ORGANIZATION STANDARD

Arrangement of bases strengthened with polymer cement mixture with polymer additive **"Nano Terra Soil"**

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1 Scope

Polymer cement concrete mixture (hereinafter referred to as PCGS) with the polymer additive "Nano Terra Soil" - NTS (hereinafter referred to as the additive), is used for the construction of the foundations of road pavements. It is possible to use the CPGS as the lower layer of the coating, provided that the wear layer is protected and the transport performance quality of the roadway is ensured. As well as:

- airfields;
- areas for various purposes;
- temporary roads and sites in the performance of construction and installation works.

2 Normative references

This standard refers to the following standards:

GOST R 52128-2003 Road bitumen emulsions. Specifications

GOST 4.224-83 System of indicators of product quality. Construction. Polymeric building materials and products sealing and sealing. Nomenclature of indicators

GOST 5180-84 Primers. Methods for laboratory determination of physical characteristics

GOST 8736-93 Sand for construction works. Specifications

GOST 10060.0-95 Concretes. Methods for determining frost resistance. General Requirements

GOST 10178-85 Portland cement and slag Portland cement. Specifications

GOST 10180-90 Concretes. Methods for determining strength from control samples

GOST 10296-79 Isol. Specifications

GOST 12536-79 Soils. Methods of laboratory determination of grain (granulometric) and microaggregate composition

GOST 12730.1-78 Concretes. Methods for determining density

GOST 12801-98 Materials based on organic binders for road and airfield construction. Test methods

GOST 14791-79 Sealing non-hardening construction mastic. Specifications

GOST 15836-79 Mastic bitumen-rubber insulating. Specifications

GOST 17623-87 Concretes. Radioisotope method for determining the average density

GOST 17624-87 Concretes. Ultrasonic method for determining strength

GOST 22733-2002 Primers. Laboratory method of determination maximum density

GOST 23558-94 Mixtures of crushed stone-gravel-sand and soils treated with inorganic binders for road and airfield construction.

GOST 23732-79 Water for concretes and mortars. Specifications

GOST 23735-79 Sand and gravel mixtures for construction works. Specifications

GOST 24064-80 Adhesive rubber mastics. Specifications

GOST 25100-95 Primers. Classification

GOST 28514-90 Construction geotechnics. Determination of soil density by volume substitution

GOST 30108-94 Building materials and products. Determination of specific effective activity of natural radionuclides

GOST 30491-97 Organic mineral mixtures and soils reinforced with organic binders for road and airfield construction. Specifications

GOST 30740-2000 Sealing materials for joints of airfield coatings. General Specifications

3 General

When using this technology, an NTS polymer solution is used in the proportion specified by the laboratory. The construction of structures with the use of PCGS is based on regulatory and methodological documents regulating the construction of soils reinforced with complex or inorganic binders: GOST 23558, GOST 30491, etc.

4 Characteristics of the materials used

4.1 Soil suitable for the production of PCGS – appropriate GOST 8736, GOST 25100, GOST 23735. The soil according to GOST 23558 should not contain humus more than 2%, gypsum more than 10%, lumps of clay larger than 5 mm more than 20 % by weight.

It is possible to use soils of any granulometric composition, depending on the projected structure of the mixture: contact, basal, pore.

4.2 Cement must meet the requirements of GOST 10178, grades not lower than 300 for bases and 400 for coatings, and belong to the types of PC 300, PC 400, PC 400-D0-N, PC 400-D20-N, PC 500-D0-N, PC 500-D20-N.

The beginning of cement setting is no earlier than two hours.

Do not use for the production of mixtures of the same composition different grades and brands of cement, or cement of the same brand, but different manufacturers.

4.3 Polymer additive NTS must meet the requirements of the service station

81329147-011-2008.

The NTS additive is used only at positive temperatures. It is allowed to store it at a temperature not lower than plus 5 ° C for 2 years in the original packaging.

4.4 Water must meet the requirements of GOST 23732. Maximum the salt content should not be higher than 10000 mg / l, incl. ions SO_4 - 2700 mg / l and Cl - 3500 mg / l.

5 Requirements for PCGS

5.1 The properties of the mixture are regulated by GOST 23558, GOST 30491, **[1], [2]**, **[3]** .

5.2 Total specific effective activity of natural radionuclide A_{eff} should not be higher than 740-1350 Bq / kg (according to GOST 30108).

