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ROAD WORKS

ROAD BASES AND SUB-BASES

Technical general requirements for quality

Lucrări de drumuri

STRATURI DE BAZĂ ŞI DE FUNDAŢIE

Condiţii tehnice de calitate

Travaux routiers

COUCHES DE BASE ET DE FONDATION

Prescriptions techniques de qualité

Replacing:
STAS 6400-73

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1 GENERAL

1.1 Scope

This standard specifies the general technical requirements of quality with respect to road bases and sub-bases as components of rigid and non-rigid causeway systems for public roads.

NOTE – The provisions of this standard can be applied for private roads as well provided that the beneficiary of these road works agrees to it.

1.1.1 Road bases may consist of:

- macadam;
- penetrated and semi-penetrated macadam;
- crushed stone wedged with bituminous split;
- natural aggregates stabilized with hydraulic binders (cement);
- natural aggregates stabilized with pozzolanic binders (grained slag, steam power plant ash or grinded volcanic tuffa, activated);
- hydrocarbon pavement mixture;
- cement concrete.

1.1.2 Road sub-bases can consist of:

- natural aggregates (sand, ballast, old crushed stone surfaces);
- ballast, optimal mixture;
- big crushed stone, 63-90 sort;
- crushed stone, optimal mixture;
- mechanical stabilized soil;
- natural aggregates stabilized with hydraulic binders (cement);
- natural aggregates stabilized with pozzolanic binders (grained slag, steam power plant ash or grinded volcanic tuffa, activated);
- rubble stone penning.

1.1.3 Existing coatings can be regarded as road bases or sub-bases provided they consist of:

- macadam;
- penetrated and semi-penetrated macadam;
- cement-bound macadam;
- hydrocarbon pavement mixture;
- cement concrete;
- pavements made of large and abnormal paving sets and paving bricks;
- pavements made of rubble stone and boulders.

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1.2 Terminology

In accordance with STAS 4032/1-82.

1.3 General directions

1.3.1 The provisions stipulated by STAS 1709-75 will be applied in order to prevent degradations caused by frost-thaw processes.

1.3.2 Road base and sub-base thicknesses are calculated in accordance with the provisions of STAS 1339-79 and with other valid technical requirements concerning the composition and dimensions of causeway systems.

1.3.3 In order to increase the carrying capacity of road circuits especially for the earthworks of cohesive earths, improvement and levelling of the roadbed carrying capacity can be obtained by providing its upper side with a shape layer according to STAS 12253-84 or by mechanical stabilizations through non-cohesive material admixture etc.

2 TECHNICAL REQUIREMENTS

2.1 Road bases and sub-bases

2.1.1 Road systems for both revamping and building new roads is obtained by combining different types of road bases and sub-bases with different types and technical classes of pavements applied to public roads, as shown in the table.

2.1.2 Existing crushed stone surfaces and coatings used as road bases and sub-bases have not been included in the table, since clause 2.4 from this standard provides instructions for their use.

2.1.3 For those works that have in view the improvement of traffic conditions by coating grit-blinded roads with light asphaltic lilinies, the dimensions of road sub-bases shall be established in accordance with valid legal stipulations.

2.1.4 Road sub-bases made of ballast or mechanical stabilized natural aggregates should be no more than 30 cm thick.

2.1.5 Cement concrete road base is generally used for streets.

2.1.6 Hydrocarbon pavement mixture road base is applied directly on ballast foundations in accordance with STAS 1339-79 concerning the ratio between linear deformation modules for the materials that form road bases and that for sub-bases.

2.2 Sub-bases layers

2.2.1 The draining layer is made of ballast so that it can collect and eliminate rain waters, which infiltrate through shoulders and commissures in road sub-bases during or after work processes. Considering all this, special measures will be taken to flash the water infiltrated in this layer outside the road body.

2.2.2 The inferior sub-based layer can also function as draining layer provided that it is made of ballast and it meets the necessary requirements concerning thickness, draining quality, and water flashing measures.

2.2.3 The ballast draining layer is at least 10 cm thick after consolidation. This layer is taken into account when dimensioning the road system, and its thickness is included in the total thickness of the latter settled to prevent frost damages, as stipulated by STAS 1709-75.

