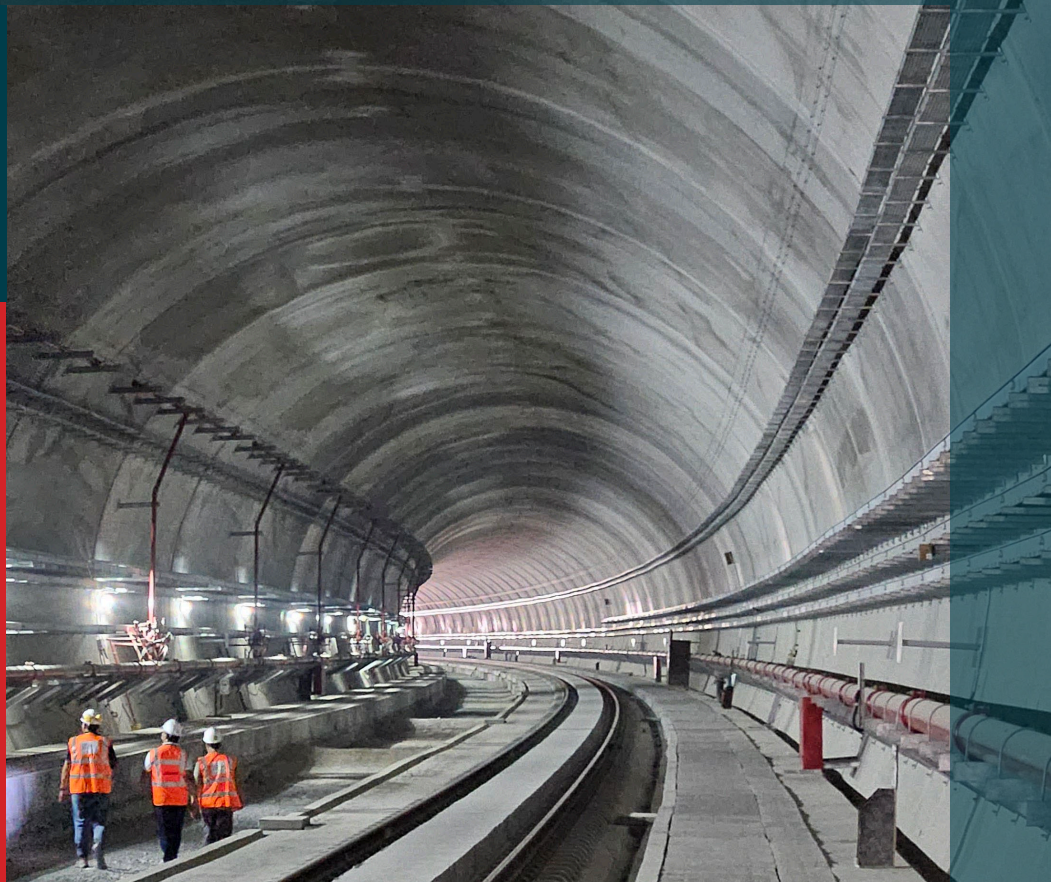


Mardi de l'AFTES – Lyon  
José González del Tánago

RETOUR SUR LE CHALLENGE DE LA  
CONCEPTION-RÉALISATION DES  
9 TUNNELS DE L'EXTENSION  
DU RÉSEAU FERROVIAIRE  
DES EMIRATS ARABES UNIS  
(UAE)

**SYSTRA**



# Sommaire

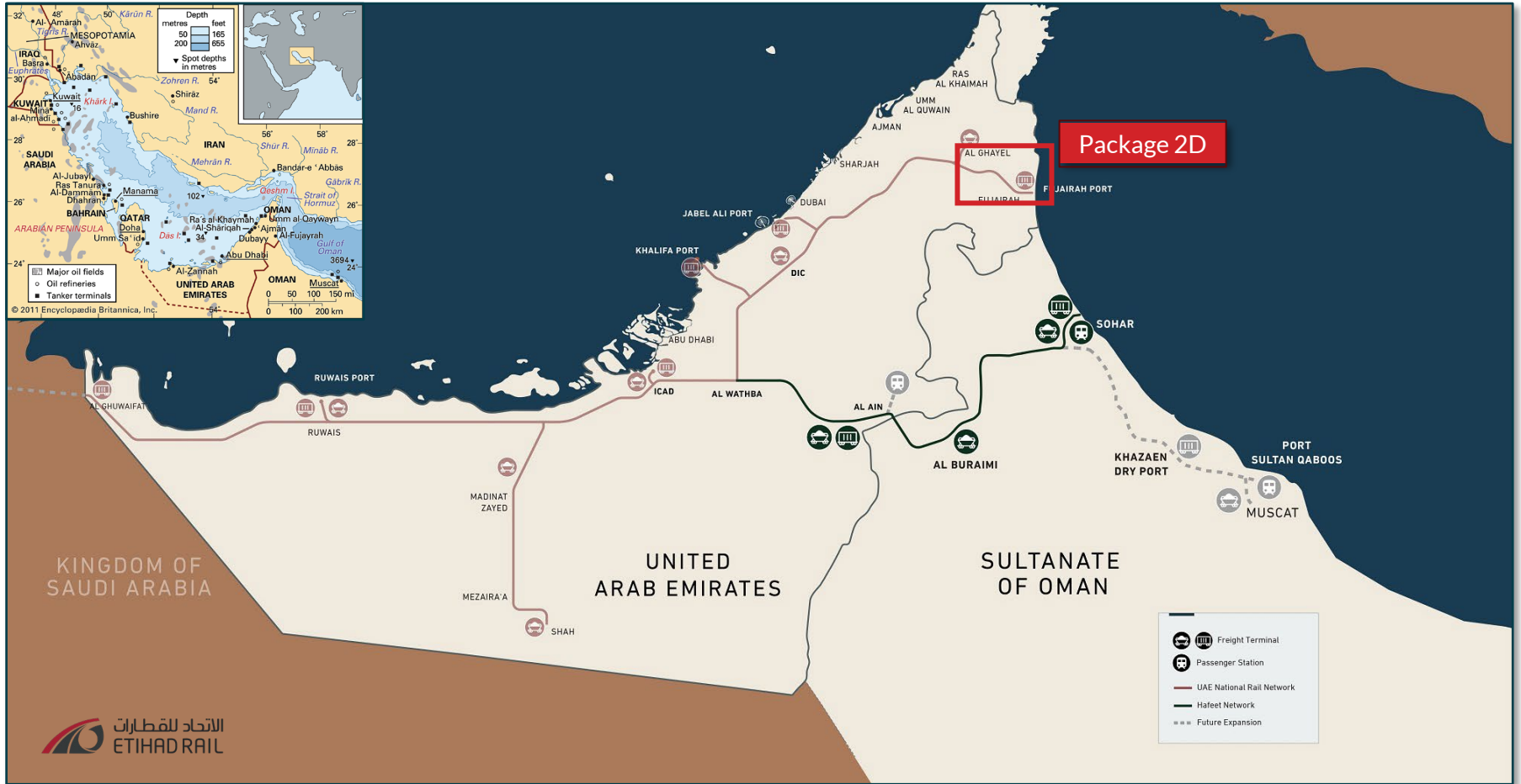
- 1. Introduction** : Le projet D&B et le contexte ferroviaire des EAU
- 2. Phase 1** : Caractérisation géotechnique
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- 4. Phase 2b** : Conception du portal et stabilité de pentes
- 5. Phase 3** : Control d'ingenierie pendant la construction
- 6. Phase 4** : Drainage, Revêtement et finalisation



