tunnel including all labour, materials, cost of pins, hooks, lead, lift, handling, wastage complete with contractor's own equipment for complete job .	32,50	cum
I205	Steel fibre reinforcement if required [Equation = a*(b+c)*d*j*e*k+a*(f+g)*j*i*k+a*l*m*n*o*k]	116,75	tonne
a	Reinforcement rate	0,002	%/100
b	Perimeter of shotcrete lining in Support Category A, top heading	35,08	meter
c	Perimeter of shotcrete lining in Support Category A, bench	-	meter
d	Thickness of shotcrete lining in Support Category A	0,05	meter
e	Predicted percentage Support Category A of overall excavation	0,196	%/100
f	Perimeter of shotcrete lining in Support Category B, top heading	15,42	meter
g	Perimeter of shotcrete lining in Support Category B, bench	-	meter
h	Thickness of shotcrete lining in Support Category B	0,05	meter
i	Predicted percentage Support Category B of overall excavation	0,196	%/100
j	Mined egress tunnel length	14.054,00	meter
k	Unit weight of steel	7,00	tonne/cum
l	Perimeter of cross passage pedestrian use	10,81	sqm/meter
m	Number of cross passage pedestrian use	37,00	pcs
n	Length of Cross passages	35,00	meter
o	Thickness of shotcrete lining cross passage pedestrian	0,10	meter
I206	Supply and placing of 150 x 150 x 6 mm Q188 (3.01 kg/m²) welded wire fabric of Fe 500 as reinforcement in primary lining as per approved drawings & Technical Specifications or as directed by Employer's Representative. The rate shall include all labour, materials, cost of pins, hooks, lead, lift, handling, wastage complete with contractor's own equipment for complete job. [Equation = ((a+b)*m*c+(d+e)*m*f+(g+h)*m*i+(j+k)*m*l)/1000]	1.218,38	tonne
a	Support Category C, top heading	97,78	kg/meter
c	Predicted percentage Support Category C of overall excavation	0,145	%/100
d	Support Category D, top heading	98,82	kg/meter
e	Support Category D, invert	57,10	kg/meter

Item No.	Description of item	Quantity	Unit
f	Predicted percentage Support Category D of overall excavation	0,333	%/100
g	Support Category E, top heading	99,31	kg/meter
h	Support Category E, invert	57,59	kg/meter
i	Predicted percentage Support Category E of overall excavation	0,125	%/100
j	Support Category F, top heading	107,69	kg/meter
k	Support Category F, invert	60,79	kg/meter
l	Predicted percentage Support Category F of overall excavation	0,005	%/100
m	Mined egress tunnel length	14.054,00	meter
I207	Supply, fabrication and erection of lattice girders and all accessories including all lead, lift, wastage, storing, drilling holes, fixing in phases etc. and installation of accessories for joining the lattice girder segments as per approved workshop drawings of contractor & Technical Specifications or as directed by Employer's Representative. The rate shall include costs of all materials, labour, equipment, welding, etc. for the complete job including additional cost for enlargement of top heading footing. [Equation = (a*i*b+c*i*d+e*i*f+g*i*h)/1000]	1.013,62	tonne
a	Support Category C, top heading	89,83	kg/meter
b	Predicted percentage Support Category C of overall excavation	0,145	%/100
c	Support Category D, top heading	127,10	kg/meter
d	Predicted percentage Support Category D of overall excavation	0,333	%/100
e	Support Category E, top heading	127,73	kg/meter
f	Predicted percentage Support Category E of overall excavation	0,125	%/100
g	Support Category F, top heading	138,51	kg/meter
h	Predicted percentage Support Category F of overall excavation	0,005	%/100
i	Mined egress tunnel length	14.054,00	meter
I208	Providing and fixing yielding elements (Lining Stress Controllers - LSC or equivalent) as per approved drawings and Technical Specifications. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job. [Equation = integer(a*b*c)]	3.526,00	meter
a	Number of LSC per tunnel meter in Support Category E	2,00	pcs
b	Predicted percentage Support Category E of overall excavation	0,125	%/100
c	Mined tunnel length	14.083,00	meter
SCHEDULE - J CONCRETE WORK			
J101	Design Mix Cement Concrete C25/30 including machine mixed, machine batched, machine vibrated, form work, etc. as per Technical Specifications & drawings or as directed by Employer's Representative. The reinforcement is compensated separately.		
J10101	Inner lining of tunnel - foundation [Equation = a*b*c*(1-d)]	9.236,39	cum
a	Concrete cross section	0,43	sqm
b	Number of foundations per cross section	2,00	pcs
c	Mined egress tunnel length	14.054,00	meter
d	Predicted length of egress tunnel with inner lining without invert	0,24	%/100

Item No.	Description of item	Quantity	Unit
J10102	Inner lining of tunnel - invert [Equation = a*b*c]	26.321,74	cum
a	Concrete cross section	4,04	sqm
b	Mined egress tunnel length	14.054,00	meter
c	Predicted length of egress tunnel with inner lining and invert	0,46	%/100
J10103	Inner lining of tunnel & niches - vault with radial formwork		
J1010301	with thickness of 25 cm [Equation = a*b*(1-c)]	48.480,41	cum
a	Concrete cross section	4,56	sqm
b	Mined egress tunnel length	14.054,00	meter
c	Predicted length of egress tunnel with inner lining without invert	0,24	%/100
J1010302	with thickness of 35 cm [Equation = a*b*c]	40.075,79	cum
a	Concrete cross section	6,15	sqm
b	Mined egress tunnel length	14.054,00	meter
c	Predicted length of egress tunnel with inner lining and invert	0,46	%/100
J102	Design Mix Cement Concrete C12/15 including mechanically mixed machine mixed, machine batched, machine vibrated, form work, etc. as per Technical Specifications & drawings or as directed by Employer's Representative		
J10201	Fill concrete in tunnel - invert [Equation = (a*b+c*d)*e]	26.150,51	cum
a	Area of fill around tunnel main drainage pipe in cross section type without invert	1,62	sqm
b	Predicted length of egress tunnel with inner lining without invert	0,24	%/100
c	Area of fill around tunnel main drainage pipe in cross section type with invert	3,16	sqm
d	Predicted length of egress tunnel with inner lining and invert	0,46	%/100
e	Mined egress tunnel length	14.054,00	meter
J10202	Binding concrete in tunnel [Equation = a*b*c]	696,25	cum
a	Area of blinding concrete (thickness 5 cm) below both foundation in cross section type without invert	0,20	sqm
b	Predicted length of egress tunnel with inner lining without invert	0,24	%/100
c	Mined egress tunnel length	14.054,00	meter
J103	No-fines porous concrete in tunnel [Equation = (a*b+c*d)*e]	2.990,19	cum
a	Area of porous concrete around left and right side wall drainage in cross section type without invert	0,26	sqm
b	Predicted length of egress tunnel with inner lining without invert	0,24	%/100
c	Area of porous concrete around left and right side wall drainage in cross section type with invert	0,32	sqm
d	Predicted length of egress tunnel with inner lining and invert	0,46	%/100
e	Mined egress tunnel length	14.054,00	meter
J104	Reinforcement for inner lining		
J10401	Reinforcement for inner lining - foundation [Equation = a*b/1000]	692,73	tonne
a	Reinforcement grate	75,00	kg/cum
b	Total volume of foundation concrete (Item J10101)	9.236,39	cum
J10402	Reinforcement for inner lining - invert [Equation = a*b/1000]	1.974,13	tonne
a	Reinforcement grate	75,00	kg/cum

Item No.	Description of item	Quantity	Unit
b	Total volume of foundation concrete (Item J10102)	26.321,74	cum
J10403	Reinforcement for inner lining - vault [Equation = a*b]	3.005,68	tonne
a	Reinforcement grate	75,00	kg/cum
b	Total volume of foundation concrete (Item J1010302)	40.075,79	cum
J105	Concrete tests		
#	All costs for concrete testing are included in Item D105		
SCHEDULE - K	**INSTRUMENTATION AND MONITORING**		
K101	Supply, install, read and maintain of 3D monitoring targets (reflectors) in top heading bench and invert as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer(s*c/a)*b+integer(s*f/d)*e+integer(s*i/g)*h+integer(s*l/j)*k+integer(s*o/m)*n+ integer(s*r/p)*q]	4.643,00	pcs
a	Support Category A, measurement section every	25,00	meter
b	Support Category A, reflectors per measurement section	3,00	pcs
c	Predicted percentage Support Category A of overall excavation	0,196	%/100
d	Support Category B, measurement section every	25,000	meter
e	Support Category B, reflectors per measurement section	3,000	pcs
f	Predicted percentage Support Category B of overall excavation	0,196	%/100
g	Support Category C, measurement section every	15,000	meter
h	Support Category C, reflectors per measurement section	3,000	pcs
i	Predicted percentage Support Category C of overall excavation	0,145	%/100
j	Support Category D, measurement section every	10,000	meter
k	Support Category D, reflectors per measurement section	5,000	pcs
l	Predicted percentage Support Category D of overall excavation	0,333	%/100
m	Support Category E, measurement section every	7,500	meter
n	Support Category E, reflectors per measurement section	5,000	pcs
o	Predicted percentage Support Category E of overall excavation	0,125	%/100
p	Support Category F, measurement section every	7,500	meter
q	Support Category F, reflectors per measurement section	5,000	pcs
r	Predicted percentage Support Category F of overall excavation	0,005	%/100
s	Mined egress tunnel length	14.054,00	meter
K102	Supply, drill, install, grout, read and maintain of borehole extensometer (four point) in the tunnel perimeter as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer(p*c/a)*b+integer(p*f/d)*e+integer(p*i/g)*h+integer(p*l/j)*k+integer(p*o/m)*n]	960,00	pcs
a	Support Category B, measurement section every	100,000	meter
b	Support Category B, reflectors per measurement section	2,000	pcs
c	Predicted percentage Support Category B of overall excavation	0,196	%/100
d	Support Category C, measurement section every	60,000	meter

