



The European Union's Tacis TRACECA programme  
for Armenia, Azerbaijan, Bulgaria, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Romania, Tajikistan, Turkey,  
Turkmenistan, Ukraine, Uzbekistan

## **Review of Railway Rehabilitation in Central Asia**

**for Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan**

**Module B - Feasibility Study of the rehabilitation  
measures for the Beyneu - Uzbek Border railway  
section (Kazakhstan)**

**Annexes**

**March 2005**



This project is funded by  
the European Union



A project implemented by  
Italferr S.p.A.

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## **ANNEX I**

### **COST ESTIMATES AND BILL OF QUANTITIES**

| Beyneu-Uzbek border section OPTION BASIC WORKS - INFRASTRUCTURE BoQ |  |                |           |          |             |                     |   |
|---|--|----------------|-----------|----------|-------------|---------------------|---|
| N   | Description  | Unit           | Quantity  | Rate     | Total Local | Total International | NOTES   |
| <b>A. WORKS</b>   |  |                |           | USD      | USD         | USD                 |   |
| 1A  | Topographic survey of the line and corrections of the existing alignment and profile   | km             | 81,00     | 3 500,00 |             | 283 500,00          | All the stations main tracks plus the line.   |
| 2A  | Demolition of line   | km             | 1,17      | 975,61   | 1 137,56    |                     | The station of Akjigit main line is equipped with P65 rails on wooden sleepers.   |
| 3A  | Excavation   | m <sup>3</sup> | 3374,40   | 0,37     | 1 234,54    |                     | 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. (no sections along the line)  |
| 4A  | Partial lateral rebuilding embankment section for 20 km, placing and compacting the removed top material for widening the top surface of about 1,0 m on both sides | m <sup>3</sup> | 108600,00 | 0,49     | 52 975,61   |                     | 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. In case the embankment is 1,0m high, it consists in removing 0,15m <sup>3</sup> /m and adding 1m <sup>3</sup> /m, in case the embankment is 2,0m high, it consists of removing 0,30m <sup>3</sup> /m and adding 2m <sup>3</sup> /m. It has been thought for a line length of 20 km. |
| 5A  | Implementation of a layer of sandy gravel material, 0,2 m thick under sleepers (sub-ballast)   | m <sup>3</sup> | 1315,25   | 0,07     | 96,24       |                     | It includes spreading, compacting and profiling section of materials: no sections along the line  |
| 6A  | Construction of line   | m              | 1166,00   | 2,15     | 2 502,05    |                     | 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           | 241,43    | 4,00     | 965,72      |                     | (3.3 km)x2/25 less joints (as calculated in 13B and 14B). 3.3 includes also Akjigit station   |
| 8A  | Regulation of mechanical tension of long welded rails (l.w.r.)   | km             | 6,60      | 300,00   | 1 980,00    |                     | (3.3 km)*2.   |
| 9A  | Final tamping and leveling of new line   | km             | 3,30      | 316,41   | 1 044,17    |                     |   |
| 10A   | Ballast cleaning on the other existing sections  | km             | 8,40      | 116,62   | 979,64      |                     | 8,4 km into stations main tracks, excluded Akjigit  |
| 11A   | Tamping, leveling and aligning the other existing sections with l.w.r.   | km             | 77,70     | 316,41   | 24 585,42   |                     | All the line and stations, excluded Akjigit and the other 2.13 km already done.   |
| 12A   | Substitution of concrete pipes of culverts   | n              | 0,00      | 200,00   | 0,00        |                     |   |
| 13A   | Excavation of ditches  | m of line      | 25000,00  | 2,00     | 50 000,00   |                     | 15 km of line-2 ditches. In addition also 10 km in stations for laying the concrete pipe for station main track drainage. Trapezoid ditch 0.5-0.5-0.5 has a volume of 0,5m <sup>3</sup> /m  |
| 14A   | Pavement of level crossings  | unit           | 2,00      | 400,00   | 800,00      |                     | Each level crossing envisages an area of 50m by 10m.  |
| 15A   | Passenger stations: platforms new  | m <sup>2</sup> | 1200,00   | 24,00    | 28 800,00   |                     | 4 platforms: length 100m, width 3m  |