5.3 The properties of the mixture are determined by preliminary laboratory studies, depending on the requirements for its strength, the type of soil and the designed structure.

Samples are tested in the form of cylinders, beams and cores drilled out of the structure at the age of 28 days according to GOST 23558. During the tests, the following are determined: resistance to compression and tension, frost resistance, density. The modulus of elasticity is determined in accordance with ODN 218.046-01 "Design of non-rigid road clothes".

6 Production and stacking of the mixture

Construction consists of several technological operations: preparation of soil and materials, production of the mixture, transportation to the place of laying, laying and compaction with the provision of design marks and slopes, care for the laid PCGS.

6.1 Preparation of materials

Polymer NTS is delivered by dump trucks in sealed plastic containers of factory manufacture of 1000 liters.

Cement is delivered by cement trucks from hopra wagons and loaded into the cement silage by pneumatic conveyors.

Water is delivered by the PM-6000 machine from natural reservoirs and pumped by a pump into a tank.

The soil must meet the requirements **[6],** and treated with Portland cement or slag Portland cement, meeting the requirements of GOST 10178.

6.2 Production of the mixture

For the production of THE CPGS, an automated mixing plant Bertoli ECOTECH 150 continuous action with a forced mixer must be installed.

If necessary, in order to reduce the range and time of delivery of the mixture, the Bertoli ECOTECH 150 unit can be dismantled and delivered to any quarry.

The supply of soil and cement to the mixer is carried out by belt conveyors. Supply of water and polymer NTS – through pipelines.

Before the start-up of the Bertoli unit ECOTECH 150 , the technical condition of all its components is checked, they ensure the presence of cement, water, NTS polymer in the consumable tanks, sand in front of the conveyor's receiving hopper.

Control volumes of materials are set by the laboratory before the start of the current or at the end of the previous shift.

At the beginning of the shift, after starting the Bertoli ECOTECH 150 unit, a test knead is made for 10-15 minutes to check the dosage of materials, control the moisture and bulk density of the soil, control the moisture of the mixture (compliance with its optimal humidity), take a sample of the mixture to determine its bulk density, standard density and forming of cylinders and beams. The control is carried out on the spot, with the help of the equipment of the road laboratory.

It is allowed to determine humidity and density in a stationary laboratory, if the soil parameters and the composition of the mixture have not changed since the previous shift. In this case, before new data on the dosing of materials from the laboratory, the Bertoli ECOTECH 150 unit produces the mixture according to the recipe of the previous shift.

The mixture produced by the Bertoli ECOTECH 150 soil mixing unit must have optimal humidity. It is allowed to increase the humidity of the mixture by 1-2% above the optimum, if during transportation it is not covered with a tarpaulin, or in hot weather (air temperature above 20 ° C).

The capacity of the Bertoli ECOTECH 150 unit must be coordinated with the required rate of construction according to the formulas (1):

$$V_c = L \cdot B \cdot H \cdot K_w$$

$$V_{hour} = \frac{V_c}{T} \qquad (1)$$

$$Q_{hour} = V_{hour} \cdot q \ ,$$

where V_s is the rate of construction during time T, m3;

L, B, H - length, width, thickness of the laid mixture at bulk density, m;

K_z – the coefficient of reserve for compaction;

V_{hour}, Q_{hour} – hourly productivity of the Bertoli ECOTECH unit 150, m^3/h and t/h respectively;

q – bulk density of the mixture, t/m^3;

T – operating time of the Bertoli ECOTECH unit 150, ch.

Production of the mixture and construction with its use can begin at positive average daily air temperatures. The minimum air temperature is +5 ° C. If it is necessary

to perform work on the device of the base from the finished mixture at a temperature below +5 °C, they should be carried out in
compliance with the requirements **[6]** and **[2]**.

The soils of the roadbed and the quarry should completely thaw and have a positive round-the-clock temperature. Soil moisture should not be higher than the optimal moisture content of the mixture.

6.3 Transport of the mixture to the laying site

In accordance with **[1]** and **[2]**, the duration of transport of the mixture should not exceed 30 minutes if the air temperature during laying is above 20 ° C and 50 minutes if the temperature is below 20 ° C.

When the delivery time is more than 30 minutes and at an air temperature above 20 ° C, the mixture transported by dump trucks should be covered with a tarpaulin.

According to GOST 23558, the duration of the technological gap between the preparation of the mixture and the end of its compaction is allowed to be no more than 2 hours.

