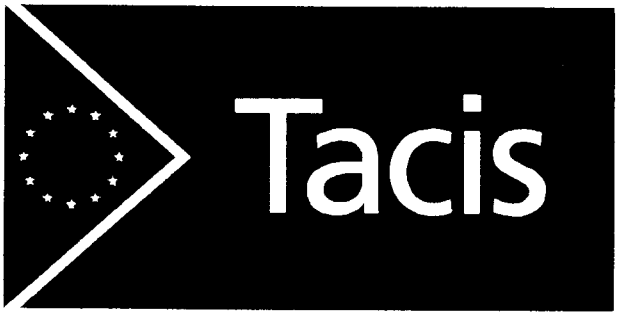

Georgian Railways Restructuring

Final Report, volume 4
Technical Specifications

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RESTRUCTURING OF GEORGIAN RAILWAYS - SAKARTVELO'S RKINIGZA (SR)

TRACKWORK RENEWAL

1. TECHNICAL SPECIFICATION FOR MANUFACTURE AND SUPPLY OF R 65 FLAT--BOTTOM RAIL
2. TECHNICAL SPECIFICATION FOR MANUFACTURE AND SUPPLY OF CONCRETE SLEEPERS AND ELASTIC RAIL FASTENINGS
3. TECHNICAL SPECIFICATION FOR SUPPLY AND DELIVERY OF HIGH PERFORMANCE TAMPING MACHINE (FOR PLAIN LINE)
4. TECHNICAL SPECIFICATIONS FOR SUPPLY AND DELIVERY OF TRACK MAINTENANCE HAND TOOLS AND EQUIPMENT - I
5. TECHNICAL SPECIFICATION FOR SUPPLY AND DELIVERY OF TRACK MAINTENANCE TOOLS AND EQUIPMENT – II
6. TECHNICAL SPECIFICATION FOR RE-INSTALLMENT OF SIGNALLING
7. RIONI BRIDGE

1. TECHNICAL SPECIFICATION FOR MANUFACTURE AND SUPPLY OF R 65 FLAT--BOTTOM RAIL

RESTRUCTURING OF GEORGIAN RAILWAYS - SAKARTVELO'S RKINIGZA (SR)

TRACKWORK RENEWAL

TECHNICAL SPECIFICATION FOR MANUFACTURE AND SUPPLY OF R 65 FLAT-BOTTOM RAIL

C O N T E N T S

TECHNICAL SPECIFICATION FOR MANUFACTURE AND SUPPLY OF R 65 FLAT-BOTTOM RAIL

1. General Requirements (CEN Specification - Note)

The CEN Specification has been prepared under the direction of the CEN Technical Committee 256 Working Group 4 and covers the provision of flat bottom symmetrical railway rails of 46 kg/m and greater linear mass, for general and high speed railway track usage.

The CEN Specification is mainly performance based and is drafted in terms of Qualifying and Acceptance testing.

Rails for this project shall be provided in accordance with the requirements of the CEN Specification and those particular requirements detailed in section 2 below.

2. Particular Technical Specification

2.1 General

Wherever reference is made in the Technical Specifications to specific standards and codes to be met by the goods and materials to be furnished or tested, the provisions of the latest current edition or revision of the relevant standards or codes in effect shall apply, unless otherwise expressly stated in the specifications. Where such standards and codes are national or related to a particular country or region, other authoritative standards that ensure substantial equivalence to the standards and codes specified will be acceptable subject to the agreement of Georgian Railways (SR).

2.2 Scope of Supply (CEN clause 1)

This specification is for the supply of a total of 4550 tonnes of R65 Flat-bottom rail, quality 350 HT made from carbon steel.

Plain line rails for use in operational lines shall be new, having a nominal weight of 65 kg/m (theoretical weight of 64.86 kg/m).

Rails shall be heat treated to obtain the specified hardness and higher strength throughout the whole cross-section of the rail.

2.3 Quality Assurance and Inspections (CEN clause 4)

The Supplier shall operate an independently approved and audited quality assurance system, conforming to the requirements of EN ISO 9002 or equivalent to be approved by Georgian Railways (SR).

The representatives of Georgian Railways (SR) shall have access at all reasonable times to observe and inspect the method of manufacture and shall be entitled to be present at all tests relating to the production of rails for the contract.

The representative shall also be allowed to examine the results from such tests.

The supervision shall be conducted in such a way that it does not interfere with the normal manufacturing operations unless there are acceptable reasons for doing so.

The manufacturer shall be bound to advise Georgian Railways (SR) at least 15 days in advance of the date anticipated for the beginning of the rolling schedule.

2.4 **Manufacture** (CEN clause 5)

Rails shall be manufactured from continuous casting blooms. The choice of steel manufacturing process has been left to the manufacturer and shall be in accordance with clause 5.1 of the CEN Specification.

2.5 **Information to be Supplied by the Purchaser** (CEN clause 6)

2.5.1 Rail Profile (CEN clause 6.1)

The rail profile shall be R65, with theoretical mass of 64.86 kg/m.

2.5.2 Steel Grade (CEN clause 6.2)

The steel grade shall be 350 HT In accordance with Table 1 of the CEN Specification. Chemical composition and mechanical properties shall be in accordance with Table 2 of the CEN Specification.

2.5.3 Profile Class and Tolerances (CEN clause 6.3)

Rail shall be produced which conforms with the tolerances relating to Profile Class Y in accordance with Table 4 of the CEN Specification.

2.5.4 Straightness Class (CEN clause 6.4)

Rail straightness shall be in accordance with Class B of CEN Specification Table 5. Crown profile shall be in accordance with Table 4 of the CEN Specification.

2.5.5 Rail Length (CEN clause 6.5)

Rails shall be provided in 25 metre lengths subject to the tolerances quoted in Table 6 of the CEN Specification.

2.5.6 Rail Drilling (CEN clause 6.6)

Rails shall be delivered undrilled or as specified by the Railways.

2.5.7 Rail Identification Paint Code (CEN clause 6.9)

The steel grade shall be identified at both rail ends using a paint code to be agreed between the manufacturer and Georgian Railways (SR).

2.6 **Identification** (CEN clause 8)

2.6.1 Branding (CEN clause 8.1)

The brand marks shown in relief on the rail web shall be as follows :-

" ROLLING MILL ═ ── 99 R65", or as specified by the Railways.

or as specified by the Purchaser.

Delivery of the rails shall be such that 50% of the rails shall be grouped with the brand marks in relief appearing on one side of the rail web and 50% shall be grouped with brand marks on the opposite side.

2.7 **Qualifying Tests** (CEN clause 9)

The results of the following qualifying tests, performed by an independent laboratory, shall be included in the offer :-

-	Fracture toughness (K_{IC})	(CEN clause 9.2)
-	Fatigue crack growth rate	(CEN clause 9.3)
-	Fatigue test	(CEN clause 9.4)
-	Residual stress in rail foot	(CEN clause 9.5)
-	Variation of centre line running surface hardness or heat treated rails	(CEN clause 9.6)
-	Tensile strength and elongation	(CEN clause 9.7)
-	Interior condition	(CEN clause 9.8)

A complete set of results for the acceptance tests described in clause 10.1 of this specification shall be provided by the Supplier.

2.8 **Acceptance Tests** (CEN clause 10)

2.8.1 General

Each lot shall be inspected by the Purchaser or its representative in the roller mill. The samples shall be taken in accordance with Table 3 of the CEN Specification.

2.8.2 Laboratory Tests (CEN clause 10.1)

Laboratory tests shall be carried out at the frequencies shown in Table 3 of the CEN Specification. Retest procedures shall be in accordance with clause 10.1.8 of the CEN Specification.

2.8.3 Chemical Composition (CEN clause 10.1.1)

Chemical analysis shall be carried out on solid samples for which the chemical composition shall be as follows :-

-	Carbon	0.70 to 0.82%
-	Silicon	0.13 to 0.60%
-	Manganese	0.65 to 1.25%
-	Phosphorus	maximum 0.025%
-	Sulphur	0.008 to 0.03%
-	Aluminium	maximum 0.004%
-	Nitrogen	maximum 0.01%
-	Chromium	residual elements
-	Vanadium	residual elements
-	Molybdenum	residual elements
-	Nickel	residual elements
-	Copper	residual elements
-	Tin	residual elements
-	Antimony	residual elements
-	Titanium	residual elements
-	Niobium	residual elements

2.8.4 Hydrogen (CEN clause 10.1.1.1)

The amount of liquid hydrogen shall be a maximum of 2.0 parts per million.

2.8.5 Determination of total oxygen content (CEN clause 10.1.1.2)

The total oxygen content shall be a maximum of 20 parts per million.

2.8.6 Microstructure (CEN clause 10.1.2)

Testing frequency for microstructure determination shall be in accordance with Table 3 of the CEN Specification.

2.8.7 Decarburisation (CEN clause 10.1.3)

Decarburisation limits are shown in Figures 7 and 8 of the CEN Specification.

2.8.8 Oxide cleanness (CEN clause 10.1.4)

The location for the testing of oxide cleanness shall be in accordance with Figure 9 of the CEN Specification.

2.8.9 Sulphur prints (CEN clause 10.1.5)

Sulphur prints shall comply with annex 3 of the CEN Specification.

2.8.10 Hardness (CEN clause 10.1.6)

The hardness on the centre-line of the head crown shall not vary by more than 30 HBW of any individual rail. The hardness shall be between 350 and 390 HBW.

2.8.11 Tensile tests (CEN clauses 10.1.7 and 10.1.7.2)

The tensile strength shall not be less than 1175 N/mm^2. Elongation shall be a minimum of 9%.

2.9 Dimension tolerances (CEN clause 10.2)

2.9.1 Gauges

The master rail profile and all the gauges required for checking the manufacture shall be provided by the Supplier, at his own expense, and shall be submitted for approval to the Purchaser.

Before manufacture the Supplier shall submit two sets of male and female gauges conforming to the theoretical outline of the rail section to be manufactured, together with two sets of plus and minus limit gauges in accordance with the stipulated maximum tolerances. These gauges shall be stamped after approval by the representative of the Purchaser. One set of all gauges shall remain in the possession of the Purchaser during the period of acceptance.

Only gauges bearing the stamp of the Purchaser shall be valid for checking purposes.

When a master rail profile or a theoretical gauge has been approved by a customer or by an external controlling body it shall be used for other customers on every possible occasion.

2.9.2 Sample rail tests

The representative of the Purchaser at the commencement of the manufacturing process shall select one 25 metre long 60 E1 section rail from the manufactured lots. This rail shall be the sample rail and shall remain on the Supplier's premises until the completion of the full delivery and shall be sent to the Purchaser with the final shipment.

The sample rail must be horizontally positioned on the support located every two metres. Supporting the rail at one metre centres is not permitted. The sample rail shall be subjected to the following measurement and tests :-

- Measurement of the rail length and marking of dimensional deviations
- Measurement of geometrical dimensions of the rail cross-section, symmetry, rail end straightness (vertical and horizontal planes) and corrugation
- Measurement of upsweep and downsweep (offset from level)
- Ultrasonic tests for determination of internal defects covering a minimum of 80% of the rail cross-section
- Checking of surface defects

The results of the above measurements and tests shall be recorded in the report prepared and signed by the representatives of the Purchaser and Supplier.

2.9.3 Profile (CEN clause 10.2.1)

Profile tolerances shall be in accordance with Table 4 of the CEN Specification.

2.9.4 Straightness, surface flatness and twist (CEN clause 10.2.2)

Straightness, surface flatness and twist shall be in accordance with Table 5 of the CEN Specification.

2.9.5 Cutting and drilling (CEN clause 10.2.3)

Rails shall be delivered undrilled. Rail length and end squareness shall be in accordance with Table 6 of the CEN Specification except that the rail length shall be 25 metres ±4 mm.

2.9.6 Inspection requirements/tolerances for internal quality and surface quality (CEN clause 10.4)

2.9.7 Internal quality (CEN clause 10.4.1)

The Supplier shall provide details in his offer of the exact areas of the rail cross-section inspected by the ultrasonic control.

2.9.8 Surface quality (CEN clause 10.4.2)

The surfaces of the rails shall be free from any detrimental defects such as skin holes, shells, hot tears, outflows, weldings, dressings and the traces of any hot or cold protective treatments for defect rectification.

Where defects appear on the rolling surface of the rail head or bottom surface of the rail foot, Eddy current testing should be carried out to determine the depth and position of such defects.

2.9.9 Hot marks and seams (CEN clause 10.4.2.2)

The maximum defect depth shall be as follows :-

- Rail running surface - 0.3 mm
- Rest of rail - 0.4 mm

Rails with continuous longitudinal guide marks shall be rejected.

2.9.10 Cold marks (CEN clause 10.4.2.3)

The maximum defect depth shall be as follows :-

- Rail running surface - 0.3 mm
- Underside of foot - 0.3 mm
- Rest of rail - 0.4 mm

6. Delivery and Acceptance

3.1 The Supplier shall arrange and take the whole responsibility for loading, transportation and unloading of rails at the location specified by the Purchaser. The Supplier shall also take responsibility for all necessary custom clearance formalities.

3.2 The costs associated with rail delivery, but excluding the custom duties and other taxes payable in the Purchaser's country, shall be met by the Supplier.

4. Warranty and Liability

4.1 The warranty period would remain valid for 10 (ten) years after the rails have been delivered to or accepted at the final destination, indicated in the Contract, against any defects attributed to manufacture and undetected at the time of the acceptance.

4.2 If during the warranty period one or more rails have to be removed from the track, due to a fracture or other such defects, then the Supplier shall replace the rails free of charge.

4.3 All costs associated with replacement/renewal of the defective rail, including transportation, but excluding the custom duties and other taxes payable in the Purchaser's country, shall be met by the Supplier.

4.4 The defective rails shall remain the property of the Purchaser.

5. Schedule of Requirements

5.1 Supply and deliver: -

- **4550 tonnes of R 65 Flat-bottom rail, 350 HT quality from carbon steel. All rail shall be supplied in 25 m length.**
- The rail shall be supplied undrilled unless instructed otherwise by the Railways.

2. TECHNICAL SPECIFICATION FOR MANUFACTURE AND SUPPLY OF CONCRETE SLEEPERS AND ELASTIC RAIL FASTENINGS

RESTRUCTURING OF GEORGIAN RAILWAYS - SAKARTVELO'S RKINIGZA (SR)

TRACKWORK RENEWAL

TECHNICAL SPECIFICATION FOR MANUFACTURE AND SUPPLY OF CONCRETE SLEEPERS AND ELASTIC RAIL FASTENINGS

C O N T E N T S

TECHNICAL SPECIFICATION FOR MANUFACTURE AND SUPPLY OF CONCRETE SLEEPERS AND ELASTIC RAIL FASTENINGS

1. CONCRETE SLEEPERS

1.1 General

The Supplier and manufacturer shall possess, operate and show evidence of an ISO certificated quality system in accordance with the requirements of Euronorm EN ISO 9002 for the approval of Georgian Railways (SR).

Wherever reference is made in this Specification to specific standards and codes to be met by the goods and materials to be furnished or tested the provisions of the latest current edition or revision of the relevant standards or codes in effect shall apply, unless otherwise expressly stated in this Specification.

Where such standards and codes are national or related to a particular country or region, other authoritative standards that ensure substantial equivalence to the norms, standards and codes specified will be acceptable subject to the approval of Georgian Railways (SR).

1.2 Design Requirements

Monoblock pre-stressed concrete sleepers shall be designed to allow for the following track parameters:

•	Rail Section	-	R65 Flat-bottom rail
•	Track Gauge	-	1520 mm
•	Rail Centres	-	1593 mm
•	Rail Seat Inclination	-	1:20
•	Axle Load	-	30 tonnes
	Traffic speed	-	120 km/h (main line passenger)
		-	80 km/h (main line freight)
•	Sleeper Spacing	-	543 mm (1840 sleepers/km) maximum
	(between centres)	-	500 mm (2000 sleepers/km) minimum
•	Dynamic Impact Factor	-	2 x static load
•	Depth of Ballast below sleeper	-	300 mm minimum (main line)
•	Minimum Horizontal Curvature	-	350 metres (main line)
•	Maximum Cant	-	150 mm (main line)

Sleepers shall be dimensioned so that the tensile stress in the concrete does not exceed 3 N/mm^2 and the compressive stress does not exceed 20 N/mm^2.

Sleepers shall be designed to withstand extreme onerous conditions (weather, oil contaminants, etc.) and shall be able to withstand extreme frost for up to six months continuously and a temperature range, in service, of - 37°C to + 55°C.

Sleepers shall be designed to accommodate an elastic fastening system in accordance with Section 2 of this Specification. The manufacturer shall submit sleeper and fastening system drawings and designs for the approval of Georgian Railways (SR). The design life of concrete sleepers shall be 40 years.

1.3 Dimensions and Tolerances

Sleeper dimensions shall be as follows:

- Length - 2700 mm ± 10 mm
- Width - Minimum 235 mm, Maximum 300 mm at base ±5 mm
  Minimum 150 mm, Maximum 180 mm at top ±5 mm
- Depth - Minimum 185 mm at centre and ends +10, -3 mm
  Minimum 220 mm at centre of rail foot +10, -3 mm

(Note: - The above dimensions are indicative only. The dimensions of the proposed sleeper, including tolerances, shall be submitted by the manufacturer to the Railways for the approval.)

The rail seat inclination shall not be less than 1:18 and not more than 1:22 towards the centre of the track gauge.

Relative rail seat inclination twist shall not be more than 0.5 degrees (1:115).

The rail seat inclination of the concrete shall be correct to a tolerance of ± 0.5 mm.

1.4 Materials

1.4.1 General

All materials shall comply with this standard or other alternative standard as agreed with Georgian Railways (SR). Materials other than those specified below shall only be used with the approval of Georgian Railways (SR).

Great care shall be exercised in the selection of materials to ensure the long term durability of the concrete. Consideration shall be given to the requirements for freeze-thaw resistance, porosity and abrasion resistance.

1.4.2 Concrete

Concrete shall generally comply with ENV 206 Procedures together with the following requirements :-

Concrete shall consist of cement, coarse aggregate, fine aggregate, water and admixture, as necessary, and shall be mixed at the sleeper factory by an appropriate mixing plant.
The concrete from which concrete sleepers are to be made shall meet the following criteria:

- The compressive strength shall be a minimum of 55 N/mm^2 at 7 days or 60 N/mm^2 at 28 days.
- The compressive strength at transfer shall be a minimum of 30 N/mm^2.
- The bending tensile strength shall be a minimum of 5 N/mm^2 at 7 days and 6.2 N/mm^2 at 28 days.
- Subject to verification and acceptance by all parties the micro cracking index shall be a maximum of 1.5 (based on zero for concrete with few or no micro cracks and 3 for concrete with numerous micro cracks).
- No recrystallite ettringite shall be allowed.
- The frost resistance value shall be in accordance with Georgian Railways (SR) agreement/practices.
- The water / cement ratio shall be less than 0.45.
- The minimum cement content shall be 300 kg/m^3.
- Compaction of the concrete shall be sufficient to minimise water penetration.

The workability of the concrete mixture shall be such as to allow it to be easily worked into the extreme corners of the moulds and around pre-stressing wires and fastening inserts, without allowing materials to segregate or free water to collect on the surface.

The manufacturer shall submit design data and test reports of the proposed mixture to be used for the approval of Georgian Railways (SR). Production of sleepers shall not commence without the approval of Georgian Railways (SR).

1.4.3 Cement

Cement shall be Ordinary Portland Cement provided in accordance with British Standard BS12 : Part 2 or equivalent.

1.4.4 Coarse Aggregate

Coarse aggregate shall be composed of washed well graded crushed stone or gravel which shall be clean, hard and durable. If necessary, dirt and other deleterious coatings shall be removed by washing.

The maximum size of coarse aggregate shall be 20 mm; aggregate shall be well graded in accordance with Table No. 1.

Sieve size (mm)	20	13	10	5
% passing by weight	100	95-100	40-70	0-15

Table No.1 - Coarse Aggregate Grading

Not more than 5% shall pass a BS No. 7 sieve.

The amount of deleterious material shall not exceed the following limits:

- Clay Lumps - 0.25% by weight
- Material finer than No. 200 sieve - 1.0% by weight

The percentage of wear resulting from the Los Angeles abrasion test shall not exceed 30%.

Alternative sieve sizes may be used to determine the particle size distribution shown in Table No.1. The Supplier shall provide details of the standard test sieves he proposes to use for the approval of Georgian Railways (SR).

1.4.5 Fine Aggregate

Fine aggregate shall be composed of clear, hard, durable, natural or manufactured sand or a combination of natural and manufactured sand, and shall be cuboid or spherical in shape.

Grading of fine aggregate shall be in accordance with Table No.2.

Sieve size (mm)	10	5	No.7	No.14	No.25	No.52	No.100
% passing by weight	100	95-100	80-100	45-80	25-60	10-30	2-10

Table No.2 - Fine Aggregate Grading

Alternative sieve sizes may be used to determine the particle size distribution shown in Table No.2. The Supplier shall provide details of the standard test sieves he proposes to use for the approval of Georgian Railways (SR).

Deleterious material such as clay lumps shall not be greater than 1.0% by weight.

The selection of aggregates shall be such as to prevent deterioration of the concrete from Alkali Aggregate Reaction (AAR) with the cement.

1.4.6 Water

Water shall be clean and shall be free from alkalis, acids, oils, organic material and any other deleterious material.

1.4.7 Admixtures

To achieve high strength concrete, admixtures shall be used which shall be of a non-harmful non-chloride type.

The concrete sleeper manufacturer shall provide details of the admixture to be used for the approval of Georgian Railways (SR).

1.4.8 Pre-Stressing Steel

Pre-stressing steel shall be manufactured from hot rolled steel, used for wire drawing.

Three wires of the same diameter shall be spun together to form a helical 3 wire strand. The amount of reinforcement (wires) shall be determine the manufacturer and agree with Railways.

The lay length or pitch shall be 14 to 22 times the nominal strand diameter.

Pre-stressing steel shall be manufactured generally in accordance with Euronorm EN 10138 or equivalent.

The manufacturer shall provide details of the standards he proposes to use for the approval of Georgian Railways (SR).

Other standards may be acceptable, at the discretion of Georgian Railways (SR) provided that their quality and performance criteria are not less than those of the above mentioned standard.

The three wire strand shall consist of 3 x 3.15 mm wires of quality standard 1860 and shall have the following minimum properties:

- Mass - 183 g/m
- Tensile Strength Rm - 1860 N/mm^2
- Diameter - 6.8 mm
- Cross-sectional area - 23.4 mm^2 ±2%
- Characteristic Breaking Load - 43.5 kN
- Maximum Breaking Load - 49.8 kN
- Characteristic 0.1% Proof Load - 37.4 kN

- Nominal modulus of elasticity - 195 kN/mm^2
- Maximum relaxation after 1000 hrs of initial load - 2.5%
- Minimum elongation at maximum load- 3.5%

The chemical composition of the steel from which the wire is made shall be in accordance with Table No 3.

	C	Si	Mn	P	S
% min	0.77	0.15	0.60	-	-
% max	0.82	0.35	0.80	0.025	0.020

Table No 3 - Chemical Composition of Steel

The manufacturer shall provide a detailed description of the steel he proposes to use for the approval of Georgian Railways (SR).

1.5 Concrete Sleeper Manufacture

1.5.1 General

The manufacturer shall provide Georgian Railways (SR) with a complete set of drawings of the pre-stressed concrete sleeper proposed and shall include a complete description of the manufacturing process including materials, labour, plant and other necessary equipment.

Prior to commencement of concrete sleeper production the manufacturer shall complete a production file for manufacturing data which shall be submitted to Georgian Railways (SR) and which shall include:

- A description of the constituent materials including origin, composition, shape and size;
- The mix design;
- A full description of the production process for the concrete including cold weather working and the storage and measurement of materials;
- A technical report on the alkali content, abrasion resistance, freeze-thaw resistance and water absorption;
- A technical report on the design tests carried out;
- Water/cement ratio and tolerance;
- Weight of each component of concrete and tolerance;

- Sieve curves for each component of concrete and tolerance;
- Minimum compressive and tensile strength on concrete samples after 7 days and 28 days;
- Minimum concrete compressive strength before releasing prestressing tendons;
- Maximum relaxation for prestressing tendons after 1,000 hours;
- Description of the prestressing system including prestressing force and tolerance on each tendon;
- Method of concrete vibration;
- Curing time and temperature cycle;
- Method used for releasing prestressing force;
- Stocking and stacking rules after manufacture;
- Minimum concrete compressive strength before releasing prestressing tendons.
- Concrete sleepers shall be manufactured using the "Long Line" or alternative system in a factory of sufficient capacity to meet the requirements of Georgian Railways (SR).

1.5.2 Sleeper Moulds

Moulds shall be of rigid high quality steel and shall be designed so that the sleepers are cast up-side down.

Prior to casting of concrete the moulds shall be covered in oil on the inside; care should be taken not to deposit oil on pre-stressing strands or fastening anchors.

The moulds shall be designed to ensure that there is no leakage of grout during casting.

1.5.3 Concrete Mixing and Production

Concrete shall be thoroughly mixed by means of concrete batching in a pan mixer machine. Alternative methods of mixing may be proposed by the Supplier for the approval of Georgian Railways (SR).

Provision shall be made for mixing the aggregates, cement and water in the correct quantities, to produce the required high strength concrete.

The production of concrete sleepers shall be by the "Long Line" or alternative method; the Supplier shall provide details of the method proposed for the production of concrete sleepers, including methods for preventing concrete leakage, and compaction details for the approval of Georgian Railways (SR).

Fresh concrete shall be protected during curing with a plastic sheet within 30 minutes of casting until stress transfer has occurred.

At the time of casting the maximum temperature of the concrete shall not be greater than 30°C.

The difference in temperature between different parts of the sleeper shall not exceed 20°C during the three days after casting. If the outdoor temperature is less than 5°C the sleepers shall be stored indoors for at least two days after casting; warm sleepers shall be protected against sudden temperature variations when being transferred to an outdoor storage site.

The underside of sleepers shall be rough to provide increased lateral resistance. The maximum deviation in bottom surface evenness shall be ±3mm, provided that a minimum 30mm concrete cover to prestressing strands is obtained.

1.5.4 Concrete Curing

The manufacturer shall provide details of the curing method proposed for the approval of Georgian Railways (SR).

The curing temperature and period shall be monitored and controlled with the temperature of concrete being taken and logged at the pre-production stage and at least four times per day.

After curing has been completed the compressive strength of the concrete at transfer of prestress shall be obtained.

Sleeper production shall not commence unless the sleepers have attained a minimum compressive strength of 35 N/mm^2.

1.5.5 Marking

Concrete sleepers shall be indelibly marked as follows:-

- Top surface of sleeper
  - SR – R65 - in "four-foot"
  - Name of the sleeper plant - "
  - Year of manufacture - sleeper end
  - Sleeper mould number - "

- Side of sleeper
  - Day and month of manufacture + standard used

1.6 Tests on Concrete Sleepers

1.6.1 General

The following tests shall be carried out on concrete sleepers:-

- Frost Salt Test
- Crack Tests
- Concrete Cube Compression and Bending Tests
- Sleeper Dynamic Loading Tests
- Sleeper Static Loading Tests
- Anchor Pulling Test

1.6.2 Frost Salt Test

The Frost Salt Test shall be carried out in accordance with Georgian Railways recommendations.

1.6.3 Crack Test

The manufacturer shall provide details of his proposed Crack Test procedures for the approval of Georgian Railways (SR).

1.6.4 Concrete Cube Tests

Compression and bending tests on concrete cubes shall be carried out in accordance with currently valid general construction standards.

The manufacture shall provide details of the proposed test procedures for the approval of Georgian Railways (SR).

1.6.5 Sleeper Dynamic Loading Test (Sleeper End)

A load shall be applied simultaneously to both rail bearing surfaces with the bottom surface of the sleeper symmetrically supported.

A minimum load of 40 kN and a maximum of 185 kN per rail seat shall be applied at a frequency of 10 Hz during two million load cycles.

No permanent cracks greater than 0.05 mm shall be accepted.

1.6.6 Sleeper Dynamic Loading Test (Sleeper Centre)

The sleeper shall be supported up-side down at the rail seat positions with the bottom surface of the sleeper loaded symmetrically.

The total upper load limit shall be 110 kN divided equally with a lower total load limit of 25 kN. These shall be applied at a frequency of 10 Hz during two million load cycles.

No permanent cracks greater than 0.05 mm shall be accepted.

1.6.7 Sleeper Static Loading Test (Sleeper End)

The sleeper shall be set up in accordance with section 1.6.5 of this Specification.

During the static test the load shall be increased at a rate of 10 kN/min up tater than 0.05 mm

- Crack details for a load of 270 kN.

The following loads shall be the minimum allowed under test procedures:-

- First Crack - 150 kN minimum
- Permanent Crack - 240 kN minimum
- Breaking - 300 kN minimum

1.6.8 Sleeper Static Loading Test (Sleeper Centre)

The sleeper shall be set up in accordance with section 1.6.6 of this Specification.

During the static tests the load shall be increased at a rate of 10 kN/min up to 40 kN and after that in steps of 5 kN.

The load shall be increased in steps until breaking occurs.

The following details shall be recorded:-

- Longest crack width
- Load value for first appearing crack
- Load value for crack length greater than 15 mm
- Load value for crack width greater than 0.1 mm
- Load value for permanent crack width greater than 0.05 mm
- Crack details for a load of 145 kN.

The following loads shall be the minimum accepted under test procedures:-

- First Crack - 80 kN minimum
- Permanent Crack - 128 kN minimum
- Breaking - 160 kN minimum

1.6.9 Anchor Pulling Test

Pulling tests shall be carried out on screw or clip fastening anchors as necessary. The manufacturer shall provide details of the proposed tests to be carried out for the approval of Georgian Railways (SR).

1.7 Inspection and Acceptance

1.7.1 General

The representatives of Georgian Railways (SR) shall be entitled, at any time during working hours, to access the concrete sleeper factory in order to inspect all aspects of the manufacturing process and materials and plant involved.

Georgian Railways (SR) shall be allowed to supervise tests and measurements and carry out inspections as required.

The Supplier shall provide details of all tests and materials relating to the concrete sleepers to be provided.

1.7.2 Dimensional Verification

The Supplier shall provide two sets of gauges for checking dimensions, one of which shall remain the property of Georgian Railways (SR).

Visual inspection of the finished concrete sleepers shall be undertaken to ensure that concrete sleepers are free from surface defects including hair cracks.

2. ELASTIC RAIL FASTENING SYSTEM

2.1 General

The rail fastening system shall consist of rail pads, spring clips, clip or screw inserts, insulators, screws and washers as required. The Supplier shall provide details of the proposed fastening system to be provided for the approval of Georgian Railways (SR).

The tenderer shall provide Georgian Railways (SR) with details of the respective quality system for each fastening component for approval. The quality systems shall be ISO certified to ISO 9000 or equivalent.

The rail fastening shall be of an elastic type capable of withstanding forces resultant from 30 tonne axle load vehicles coupled with speeds and track parameters detailed in accordance with section 1.2 of this Specification.

The rail fastening shall be of a type which will satisfactorily achieve the desired clamping force.

The manufacturer shall be permitted to submit alternative designs for fastening systems which will be supplied attached to the concrete sleeper.

The design of the rail fastening shall be such that it can be installed and removed by non-specialist labour using simple tools with the minimum of supervision. The rail fastening shall also be suitable for installation and removal by mechanical equipment.

