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Review of Railway Rehabilitation in Central Asia

for Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan

**Module B - Feasibility Study of the rehabilitation
measures for the Balykchi – Kazakh Border
railway section (Kyrgyzstan)**

Annexes

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ANNEX I

COST ESTIMATES AND BILL OF QUANTITIES

Balikchi - Bishkek - Kazakh border section OPTION 1 - INFRASTRUCTURE BoQ							
N	Description	Unit	Quantity	Rate	Total National	Total International	NOTES
B. Materials							
1B	P65 rails 140,000 m	t	6 200	450,00		2 790 000	Corresponding to 48 km of single track line
2B	Concrete sleepers 100,000	unit	100 000	30,00	3 000 000		100,000 sleepers correspond to 55 km
3B	Fastenings for concrete sleepers	pairs	100 000	20,00		2 000 000	
4B	Ballast for rehabilitated sections	m ³	40 000	6,00	240 000		Corresponding to 22 km of single track line
5B	Additional ballast for existing sections	m ³	-	6,00	-		
6B	Sandy gravel on straight track sections	m ³	-	3,00	-		
7B	Blocks for level crossings	unit		50,00	-		
8B	Concrete pipes ϕ 1,5m	n	-	6 000,00	-		
9B	Switch crossing	unit	100	4 000,00		400 000	50 for R65 and 50 for R50
10B	Switch blades	pairs	100	15 600,00		1 560 000	50 for R65 and 50 for R50
11B	New switches complete (P65 tangent 1:11)						
12B	Rail Joints	each	4 100	25,00		102 500	
13B	Insulated rail joints	each	1 500	34,00		51 000	
14B	Tamping machine	unit	1	2 883 300,00		2 883 300	Includes accessories and spare parts. Base price:2,746,000+5% for wide gauge=2883300
15B	Profiler	unit	1	1 365 000,00		1 365 000	Includes accessories and spare parts. Base price:1,300,000+5% for wide gauge=1,365,000
16B	Gantry cranes	couple	1	735 000,00		735 000	Includes accessories and spare parts. Base price:700,000+5% for wide gauge=735,000
17B	Excavators equipped with a 1,5 m ³ bucket capacity for the ballast quarry operation.	each	2	500 000,00		1 000 000	

18B	Positioner	each	1	20 000,00		20 000	
19B	Avalanche shed	m	1 000	6 000,00	6 000 000		For line protection against land slides and rock falls danger are to be built in the Boomsak canyon stretch. Materials and manpower included.
20B	Sleeper factory	each	1	2 600 000,00		2 600 000	
	D			TOT MATERIALS	9 240 000,00	15 506 800,00	

Balikchi - Bishkek - Kazakh border section OPTION 2 - INFRASTRUCTURE BoQ							
N	Description	Unit	Quantity	Rate	Total National	Total International	NOTES
A. WORKS							
1A	Topographic survey of the line and corrections of the existing alignment and profile	km	94,0	3 500,00		329 000,00	From Kazakh border to Bishkek 2.
2A	Demolition of line	km	73,1	975,61	71 317		From Kazakh border to Bishkek 2 - 18.6km (already P65 and c.w.r.) turnouts excluded.
3A	Excavation	m ³	209 943,2	0,37	76 808,49		It includes the removal of about 0.6 m thick layer of top embankment material (ballast and sub-ballast), laying it on both sides of the embankment, profiling and compacting the top section of the embankment. (75400x2,85X90% + 75400X3,33X10%)
4A	Partial lateral rebuilding embankment section for 35 km, placing and compacting the removed top material for widening the top surface of about 1,0 m on both sides	m ³	161 000,0	0,49	78 536,59		It includes control and correction of 3.A material granulometry, if necessary, placing and compacting the removed top material for widening the top surface of about 1,0 m on both sides. In case the embankment is 1,0m high, it consists in removing 0,15m ³ /m and adding 1m ³ /m, in case the embankment is 2,0m high, it consists of removing
5A	Implementation of a layer of sandy gravel material, 0,2 m thick under sleepers (sub-ballast)	m ³	79 825,2	0,07	5 840,87		It includes spreading, compacting and profiling section of materials: 75400x1,08 (on straight).
6A	Construction of line	m	73 100,0	2,15	156 861,19		It includes installation of concrete sleepers, P65 rails, fastenings, spread of ballast, tamping and lift of rails up to 3 cm to final level
7A	Flash-butt or thermic weld of P65 rail	unit	5 080,0	4,00	20 320,00		75400x2/25 less 3 by the number of insulated joints
8A	Regulation of mechanical tension of long welded rails (l.w.r.)	km	146,2	300,00	43 860,00		It includes 1 thermic weld.
9A	Final tamping and leveling of line	km	73,1	316,41	23 129,91		
10A	Ballast cleaning on the other existing sections	km	-	116,62	-		
11A	Tamping, leveling and aligning the existing section with l.w.r.	km	18,6	316,41	5 885,31		18.6 km of the Lugovaya-Bishkek have already been rehabilitated
12A	Substitution of concrete pipes of 20 culverts	n	20,0	200,00	4 000,00		On average, each culvert is 12m long (embankment between 1 and 2m high).
13A	Excavation of ditches	m	15 000,0	0,50	7 500,00		15 km of line-1 ditch. Trapezoid ditch 0.5-0.5-0.5 has a volume of 0,5m ³ /m
14A	Pavement of level crossings	unit	24,0	100,00	2 400,00		Each level crossing envisages an area of 50m by 10m
15A	Repainting and adjusting km posts and some hm posts	unit	180,0	1,00	180,00		
16A	Replacing switch crossings	unit	100,0	41,72	4 171,95		50 P50 and 50 P65
17A	Replacing switch blades	unit	100,0	41,72	4 171,95		50 P50 and 50 P65