To improve the quality of the PCGS layer, it is advisable to organize the work so that the seal is completed before the cement sets. Consequently, the duration of transportation must be calculated on the basis of these requirements.

The number of dump trucks required to deliver the mixture is determined by the formulas (2):

$$K_c = \frac{V_c \cdot t_t}{V_{cm}} = \frac{q \cdot t_t}{V_c} \qquad (2)$$

$$Q_{cm} = V_{cm} \cdot q$$

where K_c is the number of dump trucks; tn – the total time of one trip of a dump truck, h;

V_{cm} - the volume of the mixture in the body, m^3; Q_{cm} is the weight of the mixture in the body, t.

6.4 Laying of the mixture and compaction of the layer in the structure

The volume of the mixture in its natural bulk form should be greater than the volume in the dense body by the reserve coefficient for compaction K_z = 1.26, which is specified by a test rolling on the first grip of the construction. The coefficient is defined as the ratio of the thickness of the layer after the stacker to the thickness of the compacted layer at

the required design compaction coefficient K_y = 0.98.

The structure is laid in one aisle. If the thickness of the base is over 18 cm, the base should be arranged in two layers. Such laying is allowed in exceptional cases. At the same time, between the lower and upper layers, either a layer of polymer cement solution with a thickness of 1 ... 3 mm, or impregnate with bitumen emulsion. Before laying the top layer, moisten the surface of the lower layer and distribute the polymer cement of a given thickness.

Laying of the layer should be carried out for the entire width of the coating (base), eliminating the need to create a longitudinal seam of conjugation of coating strips.

When laying the layer to the full width, the trough is preliminarily arranged to the full design thickness, up to the marks of the copier string of the stacker. The string is exhibited by the geodetic service of construction support at the level of design marks. The trough is made of material to strengthen the roadsides.

If it is necessary to pass the construction transport, the laying is carried out in one lane. Work on one strip should be on the entire site prepared for laying the mixture, but not less than 3 days.

After 2 days of hardening the layer, light transport can be passed through it (wheel pressure not more than 1.0 MPa) at speeds up to 20 km / h. After 3 days of hardening, it is possible to pass transport with a wheel pressure on the coating of not more than 2.0 MPa. After 7 days of hardening, it is possible to pass trucks without weight limitation. After laying the layer on one prepared lane, it is possible to lay a second lane, passing the transport along the previously laid lane.

The axial edge of the previously laid strip to a width of 10-20 cm (depending on the width of the axial edge not compacted by rollers) is cut off with a seam cutter. The material selected from the structure must be removed to the side of the road or crushed with a roller and drowned in a crushed stone layer of the working layer of the roadbed. The mixture, removed to the side of the road, can be used to strengthen the roadsides, for which it is necessary to distribute it with a motor grader, pour water and compact.

Before laying the second strip, the interface seam of the strips must be moistened with water or an aqueous solution of the NTS polymer in the concentration accepted in the mixture. After that, the seam is treated with cement at the rate of mortar-cement ratio of 1: 1.

The joints of the interchangeable (diurnal) grippers are prepared in a similar way. In this case, the end of the previously laid layer is cut to the place where the layer corresponds to the design thickness and marks.

To reduce material losses on the mating edges, compaction should be ensured. To do this, it is necessary to sprinkle a crushed stone brow to the edge of the layer with a motor grader, thus creating a trough.

To distribute the mixture, a stacker equipped with a tracking evenness control system is used. Laying speed – 1.5-3.0 m/min.

Smooth rollers are used only for preliminary sealing of edge strips together with the side of the trough for 2 passes (once forward and backward), in order to form a clip that keeps the mixture from being squeezed out by pneumatic rollers.

Compaction of the mixture begins directly behind the stacker, after the distribution of the mixture, in the area no further than 5-10 m. The length of the gripper, on which all the rollers work in a given order , is 120 ... 150 m.

All rollers are on pneumatic tires. Compaction of the mixture is provided for combined rollers of the DU-100 type with a mass of 18tons and a seal width of 1700 mm. Sealing is provided for 6 passes along the width of the base and for 4 passes along one trace. Sealing should be carried out according to the shuttle scheme at a speed of 1.5-2.0 km / h on the first two passes with a gradual increase to the maximum possible, while ensuring that the engine is not overloaded. For 2-3 passes on one trace until the end of the sealing speed the roller should be reduced to 2.0-3.5 km / h. Reducing the speed of movement of the roller at the end of the seal contributes to the creation of a proper structure of the material and increases the strength of the compacted layer. Ironing of the surface of the laid layer with light rollers SAKHAI TS-160.