2.2.4 The anticapillary layer is made of ballast so that it can prevent water ascension through capillarity from the foundation soil to the upper road sub-base or base layers.

2.2.5 The anticapillary layer should be at least 15 cm thick, yet thicker than the maximum capillary height.

This layer is taken into account when dimensioning the road system, and its thickness is included in the total thickness of the latter settled to prevent frost damages, as stipulated by STAS 1709-75.

The anticapillary layer can also function as insulator provided that the ballast meets the requirements stipulated by STAS 662-82 (sand for insulator layer).

2.2.6 The insulator layer is made either of sand or geotextiles from recycled materials so that it can prevent road sub-base contamination with soil from the road bed.

The insulator layer can be eliminated if a shape layer is provided according to STAS 12253-84.

2.2.7 The insulator sandy layer is 7 cm thick after consolidation, and it is neither taken into account when dimensioning the road system nor included in its total thickness settled to prevent frost-thaw damages, as stipulated by STAS 1709-75.

2.2.8 The insulator layer made of geotextiles can function as draining layer as well provided it meets the requirements of being placed as far as the bauks of the ditches and at least 15 cm above the ditch bottom.

2.2.9 The thermal insulator layer is made of either expanded slag of 900-1200 class, 0-7 type, or granulated A blast-furnace slag so that it can provide the road circuit with frost-thaw resistance.

2.2.10 The minimum thickness of the thermal insulator layer is of 12 cm, and it is established in accordance with valid technical regulations. This layer is not taken into account when dimensioning the road system, yet included in its total thickness settled to prevent frost-thaw damages as stipulated by STAS 1709-75 and by other valid legal regulations.

2.2.11 The thermal insulator layer made of expanded slag functions as draining layer as well.

2.3 Flashing the water from the road sub-base

2.3.1 Flashing the water from the sub-base sublayer or inferior layer is performed as follows, in accordance with STAS 10796/1-77, and depending on the water discharge possibilities:

2.3.1.1 A continuous draining layer is made available as far as the road ramps, provided there is the possibility of flashing the water from the ditches or on the positive slopes. The surface of its support layer will have a 10…12% cross fall on the last 80 cm, up to the slopes of the road.

When expanding an existing road, shoulder slots of 25…30 cm width, 30…50 cm depth, and 10…20 m spacing according to the road longitudinal gradient, can also be supplied.

2.3.1.2 In case of a cutting or ground-levelled road, where there is no possibility of flashing the water through ditches, longitudinal drains of a minimum 0,3% gradient are placed either beneath the shoulders or the drain pipes.

Should any longitudinal drains are needed for streets, they are usually placed beneath the sidewalks or in green areas.

Streets with rain drainages can be supplied with longitudinal drains placed beneath the sidewalks (ramp), making it possible to flash the water on the outflows.

2.3.2 Shoulder slots shall have a 4-5% gradient, and are built either as usual, on the road axis when the longitudinal profile declivity is lower than 2%, or with a 60^{o} gradient, following the slope, when the declivity is higher than 2%.

2.3.3 Flashing the water from the draining layer or from the shoulder slots through the slopes of the road, is performed at least 15 cm above the ditch bottom or above the ground level or the dead-water level in the area in case of embankments.

2.3.4 No measures will be taken to flash the water from the road sub-base if the embankments are made of non-cohesive or permeable soils.

2.3.5 The above-mentioned directions to flash the water from the road sub-base are not restraining; other measures can be established by execution projects.

2.4 The use of crushed stone surfaces or old pavements for road bases or sub-bases

2.4.1 The use of existing crushed stone surfaces in building the road circuit is established in accordance with both their width and thickness and the quality of their compounding materials, as follows:

- the crushed stone surface will not be taken into account in building the road system when it is not as wide as the road bed and less than 10 cm thick; yet, it will be scabbed and reshaped;

- the crushed stone surface will form the shape layer and the road sub-base when it is as wide as the road bed and minimum 10 cm thick, being taken into account in dimensioning the road system, as stipulated by valid legal regulations;

- the crushed stone surface will be scabbed, reshaped and consolidated to function either as shape layer or road sub-base when it is not as wide as the road bed, but thicker than 10 cm; it will be taken into account in dimensioning the road system with the thickness it gets after reshaping;

- the crushed stone surface can function as a road sub-base or sub-base sublayer only when built as required or mixed with materials that meet the technical requirements stipulated for these layers according to STAS 662-82.