Item No.	Description of item	Quantity	Unit
e	Support Category C, reflectors per measurement section	2,000	pcs
f	Predicted percentage Support Category C of overall excavation	0,145	%/100
g	Support Category D, measurement section every	35,000	meter
h	Support Category D, reflectors per measurement section	4,000	pcs
i	Predicted percentage Support Category D of overall excavation	0,333	%/100
j	Support Category E, measurement section every	25,000	meter
k	Support Category E, reflectors per measurement section	4,000	pcs
l	Predicted percentage Support Category E of overall excavation	0,125	%/100
m	Support Category F, measurement section every	25,000	meter
n	Support Category F, reflectors per measurement section	4,000	pcs
o	Predicted percentage Support Category F of overall excavation	0,005	%/100
p	Mined egress tunnel length	14.054,00	meter
K103	Supply, install, read and maintain of load cells for rock bolts as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer(p*c/a)*b+integer(p*f/d)*e+integer(p*i/g)*h+integer(p*l/j)*k+integer(p*o/m)*n]	542,00	pcs
a	Support Category B, measurement section every	100,000	meter
b	Support Category B, reflectors per measurement section	2,000	pcs
c	Predicted percentage Support Category B of overall excavation	0,196	%/100
d	Support Category C, measurement section every	60,000	meter
e	Support Category C, reflectors per measurement section	2,000	pcs
f	Predicted percentage Support Category C of overall excavation	0,145	%/100
g	Support Category D, measurement section every	35,000	meter
h	Support Category D, reflectors per measurement section	2,000	pcs
i	Predicted percentage Support Category D of overall excavation	0,333	%/100
j	Support Category E, measurement section every	25,000	meter
k	Support Category E, reflectors per measurement section	2,000	pcs
l	Predicted percentage Support Category E of overall excavation	0,125	%/100
m	Support Category F, measurement section every	25,000	meter
n	Support Category F, reflectors per measurement section	2,000	pcs
o	Predicted percentage Support Category F of overall excavation	0,005	%/100
p	Mined egress tunnel length	14.054,00	meter
K104	Supply, install, read and maintain of strain gauges for shotcrete as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer(p*c/a)*b+integer(p*f/d)*e+integer(p*i/g)*h+integer(p*l/j)*k+integer(p*o/m)*n]	271,00	pcs
a	Support Category B, measurement section every	100,000	meter
b	Support Category B, reflectors per measurement section	1,000	pcs
c	Predicted percentage Support Category B of overall excavation	0,196	%/100
d	Support Category C, measurement section every	60,000	meter

Item No.	Description of item	Quantity	Unit
e	Support Category C, reflectors per measurement section	1,000	pcs
f	Predicted percentage Support Category C of overall excavation	0,145	%/100
g	Support Category D, measurement section every	35,000	meter
h	Support Category D, reflectors per measurement section	1,000	pcs
i	Predicted percentage Support Category D of overall excavation	0,333	%/100
j	Support Category E, measurement section every	25,000	meter
k	Support Category E, reflectors per measurement section	1,000	pcs
l	Predicted percentage Support Category E of overall excavation	0,125	%/100
m	Support Category F, measurement section every	25,000	meter
n	Support Category F, reflectors per measurement section	1,000	pcs
o	Predicted percentage Support Category F of overall excavation	0,005	%/100
p	Mined egress tunnel length	14.054,00	meter
K105	Supply, install, read and maintain of strain gauges for concrete as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer(p*c/a)*b+integer(p*f/d)*e+integer(p*i/g)*h+integer(p*l/j)*k+integer(p*o/m)*n]	271,00	pcs
a	Support Category B, measurement section every	100,000	meter
b	Support Category B, reflectors per measurement section	1,000	pcs
c	Predicted percentage Support Category B of overall excavation	0,196	%/100
d	Support Category C, measurement section every	60,000	meter
e	Support Category C, reflectors per measurement section	1,000	pcs
f	Predicted percentage Support Category C of overall excavation	0,145	%/100
g	Support Category D, measurement section every	35,000	meter
h	Support Category D, reflectors per measurement section	1,000	pcs
i	Predicted percentage Support Category D of overall excavation	0,333	%/100
j	Support Category E, measurement section every	25,000	meter
k	Support Category E, reflectors per measurement section	1,000	pcs
l	Predicted percentage Support Category E of overall excavation	0,125	%/100
m	Support Category F, measurement section every	25,000	meter
n	Support Category F, reflectors per measurement section	1,000	pcs
o	Predicted percentage Support Category F of overall excavation	0,005	%/100
p	Mined egress tunnel length	14.054,00	meter
K106	Supply, install, read and maintain of radial pressure cells as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer(p*c/a)*b+integer(p*f/d)*e+integer(p*i/g)*h+integer(p*l/j)*k+integer(p*o/m)*n]	1.084,00	pcs
a	Support Category B, measurement section every	100,000	meter
b	Support Category B, reflectors per measurement section	4,000	pcs
c	Predicted percentage Support Category B of overall excavation	0,196	%/100
d	Support Category C, measurement section every	60,000	meter

Item No.	Description of item	Quantity	Unit
e	Support Category C, reflectors per measurement section	4,000	pcs
f	Predicted percentage Support Category C of overall excavation	0,145	%/100
g	Support Category D, measurement section every	35,000	meter
h	Support Category D, reflectors per measurement section	4,000	pcs
i	Predicted percentage Support Category D of overall excavation	0,333	%/100
j	Support Category E, measurement section every	25,000	meter
k	Support Category E, reflectors per measurement section	4,000	pcs
l	Predicted percentage Support Category E of overall excavation	0,125	%/100
m	Support Category F, measurement section every	25,000	meter
n	Support Category F, reflectors per measurement section	4,000	pcs
o	Predicted percentage Support Category F of overall excavation	0,005	%/100
p	Mined egress tunnel length	14.054,00	meter
K107	Supply, install, read and maintain of tangential pressure cells as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer(p*c/a)*b+integer(p*f/d)*e+integer(p*i/g)*h+integer(p*l/j)*k+integer(p*o/m)*n]	1.084,00	pcs
a	Support Category B, measurement section every	100,000	meter
b	Support Category B, reflectors per measurement section	4,000	pcs
c	Predicted percentage Support Category B of overall excavation	0,196	%/100
d	Support Category C, measurement section every	60,000	meter
e	Support Category C, reflectors per measurement section	4,000	pcs
f	Predicted percentage Support Category C of overall excavation	0,145	%/100
g	Support Category D, measurement section every	35,000	meter
h	Support Category D, reflectors per measurement section	4,000	pcs
i	Predicted percentage Support Category D of overall excavation	0,333	%/100
j	Support Category E, measurement section every	25,000	meter
k	Support Category E, reflectors per measurement section	4,000	pcs
l	Predicted percentage Support Category E of overall excavation	0,125	%/100
m	Support Category F, measurement section every	25,000	meter
n	Support Category F, reflectors per measurement section	4,000	pcs
o	Predicted percentage Support Category F of overall excavation	0,005	%/100
p	Mined egress tunnel length	14.054,00	meter
SCHEDULE - L PAVEMENT			
L101	Supply, preparation of material, placing, compacting of granular sub-base with a minimum thickness of 25 cm as per approved drawings & Technical Specifications. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job. [Equation = a*b*c]	23.048,56	cum
a	Width of pavement	6,56	meter
b	Thickness of layer	0,25	meter
c	Mined egress tunnel length	14.054,00	meter

Item No.	Description of item	Quantity	Unit
L102	Supply, mixing, placing, compacting of dry lean cement concrete base layer with a minimum thickness of 5 cm as per approved drawings & Technical Specifications. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job. [Equation = a*c]	92.194,24	sqm
a	Width of pavement	6,56	meter
b	Thickness of layer	0,05	meter
c	Mined egress tunnel length	14.054,00	meter
L103	Supply, mixing, placing, compacting of cement concrete pavement with a minimum thickness of 15 cm including construction of contraction joints, expansion joints, longitudinal joints, joint sealing compound, reinforcement, dowel rods and tie bars complete as per approved drawings & Technical Specifications. The rate shall include costs of all materials, labour, equipment, quality checks etc. required for the complete job. [Equation = a*c]	92.194,24	sqm
a	Width of pavement	6,56	meter
b	Thickness of layer	0,15	meter
c	Mined egress tunnel length	14.054,00	meter
BILL 3 - CIVIL ENGINEERING VENTILATION SHAFT & VENTILATION CAVERN			
SCHEDULE - M DEWATERING ARRANGEMENT			
SCHEDULE - M1 Temporary Dewatering Arrangement			
M101	Care of water in shaft drifts d&b construction	1,00	lump sum
SCHEDULE - M2 Permanent Dewatering Arrangement			
M201	Providing and laying of perforated PVC pipe of following diameters as drainage pipes, as per approved drawings & Technical Specifications or as directed by Employer's Representative.		
M20101	250 mm internal diameter PVC pipe [Equation = a+b+c+d*e]	1.162,00	meter
a	Length shaft 1	484,00	meter
b	Length shaft 2	365,00	meter
c	Length shaft 3	208,00	meter
d	Length of caverns	35,00	meter
e	Number of caverns	3,00	pcs
M202	Providing and installing of dimpled sheets in the tunnel between primary lining and foundation as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = ((c+d)*a+e*b+g*h*i)*f]	4.251,04	sqm
a	Shaft perimeter from cross section d&b shaft	40,21	meter
b	Shaft perimeter from cross section raise boring shaft	18,69	meter
c	Length shaft 1	484,00	meter
d	Length shaft 2	365,00	meter
e	Length shaft 3	208,00	meter
f	Estimated tunnel length dimpled sheets requirement	0,10	%/100
g	Length of caverns	35,00	meter
h	Mean perimeter of ventilation cavern	42,71	meter