|                          |  |                |         |                    |            |            |  |
|--------------------------|--|----------------|---------|--------------------|------------|------------|--|
| 16A                      | Passenger stations: platforms restyling                  | m <sup>2</sup> | 600,00  | 16,00              | 9 600,00   |            | 1 platform: length 200m, width 3m  |
| 17A                      | Passenger stations: building retyling                    | m <sup>2</sup> | 540,00  | 120,00             | 64 800,00  |            | 2 stations 120m <sup>2</sup> each plus Beyneu (300m <sup>2</sup> restyling)  |
| 18A                      | Replacing switch crossings                               | unit           | 2,00    | 166,88             | 333,76     |            | For the 2 turnouts P50 to be re-used   |
| 19A                      | Replacing switch blades                                  | unit           | 2,00    | 166,88             | 333,76     |            | For the 2 turnouts P50 to be re-used   |
| 20A                      | Replacing (or installation) of switch small tg(complete) | unit           | 4,00    | 333,76             | 1 335,02   |            | Installation of 2 new P65 turnouts plus re-installation of 2 used P50 turnouts   |
| 21A                      | Construction of new double threephase overhead 10kV line | km             | 81,00   | 362,00             | 29 322,00  |            |  |
| 22A                      | Renewal of 14 bridges beams (3 bridges)                  | each           | 14,00   | 500,00             | 7 000,00   |            | Each bridge is composed by 2 beams. 2 bridges have 2 spans (4 beams), one bridge has 3 spans (6 beams). Each couple of beams, new type, costs 15,500 US\$. |
| 23A                      | Capital rimonta of piers and abutments (10 in total)     | each           | 10,00   | 100,00             | 1 000,00   |            | 2 bridges have 2 spans (2 abutments and 1 pier), one bridge has 3 spans (2 abutments and 2 piers).   |
| <b>A</b>                 |  |                |         | Subtot Local Works | 280 825,49 |            |  |
| International manpower   |  | man-months     | 20      | 8 000,00           |            | 160 000,00 | 4 months duration of works per 5 experts   |
| Total international cost |  |                |         |                    |            | 443 500,00 |  |
| <b>B. Materials</b>      |  |                |         |                    |            |            |  |
| 1B                       | P65 rails 100.000x2 m                                    | t              | 0,00    | 580,00             |            | 0,00       | no new rails are needed  |
| 2B                       | Concrete sleepers 100x1840                               | unit           | 2145,44 | 25,00              | 53 636,00  |            | 1,17 km of new sleepers  |
| 3B                       | Fastenings for concrete sleepers                         | pairs          | 2145,44 | 25,00              |            | 53 636,00  | 1,17 km of new fastenings  |
| 4B                       | Ballast for renovated sections                           | m <sup>3</sup> | 2087,14 | 5,50               | 11 479,27  |            | 1,77 m <sup>3</sup> /m on straight; 1,9034 m <sup>3</sup> /m on curve ( cantilever: 75 mm).  |
| 5B                       | Additional ballast for existing sections into stations   | m <sup>3</sup> | 7434,00 | 5,50               | 40 887,00  |            | 50% additional ballast on ballast cleaning operation (6,4 km into stations)  |
| 6B                       | Sandy gravel on track sections (new sub-ballast layer)   | m <sup>3</sup> | 1287,26 | 2,00               | 2 574,53   |            | 1,08 m <sup>3</sup> /m on straight; 1,2 m <sup>3</sup> /m on curve.  |
| 7B                       | Blocks for 2 level crossings                             | unit           | 48,00   | 50,00              | 2 400,00   |            | 0,24 m <sup>3</sup> each block. 24 blocks per L.C. Cement price 190,0 US\$/m <sup>3</sup>  |
| 8B                       | Concrete pipes φ 1,5m                                    | n              | 0,00    | 6 000,00           | 0,00       |            |  |

|     |  |                |          |               |              |            |  |
|-----|--|----------------|----------|---------------|--------------|------------|--|
| 9B  | Concrete pipes $\phi$ 2,0m                             | m              | 0,00     | 700,00        | 0,00         |            |  |
| 10B | Switch crossing  | unit           | 2,00     | 4 000,00      |              | 8 000,00   | Two P50 turnouts to be reused.   |
| 11B | Switch blades  | pairs          | 2,00     | 15 600,00     |              | 31 200,00  | Two P50 turnouts to be reused.   |
| 12B | Switch complete (small tg)                             | unit           | 2,00     | 52 000,00     |              | 104 000,00 | Two P50 turnouts to be replaced in Akjigt station.   |
| 13B | Rail Joints  | each           | 20.57    | 25,00         |              | 514,25     | (1870)/2000*22 (22 joints every 2000m of rail). All the rehabilitated sections.  |
| 14B | Insulated rail joints                                  | each           | 2,00     | 34,00         |              | 68,00      | (1870)/2000*2 (2 insulated joints every 2000m of rail). All the rehabilitated sections.  |
| 15B | Passenger stations: platforms new                      | m <sup>2</sup> | 1200,00  | 36,00         | 43 200,00    |            | 4 platforms: length 100m, width 3m   |
| 16B | Passenger stations: platforms restyling                | m <sup>2</sup> | 600,00   | 31,00         | 18 600,00    |            | 1 platform: length 200m, width 3m  |
| 17B | Passenger stations: building retyling                  | m <sup>2</sup> | 540,00   | 400,00        | 216 000,00   |            | 2 stations 120m2 each plus Beyneu (300m2 restyling)  |
| 18B | New double threephase overhead 10kV line               | km             | 81,00    | 12 000,00     | 486 000,00   | 486 000,00 |  |
| 19B | Concrete ditch (pipe) for station main track drainage. | m              | 10000,00 | 25,00         | 125 000,00   |            | It includes poor concrete bed and different layers of gravels for drainage plus pipes. 10 km for all stations main tracks.                                 |
| 20B | Renewal of 3 bridges beams (14 beams 5,5m span)        | each           | 14,00    | 7 750,00      | 108 500,00   |            | Each bridge is composed by 2 beams. 2 bridges have 2 spans (4 beams), one bridge has 3 spans (6 beams). Each couple of beams, new type, costs 15.500 US\$. |
| 21A | Capital rimonta of piers and abutments (10 in total)   | each           | 10,00    | 1 000,00      | 10 000,00    |            | 2 bridges have 2 spans (2 abutments and 1 pier), one bridge has 3 spans (2 abutments and 2 piers).   |
|     | D  |                |          | TOT MATERIALS | 1 118 276,80 | 683 418,25 |  |

