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**Bitiruv malakaviy ishi**

**Mavzu:** Designing the highway M 37 “Samarqand-Bukhara-Turkmenbashi” I<sup>a</sup> category on the 3-9 kilometers section in the Samarqand region.

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## **Introduction**

Implemented in recent years, the large-scale reforms aimed at improving the commercial potential of the regions need to be further accelerated development of road and transport infrastructure - as the most important factor in increasing the intensity of economic relations and the development of the economy.

In this direction, we carried out considerable work on the design, construction and operation of modern highways, especially the high-road. Therefore, existing roads are reconstructed and new designed.

It ensures the integrity of the operation of the Tashkent ring road in a new direction, bypassing the Sergeli district. Built complex traffic intersections in the cities of Tashkent, Nukus, Bukhara, and bypasses large settlements. The program of development of regional roads in the years 2017-2018 repaired more than 4 thousand kilometers of inter-farm roads, as well as the works on reconstruction of 265 kilometers of public roads.

In March last year, the President of Uzbekistan Shavkat Mirziyoyev organized the "Fund of improvement and welfare of Samarkand region", the region allocated \$ 50 million for the welfare of the population and radical reconstruction of high-rise buildings and roads.

All roads arrays Sogdiana and Sartepa will be asphalted in Farhod villages, Sulim Chemists and install night lighting.

In addition, experts will be engaged in the problem of the central heating high-rise buildings. By 2019, in the specified array to replace the pipe and prepare the structure for connection to the boiler.

In the regional center of the Project to be built and five above-ground pedestrian crossings and two underpasses rekonstriruyut.

In Bukhara the next few years a number of projects that will give impetus to the organization of the pilgrimage and exotic types of tourism. A set of measures on realization of the project and promote it on external markets developed Goskomturizma.

In particular, in the next two years, the government plans to assist the subjects of tourist activity in Bukhara in the organization of new types of exotic tourism. Among them: the camel safaris, visits to Baranja and cockfights, hiking in the desert area, fishing on the lakes, dinner for wildlife and many others.

President of Uzbekistan Shavkat Mirziyoyev commissioned to design and build in Bukhara small ring road, which is designed to solve many of the transport problems in the city.

In addition, the new highway will link together all the historical monuments of Bukhara, which will allow tourists and citizens to move seamlessly between them.

## **Natural conditions of Samarkand region**

Samarkand region is located in the central part of Uzbekistan, in the pool Zarafshan river. In the far north on the border with Nurata district Navoi region, In the north-west Hatyrchinskim and Karmana district of Navoi region, from the west Kyzyltepa district and Navoi region, from south to Mubarek.Kasan.Chirakchinski mand Kitabareas Kashkadarya region From east toPenjikentSughd region Republic of Tajikistan, From the north-east with Bakhmal. GallyaralandFarishareas Jizzakh region.

The central part of the area is occupied oases and hills that extend from east to west between Zarafshan and Turkestan Range. The main part of the irrigated land areas are located in this part.

The main river valleys - Zarafshan, originating from the glacier, fed by snow and glacial waters. Therefore, the river is relatively stable, which ensures smooth operation of hydroelectric power plants throughout the year, and eliminates the risk of flooding. For more efficient use of water in the middle reaches of the Zarafshan Kattakurgan built, and the bottom - Kuyumazarskoe reservoir. Via Eskianhor water Zaravshan Kashkadarja enter the region. According to the degree of water use, no river of Central Asia can not be compared to Zarafshan - 90% of them spent on irrigation. Groundwater in the area close to the surface, and although they include salt a little, yet they are not suitable for drinking.

In Samarkand territorial-production complex agriculture occupies a special place. Agriculture accounts for 75% of gross agricultural output.

## **Climatic data of the area road design**

The climate of Samarkand region can be divided into two zones. The northern part of the area and the extreme west are continental climate and the remainder (center, south and east) area covers intracontinental subtropical climate. Both are presented climate is hot and dry summer when partly cold winter. Average annual temperature is  $+16,5^{\circ}\text{C}$ ; average January temperature equal to  $0,2^{\circ}\text{C}$ , the average temperature in July  $+27,0^{\circ}\text{C}$ . The absolute minimum temperature reached  $-26^{\circ}\text{C}$ , the absolute maximum temperature  $+58^{\circ}\text{C}$ . On average, in the district falls 310-330 mm of precipitation per year (the bulk of the precipitation falls during the spring and fall). vegetation period last 218-220 days

The soil cover are formed mainly meadow soils sierozem. sands and salt marshes.

Average annual temperature is  $13,8^{\circ}\text{C}$  to Samarkand. The average annual precipitation of 350 mm.

There is a difference of 53 mm of precipitation between dry and rainy months. During the year the average temperatures range from  $26,5^{\circ}\text{C}$ . Useful tips about reading Climate table: For each month, you will find data on precipitation (mm), average, maximum and minimum temperature (Celsius and Fahrenheit). The value of the first line: (1) January (2) February (3) March (4) April (5) May (6) June (7) July (8) August (9) September (10) October (11) November (12) December.

In general, the climate in Samarkand region is sharply continental. The average air temperature  $12 - 14^{\circ}\text{C}$ . The coldest month is January, with minimum temperatures  $-26^{\circ}\text{C}$ , the hottest month of July with a maximum temperature of  $+42^{\circ}\text{C}$ . The amount of rainfall in a year 202-414 mm.

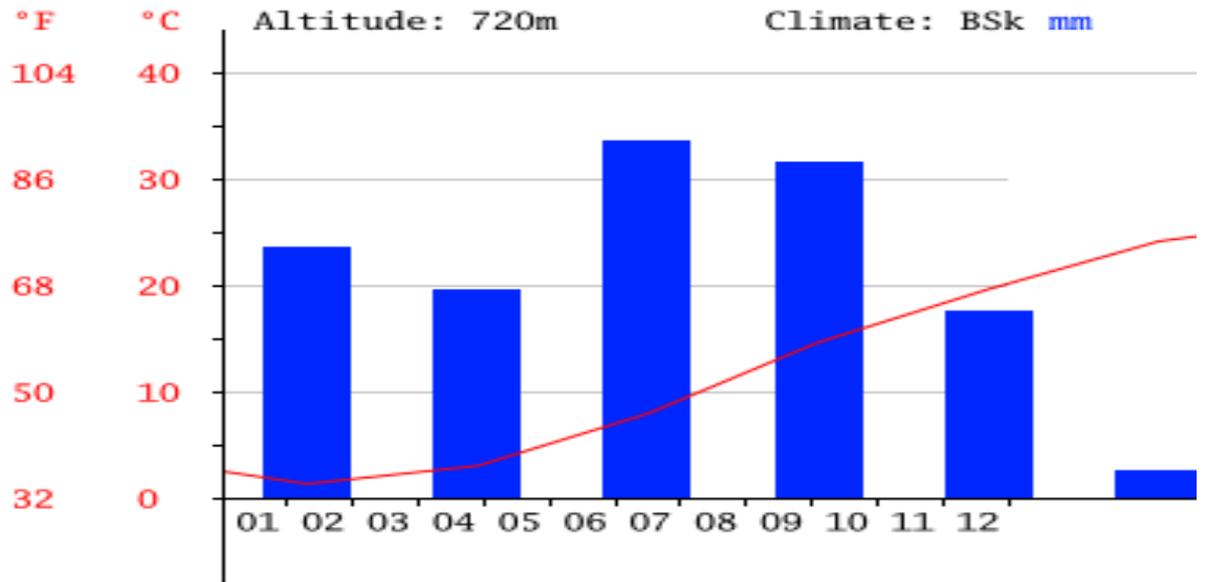


Diagram №1 Climate graph Samarkand region

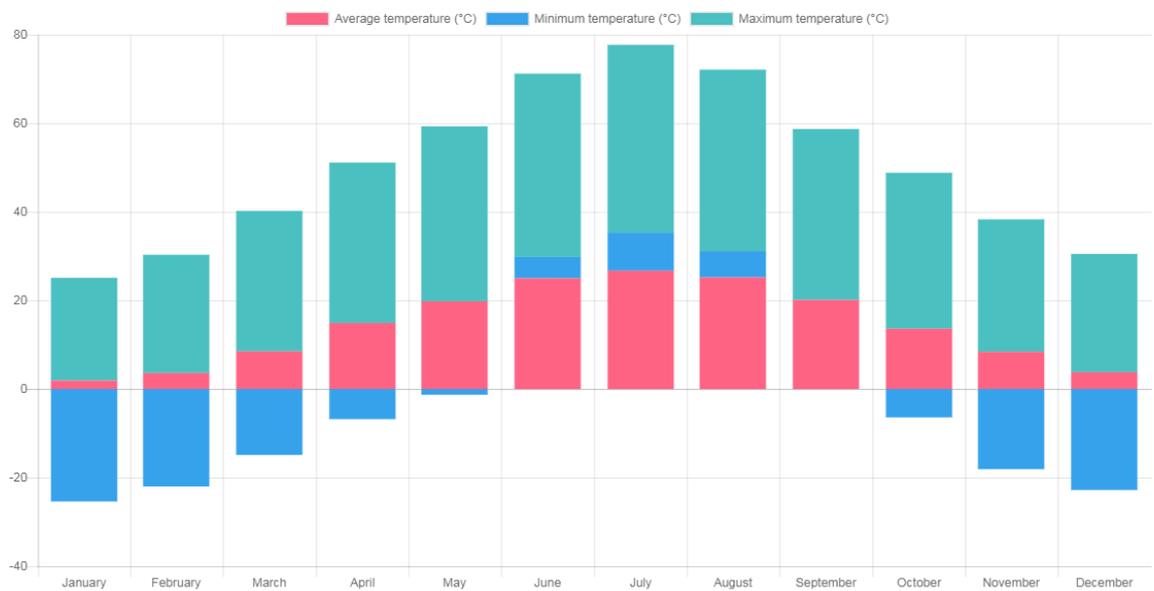


Diagram №2 Temperature graph of Samarkand region

## **Data on the projected road M37 "Bukhara-Samarkand-Turkmenbashi"**

Designing the highway M 37 “Samarqand-Bukhara-Turkmenbashi” I<sup>a</sup> category on the 3-9 kilometers section in the Samarqand region, developed on the basis of the job issued by the Department "Survey and design of automobile roads " of the Tashkent Institute for the design, construction and maintenance of automobile roads.

According to the instructions of, the materials have been collected by road M37 "Bukhara-Samarkand-Turkmenbashi" (in km area 3-9).

During production and before passing the exhaust practice materials were collected by road M37 "Samarkand- Bukhara- Turkmenbasy" (in km 3-9 section) real exhaust qualification work has been completed based on this material. Data on the road is shown below in Table №1,2 based SHNK 2.05.02-07.