2.4.2 When using old pavements as road bases or sub-bases, samples and surveys should be gathered and analyzed in labs, to establish their real thickness and the quality of the compound materials. In case of existing bituminous pavements, road deformation is also measured by means of lever deflectometers or other adequate tools; as stipulated by valid legal regulations, climatic and hydrological conditions will be considered when statistically interpreting the data.

2.4.3 When stiffening works are executed on either bituminous or cement concrete paved roads, the pavement made of cement concrete can be used as consolidation layer in accordance with valid legal regulations.

Maintenance of bituminous layers as components of the new road structure will be justified by technical and economic reasons.

2.5 Expansion of existing roads

2.5.1 When expanding an existing road, a new road structure is adopted in order to provide the road circuit with a carrying capacity equivalent to the one of the existing road.

2.5.2 The water from the road sub-base of the expansion traffic lanes is flashed according to the 2.3 clause of this standard.

2.5.3 In case of sub-base expansions of less than 0,75 m thickness, the type of sub-base is chosen depending on the consolidation equipment available for this work width; cement concrete, natural aggregates stabilized with hydraulic or pozzolanic binders, and rubble stone penning are recommended.

2.5.4 In case of road expansions by supplementing the number of traffic lanes, the combination of different layers between the two road structures is performed in a staggered manner with steps of minimum 15 cm for each layer.

2.6 Geometrical elements and limit deviations

2.6.1 The thickness of road bases and sub-bases is settled in accordance with STAS 2900-79 and STAS 1598-78.

2.6.2 A road bed made of non-cohesive soils or provided with a shape layer shall have the same slopes on the transversal profile, the same declivity on the longitudinal profile and the same tolerance as those of the pavement surface.

2.6.3 A road bed made of cohesive soils and lacking a shape layer shall be provided with a minimum 4% slope on the transversal profile. It shall have the same declivity on the longitudinal profile and the same tolerance as those of the pavement surface.

2.6.4 The transversal profiled slopes and the longitudinal profiled declivities of the road bases and sub-bases surface are similar with those of the pavements under which they are executed, and meet the requirements of specific standards regarding pavements: STAS 174-83; STAS 175-76; STAS 179-84; STAS 183-83; STAS 1120-82; STAS 6978-77 and STAS 9095-77.

2.6.5 Admitted dislevelments of road sub-bases on the transversal profile differ within ± 0,5 cm from those accepted for the pavements under which they are executed.

2.6.6 Admitted dislevelments on the longitudinal profile of road sub-base surface under a 3 m level, are of maximum 2 cm for sub-bases made of mechanical stabilized soil, natural aggregates, ballast with optimal mixture, crushed stone and rubble stone, and of maximum 1,5 cm for sub-bases made of natural aggregates stabilized with hydraulic and pozzolanic binders.

2.6.7 Admitted dislevelments on the longitudinal profile of road bases made of macadam, natural aggregates stabilized with hydraulic binders (pozzolanic included) and hydrocarbon pavement mixture, are in accordance with specific standards: STAS 179-84, STAS 10473/1-76 and STAS 7970-76.

2.6.8 Admitted dislevelments on the longitudinal profile of the surface of road bases made of cement concrete, under a 3 m level, are of maximum 1 cm.

2.7 Materials

2.7.1 Road bases and sub-bases consist of materials which shall meet the quality requirements stipulated by the provisions of specific standards, as follows:

- natural raw aggregates, according to STAS 662-82;
- rubble stone, crushed stone, broken stone, broken sand, pavings, paving bricks, according to STAS 667-84;
- expanded slag, according to STAS 8177-68;
- granulated high blast-furnace slag, according to STAS 648-74;
- bituminous earth, according to STAS 754-73;
- filler, according to STAS 539-79;
- cement, according to STAS 388-80, STAS 1500-78, STAS 10092-78;
- non-hydrated crushed lime, according to STAS 9310-77;
- hydrated powder lime, according to STAS 9201-80;
- water, according to STAS 790-84.

