05 Tunnel construction management

Construction management (CPM) - is the overall planning, coordination, and control of a project from **beginning** to **completion**.

STUDIO LEGALE PADOVAN

Common law e civil law: una premessa necessaria (segue)

- Il common law è il sistema giuridico tipico dei Paesi anglosassoni e si contraddistingue per il valore quasi normativo dei precedenti giurisprudenziali. Nel civil law, prevalente nell'Europa continentale ed affermatosi grazie anche all'influenza del codice civile napoleonico, la maggiore parte delle norme è stabilita da codici e leggi scritte e i precedenti giurisprudenziali non hanno valore normativo.
- Il divario tra *common* e *civil law* va gradualmente attenuandosi. Da un lato è in atto una tendenza nei Paesi di *civil law* a conferire maggiore importanza ai precedenti giurisprudenziali, mentre, dall'altro lato, negli Stati Uniti e nel Regno Unito un numero sempre crescente di materie è disciplinato da norme scritte (rispettivamente attraverso *federal statutes* e norme di origine comunitaria). La distinzione è comunque ancora estremamente importante nell'universo dei contratti internazionali.

In Italia

Legge 20 marzo 1865, n. 2248 (allegato F) Legge sulle opere pubbliche

Regio Decreto 25 maggio 1895, n. 350 Regolamento per la direzione, contabilità e collaudazione dei lavori dello Stato *abrogato dal <u>d.P.R. n. 554</u> del 1999.*







DESIGN is a plan or drawing produced to show the look and function or workings of a building, garment, or other object before it is made (Oxford dictionary)

So drawings, calculations, bills, tender documents technical standards, surveying and all document required to transform an idea in a real object



Different approach and roles

- DDC Detail Design consultant
- The Engineer
- Assistance for construction
- Tunnel design and construction is an ongoing project
- Designer is involved also during construction process

In any case a quality manual or a procedure manual is needed

Quality is a simple activity:

- Write what you do
- Dowhat you write

Quality manual is a simple mode to describe how to do the job. Has to be simple.

Costrution management activity during years replacement are expected

The game's players

Contractor

Designer

Sub Contractor Specialized supplier

Owner or Employer (Government, Concessionarire)

(Indipendent ?) Engineer

DDC Detail Design consultant

Employer Indian Railway

Concession company IRCON

Contractor

Designer and Detail design Consultant

Date _____ 24.02.2017 About the dush of material etchainge 32 + 146 on the nigh nice the mythem of DDC ere the following I step ; out the bolts and the drainge put pipes for further inichin es' put pipes for dreinge too intection pipes. shotcute with fiber further sho tarete if needed 3 fell with shotcrete es maximum is ponte 4 Inject from the pipe lower a mix of count and water or clust, water and band to fill the conty come out from the upper price 5 alleen growt come out from the upper price use this frite for further innection 6 Remove debus at fece bottom and of needed replace shatcret at fece

DDC	sund	estion
	Jugg	031011

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		PAGE NO.			
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2.	loading & charging	6:15	7130	1.25	and the
3.	Blast	7:30	7:45	.25	
4.	Vetung	7:45	8:15	. 5.	
51	Mucking	8:15	10:15	-20	
6.	Scalig.	10:15	11:15	1.0	
7.	U/c chipping	11:15	00:15	1.0	
8.	Sealing Sustante	00:15	13:00	.75	3.5-3
9.	Sumer	13:00	13:15	125	
10	L. On fing	13.15	14:30	1.25	14-E 81.0m
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-					
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Ungold (AFCONS)					
TROW					

Time cycle register



Design for contractor

-SIMPLE -CHEAP -FAST -SAFE -ACCORDING WITH TOOLS AND EXPERIENCE OF THE COMPANY -ACCORDING WITH THE LOCATION AND DISPOSABLE MATERIALS



Detail design for contractor cannot be done before



Detail design for contractor cannot be done before



Contractor want cheap and fast





Contractor want cheap and fast

Safe and fast too?

The contractor want the cheapest solution ... We can support but always looking at risk Our duty is not allow that the minimum level of quality will trespassed



Contractor want cheap and fast







Misunderstanding to be avoided with any system: not all people can read properly a drawing







NEVER FORGET : THE RESULT OF ENGINEERING WORK IS NOT DESIGN IS THE CONSTRUCTION









Engineer organization chart



Engineer team IN TENDER



Engineer team ON SITE



Engineer team ON SITE



4 lots
32 tunnels
3 Tunnel inspectors
40 faces
Day –Night shift
7/7 works
EPC contract

Check QA/QC system of contractor

Document control



Document control is a key question: every job a new unexplorate land

Chenani Nashri 12.000 documents Bar Boljare 32 tunnel about 40 faces

Traceability : Doc in Doc out

Format and codes: the f****g file name 20171124 05 DL tunnel Works 2018 MSRDC 893 Request for replacement denied Check list



Drawing format

A1 format why ?