Table №1

The economic value of the road	Category road	Estimated traffic, pref. units / day
International and national significance	Ia (motorway)	summary. 14,000

Table №2

№	Parameters of road elements	Motorway
	category	
1	The total number of lanes	Ia
2	The width of the lane, m	6
3	The width of the curb, m	3.75
3	The width of the edge strip at the roadside, m	3.75
5	The width of the shoulder portion fortified, m	0.75
6	The smallest width of the central dividing line without guardrails, m	3
7	The width of the separation strip, m	6

8	The width of the edge safety strip at the dividing line, m	1.0
9	The width of the roadbed, m	36

In the development of the final qualifying work following normative documents were used:

- SHNK 2.05.02-07 "Highways";
- KMC 2.05.03-12 "Bridges and pipe";
- SHNK 3.06.04-14 "Bridges and pipe";
- GOST 23457- 86 "Technical means of traffic management";
- GOST 10807-78 "Road signs. General technical conditions ";
- MCS 23-2008 "Guidelines for marking of roads" and others.
- MKN 46-2008 "Calculation of not hard road pavement »
- NeRobur v.Ardon 2 (programm, that calculate road pavement)
- GOST 31015-2002. Mixes asphalt concrete and asphalt concrete crushed stone-mastic. Technical conditions
- GOST 9128-2013 Asphaltic concrete and polimer asphaltic concrete mixtures, asphaltic concreteand polimer asphaltic concrete for roads and aerodromes. Specifications

## Brief engineering - geological characteristics of the area of designing road

For the preparation of these design estimates used to sign material on the geotechnical conditions road section.

Here are the basic details of the above conclusions.

The projected portion of the road according SHNK 2.05.02-07 relates to a road-IV climate zone and is located in the area Akdarya Samarkand region.

According to long-term observations Katta Kurgan weather station, the average temperature of + 13 ° C, in June - + 27,2 ° C, in January -1.9 ° C. The absolute minimum is lowered to -35 ° C.

The annual amount of precipitation decreases from east to west from 282 to 163mm.

Year round predominate north-eastern winds repeatable from 25 to 42% with an average rate of 3.6 - 4.3 m / sec. Strong winds marked the winter, their maximum speed of 34 m / sec. Repeatability of the wind direction in the winter and the summer is listed in Table 1.

Averaged winds of the weather station according Kattakurgan Table 3.

direction of months	North	N-E	East	S-E	South	S-W	West	N-W
January	3	25	17	7	17	17	6	7
July	15	46	20	1	1	1	3	13
Average annual	8	31	20	5	8	11	6	11

Average monthly and annual air temperature at different altitudes. table 4

Name of Station	Height of stat. Mm,	Monthly												Wed . year
		1	2	3	4	5	6	7	8	9	10	11	12	
Katta-Kurgan	485	1.9	1.8	7.2	13.9	20.0	24.9	27.2	25.1	19.1	11.0	5.9	1.4	13.0 -

According to the project organization MCHJ "Yo'l-Loyiha BUROSI" and MCHJ "YO'LINJINIRING" geomorphological data on the projected area of the road are located in terraced alluvial plain, covering floodplain and floodplain terraces p. Zarafshan. The relief is flat, locally dissected channels. Floodplain and floodplain terraces different character structure clearly, lithology and mechanical properties of the alluvial deposits. Change microrelief associated with human activities.

Primers designed on the road sections nonsaline. The quantity of solid residue is changed from 1260 to 1320 mg \ kg. S<sup>2</sup> ion content of from 60 to 80 mg \ kg, SO<sub>4</sub> ions from 520 to 565 mg \ kg.

Groundwater is mainly fed by infiltration and seepage irrigated surface water and precipitation. Their level in different places at different which depends on the drainability.

Seismicity of the area -7 points.

On the basis of lithologic structure, physical and mechanical properties and deformation explored thicker allocate following geotechnical layers:

Vegetation layer - along the road soil vegetative layer contains the roots of trees and bushes.

The average thickness of the vegetation layer is 0.20M.

Bulk primers: (longitudinal profile plotnostini olaman) - redeposited gravel inclusion loam, loam and gravel, soil density, t / m<sup>3</sup> - 1.81.

Soil Development Group - n. 21 Table 1-1A SHNK 4.02.01 - 04.

Soil density  $t / m^3$  - 1.72

IGE №2 - Sand gray fine-grained, malovlazhnogo, with the inclusion of gravel to 10%. Power from 1.8 to 2.3 m.

Soil Development Group - n. 16 Table 1-1A SHNK 4.02.01 - 04.

- soil density  $t / m^3$  - 1.9

IGE №3 - Pebble soil with sand filling with the inclusion of gravel and boulders.

Soil Development Group - n. 3 Table 1-1A SHNK 4.02.01 - 04.

- soil density  $t / m^3$  - 1.89

## **Transverse profile**

The strip of the road surface, within which the movement of cars occurs, is called the carriageway. On both sides of the roadway are the sides of the road, ensuring the safety of vehicles. Within the roadsides on the side of the roadway there are reinforced edge lanes having the same pavement design as within the roadway.

Within the limits of the curb have a stopping strip, intended for the forced stop of cars. Between the stopping strip and the edge of the curb is unfortified part of the curb.

Roads of the first category have independent carriageways for movement in each direction, between which a traffic lane is arranged for traffic safety.

The lines separating the carriageway and the edge lanes are called the edges of the carriageway. The roadbed is bounded on both sides by slopes. The lines separating the shoulders from the slopes are called the roadway edges. The distance between the edges is called the width of the roadbed. Slope steepness is characterized by the slope laying factor, defined as the ratio of the slope height to its horizontal projection.

To ensure surface drainage of the road, located in a low embankment or excavation, lateral ditches (cuvettes) are located on either side of the road.

1. The width of the shoulders on particularly difficult areas of mountainous areas, areas passing on particularly valuable land, as well as in places with transition-speed lanes and with additional strips on the rise with the appropriate feasibility study can be reduced to 1.5 m for automobile roads IB, IB and II categories and up to 1.0 m - for the rest of the categories.

2. Fences on the roadsides are located at a distance of not less than 0.50 m and not more than 0.85 m from the edge of the roadbed, depending on the rigidity of the design of road fences.

3. On the sections of the automobile roads of categories I and II, where the traffic intensity in the first five years of road operation reaches 50% or more of the estimated prospective, in the places determined and justified by the project, as well as at the intersections, junctions and exits from the roads of categories I and II (on which

the device of transition-speed lanes is not foreseen) on the roadsides at a distance of at least 100 m in both directions provide for the construction of stopping lanes 2.5 m wide.

## **Road alignment**

During the beginning of the track of the projected part of the road, received PC 30 + 00, also known as 3 km road M-37 "Samarkand r. - Bukhara r. - Turkmanboshi ". For the end of the road section of the road adopted by the PC 90 + 00, also known as the 9-th km of the aforementioned road.

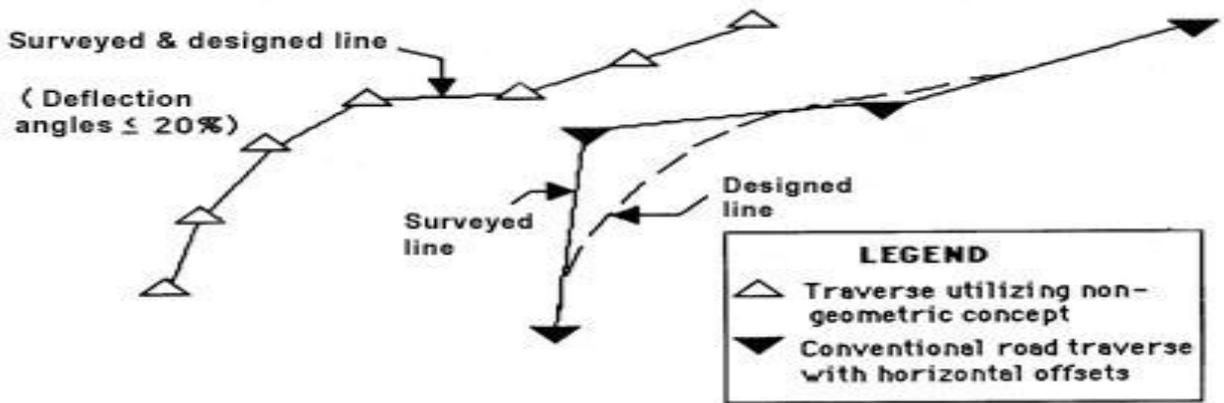
The projected portion of the road passes through the territory Akdarya fog Samarkand region.

The length of the projected portion of the road was 6 km. The general direction of the track road section - northwest. Horizontal and Vertical Alignment

Center line alignment influences haul cost, construction cost, and environmental cost (e.g., erosion, sedimentation). During the reconnaissance phase and pre-construction survey the preliminary center line has been established on the ground. During that phase basic decisions regarding horizontal and vertical alignment have already been made and their effects on haul, construction, and environmental costs. The road design is the phase where those "field" decisions are refined, finalized and documented.

The preferred method for locating low volume roads discussed in Section 2.3, the so called non-geometric or "free alignment" method, emphasizes the importance of adjusting the road alignment to the constraints imposed by the terrain. The main difference between this and conventional road design methods is that with the former method, the laying out and designing of the centerline offset is done in the field by the road locator while substantial horizontal offsets are often required with the latter method (Figure 1).

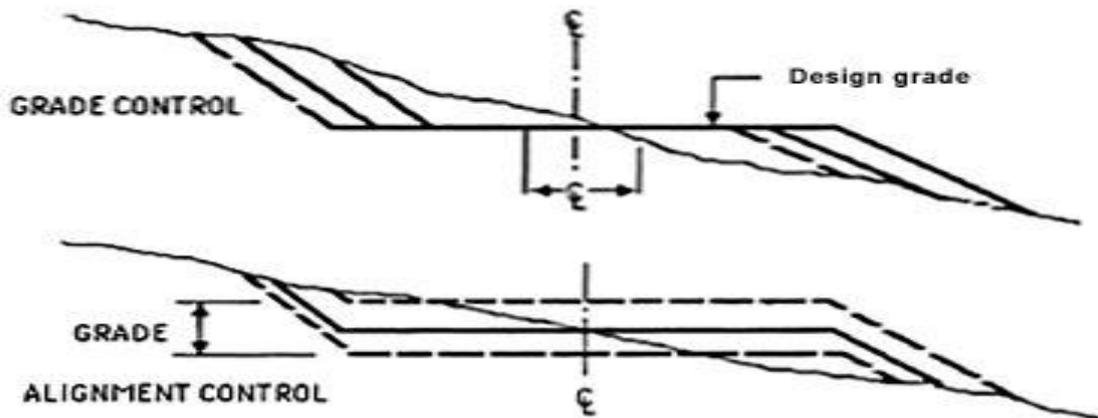
Figure 1. Non-geometric and conventional p-line traverses.



Adjustments in horizontal alignment can help reduce the potential for generating roadway sediment. The objective in manipulating horizontal alignment is to strive to minimize roadway cuts and fills and to avoid unstable areas. When unstable or steep slopes must be traversed, adjustments in vertical alignment can minimize impacts and produce a stable road by reducing cuts and fills. The route can also be positioned on more stable ground such as ridgetops or benches. Short, steep pitches used to reach stable terrain must be matched with a surface treatment that will withstand excessive wear and reduce the potential for surface erosion. On level ground, adequate drainage must be provided to prevent ponding and reduce subgrade saturation. This can be accomplished by establishing a minimum grade of 2 percent and by rolling the grade.