In any case, the weight of the rollers (as well as the composition of the squad) should be selected in accordance with the mobility of the mixture by preliminary passages.

When compacting with a detachment of rollers, it is necessary to ensure: the density of the layer, the flatness of the surface (no waves), the design slopes and marks.

To ensure design transverse slopes, all rollers begin compaction from the edge bands.

After the sealing is completed, but no later than 2 hours, a clean layout of the layer surface (cutting off the formed waves) with a motor grader is performed. After cutting, a final rolling is carried out with light pneumatic rollers in static mode for 2-3 passes on one trace.

Finish the seal as soon as the required compaction coefficient is reached.

If a break in operation is necessary, the gripping device must be completely completed and the rollers removed from the compacted strip. In case of rainy weather,

work should be stopped, and the freshly laid layer should be protected with a film-forming material, or a layer of sand or soil 5-7 cm thick.

To control the laying process, a log of work is kept.

6.5 Care of the laid layer

Care consists in ensuring the hardening of the material under a favorable heat and humidity regime, cutting deformation joints and sealing them to prevent the ingress of atmospheric and surface water into the structure during the operation of the highway.

Ensuring the heat and humidity regime of hardening is carried out in several ways.

The first method is to cover the layer with non-woven material "dornite", or polyethylene. The material is reusable, and as construction progresses and the care of previous grippers is over, it is shifted to subsequent grippers.

The second method is the bottling of bitumen emulsion EBA-1 or EBK-1 according to GOST R 52128 with a flow rate of 0.4... 0.6 l/m^2, or other film-forming materials. If the film is destroyed, it should be restored.

The third is by backfilling 5-7 cm of sand or other soil with watering for 3 days. Sand is distributed over the surface by a motor grader and moistened by a water-washing machine.

Coating the layer with "dornite" or polyethylene is preferable to care with film-forming materials in dry weather with an air temperature above + 10 ° C, since the mixture dries. At temperatures below + 10 ° C, care with film-forming materials is not recommended. The layer should be wet when hardening up to 3 days after laying, until the layer strength reaches 70% of the required strength. At a temperature above 20 ° C It is recommended to cover the PCGS with polyethylene film for all daylight hours.

Cutting of deformation joints is carried out in order to prevent the formation of uncontrolled shrinkage cracks.

The seams are cut with the increments established in the project. The depth of the seam can be from 0.5 to 0.75 layer thickness.

In areas with widening bands (transition-speed lanes, etc.), the pitch of the seams remains the same. The cutting time of the seams is determined by the time of the set of compressive strength in 2.0 MPa (approximately 3 days, i.e. the opening time of the movement of light vehicles on the coating), but no later than 4 days from the date of laying the layer. Apply a seam cutter of any brand.

After gaining 70% strength, it is possible to seal the seams. Mastic or any sealing material must meet the requirements of GOST 30740. It is possible to use mastics according to GOST 24064-80, GOST 10296,
GOST 14791, GOST 15836, GOST 4.224.

The brand of sealant is chosen depending on the minimum air temperature in the construction area.

Before the sealant is inserted into the seam, it is cleaned and dried with a jet of air from the compressor. The sealant is inserted by an injector with a nozzle with a diameter of 5 mm to the entire depth of the seam.

Until the time of laying the wear layer or coating, the PCGS layer is protected with two layers of emulsion and sand sprinkling. The sand is sunk into the surface of the emulsion with a pneumatic roller. With a sufficiently good adhesion of the emulsion and PCGS, it is possible to use layers used in care. In case of separation of the emulsion layers of care, they are periodically restored until a permanent protective wear layer is installed.

The care process is recorded in the care work log.

Table 1 shows the composition of the detachment for laying the PCGS.