Deliverable list (not matter if prepared by you or by someone else) Documents code

JOB CODE	COMPA NY CODE	TYPEO F DOC	GENERAL CODE	PHASE CODE	NUMBER	REVISION
3089	GDECEG	RPT /DWG	GA	IR	001	Α

PHASE CODE		
INCEPTION REPORT	IR	
ALIGNMENT REPORT	AR	
FEASIBILY REPORT	FS	
LA AND CLEARANCE	CL	
DETAILED PROJECT REPORT	DPR	
TECHNICAL SCHEDULES	SCH	

Documents code

GENERAL CODE	
CONTENT	GENERAL CODE
A - GENERAL	GA
B - ALIGNMENT	GA
B1 - ROADWAY TYPICAL SECTIONS	GA
B2 - TUNNEL TYPICAL SECTIONS	GA
C - GEOLOGY, HYDROGEOLOGY,	GE
HYDROLOGY, GEOTEHCNICS &	
GEOMECHANICS	
D - ROAD WORKS	RO
E - TUNNEL WORKS	TL
E.4 TUNNEL MONITORING	MO
F - BRIDGE WORKS	BR
G - BUILDINGS	BL
H - SIGNALLING AND ROAD FURNISHING	SI
I - DUMP AREAS	DU
L – GENERAL HYDRAULIC ARRANGEMENT	HY
M – MEP TUNNEL WORKS	ТМЕР
N- MEP ROAD WORKS	RMEP

Documents code

REVISION				
FIRST EMISSION	Α			
REVISED EMISSIONS	B, C, D			
FIRST APPROVED REVISION	0(ZERO)			
FURTHER REVISIONS	1,2,3			

Documents code



Documents code : ONE CODE ONE DOCUMENT

Hard copies and softcopies

Cloud MANAGEMENT Excel file with hyperlink



Am i sure that i am using the last version of the document?

Documents code : ONE CODE ONE DOCUMENT

Hard copies and softcopies

Cloud MANAGEMENT Excel file with hyperlink



Am i sure that i am using the last version of the document?

Activities of the engineer

1. Site visit

2. Material approval

3. Quality :NCN - NCR

4. Design approval

5. Method statements approval

6. Contractor direction

7. Meetings

8. Payments status

9. Diary

10. Time Schedule

11. Claim management
1.Site visit

- Request for inspection
- Holding point
- Witness point
- Random visits
 - Site visit report

Activities of the engineer 2, Material approval

RFA Documents Samples



Activities of the engineer 2, Material approval

<u>20160211 MAR 058 -</u> <u>Approved.pdf</u>

Activities of the engineer 3, Quality :NCN – NCR

NCN not conformity notice NCR not conformity report Cause of NC has to be removed Contractor is needed to have is own QA QC system = internal NCN NCR ?????

Quality control is the



INGEROP Inventing for tomorrow	Sup or Section	ervision of Des 1 the Bar – Bolj 2n Smokovac –	sign and Works are Highway, Uvač – Mateševo			DATA
	NONCON	FORMITY	NOTICE	NCN	No.42	
To: CRBC	NONCON	FORMITY	NOTICE	Date:	29 October 20	15
				Page	/1/1	
Location of the Defect:	Part 4. Section portal	on 13 betwee	en Paikov Vir tunr	nel north p	ortal and Jabuc	ki Krs south
Works Affected:	Slope protec	Slope protection on left side north portal of Pajkov Vir tunnel				
Type of Defect	Works perfo Design	Works performed without approval of MS for Portal open cut and approved Main Design				
Non Conformity Importa	High:	x	Medium:		Low:	
Description of the Defect: On site closed to North port shotcreting with dry proced On site there are no marks s	al of Tunnel Pajkov V ure machine. showing expropriation	ir slope protec corridor, aligi	ction is ongoing w	vith installa	tion of wire me	sh and
This works are performed in	n permanent final slop	e without setti	ng out grade rails	i.		
The works are performed w protection.	ithout any approval of	[°] MS, Technica	al Specifications a	and Main de	esign for the slo	ope
Supporting documents:						

	Name and Surname	Position	Signature
Engineer Representative	Angelo Villa	Tunnel resident Engineer	Stillo
Contractor Representative			Venn

Note 1: This NCN has been released in two copies. One copy is handed to Contractor and has to be recorded in the Contractor's Daily Site Diary.

Note 2: The Contractor must release the correspondent Non Conformity Report with the proposed action for correction.

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Quality control is the key to ensure proper check of the works NCN NCR

RB	NON Co	ONFORMITY REPORT štaj o neusaglašenosti	NCR 132 Date/Datum: 08.09.2016 Page 1 of 2 Strana1 od 2
Contractor/ Izvođač: Chin	a Road and Bridge Corpora	tion	
Refering to no. of NCN/	Refering to NCN (Non-Cor	nformity Notice) No.132	
U skladu sa OON :	U skladu sa IN (Izveštaj o i	neusaglašenosti) br.132	
Part of the structure/	Part 2		
Dio gradilista:	Section 2;south portal of	tunnel Vjeternik;construction site / Se	ekcija 2;juzni portal tunela
lype of Works/	Lack of safety paths for w	orkers at construction site south portal	of tunnel Vjeternik. / Nedostatak
Evaluation of defect	/ Procena štete	ine na gradnistu juzni portai tunela vjet	CTINK.
Lack of safety paths for we alternative paths. / Ned koriste ove staze.	orkers at construction site v ostatak bezbjendih staza za	vhich jeopardize the health and safety o radnike na gradilistu koji ugrozavaju zo	of workers who use these dravlje i sigurnost radnika koji
Estimated causes and pre	ventive actions / Procena u	uzroka i preventivne mere	and a second second second second
injurys.For preventive acti Procijenjeni uzrok je da ra mi smo zatvorili sve altern	ion we closed the alternativ dnici koristeci ove alternati ativne staze i sagradili step	e paths and we have built stairs and fe vne staze izlazu sebe riziku tezih ili man enice i ogradili ih zastitnom ogradom n	nced the area around it. / jih povreda.Za preventivnu mjeru ninimalne visine 1m.
A) Correcti	ve action carried out	B) Corrective	action proposal
Sproved	lene korektivne mere	Predlog ko	rektivne mere
Engineer comments / Komentari inženjera:			
Persons in charge /	Issued (CRBC) /	Approved (CRBC) /	Approved (Engineer) /
Osoba čije je zaduženje	Izdao (CRBC)	Odobrio (CRBC)	Odobrio (Inženjer)
Name and Position / Ime i pozicija			
Date / datum	1		
Signature / Potpis			
Description of corrective	action carried out / Opis spr	rovedene korektivne mere	
At the construction site so minimum height 1m to fa alternative paths. / Na minimalne visne 1m da bi alternativnih staza.	outh portal of tunnel Vjeter cilitated the movment of w gradilistu juzni portal tunela olaksali kretanje radnika i s	nik we have built staris and fence them orkers and to prevent possible injurys t v Vjeternik mi smo izgradili stepenice i sprijecili moguce povrede koji mogu na	with protective fence of hat may be result from use of ogradili ih sa zastitnom ogradom stati kao rezultat koristenja
Persons in charge / Osoba čije je zaduženje	Issued (CRBC) / Izdao (CRBC)	Closed (CRBC) / Zatvorio (CRBC)	Closed (Engineer) / Zatvorio (Inženjer)
Name and Position / Ime I pozicija	Hu Xin, HSE manager	Wang Hongbo Project Mapager	TUMANT R.S
Date / datum		1.10	2168/2010
Signature / Potpis	- Clarify	R	X
			1 de la