Achieving the required objectives for alignment requires that a slightly more thoughtful preliminary survey be completed than would be done for a more conventionally designed road. There are two commonly accepted approaches for this type of survey: the grade or contour location method (used when grade is controlling), or the centerline location method (used when grades are light and alignment is controlling). Figure 26 illustrates design adjustments that can be made in the field using the non-geometric design concept discussed earlier.

**Figure 2.** Design adjustments.



Equipment needed for either method may include a staff compass, two Abney levels or clinometers, fiberglass engineer's tape (30 or 50 m), a range rod, engineering field tables, notebook, maps, photos, crayons, stakes, flagging, and pencils. The gradeline or contour method establishes the location of the P-line by connecting two control points with a grade line. A crew equipped with levels or clinometers traverses this line with tangents that follow, as closely as possible, the contours of the ground. Each section is noted and staked for mass balance calculations. Centerline stakes should be set at even 25 - and 50 - meter stations when practicable and intermediate stakes set at significant breaks in topography and at other points, such as breaks where excavation goes from cut to fill, locations of culverts, or significant obstructions.

On gentle topography with slopes less than 30 percent and grade is not a controlling factor, the centerline method may be used. Controlling tangents are connected by curves established on the ground. The terrain must be gentle enough so that by rolling grades along the horizontal alignment, the vertical alignment will meet minimum requirements. In general, this method may be less practical than the gradeline method for most forested areas.

When sideslopes exceed 50 - 55 percent or when unstable slope conditions are present, it may be necessary to consider full bench construction shown in Figure 27.

Excavated material in this case must be end hauled to a safe location. Normally, the goal of the road engineer is to balance earthwork so that the volume of fill equals the volume of cut plus any gain from bulking less any loss from shrinkage (Figure 28).

Road design, through its elements such as template (width, full bench/side cast), curve widening and grade affect the potential for erosion. Erosion rates are directly proportional to the total exposed area in cuts and fills. Road cuts and fills tend to increase with smooth, horizontal and vertical alignment. Conversely, short vertical and horizontal tangents tend to reduce cuts and fills. Erosion rates can be expected to be lower in the latter case. Prior to the design phase it should be clearly stated which alignment, horizontal or vertical, takes precedence. For example, if the tag line has been located at or near the permissible maximum grade, the vertical alignment will govern. Truck speeds in this case are governed by grade and not curvature. Therefore, horizontal alignment of the center line can follow the topography very closely in order to minimize earthwork. Self balancing sections would be achieved by shifting the template horizontally.

## **Longitudinal profile**

Design of the longitudinal profile of the projected area of the road was carried out on a computer by «IndorCAD» program.

According SHNK 2.05.02-07 fractures of the project line in the longitudinal profile with algebraic difference of slope of 5‰ or more on the roads category I and II, 10‰ and more on the roads category III 20‰ and more on the roads IV category should be paired.

In the design of the longitudinal profile of the project took into account the level of the roadway of the bridge over the river. Karadarya and requirements SHNK 2.05.03-12 "Bridges and pipe", in terms of ensuring the minimum thickness of the filling pipe functioning.

In accordance with the n. 4.23 project line fractures in the longitudinal profile when the algebraic difference of slopes 5 ‰ and more conjugate vertical curves.

Design and working level of the longitudinal profile are related to the design of the road axis.

The longitudinal profile is a projection of the road axis on a vertical surface parallel to it. The coordinates of all picket and plus points lying on the road axis are fixed on the longitudinal profile.

When building a longitudinal profile, different scales are used for distances and heights (distance scale: 50 m = 1 cm; height scale: 5 m = 1 cm).

As a result of the fact that the scale of heights is 10 times larger than the scale of distances, the relief image on the longitudinal profile is more obvious.

In accordance with the requirements of the standard, the following elements are applied to the longitudinal profile:

- graph of pickets and distances (1 cm wide); filled in cases when there are positive points on the picket;

- graph of black marks (1.5 m); marks (heights) of all picket and plus points H0, H1 ... Hp lying on the intersection of the earth's surface with a vertical surface drawn through the axis of the road are entered into it;

- a graph of red marks (1.5 cm), in which marks of eyebrows of a roadbed are entered;

- coordinates of points, laid out in accordance with the black and red marks starting from the abscissa axis, the conditional mark of which is chosen so that the ordinates are not too stretched;

- black line connecting the upper points of the ordinates, respectively, black marks;

- the red line connecting the upper points of the ordinates, respectively, the red marks;

- working marks representing the algebraic difference between the red and black marks; if this difference is positive, then the working marks correspond to the height of the embankment and are written out above the red line; if the difference is negative, then the working marks correspond to the depth of the notch and are written out under the red line;

- the conditional plan of the route indicating the location of all straight and curved sections and the data characterizing them; this plan, conventionally extended in one straight line, is placed somewhat below the picket graph.

In addition to these elements, on the longitudinal profile is usually placed:

- information about artificial structures;

- the situation of the area (within 50 m from the axis of the road in each direction);

- soil and soil characteristics; data on the cuvettes and the type of roadway.

With the standard arrangement of elements of the longitudinal profile, the units of measurement do not affix, and also do not place the coordinate grid and the scale of heights.

The magnitudes of the black marks required for applying a black line to the longitudinal profile, which characterizes the natural topography of the terrain, are obtained with a high degree of accuracy by resorting to an instrumental survey under field survey conditions.

Approximately black marks can be obtained without leaving the terrain, but using a topographic map on which the relief is shown using contours, i.e., conditional lines, all points of which lie at the same height, and therefore have the same marks. The desired black mark of a given point is obtained by interpolation, focusing on the marks of the horizontals nearest to this point (between which it is located).

All the elements of the road positioned within the band area, which is called a strip removal. In transverse profile of the road the following elements can be distinguished.

Lane road surface, within which the vehicle motion, called carriageway. On both sides of the roadway curb arranged to ensure the safety of the vehicle. Within roadsides from the carriageway located reinforced edge strip having the same pavement structure as within the carriageway.

Within a roadside stopping lane intended for vehicles forced to stop. Between the strip and the stopping edge of the curb is unfortified shoulder portion.

Black marks can be obtained without leaving the terrain, but using a topographic map on which the relief is shown using contours, i.e., conditional lines, all points of which lie at the same height, and therefore have the same marks. The desired black mark of a given point is obtained by interpolation, focusing on the marks of the horizontals nearest to this point (between which it is located).

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table 5

Crossfalls, of categorie automobile roads

Crossfall%				
Category road	Road-climatic zone			
	I	II, III	V	V
I				
a) for each gable transverse profile of the carriageway	15	20	25	15
b) in the uni-directional profile:				
first and second strips by separating strip	15	20	20	15
third and subsequent strip	20	25	25	20

### **Small artificial structures**

On the route of the road section 1 has a tube. Element pipe a circular tube hole 1.5 m 42 + PC 24, the openings are sufficient for the passage of water streams under the highway.

On the projected road M37 "Samarkand- Bukhara- Turkmenbasy" (in km uchastake 3-9) on PC 73 + 84 there is a bridge with a length of 26.

Small artificial structures intended for passing water under railways and highways include bridges up to 25 m long, pipes of all types, trays, duckers and filter embankments. The same kind of structures include aqueducts that allow water to pass over the roadway (also no longer than 25 m) and herrings that are designed to pass mudflows above the roadway.

On low-grade roads, water passes through the roadway along special trays, which are the roadway, are used as small culverts.

Small culverts are designed on the basis of hydrological and hydraulic calculations performed by methods different from those discussed above for medium and large bridges.

Small artificial structures are arranged on small, usually periodic streams; it is almost impossible to make observations on such waterways during the survey period.

Therefore, the magnitude of the discharge of water with the required probability of exceedance is established by calculating the flow from the catchment area according to the current standards. According to them, runoff from small pools with areas up to 100 km<sup>2</sup> is currently calculated.

There is a mismatch between the term "small" in relation to a basin and to an artificial structure, which should allow outflow from this basin. In the USSR there are areas (the Far East, the Black Sea coast of the Caucasus, the Carpathians), where the three areas of basins are 801–100 km<sup>2</sup>, the maximum costs are 400–500 m<sup>3</sup> / sec. Such expenses can not miss the small buildings; Therefore, the limit of applicability of the flow norms of 100 km<sup>2</sup> seems to us to be too high. There are cases when

bridges with a length of more than 25 m have to be arranged on small streams with a pool area of less than 100 km<sup>2</sup>.

Small artificial structures have the peculiarity that at small bridges the bridge channel is, as a rule, strengthened, and the pipes have a closed, unbreakable contour and can operate under free-flow and pressure modes.

Therefore, the method of hydraulic calculations of these structures (see § 70) differs significantly from the method adopted in the calculations for medium and large bridges.

There is also a discrepancy between the longest bridge of 25 m established according to the operating conditions and the recommendation CH 200-62 — not to strengthen the sub-bed when the bridge is more than 10 m wide. However, the practice of design and construction showed that in some cases (high flow rates and small water depth) it is economically feasible to strengthen the scaffolding and with large openings of bridges.

Thus, only pipes and trays with their varieties in the form of siphons, as well as filtering embankments, can be attributed to small artificial structures according to the specifics of the method of hydrological and hydraulic calculations. For bridges and aqueducts, the boundary between small and medium-sized structures is conditional and is not associated with these features.

In the future, we will consider small a bridge with a fortified bed up to 25 m long.

On railways and roads from culverts, small bridges and pipes are the most common.

Small bridges are separated: according to the material from which they were built (wooden, stone, reinforced concrete), according to the number of spans (single-span, multi-span), according to the design of their span structures (beam, arched, frame), as well as by type.

From the beginning of the 40s, instead of the previously used beam bridges on massive supports, pile-overpass bridges began to be used on supports in the form of spatial frames made of reinforced concrete piles and fastening elements.

Small bridges, as a rule, are constructed according to standard designs.

Pile trestle and frame bridges on a natural basis with a standard span of 5 m are used on dry valleys where there are no ice phenomena, as well as on streams that have a large amount of sediment at embankment heights from 1.5 to 4.0 m; The latter limitation is adopted in the standard project for constructive reasons.

Culvert pipes under the embankments of roads and railways are currently unified, being constructed only according to standard designs.

These are round reinforced concrete pipes with a hole of 1.00; 1.25; 1.50 and 2.00 m, rectangular reinforced concrete pipes having, besides those listed, openings 2.50, 3.00 and 4.00 m, and concrete pipes having the outline of openings 1.5X2.0; 2.0X 2.0; 3.0X 2.0; 2.0X 3.0; 3.0X3.0; 4.0X3.0; 5.0x3.0 and 6.0x3.0 m.

The latter are used on permanent watercourses in the presence of ice and high flow rates of water.