Wherever reference is made in this Specification to specific standards and codes to be met by the goods and materials to be furnished or tested the provisions of the latest current edition or revision of the relevant standards or codes in effect shall apply, unless otherwise expressly stated in this Specification.

Where such standards and codes are national or related to a particular country or region, other authoritative standards that ensure substantial equivalence to the standards and codes specified will be acceptable subject to the approval of Georgian Railways (SR).

2.2 Rail Pads

2.2.1 General

Rail pads shall be provided for locations between the foot of the rail and the top surface of the concrete sleeper.

Rail pads shall be provided in accordance with the Suppliers product specification and shall be of elastomeric material with a maximum stiffness of 70 kN/mm. Pads of the same type shall have been used successfully in track with axle loads of 30 tonnes and for a minimum lifetime traffic flow of 500 million gross tonnes (MGT).

2.2.2 Marking

Each pad shall be marked in legible and indelible characters with the following details:-

- Suppliers Mark
- The date of the year of manufacture

2.2.3 Dimensional Tolerances

The following tolerances shall apply to the pad dimensions:

- Length - ±1.5 mm
- Width - ±1.5 mm
- Thickness - ±0.5 mm
- Squareness of Cut - ±0.5 mm

Pads shall have a flatness which complies with the specified tolerances and shall be free from moulding defects.

2.2.4 Tests

The following tests shall be carried out:

- Hardness Test in accordance with ISO Standard R868
- Ultimate Tensile Test in accordance with BS 903 Part A2 or equivalent
- Percentage Elongation Test in accordance with BS 903 Part A2 or equivalent
- Compression Set Test in accordance with BS 903 Part A2 or equivalent
- Electrical Resistance Test in accordance with Appendix 1 of UIC Code 864-5 or ASTM D257 or equivalent.

2.2.5 Packing

The Supplier shall provide details of the packaging proposed for the approval of Georgian Railways (SR).

Each package shall bear the following information:

- The name or mark of the Supplier
- The order number
- The number and total weight of the parts.

Packing used for despatch shall not have been used previously for any purpose which may cause it to damage the material.

2.2.6 Guarantee

The Supplier shall guarantee his supplies against all defects attributable to manufacture and materials for a period of 5 (five) years following the date of manufacture of the pads.

Test results shall be in accordance with Table No 4.

Hardness 71 ± 3 ± 5 Change		SHORE A (Acceptance) SHORE A (after 7 days at -40°C)
Ultimate Tensile Strength		17 Mpa (minimum)
Elongation		300 % of unstrained gauge length
Compression Set	Test 1	30 % Duration of Test : 22 hours Temperature :70°C Strain Constant : 25 % 30 minute recovery period at 23°C
	Test 2	20 % Duration of Test : 70 hours Temperature :23°C Strain Constant : 25 % 30 minute recovery period at 23°
Electrical Resistance		≥ 100 megohms
Density		930 -952 Kg/m^3

Table 4 - Rail Pad Test Results

2.2.7 Alternative Designs

The Supplier may offer alternative pad designs for the approval of Georgian Railways (SR) together with test procedures and criteria proposed. These details shall take into account the track design criteria detailed in Section 1.2 of this Specification and the requirement to withstand extreme onerous conditions (weather, oil contaminants etc) at a temperature range of -35°C to +53°C.

2.3 Elastic Rail Clips

2.3.1 General

Elastic rail clip fastening shall be employed for fixing R65 flat-bottom rail section onto pre-stressed concrete sleepers.

The design shall be simple and shall allow for easy installation and maintenance.

2.3.2 Rail Clamping Force

The clamping force shall be ensured for a minimum traffic flow of 500 MGT.

The average clamping force shall be between 8 kN and 12.5 kN giving a deflection in the range 10-15 mm.

The resistance to longitudinal creep with the rail resting on an elastomeric pad shall be between 14 kN and 20 kN.

2.3.3 Electrical Insulation

The elastic fastening for fixing rail to concrete sleepers shall ensure electrical insulation between the rail and the sleeper.

The electrical resistance of the fastening shall exceed 10 kΩ and shall be determined in accordance with the procedures described in ERRI D170 Report 3.

2.3.4 Raw Material

Material for elastic rail clips shall be from alloy spring steel to BS970, Part 2: 1988 Grade 251A58 or equivalent. The Supplier shall provide details of the proposed material and chemical composition for the approval of Georgian Railways (SR).

Steel shall be free from detrimental surface and internal defects.

Clips shall be heat treated to achieve a surface hardness of 44 to 48 Rockwell C or equivalent and shall be supplied free from burrs, which may be considered harmful when handled, or affect efficient assembly of the clip.

2.3.5 Protective Coating

Clips shall be provided with a protective coating which may include the following alternatives:-

- Bituminous Coating
- Hot dipped galvanising
- Sheradized zinc coating

The Supplier shall provide details of the proposed coating to be used for the approval of Georgian Railways (SR).

2.3.6 Packing and Identification

Packaged clips shall be part marked in accordance with the Supplier's drawings.

The outer packaging shall identify the following information :-

- Type of clip
- Date of manufacture
- Date of packaging
- Number of clips per package
- Gross weight of package

2.3.7 Tests and Inspections

The following tests and inspections shall be carried out:-

- Chemical analysis
- Visual inspection
- Dimensional accuracy
- Hardness
- Clip toe load determination

The steel Supplier shall submit, with each batch of raw material a certificate detailing the chemical composition of the steel.

The clips shall be free from burrs at the cropped ends. Tooling marks shall be smooth and free from sharp indentations.

Hardness tests shall be carried out in accordance with BS 891 or equivalent.

Clip toe load shall be determined using a calibrated test rig or alternative system.

Details of the above - mentioned test procedures and alternative proposals shall be provided by the Supplier for the approval of Georgian Railways (SR).

2.4 Insulators

2.4.1 General

Insulators shall be manufactured from high viscosity nylon 66 material or equivalent.

Insulators shall not contain glass fibre or other filling material with the exception that an ultra violet stabilising agent shall be added to the raw material.

The Supplier shall provide details of the proposed insulators for the approval of Georgian Railways (SR).

Design life shall allow for a minimum traffic flow of 500 MGT.

2.4.2 Marking

Each insulation shall be marked in raised 3 mm characters with the following information:-

- Manufacturers Designation
- Year of Manufacture
- Material Code
- Pattern Number

2.4.3 Raw Material

Virgin raw material shall be unfilled nylon 66 to which an ultra violet stabilising agent has been added.

Clean reground insulator sprues, which shall be ground when still hot, may be added to the virgin raw material provided that it is not to the detriment of the specified mechanical properties of the insulator.

Properties of the raw material shall be in accordance with Table No. 5.

Density	1.3 - 1.45 g/cm^3
Melt Point	250°C to 270°C
Electrical Volume Resistivity	minimum 2 x 10^{12} Ωcm (before conditioning)

Table No. 5 - Insulator Raw Material Properties

2.4.4 Tests and Inspections

The following tests shall be carried out on insulators:

- Water Absorption Test
- Ultimate Tensile Strength
- Dimensional Accuracy
- Visual Inspection

2.4.5 Water Absorption

For the water absorption conditioning test all insulators shall be conditioned in water until they have absorbed a minimum of 1.0 to 6.0 % of their original moulded weight.

2.4.6 Ultimate Tensile Strength

A tensile load of 6 kN shall be applied to the insulator before failure occurs.

2.4.7 Dimensional Accuracy

Dimensional accuracy of the insulators shall be checked by a method approved by the system designer/Supplier.

Tolerances shall be in accordance with Table No. 6.

Dimensions up to 25 mm	± 0.25 mm
Dimensions 25 - 50 mm	± 0.80 mm
Dimensions over 50 mm	± 1.50 mm
Surface against Rail Foot (convexity)	0 + 0.25 mm
Vertical surface against rail foot edge	± 0.5 mm

Table No. 6 - Dimensional Tolerances of Insulators

2.4.8 Visual Inspection

Insulator surfaces shall be clean and free from any evidence of gassing or burning.

2.5 Concrete Sleeper Cast-in Anchor

2.5.1 General

Concrete sleeper anchors shall be provided for anchorage of screw inserts or clips as necessary. The anchor shall leave sufficient grip in the sleeper to give resistance to loosening under dynamic loads, and a high tensional resistance at the top of the anchor stem.

The Supplier shall provide details of the anchorage system proposed for the approval of Georgian Railways (SR).

Design life of the anchorage system shall be 40 years.

2.5.2 Anchorage for Screw Inserts

The anchorage for screw inserts shall consist of a long plug or plastic dowel.

The Supplier shall provide details of the materials and tests proposed for the approval of Georgian Railways (SR).

2.5.3 Anchorage for Rail Clips

Cast shoulder anchorages for rail clips shall be manufactured from spheroidal graphite cast iron to BS 2789 or equivalent, grade 500/7, with a hardness range of between 170 HB and 241 HB.

The Supplier shall provide details of the materials and tests proposed for the approval of Georgian Railways (SR).

2.6 Screws

2.6.1 General

Screw fastenings shall be provided in accordance with UIC Code 864-1 as required.

2.6.2 Material

Steel shall be manufactured by the Bessemer or Siemens-Martin process, electric process or in a convertor blown with oxygen.

Steel shall be of a hardened type to give a tensile strength of between 470 and 550 N/mm^2 and a minimum elongation of 20%.

2.6.3 Manufacture

Screws shall be manufactured from a single piece without welding. The head shall be formed by hot-working from the bar-stock.

Screws shall be free from camber and the centre lines of the screw head and the thread portion shall be on the same line.

The surface of the screw shall be smooth and free from injurious wrinkles, cracks and fractures. Screws shall be galvanised by the hot zinc process. The zinc used shall not contain more than 2% of impurities, with the maximum aluminium content being 0.2%.

The coating shall be neat, smooth and free from bulges, dripping cracks or other defects.

The sleeper screws shall be free from all traces of grease, paint, etc., before the coating of zinc is applied.

2.6.4 Marking

The following marks shall be shown on the head of the screw in permanently embossed characters:

- The Suppliers mark
- The last two figures of the year of delivery
- The identification mark.

The initials "SR" shall be clearly marked on the top surface of the head of the screw.

2.6.5 Tolerances

Dimensional tolerances shall be in accordance with table No. 7.

Top of head	$\pm$ 0.5 mm
Collar diameter	$\pm$ 0.5 mm
Core diameter	$\pm$ 0.5 mm
Diameter over thread	$\pm$ 0.5 mm
Shank length	Length $\pm$ 4%

Table No. 7 - Dimensional Tolerances of Screws

2.6.6 Tests and Acceptance

Tests and Acceptance shall be in accordance with UIC Code 864-1.

The following tests shall be carried out:

- Material Test
- Tensile Test

- Bend Test
- Dimensional Inspection
- Galvanising Inspection

As an alternative to material tests the Supplier may supply a rolling mill certificate for each steel cast for acceptance by Georgian Railways (SR).

Tests on dimensional quality may be dispensed with subject to the Supplier providing an acceptable quality control procedure as approved by Georgian Railways (SR).

2.6.7 Packing

The Supplier shall provide details of the packaging proposed for the approval of Georgian Railways (SR).

Each package shall bear the following information:

- The name or mark of the Supplier
- The order number
- The number and total weight of the parts.

Packing used for despatch shall not have been used previously for any purpose which may cause it to damage the material.

2.6.8 Guarantee

The Supplier shall guarantee his supplies against all defects attributable to manufacture and materials for a period of twelve months following the date of manufacture of the screws.

2.7 Washers

2.7.1 General

Washers shall be provided in accordance with UIC Code 864-3 as required.

2.7.2 Material

Spring washers shall be manufactured from spring steel bars, made from high carbon steel wire rod and shall conform to the chemical competition shown in Table No.8.

	C	Si	Mn	P	S
% Min.	0.59	0.15	0.30	-	-
% Max.	0.86	0.35	0.90	0.04	0.04

Table No.8 - Chemical Composition of Washers

The Supplier shall provide details of the proposed washers to be used for the approval of Georgian Railways (SR).

After shaping the washers shall be hardened and tempered. Washers shall be manufactured to give a minimum tensile strength of 1375 N/mm^2 and a minimum elongation of 6%.

2.7.3 Marking

The following marks shall be stamped on each washer by a blunt-edged punch in sufficiently legible characters:

- The Suppliers mark
- The last two figures of the year of delivery

2.7.4 Finish

The washer surfaces shall be regular and clean, and free from superficial cracks, flaws, burrs, deficiency in metal, folds or any other defect likely to affect the use for which the part is intended.

2.7.5 Tolerances

Dimensional tolerances shall be in accordance with Table No. 9.

Internal diameter	1.2 mm
Section, long side, small side and diameter	0.4 mm
Height	1.6 mm

Table No. 9 - Dimensional Tolerances of Washers

2.7.6 Tests and Acceptance

Tests and acceptance shall be in accordance with UIC Code 864-3.

The following tests shall be carried out:

- Flattening Test
- Compression Test
- Torsion Test
- Texture Test
- Hardness Test
- Dimensional Inspection

Tests on dimensional quality may be dispensed with subject to the Supplier providing an acceptable quality control procedure as approved by Georgian Railways (SR).

2.7.7 Packing

The Supplier shall provide details of the packaging proposed for the approval of Georgian Railways (SR).

Each package shall bear the following information:

- The name or mark of the Supplier
- The order number
- Description of the parts
- Number and total weight of the parts.

Packaging for despatch shall not have been used previously for any purpose which may cause it to damage the material.

2.7.8 Guarantee

The Supplier shall guarantee his supplies against all defects attributable to manufacture and materials for a period of twelve months following the date of manufacture of the washers.

3. Delivery and Acceptance

3.1 The Supplier shall arrange and take whole responsibility for loading, transportation and unloading of concrete sleepers, including the rail fastening assemblies, at the location specified by the Purchaser. The Supplier shall also take responsibility for all necessary custom clearance formalities.

3.2 The costs associated with the delivery of concrete sleepers, including rail fastening assemblies, but excluding customs duties and other taxes payable in the Purchaser's country, shall be met by the Supplier.

4. Warranty and Liability

4.1 The warranty period would remain valid for 10 (ten) years after the concrete sleepers have been delivered to or accepted at the final destination, indicated in the Contract, against any defects attributed to manufacture and undetected at the time of the acceptance.

4.2 If during the warranty period the defects became apparent then the Supplier shall replace the sleepers free of any charges.

4.3 All costs associated with the replacement/renewal of defective sleepers, including rail fastening assemblies, but excluding customs duties and other taxes payable in the Purchaser's country, shall be met by the Supplier.

5. Schedule of Requirements

5.1 Supply and delivery: -

- **90 000 pre-stressed concrete monoblock sleepers together with complete elastic type rail fastening assemblies.**

3. TECHNICAL SPECIFICATION FOR SUPPLY AND DELIVERY OF HIGH PERFORMANCE TAMPING MACHINE (FOR PLAIN LINE)

RESTRUCTURING OF GEORGIAN RAILWAYS - SAKARTVELO'S RKINIGZA (SR)

TRACKWORK RENEWAL

TECHNICAL SPECIFICATION FOR SUPPLY AND DELIVERY OF HIGH PERFORMANCE TAMPING MACHINE (FOR PLAIN LINE)

C O N T E N T S

TECHNICAL SPECIFICATION FOR SUPPLY AND DELIVERY OF HIGH PERFORMANCE TAMPING MACHINE (FOR PLAIN LINE)

1. General Requirements

The plain line track tamping, line and levelling machine shall be capable of performing the following operations: -

1.1 To determine track alignment of ballasted track on either wooden or concrete sleepers with R 65, R 60 or R 50 flat-bottom rail.

1.2 To continuously tamp the track ballast under two sleepers.

1.3 To tamp the ballast at the sleeper ends.

2. Country's Climate

• Altitude above Sea Level	-	< 1500 m
• Ambient Temperature	-	Lowest: -20° C
	-	Highest: +40° C
• Climatic Zone	-	moderate climate
• Atmospheric Humidity	-	Lowest: 60%
	-	Highest: 100%

3. Track Geometry and Components

• Track Layout Arrangement	- Single and Double
• Track Gauge	- 1520, (-9; +28)
• Rail Section	- R65; (R50)
• Rail Inclination	- 1:20 nominal towards centre of track
• Minimum Horizontal Track Curvature	- 80 m in transport mode
	- 180 m in operation mode
• Maximum Track Gradient	- 35‰
• Type of Sleepers	- Wooden; length 2750 – 2780 mm
	- Concrete monoblock - 2700 mm (nom.)
• Rail Fastening	- Spikes, coachscrews, holding down bolts or elastic rail fastenings
• Type of Rail Joints	- 4 or 6 holes fishplates
• Sleeper Spacing	- 543 mm (1840 sleepers/km) maximum
	- 500 mm (2000 sleepers/km) minimum
	- 625 – 670 mm at stations
• Type of Track Ballast	- Crushed rock grain size 40-70 mm
	- River gravel size <25 mm
	- Well compacted mixture of ballast, sand, gravel, dust and clay
• Ballast Depth	- 300 mm minimum (theoretical)
• Maximum Admissible Load Gauge	- To comply with Load and Gauge Standard GOST No. 9238 - 83

4. Machine Requirements

4.1 Working

4.1.1 The tamping machine shall operate on the principle of continuous machine movement, while the actual work unit, positioned on a separate under-frame, shall move in cycle from sleeper to sleeper.

4.1.2 The machine shall be fitted with 2 tamping units, capable to tamp simultaneously under 2 sleepers, by pressure and vibration at a frequency in the range of 35-45 Hz and a minimum amplitude of 2.5 mm in the initial situation.

4.1.3 The tamping tool depth in ballast shall be at least 500 mm from the top of the running rail to the tip of the paddle of the tamping tool.

4.1.4 The tamping tool shall be made of an abrasion resistant alloy.

4.1.5 The tamping unit shall be able to move also laterally at least 85 mm.

4.1.6 The tamping machine line and levelling system shall be capable of track slewing and/or lifting by a minimum of 100 mm.

4.1.7 The machine shall be fitted with a ballast compacting device for the sleeper ends. Such compacting devices shall be capable to reach 300 mm below the top of the rail with a ballast shoulder compaction of up to 500 mm.

4.1.8 The design of the vehicle shall enable the machine operations on the track with a maximum track gradient of 35‰.

4.1.9 The ballast tamping machine shall be able to operate also within the station platform areas. The load and structure gauge detail to be supplied by the Georgian Railways.

4.1.10 The machine shall be able to tamp under sleepers that are off centre by up to 50 mm.

4.1.11 The vehicle shall be able to provide 8 hours of continuous operation.

4.1.12 The vehicle shall be designed to be operated, transported or towed at any time of the day.

4.1.13 The machine shall be able to work on either single or double track.

4.1.14 The machine tamping set up time from reaching the site to the ballast tamping operation and vice versa should be no more than 10 min.

4.1.15 The break-down time from operation position to leaving the site, in case of an incident, should be no more than 20 min.

4.2 Transfer

The machine shall be self-propelled during transfer to and from site and capable to maintain a speed of 80 km/h on an inclined track gradient of a maximum of 12‰ and a 100 km/h when it is hauled.

4.3 Braking System

4.3.1 The machine shall be equipped with pneumatically operated block brakes acting on all wheels in accordance with UIC regulations.

4.3.2 The machine shall also be equipped with a mechanically operated parking brakes.

4.3.3 The machine shall also be equipped with an indirect train brake system with KE- valve and appropriate connections.

4.3.4 All the operational units i.e. brake connections, universal joints and other such units shall be supplied with devices to prevent units from touching the track or falling outside the clearances for the vehicle.

4.4 Accommodation

4.4.1 The machine shall be equipped with fully enclosed cabins, one at each end.

4.4.2 All operations for transfer and working shall be controlled from one central driver's and operation stand in an enclosed cabin on the main frame.

4.4.3 For transfer the machine shall be equipped with a second driver's stand in the enclosed front cabin.

4.4.4 An appropriate acoustic, dust protection of the cabins, air conditioning, heating and ventilation system shall be provided.

4.4.5 The cabins shall be equipped with devices for communication between the vehicle crew members, by telephone and radio communication, including the microphones, speakers, etc.

4.4.6 All cables, conducts and electrical installations shall be protected against climatic and other elements.

4.4.7 The machine shall carry sufficient light source to allow perfect sight during dark working.

4.4.8 The machine shall be completely roofed from cabin to cabin.

5. Performance

The ballast tamping machine when in operation of tamping two sleepers at a time shall be capable of carrying out also automatic track levelling, lining and tamping of not less than 2000 sleepers per hour.

6. Equipment

6.1 Tamping Units

6.1.1 The machine shall be equipped with two tamping units.

6.1.2 The tamping unit shall be located on a separate under-frame between the bogies supported on the track by a separate axle.

6.1.3 Compaction parameters at the sleepers' end: -

- Frequency of tamping tool vibration - min. 35 Hz
- Area of tamping plate - min. 0.4 m^2
- Compacting force - 40 kN
- Amplitude of a plate in an initial situation - min. 2.5 mm

6.1.4 The machine shall be able to tamp track with varied sleeper spacing.

6.1.5 The design life of the tamping units shall be for a minimum of 400 km of tamped track.

6.1.6 The design life of the tamping tools shall be for a minimum of 200 km of tamped track.

6.2 Tamping Principle

6.2.1 Tamping operation shall be by pressure and vibration.

6.2.2 All tamping tools shall operate under the same pressure, but independent from each other. The required tamping pressure shall be easy to set. Each tamping arm shall be capable of independent movement to accommodate variations in the ballast bed.

6.2.3 The machine shall be equipped with a mechanism allowing the tamping of double sleepers.

6.2.4 The tamping depth shall be adjustable, in steps, from the operator's seat.

6.2.5 During the lifting and lining process the machine shall not be supported directly on the track ballast.

6.2.6 The machine shall be equipped with a device for removing ballast from top of the sleepers and rail fastenings.

6.3 Track Levelling, Lifting and Lining Equipment

6.3.1 The machine shall be equipped with the following: -

- A computerised unit for automatic measurement of horizontal and vertical track alignment.
- An automatic track lining and levelling system by a method of curve smoothing or by a fixed point method. The control shall be indirect.
- A laser device with a carriage and a remote control of carriage movement with an operator's monitor.
- A recording system that will record the following track parameters before, during and after track tamping operation: -
  - track versines
  - longitudinal track profile
  - track cant (superelevation)
  - track twist
- An on-board diagnostic device to be able to review quickly any malfunctions as they occur in the machine systems.

6.3.2 The track lifting and lining unit shall run along the running rails during the operation in advance of the machine.

6.3.3 The lifting and lining force must be applied on at least two points on each rail.

6.3.4 The lining process shall be carried out without previous measuring runs.

6.3.5 During the operation all the necessary adjustment values shall be continuously calculated, fed back into the system and displayed in the cabin to the operator.

6.3.6 Accuracy of the track lining shall be: -

- smoothness of the track profile over a length of 2.5 m	-	$\leq$1 mm
- track levelling	-	$\leq \pm$ 2 mm
- track lining	-	$\leq$ 2 mm

6.4 Miscellaneous

6.4.1 Lighting: -

- The machine shall be equipped with 8 driving lights. Four at each end fixed to the vehicle's under-frame in the buffer bar area (two on each side). Each pair shall contain one red and one white signal light, symmetrically placed relative to the vertical axis of the vehicle. The red lights shall be placed closer to the centre.
- The power of the signal lamps shall be sufficient to ensure the reliable visibility from a distance of 1500 m on a straight track section in clear visibility.
- In addition the vehicle shall be equipped with two searchlights mounted along the longitudinal axis of the vehicle. The searchlights shall ensure the clear visibility of not less than 800 m in clear weather.
- The vehicle shall be equipped with sufficient lighting for the operation of the vehicle at night.

6.4.2 Warning sound: -

- The vehicle shall be equipped with two sets of pneumatic horns with one set at the each end of the vehicle. One high volume (air horn) and one low volume (whistles).
- The air horns shall provide a sound level of 120 ±5 dB with a main tonal frequency of 360-380 Hz at a distance of 5 m in front of the horn at a pressure of 0.8 MPa.
- The vehicle shall also be equipped with electric alarms for the monitoring operations.

6.4.3 Fire extinguishers

- The vehicle shall be equipped with appropriate fire extinguishing devices. Each cabin shall contain not less than one extinguisher.

7. Construction

7.1 The frame shall be sturdy of welded construction designed to function.

7.2 The vehicle frame shall be sufficiently rigid for the lifting of the vehicle with jacks. The appropriate jacking points shall be clearly indicated on the body of the vehicle.

7.3 The service life of the vehicle shall be not less than 15 years.

7.4 The vehicle shall be equipped at both ends with an automatic coupling units to GOST No. 3475 – 81. The distance from the coupler to the top of the running rail shall be 1060 ±20 mm.

7.5 The installation of the automatic coupling units on the vehicle shall be carried by the Supplier.

7.6 The main frame of the machine shall be equipped with two-axle bogies. One axle shall be provided on a separate under-frame for working units.

7.7 The bogies and axles shall be equipped with an appropriate suspension.

7.8 The vehicle shall be equipped with the pair of wheels 710-950 mm diameter. The maximum axle load in the transport mode shall be 23.25 tonnes.

7.9 Axle and wheels shall be steel forged.

7.10 The rim surface profile of the wheel shall correspond to GOST 9036 – 88. The distance between the inner surface of the wheel rims shall be 1440 +1/-2 mm. The tolerance between the wheel diameters, for the roll of one wheel pair, shall be not more than 1.0 mm.

7.11 The machine shall be equipped with a Diesel engine of well known type with at least 340 HP suitable for operation in the dusty environment at altitude of 2000 m and ambient temperature of 45°C. Under the rated conditions the power of the engine shall be sufficient and correspond to the operation mode of the vehicle. Alternating current requirements for the diesel-generator unit is 50 Hz.

7.12 A pre-heating system for the engine and the operating hydraulic system shall be provided.

7.13 Painting of the vehicle. - With the exception of the tamping units and elements the vehicle painting and the corrosion-preventive coating of the vehicles shall correspond to the technical requirements and standards of UIC 842-1, 842-2, 842-3, 842-6 842-7 and to the ISO/R1461, R2085 and R2128 standards.

7.14 All signs and identifications on the vehicle shall be in Georgian (main language) and Russian.

7.15 All manuals including computer manuals, the user interface software and instructions concerning computer software shall provided in Russian and English.

8. Spare Parts

8.1 The Supplier shall provide within his tender submission a list of mandatory spare parts, amounting to approximately 5% of the total capital cost of the tamping machine. The list shall follow the requirements outlined in the Technical documentation and shall be priced by the tenderers on CIP (place of destination) basis. The cost of these spare parts would be considered for the evaluation purposes. The Purchaser reserves the right to modify the list if required.

8.2 Furthermore the Supplier shall provide within his tender price a list of consumable items that will be required for a period of 5 years machine operation. The Supplier shall itemise the list with an identification, short description and detail price breakdown.

8.3 In order to have a standard basis for comparing submitted tenders, the Purchaser will review the Supplier's lists (spare parts and consumable) and will, if required, add or delete items to these lists. This adjustment of the spare parts list for the initial 5 year period will be based on information furnished by each tenderer as well as on the past experience of the Purchaser. This list is to be used only for comparison during tender evaluation stage.

8.4 The delivery of spare parts to be within 10 (ten) working days of the written request made to the Supplier. During the warranty period all expenses associated with the supply and delivery, but excluding the costs associated with the custom duties and other taxes payable in the Purchaser's country, will be met by the Supplier.

8.5 Any machine breakdown within the warranty period, which results in downtime of 20 (twenty) working days or more shall result in an extension to the warranty by the amount of downtime period.

9. Acceptance and Commissioning

9.1 The initial, preliminary acceptance of the tamping machine will be carried out by the Purchaser at the manufacture's plant at approximately 90% completion. The Supplier shall arrange for the attendance at the factory of two officials from the Georgian Railways and for a Russian interpreter to be present during preliminary acceptance stage. The costs of travelling, including accommodation, will be met by the Purchaser.

9.2 All the necessary technical documents for the vehicle, including the operational, maintenance and repair documents shall be available to the Purchaser at least two months before the date of the preliminary acceptance. These documents shall be in Russian and English.

9.3 The Supplier shall arrange and take responsibility for, machine packing, transportation, unloading and delivery, including all the necessary custom clearance formalities.

9.4 The costs associated with the delivery of tamping machine, but excluding the costs of customs duties and other taxes payable in the Purchaser's country, will be met by the Supplier.

9.5 The final acceptance of the tamping machine vehicle will be made upon the delivery and following the tamping machine vehicle assembly, start-up and adjustments by the Supplier.

9.6 The machine commissioning shall comprise: -

- checking completeness and intactness of the machine
- removal of transport packing
- assembling of the superstructures
- filling up lubricants, fuel, hydraulic oil, etc. and verification of filling levels
- leakage tests for air, gas and liquid systems
- functional tests of the various units
- functional test of the complete machine on the basis of a work sample
- operational trials to demonstrate that all machine performance criteria are met

9.7 In case when the final acceptance are considered unsatisfactory, the operations that are considered necessary, in order to eliminate the defects, shall be conducted by the Supplier with his own resources and at his own expense. The repeated final acceptance shall be conducted upon elimination of all defects.

9.8 On the occasion of the acceptance of the machine an acceptance certificate will be issued by the Supplier and signed and dated by both parties.

10. Training

10.1 The tenderer's proposal shall include: -

10.2 The list of the personnel required for the operation of the machine, with the indication of the number of persons, their positions, responsibilities, qualifications and other relevant data.

10.3 The list of the personnel required for the machine maintenance and repair, stating the number of required persons, professions, qualifications and other relevant data.

10.4 A training plan or schedule for each category or profession of personnel, with the corresponding indication of the theoretical and/or practical subjects stating the locations and training periods for each person.

10.5 The Supplier shall itemise the costs for both Purchaser's and Supplier's personnel, showing costs separately for both.

10.6 An itemised list of the following costs of training: -

- Supplier's costs for factory-based training
- Supplier's costs for site-based training
- Travel costs for Purchaser's personnel
- Subsistence costs for Purchaser's personnel

All costs of training are to be met by the Supplier. In particular the Supplier's price shall include all costs of travel, accommodation and all meals for the Purchaser's personnel on visit to the Supplier's factory.

10.7 For the tender evaluation purpose the Supplier shall submit price, within the tender, for the following training: -

Personnel	Factory-based Period	Site-based Period
Purchaser's personnel		
Machine Operator (tamping)	3 weeks	
Machine Operator (track geometry)	3 weeks	
Machine Maintenance Mechanic	3 weeks	
Interpreter		4 weeks
Supplier's personnel		
Engineer/Lecturer	3 weeks	4 weeks
Interpreter	3 weeks	

11. Quality Control

11.1 Quality Assurance Programme - The proposal from the Supplier shall include a description of its quality assurance programme. This description shall detail the quality control system and procedures at the manufacturing facilities of the Supplier and shall also state whether the Supplier is certified by the recognised quality assurance association.

11.2 The Purchaser reserves the right to audit the quality management system of the Supplier within the period of the proposed evaluation.

11.3 Quality Plan - Within the 30 days from the notification to commence the Supplier shall provide to the Purchaser the quality plan for the contract including manufacturing, delivery, commissioning and preliminary acceptance machine testing.

11.4 Quality Control - The Purchaser, or his agent shall have the right to inspect the supplier's quality control and to audit the supplier's quality management.

