

**T-15P1 Alternative Main and Escape Tunnel Portal  
Geological Site Assessment**

**Construction of Tunnels, Bridges, Yards and Formation Works  
from Chainage 101+310 to 117+365 (FLS) Under Package-8 in  
Connection with New BG Line between Rishikesh and  
Karnaprayag (125km) in the State of Uttarakhand, India.**




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रिषिकेश (उत्तराखण्ड) 249201 / Rishikesh (UK) 249201

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## REVISION

			Geologist	
0	27.04.21	First Issue	Sidar Tekes	
Rev.	Date	Issue, Modification	Prepared	

## **INDEX**

<b>1</b>	<b>INTRODUCTION</b>	<b>3</b>
<b>1.1</b>	<b>Abbreviations</b>	<b>3</b>
<b>1.2</b>	<b>Purpose of the Report</b>	<b>3</b>
<b>1.3</b>	<b>Report Structure</b>	<b>3</b>
<b>2</b>	<b>EXECUTIVE SUMMARY</b>	<b>4</b>
<b>3</b>	<b>PROJECT GEOLOGY</b>	<b>4</b>
<b>3.1</b>	<b>Overview</b>	<b>4</b>
<b>3.2</b>	<b>Stratigraphy</b>	<b>5</b>
<b>4</b>	<b>GEOLOGICAL ASSESMENT</b>	<b>6</b>
<b>5</b>	<b>GEOTECHNICAL ASSESSMENT</b>	<b>9</b>
<b>6</b>	<b>PREVIOUS INVESTIGATIONS</b>	<b>10</b>
<b>7</b>	<b>HYDROGEOLOGICAL ASSESSMENT</b>	<b>10</b>
<b>8</b>	<b>SUMMARY AND CONCLUSION</b>	<b>11</b>

## **FIGURES**

Figure 1 Geological overview [35]: Map view with the area of Package 8 marked with a red rectangle	5
Figure 2 General View of the T-15 P1 (Main tunnel Portal)	7
Figure 3 General View of the T-15 P1 (Escape Portal)	7
Figure 4 General View of the T-15 P1 New Site Geological Investigations.	8
Figure 5 Outcrop-01 above the Main Tunnel Portal,	8
Figure 6 Outcrop-02 above the Escape Tunnel Portal	9
Figure 7 Quartzite photo from Borehole T15P1-BH1.	9

## **TABLES**

Table 1 Stratigraphic sequence in the project area of Package 8	6
Table 2 Dominant Discontinuities and Discontinuities properties Outcrop-01	10
Table 3 Dominant Discontinuities and Discontinuities properties-Outcrop-02	10
Table 4 RMR and GSI Values of Quartzite	10

## **APPENDIXES**

**I-Geological Outcrop Data, Borehole log and Core Photos.**

**II-Geological Map and Profile.**

## **1 INTRODUCTION**

Italferr and Lombardi JV " have been assigned as a Consultant by M/s. Rail Vikas Nigam Limited (RVNL) is a Public Sector Enterprise created by Ministry of Railways, Government of India, for consultancy services for "Detailed design & Project Management consultancy for construction of tunnels, bridges & formation works from chainage 101+310 to 117+365 under Package-8 in connection with new single line broad gauge rail link between Rishikesh and Karanprayag (125km) in state of Uttarakhand, India".

### **1.1 Abbreviations**

BH	Borehole
C/L	Centre Line
EL	Elevation
JV	Joint Venture
RVNL	Rail Vikas Nigam Limited
SSP	Surface Survey Mapping

### **1.2 Purpose of the Report**

This report aims to describe the "T15P1 Alternative Main and Escape Tunnel Geological Site Assessment" due diligence performed based on the route analysis which are performed at the pre-design and design stages of the project, previous Geological, Geotechnical, Hydrogeological and Geophysical studies, Additional Geological-Geotechnical Site Investigations during Site Supervision stage, and conclusions of the assessment and presents an Executive Summary.

Along the field studies previous to start the excavation in the T15 P1 for the Main and the Escape tunnel a new alternative for the location of the Escape Tunnel's Portal has been study and found beneficial in terms of excavation time, earth movement and future maintenance requirements.

### **1.3 Report Structure**

This Report contains following items:

- Site Investigations and Observations
- Site specific Geological Assessment

- Site specific Geotechnical Assessment
- Site specific Hydrogeological Assessment

## **2 EXECUTIVE SUMMARY**

The present report is addressing “T-15 P1 Main and Escape Tunnel Portal Geological Site Assessment ” and presents an Executive Summary.

The Tunnel-15 is under the package-8 and is part of New Rail Link Project between Rishikesh to Karanprayag from chainage 108.950km to 115.958km (RVNL/RKSH-KNPG/TUNNEL /PKG-8). For the main reason of that report is the shifting Escape tunnel portal to the alternative location for this purpose additional surveying and geological investigations has been carry out to confirm the suitability of the new portal location. The alternative inlet portal of T15 is located around 20-25m inside to the tunnel with same alignment. The portal area is covered with thin slope wash/alluvial terrace material. Single track escape tunnel will be constructed after completion of the construction of the Inlet Portal structure.

## **3 PROJECT GEOLOGY**

### **3.1 Overview**

The project area consists of high hills and mountains with narrow valleys, deep gorges i. e. having very high topographic gradients. The parts in the N, E and NE are the Tethyan Himalayans with snow cover throughout the year. The main river in the area is the Alaknanda River, which originates from the Satopanth-Bhagat Kharak group of glaciers. The major tributaries of the river Alaknanda are Dhauliganga, Patalganga, Nandakini, Mandakini and Pindar. The riverbed material mostly consists of pebbles, cobbles, boulders etc. in a sandy matrix resting over rocky floor. Fluvial terraces consisting of boulders, cobbles, pebbles admixed with sandy clay and thick sand horizons are preserved on the riverbanks. The Quaternary sediments are deposited in the form of fluvial terraces of river-borne material, glacial deposits and terminal moraines. The bedrock in the project area belongs to the Garhwal Grp., part of the Inner Lesser Himalaya. Figure 1 shows a geological sketch of the Indian Lesser Himalaya. Package 8 is in the area of the interference of Lesser and Higher Himalaya and lies in a tectonic foredeep. Within the Lesser Himalayan sequence, the phyllitic rocks of the Jaunsar Grp. are overridden by the rocks of the Garhwal Grp. along the North Almora Thrust (NAT), locally known as the Srinagar Thrust.

