



Government of Nepal  
Ministry of Physical Infrastructure and Transport  
**Department of Roads**

**NORMS FOR RATE ANALYSIS OF ROAD  
TUNNEL CONSTRUCTION-2077**



# Foreword

Road Tunnel Construction is new technology in Nepal. Therefore, there is a lack of norms and specification for Road Tunnel Construction in Nepal. Department of Road has formed 11 members, Department Committee to draft norms and specification for tunnel construction in Design & Build / Engineering Procurement Construction (EPC) modality. The committee has carried an extensive work with the help of experts from Nepal Tunnel Association. The committee has taken Siddhababa Tunnel's Detail Project Report (DPR) developed by Swiss Agency for Development and Corporation (SDC) as a main reference to finalize this norms. In addition to this, the committee has studied Nagdhunga Tunnel and other hydropower tunnels's documents to finalize this Norms. This norms is applicable for Rate Analysis of Road Tunnel Construction in Design & Build/EPC modality.



A handwritten signature in blue ink, appearing to read 'Arjun Jang Thapa'. The signature is fluid and cursive, with a horizontal line underneath it.

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**Er. Arjun Jang Thapa**  
Director General  
Department of Roads



# Acknowledgement

The norms for rate analysis of road tunnel construction in Design and Build/EPC modality has been prepared from departmental committee of DOR and has been approved by Nepal Government (Cabint Devise 2077/1/19)



I would like to take this opportunity of experience, my sincere thanks to the committee members, DG Arjun Jung Thapa, DDG Bhuwan Adhikari, DDG Shiva Nepal, SE Prabhat Jha, Retel SE Rajendra Sharma, SE Naresh Man Shakya, DE Arjun Suwal, Expert Tara Nath Sapkota, Expert Dr. Gyanendra Lal Shrestha, Expert Ram Hari Sharma, Expert Sakil Manandhar for their immense effort in developing this norms.

I am fully confident that this norms for Rate Analysis of Road Tunnel Constructin will lead DoR to achieve qualitative and quantitative work of Road Tunnel in an efficient way.

A handwritten signature in black ink, appearing to be 'Bijaya Jaishi', written over a dotted line.

.....  
Dr. Bijaya Jaishi  
Director  
Quality Research and Development Center  
Department of Roads





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**Department of Road  
Quality, Research and Development Center**

**Base Rate for Underground Workers**

Labour Types for Underground Works	As per Ref. 1		As per Ref. 2	As per Ref. 3	As per Ref. 4	As per Ref. 5	As per Ref. 6	As per Ref. 7	Minimum, expect Ref. 2	Maximum	Adopted Rate for FY 2076/77
	per day	per hr	per hr	per hr	per hr	per hr	per hr	per hr	per hr	per hr	per hr
Supervisor (UG)			> 69.0			100.6	190.4	149.5	100.6	190.4	190
Foreman (UG)			> 69.0	340.9	3543.8	100.6	190.4	149.5	100.6	3543.8	235
Skilled (UG)	1041.6	151.9	> 69.0	99.2	108.0	150.2	215.2	213.9	99.2	215.2	210
Semi Skilled (UG)	892.8	130.2	> 69.0	83.2		123.2	190.4	166.8	83.2	190.4	190
Unskilled (UG)	745.6	108.7	> 69.0	60.4	67.5	109.4	158.4	149.5	60.4	158.4	160
Mechanics(UG)											235
Electrician(UG)											235
Blaster (UG)		0.0	> 69.0			100.6		213.9	0.0	213.9	210
Ref. 1 : Area wise Rates of Minimum Wages for Scheduled Employments in the Central Sphere , As on 01.10.2018 , India											
Ref 2. : Gazzete 20,Part 5, 2075/04/31, GoN and Labour Act,2074 " 1 day paid leave per week"											
Ref. 3 : Feasibility Study for the Madian Hydropower Project, Pakistan											
Ref. 4: Revised Engineer's Estimate, Contract Id MDS/DI//01, Melamchi Water Supply Development Board											
Ref. 5: District rate 2076/2077 Kathmandu											
Ref. 6: Naghdhunga Tunnel Project Estimate,2017											
Ref. 7: ROCKFALL PROTECTION ALONG SIDDHARHABABASECTION OF SIDDHARTHA HIGHWAY, Ch. 28+200km – Ch. 30+600km, SDC DPR Report											
Ref. 8: R125 - Conditions of Employment of Young Persons (Underground Work) Recommendation, 1965 (No. 125), ILO											
Ref. 9: Official Gazette number 30165 on 25 August 2017 (only available in Turkish): Regulation Amending the Regulation on Working Hours, Regulation Amending the Regulation on Overtime Works											
The rate for the fiscal year other than 2076/77, shall be calculated by adjusting the above rate with respect to the Nepal Rastra Bank, published annual "National Salary and Wage Rate Index" - "Construction Labor"											

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Base Rate for Equipments/Machines

Types of Equipments/Machines	Unit	Unit Rate including hire rent,fuel,labour cost all	Reference
Air Compressor	hr	1459	DoR,2076/2077
Axial Flow Fan	hr	260	Ref. 7
Drilling Jumbo	hr	7600	Ref. 4
Shotcrete Spraying Robot	hr	7500	Ref. 4
Pneumatic Hand Drilling Machine	hr	105	Ref. 5
Shotcrete Machine	hr	1000	Ref. 7
Rock Shovels	hr	400	Ref. 7
Ventilation Duct	rm	1500	Ref. 7
Working Platform	hr	300	Expert Opinion
Concrete Pump	hr	1000	Expert Opinion
Concrete Mixture	hr	523	DoR,2076/2077
Batch Plant	hr	4061	DoR,2076/2077
Generator 33KV	hr	931	DoR,2076/2077
Transit Mixer	hr	1675	DoR,2076/2077
Grouting Pump	hr	2038	DoR,2076/2077
Dump Truck (>8 ton capacity)	hr	1454	DoR,2076/2077
Mini Dumper	hr	550	DoR,2076/2077
Grader	hr	3618	DoR,2076/2077
Tunnel Excavator	hr	3570	DoR,2076/2077
Bitumen Distributer	hr	4377	DoR,2076/2077
Wheel Loader	hr	2857	DoR,2076/2077
Asphal Plant	hr	64921	DoR,2076/2077
Paver	hr	4775	DoR,2076/2077
Pneumatic Roller	hr	3319	DoR,2076/2077
Wheeled roller	hr	1608	DoR,2076/2077
vibratbtor roller	hr	2413	DoR,2076/2077

