

CERN FCC – COST & SCHEDULE UPDATE

# 8 SHAFT SCHEME

STM, FLL, DAW / 31.07.2023



## CONSTRUCTION COSTS – FIRST ESTIMATE CLASS 4 (-30%/+40%)

### Summary Cost Table (CDR cost estimate 2019)

Cost to compare  
With Tilos

Description	Structure Length	Excavation Volume	Total Direct Costs	COSTS PER M <sup>3</sup> (Direct Costs Only)	COSTS PER KM (Direct Costs Only)	Site Investigation	Preliminary design, approvals and tender documents	Project Changes/ Unforeseen Stoppages and Missed Items	Contractor's Profit	TOTAL COSTS	%	COSTS PER M <sup>3</sup>	COSTS PER KM
	km	m <sup>3</sup>	EUR	EUR/m <sup>3</sup>	EUR/km	EUR	EUR	EUR	EUR	EUR		EUR/m <sup>3</sup>	EUR/km
<b>TOTAL PROJECT COSTS</b>			4'564'710'643			91'294'213	456'471'064	91'294'213	136'941'319	5'340'711'452	100.0		
<b>UNDERGROUND</b>	134.49	6'898'97	3'994'134'543		29'698'155	79'882'691	399'413'454	79'882'691	119'824'036	4'673'137'415	87.5		34'746'841
Machine Tunnels	112.02	3'983'532	2'051'057'636		18'310'399	41'021'153	205'105'764	41'021'153	61'531'729	2'399'737'434	44.9		21'423'167
Injection caverns	0.08	18'010	9'102'827	505	113'785'337	182'057	910'283	182'057	273'085	10'650'308	0.2	591.4	133'128'845
Beam Dump caverns	0.10	13'731	5'805'885	423	58'058'849	116'118	580'588	116'118	174'177	6'792'885	0.1	494.7	67'928'853
Bypass Tunnels	8.37	310'493	157'675'298		18'838'148	3'153'506	15'767'530	3'153'506	4'730'259	184'480'098	3.5		22'040'633
Tunnels (service and personnel)	2.75	220'379	91'021'975		33'098'900	1'820'439	9'102'197	1'820'439	2'730'659	106'495'711	2.0		38'725'713
Shafts (service and personnel)	1.76	382'589	498'882'545	1'304	282'973'650	9'977'651	49'888'255	9'977'651	14'966'476	583'692'578	10.9		331'079'171
Caverns (services)	1.19	596'292	290'001'950	486	243'699'118	5'800'039	29'000'195	5'800'039	8'700'059	339'302'282	6.4	569.0	285'127'968
Junction caverns	1.90	379'969	187'669'969	494	98'773'668	3'753'399	18'766'997	3'753'399	5'630'099	219'573'863	4.1	577.9	115'565'191
Electrical Alcoves	1.65	68'920	38'644'113		23'420'675	772'882	3'864'411	772'882	1'159'323	45'213'612	0.8		27'402'189
<b>Experiments</b>													
Shafts	1.54	288'996	365'206'455	1'264	237'919'514	7'304'129	36'520'645	7'304'129	10'956'194	427'291'552	8.0		278'365'832
Caverns	0.26	403'330	183'615'558	455	695'513'478	3'672'311	18'361'556	3'672'311	5'508'467	214'830'203	4.0	532.6	813'750'769
Connection Tunnels	1.23	15'539	8'467'123		6'883'840	169'342	846'712	169'342	254'014	9'906'534	0.2		8'054'093
Survey shafts	2.926	0	0		0	0	0	0	0	0	0.0		0
Survey galleries	0.48	5'996	3'216'479		6'700'999	64'330	321'648	64'330	96'494	3'763'281	0.1		7'840'168
Klystron Gallery and Connections	0.572	17'713	9'039'528		15'803'370	180'791	903'953	180'791	271'186	10'576'248			
Construction Accesses	2.80	193'484	94'727'203		33'879'543	1'894'544	9'472'720	1'894'544	2'841'816	110'830'828	2.1		39'639'066
<b>SURFACE</b>			558'062'624			11'161'252	55'806'262	11'161'252	16'741'879	652'933'270	12.2		
Experimental sites			229'217'210			4'584'344	22'921'721	4'584'344	6'876'516	268'184'136	5.0		
Access sites			328'845'414			6'576'908	32'884'541	6'576'908	9'865'362	384'749'135	7.2		
<b>TEMPORARY WORKS</b>			12'513'476			250'270	1'251'348	250'270	375'404	14'640'767	0.3		