12. Technical Documentation

12.1 The complete delivery of ballast tamping machine shall include the corresponding technical documentation: -

- three copies of all technical documents in Russian
- three copies in Georgian
- one copy in English
- one copy in the language of the country of the Supplier

12.2 The Supplier shall also provides certificates for the: -

- materials and devices, subject to technical inspection and checking, such us cables, lines, compressed air tanks, etc.
- wheel sets
- braking system
- complete vehicle with the additional equipment and units

12.3 The Supplier shall provide operating manuals among other things: -

- the description of the vehicle
- the design drawings and relevant diagrams of the vehicle and the main units with main clearances and overall dimensions
- instructions for driving the vehicle in the transport mode
- instructions for the preparation of the vehicle for the transport and operation modes, for the operation and the shut-down of the vehicle
- instructions for operation of all machine functions
- instructions for servicing and adjustment
- instructions for the preventive maintenance of the vehicle and main units including the hydraulic, electrical and pneumatic systems with preventative maintenance cycles for lubrication, inspection and preventative maintenance.
- diagrams of the control of the hydraulic, electrical, electronic and pneumatic systems
- general safety instructions for the maintenance personnel
- instruction for the handling of the vehicles in case of track derailment or breakdown

12.4 The Supplier shall provide the diagrams of the components which are subject to fast wear and use.

12.5 The Supplier shall provide complete list of all spare parts for operation of the vehicle to the end of the vehicle design life. For each individual item the Supplier shall provide the reference number, description, design life, place of origin, unit price and delivery time from stock with separate time for transport. The Supplier shall provide an exploded diagram of the unit showing the location of each spare part.

12.6 The documentation is to include all necessary information and technical documents related to requirements and facilities for the storage of the spare parts, the method of storage and the required storage space. Any special requirements for the condition of spare parts storage, such as temperature, humidity, etc shall be clearly stated.

12.7 Supplier's recommendations for all consumables.

12.8 All information and technical documents concerning the use and application of the devices, instruments and special equipment.

12.9 All relevant information and technical documents concerning requirements and facilities for storage of devices, instruments and special equipment, the method of storage and required storage space.

12.10 All information and technical documents describing the condition of storage of the devices, instruments and special equipment, such us temperature, humidity, etc.

12.12 The instructions for the removal and assembly with the indication of the acceptable tolerances for wear and clearances.

12.13 The documents concerning the repair of the moving parts of the vehicle.

12.14 All the dimensions and clearance limits, specified in the technical documents shall correspond to the SI - International Unit System.

12.15 The Supplier shall provide the Purchaser with all above necessary documents not later than at the machine delivery date. The documents shall correspond to the design of the vehicle as delivered. All alteration to the documents resulting from the final acceptance shall be made by the Supplier within 10 days from the date of the final acceptance and at his own expense.

13. Technical Maintenance and Repair

13.1 The Supplier shall provide the complete list, in Russian and English, of the devices, instruments and special equipment necessary for the technical maintenance and the repair of the vehicle, including the devices, instruments and equipment for the following: -

- Preliminary testing before beginning a maintenance activity on a vehicle
- Tests of sub-units and sub-systems before and after performing a maintenance activity, such as preventative, corrective, standard replacement, overhaul, etc.
- Final testing before placing the vehicle back into service including required tagging and sealing of components.

13.2 The Supplier shall include in its tender the supply of devices, instruments and special equipment required to perform technical maintenance and repair of the vehicle for the complete service life of the vehicle.

13.3 This proposal shall be itemised providing a separate detailed price breakdown and shall be placed in an appendix in the tender along with a detailed description of the operation of each item proposed.

13.4 The Supplier shall also provide, with the tamping machine, a tool kit containing a complete set of tools and equipment for servicing and routine maintenance of the tamping machine.

14. Warranty and Liability

14.1 The warranty period would remain valid for a period of 36 (thirty six) months after the ballast tamping machine has been delivered to or accepted at the final destination indicated in the Contract, or 40 (forty) months after the date of shipment from the port of loading in the source country, whichever period concludes earlier.

14.2 The Supplier shall be contractually responsible to inspect and adjust and/or remedy the tamping machine after 6 (six) months of operation. Thereafter the Supplier will make a yearly check and/or adjustment during the 3 years warranty period, including an inspection at the end of warranty period. The costs associated with these inspections will be met by the Supplier.

14.3 During the warranty period the Supplier will be obliged to remedy all defects that preclude the usage of the vehicle whether resulting from faulty design, materials or poor workmanship.

14.4 The Supplier is obliged to remedy any faults, which occur during the warranty period, at his own expense by either repair or replace defective parts as quickly as possible.

14.5 If it takes more than 20 (twenty) working days to remedy the faulty vehicle then the original warranty period will be extended by the duration that vehicle is out of service.

15. Schedule of Requirements

Supply and deliver **ONE ballast tamping machine**, with continuous mode of tamping operation, together with capability of track line and levelling for plain line operation.

4. TECHNICAL SPECIFICATIONS FOR SUPPLY AND DELIVERY OF TRACK MAINTENANCE HAND TOOLS AND EQUIPMENT – I

RESTRUCTURING OF GEORGIAN RAILWAYS - SAKARTVELO'S RKINIGZA (SR)

TRACKWORK RENEWAL

TECHNICAL SPECIFICATIONS FOR SUPPLY AND DELIVERY OF TRACK MAINTENANCE HAND TOOLS AND EQUIPMENT

C O N T E N T S

TECHNICAL SPECIFICATIONS FOR SUPPLY AND DELIVERY OF TRACK MAINTENANCE HAND TOOLS AND EQUIPMENT

1. General Requirements

The above hand tools and equipment are required for the proposed track rehabilitation programme of the Georgian Railways.

2. Country's Climate

• Altitude above Sea Level	-	< 1500 m
• Ambient Temperature	-	Lowest: -20 C
	-	Highest: +40 C
• Climatic Zone	-	moderate climate
• Atmospheric Moisture	-	Lowest: 80%
	-	Highest: 100%

2. Track Geometry Arrangement

• Track Layout Arrangement	-	Single and Double
• Track Gauge	-	1520, (-9; +28)
• Rail Section	-	R65; (R50)
• Rail Inclination	-	1:20 nominal towards centre of track
• Minimum Horizontal Track Curvature	-	180 metres (main line)
• Maximum Track Gradient	-	35‰
• Type of Sleepers	-	Wooden; length 2750 – 2780 mm
	-	Concrete monoblock - 2700 mm (nom.)
• Rail Fastening	-	Spikes, coachscrews, holding down bolts or elastic rail fastenings
• Type of Rail Joints	-	4 or 6 holes fishplates
• Sleeper Spacing	-	543 mm (1840 sleepers/km) maximum
	-	500 mm (2000 sleepers/km) minimum
	-	625 – 670 mm at stations
• Type of Track Ballast	-	Crushed rock grain size 40-70 mm
	-	River gravel size <25 mm
	-	Well compacted mixture of ballast, sand, gravel, dust and clay
• Ballast Depth	-	300 mm minimum (theoretical)

4. Track Maintenance Hand Tools - Technical Specification

4.1 Ballast Tamping Hand Tool — Qty: 100

4.1.1 The hand held ballast tamping tool shall: -

- be able to compact the track ballast under wooden, concrete or steel sleepers either on plain line or within the points and crossings track layout.
- be operated by three-phase 220 V; 50 Hz electric motor which, for safety reasons, must be completely water tight.
- have high quality ballast compaction under the sleepers with maximum vibration energy transfer to the ballast and with minimum vibration on to the handles.
- have at least triple shock absorption system with handles height adjustment.

4.1.2 The hand held ballast tamper components shall be of sturdy manufacture with a design life of at least 10 years.

4.1.3 The tamping set tips shall be manufactured from a manganese steel alloy with a minimum 300 hrs working life.

4.1.4 For handling purposes the tamping tool should not weigh more than 20 kg.

4.2 Rail Cutting Machine - Disc Type (Electric) — Qty: 6

4.2.1 The rail cutting machine shall be operated by three-faze 220 V; 50 Hz electric motor, which must be completely water tight.

4.2.2 The machine shall be of high capacity with a cutting mode indicator.

4.2.3 The machine shall have easy and quick vice-mounting suitable to fit any rail section.

4.2.4 The machine must have complete stability during rail cutting operation.

4.2.5 The rail cut produced must be straight and square/vertical.

4.2.6 The machine shall be able to cut any type of rail including rail hardened R 65 flat-bottom section in no more than 60 seconds.

4.2.7 There shall not be any mechanical or metallurgical changes to the rail steel during rail cutting operation.

4.2.8 The cutting disc diameter shall be in order of 400 mm with circumferential cutting speed of approx. 60 m/s.

4.2.9 Output of the rail cutting machine shall be in order of 5.5 kW.

4.2.10 The weight of the machine shall be not more than 105 kg

4.2.11 For safety reasons the sparks produced by rail cutting must always be deflected on to the ground.

4.2.12 The machine shall be of sturdy manufacture with a design life of at least 10 years.

4.3 Rail Cutting Machine - Disc Type (Petrol Driven) Qty: 25

4.3.1 The rail cutting machine shall be operated by air-cooled two-stroke petrol engine with a minimum output of 3.7 kW.

4.3.2 The machine shall be capable to cut any type of rail including rail hardened R 65 flat-bottom section.

4.3.3 The machine shall have easy and quick vice-mounting suitable to fit any rail section.

4.3.4 The machine must have complete stability during rail cutting operation.

4.3.5 The rail cut produced must be straight and square/vertical.

4.3.6 There shall not be any mechanical or metallurgical changes to the rail steel during rail cutting operation.

4.3.7 The cutting disc diameter shall be in order of 300 mm with a maximum circumferential cutting speed of approx. 80 m/s.

4.3.8 The weight of the machine shall be not more than 35 kg.

4.3.9 The machine shall be of sturdy manufacture with a design life of at least 10 years.

4.4 Rail Cutting Machine - Saw Blade Type (Electric) Qty: 25

4.4.1 The rail cutting machine shall be operated by three-faze 220 V; 50 Hz electric motor, which must be completely water tight.

4.4.2 The machine shaft's output shall be in order of 1.5 kW at 1400 rpm.

4.4.3 The machine shall have easy and quick vice-mounting suitable to fit any rail section and including R 65 flat-bottom.

4.4.4 The machine must have complete stability during rail cutting operation.

4.4.5 The machine shall have capability to adjust cutting force while in cut mode and a complete load relief while in idling.

4.4.6 The rail cut produced must be straight and square/vertical.

4.4.7 There shall not be any mechanical or metallurgical changes to the rail steel during rail cutting operation.

4.4.8 The machine shall be suitable to accommodate either 400 or 450 mm long saw blades.

4.4.9 The weight of the machine shall be not more than 90 kg.

4.4.10 The machine shall be of sturdy manufacture with a design life of at least 10 years.

4.5 Hydraulic Track Lining Equipment — Qty: 11

4.5.1 The hydraulic track lining machine shall be operated by air-cooled petrol engine.

4.5.2 The minimum output of the equipment shall be in order of 3.7 kW at 5400 rpm.

4.5.3 The equipment shall consists of 4 hydraulic jacks designed to fit foot of any rail section and in particular R 65 flat-bottom.

4.5.4 The track slewing force exerted by a set of 4 jacks shall not be less than 240 kN.

4.5.5 The weight of the machine shall be not more than 115 kg.

4.5.6 The equipment shall be of sturdy manufacture with a design life of at least 10 years.

4.6 Baseplate Spike Inserter — Qty: 20

4.6.1 The baseplate spike inserter shall be operated by three-faze 220 V; 50 Hz electric motor, which must be completely water tight.

4.2.4 The minimum output of the spike inserter shall be 1 kW at 2800 rpm.

4.2.5 The inserting tool shall be compatible with D0 rail fixing on wooden sleepers.

4.2.6 The spike inserter's striking frequency shall be at least 1100 impacts per minute with an energy impact of 21 J.

4.2.7 The overall weight of the spike inserter shall be not more than 25 kg.

4.2.8 The spike inserter tool shall be of sturdy manufacture with a design life of at least 10 years.

4.7 Rail Drilling Machine

Qty: 50

4.7.1 The rail drilling machine shall be operated by three-faze 220 V; 50 Hz electric motor, which must be completely water tight.

4.7.2 The minimum output of the rail drilling machine shall be1.7 kW at 2800 rpm.

4.7.3 The machine shall have easy and quick vice-mounting suitable to fit any rail section.

4.7.4 The machine must have complete stability during rail drilling operation.

4.7.5 The machine shall be able to drill any type of rail including hardened rail steel R 65 flat-bottom section.

4.7.6 The machine shall be equipped with an automatic drill feed and stop.

4.7.7 The rail drilling machine shall accommodate any type of drill bits including: -

- solid and hollowed with disposable rotary inserts
- carbide inserts
- high-speed steel

4.7.8 The machine shall have two speeds with rotation direction control: -

- Slow - approx. 180 rpm with drill feed of 16 mm/min
- Fast - " 360 rpm " " " of 32 "

4.7.9 The machine shall have the maximum hole drilling of 36 mm diameter.

4.7.10 The overall weight of the rail drilling machine shall be not more than 55 kg.

4.7.11 The rail drilling machine shall be of sturdy manufacture with a design life of at least 10 years.

4.8 Rail Grinding Machine

Qty: 40

4.8.1 The rail grinding machine shall be operated by three-faze 220 V; 50 Hz electric motor, which must be completely water tight.

4.8.2 The purpose of the machine is to grind/re-profile local rail irregularities at rail ends, switches and crossings.

4.8.3 The machine shall be of simple hand-operated tool design.

4.8.4 The output of the rail grinding machine shall be not less than 0.4 kW at 2800 rpm.

4.8.5 The machine shall accommodate an abrasive disc of 200 mm diameter with maximum allowable circumferential speed of 40 m/s.

4.8.6 The overall weight of the hand held rail grinding machine shall be not more than 12 kg.

4.8.7 The rail grinding machine shall be of sturdy manufacture with a design life of at least 10 years.

4.9 Rail Changing Equipment (Hand Crane) Qty: 50

4.9.1 The equipment shall be suitable for lateral and longitudinal movement of rails.

4.9.2 The equipment shall be of lightweight construction assembled and dismantled by maximum of two railwaymen.

4.9.3 The equipment shall not be heavier than 110 kg.

4.9.4 The hand crane equipment shall consists of two legs with four wheels

4.9.5 For safety reasons the winch shall be fitted with an automatic brake so that rail can be lowered only when crank is turned.

4.9.6 There shall be a provision of locking the winch during rail crane movement operation.

4.9.7 Lifting force of one crane shall be in order of 10 kN.

4.9.8 The hand crane rail changer shall be of a sturdy manufacture with a design life of at least 10 years.

4.10 Electric Generator - (Petrol Type) Qty: 20

4.10.1 A compact generator for supplying electric power of both three-phase and single-phase electric current.

4.10.2 The generator output shall be 4 kW of 220 V and 380 V at 50 Hz frequency.

4.10.3 The generator shall have an automatic voltage adjustment to ensure a stable and regular supply of electric power.

4.10.4 The generator shall be a petrol motor driven with fuel consumption not more than 3.2 l/hr.

4.10.5 The generator shall be equipped with a fuel tank of approx. 12 litre capacity.

4.10.6 For ease of handling and transfer the generator shall weight no more than 140 kg.

4.10.7 The electric power generating unit shall be of sturdy manufacture with a design life of at least 10 years.

4.11 Electric Generator - (Diesel Type) Qty: 20

4.11.1 A compact generator for supplying electric power of both three-phase and single-phase electric current.

4.11.2 The generator output shall be 4 kW of 220 V and 380 V at 50 Hz frequency.

4.11.3 The generator shall have an automatic voltage adjustment to ensure a stable and regular supply of electric power.

4.11.4 The generator shall be a diesel motor driven with fuel consumption not more than 1.2 l/hr.

4.11.5 The generator shall be equipped with a fuel tank of approx. 5 litre capacity.

4.11.6 For ease of handling and transfer the generator shall weight no more than 140 kg.

4.11.7 The electric power generating unit shall be of sturdy manufacture with a design life of at least 10 years.

4.12 Hydraulic Jacks — Qty: 200

4.12.1 A compacted hand operated hydraulic jack for lifting and slewing of the track.

4.12.2 The jack when in track shall not infringe on the train movement.

4.12.3 The jack, when in track, shall be capable of lifting a track load of 10 tonnes.

4.12.4 The jack shall have vertical load lift of up to 200 mm with stage lifting up to 300 mm.

4.12.5 The maximum force on the hydraulic pump handle shall be in order of 150 N.

4.12.6 The working pressure in the jack's hydraulic system shall be not more than 37 MPa.

4.12.7 The weight of the hydraulic jack shall not be more than 21 kg.

4.12.8 The hydraulic jack shall be of sturdy manufacture with a design life of at least 10 years.

4.13 Hydraulic Rail Tensor — Qty: 50

4.13.1 Manually operated tensor for longitudinal movement/shifting of rail in order to set and/or adjust the rail joint gap.

4.13.2 The tensor shall be easily set up dismounted with no more than two railway men.

4.13.3 The tensor's maximum rail pulling force shall be no less than 255 kN.

4.13.4 The working stroke of a hydro-cylinder's rod shall no less than 100 mm.

4.13.5 The force on a tensor's handle of a hydraulic pump shall be no more than 150 N.

4.13.6 The maximum weight of the equipment shall be no more than 60 kg.

4.13.7 The hydraulic rail tensor shall be of sturdy manufacture with a design life of at least 10 years.

5. Spare Parts

5.1 The Supplier shall provide, with his tender submission, a list of mandatory spare parts, amounting to approximately 3% of the total capital cost of hand tools and equipment that will be required for a period of further 3 years following the 24 (twenty four) months warranty period. The list shall be priced by the tenderers on CIP (place of destination) basis. The cost of these spare parts would be considered for the evaluation purposes The Supplier shall itemise the list with an identification and short description. The Purchaser reserves the right to modify the list if required.

5.2 The Supplier shall also provide the list of consumable items that will be required to use the tools and equipment for a duration of 5 (five) years.

5.3 The Supplier shall also supply all consumable items that will be required to operate tools and equipment for the duration of 5 (five) year period.

5.4 Should the need arise the delivery of spare parts to be within 10 (ten) working days of receiving a written request from the Purchaser.

5.5 The warranty period shall be automatically extended if any of the above hand tool and equipment is out of use, due to faulty part for more than 10 (ten) working days.

5.6 During the warranty period all expenses associated with the supply, delivery (but excluding the costs of custom duties and other taxes payable in the Purchaser's country) and repair work shall be met by the Supplier.

6. Technical Documentation

6.1 With delivery of hand tools and equipment the Supplier shall also supply operation instruction and maintenance manuals as follows: -

- three copies in Russian, or other language stipulated by the Georgian Railways
- one copy in English.

6.2 The Supplier shall provide diagrams of the components that are subject of fast wearing and frequent replacement.

6.3 The Supplier shall provide recommendations for the consumable products, such as hydraulic fluid, etc.

6.4 The instruction for the removal and assembly with an indication of the acceptable tolerances for wear.

6.5 All dimensions specified in the technical documents shall correspond to the SI – International Unit System.

7. Training

7.1 The Supplier's proposal shall include a nomination list of the personnel required for the operation of each hand tool and equipment with an indication of the number of persons, their positions, responsibilities, past experience and other such relevant data.

7.2 The Supplier shall also provide a training plan for personnel operating hand tools and equipment.

8. Quality Control

8.1 With the tender submission the Supplier shall present their quality control structure and quality system at their manufacturing base. The Supplier shall also confirm whether or not the company is certified by the recognised quality assurance association.

8.2 The Purchaser reserves the right to inspect the Supplier's quality control programme.

8.3 During the period between placing an order and proposed delivery date the Purchaser have the right to inspect quality of the manufacturing process.

9. Warranty

9.1 The warranty period would remain valid for a period of 24 (twenty four) months after the hand tools or equipment have been delivered to or accepted at the final destination indicated in the Contract, or 30 (thirty) months after the date of shipment from the port of loading in the source country, whichever period concludes earlier.

9.2 During the warranty period the Supplier will be obliged to remedy all defects that preclude the usage of the equipment resulting from faulty design, material or poor workmanship.

9.3 The Supplier will be obliged to remedy any faults, that occur during the warranty period, at his own expense by either carrying a repair or replace the defective parts.

9.4 If it takes more than 10 (ten) working days to remedy the faulty equipment then the original warranty period shall be extended by the duration that the hand tool or equipment is out of service.

10. Schedule of Requirements

Supply and delivery of the following hand tools and equipment: -

Item No.	Description	Type of power	Qty	Price per Item [US $ (000)]	Total Price [US $ (000)]	Comments
1	Ballast tamping hand tool	Electric	100			
2	Rail cutting machine	"	6			
3	Rail cutting machine	Petrol engine	25			
4	Rail cutting machine	Electric	25			
5	Hydraulic track lining	Petrol engine	11			
6	Baseplate spike inserter	Electric	20			
7	Rail drilling machine	"	50			
8	Rail grinding machine	"	40			
9	Rail changer (hand crane)		50			
10	Electric generator	Petrol	20			
11	Electric generator	Diesel	20			
12	Hydraulic jacks		200			
13	Hydraulic rail tensor		50			
	Grand Total					

5. TECHNICAL SPECIFICATION FOR SUPPLY AND DELIVERY OF TRACK MAINTENANCE TOOLS AND EQUIPMENT – II

RESTRUCTURING OF GEORGIAN RAILWAYS - SAKARTVELO'S RKINIGZA (SR)

TRACKWORK RENEWAL

TECHNICAL SPECIFICATION FOR SUPPLY AND DELIVERY OF TRACK MAINTENANCE TOOLS AND EQUIPMENT

C O N T E N T S

TECHNICAL SPECIFICATION FOR SUPPLY AND DELIVERY OF TRACK MAINTENANCE TOOLS AND EQUIPMENT

1. General Requirements

The hand tools, coachscrewing machine and motor impact wrench, together with sleeper changing machine are required for track rehabilitation of the Georgian Railways. Both, the hand tools and sleeper changing machine must be of sturdy design and manufacture suitable for working within the railway/permanent way environment.

2. Country's Climate

• Altitude above Sea Level	-	< 1500 m
• Ambient Temperature	-	Lowest: -20 C
	-	Highest: +40 C
• Climatic Zone	-	moderate climate
• Atmospheric Moisture	-	Lowest: 80%
	-	Highest: 100%

3. Track Geometry Arrangement

• Track Layout Arrangement	-	Single and Double
• Track Gauge	-	1520, (-9; +28)
• Rail Section	-	R65; (R50)
• Rail Inclination	-	1:20 nominal towards centre of track
• Minimum Horizontal Track Curvature	-	80 m in transport mode
	-	180 m in operation mode
• Maximum Track Gradient	-	35‰
• Type of Sleepers	-	Wooden; length 2750 – 2780 mm
	-	Concrete monoblock - 2700 mm (nom.)
• Rail Fastening	-	Spikes, coachscrews, holding down bolts or elastic rail fastenings
• Type of Rail Joints	-	4 or 6 holes fishplates
• Sleeper Spacing	-	543 mm (1840 sleepers/km) maximum
	-	500 mm (2000 sleepers/km) minimum
	-	625 – 670 mm at stations
• Type of Track Ballast	-	Crushed rock grain size 40-70 mm
	-	River gravel size <25 mm
	-	Well compacted mixture of ballast, sand, gravel, dust and clay
• Ballast Depth	-	300 mm minimum (theoretical)
• Maximum Admissible Load Gauge	-	To comply with Load and Gauge Standard GOST No. 9238 - 83

4. Track Maintenance Hand Tools - Technical Specifications

4.1 Coachscrewing Machine — Qty: 20

4.1.1 The coachscrewing machine shall be operated by three-phase 220 V; 50 Hz electric water tight motor.

4.1.2 The machine shall be of heavy duty type suitable for track maintenance operations.

4.1.3 It must be equipped with 2-speed gearbox – 70 and 195 rpm with the engine running at 3000 rpm.

4.1.4 The machine shall have capability of direct speed changing through a hand lever.

4.1.5 It also shall have an adjustable clutch mechanism ensuring an accurate torque control and automatic prevention from overdriving.

4.1.6 The machine shall be capable also to screw/unscrew fishbolts, without too much effort.

4.1.7 The supplier shall also provide within his tender submission a list of optional equipment (accessories) to approximately 3% of the total capital costs of 20 Coachscrewing Machines.

4.1.8 The weight of the machine shall be no more than 160 kg.

4.1.9 The coachscrewing machine shall be of sturdy manufacture with a design life of at least 10 years.

4.2 Motor Impact Wrench — Qty: 20

4.2.1 A 2-stroke air-cooled petrol engine with maximum speed of 9000 rpm, electronic ignition and diaphragm carburettor shall operate the portable motor impact wrench.

4.2.2 The wrench shall be suitable to fasten or loosen coachscrews or bolt nuts in either horizontal or vertical position.

4.2.3 For ease of operation the wrench shall be fitted with two handles.

4.2.4 The equipment shall be self-contained not requiring any external power supply.

4.2.5 The wrench shall be easily carried around and operated by one person.

4.2.6 The wrench's torque setting shall be in Nm with a variable range between 500 and 850 Nm.

4.2.7 The drive socket shall be of a size as specified by the Railway.

4.2.8 The supplier shall also provide within his tender submission a list of optional equipment (accessories) to approximately 3% of the total capital costs of 20 Motor Impact Wrenches.

4.2.9 The wrench shall be supplied with an auger attachment to allow drill holes in timber sleepers of up to 35 mm diameter.

4.2.10 The weight of shall be not more than 22 kg.

4.2.11 The wrench tool shall be of sturdy design with a minimum design life of not less than 10 years.

5. Track Maintenance Equipment

5.1 Sleeper Changing Machine Qty: 2

5.1.1 The sleeper changing machine shall be one person operated and designed to extract and insert either wooden sleepers or twin-block and monoblock concrete sleepers fitted with rail fastenings/baseplates.

5.1.2 The machine shall be self-propelled with transfer speed of not less than 30 km/h.

5.1.3 The sleeper changing machine shall be able to work/renew sleepers on either side of the track.

5.1.4 The machine shall be operational either on track embankments or in cuttings.

5.1.5 The position of machine operator shall be such as to have unobstructed view of the sleeper to be handled and at the same time have easy access to the machine control panel.

5.1.6 The machine shall have the capacity to change up to 40 sleepers in an hour.

5.1.7 It should be designed so that it can be installed/removed from the running line in no more than 2 minutes without the need for additional special equipment.

5.1.8 The sleeper changing operation shall be performed by a hydraulic mechanism control through the hand levers.

5.1.9 The machine shall be constructed of heavy duty welded steel suitable for railway working environment.

5.1.10 The machine shall be equipped with easy on/off tracking mechanism.

5.1.11 The machine shall be equipped with an air-cooled diesel engine with nominal power of around 40 kW at 2500 rpm. The effective power of the engine shall be around 36 kW at 2300 rpm.

5.1.12 A pre-heating system for the engine and the operating hydraulic system shall be provided.

5.1.13 The machine shall be equipped with hydraulic motor braking system. The machine shall also be equipped with emergency parking brakes.

5.1.14 The machine shall have the electrical starter motor for engine. The machine shall be equipped with sufficient lighting for night working.

5.1.15 The electric system shall be fitted with 12 V alternator and 12 V batteries.

5.1.16 The sleeper removal and inserter shall have a telescopic beam head with a maximum traverse stroke of 1.3 m. The sleeper extraction force shall be approx. 50 kN and the sleeper insertion force of 35 kN (approx.).

5.1.17 The weight of the machine shall be no more than 5 tonnes.

5.1.18 The sleeper changing machine shall be of sturdy manufacture with a design life of at least 15 years.

5.1.19 The design of the machine shall be such as to enable sleeper changing operation on the track with a maximum gradient of 35‰.

5.1.20 The sleeper changing machine shall be able to operate also within the station platform areas. The load and structure gauge detail to be supplied by the Georgian Railways on request.

5.1.21 The machine shall be able to provide 8 (eight) hours of continuous operation.

5.1.22 The machine shall be designed to operate, and be transported at any time of the day.

5.1.23 The machine shall be able to work on either single, double or multiple track (at stations).

5.1.24 The machine shall be able to remove also short or bad-condition sleepers.

5.1.25 The machine shall be able to insert sleepers which are not always laid on the ballast at 90°to the track.

5.1.26 The painting and corrosion-preventive coating of the machine shall in accordance of the technical requirements and standards of UIC 842-1, 842-2, 842-3, 842-6 842-7 and to the ISO/R1461, R2085 and R2128 standards.

5.1.27 All signs and identifications of the machine shall be in Georgian (main language) and Russian.

6. Acceptance and Commissioning

6.1 The initial, preliminary acceptance of the sleeper changing machine will be carried out by the Purchaser at the manufacture's plant at approximately 90% of work completion. The Supplier shall arrange, at his own expense, for a Russian interpreter to be present during preliminary acceptance stage. The costs of travelling, including accommodation, will be met by the Purchaser.

6.2 All the necessary technical documents for the machine, including the operational, maintenance and repair documents shall be available to the Purchaser at least one month before the date of the preliminary acceptance. These documents shall be in Russian or other such language as stipulated by the Georgian Railways.

6.3 The Supplier shall arrange and take responsibility for, machine packing, transportation and delivery to the location specified by the Purchaser, including all the necessary custom clearance formalities.

6.4 The costs associated with delivery of the machine and equipment, but excluding the costs associated with the custom duties and other taxes payable in the Purchaser's country, shall be met by the Supplier.

6.5 The final acceptance of the machine and equipment will be made upon the delivery and following the assembly, start-up and adjustments by the Supplier.

6.6 The machine commissioning shall comprise: -

- checking completeness and intactness of the machine
- removal of transport packing
- assembling of the superstructures
- filling up lubricants, fuel, hydraulic oil, etc. and verification of filling levels
- leakage tests for air, gas and liquid systems
- functional tests of the various units
- functional test of the complete machine on the basis of a work sample
- operational trial to demonstrate that all machine performance criteria are met

6.7 In case when the final acceptance are considered unsatisfactory, the operations that are considered necessary, in order to eliminate the defects, shall be conducted by the Supplier with his own resources and at his own expense. The repeated final acceptance shall be conducted upon elimination of all defects.

6.8 On the occasion of the acceptance of the machine an acceptance certificate will be issued by the Supplier and signed and dated by both parties.

7. Spare Parts

7.1 The Supplier shall provide, within his tender submission, a list of mandatory spare parts, amounting to approximately 3% of the total capital cost of the machines and equipment. The list shall follow the requirements outlined in the Technical documentation and shall be priced by the tenderers on CIP (place of destination) basis. The cost of these spare parts would be considered for the evaluation purposes. The Supplier shall itemise the list with an identification and short description. The Purchaser reserves the right to modify the list if required.

7.2 Should the need arise the delivery of spare parts shall be within 10 (ten) working days of receiving written request from the Purchaser.

7.3 The Supplier shall also provide the list of consumable items that will be required to use the tools and equipment for duration of 5 (five)-year period.

7.4 The Supplier shall also supply all consumable items that the Purchaser will require to operate tools and equipment for the duration of 5 (five) year period.

7.5 The Supplier shall provide a complete list of spare parts for operation of the machinery and equipment for the duration of their design life.

7.6 The delivery of spare parts to be within one week of the written request made to the Supplier. During the warranty period all expenses associated with the supply and delivery, but excluding the costs of custom duties and other taxes payable in the Purchaser's country, shall be met by the Supplier.