**NORMS FOR RATE ANALYSIS FOR MAIN ROAD TUNNEL CONSTRUCTION**  
(Tunnel Diameter 9 to 13m)

RA No. :	MT1		
Description of item :		Road Tunnel Excavation, mucking, safe disposal, necessary support system ensuring required safety level at Operation level, all complete as per Employers' Requirements (Class V: Very Poor Rock with RMR value <20 or Equivalent Q)	
Area	111.22	m2 Opening per meter	
Norms activity	Specification Clause	Resources	
		Sub-Items (A)	
		Category	Unit
	As details in Employer's Requirements		Quantity
a		Excavation by Drilling and Blasting (Ordinary Rock) including mucking	Cum
b		Shotcrete for face stabilization (100mm thick)	Cum
c		Fiber reinforced Shotcrete (50+200mm thick)	Cum
d		25mm Dia., Self drilling anchor (SDA), ultimate load >250 kN, (5.6m per meter)	Rm
e		Lattice Girder P230-36 or equivalent @ 1m spacing with plates/links	Ton
f		50cm M35/20 Concreting for Inner Lining	Cum
g		Reinforcement for Inner Lining @ 7% of Concrete	Kg
h		Formwork for Inner Lining	Sqm
i		Face stability Fiberglass Anchors with 50% overlap	Rm
j		Execution of a steel tubes forepoling umbrella (steel grade S355). Diameter min. 114.3 mm, thickness min. 16mm, drilling diameter min. 150mm	Rm
k		50cm Granular Filling for Construction Vehicle Operation	Cum

NORMS FOR RATE ANALYSIS FOR MAIN ROAD TUNNEL CONSTRUCTION

RA No. :	MT2		
Description of item :		Road Tunnel Excavation, mucking, safe disposal, necessary support system ensuring required safety level at Operation level, all complete as per Employers' Requirements (Class IV : Poor Rock with RMR value 21-40 or Equivalent Q)	
Area	111.22	m2 Opening per meter	
Norms activity	Specification Clause	Resources	
		Sub-Items (A)	
		Category	Unit
	As details in Employer's Requirements		Quantity
a		Excavation by Drilling and Blasting (Ordinary Rock) including mucking	Cum
b		Shotcrete for face stabilization (100mm thick)	Cum
c		Fiber reinforced Shotcrete (50+150mm thick)	Cum
d		25mm Dia., Self drilling anchor (SDA) , ultimate load >250 kN, (5.6m per meter)	Rm
e		Lattice Girder P230-30 or equivalent @ 1m spacing with plates/links	Ton
f		50cm M35/20 Concreting for Inner Lining	Cum
g		Reinforcement for Inner Lining @ 6% of Concrete	Kg
h		Formwork for Inner Lining	Sqm
i		Face stability Fibreglass Anchors with 50% overlap	Rm
j		Execution of a steel tubes forepoling umbrella (steel grade S355) .Diameter min. 114.3 mm, thickness min. 16mm, drilling diameter min. 150mm	Rm
k		50cm Granular Filling for Construction Vehicle Operation	Cum

**NORMS FOR RATE ANALYSIS FOR MAIN ROAD TUNNEL CONSTRUCTION**

RA No. :	MT3		
Description of item :		Road Tunnel Excavation, mucking, safe disposal, necessary support system ensuring required safety level at Operation level, all complete as per Employers' Requirements (Class III : Fair Rock with RMR value 41-60 or Equivalent Q)	
Area	111.22	m2 Opening per meter	
Norms activity	Specification Clause	Resources	
		Sub-Items (A)	
		Category	Unit
	As details in Employer's Requirements		Quantity
a		Excavation by Drilling and Blasting (Hard Rock) including mucking	Cum 111.22
b		Fiber reinforced Shotcrete (120mm thick)	Cum 4.49
c		25mm Dia., full grout Cemented Grouted Rock Bolt (SN) or equivalent, ultimate load > 250 kN, (4.5m per 1.5 meter)	Rm 100.00
e		40cm M35/20 Concreting for Inner Lining	Cum 14.95
f		Reinforcement for Inner Lining @ 5% of Concrete	Kg 1870.00
g		Formwork for Inner Lining	Sqm 37.38
h		Face stability Fibreglass Anchors with 50% overlap	Rm 14.00
i		50cm Granular Filling for Construction Vehicle Operation	Cum 5.95

NORMS FOR RATE ANALYSIS FOR MAIN ROAD TUNNEL CONSTRUCTION

RA No. :	MT4		
Description of item :		Road Tunnel Excavation, mucking, safe disposal, necessary support system ensuring required safety level at Operation level, all complete as per Employers' Requirements (Class II - Good Rock with RMR value 61-80 or Equivalent Q)	
Area	111.22		m2 Opening per meter
Norms activity	Specification Clause	Resources	
		Sub-Items (A)	
		Category	Unit
	As details in Employer's Requirements		Quantity
a		Excavation by Drilling and Blasting (Hard Rock) including mucking	Cum 111.22
b		Shotcrete (50mm thick)	Cum 1.87
c		20mm Dia., full grout Swellex Rock Bolt or equivalent (3m per 2.5meter)	Rm 45.00
d		40cm M35/20 Concreting for Inner Lining	Cum 14.95
e		Reinforcement for Inner Lining and Shotcrete @ 1 % of Concrete	Kg 421.00
f		Formwork for Inner Lining	Sqm 37.38
g		50cm Granular Filling for Construction Vehicle Operation	Cum 5.95