Item No.	Description of item	Quantity	Unit
i	Number of caverns	3,00	pcs
M203	Providing, laying and fixing of Protective Felt (geotextile) with a minimum weight of 500 g/m^2 for protection of the waterproofing membrane & drainage on the finished outer lining surface, including the cost of all materials, labour, equipment, etc. required for the completion of job, as per Technical Specifications or as directed by the Employer's Representative. [Equation = (c+d)*a+e*b+f*g*h]	42.510,35	sqm
a	Shaft perimeter from cross section d&b shaft	40,21	meter
b	Shaft perimeter from cross section raise boring shaft	18,69	meter
c	Length shaft 1	484,00	meter
d	Length shaft 2	365,00	meter
e	Length shaft 3	208,00	meter
f	Length of caverns	35,00	meter
g	Mean perimeter of ventilation cavern	42,71	meter
h	Number of caverns	3,00	pcs
M204	Providing, placing, welding of 2 mm thick PVC or ECB Water Proofing Membrane including the cost of all materials, labour, equipment, etc. required for the completion of job, as per Technical Specifications or as directed by the Employer's Representative. [Equation = (c+d)*a+e*b+f*g*h]	42.510,35	sqm
a	Shaft perimeter from cross section d&b shaft	40,21	meter
b	Shaft perimeter from cross section raise boring shaft	18,69	meter
c	Length shaft 1	484,00	meter
d	Length shaft 2	365,00	meter
e	Length shaft 3	208,00	meter
f	Length of caverns	35,00	meter
g	Mean perimeter of ventilation cavern	42,71	meter
h	Number of caverns	3,00	pcs
M205	PVC Water stop serrated with central bulb (225mm wide, 8-11mm thick) [Equation) a*b*c]	210,00	meter
a	Number of water stops per cross section	2,00	pcs
b	Number of caverns	3,00	pcs
c	Length of caverns	35,00	meter
M206	Manufacture, supply, and placing of inspection and cleaning chambers of PP or PE-HD including bell mouth, manhole cover, the cost of all materials, labour, equipment, etc. required for the completion of job as per approved detailed drawings & Technical Specifications or as directed by Employer's Representative.		
M20601	Cleaning and Inspection chamber for DN250 [Equation = a*b]	9,00	pcs
a	Cleaning chambers per cavern	3,00	pcs
b	Number of caverns	3,00	pcs
SCHEDULE - N UNDERGROUND EXCAVATION			
SCHEDULE - N1 Excavation			

Item No.	Description of item	Quantity	Unit
N101	Underground excavation for tunnel in Support Category dominating the Face Area. Including drilling, blasting, or other means of excavation, provision of surface drainage, construction ventilation, lighting arrangement during construction, temporary backfilling for traffic in tunnel, removal of the same and disposal of excavated material to muck disposal area with all lifts as per approved drawings & Technical Specifications. The quantities of excavation are determined to the design lines of excavation as per Technical Specifications. Overexcavation to the overexcavation line defined by the Technical Specifications is compensated with the unit rates.		
N10101	Support Category 01 [Equation = (b+c)*a*d]	33.341,06	cum
a	Area of top shaft excavation	130,70	sqm
b	Length shaft 1	484,00	meter
c	Length shaft 2	365,00	meter
d	Predicted percentage Support Category 01 of overall excavation	0,300	%/100
N10102	Support Category 02 [Equation = (b+c)*a*d]	35.412,90	cum
a	Area of top shaft excavation	132,73	sqm
b	Length shaft 1	484,00	meter
c	Length shaft 2	365,00	meter
d	Predicted percentage Support Category 02 of overall excavation	0,314	%/100
N10103	Support Category 03 [Equation = (b+c)*a*d]	27.350,64	cum
a	Area of top shaft excavation	134,78	sqm
b	Length shaft 1	484,00	meter
c	Length shaft 2	365,00	meter
d	Predicted percentage Support Category 03 of overall excavation	0,239	%/100
N10104	Support Category 04 [Equation = (b+c)*a*d]	13.681,38	cum
a	Area of top shaft excavation	136,85	sqm
b	Length shaft 1	484,00	meter
c	Length shaft 2	365,00	meter
d	Predicted percentage Support Category 04 of overall excavation	0,118	%/100
N10105	Support Category 05 [Equation = (b+c)*a*d]	3.412,83	cum
a	Area of top shaft excavation	141,03	sqm
b	Length shaft 1	484,00	meter
c	Length shaft 2	365,00	meter
d	Predicted percentage Support Category 05 of overall excavation	0,029	%/100
N10106	Excavation in bored pile section [Equation = a*b]	30,000	meter
a	Estimated length in bored pile section per shaft	15,00	meter
b	Number of shafts with bored pile excavation	2,00	pcs
N102	Underground excavation for ventilation cavern without rock mass classification as per approved drawings & Technical Specifications or as directed by Employer's Representative without rock mass classification. [Equation = a*b*c]	34.302,45	cum

Item No.	Description of item	Quantity	Unit
a	Mean excavation cross section of cavern	326,69	sqm
b	Number of caverns	3,00	pcs
c	Length of caverns	35,00	meter
N103	Raise boring [Equation = a*b]	5.881,06	cum
a	Length of shaft 3	208,00	meter
b	Excavation cross section of shaft 3	28,27	sqm
SCHEDULE - N2 Drilling and Grouting			
N201	Drilling of drainage drilling in the shaft perimeter, diameter 50 mm, length 3 m to 8 m [Equation = a*b]	1.556,50	meter
a	Estimated number of drainage drillings	283,00	pcs
b	Average length of drainage drilling [Equation = (3+8)/2]	5,50	meter
N202	Drilling of exploratory drilling without core recovery, diameter 50 mm, length up to 20 m [Equation = a]	6,00	pcs
a	Estimated number of exploratory drillings	6,00	pcs
N203	Drilling of exploratory drilling with core recovery, diameter 76 mm		
N20301	Drilling 0-10 m [Equation = a]	2,00	pcs
a	Number of estimated exploratory drillings	2,00	pcs
N20302	Drilling 10-20 m [Equation = a]	2,00	pcs
a	Number of estimated exploratory drillings	2,00	pcs
N20303	Drilling 20-30 m [Equation = a]	2,00	pcs
a	Number of estimated exploratory drillings	2,00	pcs
N204	Strata grouting as defined by the approved drawings the Technical Specifications or directed by the Employer's Representative [Equation = a]	275,00	cum
a	Estimated volume to be strata grouted	275,00	cum
SCHEDULE - O PRIMARY SUPPORT MEASURES			
SCHEDULE - O1 Bolts & Anchors			
O101	Supply, drilling and installation of frictional rock bolts (Swellex or similar) of the specified length, Fy≥ 150 KN (tunnel support) as per approved drawings & Technical Specifications or as directed by Employer's Representative. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job.		
O10101	Length 4 m [Equation = integer((e+f)*(a*b+c*d)+g*h*i)]	4.558,00	pcs
a	Number of bolts in Support Category 01 per excavation meter	1,50	pcs/meter
b	Predicted percentage Support Category 01 of overall excavation	0,300	%/100
c	Number of bolts in Support Category 02 per excavation meter	12,50	pcs/meter
d	Predicted percentage Support Category 02 of overall excavation	0,314	%/100
e	Length shaft 1	484,00	meter
f	Length shaft 2	365,00	meter
g	Number of bolts in cavern excavation per meter	8,00	pcs/meter
h	Length of caverns	35,00	meter
i	Number of caverns	3,00	pcs