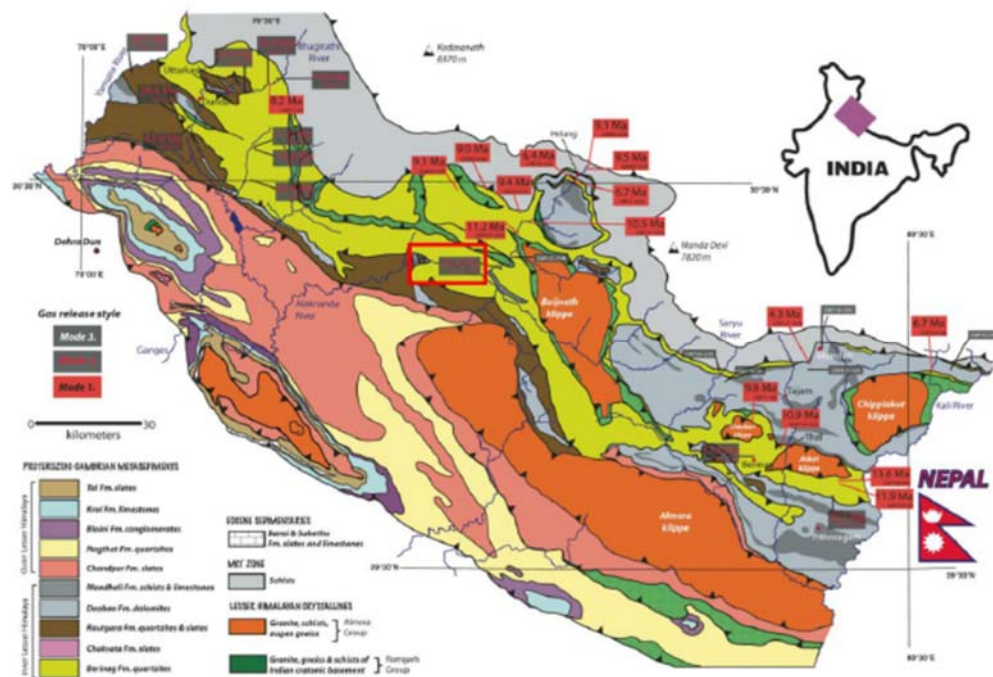


Figure 1 Geological overview [35]: Map view with the area of Package 8 marked with a red rectangle

### 3.2 Stratigraphy

Geologically the area of Package 8 is part of the Inner Lesser Himalaya. The area consists of thick Quaternary cover and the rocks of the Garhwal Grp., which is of Meso-Proterozoic age. It forms a major part of the Lesser Himalaya and is represented by a thick sequence of sediments which show a low-grade metamorphism, i. e. consisting of quartzite with mafic metavolcanics and carbonate rocks.

The Garhwal Grp. is limited in the N by the Main Central Thrust and in the S by the Main Boundary Fault. The lithologies in the Garhwal Grp. are mainly quartzite, phyllite, carbonaceous slate, limestone and Epidiorite-Amphibolite-Metavolcanics. It is internally subdivided into the following rock units:



Table 1 Stratigraphic sequence in the project area of Package 8

Domain	Group	Formation	Code	Age	Description
Quaternary			<i>Q<sub>2</sub>Fa</i>	Recent	Boulder, Cobble, Pebble, Gravel, Sand, Silt and Clay.
Inner Lesser Himalaya	Garhwal	Epidiorite Amphibolite and Metavolcanics	<i>βPt<sub>2</sub>e</i> <i>βPt<sub>2</sub>g</i> <i>βPt<sub>2</sub>gn</i>	Meso-Proterozoic	Lenses of Epidiorite, Amphibolite and Metavolcanics
		Berinag	<i>Pt<sub>2</sub>gb</i>		Sericitic & Chloritic Quartzite, dark grey to brown Phyllite occasionally Chloritic, Graphitic and Carbonaceous, Quartz Schist and Chloritic Schist
		Nagnithank	<i>Pt<sub>2</sub>gn</i>		Quartzite with subordinate purple Phyllite and basic Metavolcanics
		Pithograrh	<i>Pt<sub>2</sub>gp</i>		Dolomitic Limestone, Phyllite, carbonaceous Slate and Quartzite

#### 4 GEOLOGICAL ASSESMENT

The alternative Escape Tunnel Portal of Tunnel 15 (Portal 1) is proposed at same tunnel alignment but around 20-25m inside to the tunnel. As topography of the Escape Portal, it is mostly flat area. The portal area is covered with slope wash/Alluvial terrace deposits. The material consists of boulder and cobbles of Quartzite & Metabasics with pebbles of subrounded fragments mixture of brown color silty sand and soil.

During site supervision works additional borehole T15P1-BH01 has been drilled on the alternative escape portal location to check the geological conditions and rock depth. T15P1-BH1 executed up to depth 20.00 meter and bed rock encountered at the depth of 2.00 meter. The bed rock up to 6.50m underlying the alluvial terrace part is slightly weathered. The bed rock up to 6.50m is Whitish color, medium grained, medium strong, slightly weathered to fresh, coated with Feo, after 6.50m-20.00m fresh, strong, joint surfaces stained Quartzite Rock. Low grade metamorphic rock of Garhwal Group. Depends on the borehole data, stratigraphic projection can be made as follows;

- Slope Wash/Alluvial terrace
- Quartzite

Figure 2,3,4 represents the topographical feature of Tunnel 15- P1 Portal.



Figure 2 General View of the T-15 P1 (Main tunnel Portal)



Figure 3 General View of the T-15 P1 (Escape Portal)





Figure 4 General View of the T-15 P1 New Site Geological Investigations.



Figure 5 Outcrop-01 above the Main Tunnel Portal,



Figure 6 Outcrop-02 above the Escape Tunnel Portal



Figure 7 Quartzite photo from Borehole T15P1-BH1.

During site investigations Geological maps, outcrop survey maps and borehole logs are prepared. These are given as an appendix.

## 5 GEOTECHNICAL ASSESSMENT

The rock outcrops are observed at two different locations. The rock mass is fresh to slightly weathered, strong rock, medium grained, stained in nature.