NORMS FOR RATE ANALYSIS FOR MAIN ROAD TUNNEL CONSTRUCTION

RA No. :	MT5			
Description of item :		Road Tunnel Excavation, mucking, safe disposal, necessary supports system ensuring required safety level at Operation level, all complete as per Employers' Requirements (Class I : Very Good Rock with RMR value 81-100 or Equivalent Q)		
Area	111.22			
Norms activity	Specification Clause	Resources		
		Sub-Items (A)		
	As details in Employer's Requirements	Category	Unit	Quantity
a		Excavation by Drilling and Blasting (Hard Rock) including mucking	Cum	111.22
d		20mm Dia., full grout Swellex Rock Bolt or equivalent (3m per 3meter)	Rm	38.00
c		40cm M35/20 Concreting for Inner Lining	Cum	14.95
d		Reinforcement for Inner Lining @ 1% of Concrete	Kg	374.00
e		Formwork for Inner Lining	Sqm	37.38
f		50cm Granular Filling for Construction Vehicle Operation	Cum	5.95



### Norms to Consider Overburden Effect

Rock Quality Description	Q-Value	Norms Class	Q Range	RMR Range	GSI Range	Approx Shear Strength MK/m <sup>2</sup>	Overburden						
							150 m	300 m	450 m	600 m	750 m	1000 m	> 1000 m
Exponentially Poor	0.01	Class V: Very Poor	0	0 20	20	2.5	0.7	0.3	0.22	0.17	0.13	0.10	0.10
Extremely Poor	0.1	Class IV: Poor	0.016	21 40	21 40	15	4.0	2.0	1.3	1.0	0.8	0.6	0.6
Very Poor	1												
Poor	4	Class III: Fair	0.41	41 60	41 55	75	20.0	10.0	6.7	5.0	4.0	3.0	3.0
Fair	10												
Good	40	Class II: Good	8.1	61 80	56 75	200	53.3	26.7	17.8	13.3	10.7	8.0	8.0
Very Good	100												
Extremely Good	400	Class I: Very Good	201	81 100	75 95	250	66.7	33.3	22.2	16.7	13.3	10.0	10.0
Exponentially Good	1000												

References :	For Class V: Very Poor, with increase of overburden above 300m, Squeezing Effect may be prevalent					
		10%	20%	25%	30%	35%
Suggested Increase in Unit Rate of MT1 & BPT1 by:						

Soil		$\sigma_c < 1 \text{ MPa}$
a. Very low strength		1 – 5MPa
b. Low strength		5 – 25MPa
c. Moderate strength		25 – 50MPa
d. Medium strength		50 – 100MPa
e. High strength		100 – 250MPa
f. Very high strength		> 250MPa

Rock	
a. Very low strength	
b. Low strength	
c. Moderate strength	
d. Medium strength	
e. High strength	
f. Very high strength	

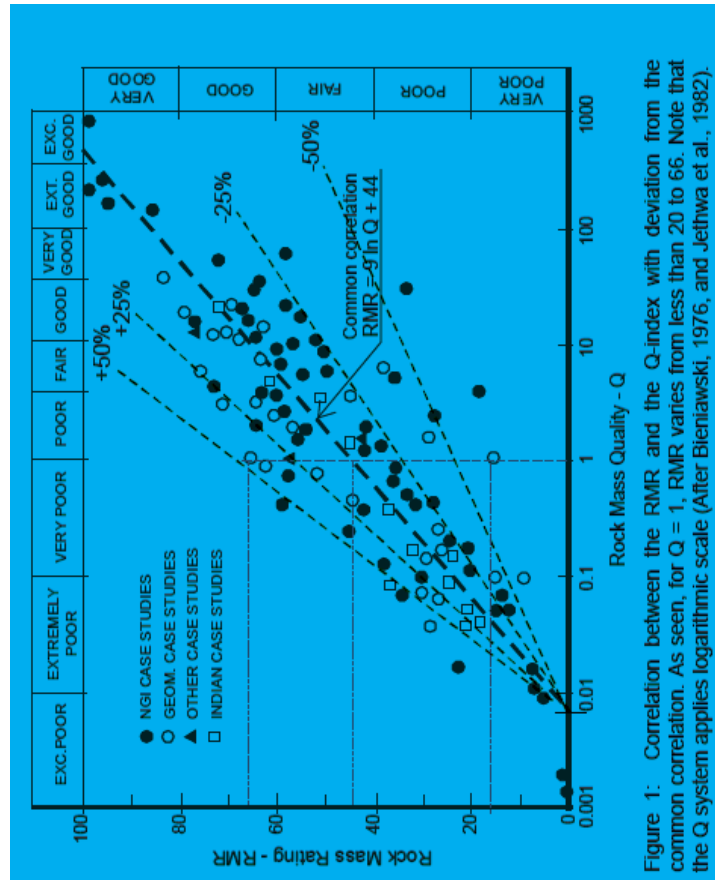
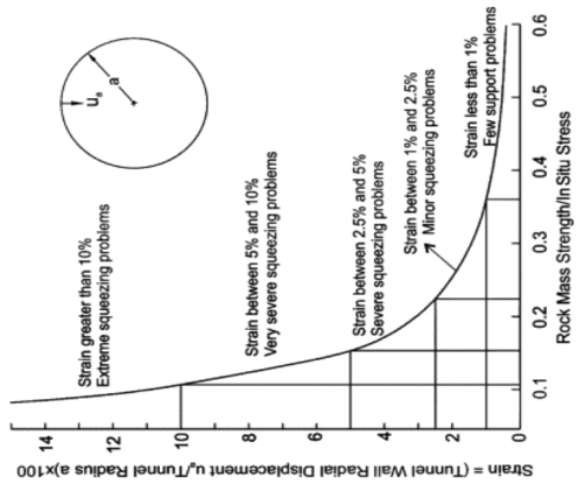


Figure 1: Correlation between the RMR and the Q-index with deviation from the common correlation. As seen, for  $Q = 1$ , RMR varies from less than 20 to 66. Note that the Q system applies logarithmic scale (After Bieniawski, 1976, and Jethwa et al., 1982).