| Beyneu-Uzbek border section OPTION "DOUBLING" - INFRASTRUCTURE BoQ |  |                |           |          |             |                     |  |
|--|--|----------------|-----------|----------|-------------|---------------------|--|
| N  | Description  | Unit           | Quantity  | Rate     | Total Local | Total International | NOTES  |
|  | <b>A. WORKS</b>  |                |           | USD      | USD         | USD                 |  |
| 1A   | Construction design for line doubling  | km             | 81,00     | 2 000,00 |             | 162 000,00          | 81km in Kazakhstan. Topographic works have already been computed in Option 1   |
| 2A   | Demolition of line   | km             | 7,80      | 975,61   | 7 604,88    |                     | All the stations first siding  |
| 3A   | Excavation   | m <sup>3</sup> |           | 0,37     | 0,00        |                     |  |
| 4A   | Lateral building of second track embankment for 73 km (line, excluded stations), placing and compacting the removed top material for widening the top surface of about 4,0 m | m <sup>3</sup> | 584000,00 | 0,49     | 284 878,05  |                     | Inter-axis between existing and new track 4,0m. For 2 m high embankment: 8m <sup>3</sup> /m  |
| 5A   | Implementation of a layer of sandy gravel material, 0,2 m thick under sleepers (sub-ballast)   | m <sup>3</sup> | 110,16    | 0,07     | 8,06        |                     | It includes spreading, compacting and profiling section of materials for the second track: 81000x1,36  |
| 6A   | Construction of new second line and new sidings into the 3 preserved stations  | m              | 84600,00  | 2,15     | 181 538,39  |                     | It includes installation of concrete sleepers, P65 rails, fastenings, spread of ballast, tamping and lift of rails up to 3 cm to final level. It includes all the line plus the second line in stations, replacing the removed siding, plus the new additional siding to be constructed into the stations left in operation (3 stations) |
| 7A   | Flash-butt or thermic weld of P65 rail   | unit           | 5710,50   | 4,00     | 22 842,00   |                     | (81000)x2/25 less joints (about 5 every 800m)  |
| 8A   | Regulation of mechanical tension of long welded rails (l.w.r.)   | km             | 169,20    | 300,00   | 50 760,00   |                     | (81)*2 km  |
| 9A   | Final tamping and leveling of new line   | km             | 84,60     | 316,41   | 26 768,68   |                     |  |
| 10A  | Ballast cleaning on the other existing sections  | km             | 0,00      | 116,62   | 0,00        |                     |  |
| 11A  | Tamping, leveling and aligning the other existing sections with l.w.r.   | km             | 0,00      | 316,41   | 0,00        |                     |  |
| 12A  | Substitution of concrete pipes of 20 culverts  | n              | 0,00      | 200,00   | 0,00        |                     |  |
| 13A  | Excavation of ditches  | m of line      | 84600,00  | 2,00     | 169 200,00  |                     | 81 km of line-1 ditch (one side only). Trapezoid ditch 0.5-0.5-0.5 has a volume of 0,5m <sup>3</sup> /m  |
| 14A  | Pavement of level crossings  | each           | 0,00      | 400,00   | 0,00        |                     |  |
| 15A  | Passenger stations: platforms new  | m <sup>2</sup> | 3000,00   | 24,00    | 72 000,00   |                     | Out of 5 stations, 2 stations will be closed and 3 will be left in operation and 1 new platform will be constructed for each one of them. New platforms will be 200m long and 5m large, so to be used as island platform between two tracks.   |