The orientation and other empirical properties of the major discontinuities have been determined and presented at the Table 1 outcrop-01 above Main tunnel and Table 2 outcrop-02 above escape tunnel area. This outcrop details given as an attachment with outcrop survey map.

Table 2 Dominant Discontinuities and Discontinuities properties Outcrop-01

Joint Set	Dip Amount (°)	Dip direction (°)	Spacing cm	Persistence (m)	Roughness	Aperture (mm)	Filling
J1	70	310	60-200mm	3-10m	Slightly rough	0.1-1 mm	surface stained
J2	50	035	60-500mm	3-10m	Slightly rough	0.1-1 mm	surface stained
J3	60	200	200-600mm	3-8m	Slightly rough	0.1-1 mm	surface stained
J4	28	030	60-200mm	3-10m	Slightly rough	0.1-1 mm	surface stained

Table 3 Dominant Discontinuities and Discontinuities properties-Outcrop-02

Joint Set	Dip Amount (°)	Dip direction (°)	Spacing cm	Persistence (m)	Roughness	Aperture (mm)	Filling
J1	47	015	60-200mm	1-3-10m	Slightly rough	0.1-1 mm	surface stained
J2	60	090	200-800mm	1-3m	Slightly rough	0.1-1 mm	surface stained
J3	62	178	20-400mm	1-3m	Slightly rough	0.1-1 mm	surface stained, soft filling >5mm
J4	77	325	60-200mm	1-3m	Slightly rough	0.1-1 mm	surface stained

The Empirical Rock Mass Rating (RMR) and Geological Strength Index (GSI) of the Quartzite is shown in the Table 2.

Table 4 RMR and GSI Values of Quartzite

Rock Group	RMR	GSI
Quartzite	60	65

## 6 PREVIOUS INVESTIGATIONS

In the Final Design stage GBR and GDR reports prepared by DDC teams.

That reports including outcrops geological surface survey mapping data around the new escape tunnel area which named as; SSP 267 and 268 and this survey data can be evaluate for new portal design too. It is similar Quartzite rocks that observed near the new escape tunnel portal area outcrops and borehole T15P1-BH1.

## 7 HYDROGEOLOGICAL ASSESSMENT

Since the report prepared at the dry season, there is not any surface water observed at the portal site during the Geological Site Investigations.

Water table has not been determined during the borehole drilling T15P1-BH1. On the other hand, seasonal changes on the water table levels shouldn't be underestimate during the long-term slope stability analysis.

## **8 SUMMARY AND CONCLUSION**

The present report is addressing "T15P1 Alternative Main and Escape Tunnel Geological Site Assessment" structure.

After reviewing all the information, it has been concluded by Site Geology Team this location is giving advantages for Portal excavation works.

In new location its observed that portal excavation is going to be done in Quartzite rock.

## APPENDIX I

Geological Outcrop Data, Borehole log,  
Core Photos.



<b>Outcrop Survey Form</b>					<b>Date:</b>	21.04.2021	
<b>Project:</b>	PK-08				<b>Outcrop No:</b>	T15OC-01	
<b>Coordinates:</b>	E		N		<b>Weather:</b>	Sunny	
	317221		3353404		<b>Logged by:</b>	S.TEKES	
<b>Location</b>	T15 Portal Area (Above to MT)						
<b>Lithology:</b>	Quartzite				<b>Formation:</b>	Garhwal Group	
<b>Colour:</b>	<b>Weathering:</b>	<b>Grain Size:</b>		<b>Strength:</b>			
Yellowish white	Fresh to slightly	Medium		Very strong			
<b>Joint Set</b>	<b>Dip Amount (°)</b>	<b>Dip direction (°)</b>	<b>Spacing cm</b>	<b>Persistence (m)</b>	<b>Roughness</b>	<b>Aperture (mm)</b>	<b>Filling</b>
J1	70	310	60-200mm	3-10m	Slightly rough	0.1-1 mm	surface stained
J2	50	035	60-500mm	3-10m	Slightly rough	0.1-1 mm	surface stained
J3	60	200	200-600mm	3-8m	Slightly rough	0.1-1 mm	surface stained
J4	28	030	60-200mm	3-10m	Slightly rough	0.1-1 mm	surface stained





Outcrop Survey Form					Date:	21.04.2021		
Project:		PK-08			Outcrop No:		T15OC-02	
Coordinates:		E		N	Weather:		Sunny	
		317219		3353440	Logged by:		S.TEKES	
Location		T15 Portal Area (close to ET)						
Lithology:		Quartzite			Formation:		Garhwal Group	
Colour:		Weathering:		Grain Size:	Strength:			
Yellowish white		Fresh to slightly		Medium	Very strong			
Joint Set	Dip Amount (°)	Dip direction (°)	Spacing cm	Persistence (m)	Roughness	Aperture (mm)	Filling	
J1	47	015	60-200mm	1-3-10m	Slightly rough	0.1-1 mm	surface stained	
J2	60	090	200-800mm	1-3m	Slightly rough	0.1-1 mm	surface stained	
J3	62	178	20-400mm	1-3m	Slightly rough	0.1-1 mm	surface stained, soft filling >5mm	
J4	77	325	60-200mm	1-3m	Slightly rough	0.1-1 mm	surface stained	



# BOREHOLE LOG

Project Name		PACKAGE-08			Borehole No	T15P1-BH1
Project Location		T15P1 New Escape Tunnel Portal			Sheet	1 of 1
Coordinates (Sistem/System .....)	N	3353455.72	Ground Elevation (m)	763	Start Date	14/04/2021
	E	317173.66			Finish Date	22/04/2011
YAS Der. / GW depth (m)	Derinlik / Depth (m)	Tarih / Date	Açıklama / Remaks		Drill Method	Rotary
Dry					Drill Rig	D-500
					BH Depth (m)	20.00 m

