

Republic of Armenia
Ministry of Transport and Communication
Transport PIU State Institution

**LIFELINE ROADS IMPROVEMENT PROJECT
FINANCING**

**Bidding Document
Volume 2**

TECHNICAL SPECIFICATION

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Section 000 - GENERAL REQUIREMENTS

Any references in the Technical Specification to the payment or pay items should be ignored and relevant provisions of the General Conditions of Contract and Special Conditions of Contract should be applied on the all matters of payment. Overall General Conditions of Contract and Special Conditions of Contract prevail on Technical Specification.

Section 001 - ACCEPTANCE OF WORK

001.01 Conformity with Contract and Project Requirements.

If any Clause or Sub-Clause in the Specifications includes a reference to international standards (standards recommended by the European Committee for Standardization on design and construction of roads and highways), these standards shall be used in addition to the national standards. The standards referred to in these Specifications are listed in the Annex.

References to standard test methods and other recognized standards authorities refer to the methods in effect on the date of solicitation for bids. Equipment, materials, or workmanship meeting other standards which ensure equal or higher quality than the standard specified will also be acceptable.

Perform work according to the present specification and the project (further "Project") requirements. Perform all work to the lines, grades, cross-sections, dimensions, and processes or material requirements shown on the plans or specified in the contract or design documents.

Plan dimensions and contract specification values are to be met unless a variance is allowed by the Employer. Perform work and provide material that is uniform in character and meets the specified requirements.

Acceptable work conforming to the contract will be paid for at the contract unit bid price unless otherwise stated in the specifications or conditions of contract. Three methods of determining conformity and accepting work are described in the Subsections 001.02 to 001.04 inclusive. The primary method of acceptance is specified in each Section of work. However, work may be rejected at any time it is found by any of the methods not to comply with the specifications and drawings.

Work that does not conform to the project and contract requirements or to prevailing industry standards where no specific contract requirements are noted, shall be removed and replaced at no cost to the Employer. The standards referred to are listed in Section 702 of these Specifications.

As an alternative to removal and replacement, the Contractor may submit a written request to the Employer's Project Manager or Project Manager's Representative to:

- (a) Have the work accepted at a reduced price, or
- (b) Be given permission to perform corrective measures to bring the work into conformity.

This point acceptable only during pavements works.

The request shall contain supporting rationale and documentation. When standard manufactured items are specified, (such as fence, wire, plates, rolled shapes, pipe conduits, etc. that are identified by gage, unit weight, section dimensions, etc.) the identification will be considered to be nominal weights or dimensions. Unless specific project and contract tolerances are noted, established manufacturing tolerances will be accepted.

001.02 Technical Inspection.

Acceptance is based on technical inspection of compliance of executed works with the contract documents and prevailing relevant technical standards.

Payment for work during the course of the project will be made as the work progress providing that it meets the conditions of the plans and specifications.

001.03 Certification of Compliance.

Provide material, fabricated products and structures (further in text "materials") from a manufacturer with an effective testing and inspection system.

Require the manufacturer to finish documentation of the testing and inspection system with a Certificate of Compliance that states the work complies with all contract requirements.

Require the manufacturer to furnish a **"Product Certificate"** for material commercially produced to a standard specification. The manufacturer shall clearly mark the material or package with unique product identification.

Only one **"Product Certificate"** may apply to all the supply of material or product incorporated into the project for the one type of manufactures described.

Require the manufacturer to furnish a *"product certificate"* for material that:

- (a) Is custom made for the project, or

(b) Is produced or shipped in bulk and therefore not readily identifiable as to manufacturer and product, or

(c) Has a specific contract requirement.

A *"product certificate"* shall accompany each shipment of material and place of manufacture as well as the lot number or other means of cross referencing to the inspection and testing system. Furnish specific test results on material from the same lot upon request.

Material or assemblies accepted on the basis of a Certificate of Compliance may be sampled and tested at any time. If found not to be in conformity with the contract requirements, all the material or assemblies will be rejected whether in place or not until the items in place are tested and approved by the Employer's Project Manager or Project Manager's Representative.

001.04 Measurement or Tested Conformance.

Provide all necessary production, processing and control performance of the work so that all of the work complies with all the contract requirements.

Results from inspection or/and tested used to support acceptance of the work incorporated into the project shall have values within the specified tolerances or specification limits. When no tolerance values are identified in the contract, the work will be accepted based on acceptable manufacturing and construction tolerances.

Section 002. MEASUREMENT AND PAYMENT

002.01 Measurement methods.

Accepted work will be measured according to the metric (SI) system.

Unless otherwise specified, measurement will be made when the work is in place, complete, and acceptable. Measurements will be made for the actual quantity of work performed, or to other adjusted or specified limits (staked limits) if not measurement. Structure will be measured to the neat lines shown on the plans or to approved lines that have been adjusted to fit field conditions.

The "*measurement*" sub sections detailing specifics and exemptions for measuring work are described under each Section.

002.02 Measurement Terms and Definitions.

Unless otherwise specified, the meanings of the following terms are as follows:

- (a) **Provisional sum.** Perform the work only when authorized by written order. The work will be measured and paid for at agreed unit prices, or lump sum price, as established in the order authorizing the work. When the unit bid price is designated "provisional sum", the quantity is designated as "All".
- (b) **Contract quantity.** The quantity to be paid for is the quantity shown in the Bill of Quantities. The contract quantity will be adjusted for authorized changes that affect the quantity or for errors made in computing this quantity. If there is evidence that a quantity specified as a contract quantity is incorrect, submit calculations, drawings or other evidence indicating why the quantity is in error and request, in writing, that the quantity shall be adjusted.
- (c) **Cubic meter.** The volume will be measured by the average end area method as follow:
 - (1) Take cross-section of the original ground and use with design or staked templates or take other comparable measurements to determine the end areas. Work outside of the established lines or slopes will not be measured.
 - (2) If any portion of the work is acceptable but is not completed to the established lines and slopes, take re-measure cross section or comparable measurements of that portion of the work. Use these measurements to calculate new end areas.
 - (3) Compute the quantity using the average end areas multiplied by the horizontal distance along a centerline or reference line between the end areas. Deduct any quantity determined outside the designed or staked slope limits.

Where it is impractical to measure material by the average end area method, other methods involving three-dimensional measurements may be used.

- (d) **Cubic meter in the hauling vehicle.** The cubic meter volume will be measured in the hauling vehicle using three-dimensional measurements at the point of delivery. Use vehicles bearing a legible identification mark with the body shaped so the actual contents may be readily and accurately determined. Before use, mutually agree in writing on the volume of material to be hauled by each vehicle. Vehicle carrying less than the agreed volume may be rejected or accepted at the reduced volume.

Level selected loads. If levelling reveals the vehicle has been hauling less than the approved volume, all material received since the last levelled load will be reduced by the same ratio as the current levelled load volume is to the agreed volume.

Material measured in the hauling vehicle may be weighed and converted to cubic meters for payment purposes if the conversion factors are mutually agreed to in writing.

- (e) **Each.** One entire unit. The quantity is the actual number of units completed and accepted.

- (f) **Liter.** The quantity may be measured by any of the following methods:

- (1) Measured volume container.
- (2) Metered volume. Use an approved metering system.
- (3) Commercially packaged volumes.

When asphalt material is measured by the liter, the volume will be measured at 15°C or will be corrected to a volume at 15°C using recognized standard correction factors.

(g) Hour. Measurement will be for the actual number of hours ordered and performed by the Contractor.

(h) Linear meter. Measurement will be from end to end parallel to the base or foundation upon which the item is placed.

(i) Lump sum. No direct measurement will be made. The bid amount is complete payment for all work described in the contract and necessary to complete the work for that item. The quantity is designated as "All". The estimated quantities of lump sum work shown in the contract are approximate.

(j) Kilometer. 1000 linear meters. Measurement will be horizontal along the centerline of each roadway, approach road, or ramp.

(k) Kilogram. The weight measured according to Subsection 002.03. If sacked or packaged material is furnished, the net weight as packed by the manufacturer may be used.

(l) Square meter. Longitudinal and transverse measurements for area computations will be made horizontally. Where a pavement structure course is measured by square meter, the width of measurement will be the top design width of the course plus allowable curve widening, not including side slopes. The length will be the distance measured horizontally along the centerline of each roadway, approach road, or ramp.

(m) Station. 100 linear meters. Measurement will be horizontal along the centerline of each roadway, approach road, or ramp.

(n) Ton. 1000 kilograms. Measurement will be according to Subsection 002.03. No contract unit price can be made for variations in quantity due to differences in the specific gravity or moisture content.

Net certified scale weights, or weights based on certified volumes in the case of rail shipments, will be used as a basis of measurement subject to correction when asphalt material is lost from the car or the distributor, wasted, all otherwise not incorporated in the work. When asphalt material is shipped by truck or transport, net certified weights, subject to correction for loss or foaming, may be used for computing quantities.

When asphalt cement for asphalt concrete pavement is stored in tanks devoted exclusively to the project, quantities will be based on invoices. When asphalt cement for asphalt concrete pavement is not stored in tanks devoted exclusively to the project, quantities will be based on the tank measurements, converted to volumes.

002.03 Weights Procedures and Devices.

Furnish, erect, and maintain scales or use permanently installed and certified commercial scales for weighing material that are proportioned or measured and paid for by weight.

If bulk material is shipped by truck or rail and is not passed through a mixing plant, the supplier's invoice with net weights or volumes converted to weights may be accepted.

Periodic check weighing may be required.

Batch weights may be acceptable for determination of pay quantities when an approved automatic weighing, cycling, and monitoring system is included as part of the batching equipment.

Before use at a new site, have the scales checked, adjusted, and certified by an approved testing firm, a laboratory of the State responsible for weight and measures, or a qualified manufacturer's representative. Maintain the scale accuracy to within 0.5% of the correct weight throughout the range of use.

Do not use spring balances.

Install and maintain platform scales with the platform level with rigid bulk heads at each end. Make the platform of sufficient length to permit simultaneous weighing of all axle loads of the hauling vehicle. Coupled vehicles may be weighed separately or together.

When a weighing device is determined to indicate less than true weight, no additional payment will be made for material previously weighed and recorded. When a weighing device is determined to indicate more than true weight, all material received after the last previously correct weighing accuracy test will be reduced by the percentage of error in excess of 0.5%.

Furnish competent scale operators to weight and record the gross, tare, and net weights of all material measured by weight. Read and record weights to the nearest 50 kilograms. Increments smaller than 50 kilograms are permitted for automatic weighing system.

Weight the empty vehicles hauling material on platform scales with full fuel tanks at least twice per shift.

Documents that support weighed pay quantities shall contain the following information, as applicable, to the type of scales and recording system used:

- (a) Project identification
- (b) Contract pay item number
- (c) Material source/plant identification
- (d) Date
- (e) Load number
- (f) Truck identification
- (g) Time of weighing
- (h) Applicable empty and loaded weight
- (i) Scale operator's signature

Use an approved pre-printed format for the weight records. Furnish the original record(s) and a written certification as to the accuracy of the weight at the end of each shift.

002.04 Receiving Procedures.

When the method of measurement requires weighing or volume measurement in the hauling vehicle, furnish a person to direct the spreading and distribution of material and to record the location and placement of the material on the project. During the placement, maintain a record of each delivery and document it in an acceptable manner. The document shall include the following information as applicable:

- (a) Project identification
- (b) Contract pay item number and description
- (c) Location where placed
- (d) Date
- (e) Load number
- (f) Truck identification
- (g) Time of arrival
- (h) Weight of volume
- (i) Spread person's signature

Use an approved pre-printed format for the weight records. Furnish the original record(s) and a written certification of the delivery of the material at the end of each shift.

002.05 Scope of Payment.

Compensation provided for in the contract is full payment for performing all contract work in a complete and acceptable manner. All risk, loss, damage, or expense arising out of the nature of prosecution of the work is included in the compensation provided by the contract.

If the contract requires work and there is no measurement of the work by the payment Section or no pay item specifically established for the work, there will be no direct payment for the work. The cost of the work is considered included under the other contract pay items.

If a Section references work is in another Section, the referenced work will not be paid for directly unless the measurement subsection of the referring Section states that the work will be measured.

Work measured and paid under one pay item will not be paid for under any other pay item.

The quantities shown in the Bill of Quantities are approximate unless designated as a contract quantity. Pay quantities will be limited to the quantities staked, ordered, or otherwise authorized before performing the work. Payment will be made for the actual quantities of the work performed and accepted or material furnished according to the contract. No pay will be made for work performed in excess of what is ordered, or otherwise authorized.

Section 003 - MOBILIZATION

Description

003.01 This work consists of moving personnel, equipment, material and accessories to the project site and performing all work necessary before beginning all necessary works.

The project site should be cleared with due consideration to the EMP, that is natural vegetation should be spared as much as possible; space for gathering of waste from the site should be prepared in advance, etc. The Contractor shall submit the layout of his temporary construction bases (if any) or the main base (if there are no temporary bases) approved by an institution of local governing to the approval by the Employer's Project Manager or Project Manager's Representative before any work has commenced.

Temporary bases should be established with minimum harm to the environment. Their sizes and borders should correspond to proper operation of equipment and machinery without going beyond the necessary range of operation. Cleaning of territories of bases shall be done by preventing cutting and grubbing up of trees and bushes as much as possible.

The site for bases must be restored after completion of construction works. The complete restoration provides for quasi-restoration of initial conditions: rehabilitation of top-soil, planting of cut trees, etc.

003.02 Readiness for commencing works will be considered real when the Contractor provides at least 30% of necessary material (bitumen, sand, aggregate, mineral filler) at the site.

003.03 All building materials transported to a construction site shall have laboratory test certificates on suitability or contract with the licensed laboratory.

Measurement

003.04 There will be no measurement for mobilization.

Payment

003.05 No payment for mobilization shall be paid as the contract already allows an advance payment.

Section 004 - EMPLOYER'S PROJECT MANAGER OR PROJECT MANAGER'S REPRESENTATIVES FACILITIES

NOT APPLICABLE

Section 005 - LABORATORY TESTING

Description

005.01 This section contains the description and Specifications for the Site Laboratory and other quality control testing services to be provided by the Contractor together with definition of the responsibilities of the Contractor for such laboratory and testing. Whenever the term "Laboratory" is used, it shall include the space, utilities and sampling and testing equipment as hereinafter detailed, unless otherwise specified in the Contract Documents or the Bills of Quantities.

The floor area of the facilities must be enough to provide space for all specified tests and test equipment.

The Contractor shall provide a sufficient number of qualified personnel to perform sampling and testing duties when so directed by the Employer. The Contractor shall bear all the costs pertaining to obtaining specimens of materials, asphalt mixes and samples cut from the paving courses after compaction, including the provision of necessary equipment and plant for obtaining these specimens and samples and transporting them to the laboratory and for conducting all tests, all as directed by the Employer.

The Contractor shall provide a suitable vehicle as approved by the Employer with competent driver and including fuel, maintenance, insurance and licensing during the contract period for the exclusive use of the site laboratory. The vehicle should be capable of transporting the driver plus 4 people and samples of materials to be delivered to the site laboratory.

a. Use of the Laboratory. The Employer's Project Manager or Project Manager's Representative shall have access to the laboratory at all times during the Contract period. When so ordered by the Employer's Project Manager or Project Manager's Representative, the Contractor shall provide a sufficient number of qualified personnel to perform sampling, testing and related duties under the direct supervision of the Employer's Project Manager or Project Manager's Representative.

b. Location of the Laboratory. The location of the laboratory shall be as approved by the Employer's Project Manager or Project Manager's Representative. The location shall be as close as possible to the work being done in order to provide continuous control over the materials being used. The laboratory shall not be removed from the project until so ordered by the Employer's Project Manager or Project Manager's Representative.

c. Maintenance of the Laboratory. The Contractor shall at all times be responsible for maintaining the building, utilities, and all testing equipment in an acceptable condition for use. Disposable supplies such as filter paper, trichloroethylene, Speedy Moisture, Reagent, S.E. Stock Solution, and other similar supplies shall at all times be kept replenished so as to prevent testing delays.

The facilities provided by the Contractor for the Site laboratory shall remain as the property of the Contractor and the Contractor shall remove the facilities after completion of the project and receiving final acceptance. He shall restore the site to match the adjacent surfaces and materials, and depending on availability of materials transport them to a new established site as directed by the Employer's Project Manager or Project Manager's Representative.

d. Approval of the Laboratory. Prior to the start of the work, the Employer's Project Manager or Project Manager's Representative shall inspect the proposed laboratory to ensure the Contractor's compliance with these Specifications. In the event the Contractor fails to comply with these Specifications at any time during the Contract period, the Employer's Project Manager or Project Manager's Representative may order any or all of the following:

1. Stoppage of all work until the Specifications have been complied with.
2. Stoppage of any portion or phase of the work until the Specifications has been complied with.
3. A penalty assessment of for each day that Specifications are not complied with, which shall commence 7 days after notification of such non-compliance.

e. Equipment and required tests for the laboratory. The laboratory shall contain at least the following items (all items are not listed) the SPECIFIED EQUIPMENT in acceptable working order and adequate storage and working space for the following equipment: The contractor will be free to choose the required instruments for laboratory testing.

Item No.	Description	Quantity
1.	SAMPLE SPLITTER (RIPPLE 1") (25.4mm)	1
2.	SAMPLE SPLITTER (RIPPLE 1/2") (12.7mm)	1
3.	CLAM SHELL SAMPLE SPLITTER (ADJUSTABLE)	1
4.	THERMOSTATICALLY CONTROL OVEN	1
5.	SCALES ACCURATE TO 0.1 GRM (CAP.5000GRAMS)	1
6.	SCALES ACCURATE TO 1 GRM (CAP.2000GRAMS)	1
7.	MECHANICAL WASHING DEVICE	1
8.	SIEVE SHAKER	1
9.	DIGITAL THERMOMETERS (2 PIECES) WITH PROBE (RANGE 50C.199)	2
10.	FINE AGGREGATE SPECIFIC GRAVITY APPARATUS	1
11.	BUOYANCE BALANCE ACCURATE TO 0.1g (CAP.5000GRAMS)	1
12.	SPECIFIC GRAVITY TANK	1
13.	WATER BATH (75°F) (25°C)	14
14.	MICROWAVE OVEN (1000 W)	1
15.	THERMOMETERS (19...27 C, DIVISION 0,1 C)	2
16.	PENETRATION APPARATUS	1
17.	MECHANICAL MARSHAL HAMMER OR HAND OPERATED MARSHALL HAMMER APPARATUS	1 4
18.	RICE FLASKS	as required
19.	VENTILATION HOODS	as required
20.	COMBINED BITUMEN EXTRACTOR SIEVING EQUIPMENT	1
21.	STOP WATCH	1
22.	SIEVE BRUSHES, SPATULAS, TROWELS, FLOAT, CONTAINERS, TRAYS, BOWLS, ETC.	as required
23.	Ring and ball	1
24.	Ductilometer	1
25.	Viscosimeter	1
26.	Hydraulic press	3
27.	Vicat apparatus (for cement)	1
28.	Standard cone	1
29.	Cubic forms (for cement)	3

005.02 In the Laboratory following tests will be carried out:

1. DETERMINATION OF PARTICLE SIZE DISTRIBUTION, GRANULOMETRIC ANALYSIS (SIEVING METHOD)
2. DETERMINATION OF PARTICLE DENSITY
3. LOS ANJELOS TYPE TESTING
4. DETERMINATION OF PARTICLE SHAPE OF COARSE AGGREGATE - FLAKINESS INDEX
5. DETERMINATION OF ASPHALT CONCRETE MIX DESIGN
6. DETERMINATION OF COLD RECYCLING DESIGN FOR A/C PAVEMENT
7. TESTING OF CORE SAMPLES AFTER COMPLETION OF A/C PAVEMENT'S COLD RECYCLING
8. DETERMINATION OF GRANULAR COMPOSITION OF A/C MIX, A/C COMPOUND, BITUMEN CONTENT
9. COMPACTION OF A/C MIXTURES
10. MAXIMUM DENSITY OF PAVING MIXTURES (% VOIDS)
11. BULK SPECIFIC GRAVITY OF BITUMINOUS PAVING MIXTURES USING SATURATED DRY SPECIMEN
12. PERCENT OF AIR VOIDS IN COMPACTED DENSE AND OPEN BITUMINOUS PAVEMENTS
13. DETERMINATION OF NEEDLE PENETRATION
14. MOISTURE-DENSITY RELATIONSHIP
15. DENSITY OF SOIL IN-PLACE
16. DETERMINATION OF THE RESISTANCE TO ABRASION
17. DETERMINATION OF STABILITY BY MARSHALL DEVICE
18. DETERMINATION OF BITUMEN MELTING POINT
19. DETERMINATION OF BITUMEN STRETCHABILITY
20. DETERMINATION OF BITUMEN VISCOSITY
21. DETERMINATION OF AGGREGATE AND CONCRETE STRENGTH
22. DETERMINATION OF NORMAL CEMENT DENSITY
23. DETERMINATION OF BITUMINOSITY OF MINERAL FILLER
24. DETERMINATION OF A/C ULTIMATE STRENGTH (20°C, 50°C)
25. DETERMINATION OF A/C WATER SATURATION
26. DETERMINATION OF A/C WATER RESISTANCE
27. GRADATION OF THE GRAVEL - SAND COURSE

005.03. The equipment described above will not be required, if the Contractor has test performed by an independent laboratory approved by the Employer's Project Manager or Project Manager's Representative.

005.04. The roughness (evenness) of the finished road shall be defined on the wearing course surface. The International Roughness Index (IRI) shall be measured by class I roughness measurement instrument.

Measurement

005.05. The laboratory tests will be measured by number of samples tested. Initially the lab tests are counted based on the volumes envisaged and in accordance with the standards provided in the table (by BoQ). In case of any volume modification the lab testing frequency will be also changed. Taking of samples and their transport is not measured separately. Drilling of core samples and their transport will be paid as a lump sum. The roughness (IRI) testing will be measured by average value km tested.

Laboratory testing of samples	Frequency
A/c mix design	Before commencement of asphalt works for each road section, at least one for each type of a/c mixtures, in case of changes of mineral or binder new design will be required
Bitumen treated fine graded crushed stone sand mixture base course mix design	Before commencement of bitumen treated fine graded crushed stone sand mixture base course works for each road section, in case of changes of mineral or binder new design will be required
Cement-concrete mix design	Before commencement of concrete works for each road section, at least one for each type of cement-concrete, in case of changes of mineral or binder new design will be required
Aggregate for embankment	One sample at the beginning of the work, then one sample from each pit in case of pit change
Aggregate for sub base (sand-gravel)	One sample at the beginning of the work, then one sample from each 2000m ³ and one additional sample from each pit in case of pit change
Aggregate for base course (crushed stone, crushed stone – sand mixture)	One sample at the beginning of the work, then one sample from each 1500 m ³ , and one additional sample from each pit in case of pit change
Determination of base course compaction	One sample for each 500 l.m
Gradation for surface treatment	One sample from each fraction at the beginning of the work, then one sample for each 10000m ² from each fraction
Bitumen binder (penetration)	One sample of bitumen from each group or binder type
Bitumen binder (ring and ball)	One sample of bitumen from each group or binder type
Bitumen binder (ductility)	One sample of bitumen from each group or binder type
Bitumen binder (flash point)	One sample of bitumen from each group or binder type
Cement	One sample from each batch not exceeding 50 tons, and one sample from each subsequent 50 tons
A/c mixture from asphalt plant	One sample for each 500 tons
Bitumen treated fine graded crushed stone sand mixture	One sample for each 500 tons
Placed but not compacted a/c mixture	One sample a day from placed, non-compacted pavement and one sample from each 500 tones in case more than 500 tons.
Placed but not compacted bitumen treated fine graded crushed stone sand mixture	One sample a day from placed, non-compacted base course and one sample from each 500 tonnes in case more than 500 tons.
Placed and compacted a/c core sample	5 core samples at the beginning for 10000 m ² , then 5 more samples for each 10000 m ²
Placed and compacted bitumen treated fine graded crushed stone sand mixture base course core sample	5 core samples at the beginning for 10000 m ² , then 5 more samples for each 10000 m ²
Soil density in place	For each 200m when h ₁ =3m and for each 50 m when h ₁ >3m
Cement-concrete	1 complete set daily, and one more complete set from each 250m ³ in case more than 250m ³
Mineral filler	One sample for each 500 tons
Determination of mix design in case of cold recycling	One sample at the beginning of the work, then one sample from each change in case of change of pavement structure (or as per engineer's request)
Core sample in case of cold recycling	5 core samples at the beginning for 10000 m ² , then 5 more samples for each 10000 m ²

Payment

005.06 Full payment for laboratory testing will be made lump sum after completion of construction works. Contractor must submit all laboratory testing results and they must be approved by the Employer's Project Manager or Project Manager's Representative..

Pay Item

Pay Unit

Laboratory testing

Lump sum

Payment will be as follows:

Work Item

Payment Unit

00501. Crushed stone for pavement's base course	piece
00502. Crushed stone for a/c mixture	- " -
00503. Crushed stone for surface dressing	- " -
00504. Black crushed stone	- " -
00505. Sand for a/c mixture	- " -
00506. Mineral filler for a/c mixture	- " -
00507. Sample of bitumen binder	- " -
00508. Sample of a/c mixture from asphalt plant	- " -
00509. Sample of a/c mixture from placed and not compacted pavement	- " -
00510. Core Sample of a/c mixture from compacted pavement	- " -
00511. Drilling of core samples and transportation	- " -
00512. Cement sample	- " -
00513. Cement-concrete sample	- " -
00514. Soil for embankment	- " -
00515. Determination of soil density in place	- " -
00516. Roughness measurement	km
00517. Sand-gravel mix for pavement	piece

SECTION 006 – AS BUILT DRAWINGS

Description

006.01. The Contractor shall prepare and furnish the Employer's Project Manager or Project Manager's Representative with accurate record for reconstruction roads and streets drawings to full size and scales as otherwise stipulated showing complete Works as executed with existing and finished levels (top, invert and formation levels, plans, cross and longitudinal sections, locations of all functions, manholes, inlets, extent of concrete beds and structures and all things necessary to form a complete record of the finished Works). Also to be shown are the locations of existing utilities. The Contractor shall provide plans with longitudinal profile and cross sections for sections where asphalt concrete and surface treatment works have been carried out.

The Contractor shall prepare all record drawings to provide accurate and complete record drawings acceptable to the Employer's Project Manager or Project Manager's Representative.

During the course of the work, the Employer's Project Manager or Project Manager's Representative shall have the right to call for as built drawings at any time so that he may check them for accuracy and completeness. The Contractor shall provide a minimum of two prints of each as built drawing for this purpose. The Contractor shall finish the as built drawings as specified within five days of the date of the request as submitted in writing by the Employer's Project Manager or Project Manager's Representative.

Drawings shall be dated and signed by the Contractor's Representative and, if approved, by the Employer's Project Manager or Project Manager's Representative. Each as built drawing shall be a clear and legible reproducible on 0.3 mm polyester film or similar material as approved by Employer's Project Manager or Project Manager's Representative and all such as built drawings shall be handed over to the Employer's Project Manager or Project Manager's Representative against receipt. Each drawing set shall be bound by a method approved by the Employer's Project Manager or Project Manager's Representative.

Final submittal

006.02. In addition to any as built drawings required during the course of work by the Employer's Project Manager or Project Manager's Representative, as described above in part 006.01., the Contractor shall supply to the Employer's Project Manager or Project Manager's Representative, as built drawings, of quantity scale, and schedule as follows:

1. One (1) complete set of as built drawings, full size reproducible and one (1) complete set of as built drawings in electronic form.
2. One (1) complete set of as built drawings, full size reproducible (for the Employer's Project Manager or Project Manager's Representative).
3. One (1) complete set of utility drawings, full size reproducible and one (1) complete set of utility drawings, full size blue or black line print (for any utility agencies for which utility relocation /repairs/ modifications have been performed within this project).

Measurements

006.03. There will be no measurements of this item.

Payments

006.04. There will be no payment of this item. Costs associated with this task will be considered as being included in the related pay items for the construction work. The final certificate of payment will not be issued until all required record drawings have been approved and supplied to the Employer's Project Manager or Project Manager's Representative.

SECTION 007 - PUBLIC TRAFFIC

Description

007.01. This work consists of controlling and protecting public traffic adjacent to and within the project. Before starting construction works, the contractor must install Project information signs at the beginning and end of works indicating the name of Works, the Client, the Contractor, deadlines of construction works and 5533-5533 SMS number for complaints. The mentioned works should be carried out in the stage of mobilization works, which requires no additional payment.

The Contractor shall be responsible for the safety of all activities on the Site. Only those persons are allowed to work with machinery and equipment who are well familiar with safety rules.

Always there should be fire extinguishers, as well as first aid kit and facilities at the construction site in order to provide first aid in case of necessity.

The foreman and chief engineer of the construction company bear the responsibility for observation of works safety.

Material

007.02. Material shall conform to the Section: Temporary traffic control, Section 606

Construction Requirements

007.03. Accommodating Traffic During Work. Accommodate traffic through work zones according to VSN 37-84. Before starting construction works the Contractor shall submit approval of the Employer's Project Manager or Project Manager's Representative of traffic control implementation drawings and alternate traffic control proposals including the following:

1) A detailed diagram, which shows the location of all traffic control devices, including advance construction signs and speed limit signs, method, length and time duration for lane closures; and location of flaggers and time duration of flagging operation. The worker appointed as flagger should have sufficient knowledge of using the flag and be provided sufficient personal equipment like safety vest.

2) A tabulation of all traffic control devices shown in the detailed diagram.

3) An access maintenance plan for all properties requiring access during construction. This plan shall also indicate the areas where equipment will be stored, vehicles parked, construction signs and materials stored, if within the construction site limits. The contractor shall indicate ingress and egress to the construction site unless otherwise approved.

4) Pedestrian traffic control. Submit alternate traffic control proposals for approval at least 7 days before use.

Perform work in a manner that assures the safety and convenience of the public and protects the residents and property adjacent to the works. Accommodate public traffic on roads adjacent to and within the project until the work is accepted. The contractor shall cooperate with local traffic police and obtain all permissions required to implement traffic control plan. Request for each lane closure shall be made at least twenty-four hours in advance of the time the lane closure is to be implemented. Lane closures will not be allowed to remain for more than needed for work execution.

007.04. Maintaining Roadways During Work. Perform roadway maintenance as follows:

a) Maintain intersections with trails, roads, streets, enterprises, parking lots, residences, guarantees, farms, and other objects.

b) Remove accumulations of soil and other material from travelled way.

Maintain the roadway in a safe and acceptable condition. If corrective action is requested and the corrective action is not taken immediately, the condition may be corrected and the Contractor will be charged for the cost of the corrective action.

007.05. Maintain Roadways During Suspension of Work.

Maintain roadways for public traffic during all work suspensions.

007.06. Limitations on Construction Operations.

When the roadway is open to public traffic, restrict operations as follows:

- (a) Operate equipment in the direction of traffic, where practical

Complete construction of adjacent traffic lanes to the same elevation each day, except that differences in excess of 75 mm with a 1:3 fillet may be left overnight with "Uneven Pavement" warning signs and barriers with lightning band.

- (b) Complete the construction of shoulders to traffic lanes to the same elevation within 60 days. Sign shoulder drop of in excess of 75 mm with a warning sign "Road Works" and "Low Shoulder".
- (c) Provide minimum lane widths of 3.5 meters.
- (d) Locate staging areas at least 4 m from the travelled way or behind approved traffic barriers. Obtain approval of the location and access to staging areas. Store unused traffic control devices at staging areas.
- (e) Park equipment at least 4 m from the travelled way or behind approved traffic barriers.
- (f) Provide parking areas for employees' personal vehicles in approved areas.
- (g) Where switching traffic to a completed lane, provide adequate personnel and equipment to set or relocate traffic control devices.
- (h) Limit construction caused delays to public traffic.
- (i) Install permanent traffic barriers within 30 calendar days of completing the surface course.

007.07. Working Hours.

The Contractor shall perform construction operations during the hours of daylight (after sunrise to before sunset) or as directed by the Employer's Project Manager or Project Manager's Representative. Specific restrictions of working must be done according EMP.

007.08. Traffic and Safety Supervisor.

Provide a competent traffic and safety supervisor for the project who is someone other than the superintendent. Identify this supervisor at the pre-construction conference and provide the supervisor's address and phone number(s). The traffic and safety supervisor shall:

- a) Have traffic safety training or experience in maintaining traffic control devices and protecting traffic through highway construction projects.
- b) Understand the contract requirements.
- c) Inspect the condition and position of traffic control devices in use.
- d) Review the project for traffic control devices needed to maintain safe and efficient traffic movement.
- e) Correct all traffic control deficiencies.
- f) Coordinate maintenance of traffic operations with the Employer's Project Manager or Project Manager's Representative.
- g) Review work areas, equipment operation and storage, and material handling and storage related to traffic safety.
- h) Conduct weekly traffic safety meetings for contractor's employees. Advise the Employer's Project Manager or Project Manager's Representative of improved safety measures. Invite the Employer's Project Manager or Project Manager's Representative to attend these meeting.

007.09. Acceptance. The work will be accepted for payment providing that it has been built in conformance to the plans and specifications pertaining to the segment involved and is accepted by the Employer's Project Manager or Project Manager's Representative.

Measurement and Payment

007.10. Temporary traffic control items will be measured and paid under Section 606.

Section 008 - CONTROL OF MATERIAL

008.01 Source of Supply and Quality Requirements.

Contractor selects sources and provides acceptable material. Notify the Employer's Project Manager or Project Manager's Representative of all proposed sources before delivery to the project, to expedite material inspection and testing. Do not incorporate material requiring submittal testing into the work until approved.

Material must be approved at the source of supply before delivery to the project. This approval does not constitute acceptance of material. If an approved source does not continue to supply acceptable material during the life of the project, further use of that source may be denied.

008.02 Local Material Sources.

These identified sources are listed as information to aid the Contractor in locating a source. The decision to use an identified source is solely that of the Contractor.

After finishing the material borrow the borrow site should be restored in an environmental acceptable way according EMP.

(a) Employer-listed sources. The Employer may list possible material sources. The Employer makes no representation as to the quality or quantity of material, or rights to the availability of material from these sources. These sources are considered to be Contractor-located sources under (b) below.

(b) Contractor-located sources. The Contractor is responsible for these sources, including established commercial sources. Use sources that fulfill the contract quantity and quality requirements. Determine the quantity and types of equipment and work necessary to select and produce acceptable material. Secure all clearances for use of the source and provide copies of the documents.

Provide laboratory test reports and data indicating that acceptable material is available from the source. Do not use material from a source that is unacceptable to the Employer. Dispose of unacceptable material and locate another source at no cost to the Employer.

008.03 Storing and Handling Material.

Store and handle material to preserve its must be done in according EMP. Stored material approved before storage may again be inspected before use in the work. Locate stored material to facilitate prompt inspection.

Use only approved portions of the right-of-way for storing material and placing plants and equipment.

Provide all additional space needed. Do not use private property for storage without written permission of the owner or lessee. Furnish copies of all agreements to the Employer's Project Manager or Project Manager's Representative. Restore all Employer provided storage sites to their original condition.

The Contractor is responsible for the security of all stored material.

The material, especially oil products and chemicals, shall be stored in such a way that no leaking or spreading to surrounding ground or air occurs. The storage should be done according EMP.

008.04 Use of Material Found in the Work.

The right to use and process material found in the work does not include the use and processing of material for other work except for the disposal of waste material. Waste material must be disposed on site if approved by the Employer's Project Manager or Project Manager's Representative, or off site at approved locations. If required, the Contractor shall be responsible for locating and securing off site waste areas in an environmentally acceptable way, at no cost to the Employer. If the Contractor produces or processes material from Employer lands in excess of the quantities required for the contract, the Employer may:

- (a)** Take possession of the excess material and direct its use, paying the Contractor only for the cost of production, or
- (b)** Require removal, replacement with suitable fill material and restoration of the over excavated area to a satisfactory condition at no cost to the Employer.

Section 009 - CEMENT

009.01. Portland Cement and Masonry Cement.

Furnish cement according to GOST 10178-85 (National standard)

NN	Indicators	Unit of measure	Standard requirements
1	Fineness disintegration passage through 0.08mm sieve	%	not less than 85%
2	Filling density	kg/m ³	
3	Normal density of cement grout	%	24-28
4	Binding period of cement grout a) beginning b) end	hour, minute hour, minute	not earlier than 45 minutes not later than 10 hours
5	Change in volume uniformity in the curing pit		maintained

Do not use different brands or types of cement for the same structure, or the same brand or type of cement from different mills without Employer's Project Manager or Project Manager's Representative's approval.

Provide suitable means of storing and protecting the cement from dampness. Do not use cement that:

- (a) Has become partially set
- (b) Contains lumps of caked cement
- (c) Is salvaged from discarded or previously opened bags.

Section 010 - BITUMINOUS MATERIAL

010.01. Bitumen.

Viscous bitumen should be in compliance with the requirements of Table 1 (GOST 22245-90, GOST 9128-2009,).

Table 1 Requirements to the quality of viscous bitumen

Types of materials	Standards for bitumen brands								
	BND 200/300	BND 130/200	BND 90/130	BND 60/90	BND 40/60	BN 200/300	BN 130/200	BN 90/130	BN 60/90
	OKP 025612 0115	OKP 025612 0114	OKP 025612 0113	OKP 025612 0112	OKP 025612 0111	OKP 025612 0115	OKP 025612 0205	OKP 025612 0204	OKP 025612 0202
Depth of needle penetration, 0.1mm under 25°C	201-300	131-200	91-130	61-90	40-60	201-300	131-200	91-130	60-90
under 0°C	45	35	28	20	13	24	18	15	10
Softening temperature by ring by ball, °C, not less	35	40	43	47	51	33	38	41	45
Stretchability cm, not less under 25°C	-	70	65	55	45	-	80	80	70
under 0°C	20	6,0	4,0	3,5	-	-	-	-	-
Brittle temperature, °C, not lower	-20	-18	-17	-15	-12	-14	-12	-10	-6
Flash point, °C, not higher	220	220	230	230	230	220	230	240	240
Change in softening temperature after heating, °C, not more	7	6	5	5	5	8	7	6	6
Penetration index			-1.0 up to	+1.0			-1.5 up to	+1.0	
Content of soluble units, %, not more	0.20	0.20	0.30	0.30	0.30	-	-	-	-

010.02. Cutback bitumen should be in compliance with the requirements of Table 2

	Indices	GOST 11955-82
1.	Conventional viscosity 5mm 60°C	40-130
2.	Distillation	7-10
3.	Softening temperature	28-39
4.	Burning temperature	45-110
5.	Adhesiveness with marble or sand	maintained

010-01

010.03. Emulsified Bitumen. Emulsified bitumen should conform to Table 3 (GOST 18659-2005)

Indices	Grades of emulsion					
	Anodic emulsion			Cathode emulsion		
	ԱրԱ -1	ԱրԱ -2	ԱրԱ -3	ԱրԽ -1	ԱրԽ -2	ԱրԽ -3
Content of bitumen with emulsifier	45-55%	45-55%	45-55%	45-55%	45-55%	45-55%
Conditional density of emulsion, no more	35c	35c	35c	35c	35c	35c
Adhesiveness of binder membrane with crushed stone	75%	75%	75%	95%	95%	95%
Quantity of bitumen particles > 0.14mm	No more than 0.5%	No more than 0.5%	No more than 0.5%	No more than 0.5%	No more than 0.5%	No more than 0.5%
Emulsion stability during transportation, size of particles ≤ 0.14mm						
after 7 days, %	0.8	0.8	0.8	0.5	0.5	0.5
after 30 days, %	1.2	1.2	1.2	0.8	0.8	0.8

010.04. Application Temperatures. Apply bitumen within the temperature ranges shown underneath:

Bitumen grade	40-60	61-90	91-130	131-200	201-300
Application temperature, °C	150-160	140-150	130-140	110-120	100-110

010.05. Bituminous material will be supplied by the Contractor.

010.06. The Contractor has to provide for Employer's Project Manager or Project Manager's Representative's approval certificates of origin and quality certificate for each type of bitumen he intends to use as well as a sample for control testing

010.07 It is recommended to use cellulose fibers as additives complying with specification requirements.

Cellulose fibers should have a form of a strip 0.1 – 2.0 mm long. Fibers must be homogeneous and without bundles. Cellulose fibers should satisfy the following requirements:

1. moisture - no more than 8.0 % of the weight;
2. heat resistance at 220°C, loss of weight during heating should be no more than 7.0 %;
3. length of fibers 0.1-2.0 mm must be at least 80 % of the weight.