|  |   |                |           |                    |              |              |  |
|--|---|----------------|-----------|--------------------|--------------|--------------|--|
| 16A  | Passenger stations: platforms restyling                       | m <sup>2</sup> | 0,00      | 16,00              | 0,00         |              |  |
| 17A  | Passenger stations: building restyling                        | m <sup>2</sup> | 0,00      | 120,00             | 0,00         |              |  |
| 18A  | Replacing switch crossings                                    | each           | 0,00      | 166,88             | 0,00         |              |  |
| 19A  | Replacing switch blades                                       | each           | 0,00      | 166,88             | 0,00         |              |  |
| 20A  | Installation of new switches small tg(complete)               | each           | 2,00      | 333,76             | 667,51       |              | Additional compared with Option1, for line doubling into left stations (3).  |
| 21A  | Construction of new pipe culverts (extension of the existing) | each           | 43,00     | 520,00             | 22 360,00    |              | 43 pipe culverts   |
| 22A  | Construction of new bridges                                   | each           | 4,00      | 6 000,00           | 24 000,00    |              | 4 bridges (2-3 spans 5.5 m long)   |
| 23A  | Construction of the catenary                                  | km             | 170,00    | 6 000,00           | 1 020 000,00 |              |  |
| <b>A</b>   |   |                |           | Subtot Local Works |              |              |  |
| International manpower (to be added to International Manpower of Option 1) |   | man-months     | 180       | 8 000,00           |              | 1 440 000,00 | 18 months duration of works per 10 experts   |
| Total international cost   |   |                |           |                    |              | 1 602 000,00 |  |
| <b>B. Materials</b>  |   |                |           |                    |              |              |  |
| 1B   | P65 rails 81 000x2 m  | t              | 10998,00  | 580,00             |              | 6 378 840,00 | 85 km of new single track. In the existing stations, the new trak will replace the existing first siding infrastructure and a new siding is constructed. |
| 2B   | Concrete sleepers 81x1840                                     | unit           | 155664,00 | 25,00              |              | 3 891 600,00 | It includes 1,840 sleepers per km, per 85km  |
| 3B   | Fastenings for concrete sleepers                              | pairs          | 155664,00 | 25,00              |              | 3 891 600,00 |  |
| 4B   | Insulated rail joints   | unit           |           |                    |              | 0,00         |  |
| 5B   | Ballast for renovated sections                                | m <sup>3</sup> | 149911,20 | 5,50               |              | 824 511,60   | 1,77 m <sup>3</sup> /m on straight (98%); 1,9034 m <sup>3</sup> /m on curve (2%) (cantilever: 75 mm).  |
| 6B   | Additional ballast for existing sections                      | m <sup>3</sup> |           | 5,50               |              | 0,00         | 30% additional ballast on ballast cleaning operation   |
| 7B   | Sandy gravel on track sections (new sub-ballast layer)        | m <sup>3</sup> | 110,16    | 2,00               |              | 220,32       | 1,08 m <sup>3</sup> /m on straight; 1,2 m <sup>3</sup> /m on curve.  |
| 8B   | Blocks for level crossings                                    | unit           |           |                    |              | 0,00         |  |



|     |   |                |           |               |              |               |  |
|-----|---|----------------|-----------|---------------|--------------|---------------|--|
| 9B  | Concrete pipes $\phi$ 1,5m                                    | n              | 0,00      | 6 000,00      | 0,00         |               |  |
| 10B | Concrete pipes $\phi$ 2,0m                                    | m              |           | 700,00        |              |               |  |
| 11B | Switch crossing   | unit           |           | 4 000,00      |              | 0,00          |  |
| 12B | Switch blades   | pairs          | 0,00      | 15 600,00     |              | 0,00          |  |
| 13B | Switch complete (small tg)                                    | unit           | 2,00      | 52 000,00     |              | 104 000,00    | New compared with Option 1   |
| 14B | Passenger stations: platforms new                             | m <sup>2</sup> | 3000,00   | 36,00         | 108 000,00   |               |  |
| 15B | Passenger stations: platforms restyling                       | m <sup>2</sup> | 0,00      | 31,00         | 0,00         |               |  |
| 16B | Passenger stations: building restyling                        | m <sup>2</sup> | 0,00      | 400,00        | 0,00         |               |  |
| 17B | Construction of new pipe culverts (extension of the existing) | each           | 43,00     | 6 000,00      | 258 000,00   |               | The price is calculated for a pipe under a 3,0m high embankment for single track line  |
| 18B | Construction of new bridges                                   | each           | 4,00      | 35 000,00     | 140 000,00   |               | Each span is composed by 2 beams. 3 bridges have 2 spans (4 beams), one bridge has 3 spans (6 beams). An average cost has been used. |
| 19B | Electrification: catenary                                     | km             | 170,00    | 132 000,00    |              | 22 440 000,00 | Including masts and wires. Including stations main tracks electrification  |
| 20B | Electrification: Electric Sub-Stations                        | each           | 1,00      | 2 080 000,00  |              | 2 080 000,00  | Approximately one every 60 km. The cost includes the construction.   |
| 21B | Earth for new embankment on side                              | m <sup>3</sup> | 584000,00 | 3,00          | 1 752 000,00 |               |  |
|     | D   |                |           | TOT MATERIALS | 6 974 331,92 | 34 894 440,00 |  |