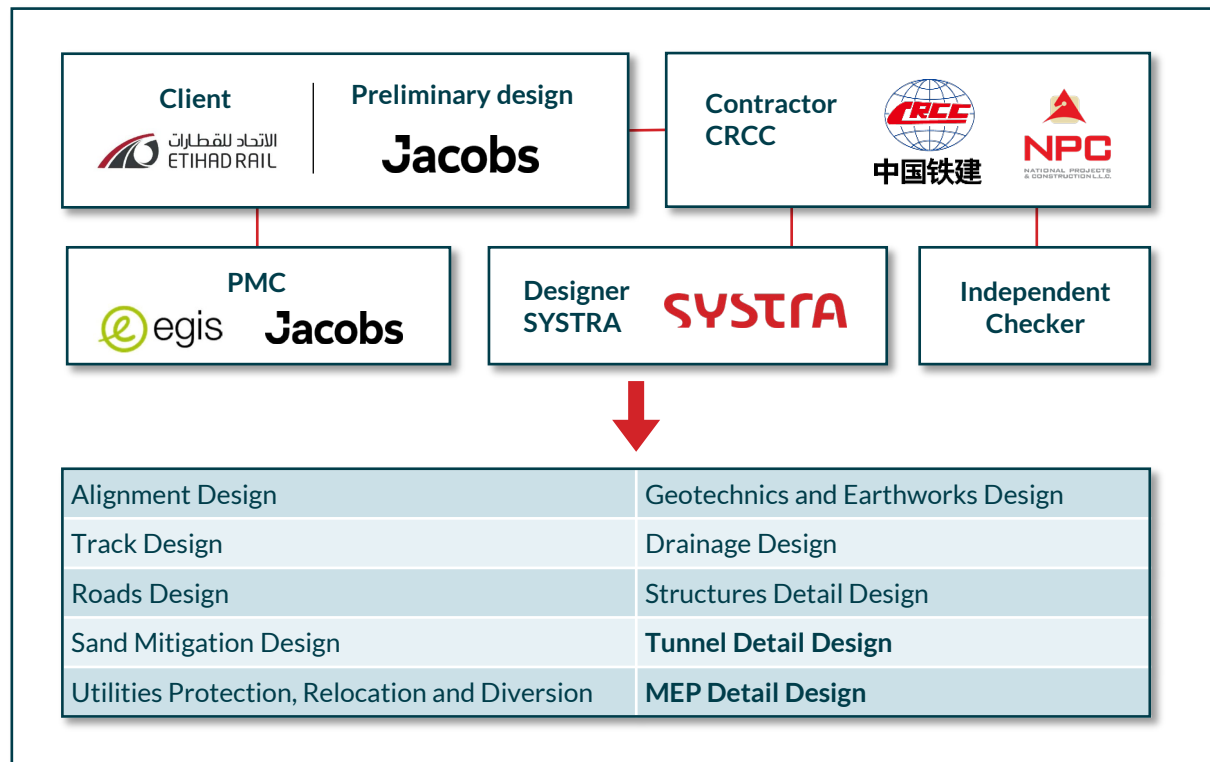
## Introduction

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# **Le projet D&B et le contexte ferroviaire des EAU**



# Les projets conception - réalisation (Design & Build) - étapes





Tunnel	L <sub>tunnel mined</sub> [m]	L <sub>tunnel total</sub> [m]
T1	1623	<b>1783</b>
T2	386	406
T3	1259	<b>1279</b>
T6	288	308
T7	1085	<b>1105</b>
T8	273	293
T9	328	348
T10	967	<b>987</b>
T11	323	343
<b>Total 9</b>	6533	6853

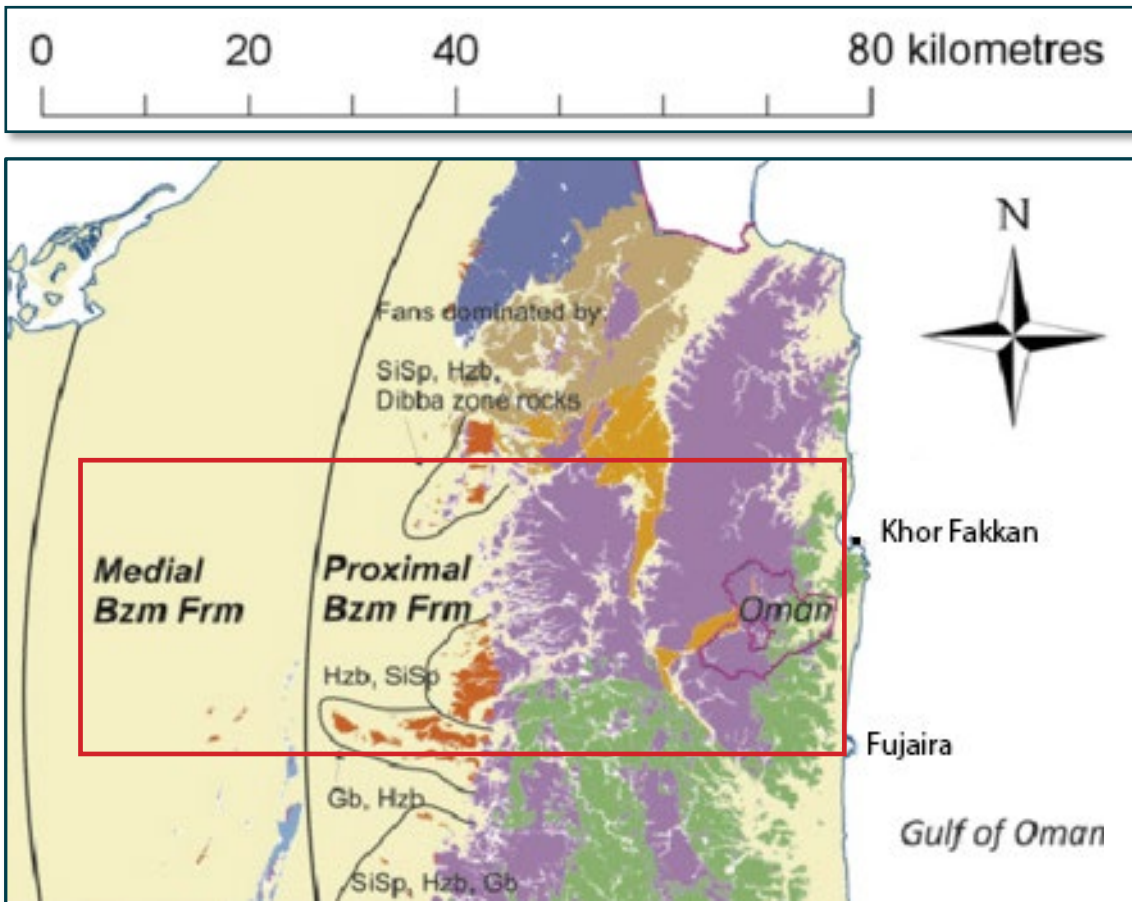
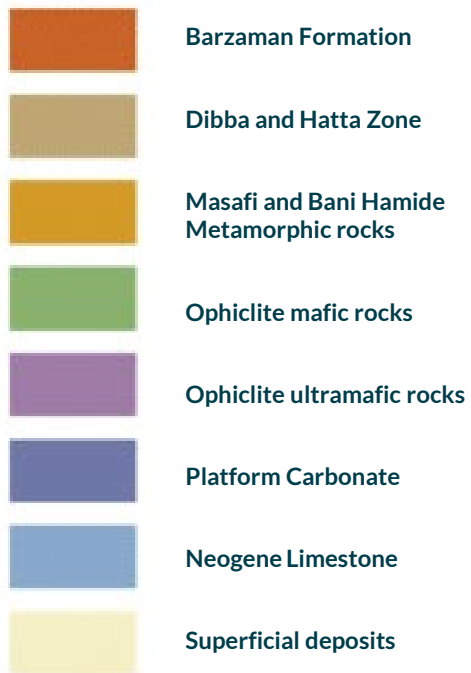