Additives must comply with GOST 12801-98.

Section 011 - AGGREGATE

011.01. Aggregate for Portland Cement Concrete.

Aggregate shall conform to GOST 8267-93 and sand shall conform to GOST 8736-93

011.02. Aggregate for Subbase and Base (SNiP 2.05.02-85)

- (a) **General.** Aggregates shall consist of hard, durable particles or fragments of crushed stone, crushed slag, or crushed gravel meeting the requirements of GOST 8267-93.

Main requirements

1. Granulometric composition
2. Crushability (grade)-----600-1200
3. Deterioration -----up to 35%
4. Quantity of crushed particles----- not less than 80%
5. Frost resistance ----- in accordance with table 8, GOST 8267-93
6. Content of dust-like and clay particles -----1-3%
7. Clay content in pellets-----up to 0.5%
8. Voids
9. Content of slate grains ----- no more than 15 %

Furnish a material that is free from organic matter and lumps or balls of clay. Do not use material that break up when alternately frozen and thawed or wetted and dried.

Obtain the aggregate gradation by crushing, screening, and blending processes as necessary. Fine aggregate, material passing the 5 (6) mm sieve, shall consist of natural or crushed sand and fine mineral particles.

011.03. Hot Asphalt Concrete and Surface Dressing Aggregates

Aggregate for hot asphalt concrete pavement and surface dressing shall consist of hard, durable particles or fragments of crushed stone, crushed slag, or crushed gravel. Crushed gravel must contain completely crushed particles accounting for at least 30% by weight of particle sizes in excess of 6 mm and completely uncrushed particles accounting for no more than 30% by weight. The aggregate may not contain any detrimental amount of impurities, such as clay, peat, organic matter etc.

The Los Angeles Test Value shall be less than 16 and the Flakiness Index less than 15 for coarse aggregate. (Strength can be measured by using GOST 8267-93 method, if ball mill apparatus is not available). Aggregate for hot asphalt concrete must be sieved to at least three fractions. Size, grade, and combine the aggregate fractions for the mixture in such proportions that the resulting composite blend conforms to the requirements of section 308.

011.04. Sand (natural or crushed).

Requirements for fine aggregate in bituminous mixtures are shown in GOST 8736-93. Sand for bed course shall conform to SNiP 3.06.03.85.

Main requirements

1. Granulometric composition
2. Content of dust-like and clay particles -----3-10%
3. Voids
4. fineness modulus -----0.7->3.5
5. Class----- I-II
6. Group-----from very fine to too very course
7. Actual density

011.05. Mineral filler for hot bituminous mixes shall conform to GOST 16557-2005.

Main requirements

1. Humidity----- no more than 1%
2. Porosity----- no more than 35%
3. Granulometric composition 0.071mm ----- no less 70-80 %
4. Density after compaction 400 kg/cm³

Section 012 - MISCELLANEOUS MATERIAL

012.01 Water.

Only potable water that complies with the standards of World Health Organisation may be used.

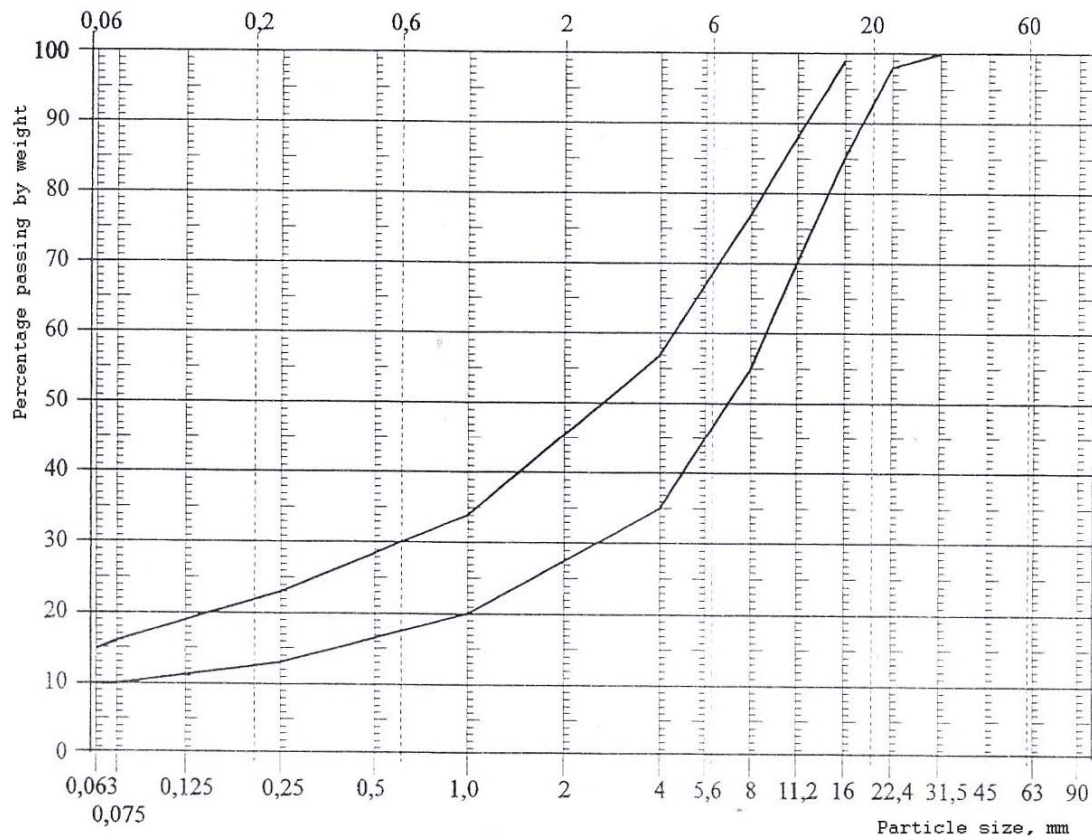
012.02. Water supply

If it's necessary the Contractor shall design, supply, install, operate and maintain a water supply system providing potable water for the construction facilities and buildings in the works area, including the site offices of the Employer's Project Manager or Project Manager's Representative.

012.03 Material for gravel wearing course

Material for gravel wearing course, requirements on particle size distribution

Sieve size, mm	0.063	0.075	0.25	1.0	4.0	8.0	16	22.4	31.5
Max %	15	16	23	34	57	77	99	-	-
Min%	10	10	13	20	35	55	85	98	100



Conditional resistant - $R=5.0 \text{ km/sm}^2$

Module of deflection 400 km/sm^2

Angel of internal friction $\varphi=40^\circ$

Section 013 - INSURANCE

013.01. This item consists of Insurance of the Contract.

Acceptance

013.02. This item will be accepted for payment after the Employer's Project Manager or Project Manager's Representative has approved Insurance provided by the Contractor.

Payment

013.03. Payment will be full compensation for the Insurance provided by the Contractor.

Pay item

Pay unit

01300 Insurance

Lump sum

Section 014 – ENVIRONMENTAL PROTECTION

014.1 This section describes the environmental mitigation requirements to be followed by the Contractor and measures to be carried out by the Contractor related to environmental protection.

014.2 Requirements of the Armenian legislation concerning environmental protection and human health and safety, as well as the following regulations shall be followed:

Resolution of the Government of RA № 750-N of 26.05.06

Resolution of the Government of RA № 1026-N of 20.06.2006

Resolution of the Government of RA № 192 –N of 30.03.1999

Ecological passport

Environmental mitigation measures are specified in the Environmental Management Plan (EMP) developed by the designer.

In addition to this section there are, under different items, described adjacent environmental mitigation demands.

014.3 Production technology of asphalt concrete mix consists of:

Loading, unloading and sorting of stone (rocks) and mineral powder, heating and dehydration of bitumen, dosing and mixing of bitumen with aggregate and mineral powder, loading and transportation of hot asphalt concrete mix. All these operations result in exhalation of dust, gas, carbon, sulphurous gas, oxides and nitrogen oxides.

Main sources of emission of harmful substances in a mixture plant are chimneys, drying drums, hot elevators, pouring of mineral powder into the bunker, as well as bitumen heating equipment and crushing section.

Main sources of noise in a mixture plant are chimney, compressor and ventilator of burning unit. In case of unsatisfactory technical condition of equipment, noise can generate from drying drum and faulty mechanisms. Timely technical servicing and repair of faulty equipment is an effective means for reduction of noise.

As per Resolution of the Government of RA № 192 –N of 30.03.1999, a maximum permissible emissions (MPE) must be approved by the Ministry of Health for each contractor or subcontractor. For environmental purposes, actual conformity with the approved MPE should be controlled in order to prevent from atmospheric emissions exceeding maximum permissible concentration and pollutions of water and earth resources.

Annual maximum permissible emissions are also being considered for evaluation of economic and environmental consequences of air pollution. Background pollution of atmosphere in the particular region will also be taken into account.

The following environmental mitigation measures are recommended:

- a) improvement of technological equipment;
- b) improvement of production process;
- c) increase of efficiency of dust cleaning.

Ecological passports for each Contractor (for asphalt plant, crusher, and concrete equipment) , which shall be approved by the Ministry of Environmental Protection and confirmed by the director of the Contractor, shall be prepared. Ecological passports shall include the following information:

1. Technologies applied by the Contractor;
2. Quantitative and qualitative characteristics of used resources: raw material, fuel and energy;
3. Qualitative characteristics of produced goods;
4. Quantitative and qualitative characteristics of harmful substances;
5. Description of climate conditions of the region where the work is carried out;
6. Meteorological characteristics and coefficients of dispersion of harmful substances in the atmosphere;
7. Characteristics of water supply sources and water circulation systems;
8. Characteristics of cleaning equipment;
9. Harmful substances generated in the course of production by the Contractor;
10. Calculation of poisonous gas quantities from motor transport.

014.4 Noise: All noise not related to the construction shall be done according EMP.

014.5 Waste material and rubbish: Waste material and rubbish shall be piled and disposed in time or removed to an approved dumping place. Location of a dumping place shall be approved by the head of an institution of local governing after appropriate application indicating quantities and volumes of wastes. If the disposal or removal cannot be carried out in time, the Contractor shall cover the waste materials to protect the site from pollution.

Special attention should be paid to hazardous waste like asphalt, chemicals and oil products. For these types of waste the dump site should be prepared beforehand to prevent pollution of earth, ground water and underground water. The preparation should be approved by the supervisor and Local Department of Environmental protection before the waste is dumped.

014.6 Sewage: Sewage is only allowed to be discharged to nature after its being collected and treated in accordance with the requirements of environment protection. After proper cleaning, sewage should comply with MPC and only then discharged to the environment.

014.7 Other requirements: Besides the directions given in this section, the Contractor shall follow the detailed requirements of environmental protection like traffic arrangements etc. given in other Sections of these Specifications. The Contractor shall strictly obey these requirements during construction. The Contractor shall be responsible for pollution or any other environmentally harmful effects due to his activities and take all measures necessary to prevent or eliminate these effects.

Measurement

014.8 No measurement is envisaged for the final payment.

014.9 The following mitigation measures shall be envisaged during implementation of rehabilitation works:

- Obtain permits from the Ministry of Nature Protection and as needed from the other state/regional authorities for the opening and/or use of quarries;
- Obtain permits from the relevant local/regional authorities for disposal of construction wastes;
- Provide for zones of preliminary accumulation of wastes that will cause no damage to the vegetation cover and other components of the environment;
- Strengthen the steep slopes with vegetation, grass and plants or gabions;
- Transportation and disposal of construction concrete rubbles, debris and spoils in special approved paths and dump sites;
- The traffic management plan should be developed and approved to ensure smooth traffic flow and safety both for workers and the passing traffic;
- Closed or covered trucks should be used for transportation of untreated construction materials;
- Clean the surrounding area by water sprinkling, remove excess materials and clean sites upon completion of activities;
- Noise should be reduced as far as possible close to resident areas, near schools, etc. through establishment of work time schedule (e.g. works could be conducted at daylight, working in peak hour could be avoided etc.). The vehicles should be equipped with exhaust silencers;
- Workers on the road should have and use safety equipment. In some cases appropriate guidance could be given to the workers in charge for handling oil, chemicals, etc.;
- Arrange all preservation measures for passer-by safety and safety of means of transportation (establish protection zones, by-passes, etc.). Relevant safety elements such as metal guardrails, traffic signs, pavement markings, barricades, warning lights should be installed. In some cases a flagman for traffic control could be engaged;
- Restoration to quasi-original conditions of landscape after completion of construction and rehabilitation works;
- Cease the works as soon as historical and cultural monuments are unexpectedly found during earthworks and provide relevant information to the State Agency for Historical and Cultural Monuments Protection;
- During the works, the drainage system should be periodically maintained in order to prevent flooding and damages caused by penetration of water in the road structure and frost heave
- Clean the surrounding area from dust by water sprinkling

Payment

014.10 Full payment for environmental mitigation measures will be made lump sum after completion of construction works against documents certifying proper implementation of measures provided by EMP. In case of violations of requirements of the Armenian laws and conditions specified in EMP during construction works, 10% for each violation regardless of who and when stated it will be deducted from the Lump sum amount for Environmental impact mitigation measures to be paid to the Contractor. In case of more than 7 violations or any violation causing significant damage to the environment, the construction agreement with a contractor may be cancelled.

Pay Item

Pay Unit

014.00 Environmental mitigation measures

Lump sum

1. PREPARATORY WORKS

Section 101 –CLEARING AND GRUBBING

Description

101.01 This work consists of all clearing other than specified in the section 102.

Construction Requirements

101.02 General.

Remove debris by methods that prevent damage to vegetation not to be removed. Dispose of clearing and grubbing debris off the project site to a dump area acceptable from environmental point of view and approved by the Employer's Project Manager or Project Manager's Representative and the Local Environmental protection Department.

Acceptance

101.03 The work will be accepted for payment providing it has been done in conformance to the plans and specifications pertaining to the segments involved and is approved by the Employer's Project Manager or Project Manager's Representative.

Measurement

101.04 Clearing and grubbing will be measured by the square meter. Clearing and grubbing of shoulders will be measured under section 310 and Clearing and grubbing of existing ditches will be measured under section 102.

Payment

101.05 The accepted quantity, measured as provided above, will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section. Payment will be made under:

Pay Item	Pay Unit
10101 Clearing and grubbing	Square meter

Section 102 - CLEARING AND REGRADING OF EXISTING DITCHES

Description

102.01 This work consists of all clearing, grubbing and re-grading of the existing ditches for the project.

Construction Requirements

102.02 General. Clear, grub and regrade as required for ditches. Remove debris by methods that prevent damage to vegetation not to be removed. Dispose of clearing and grubbing debris off the project site to a dump area acceptable from environmental point of view and approved by the Employer's Project Manager or Project Manager's Representative and the Local Environmental protection Department.

Slope, grade, and shape ditches. Remove all projecting roots, stumps, rock, or similar matter. Maintain all ditches in an open condition and free from leaves, sticks, and other debris.

Acceptance

102.03 The work will be accepted for payment providing it has been done in conformance to the plans and specifications pertaining to the segments involved and is approved by the Employer's Project Manager or Project Manager's Representative.

Measurement

102.04 Clearing, grubbing and regarding existing ditches will be measured by area.

Payment

102.05 The accepted quantity, measured as provided above, will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section.

Payment will be made under:

Pay Item	Pay Unit
10201 Clearing, grubbing and regrading existing ditches	Square meter

Section 103 - REMOVAL OF STRUCTURES, OBSTRUCTIONS AND TREES

Description

103.01. This work consists of salvaging, removing, and disposing of trees; signs and posts; sign pole mounts, and any other obstructions.

Transportation of all construction materials and removal of waste must be done by such vehicles that have appropriate covers and are included in the unit price.

Material

103.02. Material shall conform to the following Subsection:

Backfill material 203.07

Construction Requirement

103.03 Salvaging material. Salvage, with reasonable care, all material designated to be salvaged. Salvage in readily transportable sections or pieces. Replace or repair all members, pins, nuts, plates, and related hardware damaged, lost or destroyed during the salvage operations. Wire all loose parts to adjacent members or pack them in sturdy boxes with the contents clearly marked.

Stockpile salvaged material to a designated area on the project.

103.04 Removing Material. Saw cut curbs and pavements when partial removal is required.

Except in excavation areas, backfill and compact cavities left by removal of structures with backfill material (according to Clause 203) in horizontal layers not exceeding 20 cm in depth. Bring backfill up evenly on all sides of the cavity and/or structure as appropriate. Extend each layer to the limits of the excavation or to natural ground. Compact backfill with small approved mechanical or vibratory compactors.

Pavement material should, if not used in the structure, be transported to an approved dumpsite and treated according instructions from the Local Environmental protection Department.

Removing of material in water shall be made in such a way that mud spreading is avoided. Sufficient protection like silt fences should be used.

103.05 Disposing of Material. Dispose of material not designated for salvage as follows:

(a) Removal from the Project. Make necessary arrangements with property owners and haul debris to suitable disposal locations. Furnish a signed copy of the disposal agreement to the Employer's Project Manager or Project Manager's Representative.

(b) Burn. Obtain necessary burning permits. Furnish a copy of the burning permits to the Employer's Project Manager or Project Manager's Representative before burning begins.

Burn using high intensity burning processes that produces minimal emissions. Provide a competent watch person during the burning operation.

When burning is complete, extinguish the fire. Dispose of unburned material according to (a) above.

103.06 Acceptance. Removal of trees, signs, posts, sign pole mounts, and all other obstructions will be accepted under Subsection 001.02, provided it will be carried out in conformity with Design, Specifications and approved by the Employer's Project Manager or Project Manager's Representative.

Measurement

103.07 Removal of signs, trees, posts and sign pole mounts will be measured by their number and shall include clean-up of burn piles, backfilling of holes as required, replacement of curbs and paying removed for access and replacement of missing parts. Removal of fences will be measured by length or by volume.

Payment

103.08 The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section.

Payment will be made under:

Pay Item	Pay Unit
10301 Remove signs	Each
10302 Remove sign pole mounts	Each
10303 Remove trees	Each
10304 Remove fence	Linear meter/cubic meter
10305 Remove delineators	Each
10306 Remove curbs	Linear meter/cubic meter
10307 Remove culvert (water port. building)	Linear meter/cubic meter

2. EARTH WORKS

Section 201 - EXCAVATION AND EMBANKMENTS

Description

201.01. This type of works includes all works on road sub-grading, excavation (or soil excavation in reserve), embankments (soil replacement, layer by layer placing and soil compaction, road-bed layout and slope grading) in accordance to designed profiles, also the transportation to the dumping place of the excavated material and from the borrow pit for the embankment are included.

201.02 Definitions

Excavation and embankment should be implemented according to SNiP 3.02.01-87.

(a) Excavation. Cut ground below the ground surface. Excavation consists of the following:

- (1) Roadway excavation.** All material excavated from within the right-of-way or easement areas, except sub-excavation specified below in (2). Roadway excavation included all material encountered regardless of its nature or characteristics.
- (2) Sub-excavations.** Unsuitable material excavated from below subgrade elevation or from below the natural ground in embankment sections. Sub-excavation does not include conserving the topsoil.
- (3) Borrow excavation.** Material used for embankment construction that is obtained from outside the right of way limits of the project road. Borrow excavation includes unclassified borrow, select borrow, and select topping.
- (4) Rocky, semi-rocky ground excavation.** DBO design and cost estimate should be implemented according to BCH 178-91.

(b) Embankment. Ground filled above the ground surface.

(c) Conserved topsoil. Excavated material conserved from the excavation and embankment foundation areas that is suitable for growth of grass or other cover plants. A material reasonable free from hard soil, rock, clay, toxic substances, litter, or other deleterious material shall be used according to SNiP 3.06.03-85 and SNiP 2.06.02-85.

Material

201.03. Material shall conform to SNiP 2.05.02-85 and VSN 449-72

There is no limitation for use of soil or slag if their strength and stability is only changed slightly under exposure to weather and climatic conditions. If blocky embankment is applied a leveling blanket at least 0.5m thick should be ensured between embankment and pavement. Materials for the blanket should be of the same size grains differing no more than 0.15m.

Sizes of block stones in embankment should not exceed 2/3 of the blanket height.

Permissible limits for soil moisture during compaction

Soil type	Permissible moisture content W_{plm} as a percentage of the optimum moisture content at the required degree of compaction m_b			
	1.0	1.0-0.98	0.96	0.90
Dust-like sand; light, coarse-grained clay sand	1.3	1.36	1.6	1.6
Dust-like and light clay sand	1.20	1.25	1.36	1.6
Dust-like heavy clay sand, light and dust-like sandy clay	1.10	1.15	1.30	1.50
Dust-like heavy sandy clay, clay	1.0	1.05	1.20	1.30

Subgrade surface course (effective layer) should consist of non-swelling and non-subsiding soil (SNiP 2.05.02 - 82, CNRA-IV-11.05.02-99, Appendix, Tables 4, 5).

Soil type (when moisture content is 0.5 Wo)	Relative deformation caused by soil heaving (thickness as % of moistened layer)	Soil type	Coefficient of subsidence	Relative deformation caused by subsidence (thickness as % of moistened layer)
non-swelling	Less than 2	non-subsiding	Average moisture 0.92	Less than 2

Construction Requirements

201.04. Preparation for Roadway Excavation and Embankment Construction.

Clear the area of vegetation and obstructions according to section 101 and 102.

201.05. Conservation of Topsoil. Conserve topsoil from roadway excavation and embankment foundation areas. Stockpile conserved topsoil in wind rows immediately beyond the rounding limits of cut and embankment slopes or in other approved locations. Separate topsoil from other excavated material.

201.06. Roadway Excavation. Excavate according to SNiP 3.06.03-85. The preparation of subgrade for earthworks shall be done in accordance with 4.6-4.12 of SNiP 3.06.03-85, and excavation and embankment works in accordance with 4.13-4.25 and 4.51-4.56 of SNiP 3.06.03-85 (presented below). The compaction degree of subgrade, defined by compaction ratio, shall meet the requirements of Table 24 of CNRA IV -11.05.02-99.

Pavement components	The minimum compaction degree below pavement
	Pavement type: capital light and transitional 0.95 0.95
Subgrade	0.95 0.90
Embankment	
Flooded part of embankment, when embankment height is less than 6 m	0.95 0.95
Flooded part of embankment, when embankment height is over 6 m	0.98 0.95
In working layer excavations that shallower than seasonal freezing zones	0.92 0.92

4.6

Staking of subgrade should be done in accordance with СНиП 3.01.03 - 84.

All points and pluses are marked and fixed during staking.

4.7

Topsoil to be removed as per design should be removed with the designed thickness and across subgrade width, stored and piled in reserves and structures for further.

4.8

Before starting works for subgrade construction, it is necessary to build mountain ditches, water intake wells and other structures required for catching rainwater, floods and snowmelt.

4.9

Before starting works for embankment, it is necessary to build drainage and all communications at the subgrade base level.

4.10

Area envisaged for embankment should be cleaned from those stones sizes of which exceed 2/3 of thickness of the placed layer.

4.11

To compact bases of embankment and excavation, it is necessary to maintain the thickness of the optimum compaction layer.

4.12

To widen subgrade on road reconstruction sections (where the embankment height is more than 2 meters) slopes are scarified and 2m wide terraces are built.

4.13

Excavation and borrow excavation should be implemented from the lower part of the relief.

4.14

Excavation and embankment works in those road sections where the slope is greater than 1:3 should be done after building special protective structures.

4.15

Excavation works in some grounds should be done by meeting the requirements of hHŊŲ III-8-76.

4.16

Embankment with various types of ground (in the constructed layer) is not permitted, except when envisaged by the design.

4.17

Filling of soil in embankment is performed from edges to the center across the whole subgrade width including slopes.

4.18

Ground compaction should meet the requirements of hHŊŲ 2.05.02-85.

4.19

Compaction of ground at culverts, supports, and cone sections of bridges is implemented with use of vibratory impact machines or percussion machines

4.20

As a rule, compaction of clay embankment is implemented with sheep's foot roller, grid roller, or rollers (with pneumatic wheels) with partial functioning capacity (10-16 tons in weight) and finished with rollers (with pneumatic wheels) weighing 25 tons and more or self-propelled vibrorollers weighing 16 tons and more.

4.21

Moisture of ground compacted with rollers (with pneumatic wheels) should meet the requirements of optimum moisture (pŲhŲ 22733-77)

4.22

If moisture of ground is less than the optimum moisture the number of roller passages must be increased

4.23

If moisture of ground is more than the permissible moisture ground must be dried.

4.24

Bending and semi-bending ground is first rolled up and then compacted.

4.51

Excavation in rocky ground is done by blasting or in a mechanized way.

4.52

When constructing embankment with rocky ground the largest size of the material should be not greater than 2/3 of the compacted layer.

4.53

When compacting blocky ground requirements of Table N 1 should be observed.

Table N 1

Type of ground	Moisture by required compacting factor		
	1-0,98	0,95	0,90
Dust-like sand, light coarse-grained clay sand	no more than 1,35	no more than 1,6	not standardized
Dust-like and light clay sand	0,8-1,25	0,75-1,35	0,7-1,6
Heavy dust-like clay sand, light sandy clay, and light dust-like sandy clay.	0,85-1,15	0,8-1,2	0,75—1,4
Heavy sandy clay and heavy dust-like clay.	0,95-1,05	0,9-1,1	0,85-1,2

4.54

Moisture of small particles of slightly weathered and softened blocky ground should be maximum 1.2 times more than optimum moisture.

4.55

Placing of clay protective layer on slopes should be done in parallel with the main works for embankment.

4.56

Blocky ground that can become moist because of rainwater and surface water must be protected against residual moisture.

201.07. Material Replacement. Excavate unsuitable material to the limits designated by the Employer's Project Manager or Project Manager's Representative. Prevent unsuitable material from becoming mixed with the backfill. Dispose of unsuitable material according to Subsection 201.14. Backfill the sub-excavation with topping or other suitable material. Compact the material according to Subsection 201.11.

201.08. Borrow Excavation. Do not use borrow excavation until all suitable roadway excavation is used. Use select borrow and select topping as shown on the plans. All excess borrow excavation will be deducted from the appropriate borrow excavation quantity.

Obtain borrow source approval according to Subsection 008.02. Develop and restore Government located and provided borrow sources according to Subsection 008.03. Do not excavate beyond the established limits. When applicable, shape the borrow source to permit accurate measurements when excavation is complete. The borrow pit shall be landscaped after the excavation according to EMP.

201.09. Preparing Foundation for Embankment Construction.

Prepare the foundation for the embankment construction as follows:

(a) **Embankment less than 1.2 m high over natural ground.** Completely break up the cleared ground surface to a minimum depth of 150 mm by ploughing or scarifying. Compact the ground surface according to Subsection 201.11.

(b) **Embankment less than 0.6 m high over an existing asphalt, concrete, or gravel road surface.**

Scarify gravel roads to a minimum depth of 150 mm. Scarify or pulverize asphalt and concrete surfaces to 150 mm below the pavement. Reduce all pieces to a maximum size of 150 mm and a uniform material, prior to placing embankment.

(c) **Embankment across ground not capable of supporting equipment.** Dump successive loads of embankment material in a uniformly distributed layer to construct the lower position of the embankment. Limit the layer thickness to the minimum depth necessary to support the equipment.

(d) **Embankment on an existing slope steeper than 3:1.** Cut horizontal benches in the existing slope to a sufficient width to accommodate placing and compacting operations and necessary equipment. Bench the slope as the embankment is placed and compacted in layers. Begin each bench at the intersection of the original ground and the vertical cut of the previous bench.

201.10. Embankment Construction. Construct embankment conforming to the requirement of SNiP 3.06.03-85.

201.11. Compaction.

Compact as follows:

Rock embankment. Adjust the moisture content of the material to a moisture content suitable for compaction. Compact each layer of material to the full width with:

- (1) Two passes of 45-50 t compression-type roller, or
- (2) Two passes of a vibratory roller having a minimum dynamic force of 18 t impact per vibration and a minimum frequency of 1,000 vibrations per minute, or
- (3) Eight passes of 9 t compression-type roller or
- (4) Eight passes of a vibratory roller having a minimum dynamic force of 13.6 t impact per vibration and a minimum frequency of 1,000 vibrations per minute.

Proportion the compacting effort for layers deeper than 300 mm as follows:

For each additional 150 mm or fraction thereof, increase the number of roller passes in (1) and (2) above by two.

For two additional 150 mm or fraction thereof, increase the number of roller passes in (3) and (4) above, by four.

Operate compression-type rollers at speeds less than 6 km/h and vibratory rollers at less than 2.5 km/h.

- (b) **Earth embankment.** Adjust the moisture content of the material to within 2 per cent of the optimum moisture content. Determine the optimum moisture content according to GOST 22733-77.

Compact material placed in all embankment layers and the material scarified to a uniform density of not less than 95 per cent of the maximum density. Determine the maximum density according to GOST 22733-77.

The density and moisture content may be determined in conformity with GOST 5180-84 and using Kovalev device.

201.12. Ditches. Slope, grade, and shape ditches. Remove all projecting roots, stumps, rock, or similar matter. Maintain all ditches in an open condition and free from leaves, sticks and other debris.

Form furrow ditches by plowing or using other acceptable methods to produce a continuous furrow. Place all excavated material on the downhill side so that the ditch is approximately 500 mm below the crest of the loose material. Clean the ditch using a hand shovel, ditcher, or other suitable method. Shape to provide drainage without overflow.

201.13. Sloping, Shaping, and Finishing. Slope, shape, and finish according to SNiP 3.06.03-85.

201.14 Measurement. Measurements will be made as follows:

(A) Roadway excavation. When a roadway excavation pay item is shown in the Bill of Quantities and there is no pay item for embankment construction, measurement will be by volume as follows:

(1) Roadway excavation will include the following volumes:

- (a) Roadway prism excavation.
- (b) Rock material excavated and removed from below subgrade in cut sections.
- (c) Unsuitable material below subgrade and unsuitable material beneath embankment areas when a pay item for sub-excavation is not shown in the Bill of Quantities.
- (d) Ditches, except ditches measured under a separate bid item.
- (e) Conserved topsoil
- (f) Borrow material used in the work when a pay item for borrow is not shown in the Bill of Quantities.
- (g) Loose scattered rocks removed and placed as required within the roadway.
- (h) Conserved material taken from stockpiles and used in the work.
- (i) Slide and slipout material not attributable to the Contractor's method of operation.

(2) Roadway excavation will not include the following:

- (a) Overburden and other spoil material from borrow sources.
- (b) Overbreakage from the backslope in rock excavation.
- (c) Water or other liquid material.
- (d) Material used for purposes other than required.
- (e) Roadbed material scarified in place and not removed.
- (f) Material excavated when rounding cut slopes.
- (g) Preparing foundations for embankment construction.
- (h) Material excavated when benching for embankments.
- (i) Side or slipout material attributable to the Contractor's method of operation.
- (j) Conserved material stockpiled at the option of the Contractor.
- (k) Material excavation outside the established slope limits.

(B) Material Replacement. When a sub-excavation (replacement of roadbed soil) pay item is shown in the Bill of Quantities, measurement will be by volume in-situ.

(C) Borrow excavation. When a borrow excavation pay (unclassified borrow, select borrow, and select topping) is shown in the Bill of Quantities, measurement will be by volume in-situ or by weight. If borrow excavation is measured by volume, take initial cross-section of the ground surface after stripping overburden. Upon completion of excavation, re-measure cross-sections or take comparable measurements.

(D) Embankment construction. When an embankment construction pay item is shown in the Bill of Quantities, measurement will be by volume in final position. No measurements will be made for roadway excavation except as described in (3) below. No deductions will be made from the embankment construction quantity for the volume of minor structures.

(1) Embankment construction will include the following volumes:

- (a) Roadway embankments.
- (b) Materials used to backfill sub-excavated areas, holes, pits, and other depressions.
- (c) Material used to restore obliterated roadbeds to original contours.
- (d) Material used for dikes, ramps, mounds, and berms.

(2) Embankment construction will not include the following:

- (a) Preparing foundation for embankment construction.
- (b) Adjustments for subsidence or settlement of the embankment or the foundation on which the embankment is placed.

(3) When embankment construction and roadway excavation pay items are shown in the Bill of Quantities, roadway excavation will be measured by volume and include only the following:

- (a) Unsuitable material below subgrade and unsuitable material beneath embankment areas when a pay item for subexcavation is not shown in the Bill of Quantities.
- (b) Slide and slipout material not attributable to the Contractor's method of operations.
- (c) Drainage ditches, channel changes and diversion ditches.
- (d) Furrow ditches. Furrow ditches will be measured by length.
- (e) Rounding cut slopes. Rounding cut slopes will be measured by length horizontally along the centerline of the roadway for each side of the roadway.

Payment

201.15. The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for pay items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section.

Payment will be made under:

Pay Item	Pay Unit
20101 Roadway excavation	Cubic meter
20101A Rock loosening	Cubic meter
20102 Material Replacement	Cubic meter
20103 Unclassified borrow	Cubic meter
20104 Unclassified borrow	Ton
20105 Select borrow	Cubic meter
20106 Select borrow	Ton
20107 Select topping	Cubic meter
20108 Select topping	Ton
20109 Embankment construction	Cubic meter
20110 Furrow ditches	Linear meter
20111 Rounding cut slopes	Linear meter
20112. Leveling of slopes:	
– Cut slope	square meter
– Embankment slope	square meter
20113 Slope pitching	square meter

Section 202 - EXCAVATION OF NEW DITCHES

Description

202.01. This work consists of constructing new ditches and transportation of the excavated material to the dumping place.

Construction Requirements

202.02. Preparation for Ditch Construction.

Clear the area of vegetation and obstructions.

202.03. Ditches.

Excavate ditches according to the Drawings. Remove all projecting roots, stumps, rock, or similar matter. Maintain all ditches in an open condition and free from leaves, sticks, and other debris. No extra material is allowed to be left on ditch edges and all removed material should be taken to an approved waste dump.

202.04. Acceptance.

Ditched will be accepted under subsection 001.04.

Measurement

202.05. Construction of new ditches will be measured by volume.

Payment

202.06. The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section.

Payment will be made under:

Pay Item	Pay Unit
20201 Side ditch construction	Cubic Meter

SECTION 204 SUBGRADE PREPARATION

204.01 Description

Shape and compact subgrade before placing a base or surface course.

204.02 Material

Reserved.

204.03 Construction

Shape subgrade for its full width to required grade and cross section. Scarify the top of the subgrade and increase necessary materials to achieve the specified density and stability. Compact to [100] percent of maximum density to allow placement of base or surface course material without rutting or displacing the roadbed.

The Engineer will determine maximum density and in-place field density according to RACS IV -11.05.02-99 Table 24.

Ensure the finished subgrade surface is smooth and conforms to prescribed elevations before constructing the base or surface course. Limit the maximum variation from the subgrade to the prescribed elevation to [12mm].

Correct all finished sections damaged during construction operations at no cost to the Agency.

204.04 Measurement

- A. The Engineer will measure work acceptably completed as specified in Subsection 002 and as follows:
- B. The Engineer will measure the roadbed of divided highways separately.
- C. The Engineer will measure the length of ramps and loops between the ends of the exit and entrance noses along the centerline.

204.05 Payment

It will pay for accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
(A) Subgrade preparation	(m ³)

Such payment is full compensation for furnishing all materials, equipment, labor, and incidentals to complete the work as specified.

3. PAVEMENT

Section 301A – ASPHALT CONCRETE PAVEMENT WITH COLD RECYCLING METHOD

301.01. Works include demolition of the surface and mixing enriched with cement, leveling, compaction and forming in accordance with this specification and dimensions specified in drawings and/or Engineer's requirement. The final stabilized layer must have the thickness of the layer specified in the contract but not more than 300 mm.

Preparatory works

301.02. Prior to commencement of works the areas for milling/scarifying should be thoroughly investigated and checked. Presence of any underground utilities shall be detected and marked in order to avoid damage during the recycling operation. For any utilities which cannot be avoided during the recycling process have to be relocated.

Soft spots/weak sub grade.

301.03. Areas of weak sub grade or soft spots which have been identified either by preliminary investigations or during the recycling process shall be treated as follows:

- Removing and recovering the material of the pavement layers overlying the unstable material and stockpile for reuse
- Excavating the soft/unsuitable material to required depth and disposal
- Backfilling the excavation with suitable material in layers not exceeding 200mm

Coring and investigation

301.04. Coring need to be done to determine correct milling depth to ensure that the asphalt material can be milled or cut preferably without taking material from the existing unbound base course, drilling cores are to be extracted at least every 300 m. Based on this investigation the needed milling or cutting depth can be determined sufficiently exact.

A joint survey of the existing pavement shall be carried out prior to the commencement of milling works.

Construction Requirements

301.05. General

The direct-in-place cold recycling shall be performed with self-propelled equipment that is capable of

- milling/scarifying the surface to the depth shown on the plans,
- blending and mixing recycled asphalt and/or new aggregate and additives
- spreading and leveling the material and
- Compacting the resulting mixture to the desired density.

301.06. Weather limitations

Recycling operations shall not be performed when the ambient air temperature is below 10°C, when the weather is foggy or rainy, or when the conditions are such that in the Engineer's judgment, proper mixing, spreading and compaction of the material cannot be accomplished.

301.07. Cleaning of existing surface

The existing paved surface which is to be recycled shall be cleaned of all dirt, fabric, thermoplastic markers, rubberized materials, oils and other objectionable materials by an approved method prior to beginning the direct-in-place recycling process.

301.08 Milling/Scarifying

The pavement surface shall be milled/scarified to the required widths and depths. There shall be no damage to trees, shrubs or other items near the recycled pavement. It shall be the responsibility of the contractor to protect the adjacent landscape and environment from dust and other damage by shielding and/or water spray or other methods approved by the engineer.

