Innovative: International Multi-disciplinary Journal of Applied Technology
(ISSN 2995-486X) VOLUME 02 ISSUE 09, 2024

The Main Defects and Deformations of the Roadbed and Urgent Measures to Eliminate Them

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Abstract:

This article discusses the task of the roadbed, strengthening of supervision over the condition of the road, identification signs, slides of the embankment slopes, deformation of the roadbed, causes and urgent measures to eliminate.

Keywords: highway, roadbed, road deformation, protective works.

Introduction

The main task of maintaining the roadbed is to ensure the serviceability of the condition of all its elements, prevent the occurrence of malfunctions, eliminate them in a timely manner, as well as eliminate the causes of malfunctions. The roadbed serves as the basis for the pavement and consists of a complex of engineering structures designed for long service life.

The basis for the maintenance of the roadbed is the supervision of its condition in order to timely identify signs and causes of deformations, the prevention of dangerous deformations that can lead to accidents, the implementation of urgent measures, the implementation of scheduled preventive works in the complex of works on the superstructure of the road, as well as its repair or strengthening as independent work on individual projects [1, 2].

Over a long service life, the roadbed undergoes various modifications, which lead to the transformation of standard transverse profiles into operational (typical) ones. The roadbed and its structures must ensure the safety of traffic of vehicles with specified loads, speeds of movement at the established load density. The roadbed, its individual elements and structures must meet the requirements of strength, stability for the entire service period, subject to the frequency of repairs.

Defects are the result of shortcomings in the design of the roadbed, its protective and strengthening structures; violations of the technology of the construction process; unsatisfactory current maintenance and repairs of roads.

Deformations of the roadbed occur when the bearing capacity of the soils from which it is erected is insufficient; discrepancy between the capacity of the superstructure of the road and the loads from the rolling stock in circulation; in case of insufficient protection of the subgrade soils from adverse effects of climatic and engineering-geological factors (landslides, mudflows, floods). Low quality of roadbed maintenance, when surface and groundwater water is not provided with, minor damage to protective and strengthening devices is not eliminated in a timely manner, the causes of a decrease in the bearing capacity of soils and other violations during the maintenance and repair of the highway are not eliminated, leads to the development of minor damage into dangerous deformations that threaten the safety and movement of cars [3, 4].

Roadbed is an engineering structure with a long service life, in which defects and deformations can occur and accumulate. The main more common deformations of the roadbed, identification signs, causes and urgent measures for elimination are given below.

1. Abysses are deformations and destructions in the form of mounds and a network of cracks formed during seasonal freezing and thawing on the pavement under certain conditions. They arise as a result of heaving (heaving formation), heterogeneous swelling of the pavement over the area of the carriageway, formed with a simultaneous combination of the following three factors: 1 - intense frost moisture accumulation; 2 - freezing of the soil under the pavement to a depth of $h_{np} > 0.5$ m; 3 - the presence of fine dusty sands and sandy loams, dusty loams and other heaving soils. The size of heaving deformation depends on the moisture content of the soil, the depth of freezing, the duration of the cold period, the rate of soil freezing, and the strength of the pavement. Uneven frost heaving can reach 8-10 cm, which significantly reduces the speed of cars.

Figure-1. Abyssing on roads

Identification signs: deformations occur during periods of freezing and thawing of soils; deviations of the road both in level and in the longitudinal profile, causing restless movement of cars when moving along the abyss; hanging of the asphalt concrete pavement above the base near the abyss irregularities; longitudinal cracks in the snow cover, on the surface of the slope part; When the soil thaws, subsidence, distortions, splashes, bulging of the soil during the passage of cars with bulging of roadsides, slopes of ditches and ditches, squeezing of gutters occur.

Causes: the presence of heterogeneous or unequally moistened soils of the main site; moistening of clayey soils that make up the main site due to the presence of endorheic irregularities; uneven moistening of soils in the zone of seasonal freezing by groundwater and with neglected state of drainage; unequal depth of freezing of the roadbed; uneven contamination and moistening of the working layer [6].