Item No.	Description of item	Quantity	Unit
O10102	Length 6 m [Equation = integer(a*b*(c+d)+e*f*g)]	3.267,00	pcs
a	Number of bolts in Support Category 03 per excavation meter	14,29	pcs/meter
b	Predicted percentage Support Category 03 of overall excavation	0,239	%/100
c	Length shaft 1	484,00	meter
d	Length shaft 2	365,00	meter
e	Number of bolts in cavern excavation per meter	3,50	pcs
f	Length of caverns	35,00	meter
g	Number of caverns	3,00	pcs
O10103	Length 9 m [Equation = integer(a*b*c)]	814,00	pcs
e	Number of bolts in cavern excavation per meter	7,75	pcs
f	Length of caverns	35,00	meter
g	Number of caverns	3,00	pcs
O102	Supply, drilling, installation and grouting of grouted rock bolts (SN type) of the specified length, Fy≥ 200 KN (tunnel perimeter & face) as per approved drawings & Technical Specifications or as directed by Employer's Representative. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job.		
O10201	Length 6 m [Equation = a*b*(c+d)]	1.666,25	pcs
a	Number of bolts in Support Category 04 per excavation meter	16,67	pcs/meter
b	Predicted percentage Support Category 04 of overall excavation	0,118	%/100
c	Length shaft 1	484,00	meter
d	Length shaft 2	365,00	meter
O10202	Length 8 m [Equation = a*b*(c+d)]	484,00	pcs
a	Number of bolts in Support Category 05 per excavation meter	20,00	pcs/meter
b	Predicted percentage Support Category 05 of overall excavation	0,029	%/100
c	Length shaft 1	484,00	meter
d	Length shaft 2	365,00	meter
SCHEDULE - O2 Shotcrete & Wire Mesh			
O201	Shotcreting of primary lining (shaft, caverns) with designed mix cement concrete SpC20/25(56)/II/J2/XC1/GK8 as per Technical Specifications & drawings or as directed by Employer's Representative in charge including all materials, labour, equipment, etc. required for complete job. The reinforcement is compensated separately.		
O20101	50 mm thick shotcrete lining in shaft [Equation = (a*(c+d)+e*f)*b]	14.202,76	sqm
a	Perimeter of shotcrete lining in Support Category 01	40,37	meter
b	Predicted percentage Support Category 01 of overall excavation	0,300	%/100
c	Length shaft 1	484,00	meter
d	Length shaft 2	365,00	meter
e	Perimeter of shotcrete lining in shaft 3	18,77	meter
f	Length of shaft 3	208,00	meter

Item No.	Description of item	Quantity	Unit
O20102	100 mm thick shotcrete lining in shaft [Equation = a*b*(c+d)]	10.812,60	sqm
a	Perimeter of shotcrete lining in Support Category 02	40,53	meter
b	Predicted percentage Support Category 02 of overall excavation	0,314	%/100
c	Length shaft 1	484,00	meter
d	Length shaft 2	365,00	meter
O20103	150 mm thick shotcrete lining in shaft	8.255,80	sqm
a	Perimeter of shotcrete lining in Support Category 03 [Equation = a*b*(c+d)]	40,68	meter
b	Predicted percentage Support Category 03 of overall excavation	0,239	%/100
c	Length shaft 1	484,00	meter
d	Length shaft 2	365,00	meter
O20104	200 mm thick shotcrete lining in shaft	4.083,08	sqm
a	Perimeter of shotcrete lining in Support Category 04 [Equation = a*b*(c+d)]	40,84	meter
b	Predicted percentage Support Category 04 of overall excavation	0,118	%/100
c	Length shaft 1	484,00	meter
d	Length shaft 2	365,00	meter
O20105	300 mm thick shotcrete lining in shaft [Equation = a*b*(c+d)]	995,95	sqm
a	Perimeter of shotcrete lining in Support Category 05	41,16	meter
b	Predicted percentage Support Category 05 of overall excavation	0,029	%/100
c	Length shaft 1	484,00	meter
d	Length shaft 2	365,00	meter
O20106	100 mm thick shotcrete lining in cavern [Equation = a*b*c]	3.834,60	sqm
a	Length of lining	36,52	meter
b	Length of caverns	35,00	meter
c	Number of caverns	3,00	pcs
O20107	200 mm thick shotcrete lining in cavern [Equation = a*b*c]	5.262,60	sqm
a	Length of lining	50,12	meter
b	Length of caverns	35,00	meter
c	Number of caverns	3,00	pcs
O202	Supply and placing of 150 x 150 x 6 mm welded wire fabric of Fe 500 as reinforcement in primary lining as per approved drawings & Technical Specifications or as directed by Employer's Representative. The rate shall include all labour, materials, cost of pins, hooks, lead, lift, handling, wastage complete with contractor's own equipment for complete job.		
O20201	Shaft Construction [Equation = ((a*b+c*d+e*f+g*h+i*j)*(k+l)+m*n)/1000]	160,74	tonne
a	Support Category 01	125,55	kg
c	Predicted percentage Support Category 01 of overall excavation	0,300	%/100
b	Support Category 02	126,04	kg
d	Predicted percentage Support Category 02 of overall excavation	0,314	%/100
e	Support Category 03	253,05	kg

Item No.	Description of item	Quantity	Unit
f	Predicted percentage Support Category 03 of overall excavation	0,239	%/100
g	Support Category 04	254,03	kg
h	Predicted percentage Support Category 04 of overall excavation	0,118	%/100
i	Support Category 05	255,98	kg
j	Predicted percentage Support Category 05 of overall excavation	0,029	%/100
k	Length shaft 1	484,00	meter
l	Length shaft 2	365,00	meter
m	Reinforcement for shaft 3	58,38	kg
n	Length of shaft 3	208,00	meter
O20202	Cavern Construction [Equation = (a+2*b)*c*d*e/1000]	44,66	tonne
a	Length of lining for 1 layer wire mesh	36,52	meter
b	Length of lining for 2 layers wire mesh	50,12	meter
c	Length of caverns	35,00	meter
d	Number of caverns	3,00	pcs
e	Weight of wire mesh	3,11	kg/sqm
O203	Supply, fabrication and erection of lattice girders and all accessories including all lead, lift, wastage, storing, drilling holes, fixing in phases etc. and installation of accessories for joining the lattice girder segments as per approved workshop drawings of contractor & Technical Specifications or as directed by Employer's Representative. The rate shall include costs of all materials, labour, equipment, welding, etc. for the complete job including additional cost for enlargement of top heading footing. [Equation = (a*b+c*d)*(e+f)]	60,41	tonne
a	Support Category 04	445,85	kg
h	Predicted percentage Support Category 04 of overall excavation	0,118	%/100
b	Support Category 05	654,36	kg
j	Predicted percentage Support Category 05 of overall excavation	0,029	%/100
k	Length shaft 1	484,00	meter
l	Length shaft 2	365,00	meter
SCHEDULE - P CONCRETE WORK			
P101	Design Mix Cement Concrete C25/30 for inner lining of ventilation shaft and cavern including machine mixed, machine batched, machine vibrated, form work, etc. as per Technical Specifications & detailed drawings or as directed by Employer's Representative. The reinforcement is compensated separately.		
P10101	Ventilation shaft d&b [Equation = a*(b+c)]	16.215,90	cum
a	Area of concreting cross section	19,10	sqm
b	Length shaft 1	484,00	meter
c	Length shaft 2	365,00	meter
P10102	Ventilation shaft raise boring [Equation = a*b]	1.318,72	cum
a	Area of concreting cross section	6,34	sqm
n	Length of shaft 3	208,00	meter

Item No.	Description of item	Quantity	Unit
P10103	Ventilation cavern - foundation [Equation = a*b*c]	78,75	cum
a	Area of concreting cross section	0,75	sqm
b	Length of caverns	35,00	meter
c	Number of caverns	3,00	pcs
P10104	Ventilation cavern - vault [Equation = a*b*c]	1.777,65	cum
a	Area of concreting cross section	16,93	sqm
b	Length of caverns	35,00	meter
c	Number of caverns	3,00	pcs
P10105	Ventilation cavern - ventilation ducts	1.183,35	cum
a	Area of concreting cross section	11,27	sqm
b	Length of caverns	35,00	meter
c	Number of caverns	3,00	pcs
P10106	Bored piles [Equation = a*b*c*d]	1.137,60	cum
a	Number of bored piles per shaft cross section	48,00	pcs
b	Estimated bored pile length	15,00	meter
c	Cross section area of pile	0,79	sqm/pcs
d	Number of shafts with bored pile excavation	2,00	pcs
P102	Reinforcement for inner lining of ventilation tunnel & cavern		
P10201	Reinforcement for inner lining of ventilation shaft d&b [Equation = a*b*c/1000]	608,10	tonne
a	Reinforcement rate	75,00	kg/cum
b	Total volume of concrete (Item P10101)	16.215,90	cum
c	Estimated volume reinforced	0,50	%/100
P10202	Reinforcement for inner lining of ventilation shaft raise boring [Equation = a*b*c/1000]	98,90	tonne
a	Reinforcement rate	75,00	kg/cum
b	Total volume of concrete (Item P10102)	1.318,72	cum
c	Estimated volume reinforced	1,00	%/100
P10203	Reinforcement for inner lining of ventilation cavern - foundation [Equation = a*b/1000]	5.906,25	tonne
a	Reinforcement rate	75,00	kg/cum
b	Total volume of concrete (Item P10103)	78,75	cum
P10204	Reinforcement for inner lining of ventilation cavern - vault [Equation = a*b/1000]	133,32	tonne
a	Reinforcement rate	75,00	kg/cum
b	Total volume of concrete (Item P10104)	1.777,65	cum
P10205	Reinforcement for inner lining of ventilation cavern - ventilation ducts [Equation = a*b/1000]	88,75	tonne
a	Reinforcement rate	75,00	kg/cum
b	Total volume of concrete (Item P10105)	1.183,35	cum
P10206	Reinforcement for bored piles [Equation = a*b/1000]	42,66	tonne
a	Reinforcement rate	75,00	kg/cum
b	Total volume of concrete (Item P10105/2)	568,80	cum