## **ANNEX II**

### **DETAILS OF MAINTENANCE COSTS**

| ANNEX II Details of maintenance costs      |           |                  |             |                  |
|--|-----------|------------------|-------------|------------------|
| Description                                | Unit      | Unit Cost (US\$) | Quantity/km |                  |
|  |           |                  | Quantity/km | Amount (US\$/km) |
| <b>Lifting Repair</b>                      |           |                  |             |                  |
| Labour                                     | hour      | 1,51             | 2723,1      | 4112             |
| Light works                                | m of line | -                | 400         | 0                |
| Equipment                                  | hour      | 486,40           | 15,0        | 7296             |
| Rails R-65                                 | tonne     | 580,00           | 13,0        | 7540             |
| Turnouts                                   | each      | 52 000,00        | 0,0         | 0                |
| Sleepers                                   | each      | 25,00            | 368,0       | 9200             |
| Fastenings                                 | couple    | 25,00            | 368,0       | 9200             |
| Ballast                                    | m3        | 5,50             | 540,0       | 2970             |
| Sub-Ballast                                | m3        | 2,00             | 0,0         | 0                |
| Earthworks                                 | m3        | 4,00             | 30,0        | 120              |
| Switch crossings                           | each      | 4 000,00         | 0,0         | 0                |
| Switch blades                              | pair      | 15 600,00        | 0,0         | 0                |
| Joints                                     | each      | 25,00            | 1,0         | 25               |
| Insulated joints                           | each      | 34,00            | 1,0         | 34               |
| Pipe culverts $\Phi$ 1,5m                  | each 12 m | 6 000,00         | 0,0         | 0                |
| <b>Tot net constuction cost</b>            |           |                  |             | <b>44 216</b>    |
| Tot cost with client and constructor costs |           | 29%              |             | 57 039           |
| Tot cost with taxes                        |           | 25%              |             | 71 298           |
| <b>Tot cost with insurance</b>             |           | <b>0,40%</b>     |             | <b>71 583</b>    |
| <b>Tot cost with risk coefficient</b>      |           | <b>15%</b>       |             | <b>82 321</b>    |

| ANNEX II Details of maintenance costs      |           |                  |             |                  |
|--|-----------|------------------|-------------|------------------|
| Description                                | Unit      | Unit Cost (US\$) |             |                  |
|  |           |                  | Quantity/km | Amount (US\$/km) |
| <b>Medium Maintenance</b>                  |           |                  |             |                  |
| Labour                                     | hour      | 1,51             | 4930,4      | 7445             |
| Equipment                                  | hour      | 486,40           | 40          | 19456            |
| Rails R-65                                 | tonne     | 580,00           | 39          | 22620            |
| Turnouts                                   | each      | 52 000,00        | 0           | 0                |
| Sleepers                                   | each      | 25,00            | 736         | 18400            |
| Fastenings                                 | couple    | 25,00            | 736         | 18400            |
| Ballast                                    | m3        | 5,50             | 1080        | 5940             |
| Sub-Ballast                                | m3        | 2,00             | 33          | 67               |
| Earthworks                                 | m3        | 4,00             | 60          | 240              |
| Switch crossings                           | each      | 4 000,00         | 0,5         | 2000             |
| Switch blades                              | pair      | 15 600,00        | 0,5         | 7800             |
| Joints                                     | each      | 25,00            | 2           | 50               |
| Insulated joints                           | each      | 34,00            | 1           | 34               |
| Pipe culverts $\Phi$ 1,5m                  | each 12 m | 6 000,00         | 0,05        | 300              |
| <b>Tot net constuction cost</b>            |           |                  |             | <b>110 876</b>   |
| Tot cost with client and constructor costs |           | 29%              |             | 143 030          |
| Tot cost with taxes                        |           | 25%              |             | 178 788          |
| <b>Tot cost with insurance</b>             |           | <b>0,40%</b>     |             | <b>179 503</b>   |
| <b>Tot cost with risk coefficient</b>      |           | <b>15%</b>       |             | <b>206 428</b>   |

| ANNEX II Details of maintenance costs      |           |                  |             |                  |
|--|-----------|------------------|-------------|------------------|
| Description                                | Unit      | Unit Cost (US\$) | Quantity/km |                  |
|  |           |                  | Quantity/km | Amount (US\$/km) |
| <b>Capital Maintenance</b>                 |           |                  |             |                  |
| Labour                                     | hour      | 1,51             | 12499,0     | 18873            |
| Equipment                                  | hour      | 486,40           | 60          | 29184            |
| Rails R-65                                 | tonne     | 580,00           | 130         | 75400            |
| Turnouts                                   | each      | 52 000,00        | 0,2         | 10400            |
| Sleepers                                   | each      | 25,00            | 1840        | 46000            |
| Fastenings                                 | couple    | 25,00            | 1840        | 46000            |
| Ballast                                    | m3        | 5,50             | 1800        | 9900             |
| Sub-Ballast                                | m3        | 2,00             | 1080        | 2160             |
| Earthworks                                 | m3        | 4,00             | 1000        | 4000             |
| Switch crossings                           | each      | 4 000,00         | 0,1         | 400              |
| Switch blades                              | pair      | 15 600,00        | 0,1         | 1560             |
| Joints                                     | each      | 25,00            | 4           | 100              |
| Insulated joints                           | each      | 34,00            | 2           | 68               |
| Pipe culverts $\Phi$ 1,5m                  | each 12 m | 6 000,00         | 0,1         | 600              |
| <b>Tot net constuction cost</b>            |           |                  |             | <b>265 500</b>   |
| Tot cost with client and constructor costs |           | 29%              |             | 342 495          |
| Tot cost with taxes                        |           | 25%              |             | 428 119          |
| <i>Tot cost with insurance</i>             |           | 0,40%            |             | 429 831          |
| <b>Tot cost with risk coefficient</b>      |           | <b>15%</b>       |             | <b>494 306</b>   |