18A	Installation of new turnouts	each					
	A			Subtot Local Works	504 983,33		
	Seniority			15% A	75 747,50		
	Professional premium			40% A	201 993,33		
	B			Subtot Local Works	782 724,16		
	Social insurance			25% B	195 681,04		
	C			TOT LOCAL WORKS	978 405,20		
	International manpower	man-months	132,0	8 000,00		1 056 000,00	12 months duration of works per 11 experts
	Total international cost					1 385 000,00	
B. Materials							
1B	New P65 rails	t	6 225,7	450,00		2 801 565	73.1 km x2 - 25.21x2 (25.21 km of recovered P65 rails). Therefore only about 47.9 km of new rails are requested.
2B	Concrete sleepers 73,1 km	unit	141 229,2	30,00	4 236 876		154km (Bishkek-Lugovaya) - 60km (Kazak section) - 18,6km (already upgraded)=73,1 km (turnouts excluded). It includes 1,840 sleepers per km on straight, 2000 on curve with R<1200m. The recovered concrete sleepers are considered in the residual value. The total number includes 5% more for maintenance
3B	Fastenings for concrete sleepers	pairs	141 229,2	20,00		2 824 584	
4B	Ballast for rehabilitated sections	m³	138 670,7	6,00	832 024		1,77 m³/m on straight (95%); 1,9034 m³/m on curve (5%) (cantilever: 75 mm).
5B	Additional ballast for existing sections	m³	8 230,5	6,00	49 383		25% additional ballast on ballast cleaning operation
6B	Sandy gravel on straight track sections	m³	79 825,2	3,00	239 476		1,08 m³/m on straight; 1,2 m³/m on curve.
7B	Blocks for level crossings	unit	576,0	50,00	28 800		0,24 m3 each block. 24 blocks per L.C. Cement price 190,0 US\$/m3
8B	Concrete pipes φ 1,5m	n	20,0	6 000,00	120 000		
9B	Switch crossing	unit	100,0	4 000,00		400 000	50 P50 and 50 P65

10B	Switch blades	pairs	100,0	15 600,00		1 560 000	50 P50 and 50 P65
11B	Switch complete (small lg)	unit	3,0	52 000,00		156 000	Replacement of the existing P50 switches into Bishkek 2 station.
12B	Rail Joints	each	1 050,0	25,00		26 250	As insulated rail joints, by 4.
13B	Insulated rail joints	each	256,0	34,00		8 704	75400*2*2/1600 (on average 2 joints every 1600m of rail-block section average length) plus stations.
14B	Flash-butt welds of P65 rail	each	5 080	40,00		203 200	75400x2/25 less 3 by the number of insulated joints
15B	Avalanche shed for line protection against slides.	m	1 000,0	6 000,00	6 000 000		For line protection against land slides and rock falls danger are to be built in the Boomsk canyon stretch. Materials and manpower included.
16B	Tamping machine	unit	1	2 883 300,00		2 883 300	Includes accessories and spare parts. Base price:2.746,000+5% for wide gauge=2883300
17B	Profiler	unit	1	1 365 000,00		1 365 000	Includes accessories and spare parts. Base price:1,300,000+5% for wide gauge=1,365,000
18B	Gantry cranes	couple	1	735 000,00		735 000	Includes accessories and spare parts. Base price:700,000+5% for wide gauge=735,000
19B	Excavators equipped with a 1,5 m ³ bucket capacity	each	2	300 000,00		600 000	
20B	Positioner	each	1	20 000,00		20 000	
21B	Sleeper factory	each	1	2 600 000,00		2 600 000	
	D			TOT MATERIALS	7 269 682,80	238 154,00	purchased by Contractor
	D1			TOT MATERIALS	4 236 876	15 945 449	purchased by Railway Administration

Balikhchi - Bishkek - Kazakh border section OPTION 3 - INFRASTRUCTURE BoQ							
N	Description	Unit	Quantity	Rate	Total Local	Total International	NOTES
A. WORKS							
1A	Topographic survey of the line and corrections of the existing alignment and profile	km	262,00	3 500,00		917 000,00	From the Kazakh border to Balikhchi.
2A	Demolition of line	km	239,82	975,61	233 970,73		From the Kazakh border to Balikhchi except 18,6 km already rehabilitated and except total turnouts length.
3A	Excavation	m ³	694 039,08	0,37	253 916,74		It includes the removal of about 0.6 m thick layer of top embankment material (ballast and sub-ballast), laying it on both sides of the embankment, profiling and compacting the top section of the embankment. (243400x2,85X60% + 75400X3,33X40%)
4A	Partial rebuilding of embankment section, placing and compacting the removed top material for widening the top surface of about 1,0 m on both sides	m ³	230 000,00	0,49	112 195,12		It includes control and correction of material granulometry, if necessary (50000*2,35)
5A	Implementation of a layer of sandy gravel material, 0,2 m thick under sleepers (sub-ballast)	m ³	264 761,3	0,07	19 372,76		It includes spreading, compacting and profiling section of materials. 20% curved sections, 80% straight sections.
6A	Construction of line	m	239 820,00	2,15	514 616,28		It includes installation of concrete sleepers, P65 rails, fastenings, spread of ballast, tamping and lift of rails up to 3 cm to final level
7A	Flash-butt or thermic weld of P65 rail	unit	17 679,60	4,00	70 718,40		239000x2/25 less 3 by insulated joints, less 820, corresponding to 37 no welded curves with R<350m (9,0km).
8A	Regulation of mechanical tension of long welded rails (l.w.r.)	km	479,64	300,00	143 892,00		
9A	Final tamping and leveling of line	km	239,82	316,41	75 882,56		
10A	Ballast cleaning on the other existing sections	km	-	116,62	0,00		
11A	Tamping, leveling and aligning the existing section implemented 20 years ago with l.w.r.	km	18,60	316,41	5 885,31		18,6 km of the Lugovaya-Bishkek have already been rehabilitated
12A	Substitution of concrete pipes of 40 culverts	n	40,00	200,00	8 000,00		On average, each culvert is 12m long (embankment between 1 and 2m high).
13A	Excavation of ditches	m	50 000,00	0,50	25 000,00		50 km of line-2 ditches. Trapezoid ditch 0.5-0.5-0.5 has a volume of 0,5m ³ /m
14A	Pavement of level crossings	unit	52,00	100,00	5 200,00		Each level crossing envisages an area of 50m by 10m
15A	Repainting and adjusting km posts and some hm posts	unit	180,00	1,00	180,00		
16A	Replacing switch crossings	unit	100,00	41,72	4 171,95		50 P50 and 50 P65
17A	Replacing switch blades	unit	100,00	41,72	4 171,95		50 P50 and 50 P65