GEODATA

LEIGHTON

TUNNEL PRIMARY SUPPORT SYSTEM

TUNNEL	TUNNEL METER	ROUND NUMBER	BLAST LENTGH
Main South	2318.00	1108	1.00 mbr

SECTION A: DETERMINATION OF SUPPORT CLASS (SC)

SECTION A1: TO BE FILLED BY GEOLOGIST

ROCK MASS CLASS:	01		DATE: 09/10/2013
RMR	GSI	OVERBURDEN	NAME: Manaj Kymar
50	50-60	+ 6 co w mtr	SIGN: Balan
COMMENTS O	1	a mar I all Cand stress	a contrict stores a filtatones

Rocka man composed of Sand stone same itstones sittetones

Recommended support class BL (AS Per RELY Design

SECTION A2: TO BE FILLED BY TUNNEL MANAGER

SUPPORT CLASS :	B1+				DATE: 9 10 2013
SHOTCRETE	LG	SWELLEX	IBO	BLAST LENGTH	NAME: 4. BASTIS
$12m^3 + 12m^3$	1 (3bars/32-25)	8nos 5-m long	4nos 9-m long	1.50 m	SIGN:

Stress relief holes every 20cm, alternatively ream to 89mm and blast the 51mm with double cordex 40gr/m.

SECTION B: COMMENTS ON DETERMINED SC BEFORE INSTALLATION

SECTION B1: TO BE FILLED BY GEODATA

DATE 5-10 6015
NAME: Angelo Villa SIGN:
N
DATE: 09.10. 2013
NAME: Drives Shresthe

NAME:	DIVING	Shres
SIGN:	£	mal

DATE:

GN

0-

9/10/2013

11007-OPR-FM-015M(1)

NAME U-BASTIS

SECTION B3: TO BE FILLED BY TUNNEL MANAGER

afety shotcrete at the excavation perimeter and face 6m ³ and 6m ³ on the previous round. Install LG B-	DATE:	9/10/20	513
lass at 1.50m with 8nos Swellex 5-m long on the LG. Fibre shotcrete 20cm to fully embend the LG. Install	NAME	Konstantinos	Bastis
nos IBO 9-m long on the right side between LGs. Stress relief holes on the right crown, blast for a pair of	SIGN:	G -	-

SECTION C: CERTIFICATION OF AS BUILT DETAILS OF SC IN SITU

SECTION C1: TO BE FILLED BY GEODATA

		DATE: 3
Conect	Jupports	NAME:
Creation,		SIGN:

SECTION C2: TO BE FILLED BY TUNNEL MANAGER

completed



Tunnel Primary Support System

TPSS

RESS

Request Excavation Support System

CLIENT:		PROJE	CT:			RESS	
KONKAN RAILWAY CORPOR	ATION LIMITED	Constru Tunnel	uction of balance Tunneling works of T1 -(from 30+000 to 33+160 approx.)		Sheet No: 07		
(A Government of India Undertaking) Or Max Jun			Katra Dhara , in J & K.	im Sec	tion of USBR Link	Date: 19/05/2015	
REQUIRED EXCAVATION &		FET	TUNNEL:			T1 P2	
REGULED EXCAVATION &	Sorr old on	Face Chaina		age:		33+038.00	
			Distance fro	om Por	tal (m):	122.00	
			SUPPORT	CLAS	S:	C1	
			RMR CLAS	SS:		111	
and a strength			GSI:			30-40	
and the second	the second		Overburder	n Heiat	nt:	65-75 m	
1.			Round Len	ath:		1.5-2.5m	
14			Full Face-H	leading	-Benchina:	Full Face	
			Prevalent I	lazard	, containing:	Wedge instability	
			Rockmass	Behav	ior:	Development of Plastic zone	
1			Probe Hole	s (Typ	e/Nos/Length)	Not Requried	
	1		Drainage H	loles:		Not Required	
1			Grouting H	oles:		Not Required	
			Reference	Drawin	ıg:	3040-T1-TFD-E-015 E-007, E-008, E-009	
Element					Support Elemen	nts	
General		De	escription		Fu	II Face	
Supporting Wedge/boulders		Y/N			Requried		
Lattice Girder Spacing			М		Not	requried	
Temporary invert (incl. sprayed concrete)			Y/N-mm			No	
Support of Tunnel Face		D	escription		Fu	II Face	
Shotcrete		mm		Not	requried		
Rock Bolts		Type/Nos/Length		Not	requried		
Wire Mesh		Туре		Not	requried		
Support of Tunnel Arch		Description		Fu	Il Face		
Wire mesh first layer (extrados)		Туре		Not required			
Vire mesh second layer (intrados)		Туре		150x150x6			
Lattice Girder		Туре		Not	Not requried		
Snotcréte Deck helte		mm		150mm			
Rock Dolls		Туре	e/Nos/Length		25mm SN/G	and (1.5+1.5)/4m	
			Type/Nos/Length		Not		
Prepared by:	Reviewed	by:		Appr	oved by:	CORPORATION LIMITED	
Name:	Name	EQL	AIA	Nor	(A Government	of India Undertaking)	
Day of Torit	ivame:			Name	5.		
Sign: Rakethlellus	Sign:			Sign:			
Date: n Arla . I -	Data			Deter			
20/0/2015	Date.			Date:			