Item No.	Description of item	Quantity	Unit
SCHEDULE - Q INSTRUMENTATION AND MONITORING			
Q101	Supply, install, read and maintain of 3D monitoring targets (reflectors) in top heading bench and invert as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer((l+k)*b/a+(l+k)*d/c+(l+k)*f/e+(l+k)*h/g+(l+k)*j/i)*m]	384,00	pcs
a	Support Category 01, measurement section every	25,00	meter
b	Predicted percentage Support Category 01 of overall excavation	0,300	%/100
c	Support Category 02, measurement section every	25,00	meter
d	Predicted percentage Support Category 02 of overall excavation	0,314	%/100
e	Support Category 03, measurement section every	17,50	meter
f	Predicted percentage Support Category 03 of overall excavation	0,239	%/100
g	Support Category 04, measurement section every	10,00	meter
h	Predicted percentage Support Category 04 of overall excavation	0,118	%/100
i	Support Category 05, measurement section every	5,00	meter
j	Predicted percentage Support Category 05 of overall excavation	0,029	%/100
k	Length shaft 1	484,00	meter
l	Length shaft 2	365,00	meter
m	Reflectors per measurement section	8,00	pcs
Q102	Supply, drill, install, grout, read and maintain of borehole extensometer (four point) in the tunnel perimeter as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer((i+j)*b/a+(i+j)*d/c+(i+j)*f/e+(i+j)*h/g)*k]	55,00	pcs
a	Support Category 02, measurement section every	100,00	meter
b	Predicted percentage Support Category 02 of overall excavation	0,314	%/100
c	Support Category 03, measurement section every	60,00	meter
d	Predicted percentage Support Category 03 of overall excavation	0,239	%/100
e	Support Category 04, measurement section every	35,00	meter
f	Predicted percentage Support Category 04 of overall excavation	0,118	%/100
g	Support Category 05, measurement section every	20,00	meter
h	Predicted percentage Support Category 05 of overall excavation	0,029	%/100
i	Length shaft 1	484,00	meter
j	Length shaft 2	365,00	meter
k	Borehole extensiometer per measurement section	5,00	pcs
Q103	Supply, install, read and maintain of load cells for rock bolts as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer((i+j)*b/a+(i+j)*d/c+(i+j)*f/e+(i+j)*h/g)*k]	22,00	pcs
a	Support Category 02, measurement section every	100,00	meter
b	Predicted percentage Support Category 02 of overall excavation	0,314	%/100
c	Support Category 03, measurement section every	60,00	meter
d	Predicted percentage Support Category 03 of overall excavation	0,239	%/100

Item No.	Description of item	Quantity	Unit
e	Support Category 04, measurement section every	35,00	meter
f	Predicted percentage Support Category 04 of overall excavation	0,118	%/100
g	Support Category 05, measurement section every	20,00	meter
h	Predicted percentage Support Category 05 of overall excavation	0,029	%/100
i	Length shaft 1	484,00	meter
j	Length shaft 2	365,00	meter
k	Load cells per measurement section	2,00	pcs
Q104	Supply, install, read and maintain of strain gauges for shotcrete as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer((i+j)*b/a+(i+j)*d/c+(i+j)*f/e+(i+j)*h/g)*k]	11,00	pcs
a	Support Category 02, measurement section every	100,00	meter
b	Predicted percentage Support Category 02 of overall excavation	0,314	%/100
c	Support Category 03, measurement section every	60,00	meter
d	Predicted percentage Support Category 03 of overall excavation	0,239	%/100
e	Support Category 04, measurement section every	35,00	meter
f	Predicted percentage Support Category 04 of overall excavation	0,118	%/100
g	Support Category 05, measurement section every	20,00	meter
h	Predicted percentage Support Category 05 of overall excavation	0,029	%/100
i	Length shaft 1	484,00	meter
j	Length shaft 2	365,00	meter
k	Strain gauges per measurement section	1,00	pcs
Q105	Supply, install, read and maintain of strain gauges for concrete as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer((i+j)*b/a+(i+j)*d/c+(i+j)*f/e+(i+j)*h/g)*k]	11,00	pcs
a	Support Category 02, measurement section every	100,00	meter
b	Predicted percentage Support Category 02 of overall excavation	0,314	%/100
c	Support Category 03, measurement section every	60,00	meter
d	Predicted percentage Support Category 03 of overall excavation	0,239	%/100
e	Support Category 04, measurement section every	35,00	meter
f	Predicted percentage Support Category 04 of overall excavation	0,118	%/100
g	Support Category 05, measurement section every	20,00	meter
h	Predicted percentage Support Category 05 of overall excavation	0,029	%/100
i	Length shaft 1	484,00	meter
j	Length shaft 2	365,00	meter
k	Strain gauges per measurement section	1,00	pcs
Q106	Supply, install, read and maintain of radial pressure cells as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer((i+j)*b/a+(i+j)*d/c+(i+j)*f/e+(i+j)*h/g)*k]	55,00	pcs

Item No.	Description of item	Quantity	Unit
a	Support Category 02, measurement section every	100,00	meter
b	Predicted percentage Support Category 02 of overall excavation	0,314	%/100
c	Support Category 03, measurement section every	60,00	meter
d	Predicted percentage Support Category 03 of overall excavation	0,239	%/100
e	Support Category 04, measurement section every	35,00	meter
f	Predicted percentage Support Category 04 of overall excavation	0,118	%/100
g	Support Category 05, measurement section every	20,00	meter
h	Predicted percentage Support Category 05 of overall excavation	0,029	%/100
i	Length shaft 1	484,00	meter
j	Length shaft 2	365,00	meter
k	Pressure cells per measurement section	5,00	pcs
Q107	Supply, install, read and maintain of tangential pressure cells as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer((i+j)*b/a+(i+j)*d/c+(i+j)*f/e+(i+j)*h/g)*k]	55,00	pcs
a	Support Category 02, measurement section every	100,00	meter
b	Predicted percentage Support Category 02 of overall excavation	0,314	%/100
c	Support Category 03, measurement section every	60,00	meter
d	Predicted percentage Support Category 03 of overall excavation	0,239	%/100
e	Support Category 04, measurement section every	35,00	meter
f	Predicted percentage Support Category 04 of overall excavation	0,118	%/100
g	Support Category 05, measurement section every	20,00	meter
h	Predicted percentage Support Category 05 of overall excavation	0,029	%/100
i	Length shaft 1	484,00	meter
j	Length shaft 2	365,00	meter
k	Pressure cells per measurement section	5,00	pcs
Q108	Supply, install, read and maintain of temperature gauges as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = integer((d+c)/a*b)]	17,00	pcs
a	Formwork block length	12,500	meter
b	Temperature gauge per formwork block	0,250	pcs
c	Length shaft 1	484,00	meter
d	Length shaft 2	365,00	meter
SCHEDULE - R PAVEMENT			
R101	Supply, preparation of material, placing, compacting of granular sub-base with a minimum thickness of 30 cm as per approved drawings & Technical Specifications. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job. [Equation = a*b*c*d]	756,00	cum
a	Width of pavement	24,00	meter
b	Thickness of layer	0,30	meter
c	Length of caverns	35,00	meter

Item No.	Description of item	Quantity	Unit
d	Number of caverns	3,00	pcs
R102	Supply, mixing, placing, compacting of dry lean cement concrete base layer with a minimum thickness of 5 cm as per approved drawings & Technical Specifications. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job. [Equation = a*c*d]	2.520,00	sqm
a	Width of pavement	24,00	meter
b	Thickness of layer	0,05	meter
c	Length of caverns	35,00	meter
d	Number of caverns	3,00	pcs
R103	Supply, mixing, placing, compacting of cement concrete pavement with a minimum thickness of 25 cm including construction of contraction joints, expansion joints, longitudinal joints, joint sealing compound, reinforcement, dowel rods and tie bars complete as per approved drawings & Technical Specifications. The rate shall include costs of all materials, labour, equipment, quality checks etc. required for the complete job. [Equation = a*c*d]	2.520,00	sqm
a	Width of pavement	24,00	meter
b	Thickness of layer	0,25	meter
c	Length of caverns	35,00	meter
d	Number of caverns	3,00	pcs
BILL 4 - CIVIL ENGINEERING PORTAL WEST			
SCHEDULE -S DEWATERING ARRANGEMENT			
SCHEDULE -S1 Temporary Dewatering Arrangement			
S101	Care of water in temporary portal construction site	1,00	ls
SCHEDULE - S2 Permanent Dewatering Arrangement Portal			
S201	Providing and laying of PVC pipe of following diameters as main collector pipe, connection pipes, cleaning access pipes etc., as per approved drawings & Technical Specifications or as directed by Employer's Representative.		
S20101	250 mm internal diameter PVC pipe [Equation = a]	115,50	meter
a	Distance between tunnel portal and settling basin	115,50	meter
S20102	400 mm internal diameter PVC pipe [Equation = a]	195,50	meter
a	Distance between tunnel portal and outlet surface drainage	195,50	meter
S202	Providing and laying of perforated PVC pipe of following diameters as drainage pipes, as per approved drawings & Technical Specifications or as directed by Employer's Representative.		
S20201	250 mm internal diameter PVC pipe [Equation = a+b]	124,60	meter
a	Length of side drainages portal	124,60	meter
S203	Manufacture, supply, and placing of pre-cast concrete slot channel elements as per approved drawings for carriageway drainage [Equation = a*b+c]	94,00	meter
a	Number of pre-cast elements per cross section	2,00	pcs
b	Length of cut & cover tunnel west	37,00	meter
c	Additional element at portal	20,00	meter