18A	Dismantling and installation of new turnouts	each	44,00	283,00	12 452,00		3 in Bishkek 2 and 41 on line between Bishkek 2 and Balikhchi.
	A			Subtot Local Works	1 595 058,62		
	Seniority			15% A	239 258,79		
	Professional premium			40% A	638 023,45		
	B			Subtot Local Works	2 472 340,87		
	Social insurance			25% B	618 085,22		
	C			TOT Local WORKS	3 090 426,08		
	International manpower	man-months	312,00	8 000,00		2 496 000,00	24 months duration of the works per 13 experts
	Total international cost					3 413 000,00	
B. Materials							
1B	P65 rails 219,5*1000x2 m	t	27 896,70	450,00		12 553 515,00	214.59km of old rails will be replaced (25.21 km of existing P65 will be ree-used).
2B	Concrete sleepers	unit	448 943,04	30,00		13 468 291,20	239.8 km of new sleepers (in curves 2000 sleepers per km).
3B	Fastenings for concrete sleepers	pairs	448 943,04	20,00		8 978 860,80	447856x2
4B	Ballast for rehabilitated sections	m³	454 219,08	6,00		2 725 314,48	1,77 m³/m on straight (80%); 1,9034 m³/m on curve (20%) (cantilever: 75 mm).
5B	Additional ballast for existing sections	m³	8 230,50	6,00		49 383,00	50% additional ballast on ballast cleaning operation
6B	Sandy gravel on straight track sections	m³	264 761,28	3,00		794 283,84	1,08 m³/m on straight; 1.2 m³/m on curve.
7B	Blocks for level crossings	unit	1 248,00	50,00		62 400,00	0,24 m3 each block. 24 blocks per L.C. Cement price 190,0 US\$/m3
8B	Concrete pipes φ 1,5m	n	40,00	6 000,00		240 000,00	
9B	Switch crossing	unit	100,00	4 000,00		400 000,00	

10B	Switch blades	pairs	100,00	15 600,00		1 560 000,00	
11B	Switch complete (small tg)	unit	44,0	52 000,00		2 288 000,00	Existing P50 switches into stations
12B	Rail Joints	each	2 828,00	25,00		70 700,00	As insulated rail joints, by 4 plus 820 corresponding to 37 not welded curves.
13B	Insulated rail joints	each	502,00	34,00		17 068,00	
14B	Thermic weld of P65 rail	each	17 680	40,00		707 184,00	
15B	Avalanche shed for line protection against slides.	m	2 000,0	6 000,00	12 000 000		
16B	Installation of gabions	m ³	10 000,00	60,00	600 000,00		For formation protection against river flood.
	D			TOT MATERIALS	16 471 381,32	2 754 952,00	purchased by Contractor
	D1			TOT MATERIALS	13 468 291,20	23 820 375,80	purchased by Railway Administration

ANNEX II

DETAILS OF MAINTENANCE COSTS

ANNEX V Details of maintenance costs				
Description	Unit	Unit Cost (US\$)	Quantity/km	
			Quantity/km	Amount (US\$/km)
Lifting Repair				
Labour	hour	1,28	5249,1	6 719
Light works	m of line	-	400	-
Equipment	hour	-	0,0	-
Rails R-65	tonne	450,00	13,0	5 850
Turnouts	each	52 000,00	0,0	-
Sleepers	each	30,00	368,0	11 040
Fastenings	couple	20,00	368,0	7 360
Ballast	m3	6,00	540,0	3 240
Sub-Ballast	m3	3,00	0,0	-
Earthworks	m3	4,00	30,0	120
Switch crossings	each	4 000,00	0,0	-
Switch blades	pair	15 600,00	0,0	-
Joints	each	25,00	1,0	25
Insulated joints	each	34,00	1,0	34
Pipe culverts Φ 1,5m	each 12 m	6 000,00	0,0	-
Sub tot with transport exp.	6%			36 451
Sub tot with railway expenses	9%			39 732
Taxes	20%			7 946
Risk coefficient	5%			2 384
Totals				50 062

ANNEX V Details of maintenance costs				
Description	Unit	Unit Cost (US\$)	Quantity/km	
			Quantity/km	Amount (US\$/km)
Medium Maintenance				
Labour	hour	1,28	9992,4	12 790
Equipment	hour	-	0	-
Rails R-65	tonne	450,00	39	17 550
Turnouts	each	52 000,00	0	-
Sleepers	each	30,00	736	22 080
Fastenings	couple	20,00	736	14 720
Ballast	m3	6,00	1080	6 480
Sub-Ballast	m3	3,00	33	100
Earthworks	m3	4,00	60	240
Switch crossings	each	4 000,00	0,5	2 000
Switch blades	pair	15 600,00	0,5	7 800
Joints	each	25,00	2	50
Insulated joints	each	34,00	1	34
Pipe culverts Φ 1,5m	each 12 m	6 000,00	0,05	300
Sub tot with transport exp.	6%			89 193
Sub tot with railway expenses	9%			97 220
Taxes	20%			19 444
Risk coefficient	5%			5 833
Totals				122 498