Under the embankments of roads allowed the use of pipes with a hole of 0.75 m. The use of a minimum opening of a pipe of 1.0 m is limited under operating conditions on railways with a pipe length of no more than 20 m, and on roads of no more than 30 m, pipes with a hole of 0.75 m are used with a length of no more than 15 m.

Previously, during construction, in addition to round and rectangular, pipes with different hole outlines were used: duct, semicircular, ovoidal and triangular. In addition to concrete and reinforced concrete, the materials for the pipes were: rubble stone.

## **Subgrade of automobile roads**

Subgrade is one of the most basic structural layers of pavement. It is an artificially erected structure of soils having a density, strength and origin.

Main purpose

aligning the profile of the earth's surface in order to save non-metallic materials and transdniestria is the future road of the rear horizontal and vertical slopes.

All these objects should be presented relative to the level of the earth's surface (hills, mountains, slopes, etc.). when the extra soil of the road bed must be “cut off”.

The height of the embankment and the depth of excavation depends on the category of the road.

Bulldozer, grader, scraper and excavator.

The technique depends on:

- the length of the grip and range of movement of the soil;
- soil and hydrological conditions of the work site;
- heights / depths of the future embankment / excavation.

Features of the construction of the subgrade on slopes:

1. A very large number of work jobs (cutting ledges, development of entrances).
2. Decreased productivity.
3. Uneven wear of working bodies and running gear of road machines.

If the ratio of the alleged riding to the opposite is 1 to 5 (1: 5) and positive, then the grader is used. When the slope is 1: 2.5 to 1: 5, the mound is bulldozed. The ground surface is derived in a combined way: first with a bulldozer, then with an excavator.

Features of the construction of the subgrade in mountain conditions:

1. The presence of drilling and blasting.
2. Lack of access and junctions.
3. SHarp change in weather conditions.
4. The need for protective structures from rockfalls and landslide processes.

Subgrade construction in the rocks of the soil produced in 3 stages:

- device trails;

- construction of a working passage (using the passage of a tractor) using a minimum of two bulldozers. During the device, retaining walls are erected from improvised stone materials.

- construction of the road bed in accordance with the project.

The thickness of the layer is about 30-40 cm, the maximum stone size is not more than 25 cm. At the first stage, the seals remain decisive, the rollers, ends - on pneumatic tires. tires.

## **Pavement of automobile roads**

The type of terrain within the limits of the roadway under the conditions of humidification throughout the length of the -2nd.

The existing roadbed is represented by the following soils: soil-vegetative soil grayish-brown in the base, grayish-brown loam with patches in the form of interlayers of brown and gray clay loams in the bottom of the soil-vegetation layer grayish-brown loam mixed with small building debris in the base of the soil and vegetative soil.

The width of the roadbed in the area of 3-lane traffic averages from 17.50-19.80 m. The width of the shoulders is on average from 3.70 - 4.20 m.

On the sections of the embankment to 2.0 m, the slope steepness is 1: 1.5-1: 2.

The existing embankment slopes are sodded and are in a satisfactory condition. Roadside understated in relation to the roadway. Scour and no drawdowns.

Under existing conditions, water stagnates in the cuvettes and cuvette reserves. The reason is the late work on the content: the cell, overgrown with dense vegetation, not planned, not strengthened.

### **Road pavement**

Work on the pavement device should be performed only on the ready-made and approved in the prescribed manner road bed. The device of the pavement is to be carried out in a mechanized way, with a link complete with the necessary machines and mechanisms.

When arranging the pavement, special attention should be paid to the quality control of work on each layer with the provision of design parameters, tight and even preservation of the pavement layers to be laid. Prior to the beginning of the filling of each layer of the base and the coating, one should perform centering works on fixing the position of the edges and elevations of the layers.

### **Device pavement:**

1. The device of the underlying layer of sand, which consists of the following types of work:

- planning and compaction of the road bed;
- transportation of sand;
- scattering and leveling of sand;
- layered sand compaction.

2. The device macadam base:

- movement of rubble from the unloading area to the work site,
- scattering and leveling of rubble;
- profiling and grading of gravel base;
- rolling gravel base.

3. The device of the lower layer of the base and coating and asphalt concrete mixtures includes the following types of work:

- preparation of the basis, processing by viscous bitumen;
- transportation of the asphalt concrete mixture with its unloading into the paver bunker;
- distribution of asphalt mix;
- rolling and rolling layers.

The number of compacted impacts and the thickness of the layer is determined by the method of test rolling.

The device of the two-layer base of crushed stone by the spear method is performed in three stages:

- distribution of the main fraction of rubble in the lower layer and its compaction with water moistening;
- distribution of the main fraction of rubble in the upper layer of the base and its compaction;
- distribution of ripping rubble and its compaction.

The basis for the device of the layer of asphalt mixture should be smooth, clean and dry. For transportation of asphalt mixes used construction dump trucks. Mix loading is allowed only in a clean and dry car body. Each truck is equipped with an awning of tarpaulin or a suitable material to protect the mixture from the effects of

precipitation and reduce temperature loss. Laying and compaction of asphalt concrete mix is made in accordance with SNIP 3.06.03.-85. Laying, preferably, to carry mated strips, and the place of pairing strips after the end of rolling must be smooth and dense. If possible, asphalt mixes are stacked continuously. Avoid the passage of the rollers along the exposed edges of the freshly laid mixture. The quality of the longitudinal and transverse mates of the stacked strips is monitored constantly, with special attention being paid to the quality of their compaction and evenness.

In accordance with the task to develop the detailed design and manufactured according approvals portion of the road is designed, with the following parameters of the transverse profile of the roadbed and roadway:

- total number of lanes - 6;
- movement-width of - 3.75 m band;
- the width of the median strip of the road - 6 m;
- the width of the safety edge strip at the strip separation - 1.0 m;
- the width of the security strip on the sides of the carriageway each direction of motion (on the road sections extending within towns) - 0.5 m;
- the width of the curb (on sections of the road extending outside towns) - 3.75 m;
- the width of the edge strip at the curb - 0.75 m;
- the width of the reinforced part of the side of - 3.0 m;
- width "green zone" (in road sections extending within settlements)  $\geq 2,0$  m;

In the sections of the road extending outside settlements, subgrade width sufficient to accommodate the design parameters of the roadbed.

A typical cross section is provided on the Type I road portions extending at the level mound  $h < 1,2$ .

The steepness of the slopes of the mound adopted 1: 1.5.

Typical Type II transverse profile is provided on the road portions extending in the embankment height  $h > 1,2$ .

The steepness of the slopes of the mound adopted 1: 1.5.

Pavement Design calculated taking into account the data based on the load on a single axle vehicle 130 loaded Kn (13ts).

Two variants of the pavement, consisting of the following structural layers adopted in the project:

### I variant

number (Layer)	Name of layers
1	Top layer of pavement of hot dense fine-grained asphalt concrete mixture type B of mark II / by GOST 9128-2009
2	Average layer of pavement of hot porous coarse-grained asphalt concrete mixture type B of mark/ by GOST 9128-2009
3	Lower layer pavement of hot highly porous coarse-grained asphalt concrete mixture of mark II by GOST 9128-2009
4	Top layer of subbase of gravel sand mixture by GOST 8267-93 fractions over from 40 to 80 (70) mm with the addition 30% broken stone
5	Lower layer of base of gravel-sand mixture by GOST 8262-93 fractions over 40 to 80 (70) mm

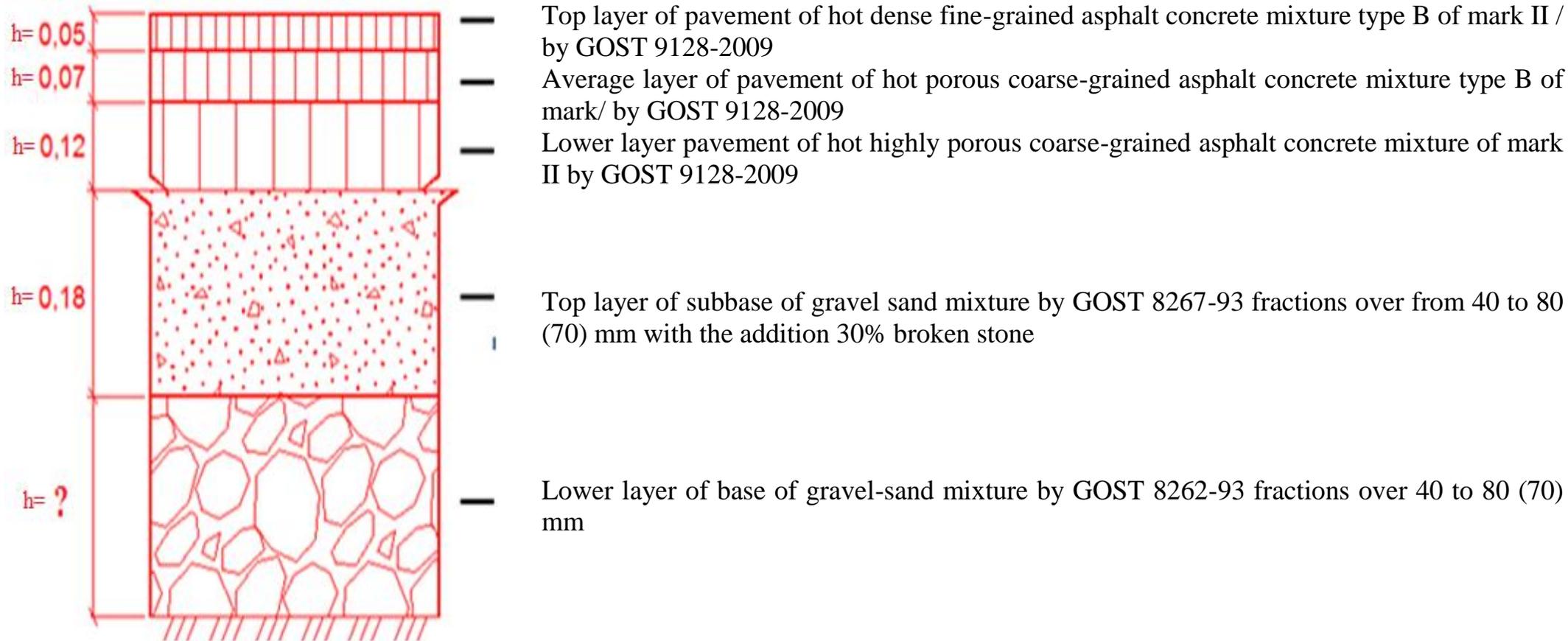
## II variant

number (Layer)	Name of layers
1	Top layer of pavement of hot dense fine-grained asphalt concrete mixture type B of mark II / by GOST 9128-2009
2	Average layer of pavement of hot porous coarse-grained asphalt concrete mixture type B of mark/ by GOST 9128-2009
3	Lower layer pavement of hot highly porous coarse-grained asphalt concrete mixture of mark II by GOST 9128-2009
4	Top layer of subbase of black rubble by GOST 9128-2009
5	Lower layer of base of gravel-sand mixture by GOST 8262-93 fractions over 40 to 80 (70) mm