301.09 Overlap of joints

To ensure complete recycling across the full width of the road, longitudinal joints between successive cuts shall overlap by a minimum of 150 mm. Cut lines pre-marked on the road surface shall be checked to ensure that only the first cut is the same width as the milling drum. All successive cut widths shall be narrower than the drum width by at least 150 mm. The recycling machine shall be steered so as to accurately follow the pre-marked cut lines. Any deviation in excess of 100 mm shall be rectified immediately by reversing to where the deviation commenced and reprocessing along the correct line, without the addition of any further water or stabilising agent.

The overlap width shall be confirmed before starting each new cut sequence and any adjustments made to ensure that the amount of water and fluid stabilising agent to be added is reduced proportionately by the width of the overlap.

The contractor shall ensure that between successive cuts (along the same longitudinal cut line) no gaps of unrecycled material remain, nor are any untreated wedges created where the milling drum first enters the existing material. The exact location at which each cut terminates shall be carefully marked. This mark shall coincide with the position of the centre of the mixing drum at the point at which the supply of stabilising agent ceased. To ensure continuity of the stabilised layer, the next successive cut shall be started at least 0.5 m (500 mm) behind this mark

301.10. Blending, mixing, spreading and levelling

For “direct-in-place” cold recycling method the required amount of new aggregates according mix design, usually a gravel-sand material will be laid on the surface of the existing asphalt pavement. Then both layers are to be homogenized by milling in the needed layer thickness. The recycled asphalt material and gravel-sand material, proportions according mix design shall be blended homogeneously. A grader should be used to manufacture the designed cross and longitudinal sections. The next step is the compaction of the layer in such a form, that subsequent driving on it by the recycler is possible...

301.11 Pre-treatment

If the new base or milled asphalt material is wet and above the optimum moisture content the material is to be pre-treated to dry out the material until below the optimum moisture content before spreading the cement for stabilisation. The pre-treatment can be done by mechanical means as the stabilizer or any other method approved by the Engineer.

301.12 Spreading of stabilising agent

The determined areas for stabilising shall be marked. On the surface of the layer constructed the determined rate of cement will be applied using an appropriate spreader.

Cement is to be uniformly spread according the determined amount or incorporated in the mixture by using a recycler. The moisture content shall be maintained at or below the optimum moisture during application of cement. Immediately after blending the required cement, the required amount of water shall be incorporated into the mixture, ensuring that no excessive concentration of water is on or near the surface of the mixture. Water, cement, and the recycled asphalt material shall be thoroughly mixed until water and cement are uniformly distributed throughout the mixture. The moisture content shall be maintained within a range of minus 1.0 percent of optimum moisture to plus 1.5 percent of optimum moisture during final mixing and compaction.

Mixing of both materials (the milled asphalt material and the gravel-sand material) as well as adding of cement into the material mixture shall be done by means of appropriate stabilizer equipped with a water batcher or with a recycler.

301.13 Compaction and trimming

Following the mix of the asphalt granulates and gravel-sand mixture with the cement this layer of the material stabilized by cement has to be shaped according to the profile and any undulations eliminated. Then the compaction of the mixture stabilized by cement shall commence by appropriate roller to the required density.

Stabilized material which for any reason cannot be compacted to the specified density shall be removed.

Pneumatic tire roller as well as vibrating steel drum roller should be used for compaction. The sequence and frequency of the rolling pattern to reach optimal results shall be as determined during the trials.

The final surface shall be free from surface laminations, segregated areas, corrugations, or any defects that the Engineer deems may adversely affect the performance of the layer. Defective sections shall be repaired at Contractor's expense to the satisfaction of the Engineer.

Fine trimming if necessary by motor grader to obtain the required levels shall be followed by final smooth rolling by pneumatic tire roller to knead down any loose material left on the surface.

The surface of the compacted layer stabilized by cement is to keep wet by spraying water.

After approx. 24 hours of laying time a vibrating roller is to drive on the surface of the by cement stabilized layer for getting micro cracks in the layer. These micro cracks in the layer stabilized by cement are necessary in order that uncontrolled shrinkage cracks will not appear in the base course stabilized by cement. These micro cracks in the base course can be achieved in the rule after three passes of the vibrating roller.

301.14 Prime coating / Curing

Subsequently the surface of the base course stabilized by cement shall be sprayed by bituminous emulsion as protection against evaporation. The addition rate of bituminous emulsion (bitumen content of min 50% by mass) shall be between 0.5 and 1.0 l/m². If the base course stabilized by cement and covered with bituminous emulsion will be under site traffic, the aggregate of size 4/8 mm is to spread on the surface (approx. 10 kg/m²).

The asphalt pavement on top of the cement stabilized base course shall not be placed earlier than 4 days after construction of the cement stabilised layer.

301.15 Technological requirements for a cement stabilized base course

The finished cement stabilised layer shall comply with the following requirements

(1) Cement

- Type of cement: CEM II 32,5 or
CEM III 32,5
- Cement rate: ≥ 80 kg/m² per m² of the mixture stabilized by cement

(2) Recommended grading for cement stabilized material from recycled asphalt and natural material

Sieve size Mm	Percentage by mass of total aggregate passing	
	min %	max %
50	100	
31.5	75	100
16.0	50	90
8.0	40	70
4.0	30	50
1.0	10	35
0.063	0	15

(3) Requirements to the mixture stabilized by cement

	Characteristic	Unit	Requirement
(1)	Proctor density (Standard Proctor value)	kN/m ³	≥ 21.0
(2)	Compressive strength after 7 days (Proctor specimen d: 150 mm) Standard Proctor compaction	MPa	≥ 3.0 - ≤ 5.0
(3)	Indirect tensile strength after 7 days (Proctor specimen d: 150 mm)	MPa	≥ 0.25 - ≤ 0.55

(4) Requirements to the base course stabilized by cement

	Characteristic	Unit	Requirement
(1)	Degree of compaction	%	≥ 97 single value ≥ 100 average value for each production shift
(2)	Evenness	mm	~ 15/4m lath
(3)	Thickness	%	Difference < 10 from required thickness

301.15. Acceptance. Cold regeneration construction will be accepted according to Subsection 002.04, provided that the work conforms to the plans and Specifications and is approved by the Employer's Project Manager or Project Manager's Representative

Measurement

Cold recycling

m²

Payment

Pay Item

Pay Unit

30101 Cold recycling h_{average}=

m²

Section 301B - ASPHALT CONCRETE PAVEMENT WITH COLD RECYCLING METHOD AND SUPPLEMENTED WITH BITUMEN

Description

301.01. Works include demolition of the surface and mixing enriched with cement and bitumen or bitumen emulsion, leveling, compaction and forming in accordance with this specification and dimensions specified in drawings and/or Engineer's requirement. The final stabilized layer must have the thickness of the layer specified in the contract but not more than 300 mm.

Preparatory works

301.02. Prior to commencement of works the areas for milling/scarifying should be thoroughly investigated and checked. Presence of any underground utilities shall be detected and marked in order to avoid damage during the recycling operation. For any utilities which cannot be avoided during the recycling process have to be relocated.

Soft spots/weak sub grade.

301.03. Areas of weak sub grade or soft spots which have been identified either by preliminary investigations or during the recycling process shall be treated as follows:

- Removing and recovering the material of the pavement layers overlying the unstable material and stockpile for reuse
- Excavating the soft/unsuitable material to required depth and disposal
- Backfilling the excavation with suitable material in layers not exceeding 200mm

Coring and investigation

301.04. Coring need to be done to determine correct milling depth to ensure that the asphalt material can be milled or cut preferably without taking material from the existing unbound base course, drilling cores are to be extracted at least every 300 m. Based on this investigation the needed milling or cutting depth can be determined sufficiently exact.

A joint survey of the existing pavement shall be carried out prior to the commencement of milling works.

Construction Requirements

301.05. General

The direct-in-place cold recycling shall be performed with self-propelled equipment that is capable of

- milling/scarifying the surface to the depth shown on the plans,
- blending and mixing recycled asphalt and/or new aggregate and additives (cement, bitumen, frothed bitumen, bitumen emulsion)
- spreading and leveling the material and
- Compacting the resulting mixture to the desired density.

301.06. Weather limitations

Recycling operations shall not be performed when the ambient air temperature is below 10°C, when the weather is foggy or rainy, or when the conditions are such that in the Engineer's judgment, proper mixing, spreading and compaction of the material cannot be accomplished.

301.07. Cleaning of existing surface

The existing paved surface which is to be recycled shall be cleaned of all dirt, fabric, thermoplastic markers, rubberized materials, oils and other objectionable materials by an approved method prior to beginning the direct-in-place recycling process.

301.08. Milling/Scarifying

The pavement surface shall be milled/scarified to the required widths and depths. There shall be no damage to trees, shrubs or other items near the recycled pavement. It shall be the responsibility of the contractor to protect the adjacent landscape and environment from dust and other damage by shielding and/or water spray or other methods approved by the engineer.

301.09. Overlap of joints

To ensure complete recycling across the full width of the road, longitudinal joints between successive cuts shall overlap by a minimum of 150 mm. Cut lines pre-marked on the road surface shall be checked to ensure that only the first cut is the same width as the milling drum. All successive cut widths shall be narrower than the drum width by at least 150 mm. The recycling machine shall be steered so as to accurately follow the pre-marked cut lines. Any deviation in excess of 100 mm shall be rectified immediately by reversing to where the deviation commenced and reprocessing along the correct line, without the addition of any further water or stabilising agent.

The overlap width shall be confirmed before starting each new cut sequence and any adjustments made to ensure that the amount of water and fluid stabilising agent to be added is reduced proportionately by the width of the overlap.

The contractor shall ensure that between successive cuts (along the same longitudinal cut line) no gaps of unrecycled material remain, nor are any untreated wedges created where the milling drum first enters the existing material. The exact location at which each cut terminates shall be carefully marked. This mark shall coincide with the position of the centre of the mixing drum at the point at which the supply of stabilising agent ceased. To ensure continuity of the stabilised layer, the next successive cut shall be started at least 0.5 m (500 mm) behind this mark.

301.10. Blending, mixing, spreading and levelling

For “direct-in-place” cold recycling method the required amount of new aggregates according mix design, usually a gravel-sand material will be laid on the surface of the existing asphalt pavement. Then both layers are to be homogenized by milling in the needed layer thickness. The recycled asphalt material and gravel-sand material, proportions according mix design shall be blended homogeneously. A grader should be used to manufacture the designed cross and longitudinal sections. The next step is the compaction of the layer in such a form, that subsequent driving on it by the recycler is possible.

301.11. Pre-treatment

If the new base or milled asphalt material is wet and above the optimum moisture content the material is to be pre-treated to dry out the material until below the optimum moisture content before spreading the cement and bitumen/bitumen emulsion/frothed bitumen for stabilisation. The pre-treatment can be done by mechanical means as the stabilizer or any other method approved by the Engineer

301.12. Spreading of stabilising agent

The determined areas for stabilising shall be marked. On the surface of the layer constructed the determined rate of cement will be applied using an appropriate spreader, and spreading of bitumen/bitumen emulsion/frothed bitumen will be carried out by means of recycling device.

Cement is to be uniformly spread according the determined amount or incorporated with bitumen/bitumen emulsion/frothed bitumen in the mixture by using a recycler. The moisture content shall be maintained at or below the optimum moisture during application of cement, bitumen/bitumen emulsion/frothed bitumen. Immediately after blending the required cement, bitumen/bitumen emulsion/frothed bitumen the required amount of water shall be incorporated into the mixture, ensuring that no excessive concentration of water is on or near the surface of the mixture. Water, cement, bitumen/bitumen emulsion/frothed bitumen and the recycled asphalt material shall be thoroughly mixed until water, cement and bitumen/bitumen emulsion/frothed bitumen are uniformly distributed throughout the mixture. The moisture content shall be maintained within a range of minus 1.0 percent of optimum moisture to plus 1.5 percent of optimum moisture during final mixing and compaction.

Mixing of both materials (the milled asphalt material and the gravel-sand material) as well as adding of cement, bitumen/bitumen emulsion/frothed bitumen into the material mixture shall be done by means of appropriate stabilizer equipped with a water batcher or with a recycler.

301.13. Compaction and trimming

Following the mix of the asphalt granulates and gravel-sand mixture with the cement, bitumen/bitumen emulsion/frothed bitumen this layer of the material stabilized by cement and bitumen/bitumen emulsion/frothed bitumen have to be shaped according to the profile and any undulations eliminated. Then the compaction of the mixture stabilized by cement and bitumen/bitumen emulsion/frothed bitumen will commence by appropriate roller to the required density.

Stabilized material which for any reason cannot be compacted to the specified density shall be removed.

Pneumatic tire roller as well as vibrating steel drum roller should be used for compaction. The sequence and frequency of the rolling pattern to reach optimal results shall be as determined during the trials.

The final surface shall be free from surface laminations, segregated areas, corrugations, or any defects that the Engineer deems may adversely affect the performance of the layer. Defective sections shall be repaired at Contractor's expense to the satisfaction of the Engineer.

Fine trimming if necessary by motor grader to obtain the required levels shall be followed by final smooth rolling by pneumatic tire roller to knead down any loose material left on the surface.

The surface of the compacted layer stabilized by cement is to keep wet by spraying water.

After approx. 24 hours of laying time a vibrating roller is to drive on the surface of the by cement stabilized layer for getting micro cracks in the layer. These micro cracks in the layer stabilized by cement are necessary in order that uncontrolled shrinkage cracks will not appear in the base course stabilized by cement. These micro cracks in the base course can be achieved in the rule after three passes of the vibrating roller.

301.14. Prime coating / Curing

Subsequently the surface of the base course stabilized by cement and bitumen/bitumen emulsion/frothed bitumen will be sprayed by bituminous emulsion as protection against evaporation. The addition rate of bituminous emulsion (bitumen content of min 50% by mass) shall be between 0.5 and 1.0 l/m². If the base course stabilized by cement and covered with bituminous emulsion will be under site traffic, the aggregate of size 4/8 mm is to spread on the surface (approx. 10 kg/m²). The asphalt pavement on top of the cement and bitumen/bitumen emulsion/frothed bitumen stabilized base course shall not be placed earlier than 4 days after construction of the cement stabilised layer.

301.15. Technological requirements for a cement and bitumen/bitumen emulsion/frothed bitumen stabilized base course

The finished cement and bitumen/bitumen emulsion/frothed bitumen stabilised layer shall comply with the following requirements.

(1) Cement

- Type of cement: CEM II 32,5 or
CEM III 32,5
- Cement rate: 1% per m³ for stabilized mixture

(2) bitumen/bitumen emulsion/frothed bitumen

- bitumen/bitumen emulsion/frothed bitumen: CEM II 32,5 or
CEM III 32,5
- bitumen/bitumen emulsion/frothed bitumen rate: 1% per m³ for stabilized mixture

(3) Recommended grading for cement stabilized material from recycled asphalt and natural material

Sieve size mm	Percentage by mass of total aggregate passing	
	min %	max %
50	100	
31.5	75	100
16.0	50	90
8.0	40	70
4.0	30	50
1.0	10	35
0.063	0	15

(4) Requirements to the mixture stabilized by cement and bitumen/bitumen emulsion/frothed bitumen

	Characteristic	Unit	Requirement
(1)	Proctor density (Standard Proctor value)	kN/m ³	≥ 21.0
(2)	Compressive strength after 7 days (Proctor specimen d: 150 mm) Standard Proctor compaction	MPa	≥ 3.0 - ≤ 5.0
(3)	Indirect tensile strength after 7 days (Proctor specimen d: 150 mm)	MPa	≥ 0.25 - ≤ 0.55

(5) Requirements to the base course stabilized by cement and bitumen/bitumen emulsion/frothed bitumen

	Characteristic	Unit	Requirement
(1)	Degree of compaction	%	≥ 97 single value ≥ 100 average value for each production shift
(2)	Evenness	mm	± 15/4m lath
(3)	Thickness	%	Difference < 10 from required thickness

301.15. Acceptance. Cold regeneration construction will be accepted according to Subsection 002.04, provided that the work conforms to the plans and Specifications and is approved by the Employer's Project Manager or Project Manager's Representative

Measurement

Cold recycling m²

Payment

Pay Item **Pay Unit**

30101 Cold recycling haverage= m²

Section 302 - THERMAL REGENERATION

NOT APPLICABLE

Section 303 - COLD MILLING OF ASPHALT CONCRETE PAVEMENT

Description

303.01 This work consists of milling of a/c pavement and transportation of a/c material to the dumping place.

Construction Requirements

303.02 Equipments:

Equipment with following capabilities should be provided:

- (a) **Compressed air lance.** A lance capable of providing clean, oil-free compressed air at a volume, pressure and temperature necessary to apply the sealant.
- (b) **Application wand.** A crack sealant applicator wand attached to a heated hose that is attached to a heated sealant chamber should be supplied as directed by the Engineer. The temperature controls shall maintain the temperature of the sealant within tolerances given by the manufacturer.
- (c) **Heating kettle.** An indirect-heating-type double boiler with a space between the inner and outer shells filled with oil or other heat transfer medium capable of constant agitation volume. Provide an accurate and calibrated thermometer having a range from 100°C to 350°C in 5°C graduations. Locate the thermometer so that the temperature of the joint sealant may be safely and reliably checked.
- (d) **Squeegee.** A hand-held squeegee for ensuring that the crack is filled to the existing surface.

303.03. Acceptance. The work will be accepted for payment provided that it has been built in conformance to the design and specifications pertaining to the payment involved and are approved by the Engineer.

Measurement

303.04. A/c milling is measured by surface.

Payment

303.05. Volumes measured and accepted as described above will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section.

Payment will be made under:

Pay Item	Pay Unite
30301 Cold milling of a/c pavement h= cm	Square meter

Section 304 - SEALING OF CRACKS AND JOINTS AND PATCHING

Description

304.01 This work consists of saw cutting (when applicable) patching of potholes, reconditioning of designated areas of asphalt pavement, and cleaning and filling cracks and joints in the asphalt pavement.

Material

304.02 Material shall conform to the following:

Bitumen	see 010.01
Aggregate	GOST 9128-2009 Table 2
Joint sealant	see 010.02
Emulsified bitumen	see 010.02

Construction Requirements

304.03 Equipment.

Furnish the equipment with the following capabilities:

- (e) **Compressed air lance.** A lance capable of providing clean, oil-free compressed air at a volume, pressure and temperature necessary to apply the sealant.
- (f) **Application wand.** A crack sealant applicator wand attached to a heated hose that is attached to a heated sealant chamber should be supplied as directed by the Employer's Project Manager or Project Manager's Representative. The temperature controls shall maintain the temperature of the sealant within tolerances given by the manufacturer.
- (g) **Heating kettle.** An indirect-heating-type double boiler with a space between the inner and outer shells filled with oil or other heat transfer medium capable of constant agitation volume. Provide an accurate and calibrated thermometer having a range from 100C to 350C in 5C graduations. Locate the thermometer so that the temperature of the joint sealant may be safely and reliably checked.
- (h) **Squeegee.** A hand-held squeegee for ensuring that the crack is filled to the existing surface.

304.04 Crack Cleaning and Sealing.

Clean the existing surface of all loose material, dirt, or other deleterious substances by brooming, flushing with water, or other approved methods. Clean all cracks and/or potholes with an average opening of 6 mm or more to make a sealant reservoir to the depth of the crack or at least 20 mm deep. Dry cracks before sealing.

When using the hot-compressed air lance, keep it moving so as not to burn the surrounding pavement and the joint. Place and finish the sealant within 5 minutes after heating with the hot-compressed air lance.

Seal with hot-poured elastic sealant.

Immediately screed the joint sealant or asphalt mixture to the elevation of the existing surface. Use a squeegee to ensure that a 75 mm wide band is centered on the finished sealed crack. Cover the sealed crack with a light application of blotter.

304.05 Resealing Defective Joints or Cracks. Reseal areas exhibiting adhesion failure, damage, missed areas, foreign objects in the sealant, or other problems which may accelerate failure.

304.06 Patching of potholes on designated areas. Cut sides of the area so that they be perpendicular or parallel to the road axis and edges be vertical. Depth of the cut must be > 3cm. Clean the cut potholes (by removing debris), deduct them, place bitumen on the bottom and edges of the cut, where bitumen consumption is 1.4kg/m² for the bottom, and 0.6kg/m² for edges in case of 3cm depth and 0.05kg/m² for each successive centimeter of depth. Patching should be on the same level with the adjacent areas and meet requirements for evenness. Patch the areas with dense asphalt concrete mix that is compatible with the adjacent pavement structure. Where patching depth is greater than thickness of pavement, it is necessary to place aggregate base course h=16-20cm impregnated with bitumen 4.12kg/m² depending on the difference between the required patching depth and thickness of the existing pavement.(see 306.03 & 306.05)

Compaction – Where necessary, the Contractor should use additional rollers, as needed, to ensure the specified asphalt thickness and characteristics of the surface efficiently and continuously.

Immediately after spreading asphalt mix, evenness of the surface is to be checked and irregularities eliminated.

To prevent sticking of the mix to steel-wheel rollers, wheels must be kept properly wet but excessive water is not allowed. Only water is permitted for moistening. Use of petrol, diesel fuel and other solvents is strictly prohibited.

Rolling starts along the road edges and directed towards the center gradually. The speed of this action should be approved by the Engineer. The axis of rolling should not be altered, and the direction should not be changed to the opposite abruptly. The compacting factor of hot mix of dense asphalt-concrete of types A and B (at precision 0.01) should not be less than 0.96, and that of dense asphalt-concrete of types B, Г, Д, and porous type – less than 0.95.

304.07. Acceptance. The work will be accepted for payment provided that it has been built in conformance to the plans and specifications pertaining to the payment involved and are accepted by the Employer's Project Manager or Project Manager's Representative.

Measurement

304.08. Joint sealant, crack cleaning and sealing will not be measured for payment. Patching will be measured by area.

Payment

304.09. Crack cleaning and sealing will not be paid. It is assumed that their cost is included in the cost of asphaltting works. Volumes measured and accepted as described above will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section.

Payment will be made under:

Pay Item	Pay Unit
30401 Asphalt patching	Square meter
30402 Asphalt patching with base replacement	Square meter

Section 305 - LEVELLING COURSES
Description

305.01 This work consists of building a levelling course of hot asphalt concrete mix.

Material

305.02. The applicable hot asphalt concrete mix and materials for mix fabrication shall conform to the requirements for fine graded porous asphalt concrete, where the maximum grain size of the coarse aggregate is 12 mm. Bitumen content can be reduced as directed by the Employer's Project Manager or Project Manager's Representative.

Construction Requirements

305.03. General. The mix design and placing, and the equipment used shall meet the requirements of Subsections 308.03-12.

Residual porosity should be 2.5-5% for dense asphalt-concrete, and 5-10% for porous asphalt-concrete.

The thickness of the levelling layer shall conform to the design thickness.

305.04. Mixing and Spreading. Prior to placement of the levelling layer the existing asphalt surface shall be prepared according to the Subsection 307.04. Carefully place tack coat as specified in section 307 to all surfaces to be levelled. Measure the aggregate and asphalt into the mixer according to the approved job mix formula, mix until all the particles are completely and uniformly coated with asphalt. Maintain the discharge temperature within the approved range given in sub-section 308.03. Spread the mixture on the prepared surface in a uniform layer. Do not place the mixture in a layer exceeding 50 mm in compacted thickness. When more than one layer is necessary, shape and compact each layer before the succeeding layer is placed. Approved asphalt paving equipment to be used for laying levelling courses. On small areas as instructed by the Employer's Project Manager or Project Manager's Representative, hand spreading is acceptable. Shape the final layer to line, grade, and cross-section. Tack coat between layers will be applied (if required by the Employer's Project Manager or Project Manager's Representative) according to Section 307.

305.04. Acceptance Sampling Procedure. Gradation, bitumen content of the mix and density of the course shall be tested according to the Subsection 308.16 (b).

305.05. Compacting. At least two rollers shall be required at all times: one self-propelled pneumatic-tired and one steel-wheeled roller. As many additional rollers as necessary shall be used by the Contractor to provide specified asphalt density and surface characteristics in an orderly, efficient and continuous manner. Immediately after asphalt mix has been spread the surface shall be checked and any irregularities adjusted. To prevent adhesion of the mix to steel-wheeled rollers, the wheels shall be kept properly moistened but excess water will not be permitted. Only water is accepted for moistening, solvents such as gasoline, diesel etc. is strictly forbidden.

Rolling shall start longitudinally at the sides of the road and shall gradually progress towards the center. On super-elevated sections, rolling shall begin on the low side and progress to the high side. The operating speed shall be approved by the Employer's Project Manager or Project Manager's Representative. The line of rolling shall not be charged suddenly or the direction reversed suddenly.

305.06. Surface Tolerance. Use a 3 m straight edge to measure the final surface in cross and longitudinal directions. A defective area is in this case an area with surface deviations of more than 6 mm in either of the directions. Correct all defective areas by loosening the material, adding or removing material, reshaping and compacting.

305.07. Acceptance. The placed and compacted levelling course is accepted in accordance with Subsection 002.04

Measurement

305.08. The levelling course of hot asphalt concrete mix is measured by weight.

Payment

305.09. The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the bid, schedule. Payment will be full compensation for the work prescribed in this Section.

Payment will be made under:

Pay Item	Pay Unit
30501 Placing of levelling layer of hot asphalt concrete mix	Ton

Section 306 - RECONSTRUCTION AND WIDENING OF EXISTING PAVEMENT

Description

306.01. This work consists of reconstruction and widening of the existing pavement by replacing and/or widening completely or partially road and/or pavement construction layers. The road and pavement structure may consist of one or several layers including pavement, base-course, sub-base and additional courses; like frost-resisting -, filter - layers, etc.

Pavement: The Uppermost layers of road structure that accommodates traffic load and is subject to direct disintegrating factors of climate; the pavement should provide the required running comfort of carriageway; pavement consists mostly of a lower bound course and a wearing course

Road base: Part of road structure, which provides distribution of traffic load, as well as reduces the pressure, on sub-base layers of pavement structure or directly on subgrade.

Sub-base layers (frost-resisting -, filter -courses): Layers between subgrade and upper pavement layers providing frost-resistance and drainage of pavement as well as preventing the mixing of pavement structure from subgrade.

Materials

306.02 Sub-base layers: Sand and gravel (sand and crushed stone) mix for sub-base layers shall meet the requirements of GOST 25607-2009 and of Table 45 of SNiP 2.05.02-85;

Mix Number	Total remainder, % in mass, on sieves of holes size, mm								
	70	40	20	10	5	2.5	0.63	0.16	0.05
1	0	10-20	20-40	25-65	40-75	60-85	70-90	90-95	97-100
2	0	0-5	0-10	10-40	30-70	45-80	60-85	75-92	97-100

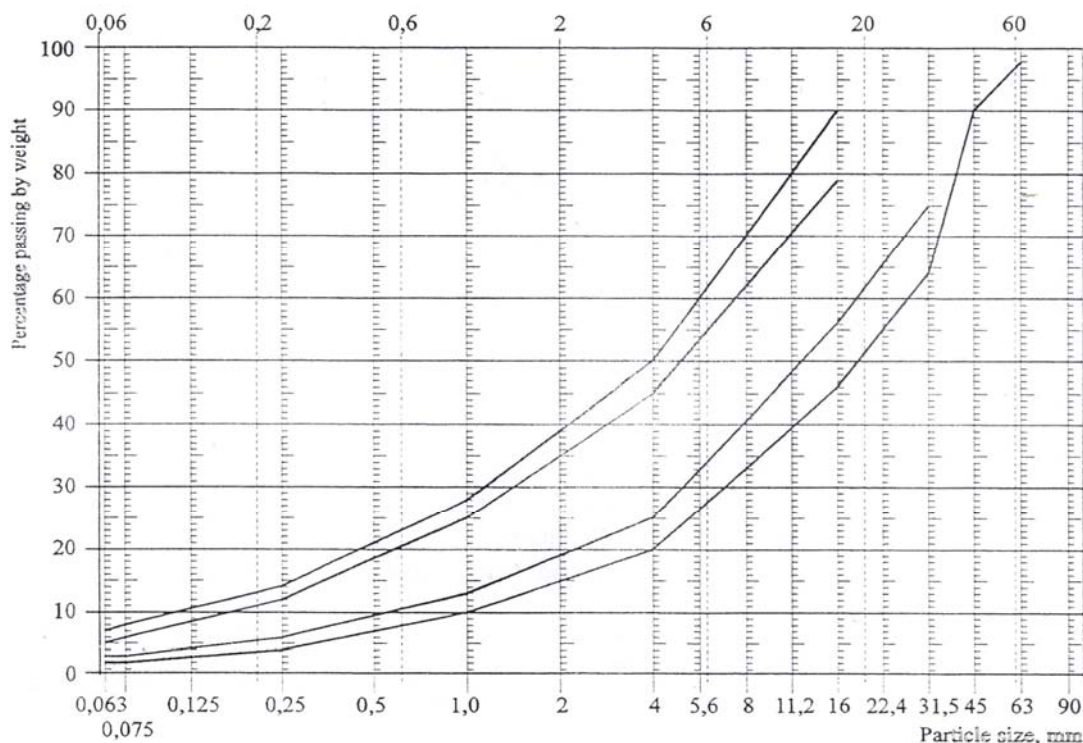
Crushed stone (gravel) of mix for additional base layers for roads of 1-111 categories shall have the strength grade of not lower than 200 (crushability shall be at least 24 for gravel and aggregate made out of gravel).

For filter layers of pavement the sand in accordance with GOST 8736-93 is permissible without additional testing, if the fraction of less than 0.14 mm in grain size is less than 25% of the total mass and clay fraction of no more than 5% of the total mass. The clay fraction for natural sand shall not be more than 0.5% of the total mass and for crushed stone not more than 1% , respectively. The permeability under maximum density shall not be less than 1 m/day (SNIP2.05.02-85, p.7.49).

Base course: Materials to be used for crushed stone and gravel pavement, and for base-course shall meet the requirements of GOST 25607-2009 (mix No.1 and 2 for pavement and No.3,4,5,6,7 and 8 for base-course) (p.7.47 SNiP 2.05 - 2-85) or Swedish National Publ.994:25E Road 94, Chapter 5 table 5.5.-1.

Sieve, mm	(0,063) ¹⁾	0,075	0,25	1	4	16	31,5	45	63
Highest max %	(7)	8	14	28	50	90	-	-	-
Normal max %	(5)	6	12	25	45	79	-	-	-
Normal min %	(3)	3	6	13	25	56	75	-	-
Lowest min %	(2)	2	4	10	20	46	64	90	98

¹⁾ Sieve 0.063 (and its value) is an alternative to sieve 0.075.



Grade on strength and frost-resistance of crushed stone/gravel in the mix shall meet the requirements of table 44 of SNiP 2.05.02-85.

Property indices of stone materials	For pavement	For base
Strength grade of stone crush in saturated state;		
minimum value		
- volcanic and metamorphic rocks	800	600
- sedimentary rock	600	200
Gravel and crushed stone out of gravel	crushability 12	crushability 24
Grade by wear out abrasion, not lower than	abrade III	abrade IV
Grade by frost-resistance for regions with average;		
Monthly air temperature of the coldest month, °C		
- from 0 up to minus 5	15	-
- from minus 5 up to minus 15	25	-
- from minus 15 up to minus 30	50	15
Quantity of crushed grains; % on mass, not less than:	70	70

Note: The grading and material consumption in the design documents are for guidance only.

Construction Requirements

306.03. General. Excavation for reconstruction shall be carried out in accordance with the Section 201. Before widening the existing pavement, existing shoulders specified in this Section are to be removed in accordance with the Subsection 310.03.

306.04. Sand sub-base shall be placed along the whole width of widening part and shoulders, where shown. Base course for the whole road width or for the widening part shall be placed according to the design and in conformity with SNiP 3.06.03-85. Asphalt concrete shall be placed, compacted and finished in accordance with Subsection 308 and p. 10.16-10.32 of SNiP 3.06.03-85 (presented below). Joints, edges and connection points of existing pavement and re-spreading shall be done in conformity with Subsection 308.14.

10.16

Works for construction of a/c pavement and base course shall necessarily be carried out in dry weather conditions. Placement of a/c mix in spring and summer when air temperature is not lower than 5 °C, and in autumn when air temperature is at least 10 °C.

10.17

Before placing a/c mix (1-6 hours), it is necessary to treat the surface of bottom course with cutback bitumen (Table N 14).

10.18

It is necessary to place a/c mix by asphalt paver across the whole road width.

10.19

When placing a/c layer by asphalt paver, the placed thickness should be more than the designed one by 10-15%.

10.20

As a rule, active compacting asphalt paver is used when placing structural layer of more than 10cm.

10.21

Active compacting asphalt paver, dense a/c of type A and B, porous and highly porous a/c where the content of crushed stone (gravel) is more than 40% of the whole mass, paving rate – 2-3 meter per minute.

10.22

When placing the structural layer of road dressing, the temperature of a/c mix should comply with GOST 9128-2009.

It is necessary to start compaction of a/c mix immediately after placement in accordance with requirements of Table N 14.

Table N 14

Type of mix Թիպի խմոր	Bitumen brand	Temperature of a/c mix before compaction, °C	
		Dense a/c of type A and B, Porous and highly porous a/c, where the content of crushed stone (gravel) is more than 40% of the whole mass	Dense a/c of type B, Г and Д, Porous and highly porous a/c, where the content of crushed stone (gravel) is more than 40% of the whole mass and highly porous sandy asphalt
Hot	БНД 40/60, БНД 60/90, БН 90/130, БН 60/90, БН 90/130	120-150	100-130
Warm	БНД 130/200, БНД 200/300, БН 130/200, БН 200/300,	100-140	80-110
	СГ 130/200, МГ 130/200, МГО 130/200,	70-100	
Cold	СГ 70/130, МГ 70/130, МГО 70/130,	Not lower than 5	

10.23

Dense a/c of type A and B, as well as porous and highly porous a/c, where the content of crushed stone is more than 40% of the whole mass is first compacted by 16-ton rollers (with pneumatic wheels) (6-10 passages) or 10-13-ton flat rollers (8-10 passages) or 6-8-ton vibrorollers (5-7 passages) and finally by 11-18-ton flat rollers (6-8 passages).

10.24

When an asphalt paver with ramming board and vibrating plate (ДС-155) is used to place dense a/c of type A and B, as well as porous and highly porous a/c where the content of crushed stone is more than 40% of the whole mass, it is first compacted by 10-13-ton flat rollers, 16-ton rollers (with pneumatic wheels), or 6-8-ton vibrorollers (4-6 passages) and then by 11-18-ton flat rollers (4-6 passages).

10.25

Cold a/c mix is preliminary compacted by 16-ton rollers (with pneumatic wheels) (6-8 passages) or 6-8-ton flat rollers (4-6 passages) and the final compaction is done under traffic by regulating movement of vehicles on the whole road width where speed is not greater than 40 km/ph.

10.26

When placing a/c layer 10-18cm thick, it is first compacted by self-propelled rollers (with pneumatic wheels) (6-8 passages), and then by 11-18-ton flat rollers (4-6 passages).

10.27

A/c mix containing polymer is compacted by 6-8 or 10-13-ton rollers.

10.28

When a/c pavement is placed across the whole road width in two layers, it is necessary to place it by using two asphalt pavers simultaneously or warm up the laid layer with infra-red rays when placing the next lane or cover the bordering of the laid layer with hot a/c 10-20cm wide. After heating, it is cleaned and poured under the new layer.

10.29

During compaction of the first layer, a strip 10cm wide is not compacted from the side of joining bordering. Compaction of the next layer starts from the joining section longitudinally so that connection is smooth and dense.

10.30

Cross-sectional connection should be perpendicular to the road axis.

10.31

If defects (cavities, sections with more or less bitumen, etc.) are observed on the pavement or the base after completing compaction such sections are cut (vertical walls parallel to the axis), bituminized, a/c mix is placed and compacted.

10.32

During reconstruction, it is necessary to eliminate damages (cracks and potholes) before placing an a/c layer.

306.05 Construction of base-course. The moisture content of the sand and gravel mix during the construction shall be close to the optimum and the deviation shall not be more than $\pm 5\%$. If the moisture content, differs more the mix shall be moistened as required 20-30 minutes before the compaction is carried out (SNiP 3.06.03-85 p.7.9). The placed mix shall be compacted in accordance to requirements of p.7.1 and p.7.5 of SNIP 3.06.03-85. Construction of base-course and pavement structure by penetration method shall be carried out in accordance with p.9.1 and p 9.32-9.39 of SNiP 3.06.03-85 (presented below).

7.9

It is not allowed to prepare gravel-sand or sand-crushed stone mix directly on the road(will be done preferably at the plant).. The optimum grading should conform to the requirements of GOST 25607-2009. When placing, moisture of the mix should be close to the optimum (permissible deviation – no more than 10%). If the moisture content is not sufficient then it is necessary to moisten the mix 20 -30 before compaction.

- a) For each type of unbound pavement material, the Contractor will, before the works commence, construct a trial section of at least 300 sq.m. in order to:
 - properly select equipment for mixing, placing and compacting,
- b) Determine the number of roller passes for required compaction of the course.
 - determine the required thickness of the course in its loose state, in order to achieve the required thickness in the compacted state,

7.1

Thickness of the layer should be 1.5 times more than the size of the largest particle and at least 10cm when placed on solid ground and at least 15cm when placed on sand.

7.5

Compaction of the base in the first and second stages is done by rollers (with pneumatic wheels) weighing at least 16 tons (air pressure in tires – at least 0.6-0.8 MPa), trailed vibrorollers weighing at least 6 tons, grid rollers weighing at least 15 tons, self-propelled flat rollers weighing 10 tons with combined weight 16 tons more. The total number of passages should be at least 30 (10 in the first stage and 20 in the second stage).

9.1

Before starting the works, it is necessary to check adhesion of binder with minerals according to GOST 12801-98, GOST 18659-2005.

9.32

Paving and construction of the base with bitumen, oil tar or emulsion by impregnation should be implemented in dry weather with air temperature at least 5 °C.

9.33

Pavement with crushed stone by impregnation with materials of volcanic origin should have strength of at least grade 800. Pavement with materials of sedimentary and metamorphic origin should have strength of at least grade 600. The strength of materials for bases where crushed stone is used should be at least grade 600.

9.34

When building a structural layer by impregnation, crushed stone should be of four fractions: 20-40 (or 25-40), 10-20 (or 15-25), 5-10 (or 3-15) mm.

9.35

When building the base and pavement, the designed layer of 0.9 size is accepted with sizes 40-70 or 20(25)-40mm of the main (first) fraction of crushed stone where the compacting factor is 1.25.

9.36

Construction of base and pavement with bitumen or tar penetration is carried out with the following sequence: main (first) fraction of crushed stone is distributed then compacted with 6-8 tons rollers (5-7 passing), 50% of total volume of penetration is spread, the first portion of wedging crushed stone is distributed, compacted with 10-13 tons rollers (2-4 passing), 30% of total volume of penetration is spread, the second portion of wedging crushed stone is distributed, compacted with 10-13 tons rollers (3-4 passing), 20% of total volume of penetration is spread, Last portion of wedging crushed stone is distributed, compacted with 10-13 tons rollers (3-4 passing).

9.37

Crushed stone is compacted with water (8-10 liter/m³). Bitumen or oil tar should be poured when crushed stone is dry, and emulsion should be poured when it is moist.