**NORMS FOR RATE ANALYSIS FOR ROAD TUNNEL BYPASS**  
(Tunnel Diameter 5 to 7m)

RA No. :	BPT1			
Description of item :	Road Tunnel Excavation,mucking,safe disposal, necessary support system ensuring required safety level at Operation level, all complete as per Employers' Requirements (Class V: Very Poor Rock with RMR value <20 or Equivalent Q)			
UNIT	Area	23.76	m <sup>2</sup> Opening per meter	
Norms activity	Specification Clause	Resources		
		Sub-Items (A)		
		Category	Unit	Quantity
	As details in Employer's Requirements			
a		Excavation by Drilling and Blasting (Ordinary Rock) including mucking	Cum	23.76
b		Shotcrete for face stabilization (100mm thick)	Cum	1.73
c		Fiber reinforced Shotcrete (50+200mm thick)	Cum	4.32
d		25mm Dia., Self drilling anchor (SDA), ultimate load >250 kN, (3m per meter)	Rm	52.00
e		Latice Girder P230-36 or equivalent @ 1m spacing with plates/links	Ton	0.79
f		40cm M35/20 Concreting for Inner Lining	Cum	6.91
g		Reinforcement for Inner Lining @ 6% of Concrete	Kg	1037.00
h		Formwork for Inner Lining	Sqm	17.28
i		Face stability Fiberglass Anchors with 50% overlap	Rm	24.00
j		Execution of a steel tubes forepoling umbrella (steel grade S355). Diameter min. 114.3 mm, thickness min. 16 mm, drilling diameter min. 150 mm	Rm	23.40
k	50cm Granular Filling for Construction Vehicle Operation	Cum	2.75	

## NORMS FOR RATE ANALYSIS FOR ROAD TUNNEL BYPASS

RA No. :	BPT2			
Description of item :		Road Tunnel Excavation,mucking,safe disposal, necessary support system ensuring required safety level at Operation level, all complete as per Employers' Requirements (Class IV : Poor Rock with RMR value 21-40 or Equivalent Q )		
	Unit:	23.76	m2 Opening per meter	
Norms activity	Specification Clause	Resources		
		Sub-Items (A)		
		Category	Unit	Quantity
	As details in Employer's Requirements			
a		Excavation by Drilling and Blasting (Ordinary Rock) including mucking	Cum	23.76
b		Shotcrete for face stabilization (100mm thick)	Cum	1.73
c		Fiber reinforced Shotcrete (200mm thick)	Cum	3.46
d		25mm Dia., Selfdrilling anchor (SDA), ultimate load >250 kN, (3m per meter)	Rm	52.00
e		Lattice Girder P230-30 or equivalent @ 1m spacing with plates/links	Ton	0.57
f		50cm M35/20 Concreting for Inner Lining	Cum	8.64
g		Reinforcement for Inner Lining @ 5% of Concrete	Kg	1080.00
h		Formwork for Inner Lining	Sqm	17.28
i		Face stability Fiberglass Anchors with 50% overlap	Rm	10.00
j		Execution of a steel tubes forepoling umbrella (steel grade S355). Diameter min. 114.3 mm, thickness min. 16 mm, drilling diameter min. 150 mm	Rm	23.00
k	50cm Granular Filling for Construction Vehicle Operation	Cum	2.75	

**NORMS FOR RATE ANALYSIS FOR ROAD TUNNEL BYPASS**

RA No. :	BPT3			
Description of item :		Road Tunnel Excavation, mucking, safe disposal, necessary support system ensuring required safety level at Operation level, all complete as per Employers' Requirements (Class III: Fair Rock with RMR value 41-60 or Equivalent Q)		
	Unit:	23.76	m <sup>2</sup> Opening per meter	
Norms activity	Specification Clause	Resources		
		Sub-Items (A)		
		Category	Unit	Quantity
	As details in Employer's Requirements			
a		Excavation by Drilling and Blasting (Hard Rock) including mucking	Cum	23.76
b		Fiber reinforced Shotcrete (100mm thick)	Cum	1.73
c		25mm Dia., full grout Cemented Grouted Rock Bolt (SN) or equivalent, ultimate load >250 kN, (3 per 1.5 meter)	Rm	35.00
d		30cm M35/20 Concreting for Inner Lining	Cum	5.18
e		Reinforcement for Inner Lining @ 4% of Concrete	Kg	519.00
f		Formwork for Inner Lining	Sqm	17.28
g		Face stability Fiberglass Anchors with 50% overlap	Rm	10.00
h		50cm Granular Filling for Construction Vehicle Operation	Cum	2.75

## NORMS FOR RATE ANALYSIS FOR ROAD TUNNEL BYPASS

RA No. :	BPT4			
Description of item :		Road Tunnel Excavation, mucking, safe disposal, necessary support system ensuring required safety level at Operation level, all complete as per Employers' Requirements (Class II : Good Rock with RMR value 61-80 or Equivalent Q )		
	Unit:	23.76	m2 Opening per meter	
Norms activity	Specification Clause	Resources		
		Sub-Items (A)		
		Category	Unit	Quantity
	As details in Employer's Requirements			
a		Excavation by Drilling and Blasting (Hard Rock) including mucking	Cum	23.76
b		Shotcrete (50mm thick)	Cum	0.86
c		20mm Dia., full grout Swellex Rock Bolt or equivalent (3m per 2.5meter)	Rm	21.00
d		30cm M35/20 Concreting for Inner Lining	Cum	5.18
e		Reinforcement for Inner Lining and Shotcrete @ 1 % of Concrete	Kg	152.00
f		Formwork for Inner Lining	Sqm	17.28
g		50cm Granular Filling for Construction Vehicle Operation	Cum	2.75

**NORMS FOR RATE ANALYSIS FOR ROAD TUNNEL BYPASS**

RA No. :	BPT5			
Description of item :		Road Tunnel Excavation, mucking, safe disposal, necessary support system ensuring required safety level at Operation level, all complete as per Employers' Requirements (Class I: Very Good Rock with RMR value 81-100 or Equivalent Q)		
	Unit:	23.76	m2 Opening per meter	
Norms activity	Specification Clause	Resources		
		Sub-Items (A)		
		Category	Unit	Quantity
	As details in Employer's Requirements			
a		Excavation by Drilling and Blasting (Hard Rock) including mucking	Cum	23.76
b		20mm Dia., full grout Swellex Rock Bolt or equivalent (3m per 2.5meter)	Rm	21.00
c		30cm M35/20 Concreting for Inner Lining	Cum	5.18
d		Reinforcement for Inner Lining @ 1% of Concrete	Kg	130.00
e		Formwork for Inner Lining	Sqm	17.28
f		50cm Granular Fillig for Construction Vehicle Operation	Cum	2.75