ANNEX V Details of maintenance costs				
Description	Unit	Unit Cost (US\$)	Quantity/km	
			Quantity/km	Amount (US\$/km)
Capital Maintenance				
Labour	hour	1,28	25959,0	33 228
Equipment	hour	-	0	-
Rails R-65	tonne	450,00	130	58 500
Turnouts	each	52 000,00	0,2	10 400
Sleepers	each	30,00	1840	55 200
Fastenings	couple	20,00	1840	36 800
Ballast	m3	6,00	1800	10 800
Sub-Ballast	m3	3,00	1080	3 240
Earthworks	m3	4,00	1000	4 000
Switch crossings	each	4 000,00	0,1	400
Switch blades	pair	15 600,00	0,1	1 560
Joints	each	25,00	4	100
Insulated joints	each	34,00	2	68
Pipe culverts Φ 1,5m	each 12 m	6 000,00	0,1	600
Sub tot with transport exp.	6%			227 789
Sub tot with railway expenses	9%			248 290
Taxes	20%			49 658
Risk coefficient	5%			14 897
Totals				312 846

ANNEX V Details of maintenance costs				
Description	Unit	Unit Cost (US\$)	Quantity/km	
			Quantity/km	Amount (US\$/km)
<i>Option 1 all materials covered</i>				
Capital Maintenance				
Labour	hour	1,28	25959,0	33 228
Equipment	hour	-	0	-
Rails R-65	tonne	-	130	-
Turnouts	each	52 000,00	0,2	10 400
Sleepers	each	-	1840	-
Fastenings	couple	-	1840	-
Ballast	m3	-	1800	-
Sub-Ballast	m3	3,00	1080	3 240
Earthworks	m3	4,00	1000	4 000
Switch crossings	each	-	0,1	-
Switch blades	pair	-	0,1	-
Joints	each	25,00	4,0	100
Insulated joints	each	-	2,0	-
Pipe culverts Φ 1,5m	each 12 m	6 000,00	0,1	600
Sub tot with transport exp.	6%			54 662
Sub tot with railway expenses	9%			59 581
Taxes	20%			11 916
Risk coefficient	5%			3 575
Totals	-			75 072

ANNEX V Details of maintenance costs				
Description	Unit	Unit Cost (US\$)	Quantity/km	
			Quantity/km	Amount (US\$/km)
<i>Option 1 sleepers covered</i>				
Capital Maintenance				
Labour	hour	1,28	25959,0	33 228
Equipment	hour	-	0	-
Rails R-65	tonne	450,00	130	58 500
Turnouts	each	52 000,00	0,2	10 400
Sleepers	each	-	1840	-
Fastenings	couple	-	1840	-
Ballast	m3	6,00	1800	10 800
Sub-Ballast	m3	3,00	1080	3 240
Earthworks	m3	4,00	1000	4 000
Switch crossings	each	4 000,00	0,1	400
Switch blades	pair	15 600,00	0,1	1 560
Joints	each	25,00	4,0	100
Insulated joints	each	34,00	2,0	68
Pipe culverts Φ 1,5m	each 12 m	6 000,00	0,1	600
Sub tot with transport exp.	6%			130 269
Sub tot with railway expenses	9%			141 993
Taxes	20%			28 399
Risk coefficient	5%			8 520
Totals				178 912

ANNEX IV

SAFETY DEVICES TABLES

Module B Feasibility Study

Table A Present Stations Signalling description

N°	Location (Km)	Station name	Interlocking technology	Train detector device	Electrical power supply (4)	Presence of UPS with diesel generator / power	Remote control	number of point switches electrically operated -1	present maximum allowed speed (2)	Installation Year
1	3703,3	Kaindy	relay	track circuit	380V,	yes/24kva	yes	12	80 (100)	1983-1985
2	3718,242	Karabalta	relay	track circuit	380V,	yes/48kva	only tracks/signal	38	80 (100)	1983-1985
3	3730,908	R. 141	relay	track circuit	380V	not	yes	8	80 (100)	1983-1985
4	3740,092	Belovodskaya	relay	track circuit	380V	yes/24kva	yes	19	80 (100)	1983-1985
5	3755,435	Shopokovo	relay	track circuit	380V,	yes/24kw	yes	16	80 (100)	1983-1985
6	3765,2	R. 3766-Soklukh	relay	track circuit	380V,	not	yes	4	80 (100)	1983-1985
7	3774,708	Bishkek 1	relay	track circuit	380V	yes/48kva	only tracks/signal	108	50(100)	1979
8	3780,049	Bishkek 2	relay	track circuit	380V,	yes/24kw	not	25	50(100)	1979
9	3783	Alamedin	keys	track circuit	220V	not	not	-16	50(100)	1975
10	3800,568	Kant	keys	track circuit	220V	not	not	-17	50(100)	1975
11	3819,089	Ivanovka	relay	track circuit	380V,	yes/16kw	not	10	50(100)	1975
12	3839,578	Tokmak	keys	track circuit	220V,	yes/16kw	not	-19	50(100)	1986
13	3848	Post 3848км	relay	track circuit	220V	yes/16kw	not	1	50(100)	1975
14	3871	Bistrovka	relay	track circuit	380V,	yes/16kw	not	14	50(100)	1976
15	3884,15	Djil-Aryk	relay	track circuit	380V,	yes/16kw	not	17	50(100)	1988
16	3899,7	R. 148	relay	track circuit	220V,	not	not	3	50(100)	1984
17	3936,951	Koyamat - Kurkol	relay	track circuit	220V	yes/16kw	not	3	50(100)	1984
18	3947,226	Balykchi	keys	track circuit	220V	yes/16kw	not	-23	50(100)	1984