Phase 1

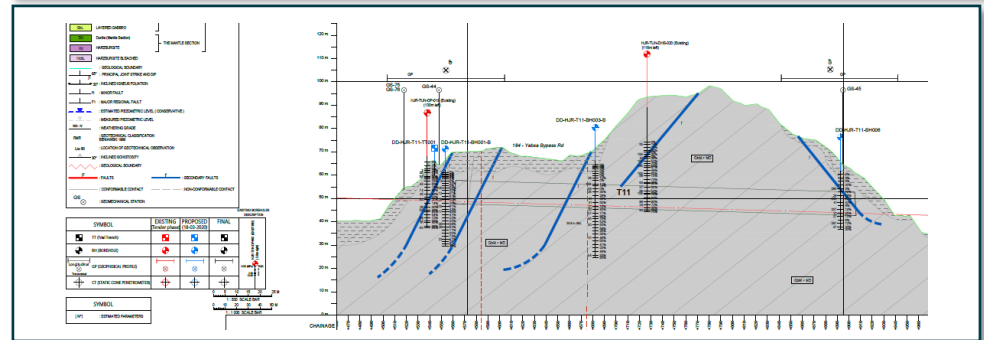
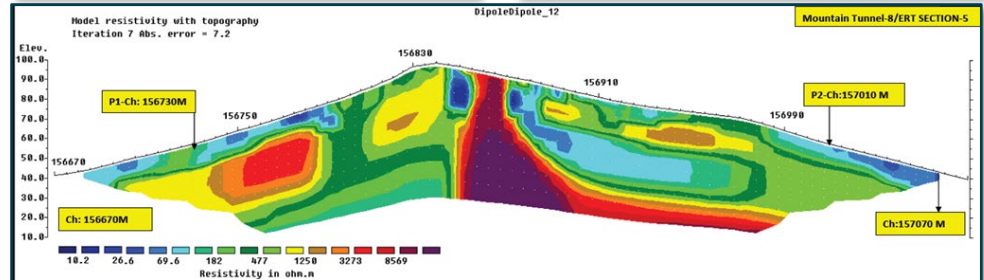
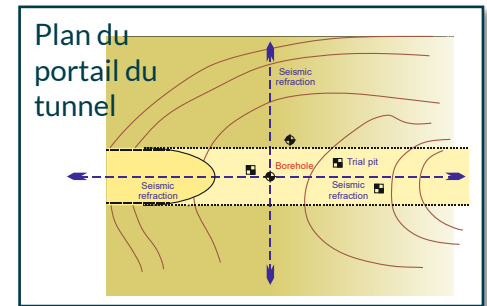
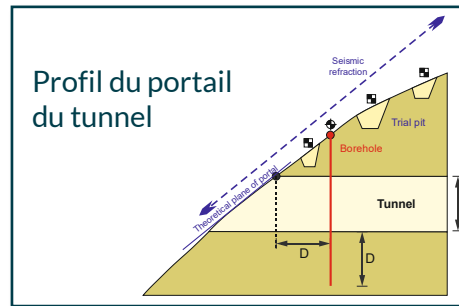
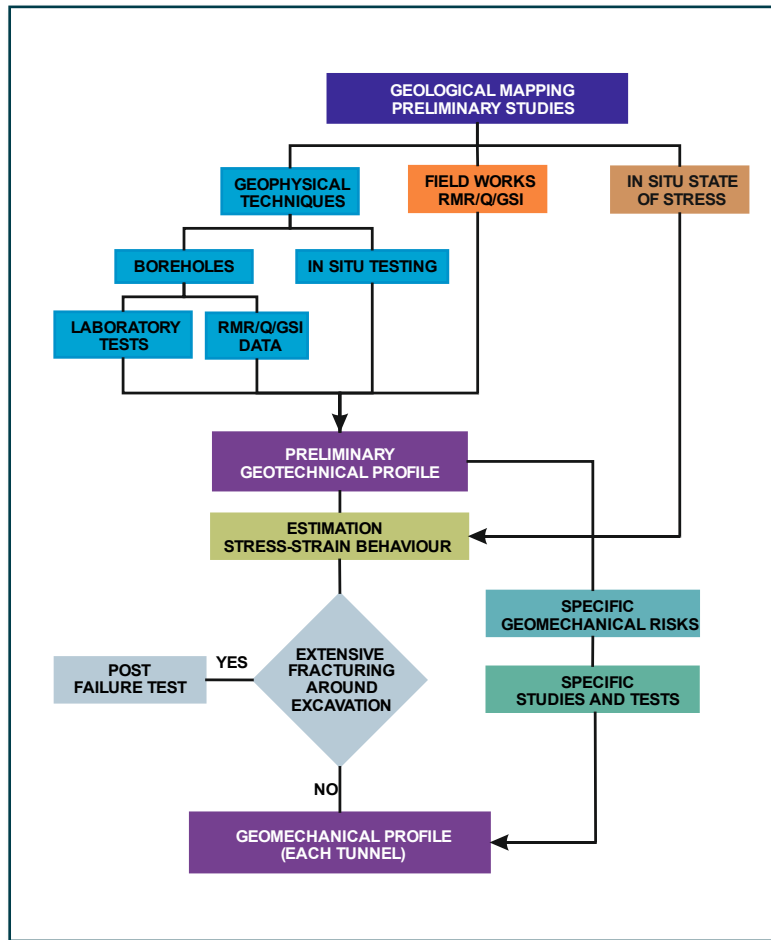
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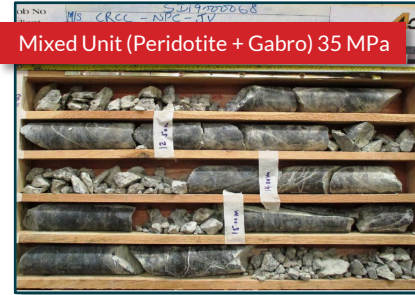
## **Caractérisation géotechnique**

## Geology 250k

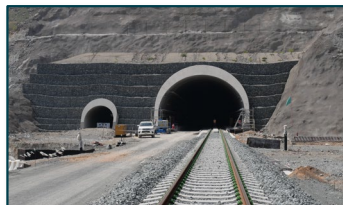








Tunnel	Lithologies found
T-1	Peridotites (Harzburgite, Harzburgite Bleached, Dunite, Mixed Unit)
T-2	Mixed Unit, Fujairah Gabbro
T-3	Harzburgite, Fujairah Gabbro
T-6	Layered Gabbro
T-7 T-8	Fujairah Gabbro, Layered Gabbro
T-9	Fujairah Gabbro
T-10	Fujairah Gabbro, Mirbah Gabbro
T-11	Mirbah Gabbro

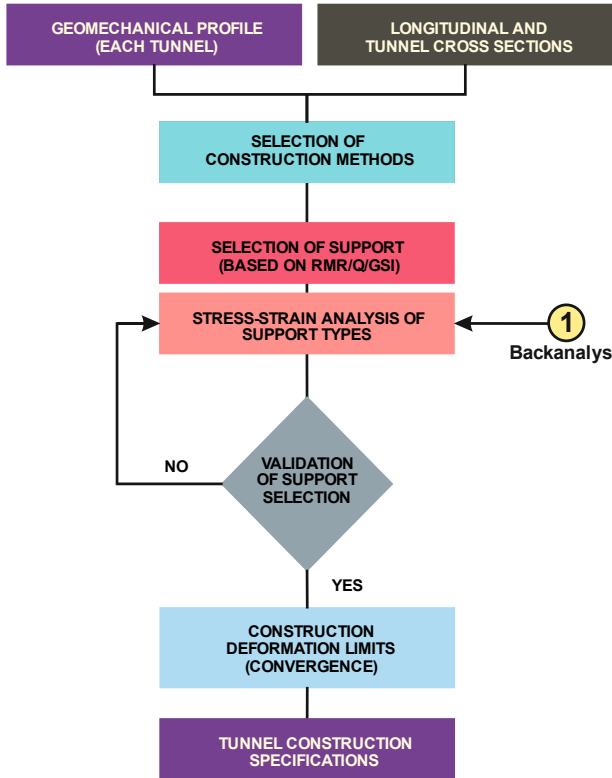




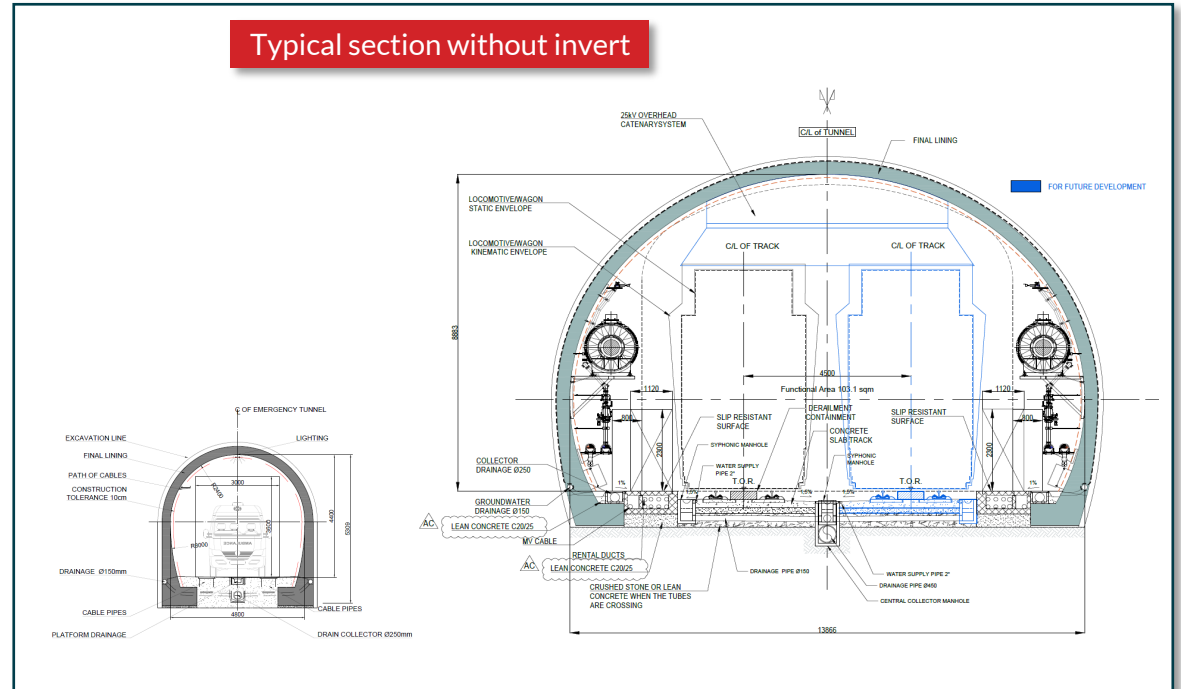
Phase 2a

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**Conception du tunnel  
(sécurité - structurel)**