## Miscellaneous Cost Norms

For Main Tunnel	For Bypass Tunnel
Cost for Portal Construction (After Detailed Estimate)	Cost for Portal Construction (After Detailed Estimate)
Cost for water proofing drainage construction @ 3% of E & S	Cost for Waterproofing Drainage Construction @ 2% of E&S
Cost per meter for M&E	Cost per meter for M&E
Tunnel : 5% of E&S	[upto 1Km Tunnel: 2.5% of E&S, from 1-2Km: 5% of E&S and above 2KM : 10% of E&S]
	Mobilization/Demobilization @ 2% of E&S
	Dewatering during Construction (0.25% of E&S)
	Construction Power [ upto 1Km Tunnel : 3% of E&S, from 1-2Km : 4% of E&S and above 2KM : 5% of E&S ]
	Cost for Investigation and Design [ 3%-4% of Total Tunnel Project Cost]
	Higher side of % is adopted when the geology seems complex , ex. possible fault zones, unfavorable bedding orientation
	“Cost for Insurance
	[upto 1Km Tunnel: 0.75% of Total Tunnel Project Cost, from 1-2Km: 0.7% of Total Tunnel Project Cost and above 2KM: 0.6% of Total Tunnel Project Cost]
	Operational Building based on Plinth area method
	“Estimation of Inflation Cost :
	Step 1 : Calculation of average inflation of last 10 years, ΔI
	As the Contract Model is EPC/DB : No need for Price Adjustment and Physical Contingencies



NORMS FOR RATE ANALYSIS FOR PEDESTRIAL ROCKSHED CONSTRUCTION

RA No. :	PRS1	
Description of item:		
	778.00	meter
(BxH=3.5mx5.0m)		
Norms activity	Resources	
	Sub-Items (A)	
	Category	Unit
		Quantity
a	Excavation by Drilling and Blasting (Ordinary Rock)	Cum
b	Filling Works	Cum
c	150mm thick Shotcrete	Cum
d	Reinforcement for Shotcrete @ 2% of Concrete	Kg
e	25mm Dia., full grout Swellex Rock Bolt or equivalent	Rm
f	M10 Concrete	Cum
g	M35/20 Concrete	Cum
h	M40/20	Cum
i	Reinforcement for Rock Shed	Kg
j	Formwork	Sqm
k	Leca Fill	Cum
l	Drainage and Miscellaneous (LS @ 2% of above)	

RA No. : Ex-1

Description of item : Road Tunnel Excavation, mucking, all complete (Class V :Very Poor Rock with RMR value <20 or Equivalent Q )  
Volume

1.00 Cum

Norms activity	Specification Clause	Resources														
		Labour (A)			Materials (B)			Equipment (C)								
		Category	Unit	Qty	Category	Unit	Qty	Category	Unit	Qty	Category	Unit	Qty			
Ex-1		Supervisor (UG)	hr	0.680	Lubricants	Lit.	0.170									
		Foreman (UG)	hr	1.020	Gelatine	Kg	2.750	Tunnel Excavator	hr							0.020
		Skilled (UG)	hr	3.000	Detonator	No.	4.000	Air Compressor	hr							0.054
		Semi Skilled (UG)	hr	3.000	Detonating Cord	m	10.000	Axial Flow Fan	hr							0.081
		Unskilled (UG)	hr	6.000	Drill Bits	No.	0.040	Drilling Jumbo	hr							0.027
		Blaster (UG)	hr	0.200	Drill Rods with accessories	No.	0.020	Pneumatic Hand Drilling Machine	hr							0.010
		Mechanics(UG)	hr	0.100				Rock Shovels/Wheel Loader	hr							0.396
		Electrician(UG)	hr	0.100				Ventilation Duct	hr							0.132
								Working Platforms	hr							0.600
								Mucking Truck	hr							0.720

Description of item : Road Tunnel Excavation, mucking, all complete (Class IV : Poor Rock with RMR value 21-40 or Equivalent Q )  
Volume 1.00 Cum

Norms activity	Specification Clause	Resources				Materials (B)				Equipment (C)			
		Labour (A)											
		Category	Unit	Qty		Category	Unit	Qty		Category	Unit	Qty	
Ex-2		Supervisor (UG)	hr	0.680	Lubricants	Lit.	0.170						
		Foreman (UG)	hr	1.020	Gelatine	Kg	2.613		Tunnel Excavator	hr		0.019	
		Skilled (UG)	hr	3.000	Detonator	No.	3.800		Air Compressor	hr		0.051	
		Semi Skilled (UG)	hr	3.000	Detonating Cord	m	9.500		Axial Flow Fan	hr		0.077	
		Unskilled (UG)	hr	6.000	Drill Bits	No.	0.038		Drilling Jumbo	hr		0.026	
		Blaster (UG)	hr	0.200	Drill Rods	No.	0.019		Pneumatic Hand Drilling Machine	hr		0.010	
		Mechanics(UG)	hr	0.100					Rock Shovels/Wheel Loader	hr		0.376	
		Electrician(UG)	hr	0.100					Ventilation Duct	hr		0.125	
									Working Platforms	hr		0.570	
									Mucking Truck	hr		0.684	

RA No. : Ex-3

Description of item : Road Tunnel Excavation, mucking, all complete (Class III : Fair Rock with RMR value 41-60 or Equivalent Q )

Volume

1.00 Cum

Norms activity	Specification Clause	Resources												
		Labour (A)			Materials (B)			Equipment (C)						
		Category	Unit	Qty	Category	Unit	Qty	Category	Unit	Qty				
Ex-3		Supervisor (UG)	hr	0.612	Lubricants	Lit.	0.170							
		Foreman (UG)	hr	0.918	Gelatine	Kg	2.482	Tunnel Excavator	hr				0.018	
		Skilled (UG)	hr	2.700	Detonator	No.	3.610	Air Compressor	hr				0.049	
		Semi Skilled (UG)	hr	2.700	Detonating Cord	m	9.025	Axial Flow Fan	hr				0.073	
		Unskilled (UG)	hr	5.400	Drill Bits	No.	0.036	Drilling Jumbo	hr				0.024	
		Blaster (UG)	hr	0.180	Drill Rods	No.	0.018	Pneumatic Hand Drilling Machine	hr				0.009	
		Mechanics(UG)	hr	0.100				Rock Shovels/Wheel Loader	hr				0.357	
		Electrician(UG)	hr	0.100				Ventilation Duct	hr				0.119	
								Working Platforms	hr				0.542	
								Mucking Truck	hr				0.650	