## **ANNEX III**

### **SAFETY DEVICES TABLES**

**Table 0** Kungrad-Beyneu line: location of automated level crossings

| N° | Line section                  | 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: |
|----|-------------------------------|--|---|
| 1  | <b>Kungrad- Raushan</b>       | 2  |   |
| 2  | Raushan- Kunkhoja             | 2  |   |
| 3  | Kunkhoja- <b>Kyrk-Kyz</b>     | 1  |   |
| 4  | <b>Kyrk-Kyz- Barsa-Kelmes</b> | 1  |   |
| 5  | Barsa-Kelmes - Ajiniyaz       | 1  |   |
| 6  | Ajiniyaz- <b>Abadan</b>       | 1  |   |
| 7  | <b>Abadan- Kuanysh</b>        | 1  |   |
| 8  | Kuanysh- <b>Jaslyk</b>        | 2  |   |
| 9  | <b>Jaslyk- Ayapbergen</b>     | 1  |   |
| 10 | Ayapbergen- Berdakh           | 1  |   |
| 11 | Berdakh- <b>Bostan</b>        | 1  |   |
| 12 | <b>Bostan- Ak-Tobe</b>        | 1  |   |
| 13 | Ak-Tobe- Kiyiksay             | 1  |   |
| 14 | Kiyiksay- <b>Karakalpakia</b> | 1  |   |
| 15 | <b>Karakalpakia- Oasis</b>    | 1  |   |
| 16 | Border                        |  |   |
| 17 | Oasis- Akjigit                | 1  |   |
| 18 | Akjigit- Kzyl-Asker           | 1  |   |
| 19 | Kzyl-Asker - Kok-Bekty        | 1  |   |

**Table A: Present signalling stations system**

| TableA:<br>Present<br>signalling<br>stations<br>systemN° | Location<br>(Km) | Station name | Interlocking<br>technology | Train<br>detector<br>device | Electrical<br>power<br>supply | Presence<br>of UPS<br>with<br>diesel<br>generator<br>/ power | Remote<br>control    | number<br>of point<br>switches | present<br>maximum<br>allowed<br>speed | Installation<br>Year |
|--|------------------|--------------|----------------------------|-----------------------------|-------------------------------|--|----------------------|--------------------------------|--|----------------------|
|  | 953+500          | Border       |                            |                             |                               |  |                      |                                |  |                      |
| 1  | 954+970          | Oasis        | relay                      | track<br>circuit            | 220                           |  | Yes-<br>Atyrau(2003) | 5                              | 80                                     | 1972                 |
| 2  | 979+521          | Akjigit      | relay                      | track<br>circuit            | 220                           |  | Yes-<br>Atyrau(2003) | 5                              | 80                                     | 1972                 |
| 3  | 1003+638         | Kzyl-Asker   | relay                      | track<br>circuit            | 220                           |  | Yes-<br>Atyrau(2003) | 5                              | 80                                     | 1972                 |
| 4  | 1023+161         | Kok-Bekty    | relay                      | track<br>circuit            | 220                           |  | Yes-<br>Atyrau(2003) | 5                              | 80                                     | 1972                 |
| 5  | 1033+579         | Beyneu       | relay                      | track<br>circuit            | 380                           | yes-10kva  | not                  | more<br>than 50                |  | 1972                 |



**Table B: Present Line Signalling Description - Block Systems**

| N° | Line Section from station X to station Y | Section length (Km) (1) | Control over the overall traffic operation of the line (Yes/not)/from | Block system technology | Block sections average length | Block sections number (2) | Presence of cab signal | Present Line classification |
|----|--|-------------------------|---|-------------------------|-------------------------------|---------------------------|------------------------|-----------------------------|
| 1  | Karakalpakiya-Border-Oasis               | 21,82                   | Yes-Tashkent  | Coded automatic         | 1678                          | 13                        | yes                    | Traceca                     |
| 2  | Oasis- Akjigit                           | 24,55                   | Yes-Atyrau  | "                       | 2045                          | 12                        | "                      | "                           |
| 3  | Akjigit- Kzyl-Asker                      | 24,12                   | Yes-Atyrau  | "                       | 2190                          | 11                        | "                      | "                           |
| 4  | Kzyl-Asker - Kok-Bekty                   | 19,52                   | Yes-Atyrau  | "                       | 1952                          | 10                        | "                      | "                           |
| 5  | Kok-Bekty - Beyneu                       | 10,42                   | Yes-Atyrau  | "                       | 2084                          | 5                         | "                      | "                           |