T a b l i c a 1

№ p/n	Name, functions	Characteristic	Colvo
	Production and stacking of the mixture		
1	Bulldozer (overburden, quarrying)	100-300 kW	1
2	Loader (loading of soil bins)	1-3 m^3	1
3	Mixing plant Bertoli ECOTECH 150 (production of PCGS)		1
4	Dump trucks (depending on the range of the truck)		4-6
5	Mix stacker with vibrating plate (width not less than 8.0 m)	VOGEL	1

7	Light pneumatic coil (rolling layer) Sakhai TS-160	2-4 tons	2
9	Heavy roller on pneumatic tires DU-100	18-25 tons	2
10	Motor Grader Medium	DZ-122, etc.	1
	Control and maintenance		
11	Road Laboratory		1
12	Geodetic tools for breakdown and control of planned dimensions and elevation marks	set	
	Care of the laid layer		
13	Watering washing machine	PM-6000	1
14	Autogudronator (emulsion treatment)		1
15	Polyethylene film (if necessary)	M_2	2000
16	Milling cutter for cutting deformation joints		1
17	Mastic stitch filler		1
18	Excavator for quarry development and soil loading EO-4225		1

7 Quality Assurance

7.1 Quality control of input materials

Granulometric composition, bulk density and natural soil moisture are monitored at least once a shift according to GOST 12536 and

[2].

Humidity and soil density are monitored before the start of the shift. With stable weather, it is possible to be guided by the humidity of the soil of the previous shift, while the humidity during the current shift is necessarily controlled.

To monitor the dynamics of the properties of the mixture, 18 standard samples should be formed daily, three of which are tested at the age of 7 days. Thus, data are obtained for operational control and changes in the composition, if necessary. The remaining samples are tested at the age of 28 days for all parameters required by GOST 23558.

Before starting work, the content of easily soluble salts in soils according to GOST 25100 is monitored. The properties of cement (setting period, activity and grade) are controlled by accelerated methods 1 time in 10 shifts or with the arrival of each new batch (wagon) of cement according to GOST 10178.

The quality of the NTS polymer is not controlled, guaranteed by the supplier.

The results of assessing the quality of materials are recorded in laboratory control logs, in accordance with the requirements for construction support.

7.2 Quality control of the mixture and the compacted layer

Humidity and standard density of the mixture are monitored at least four times a shift according to GOST 5180 in a stationary laboratory. It is possible to quickly control the humidity directly at the installation, if there is a mobile road laboratory.

Control is performed before the start of the shift, simultaneously with the control of soil moisture, bulk soil density and bulk density of the mixture.

If the humidity of the mixture is lower (higher), it is optimal to add (decrease) the amount of water to be added. It is possible to determine the optimal humidity by the "dew point" method if the mobile laboratory does not work temporarily. At the same time, during one shift, it is necessary to determine the optimal humidity and standard density in a stationary laboratory.

The accuracy of dosing of the mixture components is checked by control weighing at least 1 time in 2 shifts. Promptly determine the accuracy of dosing on the control panel of the Bertoli unit ECOTECH 150 according to the readings of the flowmeters of water, cement and polymer NTS.

The accuracy of dosing of the materials constituting the mixture must correspond to:

cement and polymer additive NTS – not more than ±1% by weight; soil - not more than ±3% by weight; water and aqueous solutions - no more than ±1% of its optimal amount.

Acceptance of the mixture is carried out in batches. A batch is considered to be the amount of mixture manufactured during one shift, but not more than 1000 m^3. The manufacturer must check the composition of the mixture, compressive strength, tensile strength during bending or splitting, frost resistance and modulus of elasticity. For this purpose, samples are taken from the batch and samples are formed according to GOST 23558 in the amount of 18 pieces or at least 3 samples per 250 m^3 Mixture. Samples are

stored in conditions close in temperature and humidity to the conditions of laying the mixture in the structure. Samples are numbered, fix the date and change of production of the mixture, as well as picketing the site where the mixture will be laid in the structure.

The strength characteristics of the samples are determined after 7 and 28 days. Frost resistance is determined according to GOST 10060.0. Compressive and tensile strength during bending - according to GOST 10180.

The average strength of all series of samples should not be lower than the design brand. The absolute value of the permissible deviation from the required parameters of the mixture shall be not more than 8%, in the case of the production of the mixture in the installation.

In order to assess the performance of the material, cores are drilled out of the structure 28 days after compaction of the layer. The strength of the cores is assessed by their testing according to GOST 10180. The density of the core material is determined according to GOST
12730.1.

To assess the performance of the structure, cores are drilled after a year of operation or with a certain periodicity, depending on the purposes of control and study of the properties of the material and the structure as a whole. Tests are also carried out according to GOST 10180 and GOST 12730.1.

The results of the control are recorded in the laboratory journal.