Note: (1) in brackets number foreseen of points electrically operated
(2)in brackets speed before temporary present restriction 3) border distance 3689Km

Module B Feasibility Study

Table B Present Line Signalling Description - Block Systems

N°	Line Section from station X to station Y	Line Section length (Km) (1)	Control over the overall traffic operation of the line (Yes/not)/from	Block system technology	Block sections number (2)	Presence of cab signal	Present Line classification
1	Chaldovar- Border-Kaindy	16,975	Yes/Bishkek1	"	11	"	"
2	Kaindy-Karabalta	14,942	Yes/Bishkek1	"	9	"	"
3	Karabalta-R. 141	12,666	Yes/Bishkek1	"	6	"	"
4	R. 141-Belovodskaya	9,184	Yes/Bishkek1	"	6	"	"
5	Belovodskaya—Shopokovo	15,343	Yes/Bishkek1	"	9	"	"
6	Shopokovo-R. 13766	9,765	Yes/Bishkek1	"	5	"	"
7	R. 13766- Bishkek 1	9,508	Yes/Bishkek1	"	5	"	"
8	Bishkek 1 -Bishkek 2	5,341	not	"	2	"	"
9	Bishkek2-Alamedin	2,951	not	semiautomatic	-2	not	"
10	Alamedin-Kant	17,568	not	"	-8	"	"
11	Kant-Ivanovka	18,521	not	"	-9	"	"
12	Ivanovka- Tokmak	20,489	not	"	-10	"	"
13	Tokmak-Post 3848	8,422	not	"	-3	"	"
14	Post 3848--Bistrovka	23	not	"	-10	"	"
15	Bistrovka-Djil/Aryk	13,15	not	"	-5	"	"
16	Djil/Aryk-R. 148	15,55	not	"	-6	"	"
17	R. 148-Koyamat/Kurkol	37,251	not	"	-15	"	"
18	Koyamat/Kurkol-Balykchi	10,275	not	"	-4	"	"

Note: (1)Distances from building axis
(2) in brackets envisaged number of automatic blocks sections (direction Balykchi)

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Table C.1 Investment Costs Alternative 3

Option 3 Bishkek2-Balykchi section	unities of measurement	Quantities of unities	Unities prices \$	Total \$	supply quote	works quote	national quote	foreign quote
Signal System								
Interlocking								
Alamedin	Points n°	16	50.000	800.000	640.000	160.000	80000	720000
Kant	Points n°	17	50.000	850.000	680000	170000	85000	765000
Tokmak	Points n°	19	48.000	912.000	729600	182400	91200	820800
Post 3848km	Whole system			650.000	520000	130000	65000	585000
Balykchi	Points n°	23	40.000	920.000	736000	184000	92000	828000
Bishkek 2	Points n°	25	40.000	1.000.000	800.000	200.000	100000	900000
Ivanovka	Points n°	10	72.000	720.000	576000	144000	72000	648000
Bistrovka	Points n°	14	52.000	728.000	582400	145600	72800	655200
Djil-Aryk	Points n°	17	50.000	850.000	680000	170000	85000	765000
R. 148	Whole system	3		670.000	536000	134000	67000	603000
Koyamat - Kurkol	Whole system	3		670.000	536000	134000	67000	603000
Power supply								
U.P.S. with Diesel gen 16kva	n°	7	31.363	219.541	175.633	43908,2	43908,2	175.633
U.P.S. with Diesel gen 24kva	n°	1	33.376	33.376	26700,8	6675,2	6675,2	26700,8
U.P.S. without Diesel gen		3	22.010	66.030	52824	13206	13206	52824
Block system								
	Block section n°	144	35.000	5.040.000	3.780.000	1260000	1008000	4032000
Level crossing								
with lights	n°	14	31.000	434.000	303800	130200	130200	303800
with lights and barriers	n°	8	49.000	392.000	274400	117600	117600	274400
Centralised Traffic Control (without TLC cable)								
	Central Post	1	44.000	44.000	41800	2200	2200	41800
	Peripheral Places n°	10	20.000	200.000	150.000	50000	50000	150000
total				15.198.947	11.821.158	3377789,4	2248789	12950158

%	100	78	22	15	85
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Module B – Feasibility Study

Lugovaya(e)-Balykchi: operational and maintenace work force

№	Station master	Name and class of the station	Traffic operators	Other traffic operator in help	Switchmen	senior electromechanic	electromechanic	electrical engineer
1	1	Balykchi (3)	5	1	-		1	1
2	1	Koyamat – Kurkol (5)	2	-	-			
3	1	R. 148 (5)	2	-	-			1
4	1	Djil-Aryk (4)	2	-	-			1
5	1	Bistrovka (4)	4	-	-	1		2
6	-	Post 3848	-	-	-			
7	1	Tokmak (2)	5	-	9		1	1
8	1	Ivanovka (4)	4	-	-			2
9	1	Kant (2)	5	2	9	1	1	
10	1	Alamedin (1)	5	2	10			1
11	1	Bishkek 2 (2)	5	-	-		1	1
12	1	Bishkek 1 (1)	5	4	-	1	5	4
13	1	R3766-Soklukh (4)	2	-	-	1	1	1
14	1	Shopokovo (3)	4	-	-		1	1
15	1	Belovodskaya (3)	5	-	-		1	2
16	1	R 141 (4)	1	-	-		1	1
17	1	Karabalta (2)	5	-	-			1
18	1	Kaindy (3)	5	-	-		1	1
19	1	Chaldavar(5)	1	-	-		1	1
20	1	Merke (3)	5	-	-	1	2	
21	1	Munke (5)	1	-	-			
22	1	Post 3639(5)	1					