9.38

Wedging and compacting works shall be carried out immediately after impregnation before cooling.

9.39

Traffic is allowed after applying and compacting the last portion of crushed stone.

306.06 Quality Control shall follow the requirements and methods indicated below:

- (a) aggregate, gravel pavement and sub-base construction; p.1.13, p.7.35-7.36 of SNiP 3.06.03.85.
- (b) base course and pavement by penetration method; p.9.50 of SNiP 3.06.03.85
- (c) asphalt concrete mix; p.10.39 of SNiP 3.06.03-85
- (d) asphalt concrete pavement and base course construction; p.1.14, 10.40 of SNiP 3.06.03- 85.
- (e) compaction degree (accurate within 0.01) of bearing course of pavement shall be not less than:
 - 0.99 - for dense asphalt concrete of hot mix A and B
 - 0.98 - for dense asphalt concrete of hot mix B, porous and high porosity asphalt concrete.

SNiP 3.06.03.85, p.1.13, p.7.35-7.36, p.9.50, p.10.39, 10.40 presented below.

1.13

During construction of the road "dressing", it is necessary to check the quality of works on each 100m: road marking endwise, width, thickness of uncompacted layer placed endwise, cross slope, etc.

7.35

Besides requirements of clause 1.13, it is necessary to check the following in each shift during construction of crushed stone, gravel and slag pavement, base and roadway:

Moisture of crushed stone and sand-cement mixture in accordance with GOST 8269.0-97 and GOST 5180-84, and the strength of sand-cement in accordance with GOST 23558-94.

Permanently conduct visual supervision of the quality of compacting and establish a procedure for supervision of maintenance.

7.36

To check the quality of compacting crushed stone, gravel and slag base and pavement, it is necessary to make control passing with 10-13-ton rollers: there should appear no trace and wave on the base (pavement). Compaction control of the placed material shall be carried out using the Proctor method according to GOST 22733-2002, ASTM D 1557 or EN 13286

9.50

When constructing the base and pavement by impregnation, it is necessary to check:

Temperature of binder during each impregnation

Conduct permanent visual control of even distribution of the binder and the quality of its compaction according to clause 8.25.

10.39

When producing a/c mix, it is necessary to check:

Temperature of bitumen and mineral fillers. Temperature of finished a/c mix should be checked on each truck.

The quality of the mix is checked during each shift in accordance with GOST 9128-2009 and GOST 12801-98. The quality of bitumen is checked in accordance with GOST 11501-78 and GOST 11503-74.

10.40

Besides requirements of clause 1.14, it is necessary to check the following when constructing the base and pavement:

Temperature of hot and warm a/c mix on each truck,

Perform permanent control over cross-sectional and longitudinal connections of the applied layer.

306.07. Acceptance. Reconstruction and widened pavement construction will be accepted according to Subsection 002.04, provided that the work conforms to the plans and Specifications and is approved by the Employer's Project Manager or Project Manager's Representative.

Measurement

306.08. Reconstruction and widening of existing pavement is measured by area. Sub-base and base course placing is measured by area mentioning the thickness of compacted course..

Payment

306.09. The accepted quantities measured as provided above, will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section and must be approved by the Employer's Project Manager or Project Manager's Representative.

Payment will be made under:

Pay Item

Pay Unit

30601 Placing sub-base course (sand)	square meters
30602 Asphalt concrete 4cm	square meters
30602 Asphalt concrete 5cm	square meters
30602 Asphalt concrete 6cm	square meters
30603 Base course (crushed stone)/lower layer	square meters
30603 Base course (crushed stone)/upper layer	square meters
30604 Dismantling of pavement h_{average}	square meters

Removed old A/C layers shall be used in the unbound base course after crushing to a maximum size of 30 mm. The old A/C material shall be mixed into the base course material.

Old A/C can also be used as filling in shoulders or under sidewalks after crushing.

Section 307 - BITUMEN PRIME AND TACK COAT

Description

307.01. This work consists of applying a cut back bitumen prime and tack coat or emulsified bitumen.

Material

307.02. Material shall conform to the following documents:

- Bitumen	Subsection 010.01
- Cut back bitumen	Subsection 010.02
- Emulsified bitumen	Subsection 010.03

Construction Requirements

307.03. Equipment. Equipment to be used shall be approved by the Employer's Project Manager or Project Manager's Representative.

307.04. Surface Preparation.

307.04.1 Prepare the surface for a prime coat as follows:

Clear the existing surface of all loose material, dirt, or other delirious substances by approved methods. Where required by the Employer's Project Manager or Project Manager's Representative, immediately prior to the application of prime coat, the surface of the base layer shall be lightly sprayed with water, but in no case saturated.

307.04.2 Prepare the surface for a tack coat as follows:

(a) Patching. Remove and dispose of unsuitable asphalt material in the area to be coated. Smoothen all rough edges within the pothole. Clear the existing surface of all loose material, dirt, or other delirious substances by approved methods.

(b) Prelevelling. After prelevelling dips, depressions, sags, excessive or non existing crown or other surface irregularities with asphalt concrete according to Section 311 clear the existing surface of all loose material, dirt, or, other delirious substances by approved methods.

(c) Asphalt surfaced roads. Clean the existing surface of all loose material, dirt, or other delirious substances by approved methods.

307.05. Weather Limitations. Apply binder prime and tack coat on a dry, unfrozen surface according to Subsection 308.07.

307.06. Bitumen Application.

Calibrate the bitumen distributor spray bar height, nozzle angle, and pump pressure and check longitudinal and transverse spread rates weekly.

Protect the surfaces of nearby objects to prevent spattering or marring. Spread building paper on the surface for a sufficient distance from the beginning and end of application so that the flow through the distributor nozzles may be started and stopped on the paper. All equipments to be used in the work must be in good condition and functioning property.

Prime coat application is to be at the rate of 0.6 – 1.0 kg/sq.m, or as required in the plans.

Tack coat application is to be at the rate of 0.2 – 0.3 kg/sq.m, or as required in the plans.

The Employer's Project Manager or Project Manager's Representative will approve the exact application rate, temperature, and area to be treated before the application and may make adjustments for variations in the field conditions. Apply the bitumen uniformly with an asphalt distributor. Move the distributor forward at the proper application speed at the time the spray bar is opened. Use care not to apply excess bitumen at the junction of spreads.

Apply the coat at a rate to be established by the Employer's Project Manager or Project Manager's Representative. When a tack coat cannot be applied with an asphalt distributor spray bar, apply the tack coat uniformly and completely by fogging with a hand spray attachment or by another approved method.

If excess binder material is applied, squeegee the excess from the surface. Allow the primed or tacked surfaces to completely cure before placing the covering course. Place the covering course within 8 hours of placing the prime/tack coat.

307.07 Acceptance. Prime and tack coat treatment will be accepted under Subsection 002.04.

Measurement

307.08. There will be no measurements of this item.

Payment

307.09. There will be no payment of this item. Costs associated with this task will be considered as being included in the related pay items for the construction work.

Section 308 - HOT ASPHALT CONCRETE PAVEMENT

Description

308.01. This work consists of constructing one or more courses of hot asphalt concrete prepared according to the requirements presented below.

Material

308.02. Materials for asphalt concrete mix shall comply with the requirements of existing standards. The quality of bitumen by its physical properties shall comply with requirements of Section 010 of these specifications.

(a) Binder (Bitumen) testing shall be carried out in accordance with corresponding tests complying with GOST 11501-78, 11505-75, 11506-73, 18180-72, 4333-87. Bitumen grade depends on asphalt concrete mix type, climatic conditions and road category.

(b) Coarse aggregate (crushed stone) shall comply with the requirements of Section 011 of these Specifications.

(c) Fine aggregate (sand) shall comply with requirements of Section 011 of these Specifications.

(d) Filler (mineral powder) shall comply with requirements of Section 011 of these Specifications.

308.3. Asphalt concrete mix shall be designed taking into account asphalt concrete type, grade and usage indicated in designs.

(a) Physical and mechanical indices shall be as follows:

Indices	Asphalt concrete mix grades	
	I	II
1. Required strength in compression, MPa (kg/cm ²), at temperature:		
a) 20C, not less than	2.5 (25)	2.2(22)
b) 50C, not less than, for a/c type A/B	0.9(9)/ 1.3 (13)	0.8(8)/ 1.2(12)
c) 0C, not more than	13(130)	13(130)
2. Water stability ratio, not less than	0.85	0.8
3. Water stability ratio under long term saturation, Not less than	0.75	0.7
4.Swelling, % in mass, not more than	0.5	1.5

(b) Residual porosity of asphalt concrete shall be: 2.5-5.0% of volume for dense asphalt-concrete, and 5-10% of volume for porous asphalt-concrete.

(c) The grading of the asphalt concrete mix shall comply with the following requirements of GOST 9128-2009:

Type of mix	Sieve holes, mm (passage)									
	20	15	10	5	2.5	1.25	0.63	0.315	0.16	0.071
Hot										
High density	90-100	70-100	56-100	35-50	24-50	18-50	13-50	12-50	11-28	10-16
Dense										
	continuous grading									
A	90-100	75-100	62-100	40-50	28-38	20-28	14-20	10-16	6-12	4-10
Б	90-100	80-100	70-100	50-60	38-48	28-37	20-28	14-22	10-16	6-12
В	90-100	85-100	75-100	60-70	48-60	37-50	28-40	20-30	13-20	8-14
Г				80-100	65-82	45-65	30-50	20-36	15-25	8-16
Д				80-100	60-93	45-85	30-75	20-55	25-33	10-16
	Gap grading									

A	90-100	75-85	62-70	40-50	28-50	20-50	14-50	10-28	6-16	4-10
Б	90-100	80-90	70-77	50-60	38-60	28-60	20-60	14-34	10-20	6-12
Cold										
Бх	90-100	85-100	70-100	50-60	33-46	21-38	15-30	10-22	9-16	8-12
Вх	90-100	85-100	75-100	60-70	48-60	38-50	30-40	23-32	17-24	12-17
Гх, Дх				80-100	62-82	40-68	25-55	18-43	14-30	12-20

(d) Recommended bitumen content in mix is 5...6,5%

(e) Tolerance in dosage of asphalt concrete mix component compared to the total mass is as follows:

- Coarse and fine aggregates (crushed stone and sand): +/- 3%
- Filler and binder (mineral powder and bitumen): +/- 1,5%

(f) Application temperature of asphalt concrete mix shall comply with the requirements of the Subsection 010.03 in these Specifications.

308.04. Mixing Plant. The mixing plants should be approved by the Employer's Project Manager or Project Manager's Representative. The asphalt plants shall be of batch mix type with automatic controls and with a capacity of at least 50 tons/hour. At least four cold bins for different aggregate fractions are required. The weighs of the plant shall be calibrated before the start of the production or whenever directed by the Employer's Project Manager or Project Manager's Representative. Asphalt concrete mix should be weighed on vehicle scales up to 2% in accuracy.

308.05. Pavers. After 10 m testing of layering a/c pavers shall be approved by the Employer's Project Manager or Project Manager's Representative and shall be of modern manufacture and equipped with ramming timber and vibrating screed. It shall be capable of laying asphalt concrete with no segregation, dragging, burning or other surface defects and within specified level and surface regularity tolerances. The auger and compacting beam must not be so worn out, to cause segregation or unevenness.

308.06. Road base preparation. The surface shall be prepared according to Section 307 of the Specifications. An even bitumen prime or tack coat shall be applied along entire surface, contact surface of curbs, gutters, manholes and other structures, according to SNiP 3.06.03-85. Protect near by areas from spatter or splashing during the application.

308.07. Weather Limitations. Works, on asphalt concrete pavement and sub-grades construction shall be carried out in dry weather and during daylight hours. Place hot mixes at the air temperature of not less than +5C.

308.08. Asphalt Preparation. Before starting asphalt operations the following should be carried out:

a) Trial batch

1. Prior to the commencement of mixture production, the Contractor will prepare a trial batch of the mixture in presence of the Supervisor. The trial batch will first be performed without binder, so that the accuracy of aggregate proportions and the compliance of the combined aggregate grading with the design grading curve can be determined. A combined aggregate sample shall be collected after discharge from the mixer.
2. After the combined aggregate grading has been tested, the full trial batch, with the binder content in accordance with the Job Mix Formula, will be produced. The binder content in the mixture shall be determined by the extraction test method.

b) Compaction Trial

The Contractor shall prepare a compaction trial at least three days prior to the commencement of the Works, for the purpose of:

- 1) Determining the suitability of the used equipment,
- 2) Determining the pre-compaction thickness of the asphaltic mixture lift necessary to obtain the layer thickness specified in the design documentation,
- 3) Determining the necessary number of roller passes, so that the layer is adequately compacted.

NB: For such a trial, the Contractor shall use the same materials and equipment which will be used for the asphalt works in the Project.

The Supervision and the Project Manager Representative will fix the location of the trial section. The trial area will be not less than 30m not more than 50m long and of a width and thickness approved by the Supervision and the Project Manager Representative. A set of cores shall be taken and assessed for compliance with respect to degree of compaction in accordance with SNIP 3.06.03.85 and with respect to the laboratory density of samples prepared in accordance with GOST 12801-98. The Contractor will be allowed to start asphalt works only after the test section has been approved by the Supervision and the Project Manager Representative. Heat evenly the bitumen to provide a continuous supply of the heated bitumen from storage to the mixer. Do not heat bitumen above temperature limits given in Subsection 010.03 of these Specifications.

308.09. Aggregate Preparation. Prior to mixing supply, heat, dry, and deliver crushed stone (gravel) and sand to the mixer at a temperature sufficient to produce a mixture within approved temperature range. Reduce the moisture content of the aggregate up to 1 per cent or less. Adjust flames used for drying and heating to prevent damage to and contamination of the aggregate.

308.10. Mixing. Measure the aggregate and bitumen into the mixer in accordance to the job-mix formula approved by the Employer's Project Manager or Project Manager's Representative. Mix until all the particles are completely and uniformly coated with bitumen. The temperature of mix shall all the time during mixing and loading be maintained within the approved range given in Subsection 010.03.

308.11. Hauling. Use vehicles with tight, clean, and smooth surface for hauling asphalt concrete mixtures and provide each vehicle with necessary documentation related weigh calibration. The duration of asphalt concrete hauling is determined by the minimum temperature condition for spreading in accordance with Subsection 308.13. The surface of beds should be covered by thin coat of approved material to prevent the mixture from adhering to the beds. Do not use petroleum derivatives or other coating materials which contaminate or alter the characteristics of the mixture. Drain the bed before mix loading. Equip each truck with a canvas cover or other suitable material of sufficient size to protect the mixture from the weather influence. Where necessary to maintain the mix temperature, use insulated truck beds and securely fastened covers. Provide access ports or holes for checking the temperature of the asphalt mixture in the truck.

308.12. Placing and Finishing. Mixture placing and finishing must be arranged without any unnecessary pauses and the temperature of the mixture shall not drop below the permissible temperature. The laying temperature measured from several points of the load must meet the requirements of mixing temperature of Subsection 010.03. If the temperature is incorrect the load must be rejected, if not approved by the Employer's Project Manager or Project Manager's Representative to be used in secondary places. Before beginning of laying the adjustments of the machinery, which have effect on how well the mix moves in the paver and the quality of surface, must be put in order. Place the asphalt concrete mixture as continuously as possible. Work and traffic arrangements must be done in a way that the traffic does not damage the edges of laid pavement. The damaged edges must be cut and repaired by repaving the damaged area. Asphalt concrete mix shall be placed by paver providing full width of the strip.

308.13 Compacting. Compact the mixture so that the asphalt concrete residual porosity is within the range of 2.5% - 5% for dense asphalt concrete and 5%-10% for porous one. The density of asphalt concrete of hot mix of "A" and "B" types shall not be less than 0.99 (accurate within 0.01), and of "B", "C", "D" types and porous asphalt concrete type not less than 0.98 (accurate within 0.01). The number of rolling equipment must be sufficient compared with the capacity of the production. Compact the surface so that no harmful roller tracks or cracks will appear. Do not pass rollers over the unprotected end of a freshly laid mixture or leave the roller on freshly laid soft surface. The proper evenness and pavement cross-fall shall be kept continuously during rolling. Do not allow traffic on newly laid pavement before it has cooled down enough to avoid rutting.

Start compaction immediately after placing, keeping the temperature range of the mix at the beginning not less than 120° C. Mix of asphalt concrete of A and B types and for porous asphalt concrete shall be compacted first with a pneumatic-tired roller at least 16 tons in weight (6-10 passages) or with a steel-wheel roller at least 10-13 tons in weight (8-10 passages) or by vibrating rollers 6-8 tons in weight (5-7 passages). Intermediate rolling should be carried out with a pneumatic-tired roller and final rolling with a steel-wheel 11-18 tons in weight (6-8 passages). Rolling shall begin at the side and proceed longitudinally parallel to the centre-line, each trip overlapping one-half of the roller width. On super-elevated curves, rolling shall begin at the low side.

At the beginning the speed of roller should not exceed 5 km/hour for steel-wheel roller, 3 km/hour for vibrating roller and 10 km/hour for pneumatic-tired roller. The roller wheels should be continuously moistened to avoid the adhesion with surface of the mix laid.

308.14. Joints, Trimming Edges, and Clean Up. At connections to the existing pavement and previously placed lifts, make the transverse joints vertical to the depth of the new pavement. Form transverse and longitudinal joints by cutting of the previous layer to expose the full depth of the course. No ruts or unevenness should be formed to the joint area. Joint area must be carefully cleaned and if cooled it must be heated or coated with tack coat before doing adjacent pavement. Apply a bitumen tack coat to the edge of the joint for both transverse and longitudinal joints according to Section 307. Avoid the rolling along non-protected ends of newly laid mix. Cut material from edges and dispose all discarded asphalt material to a site, approved by Employer's Project Manager or Project Manager's Representative.

308.15. Pavement Smoothness. Measure the smoothness of the finished surface course after final rolling. For smoothness measurement both in cross direction and in parallel to the centre line a metal straightedge 3 m in length shall be used. A defective area is considered an area with surface deviations in excess of 7mm between the straightedge and the surface. Correct defective area and measure again after the correction for acceptance. New pavement should be uniform without segregations, cracks, bleeding of binder etc.

308.16. Acceptance Procedures for Asphalt. Asphalt materials will be accepted in accordance to Subsection 002.04 and the requirement of section 308.02

(a) Certification. Deliver a certification signed by the supplier to cover the quality and the quantity of binder and the condition of container for each shipment. Provide test result as required by the Employer's Project Manager or Project Manager's Representative.

(b) Acceptance sampling procedures. Mix and asphalt concrete samples for acceptance will be selected, obtained and tested, as follows:

1) Gradation of asphalt concrete and bitumen content: At starting of asphalt production and in case of job-mix formula is changed or if in any doubt of the right composition of the mixture, the required number of samples is taken from asphalt plant for testing. On sample for every 500 tons to be taken randomly or one sample at least daily from placed but not compacted pavement.

2) Thickness and density of samples selected from the finished asphalt concrete layer: A set of 5 core samples from carriageway is taken at the beginning of works, thereafter one set per each 10 000 m² of pavement. Core samples shall be taken randomly and thickness and density shall be determined. If required, the additional set of cores might be taken. If traffic intensity is ≥ 4000 vehicle/day or there are cracks and large porosity then the testing of samples have to be done with Marshall device. .

3) One sample of bitumen shall be taken from each shipment to the plant and from each binder type as directed by the Employer's Project Manager or Project Manager's Representative

4) Aggregate samples shall be tested in the beginning of the production and, if aggregate is changed or as directed by the Employer's Project Manager or Project Manager's Representative

5) Mineral filler: Mineral filler is tested for each 5000 tons or whenever the quality is suspected or as instructed by Engineer.

308.17. Acceptance.

Mineral filter will be accepted under Subsection 002.03.

Hot asphalt concrete pavement construction will be accepted under Subsection 002.04.

Asphalt content, aggregate gradation and density will be accepted under Subsection 002.02.

(a) Density (void content). Core samples will be taken and tested by the Contractor to verify the required density of the compacted pavement. The unit price of asphalt concrete is reduced as follows, if the requirement for density is not fulfilled:

Hot asphalt concrete, types A and E:

For full payment acceptance criteria for average density of core samples is 0.99. For each 0.001 (0,1%) part, that the density is less than the required value the price of the asphalt paving is reduced by 1%. The maximum deduction is 5%. If the average density accurate within 0.01 is less than 0.99, the corresponding production is rejected.

Hot dense asphalt concrete and porous asphalt concrete, types B, Г and Д:

For full payment acceptance criteria for average density of core samples is 0.98 (98%). For each 0.001 (0,1%) part, that the density is less than the required value the price of the asphalt concrete is reduced by 1%. The maximum deduction is 5%. If the average density accurate within 0.01 is less than 0.98, the corresponding production is rejected.

Extra sample set may be taken, if so directed by the Employer's Project Manager or Project Manager's Representative.

- (b) **Pavement smoothness.** The acceptance criterion is given in Subsection 308.15. In addition the IRI value of reconstructed or newly constructed sections shall be less than 2.5 mm/m in terms of implementation of two-layer a/c pavement. Each 100 m section, where the IRI value is more than 3.5, shall be rejected. IRI measurement must be done with I class IRI measure equipment. IIRI measurement must be done each traffic line of road.
- (c) For each increment of 0.1 mm/m, that the IRI value exceeds the permitted value of 2,5 mm/m the price of the asphalt paving is reduced by 1% calculated for each 100 m tested. The maximum deduction is 10%. For rehabilitated sections ((1) pothole patching, placing of levelling or wearing layer or (2) bitumen layer removal and construction of crushed stone base and 1 layer of a/c layer) IRI value of the whole section has to be lower than 3.5mm/m. At the same time in each 100m, where IRI value exceeds 4.5mm/m, will not be accepted. For each 0.1mm/m exceeding the permissible 3.5mm/m value will reduce a/c works' price by 1% for that particular 100 m checked. Maximum deduction is 10%: In densely constructed sections in order to provide sufficient drainage and in terms of keeping accesses' benchmarks, for rehabilitated sections ((1) pothole patching, placing of levelling or wearing layer or (2) bitumen layer removal and construction of crushed stone base and 1 layer of a/c layer) IRI value of the whole section has to be lower than 4.5mm/m. At the same time in each 100m, where IRI value exceeds 5.5mm/m, will not be accepted. For each 0.1mm/m exceeding the permissible 4.5mm/m value will reduce a/c works' price by 1% for that particular 100 m checked. Maximum deduction is 10%:
- (d) **Thickness.** Required amount is indicated in the drawings or Bill of Quantities. The allowable deviation is +/-10%. Amount is calculated based on core samples (same sample set as for density). For full payment, it is necessary that the average thickness be not less than the required one and the thickness of any core sample be less than the required one at most 10%. If the average thickness of the placed and compacted pavement, as well as the thickness of the core sample is less than the required thickness for no more than 10%, then the payable amount for asphalt paving shall be determined in the following way: the thickness of the core sample with the required less thickness is divided by the required value, multiplied by unit price and multiplied by the area distributed to the given sample. Average thickness (weight per unit area) is also calculated daily on the basis of the weight of asphalt concrete placed in that day, and pavement area. If the average thickness (amount of a/c laid per unit area) is less than ordered one in permissible limits, then the realized value of pavement in that day shall be reduced accordingly. If the average thickness (amount of a/c laid per unit area) is less than ordered one in impermissible limits, then constructed pavement for that day shall be rejected.
- (e) **Bitumen content.** If the bitumen content in the placed asphalt concrete is less than that determined by the standard recipe (taking into account the tolerance mentioned in clause 308.03), the value of pavement constructed with that particular asphalt concrete will be reduced in the following way:

Binder content deviation	Value deduction in %
< =0.05	0
0.10	4
0.15	9
0.20	13

Intermediate values are interpolated. In case of bitumen content lesser than the mentioned one, the corresponding pavement are shall be rejected.

Measurement

308.18. Hot asphalt concrete pavement will be measured by weight or area and will include the construction of asphalt concrete pavement and tack coat application as described under Section 307 as well as trimming of joints edges and clean up as shown in Section 308.14.

Payment

308.20. The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section and must be approved by the Employer's Project Manager or Project Manager's Representative.

308-05

Payments will be made according to the following items:

Pay Item	Pay Unit
30801 Hot asphalt concrete pavement 3,0cm depth	Square meter
30802 Hot asphalt concrete pavements, 4,0cm depth	Square meter
30803 Hot asphalt concrete pavement 5,0cm depth	Square meter
30804 Hot asphalt concrete pavement 6,0cm depth	Square meter
30805 Hot asphalt concrete pavement 7,0cm depth	Square meter

308-06

Section 309 - SURFACE TREATMENT

Description

309.01. This work consists of either single or double surface treatment of asphalt concrete pavement and crushed stone base.

Material

309.02. For surface treatment, crushed stone of grade over 1000 kp/cm² of rocks with non-polishing properties shall be used. The grain size of the aggregate shall be 12-16mm, and in double surface treatment for upper layer aggregate of the size 8-12 mm shall be used.

The grading of the aggregates shall comply with the following requirements:

Aggregate	Grading limits; Grading (passing %)										
	Sieve size (mm)										
	0.063	0.125	0.25	0.5	1	2	4	8	11.2	16	22.4
8-12	0-1	0-2	0-2,5	0-3	0-3,5	0-4	0-10	0-50	90-100	100	100
12-16	0-1	0-2	0-2,5	0-3	0-3,5	0-4	0-5	0-10	0-50	90-100	100

Crushed stone shall be clean, without any dust and clay. Clay in form of lumps and any other harmful debris, like organic matter, is not acceptable. Crushed stone shall not be wet. The heavy bitumen, emulsified bitumen or cut back bitumen may be used as a binder. Binder for surface treatment shall be used in temperatures providing normal adhesion to the aggregates. The adhesion improving additives may be used for bitumen binders, but not for emulsion. The bitumen viscosity is determined on the basis of the climatic conditions. Bitumen emulsion BE SIP or cut back bitumen BL-5 is recommended to be used.

Construction Requirements

309.03. General requirements. Surface treatment shall be made on clean, dust free and dry surface – for bitumen application and on wet surface - for emulsified bitumen application. Binder is applied at temperature of 75°C - 85°C, if bitumen emulsion is used, and at 140°C +/-10°C, if cut-back bitumen is used. Aggregate shall be mechanically spread immediately after binder pouring and rolled by pneumatic-tired roller of 16-18 tons in weight with 4 to 5 passages along one trace. The placing shall be performed as a continuous operation. The surface treatment shall be carried out after repair of all damages and deformations on pavement and after carefully cleaning from dust. The guiding amounts of binder and aggregate are given below:

	Chipping size mm	
	8-12	12-16
Heavy Bitumen		
Binder consumption kg/m ²	1.0	1.2
Chipping consumption l/m ²	12	14
Cut back bitumen		
Binder consumption kg/m ²	1,5	1,7
Chipping consumption l/m ²	12	14

Binder consumption depends on existing pavement condition, traffic volume and special factors of the site. It is required to adjust the quantity of binder by trial tests at the site before the work is commenced. If the underlay is worn and traffic volume is low, then the binder quantity shall be increased. If the underlay is even and impermeable and traffic volume is high, then the binder consumption shall be decreased.

The spraying of the binder shall be done using binder ramp. The stream of each nozzle shall be regulated separately. The driving speed shall not vary. If any of the nozzles does not work properly the spraying shall be interrupted immediately.

The chipping is spread in an even course immediately after the binder has been sprayed. Coarse, open places and aggregate accumulations are levelled by hand at once by the advancement of the work.

When a double surface treatment is being made, the second layer shall be placed as soon as is practical after the first layer has been finished, rolled and cooled, and the Employer's Project Manager or Project Manager's Representative may at his discretion request cleaning of the first layer. Traffic should not be allowed on the road surface between the laying of the first surface treatment and the second surface treatment. Transverse joints in succeeding layers shall be offset at least by 2 meters.

Surface treatment shall be rolled by a pneumatic-tired roller. Care must be taken in rolling of areas that traffic does not use often. Loose chippings are removed by brushing at the latest one day after opening to traffic. During the first 3 days after surface treatment has been finished the Contractor shall provide traffic speed limit of 40 km/h and vehicle distribution on full pavement width. Loose aggregate shall be removed after that.

Surface treatment is not allowed to be done on frozen or wet surface or during rain and the air temperature shall not be less than +15°C.

The surface treatment methodology on crushed stone base is described below:

Methodology

DBST construction on crushed stone base

Plant and equipment

The success of a surface dressing is very dependent on the binder being applied uniformly at the correct rate of spread. The method adopted for distributing binder must therefore;

- be capable of spreading the binder uniformly and at the predetermined rate of spread; and
- be able to spray a large enough area in a working day to match the required surface dressing programmed.

The spreading of binder on a larger scale requires the use of a bulk binder distributor, which may be either a self propelled or a towed unit.

There are two basic types of bulk binder distributors, the pressurized tank, and constant rate of spread, constant volume, and constant pressure machines.

Bitumen pressure distributor

In these machines a pump of adequate capacity delivers binder to the spray bar at a pre-set pressure. A relief valve regulates the pressure and permits binder to bypass the spray bar and return to the tank. The pressure in the spray bar is not affected by the number of jets in use, and hence re-calibration is not required when spray bar extensions are fitted or the number of jets is reduced. With constant volume machines, the rate of spread of binder varies inversely with the road speed of the distributor.

Attention should also be paid to maintaining the correct height of the spray bar above the road. Whilst jets are positioned on the spray bar so that their sprays overlap to minimize the effect of variations in spray bar height on the uniformity of transverse distribution of binder. Some adverse effects are likely if the spray bar is operated at an incorrect height. Slotted jets are more critical than whirling spray jets in this respect.

Since the spray of the last jet at each end of a spray bar is not overlapped by an adjacent spray the rate of spread of binder is less at the ends of a spray bar than along its length. For this reason, adjacent spraying runs of a distributor are normally overlapped. Some distributors are fitted with a larger jet at the end of the spray bar to compensate for this effect. The alternative practice of turning the last jet of a slotted jet spray bar at right angles is not recommended, nor is the practice of attempting to spray butt joints. This invariably results in narrow unsprayed strips between adjacent paths of the distributor.

If spraying is interrupted briefly, for example, to allow the chipping operation to catch up, the spray bar should be kept hot by circulating binder, preferably with the distributor standing off the road. When spraying is stopped for a longer period, such as at the end of the day or when the tank is being re-filled, the binder pump should be opened to air and the feed line to the spray bar, the spray bar itself, and the return line back to the tank emptied. The return valve should then be closed and the jets blown out with air. If the machine is being allowed to cool completely the binder pump should be flushed out with diesel fuel. Most spray bars are fitted with a drain cock so that binder or flushing oil can be drained off when required.

On most distributors the binder pump is driven by a separate engine, usually mounted either at the rear of the tank or between the tank and the driving cab. The pump itself is normally located inside the binder tank so that it is kept hot by the surrounding binder. The engine drive to the pump is usually through a clutch and the same engine usually drives a small air compressor which supplies air and fuel under pressure to the burners.

The binder tank should be emptied at the end of a day's work so that when the tank is next filled with hot binder there is no cold binder around the pump to prevent it from warming up quickly. If the binder system is not cleaned out as described above, the pump will not work until it has been cleared of cold bitumen. This should be done by turning the engine crank manually as the bitumen in the distributor is heated and not by using the engine.

When heating binder in the tank it is necessary to ensure that the burner flues are fully covered by the binder, preferably with a depth of at least 150mm of binder over the top of the flues. On some distributors a danger level is indicated on the contents gauge. If this precaution is not observed the burner flues may burn out, causing a fire or explosion.

Most binder distributors are equipped with a 'fifth wheel' which operates a low range speedometer. The speedometer is located in the driver's cab in a prominent position so that a steady forward speed can be maintained relatively easily.

To spray binder at a specified rate of spread all that is necessary with constant pressure machines is to read off the corresponding road speed from the 'Driver's chart' or calibration chart which should be carried by every distributor. With constant volume machines it is necessary to select from the chart both the pump output and the road speed necessary to give the required rate of spread for the width of spray bar being used.

If the distributor has not previously been calibrated or if the calibration chart has been lost, either of the following two methods can be used to calibrate the machine.

Method A. This method is preferred for initial calibration. The distributor is loaded with binder which is raised to the correct spraying temperature and circulated around the spray bar to heat it. Static spraying is done into suitable containers to check the evenness of the appearance of the binder spray. Binder is then sprayed into weighed containers of suitable dimensions for an accurately measured period of time and the mass of sprayed binder determined by weighing. The mass of binder delivered per unit time is calculated and the rate of spread/speed of distributor relationship is determined.

Method B. Four or five weighed metal trays of known area (0.1m square is a suitable size) are placed in the path of the distributor as it makes a spraying run at a constant speed. The trays are then picked up and weighed and the rate of spread of binder is calculated. The process is repeated with different distributor speeds until the required rate of spread/speed chart can be drawn up. This tray test should be repeated periodically during surface dressing operations to check the consistency of the rate of spread of bitumen. It will, of course, be necessary to complete the dressing by hand on the areas where the trays were located.

Chips distributing equipment

Chippings can be spread on the sprayed binder by hand and good results can be obtained by this method with a well-trained and plentiful labor force. In general, however, better results will be obtained when chippings are spread mechanically since this facilitates a more even distribution and rapid application of the chippings after the binder has been sprayed.

There are three main types of chip spreader;

- Metering or non-metering 'tail-board' types.
- Pushed metering chip spreaders.
- Self-propelled metering or non metering chip spreaders.

Non-metering tail board chip spreaders are bolted in place of the tailgate of a normal tipping lorry. They are the cheapest and simplest kind of mechanical chip spreader, having very few moving parts. A serrated steel comb controls the flow of chippings and a rotary gate with a helical edge controls the width of spread and the starting and stopping of the flow. The 'Hornsey gritter' is a popular example of this type. The flow of chippings is controlled by an operator who walks beside the tipper lorry, whilst it is driven in reverse at walking speed with the tipper body partly raised. Since the rate of spread of the chippings is dependent on gravity and the speed of the tipper lorry acting independently, the skill of the lorry driver is crucial in ensuring an even distribution of the chippings. Nevertheless good results can be obtained with these simple machines.

However, to reduce dependence on the skill of the tipper driver, metering devices are available for tailboard chip spreaders that control the rate of discharge of the chippings by delivering them over a roller which is driven from the road wheels of the lorry or from a fifth wheel attached to the chip spreader. In this way variations in road speed of the tipper produce corresponding variations in the rate of discharge of the chippings.

Pushed metering chip spreaders operate on a similar principle but the metering roll is located at the base of a wheeled hopper which is pushed along the road by a reversing tipper lorry. The roll is driven by the road wheels of the hopper and the chippings in the hopper are replenished from the raised body of the tipper.

Self-propelled metering chip spreaders are the most effective machines available for applying chippings. They have a hopper at the rear into which chippings are discharged from the delivering tipper lorry which, during the transfer of the chippings, is towed along in reverse by the chip spreader through a quick release mechanism. Conveyor belts transfer the chippings to a transverse hopper at the front of the machine at the bottom of which is the metering roll that delivers the chippings to the road. However, there are self-propelled models which do not meter the chippings but rely on gravity feed and these machines require careful operation to ensure that a constant road speed is maintained.

It should be noted that none of these chip spreaders can deliver chippings at a pre-determined rate of spread; they simply facilitate an even distribution of the chippings and the operator must ensure that an adequate, but not excessive, rate of application is maintained.

The number of tipper lorries must be sufficient to provide a steady supply of chippings at a rate that allows the planned daily output of the surface dressing unit to be achieved. Depending on the distance of the stockpile of chippings from the surface dressing site, a minimum of four or five tippers is usually required plus one spare tipper for applying chippings by hand to awkward shaped corners and other areas that may not have been covered by the chip spreader.

Rollers

The rolling of a surface dressing plays an important part in ensuring the retention of the chippings by assisting in the initial orientation and bedding down of the chippings in the binder. Traditionally, steel-wheeled rollers have been used but these tend to crush weaker aggregates and to crack poorly shaped chippings. Accordingly, if steel-wheeled rollers are used they should not exceed 8 tones in weight and should only be used on chippings which are strong enough. Some steel-wheeled rollers are fitted with rubber sleeves which makes them more suitable for surface dressing work but, as for any roller of this type, they will bridge' depressions in the existing road surface. In general, pneumatic tired rollers are preferred because the tires have a kneading action which tends to maneuver the chippings into a tight mosaic without splitting them and they do not 'bridge' depressions.

In favorable conditions, adhesion should be well established within 30 minutes of rolling after which considerable benefit can be obtained by allowing slow moving traffic, particularly heavy lorries, to traverse the dressing provided that traffic speed is kept below 20 to 30 km/hr. This is very important and the use of a lead vehicle to 'convoy' traffic at slow speed is recommended.

Mechanical Brooms

Other important items of equipment required for surface dressing are mechanical brooms, either towed or powered. These are invaluable for obtaining a clean road surface prior to spraying the binder. Whilst hand brooming is an alternative, it is difficult to obtain as good results by this method, particularly when sweeping the surface of a newly constructed crushed stone base from which all loose particles should be removed.

Materials used

Chippings:

Ideally, chippings used for surface dressing should be single sized, cubical in shape, clean and free from dust, strong, durable, and not susceptible to polishing under the action of traffic.

Samples of the chippings should be tested for grading, aggregate crushing value and, when appropriate, the polished stone value and aggregate abrasion value. Sampling and testing should be in accordance with the methods described in the specification.

The nominal sizes of chippings normally used for surface dressing are 6, 10, 14 and 20 mm.

The most critical period for a surface dressing occurs immediately after the chippings have been spread on the binder film. At this stage the chippings have yet to become an interlocking mosaic and are held in place solely by the adhesion of the binder film. Dusty chippings can seriously impede adhesion and can cause immediate failure of the dressing.

Most aggregates have a preferential attraction for water rather than for bitumen. Hence if heavy rain occurs within the first few hours when adhesion has not fully developed, loss of chippings under the action of traffic is possible. Where wet weather damage is considered to be a severe risk, or the immersion tray test, shows that the chippings have poor affinity with bitumen, an adhesion agent should be used. An adhesion agent can be added to the binder or, used in a dilute solution to pre-coat the chippings. However, the additional cost of the adhesion agent will be wasted if proper care and attention is not given to all other aspects of the surface dressing process.

Bitumen:

It is essential that good bonding is achieved between the surface dressing and the existing road surface. This means that non-bituminous materials must be primed before surface dressing is carried out.

Where a surface dressing is to be applied to a previously untreated road surface it is essential that the surface should be dry, clean and as dust-free as possible. On granular, cement or lime-stabilized surfaces a prime coat of bitumen ensures that these conditions are met. The functions of a prime coat can be summarized as follows.

- It assists in promoting and maintaining adhesion between the road base and a surface dressing by pre-coating the road base and penetrating surface voids.
- It helps to seal the surface pores in the road base thus reducing the absorption of the first spray of binder of the surface dressing.
- It helps to strengthen the road base near its surface by binding the finer particles of aggregate together.
- If the application of the surface dressing is delayed for some reason it provides the road base with a temporary protection against rainfall and light traffic until the surfacing can be laid.