7.3 Operational quality control of laying and sealing of the PCGS layer

On the construction site, a laboratory should be equipped in compliance with the requirements **[4].**

Visually , the quality of the seal is controlled by the passage smooth roller weighing 10-13 tons. After the passage of the roller, there should be no trace and wave on the surface in front of the roller.

The density of the layer material can also be controlled by cutting cores according to GOST 12801, or by the "hole" method according to GOST 28514, followed by volume

measurement, weighing and density calculation according to standard methods and GOST 22733. It is possible to use non-destructive methods of density and strength control according to GOST 17624, in particular by the "Beton-2" device by surface sounding, or radioisotope sounding according to GOST 17623.

The geometric dimensions of the arranged layer are controlled by the geodetic service and must meet the requirements **[2]** (for the case of stacker equipment with a tracking system).

To display the entire construction process and analyze its results, a summary list is maintained, where data from all technological stages, as well as laboratory support, are recorded.

Table 2 shows the technology of operational quality control of work in the arrangement of the base from the PCGS

T a b l i c a 2

Basic operations, subject to control	Composition of the control	Method and means of control	Mode and scope of control	Controlling person	Marginal deviations from the norms	Where the results of the control are recorded
1	2	3	4	5	6	7
Delivery of cement-soil mixture	Compliance of the mixture with the requirements of the project, ensuring the design volume	Laboratory and visual	Mixture quality – at least four times a shift, volume – at the end of the shift	Quality – laboratory assistant, volume – master	In accordance with project requirements	Quality – in laboratory journal, volume – in the journal of production of works
Mixture distribution	Width, thickness, transverse slopes of the layer	Instrumental (tape measure, measuring ruler, three-meter rail with level)	At three points across every 50 m	Master	Width – ±10cm, thickness ±15mm, slope – ±0.01	In the work log
Compaction of a layer of cement-soil mixture	Moisture content of the mixture, evenness and transverse slopes of the layer	Laboratory and instrumental (buxes, three-meter rail with level and measuring, leveler)	At least 1 time per shift, at three points across every 50 m	Laboratory assistant, master, geodesist	±1% of the optimum humidity, evenness - the gaps should not exceed 10 mm, the slopes should be within ±0.01, notes on the axis – ± 50mm from the project	In the laboratory journal, work logs and technical leveling

After the standard hardening period	Compliance of the properties of cement concrete with the requirements of the project	Core selection and laboratory testing	Once a shift, at three points across every 50 m	Master, laboratory assistant	In accordance with the requirements of the project	In the laboratory journal and the journal of production of works

8 Organization of construction

8.1 Preparation of construction

It is necessary to determine the most convenient location of the ground quarry.

The final decision on the choice of a quarry is made after a preliminary selection of the composition of mixtures from the soils of all competing quarries, the development of the order of laying the layer, agreed with the traffic scheme of construction transport, and a comparison of the estimated costs of various construction schemes.

After choosing a quarry in the laboratory, the composition of the mixture from the soils of the selected quarry is selected. The selection of the composition of the mixture takes 70-90 days, depending on the number of compared compositions. The composition must be determined three months before the start of construction. In the laboratory, it is necessary to study the materials and develop technologies that ensure the adhesion of the PCGS with the underlying layer, the adhesion of 2 layers of the PCGS to each other (in the case of laying the structure in 2 layers and joining the seams), the adhesion of the PCGS with the material adopted for coating. According to the results, the number is determined

materials (cement, NTS polymer, coating material and others).

After selecting the composition of the mixture, an order for changing the design and estimate documentation is prepared and approved. After the approval of the order, contracts for the supply of materials are concluded.

At the same time, the installation of the mixing plant is carried out. Bertoli ECOTECH 150. The plant must be installed and tested 10 days before the start of construction. For the remaining period before the start of construction, a trial layer should be made, in order to clarify the technology of its compaction and the choice of a detachment of sealing equipment.

It is advisable to deliver the NTS polymer to the on-site warehouse in time for the start of construction and arrange for the cement to be delivered to the nearest railway station in accordance with the pace of construction, thereby eliminating intermediate cement storage.

Then it is necessary to set the pace of construction and calculate the appropriate number of dump trucks and the performance of the Bertoli installation.

ECOTECH 150. Prepare the roadbed: provide design marks and slopes, soil density.