Item No.	Description of item	Quantity	Unit
S204	Providing and installing of dimpled sheets between permanent lining of cut & cover tunnel and backfill material as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = a*(b-d)+c*d]	1.147,40	sqm
a	Perimeter of cut & cover tunnel	27,80	meter
b	Length of cut & cover tunnel west	37,00	meter
c	Perimeter of ventilation building	38,60	meter
d	Length of ventilation building	11,00	meter
S205	Providing, placing, welding of 2 mm thick PVC or ECB Water Proofing Membrane including the cost of all materials, labour, equipment, etc. required for the completion of job, as per Technical Specifications or as directed by the Employer's Representative. [Equation = a*(b-d)+c*d]	1.147,40	sqm
a	Perimeter of cut & cover tunnel	27,80	meter
b	Length of cut & cover tunnel west	37,00	meter
c	Perimeter of ventilation building	38,60	meter
d	Length of ventilation building	11,00	meter
SCHEDULE - T OPEN EXCAVATION & EARTHWORK			
T101	Earthwork in open excavation in all kinds of soils and rock, including rock requiring use of blasting, crow bars, etc. at portals and construction roads and to make berms, surface drains and the like, diversion of irrigation canal, nallah & the like and disposal of the excavated material to dumping site etc. as per approved drawings & Technical Specifications or as directed by Employer's Representative. The rate for this item includes all site clearance (cutting of trees, shrubs, roots, vegetation etc.), lift, ascent descent handling & lead to designated muck dump areas as per approved drawings & Technical Specifications, dressing of cuttings to final profile, demarcation and setting out.		
T10101	Loose excavation as per classification of excavation laid down in the Technical Technical Specifications [Equation = a*b]	23.440,97	cum
a	Total volume of excavation west portal	24.674,70	cum
b	Estimated per centage of excavation in loose ground condition	0,95	%/100
T10102	Rock excavation as per classification of excavation laid down in the Technical Technical Specifications	1.233,74	cum
a	Total volume of excavation west portal	24.674,70	cum
b	Estimated per centage of excavation in rock	0,05	%/100
T102	Embankments and fillings in area of open excavation as per approved drawings & Technical Specifications or as directed by Employer's Representative. The rate for this item includes supply, preparation of material, filling and compaction in layers. [Equation = a]	47.893,00	cum
a	Total volume of filling material in west portal	47.893,00	cum
T103	Rip-rap layer on embankments with a minimum thickness of 1.0 m for erosion protection as per approved drawings & Technical Specifications or as directed by Employer's Representative. The rate for this item includes supply, preparation of material, placing, labour, equipment for complete job. [Equation = a]	5.449,00	sqm
a	Area of embankments in plan view of western portal	5.449,00	sqm

Item No.	Description of item	Quantity	Unit
T104	Supply and placing of 120 x 60 cm gabion cage with wire mesh 50 x 50 x 6 mm of Fe 500 as permanent slope protection as per drawings & Technical Technical Specifications or as directed by Employer's Representative. The rate shall compensate all labour, materials (including wire mesh, fill material with boulder size minimum 240 mm), cost of pins, overlapping, hooks, bending, lift, handling, wastage complete with contractor's own equipment for complete job. [Equation = a]	440,00	sqm
a	Area of gabion construction in vertical view of western portal	440,00	sqm
T105	Supply and placing of geotextile as filter membrane behind gabion cage	440,00	sqm
a	Total area of gabion cage (Item R104]	440,00	sqm
SCHEDULE - U PRIMARY SUPPORT MEASURES			
SCHEDULE - U1 Bolts & Anchors			
U101	Supply, drilling, installation and grouting of SN type rock bolts of the specified length, Fy≥200 KN as per approved drawings & Technical Specifications or as directed by the Employer's Representative. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job.		
U10101	Length 8 m [Equation = a]	79,00	pcs
a	Number of bolts in western portal	79,00	pcs
U102	Supply, drilling, installation, grouting and pre-stressing of pre-stressed anchors with double corrosion protection at slopes as per approved drawings and Technical Specifications or as directed by Employer's Representative. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job.		
U10201	Length 20 m [Equation = a]	200,00	pcs
a	Number of anchors in western portal	200,00	pcs
SCHEDULE - U2 Shotcrete & Wire Mesh			
U201	Sprayed concrete with designed mix cement concrete SpC20/25/II/J1/XF3/GK8 as per Technical Technical Specifications & drawings or as directed by Employer's Representative including all materials, labour, equipment, etc. required for complete job.		
U20101	Thickness of 50 mm [Equation = a+b]	503,10	sqm
a	Shotcrete area 1 (4:5 cut)	269,50	sqm
b	Shotcrete area 2 (4:5 cut)	233,60	sqm
U20102	Thickness of 100 mm [Equation = a+b]	479,30	sqm
a	Shotcrete area 3 (2:1 cut)	303,70	sqm
b	Shotcrete area 4 (2:1 cut)	175,60	sqm
U20103	Thickness of 200 mm [Equation = a+b+c]	1.423,80	sqm
a	Shotcrete area 5 (5:1 cut)	237,00	sqm
b	Shotcrete area 6 (5:1 cut)	690,00	sqm
c	Shotcrete area 7 (5:1 cut)	496,80	sqm
U202	Sprayed concrete SpC20/25/II/J1/XF3/GK8 as per Technical Technical Specifications & drawings or as directed by Employer's Representative for temporary surface drains [Equation = a]	40,00	cum
a	Additional volume of shotcrete estimated for surface drains	40,00	cum

Item No.	Description of item	Quantity	Unit
U203	Sprayed concrete SpC20/25/II/J1/XF3/GK8 as per Technical Technical Specifications & drawings or as directed by Employer's Representative for shotcrete beam with a height of 50 cm and a thickness of 50 cm including reinforcement. [Equation = (a+b+c+d+e+f+g+h+i+j+k+l+m)*n*o]	108,93	cum
a	Shotcrete beam 1	11,60	meter
b	Shotcrete beam 2	22,40	meter
c	Shotcrete beam 3	25,30	meter
d	Shotcrete beam 4	40	meter
e	Shotcrete beam 5	49,9	meter
f	Shotcrete beam 6	48,6	meter
g	Shotcrete beam 7	47,6	meter
h	Shotcrete beam 8	46,2	meter
i	Shotcrete beam 9	20	meter
j	Shotcrete beam 10	21,9	meter
k	Shotcrete beam 11	27,8	meter
l	Shotcrete beam 12	33,8	meter
m	Shotcrete beam 13	40,6	meter
n	Thickness of beam	0,5	meter
o	Height of beam	0,5	meter
U204	Supply and placing of 150 x 150 x 6 mm welded wire fabric of Fe 500 as reinforcement in slopes as per approved drawings & Technical Technical Specifications or as directed by Employer's Representative. The rate shall include all labour, materials, cost of pins, overlapping, hooks, lead, lift, handling, wastage complete with contractor's own equipment for complete job. [Equation = a*b/1000]	10,35	tonne
a	Total area of wire mesh	3.326,90	sqm
b	Unit weight of wire mesh	3,11	kg/sqm
SCHEDULE - V CONCRETE WORK			
V101	Design Mix Cement Concrete works including machine mixed, machine batched, machine vibrated, form work, etc. but excluding the cost of reinforcement as per Technical Specifications & drawings or as directed by Employer's Representative.		
V10101	Concrete C12/15 as binding concrete [Equation = a*b]	22,24	cum
a	Area of binding concrete under cut and cover foundation	0,60	sqm
b	Length of cut & cover tunnel west	37,00	meter
V10102	Concrete C25/30 [Equation = a*b+c+d+e+f+g+h]	1.936,40	cum
a	Concrete area of cut & cover tunnel	22,40	sqm
b	Length of cut & cover tunnel west	37,00	meter
c	Concrete required for wing wall and attic	217,40	cum
d	Additional concrete required for ventilation building	413,60	cum
e	Concrete required for fresh air ventilation shaft	68,30	cum
f	Concrete required for exhaust air ventilation shaft	84,80	cum