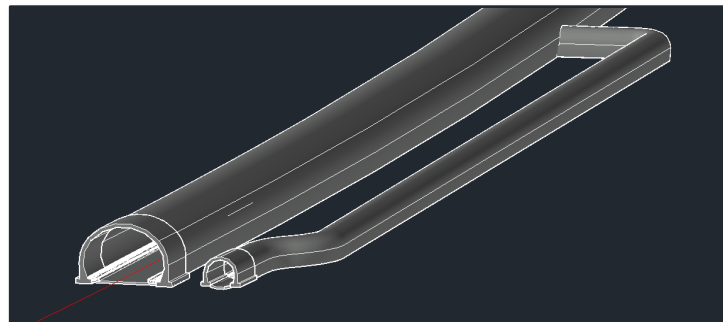
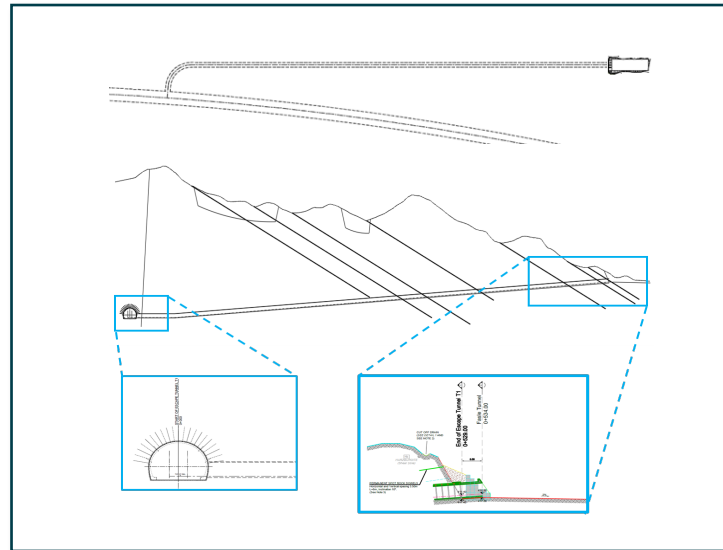
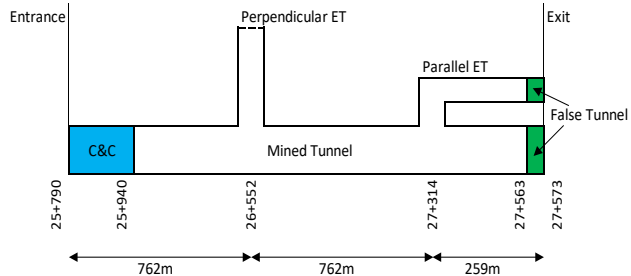


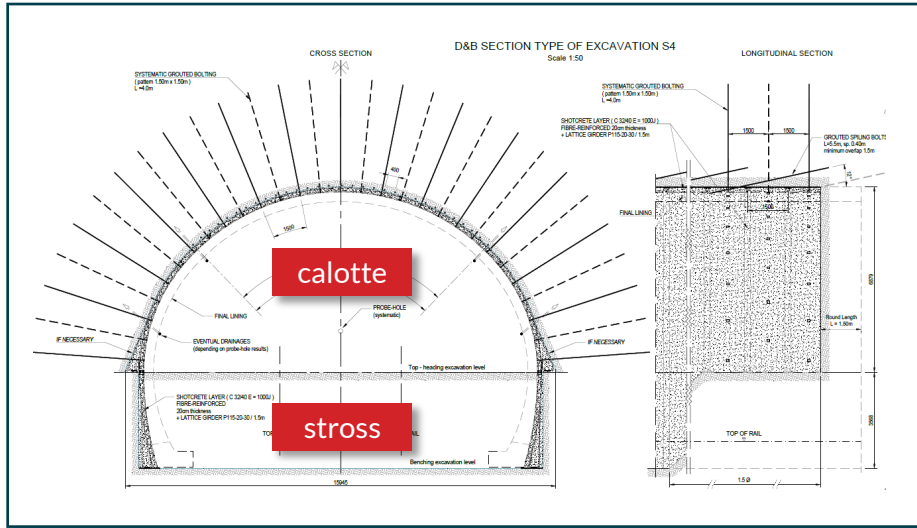
Le trafic de ce secteur est pour **le fret et les voyageurs** avec une section à double voie, une voie en exploitation et une voie en prévision pour l'avenir aussi système de catenaire



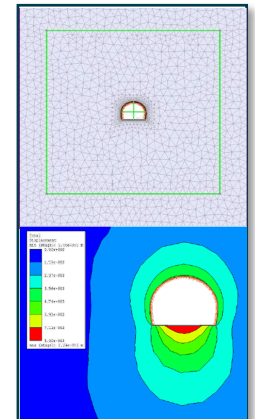
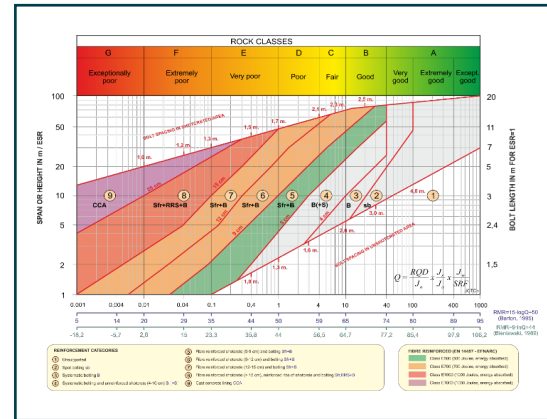
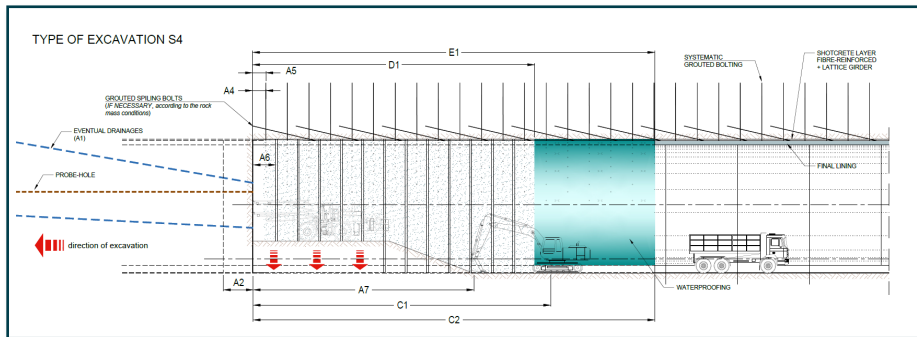
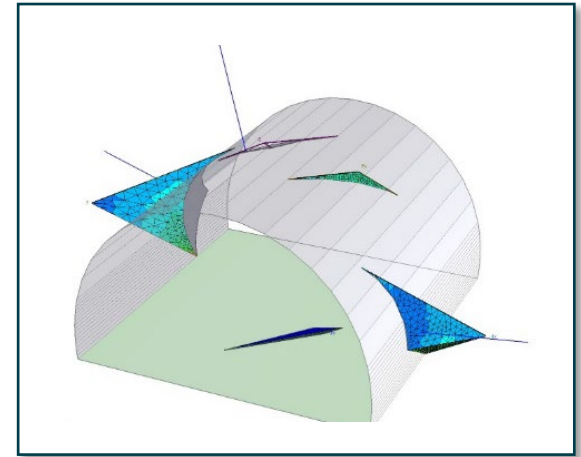
## T1 SCHEMATIC LAYOUT

Galerie  
perpendiculaire 8%  
522 m



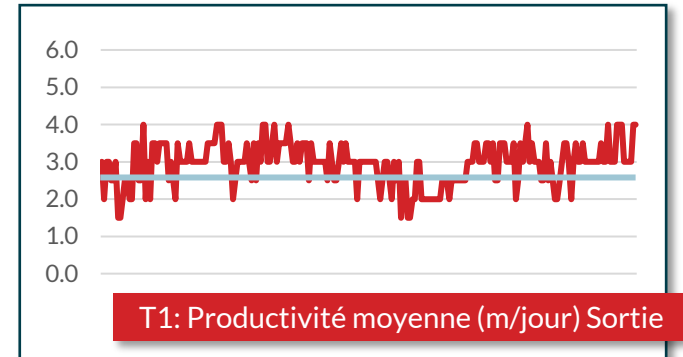
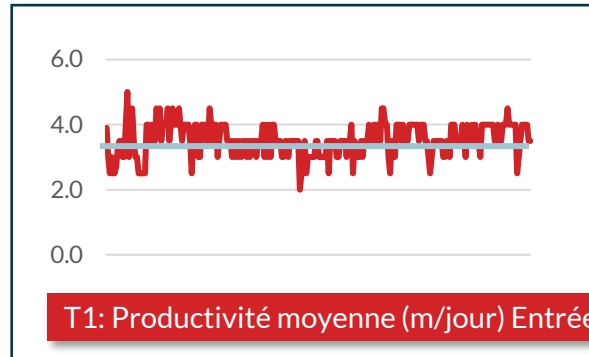
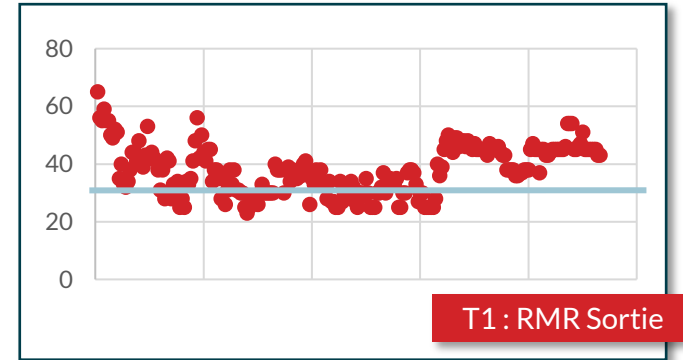
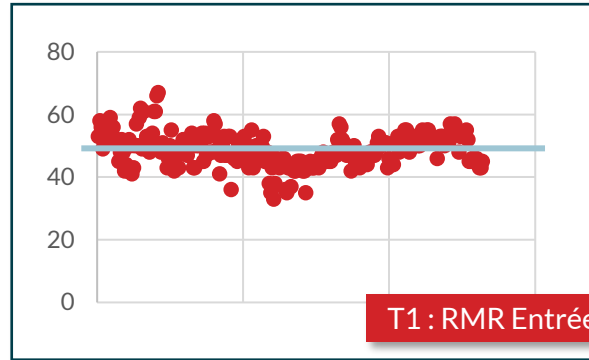