2.7.2 Insulator layer sand shall meet both the quality requirements stipulated by STAS 662-82 and the inverse filter requirement in accordance with STAS 662-82.

2.7.3 Draining layer ballast shall meet the requirements stipulated by STAS 662-82 regarding the ballast used for road sub-bases.

2.7.4 Geotextiles made of recycled materials and used for insulator layers shall meet the following quality requirements:

- mass on each surface unit 600…800 g/m^2;
- natural fibers content max. 10%;
- stretching resistance min. 400 N/5 cm;
- stretching specific elongation max. 50%;
- coefficient of longitudinal and transversal permeability min. 10^{-2} cm/sec.

3 EXECUTION OF ROAD BASES AND SUB-BASES

3.1 The execution of road bases and sub-bases begins only after the road bed reception, in accordance with STAS 2914-84.

3.1.1 The execution of draining, anticapillary and insulator layers made of ballast or sand requires the following procedures:

- gravelling and levelling the sand or the ballast with the shaping pass in layers of maximum 15 cm thickness (before consolidation);

The thickness of the graveled material can exceed 15 cm before consolidation when using consolidation equipment whose technical characteristics demand levels of thickness bigger than 15 cm. In this case, the gravelling thickness of the material will be settled on the project site, before starting the work.

- splashing the necessary water quantity to ensure the optimal humidity for consolidation determined by means of the modified Proctor test in accordance with STAS 1913/13-83;

- sand consolidation through either tamping or vibrations, and ballast consolidation through compression and vibrations, in accordance with the 3.6 clause of this standard.

3.1.2 The execution of thermal insulator layers made of expanded or granulated high blast-furnace slag is performed in accordance with valid technical regulations.

3.1.3 The execution of the insulator layer made of geotextiles from recycled materials is performed by unfolding the cloth beam on the road length and mechanically sewing the pieces together.

In order to secure the geotextile against degradations while making the superior road sub-based layer, the following measures are requested:

- the before-consolidation thickness of the superior road sub-based layer made of natural aggregates shall be of minimum 15 cm;

Unloading the natural aggregates from the lorries is performed by dumping them, preferably while slowly driving; their laying and levelling is performed by means of either motorized grader or bulldozer, whose breast plate shall not get into direct contact with the geotextile;

It is prohibited for equipments with roller-chain tracks to enter the surface of the geotextile;

- shall the superior road sub-based layer is made of crushed stone, a protection layer will be inserted between it and the geotextile; this protection layer is made either of sand or steam power plant ash, and it is 7 cm wide.

3.2 When the road sub-bases are carried out directly on the road bed, their execution begins only after the road bed reception, according to STAS 2914-84; when the road system is provided with road sub-based sublayers, the execution of road sub-bases begins only after the above-mentioned sublayers are evaluated according to the 5 clause of this standard.

The execution of superior sub-based layers is performed only after the reception of the inferior sub-based layers.

3.2.1 Ballast or sand road sub-based layers are performed according to the 3.1.1 subclause of this standard.

3.2.2 The execution of road sub-bases made of mechanical stabilized soil is performed according to STAS 8840-83.

3.2.3 The execution of road sub-bases made of ballast, optimal mixture, is performed according to both STAS 662-82 regarding the grading and the 3.1 clause of this standard.

3.2.4 The execution of road sub-bases made of big sized crushed stone, 63-90 type, requires the following procedures:

- gravelling and compressing the dried crushed stone. Until the astriction of the crushed stone, compression is performed by means of 6 t rammers with glazed rollers; later on, the procedure is executed by using 10…14 t rammers with tyres or vibrators;
- wedging the surface of the crushed stone layer with split of 16-25, and consolidating it;
- filling the remaining holes either with ballast of 0-8 or with sand, using the mudding technique.

The crushed stone layer is secured with a protective material (granulated sand, grit etc.) until the neighboring superior layer is executed.