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TUNNEL: MAIN	TUNNEL: MAIN LOCATION: CHAINAGE : EXCAVATION NORTH PORTAL 10+439.50m			ENGTH / TUNNEL METER M) : 21.50 M	TH / TUNNEL METER MAPPING SHEET NO.: 08		
DESCRIPTION OF SPE & JS3 with random join	CIAL GEOLOGICAL	FEATURES (FAULT	S/SHEAR ZONES	FRACTURED ZONES/CAN	/ITIES etc.): T	here are three mai	n joint sets JS1, JS2
DISCONTINUTIES / JOINT SETS	DIP & DIP DIRECTION	APERTURE (mm)	ROUGHNESS	PERSISTANCE CONTINUITY (cm)	SPACING (mm)	FILLING TYPE/ THICKNESS	DEGREE OF WEATHERING
J51	30º/ 170°-175°	<0.1 - 5	Slightly rough to	300 - 1500	600 ->2000	Silt & clay	Fresh to Slightly
J32	80"/ 290"	<0.1 - 1	Rough	100 - 300	600 - 2000	Silt & clay	Fresh
J53	65* - 80* / 330* - 350*	0.1 - 2	Slightly rough to	100 - 1000	200 - 600	Silt & clay	Fresh to Slightly
Random joints	75" - 80" /080" - 090"	1	filebile sauch to				weathered
	70%20*	<0.1 - 2	rough	100 - 300	100 - 600	Silt & clay	Fresh to Slightly weathered
SHAPE OF JOINTED B	ODIES/ PARTICLES	: Rockmass is interloc	ked with blocks a	nd slabbs. Blocks size are			
upto 20X25X30 cm ³ to 6	0X50X70 cm ³ and slal	bs 70x10x300 cm3				ILATION OF ROC	KMASS :
					Disconti	nuities closed	
PEMARIO - Unor	of the face is used	ada hardanala katatat	developing a	bleske (20045-100 te	Discontinuit	es partially open	Y I
average). Lower face co	rsists of massive sand	dstones.	developing small	DIDCKS (20X15X10 IN	Discontinui	ties mostly open	
				DEGREE		NG •	
WATER ENCOUNTERE	DURING EXCAYA	HON / GROUND WA	TER :	DEGREE	-		
AMOUNT :	*			SW		HW	
CONDITION : Face is dr	y.			MW		RS	
REMARKS: Face is dry.	SS. NONE			REMARKS			
BEHAVIOR OF ROO	K MASS DURING	SHAPE / LOCATION	AND CAUSES	OF OVERBREAK : Geolog	ical over break	has occurred on the	he crown (central
STABLE	TION :	crown and right crow	 along the bedd 	ing plane. It is occurred due	to intersection	different joint sets	across the bedding
AFTER BREAKING							
FRIABLE							
SQUEEZING							
LOOSE							
GENERAL REMARKS : Roo	kmass is Friable. It is co	mposed of fresh to slightly	weathered strontg	DETAILS OF ROCK / SOIL			
Sandstones and Sitstones or	n the top face and crown.			SAMPLING: None			
					Sample of Silts	tone is taken for phy	sical inspection.
				PHOTOGRAPHIC RECORDS:	FACE	CROWN	\checkmark
ROCK CLASS ACCORDING	TO THE SPECIFICATIO	N : B1			LEFT WALL	RIGHT WALL	
	NTRACTORS PER		0011050			1000	
	CONTRACTOR OF P.		CONCES	SIONAIRE'S REP.		IE'S REP	
cc							
alung	A	there	SIGNATURE :			stelle	947
Blury I	A	rkera		hr	SIGNATURE	empt Sin	25

I1007 - CHENANI-NASHRI TUNNEL PROJECT ENGINEERING GEOLOGICAL MAPPING - DATA SHEET

Leighton Contractors (India) Pvt. Ltd.