7.7 The warranty period shall be extended automatically if any of the above hand tool and equipment is out of use, due to faulty part of equipment for more than 10 (ten) working days.

8. Training

8.1 The Supplier's proposal shall include a nomination list of the personnel required for the operation of each machinery and equipment with an indication of the number of persons, their positions, responsibilities, past experience and other relevant data.

8.2 The Supplier shall prepare a list of the personnel required for the maintenance and repair of the machinery and equipment, with the indication of the number of required persons, professions, qualifications and other relevant data.

8.3 A training plan or schedule for each category or profession of personnel, with the corresponding indication of the theoretical and/or practical subjects stating the locations and training periods for each person.

8.4 The Supplier shall itemise the costs for both Purchaser's and Supplier's personnel, showing costs separately for both.

8.5 An itemised list of the following costs of training: -

- Supplier's costs for site-based training

All costs of training are to be met by the Supplier

8.6 For the tender evaluation purpose the Supplier shall submit price, within the tender, for the following training: -

Personnel	Site-based Period
Purchaser's personnel	
Interpreter	1 week
Supplier's personnel	
Engineer	1 week

9. Quality Control

9.1 With the tender submission the Supplier shall present their quality control structure and quality system at their manufacturing base. The Supplier shall also confirm whether or not he is certificated by the recognised quality assurance association.

9.2 The Purchaser reserve the right to inspect the Supplier's quality control programme.

9.3 During the period between placing an order and proposed delivery date the Purchaser have the right to inspect quality procedures/system of the manufacturing process.

10 Technical Documentation

10.1 The complete delivery of machinery and equipment shall include the corresponding technical documentation: -

- three copies of the specified technical documents in Russian, or other language as stipulated by the Georgian railways
- one copy in English
- one copy in the language of the country of the Supplier

10.2 The Supplier shall also provides certificates for the: -

- materials and devices, subject to technical inspection and checking, such us cables, lines, compressed air tanks, etc.
- complete vehicle with the additional equipment and units

10.3 The Supplier shall provides operating manuals with: -

- the description of the machinery and equipment
- the design drawings and relevant diagrams of the machine and the main units with main clearances and overall dimensions
- instruction for driving the machine in the transport mode
- instruction for the preparation of the machine for the transport and operation modes, for the operation and the shut-down of the equipment
- instruction for servicing and adjustment
- instruction for the preventive maintenance of the vehicle and main units including the hydraulic, electrical and pneumatic systems with preventative maintenance cycles for lubrication, inspection and preventative maintenance.
- diagrams of the control of the hydraulic, electrical and pneumatic systems
- general safety instructions for the maintenance personnel
- instruction for the handling of the machine in case of track derailment

10.4 The Supplier shall provide the diagrams of the components which are subject to fast wear and use.

10.5 The Supplier shall provide complete list of all spare parts for operation of the vehicle to the end of the vehicle design life. For each individual item the Supplier shall provide the reference number, description, design life, place of origin, unit price and delivery time from stock with separate time for transport. Furthermore the Supplier shall provide an exploded diagram of such unit showing the location of each spare part.

10.6 All the information and technical documents concerning the requirements and facilities for the storage of the spare parts, the method of storage and the required storage space.

10.7 All information and technical documents describing the conditions of spare parts storage, such as temperature, humidity, etc.

10.8 Supplier recommendations for consumable products, such as hydraulic fluid, etc.

10.9 All information and technical documents concerning the use and application of the devices, instruments and special equipment.

10.10 All relevant information and technical documents concerning requirements and facilities for storage of devices, instruments and special equipment, the method of storage and required storage space.

10.11 All information and technical documents describing the condition of storage of the devices, instruments and special equipment, such us temperature, humidity, etc.

10.12 The instructions for the removal and assembly with the indication of the acceptable tolerances for wear and clearances.

10.13 The documents concerning the repair of the moving parts of the machine.

10.14 All the dimensions and clearance limits, specified in the technical documents shall correspond to the SI - International Unit System.

10.15 The Supplier shall provide the Purchaser with all above necessary documents not later than at the machine delivery date. The documents shall correspond to the design of the vehicle as delivered. All alteration to the documents resulting from the final acceptance shall be made by the Supplier within 10 days from the date of the final acceptance.

10.16 All the alteration in the documents in Russian, English and in the language of the country of the Supplier shall be made by the Supplier and at the expense of the Supplier.

11. Technical Maintenance and Repair

11.1 The Supplier shall provide the complete list, in Russian, or other language stipulated by the Georgian Railways and in English, of the devices, instruments and special equipment necessary for the technical maintenance and the repair of the vehicle, including the devices, instruments and equipment for the following: -

- Preliminary testing before beginning a maintenance activity on a vehicle
- Tests of sub-units and sub-systems before and after performing a maintenance activity, such as preventative, corrective, standard replacement, overhaul, etc.
- Final testing before placing the machine back into service including required tagging and sealing of components.

11.2 The Supplier shall include in its tender the supply of devices, instruments and special equipment in order to perform technical maintenance and various repair of the vehicle for the complete service life of the vehicle.

11.3 This proposal shall be itemised providing a separate detailed price breakdown and shall be placed in an appendix in the tender along with a detailed description of the operation of each item proposed.

12. Warranty and Liability

12.1 The warranty period would remain valid for a period of 24 (twenty four) months after the hand tools or equipment have been delivered to or accepted at the final destination indicated in the Contract, or 30 (thirty) months after the date of shipment from the port of loading in the source country, whichever period concludes earlier.

12.2 During the warranty period the Supplier will be obliged to remedy all defects that preclude the usage of the equipment resulting from faulty design, material or poor workmanship.

12.3 The Supplier will be obliged to remedy any faults, that occur during the warranty period, at his own expense by either carrying a repair or replace the defective parts.

12.4 If it takes more than 20 (twenty) working days to remedy the faulty equipment then the original warranty period shall be extended by the duration that the equipment is out of service.

13. Schedule of Requirements

Supply and delivery the following machinery and hand tool equipment: -

Item No.	Description	Type of Power	Qty	Price per Item [US $ (000)]	Total Price [US $ (000)]	Comments
1	Coachscrewing machine	Electric	20			
2	Motor impact wrench	Petrol engine	20			
3	Sleeper changing machine	Diesel engine	2			
	Grand Total					

6. TECHNICAL SPECIFICATION FOR RE-INSTALLMENT OF SIGNALLING

Georgian Railways

Georgian and Azeria Railways Restructuring
Loan by EBRD for re-instatement of Signalling

TENDER SPECIFICATION

Document No: 005688-JKT-B220-J98232A
Issue 1

TABLE OF CONTENTS

APPENDICES

The following Appendices to be provided at a later date by Georgian Railways

1) INTRODUCTION

At the start of the decade a considerable amount of the signalling equipment on the Georgian Railways was either stolen or vandalised during the period of civil unrest.

During 1997 and 1998 there have been considerable improvements made to the signalling systems throughout the Georgian Railways. In many cases signalling for all the original facilities at a station has been brought back into use. However it must be stressed that the signalling in many of these cases is life expired and is still in urgent need of renewal.

Tenderers are invited to submit their proposals and outline budget costs for the items shown below.

A general specification for the work is given in Appendix A.

For the purpose of the stage 1 tender only the section of line between Zestaponi (exclusive) and Kaspi (exclusive) is to be considered. The existing layouts at each station are shown in appendix B and the requirements for immediate signalling is shown in Appendix C. (*to be provided by Georgian Railways)*

Proposals and outline costs are required for the following items of work. Separate costs to be provided for each interlocking and span.

If Georgian Railway design or installation resources are used under either option, this must be on a sub contractor basis with the tenderer having responsibility for implementation of the project to the required time scales and standards.

2) REPLACE INTERLOCKINGS.

The interlocking may be renewed using relays or may be processor controlled. The interlockings requiring renewal are Shorapani, Single / Double Junction at 2338 Km, Kharagauli, Single / Double Junction at 2347 Km, Marelisi, Moloti, Zipa, and Likhi. The layouts are shown in Appendix B.

Item 1	Replace Interlockings and interface to existing external equipment
Item 2	Replace all external equipment
Item 3	Replace interlockings and all external equipment. Where it is proposed to use a subcontractor to supply the external equipment full details of the supplier and equipment proposed must be given. A separate cost should be quoted for the external equipment.

Tenderers may offer proposals for either items 1, 2 or 3. Proposals for item 1 must provide an interface through which the existing or replacement external equipment can be fed.

Details of how the interlockings can be linked (or one central interlocking provided) to facilitate remote monitoring and / or remote control of the interlockings in the future should be provided.

3) PROVIDE SIGNALLING FOR THE SECTIONS OF TRACK BETWEEN STATIONS

Item 4 — Provide a means of fail safe continuous train detection in the spans between the controlled signals at each station. The need for insulated block joints and impedance bonds should be kept to a minimum. For this option no intermediate signals should be provided.

Item 5 — Provide a warning signal which will show a caution aspect when the stop signal controlling the entrance to the station is at red. This signal, which is not currently shown on the layouts, is be located at sufficient distance from the stop signal for a train to be brought to a stand at it. For the purpose of the stage 1 Tender this distance is to be assumed to be 1500m and to require new equipment at the trackside. The aspects to be displayed in this signal are identified in appendix D. *(t0 be provided by Georgian Railways).* Alternatively when the interlocking is to be renewed provision of this facility may be incorporated into item 1, 2 or 3.

Item 6 — Provide one intermediate signal for each direction located opposite each other as identified in Appendix C. It should be assumed at this stage that new lineside equipment is to be provided.

3) RE-INSTATE CAB SIGNALLING

Item 7 — Re- instate cab signalling system using existing equipment on the trains. Whilst continuous indications in the cab is preferred a simplified form of indication approaching signals would be considered. Automatic brake application on passing a red signal aspect must be provided.

Georgian Railways to confirm that the cab equipment in the trains is in good working order and provide details of the interface between the cab equipment and the codes currently superimposed in the track circuits.

4) TENDERERS ALTERNATIVE PROPOSALS

Item 8 — The tenderers may put forward proposals and outline costs for the provision of any other system they consider will satisfy the requirements for the signalling of the Georgian Railways to meet present day traffic levels.

Appendix A

Georgian Railways

Georgian and Azeria Railways Restructuring
Loan by EBRD for re-instatement of Signalling

GENERAL SPECIFICATION

Document No: 005687-JKT-B220-J98232A

Issue 1

TABLE OF CONTENTS

1) SIGNALLING PRINCIPLES

The signalling principles to be used are in general those applied to Russian Railways. Any variations due to local or geographic considerations will be detailed during the second stage of the tender. The presentation of lineside signals to the train driver must be consistent with current signalling in Georgia and also the identical arrangement in neighbouring Azerbaijan as through running between the two countries is under consideration. However proposals to improve the visibility of the signal by the train driver should be made as it is considered that the lens/ lighting arrangement could be improved. Circuits, Control Tables (Algorithms) and material ordering lists are provided in Appendix E for two recently installed projects to renew the Interlockings. (*to be supplied by Georgian Railways)*

2) EXISTING SIGNALLING

A brief description of some aspects of the current signalling is given in Appendix F. (*use extract from main report)*

3) INTERFACES WITH EXISTING SIGNALLING

Where alterations are required in the spans and the relevant station interlocking was commissioned prior to 1997 an interface for connections between the new work and the interlocking itself shall be provided at the Interlocking. The tenderer shall provide a separate cost for the alterations to the interlocking. Where the relevant station interlocking was commissioned in 1997 or later, or is renewed as part of this tender, a separate interface is not necessary.

4) OPERATOR INTERFACE

Renewal of the interlocking shall also include renewal of the operators panel. It shall be noted that local "shunters panels" are required if indicated on the diagrams.

5) INTERLOCKED REVERSIBLE WORKING

It should be noted that interlocked reversible working with no intermediate signals in the spans is specified in certain locations. The tenderer shall provide details of the additional cost for providing this facility at the remaining locations at the time the interlocking is renewed.

6) LEVEL CROSSINGS

Warnings of approaching trains will be required at the level crossings specified. The tenderer shall include provision of this warning in any proposals for train detection in the spans.

7) FIBRE OPTIC CABLE

It is envisaged that by the time that the contract is let a fibre optic cable will have been installed throughout the section concerned. However the tenderer must provide any connections to the fibre optic cable required for his proposals. Where it is not proposed to use the fibre optic cable the alternative means of transmission must be stated and costed.

8) POWER SUPPLY EQUIPMENT

The tenderer shall provide all power supply equipment (including stabilised supplies) except for the final connection to the overhead supply. Details of power supplies required in the spans shall be clearly stated. These must be kept to a minimum. The cost of avoiding the provision of these supplies by cabling from the stations shall be identified.

9) EQUIPMENT HOUSING

The tenderer shall provide suitable weather proof housing for equipment. It shall be assumed that the interlocking will be housed in a container supplied by the tenderer. The reduction in cost if space for the interlocking is available in a permanent building shall be stated. It shall be assumed that cable entry ducts etc. will be provided in the permanent building but the tenderer must allow for relay racks etc.

10) EQUIPMENT TENDERER EXPECTS TO BE SUPPLIED BY GEORGIAN RAILWAYS

The tenderer shall clearly identify any equipment or facilities which he expects to be supplied / made available by the Georgian Railways. This shall include Depots and site access.

11) DESIGN APPROVAL

All designs shall carry the signature of the Designer and Independent Checker. The drawings shall be approved and signed by a responsible Engineer to signify conformity with the specification. The competence level of all signatories and the means by which it is measured shall be stated in the tender. All designs and specifications shall be submitted for approval prior to commencement of manufacture. A period of 20 working days shall be allowed for this in the programme of work. Items for approval shall be submitted as they become available and not all submitted together.

12) ANTI VANDALISM MEASURES.

All reasonable steps shall be taken to reduce the effects of vandalism. The tenderer shall outline his proposals.

13) ENVIRONMENTAL CONDITIONS

The tenderer shall clearly identify the Environmental conditions in which his equipment will work. These shall include, but not be limited to, temperature and humidity.

14) PROGRAMME OF WORK

The tenderer shall provide a programme of work for each option including, as a minimum, durations for preparation of working drawings and / or software, procurement of materials, installation, testing and commissioning.

15) SPARES AND TRAINING

Details of the proposed spares holding and training requirements for each option shall be stated with an indication of cost of providing these. Proposals shall however aim to minimise these items.

16) RECORDS AND MANUALS

Manuals shall be supplied for all equipment not previously used on the Georgian Railways. Language (?? *to be agreed)*. These shall be available for any training undertaken and in any case not later than 2 weeks prior to the first time the equipment is brought into service. Records of the installation, including wiring diagrams, shall be available on site at the time of commissioning. Drawings should be provided on AutoCAD version ? (*to be supplied by Georgian Railways)*.The on site records must be immediately endorsed with any alterations made during the commissioning period. The records must be updated and final copies provided on site within 4 weeks of the relevant commissioning.

17) INSTALLATION

Following completion of installation a certificate indicating that the equipment is to specification and is fit for purpose shall be provided to the Georgian Railways.

18) TESTING AND COMMISSIONING

Following completion of installation the works must be fully tested by staff who are deemed to be competent for this activity. The competence level of all testers and the means by which it is measured shall be stated in the tender. The Georgian Railways may carry out further tests before the work is accepted and brought into service. Not withstanding this the tenderer shall provide sufficient staff to commission the works and take full responsibility for bringing into use.

The tenderer shall state the maximum period required between taking the old system out of use and commissioning the new system.

19) POST COMMISSIONING COVER

The tenderer will be required to provide staff on site for a minimum period of two weeks to rectify any failures associated with equipment not already in use on the Georgian Railways. Sufficient equipment, which shall not form part of the recommended spares holding, shall be held on site during this period. The cost of this cover to be identified separately in the tender.

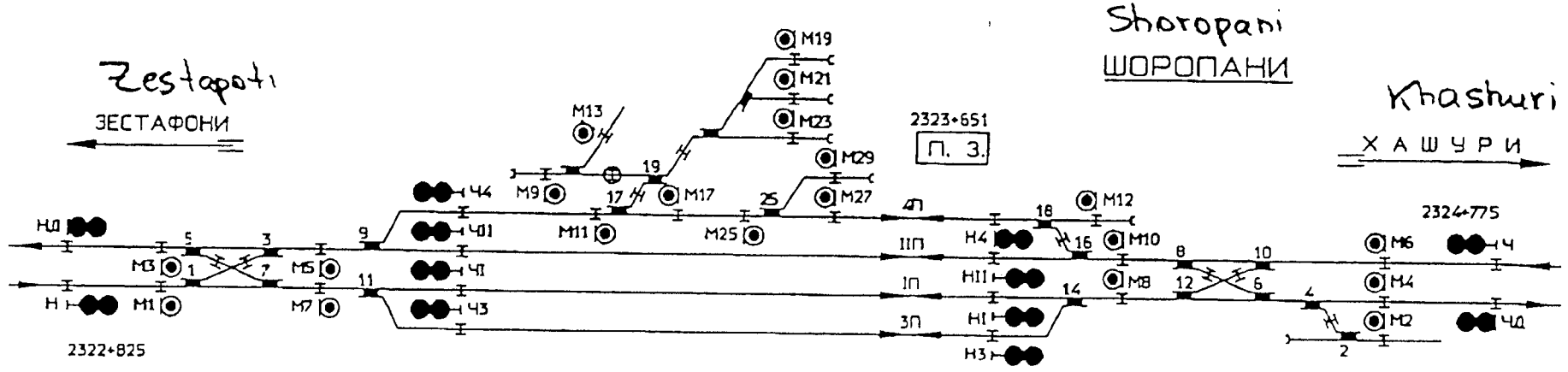
20) RECOVERED MATERIAL

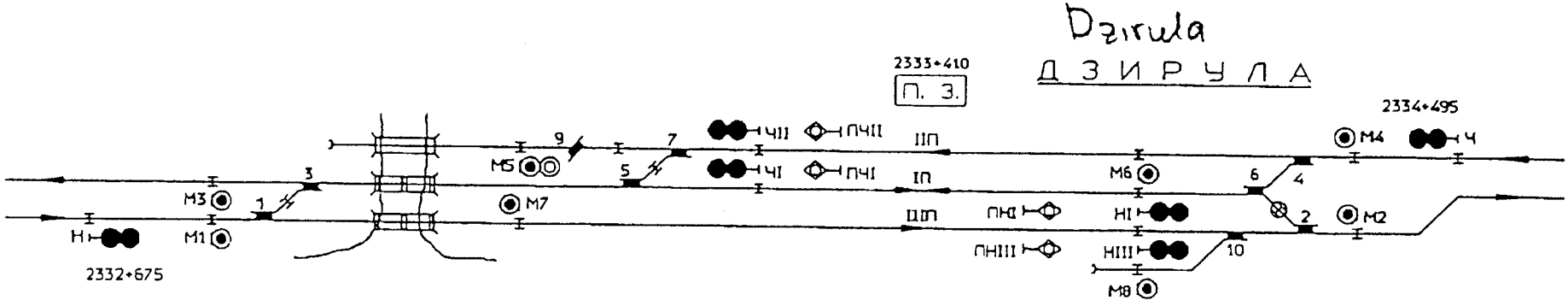
All material taken out of use shall be recovered. Serviceable material shall be made available to the Georgian Railways. Any materials not required by the Georgian Railways shall be disposed of in an environmentally friendly manner.

21) WARRANTY

The tenderer shall indicate the warranty period, which must be a minimum of 1 year, provided for all the equipment within the installation.

Appendix B





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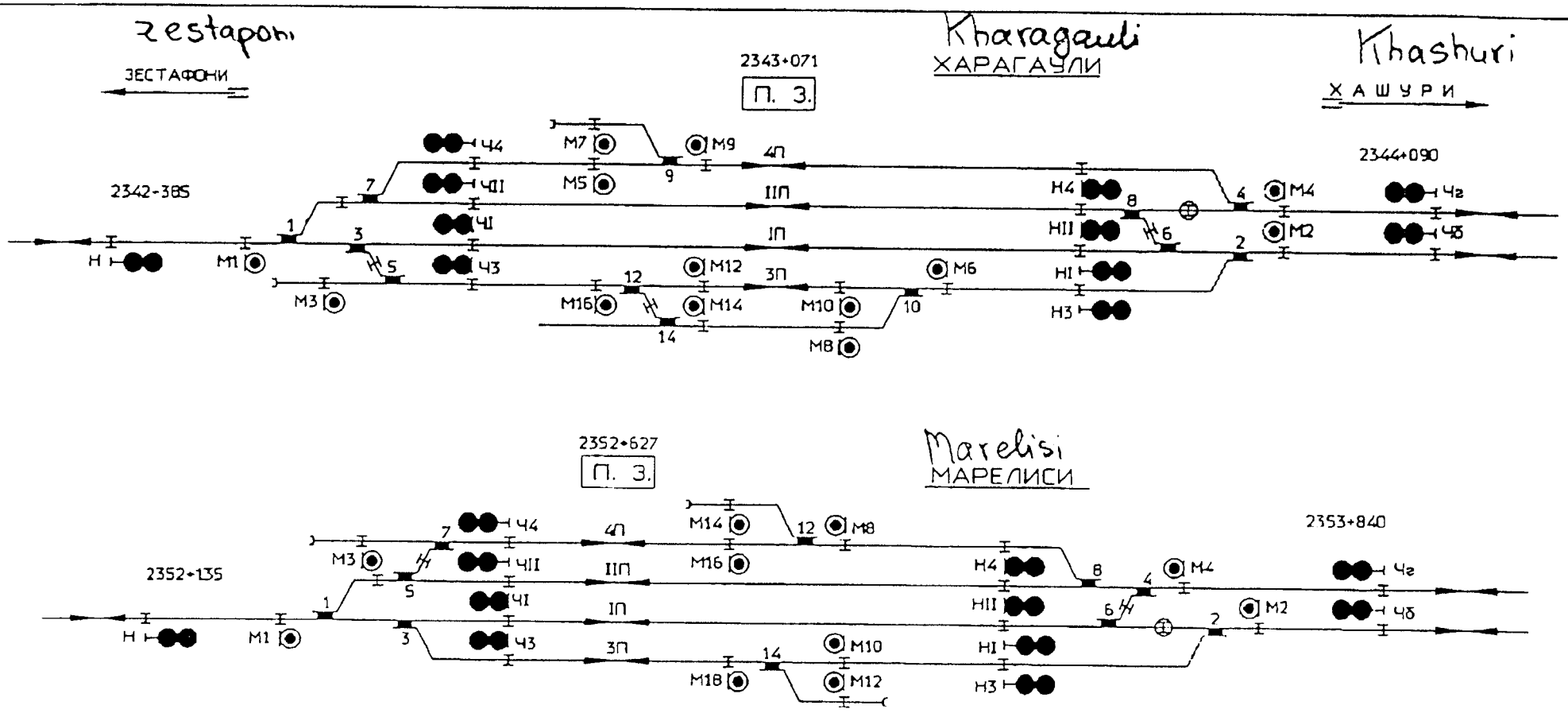
Zestaponi - Khashuri

участок

ЗЕСТАФОНИ – ХАШУРИ

ВСЕГО ЛИСТОВ ___ 3

ЛИСТ ____ 1



НАИМЕНОВАНИЕ СТАНЦИЙ	ДЕЙСТВУЮЩИЕ УСТРОЙСТВА				НАМЕЧАЕМЫЕ МЕРОПРИЯТИЯ									ПРИМЕЧАНИЕ
	ГОД СТРОИТЕЛЬСТВА	СИСТЕМА ЦЕНТРАЛИЗАЦИИ	МОЩНОСТЬ		ПОЛНАЯ ЗАМЕНА УСТАРЕВШИХ УСТРОЙСТВ	КАБЕЛЬНОЕ ХОЗЯЙСТВО И НАПОЛЬНЫЕ УСТРОЙСТВА		РЕЛЬСОВЫЕ ЦЕПИ		ПОСТОВЫЕ УСТРОЙСТВА				
			СТРЕЛКА	СИГНАЛ		ПОЛНАЯ ЗАМЕНА	УСИЛЕНИЕ, РЕКОНСТРУКЦИЯ	ПОЛНАЯ ЗАМЕНА	РЕКОНСТРУКЦИЯ СУЩЕСТВУЮЩИХ РЕЛЬСОВЫХ ЦЕПЕЙ	ЗАМЕНА АППАРАТА УПРАВЛЕНИЯ	ИЗМЕНЕНИЕ СХЕМ УВЯЗКИ С АБ	УСТРОЙСТВА КОДИРОВАНИЯ ГЛАВНЫХ ПУТЕЙ	
ХАРАГАУЛИ	1969	ЭЦ-9	35	35	●									
МАРЕЛИСИ	1959	ЭЦ-9	31	31	●									

Zestaponi - Khashuri

участок

ЗЕСТАФОНИ – ХАШУРИ

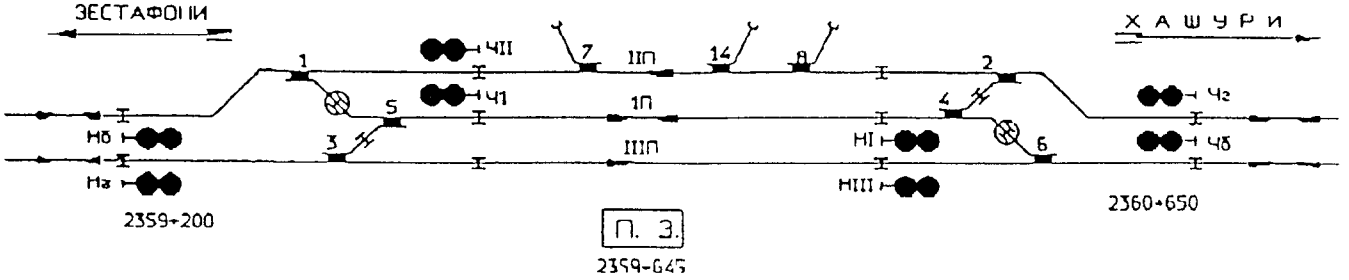
ВСЕГО ЛИСТОВ ___ 3

ЛИСТ ___ 2

Molitі
МОЛИТИ

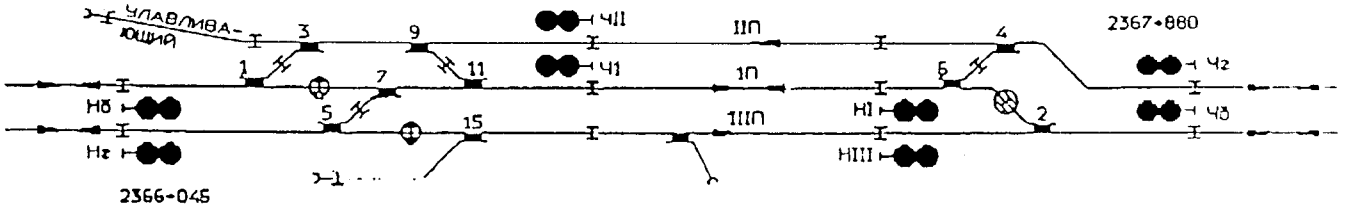
Zestaponі
ЗЕСТАФОНИ

Khashuri
ХАШУРИ

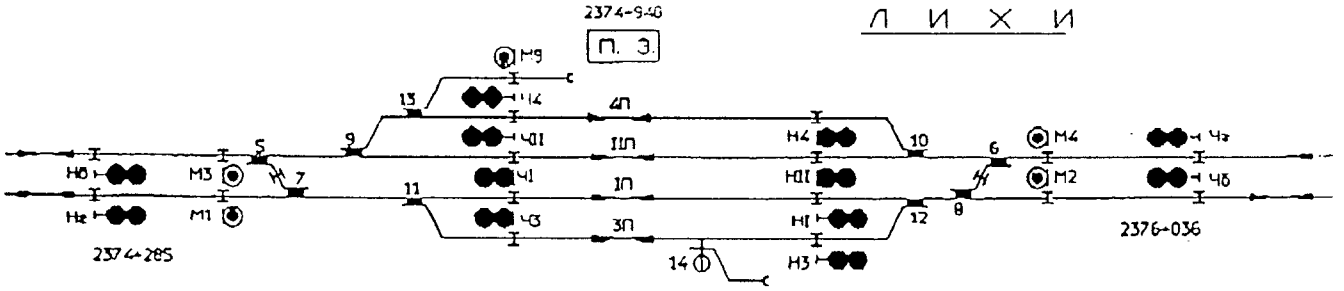


Tsipa
ЦИПА

2366+713
П. 3.