Shall the superior layer is made of macadam or cement concrete, filling the holes or securing the crushed stone layer will be omitted.

3.2.5 The execution of road sub-based layers made of crushed stone, optimal mixture, requires the following procedures:

- deciding the mixture ratio of different types of crushed stone in order to obtain the grading of the optimal mixture in conformity with valid legal regulations and with the optimal humidity for consolidation determined by means of the modified Proctor test as stipulated by STAS 1913/13-83;
- obtaining the mixture within a sand plant provided with a four-compartmented predozer;
- gravelling the material with an asphalt finisher, and if needed, adding the necessary water quantity to achieve the optimal humidity for consolidation;
- layer consolidation by means of rammers with tyres or vibrators, according to the 3.6 clause of this standard.

3.2.6 The execution of road sub-based layers made of natural aggregates stabilized with hydraulic binders (cement) is performed in accordance with STAS 10437/1-76; layers made of activated grained slag, steam power plant ash or grinded volcanic tuffa are executed according to valid legal regulations.

3.2.7 The execution of road sub-bases made of rubble stone penning requires manually arranging the stones on the inferior ballast layer as closest as possible, with cogged commissures, with the bigger bottom down and the length perpendicular on the road axis; remaining holes between stones will be filled (wedged) with crushed stone.

3.3 The execution of road bases begins only after the reception of road sub-bases as stipulated by the 5 clause of this standard.

3.3.1 The execution of macadam road bases is performed according to STAS 179-84.

3.3.2 The execution of road bases made of crushed stone wedged with bituminous is performed in accordance with valid technical regulations.

3.3.3 The execution of road bases made of natural aggregates stabilized with cement is performed in accordance with STAS 10473/1-76; layers made of activated grained slag, steam power plant ash or grinded volcanic tuffa are executed according to valid legal regulations.

3.3.4 The execution of road bases made of cement concrete requires the following procedures:

- arrangement of the supporting layer, according to STAS 183-83;
- deciding the composition of the B200 type concrete , according to valid technical regulations;
- grouting and transporting the concrete, according to STAS 183-83;
- gravelling the concrete within metal reaches or any other types of moulds, followed by its consolidation.

The concrete is graveled at temperatures of at least $+5^{o}$ C.

Below this temperature, up to a temperature of minimum 0^{o} C, all procedures can be performed if special measures concerning grouting, gravelling and securing the concrete are taken.

Traffic activities on the cement concrete layer take place in accordance with STAS 183-83.

The concrete layer shall be equipped with dilatation and work commisures on all thickness of layer at maximum 40 m spacing established according to local conditions.

3.3.4.1 Pavements made of large and abnormal paving sets or paving bricks can be deprived of transversal commissures for contraction.

3.3.4.2 Those layers made of cement concrete and wider than 5 m are provided with contact longitudinal commissures on their entire thickness.

Contraction, dilatation and contact commissures are executed in accordance with STAS 183-83, by respecting all safety measures for the specific cement concrete layers.

NOTE: When sliding roofs are not available, bast mats can be used instead.

3.3.4.3 In case the concrete layer is covered with bituminous, the coating is performed after testing the prescribed resistances for B200 type concrete. Before applying the bituminous, the concrete surface is daubed with lime paste on each side of the commissures, on stripes of 20-30 cm long; asphalting roofing-boards, polyethylene leaves, interlaces made of bituminous glass fibers, or glass fiber cloths can substitute the lime paste.

3.4 Road sub-bases made of old scabbed and reshaped crushed stone surfaces

3.4.1 When they are not totally scabbed according to the 2.4.1 clause of this standard, existing crushed stone surfaces are scabbed on an area with at least 5 cm thicker than the depth of road dislevelments and holes.

3.4.2 The material resulted from total or partial scabbing is reshaped as given or by combination with new natural aggregates, and afterwards it is consolidated according to the 3.6 clause of this standard.

3.5 Road bases and sub-bases made of existing pavements

Bituminous or cement concrete pavements, as well as pavings made of pitchstones, rubble stones or boulders, are repaired first in order to eliminate fissures and holes, and their commissures are clogged up if needed, according to valid legal requirements.