Class	RMR
S1	>80
S2	60-80
S3	40-60
S4	20-40
S5	<20



# Construction: productivité moyenne (m/jour)

Tunnel		Productivité moyenne (m/jour)
T1	Main tunnel	3.2
	Escape-1	1.5
	Escape-2	1.2
T2	Main tunnel	2.0
T3	Main tunnel	3.1
	Escape	0.5
T6	Main tunnel	3.2
T7	Main tunnel	3.1
	Escape	1.6
T8	Main tunnel	2.2
T9	Main tunnel	1.8
T10	Main tunnel	3.0
	Escape	1.0
T11	Main tunnel	1.6







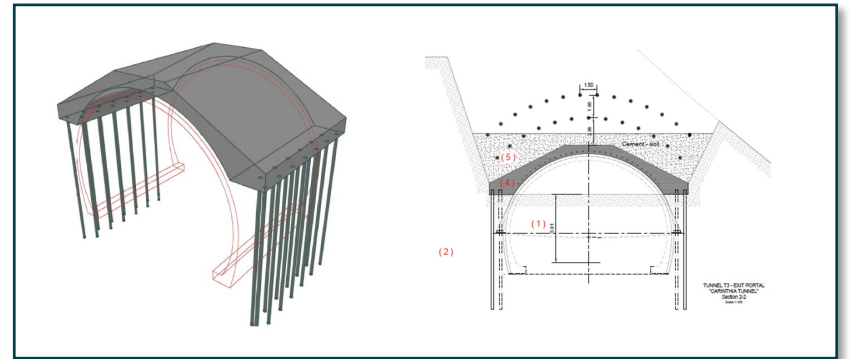
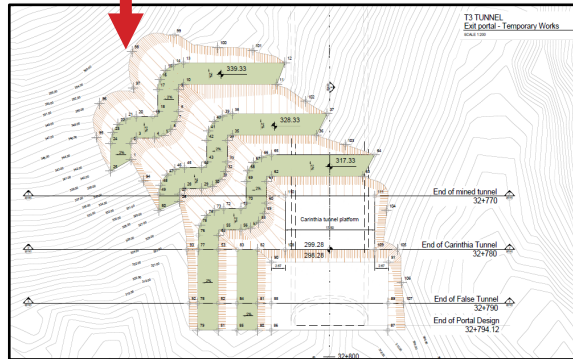
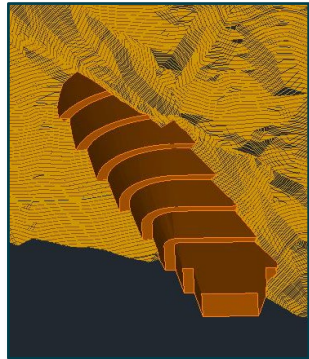
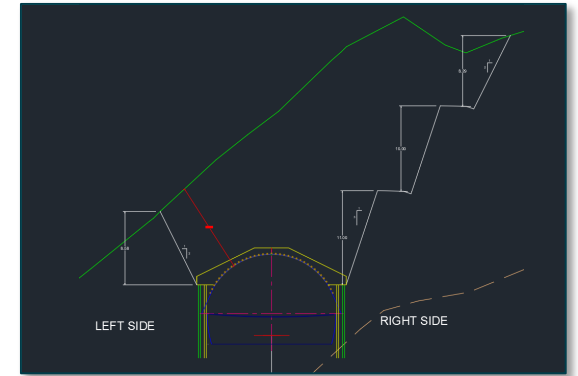
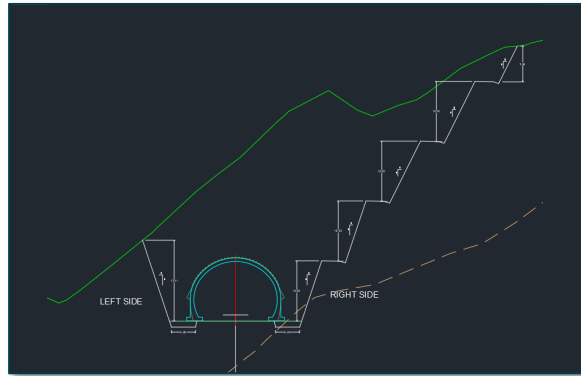
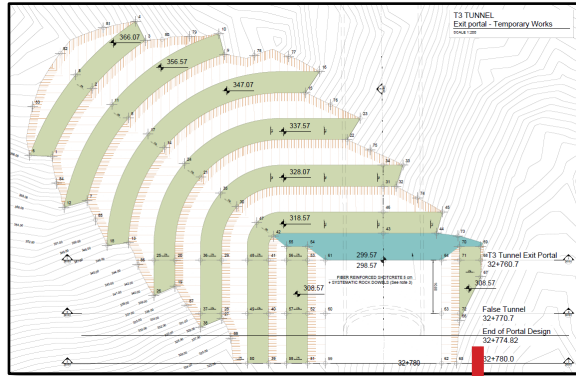
Phase 2b

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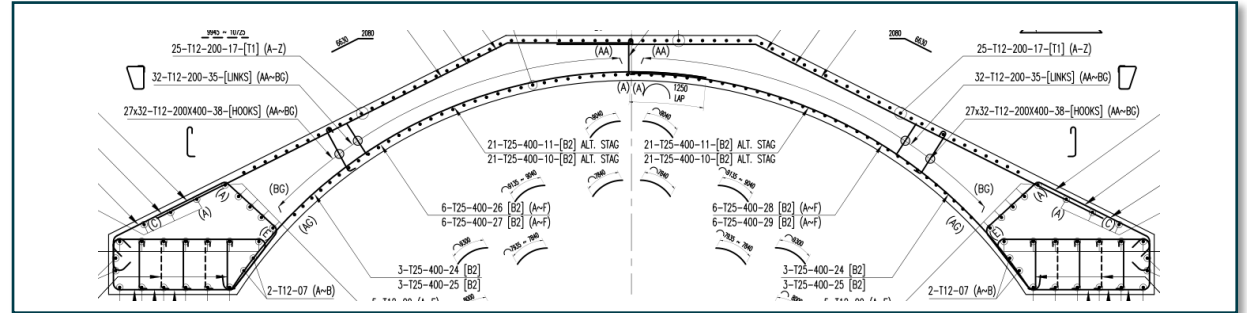
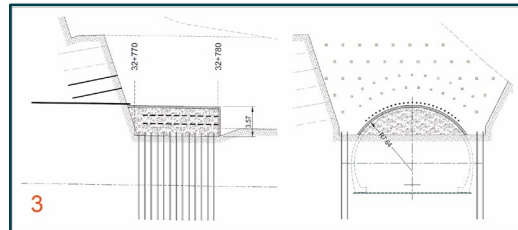
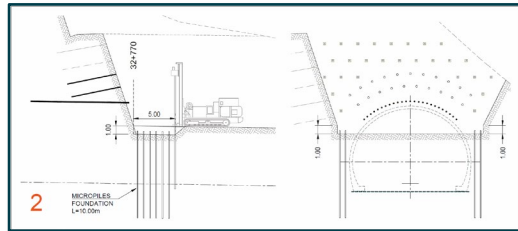
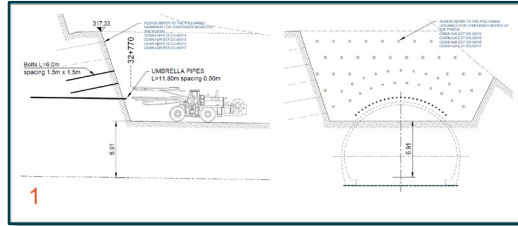
**Conception du portal  
et stabilité de pentes**



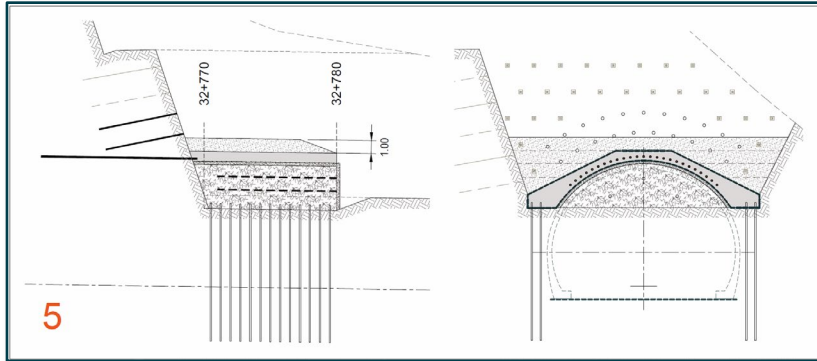
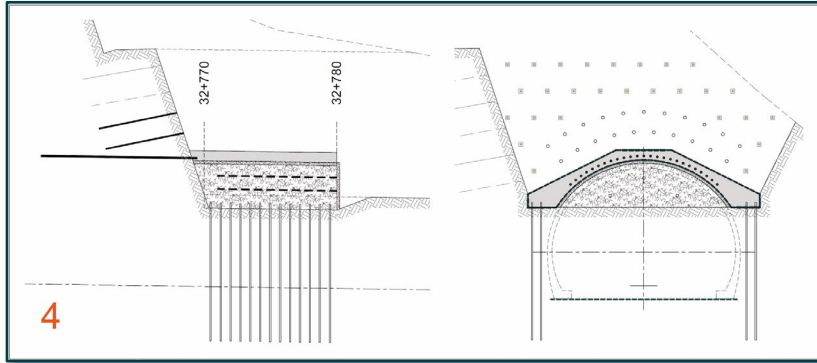
# Portail T3 sortie - Méthode Carinthia