Description of item : Road Tunnel Excavation, mucking, all complete (Class II : Good Rock with RMR value 61-80 or Equivalent Q )

1.00 Cum

Norms activity	Specification Clause	Resources														
		Labour (A)			Materials (B)			Equipment (C)								
		Category	Unit	Qty	Category	Unit	Qty	Category	Unit	Qty	Category	Unit	Quantity			
Ex-4		Supervisor (UG)	hr	0.646	Lubricants	Lit.	0.170									
		Foreman (UG)	hr	0.969	Gelatine	Kg	2.532	Tunnel Excavator	hr						0.019	
		Skilled (UG)	hr	2.850	Detonator	No.	3.682	Air Compressor	hr						0.051	
		Semi Skilled (UG)	hr	2.850	Detonating Cord	m	9.206	Axial Flow Fan	hr						0.077	
		Unskilled (UG)	hr	5.700	Drill Bits	No.	0.037	Drilling Jumbo	hr						0.026	
		Blaster (UG)	hr	0.190	Drill Rods	No.	0.018	Pneumatic Hand Drilling Machine	hr						0.010	
		Mechanics(UG)	hr	0.095				Rock Shovels/Wheel Loader	hr						0.376	
		Electrician(UG)	hr	0.095				Ventilation Duct	hr						0.125	
								Working Platforms	hr						0.570	
								Mucking Truck	hr						0.684	

RA No. : Ex-5

Description of item : Road Tunnel Excavation, mucking, all complete (Class I : Very Good Rock with RMR value 81-100 or Equivalent Q)

Volume

1.00 Cum

Norms activity	Specification Clause	Resources														
		Labour (A)			Materials (B)			Equipment (C)								
		Category	Unit	Qty	Category	Unit	Qty	Category	Unit	Qty	Unit	Quantity				
Ex-5		Supervisor (UG)	hr	0.678	Lubricants	Lit.	0.170									
		Foreman (UG)	hr	1.017	Gelatine	Kg	2.888	Tunnel Excavator	hr							0.021
		Skilled (UG)	hr	2.993	Detonator	No.	4.200	Air Compressor	hr							0.057
		Semi Skilled (UG)	hr	2.993	Detonating Cord	m	10.500	Axial Flow Fan	hr							0.085
		Unskilled (UG)	hr	5.985	Drill Bits	No.	0.044	Drilling Jumbo	hr							0.028
		Blaster (UG)	hr	0.200	Drill Rods	No.	0.020	Pneumatic Hand Drilling Machine	hr							0.011
		Mechanics(UG)	hr	0.100				Rock Shovels/Wheel Loader	hr							0.396
		Electrician(UG)	hr	0.100				Ventilation Duct	hr							0.145
								Working Platforms	hr							0.660
								Mucking Truck	hr							0.720

RA No. : SC-1

Description of item : Upto 100 mm thick shotcreting with steel fibers for underground works as per Technical Specifications.

0.10 Cum

Norms activ- ity	Specification Clause	Resources												
		Labour (A)			Materials (B)			Equipment (C)						
		Category	Unit	Qty	Category	Unit	Qty	Category	Unit	Qty	Unit	Qty		
SC-1		Supervisor (UG)	hr	0.150	Cement	mt.	0.045	Concrete Mixture	hr	0.150				
		Foreman (UG)	hr	0.300	Sand	Cum	0.110	Air Compressor	hr	0.081				
		Skilled (UG)	hr	0.800	Aggregate (5-10mm)	Cum	0.060	Transit Mixture	hr	0.150				
		Semi Skilled (UG)	hr	0.150	Silica @5%of Cement	Kg	2.250	Axial Flow Fan	hr	0.500				
		Unskilled (UG)	hr	4.200	Steel Fiber	Kg	5.000	Shotcrete Spraying Robot	hr	0.081				
		Mechanics(UG)	hr	0.300	Accelerator @ 0.7% of Cement	Kg	0.315	Working Platforms	hr	0.081				
		Electrician(UG)	hr	0.300	Plasticizer @ 1% of Cement	Kg	0.450	Others@5%ofall costs						

RA No. : SC-2

Description of item: More than 100mm to 150mm thick shotcreting with steel fibers for underground works as per Technical Specifications.  
Volume 0.15 Cum

Norms activity	Specification Clause	Resources													
		Labour (A)			Materials (B)			Equipment (C)							
		Category	Unit	Quantity	Category	Unit	Quantity	Category	Unit	Quantity	Unit	Quantity			
SC-2		Supervisor (UG)	hr	0.225	Cement	mt.	0.068	Concrete Mixture	hr	0.300					
		Foreman (UG)	hr	0.450	Sand	Cum	0.165	Air Compressor	hr	0.162					
		Skilled (UG)	hr	1.200	Aggregate (5-10mm)	Cum	0.090	Transit Mixture	hr	0.300					
		Semi Skilled (UG)	hr	0.225	Silica@5% of Cement	Kg	3.375	Axial Flow Fan	hr	1.000					
		Unskilled (UG)	hr	6.300	Steel Fiber	Kg	7.500	Shotcrete Spraying Robot	hr	0.105					
		Mechanics(UG)	hr	0.450	Accelerator @ 0.7% of Cement	Kg	0.473	Working Platforms	hr	0.105					
		Electrician(UG)	hr	0.450	Plasticizer @ 1% of Cement	Kg	0.675	Others@5%of fall costs							



RA No. : SC-3

Description of item: More than 150mm to 200mm thick shotcreting with steel fibers for underground works as per Technical Specifications. 0.20 Cum