LEIGHTON



48

Transportation				
I1007 - C	HENANI-NASHRI	TUNNEL PROJECT		
	ROCK MASS RATI	NG SYSTEM		
		EXCAVATION LENGTH IN .	DATEMINE OL Z 2 ALC	
INNEL: ESCAPE LOCATION : N. PORTAL CHAINAGE :	5915.0	EACAVATION CENTING 3293	2-0 210:30	
JCK DESCRIPTION :				
see ist page for description.				
STRENGTH OF INTACT ROCK MATERIAL ROCK QUA	ALITY DESIGNATION (RQD)	CONDITION O	FDISCONTINUITY	
Uniaxial Point-Load strength		PERSISTANCE (CONTINUITY) JS	50 JS1 JS2 JS3	
strength (Mpa) index (Mpa)				
Excellent Qua	ity no second	Very Low < 1m		
tremely Strong >250 >10 Societien das	90-100 %	Low 1-3m		
ry Strong 100-250 4-10 Good quality	C CC1 90 %	Medium 3-10m		
or 50-100 2-4 Fair Quality 6	D) 10.75 %	High 10-20m		
	¥25-50 %	Very High >20m		
Bak 5-25 <1 Very poor qua	lty < 25 %	RATING : 5		
ry Weak 1-5 RATING :	13	SEPARATION (APERTURE)		
RIRE AND DIP ORIENTATIONS		Very tight joints None	21/1/1/	
DIP ANGLE DIP DIRECTION	STRIKE	Tight joints <0.1mm		
0		Moderately open joints 0.1-1mm		
1		Open joints 1-5mm		
2		Very wide aperture >5mm		
condary Joints		3		
TING: FOUR (-J)				
Main Joints JS0 JS1 JS2	153	ROUGHNESS (State alsó if surfaces are ste	pped, undulating or planar)	
rv wide > 2m		Very rough surfaces		
de 06-2m 1	1	Rough Surfaces	1 1 1 1	
ederate 200-600mm	V	Slightly rough surfaces		
250 60-200mm		smooth surfaces		
ry close < 60mm		Slickensided surfaces		
ITING: 10		RATING : 4		
IC WATER WOL		FILLING / TECTONIC BRECCIA/GOUGE		
Wear this of burnel langth (these burn dat		Tom las day a		
- her tour or more shifter for example		There alty any		
ATER PRESSURE (KPA)		v v —		
		Uniaxial compressive strength (Mpa)		
or Seopage >				
REPAR CONDITIONS (completely dry, damp, wet, dipping or flowing		SIDES OF DISCONTUINITIES		
ser rowimedium or high pressure)			/ / / /	
TING: 4		Chabile weathered		
ROCK MASS CLASS ROCK MASS RATING		Medaratak weathered		
I Very Good et 100		Liable weathered		
Il Good at so		Checomposed		
III Far 41.60		RATING: 6		
IV Poor 21-40				
V Very Poor 0-20		ROCK MASS RATING		
		ROCK MASS CLASS :		
CONTRACTOR	co	NCESSIONAIRE (ITNL/CNTL)	APPROVED BY IE	
0	SIGNATURE		SIGNATURE	
X	1	1. Jane		
PPED BY CHECKED BY	NAME :	When	NAME	
TE DATE DATE DATE				
		/	I1007-OPR-FM-015C (1)	









Quality control is the key to ensure proper check of the works NCN NCR



4, Design approval

- Design criteria
- Standards
- Cronology of approval
- Not any works allowed without approved design

Activities of the engineer 5, Method statements approval

MS = how contractor perform the works according with his know how, wormanship, skills, equipments, working culture

5, Method statements for tunnel

- 1. MS for site clearance and site installation
- 2. MS for portal construction (included slope excavation)
- 3. MS for open cut of tunnel
- 4. MS for cut & cover of tunnel
- 5. MS for excavation and primary support of tunnel (including face mapping in tunnel)
- 6. MS for drainage and waterproofing of tunnel
- 7. MS for inner lining of tunnel
- 8. MS for monitoring and measurement of tunnel
- 9. MS for survey of tunnel (alignment control in tunnel).
- 10. MS for electrical and mechanical installation
- 11.MS for pavement
- 12.MS for signalization and finishing

Activities of the engineer <u>Method</u> statements example

6. Contractor direction

Engineer can direct contractor

Direction can be written or verbal In case of verbal is duty of contractor send to Engineer the direction in written form

Engineer cannot modify time and Price of the contract without previous consent of the Employer

6. Cor Engineer of Direction of In case of Engineer t



Engineer cannot modify time and Price of the contract without previous consent of the Employer

6. NOT TAKE ROLE AND Engine RESPONSABILTY OF **Directi THE CONTRACTOR** In case AND OF THE CONTRACTOR Engine contra DESIGNER Employer

7. Meetings

Build a common Language

- Weekly
- Fornightly
- Monthly

- <u>FOURN</u> EXAMPLE



Activities of the

7. Meetings

The Mom(minute of meeting be

MOM action Signature Silence agreement Prepared on time

- MOM example

Lesending for funerrais	Section Smokovac - Uvač - M	Section Smokovac - Uvač - Mateševo		
Minutes of/Zapisnik sa Tu Meeting/Sastanka No. 16	unel Progress Me	eting		
Held on Održava na	Start time Vrijeme početk	14h	Finish time Vrijeme završetka	
Location/Lokacija: Eucl	NOP'S CALLO			

INCEDOD

Supervision of Design and Works

GEODATA

Eugeneer	s ca	tup		
ATTEND	ANCE S	SHEET	/ Prisutnost	Stranica

Crt.	Name and Surname Ime i prezime	Company Društvo	Position in Company / Pozicija održan u društvu	Phone No. / Br. Telefona	Signature Potpis
1	IVAN MEDAK	16	APT. Eng.	063010038	la
2	CHEYS ALEYANDIZEL	ICO	PETULARY	069367879	lal
3	ALEJJO LOCCHI	16	TUNNEL INSP.	063327436	Alu
4	NIKSA ORLANDIC	16			th
5	OBREN MARINOVIC	16	Thursd Hype,	120 618 633	mapf
6	LARAR SHOLOVIC	PMY	CILIC	069188123	Kuits
7	Nixola Caponović	PMU	Geoton. inc.	069188124	1. Cola
8	Tim Balang	CRBC	EM	057 111 522	Tim Bailing
9	In Yours chan	CRRT	Tunnel engla	668111	In xine chin
10	Xing Tao	CRBC	Engineer	069111661	mptin
11	MILO MUHADIOUCE	SCAMAS	COORDINATION	069 153 345	lable
12	MUNDUR KUNUGAPOA	BETTAX	UHHerber	067 092 181	Atrygt
13	CIPEALOIC YLKTKO	CEBC	CE	069111076	July
14	zhongquary yi	CRAC	pm	06811502	the
15	Shap Xulei	CRBC	EM	069111677	Palls
16	Liu Xiao Wa	CRBC	EM	obnino 14	it
17	Zhao Zifeng	CRBC	DSZ	069111722	5x347
18	MARKO KOTUR	CRBC	PRAM	069/111-043	Mynetag
19	SHANG ZHERN	CRAC-1	Eny: weet	strungo	izzere
20	Zhang Cmanger	CRRC-1	Tryineer	089111178	Gerard.
21	PANIC DUJAN .:	IE	GASEENCE	069 327 104	1A
22	PEDANE BYRAMIMIN	General Di	2A TUNRI.	007633 958	Arionghy
n	VAGO Noval'Oui	IG	wdeageological	06-9-239-633	Barahl 4