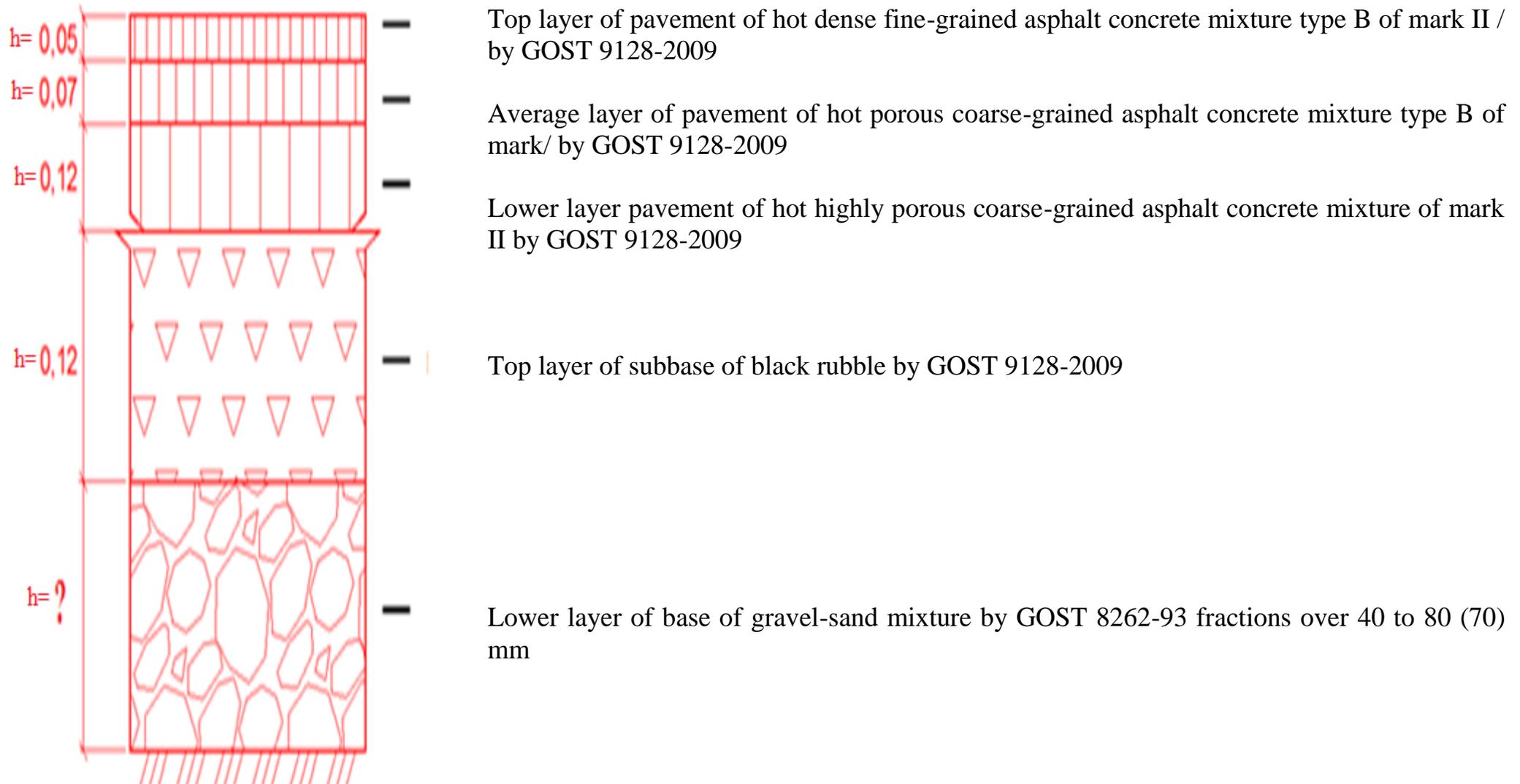
## CHOICE OF VARIANTS OF PAVEMENT AND THEIR CALCULATIONS

The projected road are I<sup>a</sup> category in the Samarkand region. Given the promising vehicular traffic 20 years is  $N = 16244$  vehicles / day and local road-building materials, select the following two variants pavement with asphalt concrete pavement.

### I – VARIANT



II – VARIANT



Initial data

district - Samarkand region

Category projected road Ia, the number of lanes 6

The required level of reliability -  $K_n = 0.98$ .

Score changes in traffic data -  $q = 1,03$  ( $\alpha-3$ ).

The long-term traffic volume (20 years):

Bringing traffic intensity to the calculated

Table 6

№	Type of vehicle	Traffic vehicles / day	Summary reduction coefficient $S_{amo}$ design load $A_3 = 130$ kN
№	1	2	3
1	Passenger, cargo-passenger and cargo light cars up to 3.6 tons, minibuses	5997	0,054
2	Light trucks with load capacity from 2 to 5 tons	275	0,063
3	Light trucks with load capacity from 2 to 5 tons	153	0.22
4	Two axle heavy trucks	143	0,315
5	Three axle heavy trucks	174	0.63
6	Four axle heavy trucks	223	0.945
7	4 - axle road trains (2 - axle truck with trailer)	309	0.79
8	5 - axle road trains (2 - axle truck with trailer)	113	1.10
9	Total intensity	7.387	4,117

Determination of total (calculation) of the module of elasticity of pavement

1. We determine the value of the reduced intensity of the last year of the term of service with the following formula:

$$N_p = f_{amo} \cdot \sum N_v \cdot \sum S_{sum}, \text{ vehicles / day,}$$

wherein  $f_{amo}$  - coefficient reflecting the number of lanes and traffic distribution thereon (two lane roads  $f = 0,55$ );

$n$  - type vehicles;

$N_v$  - is the number of passages per day in both directions of vehicles types;

$S_v$  - summary coefficient actuation effects on pavement vehicles type vehicle to the calculated load  $Q_{cal}$

2. Make calculate of the summary vehicles given traffic flow intensity

$$N_p = f_{пол} \cdot \sum N_m \cdot S_{mcyM} = 0,55 \cdot \sum 0,054 \cdot 5997 + 275 \cdot 0,063 + 153 \cdot 0,22 + 143 \cdot 0,315 + 174 + 223 \cdot 0,63 \cdot 0,945 + 309 + 113 \cdot 0,79 \cdot 1,10 = 1109 \text{ vehicles / day,}$$

3. We calculate the total estimated number of applications of the calculated load over the service life.

To calculate the permissible elastic deflection we use For the calculation of accepting resilient deflection of use

formula:

$$\sum N_r = 0,7 N_r \frac{K_s}{q^{(Tlf-1)}} T_{cdy} k_n$$

where  $N_r$  - the reduced intensity of the last year of life of the pavement ( $N_r = 121$  vehicles / day.);  $T_{cdy}$  - calculated estimated number of days per year, corresponding to a certain deformability of the structure ( $T_{cdy} = 134$  days);  $K_n$  - coefficient taking into account the probability of deviation from the mean total traffic it expected ( $K_n = 1.49$ );  $K_s$  - summing the coefficient ( $K_s = 17.2$ );  $T_{lf}$  - estimated lifetime ( $T_{lf} = 14$  years);  $q$  - rate of change of traffic volume of this type of cars by year ( $q = 1,03$ ).

$$\sum NP = 0,7 * 1109 * 134 * 17.2 * 1.49 / 1.75 = 1523390$$

Determine the required modulus of formula

Determine the required modulus of formula

$C$  - empirical parameter, taken equal to the calculated axle load ( $P = 3.05$  for load 130 kN).

$$E_{tr} = 98,65 (\lg 1523390) - 3,05 = 309 \text{ MPa}$$

(By MNK minimum value = 230 MPa)

$E_{summ} = E_{vh} * K_{vh}$ , where  $K_{vh}$  – required safety for the criterion of elastic deflection, taken in dependence on the required level of reliability. The required level of reliability is equal to 0.98, thus, to the road category I.

$$E_{summ} = E_{vh} * 309 * K_{vh} = 309 * 1,0 = 309 \text{ MPa.}$$

# 1 VARIANT

## Appointment of coating materials and the calculated characteristics

The purpose of the pavement constructive layers of the selected materials

**1st layer.** Top layer of pavement of hot dense fine-grained asphalt concrete mixture type B of mark II / by GOST 9128-2009;

**2nd layer.** Average layer of pavement of hot porous coarse-grained asphalt concrete mixture type B of mark/ by GOST 9128-2009;

**3rd layer.** Lower layer pavement of hot highly porous coarse-grained asphalt concrete mixture of mark II by GOST 9128-2009;

**4th layer.** Top layer of subbase of gravel sand mixture by GOST 8267-93 fractions over from 40 to 80 (70) mm with the addition 30% broken stone

**5th layer.** Lower layer of base of gravel-sand mixture by GOST 8262-93 fractions over 40 to 80 (70) mm, layer thickness to be calculated

The calculation is to determine

Such a thickness of the layer, which will correspond to the overall modulus of elasticity of the pavement equal  $E_{\text{summm}} = 309\text{MPa}$ .

To determine the elastic modulus at the surface layer calculated by the calculation must perform downward. All formulas were used in accordance with MCN 46-2008

For the top layer of asphalt concrete  $E_{\text{up}} = E_{\text{summm}} = 309\text{ MPa}$ .  $E_{\text{up}} / E_{\text{summm}} = 309/3200 = 0.09$ ;  $h_{1y} / D = 5/42 = 0.06$ .

By nomogram (see. Pic 4.1)  $E_{1w} / E_{1y} = 0.14$ .  $E_n = E_{1w} / E_{1y} = 0.09 \cdot 3200 = 288\text{ MPa}$ .

To determine the thickness of the lower layer a base layer of gravel-sand mixture according to GOST 8267-93 binding fractions. 40 to 80 (70) mm = 180 MPa  $E_{up}$ ,  $E_{lw} = 65$

Define the following relationship:

$$E_{up}/E_{ly}=124/180=0,68; E_{lw}/E_{ly}=65/180=0,36$$

Postpone the ordinate nomogram  $E_{lw} / E_{ly} = 0.36$  and draw a horizontal line to its intersection with the curve  $E_{up} / E_{ly} = 0.68$ . intersection point corresponds to the abscissa value  $h_{ly} / D = 1,1$ . By value found  $h_{ly} / D = 1,1$  define the thickness of the layer of asphalt concrete coarse grade I

$h_{ly} = 1,1 \cdot 42 = 46$  sm. The results of calculations are given in the table.

All calculations are carried out below in tabular form.