The depth of penetration of the prime should be between 3-10mm and the quantity sprayed should be such that the surface is dry within a few hours. The correct viscosity and application rate are dependent primarily on the texture and density of the surface being primed. The application rate is. However, it is likely to lie within the range 0.3-1.1 kg/m². Low viscosity cutbacks are necessary for dense cement or lime stabilized surfaces, and higher viscosity cutbacks for untreated coarse-textured surfaces. It is usually beneficial to spray the surface lightly with water before applying the prime coat as this helps to suppress dust and allows the primer to spread more easily over the surface and to penetrate. Bitumen emulsions are not suitable for priming as they tend to form a skin on the surface.

Low viscosity, medium curing cutback bitumen such as MC-30, MC-70, or in rare circumstances MC-250, can be used for prime coats (Asphalt Institute, 1983). The relationship between grade and viscosity for cutback primes is shown in table below.

<i>Grade of cutback binder</i>	<i>Permitted viscosity range (centistokes at 60°C)</i>
MC 250	250-500
MC 70	70-140
MC 30	30-60

The correct choice of bitumen for surface dressing work is critical. The bitumen must fulfill a number of important requirements. They must:

- be capable of being sprayed;
- 'wet' the surface of the road in a continuous film;
- not run off a cambered road or form pools of binder in local depressions;
- 'wet' and adhere to the chippings at road temperature;
- be strong enough to resist traffic forces and hold the chippings at the highest prevailing ambient temperatures;
- remain flexible at the lowest ambient temperature, neither cracking nor becoming brittle enough to allow traffic to 'pick-off' the chippings; and
- Resist premature weathering and hardening.

Some of these requirements conflict, hence the optimum choice of binder involves a careful compromise. For example, the binder must be sufficiently fluid at road temperature to 'wet' the chippings whilst being sufficiently viscous to retain the chippings against the dislodging effect of vehicle tires when traffic is first allowed to run on the new dressing.

Depending upon availability and local conditions at the time of construction, the following types of bitumen is either commonly used in the tropics or are becoming so:

- Penetration grade.
- Cutback.
- Emulsion.
- Modified bitumen.

DBST construction

Planning

Select lengths of road requiring surface dressing and detail the preliminary work required on each road before the surface dressing can be carried out.

Implement the necessary preliminary work such as patching, heating and planning, shoulder and edge repairs, drainage works, reinstatement of service trenches etc. Allow as much time as possible for trafficking before commencement of surface dressing operations.

Decide on the type of surface dressing, the binder to be used and nominal chipping sizes i.e. use the road surface hardness probe and make a preliminary design, taking into account constraints on the supplies of binder and chippings and limitations of plant and labor.

Ensure that the chippings will be of adequate quality. Stockpile chippings at convenient points along the road to be surface dressed so as to minimize haul distances during construction. Sample the chippings and confirm their suitability, modify the surface dressing design if necessary.

Order the appropriate binder for the anticipated weather conditions, or make provision for blending and adding adhesion agents as required.

Ensure that all the plant and equipment of the unit is in good working order.

Instruct the construction team of the details of the work program.

Inform the police and other organizations likely to be affected by the surface dressing operation.

Inform the Materials Laboratory and arrange for the testing of aggregates and binder and rate of spread checks during spraying.

The surface dressing operation

Raising the temperature of the binder in the depot tanks is started early in the morning so that the distributor can be loaded with bitumen. The temperature should, preferably, be just above the ideal spraying temperature.

The supervisor arrives on site with traffic control equipment and supervises the placing of warning signs, control barriers, traffic cones, etc.

The surface dressing unit arrives on site and the distributor is parked off the road, preferably on a level site where the tank can be 'dipped' before and after spraying. If the parking area is not level and alternative site must be located.

Whilst the binder temperature is adjusted using the burners; binder is circulated through the spray bar, and the jets are checked for correct operation.

The calibrated 'dip-stick' supplied with the distributor is used to measure the volume of binder in the tank at the start of the day's work.

The supervisor instructs the distributor crew on the spray rate required, the corresponding road speed and the pump output, where this is necessary.

The chipping crew loads the tipper lorry trucks with chippings and the lorry trucks line up ready to follow the distributor at the location specified by the supervisor. The rollers also prepare to follow the distributor after the chipping lorry trucks.

The road is thoroughly swept and road furniture such as manhole covers, reflective studs etc, is masked so as to prevent contamination with binder.

Cut-off sheets of paper or other material are placed at the beginning and end of the spray run. The supervisor checks that the road is in fit condition for spraying and that laboratory staff, if present, are ready to do tray tests.

The burners on the distributor are extinguished and the distributor is positioned at the beginning of the spray run.

The driver adjusts the guide chain, the fifth wheel is lowered to the ground, and the height of the spray bar is adjusted.

The distributor then commences the spraying run, the cut-off sheets being removed immediately the distributor passes to avoid contamination of the wheels of the chip spreader or tipper lorries.

The chip spreader, tippers and the rollers should follow closely behind the distributor. Spraying should be stopped if the chipping operation is delayed for any reason. A strip of binder 150mm wide is left un-chipped at the edge of the lane to allow for the overlap of the adjacent run of the distributor.

A tipper and crew should move slowly over the new dressing, spreading chippings by hand shovels on areas where there is a deficiency of chippings.

The operation is then repeated on the adjacent pass (if any) and traffic is allowed to move slowly over the new dressing.

The distributor then returns to the original level parking site and the volume of binder remaining in the tank is checked with the 'dip-stick'. The supervisor records the amount of binder used and, knowing the total area sprayed, calculates the average rate-of-spread.

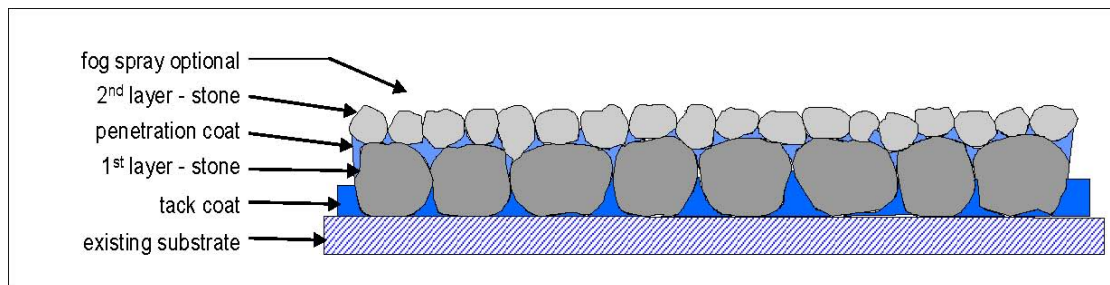
Speed control and other traffic warning signs are left in position along the length of the new surface dressing.

At the completion of the day's work the distributor spray bar is cleaned, all vehicles and plant refueled and lubricated and the supervisor checks that the bitumen heaters are loaded ready to supply the binder required for the next day.

General guidelines

Before a newly constructed base is primed, the following aspects should be checked and rectified if necessary and there should be an appropriate time interval before sealing:

- The shape of the road should conform to longitudinal and transverse levels as specified.
- Any slacks which may have been built into the road should be rectified. These slacks often occur at the joints between adjacent sections, and where deviations cross over new work.
- Any loose layers which may have occurred during the cutting of final levels should be removed and rectified with asphalt after priming. These loose layers often occur on stabilized bases and on G1 bases which have been slushed.
- All loose material should be properly broomed off the newly constructed base prior to priming, leaving a sound hard base ready for priming. (This also applies to slushed fines from a crushed stone base, which is not necessarily loose.) Care should be taken during surfacing of a natural non-plastic gravel base not to over-broom the surface, or to destroy the specified shape or surface texture of the road. In the latter case it would be more appropriate to spray water onto the base and roll the surface with a steel-wheeled roller just prior to priming, ensuring that a smooth, tightly knit and uniform surface is obtained.
- Depending on the type of surfacing to be applied, any areas of the road which would detract from the riding qualities of the road should be rectified with coarse slurry or asphalt after the road has been primed. This rectification specifically applies to roads which are to receive a single or double seal or, to a lesser extent, a Cape Seal. Asphalt surfaces are more accommodating of small inadequacies in the final surface of the newly constructed base than are seals.



- All dust and deleterious matter should be removed from the primed surface before any tack coat is sprayed. Where the primed surface has been used by construction vehicles and/or by public traffic, it will be necessary to wash off any clay or other contamination of the primed surface.
- Where sand seals are to be applied, it is recommended that the surface be watered, broom-dragged and rolled with a steel wheel roller. This process should continue until a smooth, well-knit surface has been achieved, free of roller track marks, irrespective of whether or not the specified densities were achieved with the initial compaction. The road should be primed before the surface has dried out completely (at about 50 per cent of optimum moisture content).
- After all the loose material has been broomed off the base and just before the prime is applied, a light spray of water is applied to break the surface tension of the base material and to settle any loose dust.

Note:

The base should not be flooded with water -only a very light application of water is required.

CONSTRUCTION OF SEALS

Proper double seal (shoulder to shoulder application of both stone applications)

It should be noted that the process described here applies essentially to new construction.

- 1) The distributor should not commence spraying until it has reached the required speed for the specified application rate for the binder.
- 2) Immediately after the distributor has passed over the reinforced paper joint, the two edges of the paper strip at right angles to the edge of the road are folded over to prevent any spillage of the binder, and the extreme edges of the paper parallel to the centre-line of the road are rolled over towards the centre of the section, picked up in total and placed in a truck or L.D.V. to be disposed of in a suitable place.
- 3) The chip spreader follows immediately after the jointing material is removed. The reason for this is to avoid holes being punched in the jointing material by the aggregate, which would result in leakage of the binder through the jointing material onto the existing primed surface, which would cause unsightly fatty patches in the surface at a later stage.

- 4) The chip spreader and the truck supplying it should be closely followed by trucks full of aggregate.
- 5) As each truck loading the chip spreader is emptied, it pulls out to face the oncoming traffic. Flagmen are required to control this operation. An experienced truck driver can connect up with the chip spreader in motion, without stopping, and this speeds up the process.
- 6) The distributor could spray out its whole load in one operation, provided all the equipment is sound, the operators are experienced and there is sufficient aggregate already loaded in the trucks to cover the whole section. Due to the risks related to equipment problems, this practice is not recommended.
- 7) Immediately behind the loaded trucks, the heavy pneumatic-tired rollers give the surface one completed pass of the roller. One pass of a steel-wheeled roller is often applied to the first layer of a double seal.
- 8) The brooms(2) are then brought on in tandem, the second broom overlapping the first broom by 0.3 meter and the rollers follow the brooms systematically. The brooms continue to broom the surface from the centre of the road to the edge and back again. The brooms should be set so that the bristles just touch the aggregate and do not disturb the aggregate in contact with the binder.

Note:

If emulsion is used, brooming should not take place until the emulsion has broken.

- 9) The process of lightly brooming and rolling should continue until all the loose aggregate has been placed shoulder-to-shoulder and in contact with the binder in a single layer of stone aggregate.
- 10) If the gates of the chip spreader have been properly adjusted, very little if any back chipping will be required.
- 11) Where the connection of the trucks with the chip spreader occurs, some over-application of aggregate may occur. This over-application of aggregate should be removed by hand brooming the surface before the rollers pass over the area and lock the excess aggregate in the bottom layer of stone.
- 12) The joint on the centre line of the road should be given special attention. A 3 mm twine on the centre line is used as a guide for spraying. The width of the spray should overlap the line by 100 mm. This width can be controlled accurately by fitting fish plates next to the end nozzle.
- 13) Immediately after application of aggregate and brooming, the 100 mm overspray should be cleaned of aggregate spillage while the road is still warm and before the binder has set. It is advisable for the rollers to keep within the surfaced area and not to roll across the string line. Once this operation is complete, the string line should be removed.
- 14) Once the single layer of aggregate lying shoulder-to-shoulder has been applied, the heavy 10-12 ton steel-wheeled roller may commence rolling, starting at the edge of the surfacing and moving a half wheel at a time towards the centre and back again. The quality of the final finish of the road depends on the efficiency of this operation, which should continue until a tight flat surface has been obtained. A certain amount of crushing/splitting of the coarse aggregate will occur, but the final finish should be "tight", uniform and "flat". On new construction a limited amount of "punching" in of the aggregate into the base will occur, resulting overall in a "tight", flat surface.
- 15) It should be noted that under no circumstances should this layer be opened to traffic before the second application of aggregate has been applied. If this road is opened to traffic for any reason, bleeding and fattening up of the surface will result.
- 16) If construction traffic and/or the public use the road, re-rolling would be advisable before the penetration coat of binder is applied.
- 17) Although this is not common, both applications of aggregate may be pre-coated. The pre-coating assists in immediate adhesion of the coarse aggregate to the binder and allows effective brooming to take place with minimum delay, without disturbing/turning the aggregate in contact with the binder.
- 18) If emulsion is used as a tack coat, the emulsion should be allowed to break and adhere effectively to the aggregate before brooming commences. Brooming before the emulsion has broken will result in the turning of the aggregate, which, in turn, will result in the aggregate sticking to the rollers and broom bristles.
- 19) It is most important to obtain the correct application of aggregate at initial application so as to reduce brooming and the need for back-chipping as far as possible.
- 20) If emulsion is used for the penetration sprays, the pre-coating of the aggregate of the second application of the aggregate must not be done with a tar-based pre-coating fluid but with diluted emulsion or a commercially available bitumen pre-coating product.
- 21) The quantity of binder calculated for the tack coat should be reduced to the minimum quantity of binder required to hold the first application of aggregate in place and prevent its movement when the surface is broomed. The balance of the binder should be added to the penetration sprays.
- 22) The application of the second spray should be delayed until all the excess volatiles have evaporated. Under no circumstances should cutback binders be used for the tack coat as subsequent sprays lock in the volatiles which flush up during the hot season. Heavy to medium traffic using the road under these conditions will cause excessive bleeding of the surface.

23) Rolling with the heavy pneumatic rollers should continue from the time the binder and aggregate are applied for a minimum of 8 passes per roller width. As a guide, 2q hrs rolling with one heavy pneumatic-tired roller is required for every km of single lane 3,7m wide surfaced roadway. (i.e. approximately 8 -10 passes over each "width of roller" of surfaced width of the roadway). It is recommended that the initial rolling (first roll) be completed within 15 min of spreading the aggregate. A minimum of two rollers is recommended for each chip spreader.

24) Before the road is opened to traffic, all loose stone should be removed from the surface. The surface should be broomed the day following surfacing to ensure there are no "flying chips" on the road. For wide surfaces exceeding 7,4 m it is advisable to use self-propelled brooms or (preferably) vacuum brooms to remove the unattached chips. Back-rolling the following day can further improve binder/aggregate adhesion.

25) The rollers should be ballasted (20 ton unballasted) and there should be sufficient rollers for the work envisaged. Efficient use of the brooms and rollers makes a significant improvement to the quality of the final finish.

26) The quality of the aggregate should be checked before it is delivered to site. The pre-coating of the aggregate should be uniformly done and the aggregate should be stockpiled at least 48 hrs before it is used. These stockpiles should be covered with tarpaulins if the operation is done in the rainy season.

27) Stockpile sites should be carefully selected and prepared vis-à-vis drainage, access and possible contamination of the aggregate (e.g. by mud).

28) The minimum temperature which may be expected for the ensuing 24 hours should be checked.

29) It is not advisable to use steel-wheeled rollers on single seal reseal projects if the road is deformed, as these will damage the aggregate, riding the high spots and missing the aggregate in the cusps.

30) In a hot climate it may be necessary to keep the road closed until sunset and even to spray the surfacing with water to cool the surfacing down before it is opened to traffic. If possible, the road should only be opened to traffic the next morning, while the binder is still stiff.

31) Traffic speeds should be controlled for two to three days to allow the seal to settle.

After care

After-care is an essential part of the surfacing process and consists of removing excess chippings within 24 to 48 hours of the construction of a dressing. Some of the excess chippings will have been thrown clear by passing vehicles but some loose chippings will remain on the surface and these are a hazard to windscreens and, hence, a source of public complaint. They can be removed by brooming or by purposed-made suction cleaners. Care must be taken with brooming to avoid damage to the new dressing and it is usually best to do this work in the early morning when the surface dressing binder is still relatively stiff. It is Important to stress that over-chipping can reduce the quality of a dressing, make after-care a more time consuming process and also unnecessarily increase costs.

Acceptance

309.04. Surface treatment will be accepted according to Section 002.04, provided that the work conforms to the designs and the specifications and is approved by the Employer's Project Manager or Project Manager's Representative. The quantity of laid mixture is examined with tin board method. The permissible binder content deflection from design value in one place is 0.15 kg/m². In the beginning of the work three samples are taken and thereafter one sample per each 10.000 m².

Measurement

309.05. Surface treatment will be measured by area of approved surface at the application rate specified in the designs. Items are included in the Bill of Quantities for variation in binder and aggregate application rates over or under the nominal application rates specified in the designs. Measurement shall be per kg of binder and liter of aggregate more than or less than the nominal quantity and the amount calculated by extending this quantity and the rate shall be added to or deducted from the total value of work approved.

Payment

309.06. The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for the items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section and must be approved by the Employer's Project Manager or Project Manager's Representative.

Payments will be made under the following items:

Pay Item	Pay Unit
30901 Single surface treatment	Square meter
30902 Double surface treatment	Square meter

Section 309A - CRESCENT-SHAPED PAVEMENT

Description

309A.01. This work consists of constructing course of gravel mixture prepared according to the requirements presented below.

Material

309A.02. Gravelling (crescent-shaped) is used for IV-V category roads with daily traffic of up to 300 vehicles.

Earthworks, as well as works for installation of artificial structures are carried out before gravelling. Then the subgrade is leveled by motor grader and obtains two sloping surfaces with slope 15-20%. The leveled and sloped subgrade is compacted by 25-ton pneumatic rollers passing 6 times along the same trace (and watering). After that 20 cm thick gravel surfacing is placed across the road centerline with an aim to have at least 5 cm thickness on edges of the subgrade (on the right and left sides). Gravel pavement is constructed as follows: carriageway – with 25-30 % slope, 2.25-3.0 m width, shoulders - with 35-50 % slope, 1.75-2.0 m width, and subgrade - 15-20% slope, 8-10 m width.

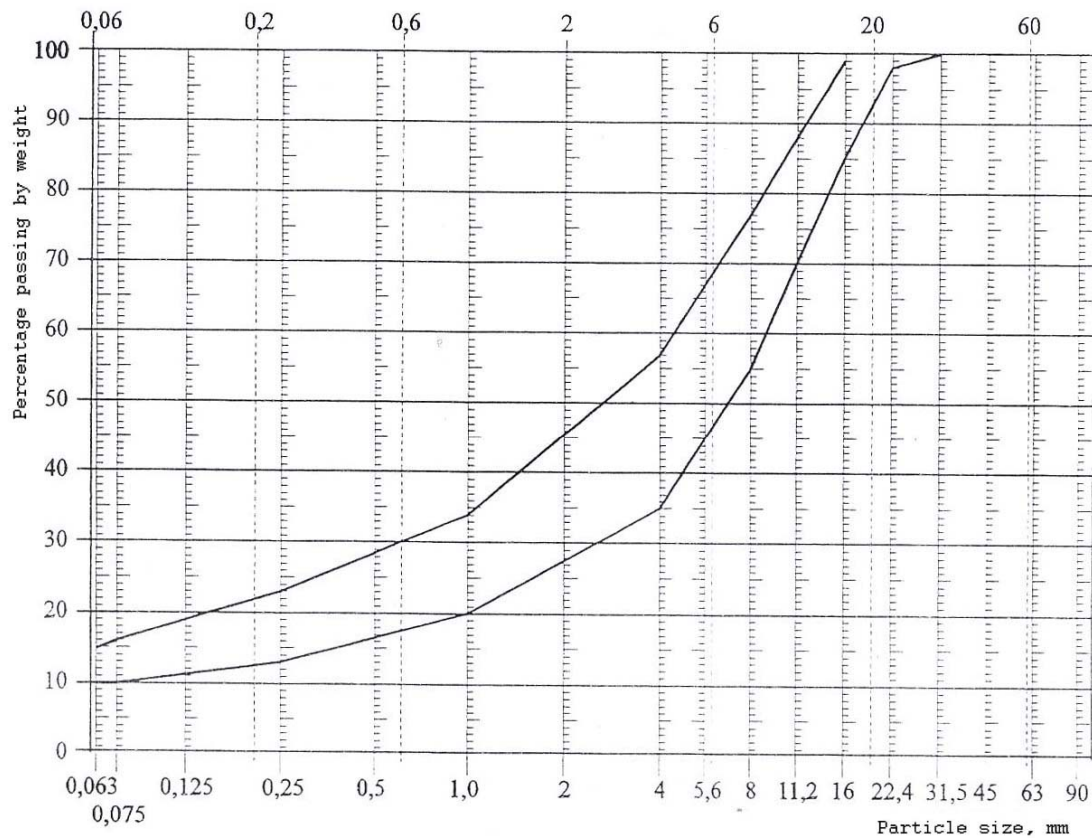
The gravel surface is compacted by pneumatic rollers (5-16 tons) passing 6 times along the same trace (and watering). 25-45 % of total volume of gravel mix has to be of bigger size than 5mm.

Calculation of the volume of gravel mix is done based on envisaged slopes and widths.

The volume of water required during gravel surfacing is 12 m³ for 1000 m².

Material for gravel wearing course, requirements on particle size distribution

Sieve size, mm	0.063	0.075	0.25	1.0	4.0	8.0	16	22.4	31.5
Max %	15	16	23	34	57	77	99	-	-
Min%	10	10	13	20	35	55	85	98	100



Acceptance

309A.03. Crescent-shaped pavement will be accepted, provided that the work conforms to the designs and the specifications and is approved by the Employer's Project Manager or Project Manager's Representative.

Measurement

309A.04. Crescent-shaped pavement will be measured by area of approved surface at the application rate specified in the designs. Items are included in the Bill of Quantities for variation in binder and aggregate application rates over or under the nominal application rates specified in the designs.

Payment

309A.05. The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for the items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section and must be approved by the Employer's Project Manager or Project Manager's Representative.

Payments will be made under the following items:

Pay Item	Pay Unit
309A01 Crescent-shaped pavement	Square meter

Section 309B- Otta sealing

309B.01. This work consists of constructing an Otta seal treatment prepared according to the requirements presented below.

Material

309B.02. A locally sourced “all-in” maintenance gravel material is used.

Requirements on particle size distribution in the gravel material.

Sieve size, mm	0.063	0.075	0.25	1.0	4.0	8.0	16	22.4	31.5
Max %	5	8	15	30	52	70	95	-	-
Min%	1	2	8	13	35	52	80	98	100

The binder is emulsified bitumen EBA-, sub-section 010.03 Tested according GOST 18659-2005

Construction Requirements

309B.03. General requirements. Earthworks, as well as works for installation of artificial structures are carried out before treatment. Then the existing gravel surface is leveled by motor grader and obtains two sloping surfaces with slope 15-20%. Ditches according design is constructed.

The leveled and sloped surface is compacted by 25-ton pneumatic rollers passing 6 times along the same trace (and watering) - before emulsified bitumen application.

Binder is applied at temperature of 75°C - 85°C. Aggregate shall be mechanically spread in an even course immediately after binder pouring and rolled by pneumatic-tired roller of 16-18 tons in weight with 3 to 4 passages along one trace. The placing shall be performed as a continuous operation.

Care must be taken in rolling of areas that traffic does not use often. During the first 3 days after surface treatment has been finished the Contractor shall provide traffic speed limit of 40 km/h and vehicle distribution on full pavement width.

The guiding amount of emulsified bitumen $2.0 - 2.2 \text{ l/m}^2$.

The thickness of the compacted gravel material 20 - 25 mm

The spraying of the binder shall be done using binder ramp. The stream of each nozzle shall be regulated separately. The driving speed shall not vary. If any of the nozzles does not work properly the spraying shall be interrupted immediately.

Otta seal treatment is not allowed to be done on frozen or wet surface or during rain and the air temperature shall not be less than +15°C.

Acceptance

309B.04. Otta seal treatment will be accepted according to Section 002.04, provided that the work conforms to the designs and the specifications and is approved by the Employer's Project Manager or Project Manager's Representative. The quantity of laid mixture is examined with tin board method. The permissible binder content deflection from design value in one place is 0.15 kg/m^2 . In the beginning of the work three samples are taken and thereafter one sample on gravel material and emulsified binder per each 10.000 m^2 .

Measurement

309B.05. Otta seal treatment will be measured by area of approved surface at the application rate specified in the designs. Items are included in the Bill of Quantities for variation in binder and aggregate application rates over or under the nominal application rates specified in the designs. Measurement shall be per kg of binder and liter of aggregate more than or less than the nominal quantity and the amount calculated by extending this quantity and the rate shall be added to or deducted from the total value of work approved.

Payment

309B.06. The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for the items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section and must be approved by the Employer's Project Manager or Project Manager's Representative.

Payments will be made under the following items:

Pay Item	Pay Unit
30901B Otta seal surface treatment	Square meter

Section 309C - GEOGRID

Description

309C.01. This work consists of the provision and installation of a geogrid mat between two asphaltic concrete layers to prevent or delay reflective cracking.

Material

309C.02. The Flexible asphalt reinforcing grid-composite shall be **HaTelit™C 40/17** or similar approved. Installation shall be in accordance with the manufacturer's installation instructions. Overlaps of geogrid material shall be 25 cm longitudinally and 15cm transversely.

The reinforcing grid shall be made of high modulus polyester yarns with low creep properties. The grid must be firmly connected to an ultra-light polypropylene nonwoven section which acts as an installation aid and must allow a proper aggregate interlock between the asphalt layers.

The composite shall have a bituminous finish (min. 50% Bitumen content).

Grids shall be able to be installed on milled surfaces. Standard roll dimensions shall be 5.0m x 150.0m or other such widths and lengths as agreed by the Engineer.

The grid shall have the following properties:

- Tensile strength (acc. EN ISO 10319): $\geq 50/50$ kN/m
- Strain at 50 kN/m (acc. EN ISO 10319): $\leq 12/12$ %
- Strength at 3 % strain: $\geq 12/12$ kN/m
- Strength after Installation Damage Test (acc. EN ISO 10722-1): ≥ 85 %
- Heat resistance of grid: ≥ 190 °C
- Grid mesh size: 40 x 40 mm

The following technical data shall be verified by test certifications of an accredited laboratory.

- Tensile strength of the finished product (acc. to EN ISO 10319)
- Tensile strength after installation damage test (acc. to EN ISO 10722-1)

The possibility of milling the grid has to be proven by an independent institute.

The non-woven part attached to the grid has the function to ease the installation and it shall not act as a separator, and should allow a proper aggregate interlock between the asphalt layers. The resistance against penetration shall not be larger than 0.14 kN following NF G 38-019.

The grid shall be resistant to de-icing agents.

The application of an asphalt reinforcement shall not have a significant negative impact on the bonding strength between asphalt layers. When applied between asphalt layers the resulting shear resistance of an asphalt core Ø150 mm shall be at least 15 kN (acc. to ZTV Asphalt StB 07, German Technical Guideline for Road Construction) to be verified by an independent authorised testing laboratory prior to installation.

All mechanical properties shall be verified in accordance to DIN 18200 by both internal quality assurance and external quality control and assurance by accredited laboratories (DIN EN ISO 17025:2005).

The production of the asphalt reinforcing grid shall be EN ISO 9001:2008 certified.

The Supplier shall submit a reference list for the asphalt reinforcement indicating at least 35 years experience with the system, indicating references on all continents worldwide in order to prove sufficient experience with the system.

An adequate product liability insurance covering the risks of performance of the reinforcing grid related to product defaults shall be provided by the supplier.

Construction Requirements

309C.03. General Requirements

Surface Preparation

The surface shall be clean, dry and free of any loose material. The surface shall be even to ensure full contact between the grid and the underlying layer. Uneven surfaces shall either be milled or have a regulating asphalt layer laid over it. Milled or regulated surfaces should not have irregularities greater than 10mm. Cracks less than 3mm may be left untreated. Cracks greater than 3mm should be sealed with a bitumen sealant.

An unstable cationic bitumen emulsion of 70% bitumen content shall be evenly sprayed at a rate of 0.6 to 1.2kg/m² (adjusted on site to suit particular conditions). The tack coat shall be sufficient too keep the geogrid in place. The grid shall be placed after the tack coat breaks (changes from brown to black).

Laying the Grid

The grid shall be pulled flat out over the prepared surface and in a crease-free condition. The grid roll shall lay on the prepared surface and not hang in the air. After laying the grid shall be rolled using a light tandem roller ensuring that no folds or waves develop. Transverse and longitudinal overlaps at joints in the grid shall be 150mm and 250mm respectively. The end of a roll shall be placed under the beginning of a new roll. Such joints shall be treated with 0.15kg/m² of bitumen emulsion. On curves the grid mat may be cut to suit and laid with overlaps. The grid covered surface should not carry normal road traffic until the asphalt course has been laid. Moving vehicles on the grid shall avoid sharp turns, rapid changes in speed and hard breaking.

Laying the Asphalt

Laying of the asphalt overlay shall follow the installation of the grid without delay.

Measurement and Payment

Measurement and payment shall be per m² of grid laid according to these specifications.

The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for the items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section and must be approved by the Employer's Project Manager or Project Manager's Representative.

Payments will be made under the following items:

Pay Item	Pay Unit
309C Geogrid	Square metre

Section 310 - SHOULDER RECONDITIONING

Description

310.01. This work consists of removing, filling up shoulders and paving with asphalt concrete or aggregate.

Material

310.02. Material for filling and paving shall meet the following requirements:

- Hot asphalt concrete as shown in Section 308.
- Sand (for shoulder fill) should shall meet either Option 1 or Option 2:

a) Option 1:

GOST 25607-2009. Grading should meet the requirements of the following table.

Mix number	Maximum size of grains (D)	The whole sieve residue, size in mm									
		120	80	40	20	10	5	2.5	0.63	0.16	0.05
C4	80	0	0-10	15-35	28-55	40-70	50-80	60-85	80-95	91-97	95-100
C5	40	0	0	0-10	25-60	45-80	57-85	67-88	80-95	90-97	95-100
C10	40	0	0	0-10	25-60	45-80	57-85	57-85	71-91	87-97	95-100
C11	20	0	0	0	0-10	25-60	50-77	50-77	70-88	85-97	95-100

b) Option 2 (described below):

General

Aggregates for Granular A, O, B, M shall be according to this specification and shall conform to the requirements of Table 1 and Table 2 when tested according to the test methods identified herein.

Aggregates shall be clean, hard, durable particles and shall be produced from material free of earth, humus, clay coatings, and clay lumps or fragments of any size or shape. The total amount of clay brick, gypsum, gypsum plaster wallboard and other contaminants shall not exceed a combined total of 1.0 percent by mass.

Where reclaimed asphalt pavement (RAP), post-consumer glass or ceramic material is used, it shall be homogeneously blended in a manner acceptable to the Contract Administrator.

Steel slag shall not be used.

Granular O

Aggregates for Granular O shall be produced from a quarry or from boulders, cobbles or gravel retained on the 50 mm sieve. Recycled or reclaimed materials, including hydraulic cement concrete, RAP, slag, glass and ceramic, are not permitted.

Granular A and M

Aggregates for Granular A and M shall be produced from:

- i) boulders cobbles, gravel, sand and fines from naturally formed deposits;
- ii) a quarry or talus;
- iii) reclaimed hydraulic cement concrete; or
- iv) iron blast furnace slag or nickel slag.

Granular A and M aggregates may include up to 30 percent by mass of asphalt coated particles derived from RAP, and not more than a combined total of 15 percent by mass of glass and/or ceramic material, unless specified elsewhere in the Contract Documents.

Granular B

Granular B may be of Type I, Type II or Type III.

Aggregates for Granular B shall be aggregates produced from the following, subject to the restrictions given below:

- i) boulders, cobbles, gravel, sand and fines from naturally formed deposits;
- ii) a quarry or talus;
- iii) reclaimed hydraulic cement concrete;

Aggregates for Granular B Type I and Type III may include up to 30 percent by mass of asphalt coated particles derived from RAP.

Aggregates for Granular B Type II shall only be produced from a quarry or from talus. Recycled materials are not permitted.

QUALITY ASSURANCE

General

All samples shall be obtained by the Contractor, in the presence of the Contract Administrator, as indicated elsewhere in the Contract Documents.

QA sampling and testing shall be based on lots which are established for each aggregate type: Granular A, O, B, M, and SSM. Where more than one aggregate source is used, separate lots shall also be established for each source. Where aggregates are produced from materials which are extracted from within the right-of-way, each area within a 1000 m segment of the right-of-way or within a radius of 500 m of the extraction operation located within the right-of-way shall be considered equivalent to a single aggregate source for QA acceptance purposes. Where aggregates are produced with blended or reclaimed materials or both, QA testing shall be performed on the final product. Individual test results shall be forwarded to the Contractor, as they become available.

Notwithstanding the requirements for QA sampling as indicated in this specification, the Owner reserves the right to obtain a QA sample at any time without notice.

Either QA test results or referee test results, where applicable, shall be used for the acceptance of physical and production property requirements of this specification. QA testing for physical properties may be waived by the Contract Administrator where the delivered quantity of Granular A, O, B, M, or SSM is less than 5,000 tonnes.

QA Samples

QA samples shall be taken in accordance with a location determined by the Contract Administrator. Where required, the Contractor shall provide a front-end loader to obtain material for QA samples.

Where it is not possible to take road or delivery samples, samples of compacted material, shall be used for QA acceptance purposes.

In the event that the Contractor is unavailable to take a sample, no further materials shall be placed in the Work until the required QA samples have been taken.

The Contractor shall provide new or clean sample bags or containers that are constructed to prevent the loss of any part of the material or contamination or damage to the contents during shipment. Metal or cardboard containers are unacceptable.

QA samples shall be identified both inside and outside of the sample container. Data to be included with QA samples shall conform to the requirements of Form PH-D-10 (Sample Data Sheet).

All QA samples shall be duplicate samples. One of the samples shall be randomly selected for testing by the QA laboratory and the remaining sample shall be retained by the QA laboratory for possible referee testing.

Sample Size

The mass of the each sample shall conform to Table 4, which contains field sample masses that are expected to furnish reasonable quantities for most routine testing for the necessary physical or production property tests. Individual sample containers shall hold no more than 30 kg of material. Where more than 30 kg of material is required, additional containers shall be used and the total sample shall be recombined prior to testing.

Physical Properties

At least one set of duplicate QA samples of each aggregate to be used in the Work shall be randomly sampled, in accordance with clause 1010.08.01.01, from lots of 25,000 tonnes or part thereof for physical properties. All materials delivered to the Work shall be included within a lot.

Testing of Physical Properties

The QA laboratory shall carry out testing for each physical property requirement given in Table 1, as applicable for each QA sample.

Acceptance of Physical Properties

The acceptability of a lot on the basis of physical properties may result in payment at full price or rejection. When the QA test results for a lot meet the requirements of Table 1, the Contract Administrator shall accept that lot at full price.

When QA test results for a lot do not meet the requirements of Table 1, the Contract Administrator shall notify the Contractor that the lot is rejectable and any materials within that lot that are in the Work, in existing stockpiles or stockpiles under construction shall be removed at no cost to the Owner.

The Contractor may invoke referee testing for lots deemed rejectable, on the basis of physical properties.

Table 1. Physical Property Requirements

Laboratory Test	MTO Test Number	Granular O	Granular A	Granular B		Granular M	Select Subgrade Material
				Type I Type III	Type II		
Freeze-Thaw Loss, % Maximum	LS-614	15	-	-	-	-	-
Micro-Deval Abrasion Coarse Aggregate loss, % maximum	LS-618	21	25	30 (Note 1)	30	25	30 (Note 1)
Micro-Deval Abrasion Fine Aggregate loss, % maximum	LS-619	25	30	35	35	30	-
Amount of Contamination	LS-630	(Note 2)					
Plastic Fines	LS-631	NP (Non-Plastic)					
Determination of Permeability, k	LS-709	(Note 3)					

Note 1: The coarse aggregate micro-Deval abrasion loss test requirement shall be waived if the material has more than 80% passing the 4.75 mm sieve.

Note 2: Granular A, B Type I, B Type III, or M may contain up to 15 percent by mass crushed glass and/or ceramic material. Granular A, O, B Type I, B Type III, and M shall not contain more than 1.0 percent by mass of wood, clay brick and/or gypsum and/or gypsum wall board or plaster. Granular B Type II and SSM shall not contain more than 0.1 percent by mass of wood.

Table 2. Production Requirements

Lab Test	MTO Test Number	Granular						SSM
		O	A	B (Note 1)			M	
Sieve Analysis, % passing	LS-602 (sieve)			Type I (Note 2)	Type II	Type III (Note 2)		
	150 mm	-	-	100	-	100	-	100
	106 mm	-	-	-	100	-	-	-
	37.5 mm	100	-	-	-	-	-	-
	26.5 mm	95.0-100	100	50.0-100	50.0-100	50.0-100	-	50.0-100
	19.0 mm	80.0-95.0	85.0-100 (87.0-100) Note 3	-	-	-	100	-
	13.2 mm	60.0-80.0	65.0-90.0 (75.0-95.0) Note 3	-	-	-	75.0-95.0	-
	9.5 mm	50.0-70.0	50.0-73.0 (60.0-83.0) Note 3	-	-	32.0-100	55.0-80.0	-
	4.75 mm	20.0-45.0	35.0-55.0 (40.0-60.0) Note 3	20.0-100	20.0-55.0	20.0-90.0	35.0-55.0	20.0-100
	1.18 mm	0 – 15.0	15.0-40.0	10.0-100	10.0-40.0	10.0-60.0	15.0-40.0	10.0-100
	300 µm	-	5.0-22.0	2.0-65.0	5.0-22.0	2.0-35.0	5.0-22.0	5.0-95.0
	150 µm	-	-	-	-	2.0-65.0	150 µm	-
	75 µm	0 - 5.0	2.0-8.0 (2.0-10.0) Note 4	0-8.0 (0-10.0) Note 4	0-10.0	0-8.0 (0-10.0) Note 4	2.0-8.0 (2.0-10.0) Note 4	0-25.0
Percent Crushed, minimum %	LS-607	100	60	-	100	-	60	-
2 or more crushed faces, min. %	LS-617	85 Note 5	-	-	-	-	-	-
% Asphalt Coated Particles, Coarse Agg, max.	LS-621	0	30	30	0	30	30	0

Note 1: Where Granular B is used for granular backfill for pipe subdrains, 100 percent of the material shall pass the 37.5 mm sieve.

Note 2: Where RAP is blended with Granular B Type I or Type III, 100 percent of the RAP shall pass the 75 mm sieve. Conditions in Note 1 supersede this requirement.

Note 3: Where the aggregate is obtained from an iron blast furnace slag source.

Note 4: Where the aggregate is obtained from a quarry or blast furnace slag or nickel slag source.

Note 5: Where Granular O is produced from boulders, cobbles or gravel retained on the 50 mm sieve.

Table 4. Sample Size

Material	Minimum mass of field samples (kg)
Granular O, A, M	20
Granular B, SSM	50
Granular B, SSM (100% passing 26.5 mm sieve)	20

Note: Individual shipping containers shall hold no more than 30 kg of aggregate. Where more than 30 kg is required, additional sample containers shall be used.