Likhi
ЛИХИ



НАИМЕНОВАНИЕ СТАНЦИИ	ДЕЙСТВУЮЩИЕ УСТРОЙСТВА				НАМЕЧАЕМЫЕ МЕРОПРИЯТИЯ									ПРИМЕЧАНИЕ
	ГОД СТРОИТЕЛЬСТВА	СИСТЕМА ЦЕНТРАЛИЗАЦИИ	МОЩНОСТЬ СТРЕЛКА	МОЩНОСТЬ СИГНАЛ	ПОЛНАЯ ЗАМЕНА УСТАРЕВШИХ УСТРОЙСТВ	КАБЕЛЬНОЕ ХОЗЯЙСТВО И НАПОЛЬНЫЕ УСТРОЙСТВА: ПОЛНАЯ ЗАМЕНА	КАБЕЛЬНОЕ ХОЗЯЙСТВО И НАПОЛЬНЫЕ УСТРОЙСТВА: УСИЛЕНИЕ, РЕКОНСТРУКЦИЯ	РЕЛЬСОВЫЕ ЦЕПИ: ПОЛНАЯ ЗАМЕНА	РЕЛЬСОВЫЕ ЦЕПИ: РЕКОНСТРУКЦИЯ СУЩЕСТВУЮЩИХ РЕЛЬСОВЫХ ЦЕПЕЙ	ПОСТОВЫЕ УСТРОЙСТВА: ЗАМЕНА АППАРАТА УПРАВЛЕНИЯ	ПОСТОВЫЕ УСТРОЙСТВА: ИЗМЕНЕНИЕ СХЕМЫ УВЯЗКИ С АБ	ПОСТОВЫЕ УСТРОЙСТВА: УСТРОЙСТВА КОНТРОЛЯ ГЛАВНЫХ ПУТЕЙ	
М О Л И Т И	1969	ЭЦ-2	17	17	●									
Ц И П А	1979	ЭЦ-2	18	18	●									
Л И Х И	1975	ЭЦ-9	24	24	●									

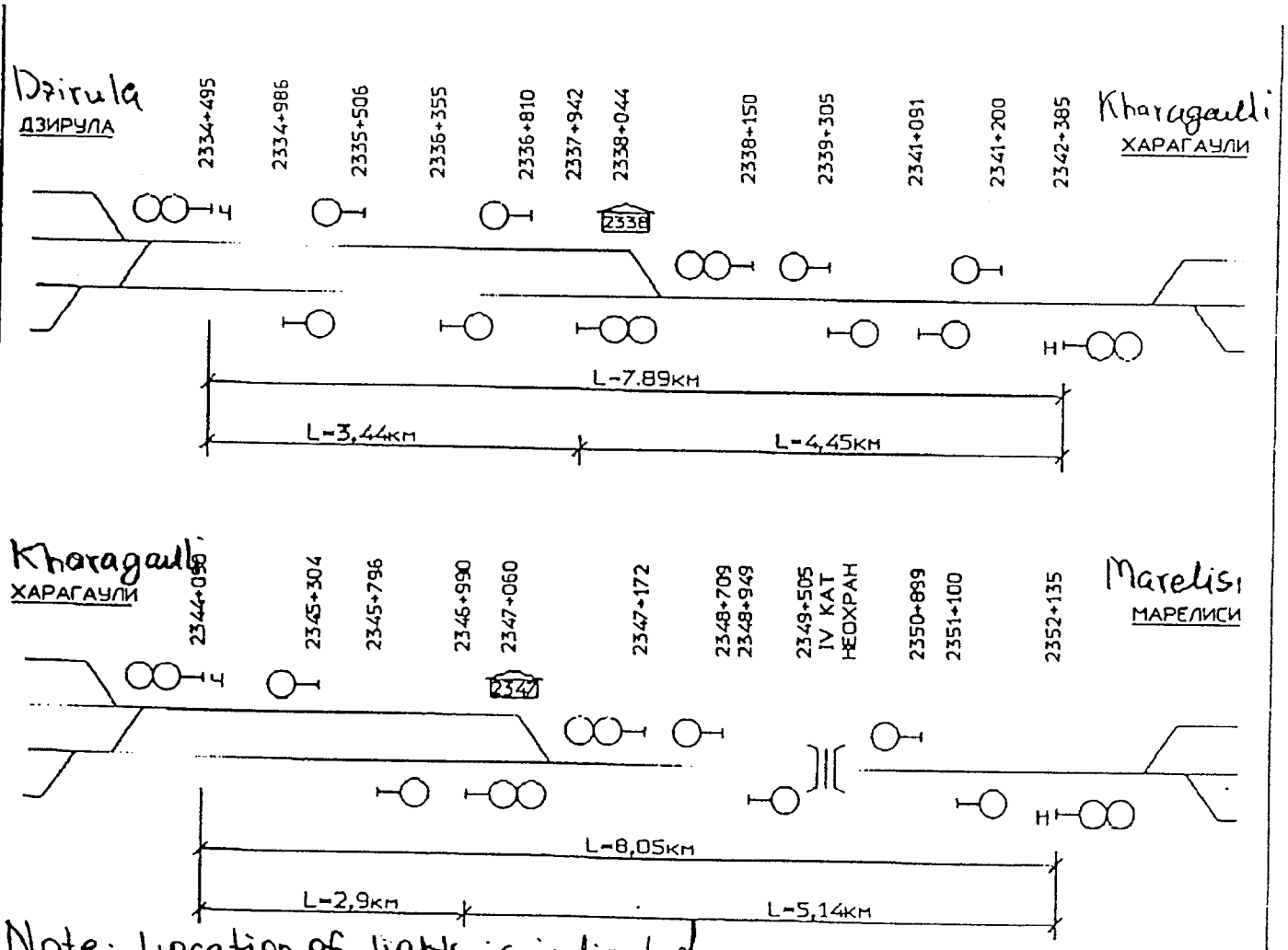
Zestaponі - Khashuri

УЧАСТОК
ЗЕСТАФОНИ – ХАШУРИ

ВСЕГО ЛИСТОВ ___ 3
ЛИСТ ___ 3

This diagram is provided to show the interlockings at the double to single line junctions at 2338km and 2347km

The position of intermediate signals should be disregarded



Note: Location of lights is indicated at the time when auto block system was in operation till 01 01 98

ПРИМЕЧАНИЕ

РАСПОЛОЖЕНИЕ ПРОХОДНЫХ СВЕТОФОРОВ УКАЗАНО НА МОМЕНТ ФУНКЦИОНИРОВАНИЯ АВТОМАТИЧЕСКОЙ БЛОКИРОВКИ ДО 01.01.90

Zestaponi - Khashuri
ЗЕСТАФОНИ – ХАШУРИ

ВСЕГО ЛИСТОВ ___ 2

ЛИСТ ____ 1

Appendix A

APPENDIX A

STATUS OF SIGNALLING ON ROUTE BETWEEN BATUMI / POTI AND BEUK KYASIK AT OCTOBER 1998.

During 1997 and 1998 there have been considerable improvements made to the signalling systems throughout the Georgian Railways. In many cases signalling for all the original facilities at a station has been brought back into use. However it must be stressed that the signalling in many of these cases is life expired and is still in urgent need of renewal.

In 11 cases new Interlockings have been provided and in all but one case all external points, signals and track circuits were renewed. All existing facilities appear to have been reinstated and I do not know whether consideration was given to what is really required for current traffic.

Points in the route which are out of use are detected but not padlocked. They can be wound by hand to store failed vehicles, etc..

It is custom, and an essential safety factor, that the signal controlling the entrance to a station at which a train can be brought to a stand is preceded by a warning signal which will show a caution aspect when the station signal is at red requiring the train to stop. This signal is located at sufficient distance from the stop signal for a train to be brought to a stand at it. This facility was originally incorporated into the Autoblock system but in most cases does not exist today. Reinstatement of these signals is probably the most critical requirement from a safety aspect.

However in most cases neither the signalling in the "Spans" between the stations with signal control rooms (as against intermediate stations with no signalling control centre) has not yet been reinstated apart from the section between Kaspi and Tbilisi Passenger Station. In this section Autoblock is operational together with Cab Signalling.

It is custom with Russian signalling for cab signalling to be always provided with Autoblock.

For a period after the Civil unrest "Paper Ticket" working was introduced to ensure safe passage of trains between stations. A form of interlocking now exists between signal control rooms at each end of a single line section and a similar arrangement has been applied to double lines preventing two trains being released into the section together. In each case the track circuits at the far end of the section need to be occupied to show a train passed into one of the loops at the station. Safety is thus significantly improve over "Paper Ticket" working, where a paper ticket was given to the driver as authority to proceed, and "Paper Ticket" working has been withdrawn.

However there is no train detection system in operation on the section of line between the stations (termed the "span" in Russian Railway terms) and therefore the Georgian Railway representatives see two potential problems:

- Part of a divided train may be left undetected in section
- Broken rails do not cause a track circuit to show occupied and are therefore not detected.

It should be noted that neither of these items are considered to be major safety issues in many countries. In the first case with fully fitted trains both parts of a divided train are brought to a stand. In the second case it is now widely accepted that only 25% of "broken" rails are likely to be detected by a track circuit. Generally hairline cracks and lumps out of the rail will not be detected. Failures at non insulated joints (approximately every 25m) will also not be detected because they are bonded out anyway for electrical continuity.

On heavily used railways there is advantages in providing train detection between the sections as uni directional trains can be run automatically through the section without any action from the control room.

This is particularly useful where the span is broken into sections by the provision of intermediate signals.

The Pre 1990 signalling system was quite sophisticated with automatic working between stations and cab signalling. A centralised control system was in operation with the Batumi to Samtredia lines, the Poti to Samtredia and Ingiri to Samtredia lines controlled from Samtredia. The layouts at the stations were complex with the smaller stations having at least 3 or 4 bi-directional passing loops and the larger ones many more. The spans between the stations were signalled to permit 8 minute headway. Whilst this level of infrastucture may have been necessary for the pre 1990 volumes of traffic it certainly is not necessary for traffic levels now or in the foreseeable future.

There would appear to be a desire by Georgian Railways to reinstate the pre 1990 level of facilities "just in case" a factory reopens or through traffic increases.

Generally the ability to pass through the longest sections in 30 minutes represents 48 trains per day on double line. Even allowing for the fact that the trains will not run to exactly regular intervals there will be no problem accommodating 30 trains a day which is well above the forecasts. If additional traffic arises capacity can be increased by providing additional signals in the sections. Current traffic tariffs should not reflect costs for significant over capacity which may never be required. On single lines the number of trains would be reduced to 15 in each direction, assuming even traffic flows.

Another factor which will affect time to pass through the sections is the number of intermediate passenger stations. Generally only EMU's stop at these stations and then only for a half minute dwell time. The impact on daily capacity is therefore not likely to be highly significant. It should be noted that currently there are no intermediate signals between stations except in the Kaspi to Tbilisi section.

The servicing of in section ground frames can also increase the length of time trains are in section but these are few in number and only used infrequently.

There are 13 level crossings where protection is required. Initially warnings initiated by track circuits will be required except where the warning point would be within a station. In this case the warning is initiated by the controller and the signal clearance delayed. If axle counters were used for train detection the level crossing initiation could be by axle counters or treadles. In due course some of the these crossings could be converted to automatic operation. Interlocking with signals is not provided although a white light is displayed if it is safe for the train to proceed. When autoblock existed the proceed function was incorporated into one of the autoblock signals where these were adjacent to the crossing.

Protection is not currently required at a further 41 level crossings.

The state of the existing facilities is given below. For convenience the line has been divided into 4 sections.

1 BATUMI to SAMTREDIA (Exclusive)

1.1 GENERAL

The line is single throughout. There is a branch line at Natenbi. Signalled controls are provided for sidings at Sajevakho, Ureki and Natenbi. Progress with restoration on this section of line is less than the other sections. 166 points and signals are now controlled from the interlockings compared with 353 pre 1990. Of the 187 points and signals not connected to the interlocking 78 are at Batumi. The Georgian Railways need to consider how many of those not connected are actually required.

1.2 SIGNAL CONTROL ROOMS and INTERLOCKINGS

There are 13 signal control rooms currently in operation at stations between Batumi (inclusive) and Samtredia 1 (exclusive). An additional control room was situated at 101km near Samtredia and controlled a single line chord between the Batumi and Poti lines. This chord is currently out of use and the need for reinstatement needs to be evaluated.

Four of the interlockings were renewed in 1997 and restored all the previous facilities. 3 of these at Makhinjauri, Natanebi and Ureki were supplied pre assempled in containers from the Electro - Technical Factory in St. Petersburg. The other at Japana was assembled by Georgian Railway staff. This is the only site where renewal of the interlocking has taken place that all the external equipment has not been renewed.

A new interlocking was also provided as a temporary measure at Batumi but this only controls 20 points and signals compared with the original 98. Many of the remaining functions will need to be controlled from a larger interlocking as soon as resources permit.

All the 8 remaining interlockings, whilst currently functioning, require renewal. Only at Sajevakho is the layout as existed pre 1990 operated from the interlocking. At the others the layout has been reduced to a simple passing loop with no siding facilities.

Two of the interlockings were commissioned in 1965, 2 in 1966, 1 in 1967, 2 in 1980, 1 in 1988 and 5 in 1997. Searchlight signals exist at 3 of the old interlockings.

Full details of the signalling in this section is provided in Appendix AA.

1.3 INTERMEDIATE PASSENGER STATIONS AND FREIGHT SIDINGS WHICH MAY AFFECT HEADWAY REQUIREMENTS.

Intermediate Passenger Halts used mainly by EMU's are provided at
Mtsvane Kontskhi 10 Km, Bostan-Bagi 11 Km, Buknari 17 Km, Tsikhisdziri 18 Km, Bobokvati 21 Km, Choloko 35 Km, Tsvermagali 44 Km, Kolshroma 58 Km, Guria 61 Km, Lesa 69 Km, Chibati 71 Km, Platform at 79 Km, Kviani 86 Km, Khevistskali 93 Km and Dapnari 100 Km.

Intermediate Freight Sidings are provided at 10km 620 and 21Km 430.

1.4 LEVEL CROSSINGS

There are six level crossings within this section with crossing keepers which will eventually require train initiated warnings when the train running at 90 kph is a minimum of 43 seconds running time from the crossing. Of these 3 are within the station signals and will only require train initiated warnings in one direction.

In addition there are a further 24 level crossings where it is not currently proposed to provide protection.

1.5 HEADWAYS

The length of the spans between stop signals at adjacent stations is shown in appendices D1, D2, E1 and E2.

2 POTI to ZESTAPONI (Exclusive)

2.1 GENERAL

The line is single from Poti to Abasha and then double from Abasha to Zestaponi.

There are branch lines at Senaki, Brotseula and Rioni. Signalled controls are provided for sidings at Stations except Chaladidi.

2.2.1 SIGNAL CONTROL ROOMS and INTERLOCKINGS. - Poti (inclusive) and Samtredia 1 (exclusive).

There are 7 signal control rooms currently in operation at stations between Poti (inclusive) and Samtredia 1 (exclusive). A single line chord between the Batumi and Poti lines was controlled from Kolabani but has not been reinstated. This chord is currently out of use and the need for reinstatement needs to be evaluated.

Six of the seven interlockings have been renewed. The remaining interlocking at Senaki is in need of total renewal. All facilities existing at the stations prior to the civil unrest have been restored. 229 points and signals are controlled from the seven interlockings.

Five of the interlockings were renewed in 1998 and restored all the previous facilities. 3 of these at Chaladidi, Kvaloni and Agur-Karkhana were supplied pre assempled in containers from the Electro - Technical Factory in St. Petersburg. The other two at Poti and Abasha was assembled by Georgian Railway staff.

Both the remaining interlockings, whilst currently functioning, require complete renewal. The full pre 1990 layout is currently in operation at Senaki but only a reduced layout is controlled from the interlocking at Kolabani.

One of the interlockings were commissioned in 1964, 1 in 1988 and 5 in 1998.

A summary of the details of the signalling in this section is provided in Appendix AB.

2.2.2 SIGNAL CONTROL ROOMS and INTERLOCKINGS - Samtredia 1 (inclusive) and Zestaponi (exclusive).

There are 9 signal control rooms currently in operation at stations between Samtredia 1 (inclusive) and Zestaponi (exclusive). Although none of these have been completely renewed only those at Samtredia 1, Kopitnari and Brotseula are in need of total renewal. At the remaining 6 the cabling needs refurbishing and most of the track circuits are in need of renewal.

Equipment worked from the control rooms is as existed Pre 1990 except at Brotseula where only 13 points and signals are operational compared with 35 Pre 1990. In total 674 points and signals are now controlled from the interlockings compared with 709 previously. Of these 356 points and signals are at the two Samtredias with the Marshalling Yards etc.

One of the interlockings were commissioned in 1960, 1 in 1966, 4 in 1978, 1 in 1980, 1 in 1988 and 1 in 1991. Searchlight signals exist at Brotseula.

A summary of the details of the signalling in this section is provided in Appendix AB.

2.3 INTERMEDIATE PASSENGER STATIONS AND FREIGHT SIDINGS WHICH MAY AFFECT HEADWAY REQUIREMENTS.

Intermediate Passenger Halts used mainly by EMU's are provided at Platform at 31 Km, Khorga 18 Km, Teklati 4 Km, Nosiri 2237 Km, Marani 2254 Km, Ianeti 2266 Km, Partskhana 2277 Km and Platform at 2279 Km.

There are no Intermediate Freight Sidings.

2.4 LEVEL CROSSINGS

There is one level crossings within this section with a crossing keeper which will eventually require train initiated warnings when the train running at 90 kph is a minimum of 43 seconds running time from the crossing. The crossing is not within the station signals.

There are 11 level crossings where it is not currently proposed to provide protection.

2.5 HEADWAYS

The length of the spans between stop signals at adjacent stations is shown in appendices D3, D4, E3 and E4.

3 ZESTAPONI (Inclusive) to KASPI (Exclusive)

3.1 GENERAL

The line is double track except two single line sections between Kharagauli and Marelisi and between Dzirula and Kharagauli. There are plans in the future to double the single line section between Kharagauli and Marelisi and shorten the section of single line between Dzirula and Kharagauli . Complete doubling between Dzirula and Kharagauli is unlikely because tunnelling would be involved.

There are two branch lines at Khashuri to Surami and Borjmi and at Gori there is a branch line to Tskhinvali. A former branch / station between Khashuri and Gomi has been closed.

Signalled controls are provided for sidings at all the stations.

There are two Tunnels in the section.

3.2.1 SIGNAL CONTROL ROOMS and INTERLOCKINGS - Zestaponi (inclusive) and Khashuri (exclusive)

There are 10 signal control rooms currently in operation at stations between Zestaponi (inclusive) and Khashuri (exclusive). Only the interlocking at Dzirula has been completely renewed and all the rest are in need of total renewal.

All equipment worked from the control rooms is as existed Pre 1990. In total 370 points and signals are now controlled from the interlockings, of these 133 points and signals are at Zestaponi.

Both of the lines of the double line spans between Kharagauli and the double / single line junction at 2347 Km, Marelisi to Moliti, Moliti to Zipa and Zipa to Likhi are signalled for bi directional working. The East to West line between Likhi and Khashuri is also signalled for bi directional working.

Five of the interlockings were commissioned in 1969, 1 in 1970, 1 in 1975, 1 in 1979, 1 in 1990 and 1 in 1998.

Full details of the signalling in this section is provided in Appendix AC.

3.2.2 SIGNAL CONTROL ROOMS and INTERLOCKINGS - Khashuri (inclusive) and Kaspi (exclusive).

There are 9 signal control rooms currently in operation at stations between Khashuri (inclusive) and Kaspi (exclusive). Although none of these have been completely renewed only that at Khashuri is in need of total renewal. At the remaining 8 the cabling needs refurbishing and both the track circuits and panels are in need of renewal.

Apart from at Khashuri, where there are 102 points and signals in operation, reduced facilities compared with pre1990 are in operation. 246 points and signals are now controlled from the 8 interlockings compared with 357 previously.

One of the interlockings were commissioned in 1968, 1 in 1974, 2 in 1978, 1 in 1980, 3 in 1981 and 1 in 1988.

Full details of the signalling in this section is provided in Appendix AC.

3.3 INTERMEDIATE PASSENGER STATIONS AND FREIGHT SIDINGS WHICH MAY AFFECT HEADWAY REQUIREMENTS.

Intermediate Passenger Halts used mainly by EMU's are provided at Tsevi 2327 Km, Platform at 2328 Km, Lashe 2337 Km, Platform at 2338 Km, Bazaleti 2342 Km, Platform at 2347 Km, Grekhil Aveji 2350 Km, Platform at 2355 Km, Platform at 2357 Km, Chrdili 2362 Km, Platform at 2363 Km, Platform at 2369 Km, Platform at 2373 Km, Savanis Ubani 2373 Km, Tezeri 2379 Km, Platform at 2380 Km, Osiauri 2387Km, Platform at 2391 Km, Mokhisi 2399 Km, Urbnisi 2416 Km, Khidstavi 2430 Km and Kvakhvreli 2437 Km

There are no Intermediate Freight Sidings.

3.4 LEVEL CROSSINGS

There is four level crossings within this section with a crossing keeper which will eventually require train initiated warnings when the train running at 90 kph is a minimum of 43 seconds running time from the crossing . Three of the crossings are within the station signals and will only require train initiated warnings in one direction. The other crossing is not within the station signals.

In addition there are three level crossings where it is not currently proposed to provide protection.

3.5 HEADWAYS

The length of the spans between stop signals at adjacent stations is shown in appendices D5, D6, E5, E6, E7 and E8.

4 KASPI (Inclusive) to BEUK KYASIK (Exclusive)

4.1 GENERAL

The line is double track throughout with some bi -directional signalling between Tbilisi passenger Station and Tbilisi Marshalling Yard. There are two branch lines at Khashuri to Surami and Borjmi, at Gori there is a branch line to Tskhinvali and there are two branch lines at Tbilisi Junction to Kahketi and Erevan. A former branch / station between Khashuri and Gomi has been closed.

Signalled controls are provided for sidings at all the stations.

4.2.1 SIGNAL CONTROL ROOMS and INTERLOCKINGS - Kaspi (inclusive) to Tbilisi Freight (Exclusive)

There are 9 signal control rooms currently in operation at stations between Khashuri (inclusive) and Kaspi (exclusive). Although none of these have been completely renewed only that at Khashuri is in need of total renewal. At the remaining 8 the cabling needs refurbishing and both the track circuits and panels are in need of renewal.

Apart from at Khashuri, where there are 102 points and signals in operation, reduced facilities compared with pre1990 are in operation. 246 points and signals are now controlled from the 8 interlockings compared with 357 previously.

Autoblock with Cab Signalling is functioning between Kaspi and Tbilisi Passenger Station. I am led to believe that the locomotive part of the equipment functions on all the locomotives.

One of the interlockings were commissioned in 1968, 1 in 1974, 2 in 1978, 1 in 1980, 3 in 1981 and 1 in 1988.

Full details of the signalling in this section is provided in Appendix AD.

4.2.2 SIGNAL CONTROL ROOMS and INTERLOCKINGS - Tbilisi Freight (inclusive) and Beuk - Kyasik (exclusive)

There are 9 signal control rooms currently in operation at stations between Tbilisi Freight (inclusive) and Beuk - Kyasik (exclusive). None of these have been completely renewed and 5 are in need of total renewal. At the remaining 3 the cabling and track circuits need refurbishing and 2 of the 3 panels are in need of renewal.

Apart from at Tbilisi Freight , where there are only 74 points and signals in operation compared with 120 previously, the full facilities provided pre1990 are in operation. 851 points and signals are now controlled from the 8 interlockings apart from Tbilisi freight. Extensive facilities are provided at Tbilisi Marshalling Yard and there is a separate control room for the humping operations but this does not control any facilities on the main line.

One of the interlockings were commissioned in 1963, 1 in 1964, 1 in 1970, 2 in 1973, 2 in 1976 and 1 in 1990

Full details of the signalling in this section is provided in Appendix AD.

4.3 INTERMEDIATE PASSENGER STATIONS AND FREIGHT SIDINGS WHICH MAY AFFECT HEADWAY REQUIREMENTS.

Intermediate Passenger Halts used mainly by EMU's are provided at Khandaki 2464 Km, Platform at 2468 Km, Shiomgvime 2474 Km, Armazi 2479 Km, Karsani 2484 Km, Didube 2499 Km, Platform at 6 Km, Platform at 13Km, Platform at 18 Km, Platform at 21 Km, Rustavi Passenger 22 Km, Platform at 23 Km and Mtavari Arkhi 27Km.

There are no Intermediate Freight Sidings.

4.4 LEVEL CROSSINGS

There are two level crossings within this section with crossing keepers which will eventually require train initiated warnings when the train running at 90 kph is a minimum of 43 seconds running time from the crossing. Neither crossing is within the station signals.

There are 3 level crossings where it is not currently proposed to provide protection.

4.5 HEADWAYS

The length of the spans between stop signals at adjacent stations is shown in appendices D7, D8, E9 and E10.

Appendices AA to AD

I/L Kms &	STATION	DATE OF I/L	TYPE OF I/L	Frt Term	More than 10K pass.	BORIS NUMBER OF POINTS AND SIGS AT STATION		NUMBER OF BI DIRECTIONAL LINES AT STATION		NUMBER OF SIDINGS / BRANCH (STATION or SPAN)		TOTAL RENEWAL REQUIRED	WORK WHERE TOTAL RENEWAL NOT REQUIRED					OTHER WORK		STN or SPAN	LEVEL XINGS	
													CABLES		TRACK CIRCUITS		RENEW	DIAGRAM TO BE ALTERED	CODES REQUIRED			
						Pre 1990	NOW	Pre 1990	NOW	Pre 1990	NOW		TOTAL RENEWAL	REFURB.	TOTAL RENEWAL	REFURB	PANEL	FOR AUTO BLOCK	FOR CAB SIGNALS		PROT	NOT PROT
????	BATUMI	1997	3U-2	MF	$	98	20	@	@	@	@	YES						YES	YES	STN	0	1(West)
																				SPAN	1	1
6925	**MAKHINJAURI**	**1997**	KOHT		$	13	13	2	2	1	1	NO	NONE	NONE	NONE	NONE	NONE	YES	YES	STN	0	0
																				SPAN	0	0
13923	CHAKVA	1965	3U-2			31	8	4	2	5	3	YES						YES	YES	STN	0	1
																				SPAN	0	1
23517	KOBULETI	1965	3U-2		$	29	8	5	2	???	???	YES						YES	YES	STN	2	0
																				SPAN	1	0
30348	OCHKHAMURI	1967	3U-2			21	9	3	2	2	0	YES						YES	YES	STN	0	1
																				SPAN	0	0
39491	**NATANEBI**	**1997**	KOHT			21	21	3	3	3 +Branch	3 +Branch	NO	NONE	NONE	NONE	NONE	NONE	YES	YES	STN	0	1
																				SPAN	0	0
47555	**UREKI**	**1997**	KOHT			20	20	3	3	3	3	NO	NONE	NONE	NONE	NONE	NONE	YES	YES	STN	0	1
																				SPAN	0	0
54493	SUPSA	1966	3U-2			24	8	3	2	2	0	YES						YES	YES	STN	1	0
																				SPAN	0	2
63401	JUMATI	1980	3U-2	0	1.9K	18	8	4	2	0	0	YES						YES	YES	STN	0	0
																				SPAN	1	2
????	LANCHKHUTI	1980	3U-2		$	24	9	3	2	1	0	YES						YES	YES	STN	0	1
																				SPAN	0	3
????	NIGOITI	1988	3U-2	0	3.2K	20	8	4	2	1	0	YES						YES	YES	STN	0	1
																				SPAN	0	3
88095	**JAPANA**	**1997**	3U-9	0	118	10	10	3	3	0	0	NO		YES		YES	YES	YES	YES	STN	0	0
																				SPAN	0	2
96024	SAJEVAKHO	1966	3U-2			24	24	4	4	2	2	YES						YES	YES	STN	0	2
																				SPAN	0	0
????	SAMTREDIA 1	1966	TP-47	MF	$	106	106	@	@	@	@	YES						YES	YES	STN	0	1(East)

STATION NAMES AND DATES IN BOLD AND SHADED ARE RENEWALS IN FINAL FORM SINCE 1997 (NOTE ONLY PART OF LAYOUT RENEWED AT BATUMI)

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INTERLOCKING AT FORMER JUNCTION AT 101 KM UNLIKELY TO BE RENEWED IN FORSEEABLE FUTURE AND EXCLUDED FROM CHARTS

& BORIS TO PROVIDE FINAL DETAILS OF LOCATIONS OF INTERLOCKINGS

I/L Kms &	STATION	DATE OF I/L	TYPE OF I/L	Frt Term	More than 10K pass.	BORIS NUMBER OF POINTS AND SIGS AT STATION		NUMBER OF BI DIRECTIONAL LINES AT STATION		NUMBER OF SIDINGS / BRANCH (STATION or SPAN)		TOTAL RENEWAL REQUIRED	WORK WHERE TOTAL RENEWAL NOT REQUIRED					OTHER WORK		STN or SPAN	LEVEL XINGS	
													CABLES		TRACK CIRCUITS		RENEW PANEL	DIAGRAM TO BE ALTERED FOR AUTO BLOCK	CODES REQUIRED FOR CAB SIGNALS		PROT	NOT PROT
						Pre 1990	NOW	Pre 1990	NOW	Pre 1990	NOW		TOTAL RENEWAL	REFURB	TOTAL RENEWAL	REFURB						
????	**POTI**	**1998**	3U-9	MF	$	65	65	@	@	@	@	NO	NONE	NONE	NONE	NONE	NONE	YES	YES	STN	0	0
																				SPAN	0	1
23242	**CHALADIDI**	**1998**	KOHT	0	964	20	20	4	4	0	0	NO	NONE	NONE	NONE	NONE	NONE	YES	YES	STN	0	1
																				SPAN	0	1
????	**KVALONI**	**1998**	KOHT	0	806	18	18	3	3	1	1	NO	NONE	NONE	NONE	NONE	NONE	YES	YES	STN	0	1
																				SPAN	0	2
00000 2231600	SENAKI	1964	3U-2		$	43	43	6	6	4+Branch	4+Branch	YES						YES	YES	STN	0	1
																				SPAN	0	1
2238872	**AGUR-KARKHANA**	**1998**	KOHT	0	88	20	20	3	3	3	3	NO	NONE	NONE	NONE	NONE	NONE	YES	YES	STN	0	0
																				SPAN	0	0
2245553	**ABASHA**	**1998**	3U-9		$	32	32	4	4	1	1	NO	NONE	NONE	NONE	NONE	NONE	YES	YES	STN	0	1
																				SPAN	0	0
2251460	KOLOBANI	1988	3U-9		$	50	31	8	4	2	0	YES						YES	YES	STN	0	1
																				SPAN	0	1
????	SAMTREDIA 1	1966	TP-47	MF	$	106	106	@	@	@	@	YES						YES	YES	STN	0	0
																				SPAN	0	0
????	SAMTREDIA 2	1988	MPU-1	MF		250	250	@	@	@	@	NO		YES		YES		YES	YES	STN	0	0
																				SPAN	0	0
????	KOPITNARI	1978	3U-9			48	48	5	5	2	2	YES						YES	YES	STN	0	0
																				SPAN	0	0
????	MUKHIANI	1978	3U-9			44	44	5	5	3	3	NO		YES	YES			YES	YES	STN	0	0
																				SPAN	0	0
????	BROTSEULA	1960	3U-2		$	35	13	1+2 UNI	1+2 UNI	5+Branch	5+Branch	YES						YES	YES	STN	0	0
																				SPAN	0	0
????	RIONI	1991	3U-9			81	81	8 + 2	8 + 2	4+Branch	4+Branch	NO		YES	YES			YES	YES	STN	0	0
																				SPAN	0	0
????	AJAMETI	1978	3U-9			47	47	6	6	3	3	NO		YES	YES			YES	YES	STN	0	0
																				SPAN	0	0
????	SVIRI	1978	3U-9	O	3.9K	32	32	5	5	1	1	NO		YES	YES			YES	YES	STN	0	0
																				SPAN	0	0
????	ARGVETA	1980	3U-9			66	66	6	6	6	6	NO		YES	YES			YES	YES	STN	0	0
																				SPAN	1	0
????	ZESTAPONI	1990	MPU-1	MF	$	133	133	@	@	@	@	NO		YES	YES			YES	YES	STN	0	0

STATION NAMES AND DATES IN BOLD AND SHADED ARE RENEWALS IN FINAL FORM SINCE 1997 (NOTE ONLY PART OF LAYOUT RENEWED AT BATUMI)