BH Depth	Sample No	Sample Depth	Hole Diameter&Casing	Insitu Tests	Standard Penetration Test			TCR (%)	RQD (%)		Fracture Intercept/Run	Weathering	Strength	Description	Symbol
					(SPT)										
					# of Blows										
m		m		15	30	45	%	%	%						
1		1.00					20	-						Overburden Consist of Medium to Fine grained, boulder and cobbles of Quartzite&Metabasics with pebbles of subrounded fracments mixture of brown color silty sand wash out during drilling.	
		1.50					50	-							
2							55	11							
		2.50												Whitish color,medium grained,fresh-slightly weathered, medium strong,Quartzite,slightly rough,joint surfaces stained	
3		3.00					90	0							
		3.50					80	28							
4		4.10					97	53							
							78	0							
5		5.00												Vertical-subvertical joints,surfaces stained. 6.35-6.50m crushed material	
6							87	41							
		6.50												Whitish color,medium grained,fresh,strong rock,Quartzite,slightly rough,joint surfaces stained	
7							95	80							
		7.50					80	0							
8		7.75													
							96	64							
9		9.15													
							92	80							
10		10.40													
11							92	48						Joint set 1;50-55° surface staining,slightly rough,moderately spacing Joint set 1;70-75° surface staining,slightly rough,wide spacing	
		11.60					94	63							
12		12.08					87	67							
		12.68					95	78							
13		13.23					79	39							
14		13.93													
							89	77							
15		14.88													

## SOIL - ROCK EVALUATION

KAYA KALİTESİ / RQD			KIRIKLILIK (adet/m)/FRACTURES (nos/m)			BASINÇLI SU TESTİ / WATER PRESSURE TEST			SPT-YOĞUNLUK / SPT-DENSITY		
0 - 25 %	Çok Zayıf	/ Very Poor	<1	Masif	/ Massive	1 lugeon	: Geçirimsiz / Impervious	N : 0 - 4	Çok Gevşek	/ Very Loose	
25 - 50 %	Zayıf	/ Poor	1 - 3	Az kırıklı	/ Slightly fractured	1-5 lugeon	: Az geçirimli / Semi-pervious	N : 5 - 10	Gevşek	/ Loose	
50 - 75 %	Orta	/ Fair	4 - 10	Kırıklı	/ Fractured	5-25 lugeon	: Geçirimli Pervious	N : 11 - 30	Orta Sıkı	/ M. Dense	
75 - 90 %	İyi	/ Good	11 - 50	Çok kırıklı	/ Highly fractured	> 25 lugeon	: Çok geçirimli / Highly pervious	N : 31 - 50	Sıkı	/ Dense	
90 - 100 %	Çok İyi	/ Excellent	>50	Parçalanmış	/ Crushed			N : > 50	Çok Sıkı	/ Very Dense	
WEATHERING			STRENGTH			KISALTMALAR / ABBREVIATIONS			NOTLAR / REMARKS		
W1	Fresh		R0	Extremely Weak	R5	Very Strong	UD	: Şelbi Tüp / Shelby Tube			
W2	Slightly Weathered		R1	Very Weak	R6	Extremely Strong	CR	: Karot Num. / Core Sample			
W3	Mod. Weathered		R2	Weak			WPT	: Paker Den. / Packer Test			
W4	Highly Weathered		R3	Medium Strong			PT	: Geçirgenlik D./ Permeability T.			
W5	Completely Weathered		R4	Strong			S	: Sediman / Sediment			
W6	Residual Soil										

Driller:

Logged by:

Checked by:

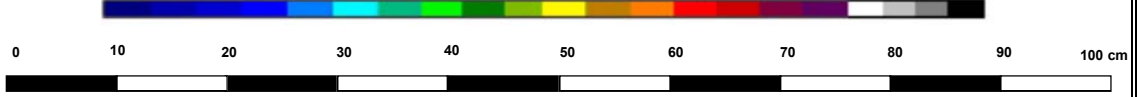
# BOREHOLE LOG

Proje İsmi / Project Name					PACKAGE-08					Borehole No			T15P1-BH1				
Proje Yeri / Project Location					T15P1 New Escape Tunnel Portal					Sheet			1 of 2				
Koordinatlar / Coordinates (Sistem/System .....)					N			3353455.72		Kot Ground Elevation (m)		763		Start Date		14/04/2021	
					E			317173.66						Finish Date		22/04/2011	
BH Depth	Sample No	Sample Depth	Hole Diameter&Casing	Insitu Tests	Standard Penetration Test (SPT)			TCR (%)	RQD (%)	SCR (%)	Fracture Intercept/Run	Weathering	Strength	Description			Symbol
					# of Blows												
m		m			15	30	45	%	%	%							
16		15.00 15.73						100	80					Whitish color,medium grained,fresh,strong rock,Quartzite,slightly rough,joint surfaces stained  Joint set 1;50-55° surface staining,slightly rough,moderately spacing Joint set 1;70-75° surface staining,slightly rough,wide spacing			
17		16.67 17.10						97	90								
18								93	81								
19		18.35						99	92								
20		19.25						94	89								
21		20.00						100	84								
22																	
23																	
24																	
25																	
26																	
27																	
28																	
29																	
30																	
31																	
32																	
33																	
34		34.00															

Driller: \_\_\_\_\_ Logged by: \_\_\_\_\_ Checked by: \_\_\_\_\_

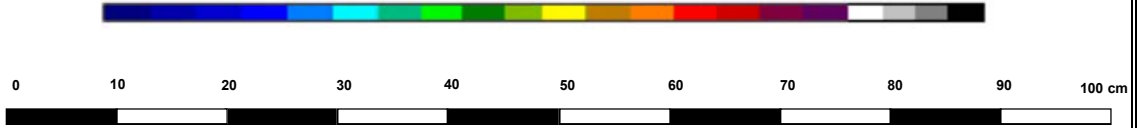
**PACKAGE-08**

Sondaj No / Borehole No : T15P1-BH1-Escape T  
Sandık No / Box No : 1 / 5  
Derinlik / Depth : 0.00 m. - 3.00 m.



**PACKAGE-08**

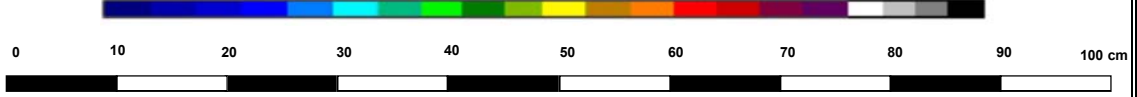
Sondaj No / Borehole No : T15P1-BH1  
Sandık No / Box No : 2 / 5  
Derinlik / Depth : 3.00 m. - 7.75 m.