3.6 Consolidation of road bases and sub-bases

3.6.1 When consolidating road bases and sub-bases, the following shall be considered:

- the parameters of the rammers shall be in accordance with STAS 9348-80, STAS 9652-80 and STAS 9831-80;
- the rammers shall follow a straight line, not a winding one, and they shall not be turned back on those surfaces that are being consolidated or have been consolidated recently;
- consecutive consolidation stripes shall overlap on a minimum 20 cm thickness;
- the number of passes over to obtain optimal consolidation as stipulated by the 4.3.2 subclause of this standard, is decided before beginning to work.

3.6.2 Shoulders are completed and consolidated in the same time with road bases and sub-bases so that the former would border the latter on a permanent basis, by ensuring the water flashing procedures as described in the 2.3 subclause of this standard.

3.6.3 It is not recommended to assemble road borders or lanes in advance because they may prevent the consolidation of road bases and sub-bases on their entire thickness.

After installing road borders or lanes, the consolidation of shoulder pavements shall be performed with equipments that fit their thickness.

3.6.4 Dislevelments that result from and persist after the consolidation process of road bases and sub-bases are corrected with supplied materials of the same type, which are also consolidated after appliance.

Surfaces with more than 4 cm dislevelments are passivated in regular forms on the entire layer thickness, filled with materials of the same type and reconsolidated.

4 RULES AND PROCEDURES FOR TESTING WORK QUALITY

4.1 Testing the quality of materials

4.1.1 Materials are checked for quality throughout the entire duration of work processes in accordance with specific standards; the following explanatory notes are needed:

- the quality of geotextiles is tested according to STAS 9051/1-74 and STAS 9051/2-79
- the quality of expanded slag is tested by establishing its grading according to STAS 4606-80;
- the quality of expanded or granulated blast-furnace slag is tested by establishing both its grading according to STAS 4608-80, and its apparent density when piled up according to STAS 648-74;

4.1.2 Quality tests are performed by either the project site laboratory or the central laboratory of the producer; in case of tests that neither of these two can perform, a specialized laboratory will be involved.

4.2 Testing the geometrical elements

4.2.1 The surface of road bases and sub-bases is checked on both longitudinal and transversal profiles so that it would meet the technical regulations and the limit deviations stipulated by the 2.6 subclause of this standard.

4.2.2 Road bases and sub-bases thickness are tested according to STAS 2900-79 and STAS 1598-78, making sure they correspond the data included in the execution project.

Tests are performed no less than every 200 m.

4.2.3 Road bases and sub-bases thickness shall meet the data included in the execution project and the requirements of this standard.

Survey tests on road thickness are performed no less than every 200 m.

Road base thickness is also checked through survey tests as follows:

- at least one survey at every 200 m of the road length or at every 1500 m^2 of its surface, when using macadam or natural aggregates stabilized with hydraulic or pozzolanic binders;
- two drill cores at every 7000 m^2 of road surface, when using hydrocarbon pavement mixture;
- direct measurements of the road slab and minimum four drill cores at 10 000 m^2 of road surface, when using cement concrete.

4.2.4 Levels of the longitudinal profile are checked on the road axis with level instruments, and they shall meet the figures stipulated in the work project.

4.3 Work process check

4.3.1 Observation of the technological processes stipulated by the 3 clause of this standard is performed.

4.3.2 Check of the road foundation consolidation is performed.

4.3.2.1 Road sub-bases made of mechanical stabilized soil shall be consolidated until achieving the consolidation degree as STAS 8840-82 stipulates it.

4.3.2.2 Road sub-bases made of natural aggregates (ballast, sand) shall be consolidated as follows:

- roads from the IV and V technical classes shall have a consolidation degree of minimum 98% of the density attained in the maximum drying stage and determined through the modified Proctor test in accordance with STAS 1913/13-83, in at least 93% of the measurement points; and of minimum 95% in all measurement points;
- roads from the I, II and III technical classes shall have a consolidation degree of minimum 100% of the density in the maximum drying stage and determined through the modified Proctor test in accordance with STAS 1913/13-83, in at least 95% of the measurement points; and of minimum 98% in all measurement points.