Construction Requirements

310.03. Removing and filling up shoulders. Filling up shoulders is done on the sections where roadway is to be widened, in areas, where emergency lanes are located, in areas where embankment height is increased, or when existing shoulders are to be paved with asphalt concrete.

Filling up shoulders is done after placing sand bed course and pavement construction or widening is completed.

Filling up shoulders is done after removing existing shoulders. Material may be reclaimed and used in embankment fill, if it conforms to Section 201 requirements. If not, is to be removed and disposed of by the Contractor. Spoil area will be the responsibility of the Contractor.

Compaction shall be done layer by layer according to SNiP 2.05.02-85 relevant to construction subgrade layers. Compaction will be done at optimum mixture content.

Borrow sources for shoulder filling shall be approved by the Employer's Project Manager or Project Manager's Representative.

310.04. Shoulder paving with asphalt concrete. The shoulder may be paved with:

Two layer asphalt concrete, the upper of 4cm thick fine-graded asphalt mix, the lower of 6cm thick porous asphalt mix over 18cm thick base course of crushed stone and sand bed course of variable thickness.

Before placing asphalt concrete the existing shoulder is to be cleaned from dust and mud. Prime coat shall be applied in conformity with Section 307. Placing base course, asphalt concrete and bed course of sand shall meet the requirement of Section 306.

310.05. Aggregate or gravel/sand mix paved shoulders. Shoulder strengthening with a 15cm thick layer of crushed stone or gravel/sand mix shall be done using material with maximum particle size less than 70 mm.

Maximum difference shoulders and pavement surfaces can be 50 mm.

Material will be spread in one layer using self-propelled grader and compacted with rollers according to SNiP 3.06.03-85 for aggregate bases. To reduce friction between grains water shall be spread during compaction.

310.06 Acceptance. The work will be accepted according to Subsection 001.04 providing that it has been done according to plans and specifications and is accepted by the Employer's Project Manager or Project Manager's Representative.

Measurement

310.07. Removing materials will be measured by area or volume. Paving with aggregate or asphalt concrete will be measured by area or volume with indication of thickness of the compacted layer. Filling of shoulders will be measured by area or volume. Construction of sand bed course will be measured by volume or area with indication of thickness of the compacted layer, and will be paid according to Pay item 30601.

Payment

310.08. The accepted quantities, measured as indicated above, will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section.

Payment will be made under:

Pay Item	Pay Unit
31001 Removing shoulders with asphalt	cubic meters
31001A Removing shoulders without asphalt	cubic meters
31002 Shoulder fill	cubic meters
31003 Paving shoulders with aggregate <u>h</u> cm thick	square meters
31004 Paving shoulders with asphalt concrete <u>h</u> cm thick	square meters
31005 Paving shoulders with asphalt concrete <u>h1</u> cm thick on <u>h2</u> cm aggregate and sand bed	square meters
31006 Paving shoulders with two-layer asphalt concrete <u>h1</u> cm thick on <u>h2</u> cm aggregate	square meters

Section 311 - MINOR ASPHALT CONCRETE

Description

311.01. This work consists of constructing minor hot asphalt concrete for sidewalks, bus stops, curbs, artificial structures and roadway surfacing.

Construction Requirements

311.02. Composition of Mixture (Job-Mix Formula). Provide an asphalt concrete mixture composed of crushed stone or gravel and bitumen approved by the Employer's Project Manager or Project Manager's Representative.

Submit the strength, quality, and gradation specifications for the asphalt concrete mixture to the Employer's Project Manager or Project Manager's Representative. Include copies of laboratory test reports which demonstrate that the properties of the aggregates, bitumen cement, additives, and mixture meet the specifications. Also submit the maximum laboratory density of the mixture.

311.03. Surface Preparation. Prepare the surface according to Section 307.04. Apply a bitumen tack coat to contact surfaces of curbing, gutters, manholes, and other structures according to Section 307. Protect near by areas from spatter or splashing during the application.

311.04. Weather Limitations. Construct asphalt concrete pavements and base courses in dry weather, on unfrozen surface according to the requirements of Section 308.07. Place hot and cold mixes at the ambient air temperature of not less than +5°C.

311.05. Hauling. Use vehicles with tight, clean, and smooth metal beds for hauling asphalt concrete mixtures.

Thinly coat the beds with an approved material to prevent the mixture from adhering to the beds. Do not use petroleum derivatives or other coating material which contaminate or alter the characteristics of the mixture. Drain the bed before loading.

Equip each truck with a canvas cover or other suitable material of sufficient size to protect the mixture from the weather. When necessary to maintain temperature, use insulated truck beds and securely fastened covers. Provide access ports or holes for checking the temperature of the asphalt mixture in the truck.

311.06. Placing. Place the mixture with mechanical paver. In areas where mechanical spreading and finishing is impractical, spread and finish each course by hand raking, screeding, or by other approved methods. Construct a surface that is uniform in texture and cross-section.

311.07. Compacting. Compact the mixture to a minimum of 96 per cent of laboratory mix design density using a roller weighing not less than 135 kg or with a small power roller. Compact areas that are not accessible by rollers by vibrating plates or other methods.

311.08. Pavement Smoothness. Use a 3m metal straightedge to measure at right angles and parallel to the centerline at designated sites.

Defective areas are surface deviations in excess of 5 mm between any two contacts of the straightedge with the surface. Correct defective areas using approved methods.

311.09. Acceptance. The work will be accepted according to Subsection 001.04 providing that it has been done in conformance to the plans and specifications and is accepted by the Employer's Project Manager or Project Manager's Representative.

Measurement

311.10. Asphalt concrete will be measured by weight or area.

Payment

311.11. The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in the Section and must be approved by the Employer's Project Manager or Project Manager's Representative.

Payments will be made under:

Pay Item	Pay Unit
31101 Minor asphalt concrete pavement, 3cm depth	square meter
31102 Minor asphalt concrete pavement, variable depth	ton

Section 312 - PORTLAND CEMENT STABILIZED GRAVEL PAVEMENT

312.01 Description

Construction of a Portland cement stabilized gravel pavement with Portland cement, gravel sands material mixture with optimum water content stabilized by the recycler or stabilizer, shaped and compacted to the required density.

312.02 Materials

Portland cement

The cement shall be Portland cement Type II 32.5 or Type III 32.5 and must meet the requirements of Section 009 of this specification.

Gravel sands material

Gravel sands materials to be used for Portland cement stabilized gravel pavement shall meet the requirements of GOST 25607-94 (mix C1 and C2).

Water

Unless otherwise authorized in writing by the Engineer, only potable water free from oil, salt, acid, sugar, vegetable or any other substance injurious to the concrete may be used for products containing cement.

312.03 Construction

Construction method and equipment

Soft or yielding subgrade areas shall be corrected prior starting pavement works. Gravel sands material shall be placed and spreaded uniformly to required thickness and width as shown in the drawings. When placing, moisture of the mix should be close to the optimum (permissible deviation – no more than 2%). 5% of cement from the mass of the gravel sands material must be applied uniformly throughout the material to be stabilized. Cement lost must be replaced before mixing at no cost to the Client. The Contractor shall ensure that the quantity of cement applied as required.

The materials must be blended by stabilizer or recycler. Water must be introduced uniformly during the mixing cycle. The materials must be blended thoroughly to prevent formation of cement balls as water is applied. Mixing of materials as well as adding of cement into the material mixture shall be done by means of appropriate stabilizer equipped with a water batcher or with a recycler. Wet mixing, lay down and finishing operations must be completed within 2 hours after adding cement. Works must be suspended when windy conditions cause a cement loss.

To ensure complete recycling or stabilizing across the full width of the road, longitudinal joints between successive cuts shall overlap by a minimum of 150 mm. Cut lines pre-marked on the road surface shall be checked to ensure that only the first cut is the same width as the milling drum. All successive cut widths shall be narrower than the drum width by at least 150 mm. The recycling or stabilizing machine shall be steered so as to accurately follow the pre-marked cut lines. Any deviation in excess of 100 mm shall be rectified immediately by reversing to where the deviation commenced and reprocessing along the correct line, without the addition of any further water or stabilizing agent.

The overlap width shall be confirmed before starting each new cut sequence and any adjustments made to ensure that the amount of water and fluid stabilizing agent to be added is reduced proportionately by the width of the overlap.

The contractor shall ensure that between successive cuts (along the same longitudinal cut line) no gaps of unrecycled or unstabilizing material remain, nor are any untreated wedges created where the milling drum first enters the existing material. The exact location at which each cut terminates shall be carefully marked. This mark shall coincide with the position of the center of the mixing drum at the point at which the supply of stabilizing agent ceased. To ensure continuity of the stabilized layer, the next successive cut shall be started at least 0.5 m (500 mm) behind this mark

Compacting and finishing

Following the mix of the gravel-sand mixture with the cement this layer of the material stabilized by cement has to be shaped according to the profile and any undulations eliminated. Then the compaction of the mixture stabilized by cement shall commence by appropriate roller to the required density.

Stabilized material which for any reason cannot be compacted to the specified density shall be removed.

Pneumatic tire roller as well as vibrating steel drum roller should be used for compaction. The sequence and frequency of the rolling pattern to reach optimal results shall be as determined during the trials.

The final surface shall be free from surface laminations, segregated areas, corrugations, or any defects that the Engineer deems may adversely affect the performance of the layer. Defective sections shall be repaired at Contractor's expense to the satisfaction of the Engineer.

Fine trimming if necessary by motor grader to obtain the required levels shall be followed by final smooth rolling by pneumatic tire roller to knead down any loose material left on the surface.

The mixture must be compacted to a minimum of 97% of the maximum density as determined from a field sample, taken as compaction begins. Compacting and finishing must be completed within 2 hours after adding water to the mixture.

Surface tolerance

The surface must be finish so that deviations do not exceed to 15mm, longitudinal or transverse. The Engineer will test the surface with a 4m straightedge at random locations. The Contractor will identify pavement areas that deviate more than 15 mm from the straightedge as defective work. These areas must be removed and replaced. After the Contractor performs corrective work, he will retest the area.

Cross section

During construction special attention must be paid to the cross section to prevent water standing on the pavement. The sufficient surface water drain must be ensured along the all road length. On straight section the pavement must be constructed double-slop and super elevation on the curves as specified in the design drawings. Unless otherwise is mentioned in the design drawings the cross section for Portland cement stabilized gravel roads must have double-slope and must be 30% for carriageway and 50% for shoulders. More details are presented in the design drawings.

Protecting and curing

The surface must be kept moist during hot weather. The surface must be protected and maintained until the pavement reaches 70% of its design strength. The pavement must be protected from freezing for [5] days after placement.

Quality requirements and control

For quality control 5 core samples for each 10000 m² of Portland cement stabilized gravel pavement must be taken and tested in the laboratory according to Section 005 of this specification and the results must meet the requirements presented in the tables 312-1 and 312-2 below.

Table 312-1: Requirements to the mixture stabilized by cement

	Characteristic	Unit	Requirement
1	Proctor density (Standard Proctor value)	kN/m ³	≥ 21.0
2	Compressive strength after 7 days (Proctor specimen d: 150 mm) Standard Proctor compaction	MPa	≥ 4

Table 312-2: Requirements to the Portland cement stabilized gravel sand pavement

	Characteristic	Unit	Requirement
1	Degree of compaction	%	≥ 97 single value
2	Evenness	mm	± 15/4m lath
3	Thickness	%	Difference < 10 from required thickness

Weather limitation

Portland cement stabilized gravel pavement can be constructed only when the air temperature is above 5°C. Portland cement stabilized gravel pavement must be placed only on unfrozen subgrade, incorporates only unfrozen aggregate, and do not place during rainy conditions.

312.04 Measurement

Portland cement stabilized gravel pavement will be measured by area and will include all required materials, transportation of materials, construction of Portland cement stabilized gravel pavement and compaction.

312.05 Payment

The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section and must be approved by the Employer's Project Manager or Project Manager's Representative.

Payments will be made according to the following items:

Pay Item	Pay Unit
31201 Portland cement stabilized gravel pavement 20,0cm thickness	Square meter

Section 313 – BITUMEN TREATED BASE COURSE

313.01 Description

Construction of a bitumen treated fine graded crushed stone sand hot mixture base course layer prepared in the asphalt plant, transported to the construction site, placed with the paver and compacted to the required density and thickness on a prepared base.

313.02 Materials

Materials for bitumen treated base course shall comply with the requirements of existing standards.

The quality of bitumen by its physical properties shall comply with requirements of Section 010 of these specifications.

Coarse aggregate (crushed stone) shall comply with the requirements of Section 011 of these Specifications.

Fine aggregate (sand) shall comply with requirements of Section 011 of these Specifications.

313.03 Construction

High porous crushed stone type hot mixture shall comply with the requirements of GOST 9128-2013.

313.03.01 Mix design

The Contractor shall develop and submit a job mix formula according to the GOST 9128-2013 for high porous crushed stone (високопористый щебеночный) type mixture (later on mixture). In particular the mixture must comply with the following requirements:

Gradation:

In percent by weight

Type of the mixture	Gran size, mm, less than									
	20	15	10	5	2.5	1.25	0.63	0.315	0.16	0.071
	Gap grading									
High porous crushed stone	90-100	35-64	22-52	15-40	10-28	5-16	3-10	2-8	1-5	1-4

Source: Table 2, GOST 9128-2013

Aggregate:

Besides the requirements in sub section 313.02 of current section the strength and frost resistance of the aggregate used in the mixture must comply with the requirements of table 10 of GOST 9128-2013.

Bitumen content:

The recommended bitumen content in the high porous crushed stone type hot mixture is 2.5%-4.5% by the weight of mixture.

Tolerance:

Tolerance in dosage of bitumen treated fine graded crushed stone sand hot mixture component compared to the total mass is as follows:

- Coarse and fine aggregates (crushed stone and sand): +/- 3%
- Binder (bitumen): +/- 1.5%.

Physical-mechanical properties

The physical-mechanical properties of the bitumen treated fine graded crushed stone sand base course layer from hot type mixture must comply with the requirements presented in the table 6 of the GOST 9128-2013.

Note: The grading and bitumen content in the design documents are for guidance only. The mix design must be prepared by the Contractor based on his materials which will satisfy the requirements mentioned in this section.

313.03.02 Weather limitation

The mixture shall be placed only on dry weather and during daylight hours, unfrozen surface and only when weather conditions allow for proper handling and compaction. Hot mixes must be placed at the air temperature of not less than +5°C.

313.03.03 Asphalt mixing plant

The mixing plants should be approved by the Employer's Project Manager or Project Manager's Representative. The asphalt plants shall be of batch mix type with automatic controls and with a capacity of at least 50 tons/hour. At least four cold bins for different aggregate fractions are required. The weighs of the plant shall be calibrated before the start of the production or whenever directed by the Employer's Project Manager or Project Manager's Representative. Bitumen treated fine graded crushed stone sand hot mixture should be weighed on vehicle scales up to 2% in accuracy.

313.03.04 Construction method and Equipment

Aggregate Preparation. Prior to mixing supply, heat, dry, and deliver crushed stone (gravel) and sand to the mixer at a temperature sufficient to produce a mixture within approved temperature range. Reduce the moisture content of the aggregate up to 1 per cent or less. Adjust flames used for drying and heating to prevent damage to and contamination of the aggregate.

Mixing. Measure the aggregate and bitumen into the mixer in accordance to the job-mix formula approved by the Employer's Project Manager or Project Manager's Representative. Mix until all the particles are completely and uniformly coated with bitumen. The temperature of mix shall all the time during mixing and loading be maintained within the approved range given in table 41 of the CSRA IV-11.05.02-99 "Automobile roads" standards.

Preparing of crushed stone bas. The surface shall be prepared according to Section 307 of the Specifications. An even bitumen prime or tack coat shall be applied along entire surface, contact surface of curbs, gutters, manholes and other structures, according to SNiP 3.06.03-85. Protect nearby areas from spatter or splashing during the application.

Hauling Equipment. Equipment must be furnished with tight, clean, smooth metal beds to haul bitumen treated fine graded crushed stone sand mixture. Beds must be kept free of petroleum oils, solvents, or other materials that would adversely affect the mixture. A thin coat of approved release agent must be applied to beds as necessary to prevent mixture adherence. Equip each truck with a canvas cover or other suitable material of sufficient size to protect the mixture from the weather influence.

Do not use petroleum derivatives or other coating materials which contaminate or alter the characteristics of the mixture. Drain the bed before mix loading. Where necessary to maintain the mix temperature, use insulated truck beds and securely fastened covers. Provide access ports or holes for checking the temperature of the asphalt mixture in the truck.

Asphalt Pavers. Self-propelled asphalt pavers with activated heated screed assemblies to spread and finish to the specified section widths and thicknesses must be used. Ensure the paver's distribution system places the mixture uniformly in front of the screed. Screed or strike-off the surface without tearing, shoving, or gouging the mixture.

It shall be capable of laying mixture with no segregation, dragging, burning or other surface defects and within specified level and surface regularity tolerances. The auger and compacting beam must not be so worn out, to cause segregation or unevenness.

Operate the paver at consistent speeds to apply the material in an even, continuous layer. Avoid stop and go operation.

Equip pavers with automatic screed controls capable of operating from a reference line or a ski from either or both sides of the paver. Control the screed to maintain the transverse slope according to plan.

The Contractor may operate equipment manually in irregularly shaped and minor areas.

If automatic controls fail, operate equipment manually only for the remainder of the work day and only if specified results are obtained.

Suspend paving if the specified surface tolerances are not met. Resume only after correcting the situation.

Rollers. Rollers capable of reversing without shoving or tearing the mixture must be used. Vibratory rollers with separate energy and propulsion controls must be equipped. Equipment that will not crush the aggregate or displace the mixture must be selected.

Placing and Finishing. The mixture must be placed and finished with asphalt pavers to specified grade and thickness. Mixture placing and finishing must be arranged without any unnecessary pauses and the temperature of the mixture shall not drop below the permissible temperature. The laying temperature measured from several points of the load must meet the requirements of mixing temperature of table 42 of the CSRA IV-11.05.02-99 "Automobile roads" standards. If the temperature is incorrect the load must be rejected, if not approved by the Employer's Project Manager or Project Manager's Representative to be used in secondary places. Before beginning of laying the adjustments of the machinery, which have effect on how well the mix moves in the paver and the quality of surface, must be put in order.

Place mixture as continuously as possible. Work and traffic arrangements must be done in a way that the traffic does not damage the edges of laid pavement. The damaged edges must be cut and repaired by repaving the damaged area. Mixture shall be placed by paver providing full width of the strip.

Maintain a consistent supply of mixture to ensure uninterrupted paving.

Compacting. Compact the mixture so that the bitumen treated fine graded crushed stone sand mixture base course layer residual porosity is within the range of 10%-18%. The density shall not be less than 0.98 (accurate within 0.01). The number of rolling equipment must be sufficient compared with the capacity of the production. Compact the surface so that no harmful roller tracks or cracks will appear. Do not pass rollers over the unprotected end of a freshly laid mixture or leave the roller on freshly laid soft surface. The proper evenness and pavement cross-fall shall be kept continuously during rolling. Do not allow traffic on newly laid pavement before it has cooled down enough to avoid rutting.

Start compaction immediately after placing, keeping the temperature range of the mix at the beginning not less than specified in table 42 of the CSRA IV-11.05.02-99 "Automobile roads" standards. Mixture shall be compacted first with a pneumatic-tired roller at least 16 tons in weight (6-10 passages) or with a steel-wheel roller at least 10-13 tons in weight (8-10 passages) or by vibrating rollers 6-8 tons in weight (5-7 passages). Intermediate rolling should be carried out with a pneumatic-tired roller and final rolling with a steel-wheel 11-18 tons in weight (6-8 passages). Rolling shall begin at the side and proceed longitudinally parallel to the centre-line, each trip overlapping one-half of the roller width. On super-elevated curves, rolling shall begin at the low side.

At the beginning the speed of roller should not exceed 5 km/hour for steel-wheel roller, 3 km/hour for vibrating roller and 10 km/hour for pneumatic-tired roller. The roller wheels should be continuously moistened to avoid the adhesion with surface of the mix laid.

Smoothness. Measure the smoothness of the finished base course after final rolling. For smoothness measurement both in cross direction and in parallel to the centre line a metal straightedge 3 m in length shall be used. A defective area is considered an area with surface deviations in excess of 10mm between the straightedge and the surface. Correct defective area and measure again after the correction for acceptance. New base course should be uniform without segregations, cracks, bleeding of binder etc.

**313.03.05 Acceptance Procedures for bitumen treated fine graded crushed stone sand hot mixture
base course layer**

Bitumen treated fine graded crushed stone sand hot mixture base course materials will be accepted in accordance to section 002 and the requirement of section 313.02.

(b) Certification. Deliver a certification signed by the supplier to cover the quality and the quantity of binder and the condition of container for each shipment. Provide test result as required by the Employer's Project Manager or Project Manager's Representative.

(c) Acceptance sampling procedures. Bitumen treated fine graded crushed stone sand hot mixture and base course samples for acceptance will be selected, obtained and tested, as follows:

1. Gradation of bitumen treated fine graded crushed stone sand hot mixture and bitumen content: At starting of bitumen treated fine graded crushed stone sand hot mixture production and in case of job-mix formula is changed or if in any doubt of the right composition of the mixture, the required number of samples is taken from asphalt plant for testing. On sample for every 500 tons to be taken randomly or one sample at least daily from placed but not compacted pavement.
2. Thickness and density of samples selected from the finished bitumen treated fine graded crushed stone sand hot mixture base course layer: A set of 5 core samples from carriageway is taken at the beginning of works, thereafter one set per each 10 000 m² of pavement. Core samples shall be taken randomly and thickness and density shall be determined. If required, the additional set of cores might be taken. If traffic intensity is ≥ 4000 vehicle/day or there are cracks and large porosity then the testing of samples have to be done with Marshall Device.
3. One sample of bitumen shall be taken from each shipment to the plant and from each binder type as directed by the Employer's Project Manager or Project Manager's Representative
4. Aggregate samples shall be tested in the beginning of the production and, if aggregate is changed or as directed by the Employer's Project Manager or Project Manager's Representative

(d) Acceptance.

1. **Density (void content).** Core samples will be taken and tested by the Contractor to verify the required density of the compacted pavement. The unit price of bitumen treated fine graded crushed stone sand hot mixture base course is reduced as follows, if the requirement for density is not fulfilled:

For full payment acceptance criteria for average density of core samples is 0.98 (98%). For each 0.001 (0.1%) part, that the density is less than the required value the price of the bitumen treated fine graded crushed stone sand hot mixture base course is reduced by 1%. The maximum deduction is 5%. If the average density accurate within 0.01 is less than 0.98, the corresponding production is rejected.

Extra sample set may be taken, if so directed by the Employer's Project Manager or Project Manager's Representative.

2. **Thickness.** Required amount is indicated in the drawings or Bill of Quantities. The allowable deviation is +/-10%. Amount is calculated based on core samples (same sample set as for density). For full payment, it is necessary that the average thickness be not less than the required one and the thickness of any core sample be less than the required one at most 10%. If the average thickness of the placed and compacted base course, as well as the thickness of the core sample is less than the required thickness for no more than 10%, then the payable amount for bitumen treated fine graded crushed stone sand hot mixture base course shall be determined in the following way: the thickness of the core sample with the required less thickness is divided by the required value, multiplied by unit price and multiplied by the area distributed to the given sample. Average thickness (weight per unit area) is also calculated daily on the basis of the weight of bitumen treated fine graded crushed stone sand hot mixture placed in that day, and pavement area. If the average thickness (amount of bitumen treated fine graded crushed stone sand hot mixture laid per unit area) is less than ordered one in permissible limits, then the realized value of pavement in that day shall be reduced accordingly. If the average thickness (amount of bitumen treated fine graded crushed stone sand hot mixture laid per unit area) is less than ordered one in impermissible limits, then constructed base course layer for that day shall be rejected.

3. **Bitumen content.** If the bitumen content in the placed bitumen treated fine graded crushed stone sand hot mixture is less than that determined by the standard recipe (taking into account the tolerance mentioned in clause 313.03), the value of layer constructed with that particular bitumen treated fine graded crushed stone sand hot mixture will be reduced in the following way:

Binder content deviation	Value deduction in %
< =0.05	0
0.10	4
0.15	9
0.20	13

Intermediate values are interpolated. In case of bitumen content lesser than the mentioned one, the corresponding pavement are shall be rejected.

313.04 Measurement

Bitumen treated fine graded crushed stone sand hot mixture base course layer will be measured by area and will include the construction of Bitumen treated fine graded crushed stone sand hot mixture base course layer and tack coat application as described under Section 307 as well as trimming of joints edges and clean up as shown in Section 308.14.

313.05 Payment

The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section and must be approved by the Employer's Project Manager or Project Manager's Representative.

Payments will be made according to the following items:

Pay Item	Pay Unit
31301 Bitumen treated fine graded crushed stone send mixture base course 4cm depth	Square meter
31302 Bitumen treated fine graded crushed stone send mixture base course 5cm depth	Square meter
31303 Bitumen treated fine graded crushed stone send mixture base course 8cm depth	Square meter
31304 Bitumen treated fine graded crushed stone send mixture base course 9cm depth	Square meter

4. DRAINAGE

Section 401 - CULVERTS

Description

401.01. This work consists of constructing culverts, extending existing culverts and/or replacing culverts.

Material

401.02. General. Culverts and materials used for works of the present section shall meet requirements of SNiP 2.05.03-84, SNiP 2.05.02-85, Album of type constructions GOST 35-27.0-85, GOST 5781-82 and 13015.2-81.

401.03. Joint fill. Apply joint fill of the type and mix design approved by the Employer's Project Manager or Project Manager's Representative.

401.04. Pipes. Culvert pipes shall conform to SNiP 2.05.03-85 and GOST 6482-88. The length of culvert pipes shall be as stipulated in the Album of typical drawings unless otherwise specified. Metal pipes shall conform to VSN 176-78.

Concrete pipe will be accepted for use in the project if "product certification" is furnished to the Employer's Project Manager or Project Manager's Representative by the manufacturer stating that it has been commercially produced according to a standard specification.

Construction Requirements

401.05. General. Use the same material on all continuous culvert sections and extensions. Use special sections, such as elbows and branch connections that are the same material and coating as the attached pipe. Culvert material, sizes, and approximate locations are shown on the plans.

The longitudinal slopes of new culvert should correspond to the value specified in drawings. The longitudinal slopes of new parts of reconstructing or extending culverts should be equal to slope of existing part of culvert.

401.06. Extension of the existing culverts. Extension of the existing culverts shall be started from removing the existing culvert heads. Start at the lower end and lay the bell or groove end upgrade. Fully joint all sections. Structures and materials should be moved to special areas and disposed or buried. Extension of the existing culverts shall be done according to the designs. Placing materials and structures shall be done only after the Employer's Project Manager or Project Manager's Representative's approval.

401.07. Replacement of existing culverts. Before replacing existing culverts scarify the existing pavement and remove pavement and subgrade and pile in approved areas.

The Contractor shall prepare provisional schemes of traffic control during the construction periods and get approval from the relevant authorities and the Employer's Project Manager or Project Manager's Representative.

Demounted culverts and culvert heads shall be disposed by the Contractor. The work consists of excavation, placing crushed stone bed foundation, installation of culverts, making culvert joints, waterproof new culvert, inlet installation and waterproofing, backfilling and soil compaction, concrete inlet and outlet at culvert heads.

The soil for back filling shall meet requirements of Section 201. Laying and compaction of the pavement shall conform to Section 306.

Metal pipes shall be protected from corrosion: they should be coated with lubricating layer or surface waterproofing.

401.08. Construction of new culvert. Construction of a new culvert shall be done in accordance with Section 401.07, except for existing culvert removing.

401.09 Acceptance. The work of existing culverts extension, replacement and new culvert construction will be accepted according to subsections 002.03 and 002-04 providing it has been done according to the plans, specifications and accepted by the Employer's Project Manager or Project Manager's Representative.

Measurements

401.10. Extension, replacement of existing culverts and construction of new culverts are measured as follows:

Item	Measured by
Removing of existing culvert heads	Number
Removing existing culverts (particular diameter)	Length
Placing culvert heads (for particular diameter culverts)	Number
Placing culverts (particular diameter, if it will replace existing culverts and construct a new one)	Length
Extension of culverts (Particular diameter)	Length
Concrete apron	Volume

Payment

401.11. Accepted and measured quantities as described above shall be paid at the contract price per unit of measurement. The payments mentioned below include costs of relevant quantities of trenching, back filling pits, subgrade, demounting and paving, building crushed stone pads for culvert foundation, placing of foundation, waterproofing, join filling and all other incidental items required for construction. The Payment will be full compensation for the work prescribed in this Section.

The Payment will be made under.

Pay item	Pay Unit
40101 Removing existing culvert heads	each
40102 Removing existing culverts	linear meter
40102A Removing existing Slovinski type bridge	each
40103 Culvert heads installation (for diameter 0.75 m culverts)	each
40104 Culvert heads installation (for diameter 1.0 m culverts)	each
40105A Culvert heads installation (for diameter 1.5 m culverts)	each
40105B Culvert heads installation (for diameter 1.5*2 m culverts)	each
40106 Extension of culverts (diameter 0.75 m)	linear meter
40107 Extension of culverts (diameter 1.0 m)	linear meter
40108 Extension of culverts (diameter 1.5 m)	linear meter
40109 Construction of culverts	linear meter
40109 A Construction of metal culverts	linear meter
40110 Construction of culverts (for diameter 1.0 m)	linear meter
40111A Construction of culverts (for diameter 1.5 m)	linear meter
40111B Construction of culverts (for diameter 2*1,5 m)	linear meter
40111C Construction of Slovinski type bridge	each
40112 Concrete apron	cubic meter
40113 Concrete support element	cubic meter
40114 Stone paving	cubic meter
40115 Waterproofing	linear meter

Section 402 - RECONDITIONING EXISTING DRAINAGE STRUCTURES

Description

402.01. This work consists of cleaning existing culverts in place, reconditioning existing inlets, and repairing and cleaning existing spillways and chutes.

Material

402.02. Materials.

1. Concrete Composition. Concrete shall conform to Table 404-1. Before batching concrete submit the proposed concrete proportions for approval to the Employer's Project Manager or Project Manager's Representative. As a minimum, submit the following:

- (a) Type and source(s) of all material proposed for use.
- (b) Material certification for all material proposed for use.
- (c) Saturated surface dry weight of the fine and coarse aggregate per cubic meter of concrete.
- (d) Gradation of fine and coarse aggregate.
- (e) Weight of mixing water per cubic meter of concrete.
- (f) Weight of cement per cubic meter of concrete.
- (g) Entrained air content of concrete mix in percent by volume
- (h) Maximum slump of concrete mix in cm.

2. Joint mortar used for concrete minor structure shall consist of the following:

- (a) One part hydraulic cement (see GOST 25192-87, GOST 26633-89 and table 3.1 of SNiP 2.05.02-85) shall not contain lumps, be partially set, or come from previously opened bag subject to hydration.
- (b) Two parts fine sand free of clay or other deleterious materials.
- (c) Water as required to obtain a freely working mix capable of being forced into small interstices.

3. Inlet metal grates shall be used as available from local suppliers.

Construction Requirements

402.03. Cleaning Culverts in Place. Remove and dispose of all foreign material within the barrel and appurtenances of the culvert by any method that does not damage the culvert.

402.04. Reconditioning Drainage Structures. Remove all debris from inlets designated to be reconditioned. Repair all leaks and structural damage.

402.05. Acceptance. The work will be accepted for payment providing that it has been built in conformance to the plans and specifications pertaining to the Sections involved and is accepted by the Employer's Project Manager or Project Manager's Representative.

Measurement

402.06. Cleaning culvert in place will be measured by length. If the culvert is removed and relayed there will be no additional measurement or payment except as specific in section 401. Reconditioning drainage structures will be measured by number. Repairing and cleaning spillways will be measured by number and by length.

Payment

402.07. The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section.

Payment will be made under:

Pay Item	Pay Unit
40201 Clean culverts in place	Linear meter.
40202 Reconditioning inlets	Each
40203A Repair and cleaning of gully	Each
40203B Repair and cleaning of chutes	Linear meter
40203C Repairing and cleaning of Slavinski type bridge	each

Section 403 - SPILLWAYS, GULLIES AND LINED DITCHES

Description

403.01. This work consists of constructing lined spillways, gullies, and similar ditches.

Lined ditches will be constructed according to the Project and Typical Album.

Spillways, gullies, and ditches will be precast of Portland cement concrete, available from local suppliers and will require a product certification from the manufacturer stating that it has been commercially produced in conformity with standard specifications provided by the Employer's Project Manager or Project Manager's Representative.

Material

403.02. Material shall conform to the design.

Construction Requirements

403.03. General. Form the bed parallel to the finished surface of the waterway.

403.04. Concrete Spillway and Gullies. Perform the work according to Section 404, utilizing commercially available precast units.

403.05. Lined Ditches. Ditch lining with crushed stone and prefabricated concrete slabs shall be done according to the typical drawings, specifications and designs.

403.06. Acceptance. The work will be accepted for payment providing that it has been built in conformance to the plans and specifications to the Sections involved and is accepted by the Employer's Project Manager or Project Manager's Representative.

Measurement

403.07. Lined ditches and concrete spillways on the slope will be measured by length on the shoulder, and ditch lining by volume. The cost of excavation, bedding support of excavation and backfill shall be included in the costs by length.

Payment

403.08. The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section.

Payment will be made under:

Pay Item	Pay Unit
40301 Concrete shoulder spillway (type 1)	each
40302 Concrete shoulder spillway (type 2)	each
40303 Concrete shoulder spillway (type 3)	each
40304 Concrete shoulder spillway (type 4)	each
40305 Concrete slope spillway along slope	linear meter
40306 Concrete apron at the road-bed foot	square meter
40307 Concrete apron at ditch	square meter
40308 Paved gully	linear meter
40309 Concrete apron with baffle	each
40310 Ditch lining with concrete (tiles)	cubic meter
40311 Ditch lining with aggregate 10cm in thickness	square meter
40312 Chute type of ..	linear meter

Section 404 - MINOR CONCRETE STRUCTURE

Description

404.01. This work consists of constructing minor concrete structures.

Material

404.02. Materials.

1. Aggregate shall conform to (see Section 011) and shall consist of hard durable particles of crushed stone, crushed slag or crushed gravel and shall be subject to the following tests: Sieve analysis, Strength, Wearing and amount of fines.

2. Joint mortar used for concrete minor structures shall consist of the following:

- a. One part hydraulic cement (see Section 009) shall not contain lumps, be partially set, or come from previously opened bags subject to hydration.
- b. Two parts fine sand free of clay or other deleterious materials.
- c. Water as required to obtain a freely working mix capable of being forced into small cracks.

3. Masonry Cement.

Masonry cement shall meet the following specifications of Section 009.

Do not use cement which has lumps, become partially set or is salvaged from previously opened bags. Do not mix brands or types of cement from different mills without the Employer's Project Manager or Project Manager's Representative's approval.

If approved by the Employer's Project Manager or Project Manager's Representative, asphalt may be used for sidewalks in place of concrete according to Section 311.

Concrete curbs can be cast-in-place or prefabricated in unified block length.

404.03. Concrete Composition. Concrete shall conform to Table 404-1. Before batching concrete, submit the proposed concrete proportions for approval. As a minimum, submit the following:

- (a) Strength of Concrete
- (b) Type and source(s) of all material proposed for use.
- (c) Material certification for all material proposed for use.
- (d) Saturated surface dry weight of the fine and coarse aggregate per cubic meter of concrete.
- (e) Gradation of fine and coarse aggregate.
- (f) Weight of mixing water per cubic meter of concrete.
- (g) Weight of cement per cubic meter of concrete
- (h) Entrained air content of concrete mix in per cent by volume.
- (i) Maximum slump of concrete mix in cm.

TABLE 404-01: Composition of Minor Structure Concrete

Property	Specification
Maximum W/C ratio	0.49
Maximum slump, cm	10
Minimum air content, per cent	4
Aggregate size	Varies
Minimum 28-day compressive strength, Mpa	20

Construction Requirements

404.04. General. Design and construct forms that are free of bulge and wrap and allow for removal without causing damage to the concrete.

Use wood, metal, or other suitable material for the forms. Keep forms clean and coat with a form release agent or form oil before placing concrete.

404.05. Placing Concrete. Moisten the forms and foundation immediately before placing concrete. Discharge concrete within one hour of mixing.

Place concrete avoiding segregation of material. Do not use aluminum pipe for transporting or placing concrete. The intervals between deliveries of batches for a single pour on a structure shall not exceed 30 minutes.

All work must occur at an air temperature not below +5C.

Do not apply water on fresh concrete surfaces during finishing operations.

404.06. Curing Concrete. Cure concrete a minimum of 7 days. Finish exposed concrete surfaces according to the following:

Remove and replace or repair, as approved, all rock pockets or honeycombed concrete.

Clean all form tie cavities, holes, broken corners and edges, and other defects. Saturate the area to be repaired with water. Finish the area with mortar that is less than one hour old. After the mortar is set rub it and continue curing. Match exposed surfaces to surrounding concrete.

Carefully tool and remove free mortar and concrete from construction joints.

404.07. Acceptance. The work will be accepted for payments providing that it has been build in conformance to the plans and specifications pertaining to the Section involved and is approved by the Employer's Project Manager or Project Manager's Representative.

Measurement

404.08. Curbs and concrete barriers will be measured by length, and concrete posts - by number.

Payment

404.09. The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section.

Payment will be made under:

Pay Item	Pay Unit
40402 Curbs	Linear meter
40403 Shoulder support (concrete)	Linear meter
40404 Concrete barriers	Linear meter
40405 Concrete posts	Each

Section 405. MANHOLES, INLETS, AND CATCH BASINS

Description

405.01 This work consists of constructing or adjusting inlets and inlet aprons.

Material

405.02 Materials.

1. Concrete Composition. Concrete shall conform to the requirements of Subsection 404.03.
2. Joint mortar shall conform to the Subsection 402.02.
3. Inlet grates shall be used as available from local suppliers.

Construction Requirements

405.03 General. Perform the work described under Section 404.

405.04 Concrete Construction. Construct concrete inlets according to Section 404. Concrete structures must be cast-in-place. Finish the surface according to Section 404.

Grout all joints and opening to make them watertight.

Finish the channel flow line in inlets accurately to match the pipe flow line. Set metal frames in a fill joint mortar bed.

405.05 Grade Adjustment of Existing Structures. Adjust metal frames and grates to appropriate grades before placing the surface course.

Remove and clean the frames, covers, and grates. Trim the walls down to the solid material. Reconstruct the walls with the same material as existing and reset the cleaned frames at the required elevation.

When inlets are adjusted to grade and abut existing concrete structure, separate the castings from the adjacent concrete with a performed expansion joint no less than 15 mm in thickness.

Clean each structure of all accumulated silt, debris, or foreign matter.

405.06 Acceptance. The work will be accepted for payment providing that it has been built in conformance to the plans and specifications pertaining to the item involved and is accepted by the Employer's Project Manager or Project Manager's Representative.

Measurement

405.07 Inlets, inlet adjustments, inlet metal grates, concrete inlet aprons, metal frames and grates, manholes covers and frames will be measured by number.

