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THE ACTUAL STAGE OF RESEARCH IN THE FIELD OF MEASURES TO REDUCE THE SENSITIVITY AT THE MOISTURE OF THE PATENT LITERATURE

BY

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Abstract. Inventions in the field of reducing the moistening sensitivity of road trips address a theme related to the evolution of technology .

Of particular importance is the impermeability of the road layer. An invention (Iorgoiu & Velcea, 2011) refers to a composition for pavement roads . The invention described above refers to another invention of a porous concrete road surface made of polymer modified cement (Zhijian, 2009).

The stability of the road slopes is important for reducing the moistening sensitivity of the embankments, by supporting walls. The following described invention (Popescu, 2000) refers to a support wall of prefabricated elements which also combines the prefabricated elements recovered.

Of particular importance in reducing moisture sensitivity are drainage technologies. An invention (Strunga, 1994) refers to the drainage screen for roads that collects, transports and discharges infiltrated water from the moorings and from the active area of the roads.

Keywords: road; water; invention; research; embankment.

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1. Introduction

Inventions for the reduction of wetland sensitivity on roadways address a multi-faceted and complex theme, closely related to the current technology evolution. Below are some of the more representative patents in this area.

2. Patents in the Field of Reducing the Sensitivity to Wetting of Roads

Of particular importance is the impermeability of the road layer that prevents rainwater from penetrating into the foundation layer of the road and below it. An invention (Iorgoiu & Velcea, 2011) refers to a composition for pavement roads and roads, and to a process for obtaining it. The composition according to the invention is constituted, by mass, of 14.5,...,16,5% cement, 5.5,...,7.5% mountain river water, 0.5,...,1.93% mixture of polymers in a ratio of 1: 3.9 to 1: 4.1 to water, asphalt, carbon black, zinc oxide and 75,...,80% mineral aggregates. The process according to the invention consists in mixing portland cement with mineral aggregates, zinc oxide and 60 ... 70% of the total amount of water for 1,...,3 minutes at 10,...,15°C , add the ash of the thermal power plant, then the remaining water in the form of the solution containing the mixture of polymers in a ratio of 1: 4 to 1: 8, and stirring is continued for a further 10 to 15 minutes, resulting in a product with a density of 1,597,..., 2,200 kg/m^3, compressive strength of 5.8,...,15.8 N/mm^2.

The composition described is part of the new type of material that finds widespread use in the road and road construction industry. This composition has very good results in this area because it has increased strength in use at a low cost price compared to materials known to date.

The problem solved by the invention is to provide a cement-polymer composition which, by associating the components and the ratios between them, results in a product which after application leads to the development of roads with improved characteristics over existing solutions, consist of:

– lack of expansion joints;

– the color of the tread surface from gray to gray;

– the roughness of the road that can be controlled in the casting stage, this being adapted to the degree of declivity and the adhesion requirement;

– the composition does not disintegrate in the environment, does not produce emissions of dust, gases, other toxic substances being even ecological;

– being non-combustible, road composition is a real barrier to areas that are in poor condition in alpine areas at risk of fire (burns or fire caused by negligence);

– the price represents 60% of the estimated need for building a section of traditional asphalt or road concrete recipe, with a lifetime from 5 to 10 to 40 years depending on the weather conditions.

Advantages of applying the composition according to the invention consist in the fact that:

– the roads on which it is used do not require expansion joints,

– the color of the tread surface can be controlled from white to gray to gray,

– the roughness of the road can be controlled in the casting stage, this being adapted to the degree of gradient and the adhesion requirement,

– from an ecological point of view, the roads built with the composition according to the invention and the process of the invention do not disintegrate in the environment, do not produce dust, gases, other toxic substances,

– is not a fuel, representing a real barrier to forest areas in alpine areas at risk of fire (burning or fire caused by negligence).

– in terms of the quality-price ratio, lifetime from construction varies from 10 to 40 years depending on the weather conditions, the operating and maintenance conditions; the warranty given by the manufacturer varies from 5 to 10 years depending on the above elements; the price represents 60% of the estimated need for building a section of traditional, asphalt or road concrete,

– the execution speed is 5 km/day for a road surface of 8 meters width and 10 cm thickness on a pre-existing foundation of 25,...,40 cm depending on the geotechnical indicators.

In the construction of roads, the combination of components that make up the casting composition on roads or highways is of great importance. A factor that influences the quality of concrete after casting is its contraction over time, which means volumetric instability over time; this property of concrete to contract and crack during its drying is very low in concrete and high quality cements.

The materials in the composition influence the contraction of the concrete as follows:

– cement: by mineralogical nature it gives the greatest contraction; the higher the amount of cement in the composition, the shrinkage of the formed mass increases; cement granulation also influences shrinkage, so that the growth of the gel component implies an increase in cement slurry shrinkage;

– aggregates: increasing the amount of aggregates in the composition results in reduced shrinkage of the formed mass; the nature, aggregate hardness and granulometry positively influence the formed mass; the shape of the granules as close as possible to the spherical one is the 3 indicated, as well as those obtained by crushing rocks with low porosity and high resistance; the

porosity and water absorption of the total aggregate and of the large aggregate have also such influence that the aggregate must have a maximum absorption of 1% in 24 hours and come from compact and hard rocks;

– sand: it must have a high hardness, so it must contain a high amount of SiO2 and be close to cement granulometry;

– water: increasing the amount of water leads to increased concrete contraction, as the number of concrete pores increases, and water with large amounts of calcium ions is also preferred, which positively influences the additives; this ensures cement and concrete workability, cohesion and hydration of cement; is present in the composition in free form and absorbed by the granules of the open porosity aggregate;