Item No.	Description of item	Quantity	Unit
g	Concrete required for fresh air duct	29,20	cum
h	Concrete required for exhaust air duct	294,30	cum
V102	Reinforcement steel [Equation = a*b]	154,91	tonne
a	Reinforcement grate	0,08	tonne/cum
b	Total volume of concrete works (Item T10102)	1.936,40	cum
V103	Water stop [Equation = a*b]	74,00	meter
a	Number of water stops per cross section	2,00	pcs
b	Length of cut & cover tunnel west	37,00	meter
SCHEDULE - W	**PAVEMENT**		
W101	Supply, preparation of material, placing, compacting of granular sub-base with a minimum thickness of 30 cm as per approved drawings & Technical Specifications. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job. [Equation = (a*b+c*d+e+f*g)*h]	1.341,51	cum
a	Pavement width of cut & cover tunnel	8,50	meter
b	Length of cut & cover tunnel west	37,00	meter
c	Pavement width of road from portal to junction of service road and highway	8,50	meter
d	Length of road from final portal to junction of service road and highway	130,20	meter
e	Area of vehicle hard standing in portal west	1.721,20	sqm
f	Pavement width of service road length	3,00	meter
g	Service road length	443,10	meter
h	Layer thickness	0,30	meter
W102	Supply, mixing, placing, compacting of dry lean cement concrete base layer with a minimum thickness of 5 cm as per approved drawings & Technical Specifications. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job. [Equation = a*b+c*d+e]	3.142,40	sqm
a	Pavement width of cut & cover tunnel	8,50	meter
b	Length of cut & cover tunnel west	37,00	meter
c	Length of road from final portal to junction of service road and highway	130,20	meter
d	Pavement width of road from portal to junction of service road and highway	8,50	meter
e	Area of vehicle hard standing in portal west	1.721,20	sqm
W103	Sloping concrete C12/15 [Equation = a*b*c]	47,18	cum
a	Pavement width of cut & cover tunnel	8,50	meter
b	Length of cut & cover tunnel west	37,00	meter
c	Mean layer thickness	0,15	meter
W104	Supply, mixing, placing, compacting of cement concrete pavement with a minimum thickness of 22 cm including construction of contraction joints, expansion joints, longitudinal joints, joint sealing compound, reinforcement, dowel rods and tie bars complete as per approved drawings & Technical Specifications. The rate shall include costs of all materials, labour, equipment, quality checks etc. required for the complete job. [Equation = a*b+c*d+e]	3.142,40	sqm
a	Pavement width of cut & cover tunnel	8,50	meter

Item No.	Description of item	Quantity	Unit
b	Length of cut & cover tunnel west	37,00	meter
c	Length of road from final portal to junction of service road and highway	130,20	meter
d	Pavement width of road from portal to junction of service road and highway	8,50	meter
e	Area of vehicle hard standing in portal west	1.721,20	sqm
W105	Manufacture, supply, and placing of pre-cast footpath elements in tunnel as per approved drawings, including application of 2 cm mastic asphalt surface. The rate shall include costs of all materials, labour, equipment, quality checks etc. required for the complete job. [Equation = a*b]	74,00	meter
a	Number of pre-cast elements per cross section	2,00	pcs
b	Length of cut & cover tunnel west	37,00	meter
W106	Supply, preparation of material, placing, compacting of granular base with a minimum thickness of 20 cm as per approved drawings & Technical Specifications. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job. [Equation = a*b*c]	265,86	cum
a	Pavement width of service road length	3,00	meter
b	Service road length	443,10	meter
c	Layer thickness	0,20	meter
W107	Supply, mixing, placing, compacting of bituminous pavement with a minimum thickness of 10 cm as per approved drawings & Technical Specifications. The rate shall include costs of all materials, labour, equipment, quality checks etc. required for the complete job. [Equation = a*b]	1.329,30	sqm
a	Pavement width of service road length	3,00	meter
b	Service road length	443,10	meter
SCHEDULE - X BUILDINGS			
X101	Construction of buildings [Equation = 3*a+3*b+2*c+2*d+2*e]	5.424,00	sqm
a	Main control centre	600,00	sqm
b	Ventilation Building	950,00	sqm
c	Fire brigade post	75,00	sqm
d	Operation and maintenance building	200,00	sqm
e	Traffic aid port/medical/rescue	112,00	sqm
BILL 5 - CIVIL ENGINEERING PORTAL EAST			
SCHEDULE -Y DEWATERING ARRANGEMENT			
SCHEDULE - Y1 Temporary Dewatering Arrangement Portal			
Y101	Care of water in temporary portal construction site	1,00	ls
SCHEDULE - Y2 Permanent Dewatering Arrangement Portal			
Y201	Providing and laying of PVC pipe of following diameters as main collector pipe, connection pipes, cleaning access pipes etc., as per approved drawings & Technical Specifications or as directed by Employer's Representative.		
Y20101	250 mm internal diameter PVC pipe [Equation = a]	79,40	meter
a	Distance between tunnel portal and inlet surface channel	79,40	meter
Y20102	400 mm internal diameter PVC pipe [Equation = a]	74,00	meter

Item No.	Description of item	Quantity	Unit
a	Distance between tunnel portal and inlet surface channel	74,00	meter
Y202	Providing and laying of perforated PVC pipe of following diameters as drainage pipes, as per approved drawings & Technical Specifications or as directed by Employer's Representative.		
Y20201	250 mm internal diameter PVC pipe [Equation = a]	334,00	meter
a	Length of side drainages portal	334,00	meter
Y203	Manufacture, supply, and placing of pre-cast concrete slot channel elements as per approved drawings for carriageway drainage [Equation = a*b+c]	80,00	meter
a	Number of pre-cast elements per cross section	2,00	pcs
b	Length of cut & cover tunnel east	30,00	meter
c	Additional slot element at portal	20,00	meter
Y204	Providing and installing of dimpled sheets between permanent lining of cut & cover tunnel and backfill material as per approved drawings & Technical Specifications or as directed by Employer's Representative. [Equation = a*(b-d)+c*d]	952,80	sqm
a	Perimeter of cut & cover tunnel	27,80	meter
b	Length of cut & cover tunnel east	30,00	meter
c	Perimeter of ventilation building	38,60	meter
d	Length of ventilation building	11,00	meter
Y205	Providing, placing, welding of 2 mm thick PVC or ECB Water Proofing Membrane including the cost of all materials, labour, equipment, etc. required for the completion of job, as per Technical Specifications or as directed by the Employer's Representative. [Equation = a*(b-d)+c*d]	952,80	sqm
a	Perimeter of cut & cover tunnel	27,80	meter
b	Length of cut & cover tunnel east	30,00	meter
c	Perimeter of ventilation building	38,60	meter
d	Length of ventilation building	11,00	meter
SCHEDULE - Z OPEN EXCAVATION & EARTHWORK			
Z101	Earthwork in open excavation in all kinds of soils and rock, including rock requiring use of blasting, crow bars, etc. at portals and construction roads and to make berms, surface drains and the like, diversion of irrigation canal, nallah & the like and disposal of the excavated material to dumping site etc. as per approved drawings & Technical Specifications or as directed by Employer's Representative. The rate for this item includes all site clearance (cutting of trees, shrubs, roots, vegetation etc.), lift, ascent descent handling & lead to designated muck dump areas as per approved drawings & Technical Specifications, dressing of cuttings to final profile, demarcation and setting out.		
Z10101	Loose excavation as per classification of excavation laid down in the Technical Technical Specifications [Equation = a*b]	2.778,54	cum
a	Total volume of excavation east portal	18.523,60	cum
b	Estimated per centage of excavation in loose ground condition	0,15	%/100
Z10102	Rock excavation as per classification of excavation laid down in the Technical Technical Specifications [Equation = a*b]	21.499,99	cum

Item No.	Description of item	Quantity	Unit
a	Total volume of excavation east portal	25.294,10	cum
b	Estimated per centage of excavation in loose ground condition	0,85	%/100
Z102	Embankments and fillings in area of open excavation as per approved drawings & Technical Specifications or as directed by Employer's Representative. The rate for this item includes supply, preparation of material, filling and compaction in layers. [Equation = a]	97.597,00	cum
a	Total volume of filling material in east portal	97.597,00	cum
Z103	Rip-rap layer on embankments with a minimum thickness of 1.0 m for erosion protection as per approved drawings & Technical Specifications or as directed by Employer's Representative. The rate for this item includes supply, preparation of material, placing, labour, equipment for complete job. [Equation = a]	9.100,00	sqm
a	Area of embankments in plan view of eastern portal	9.100,00	sqm
Z104	Supply and placing of 120 x 60 cm gabion cage with wire mesh 50 x 50 x 6 mm of Fe 500 as permanent slope protection as per drawings & Technical Technical Specifications or as directed by Employer's Representative. The rate shall compensate all labour, materials (including wire mesh, fill material with boulder size minimum 240 mm), cost of pins, overlapping, hooks, bending, lift, handling, wastage complete with contractor's own equipment for complete job. [Equation = a]	1.003,00	sqm
a	Area of gabion construction in vertical view of eastern portal	1.003,00	sqm
Z105	Supply and placing of geotextile as filter membrane behind gabion cage [Equation = a]	1.003,00	sqm
a	Total area of gabion cage (Item W104]	1.003,00	sqm
SCHEDULE - ZA PRIMARY SUPPORT MEASURES			
SCHEDULE - ZA1 Bolts & Anchors			
ZA101	Supply, drilling, installation and grouting of 16 mm dia. reinforcement bars as soil nails at slopes as per approved drawings and Technical Specifications or as directed by Employer's Representative. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job.		
ZA10101	Length 8 m [Equation = a]	171,00	pcs
a	Number of nails in eastern portal	171,00	pcs
ZA102	Supply, drilling, installation, grouting and pre-stressing of pre-stressed anchors with double corrosion protection at slopes as per approved drawings and Technical Specifications or as directed by Employer's Representative. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job.		
ZA10201	Length 20 m [Equation = a]	77,00	pcs
a	Number of ground anchors in eastern portal	77,00	pcs
ZA103	Supply, drilling, installation, grouting and glass fibre plastic (GFP) self-drilling bolt at slopes as per approved drawings and Technical Specifications or as directed by Employer's Representative. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job.		
ZA10301	Length 9 m [Equation = a]	84,00	pcs
a	Number of self drilling bolts at eastern portal	84,00	pcs
SCHEDULE - ZA2 Shotcrete & Wire Mesh			