Real density is determined by sand substitution according to STAS 1913/15-75 and STAS 12288-85.

Moisture is determined according to STAS 1913/1-82

Tests are performed at least once every 250 m of the road length.

4.3.2.3 Road sub-bases made of crushed stone shall have their consolidation checked by crushing a stone which has the same petrographical characteristics as the one used in executing the layers, and measures ca. 40 mm; this stone is to be thrown in front of the rammers that have initially performed the consolidation.

Consolidation is labeled as successful if the layer does not display dislocations or deformations.

4.3.3 Work quality checks for road bases or sub-bases made of natural aggregates stabilized with hydraulic binders (pozzolanic binders included) are performed in accordance with STAS 10473/1-76 and STAS 10473/2-76, as well as other valid technical requirements.

4.3.4 Work quality checks for road bases made of hydrocarbon pavement mixture are performed in accordance with STAS 7970-76.

4.3.5 Work quality checks for road bases made of cement concrete are performed in accordance with STAS 183-83.

4.4 **Tests of road bases and sub-bases carrying capacity** consist of measures performed with lever deflectometers according to valid legal regulations.

4.5 **Tests of levelness** consist of measures performed with levered deflectometers according to valid legal regulations.

4.6 The beneficiary shall survey and check **all procedures concerning the quality of materials and work processes**, as this standard stipulates them.

4.7 **Results of all measurements, tests and checks will be up-dated in the documentation of the project site**, which will also be used as control documentation for work reception.

5 WORK RECEPTION

5.1 Road bases and sub-bases reception is performed in three steps: on each stage, preliminary, and final.

5.2 Stage reception is performed as follows:

5.2.1 When finishing a component layer and before starting the execution of another. Tests of technological processes involved, thickness and thickness observations, cross and surface slopes measurements, quality checks for materials and work, as well as carrying capacity determinations, are performed on this occasion, with respect to the specific layer.

The accuracy of data registered in laboratory documentations is also checked.

An acceptance report is signed in accordance with valid legal regulations, and potential remedies are mentioned on this occasion.

The execution of the next layer does not begin unless these remedies have been corrected.

5.2.2 The stage reception procedure is also performed when finishing the execution of road bases and sub-bases and before moving on to road pavings.

Results are registered within an acceptance report, by observing the same rules as before.

5.3 Preliminary reception for road bases and sub-bases is performed simultaneously with the preliminary reception of the entire work, in accordance with valid legal regulations.

The reception commission will examine the work and will compare the results with the provisions of the approved technical and control documentation, as well as with the acceptance reports signed throughout the execution of the project.

Road bases and sub-bases can have their thickness checked by means of surveys, two on each kilometer or in the same measurement points where surveyed the thickness and quality of the pavement.

5.4 **Final reception**

Final reception for road bases and sub-bases is performed simultaneously with the paving reception, once its probationary period expires.

Final reception are performed in accordance with the provisions of valid legal regulations.

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-Management of Roads and Bridges, Timisoara
-Management of Roads and Bridges, Craiova
-The Enterprise for Roads and Bridges, Bucharest