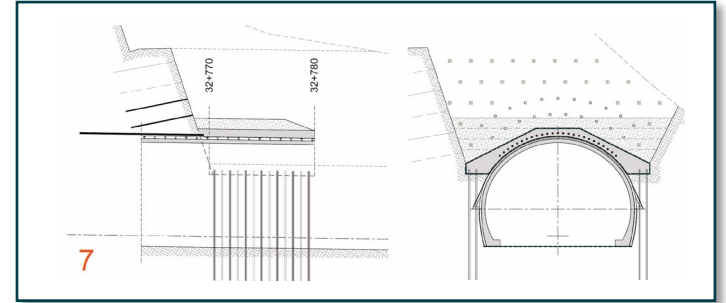
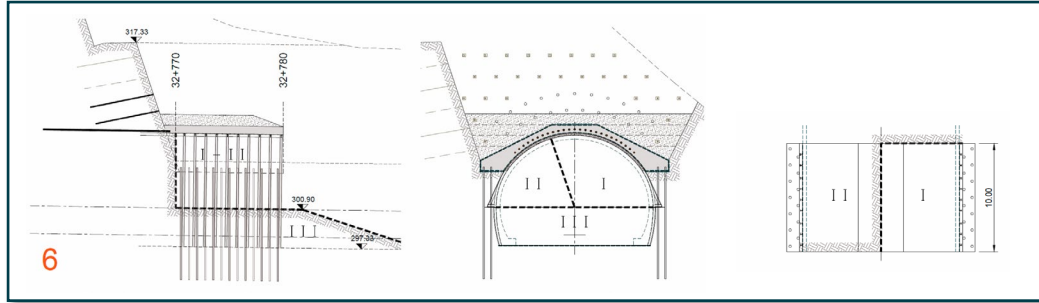
# Phases de la méthode Carinthia



# Phases de la méthode Carinthia



# Phases de la méthode Carinthia





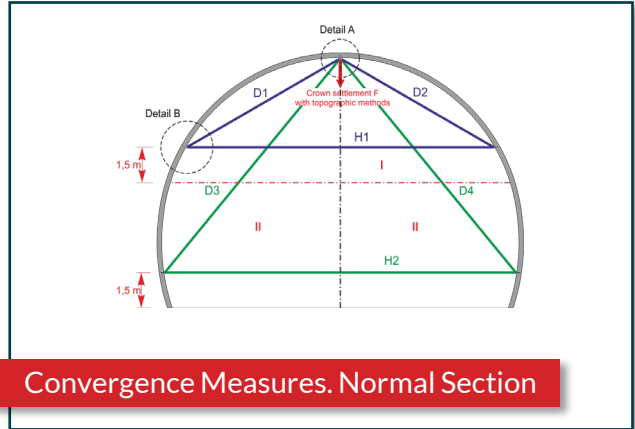
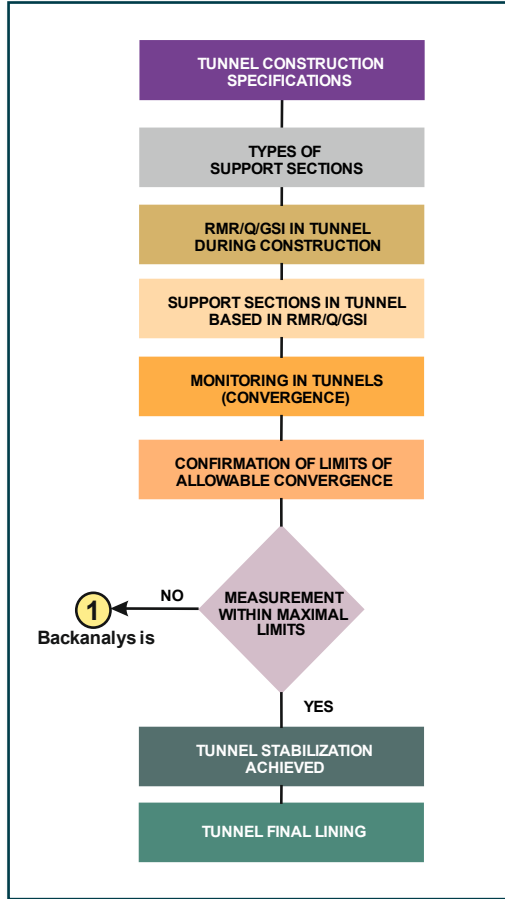


Phase 3

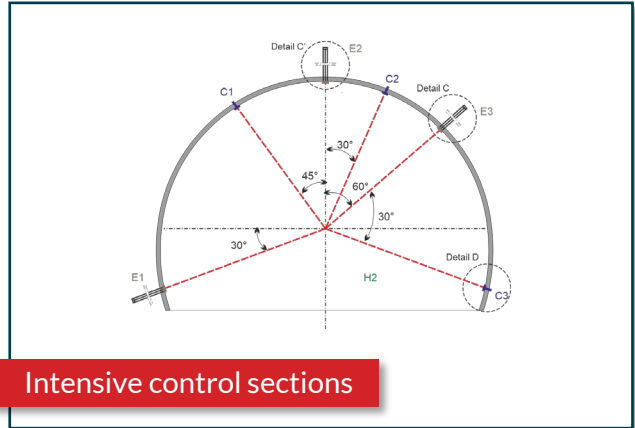
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**Control d'ingenierie  
pendant la construction**

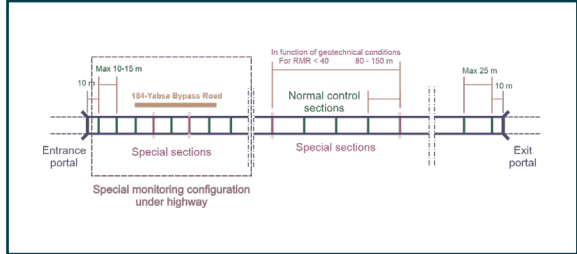
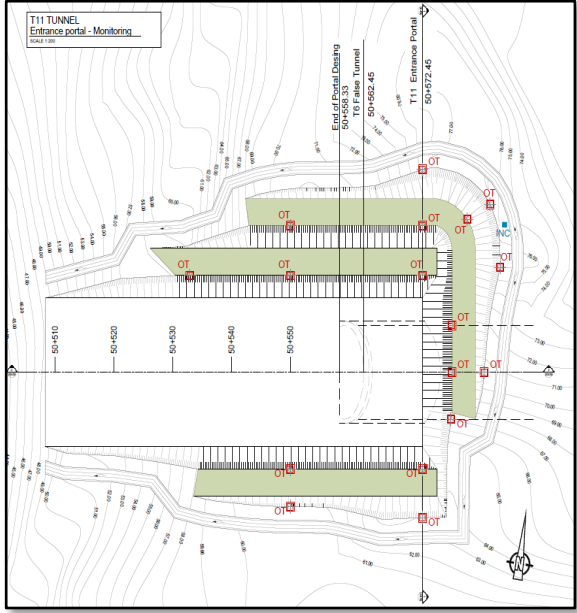