Table-1

Classification of soils by the degree of heaving during freezing

Groups of soils by heaving	Degree of heaving	Relative frost heaving
I	Non-heaving	1 or less
II	Slightly heaving	Over 1 to 4
III	Puchinisty	Over 4 to 7
IV	Strongly heaving	Over 7 to 10
V	Excessively heaving	Over 10

Urgent measures: increased supervision of the condition of the road and during periods of growth in the depths in winter and especially when they decline in spring (up to daily inspections); timely elimination of deviations from the standards for the maintenance of road ruts with the use of abyss pads or under covered pads; thorough maintenance of drainage devices (ditches, ditches, flumes, drains) with advance preparation for water drainage during periods of prolonged thaws and spring snowmelt; During periods of rapid precipitation of the depths at high outdoor temperatures and intense precipitation, it is possible to limit the speed of cars. After the abyss subsides and subsidence stops, it is necessary to straighten the roads with the removal of the abyss linings [1-4].

2. Slide of embankment slopes - delamination of the slope part of the embankment with the capture of the main platform most often to the axis of the road and its displacement to the bottom of the slope, sometimes with the capture of the embankment base.

Identification signs: the appearance of longitudinal cracks on the roadsides, slopes of the asphalt concrete pavement, bumps on the slope and moistened folds in the lower part of the slope; distortion of the outlines of the slopes and the ground surface near the base of the slope. In the case of a slide, at first there is a vertical displacement of the soil with the formation of a separation wall, then the displacement of the soil to the left side. As a rule, the other part of the embankment remains stable. This distinguishes the slope slide from the general displacement of the entire embankment.

Figure 2. Landslides of the slopes of the embankment of the road.

Causes: insufficient density of embankment soils and slope parts; overestimated steepness of slopes; construction of an embankment of weak soils that are not suitable for construction; difference in density and moisture content of the core and slope soils; the presence of longitudinal beds, the presence of an overestimated steepness of its slope and the wetting of the contact of clayey and draining soils; the presence of weak soils at the base of the slope part of the embankment; poor current maintenance of the roadbed; waterlogging of the soil by abundant precipitation, melt water.

Urgent measures: leveling of roadsides, sealing cracks, snow removal at the end of winter; preventing water from entering the embankment body (waterproofing) or interception of water and from its waters beyond the embankment); cutting of creeping soils, slopes; cutting benches on a clay core and restoration with high-quality soil with standardized compaction; sprinkling berms or counter-banquets to strengthen the slope. When restoring the embankment with draining soils, it is unacceptable to overload the upper part of the slope, and it is necessary to protect from the contact of clayey and draining soils from the water of absorbing water.

3. Washing away the base of the roadbed by water flows.

Identification signs: erosion of the bank at the base of the slope of the roadbed with sediment deposits in the bends and erosion of the lower parts of the slopes; obstruction of the channel with karches, boulders, small stones and sand with the formation of local water backwaters and raising it to the top of the roadbed; with heavy precipitation, melting glaciers, complete flooding of the road is likely with erosion of the working layer, damage and destruction of regulatory structures, bridge supports, culverts; during catastrophic floods, there is a threat to the safety of vehicle traffic [1-4].

Causes: untimely elimination of damage and defects in the structures of protective and strengthening devices and structures; unsatisfactory maintenance of regulatory, jet-guiding structures and their fasteners; insufficient resistance of soils and protective structures to waves, ice effects and water flow; change in the regime of the watercourse (water body) associated with the straightening of channels, the construction of dams.

Urgent measures: performance of protective work in accordance with the plans of the combat waters, local instructions, instructions of the operational headquarters created for the dangerous period by the head of the road section, and, if necessary, by the head of the department or the head of the road; build-up of existing regulatory structures or their re-erection in areas of erosion threat (from rock mass filling, bunding and other measures); removal of local blockages in the riverbed, which create water backwater; supervision of the condition of the road section and elimination of emerging malfunctions.

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