Payment

405.08. The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section.

Payment will be made under:

Pay Item	Pay Unit
40501 Inlet	Each
40502 Inlet adjustment	Each
40503 Inlet metal grate	Each
40504 Concrete inlet apron	Each
40505 Manhole covers	Each

5. JUNCTIONS

NOT APPLICABLE

6. ROAD FURNITURE

Section 601 – GUARDRAILS AND PARAPETS

Description

601.01. This work consists of constructing guardrails and parapets and modifying, removing, resetting, and raising existing guardrails.

Materials

601.02. Material shall conform to the following:

Concrete	Section 404
Metal guardrails	see the design
Guardrail hardware	Standard design Serial #3.503.1-89
Guardrail posts Serial	Standard design #3.503.1-89
Parapet	see the design

Paint for guardrail posts. Painting of guardrail posts shall be performed under specification approved by the road police.

Guardrail installation shall conform to the design.

Construction Requirements

601.03. Posts. When pavement is within 1 m of the guardrail, set posts before placing the pavement.

Do not shorten guardrail posts unless the cut end is set in concrete. Drive posts into pilot holes that are punched or drilled. The dimensions of the pilot hole shall not exceed the dimensions of the post by more than 15 mm. Install posts back-fill, and compact.

601.04. Rail Elements. Install the rail elements after the pavement adjacent to the guardrail is complete. Do not modify specified hole diameters or slot dimensions.

(a) Steel rail. Shop bend all curved guardrails with a radius of 45cm or less.

Erect rail elements in a smooth continuous line with the top lapped in the direction of traffic flow. Use bolts that extend at least 6 mm but not more than 25 mm beyond the nuts. Tighten all bolts.

(b) Parapets. Parapets must be provide from stone and concrete. Concrete must be B20, and strength of stone must be more than 20% of strength of concrete .

601.05 Terminal Sections. Construct cast-in-place or pre-cast concrete end anchors according to the drawing. Do not connect the guardrail to cast-in-place anchors until the concrete has cured 7 days. Install the end anchor cables tightly without slack.

601.06. Removing and Resetting Guardrail. Remove and store the existing guardrail, posts, and appurtenances. Remove and dispose of posts that are set in concrete. Replace all guardrail, posts, and hardware damaged during use, removal, storage, or resetting.

601.07. Raising Guardrail. Remove the existing guardrail and appurtenances. Replace and reset posts as needed. Replace all guardrail, posts, and hardware damaged during the removal and raising.

601.08. Acceptance. The work will be accepted for payment providing that it has been built in conformance to the plans and specifications pertaining to the sections involved and is approved by the Employer's Project Manager or Project Manager's Representative.

Measurement

601.09. Guardrail will be measured by length along the face of the rail not including terminal sections. Terminal sections will be measured by number.

Removing and resetting guardrail and raising guardrail will be measured by length along the face of the rail including reset terminal sections. Replacement posts (except replacement posts for posts damaged by construction operations) used in the removing, resetting, or raising guardrail, will be measured by number.

Payment

601.10. The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section.

Payment will be made under:

Pay Item	Pay Unit
60101 Install guardrail, (metallic or parapets)	Linear meter
60102 Install guardrail terminal section	Each
60103 Repair and reset guardrail	Linear meter
60104 Replace guardrail posts	Each
60105 Paint guardrail posts	Each
60106 Remove guardrail	Linear meter
60107 Painting of guardrails	Linear meter

Section 602 - PEDESTRIAN AND BRIDGE RAIL

NOT APPLICABLE

Section 603 - BUS STOPS

NOT APPLICABLE

Section 604 - PERMANENT TRAFFIC CONTROL

Description

604.01 This work consists of constructing permanent traffic control signs with supports, delineators, and object markers.

Material

604.02 Material shall conform to the following:

All sign panels and delineators shall comply with the design.

All hardware and signposts shall be manufactured according to GOST 25458-82, GOST 25459-82 and Typical Album Serial # 3.503.9-80.

Delineators are to be manufactured according to Typical Album Serial # 3.503.1-89.

Concrete to be as according to Section 404.

Construction requirements

604.03 General. Furnish traffic control devices according to GOST 23457-79, *Technical Methods for Organizing Traffic Movement*, and Corrections #3 to GOST 10807-78. Submit the sign list roadside and delineator soaking for approval to the Employer's Project Manager or Project Manager's Representative before ordering. The design of traffic sign and their installation shall be approved by GAI.

604.04 Supports. Sign locations and delineator locations shown on the plans may be changed in agreement with the Employer's Project Manager or Project Manager's Representative to fit the field conditions. Determine the lengths of posts at time of staking.

Drive posts with a suitable driving head or set posts in drilled or punched holes. Replace all posts damaged by driving. Erect sign supports plumb, backfill, and compact.

Construct concrete footings according to Section 404.

604.05 Panels. Road sign panels are installed on posts in accordance with the design. Mounting of individual signs consisting of prefabricated panels may be made at the place of installation. Do not field drill holes in any part of the panel. Use anti-theft fasteners where possible. Paint all bolt heads, screw heads, and washers that are exposed on the sign face. Match the color of the paint to the color of the background or the message area at the point where the fitting is exposed.

If a sign message is not applicable, completely cover the face of the sign with an opaque material.

Maintain the covering in good condition until the message becomes applicable. Do not use adhesive tape on the face of a sign.

Repair or replace damaged parts including reflective sheeting.

604.06 Acceptance. The work will be accepted for payment providing that it has been built in conformance to the plans and Specifications pertaining to the segment involved and is approved by the Employer's Project Manager or Project Manager's Representative.

Measurement

604.07 Sign installations will be measured by the area of the front face of the sign panel. Nominal dimensions will be used. A sign installation includes the support.

Signs will be measured by the area of the front face of the sign panel. Each sign in a multiple configuration will be measured.

Posts will be measured by length. Roadside delineators will be measured by number. Sign supports will be measured by number.

Payment

604.08 The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section.

Payment will be made under:

Pay Item	Pay Unit
60401 Installation of new signs	Each
60402 Replace sign panels	Square meter
60403 Remove and reset existing signs	Each
60404 Galvanized steel sign posts	Meter
60405 Road delineators	Each
60406 Sign mount replacement	Each
60407 Pole sign mount	Each
60408 Γ-shaped galvanized sign mount and cable sign mount	Each
60409 Existing sign post and mount painting	Each
60410 Berm embankment for installation of signs	Cubic meters
60411 Drainage pipe diameter 300mm installation under berm	Linear meters

Section 605 - PERMANENT PAVEMENT MARKINGS

Description

605.01 This work consists of applying permanent pavement markings on the completed pavement.

Material

605.02 Material shall conform to GOST 13508-74 and Correction No. 4 of GOST 13508-74. The materials are conventional traffic paint.

Construction requirements

605.03 General. Where existing and final pavement marking locations are identical, stake the limits of all existing pavement markings (no-passing zones, edge stripes, etc.) before any pavement work. Upon completion of the final surface course, establish line limits for the new pavement for approval before marking. Establish markings according to the design.

Remove loose particles, dirt, tar, grease, and other deleterious material from the surface to be marked. Apply markings to a clean, dry surface.

At least 7 days before starting pavement marking applications, furnish a written copy to the Employer's Project Manager or Project Manager's Representative of the marking manufacturer's instructions for material usage. A field demonstration may be required to verify the adequacy of recommendations.

Ship marking material in appropriate containers plainly marked with the following information as appropriate for the material being furnished:

- (a) Manufacturer's name and address
- (b) Name of product
- (c) Lot/batch number
- (d) Color
- (e) Net weight and volume of contents
- (f) Date of manufacture
- (g) Date of expiration
- (h) Statement of contents, if mixing of components is required
- (i) Mixing proportions and instructions
- (j) Safety information

Apply pavement marking in the direction of traffic. Apply all markings to provide a clean-cut, uniform and workmanlike appearance by day or night.

Protect marked areas from traffic until the markings are dried to no-tracking condition. Remove all tracking marks, spilled marking material, markings in unauthorized areas, and defective markings.

605.04 Conventional Traffic Paint.

Paint according to the manufacturer's instructions for material usage.

605.05 Acceptance. The work will be accepted for payment providing that it has been built in conformance to the plans and specifications pertaining to the segment involved and is approved by the Employer's Project Manager or Project Manager's Representative.

Measurement

605.06 Pavement markings will be measured by area. Directional arrows will be measured by number.

Payment

605.07 The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section.

Payment will be made under:

Pay Item

60501 Pavement markings, paint
60502 Directional arrows

Pay Unit

Square meter
Each

Section 606 - TEMPORARY TRAFFIC CONTROL MEANS

Description

606.01 This work consists of furnishing, maintaining, relocating, and removing temporary traffic control devices and services as ordered for the control and protection of public traffic through the project.

Barricades and warning light types are designated as shown in plans. Temporary concrete barriers shall be done as shown in plans and as appendix 2 "Safe working on the highway"

Material

606.02

Construction sign panels:	see the design
Retro reflective sheeting:	Correction #3 to GOST 10807-78 and appendix 2 "Safe working on the highway"
Temporary traffic control devices:	according to Subsection 604.03.

Construction Requirements

606.03 General. Install and maintain temporary traffic control devices adjacent to and within the project according to the approved traffic control implementation drawings and Section 008. Install and maintain traffic control devices as follows:

- (a) Furnish and place traffic control devices before the start of construction operations.
- (b) Install only those traffic control devices needed for each stage or phase.
- (c) Relocate temporary traffic control devices as necessary.
- (d) Remove devices that no longer apply to the existing conditions.
- (e) Whenever the Contractor removes, obliterates, or overlays any pavement markings, he shall replace them on a daily basis in accordance with the contract or as directed by the Employer's Project Manager or Project Manager's Representative.
- (f) Immediately clean, or replace any device that is lost, destroyed, or damaged or when its retro-reflectivity is reduced by 50% of its required retro-reflectivity.
- (g) Keep temporary traffic control devices clean.
- (h) Repair scratches and rips in the retro-reflective sheeting.
- (I) Remove all temporary traffic control devices upon contract completion or when approved.

606.04 Barricades. Perform the work described in the above document. Use wood, metal, or plastic barricades.

606.05 Cones. Perform the work described in the above document and as described in the plans.

606.06 Construction Signs. Recto-reflective sheeting shall be used on all signs for temporary traffic control. Use wood, metal, or other approved posts. Remove or completely cover all unnecessary signs with metal, plywood, or other acceptable material.

606.07 Flagmen. Perform the work described in the above document, Sub-section 606.01. Train flaggers in their duties. Use flagmen or striped black and white batons.

606.08 Vertical signs. Perform the work described in the above document. Use wood, metal, or plastic vertical signs.

606.09 Warning Lights. Perform the work described in the above document.

606.10 Temporary pavement. Are not permeations.

606.11 Temporary construction barriers, traffic cones and traffic delineators. The Contractor shall furnish maintain and remove on completion of the Works or when directed by the Employer's Project Manager or Project Manager's Representative all temporary construction barricades, traffic cones, traffic delineators and appurtenances as indicated on the drawings or required where roads are closed, partially closed, or where required to direct, inform or assist traffic in the area of construction. The Contractor shall relocate all temporary construction barricades and traffic cones as required by the construction stages or steps and his sequence of construction operations.

Temporary construction barricades, traffic cones and traffic delineators shall be placed as indicated on the drawings and as directed by the Employer's Project Manager or Project Manager's Representative to direct traffic smoothly and safely.

Temporary construction barricades shall have yellow lamps in the steady and/or flashing mode at the side bordering the line of traffic for the sake of giving warning. The light shall be placed in such a way that it lights the barricades without the use of vehicle light.

Maintenance of all temporary construction barricades furnished under this Contract shall include, but not limited to all reflective sheeting, lighting, flashing warning lights, replacement or other work required to maintain barricade in a condition and position as approved by the Employer's Project Manager or Project Manager's Representative.

At the completion of construction or when directed by the Employer's Project Manager or Project Manager's Representative, the Contractor shall remove and dispose of all barricades, cones and delineators, as approved by the Employer's Project Manager or Project Manager's Representative.

606.12. Temporary Marking of Signs. Sign legend that conflicts with the construction signing shall be completely covered by the Contractor so that none of the covered sign or legend is visible to traffic. If the whole sign is to be covered, it shall be covered with a non-transparent material that covers the entire face at the sign.

606.13. Acceptance. The work will be accepted for payment providing that it has been built in conformance to the plans and specifications pertaining to the Sections involved and is accepted by the Employer's Project Manager or Project Manager's Representative.

Measurement

606.14. Barricades will be measured by the number and will be measured only one time even if relocated or replaced.

Cones will be measured by the number and will be measured only one time even if relocated or replaced.

Construction signs will be measured by area of front face sign panel and will be measured only one time even if relocated or replaced.

Flagmen will be measured by the hour.

Vertical signs will be measured by the number and will be measured only one time even if relocated or replaced.

Warning lights will be measured by the number and will be measured only one time if relocated or replaced.

Temporary pavements will be measured by weight.

Traffic control supervisor will be measured by time.

Temporary Concrete Barriers will be measured by length.

Payment

606.15. Supply and construction of traffic control devices, as determined by the traffic control plan will be paid as follows: 50 percent at the accepted amount upon first utilization, an additional 40 percent at the accepted amount when 75 percent of the original contract has been earned, and the final 10 percent when the project has been completed.

Payment will be made under:

Pay Item	Pay Unit
60601 Barricade	Each
60602 Cone	Each
60603 Construction sign	m ²
60604 Vertical sign	Each
60605 Warning light	Each
60606 Flagmen	Hour
60607 Temporary pavement	Ton
60608 Traffic control supervisor	Day
60609 Concrete barriers temporary	Linear meter

7. UTILITY RELOCATION

Section 701 - UTILITIES

701.01. The work under this Section includes but is not limited to the relocation, replacement and rerouting of all utilities located on the Project. The contractor is responsible for working closely with any utility company having their infrastructure located within the public right-of-way.

Material

701.02. Materials used in the repairing, replacing, rerouting of any utility company's equipment shall be compatible with the existing utility and approved by the utility company's representative.

Construction Requirements

701.03. Before any construction is begun the Contractor shall notify the utility companies of the proposed work area and request that they mark the location of any types of equipment in the area.

The Contractor is responsible for any and all damage caused to any utility during construction and shall repair them with his equipment or, if the utility company desires, they shall be allowed a free use of his equipment and personnel as required in order to complete repair works.

Should the utility company chose to repair the damaged utility themselves costs incurred shall be the responsibility of the Contractor.

If any utility equipment is encountered in the proposed work area the Contractor shall submit to the Employer's Project Manager or Project Manager's Representative for approval his proposal to relocate the utility outside the construction limits in writing. This proposal shall include, but not be limited to the proposed duration of the works, plans and details of a new utility route, materials to be used, together with any required certification that the material meets the utility company's specification and details of protection methods to be used for any utility materials to be left in place. After the utility has been rerouted the interested utility company shall be notified to inspect the work prior to commencing the backfill operation. The Contractor shall take all necessary steps required and as directed by the Employer's Project Manager or Project Manager's Representative to ensure that all utilities are protected from damage by frost.

Excavation and backfill shall meet the requirement of Section 202.

Measurement

701.04. Measurement for relocation and protection-in-place of electrical utilities will be measured by the length. Communication cables will be measured by length.

Payment

701.05. The accepted quantities, measured as provided above, will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the Bill of Quantities. Payment will be full compensation for the work prescribed in this Section.

Payment will be made under:

Pay Item	Pay Unit
70101 Relocation and protection-in-place of electrical cable	Linear meter
70102 Relocation and protection-in-place of communication cable	Linear meter

Standards Incorporated by Reference

	Standard name/ number	Title
1	GOST 8269.0-97	DETERMINATION OF PARTICLE SIZE DISTRIBUTION
2	GOST 8269.0-97	DETERMINATION OF PARTICLE SHAPE OF COARSE AGGREGATE
3	GOST 8269.0-97	SPECIFIC GRAVITY (COARSE) DETERMINATION OF PARTICLE DENSITY
4	GOST 8735	SPECIFIC GRAVITY (FINES), DETERMINATION OF PARTICLE DENSITY
5	GOST 12801-98	COMPACTION OF BITUMINOUS MIXTURES USING MARSHALL APPARATUS AND MAXIMUM DENSITY OF PAVING MIXTURES (%VOIDS) AND SPECIFIC GRAVITY OF PAVING MIXTURES
6	GOST 12801-98	BULK SPECIFIC GRAVITY OF BITUMINOUS PAVING MIXTURES USING SATURATED SURFACE DRY SPECIMEN
7	GOST 12801-98	PERCENT OF AIR VOIDS IN COMPACTED DENSE AND OPEN BITUMINOUS PAVEMENT
8	GOST 12801-98	DETERMINATION OF BITUMEN CONTENT AND GRADATION OF ASPHALT CONCRETE MIX
9	GOST 22733-2002	MOISTURE DENSITY RELATIONSHIP
10	GOST 5180-84	DENSITY OF SOIL IN-PLACE BY RUBBER BALLOON METHOD
11	GOST 5180-84	IN-PLACE DENSITY AND MOISTURE CONTENT
12	GOST 22245-90	BITUMEN AND BITUMINOUS BINDERS
13	GOST 11501-78	PAVING BITUMEN PENETRATION TEST
14	SNIP 2.05.03-84	BRIDGES AND CULVERTS (DESIGN NORMS)
15	URMORM	"UNIFORM REQUIREMENT FOR METHODS OF ORGANIZATION OF ROADWAY MOVEMENT, UTILIZED DURING ROADWAY CONSTRUCTION "PUBLISHED IN MOSCOW 1989.
16	GOST 10178-85	PORTLAND AND BLAST-FURNACE SLAG CEMENT (TECHNICAL CONDITIONS)
17	VSN 37-84	INSTRUCTIONS FOR ORGANIZATION OF TRAFFIC AND PROHIBITING ACCESS TO SITES DURING ROAD CONSTRUCTION WORKS
18	VSN 24-88 (17.5.21-5.5-23)	TECHNICAL CONDITIONS OF ROAD REPAIR AND MAINTENANCE WORKS
19	SNIP 2.05.02-85	ROADS (DESIGN STANDARDS)
20	SNIP 3.06.03-85	ROADS (DESIGN STANDARDS)
21	SNIP 2.06.02-85	BASES OF HYDRAULIC STRUCTURES
22	VSN 46-83	INSTRUCTION FOR DESIGNING NONRIGID PAVEMENT
23	GOST 25192-82/87	CLASSIFICATION OF AND GENERAL TECHNICAL REQUIREMENTS TO CONCRETE
24	VSN 42-91	"RATES OF APPLICATION DURING CONSTRUCTION AND MAINTENANCE OF HIGHWAY AND BRIDGES"
25	GOST 8267-93	CRUSHED STONE AND GRAVEL (TECHNICAL CONDITIONS)
26	GOST 8267-82	AGGREGATES
27	GOST 26633-91	HEAVY CONCRETE (TECHNICAL CONDITIONS)
28	SNIP 3.06.06-88	"MANUAL OF ASPHALT CONCRETE PAVEMENT AND SUBGRADE CONSTRUCTION FOR ROADS AND AIRFIELDS"
29	GOST 8736-93	SAND FOR CONSTRUCTION WORKS (TECHNICAL CONDITIONS)
30	3.501.1-144 3.501.0-46 3.501-59	TYPICAL STRUCTURES: "ROUND PRECAST REINFORCED CONCRETE CULVERTS FOR RAILROADS AND HIGHWAYS", ISSUE 0-0; 0-1; ISSUE 1 "REINFORCEMENT OF WATERCOURSES AND FILL SLOPES AT CULVERTS" "PRECAST CULVERTS FOR HIGHWAYS. ROUND CULVERTS (TEMPLATE BASE BLOCKS)"
31	503-09-7.84	STANDARD DESIGN SOLUTIONS: DRAINAGE STRUCTURES ON PUBLIC ROAD NETWORK OF THE USSR. ALBUM 1
32	GOST 23457-79186	TECHNICAL METHODS FOR ORGANIZING TRAFFIC MOVEMENT

33	GOST 52290-2004	TRAFFIC SIGNS
701 - 02		
34	GOST 52289-2004	WOOD SIGN POSTS REINFORCED CONCRETE SIGN POSTS
35	3.503.9-80	TYPICAL ALBUM FOR HARDWARE AND SIGN POST MATERIAL
36	GOST P51256-99, 52289-2004	ROAD MARKING
37	GOST 22733-2002	SOILS. MAXIMUM DENSITY LABORATORY TEST METHOD
38	GOST 5180-84	SOILS. PHYSICAL CHARACTERISTICS LABORATORY TEST METHOD
39	GOST 15836-79	BITUMINOUS RUBBER MASTIC (TECHNICAL CONDITIONS)
40		SWEDEN STANDARDS, GRAVEL ROADS

8. BRIDGE WORKS

Section 801. MATERIALS AND SAFETY PRECAUTIONS

Materials

801.01. All materials incorporated in the Main Work shall be tested either at the place of manufacture or on the Site in order to determine, to the satisfaction of the Employer's Project Manager or Project Manager's Representative, that they comply with the quality requirements of the Contract. If such testing is undertaken at the place of manufacture, the Contractor shall submit the supplier's test certificates to the Employer's Project Manager or Project Manager's Representative in good time before dispatch to the Site of the relevant consignment.

The Contractor shall be responsible for ensuring that sufficient time is allowed for testing any materials required for the Works, and may not claim for delay arising as a result of time required for conducting such tests.

Safety precautions

801.02. In the performance of the Works, the Contractor shall exercise every reasonable precaution to protect persons or property from injury or damage. He shall erect and maintain all necessary temporary fencing, barricades, barriers, multilingual signs and lights and provide fire alarms, fire extinguishing and fire fighting services at strategic points on the Site. The Contractor shall adopt and enforce such rules and regulations as may be necessary, desirable or proper to safeguard the public, all persons engaged in the Works and its supervision and all traffic in adjacent thoroughfares.

The Contractor is responsible for the Health and Safety of all persons on all of the Sites. All necessary precautions shall be made to prevent accidents and personal injuries. The Contractor shall present his planning and organization for the Health and Safety well in advance of the actual construction works for the Employer's Project Manager or Project Manager's Representative's approval.

An emergency service must be established and maintained at the Site to an acceptable standard.

In case of an accident connected with the execution of the Works, the Contractor shall immediately notify the Employer's Project Manager or Project Manager's Representative of the accident and shall provide full details of the circumstances and events regarding the accident.

The Contractor shall appoint a Safety Officer and hold regularly scheduled safety meetings with the Employer's Project Manager or Project Manager's Representative and with his own supervisors and foremen.

Payment

801.03. The cost for these arrangements shall be included in the Contract price.

Section 802. INITIAL CONSTRUCTION WORK

Removal of existing structures

802.01. Remove the shown parts of the rehabilitating bridge according to the drawings carefully. If the bridge crosses water, no material should be allowed to fall into the water. If foundation in water is being removed cofferdams or silt fences should be used to prevent spreading of mud or other pollution down stream. The same goes for other major works in water.

Removal method of the bridge carriage way's asphalt concrete and other layers shall be approved by the Employer's Project Manager or Project Manager's Representative.

The Employer's Project Manager or Project Manager's Representative shall approve the concrete chiseling equipment. When dismantling concrete, marked straight cutting lines shall be used, which do not damage the reinforcement. Damaged concrete shall be chiseled behind the steel bars to a depth of at least 20 mm or equal to bar diameter.

All cutting concrete surfaces and reinforcing bars shall be abrasive-blasted or high-pressure water-blasted to remove all debris, loose concrete and rust. Concrete surfaces shall be blasted to produce a clean rough surface.

If the whole construction, including foundation down to 1 meter beneath ground level or according to drawings, will be removed, check the required lifting capacity of the crane beforehand.

Payment

802.02. The cost for these arrangements will be unit price according to the priced Bill of Quantities.

Section 803. EXCAVATION AND BACKFILL

Structure excavation and backfill

803.01. The ditches and pits dimensions should take with consideration of possibilities for installation of forms and workers moving. The additional areas of ditches and pits should allow safety fix the forms and construction works implementation. The slope of pits and ditches must be take in accordance with data included in Drawings. If in Drawings the value of slopes is not shown the Contactor should accept the slope with taking in consideration soil type and corresponding to SNIIP 3.02.01-87 SniP III-4-80* requirements.

Material used for backfill and for erosion protection shall be in accordance with SNIIP 2.05.02-85

The soil compaction degree of working layer behind the abutments and walls, defined by compaction ratio, should meet the requirements of SNIIP 2.05.02-82 table 22. (Ratio 0.95)

Payment

All excavation and backfill works will be paid according to the Bill of Quantities.

Section 804. FORMWORKS

General

804.01. This work includes constructing and removing of all scaffolding and formwork as well as work platforms and safety railings. Design is included in the work, respectively. The Contractor shall submit the design documents for Employer's Project Manager or Project Manager's Representative's approval at least one week before planned starting date for construction of the temporary supports, formwork and scaffolding.

Formworks should be done in according to SNiP 3.01.01-85, III-15-76, III-43-75 and the description below.

Material

804.02. On the Site, the material in the form shall be wooden material, either formwork timber or plywood. Aluminum ties should be used for bracing of the formwork, if possible.

Work description

804.03. Temporary supports shall be designed, constructed and removed according to SNiP 3.06.04-91. Maximum acceptable form deformation is $L/300$, for beams $L/500$.

The formwork shall be well moistened before casting the concrete so that it will not leak or take up water from the fresh concrete. The surface shall be well oiled to prevent the formwork to get stuck to the concrete.

Tolerances

804.04. The tolerances of the formwork should be $\pm 5\text{mm}$ of the measures shown at the drawings

Removal of the formworks

804.05. The Contractor will not be allowed to remove the formwork until 70% of the concrete compression strength has been achieved. Formwork removal shall be carried out without any damage to structures.

The Employer's Project Manager or Project Manager's Representative shall approve the time of removal of the formwork.

Payment

804.06. The cost of the formwork shall be included in the price of the cast concrete.

Section 805. REINFORCEMENT

General

805.01. Material shall comply with the requirements of SNiP 2.05.03-84 and GOST 5781-82, GOST P 52544-2006. The Employer's Project Manager or Project Manager's Representative shall approve all materials and equipment. Works shall be carried out in accordance with the requirements of SNiP 3.06.04-91, SNiP 2.05.03-84, SNiP III-43-75Ø, and SNiP 3.01.01-85. The Contractor shall deliver reinforcement plans for Employer's Project Manager or Project Manager's Representative's approval at least one week before starting date of the reinforcement works.

Concrete cover, reinforcement implementation

805.02. The concrete cover thickness should correspond to the drawings and minimal thickness of cover layer can not be less than values shown in the Table 44 and points 3.119, 3.120 of SNiP 2.05.03-84. The cover shall be achieved by placing distance blocks between the reinforcement and the formwork with c/c 1.0 meter. These blocks shall be manufactured of the same sort of cement as the structural concrete.

The minimal distance between bars should satisfy the requirements of points 3.121-3.123 and Table 45 of SNiP 2.05.03-84.

The junction of bars which foreseen to implement by welding should correspond to requirements of SNiP 2.05.03-84 (points 3.155-3.161), GOST 14098-91 and GOST 10922-90. The junction of bars without welding should correspond to requirements of points 3.162-3.164 of SNiP 2.05.03-84.

Measurement

805.03. The steel reinforcement in the formworks is measured in tons.

Payment

805.04. In general, the cost of reinforcement is included in the price of the cast concrete. The reinforcement in monolithic foundations and guard rails is paid separately according to the priced Bill of Quantities.

Section 806. CONCRETE WORKS

Materials

806.01. Materials shall comply with the SNiP 2.05.03-84, SNiP 3.06.04-91, Russian Standard Drawings and VSN 24-88.

In the following are additions to some of the standards. The additions precede what is written above:

- Concrete shall be composed of Portland cement, fine aggregate, coarse aggregate, water and admixtures as specified, all well mixed and brought to the proper consistency.
- Storage of aggregates: After washing, fine aggregate shall be stored in stockpiles with a free draining base for at least 72 hours and shall be subsequently handled to ensure that sand delivered to the batching plant has a uniform and stable moisture content.
- Storage of Cement: Cement that has not been used within three (3) months from the date of initial sampling shall not be used in the Works unless it has been retested and is shown to conform to the specified requirements.

Before doing concrete works contractor must to provide the TRIAL MIXES to request the contractor to carry out a lab mixes to be approved by the Engineer. After that only contractor can start concrete works.

The following requirements shall apply to the storage and handling of cement at the Site or at any intermediate transfer or storage point:

- All methods for transporting, handling and storing bulk and bagged cement shall be designed beforehand.
- All storage bins and silos shall be drawn down (so as to be substantially empty) at least once every three (3) months.
- All bagged cement shall be stored at all times, up to its use in the Works, in completely weatherproof structures, which shall include a raised floor and be adequately ventilated to prevent the accumulation of moisture. Cement of different types shall be stored separately.
- Do not use cement that: **a)** has become partially set **b)** contains lumps or caked cement **c)** is salvaged from discarded or previously opened bags.

Addition of water to overcome stiffening of the concrete before placing will not be permitted.

Aggregate shall not be batched for concrete or mortar when free water is dripping from the aggregate.

Cement shall be sampled at the source and tested by the manufacturer and certified as conforming to the requirements of this Specification before being dispatched from the factory of the cement manufacturer. All costs associated with the sampling and testing shall be included in the rates for furnishing and handling cement.

806.02. The concrete mixture

The maximum ballast size shall be 32 mm. No aggregates that can cause alkali reactions can be used.

The grading scale of the aggregates can be as follows:

- 38% 0 mm – 4 mm sand (i.e. washed quarts)
- 60% 5 mm - 32 mm (i.e. basalt or granite).

All the components and aggregates used in the concrete mix must be laboratory tested according to GOST standards. Moreover, the contractor must specify:

- Place of origin of components and aggregates
- Petrography analysis and chemical composition of all components, including water
- Quality and compressive strength of the aggregates
- Water absorption capabilities of all fractions used (<1% weight percent)

All reinforced concrete tests, certifications, verifications and documents required by GOST for bridge construction must be complied with.

Requirements for the composite parts of concrete

806.03. The composite parts of the structural concrete mass, including filler, sand, rock, additives or plasticizers must have known documented origin and documented properties. The composite parts may not contain any items that can endanger or diminish the structural concrete's or reinforcement's properties and function.

The chloride content of the composite materials must be so low that the total free chloride content (Cl) of the structural concrete not exceeds 0,1% of the binder weight. An independent laboratory must test this criterion.

806.04. Cement

The cement must be Standard Portland 400 and comply with the GOST standards and quality requirements.

The chemical composition of the Portland cement 400 must convey to GOST standard. However, the cement type used must be low alkali and high sulphate resistance, LA/SR. The upper C₃A limit must be 5%. The requirements of the Tables 1 and 2 must be fulfilled, too.

Chemical composition	Weight percentage
Cl	0,1
Gravimetric SO ₃ ,	4,0
Inorganic correction materials	5,0
MgO	5,0

Table 1 Maximum values for certain chemical components in the cement.

Cement qualities		
Cementation	3 hours	8 hours
Heat development	Maximum	Maximum
	210 J/g	250 J/g
	days 1-3	days 1-7
Compressive strength	Minimum	Minimum 29
	16 MPa	MPa day 28
	day 7	
Bend / Shear	Minimum	Minimum
	3 MPa	5 MPa
	day 7	day 28

Table 2 Complying values for certain properties of the cement.

806.05. Mineral additives

If mineral additives are used in the concrete, the Contractor must present a special report containing the physical properties of the mineral additives and their chemical composition together with their variation.

This report must include:

- Specific Area
- Combined Aggregate Grading
- Production Certificate

Fly ash is not permitted as mineral additive. Other mineral additives will only be allowed in factory-produced concrete. In-situ use of mineral additives is only permitted after the written permission of the Employer. Before the use in the structural concrete, the mineral additives have to be tested and analyzed and the results presented to the Employer. The test results may not exceed the values shown in Table 3.

	Silica	Slag
Cl	0,2	0,1
SO ₃ ,	4,0	4,0
CaO	2,0	
MgO	5,0	
Equivalent alkali content (Calculated as Na ₂ O + 0,66K ₂ O)	0,6	0,6
Glow, loss	5,0	

Table 3 The maximum content values for some products accepted in mineral additives. (Values expressed in weight percentage of dry material).

Concrete casting

806.06. The Contractor shall make a work plan for the concrete casting. When necessary, the work plan shall be revised before each casting. Work Plan shall include at least the following items:

- General description of structures
- Special requirements for concrete, e.g. frost resistance
- Requirements for work conditions, e.g. readiness for hot weather conditions
- Available equipment
- Management of works and personnel
- Preparations for concrete casting
- Arrangements to avoid cracks formation
- Mixing
- Casting
- Vibration
- Construction joints
- Temperature measurements during concrete hardening
- Strength measurements
- Repair and finishing

The Contractor shall, where necessary, employ effective means such as pre-cooling the aggregates, refrigerating the mixing water, adding chipped or flaked ice into the mixing water, placing at night or a combination of these, to ensure that the concrete does not exceed the temperature of 35⁰ C or is less than 5⁰ C during curing.

Under no circumstances will concrete be accepted if the temperature of the concrete, as deposited into the formwork, is not within these limits.

The Contractor shall provide for the cooling of mixing water and for the efficient insulation of any storage tanks and pipelines for mixing water.

Aggregate bins, batching and mixing equipment shall be painted white and protected from sunshine as far as practicable.

Appropriate measures shall be taken with respect to transporting and placing the concrete to control the temperature of concrete. Pipelines for conveying concrete shall be shaded and insulated or painted white; the elapsed time from mixing to placing shall be minimized. Concrete shall be placed promptly when delivered and finishing operations shall not be delayed. Concrete surfaces shall be protected from wind and sun, if directed by the Employer's Project Manager or Project Manager's Representative, during placing, finishing or curing operations.

Immediately before placing concrete, all surfaces upon or against which the concrete is to be placed shall be free from standing water, mud, debris, oil, objectionable coatings and loose, semi-detached fragments. Where directed by the Employer's Project Manager or Project Manager's Representative, the surfaces shall be cleaned with water jet.

The surfaces of construction joints shall be clean when covered with fresh concrete or mortar. Cleaning shall consist of the removal of all laitance, loose or defective concrete, coatings, sand, curing compound if used, and other foreign material to the satisfaction of the Employer's Project Manager or Project Manager's Representative.

Construction joints shall be wet usually for 12-14 hours before casting, so that moisture will not be drawn from the freshly placed concrete. Wooden forms shall be wet few days before casting and tightened just before casting.

The Contractor shall place all concrete in structures as shown on the Drawings, or as directed by the Employer's Project Manager or Project Manager's Representative, in accordance with this Specification, or as approved by the Employer's Project Manager or Project Manager's Representative. Concrete shall be deposited continuously and at a rate, which will give the prescribed rise of the fresh concrete in the formwork, while a block of concrete is being completed.

At every place where concreting is in progress, one of the Contractor's supervisors, well experienced in concrete works, shall be present and responsible for the work. All concreting shall be carried out by skilled workmen under the supervision of a foreman with sound technical knowledge and experience. During concreting, a sufficient number of workmen shall be present to handle the concrete and an adequate number of steel fixers and carpenters shall keep the steel reinforcement and form work under surveillance.

If and when concreting is carried out in the dark, ample lighting shall be provided at the mixing station and at every place where concrete is being deposited.

The concrete shall be handled and placed in such a manner that it will have an approximately horizontal, plastic surface throughout the casting. The rise of concrete in the formwork shall not be less than 100 mm per hour. The maximum permitted rise of concrete in formwork shall not exceed 750 mm per hour, unless otherwise approved by the Employer's Project Manager or Project Manager's Representative.

When casting the concrete, it must be vibrated so that homogenous construction is obtained. Concrete shall be vibrated in layers 250...300 mm in thickness. At the same time previously placed layer shall be vibrated. Vertical structures shall be vibrated with vibrators with D=25...48 mm. Vibrator should be kept as vertical as possible. Vibrating time is at least 10 minutes per cubic meter. The Employer's Project Manager or Project Manager's Representative shall approve vibrators.

Concrete shall be protected against damage from sunshine and rainfall. Concrete may not be placed in water, unless specifically indicated on the Drawings or approved by the Employer's Project Manager or Project Manager's Representative. The Contractor shall deal with all water encountered during concreting operations in such a manner that the water is prevented from flowing over or exerting pressure against the concrete, until such time after depositing as approved by the Employer's Project Manager or Project Manager's Representative.

While the concrete is at an early age, the surface of the joint shall be prepared for the subsequent deposition of fresh concrete by the application of high velocity water jet with a pressure of at least 3 atmospheres at the nozzle. The jet shall be applied so that laitance and foreign matters are removed and the clean aggregate exposed, but not so that the edges of the larger particles of the aggregate are undercut.

The Contractor shall inform the Employer's Project Manager or Project Manager's Representative when concrete will be placed.

Sprinkling of the surfaces with dry cement or any other material during finishing operations for drying off the concrete, to facilitate trowelling or for any other purpose will not be permitted.

Curing

806.07. At least fourteen (14) days before placing concrete in any structure to be water cured, the Contractor shall submit to the Employer's Project Manager or Project Manager's Representative details of the equipment and methods he proposes to use for water curing. Water used for curing shall meet the requirements of this Specification for water used in concrete, but with the additional requirement that the water shall not contain any chemicals or other substances that will cause staining of concrete surfaces.

Concrete cured with water shall be kept continuously wet for at least fourteen (14) days immediately following placement of the concrete, or until covered with fresh concrete.

In case of sunshine or windy weather concrete shall be covered with plastic sheeting. Immediately after curing period surfaces will be checked for cracks. Maximum acceptable width of crack is 0,2 mm. In parapets and sidewalk areas cracks 0,1 mm or more in width shall be injected or grouted.

Prefabricated structures

806.08. A certificate that states their conformity with the requirements according to Drawings shall accompany the prefabricated structures. The required concrete quality shall correspond to the data shown in Drawings.

All implemented or mounted concrete and reinforced concrete structures shall be well prepared and approved by the Employer's Project Manager or Project Manager's Representative before placement of the other structural elements which implementation foreseen by Design.

Tolerances

806.09. Dimensions shall conform to design documentation. Tolerance for bridge span clearances shall be ± 30 mm. Falls on concrete surfaces shall be $\pm 0,5\%$. Bridge span surface acceptable evenness is 5 mm measured by a straight-line 4 m in length. Concrete cover shall not be less than 5 mm under minimum acceptable.

Measurement

806.10. Concrete casting will be measured in cubic meters.

Payment

806.11. All costs for mixing and handling the concrete up to acceptance of the work shall be included in the cost per cubic meter.

For prefabricated beams all costs for transportation and placing of the beams shall be included in the unit price. The casting of the joints between the beams shall also be included in the price.

All concrete works will be paid according to the Bill of Quantities.

Section 807. REPAIR OF SMALL CONCRETE DAMAGES WITHOUT FORMS

Description

807.01. This work consists of repair of small concrete damages caused by faulty pours and other poorly compacted places and local deterioration or breaks.