Table 7

№	layer name	$E_{ly}$	$h_{ly}$	$h_{ly} / D$	$E_{summy}$	$E_{lw} / E_{ly}$	$E_{up}$	$E_{lw}$
1	2	3	4	5	6	7	8	9
1	Top layer of pavement of hot dense fine-grained asphalt concrete mixture type B of mark II / by GOST 9128-2009	3200	five	0.12	309	0.09	309	288
2	Average layer of pavement of hot porous coarse-grained asphalt concrete mixture type B of mark/ by GOST 9128-2009	2000	7	0.16	288	0.13	288	260
3	Lower layer pavement of hot	2000	12	0.29	260	0.08	260	160

	highly porous coarse-grained asphalt concrete mixture of mark II by GOST 9128-2009							
4	Top layer of subbase of gravel sand mixture by GOST 8267-93 fractions over from 40 to 80 (70) mm with the addition 30% broken stone	270	18	0.43	124	0.16	160	124
5	Lower layer of base of gravel-sand mixture by GOST 8262-93 fractions over 40 to 80 (70) mm	180	46	1.1	65	0.36	124	

The thickness of the lower layer of the base gravel-sand mixture according to GOST 8267-93 binding fractions. 40 to 80 (70) mm, equal to 46 cm turned

After the calculation of the pavement you need to check for resistance of monolithic layers of fatigue failure from stretching during bending.

Calculation of the design to monolithic layers resistance to fatigue failure by tensile flexural

The calculation is performed in the following order.

a) The construction of the drive to the two-layer model, where the lower layer model - part of the structure located below the asphalt layers of the package.

The modulus of elasticity of the lower layer is determined based on data geotechnical survey and calculation of an existing structure  $E_{vscheb} = 90 \text{ MPa}$ .

To the upper layer refers to all layers of asphalt (and current, gain and layers).

The modulus of elasticity of the upper layer set according to the formula

$$E_{av} = (4500 * 5 + 2800 * 7 + 2100 * 12) / (5 + 7 + 12) = 43150 \text{ MPa}$$

$$E_{av} / E_{sze} = 43150/160 = 33.3$$

$$h / D = 24/42 = 0.57$$

$$\text{nomogram } \sigma_r = 1.9$$

$$R_N = R_0 k_1 k_2 (1 - \nu R t)$$

wherein  $R_0$ - standard value limiting tensile strength (strength) at the calculated flexural spring low temperature after a single application of a load received on the table data (C Appendix, Table 1);  $R_0 = 9,8$

$k_1$  - coefficient reflecting the decrease in strength due to phenomena of fatigue during repeated application of a load;

$k_2$ - coefficient considering reduction in time from exposure to weather durability of climatic factors (Table 3.7);  $k_2 = 0,80$

$\nu R$ - coefficient of variation of tensile strength (Appendix D);  $\nu R = 0,10$

$t$ - regulatory factor deviation (Appendix D).  $t = 2,019$

$$k_1 = \frac{\alpha}{\sqrt[m]{\sum N_p}}$$

$$k_1 = \frac{5.9}{\sqrt[5.5]{1523390}} = 3.78 \sigma_r < \frac{R_N}{K_{np}^{mp}}$$

$$R_N = 0.8 * 3.78 * 9.8 * (1 - 0,781) = 3.9$$

$$1,9 < \frac{3,9}{0,98} \quad 1,9 < 3,97$$

Because  $\sigma_r < \frac{R_N}{K_{np}^{mp}}$  It means our coverage meets the regulatory

requirements.

## Shear stability calculation

Soil of road pavement

Material : Heavy loam

$$E = 65,0 \text{ МПа}, \varphi = 6,34^\circ, \varphi_{\text{стат.}} = 21,00^\circ, c = 0,02400 \text{ МПа}$$

The weighted average modulus of elasticity of the upper layers [1, formula 3.12]:

$$E_{up} = \frac{\sum_{i=1}^5 E_i \times h_i}{\sum_{i=1}^5 h_i} = \frac{460 \times 5 + 432 \times 7 + 432 \times 12 + 450 \times 18 + 180 \times 46}{5 + 7 + 12 + 18 + 46} = 221 \text{ МПа}$$

Specific active shear stress from unit load [1, nomogr. 3.2, 3.3]:

$$\frac{E_{tw}}{E_{sum}} = \frac{288}{65} = 4,43; \frac{h_{up}}{D} = \frac{88}{42} = 2; t \approx 0,02231 \text{ МПа}$$

Active shear stress [1, formula 3.13]

$$T = \tau_H \times p = 0,02231 \times 0,8 = 0,01784 \text{ МПа}$$

Coefficient  $k_d = 1$

The depth of the surface of the checked layer from the top of the structure

$$z_{dg} = 5 + 7 + 12 + 18 + 46 = 88 \text{ см}$$

The weighted average specific gravity of the layers located above the test

$$\gamma_{av} = \frac{2400 \times 5 + 2300 \times 7 + 2200 \times 12 + 1600 \times 18 + 1800 \times 46}{5 + 7 + 12 + 18 + 46} = 1887 \frac{\text{kg}}{\text{m}^3} = 0,0022 \frac{\text{кГ}}{\text{см}^3}$$

Ultimate shear stress [1, formula 3.14]

$$T_{sm} = k_d \times c_n + 0,1 \times \gamma_{cp} \times z_{dg} \times tg\varphi_{\text{стат.}} = 1 \times 0,024 + 0,1 \times 0,0019 \times 88 \times tg21^\circ \approx 0,03124 \text{ МПа}$$

$$K_{colocate} = \frac{T_{sm}}{T} = \frac{0,03124}{0,01784} = 1,75; \frac{K_{colc} - K_{en}}{K_{en}} \times 100\% = \frac{1,75 - 0,8}{0,8} \times 100\% = 119\%$$

## Variant 2

**1st layer.** Top layer of pavement of hot dense fine-grained asphalt concrete mixture type B of mark II / by GOST 9128-2009;

**2nd layer.** Average layer of pavement of hot porous coarse-grained asphalt concrete mixture type B of mark/ by GOST 9128-2009;

**3rd layer.** Lower layer pavement of hot highly porous coarse-grained asphalt concrete mixture of mark II by GOST 9128-2009;

**4th layer.** Top layer of subbase of black rubble by GOST 9128-2009.

**5th layer.** Lower layer of base of gravel-sand mixture by GOST 8262-93 fractions over 40 to 80 (70) mm

The calculation is to determine

Such a thickness of the layer, which will correspond to the overall modulus of elasticity of the pavement equal  $E_{\text{summ}} = 309 \text{ MPa}$ .

To determine the elastic modulus at the surface layer calculated by the calculation must perform downward. All formulas were used in accordance with MCN 46-2008

For the top layer of asphalt concrete  $E_{\text{summ}} = E_{\text{up}} = 309 \text{ MPa}$ .  $S / E_{\text{ly}} = 309/3200 = 0.09$ ;  $h_{\text{ly}} / D = 5/42 = 0.06$ .

By nomogram (see. Figure 4.1)  $E_{\text{n}} / E_{\text{ly}} = 0.14$ .  $E_{\text{lw}} = E_{\text{lw}} / E_{\text{ly}} = 0.09 \cdot 3200 = 288 \text{ MPa}$ .

To determine the layer thickness of the lower base of gravel-sand mixture according to GOST 8267-93 binding fractions. 40 to 80 (70) mm = 108 MPa EB,  $E_{\text{lw}} = 65$

Define the following relationship:

$$E_{\text{up}} / E_{\text{ly}} = 108/180 = 0.6; E_{\text{lw}} / E_{\text{ly}} = 65/180 = 0.36$$

Postpone the ordinate nomogram  $E_{\text{lw}} / E_{\text{ly}} = 0.36$  and draw a horizontal line to its intersection with the curve  $E_{\text{up}} / E_{\text{summ}} = 0.6$ . intersection point corresponds to the abscissa value  $h_{\text{sl}} / D = 0,7$ . By value found  $h_{\text{ly}} / D = 0,7$  define the

thickness of the base layer of gravel-sand mixture  $h_{ly} = 0.7 \cdot 42 = 29.0$  cm. The results of calculations are given in the table.

All calculations are carried out below in tabular form.

Table 7

№	layer name	$E_{ly}$	$h_{ly}$	$h_{ly} / D$	$E_{summ} / E_{ly}$	$E_{lw} / E_{ly}$	$E_{up}$	$E_{lw}$
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4	Top layer of subbase of black rubble by GOST 9128-2009	270	12	0.43	124	0.16	160	108
5	Lower layer of base of gravel-sand mixture by GOST 8262-93 fractions over 40 to 80 (70) mm	180	29	1.1	65	0.36	124	

The thickness of the lower layer of the base gravel-sand mixture according to GOST 8267-93 binding fractions. 29 to 80 (70) mm, turned out of 29 cm

After the calculation of the pavement you need to check for resistance of monolithic layers of fatigue failure from stretching during bending.

Calculation of the design to monolithic layers resistance to fatigue failure by tensile flexural

The calculation is performed in the following order.

a) The construction of the drive to the two-layer model, where the lower layer model - part of the structure located below the asphalt layers of the package.

The modulus of elasticity of the lower layer is determined based on data geotechnical survey and calculation of an existing structure  $E_{vscheb} = 90$  MPa.

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The modulus of elasticity of the upper layer set according to the formula

$$E_{av} = (4500 * 5 + 2800 * 7 + 2100 * 12) / (5 + 7 + 12) = 43150 \text{ MPa}$$

$$E_{av} / E_{sze} = 43150 / 160 = 33.3$$

$$h / D = 24 / 42 = 0.57$$

$$\text{nomogram } \sigma_r = 1.9$$

$$RN = R_0 k_1 k_2 (1 - \nu R t)$$

wherein  $R_0$  - standard value limiting tensile strength (strength) at the calculated flexural spring low temperature after a single application of a load received on the table data (C Appendix, Table 1);  $R_0 = 9,8$

$k_1$  - coefficient reflecting the decrease in strength due to phenomena of fatigue during repeated application of a load;

$k_2$ - coefficient considering reduction in time from exposure to weather durability of climatic factors (Table 3.7);  $k_2 = 0,80$

$v_R$ - coefficient of variation of tensile strength (Appendix D);  $v_R = 0,10$

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$$k_1 = \frac{\alpha}{\sqrt[m]{\sum N_p}}$$

$$k_1 = \frac{5,9}{\sqrt[5,5]{1523390}} = 3,78$$

$$\sigma_r < \frac{R_N}{K_{np}^{mp}}$$

$$R_N = 0,8 * 3,78 * 9,8 * (1-0,781) = 3,9$$

$$1,9 < \frac{3,9}{0,98} \quad 1,9 < 3,97$$

Because  $\sigma_r < \frac{R_N}{K_{np}^{mp}}$  It means our coverage meets the regulatory

requirements.