Table C.2

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Post	The cost price per unit (\$/year)	Salary(\$/year)	Quantity of monthly set / year	Quantity of working hours per day	Average quantity of the working days in one year
Station master 1	2934	2348	13	12	256
Station master 2	2513	2015	13	12	256
Station master 3	2160	1725	13	12	256
Station master 4	1885	1510	13	12	256
Traffic operator 1	2058	1650	13	12	256
Traffic operator 2	1558	1250	13	12	256
Traffic operator 3	1645	1315	13	12	256
Traffic operator 4	1315	1050	13	12	256
Operator in help	1332	1065	13	12	256
Switchman	1150	920	13	12	256

Table C.3 : Kyrghyz cost for operational unit

Source: Kyrghyz Railways, 2005

Post	The cost price per unit (\$/year)	Salary(\$/year)	Quantity of monthly set / year	Quantity of working hours per day	Average quantity of the working days in one year
Senior electromechanic	2708	2166	13	12	256
Electromechanic	1971	1577	13	12	256
Electrical engineer	1232	986	13	12	256

Table C.4: Kyrghyz cost for maintenance unit

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Present Line Signalling Description - Level crossing

(Source Kyrgyz railways)

Table D

N°	Line section: from station X to station Y or station Z	Level crossings (without barriers with Saint Andrew crosses and stop not lighted sign) (Number)	Level crossings (without barriers and with lighth signals)/presence of operator(1) number:	Level crossings with barriers switched by trains (protected by block signals)/presence of operator(1) number:	Level crossings (with barriers protected both sides by station signals)/presence of operator(1) number:
1	Lugovaya- PI 3639		1	0	0
2	PI 3639 -Munke		1	0	0
3	Munke-Merke		1	0	1
4	Merke-Border-Chaldovar		3	0	0
5	Chaldovar-Kaindy		2	1	0
6	Kaindy-Karabalta		2	2	0
7	Karabalta-R.141	4	0	0	0
8	R.141-Belovodskaya		2	0	1
9	Belovodskaya—Shopokovo		2	0	0
10	Shopokovo-R.3766		1	0	1
11	R.3766- Bishkek 1	2	1	0	0
12	Bishkek 1 -Bishkek 2		0	1	1
13	Bishkek2-Alamedin		0	0	0
14	Alamedin-Kant		2	1	0
15	Kant- -Ivanovka	1	2	0	1
17	Ivanovka-Tokmak	1	3	1	0
19	Tokmak-Post3848km		1	1	0
21	Post3848km-Bistrovka	1	3	1	0
23	Bistrovka-Djil/Aryk		1	0	0
24	Djil/Aryk-R.148	1	1	0	0
25	R.148-Kayamat/Kurkol	1	0	0	0
27	Kayamat/Kurkol-Balykchi	1	1	1	0
28	total	12	30	9	6
29	staff needs (*)			36	24
note	(*) presence of operator when there are barriers; need: 4 Man for each crossing				
total	Lugovaya-Chaldovar		6	0	1
total	Chaldovar-Bishkek2	6	10	4	2
total	Bishkek2-Balykchi	6	14	5	3

**Specifications of number of workers of the signaling system,
interlocking and block signalling**

Table E

Divisions and served devices	Post	Measuring	Norm of service			Norm of number on a measuring
			1	2	3	
Crew on service of the station equipment:	senior electromechanic	Part Electromechanics	6	6	6	1
devices of an electric interlocking installation of large and small stations	electromechanic	switch	25	30	33	1 *
	electrical engineer	switch	36	37	38	1
control-dimensional devices, devices of the control of the derailment of the rolling stock	electromechanic	complete set	200	200	200	1
block of power station without autostart	electromechanic	block	35	35	35	1
block of power station with autostart	electromechanic	block	11	11	11	1
Diesel engine - generating set	electromechanic	set	7	7	7	1

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Divisions and served devices	Post	Measuring	Norm of service			Norm of number on a measuring
			1	2	3	
Crew on service of devices of automatic block relay systems	senior electromechanic	Part Electromechanics	6	6	6	1
On a single-track site	electromechanic	km	29	32	34	1
	electrical engineer	km	58	60	62	1
On a double-track site:						
Three-value	electromechanic	km	19	20	21	1
	electrical engineer	km	38	40	42	1
Four-value	electromechanic	km	16	16	16	1
	electrical engineer	km	32	32	32	1
route - control gears	electromechanic	swith	43	45	47	1
	electrical engineer	swith	67	70	72	1
Crew for service of devices:	senior electromechanic	central post	1	1	1	1
Central control point CTC (relay system)	electromechanic	Dispatching circle	6	6	6	4
	electrical engineer	Dispatching circle	6	6	6	1
The dispatching control of relay systems	electromechanic	km	64	64	64	1

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Divisions and served devices	Post	Measuring	Norm of service			Norm of number on a measuring
			1	2	3	
The crew serving crossings:	senior electromechanic	Part Electromechanics			6	1
With autobarriers	electromechanic	crossing			29	1
	electrical engineer	crossing			44	1
Without an autobarrier	electromechanic	crossing			44	1
	electrical engineer	crossing			50	1
The crew of a signal system serving wires, suspended on air and power distribution circuits	senior electromechanic	Part Electromechanics			6	1
	electromechanic	km			400	1
	electrical engineer	km			800	1
The crew of a signal system serving the devices of a controlled manual block	senior electromechanic	Part Electromechanics			6	1
	electromechanic	key dep. Switch			47	1
	electrical engineer	key dep. Switch			72	1