Convergence Measures. Normal Section



Intensive control sections



# Tunnel T11 sous l'autoroute

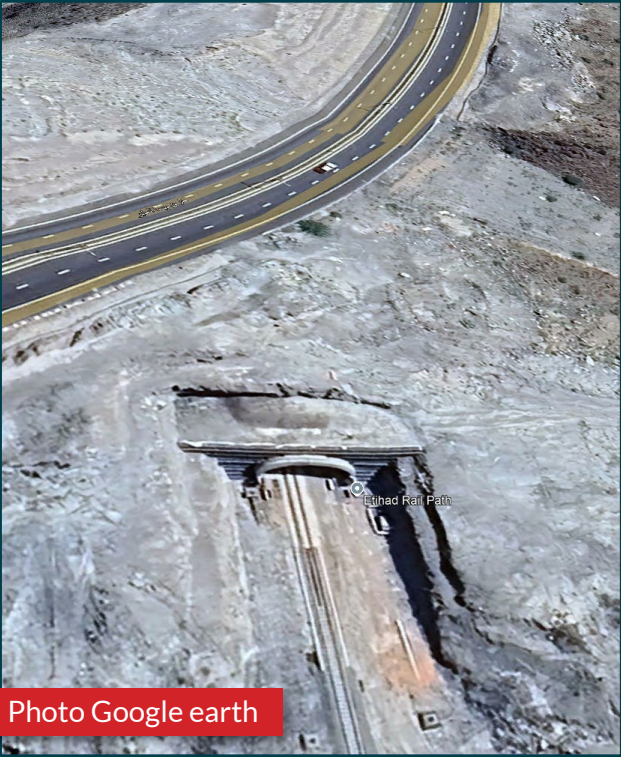
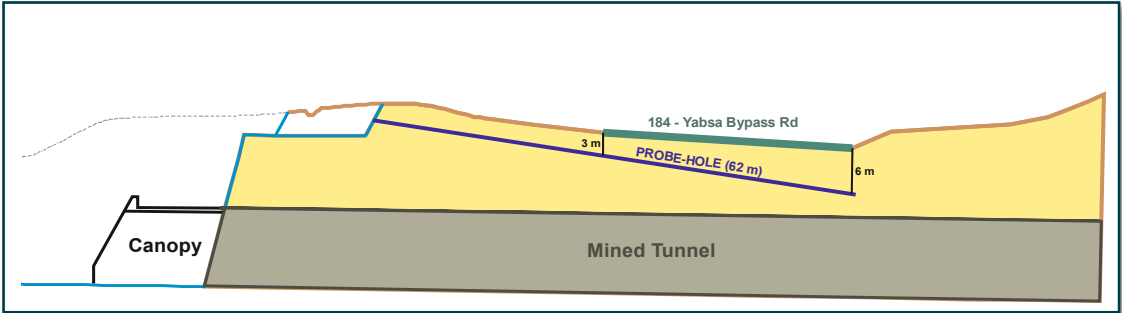
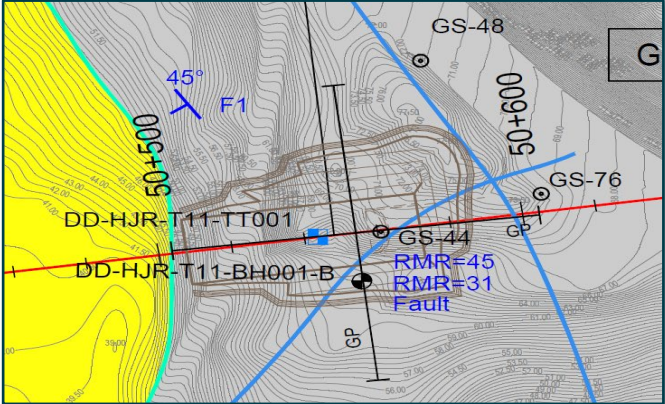
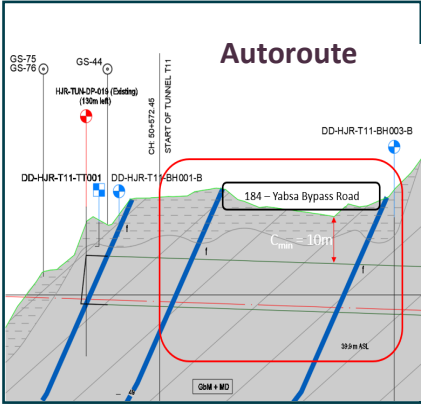
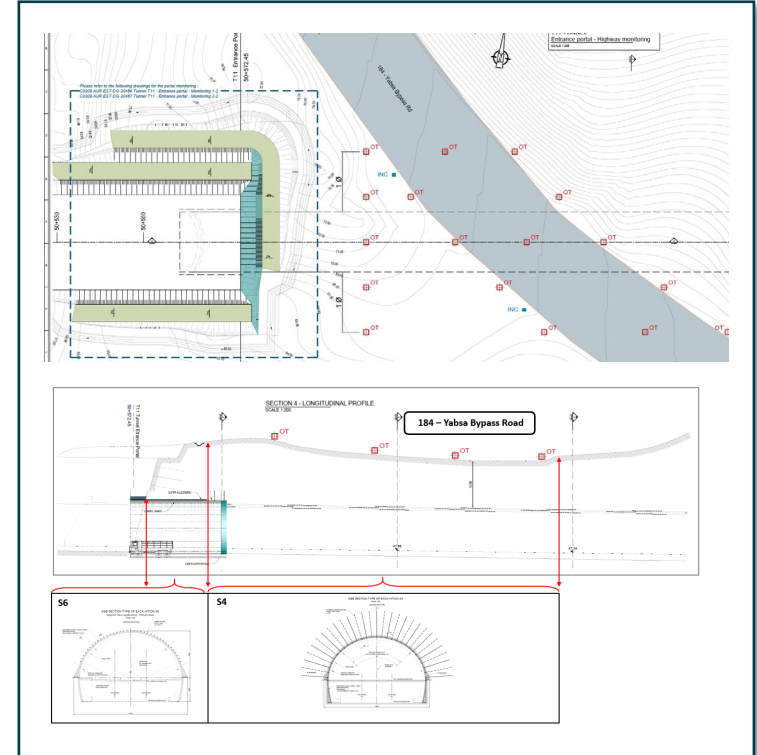
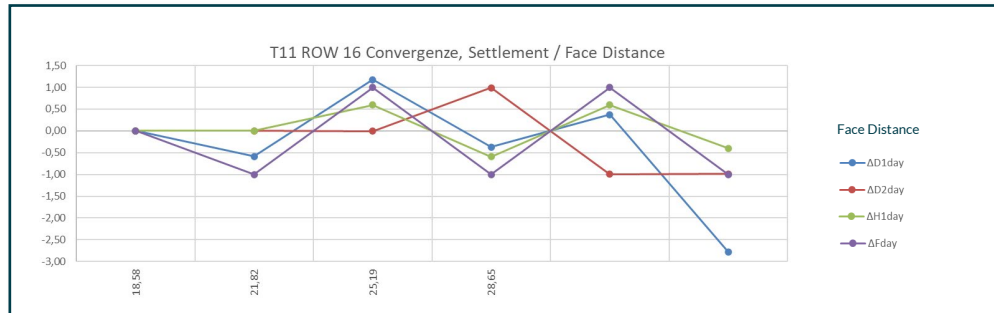


Photo Google earth



# Tunnel T11 sous l'autoroute



# Tunnel T11 sous l'autoroute

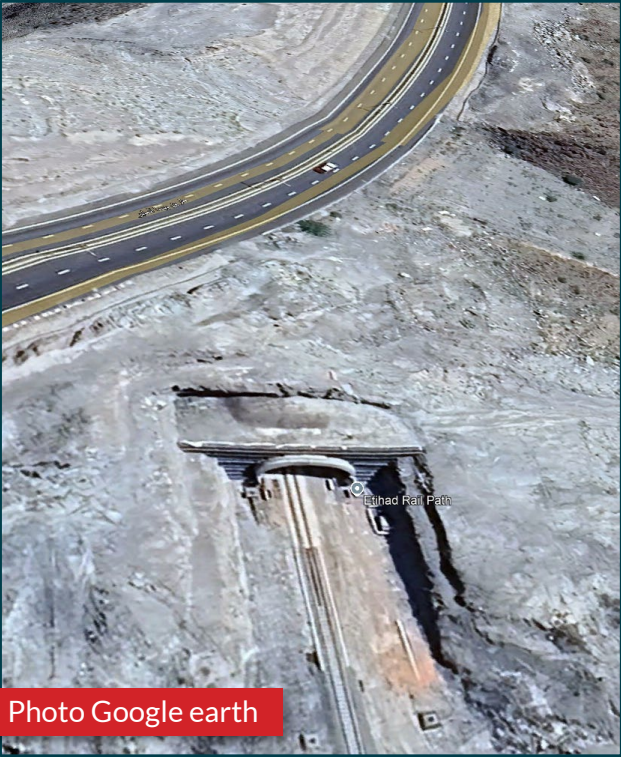
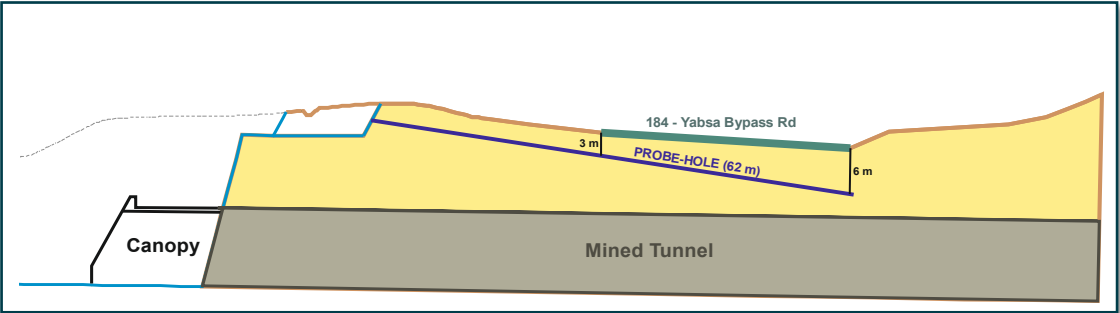
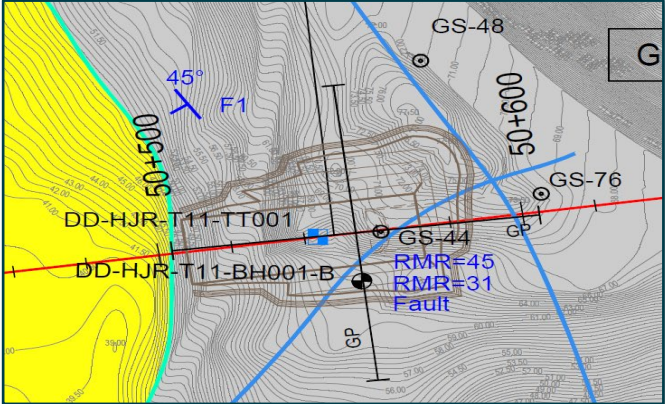
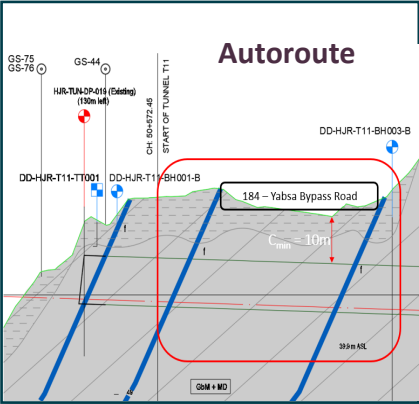