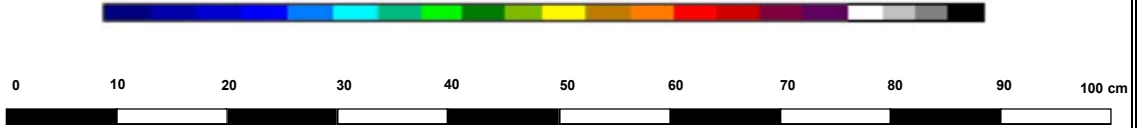
### PACKAGE-08

Sondaj No / Borehole No : T15P1-BH1-Escape T  
Sandık No / Box No : 3 / 5  
Derinlik / Depth : 7.75 m. - 12.08 m.



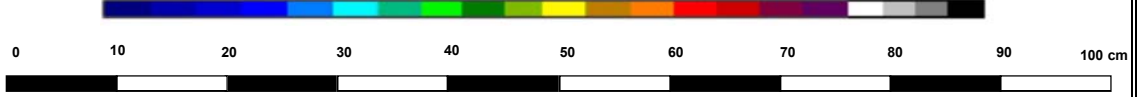
### PACKAGE-08

Sondaj No / Borehole No : T15P1-BH1  
Sandık No / Box No : 4 / 5  
Derinlik / Depth : 12.08 m. - 16.67 m.



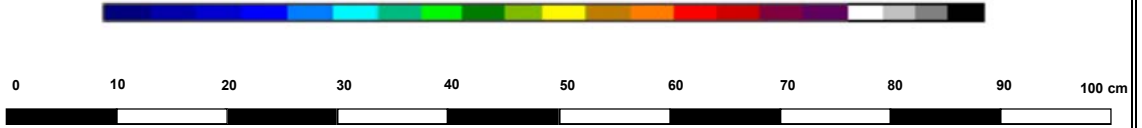
**PACKAGE-08**

Sondaj No / Borehole No : T15P1-BH1-Escape T  
Sandık No / Box No : 5 / 5  
Derinlik / Depth : 16.67 m. - 20.00 m.



**PACKAGE-08**

Sondaj No / Borehole No : T15P1-BH1  
Sandık No / Box No :  
Derinlik / Depth :



# BOREHOLE LOG

Project Name	PACKAGE-08			Borehole No	T15P1-BH2
Project Location	T15P1-BH02 Main Tunnel Portal			Sheet	1 of 1
Coordinates (Sistem/System .....)	N	3353428	Ground Elevation (m)	Start Date	01/07/2021
	E	317139		Finish Date	06/07/2011
YAS Der. / GW depth (m)	Derinlik / Depth (m)	Tarih / Date	Açıklama / Remaks		Drill Method
Dry					Drill Rig
					BH Depth (m)

BH Depth	Sample No	Sample Depth	Hole Diameter&Casing	Insitu Tests	Standard Penetration Test			TCR (%)	RQD (%)		Fracture Intercept/Run	Weathering	Strength	Description	Symbol
					(SPT)										
					# of Blows										
m		m		15	30	45	%	%	%						
1		1.50					-	-						Hand excavation Top Soil.	
2							-	-							
3		3.00					41	-						Overburden Consist of Medium to Fine grained, boulder and cobbles of Quartzite&Metabasics with pebbles of subrounded fracments mixture of brown color silty sand wash out during drilling.	
4		4.00					28	-							
		4.50					70	-							
5		5.00					86	24							
		5.50													
6							75	19						Whitish color,medium grained,fresh-slightly weathered, medium strong,Quartzite,slightly rough,joint surfaces stained	
		6.50													
7		7.30					81	31							
8							88	29							
		8.50													
9		9.00					86	68							
10		10.40					90	32						Joint set 1;75-80° surface staining,slightly rough,close to mod. spacing	
11		11.60					88	32							
12							83	42						Quartz band	
		12.80													
13															
							101	42						Greenish color,medium grained,fresh-slightly weathered, medium strong,Sandstone-Quartzite,slightly rough,joint surfaces stained	
		14.20													
15							88	38							

## SOIL - ROCK EVALUATION

KAYA KALİTESİ / RQD				KIRIKLILIK (adet/m)/FRACTURES (nos./m)				BASINÇLI SU TESTİ / WATER PRESSURE TEST				SPT-YOĞUNLUK / SPT-DENSITY			
0 - 25 %	Çok Zayıf	/	Very Poor	< 1	Masif	/	Massive	1 lugeon	: Geçirimsiz / Impervious	N : 0 - 4	Çok Gevşek	/	Very Loose		
25 - 50 %	Zayıf	/	Poor	1 - 3	Az kırıklı	/	Slightly fractured	N : 5 - 10	Gevşek	/	Loose				
50 - 75 %	Orta	/	Fair	4 - 10	Kırıklı	/	Fractured	1-5 lugeon	: Az geçirimli / Semi-pervious	N : 11 - 30	Orta Sıkı	/	M. Dense		
75 - 90 %	İyi	/	Good	11 - 50	Çok kırıklı	/	Highly fractured	5-25 lugeon	: Geçirimli Pervious	N : 31 - 50	Sıkı	/	Dense		
90 - 100 %	Çok İyi	/	Excellent	>50	Parçalanmış	/	Crushed	> 25 Lugeon	: Çok geçirimli / Highly pervious	N : > 50	Çok Sıkı	/	Very Dense		
WEATHERING				STRENGTH				KISALTMALAR / ABBREVIATIONS				NOTLAR / REMARKS			
W1	Fresh			R0	Extremely Weak	R5	Very Strong	UD	: Şelbi Tüp / Shelby Tube						
W2	Slightly Weathered			R1	Very Weak	R6	Extremely Strong	CR	: Karot Num. / Core Sample						
W3	Mod. Weathered			R2	Weak			WPT	: Paker Den. / Packer Test						
W4	Highly Weathered			R3	Medium Strong			PT	: Geçirgenlik D./ Permeability T.						
W5	Completely Weathered			R4	Strong			S	: Sediman / Sediment						
W6	Residual Soil														

Driller:

Logged by:

Checked by:

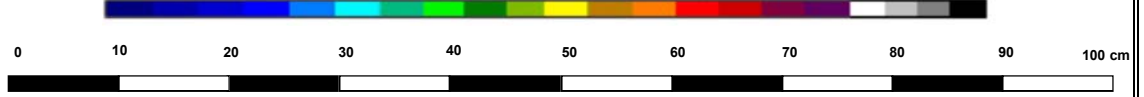
# BOREHOLE LOG

Proje İsmi / Project Name		PACKAGE-08				Borehole No		T15P1-BH1							
Proje Yeri / Project Location		T15P1-BH02 Main Tunnel Portal				Sheet		1 of 2							
Koordinatlar / Coordinates (Sistem/System .....)		N 3353428		Kot Ground Elevation (m)		762		Start Date		01/07/2021					
		E 317139						Finish Date		06/07/2011					
BH Depth m	Sample No	Sample Depth m	Hole Diameter&Casing	Insitu Tests	Standard Penetration Test (SPT)			TCR (%)	RQD (%)	SCR (%)	Fracture Intercept/Run	Weathering	Strength	Description	Symbol
					# of Blows										
					15	30	45								
16		15.20						94	41					Whitish color,medium grained,fresh-slightly weathered, medium strong,Quartzite,slightly rough,joint surfaces stained  Joint set 1;40-45° surface staining,slightly rough,60-200mm spacing	
17		16.00						85	-						
18		16.60						95	26						
19		18.10												18.10 (End of hole)	
20															
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															
31															
32															
33															
34		34.00													



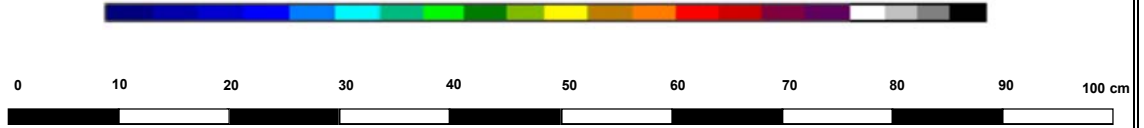
### PACKAGE-08-T15P1 Main Tunnel

Sondaj No / Borehole No : T15P1-BH2  
Sandık No / Box No : 1 / 4  
Derinlik / Depth : 0.00 m. - 5.50 m.



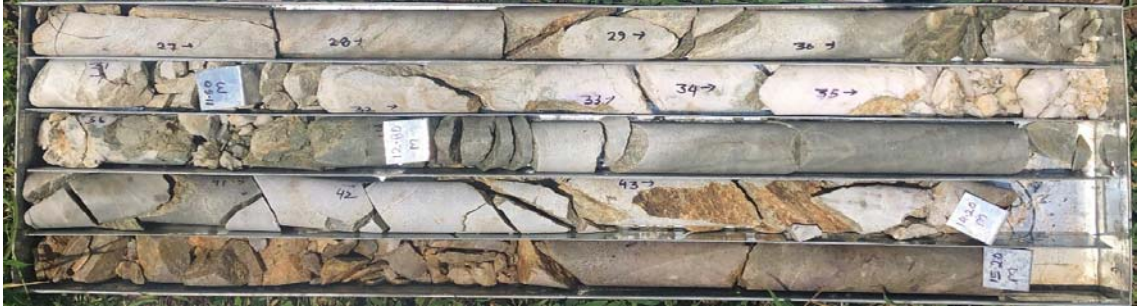
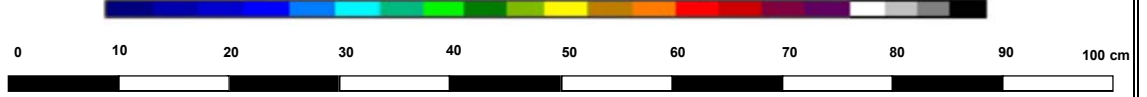
### PACKAGE-08

Sondaj No / Borehole No : T15P1-BH2  
Sandık No / Box No : 2 / 4  
Derinlik / Depth : 5.50 m. - 10.40 m.



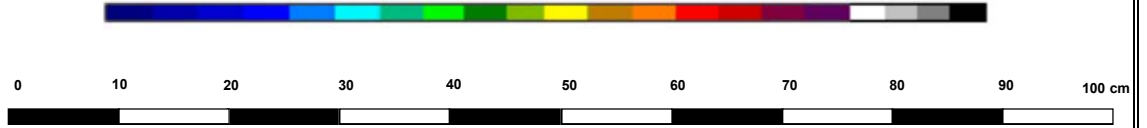
**PACKAGE-08-T15P1 Main Tunnel**

Sondaj No / Borehole No : T15P1-BH2  
Sandık No / Box No : 3 / 4  
Derinlik / Depth : 10.40 m. - 15.20 m.



**PACKAGE-08**

Sondaj No / Borehole No : T15P1-BH2  
Sandık No / Box No : 4 / 4  
Derinlik / Depth : 15.20 m. - 18.10 m.



# BOREHOLE LOG

Project Name	PACKAGE-08			Borehole No	T15P1-BH2
Project Location	T15P1-BH02 Main Tunnel Portal			Sheet	1 of 1
Coordinates (Sistem/System .....)	N	3353428	Ground Elevation (m)	Start Date	01/07/2021
	E	317139		Finish Date	06/07/2011
YAS Der. / GW depth (m)	Derinlik / Depth (m)	Tarih / Date	Açıklama / Remaks		Drill Method
Dry					Drill Rig
					BH Depth (m)

BH Depth	Sample No	Sample Depth	Hole Diameter&Casing	Insitu Tests	Standard Penetration Test			TCR (%)	RQD (%)		Fracture Intercept/Run	Weathering	Strength	Description	Symbol
					(SPT)										
					# of Blows										
m		m		15	30	45	%	%	%						
1		1.50					-	-						Hand excavation Top Soil.	
2							-	-							
3		3.00					41	-						Overburden Consist of Medium to Fine grained, boulder and cobbles of Quartzite&Metabasics with pebbles of subrounded fracments mixture of brown color silty sand wash out during drilling.	
4		4.00					28	-							
		4.50					70	-							
5		5.00					86	24							
		5.50													
6							75	19						Whitish color,medium grained,fresh-slightly weathered, medium strong,Quartzite,slightly rough,joint surfaces stained	
		6.50													
7		7.30					81	31							
8							88	29							
		8.50													
9		9.00					86	68							
10		10.40					90	32						Joint set 1;75-80° surface staining,slightly rough,close to mod. spacing	
11		11.60					88	32							
12							83	42						Quartz band	
		12.80													
13															
							101	42						Greenish color,medium grained,fresh-slightly weathered, medium strong,Sandstone-Quartzite,slightly rough,joint surfaces stained	
		14.20													
15							88	38							