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& BORIS TO PROVIDE FINAL DETAILS OF LOCATIONS OF INTERLOCKINGS

I/L Kms &	STATION	DATE OF I/L	TYPE OF I/L	Frt Term	More than 10K pass.	BORIS NUMBER OF POINTS AND SIGS AT STATION		NUMBER OF BI DIRECTIONAL LINES AT STATION		NUMBER OF SIDINGS / BRANCH (STATION or SPAN)		TOTAL RENEWAL REQUIRED	WORK WHERE TOTAL RENEWAL NOT REQUIRED					OTHER WORK		STN or SPAN	LEVEL XINGS	
													CABLES		TRACK CIRCUITS		RENEW PANEL	DIAGRAM TO BE ALTERED FOR AUTO BLOCK	CODES REQUIRED FOR CAB SIGNALS		PROT	NOT PROT
						Pre 1990	NOW	Pre 1990	NOW	Pre 1990	NOW		TOTAL RENEWAL	REFURB	TOTAL RENEWAL	REFURB						
????	ZESTAPONI	1990	MPU-1	MF	$	133	133	@	@	@	@	YES						YES	YES	STN	0	0
																				SPAN	0	0
2323651	SHORAPANI	1969	3U-9			61	61	4	4	3	3	YES						YES	YES	STN	0	0
																				SPAN	TUNNEL	
2333410	**DZIRULA**	**1998**	KOHT			26	26	1 + 2 UNI	1 + 2 UN	2	2	NO	NONE	NONE	NONE	NONE	NONE	YES	YES	STN	0	0
																				SPAN	0	0
2338044	Single/Double at 2338	1970	3U-2			4	4	Junction	Junction	0	0	YES						YES	YES	STN	0	0
																				SPAN	0	0
2343071	KHARAGAULI	1969	3U-9		$	35	35	4	4	3	3	YES						YES	YES	STN	0	0
																				SPAN	0	0
2347060	Single/Double at 2347	1969	3U-2			4	4	Junction	Junction	0	0	YES						YES	YES	STN	0	0
																				SPAN	0	1
2352627	MARELISI	1969	3U-9		$	35	35	4	4	3	3	YES						YES	YES	STN	0	0
																				SPAN	1	0
2359645	MOLITI	1969	3U-2		$	17	17	1 + 2 UNI	1 + 2 UN	3	3	YES						YES	YES	STN	0	0
																				SPAN	0	0
2366713	ZIPA	1979	3U-2	0	$	31	31	1 + 2 UNI	1 + 2 UN	3	3	YES						YES	YES	STN	0	0
																				SPAN	TUNNEL	
2374940	LIKHI	1975	3U-9	0	$	24	24	4	4	2	2	YES						YES	YES	STN	0	0
																				SPAN	0	0
2383159	KHASHURI	1968	TP-47	MF	$	102	102	@	@	@	@	YES						YES	YES	STN	0	0
																				SPAN	0	0
2393953	GOMI	1988	3U-9		$	38	32	5	5	2	1	NO		YES	YES		YES	YES	YES	STN	1	0
																				SPAN	0	0
2402728	AGARA	1981	3U-9			58	33	5	5	8	0	NO		YES	YES		YES	YES	YES	STN	1	0
																				SPAN	0	0
2409140	KARELI	1980	3U-9		$	47	32	5	5	2	0	NO		YES	YES		YES	YES	YES	STN	1	0
																				SPAN	0	0
2419160	SKRA	1974	3U-9	0	4.1K	29	25	4	4	1	0	NO		YES	YES		YES	YES	YES	STN	0	1
																				SPAN	0	0
????	GORI	1978	3U-9	MF	$	75	46	6	6	@	2	NO		YES	YES		YES	YES	YES	STN	0	0
																				SPAN	0	0
2434514	UPLISTSIKHE	1978	3U-9		$	33	26	4	4	2	0	NO		YES	YES		YES	YES	YES	STN	0	0
																				SPAN	0	1
2441774	GRAKALI	1981	3U-9	0	$	45	30	5	5	3	0	NO		YES	YES		YES	YES	YES	STN	0	0
																				SPAN	0	0
2447310	METEKHI	1981	3U-9			42	32	5	5	4	1	NO		YES	YES		YES	YES	YES	STN	0	0
																				SPAN	0	0
2454311	KASPI	1980	3U-9		$	54	54	6	6	7	7	NO		YES	YES		YES	YES	YES	STN	1	0

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INTERLOCKING AT FORMER JUNCTION AT 2389 KM BETWEEN KASHURI AND GOMI UNLIKELY TO BE RENEWED IN FORSEEABLE FUTURE AND EXCLUDED FROM CHARTS

& BORIS TO PROVIDE FINAL DETAILS OF LOCATIONS OF INTERLOCKINGS

I/L Kms &	STATION	DATE OF I/L	TYPE OF I/L	Frt Term	More than 10K pass.	BORIS NUMBER OF POINTS AND SIGS AT STATION		NUMBER OF BI DIRECTIONAL LINES AT STATION		NUMBER OF SIDINGS / BRANCH (STATION or SPAN)		TOTAL RENEWAL REQUIRED	WORK WHERE TOTAL RENEWAL NOT REQUIRED					OTHER WORK		STN or SPAN	LEVEL XINGS	
													CABLES		TRACK CIRCUITS		RENEW PANEL	DIAGRAM TO BE ALTERED FOR AUTO BLOCK	CODES REQUIRED FOR CAB SIGNALS			
						Pre 1990	NOW	Pre 1990	NOW	Pre 1990	NOW		TOTAL RENEWAL	REFURB	TOTAL RENEWAL	REFURB					PROT	NOT PROT
2454311	KASPI	1980	3U-9		$	54	54	6	6	7	7	NO	YES		YES		YES	YES	YES	STN	1	0
																				SPAN	0	0
2459869	KAVTISKHEVI	1980	3U-9	MF		49	49	5	5	4	4	NO	YES		YES		YES	YES	YES	STN	0	0
																				SPAN	0	0
2469902	KSANI	1979	3U-9		$	41	41	5+Bay	5+Bay	3	3	NO	YES		YES		YES	YES	YES	STN	0	0
																				SPAN	0	0
2475004	DZEGVI	1978	3U-9			61	61	6	6	5	5	NO	YES		YES		YES	YES	YES	STN	0	0
																				SPAN	0	0
2481487	MTSKHETA	1976	3U-9			44	44	5	5	1+Tunnel	1+Tunnel	YES						YES	YES	STN	0	0
																				SPAN	1	0
2489434	ZAGES	1977	3U-9	0	3.2K	40	40	4	4	3	3	YES						YES	YES	STN	0	0
																				SPAN	0	0
2492478	**AVCHALA**	**1998**	3U-9		$	44	44	4	4	3	3	NO	NONE	NONE	NONE	NONE	NONE	YES	YES	STN	0	0
																				SPAN	0	0
????	TBILISI FREIGHT	1963	TP-47	MF		120	74	5	5	4	1	YES						YES	YES	STN	0	0
																				SPAN	0	0
????	TBILISI PASSENGER	1976	MPU-13		$	160	160	@	@	@	@	NO		YES		YES	YES	YES	YES	STN	0	0
																				SPAN	0	0
????	TBILISI JUNCTION	1964	TP-47			141	141	@	@	@	@	YES						YES	YES	STN	0	0
																				SPAN	0	0
???? 00000	TBILISI MARSHAL YD	1990	MPU-1	MF		212	212	@	@	@	@	NO		YES		YES		YES	YES	STN	0	0
																					---	---
9621	VELI	1978	3U-9			39	39	5	5	5	5	YES						YES	YES	SPAN	0	0
																				STN	0	0
15210	GACHIANI	1970	TP-47			58	58	7	7	4	4	NO		YES		YES	YES	YES	YES	SPAN	0	0
																				STN	0	0
24573	RUSTAVI	1973	TP-47	MF	$	101	101	@	@	@	@	YES						YES	YES	SPAN	0	0
																				STN	0	0
32600	GARDABANI	1973	MPU-13		$	66	66	7	7	6+Branch	6+Branch	YES						YES	YES	SPAN	0	1
																				STN	0	1
????	BEUK KIASIK	N/A	N/A					@	@	@	@	N/A	N/A	N/A	N/A	N/A	N/A			SPAN	0	1
																				STN	0	0

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Appendix B

1.60 SECONDS

GREEN ASPECT IN CAB - APPROACHING GREEN LINE SIDE

0.35 0.12 0.22 0.12 0.22 0.57

YELLOW ASPECT IN CAB - APPROACHING YELLOW LINE SIDE

0.38 0.12 0.38 0.72

RED & YELLOW ASPECT IN CAB - APPROACHING RED LINE SIDE

0.23 0.57 0.23 0.57

NO CODE - PASSED RED LINE SIDE

Appendix C

FROM (INCLUSIVE)	TO (EXCLUSIVE)	NUMBER OF STATIONS	NUMBER OF POINTS AND SIGNALS		Pre 1990 FACILITIES REINSTATED		RENEWAL / REFURBISHMENT REQUIRED		
			Pre 1990	TODAY	ALL	REDUCED	RENEWED	NEEDS RENEWING	NEEDS REFURBISHMENT
BATUMI	SAMTREDIA 1	14	353	166	6	8	4	10	(*)
POTI	SAMTREDIA 1	7	248	229	6	1	5	2	0
SAMTREDIA 1	ZESTAPONI	9	709	687	8	1	0	2	7
ZESTAPONI	KHASHURI	9	353	353	9	0	1	8	0
KHASHURI	KASPI	9	469	358	1	8	0	1	8
KASPI	TBILISI FREIGHT	7	337	337	7	0	1	2	4
TBILISI FREIGHT	BEUK KIASIK	8	971	925	7	1	0	5	3
		63	3440	3055	44	19	11	30	22
						63			63

NOTE * Only part of the layout at Batumi is currently operated from the control room.

Appendices D1 to D8

FROM	TO	Distance between Stop Signals leaving one station and first stop signal on arriving at next station(metres)		No. of inter-mediate stations	Number of Sections required	Number of Sections Pre 1990	Average length per signal spacing Pre 1990	Location of protected Level Crossings (Kms)		OTHER POINTS TO NOTE
								Warning from West direction required	Warning from East direction required	
		Station	Span							
BATUMI	MAKHINJAURI		3517			2	1759	4403	4403	Single Line
		1529								
MAKHINJAURI	CHAKVA		5933	2		3	1978			Single Line
		845								
CHAKVA	KOBULETI		8365	3		5	1673	22615		Single Line
		1357								
KOBULETI	OCHKHAMURI		5748			3	1916	24533	23910, 24533	Single Line
		1017								
OCHKHAMURI	NATANEBI		7788	1		4	1947			Single Line
		1466								Branch at Natenebi to Ozurgeti
NATANEBI	UREKI		7484	1		4	1871			Single Line
		1075								
UREKI	SUPSA		4775			3	1592			Single Line
		1743								
SUPSA	JUMATI		7730	2		4	1933		55038	Single Line
		1293								
JUMATI	LANCHKHUTI		10369	2		5	2074	67108	67108	Single Line
		2403								
LANCHKHUTI	NIGOITI		4412	1		3	1471			Single Line
		716								
NIGOITI	JAPANA		5074	1		3	1691			Single Line
		1538								
JAPANA	SAJEVAKHO		6729	1		4	1682			Single Line
		1296								
SAJEVAKHO	SAMTREDIA 1		7432	1		4	1858			Single Line

INTERLOCKING AT FORMER JUNCTION AT 101 KM UNLIKELY TO BE RENEWED IN FORSEEABLE FUTURE AND EXCLUDED FROM CHARTS

FROM	TO	Distance between Stop Signals leaving one station and first stop signal on arriving at next station(metres)		No. of inter-mediate stations	Number of Sections required	Number of Sections Pre 1990	Average length per signal spacing Pre 1990	Location of protected Level Crossings (Kms)		OTHER POINTS TO NOTE
		Station	Span					Warning from West direction required	Warning from East direction required	
SAMTREDIA 1	SAJEVAKHO		7754	1		4	1939			Single Line
		1455								
SAJEVAKHO	JAPANA		6937	1		4	1734			Single Line
		1368								
JAPANA	NIGOITI		4842	1		3	1614			Single Line
		854								
NIGOITI	LANCHKHUTI		5616	1		3	1872			Single Line
		1686								
LANCHKHUTI	JUMATI		10064	2		5	2013	67108	67108	Single Line
		1272								
JUMATI	SUPSA		7538	2		4	1885		55038	Single Line
		1490								
SUPSA	UREKI		5370			3	1790			Single Line
		1003								
UREKI	NATANEBI		7312	1		4	1828			Single Line Branch at Natenebi to Ozurgeti
		1101								
NATANEBI	OCHKHAMURI		8136	1		4	2034			Single Line
		1239								
OCHKHAMURI	KOBULETI		5499			3	1833	24533	23910, 24533	Single Line
		1191								
KOBULETI	CHAKVA		8059	3		4	2015	22615		Single Line
		1448								
CHAKVA	MAKHINJAURI		5960	2		3	1987			Single Line
		1177								
MAKHINJAURI	BATUMI		2122			2	1061	4403**	4403**	Single Line

INTERLOCKING AT FORMER JUNCTION AT 101 KM UNLIKELY TO BE RENEWED IN FORSEEABLE FUTURE AND EXCLUDED FROM CHARTS

FROM	TO	Distance between Stop Signals leaving one station and first stop signal on arriving at next station(metres)	No. of inter-mediate stations	Number of Sections required	Number of Sections Pre 1990	Average length per signal spacing Pre 1990	Location of protected Level Crossings (Kms)		OTHER POINTS TO NOTE
							Warning from West direction required	Warning from East direction required	
		Station Span							
POTI	CHALADIDI	13105	1		6	2184			Single Line
		1412							
CHALADIDI	KVALONI	11748	1		6	1958			Single Line
		1458							
KVALONI	SENAKI	8389	1		4	2097			Single Line
		1463							Junction at Senaki to Ingiri
SENAKI	AGUR-KARKHANA	6210	1		3	2070			Single Line
		1095							
AGUR-KARKHANA	ABASHA	5703			4	1426			Single Line
		1447							
ABASHA	KOLABANI	4325			3	1442			Double Line
		1599							
KOLABANI	SAMTREDIA 1	6231	1		4	1558			Double Line
		N/A							
SAMTREDIA 1	SAMTREDIA 2	N/A		N/A			N/A	N/A	Double Line
		N/A							Connections to Hump etc.
SAMTREDIA 2	KOPITNARI	5030	1		3	1677			Double Line
		1150							
KOPITNARI	MUKHIANI	6580	2		4	1645			Double Line
		1480							
MUKHIANI	BROTSEULA	3402			2	1701			Double Line
		2295							Jcn at Brotseula to Kutaisi
BROTSEULA	RIONI	2873			2	1437			Double Line
		2720							Junction at Rioni to Kutaisi
RIONI	AJAMETI	5100			3	1700			Double Line
		712							
AJAMETI	SVIRI	8368			5	1674			Double Line
		1451							
SVIRI	ARGVETA	4823			3	1608			Double Line
		1461							
ARGVETA	ZESTAPONI	4783			3	1594	2316784	2316784	Double Line
		2542							Jcn at Zestaponi to Chiaturia

FROM	TO	Distance between Stop Signals leaving one station and first stop signal on arriving at next station(metres)		No. of inter-mediate stations	Number of Sections required	Number of Sections Pre 1990	Average length per signal spacing Pre 1990	Location of protected Level Crossings (Kms)		OTHER POINTS TO NOTE
		Station	Span					Warning from West direction required	Warning from East direction required	
		2181								Jcn at Zestaponi to Chiaturia
ZESTAPONI	ARGVETA		4836			3	1612	2316784	2316784	Double Line
		1668								
ARGVETA	SVIRI		4555			3	1518			Double Line
		1473								
SVIRI	AJAMETI		8427			5	1685			Double Line
		1498								
AJAMETI	RIONI		4362			3	1454			Double Line
		2690								Junction at Rioni to Kutaisi
RIONI	BROTSEULA		2983			2	1492			Double Line
		1631								Jcn at Brotseula to Kutaisi
BROTSEULA	MUKHIANI		4046			2	2023			Double Line
		1343								
MUKHIANI	KOPITNARI		6837	2		4	1709			Double Line
		1570								
KOPITNARI	SAMTREDIA 2		4380	1		3	1460			Double Line
		N/A								Connections to Hump etc.
SAMTREDIA 2	SAMTREDIA 1		N/A		N/A			N/A	N/A	Double Line
		N/A								
SAMTREDIA 1	KOLABANI		6250	1		4	1563			Double Line
		2052								
KOLABANI	ABASHA		3548			3	1183			Double Line
		1163								
ABASHA	AGUR-KARKHANA		6087			4	1522			Single Line
		1015								
AGUR-KARKHANA	SENAKI		5749	1		3	1916			Single Line
		1727								Junction at Senaki to Ingiri
SENAKI	KVALONI		8339	1		4	2085			Single Line
		1686								
KVALONI	CHALADIDI		11544	1		6	1924			Single Line
		1469								
CHALADIDI	POTI		13046	1		6	2174			Single Line

FROM	TO	Distance between Stop Signals leaving one station and first stop signal on arriving at next station(metres)		No. of inter-mediate stations	Number of Sections required	Number of Sections Pre 1990	Average length per signal spacing Pre 1990	Location of protected Level Crossings (Kms)		OTHER POINTS TO NOTE
								Warning from West direction required	Warning from East direction required	
		Station	Span							
		2542								
ZESTAPONI	SHORAPANI		1885			2	943			Double Line
		1093								
SHORAPANI	DZIRULA		8757	2		5	1751			Double Line. Tunnel.
		1323								
DZIRULA	Single/Double at 2338		3944	2		3	1315			Double Line
Single/Double at 2338	KHARAGAULI		4433	1		3	1478			Single Line
		1223								
KHARAGAULI	Single/Double at 2347		3372	1		2	1686			Double Line. Bi directional on both lines
Single/Double at 2347	MARELISI		5145	1		3	1715			Single Line
		1338								
MARELISI	MOLITI		5727	2		4	1432	2356505	2356505	Double Line. Bi directional on both lines
		1145								
MOLITI	ZIPA		5700	2		4	1425			Double Line. Bi directional on both lines
		1578								
ZIPA	LIKHI		6662	2		5	1332			Double Line. Bi directional on both lines. Surami Tunnel
		1353								
LIKHI	KHASHURI		6507	3		4	1627			Double Line. Bi directional W to E only Jcns at Khashuri to Surami and Barjomi
		1587								
KHASHURI	GOMI		8868	2		5	1774			Double Line
		1538								
GOMI	AGARA		7477	1		4	1869	2402241	2394310	Double Line
		1633								
AGARA	KARELI		4752			3	1584	2408536		Double Line
		1685								
KARELI	SKRA		8240	1		5	1648			Double Line
		1510								
SKRA	GORI		6847			4	1712			Double Line Jcn at Gori to Tskhinvali
		1630								
GORI	UPLISTSIKHE		5035	1		3	1678			Double Line
		1620								
UPLISTSIKHE	GRAKALI		5975			3	1992			Double Line
		1159								
GRAKALI	METEKHI		4244			3	1415			Double Line
		1499								
METEKHI	KASPI		5436			3	1812			Double Line
		1581								

INTERLOCKING AT FORMER JUNCTION AT KM BETWEEN KASHURI AND GOMI UNLIKELY TO BE RENEWED IN FORSEEABLE FUTURE AND EXCLUDED FROM CHARTS

& site to be checked and direction of gradient. Train required to stop in satation at bottom of incline for 20 minutes for brakes to cool

FROM	TO	Distance between Stop Signals leaving one station and first stop signal on arriving at next station(metres)		No. of inter-mediate stations	Number of Sections required	Number of Sections Pre 1990	Average length per signal spacing Pre 1990	Location of protected Level Crossings (Kms)		OTHER POINTS TO NOTE
								Warning from West direction required	Warning from East direction required	
		Station	Span							
KASPI	METEKHI	1630	5550			4	1388			Double Line
METEKHI	GRAKALI	1422	4158			3	1386			Double Line
GRAKALI	UPLISTSIKHE	1401	5699			4	1425			Double Line
UPLISTSIKHE	GORI	1585	5180	1		3	1727			Double Line
GORI	SKRA	1695	6955			4	1739			Jcn at Gori to Tskhinvali Double Line
SKRA	KARELI	1241	8499	1		5	1700			Double Line
KARELI	AGARA	1501	4939			3	1646	2408536		Double Line
AGARA	GOMI	1515	7595	1		5	1519	2402241	2394310	Double Line
GOMI	KHASHURI	1477	8663	2		5	1733			Double Line Jcns at Khashuri to Surami and Barjomi
KHASHURI	LIKHI	1642	6952	3		5	1390			Double Line. Bi directional W to E only
LIKHI	ZIPA	1170	6986	2		3	2329			Double Line. Bi directional on both lines. Surami Tunnel
ZIPA	MOLITI	1241	5989	2		4	1497			Double Line. Bi directional on both lines
MOLITI	MARELISI	1055	5755	2		4	1439	2356505	2356505	Double Line. Bi directional on both lines
MARELISI	Single/Double at 2347	1301	5367	1		3	1789			Single Line
Single/Double at 2347	KHARAGAULI		3082	1		2	1541			Double Line. Bi directional on both lines
KHARAGAULI	Single/Double at 2338	1256	4684	1		3	1561			Single Line
Single/Double at 2338	DZIRULA		3655	2		3	1218			Double Line
DZIRULA	SHORAPANI	1337	8383	2		5	1677			Double Line. Tunnel.
SHORAPANI	ZESTAPONI	1711	1764			1	1764			Double Line
		2181								

INTERLOCKING AT FORMER JUNCTION AT KM BETWEEN KASHURI AND GOMI UNLIKELY TO BE RENEWED IN FORSEEABLE FUTURE AND EXCLUDED FROM CHARTS

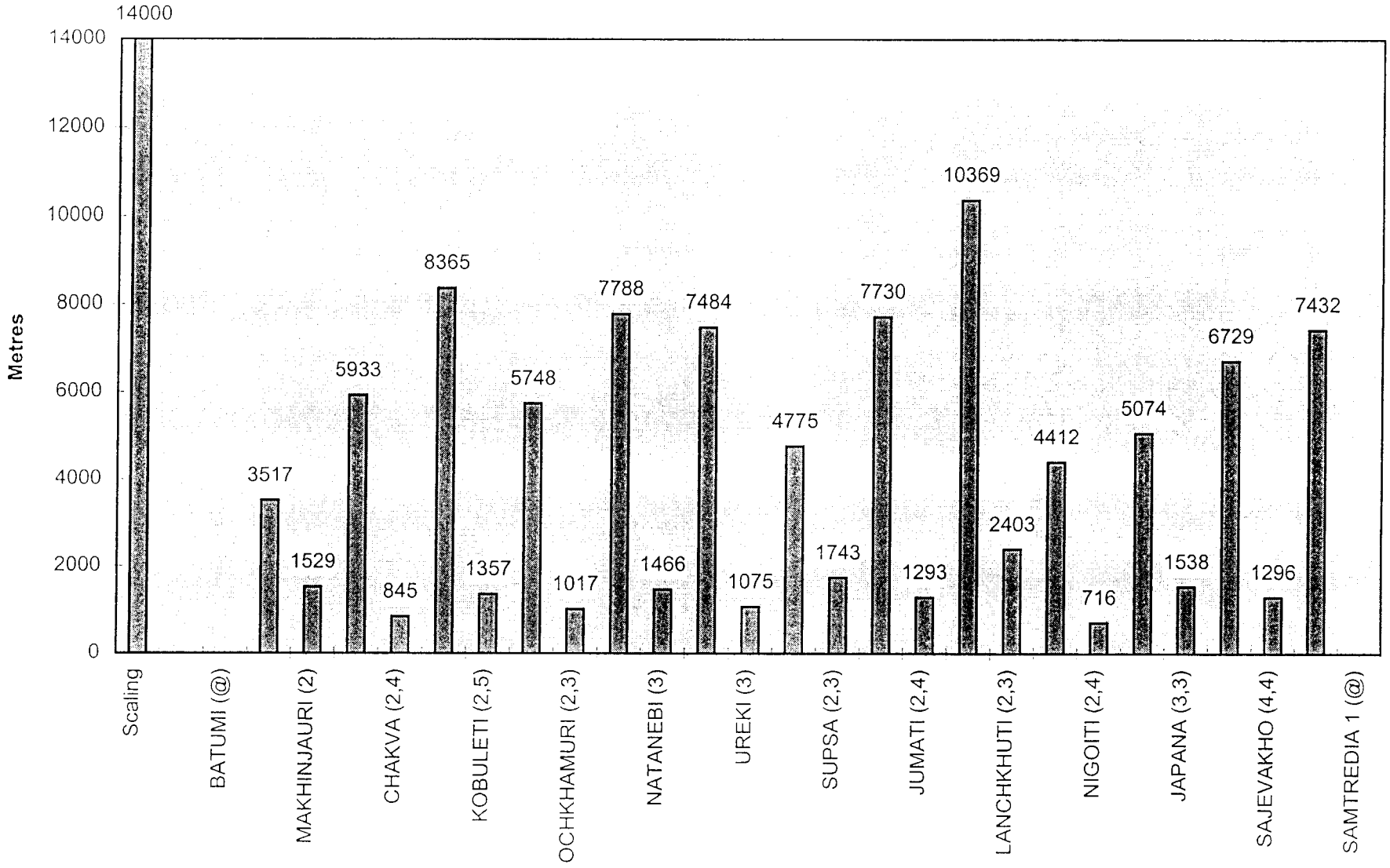
& site to be checked and direction of gradient. Train required to stop in satation at bottom of incline for 20 minutes for brakes to cool

FROM	TO	Distance between Stop Signals leaving one station and first stop signal on arriving at next station(metres)		No. of inter-mediate stations	Number of Sections required	Number of Sections Pre 1990	Average length per signal spacing Pre 1990	Location of protected Level Crossings (Kms)		OTHER POINTS TO NOTE
		Station	Span					Warning from West direction required	Warning from East direction required	
KASPI	KAVTISKHEVI	1581	2224			2	1112		2454761	Double Line
KAVTISKHEVI	KSANI	1526	8693	2		3	2898			Double Line
KSANI	DZEGVI	1480	3835	1		2	1918			Double Line
DZEGVI	MTSKHETA	1447	4748	1		3	1583	2480616		Double Line
MTSKHETA	ZAGES	1423	6596			3	2199			Double Line
ZAGES	AVCHALA	1829	1102	1		1	1102			Double Line
AVCHALA	TBILISI FREIGHT	1138	6717			3	2239			Double Line
TBILISI FREIGHT	TBILISI PASSENGER					1				Double Line
TBILISI PASSENGER	TBILISI JUNCTION					2				Double Line
TBILISI JUNCTION	TBILISI MARSHAL YD					1				Jcns at Tbilisi Junction to Erevan and Kahketi Double Line
TBILISI MARSHAL YD	VELI		2295	1		1	2295			Double Line
VELI	GACHIANI	1585	4450	1		2	2225			Double Line
GACHIANI	RUSTAVI	1545	7411	4		5	1482			Double Line
RUSTAVI	GARDABANI	1692	6622			4	1656			Double Line
GARDABANI	BEUK KIASIK	1550	9250			5	1850			Double Line

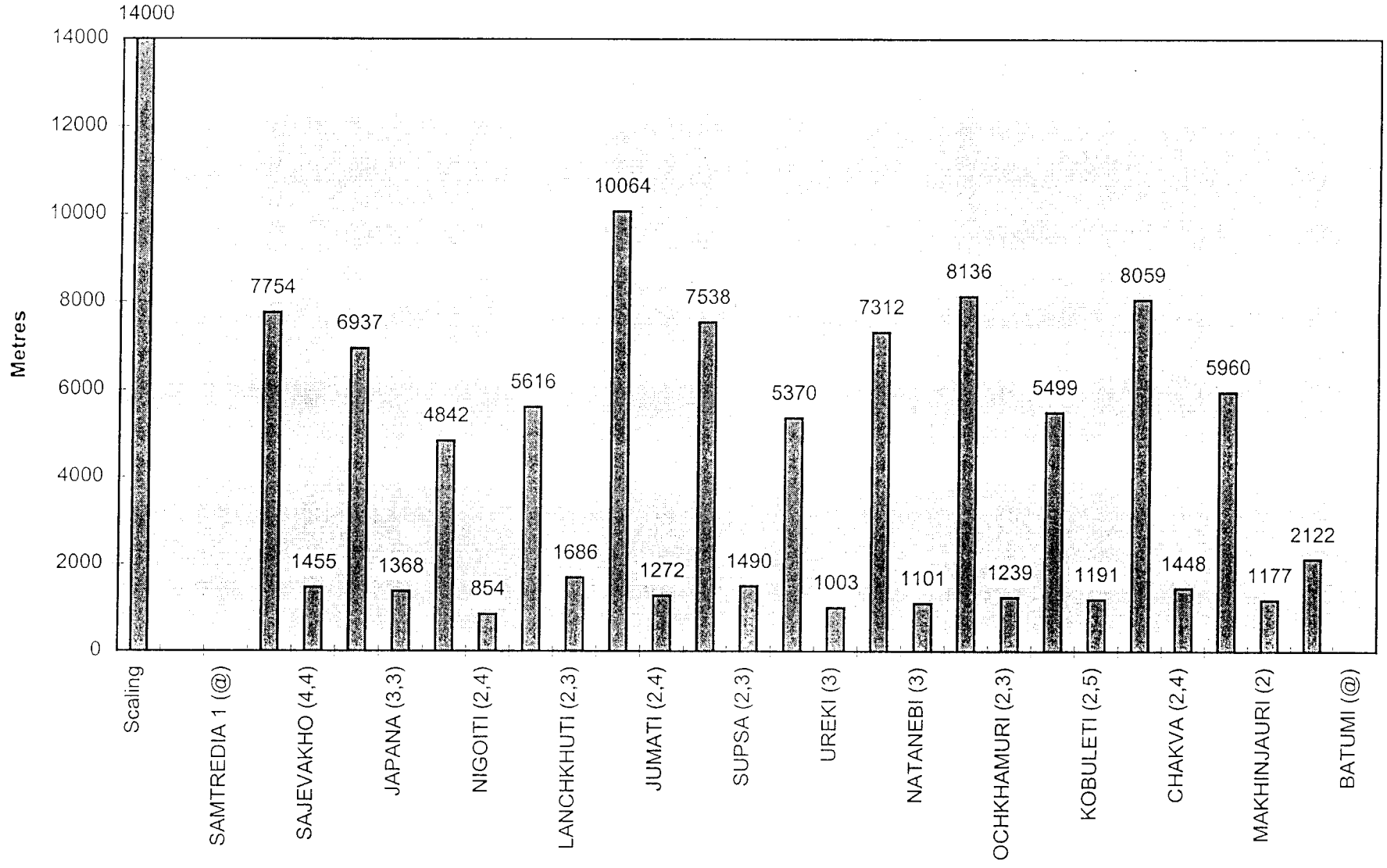
FROM	TO	Distance between Stop Signals leaving one station and first stop signal on arriving at next station(metres)		No. of inter-mediate stations	Number of Sections required	Number of Sections Pre 1990	Average length per signal spacing Pre 1990	Location of protected Level Crossings (Kms)		OTHER POINTS TO NOTE
		Station	Span					Warning from West direction required	Warning from East direction required	
BEUK KIASIK	GARDABANI					5				Double Line
		1460								
GARDABANI	RUSTAVI		6220			4	1555			Double Line
		1839								
RUSTAVI	GACHIANI		7651	4		5	1530			Double Line
		1480								
GACHIANI	VELI		4320	1		3	1440			Double Line
		1757								
VELI	TBILISI MARSHAL YD		2033	1		1	2033			Double Line
TBILISI MARSHAL YD	TBILISI JUNCTION					1				Double Line
										Jcns at Tbilisi Junction to Erevan and Kahketi
TBILISI JUNCTION	TBILISI PASSENGER					2				Double Line
TBILISI PASSENGER	TBILISI FREIGHT					1				Double Line
TBILISI FREIGHT	AVCHALA		6387			3	2129			Double Line
		1693								
AVCHALA	ZAGES		861	1		1	861			Double Line
		1433								
ZAGES	MTSKHETA		5926			3	1975			Double Line
		2449								
MTSKHETA	DZEGVI		4771	1		4	1193	2480616		Double Line
		1458								
DZEGVI	KSANI		3832	1		2	1916			Double Line
		1564								
KSANI	KAVTISKHEVI		8573	2		3	2858			Double Line
		1308								
KAVTISKHEVI	KASPI		4150			3	1383		2454761	Double Line
		1630								