## CONSTRUCTION COST – FIRST ESTIMATE CLASS 4 (-30%/+40%)

### Total Direct Costs

- CDR 3'995 Mio. EUR
- 8 POINT FCC 4'027 Mio. EUR

### Delimitations

- Spoil management to the Installations site location at each shaft point
- All Machine Tunnel drives taken as Single Lining TBM drives
- Internal Steel structures, passive fire protection, Safety doors not included in Costs (approx. 161 Mio EUR)
- Costs do not include
  - » Site investigation (2%)
  - » Design, Site Supervision (10%)
  - » Unforeseen, Project changes (2%)
  - » Contractors Profit (3%)

## CONSTRUCTION COSTS – FIRST ESTIMATE CLASS 4 (-30%/+40%)

### Explanatory Notes

- Main changes of Volumes between CDR and 8 point FCC

Object	CDR		8 shaft	
Machine Tunnel	TBM Single lining:	67.0 km	TBM Single Lining:	<b>78.6 km</b>
	TBM with Inner lining:	8.0 km		
	TBM (Lake crossing):	6.4 km		
	Mined Tunnel GR:	12.9 km		
	<u>Mined Tunnel PR:</u>	<u>1.5 km</u>		
	<b>Sumup</b>	<b>95.7 km</b>		
Beam Transfer / Beam Dump Tunnel	Transfer Tunnel Ø 4 m	11.9 km	Transfer Tunnel Ø 4 m	4.7 km
	Beam Dump Tu Ø 4 m	4.2 km	Beam Dump Cavern Ø 13 m	0.6 km
Shafts	Experimental Shafts Ø 15 m	765 m	Experimental Shafts Ø 18 m	861m
	Exp 2 <sup>nd</sup> shaft Ø 10 m	765 m	Service Shaft oval 18.4/12 m	427m
	Service Shafts oval 18.4/12 m	451 m	Service Shafts Ø 12 m	1520m
	Service Shafts Ø 12 m	1568 m		
	<b>Sum</b>	<b>3549 m</b>	<b>Sum</b>	<b>2808 m</b>
	15 % in Moraine		15 % in Moraine	

## CONSTRUCTION COSTS – FIRST ESTIMATE CLASS 4 (-30%/+40%)

### Explanatory Notes

- Main changes of Volumes between CDR and 8 point FCC

Object	CDR		8 shaft	
Caverns (width/length)	Experimental Cavern 35/66	2	Experimental Cavern 35/66	2
	Experimental Cavern 25/66	2	Experimental Cavern 25/66	2
	Service Cavern 25/100	12	Service Cavern 25/100	3
			Service Cavern 25/60	2
			Service Cavern 25/60 H=19	2
Klystron	Clystron Gallery	162 m	Clystron Gallery	3200 m



## CONSTRUCTION COST – FIRST ESTIMATE CLASS 4 (-30%/+40%)

### Comparison of Quantities between CDR and 8 POINT FCC

Description	8-shaft Quantity	CDR Quantity
Molasse [m3] - Spoil	5'793'215	6'700'000
Moraine [m3] - Spoil	188'744	280'000
01 G. Treatment [m3]	55'921	76'169
02 Shotcrete [m3]	263'332	203'725
03 Rockbolts	532'476	637'485
05 D-Wall Concrete [m3]	42'964	54'065
06 Pre-Cast C. [m3]	451'635	639'146
07 Annulous Grout	160'000	242'861
08 Cast Insitu C.	1'148'932	417'895
09 Waterproofing	2'211'950	1'176'468
10 Invert Insitu C.	614'272	550'913

Description	8-shaft Quantity	CDR Quantity
11 Invert Precast C.	106'698	158'835
12 Filter Material	147'878	33'719
13 Dimple Sheet	447'011	514'767
14 Drainage Pipe	101'524	105'036
15 Internal Str. C.	43'550	69'024
16 Bar Reinforc.	234'890'337	118'530'380
17 Steel Fibre	7'719'276	9'538'470
18 Backfill Grout	117'961	62'584
19 Int. Str. Steelw.	17'281'644	21'479'990
20 Passive Prot.	877'317	1'079'072
21 Safety Door	403	474

Marked lines still under Q-Check!