Materials

807.02. Following or equal cement based patch mortars should be used:

- 1) Polymer cement mortar (Russia):
 - Portland cement M 400-500; GOST 10178-85
 - Sand M 0,4-0,8; GOST 8736-85
 - 44% emulsion divinyl styrene latex SKS-65 GP mark TU 38.103111-83
 - Water GOST 23732-79

The ratio of the above mentioned mass parts in the polymer cement mixture is the following:
100:100:41:17.

- 2) Structurite 300 Thoro N.V. (Belgium)
- 3) Sika Top 122 Sika AG (Switzerland)
- 4) Vandex CRS 05 Vandex GmbH (Germany)

Materials shall be approved by the Employer's Project Manager or Project Manager's Representative.

Construction Requirements

807.03. Patching works shall be made according to the instructions of the manufacturer.

Damaged concrete shall be chiseled. The boundaries of the concrete to be removed shall be saw cut to a depth just missing the reinforcing bars. Concrete within the marked boundaries shall be removed by high pressure water jet blasting equipment or light pneumatic hammer.

Concrete shall be removed to a depth of at least 20 mm behind the reinforcing bars. The bars shall be cleaned with steel brush and compressed air. Recommended temperature during works is +10...+15 °C. Air temperature must be at least +5 °C.

The work will be accepted for payment providing that it has been done in conformance to the drawings and specifications and is accepted by the Employer's Project Manager or Project Manager's Representative.

Measurement

807.04. Small repair of concrete surfaces will be measured in cubic meters of the used polymer mortar.

Payment

807.05. Payment for all working platforms and scaffoldings are included in the unit price. Payment will be made by cubic meters according to the priced Bill of Quantities.

Section 808. PAINTING OF THE EXISTING STEEL STRUCTURES

Description

808.01. This work consists of cleaning, sand blasting and painting of existing steel structures. Works include construction and removal of scaffoldings and working platforms.

Materials and construction requirements

808.02. Paintwork materials shall comply with the SNiP 2.03.11-85 requirements. Touch-up painting should be done with the same paint material as was used before.

Surface treatment shall consist of at least three paint layers in total thickness not less than 160 µm.

Works shall be carried out in accordance to requirements of SNiP 3.06.04-91. Works shall be carried out in dry weather at the temperature +10C...+30C. Relative air humidity shall not exceed 80% and the metal surface shall be clean and dry.

Final cleaning shall be done by sand blasting just before painting. Dry quartz sand of 0,6...1,5 mm in grain size shall be used for sandblasting.

The Contractor shall submit the work plan of surface treatment and painting and description of proposed materials to the Employer's Project Manager or Project Manager's Representative for approval at least two weeks before planned procurement of paint materials. Design of necessary scaffoldings must be submitted within work plan.

Measurement

808.03. Painting is measured in square meters of the painted surfaces.

Payment

808.04. Accepted quantities are paid per unit at the contract price. Payment includes the old painting removal by sandblasting, design, construction and removal of temporary scaffoldings and working platforms and necessary vessels.

Section 809. DOWN PIPES

Description

809.01. This work consists of repair of the existing down pipes and construction of new down pipes.

Materials

809.02. Stainless steel should be used for down pipes, if possible. The Employer's Project Manager or Project Manager's Representative can accept also the following materials:

Cast iron pipe, TCK- GOST 69423-80–150-200

Cast iron funnel, mark GOST 1412-85 C415

Cast iron webbing, mark GOST 14122-85 C415

Polymer cement mortar shall be made according to GOST 28013-89 and SNiP 3.06.04-91

Construction Requirements

809.03. Down pipes installation works shall be executed according to the requirements of SNiP 3.06.04-91.

The rehabilitation of existing down pipes includes installation of new down pipes, funnels and webbings on the designed levels.

New down pipes will be constructed, where distance between the existing down pipes exceeds 10 m. The pipes bottom edge should lower than beam bottom flange not less than 50cm.

The location of new down pipes shall be approved by the Employer's Project Manager or Project Manager's Representative.

Down pipes shall be glued with stiff epoxy glue.

Measurement

809.04. Repair of existing down pipes and installing new down pipes are measured by number.

Payment

809.05. The accepted quantities will be paid at the contract price per unit of measurement.

Section 810. BRIDGE RAILINGS AND SIDEWALKS

Description

810.01. This work comprises dismantling of existing sidewalks blocks railing sections which current condition are bad, their re-installation, straightening or replacement of damaged sidewalks and railing elements including fixing details, sand blasting of existing railings and painting as well as manufacturing, installation and painting new railing sections.

Materials and Construction Requirements

810.02. Railing elements material, fixings and technical requirements when manufacturing bridge rails shall comply with the SNiP 3.503.1-81 and SNiP 3.06.04-91 under GOST 380.88. Paintwork materials shall comply with the SNiP 2.03.11-85 requirements. Cleaning of railings from corrosion and the old paint are done according to the VSN 24-88 requirements. Railing elements surface under lacquer coating shall be cleaned till I grade purification efficiency under GOST 9.402-80. Cleaning shall be done by sand blasting.

Surface treatment materials shall consist of two paint layers on two primer layers in total thickness not less than 160 μm .

The quality of the paintwork layer shall correspond to the VI class under GOST 9.032-74.

The Contractor shall submit the work plan of surface treatment and painting and description of proposed materials to the Employer's Project Manager or Project Manager's Representative for approval at least two weeks before planned procurement of paint materials.

810.03. The re-installing or new installing reinforced concrete sidewalks blocks placed on the cement-sand mortar and their reinforcement bars should be joint with reinforcement mesh's bars. During the installation of sidewalks blocks Contractor must keep the longitudinal and cross slopes which foreseen by Design. The water proofing of sidewalks parts and bridge deck in sidewalks area should be done in accordance to Drawings. The prefabricated reinforced concrete sidewalks blocks should be approved by Employer's Project Manager or Project Manager's Representative before their installation, each blocks must have the quality certificate form manufacturer.

The length of concrete sidewalk block should be less than 1.5 times of width

Measurement

810.04. Bridge pedestrian railing will be measured in linear meters.
The reinforced concrete sidewalks measured in cubic meters.

Payment

810.05. The accepted quantities will be paid at the contract price per unit of measurement. The works and materials which necessary to have for the sidewalks installation should be included in cubic meter cost.

Section 811. BEARINGS

General

811.01. The following description and specification for the bridge beam bearings shall be applied to.

The reinforced elastomer bearing is one of the most universally used types and should be given preference on account of its easy applicability and reliability. Due to the elastomer layer on the contact surface, it adjusts smoothly to minor irregularities of the bed of adjoining structural members, ensuring uniform force transfer. Therefore, reinforced elastomer bearings should be used, where possible. They are composed of elastomer layers hot vulcanized to steel plates between them (type Elastoplast or similar).

Proposed bearing with manufacture's certificate should obtain approval from Engineer prior to order

"The installation of the bearings shall be as approved by the Engineer. Bearings shall be maintained in their correct position during the construction.

"Contacting surfaces of bearings shall be kept free from contamination and, after the deck has been completed, each bearing and the area around shall be left clean"

"Contact adhesive shall be applied to all concrete/neoprene bearing surfaces in accordance with manufacturer's instructions prior to placing the bearings and beams in their final position of the structure."

Calculation Assumption

811.02. Appropriate bearings should be selected on the basis of the following data.

Permissible stress for standard size bearings may be taken from the table below: (DIN 4141, part 14)

Bearing Area A 10 ² mm ²	Permissible Stress σ_m N/mm ²
< 500	10.0
< 1200	12.5
≥1200	15.0

The permissible stress is determined as the average bearing stress as follows:

$$\sigma_m = \frac{F}{A}$$

where

σ_m = average bearing stress

F= maximum load

A= ground area for bearing

Installation

811.03. DIN 4141, part 14, section 7 contains very detailed guide lines for the installation of reinforced elastomeric bearings with an emphasis on the roughness of the area into which the bearings are to be placed. In order to prevent slipping of bearings under the action of force referred to above, it is indispensable that the seating of the structures shows this certain roughness. As a rule, cement bound concrete provides this roughness, whereas caution is to be exercised when plastic bound concrete is used. In order to achieve the required roughness of the seating, it may be advisable to cover surfaces with a 1-2 mm layer of sand mixed with corundum or quartz prior to setting.

Payment

811.04. The bearings are measured and paid according to the priced Bill of Quantities.

Section 812. BRIDGE EXPANSION JOINTS

General

812.01. The following description and specification for the bridge deck expansion joints shall be applied to. Expansion joints structures shall be manufactured at plant conditions meeting SNiP 3.03.01-87, SNiP III-18-75 and SNiP 3.06.04-91 requirements. The joints structures shall be manufactured with the control erection of all elements at the plant. Packages are completed with all the necessary elements including catch drains.

The Expansion Joint system shall be approved by Engineer with experienced manufacturers/suppliers.

Installation

812.02. The existing expansion joints shall be removed without damaging the deck parts. After the joint elements have been removed embedded surfaces are subjected to cleaning and leveling. Installation works and joints fixing to deck shall be executed according to the SNiP 3.03.01-87, SNiP 3.06.04-91 requirements and "Expansion joints construction recommendations".

Payment

812.03. Payment for expansion joints on the bridge concrete slab shall be paid according to the priced Bill of Quantities.

Section 813. WATERPROOFING

General

813.01. The following complement to Russian Standard drawings shall be complied with.

The bridge deck shall be waterproofed by two watertight layers to ensure protection against damage caused by moisture, frost action and de-icing salts. The waterproofing shall be protected by a protection course. All works should be down with accordance to VSN 32-81 requirements.

Slab waterproofing

813.02. The waterproofing mats should fulfill the following properties:

Property	Value	Tolerance
Thickness	5 mm	±0,5 mm
Shear strength	>800 N	
Strength of the overlap	>650 N	
Shrinkage	<0,40%	
Elongation	<0,25%	
Heat resistance		
Chemical resistance Water De-icing salts Alkali		
Capacity to resist dynamic water pressure after perforation		
Soft point	<120°C	

Edge waterproofing

813.03. In contact with vertical surfaces, the waterproofing shall be completed with an edge waterproofing.

The material used shall be thixotrop epoxy in two layers, with a total thickness of 1 mm.

The thixotrop epoxy used shall have the density and the mixture to achieve the viscosity required to obtain an application of 500µm on a vertical surface (at +5C).

The hardness shall be ≥ 60 D Shore at room temperature and the stickiness to concrete should be ≥ 3.0 N/mm²

The concrete surface

813.04. The surface that is to be waterproofed must be blasted in order to obtain a thoroughly roughened and clean surface. The work shall be carried out so that no particles over 1,5 mm protrude from the concrete surface. Prior to the waterproofing, the entire surface of the concrete shall be cleaned with compressed air. No vehicle traffic is allowed on the cleaned parts. Only personal that are involved in the waterproofing works are permitted on the cleaned parts of the bridge deck. It is important that no execution works that can generate dust or dirt are to be carried out in the vicinity of the waterproofing area.

The surface of the drain outlet must be sanded slightly in such a way that a mat surface is obtained.

Working conditions

813.05. All the waterproofing work shall be done on dry and clean surface, at least 21 days after the concreting work. No stains of oil, petrol or other fluids are allowed on the surface of the concrete.

No waterproofing, seal or protective course works are allowed if the temperature of the underlying concrete surface, waterproofing material or outside air temperature is below +5 C⁰.

The protective and binder course are to be applied within 12 hours after the waterproofing has been placed on the concrete surface. No vehicles, tools or other personal are allowed to stand on the waterproofing.

Texture of waterproofing

813.06. The bridge deck will be waterproofed with two (2x5 mm) layers of waterproofing mat.

The clean concrete surface will be at first primed with bitumen solution, 0,3 kg/m².

The waterproofing mats will be placed as shown in Figure 1. The first waterproofing mat can be either welded or glued to the deck with bitumen. In both cases great care should be taken in the amount of heat applied.

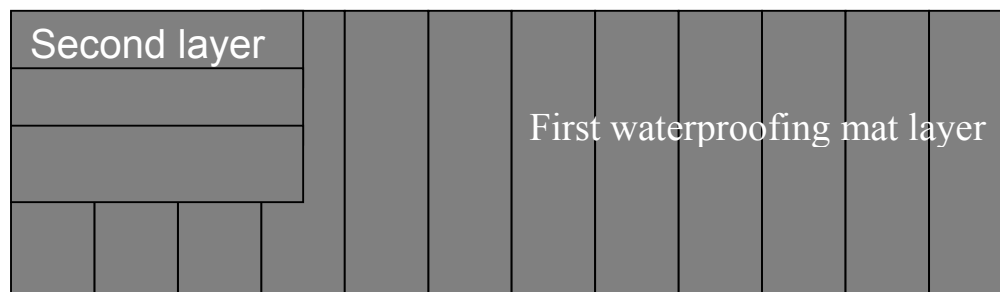


Figure 1. The principle of the waterproofing layout.

The execution must start at the lowest point of the structure. The mat is to be rolled out in such a manner that there is a wave of melted bitumen in front of it.

The waterproofing mat will be rolled out in such a way that the longitudinal overlapping will be 80 mm and the transversal overlapping of 120 mm.

The waterproofing mat must withstand the minimum bond strength. This will be verified by cutting a rectangle of the waterproofing mat with the dimensions 0,1 x 0,3 m. The waterproofing mat and the underlying layer must have the same temperature. The rectangle will be cut into 3 parts with the length of 0,3 m. Thereafter, the short ends will be pulled evenly. The minimum bond strength of 0,5 MPa must be achieved.

Water proofing of piers, abutments, retaining walls and other structures surfaces which covered by backfill

813.07. The isolation of surfaces which covered by backfill should be done by waterproofing with hot bitumen mastic. Before the mastic implementation the waterproofed surface should be cleaned from dust, mud and forms remainders. If it is necessary the surface should be leveled. The cleaning works shall be done by dry air or by mechanical ways, by brush. The concrete of structure must be dry before the waterproofing implementation. The waterproofing should be executed in two layers in accordance with the SN 301-65 and SNiP 2.05.03-84 (points 3.182-3.186) requirements. The prepared to waterproofing surfaces must be approved by Employer's Project Manager or Project Manager's Representative before the waterproofing first layer implementation.

Measurement

813.08. The waterproofing will be measured by square meter and the protective concrete layer on the bridge slab by cubic meter.

Payment

813.09. Payment will be made under:

Pay Item

81301 Waterproofing

Pay Unit

Square meter

Section 901 GABION WORKS

901.01 Gabions are constructed to protect fill slopes and river banks from rapid and deep rivers.

Gabion reinforcement can be used in any climatic conditions when the speed of water flow is 4-6 m/sec.

It is advisable to apply gabion structure in flows with sufficient sediment loads, dense rocks and arid places.

As a material for gabion "dressing", an elastic metal wire $d=2.0 \div 4.2\text{mm}$ for knitting a mesh and iron rods $d=6 \div 8\text{mm}$ for the skeleton are used. Sometimes, gabions are produced without a skeleton - in the form of a wire bag. Strength of gabion is determined by strength of the wire mesh. The service life of gabion (in non-aggressive environment) is 3-5 years. During this period the structure of gabion is thickened so much that it does not need a mesh anymore.

Gabion boxes are filled with strong, maximum heavy and slightly weathered water-resistant stones that are not smaller than dimensions of cells of the gabion mesh but also not less than 0.04m. There should be relatively larger stones in the front that stick out of cells and smaller-size stones inside the box. Gabions are joined each other with knitted annealed metal wire $d=3\text{mm}$, $0.30 \times 0.35\text{m}$ long and $0.15 \times 0.20\text{m}$ far from each other.

Crushed stone or gravel cushion $0.2 \times 0.4\text{m}$ thick is laid under the gabion. The upper part of the cushion is made of relatively large stones.

The lower part of the gabion is fixed to the ground with its iron rods ($d=16 \times 19\text{mm}$) stuck angularly.

Gabions are divided into 3 groups: gabion boxes, gabion mattress and gabion cylinders. Gabion boxes serve as protective walls for underwater section of the slope. Gabion mattresses differ from gabion boxes by low height ($0.25 \times 0.50\text{m}$) and are applied as "clothes" for slopes, as well as serve as foundation for walls of gabion boxes or continue in the gentle slope. Gabion cylinders are applied mainly in those cases when water flow is rapid and high which does not allow to lay a gabion properly. During struggling with water, they are stacked up in water by filling the edge of the slope with stones in advance.

Gabion laying may be applied at any time during a year.

Dimensions of fixing gabion boxes and their mutual alignment for gabion laying are defined by the design.

Payment

The accepted quantity, measured as provided above, will be paid at the contract price per unit of measurement for the pay items listed below that are shown in the Bill of Quantities.

Payment shall be made as follows:

Pay item	Pay unit
Installation of gabions	Cubic meter

Section 10. SIDE WALKS WORKS

1001. Sidewalk Implementation Works include existing sidewalk rehabilitation or construction of new sidewalks.

1002. Sidewalk rehabilitation

Sidewalk rehabilitation works include following:

- Correction and reinforcement of existing curbs (if necessary)
- Remove damaged curbs and replace with new ones
- Sidewalk pavement base leveling (if necessary)
- Sidewalk pavement rehabilitation with fine-grained a/c ($h = 3-4\text{cm}$) or with concrete ($h = 5-7\text{cm}$)

In case, if rehabilitating sidewalk sections are not shown in designs, Contractor must recognize required sections himself and present them to the Engineer for the approving. In this case rehabilitation work volumes of discovered sections must not exceed the volumes foreseen by designs.

1003. Construction of new sidewalks

Construction of new sidewalks must be implemented according to appropriate design solutions. Contractor must implement curb bases with high quality and maintain their direction.

1004. Installation of new curbs

New concrete curbs will meet requirements - GOST 6665-91. Before installation of curbs Contractor must introduce them to the Engineer for confirmation. Concrete should have quality certificates which issue the curbs manufacturer.

1005. Sidewalk base

The sub-base of sidewalks should correspond to points 201.1-201.11 requirements.

1006a. Sidewalk pavement (a/c)

The pavement of sidewalks should correspond to points 308 and 311 requirements.

1006b. Sidewalk pavement (concrete)

Concrete pavement thickness must be implemented according to the table

Material	Sidewalk pavement thickness by road type, cm		
	I	II	III-IV
Concrete B20	7-10	7	7

To ensure crack-resistance of in-situ cement-concrete pavement, cross-sectional joints must be designed. Press and release joints distance must be accepted, according to climate of the terrain, but it can't be more than sidewalk width multiplied by 1.5.

Note. Climate is characterized with the frequency of 50 or more repetition of more than 12°C difference of temperature during a day in a year.

If during a day maximum temperature is more than 30°C , temperature difference more than 12°C and relative air humidity is less than 50%, as a rule concreting is performed in the evenings or at nights. In case of average air temperature in month is lower than 5°C and minimum temperature during a day is lower than 0°C , concreting must be implemented in accordance with SNiP 3.03.01-87.

Concrete mix must meet GOST 26633-91 and GOST 25192-82 requirements.

Concrete mix transportation duration will not exceed 30 minutes in case of lower than $20-30^{\circ}\text{C}$ of air temperature and 60 minutes in case of lower than 20°C . During transportation concrete mix must be protected from precipitations and moisture evaporation.

As a rule pavement concrete must be compacted and shaped continued, avoiding concrete-shaper stops.

During precipitations water- and vapour-penetrating materials must be used. Fresh implemented concrete must be taken care until designed strength acquisition, but not less than 28 days.

Shaping joints must be cut with diamond disks, when concrete press-strength reaches $8-10\text{MPa}$. It is allowed to perform press joints in complex way – elastic inserts are inserted into fresh concrete and the joints are cut with inserts, in hardened concrete.

To ensure agreed work of press joints, as a rule they must be cut in passing queue.

When turn ends, or work stop is necessary, transverse working joint must be installed as a press joint. From working joint, pavement must be implemented after treatment of front part of the slab with hot bitumen material.

For joint filling sealants, that are made in bitumen base, must be heated to 150-180° C, before utilization: Before infilling of shaping joints one needs to.

- Wash the joints, cleaning from deposits immediately after cutting and dry.
- Clean the joints and neighbourhood from sand and crushed stone with pressed air

Shaping joints, made of bitumen based mastic, must be filled in following order:

- Cotton wires are placed on the joint bottom
- Liquid bitumen is implemented on joint walls
- Joint is filled with mastic, 2-3 mm above pavement level
- The mastic, above the pavement surface must be cut with sharp knife.

Cement-concrete pavement joints must be filled with sealant, in accordance to climate.

When implementing cement-concrete sidewalk pavement, appropriate vibrators must be used.

Measurement

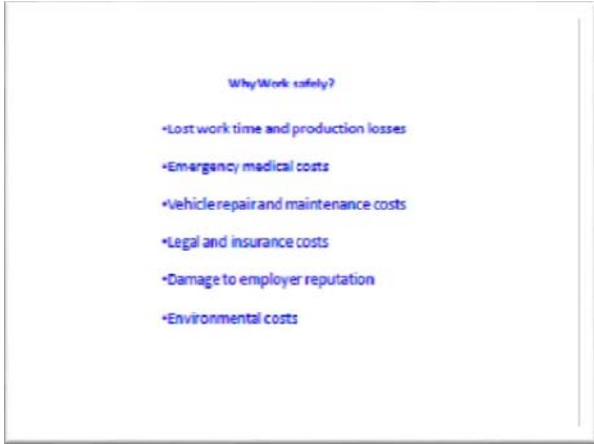
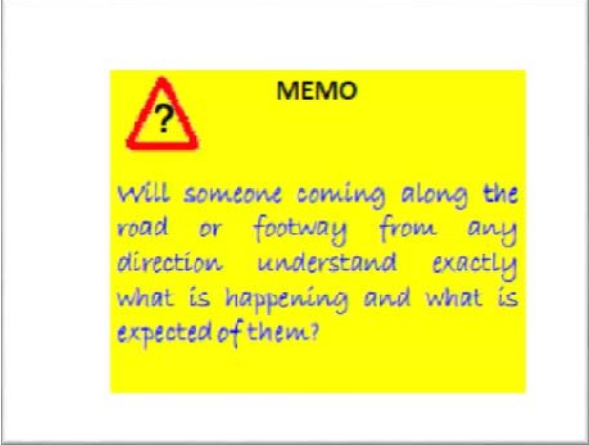

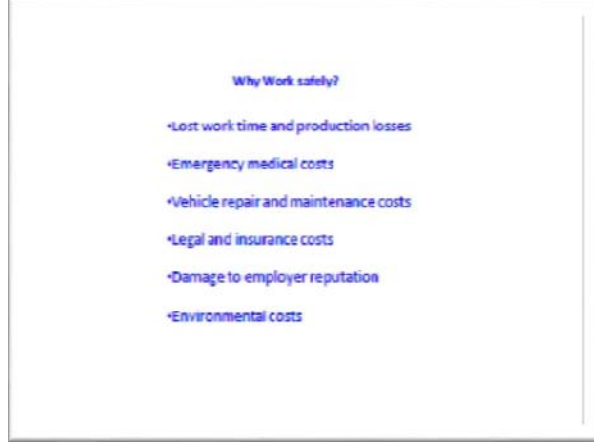
1007 A/c or concrete pavement of the sidewalk is measured in m², gravel-sand base course in m², curbs – in r.m.

Payment

1008 Payment will be done according to Bill of Quantity

Appendix
Environmental Management Plan
(provided as a separate document)

Appendix 2 Safe Working on the Highway

<p>There are reasons for working safely on the highway and there are costs associated with poor practice:</p> <ul style="list-style-type: none"> • Lost work time and production losses • Emergency medical costs • Vehicle repair and maintenance costs • Legal and insurance costs • Damage to employer reputation • Environmental costs 	
	
<p>Consider if you have explained to other road users what you are doing and what they must do to remain safe.</p> <p>You are responsible for the safety of:</p> <ul style="list-style-type: none"> • Workers (your colleagues and YOU) • Drivers • Pedestrians (especially children and the elderly) 	

Secure your signs

CHECKLIST

- Signs, lights and guarding equipment must be secured against being blown over or out of position by the wind or by passing traffic.
- Use sacks at low level containing fine granular material.
- Do not use barrels, kerbstones or similar objects for this purpose - they could be dangerous if hit by traffic. Do not use road pins under any circumstances



Make sure that the signs you use do not become a danger to others because they are not fixed securely

Visibility is a key factor in safety at road works. Make sure that the road signs and the workers are visible to drivers.

Do not presume that because you can see a vehicle, the driver of the vehicle can see you. Always wear a high visibility (reflective jacket).

"See and be Seen"



Do not think that because you can see a car, the driver can see you

Worker Safety

"See and be Seen"

- Plan the start of your day
- Check that you have the correct road signs
- Check that the signs are clean
- Check that the signs are in the correct order on the road
- Regularly check that the signs have not been moved
- Always wear a **HIGH VISIBILITY** jacket
- Always wear a safety helmet and safety shoes
- Wear safety glasses when appropriate



Weather can affect site safety:




Weather

Weather can affect site safety

- Rain and ice will increase a vehicle stopping distance. Make sure the signs are placed far enough from the works to allow vehicles to slow down safely
- Fog may obscure the signs
- If in any doubt about the conditions contact the site supervisor and if necessary suspend work



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- If in any doubt about the conditions contact the site supervisor and if necessary suspend work

<p>Speed is an important factor in establishing safe workforce operations and it is therefore recommended that measures be put in place to maintain appropriate speeds. If the traffic does not observe the speed limit at road works, advise the police and ask them for enforcement.</p>	<div data-bbox="812 136 1393 583"> <h3>Speed</h3> <p>Speed is an important factor in establishing safe workforce operations and it is therefore recommended that measures be put in place to maintain appropriate speeds</p> <ul style="list-style-type: none"> •The international literature shows that road works crashes are relatively often rear-end crashes. •31% of all rural road works crashes are rear-end crashes, in comparison with 15% of all rural crashes. •Short headway distances and speeding play an important role in the occurrence of rear-end crashes. •In addition, a number of rural crashes involve work vehicles and road blocks. Also in these cases speeding is one of the causes. <p>Ask the traffic police to measure the speed at your work site</p>  </div>
<p>If night working is unavoidable, check that:</p> <ul style="list-style-type: none"> • The correct signs are used for each situation and is each sign necessary? • The worksite is visible (from a distance of 200 metres)? • All workers are wearing reflective jackets? 	<div data-bbox="812 699 1398 1140"> <h3>Day/Night Signs Requirements</h3> <div data-bbox="860 835 1133 1014"> <p>CHECKLIST</p> <ul style="list-style-type: none"> •Are the correct signs used for each situation including at night where required, and is each sign necessary? •Is the worksite visible (from a distance of 200 metres)? •Are all workers wearing reflective jackets? </div>   </div>
<div data-bbox="175 1297 766 1738"> <h3>Setting up the signs</h3> <p>Park your vehicle in a safe place and protect it from traffic going past.</p> <ul style="list-style-type: none"> •Set up a 'Keep Left' sign at the outside corner of the vehicle, along with a Traffic Cone. •Set out the 'Road Works Ahead' sign at the correct distance and another on the other side of the road if required. •Using the diagrams to help you, work back towards the site placing more signs as necessary. • Keep on the verge or footway if you can. •If you are on a two-way road repeat this procedure and place signs for traffic going in the opposite direction. •If portable traffic signals or stop/go boards are needed, start using them now. •Finally cone off the works area.    </div>	<p>Be particularly careful when setting up the traffic signs. Decide and agree a method with the site supervisor before commencing work.</p>

Check the installation has been carried out correctly:

- Are traffic lanes clearly marked out
- Have temporary Reflective Markers (cones) been installed? Where coloured Reflective Markers are used, have they been set up correctly?

Installing/maintaining/removing the signs

A project-specific detailed method statement should be prepared for:

- the installation,
- maintenance and
- removal of the detailed traffic management arrangements

The purpose of this statement is to identify and manage risks before the installation

CHECKLIST FOR METHOD STATEMENT

- Crossing the carriageway on foot
- Pre-placement – placing temporary traffic management equipment out in advance ready for erection
- Temporary arrangements for pedestrians
- Carriageway closure during installation and removal
- Storage of equipment – this should allow easy access and availability
- Erection of signs – the sequence of erection
- Construction of tapers
- Placement of longitudinal cones
- Maintenance regime – arrangements for remedial action and the replacement of damaged equipment
- Contingency planning (weather, night working)
- Temporary speed limit enforcement regime

Make sure that all staff are familiar with the incident reporting form. This must be completed without delay after the incident.

Make sure that all staff are aware of the emergency numbers and that their personal details are on record.

Working in the safety zone

• Check that you have created a Safety Zone that is large enough to have room for operating equipment

• Never let your equipment intrude into the traffic lane

• If this is unavoidable, stop the traffic in both directions



EMERGENCY

Write down the key contact telephone numbers below
They could save lives – including yours

Organisation	Telephone	Contact	Telephone
National Police		Contractor	
National Fire service		Chief engineer	
National Ambulance		Resident engineer	
		Site supervisor	
Local Police		Foreman	
Local Fire service		Site Depot	
Local Ambulance			
Local Hospital		Your family contact	

If you have any concerns about site safety contact the supervisor

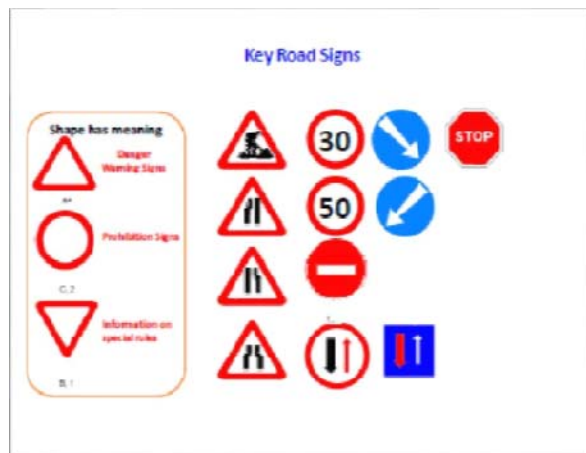
Incident reporting

An INCIDENT is a single distinct event that may have lead to a crash or injury or results in a crash or injury. Recording incidents improves both Worker safety and the public safety. **Notify your Supervisor of incidents.**

Subject	Information	Subject	Information
Date of incident:		Description of incident	
Time of incident:			
Name of person reporting incident:			
Name of Supervisor		Names of persons involved:	
		Injuries (if any)	
Location (road number)		Reported to Police (yes/no)	
Highway Contract number		Corrective action:	
Description of weather			

Signs and signals

Signs must be easily understood and give the driver the amximum infromation in the shortest time. Safety relies upon the driver knowing what the signs means .



Always ask the question: "Will someone coming along the road or footway from any direction understand exactly what is happening and what is expected of them?"

The most common signs that will be used at road works are shown in the diagram. Do you understand what they mean?

Other signs commonly used in Armenia are given below. As an exercise try to identify what each sign is used for.



Plan carefully how you will:

- Choose the correct signs
- Install the signs
- Maintain the signs and
- Remove the signs

It will help to write a method statement.

The purpose of this statement is to identify and manage risks before the installation of the signs.

Try to put yourself in the position of other road users, for example, drivers or pedestrians. Have each of these users enough information to negotiate the road works safely?

The sequence of images shows how the signs are located and the information given to drivers approaching road works.

The driver eye view approaching road works



Locating the signs






The site supervisor will have a copy of the site plans. These plans will show the signing layout required. Make every site worker aware of the signing layout.

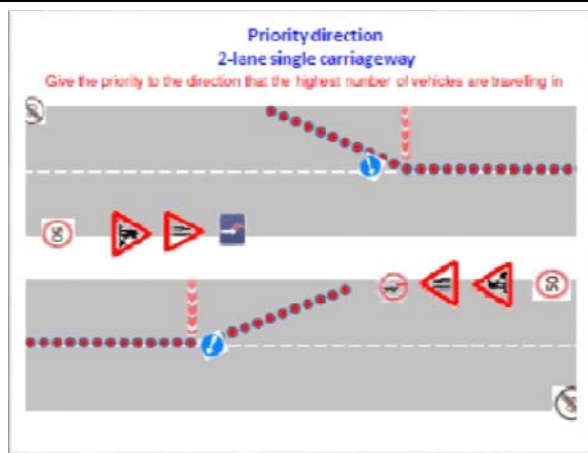
Make sure that you have enough road signs, that the signs are clean and in good condition and that they are the correct size (so that they can be seen by drivers travelling at the speed limit on those roads).

Size matters. Make sure the signs are visible



<div data-bbox="170 195 761 640" data-label="Image"> </div>	<p>If the road layout is complicated it may be necessary to reduce the speed limit at the road works.</p> <p>Hazards at the side of the carriageway should be clearly signed and protected to avoid causing injury to pedestrians.</p>
<p>Encourage safe working practices and develop a culture of safety. A safety culture is a term often used to describe the way in which safety is managed in the workplace, and often reflects "the attitudes, beliefs, perceptions and values that employees share in relation to safety". Talk together about safety issues.</p>	<div data-bbox="805 808 1343 1089" data-label="Image"> </div>
<p>THINK SAFE.</p> <p>It is your responsibility to sign, guard, light and maintain your works safely. Take time to plan how you will do this and to decide on what equipment you will need.</p> <p>You are responsible for the safety of:</p> <ul style="list-style-type: none"> • Workers (your colleagues and YOU) • Drivers • Pedestrians (especially children and the elderly) <p>Plan the process that you will use to set up the signs. Using the diagrams to help you, work back towards the site placing more signs as necessary.</p>	<div data-bbox="805 1308 1385 1757" data-label="Complex-Block"> <p>Road Safety – your responsibilities</p> <div data-bbox="841 1381 1143 1713" data-label="Text"> <p>THINK SAFE</p> <p>It is your responsibility to sign, guard, light and maintain your works safely. Take time to plan how you will do this and to decide on what equipment you will need.</p> <p>You are responsible for the safety of:</p> <ul style="list-style-type: none"> • Workers (your colleagues and YOU) • Drivers • Pedestrians (especially children and the elderly) </div> <div data-bbox="1157 1388 1360 1713" data-label="Image"> </div> </div>

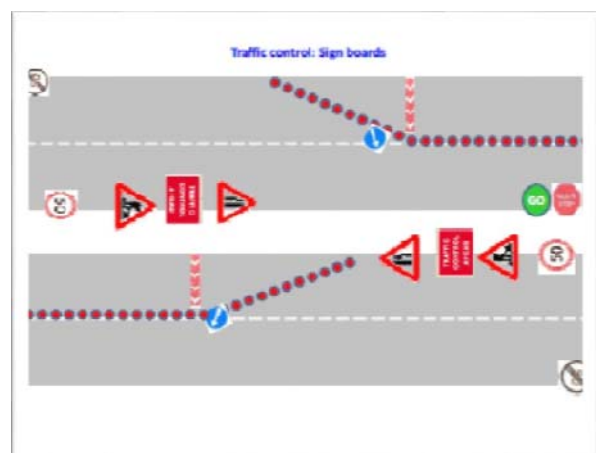
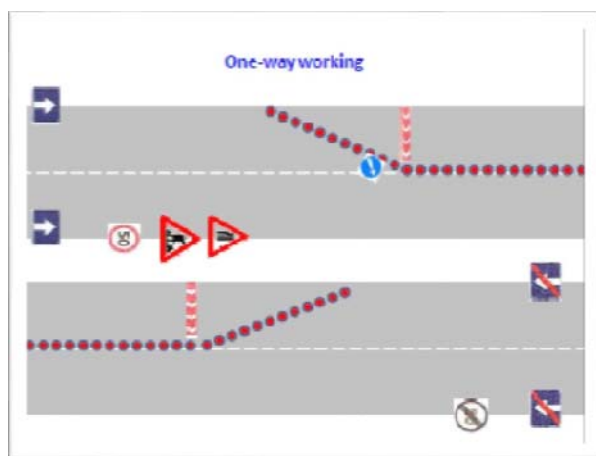
<p style="text-align: center;">Signs</p> <div style="border: 1px solid red; padding: 5px; margin: 10px;"> <p style="text-align: center; color: red; margin: 0;">CHECKLIST:</p> <ul style="list-style-type: none"> •Have you chosen the correct signs for the site work? •Do you have enough signs? •Are they clean, and visible? •Do they conform with guidelines, or other recognised guidelines? </div> 	<p>It will increase your safety if a colleague is observing the traffic while you are placing the signs.</p> <p>Signs must be secured.</p> <ul style="list-style-type: none"> • Signs, lights and guarding equipment must be secured against being blown over or out of position by the wind or by passing traffic. • Use sacks at low level containing fine granular material. <p>Do not use barrels, kerbstones or similar objects for this purpose - they could be dangerous if hit by traffic. Do not use road pins under any circumstances</p>
<p>Signs must be secured.</p> <ul style="list-style-type: none"> • Signs, lights and guarding equipment must be secured against being blown over or out of position by the wind or by passing traffic. • Use sacks at low level containing fine granular material. • Do not use barrels, kerbstones or similar objects for this purpose - they could be dangerous if hit by traffic. Do not use road pins under any circumstances. 	<p style="text-align: center;">Signing and Reflective Markers</p> <div style="border: 1px solid red; padding: 5px; margin: 10px;"> <p style="text-align: center; color: red; margin: 0;">CHECKLIST:</p> <ul style="list-style-type: none"> •Are traffic lanes clearly marked out •Have temporary Reflective Markers (cones) been installed? •Where coloured Reflective Markers are used, have they been set up correctly? </div> 
<p>The following terms are used to describe the layout of the traffic management. Learn these terms and take particular care when setting up the Work Zone and the Safety Zone.</p>	<p style="text-align: center;">Definitions</p> <p>The terms "traffic" and "road users" shall be taken to include both motorised and non-motorised users such as pedestrians, cyclists and horse riders.</p> <p>"Road works" are defined as any works or temporary restrictions which cause partial or total obstruction of any road or highway, whether on the verge, hard shoulder, footway, cycleway or carriageway.</p> <div style="display: flex; flex-wrap: wrap;"> <div style="border: 1px solid red; padding: 5px; margin: 5px; width: 30%;"> <p>Danger warning signs: The triangular sign warns drivers of the approaching hazard</p> </div> <div style="border: 1px solid red; padding: 5px; margin: 5px; width: 30%;"> <p>Taper: A line of cones that directs vehicles around your work area</p> </div> <div style="border: 1px solid red; padding: 5px; margin: 5px; width: 30%;"> <p>Safety Zone: Where you are working around the Work Zone</p> </div> <div style="border: 1px solid red; padding: 5px; margin: 5px; width: 30%;"> <p>Prohibition signs: The circular signs warn drivers of a change in speed or other circumstance.</p> </div> <div style="border: 1px solid red; padding: 5px; margin: 5px; width: 30%;"> <p>Work Zone: Where the construction is taking place</p> </div> <div style="border: 1px solid red; padding: 5px; margin: 5px; width: 30%;"> <p>Cones: Boundary markers for the working area.</p> </div> </div> 



The signing layout and the choice of signs will vary depending on the type of road (single carriageway, dual carriageway).

Signs must indicate:

- Speed (if the limit is reduced)
- Persons working on the highway
- Road narrowing
- Priority direction for traffic
- Move right or left signs
- Traffic control (if lights or signal men are used)



Keep the working area clear and do not allow mechanical equipment into the carriageway where traffic is moving.