Appendices E1 to E10

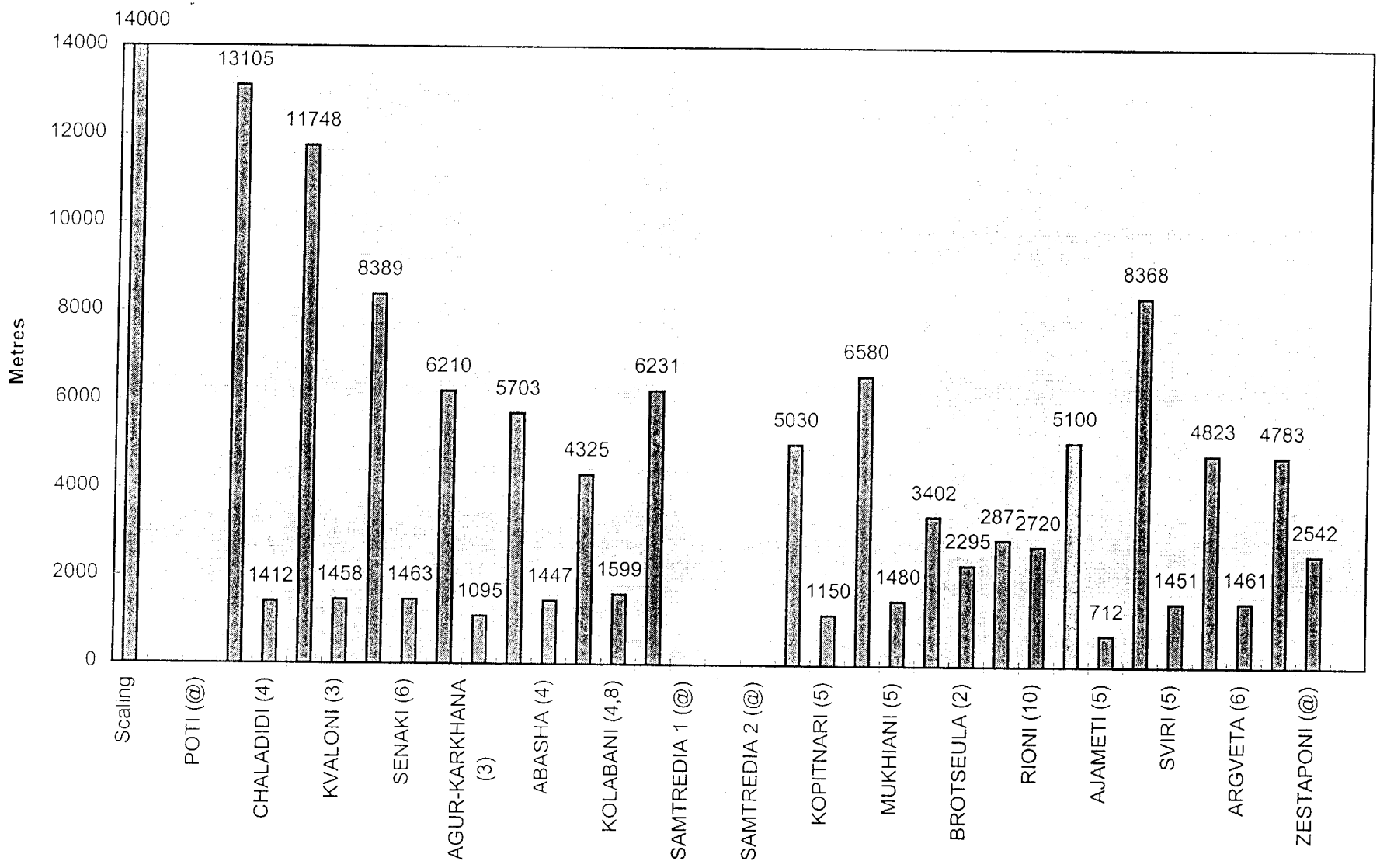
SPAN AND SECTION LENGTHS - BATUMI to SAMTREDIA (WEST to EAST)



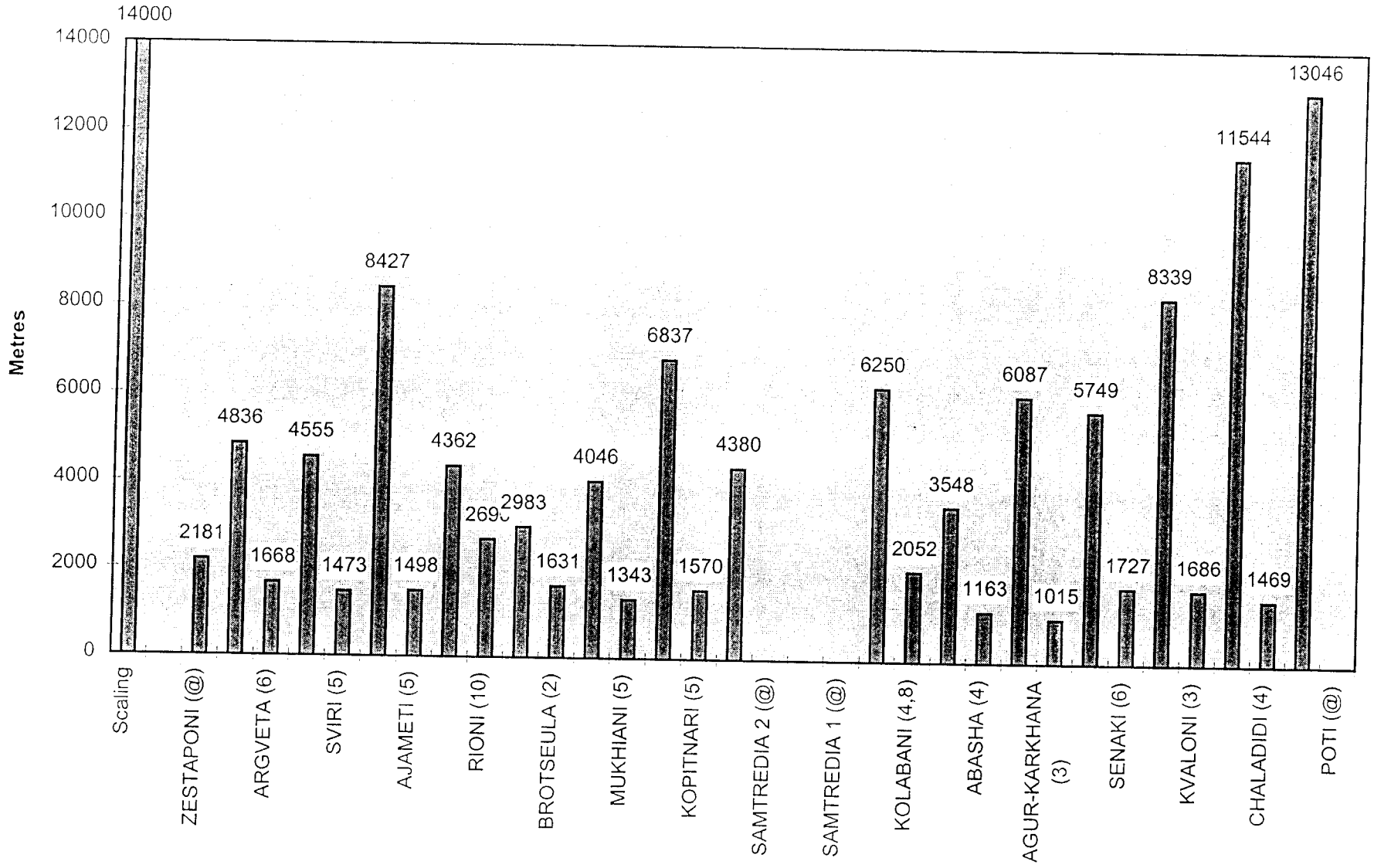
SPAN AND SECTION LENGTHS - SAMTREDIA 1 to BATUMI (EAST to WEST)



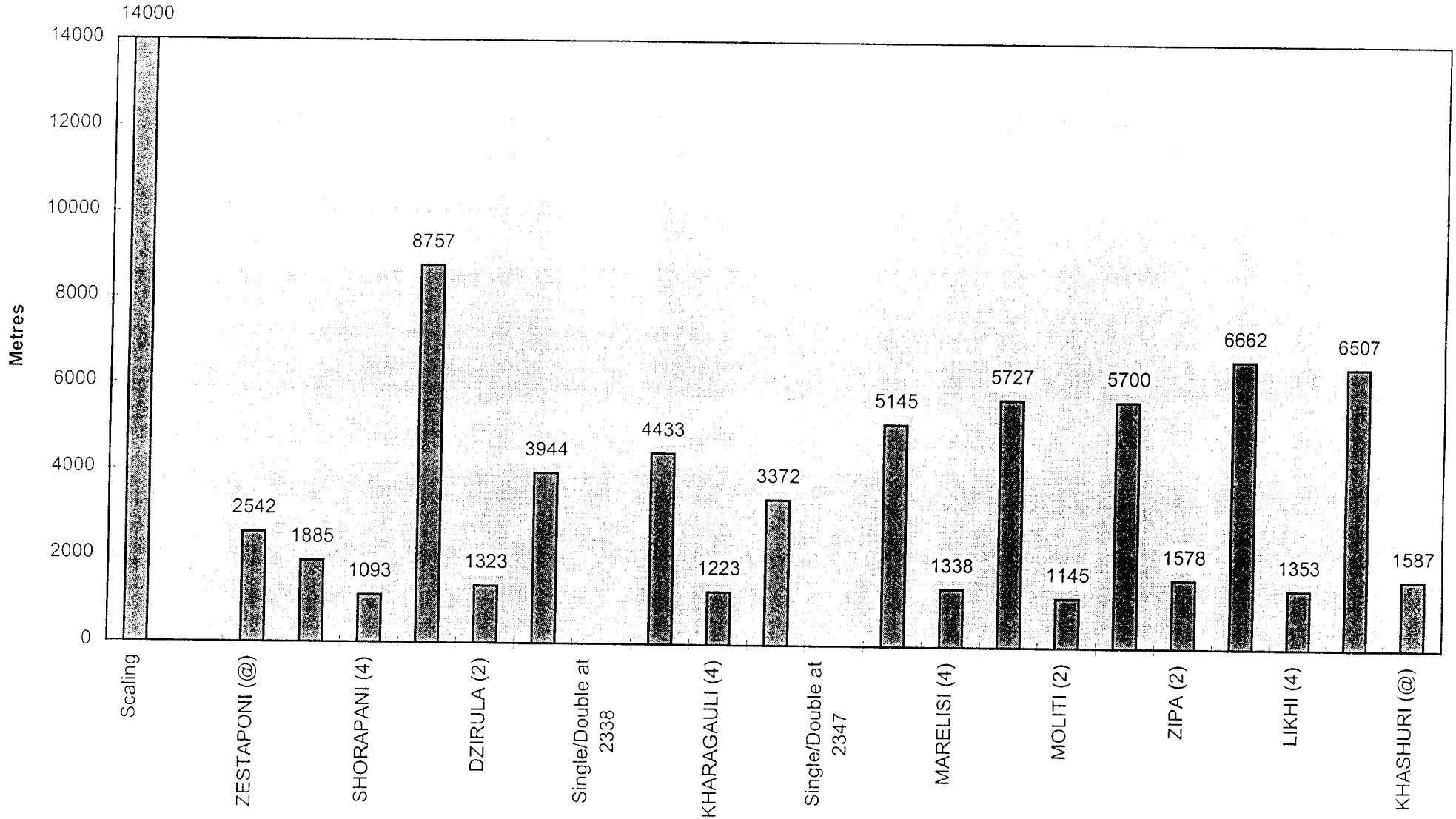
SPAN AND SECTION LENGTHS - POTI TO ZESTAPONI (WEST to EAST)



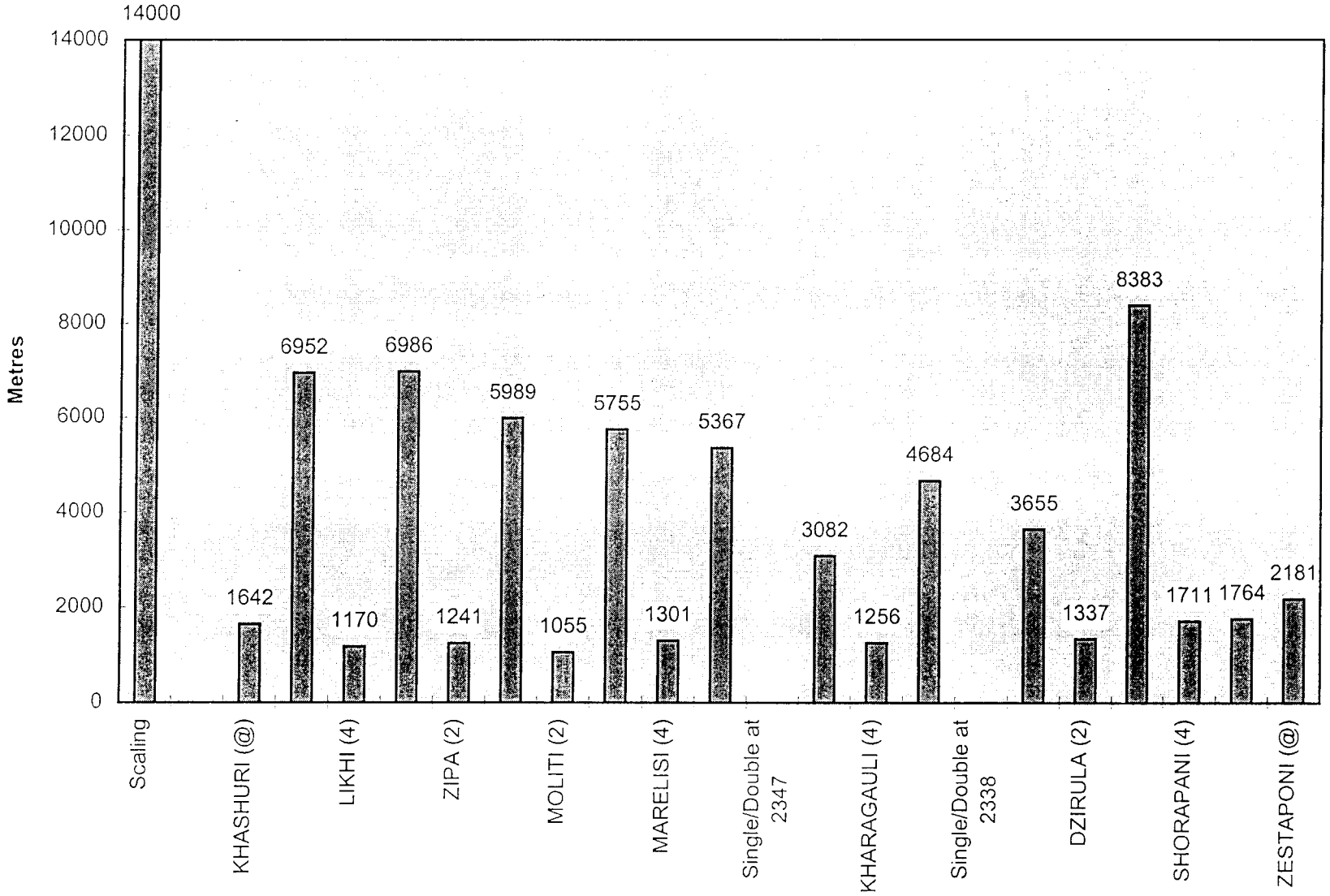
SPAN AND SECTION LENGTHS - ZESTAPONI TO POTI (EAST to WEST)



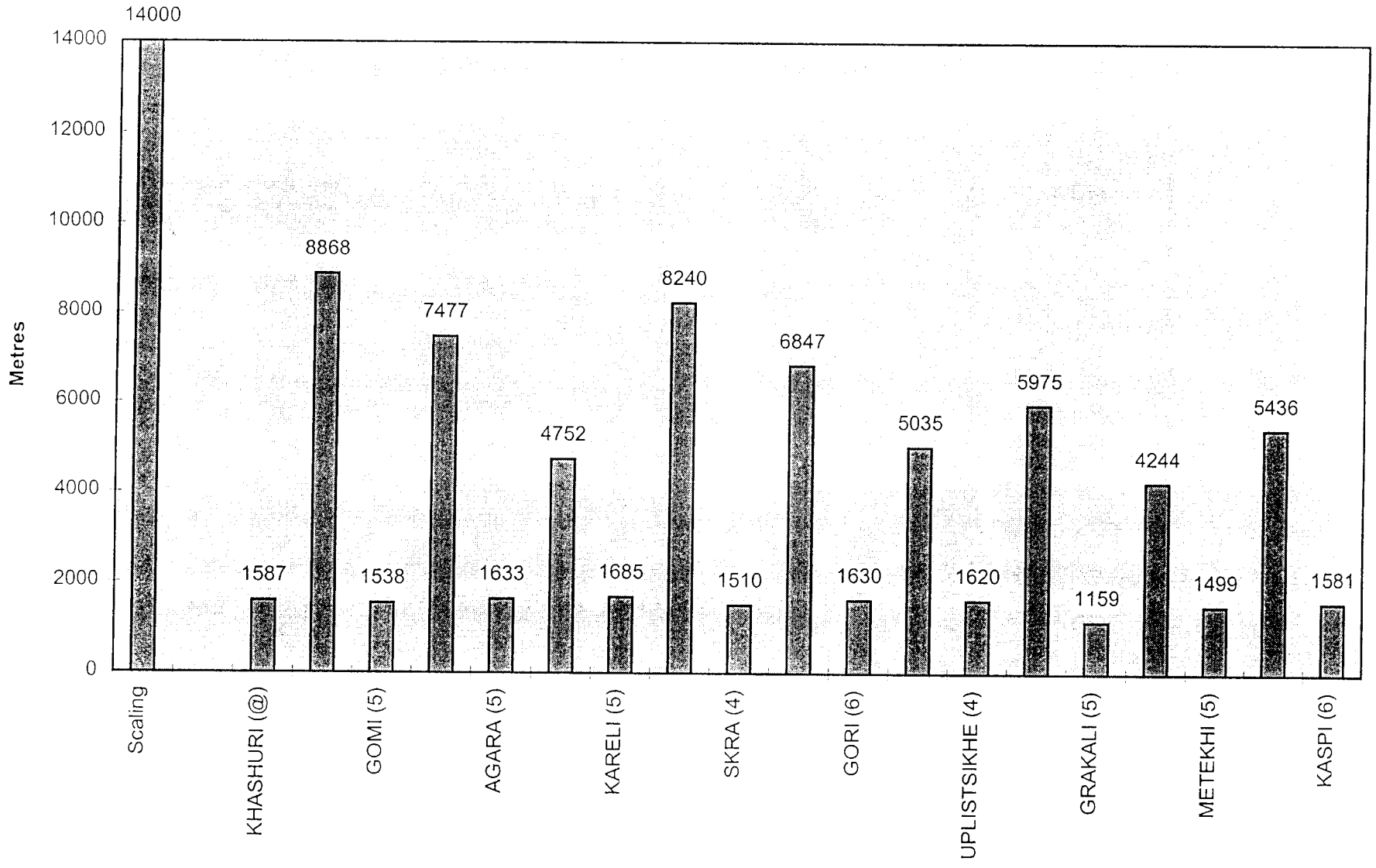
SPAN AND SECTION LENGTHS - ZESTAPONI TO KASHURI (WEST to EAST)



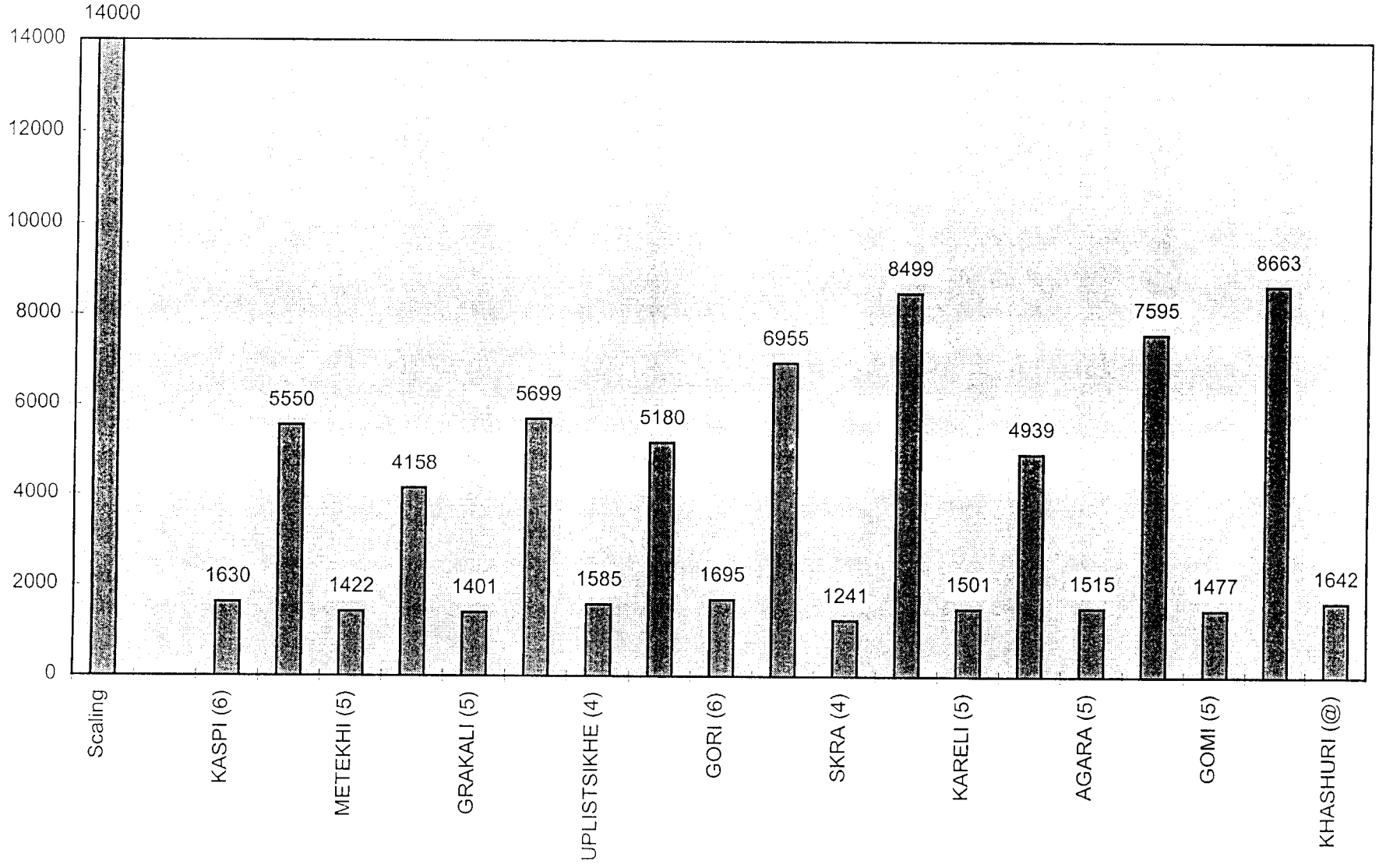
SPAN AND SECTION LENGTHS - KASHURI TO ZESTAPONI (EAST to WEST)



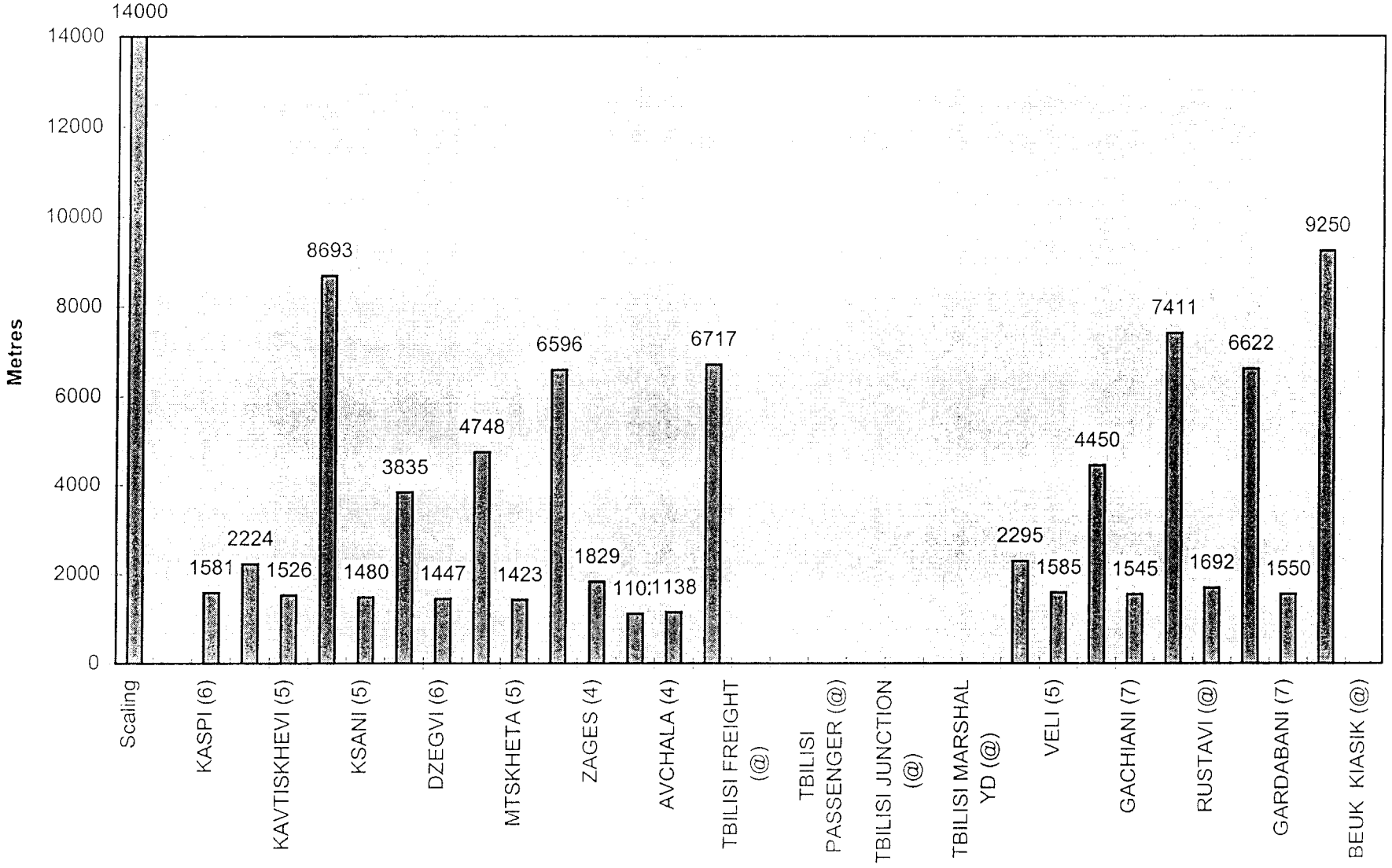
SPAN AND SECTION LENGTHS - KHASHURI to KASPI (WEST to EAST)



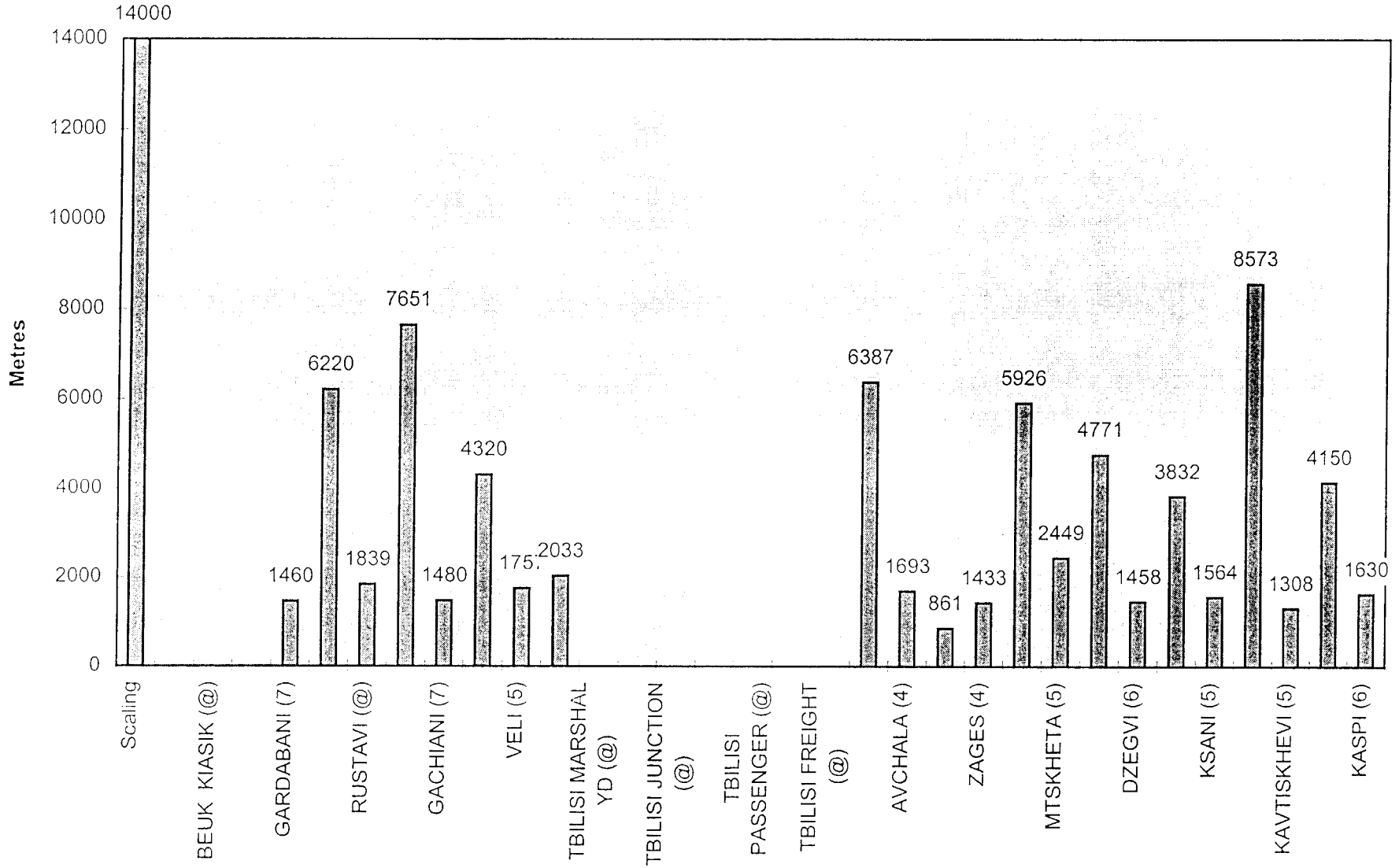
SPAN AND SECTION LENGTHS - KASPI to KHASHURI (EAST to WEST)



SPAN AND SECTION LENGTHS - KASPI TO BEUK -KIASIK (WEST to EAST)



SPAN AND SECTION LENGTHS - BEUK- KIASIK TO KASPI (EAST to WEST)



Appendix F

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	TOTAL
B to S						2	2	1													2								1									5		13
P to S					1																								1										5	7
S to Z	1						1				4										1								1			1								9
Z to K										1	1					1				1											1									6
K to K									1						1				2		1	3							1											9
K to T									1						1				2		1	3							1											9
T to BK				1	1						1			2			2													1									8
	1	0	0	1	2	2	3	1	2	1	2	0	0	2	2	1	2	0	8	1	5	6	0	0	0	0	0	0	5	0	2	1	0	0	0	0	0	5	6	61
																																							61	
	1										14						7					20										8							11	
																																							61	