8 Payments status

 Lump sum contract
 Measurement contract (or measure and value)

8 Payments status

 IPS Interim payment Status
 IPC Certificate

Main Element	Works Element	Method of Measurement for
		Payment
Tunnels	Portal	For Tunnels with 4 portal, the
		payment will be 20% on the
		opening of each portal and 5%
		when the tunnel is complete
		For Tunnels with 2 portal, the
		payment will be 40% on the
		opening of each portal and 10%
		when the tunnel is complete
	Excavation and construction of preliminary	Payment in Limestone the length
	lining	of work is 75 metres 100%
	Construction of waterproofing and drainage	complete
	Construction of secondary lining	Payment in Flysch the length of
		work is 40 metres, 100% complete
	Tunnel Equipment	Per tube 45%, (of the total price
		for the equipment for the tunnel),
		when the tunnel equipment is
		installed and the remaining 5%
		when the equipment is
		commissioned

Interim Payment Certificate

IPC <u>cover</u> IPC <u>summary</u> IPC <u>NCN status</u>

9 Diary and reports

A daily diary is needed . By the contractor mandatory By the engineer useful. Daily Weekly Monthly report

Diary contents:

- Manpower on site
- Equipment
- Activities performed
- Visit on site
- Wheater conditions
- Any other circumstance that influence the Works
- Per day
- Per shift
- Per location
- Per activity

Diary

and the second sec					
IZVOĐAČ RADOVA LCRBC	INVESTITOR MINISTARSTVO	GRAĐEVINSKI DNEVNIK			
OBJEKAT AUTOPUT BAY - DOLARE	Pokovstva i Sabbracaja	UUBUI			
CONTRACT IN A MATERIA	The second se	DANPONED. DATUM 11.05.2015.4.			
MJESTO SHOKOVAC - Wac - MALEJE VO					
RADNO VRIJEME Smjen	a Grad. Zenari Tehn. On Ukemma Mehanizacija	Temperatura Vrijeme			
1 smjena od do ukupno casova	men zana. exch. tali okogini	(sunčano, oblačno, kiša)			
Il smjena od do časova		UCasC (bezina vjetra)			
III smjena od do ukupno časovaIII-	S.P. LEWIS MARK MARKEN MARK	UeasC" (nivo podzemails voda) 7			
OPIS RADA	. An an an an an	PRIMJEDBE			
NA ONOVU: - Ugovora o pre	siektovanju i izgradnija	utoputa BAR-Boliare			
dionica Smokover- Unac -+	latesevo br. 01- 827/1	od 26.02.2015. godine;			
- Ugovara o pratania konsu	Itautorich usluga za 1	adzor had izradow projection			
dokumentacije i izvođenjem	radova na izgraduji aut	operta ber-Boliare diourica			
Smokovac - Uyaz-Matesevi	0 for 01 - 4683/2 od 11.0	7. 2014 godine;			
- Zakony ouredeniu prostora	1 IZGRADUL OBJEKATA (SR.)	ist cg: br 51/08; 40/10; 34/11: 49,11;			
35/13; 39/13; 33/14)	it the second of the	the second s			
- Pisma Juze nera bro	x51 od pa. 05. 2015.99	dene, and and all			
- Sagla SHOST, VLade V	la levodenje pripremu	114 radoug br 08-16 2003 0213			
+ Zapi suika sa sastavan	la ad 07 do 10 Haya 2015	br 1244 od 10.05.2015.90d.			
US In Sty Und Tori	a order an lot	pripretty h radava			
U Stojstuk Nadeory	by organia the prese	Taut - Laws II			
Mesenje 15/0166/JL of 11.05, 2015. godine) Uvodin Jeuragea radova 4					
posao na Jevodenia	propresentin readuce	a na alonicalia			
- 5 (od kun 0+00 do ku	1 64460,21M1	0 Km 9+445.35 do Km 11493.05.			
- 1 (00 KM 6+ 900,21 M 8	10 KM/+490, 05 m/ 1 0 1				
That a drive Prento	PIPERN'S D IMPUDVANUE	IRDROKADE DISQUE ZO FOR			
VODE DNEVNIK	C RUKOVODILAC RADOVA	ADZORNI ORGAN:			
Pripromnah Radora (15/0166	5/1L od 1205.2015) K20 1	KOPIje LICENCI			
illipring ling (1 az	- 20Kal, 1 ha az - 20/01-	2 al 23 de 1009 godike			
INT NOVENOG LICA (Dr. 03	- 100/1 1 97.03-2700/2	MP			
- NASTAUAK X	JA stubal stran	- ++			