Norms activity	Specification Clause	Resources												
		Labour (A)			Materials (B)			Equipment (C)						
		Category	Unit	Quantity	Category	Unit	Quantity	Category	Unit	Quantity	Quantity			
SC-3		Supervisor (UG)	hr	0.300	Cement	mt.	0.090	Concrete Mixture	hr	0.600				
		Foreman (UG)	hr	0.600	Sand	Cum	0.220	Air Compressor	hr	0.324				
		Skilled (UG)	hr	1.600	Aggregate (5-10mm)	Cum	0.120	Transit Mixture	hr	0.600				
		Semi Skilled (UG)	hr	0.300	Silica @5% of Cement	Kg	4.500	Axial Flow Fan	hr	2.000				
		Unskilled (UG)	hr	8.400	Steel Fiber	Kg	10.000	Shotcrete Spraying Robot	hr	0.210				
		Mechanics(UG)	hr	0.600	Accelerator @ 0.7% of Cement	Kg	0.630	Working Platforms	hr	0.210				
		Electrician(UG)	hr	0.600	Plasticizer @ 1% of Cement	Kg	0.900	Others@5%of fall costs						

RA No. : SC-4

Description of item : Upto 100mm thick shotcreting without steel fibers for underground works as per Technical Specifications.  
Volume 0.10 Cum

Norms activity	Specification Clause	Resources												
		Labour (A)			Materials (B)			Equipment (C)						
		Category	Unit	Quantity	Category	Unit	Quantity	Category	Unit	Quantity	Unit			
SC-4		Supervisor (UG)	hr	0.150	Cement	mt.	0.045	Concrete Mixture	hr	0.150				
		Foreman (UG)	hr	0.300	Sand	Cum	0.110	Air Compressor	hr	0.081				
		Skilled (UG)	hr	0.800	Aggregate (5-10mm)	Cum	0.060	Transit Mixture	hr	0.150				
		Semi Skilled (UG)	hr	0.150	Silica @5% of Cement	Kg	2.250	Axial Flow Fan	hr	0.500				
		Unskilled (UG)	hr	4.200				Shotcrete Spraying Robot	hr	0.081				
		Mechanics(UG)	hr	0.300	Accelerator @ 0.7% of Cement	Kg	0.315	Working Platforms	hr	0.081				
		Electrician(UG)	hr	0.300	Plasticizer @ 1% of Cement	Kg	0.450	Others@5%ofall costs						

Description of item : Lattice Girder Installation with plates/links as per Technical Specifications.  
Weight

1.00 kg

Norms activity	Specification Clause	Resources											
		Labour (A)				Materials (B)				Equipment (C)			
		Category	Unit	Qty	Category	Unit	Qty	Category	Unit	Qty			
SS-1		Supervisor (UG)	hr	0.007	Lattice Girder P230-36 or equivalent with plates/links	Kg	1.200	Mini Dumper	hr	0.009			
		Foreman (UG)	hr	0.007				Tripod Machine	hr	0.009			
		Skilled (UG)	hr	0.043				Working platform		0.010			
		Semi Skilled (UG)	hr	0.022				Axial Flow Fan	hr	0.500			
		Unskilled (UG)	hr	0.087				Others@1%of all costs					
		Mechanics(UG)	hr	0.007									
		Electrician(UG)	hr	0.007									

Description of item : Steel Rib Support Installation with plates/links as per Technical Specifications.  
Weight 1.00 kg

Norms activity	Specification Clause	Resources												
		Labour (A)			Materials (B)			Equipment (C)						
		Category	Unit	Qty	Category	Unit	Qty	Category	Unit	Qty	Qty			
SS-2		Supervisor (UG)	hr	0.007	HEB 180 steel ribs (steel grade S355) with a longitudinal spacing or equivalent with plates/links	Kg	1.150	Mini Dumper	hr	0.009				
		Foreman (UG)	hr	0.007				Working platform		0.010				
		Skilled (UG)	hr	0.043				Tunnel excavator/ steel rib lifter	hr	0.009				
		Semi Skilled (UG)	hr	0.022				Axial Flow Fan	hr	0.500				
		Unskilled (UG)	hr	0.087				Others@1% of all costs						
		Mechanics(UG)	hr	0.007										
		Electrician(UG)	hr	0.007										

Description of item: 20mm Dia., full grout Swellex Rock Bolt to equivalent, ultimate load > 250 kN, including injections for underground works as per Technical Specifications.  
Length 1.00 m

Norms activity	Specification Clause	Resources													
		Labour (A)			Materials (B)			Equipment (C)							
		Category	Unit	Qty	Category	Qty	Unit	Category	Qty	Unit	Qty				
RB-1		Supervisor (UG)	hr	0.100	Swellex Rockbolts	2.470	Kg								
		Foreman (UG)	hr	0.100	Bearing Plates and Bolt	0.333	Nos.	Air Compressor	hr	0.080					
		Skilled (UG)	hr	0.376				Grout pump	hr	0.100					
		Unskilled (UG)	hr	0.751											
		Mechanics (UG)	hr	0.100				Working Platforms	hr	0.200					
		Electrician (UG) (UG)	hr	0.100				Axial Flow Fan	hr	0.124					
					Drill Bits	0.040	No.	Drill Jumbo	hr	0.060					
					Drill Rods with accessories	0.020	No.	Others @ 5% of all costs							

Description of item: 25mm Dia., Self drilling anchor (SDA), ultimate load >250 kN, including injections for underground works as per Technical Specifications.