Notes:(1)Distances from building axis (2) estimated

| SINGLE OPTION<br>Karakalpakia (e)-<br>Beyneu(e)            | unities of<br>measurement | Quantities of<br>unities | Unities<br>prices<br>\$ | Total<br>\$      | supply<br>quote | works<br>quote | national<br>quote | foreign<br>quote |
|--|---------------------------|--------------------------|-------------------------|------------------|-----------------|----------------|-------------------|------------------|
| <b>Signal System<br/>Interlocking</b>                      |                           |                          |                         |                  |                 |                |                   |                  |
| Oasis  | Points n°                 | 5                        | 73.000                  | 365000           | 292000          | 73000          | 73000             | 292000           |
| Akjigit  | Points n°                 | 5                        | 73.000                  | 365000           | 292000          | 73000          | 73000             | 292000           |
| Kzyl-Asker   | Points n°                 | 5                        | 73.000                  | 365000           | 292000          | 73000          | 73000             | 292000           |
| Kok-Bekty  | Points n°                 | 5                        | 73.000                  | 365000           | 292000          | 73000          | 73000             | 292000           |
| <b>Power supply</b>  |                           |                          |                         |                  |                 |                |                   |                  |
| U.P.S. with Diesel gen                                     | n°                        | 0                        |                         |                  |                 |                |                   |                  |
| U.P.S. without Diesel gen                                  | n°                        | 4                        | 22010                   | 88.040           | 70432           | 17608          | 17608             | 70432            |
| <b>Level crossing</b>                                      |                           |                          |                         |                  |                 |                |                   |                  |
| with lights  | n°                        | 4                        | 31.000                  | 124.000          | 86800           | 37200          | 37200             | 86800            |
| with lights and barriers                                   | n°                        | 0                        | 0                       | 0                |                 |                |                   |                  |
| <b>Block system</b>  |                           |                          |                         |                  |                 |                |                   |                  |
| Block section n°   |                           | 51                       | 35.000                  | 1.785.000        | 1338750         | 446250         | 357000            | 1428000          |
| <b>Centralised Traffic Control<br/>(without TLC cable)</b> |                           |                          |                         |                  |                 |                |                   |                  |
| Central Post   |                           | 0                        |                         |                  |                 |                |                   |                  |
| Peripheral<br>Places<br>n°                                 |                           | 4                        | 20.000                  | 80.000           | 60000           | 20000          | 8.000             | 72000            |
| <b>total</b>   |                           |                          |                         | <b>3.537.040</b> | <b>2723982</b>  | <b>813058</b>  | <b>711808</b>     | <b>2825232</b>   |
|  |                           |                          | %                       | <b>100</b>       | <b>77</b>       | <b>23</b>      | <b>20</b>         | <b>80</b>        |

Table C

Investments costs

| Quantities                     | Kungrad   | Jaslyk       | Karakalpakia(e) | Total   |
|--------------------------------|-----------|--------------|-----------------|---------|
|                                | Jaslyk(e) | Karakalpakia | Beyneu(e)       |         |
| Points n°                      | 122       | 63           | 20              | 218     |
| Block section n°               | 88        | 72           | 51              | 211     |
| Length km                      | 170+386   | 135+848      | 100+428         | 406+662 |
| level crossings<br>with lights | 11        | 6            | 4               | 21      |

Table D Quantities

Note:( Beyneu is not included)

**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   |                               |
| <b>Crew on service of the station equipment:</b>   | 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                             |

| Divisions and served devices                                       | Post                   | Measuring             | Norm of service |    |    | Norm of number on a measuring |
|--|------------------------|-----------------------|-----------------|----|----|-------------------------------|
|  |                        |                       | 1               | 2  | 3  |                               |
| <b>Crew on service of devices of automatic block relay systems</b> | 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                             |
|  |                        |                       |                 |    |    |                               |
| <b>Crew for service of devices:</b>                                | 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                             |

| Divisions and served devices   | Post                   | Measuring             | Norm of service |   |     | Norm of number on a measuring |
|--|------------------------|-----------------------|-----------------|---|-----|-------------------------------|
|  |                        |                       | 1               | 2 | 3   |                               |
| <b>The crew serving crossings:</b>   | 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                             |
| <b>The crew of a signal system serving wires, suspended on air and power distribution circuits</b> | senior electromechanic | Part Electromechanics |                 |   | 6   | 1                             |
|  | electromechanic        | km                    |                 |   | 400 | 1                             |
|  | electrical engineer    | km                    |                 |   | 800 | 1                             |
| <b>The crew of a signal system serving the devices of a controlled manual block</b>                | senior electromechanic | Part Electromechanics |                 |   | 6   | 1                             |
|  | electromechanic        | key dep. Switch       |                 |   | 47  | 1                             |
|  | electrical engineer    | key dep. Switch       |                 |   | 72  | 1                             |