## SOIL - ROCK EVALUATION

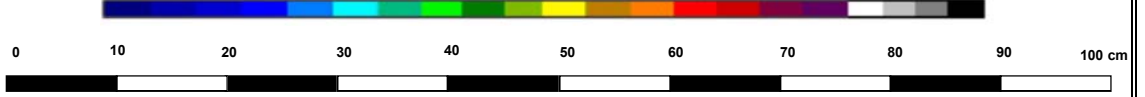
KAYA KALİTESİ / RQD			KIRIKLILIK (adet/m)/FRACTURES (nos./m)			BASINÇLI SU TESTİ / WATER PRESSURE TEST			SPT-YOĞUNLUK / SPT-DENSITY		
0 - 25 %	Çok Zayıf	/ Very Poor	< 1	Masif	/ Massive	1 lugeon	: Geçirimsiz / Impervious	N : 0 - 4	Çok Gevşek	/ Very Loose	
25 - 50 %	Zayıf	/ Poor	1 - 3	Az kırıklı	/ Slightly fractured	1-5 lugeon	: Az geçirimli / Semi-pervious	N : 5 - 10	Gevşek	/ Loose	
50 - 75 %	Orta	/ Fair	4 - 10	Kırıklı	/ Fractured	5-25 lugeon	: Geçirimli Pervious	N : 11 - 30	Orta Sıkı	/ M. Dense	
75 - 90 %	İyi	/ Good	11 - 50	Çok kırıklı	/ Highly fractured	> 25 lugeon	: Çok geçirimli / Highly pervious	N : 31 - 50	Sıkı	/ Dense	
90 - 100 %	Çok İyi	/ Excellent	> 50	Parçalanmış	/ Crushed			N : > 50	Çok Sıkı	/ Very Dense	
WEATHERING			STRENGTH			KISALTMALAR / ABBREVIATIONS			NOTLAR / REMARKS		
W1	Fresh		R0	Extremely Weak	R5	Very Strong	UD	: Şelbi Tüp / Shelby Tube			
W2	Slightly Weathered		R1	Very Weak	R6	Extremely Strong	CR	: Karot Num. / Core Sample			
W3	Mod. Weathered		R2	Weak			WPT	: Paker Den. / Packer Test			
W4	Highly Weathered		R3	Medium Strong			PT	: Geçirgenlik D./ Permeability T.			
W5	Completely Weathered		R4	Strong			S	: Sediman / Sediment			
W6	Residual Soil										
Driller:			Logged by:			Checked by:					

# BOREHOLE LOG

Proje İsmi / Project Name		PACKAGE-08				Borehole No		T15P1-BH1							
Proje Yeri / Project Location		T15P1-BH02 Main Tunnel Portal				Sheet		1 of 2							
Koordinatlar / Coordinates (Sistem/System .....)		N	3353428		Kot Ground Elevation (m)	762	Start Date		01/07/2021						
		E	317139				Finish Date		06/07/2011						
BH Depth m	Sample No	Sample Depth m	Hole Diameter&Casing	Insitu Tests	Standard Penetration Test (SPT)			TCR (%)	RQD (%)	SCR (%)	Fracture Intercept/Run	Weathering	Strength	Description	Symbol
					# of Blows										
					15	30	45								
16		15.20						94	41					Whitish color,medium grained,fresh-slightly weathered, medium strong,Quartzite,slightly rough,joint surfaces stained  Joint set 1;40-45° surface staining,slightly rough,60-200mm spacing	
17		16.00						85	-						
18		16.60						95	26						
19		18.10												18.10 (End of hole)	
20															
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															
31															
32															
33															
34		34.00													

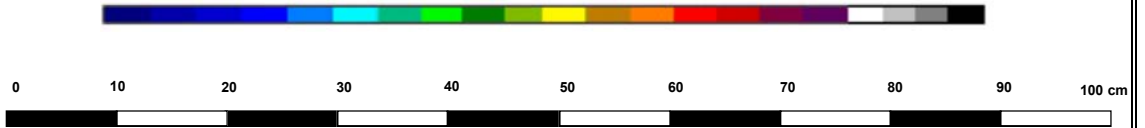
### PACKAGE-08-T15P1 Main Tunnel

Sondaj No / Borehole No : T15P1-BH2  
Sandık No / Box No : 1 / 4  
Derinlik / Depth : 0.00 m. - 5.50 m.



### PACKAGE-08

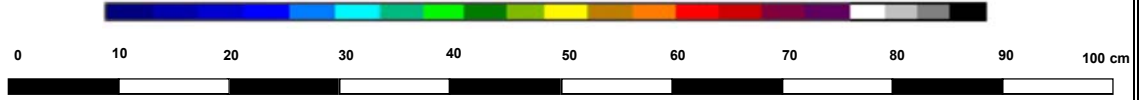
Sondaj No / Borehole No : T15P1-BH2  
Sandık No / Box No : 2 / 4  
Derinlik / Depth : 5.50 m. - 10.40 m.





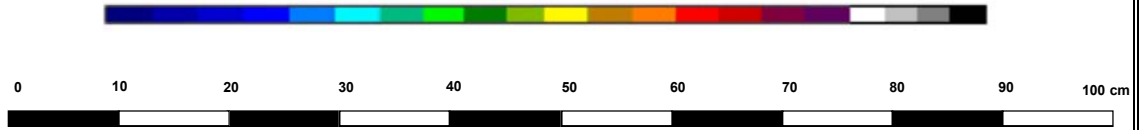
**PACKAGE-08-T15P1 Main Tunnel**

Sondaj No / Borehole No : T15P1-BH2  
Sandık No / Box No : 3 / 4  
Derinlik / Depth : 10.40 m. - 15.20 m.



**PACKAGE-08**

Sondaj No / Borehole No : T15P1-BH2  
Sandık No / Box No : 4 / 4  
Derinlik / Depth : 15.20 m. - 18.10 m.



## APPENDIX II

Alignment Plan, Geological Map and Profile.