No.	Road sub-bases		Road bases		Types of pavings							
	Composition	Minimum thickness after consolidation, cm	Composition	Minimum thickness after consolidation, cm	Macadam	Penetrated and semi-penetrated macadam			Road technical class according to valid legal			
					V	III	IV	V	I	II	III	IV
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Ballast 1	15	—	—	da	—	da	da	—	—	—	—
			macadam	8	—	—	—	—	—	—	—	da
			natural aggregates stabilized with hydraulic or pozzolonic binders	12	—	—	—	—	—	—	da	da
			hydrocarbon pavement mixture	5 for small and medium aggregates 6 for big aggregates	—	—	—	—	—	—	—	da
			cement concrete	analysis	—	—	—	—	da	da	da	—
2	Sand	15	—	—	—	—	—	—	—	—	—	—
3	An inferior ballast layer and a superior layer made of ballast, optimal mixture	10, for the inferior layer 10, for the superior layer	—	—	da	—	—	da	—	—	—	—
			macadam	8	—	—	—	—	—	—	—	da
4	An inferior ballast layer and a superior layer made either of big choke aggregate, 63-90 type, or choke aggregates, optimal mixture	10 for the inferior layer; 12 for the superior layer	—	—	da	da	da	—	—	—	—	da
			macadam	8	—	—	—	—	—	—	—	da
			hydrocarbon pavement mixture	5 for small and medium aggregates 6 for big aggregates	—	—	—	—	da***	da***	da***	da
			cement concrete	analysis	—	—	—	—	da	da	da	—
5	An inferior ballast layer, a medium rubble stoned layer, a levelling layer made of choke aggregate	10 for the superior layer; 21 for the medium layer (including 5 cm of sand); 6 for the levelling layer	—	—	—	da	—	—	—	—	da	—
			macadam	8	—	—	—	—	—	da	da	—
			hydrocarbon pavement mixture	5 for small and medium aggregates 6 for big aggregates	—	—	—	—	—	da	da	—
6	An inferior ballast layer and a superior layer made of natural aggregates stabilized with hydraulic or pozzolanic binders	10 for the inferior layer; 12 for the superior layer	—	—	—	—	—	—	—	—	—	—
			hydrocarbon pavement mixture	5 for small and medium aggregates 6 for big aggregates	—	—	—	—	da	da	da	da
			choke aggregate wedged with bituminous split	9	—	—	—	—	—	—	da	da
			natural aggregates stabilized with hydraulic or pozzolonic binders	12	—	—	—	—	da	da	da	da

NOTES

da = yes

*) with obligation of bituminated commissures in accordance with STAS 6978-77

**) At the risk of the appearance a contracting fissures in time.

***) Recommended a structure of a superior layer made of crushed stone, optimal mixture

Tipuri de îmbrăcăminţi															Special technical requirements for bituminous pavings	
Cement concrete						Pavements made of paving bricks			Pavements made of large and abnormal paving sets			Pavements made of rubble stone and boulders			Minimum thickness of bituminous layers that compose road bases and pavings	Equivalent deformation modules of the road circuit, which restrict the using of some types of road bases and sub-bases beneath bituminous pavings, N/mm^2
V	I	II	III	IV	V	I	II	III	II	III	IV	V	IV	V		
14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
—	—	—	da	da	da	—	—	—	—	da*	da*	da	da	da	—	—
da	—	—	—	—	—	—	—	da	—	da	—	da	—	—	3 the asphalt carpet 6 in two layers	40 50
da	—	—	—	—	—	—	—	—	—	da	da	—	—	—	8** for classes IV and V 10** for class III	55 60
da	—	—	—	—	—	—	—	—	—	—	—	—	—	—	11 for road bases made of small and medium aggregates 12 for road bases made of big aggregates	45
—	—	—	—	—	—	da	da	da	da	da	—	—	—	—	12** for classes II and III 15 for class I	—
—	—	—	—	—	—	—	—	—	—	—	—	da	—	da	—	—
da	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7	40
da	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3 the carpet 6 in two layers	50
da	—	—	da	da	da	—	—	—	—	da	da	da	da	—	7	50
da	—	—	—	—	—	da	da	da	da	da	—	—	—	—	3 the carpet 6 in two layers	50 60
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	10 and 12 for classes III and IV when the road base is made of small, medium and big aggregates, respectively 15 for classes I and II	—
—	—	—	—	—	—	da	da	da	da	da	—	—	—	—	12 for classes IV and V 15 for class I	—
—	—	—	—	—	—	—	—	—	da	da	—	—	—	—	7	65
—	—	—	—	—	—	da	da	—	da	—	—	—	—	—	6 for class III 12 for class II	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	11 for road bases made of small and medium aggregates 12 for road bases made big aggregates	—
—	da	da	da	—	—	—	—	—	—	—	—	—	—	—	—	—
da	—	—	—	—	—	—	—	—	—	—	—	—	—	—	8** for classes IV and V 10** for class III 15 for classes I and II	—
da	—	—	—	—	—	—	—	—	—	—	—	—	—	—	8	—
—	—	—	—	—	—	da	da	da	da	da	—	—	—	—	8** for classes IV 10** for class III 15 for classes I and II	—