Length 1.00 m

Norms activity	Specification Clause	Resources													
		Labour (A)			Materials (B)			Equipment (C)							
		Category	Unit	Qty	Category	Unit	Qty	Category	Unit	Qty	Unit	Qty			
RB-1		Supervisor (UG)	hr	0.100	SDA Rockbolts	Kg	3.851								
		Foreman (UG)	hr	0.100	Bearing Plates and Bolt	Nos.	0.333	Air Compressor	hr					0.080	
		Skilled (UG)	hr	0.376	Cement	mt.	0.0023	Grout pump	hr					0.100	
		Unskilled (UG)	hr	0.751	Sand	Cum	0.0045								
		Mechanics (UG)	hr	0.100				Working Platforms	hr					0.200	
		Electrician(UG)	hr	0.100				Axial Flow Fan	hr					0.124	
								Drill Jumbo	hr					0.032	
								Others@5%ofall costs							

Description of item: 25mm Dia., full grout Cemented Grouted Rock Bolt (SN Bolt) or equivalent, ultimate load >250 kN, including injections for underground works as per Technical Specifications.  
Length 1.00 m

Norms activity	Specification Clause	Resources												
		Labour (A)			Materials (B)			Equipment (C)						
		Category	Unit	Qty	Category	Qty	Unit	Qty	Category	Unit	Qty			
RB-1		Supervisor (UG)	hr	0.100	Rebar Rockbolts	Kg	3.851							
		Foreman (UG)	hr	0.100	Bearing Plates and Bolt	Nos.	0.333	Air Compressor	hr	0.080				
		Skilled (UG)	hr	0.376	Cement	mt.	0.0023	Grout pump	hr	0.100				
		Unskilled (UG)	hr	0.751	Sand	Cum	0.0045							
		Mechanics (UG)	hr	0.100				Working Platforms	hr	0.200				
		Electrician(UG)	hr	0.100				Axial Flow Fan	hr	0.124				
					Drill Bits	No.	0.030	Drill Jumbo	hr	0.032				
					Drill Rods with accessories	No.	0.020	Others@5%of all costs						

Description of item : Face stability Fiberglass Anchors with ultimate load >350 kN, as per Technical Specifications.  
 Length 1.00 m

Norms activity	Specification Clause	Resources												
		Labour (A)			Materials (B)			Equipment (C)						
		Category	Unit	Qty	Category	Qty	Unit	Qty	Category	Unit	Qty			
RB-2		Supervisor (UG)	hr	0.200	Fiberglass	1.000	Rm	1.000						
		Foreman (UG)	hr	0.200	Drill Bits	0.100	No.	0.100	Air Compressor	hr	0.160			
		Skilled (UG)	hr	0.751	Drill Rods	0.075	No	0.075						
		Unskilled (UG)	hr	1.502										
		Mechanics (UG)	hr	0.200					Working Platforms	hr	0.400			
		Electrician(UG)	hr	0.200					Axial Flow Fan	hr	0.249			
									Drill Jumbo	hr	0.080			
									Others@5%ofall costs					



Description of item : Execution of a steel tubes forepoling umbrella (steel grade S355) . Diameter min. 114.3 mm, thickness min. 16 mm, drilling diameter min. 150 mm, for underground works as per Technical Specifications.

Length

1.00 m

Norms activity	Specification Clause	Resources												
		Labour (A)			Materials (B)			Equipment (C)						
		Category	Unit	Qty	Category	Unit	Qty	Category	Unit	Qty				
RB-3		Supervisor (UG)	hr	0.400	114.3mm dia steel forepoles with 16mm wall thickness	Kg	39.000							
		Foreman (UG)	hr	0.400				Air Compressor	hr	0.480				
		Skilled (UG)	hr	1.502	Drill Bits	No.	0.150							
		Unskilled (UG)	hr	3.004	Drill Rods	No	0.113							
		Mechanics (UG)	hr	0.400				Working Platforms	hr	1.200				
		Electrician(UG)	hr	0.400				Axial Flow Fan	hr	0.747				
								Drill Jumbo	hr	0.240				
								Others@5%of all costs						

RA No. : C-1

Description of item: M35/20 Concreting for Underground Works all complete as per Technical Specification  
Volume

15.00 Cum

Norms activity	Specification Clause	Resources												
		Labour (A)			Materials (B)			Equipment (C)						
		Category	Unit	Qty	Category	Unit	Qty	Category	Unit	Qty	Unit	Qty		
C-1		Supervisor (UG)	hr	24.000	Cement	mt	6.330	Batch Plant	hr	4.200				
		Foreman (UG)	hr	24.000	Sand	Cum	6.750							
		Skilled (UG)	hr	24.000	20mm Aggregate	Cum	8.100	Transit Mixer	hr	2.750				
		Unskilled (UG)	hr	240.000	10mm aggregate	Cum	5.400	Concrete Pump	hr	2.500				
		Mechanics (UG)	hr	24.000	Water	Lit	3000.000							
		Electrician (UG)	hr	24.000	Silica@4% of Cement	Kg	253.200	Axial Flow Fan	hr	0.500				
								Working Platforms	hr	1.875				
					Plasticizer @ 1% of Cement	Kg	63.300	Others@1% of all costs						

Description of item: Providing and laying, fitting and placing un-coated Mild steel/HYSR reinforcement complete in foundation technical specification

Weight 1.00 ton

Norms activity	Specification Clause	Resources													
		Labour (A)				Materials (B)				Equipment (C)					
		Category	Unit	Qty	Unit	Category	Unit	Qty	Unit	Category	Unit	Qty			
R-1		Supervisor (UG)	hr	8.800	MS Bar	mt	1.100								
		Foreman (UG)	hr	17.600	Binding Wire	Kg	8.000								
		Skilled (UG)	hr	35.200						Axial Flow Fan	hr	1.000			
		Unskilled (UG)	hr	79.200						Working Platforms	hr	1.000			
		Mechanics (UG)	hr	4.400						Others for placement @ 2.5% of all costs					
		Electrician (UG)	hr	4.4											

RA No. : F-1

Description of item: F3 Finishing Formwork including Falsework in all type of shape of structure all complete as per Technical Specification

Area

10.00 Sqm

Norms activity	Specification Clause	Resources														
		Labour (A)			Materials (B)			Equipment (C)								
		Category	Unit	Qty	Category	Unit	Qty	Category	Unit	Qty	Unit	Qty				
F-1		Supervisor (UG)	hr	26.608	MS Sheet 14 gauge and angle stiffner (40 times use)	Kg	10.600									
		Foreman (UG)	hr	26.608	MS Pipes 40mm Dia (60 times use)	Rm	9.500									
		Skilled (UG)	hr	53.215	Clamps (40 times use)	No.	8.130	Axial Flow Fan	hr	0.500						
		Unskilled (UG)	hr	81.652	Nut&Bolts(35 times)	No.	5.090	Working Platforms	hr	0.600						
		Mechanics (UG)	hr	6.600				5% for design drawing, others of all costs								
		Electrician (UG)	hr	6.600												