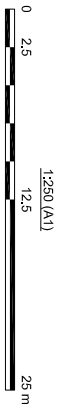
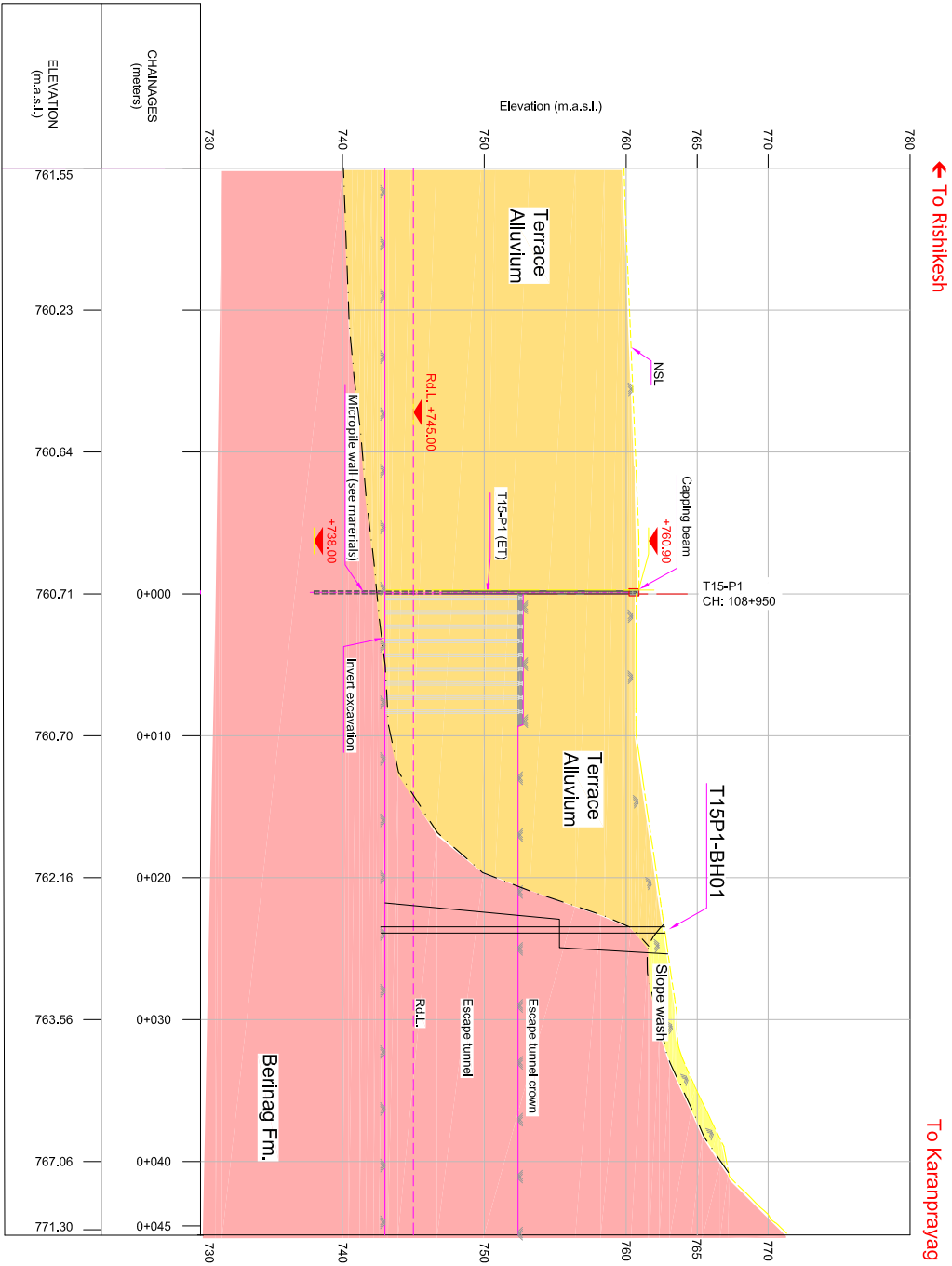


- Notes:**
- All dimensions are given in meter
  - The elevation levels are given as meter above sea level (m.a.s.l.)
  - All topography for illustration only & contractor is responsible for providing his own survey
  - All actual positions of portals, bridges and station location is the responsibility of the contractor
  - Drawing is based on survey dated 28/06/2019

- Reference drawing:**
- LO/TFE\_JV/P8-J-F-GW-F3-DW-001
  - LO/TFE\_JV/P8-J-F-GW-F3-DW-002
  - LO/TFE\_JV/P8-J-F-GW-F3-DW-003

Legend		Abbreviations:	
Berhag Fm.		NSL	Natural Surface Line
Slope wash		MT	Main Tunnel
Terrace Alluvium		ET	Escape Tunnel
Excavated bed		Fm.	Formation
Rock-sill interface		RL	Rail Level
		Rd.L.	Road Level
		T15P1	Tunnel 15 Portal 1

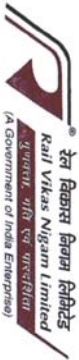
LONGITUDINAL SECTION B-B, ALONG ESCAPE TUNNEL  
(1:250)



GOOD FOR CONSTRUCTION

Signature of RVNL officers		CPM/RKSH
AGM(Projects)/RKSH		Vikas Bahuguna
Signature of DDC officers		Authorized Signatory
Deputy Team Leader		Team Leader (Design)
Georgios Tziellias		Devide Ishari

TRANSMISSION STATUS		APPROVAL RETURN STATUS:	
A	MS	GT	DF
0	MS	GT	GT
REV	DRAWN	CHECKED	APPROVED
			DATE
			REMARK
			STAT



(A Government of India Enterprise)

PROJECT:

DETAILED DESIGN AND PROJECT MANAGEMENT CONSULTANCY	
RISHIKESH - KARANPRAYAG RAIL LINK - PACKAGE 8	
Lombardi Engineering Limited - Italferr S.p.A. JV	
DETAILED DESIGN CONSULTANT:	
ITALFERR	
Lombardi	

TITLES:

CIVIL WORKS

EXCAVATION AND SLOPE SUPPORT  
TUNNEL-15, PORTAL-1

LONGITUDINAL SECTION ALONG ESCAPE TUNNEL

DOCUMENT CODE:					FILE NAME: LO/TFE_JV/P8-J-F-GW-F3-DW-001	SH. IN. OF SH.
Project	Author	Phase	System	Area	Rev.	Stat.
LO/TFE_JV-P8	J	F	CW	P3	DW	001
					A	
					Scale	1:250
						3