# VIELEN DANK FÜR IHRE AUFMERKSAMKEIT!



Vorname Nachname  
Vorname.Nachname@ilf.com  
T +00 0000 00 00

[WWW.ILF.COM](http://WWW.ILF.COM)



**CONSTRUCTION COST – FIRST ESTIMATE CLASS 4 (-30%/+40%)**

**Summary Cost Table (CDR cost estimate 2019)**

Description	Structure Length	Total Direct Costs	Site Investigation	Preliminary design, approvals and tender documents	Project Changes/ Unforeseen Stoppages and Missed Items	Contractor's Profit	TOTAL COSTS	%	COSTS PER M <sup>3</sup>	COSTS PER KM	Differenz	CDR Summen	
												TOTAL COSTS	Structure Length
	km	EUR	EUR	EUR	EUR	EUR	EUR		EUR/m <sup>3</sup>	EUR/km		EUR	km
<b>TOTAL PROJECT COSTS</b>		4'346'086'545	86'921'731	434'608'655	86'921'731	130'382'596	5'256'672'286	100.0			-84'039'166 CHF	5'340'711'452	
											0 CHF		
<b>UNDERGROUND</b>	117.42	3'775'510'445	75'510'209	377'551'045	75'510'209	113'265'313	4'589'098'249	87.3		39'081'434	-84'039'166 CHF	4'673'137'415	134.49
											0 CHF		
<b>Machine Tunnels</b>	96.34	1'895'100'154	37'902'003	189'510'015	37'902'003	56'853'005	2'217'267'180	42.2		23'014'305	-182'470'254 CHF	2'399'737'434	112.02
<b>Injection caverns</b>	0.08	9'102'827	182'057	910'283	182'057	273'085	10'650'308	0.2	591.4	133'128'845	0 CHF	10'650'308	0.08
<b>Beam Dump caverns</b>	0.00	5'805'885	116'118	580'588	116'118	174'177	6'792'885	0.1	494.7	3'396'442'645	0 CHF	6'792'885	0.10
<b>Bypass Tunnels</b>	8.37	157'675'298	3'153'506	15'767'530	3'153'506	4'730'259	184'480'098	3.5		22'040'633	0 CHF	184'480'098	8.37
<b>Tunnels (service and personnel)</b>	2.75	91'021'975	1'820'439	9'102'197	1'820'439	2'730'659	106'495'711	2.0		38'725'713	0 CHF	106'495'711	2.75
<b>Shafts (service and personnel)</b>	1.95	452'616'052	9'052'321	45'261'605	9'052'321	13'578'482	529'560'781	10.1		271'569'631	-54'131'796 CHF	583'692'578	1.76
<b>Caverns (services)</b>	0.56	290'001'950	5'800'039	29'000'195	5'800'039	8'700'059	339'302'282	6.5	569.0	601'599'790	0 CHF	339'302'282	1.19
<b>Junction caverns</b>	1.90	187'669'969	3'753'399	18'766'997	3'753'399	5'630'099	219'573'863	4.2	577.9	115'565'191	0 CHF	219'573'863	1.90
<b>Electrical Alcoves</b>	1.65	38'644'113	772'882	3'864'411	772'882	1'159'323	45'213'612	0.9		27'402'189	0 CHF	45'213'612	1.65
<b>Experiments</b>											0 CHF		
<b>Shafts</b>	0.87	348'806'331	6'976'127	34'880'633	6'976'127	10'464'190	408'103'408	7.8		471'795'847	-19'188'144 CHF	427'291'552	1.54
<b>Caverns</b>	0.26	183'615'558	3'672'311	18'361'556	3'672'311	5'508'467	214'830'203	4.1	532.6	813'750'769	0 CHF	214'830'203	0.26
<b>Connection Tunnels</b>	1.23	8'467'123	169'342	846'712	169'342	254'014	9'906'534	0.2		8'054'093	0 CHF	9'906'534	1.23
<b>Survey shafts</b>	2.926	0	0	0	0	0	0	0.0		0	0 CHF	0	2.93
<b>Survey galleries</b>	0.48	3'216'479	64'330	321'648	64'330	96'494	3'763'281	0.1		7'840'168	0 CHF	3'763'281	0.48
<b>Klystron Gallery and Connections</b>	0.572	180'790'556	180'791	903'953	180'791	271'186	182'327'276				171'751'028 CHF	10'576'248	0.57
<b>Construction Accesses</b>	2.80	94'727'203	1'894'544	9'472'720	1'894'544	2'841'816	110'830'828	2.1		39'639'066	0 CHF	110'830'828	2.80
											0 CHF		
<b>SURFACE</b>		558'062'624	11'161'252	55'806'262	11'161'252	16'741'879	652'933'270	12.4			0 CHF	652'933'270	
<b>Experimental sites</b>		229'217'210	4'584'344	22'921'721	4'584'344	6'876'516	268'184'136	5.1			0 CHF	268'184'136	
<b>Access sites</b>		328'845'414	6'576'908	32'884'541	6'576'908	9'865'362	384'749'135	7.3			0 CHF	384'749'135	
											0 CHF		
<b>TEMPORARY WORKS</b>		12'513'476	250'270	1'251'348	250'270	375'404	14'640'767	0.3			0 CHF	14'640'767	