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Divisions and served devices	Post	Measuring	Norm of service			Norm of number on a measuring
			1	2	3	
Crew of maintenance work of devices of an automatic cab signalling	senior electromechanic	Control point			3	1
	electromechanic	set			34	1
	electrical engineer	set			30	1
Staff system	electrical engineer	km			50	1

Notes:

1. The measuring on automatic block system and a centralized dispatching control (CTC) is accepted in kilometers of operational length
2. On sites with constant using double-track traffic on each track, norm of service to apply with factor 0,8
3. The norm of service at imposing on automatic block system of frequency track circuits is applied with factor 0,85
4. At service of devices which life time has expired from 1 year till 5 years, before their modernization, norm of service to apply with factor 0,95, after expiry of the term from 5 till 10 years and over 10 years factors are accordingly equal 0,9 and 0,35
5. Items 1 - 4 are applicable for calculation of specifications of number in repair - technological site of a signal system
6. In devices of an automatic block, a centralized dispatching control and the dispatching control (CTC) with microprocessors, the norm of service is applied with factor 1,2

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		Number	number for each electromechanic	number for each electric engineer	electromechanic need	electric engineer need	senior need
Switiches	n °	48	33	38	1,45	1,26	
Station power blocks	n °	4	11		0,36		
Diesel elec generator	n °	2	7		0,28		
Total					2,09	1,26	1
Total approximated Equipment with life-time expired from over 10 year						5	
			plus 60%			3	
need						8	

Table F.1

Present maintenance needs

Bishkek2-Balykchi (only key dependent interlockings i. e. Alamedin, Kant, Tokmak and Balykchi)

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		Number	Number for each electromechanic	Number for each electric engineer	Electromechanic need	Electric engineer need	Senior need
Switches	n °	76	33	38	2,3	2	
Station power blocks	n °	7	11		0,64		
Diesel elec generator	n °	6	7		0,86		
Manual block	n°of points	148	47	72	3,15	2,05	
Level crossings with autobarriers	n°	8	29	44	0,27	0,18	
Level crossings without autobarriers	n°	14	44	50	0,32	0,28	
Total					7,54	4,51	
Total approximated of basic needs					8	4	2
Equipment with over 10 year of expired life time			plus 60%			8	
Total needs						22	

Table F.2

Present maintenance needs

Bishkek2-Balykchi (only relay interlockings: Bishkek 2, Ivanovka, Bistrovka, Djil-Aryk, R148, Kayamat-Kurkol plus level crossings and manual block)

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Post/number	The cost price per unit (\$/year)	Salary \$/year
Senior electromechanic	2708	2166
Electromechanic	1971	1577
Electrical engineer	1232	986

Average cost

1682

Table F.3

Maintenance salaries

Source Kyrghiz railways

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Project implementation planning												
Kazakh border-Balykchi Alternative 2		First year				Second year				Third year		
Activity	Tri 1	Tri 2	Tri 3	Tri 4	Tri 1	Tri 2	Tri 3	Tri 4	Tri 1	Tri 2	Tri 3	
1 Project Implementation												
2 Sign of implementation contract	▽											
3 Working and shop drawings and detailed specifications												
4 Construction on factory and supply on site												
5 Site installations												
6 Subsystem tests on site out of operation												
7 Comissioning												

Table G.1

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Project Implementation planning													
Kazakh border-Balykchi Alternative 3		First year				Second year				Third year			
Activity		Tri 1	Tri 2	Tri 3	Tri 4	Tri 1	Tri 2	Tri 3	Tri 4	Tri 1	Tri 2	Tri 3	Tri 4
1	Project Implementation												
2	Sign of implementation contract	▽											
3	Working and shop drawings and detailed specifications		▬										
4	Construction on factory and supply on site			▬									
5	Site installations					▬							
6	Subsystem tests on site out of operation										▬		
7	Comissioning											▬	

Table G.2

Fig. a Spacing time calculation (crossing trains succession)