| 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

Module B – Feasibility Study

|  |             | Number  | number for each electromechanic | number for each electric engineer | electromechanic need | electric engineer need | senior need |
|--|-------------|---------|---------------------------------|-----------------------------------|----------------------|------------------------|-------------|
| Switches   | n °         | 20      | 33                              | 38                                | 0,61                 | 0,53                   |             |
| Station power blocks   | n °         | 4       | 11                              |                                   | 0,36                 |                        |             |
| Diesel elec generator  | n °         | 2       | 7                               |                                   | 0,3                  |                        |             |
| Manual block   | n°of points | n.n.    |                                 |                                   |                      |                        |             |
| Level crossings with autobarriers                              | n°          | n.n.    |                                 |                                   |                      |                        |             |
| Level crossings without autobarriers                           | n°          | 4       | 44                              | 50                                | 0,09                 | 0,08                   |             |
| Automatic block  | km          | 100,428 | 32                              | 60                                | 3,14                 | 1,67                   |             |
| basic total equipment with life-time expired from over 10 year |             |         |                                 |                                   | 4,5                  | 2,28                   | 1           |
|  |             |         |                                 |                                   | 8                    |                        |             |
|  | plus 60%    |         |                                 |                                   | 5                    |                        |             |
| <b>need</b>  |             |         |                                 |                                   | <b>13</b>            |                        |             |

Table F Maintenance needs



Module B – Feasibility Study

Table G Existing quantity of man power on stations

| №  | Arrangement (km) | Name of the station  | The station supervisor | The traffic operator | Switchmen | senior electromechanic | electromechanic | The chief of the section | electrical engineer |   |
|----|------------------|----------------------|------------------------|----------------------|-----------|------------------------|-----------------|--------------------------|---------------------|---|
| 1  | 626+917          | <b>Kungrad</b>       | 5                      | 34                   |           | 1                      | 6               |                          | 8                   |   |
| 2  | 646+568          | Raushan              | 5                      |                      |           | }                      | 1               |                          | 1                   |   |
| 3  | 671+602          | Kunkhoja             | 5                      | 3                    |           |                        | 1               |                          | 1                   | 1 |
| 4  | 688+184          | <b>Kyrk-Kyz</b>      | 5                      | 3                    |           |                        | 1               |                          | 2                   |   |
| 5  | 712+492          | Barsa-Kelmes         | 4                      |                      |           | }                      | 1               | 1                        | 1                   |   |
| 6  | 734+092          | Ajiniyaz             | 5                      |                      |           |                        | 1               | 1                        | 1                   |   |
| 7  | 757+142          | <b>Abadan</b>        | 5                      |                      |           | }                      | 1               |                          | 1                   |   |
| 8  | 778+682          | Kuanysh              | 5                      |                      |           |                        |                 | 1                        | 1                   |   |
| 9  | 797+303          | <b>Jaslyk</b>        | 5                      | 7                    |           | 1                      | 1               |                          | 2                   |   |
| 10 | 822+113          | Ajapbergen           | 4                      |                      |           | }                      | 1               | }                        | 1                   |   |
| 11 | 846+493          | Berdakh              | 5                      |                      |           |                        |                 |                          | 1                   | 1 |
| 12 | 870+933          | <b>Bostan</b>        | 4                      |                      |           |                        | 1               |                          | 1                   | 2 |
| 13 | 892+793          | Ak-Tobe              | 5                      |                      |           |                        |                 |                          | 1                   | 2 |
| 17 | 913+544          | Kiyiksay             | 5                      |                      |           | }                      |                 | 1                        | 2                   |   |
| 18 | 933+151          | <b>Karakalpakiya</b> | 5                      | 24                   |           |                        |                 | 2                        |                     | 3 |
| 19 | 953+500          | <b>Border</b>        |                        |                      |           | }                      |                 | }                        |                     |   |
| 20 | 954+970          | <b>Oasis</b>         | 5                      |                      |           |                        | 1               |                          | 1                   | 2 |
| 21 | 979+521          | <b>Akjigit</b>       | 5                      |                      |           |                        |                 |                          | 2                   | 2 |
| 22 | 1003+638         | <b>Kzyl-Asker</b>    | 5                      |                      |           | }                      |                 | 1                        | 1                   |   |
| 23 | 1023+161         | <b>Kok-Bekty</b>     | 5                      |                      |           |                        | 1               | 1                        | 2                   |   |
| 24 | 1033+579         | <b>Beyneu</b>        | 5                      | 24                   |           | 1                      | 4               |                          | 3                   |   |
| 25 |                  | Total                | 97                     | 95                   |           | 9                      | 30              | 3                        | 39                  |   |

| Karakalpakya(e)-Beyneu |   | First year |     |     |     | Second year |     |     |     |
|------------------------|---|------------|-----|-----|-----|-------------|-----|-----|-----|
|                        |   | Q 1        | Q 2 | Q 3 | Q 4 | Q 1         | Q 2 | Q 3 | Q 4 |
| 1                      | <b>Project Implementation</b>                         |            |     |     |     |             |     |     |     |
| 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 H

**Project implementation planning**



Published March 2005

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