Photo Google earth



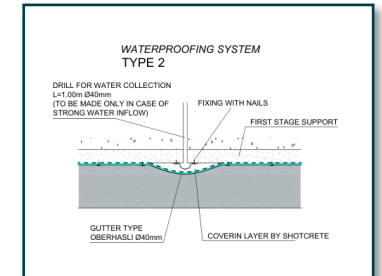
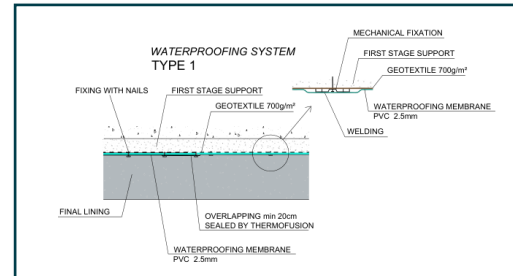
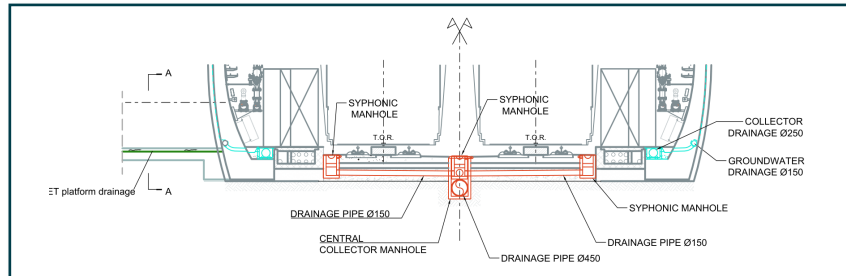
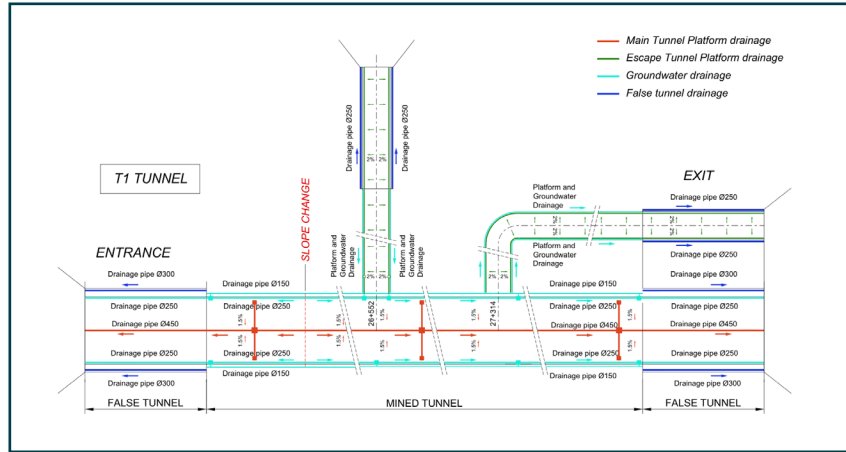


Phase 4

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**Drainage, Revêtement  
et finalisation**

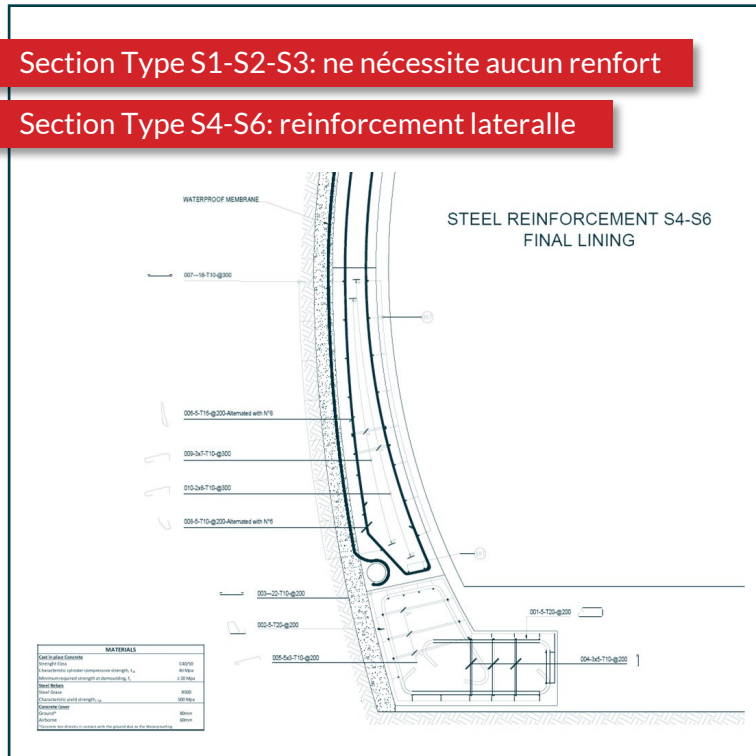
# Drainage



# Revêtement définitif

Section Type S1-S2-S3: ne nécessite aucun renfort

Section Type S4-S6: renforcement lateralle



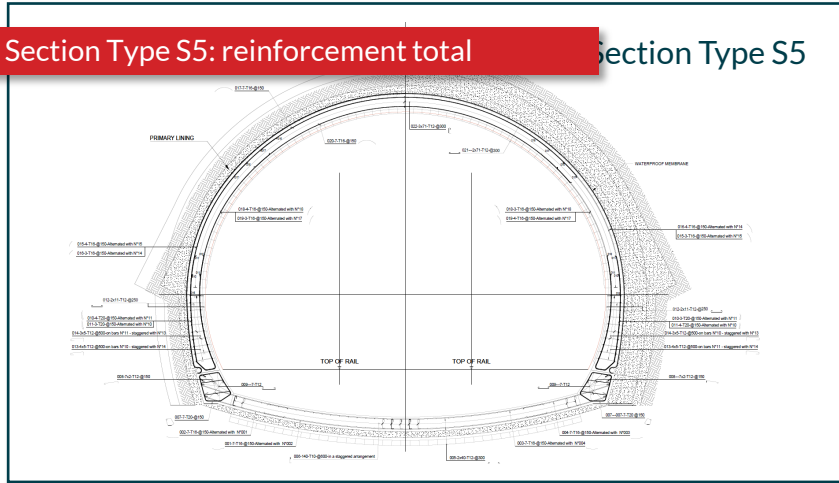
## ACTIONS À CONSIDÉRER :

- Poids propre du tunnel (SW) - action permanente G
- Équipement de ligne aérienne (OHLE) – action variable Q
- Ventilateurs (VF) - action permanente G
- Services électromécaniques (S&E) – action permanente G
- Voie sur dalle et autre superstructure inversée (ST) – action permanente G
- Charge du train (EM360) - action variable Q
- Charge de roche (R) - action permanente G
- Retrait (SH) – précontrainte P
- Charge sismique (S) - action accidentelle A
- Explosion (EX) - action accidentelle A
- Déraillement (DE) - action accidentelle A
- Drain bouché (CD) - action accidentelle A
- Charge de feu (spalling) - action accidentelle A

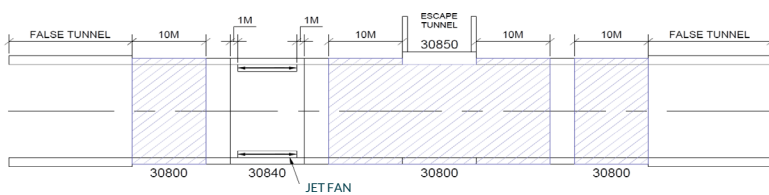
# Revêtement définitif

Section Type S5: reinforcement total

Section Type S5



Mandatory use of Full Section Steel Reinforcement in hatched stretches







Détachement de blocs en calotte



Tassement « Terramesh » en raison de fortes pluies



SYSTRA



LA CONFIANCE TRANSPORTE LE MONDE