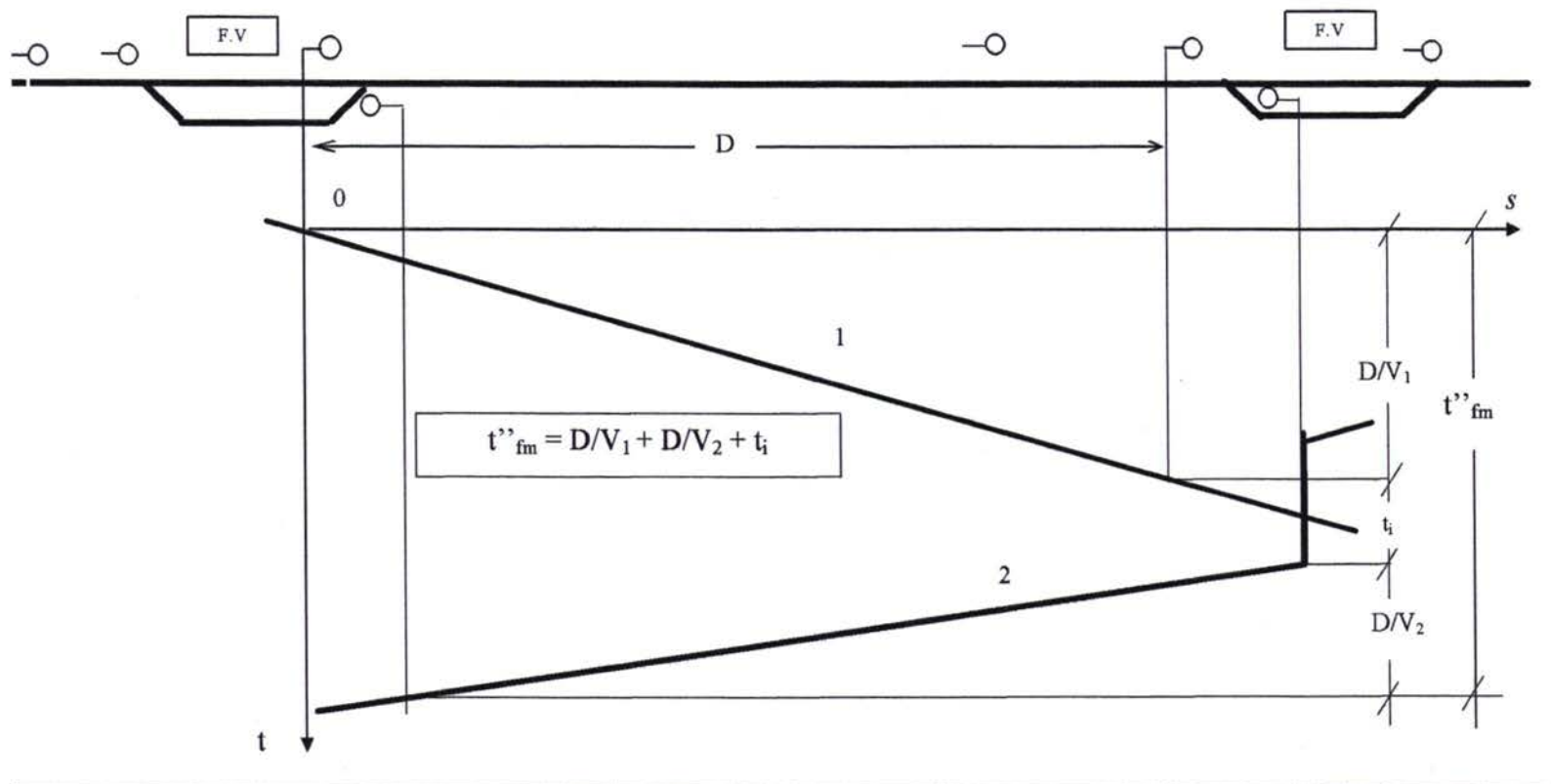
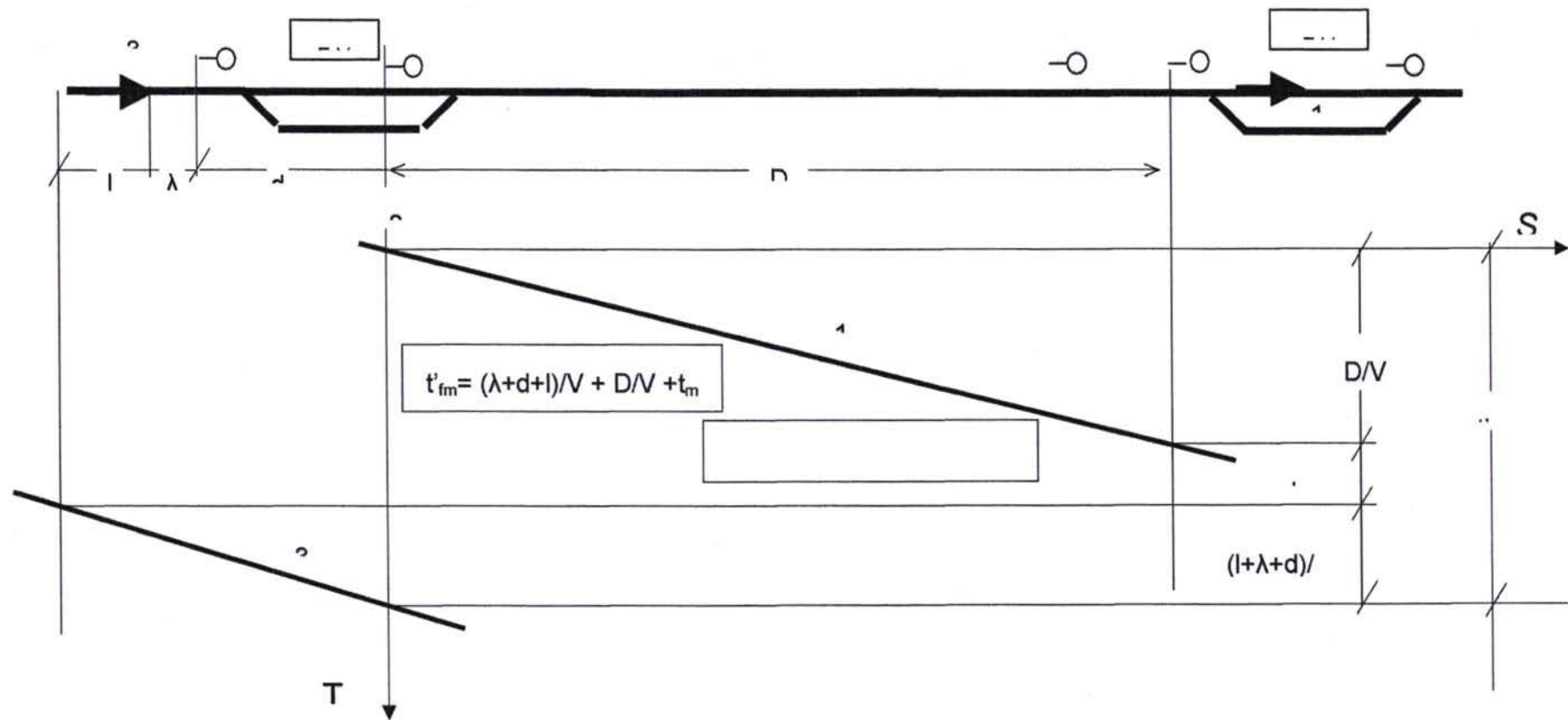



Fig. b Spacing time calculation (one way trains succession)





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