Execution Record Card

10 Time schedule Gantt Diagram (1917) Milestones Intermediate targets



10 Time schedule


10 <u>Time</u> schedule

Tazk Name	Duration	Start	Finish	2015	2016	2017	2018
r-Boljare Highway Section Smocovac-Uvac-Matesevo	1461 days	Mon 5/11/15	Fri 5/10/19	14151617181910111121112	131415161718191101111	2112131415161718191101111	
mmencement date	1 day	Mon 5/11/15	Mon 5/11/15	5/11 I 5/11			1
10000 Preparation of the project	278 days	Tue 5/12/15	Sat 2/13/16	ýý			
20000 Part 1 construction of main part of the project	1135 days	Sun 1/10/16	Sun 2/17/19			-	
121000 Construction of Bridges	884 days	Sun 1/10/16	Wed 12/12/18				
122000Construction of Tunnels	820 days	Mon 2/1/16	Mon 4/30/18				
122010Construction of SUKA	465 days	Fri 4/1/16	Sun 9/17/17		Ψ.		
122020Construction of VEZESNIK 1	655 days	Fri 4/1/16	Mon 4/30/18		P	1	
122030Construction of VEZESNIK 2	633 days	Fri 4/1/16	Tue 4/3/18		₽		
122040Construction of MRKE	538 days	Mon 2/1/16	Tue 10/10/17				1 1
123000 K0+000 ~ K11+487 Subgrade construction	802 days	Mon 2/1/16	Sat 9/29/18				
124000 K0+000 ~ K11+487 Construction of pavement structure	280 days	Thu 1/4/18	Fri 12/7/18				÷
125000 Traffic signalization and equipment	150 days	Fri 8/24/18	Sun 2/17/19				
126000 Construction of infrastructure	707 days	Sat 8/20/16	Wed 12/12/18	1 1			V
130000 Part 2 construction of main part of the project	1152 days	Fri 11/20/15	Mon 1/14/19				
131000 Construction of Bridges	874 days	Tue 4/5/16	Sun 8/26/18	1.1	ψ		
132000 Construction of Tunnels	1079 days	Fri 11/20/15	Fri 11/2/18				
132050Construction of KLOPOT	652 days	Thu 2/4/16	Thu 3/1/18	i gi			
132060Construction of VILAC	703 days	Thu 2/4/16	Thu 5/3/18				
132070Construction of VJETERNIK	930 days	Fri 11/20/15	Fri 11/2/18			1. 1	
133000 K11+487 * K22+744 Subgrade construction	837 dava	Sun 1/10/16	Wed 10/24/18			<u> </u>	
134000Construction of interchange	657 davs	Tue 4/19/16	Sun 2/4/18				
135000Construction of overpass	453 days	Fri 4/22/16	Tue 7/18/17	1			1
136000 K11+487 ~ K22+744 Construction of pavement structure	250 days	Thu 12/28/17	Thu 11/1/18				~ ~ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
137000 Traffic signalization and equipment	265 days	Sun 3/4/18	Wed 1/9/19				
138000 Construction of infrastructure	307 days	Mon 1/1/18	Mon 1/14/19				ý
140000 Part 3 construction of main part of the project	1162 days	Fri 11/20/15	Thu 1/24/19			1	
141000 Construction of Bridges	600 days	Fri 4/1/16	Fri 8/3/18				
142000 Construction of Tunnels	1076 days	Fri 11/20/15	Tue 10/30/18		· ·		
142080 Construction of MEKI KES	782 days	Fri 3/11/16	Thu 9/27/18				
142090Construction of URILOVAC	742 days	Pri 4/1/16	Thu 9/6/18	1 1	·	1	
142100Construction of KOSMAN	SS4 days	Fri 11/20/15	Tue 10/30/18	أسنعه	·		
142110Construction of MALATRAVA	781 days	Fri 3/11/16	Wed 9/26/18	- 1 - 1	G		
143000 E22+744 ~ E31+800 Subgrade construction	700 days	Bri 4/1/16	Map 11/19/18			+	
144000 Construction of Interchange	637 days	Sun 4/3/16	Set 12/30/17		ů.		. · · ·
145000 K22+744 " K31+800 Construction of pavement structure	193 days	Sat 4/7/18	Wed 11/7/18		•		
146000 Traffic signalization and equipment	240 days	Sat 4/7/18	Thu 1/3/19				
147000 Construction of infrastructure	548 days	Wed 4/5/17	Thu 1/24/19	11		÷	
150000 Part 4 construction of main part of the project	1144 days	Fri 11/20/15	Sun 1/6/19				÷
151000 Construction of Bridges	663 days	Fri 4/1/16	Tue 10/9/18		V	1	
152000 Construction of Tunnels	1045 days	Fri 11/20/15	Sat 9/29/18				
152120Construction of CESTOGAZ	242 days	Mon 9/25/17	Wed 7/25/18				
152130Construction of VITANOVICE	634 days	Fri 4/1/16	Ted 5/9/18		Q		
152140Construction of BRATOJEVICIKI POTOK	206 days	Sat 11/18/17	Ted 8/8/18				
152150Construction of ZECKA	704 days	Fri 4/1/16	Sat 7/28/18		2		
152160Construction of PATKOV VIR	422 days	Sat 4/8/17	Mon 8/27/18		353		
152170Construction of JABUCKI KRS	672 days	Fri 11/20/15	Tue 2/27/18	السنسي ا			
152180Construction of PRESLO	455 days	Thu 4/6/17	Sat 9/29/18	• 11		-	
152190Construction of MATESEVO	S21 days	Sat 4/2/16	Thu 11/30/17				•
152000 F21+900 * F40+971 Subgrade construction	762 dame	Dri 4/1/10	Cat 0/20/10				
154000 Construction of WATESEVO interchanges	260 dame	Pri 4/1/16	Man 6/19/17		-	:	
185000 Fotoson * Figer 1 Construction of names -	309 days	Man 4/1/16	Non 6/19/17	1.1	•	1	
130000 AS1-800 A40-8/1 Construction of pavement structure	204 days	Non 4/2/18	wed 11/14/18				
156000 Traffic signalization and equipment	245 days	Mon 4/2/18	Sun 1/6/19	1 8			
157000 Construction of infrastructure	725 days	Sat 8/13/16	Sun 12/30/18	11			
160000 Completion of project	101 days	Thu 12/13/18	Fri 5/10/19				