Shear stability calculation

Soil of road pavement

Material : Heavy loam

$$E = 65,0 \text{ МПа}, \varphi = 6,34^\circ, \varphi_{\text{стат.}} = 21,00^\circ, c = 0,02400 \text{ МПа}$$

The weighted average modulus of elasticity of the upper layers [1, formula 3.12]:

$$E_B = \frac{\sum_{i=1}^5 E_i \times h_i}{\sum_{i=1}^5 h_i} = \frac{460 \times 5 + 432 \times 7 + 432 \times 12 + 450 \times 12 + 180 \times 29}{5 + 7 + 12 + 12 + 29} = 325 \text{ МПа}$$

Удельное активное напряжение сдвига от единичной нагрузки [1, номогр. 3.2, 3.3]:

$$\frac{E_{tw}}{E_{summ}} = \frac{288}{65} = 4,43; \frac{h_{up}}{D} = \frac{65}{42} = 1,5; t \approx 0,02124 \text{ МПа}$$

Specific active shear stress from unit load [1, nomogr. 3.2, 3.3]:

$$T = \tau_H \times p = 0,02124 \times 0,8 = 0,01710 \text{ МПа}$$

Coefficient  $k_d = 1$

The depth of the surface of the checked layer from the top of the structure

$$z_{dg} = 5 + 7 + 12 + 12 + 29 = 65 \text{ sm}$$

The weighted average specific gravity of the layers located above the test

$$\gamma_{av} = \frac{2400 \times 5 + 2300 \times 7 + 2200 \times 12 + 1600 \times 12 + 1800 \times 29}{5 + 7 + 12 + 12 + 29} = 1887 \frac{kg}{m^3} = 0,0038 \frac{kg}{sm^3}$$

Ultimate shear stress [1, formula 3.14]

$$T_{sm} = k_d \times c_n + 0,1 \times \gamma_{cp} \times z_{dg} \times tg \varphi_{stat.} = 1 \times 0,024 + 0,1 \times 0,0038 \times 65 \times tg 21^\circ \approx 0,04236$$

МПа

$$K_{calc} = \frac{T_{sm}}{T} = \frac{0,04236}{0,02124} = 1,9; \frac{K_{calc} - K_{en}}{K_{en}} \times 100\% = \frac{1,9 - 0,8}{0,8} \times 100\% = 137\%$$

After calculations, we compare two variants of pavement. To do this, determine the consumption of materials per 1 m<sup>2</sup>

Determine the flow of the formula  $V=H*B*C$

H-height; B width (as we determine the consumption per 1 m<sup>2</sup>, the width is determined by 1 m); C- length (since we determine the consumption per 1 m<sup>2</sup>, the length is determined by 1 m);

Below are shown in the cost tables of the pavement variants. The table shows that first variant of pavement are cheaper than the second variants (the cost of the first variant is 166.910 sums, per 1m<sup>2</sup>, and the cost of second variants is 205510 sums per 1m<sup>2</sup>,) from this calculation it is clear tha the cost od the first variant is cheaper. We are chose the first variant of road pavement.

Comparison and selection of the final version

I - Variant

number (Layer)	Name of layers	Thicknes s, h	unit of mt	Price for (sým)	Material consumptio n per 1 m <sup>2</sup>	Price 1 m <sup>2</sup> (sým)
1	Top layer of pavement of hot dense fine-grained asphalt concrete mixture type B of mark II / by GOST 9128-2009	5	1 ton	365.000	0.12 t	43.800
2	Average layer of pavement of hot porous coarse-grained asphalt concrete mixture type B of mark/ by GOST 9128-2009	7	1 ton	315.000	0.154	48.510
3	Lower layer pavement of hot highly porous coarse-grained asphalt concrete mixture of mark II by GOST 9128-2009	12	1 ton	250.000	0.24	60.000
4	Top layer of subbase of gravel sand mixture by GOST 8267-93 fractions over from 40 to 80 (70) mm with the addition 30% broken stone	18	1 M <sup>3</sup>	30 000	0.18	5.400
5	Lower layer of base of gravel-sand mixture by GOST 8262-93 fractions over 40 to 80 (70) mm	46	1 M <sup>3</sup>	20.000	0.46	9.200
TOTAL		88	-	980000	-	166910

II - Variant

number (Layer)	Name of layers	Thickness, h	unit of mt	Material consumption per 1 m <sup>2</sup>	Price for (sým)	Price 1 m <sup>2</sup> (sým)
1	Top layer of pavement of hot dense fine-grained asphalt concrete mixture type B of mark II / by GOST 9128-2009	5	1 ton	0.12 t	365.000	43.800
2	Average layer of pavement of hot porous coarse-grained asphalt concrete mixture type B of mark/ by GOST 9128-2009	7	1 ton	0.154	315.000	48.510
3	Lower layer pavement of hot highly porous coarse-grained asphalt concrete mixture of mark II by GOST 9128-2009	12	1 ton	0.24	250.000	60.000
4	Top layer of subbase of black rubble by GOST 9128-2009	12	1 ton	0.222	200 000	44.400
5	Lower layer of base of gravel-sand mixture by GOST 8262-93 fractions over 40 to 80 (70) mm	29	1 ton	0.46	20 000	5.800
TOTAL		65	-	-	-	202510

All strength requirements are met, now we can compare road pavement, and choose more acceptable variant.

## **Junctions.**

On the track portion provided projected road improvement 26 - E adjacencies.

The length of adjacency determined based on the conditions of maintenance on the approaches to intersections over distances appear to stop car longitudinal slopes of not more than 40 ‰ (p. 5.1 SHNK 2.05.02-07) and depending on the existing adjacency type coatings (Sec. 5.5 SHNK 2.05. 02-07).

All junctions within rounding in accordance with a standard album "intersections and junctions of roads in one level" Series 503-0-51.89 provided an apparatus pavement the pavement identical construction on the main road.

Outside radii adjacencies, depending on the existing coating, provided pavement device with asphalt coating (at junctions with existing asphalt coated) or coated with a gravel-sand mixture (at junctions with existing coating of gravel-sand mixture and ground closures) .

The radii of the curves at pairings adjacencies from the highway taken on the basis of the functional purpose of contiguity and management of funds to their accomplishment.

Design parameters of the cross profile of the roadbed and pavement contiguity; pavement structure provided on the closures, and data other than adjacency to PC 42 and PC 65 + 56 + 65.74, alignments are shown in Figures adjacencies.

The values of the radii of curvature at the interface with the main road junctions and the length of the joints, the amount of work and other necessary data for the improvement of adjacencies are shown in the statement of scope of work of contiguity.

In accordance with the MKH field in 39-2007 exits projected on the roadside of the road section at a distance of not less than 50.0 m in both directions is provided a device stopping strips 2.5 m wide.

Pavement stopping bands provided the following structural layers:

- an upper coating layer of hot asphalt mix dense granular type BND 40/60 grade GOST 9128-2009 thickness of 5 cm;
- a lower layer coating of hot bituminous mixture coarse porous BND 40/60 GOST 9128-2009 thickness of 9 cm;
- the base of the gravel-sand mixture according to GOST 25607-94 C4 mixture with addition of material from the disassembly of the existing asphalt coating thickness of 15 cm.

According to item 4.5 SHNK 2.05.02-07ostanovochnye strip separated from the main road markings.

stopping bands parameters, the design of the pavement, etc. are shown in the drawing "pavement design stopping lanes."

Volume of work on the pavement device stopping bands are given in amounts of works on the device stops statements bands.

## **Construction of the road.**

Design solutions for security and traffic management developed in accordance with the following regulations:

- GOST 23457 - 86 "Technical means of traffic management";
- GOST 10807-78 "Road signs. General technical conditions ";
- GOST 13508-74 "Road Layout";
- MSHN 25-2005 " Road safety ";
- MKH 23-2008 "Guidelines for marking of roads" and others.

For traffic control, warning drivers about the traffic situation changes the direction and distribution of transport flows when driving on the road and at the junction provided road signs and markings on the carriageway.

In view of the poor state of certain existing signs of dismantling provided for the project, installation of new and missing road signs corresponding to GOST 10807-78.

According to GOST 23457-86 all signs except for signs, installation of which is provided on the guide islands landfall on the ST 121 + 65.74, provided to set off the carriageway and roadsides - to prisypnyh berms.

Number of road signs, their number, size, brand provided supports for road signs and the amount of work for the installation of traffic signs are shown in the statement of scope of work for the installation of traffic signs.

In conjunction with the road signs marking the project includes roadway. Designated road marking made in accordance with the GOST 23457 - 86, GOST 13508-74 and MKH 23-2008. Volume of work on the layout of the carriageway are defined according to the standard album "Road marking" Series 3.503-79. Types of road markings provided and the area of the painted surface by species markup statements are presented in marking roadway.

The visibility of the outer edge of shoulders and hazardous obstructions at night and under adverse weather conditions, the setting of a working draft guiding devices in the form of signal bars. installation of signaling columns

places adopted in accordance with p.9.13 SHNK 2.05.02-07. Mark signaling columns accepted - SS-160.16.

To prevent forced congresses transport Weddstv with the subgrade of the road on the side of the road fences accommodate the first group. Installation of the first group of enclosures w / w, 3.100 blocks provided in accordance with para. 9.3 SHNK 2.05.02-07. Volume of work on the installation of fences of the first group on road verges shown in statement fencing installation units 1 -3,100 CRF

Designated installation of traffic signs, guardrails, projected bus stops, sidewalks and places road marking shown in the drawing "circuit arrangement expensive."

Design solutions for security and traffic management agreed with Syrdaryo viloyats Road Safety Management

## Sidewalks

For the organization of walking sidewalks device is provided, as well as the construction of approaches of sidewalks with pedestrian crossings provided for pedestrians crossing the carriageway of the road, and the bus stop.

Depending on the location of sidewalks, their width and structural elements 3 provided sidewalks typical transverse profile pavement construction (see. The drawing "Model transverse profile pavement construction").

In cramped conditions parts width pedestrian sidewalks 1.0m accepted that allowed standard draft "Typical cross sections of roads extending for locations of" Series 503-0-47.86, other uchastkah- 1.5 m.

Pavement provided the following structural layers:

- coating of dense granular hot asphalt mix type B grade I according to GOST 9128-2009 4 cm thick;
- the base of the gravel-sand mixture thickness 12 cm.

To ensure the approaches from the sidewalks to the seats allocated to cross the carriageway of the road for pedestrians is provided an apparatus podhodov.Shirina approaches and construction of pavement on them taken identical to the corresponding parameters of sidewalks.

In sections from sidewalks approaches to places selected for intersection road carriageway, and the approaches to bus stops at longitudinal slopes greater than 60 ‰ lestnits.Konstruktsiya ladders provided an apparatus is designed to ensure convenience for pedestrians with cargo and prams. For convenience pedestrians to ladders provided broadening sidewalks to 3.0 m.

Construction of stairs shown in Figure "scheme of reinforced concrete stair handrail c".

Location of stairs and the amount of work on their device shown in the drawing "Shemaraspolozheniya stairs. Volume of work".

## **Construction Materials.**

Road construction materials required for construction of the road section, provided with bases and delivering businesses specified in statement sources of materials and methods for transporting, articles and semifinished products imported to the track (directly from receiving sources). The most common and cheapest of them are the soils of the road strip, as well as near-track and specially found quarries. In addition, gravel mixes, crushed stone, slags, cobble stones or organic and mineral binders are used to stabilize and strengthen the soil (stabilization is understood as maintaining the soil properties inherent in its dry condition under adverse conditions). To reduce the cost of pavement work, various local materials and industrial waste should be widely used.