Item No.	Description of item	Quantity	Unit
ZA201	Sprayed concrete with designed mix cement concrete SpC20/25/II/J1/XF3/GK8 as per Technical Technical Specifications & drawings or as directed by Employer's Representative including all materials, labour, equipment, etc. required for complete job.		
ZA20101	Thickness of 50 mm [Equation = -]	-	sqm
ZA20102	Thickness of 100 mm [Equation = a+b+c+d+e+f]	847,20	sqm
a	Shotcrete area 1 (2:1 cut)	140,00	sqm
b	Shotcrete area 2 (2:1 cut)	224,00	sqm
c	Shotcrete area 3 (2:1 cut)	144,00	sqm
d	Shotcrete area 4 (2:1 cut)	115,20	sqm
e	Shotcrete area 5 (2:1 cut)	113,80	sqm
f	Shotcrete area 6 (2:1 cut)	110,20	sqm
ZA20103	Thickness of 200 mm [Equation = a+b+c]	1.202,60	sqm
a	Shotcrete area 7 (5:1 cut)	588,00	sqm
b	Shotcrete area 8 (5:1 cut)	425,60	sqm
c	Shotcrete area 9 (5:1 cut)	189,00	sqm
ZA202	Sprayed concrete SpC20/25/II/J1/XF3/GK8 as per Technical Technical Specifications & drawings or as directed by Employer's Representative for temporary surface drains [Equation = a]	37,00	cum
a	Additional volume of shotcrete estimated for surface drains	37,00	cum
ZA203	Supply and placing of 150 x 150 x 6 mm welded wire fabric of Fe 500 as reinforcement in slopes as per approved drawings & Technical Technical Specifications or as directed by Employer's Representative. The rate shall include all labour, materials, cost of pins, overlapping, hooks, lead, lift, handling, wastage complete with contractor's own equipment for complete job. [Equation = a*b/1000]	10,11	tonne
a	Total area of wire mesh	3.252,40	sqm
b	Unit weight of wire mesh	3,11	kg/sqm
SCHEDULE - ZB CONCRETE WORK			
ZB101	Design Mix Cement Concrete works including machine mixed, machine batched, machine vibrated, form work, etc. but excluding the cost of reinforcement as per Technical Specifications & drawings or as directed by Employer's Representative.		
ZB10101	Concrete C12/15	18,03	cum
a	Area of binding concrete under cut and cover foundation	0,60	sqm
b	Length of cut & cover tunnel east	30,00	meter
ZB10102	Concrete C25/30 [Equation = a*b+c+d+e+f+g+h]	1.770,20	cum
a	Concrete area of cut & cover tunnel	22,40	sqm
b	Length of cut & cover tunnel east	30,00	meter
c	Concrete required for wing wall and attic	150,30	cum
d	Additional concrete required for ventilation building	413,60	cum
e	Concrete required for fresh air ventilation shaft	61,10	cum
f	Concrete required for exhaust air ventilation shaft	139,50	cum

Item No.	Description of item	Quantity	Unit
g	Concrete required for fresh air duct	24,00	cum
h	Concrete required for exhaust air duct	309,70	cum
ZB102	Reinforcement steel [Equation = a*b]	141,62	tonne
a	Reinforcement grate	0,08	tonne/cum
b	Total volume of concrete works (Item ZA10102)	1.770,20	cum
ZB103	Water stop	60,00	meter
a	Number of water stops per cross section	2,00	pcs
b	Length of cut & cover tunnel east	30,00	meter
SCHEDULE - ZC PAVEMENT			
ZC101	Supply, preparation of material, placing, compacting of granular sub-base with a minimum thickness of 30 cm as per approved drawings & Technical Specifications. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job. [Equation = (a*b+c*d+e+f*g)*h]	1.363,11	cum
a	Pavement width of cut & cover tunnel	8,50	meter
b	Length of cut & cover tunnel east	30,00	meter
c	Pavement width of road from portal to junction of service road and highway	8,50	meter
d	Length of road from final portal to junction of service road and highway	87,40	meter
e	Area of vehicle hard standing in portal east	2.216,50	sqm
f	Pavement width of service road length	3,00	meter
g	Service road length	443,10	meter
h	Layer thickness	0,30	meter
ZC102	Supply, mixing, placing, compacting of dry lean cement concrete base layer with a minimum thickness of 5 cm as per approved drawings & Technical Specifications. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job. [Equation = a*b+c*d+e]	2.719,10	sqm
a	Pavement width of cut & cover tunnel	8,50	meter
b	Length of cut & cover tunnel east	30,00	meter
c	Length of road from final portal to junction of service road and highway	87,40	meter
d	Pavement width of road from portal to junction of service road and highway	8,50	meter
e	Area of vehicle hard standing in portal east	1.721,20	sqm
ZC103	Sloping concrete C12/15 [Equation = a*b*c]	38,25	cum
a	Pavement width of cut & cover tunnel	8,50	meter
b	Length of cut & cover tunnel east	30,00	meter
c	Layer thickness	0,15	meter
ZC104	Supply, mixing, placing, compacting of cement concrete pavement with a minimum thickness of 22 cm including construction of contraction joints, expansion joints, longitudinal joints, joint sealing compound, reinforcement, dowel rods and tie bars complete as per approved drawings & Technical Specifications. The rate shall include costs of all materials, labour, equipment, quality checks etc. required for the complete job. [Equation = a*b+c*d+e]	2.719,10	sqm
a	Pavement width of cut & cover tunnel	8,50	meter

Item No.	Description of item	Quantity	Unit
b	Length of cut & cover tunnel east	30,00	meter
c	Length of road from final portal to junction of service road and highway	87,40	meter
d	Pavement width of road from portal to junction of service road and highway	8,50	meter
e	Area of vehicle hard standing in portal east	1.721,20	sqm
ZC105	Manufacture, supply, and placing of pre-cast footpath elements in tunnel as per approved drawings, including application of 2 cm mastic asphalt surface. The rate shall include costs of all materials, labour, equipment, quality checks etc. required for the complete job. [Equation = a*b]	60,00	meter
a	Number of pre-cast elements per cross section	2,00	pcs
b	Length of cut & cover tunnel east	30,00	meter
ZC106	Supply, preparation of material, placing, compacting of granular base with a minimum thickness of 20 cm as per approved drawings & Technical Specifications. The rate shall include costs of all materials, labour, equipment, etc. required for the complete job. [Equation = a*b*c]	261,42	cum
a	Pavement width of service road length	3,00	meter
b	Service road length	435,70	meter
c	Layer thickness	0,20	meter
ZC107	Supply, mixing, placing, compacting of bituminous pavement with a minimum thickness of 10 cm as per approved drawings & Technical Specifications. The rate shall include costs of all materials, labour, equipment, quality checks etc. required for the complete job. [Equation = a*b]	1.307,10	cum
a	Pavement width of service road length	3,00	meter
b	Service road length	435,70	meter
SCHEDULE - ZD BUILDINGS			
ZD101	Construction of buildings [Equation = 3*a+3*b+2*c+2*d]	4.674,00	sqm
a	Main control centre	400,00	sqm
b	Ventilation Building	950,00	sqm
c	Operation and maintenance building	200,00	sqm
d	Traffic aid port/medical/rescue	112,00	sqm
BILL 6 -SITE FACILITY & TIME-DEPENDENT COSTS			
SCHEDULE S&T-A - SITE FACILITY			
S&T-A101	Installation of site facility and clearance of site installation including all labour, machinery and transportation to the site location.	1,00	lump sum
S&T-A102	Formwork inner lining [Equation = a+b+c+d]	11,00	pcs
a	Number of formwork carriages main tunnel vault	4,00	pcs
b	Number of formwork carriages shaft	2,00	pcs
c	Number of formwork carriages egress tunnel	4,00	pcs
d	Number of formwork carriages cavern	1,00	pcs
S&T-A103	Formwork ventilation ceiling [Equation = a]	8,00	pcs
a	Number of formwork ventilation ceiling	8,00	pcs
S&T-A104	Temporary ventilation ducts [Equation = 2*a+b+c+d]	29.223,00	meter

Item No.	Description of item	Quantity	Unit
a	Mined tunnel length	14.083,00	meter
b	Length of shaft 1	484,00	meter
c	Length of shaft 2	365,00	meter
d	Length of shaft 3	208,00	meter
S&T-A105	Temporary lighting	29.223,00	meter
a	Mined tunnel length	14.083,00	meter
b	Length of shaft 1	484,00	meter
c	Length of shaft 2	365,00	meter
d	Length of shaft 3	208,00	meter
S&T-A106	Site facility costs	1,00	lump sum
S&T-A107	Costs for miscellaneous site facility, machinery and material not included in time dependent costs and general site facility costs	1,00	lump sum
SCHEDULE S&T-B - TIME DEPENDENT COSTS			
S&T-B101	Time dependent costs from commencement of construction to commencement of mined tunnel excavation	1,00	lump sum
S&T-B102	Time dependent costs commencement of tunnel excavation to end of concrete works	1,00	lump sum
S&T-B103	Time dependent costs end of concrete works to end of construction works	1,00	lump sum