8.2 Organization of production, stacking and sealing of the mixture

The production of works on laying the CPGS can begin after the establishment of constant average positive air temperatures in the construction area, thawing and drying of the working layer of the roadbed. The work ends approximately 18 days before the establishment of constant negative temperatures. In any case, before freezing, the reinforced material must gain 70% of the design strength.

Preparatory work for the laying of the mixture consists in the preparation of the technological layer and all the machines and equipment used. 1-2 days before installation, it is necessary to check the marks of the roadbed. If necessary, add (or cut off excess) soil.

Next, the surface of the technological layer is cleaned, compacted, prepared for the passage of caterpillar propulsion. The layer must meet the requirements **[2]** for evenness and strength and is accepted according to the act of hidden work.

Break the edges of the strip to be laid. Pull the copier strings on the center stakes at the level of the design marks.

Before laying the PCGS, the surface of the roadbed is watered.

The mixture is laid at an air temperature not lower than +5 ° C.

The place of work must be fenced in accordance with the requirements **[5]** according to the scheme agreed with the traffic police, or to exclude transit traffic completely.

Load and run the stacker. Include a vibrating plate. The motor grader arranges a trough, shifting the soil of the roadside to the edge of the laid layer. The top of the trough should be at the level of the copy string. Seal the layer in accordance with paragraph 6 of this International Standard.

8.3 Organization of care for the laid layer

Care begins immediately after compaction of the layer. In any case, the coating of the layer should be constant during the care period (2 days).

After cutting the seams, the appearance of cracks on the first grippers is controlled. In case of cracks in the plates between the seams, it is necessary to change the cutting step, but not less than 3 meters.

8.4 Organization of laboratory support

For laboratory control and support, the contractor must have stationary and mobile laboratories.

The mobile laboratory takes soil samples and mixtures at the plant every morning before the start of the shift. On site, the moisture content of the soil and mixtures, as well as their bulk density, is determined.

The soil and mixture are delivered to a stationary laboratory. Standard methods determine the granulometric composition of the soil, the modulus of coarseness, the amount of dusty and clay particles, natural humidity, bulk density of wet and dry soil. For the mixture, the optimal humidity and standard density are determined.

The results are communicated to the operator of the Bertoli plant ECOTECH 150. The operator adjusts the composition of the mixture, if it changes.

Every afternoon, after forming the samples, the road laboratory goes to the road to control the moisture, density and modulus of elasticity of the layer. Samples are taken directly behind the stacker and at the beginning of the day's grappling, where the layer is already compacted. The degree of compaction is controlled indirectly by measuring the modulus of elasticity with a dynamic loading device. On the grip strips, where the module is lower, additional roller passes are organized.

The resulting samples of the laid layer are delivered to a stationary laboratory, where the actual density of the mixture and the compaction coefficient are determined.

The results are recorded in the layer compaction control log.

9 Organization of work and safety

Organization of labor, safety, acceptance of work can be performed in accordance with the approved project, as well as according to **[1]** and **[2].**

Safety of work on machines and mechanisms is provided by personnel training, briefings, implementation of instructions for their operation.

When performing work, it is necessary to comply with the rules of technology security, as set out in the relevant sections **[8]-[13].**

Bibliography

[1]	Guidelines for the arrangement of coatings and bases made of crushed stone, gravel and sand materials treated with inorganic binders (Order os-621-r)
[2] SNiP 3.06.03-85	Roads
[3] SNiP 2.05.02-85	Roads
[4]	Technical specifications for types of work in the construction, reconstruction and repair of roads and artificial structures on them (Order 177-p)
[5] VSN 37-84	Instruction on traffic management and fencing of roadworks
[6]	Guidelines for soils and materials reinforced with inorganic binders
[7]	Guidelines for the construction of foundations and road surfaces from crushed stone and gravel materials
[8] SNiP III-4-80	Safety in construction
[9] SNiP 12-03-2001	Labor safety in construction. Part 1. General Requirements
[10] TOI R-218-26-94	Standard instruction on labor protection for the driver of an auto-water-washing machine
[11] TOI R-218-05-93	Standard instruction on labor protection for the driver of a motor grader (trailed grader)
[12] TOI R-66-36-95	Standard instruction on labor protection for drivers of self-propelled rollers with smooth rollers
[13] Rules	Rules of labor protection in the construction, repair and maintenance of roads

OKS OKP

Keywords: technology of strengthened bases device, polymer cement concrete mixture (PCGS), strengthening additive NTS, quality control

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