Soils usually consist of three types of mineral particles: sandy (0.05-2 mm), silty (size 0.005-0.05 mm) and clay (less than 0.005 mm). Soil with an optimal grain composition (optimal soil) is called one in which all sand particles (70–80%) forming the skeleton touch each other, dust particles (15–25%) fill the gaps between them, and 3-8%). Such soils have the greatest density, slowly soak and offer the greatest resistance to external pressure. Soils of optimal composition are also found in natural ones, but for the most part they are formed by adding sand to clay and loamy soils and loam to loose sand in a certain proportion (specified in the road design).

The main types of clay soils are clay (the content of clay particles is more than 25%), loam (12-25%) and sandy loam (3-12%). If in loams and sandy loams silt particles are larger than sand ones, then the definition of silt particles is added to the soil name.

Sandy soils or sands are divided into gravels (25–50% of grains larger than 2 mm), large (more than 50% of grains larger than 0.5 mm), medium size (more than 50% of grains larger than 0.25 mm) and small (more than 75% grains not larger than 0.1 mm). In sandy soils of clay particles should be no more than 3%.

Coarse-grained soils are divided into gravelly (more than 50% of grains larger than 10 mm) and wood (more than 50% of grains larger than 2 mm).

Gravel materials are a natural loose rock or artificial mixture of rounded fragments of solid rocks of various sizes - mostly from 2 to 70 mm.

Distinguish between gravel, optimum gravel mix, crushed gravel and quarry gravel material. Depending on the size, the gravel is divided into fractions: very fine (5–10 mm), fine (10–20 mm), medium (20–40 mm) and large (40–70 mm). For the top layer of pavements, gravel is used with a size of no more than 40 mm, for the bottom - the maximum size may be 70 mm, but not more than 2/3 of the layer thickness. Gravel material has the greatest density and strength, in which the free space between densely packed large particles is filled with smaller particles. Such optimal mixtures are usually obtained by adding a particular fraction to the gravel pit material.

Crushed stone is obtained by crushing rocks. This material has a wide use in road making. The size of crushed-stone particles is from 2 to 70 mm. When sorting crushed stone is divided into varietal and ordinary. Varietal sizes are divided into large (40–70 mm), medium (20–40 mm), small, or wedge (10–20 mm), very small, or stone fines (5–10 mm), and seeding (0— 5 mm).

Cobblestone and shashka: a cobblestone is a boulder rough-rolled stone up to 25 cm in size, transferred to the location by water or a glacier (a larger boulder stone is chopped to the desired size); The checker used for road paving is a product of the artificial destruction of rocks. In shape, it approaches a truncated pyramid, with the face and bed almost parallel to each other. The cheapest type of checker has a square front side (10-15 cm) and a height of 12-16 cm.

Stone materials, depending on the physicomechanical properties and mainly on strength, are divided into classes. Strength is determined by crushing a stone cube on a press and is assessed by pressure causing

destruction. Density is characterized by bulk density. Water absorption is the property of a material to absorb and retain water; it is determined by the degree of filling of the pores of the stone material with water. Frost resistance is determined by the number of freezing cycles (up to  $-20^{\circ}\text{C}$ ) and thawing, maintained without a decrease in strength.

Mineral binders are mainly used in the form of cement and lime. When strengthening the soil they are mixed with improved medium. As a result of complex physical and chemical processes, the mechanical properties of the soil are improved, their strength significantly increases (by 6–10 times). To strengthen the soils, use Portland cement of a grade not lower than 400. The mark is the ultimate compressive strength of cubes with sides of 70.7 mm made from mortar with a 1: 3 ratio of cement to sand.

## **Environmental protection.**

Design and estimate documentation, a set of actions that reduce the negative impact of the road section, as in the overhaul of the road section, as well as during its operation on the environment.

To reduce dust generation project provides irrigation water the soil in the production of earthworks.

To exclude unjustified additional land provided:

- Repair road section to make maximum use of existing ROW;
- backfilling the embankment road produce the full use of the soil obtained from the "trough" of the device, with minimum use of soil concentrated precoat career;
- delivery of materials, structures and products to perform with existing quarries and plants.
- transportation of road construction materials and soil on existing roads.

To prevent erosion at the outlet pipe 11 to PC + 86 provides strengthening of the watercourse bed.

Debris, resulting in the production of works provided to take out in the designated purposes of these placesbut.

## **The environmental aspect of designing highways**

Environmental aspects to be considered in the design of roads and necessary measures to prevent the negative impact of the entire process of design, construction and operation of the car during the construction as well as the potential environmental risks.

- A violation of water-heat regime area; deterioration of water quality, the change in living conditions of aquatic life due to icing and anti-dust entering reactants into surface and ground waters;
- Interruption or change in the way of animal migration;
- A violation of the form a beautiful natural landscape;
- Improving forest fire hazard;
- A violation of the stability of slopes, especially in mountainous terrain;
- Dust and soot impairs photosynthesis in plants near roads;
- High level of noise adversely affects the properties of the recreational forests;
- Pollution that arise not only in the production of the organization, but also by the actions of road users (emissions from motor vehicles, garbage in the right of way, etc..). In many cases, environmental pollution is a result of the low level of technical solutions, low production discipline, the use of "dirty" materials.
- Working, residents neighboring settlements, flora and fauna are exposed to volatile organic compounds (optional component of smog) due to emission of volatile organic compounds in asphalt plants, plants for the preparation of bitumen emulsions;
- Use of electricity contributes to global warming by power stations and generators running on fossil fuel, worsening air quality.

Sources of influence of the road (in the life cycle) on the environment are: road with moving traffic, vehicles, construction machinery and equipment in the process of technological building operations, reconstruction, operation, maintenance and repair of roads and road facilities of the enterprise and road service, located in the roadside, the materials used.

The main types of impacts of the road on the natural and social environment are:

- The removal of (consumption) of non-renewable natural resources (road-building materials - stone materials, sand, gravel, soil, structural - ferrous, non-ferrous metals, plastics, cement, bitumen, performance - fuels, lubricants, anti-icing reagents, biological products, pesticides, energy ; withdrawal of land, water, air, oxygen); effect on fertile soil;
- Physical presence of an object (the construction and use of the facility), the impact on the landscape, hydrology, climate, social and economic conditions, the traditional way of life and natural resources of the local population;
- Chemical pollution, dust, solid waste components of the environment (air, water, soil, vegetation) and the impact on public health, the fertility of agricultural land, the biological productivity of natural landscapes and water bodies;
- Noise, vibration, electromagnetic and ionizing effect on the components of the environment, people and wildlife;
- Dynamic effect of moving machines and mechanisms on people, animals and vegetation.

The most sensitive components of the environment during construction (reconstruction) of the road are:

- Terrain, terrain, fertile soil layer due to land acquisition under the linear facilities and road facilities, quarries, building materials, construction of roadbed, pits, mounds, bridges, construction waste and the presence of illegal dumping, erosion processes. This is especially important in the specially protected natural territories;
- Surface water due to the pollution of oil, special fluids (liquids hydraulic road construction machinery, engine cooling systems, batteries), suspensions, especially when installing bridge piers in the riverbed, flushing binders and film-forming substances from construction sites;

· Population, fauna, fish fauna in the production of blasting, pile driving, operation of machines and mechanisms; ambient air due to excessive pollution of its exhaust gases of vehicles, products of roadway wear and tire.

### **Measures for labor protection and safety.**

Subgrade of the road being built self-propelled trailed or mounted machines (bulldozers, excavators, etc.) Therefore, many questions about the safety of the work they are subject to a single requirement:

- to control the machine allowed to persons 18 years of age;
- having a license for the right to operate the machine;
- past safety training.

Safety precautions when working on clearing the right of way.

ROW clearing and brush produce bulldozers, brush cutters, and pull out the roots of stubbing. Before any work is necessary to examine the reliability of mounting external components, fencing strength and condition of the blades, which must be kept sharp.

Front brush cutter work previously purified from stones, stumps and trees with a diameter of more than 15 - 20 cm. During operation of the brush cutter is necessary to fulfill the requirements of safety:

- trees cut at the level of 3-5 cm from the earth;
- knives raised and lowered with the full stop of the conveyor;
- only run with intact barriers, which protect the machine from shock felled trees and shrubs;
- laborers, removing medium trees must be located no closer than 2530 cm from the place of work of the tractor.

Safety in the work of bulldozers.

Work bulldozers on slopes exceeding 20% during the ascent, descent at 30% is forbidden.

Cross slope shall not exceed 15%. When you move a mound of soil svezheotsypannoy prohibited sum bulldozer to the edge, closer than 1m from the edge of the tracks or wheels of the tractor, in order to avoid the fall of the car into a ditch.

In brief stop bulldozer, it is necessary to squeeze the clutch, transfer to small engine revolutions, and the speed lever at the neutral position.

Safety precautions when working with excavators.

Excavator during operation must be installed on the planned surface and avoid inadvertent movement to fix excavator stops. It is not allowed to perform any work on the part of the face and people are within range of the excavator +5 m.

During operation of the excavator is prohibited:

- change the boom;
- lift loads using the arrows;
- work with worn ropes;
- change cable at the parking lot at the bottom of the sole of the excavator.

During the boom of the excavator movement it is installed strictly according to the direction of travel, and an empty bucket is raised above the ground on 0,5- 0.7 meters.

Safety in the sealing means.

Dangerous air rink with ballast body is allowed to be coupled to the tractor only with a loaded body. During roller compaction trailer of any kind is prohibited movement of the tractor in reverse. When compacting high mound distance between its Brovko and chassis must be at least 1.5 m.

Safety at work graders.

To level the ground at svezheotsypannoy mound higher than 1.5 should be especially cautious and under the supervision of a responsible person.

The distance between the external wheels grader with Brovko subgrade should be at least 1m.

Labor protection measures.

Under the influence of unfavorable weather conditions: in hot weather tolerate shifts in the cool hours of the day, the machines arrange canopies, introduced water treatments; during the cold season requires a periodical heating, warm clothing, Special lubes against frostbite and others.

When working in an environment with toxic substances and is used in dusty environments personal protection - respirators, gauze bandages, and masks if necessary.

By increasing the allowable noise level above use various types of insert hearing protector.

To eliminate the harmful effects of vibration used shoes with thick rubber soles porous redeemable vibration gloves with cotton or paralonovym gasket, rubber mats.

In poor lighting increases the illumination of workplaces to the extent permitted by sanitary norms.

## **Conclusion:**

Designing highway M37 "Bukhara-Samarkand-Turkmenbashi» Ia category between km 3-9 in the Samarkand region. I performed competently use thesis regulations MCS 46-2008 documents, 2-05-02-07 SHNK

Occupational Health and Safety.

Basic safety regulations:

Everyone is obliged to examine the safety and sign the appropriate register;

All issued clothing and personal protective equipment;

Machines and equipment should be equipped with audible and visual alarms;

Place of work must be safeguarded;

A building site must be equipped with permanent or temporary ablution devices (locker, a clothes dryer, showers, medical items, etc.)

When installing the pipe elements necessary for the two installer worked on hooks, and two - in the cutaway in the pit. Cutaway made only in the case where the pipe element is firmly secured, and took a design position.

Waterproofing works should be carried out in the open.

Special road signs warning about the place of work, possible detours must be placed, speed restrictions, etc.

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