Diagrams 1 to 4

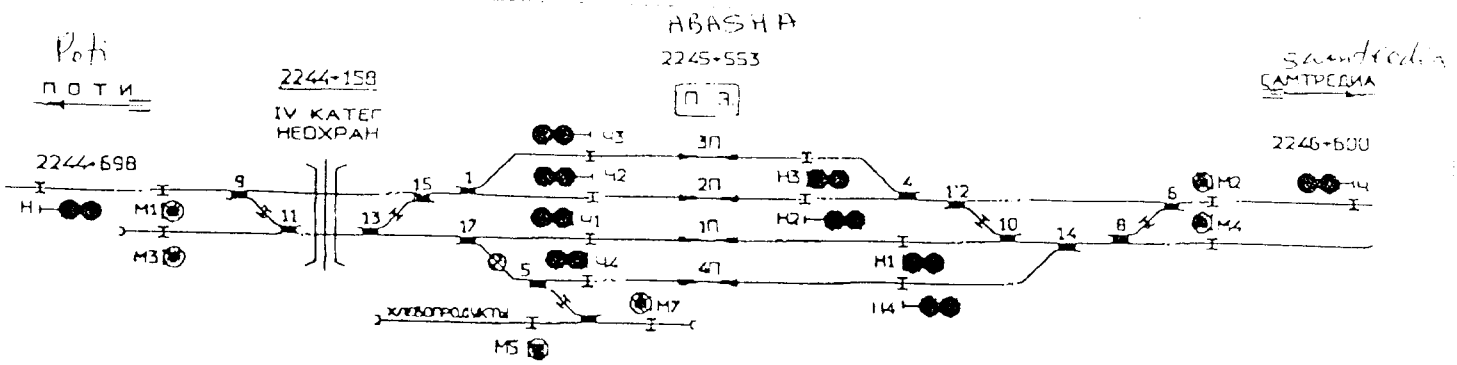


Diagram 1

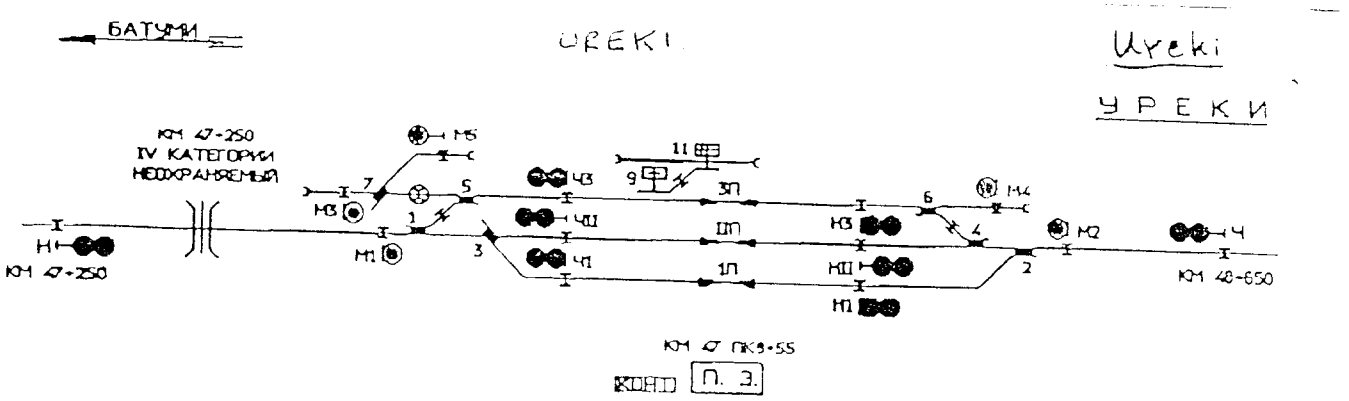


Diagram 2

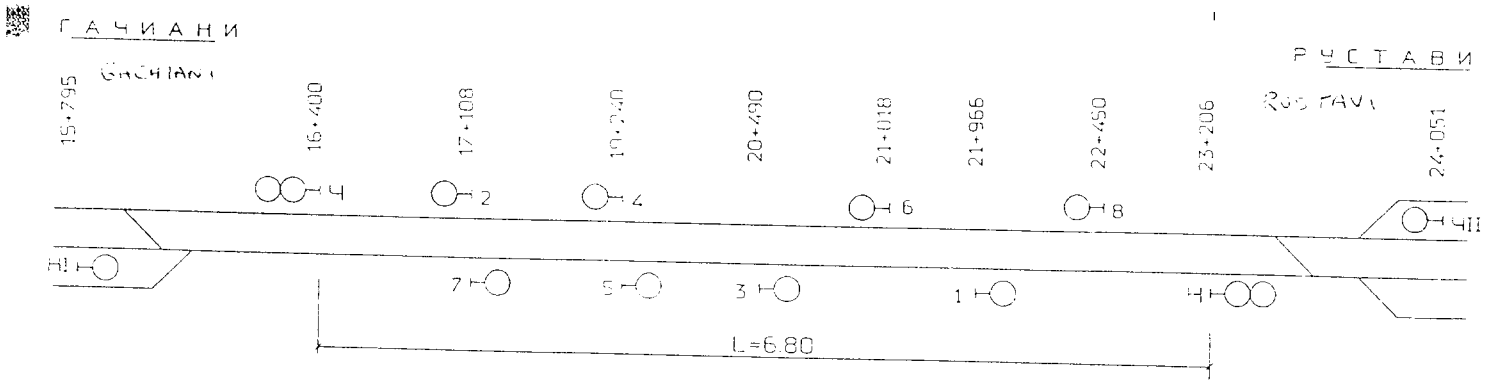


Diagram 3

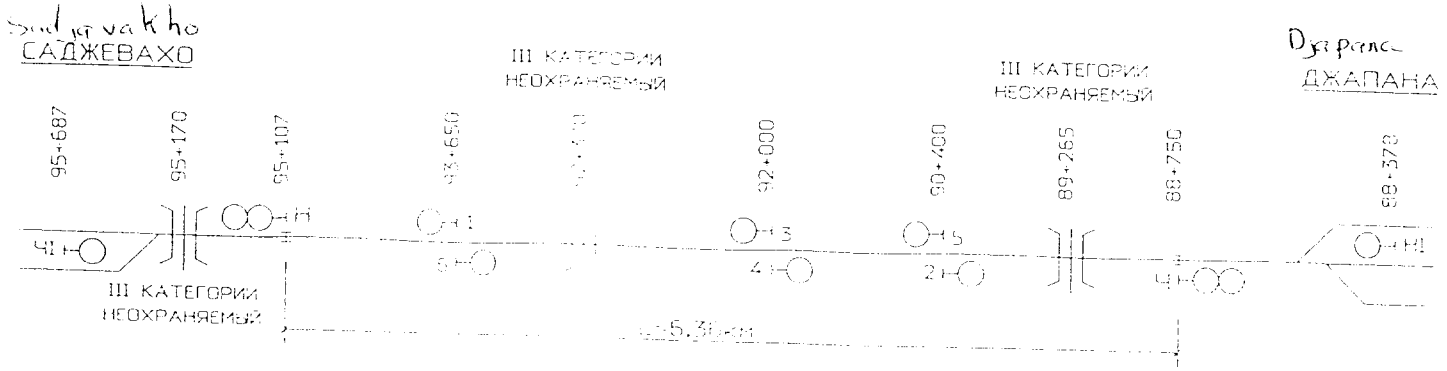


Diagram 4

7. RIONI BRIDGE

GEORGIAN RAILWAYS

RIONI BRIDGE
TECHNICAL SPECIFICATION

CONTENTS

1 GENERAL REQUIREMENTS

To design, supply, construct and hand over a complete new railway bridge for a single rail line crossing of the Rioni River.

There is a general requirement that a Georgian subcontractor is to be engaged for all of the site works on Georgia except for specialist activities to be nominated by the main contractor. The subcontractor is to be selected by the tenderer from the following list of potential subcontractors:

(List to be provided by the Georgian Railways)

2 LOCATION AND SITE

2.1 Location

The new bridge is to be constructed on a new alignment of the railway parallel to the existing, on the left hand side in the direction of increasing kilometrage.

The crossing is at km2290 on the main line of the Georgian Railway.

2.2 Access

Road access to and within the site will be the responsibility of the Contractor. Should any occasional rail access be required by the Contractor then this must be arranged with the Georgian Railways and will be subject to any charges and conditions set at the time of such arrangement. No undertaking to provide such access is implied by this document, the arrangement being subject to operational constraints.

2.3 Ground conditions

Information on the ground conditions at the site is available by consultation with the Railways. Any information so provided is not warranted for accuracy.

3 DESIGN CRITERIA

3.1 Loading and design codes

The bridge shall be designed and constructed to standards at least equivalent to the current Russian standards for bridges. The loading to be adopted shall as a minimum be equivalent to loading category S14(C14) in Russian Standard CH200-62. Other national or international standards such as the UIC 77 series may be accepted as the basis of design provided that they can be demonstrated to be at least equivalent to the said Russian standards.

The designs shall allow for seismic activity, using criteria proposed by the designer from a study of activity in the region, but at least equal to Grade 9.

3.2 Structure Gauge

Designs shall comply with Georgian Railways structure gauge.

3.3 Hydraulic design

The superstructure shall be clear of the probable 100-year maximum flood level computed by the designer plus a freeboard of 0.75m and in any event not lower than level 105.67 railway datum.

The waterway area shall be not less than that of the existing bridge.

The structure, river banks and substructure shall be protected from any damage by floodwaters and from any objects likely to be carried by flood water.

3.4 Maintenance criteria

The substructure and any concrete superstructure shall be designed and constructed to be free of periodic maintenance.

Any metal used in superstructure shall be coated to standards which will limit periodic maintenance to a minimum period of 15 years after construction.

Provision shall be made in designs and construction for access to the structure for periodic maintenance activity without infringing the structure gauge.

Provision shall be made for temporary support if any part of the structure is to be replaced during periodic maintenance: for example jacking points shall be provided to enable bearing removal.

3.5 Track and track support

Track is to be provided on the bridge using R65 flat bottomed rail and for at least 50m each side of the bridge.

Track support on the bridge is to be provided using elastic fastenings to a design acceptable to the Railway.

Sleepers on the bridge deck may be fixed directly to support steelwork and may be treated hardwood complying with current Georgian Railway standards. Track on approaches is to be laid on concrete sleepers with insulated elastic fastenings and ballast all to the approval of Georgian Railways.

Bridge decks are to be provided with derailment containment devices to the requirements of the Georgian railways.

Track geometry will be defined by Georgian Railways and will include a generally straight track but with part of a transition curve on one abutment. Track alignment tolerances shall be to Georgian Railway standards.

3.6 Earthworks

Earthworks in bridge approaches to be designed and constructed to limit the settlement during the first 12 months of use to 5mm at any point and to 2mm within 10m of the structure. The top 0.3m of earthworks is to comprise well graded granular material with a Plasticity Index not exceeding 6 percent and CBR not less than 20 percent at the specified density. It shall be laid to profiles as in Georgian Railway design standards and compacted to a density not less than 95 percent of Modified Proctor Density (AASHTO T-180 or equivalent)

All earthworks slopes are to be trimmed and compacted and covered with 150mm of topsoil capable of sustaining plant growth. Slopes are to be planted with approved grass cover.

Any surface or subsurface drainage required to protect earthworks against water ingress or erosion is to be included. Designs for drainage elements are to be based upon providing a minimum freeboard of 50mm for a 50-year flood event.

4 INDICATIVE DESIGNS

A design for this bridge has been prepared by Georgian Railways and is summarised in Appendix 1 for the information of tenderers. Further detail may be inspected during the tender period at the offices of the Georgian Railways in Tbilisi during the tender period. No warranty is given for the accuracy or completeness of this design or for the estimates of quantities of work involved. Any information is provided only as being indicative and must be verified by tenderers.

5 EMPLOYERS SUNDRY REQUIREMENTS

The following sundry requirements are to be met in addition to the Design Criteria set out above :

5.1 Construction Documents

The following documentation is to be provided:

- Preliminary Design including drawings and calculations:
  - Plan on topographical background at 1:500 scale
  - Elevations to 1:100 or 1:200 scale
  - Longitudinal section to 1:100 or 1:200 scale showing principal features and dimensions, and geotechnical information used in design
  - Typical details
  - Technical Report including design calculations, materials, construction methods, articulation, construction programme.

To be provided in three copies. One of these shall be in English and two in Russian

- Final Design and construction drawings
  - Outline drawings for any prefabricated elements
  - Construction drawings to scales suitable for construction showing all details necessary to define the works
  - Schedules of reinforcement and built-in fittings
  - Revised technical report with all relevant calculations and evidence that the design criteria have been met.
  - Certificates signed by the Designer that he has carried out the design to the codes and standards adopted and that he has used due skill and diligence in so doing
  - Certificate signed by an independent checker that a full check has been carried out on the design and drawings and that due skill and diligence has been used in this process.

To be provided in three copies. One of these shall be in English and two in Russian.

5.2 Other activities on the site

The Employer reserves the right to enter upon the site at any time and to carry out work necessary for the normal operation of the railway: and to engage any other contractor for this purpose or for activity related to the new bridge. The Contractor will be required to co-operate accordingly.

5.3 Setting out

The Contractor will be responsible for his own setting out to a layout agreed with the Employer.

5.4 Submissions, approvals and consents

5.4.1 Tender details

Tenders are to include the following details:

- Tender design including a plan of the works plus elevations and cross-sections as listed for the Preliminary Design above
- Programme of works
- Name and qualifications of the designer and checker
- Details of similar work carried out previously by the main contractor, subcontractor(s) and designer

5.4.2 Preliminary Design

To be submitted to the Employer within three months of the award of contract. It will be reviewed for compliance with the Design Criteria within a period of 30 days.

5.4.3 Final Design

To be submitted to the Employer prior to the commencement of fabrication or of any site works. It will be reviewed by the Employer for compliance with the Design Criteria within a period of 20 days.

5.5 Environmental constraints

No discharge of any kind will be permitted to enter the Rioni River from the Contractors temporary works or facilities.

Any drainage from the permanent works is to be provided with suitable oil interceptor and silt trap arrangements.

5.6 Facilities available on site

No facilities will be provided on the site by the Employer. The Employer will provide land on a temporary basis for an access road and for a work site.

The Employer will provide the following materials:

- Rails and check rails for fixing on the bridge deck
- Complete rails, sleepers and fastenings for track adjacent to the bridge

5.7 Design Personnel

The Designer and Checker appointed by the Contractor shall be professionally qualified for similar duties in their own national system and shall show evidence of Professional Indemnity Insurance cover to an amount of 3 million Dollars for any one event, with no limit on the number of events. The insurer shall be subject to the approval of the Employer.

5.8 As-constructed details

The Contractor shall provide the following at the time of completion of the bridge:

- As-built drawings at the scales shown above for the Final design, for all of the Works.
- Schedules of any items which may require replacement during the normal maintenance of the bridge, giving full details of the parts and the manufacturer
- Maintenance recommendations
- Any necessary operation instructions

The above are to be provided in three copies, bound in folders and with an index of contents. A separate reproduceable copy of the drawings is to be provided. All documentation is to be written in Russian. One English translation is to be provided in addition.

5.9 Facilities for the Employers personnel

The Contractor shall provide office accommodation for three persons from the Employers organisation on the site at the same standard as is adopted for his own senior personnel, complete with all services, cleaning, and telephone connection to the public system. The accommodation shall be available for occupation at the time of commencement of permanent works and shall be maintained for the use of the Employer until the completion of all works on site and clearance of all temporary works. One complete set of all contract documentation is to be provided in the office and this shall be additional to those listed above. All necessary stationery and office equipment, cleaning and servicing is to be included.

Personal safety equipment and clothing is to be provided for three persons.

The use of an electronic total station and automatic level (or such other survey equipment as is used by the Contractor) is to be made available to the Employers staff whenever reasonably requested and may be that equipment which is used by the Contractor for his own works. Survey assistance to the Employers staff is to be made available if so required at the same time.

5.10 Quality Control and Quality Assurance

The Contractor will be responsible for carrying out his own Quality Control and Quality Assurance in accordance with the requirements of ISO 9000 or approved similar Quality Assurance system. He shall afford the Employers staff full access for audit purposes to all of his quality records.

The Contractor shall submit with his tender and with the Preliminary Design a detailed Quality Plan which shall include a listing of all the quality control testing proposed for the works, all in accordance with normal construction practice.

5.11 Tests on completion and after completion

The works shall be offered for completion inspection only after all work s have been completed and the bridge can be safely connected to the railway for opening to railway traffic. After this time the Contractor will not be given access to the works except by arrangement with Georgian railways for track possession and under Georgian Railways track safety regulations.

At the completion inspection the Contractor shall present the results of all construction quality control testing and shall demonstrate the following by physical measurement in the presence of representatives of the Employer:

- Compliance with track geometry tolerances
- Compliance with structure gauge
- Compliance with thickness of protective coatings
- Tightness of any site connections

APPENDIX 1

Description of Rioni Bridge Design

3. Description of designed structure

Metal single-rail railway bridge with the scheme 2x88 m is designed on the river Rioni on the 2290-th km of leg of Brotseula-Rioni route; to the left from the existing bridge in 14 meters, total length of the bridge amounts to 195,344 m.

According to the plan, this bridge is located on the flat section, only part of the abutment N3 is located on the easement curve. In the longitudinal profile the bridge is constructed on the platform.

Span structures with metal trussed girder of length 88,0 m are accepted by the typical design Inv N1293/12.

Supporting parts are accepted by the typical design Inv N683.

Assembling monolith abutment and piers with concrete piled foundations are accepted by "Khidmshentresti" using contour blocks of processed reinforced concrete.

Regulating wall structure is accepted according to the typical design of series 3.501.1-135, developed by "Kavsakhtransporti".

Bridge cones are strengthened by means of concrete slabs according to the typical design Inv. N823.

Part of piers and regulating wall, located in the soil is covered with two layers of coating water proofing.

Metal span structures and visible part of piers is painted with specific paint.

4. Main issues, connected to the construction management

Construction of the bridge to be designed will be performed by the own forces of state independent construction company "Khidi". This company is equipped with modern facilities and owns sites and construction polygons in different parts of Georgia. Among them is construction polygon near the station Brotseula, which is 3 km away from our construction site.

Considering this fact, arrangement of building site for the railway bridge under construction is reasonable on the left bank of the river Rioni. Its area amounts to 6000 km^2 (60x100). For the normal building process reconstruction of access road to the construction site is required.

4.1. Construction of piers

The project includes construction of three (two abutment and one intermediate pier) piers. Shingle stone is used as a base for the piers, which is filled with sand loam, sand and sand loam lenses and boulder inclusions. Drilled and filled piles with the length of 15 meters are used as foundation for piers.

In order to ensure normal drilling works, arrangement of construction sites will be executed near the piers to be designed on the elevation more then 10 % of water discharge horizon 0,75 m and which approximately amounts to 104.5 m. Protection of construction site from flooding is performed by means of crib walls.

Construction sites are connected to each other by means of temporary motor-road bridge with the scheme 6x22,0 m and with clearance G=4.5 m. Metal beams of individual construction having weight equal to 28,0 tones will be used for the bridge in question.

Reinforced concrete piles with d=50 sm is used as foundation for N2, 3 and 4 piers of the bridge, and for the remaining two spans stone embankment is utilized, which has thickness equal to 2.0 m and is protected by means of concrete blocks bonded with each other.

Hollow type reinforced concrete blocks of dimensions 200x500x100m are used as body for the piers of temporary bridge, and reinforced concrete slabs with dimension 25x500x100 sm are used as lanes.

Drilling works will be performed by unit of type TNC-30 using metal fasteners (pipe) for wall of the well. After installation of metal frame, wells are placed with concrete up to the mark 100,50 m in case of abutments and up to the mark 98,7 m for intermediate piers. Afterwards last concrete of height equal to 1,0 m will be removed.

In order to arrange foundation mat, foundation pit will be processed to the mark 98.5 m using open-type rule (depth of foundation pit H=5.0 m).

Lowering of concrete well from the mark 10.5 m down to the mark 97.50 m must be performed before drilling in order to arrange intermediate piers. (H=7.00). The well must be filled with new soil. All wells placed with concrete up to the mark 98.70 m then must be filled with soil and it must be re-excavated in order to arrange a foundation mat.

All works connected to the erection of foundation mat and pier bodies up to the mark 102.0 m must be performed by water pumping out from the foundation pit.

4.2 Installation of span structure

Metal girder elements, manufacturing of which is planned in the factory of metal structures of the city Voronezh in Russia, will be delivered to the existing polygon of company "Khidi" at the station Brotseula, then it will be transported to the construction

site and unloaded into the special warehouses, located on the territory of construction area.

Girder elements in accordance with installation sequence will be arranged in line on the special supports with height 15 sm. Proper quantity must be obtained in order absolutely to exclude their deformation (deflection). Wooden materials (sleepers or beams) will be used as shells. Distance between girder elements must be not less then 0.75-1.0 m in order to provide their inspection and check. Their condition (quality) while receiving and handing over must be inspected and officially registered as special deed.

Contact parts of element joints must be worked out by fine sand sprayer. For this purpose quartz fine sand with thickness 0.6-2.0 mm is used. By means of this kind of sand rust can be removed from the treated area, and jet of compressed air is used in order to remove surface dirt. If during three days element will not be assembled as it is designed and dirt will be notable on its surfaces, then oil or paint layer and cement needs to be re-treated.

Installation of span structure is performed according to the semi-suspending method. For this purpose part of each span structure will be assembled on the special scaffolding, and another part using suspending method.

Reinforced concrete piles with d=60 sm and length L=12 m will be used as foundation for N1,2,5 and 6 scaffolding piers and natural foundation {stone embankment) will be used for N3 and 4.

Reinforced concrete hollowed blocks of dimensions 200x500x100 sm are used as body for scaffolding pier. Span structures consisting of flange beams are used for scaffolding roofing.

Transportation of metal girder elements from the construction site to the initial point of span structure installation is performed by trucks and then to the design location it is delivered by means of special bogies of individual construction. Loading and unloading of elements will be performed using crawler crane with load-carrying capacity equal to 25 tones, and its installation will be performed by crane of type UMK, standing on the upper belt of the girder and it is moving on the rail, arranged on the special trestle.

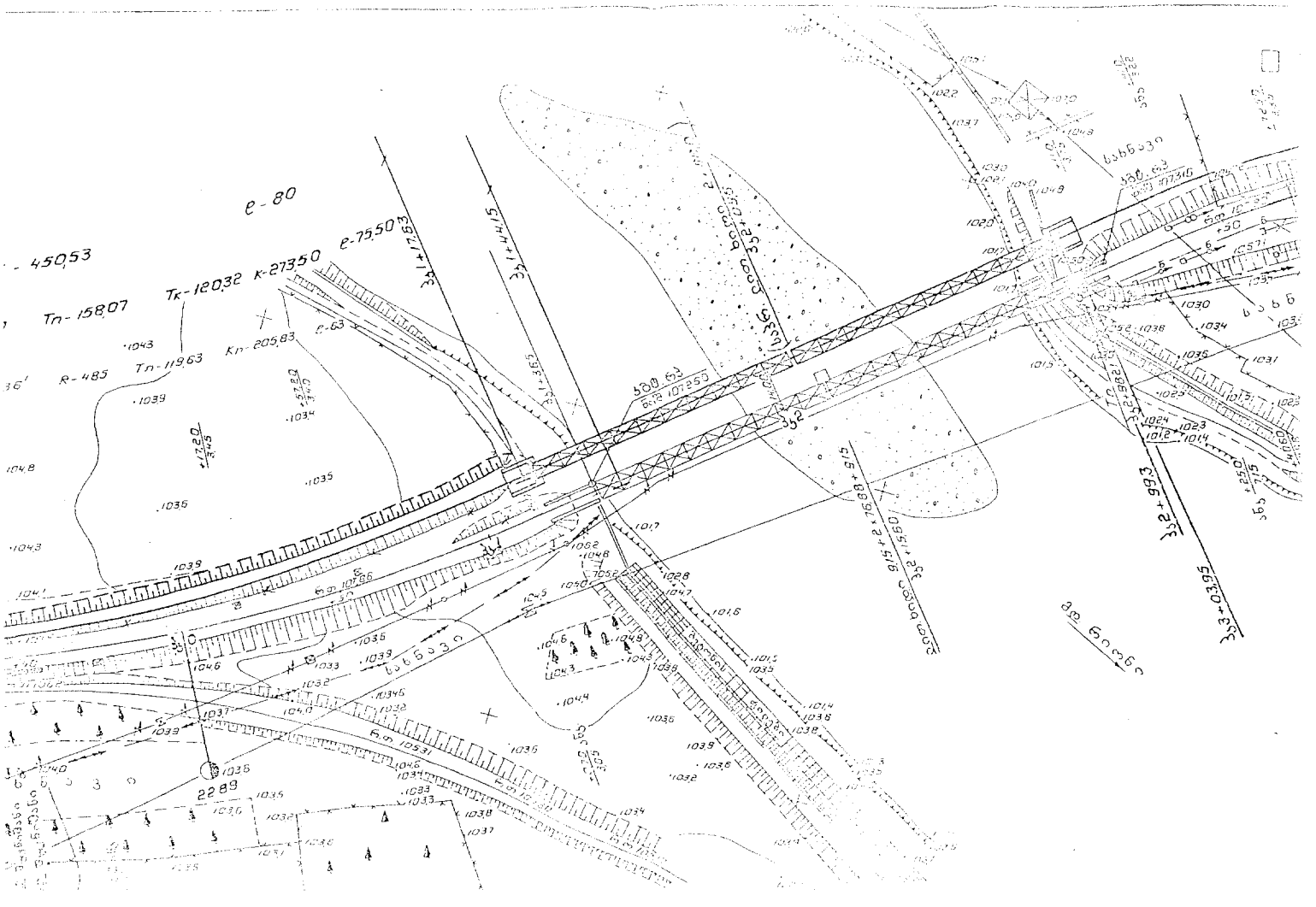
In order to install span structure in accordance with suspending method, arrangement of special suspending scaffoldings is considered in the top and bottom flanges.

Jacks with load-carrying capacity equal to 100 tones must be installed under those nodes of span structure, which are located within scaffolding. Using this jacks optional adjustment of elevation of girder location will be performed.

Table of Work Scope

	Serial N	Type of work	Unit of measure	Quantity	Notes
1	2	3	4	5	6
Abutment N1 and N3	1	Processing of the foundation pits without strengthening	m^3	2400	Soil P.6-g
	2	Processing of the foundation pits by water pumping out	"	540	Soil P.6-g
	3	Reinforced concrete pile filled with concrete	item/m^3	24/508.8	Reinf.concrete-B-22.5
	4	Monolith reinforced concrete foundation mat	m^3	283.0	--"--
	5	Reinforced concrete blocks of pier body	m^3	123.5	Reinf.concrete-B-22.5
	6	Monolith concrete of pier body	m^3	210	Concrete B-20
	7	Reinforced concrete ballast pit/covering with monolith	m^3	40.8/4.4	Reinf.concrete-B-22.5
	8	Filling of ballast pit with concrete	"	38.0	Concrete B-20
	9	Lower slab of reinforced concrete monolith girder	m^3	64.0	Reinf.concrete-B-22.5
	10	Insulation for ballast pit	m^2	110.0	
	11	Cantilevers of metal side-walk	t	1.49	Reinf.concrete-B-22.5
Intermediate Pier N2	12	Reinforced concrete side-walk slabs	m^3	1.4	
	13	Processing of the foundation pits by water pumping out	m^3	950	Soil P.6-g
	14	Reinforced concrete pile filled with concrete	item/m^3	12/318.0	Reinf.concrete-B-22.5
	15	Monolith reinforced concrete foundation mat	m^3	133	--"--
	16	Reinforced concrete blocks of pier body	m^3	50	Reinf.concrete-B-22.5
	17	Filling of pier body with monolith concrete	m^3	71.0	Concrete B-20
	18	Lower slab of reinforced concrete monolith girder	m^3	43	Reinf.concrete-B-22.5
	19	Reinforcement against seismic impact	t	1.71	
	20	Metal span structure l=87.952 m	item/t	2/733.8	
	21	Metal supporting part	t	15.552	
	22	Reinforced concrete ballast pit			
	24	Reinforced concrete side-walk and slabs			

	Serial N	Type of work	Unit of measure	Quantity	Notes
1	2	3	4	5	6
Cones	28	Drainage	g.m	19.0	
	29	Drainage soil spreading over	m^3	650	
	30	Cones arrangement	m^3	700	
	31	Reinforcement of cones with concrete slabs	m^2/m^3	260/37.5	Concrete B-20
	32	Concrete support block	m^3	13.6	--"--
	33	Concrete to be covered with monolith	m^3	2.0	Concrete B-20
Regulating Wall	34	Processing of the foundation pits without strengthening	m^3	652	P-6-g
	35	Processing of the foundation pits by water pumping out	"	310	--"--
	36	Monolith concrete foundation of wall	m^3	93	Concrete B-20
	37	Wall blocks	m^3	150.55	--"--
	38	Covering wall blocks with monolith	m^3	1.7	Concrete B-20
	39	Walls to be covered with insulation	m^2	140	
	40	Drainage	m^3	32	
	41	Drainage soil spreading over	m^3	98	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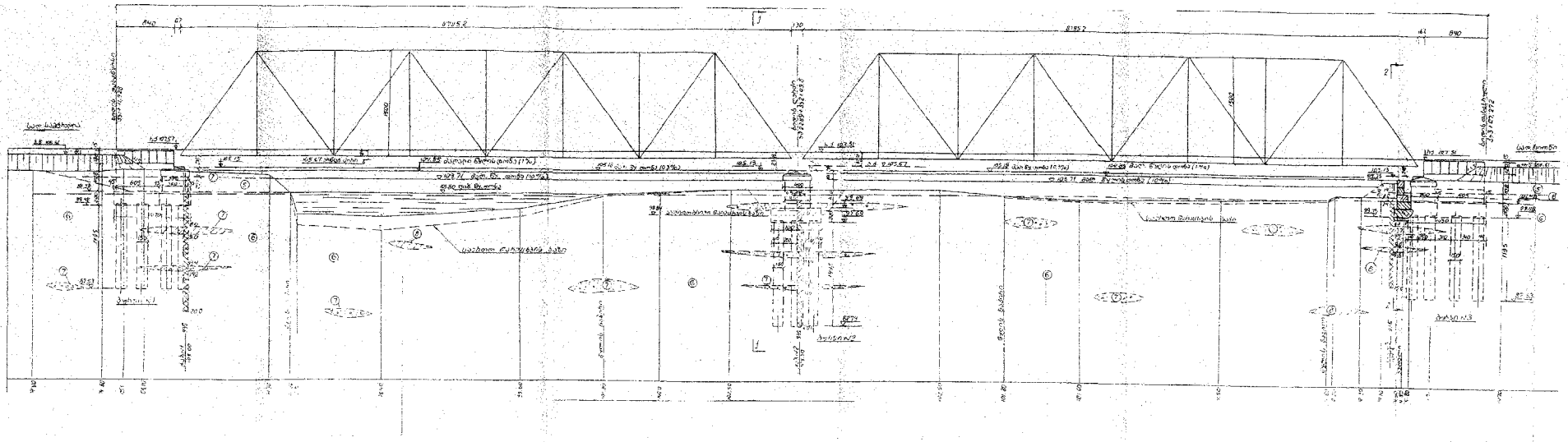

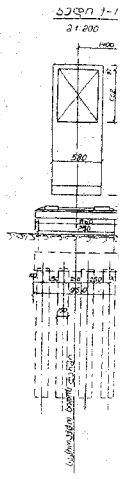
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