7-38

	KINGEROP Lustaring for Insuer	56	Supervision of Design and Works on the Bar – Boljare Highway, Section Smokovac – Uvač – Mateševo				
	Podgorica, 12 Sep	tember 2016	To: CRBC Montenegro Branch Nova Dalmatinska BB, 81000 Podgorica, Montenegro Atri, Mr. Wang Honghe, Besiert Manager				
			Cc: Mor Bul	teput D.o.o Revolucije br. 9. 81000 Podgori	ca. Montenegro		
			Attn. Mr. Goran Vujović - Director of PMU Ministry of Transport and Maritime Affairs				
	Our Pof :	10/2182/41	, Attn	. Ms Ljudinka Ivanović			
	<u>Contract</u> :	Supervision Section Smo	of Design and V okovac - Uvač - N	Vorks on the Bar - Boljare Hig Mateševo	hway,		
		Nadzor nad Dionica Sm	projektovanjem okovac - Uvač - 1	i izgradnjom autoputa Bar- B Mateševo	oljare,		
	Subject:	CRBC Plan	for use of Boon	ners. Request for Clarification			
		Plan CRBC	-a za upotrebu b	umera. Zahtjev za pojašnjenje			
	References:	CRBC letter Submission	r No. RB-BBH/1 of the Plan of Be	732/EM dated 03 September 20 pomer using	016		
	Poštovani Gospodine,	tavljanj	C-a br. RB-BBH e Plana upotrebe	/ 1732/EM od 3.9.2016. godine e bumera			
e	Primili smo vaš dopis br. 1732 u vezi upotre bumera.	be		Poštovani Gospodine,			
ct	Spisak bumera i njihove lokacije nijesu u sklad sa informacijama navedenim u nedavi	lu er No. 1 no	732 about the use	 Primili smo vaš dopis br. 1' bumera. 	732 u vezi upotrebe		
E	usvojenom Programu radova, verzija 5. U poglavlju 7 RASPORED IZGRADN. Programa radova navodi se pod naslovo	the loc E i the r m Version	alization conflict ecently accepted 5.	Spisak bumera i njihove lokacije nijesu u skla sa informacijama navedenim u nedav usvojenom Programu radova, verzija 5.			
n	"Revidirane metode za ubrzanje napretka u okvi vremena predviđenog za završetak radova obimna upotreba moderne opreme kao što bumeri.	ru FRUCTI ": "Revis su massiv iers.	ON SCHEDULE ion Method for e use of modern	U poglavlju 7 RASPOI Programa radova navodi "Revidirane metode za ubrzan vremena predviđenog za	RED IZGRADNJE se pod naslovom nje napretka u okviru završetak radova":		
3 n	Ukupni broj bumera koji je do sada prijavljen 13 pri čemu je najveći broj čela koja	je se		obimna upotreba moderne opreme kao što s bumeri.			
	istovremeno izvode (shodno Programu radov približno dvadeset.	a) mers no iber of	w informed is 13 faces ongoing in	Ukupni broj bumera koji je do sada prijavljen j 13 pri čemu je najveći broj čela koja s			
y y	Molimo vas da pojasnite svrhu ovog "Plana upotrebu bumera" jer je jasno da isti ima uticaj s	za is appro: na	ximately twenty.	istovremeno izvode (shodno približno dvadeset.	Programu radova)		
	prethodno usvojeni Plan radova. using" as it clear accepted.	of this : inpacts on t	"Plan of Boomer the IP previously	Molimo vas da pojasnite sv upotrebu bumera" jer je jasno prethodno usvojeni Plan rado	rhu ovog "Plana za o da isti ima uticaj na va.		
	Vours faithfully			101 253			

Dear Sir,

We take note of your letter No. 1732 about the u of boomers.

The list of boomers and the localization confli with the information in the recently accepted Implementation Plan (IP). Version 5.

In Chapter 7 THE CONSTRUCTION SCHEDUL of the IP is stated in "Revision Method f expediting the progress": massive use of mode equipment's such as boomers.

The total number of boomers now informed is when the maximum number of faces ongoing same moment (as per IP) is approximately twenty

Please clarify the purpose of this "Plan of Boom using" as it clearly impacts on the IP previous accepted.

Jan Lorange Team Leader

Dear Sir,

We take note of your letter No. 1732 about the use of boomers.

The list of boomers and the localization conflict with the information in the recently accepted Implementation Plan (IP). Version 5.

In Chapter 7 THE CONSTRUCTION SCHEDULE of the IP is stated in "Revision Method for expediting the progress": massive use of modern equipment's such as boomers.

The total number of boomers now informed is 13 when the maximum number of faces ongoing in same moment (as per IP) is approximately twenty.

Please clarify the purpose of this "Plan of Boomer using" as it clearly impacts on the IP previously accepted.





OPTION 1: SEPARATE EXCAVATION OF MAIN TUNNEL AND EXCAPE TUNNEL



OPTION 1: SEPARATE EXCAVATION OF MAIN TUNNEL AND EXCAPE TUNNEL

OPTION 2: CREATION OF ADDITIONAL EXACAVTION FACES THROUGH CROSS PASSAGES



2 SHIFTS x 10 HOURS change at portal



3 SHIFTS x 8 HOURS change at tunnel face

CHEMIN DE FER 3x8





Conclusion

The main scope of Project Management is to ensure that the Project will be completed :

- On time
- On cost
- Respecting the design
- With provided quality of materials

Conclusion

HEL

Project Management is NOT ONLY paper management

You need

- High knowledge of
 design and construction
- Flexibility
- Firmness
- Honesty (????)
- Hetic approach
- Cooperative skills
- Mutual respect
- Humility