## 1. CONSTRUCTION COST – FIRST ESTIMATE CLASS 4 (-30%/+40%)

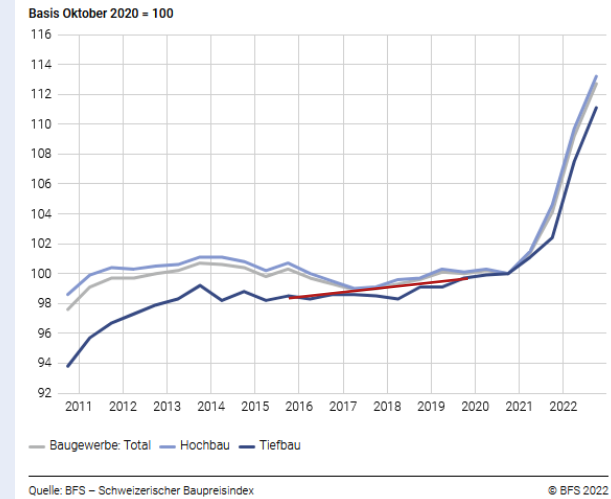
### First approach „updated Costs“ based on CDR Cost Estimate

Attempt to make a statement on price increases between 2019 (CDR) and end 2022:

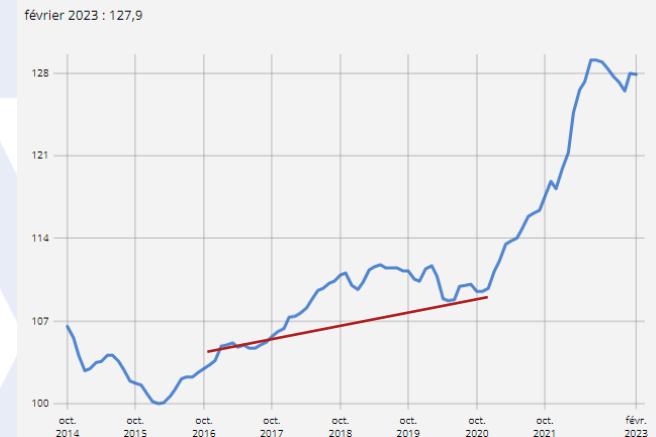
- French Index -> increase approx. 15 – 17%
- Swiss Index -> increase approx. 12 – 14 %
  
- Costs (direct costs, SI, Design) 5'260 mio. CHF
- Increase according average Index 15%  
790 mio. CHF

Entwicklung des Baupreisindex in der Schweiz

Entwicklung des Baupreisindex in der Schweiz



Index Travaux Publics - TP01 - Index général tous travaux - Base 2010



source : Voir l'onglet Documentation