– the environmental conditions for the preparation of the mixtures also have an influence on the quality of the material obtained;

– additives such as superplasticizers are absorbed in the presence of Ca+2 ions from 17 minerals, which is not valid in the presence of Li+, Na+ and K+ ions when the cement mixture, fine aggregates and water flocculate; their main property is the fluidization of cement or concrete, it can be poured easily without segregation, with a small amount of air entrained in the material; the use of superplasticizers involves a reduction in the amount of water, an increase in the strength of the hardened material; superplasticizers are polymers that can physically and chemically interact with cement and sand particles, and interact through several mechanisms:

a) by reducing the attraction forces between the different charges of deflocculating loads and the induction of particle rejection forces due to the negative charge imparted to the particles by the superplasticizer absorbed;
b) absorption of plasticizing molecules by forces of Van der Waals and electrostatic forces, on particles;
c) steric hindrance between the absorbed polymer macromolecules and the neighboring particles; the chemical interaction is given by reacting with the most reactive complex compounds in the cement composition and can substantially reduce the superficial hydration rate; these interactions have practical implications as they can prolong the duration of the cement paste and can reduce the mechanical properties significantly; the delaying effect of the plasticizer is directly proportional to the amount of superplasticizer; another part of the superplasticizer is absorbed into other mineral phases, which reduces the surface reaction velocity;

– the ash present in the mixture increases the homogeneity, leads to the more appealing surfaces after decoking, increases the impermeability of the concrete, improves the resistance to fire and thermal shocks; also slightly increases the strength of the material;

– other additions can be of mineral nature and are introduced for appearance, color, etc.

The values obtained for the laboratory test of the composition were within ±5% of the controls tested.

Table 1

Characteristic Values Determined in the Laboratory

Characteristics determined	U.M.	Values		
		1	2	3
Temperature	°C	25	26	22
Humidity	%	49	77	57
Drying time	Minimum	103	84	98
Pellicle thickness	Minimum	0.55	0.23	0.45

The invention described above refers to another invention of a porous concrete road surface made of polymer modified cement (Zhijian, 2009). The structure comprises successively a foundation layer, a bonding layer, a porous concrete layer and a surface treatment layer. Ad layer is rent is located on the lower layer, and the porous concrete layer on the bonding layer is prepared by paving, leveling and pouring the blended mixture of crushed stone, sand and cement slurry of a mixture of modified polymer. The polymer addition makes binding granular materials with the slurry blend. Using the bonding layer makes the road surface structure and the lower layer form an integral body. Thus, the road surface structure has good crack resistance, water resistance, aging resistance and corrosion resistance. This invention reduces the penetration of surface water into the road. Surface treatment can significantly improve surface properties. By using it in accordance with the requirements, the porous concrete layer can be rigid or flexible. The porous concrete road surface can be laid manually or mechanically.

The stability of the road slopes is also important for reducing the moistening sensitivity of the embankments, made by supporting walls. The following described invention (Popescu, 2000) relates to a prefabricated support wall (Fig. 1) which also advantageously combines the prefabricated elements recovered, realizing a construction made on a foundation (1) and made up of a tiled roof of prefabricated pillars (2) provided on three sides with some edges

(3) in which the ends of the recovered prefabricated elements (6) penetrate, being tied in height with prefabricated longitudinal pliers (4) and prefabricated pliers (5), elements provided at the ends with some hollow holes for the pillars (2) to form cassettes filled with raw stone, and to the surface, a concrete slab (8) on which the parapet is mounted, is cast, if it has the role of pathway.

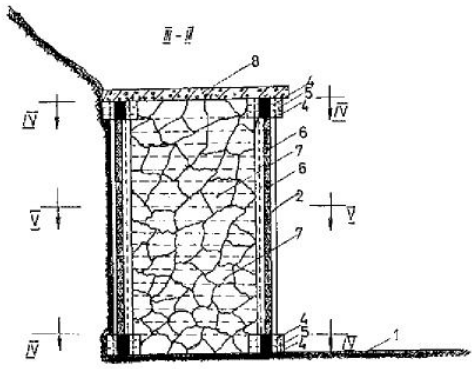

Fig. 1 − Support wall made of prefabricated elements.

Constructions of supporting walls or dams are known for retaining alluviums in hydrotechnical works or communications infrastructure infrastructures. These classical constructions are made in the form of monolithic constructions, from stone or concrete walls and reinforced concrete prefabricated, under different forms of construction and joining.

These constructions have the disadvantage that they are made only from materials on first use, and are therefore costly, the joining of prefabricated buildings is vulnerable and in most cases also requires substantial foundations in volume.

Application of the invention results in the following advantages:

– reuse, after dismantling, of the used concrete traverses from railway, tram and underground railway, significantly reducing the consumption of concrete;

– increasing labor productivity;

– execution speed;

– resulting in massive work with a high degree of resistance and stability;

– are fully industrialized.

Of particular importance in reducing the moistening sensitivity of earthworks are drainage technologies. An invention (Strunga, 1994) refers to the drainage screen (Figs. 2 *a* and 2 *b*) for roads and highways which collects,

transports and discharges infiltrated water from the moorings and the active area of the roads, while at the same time aerating the water from the infiltration being pressed at the edge of the garments and road on one side of the other, consisting of a geomembrane (*1*) or a leaky and drainable prefabrication (*5*) placed in the middle of the drainage trench and a puffed tube plastic, perforated (*4* and *7*) to collect infiltrated water.

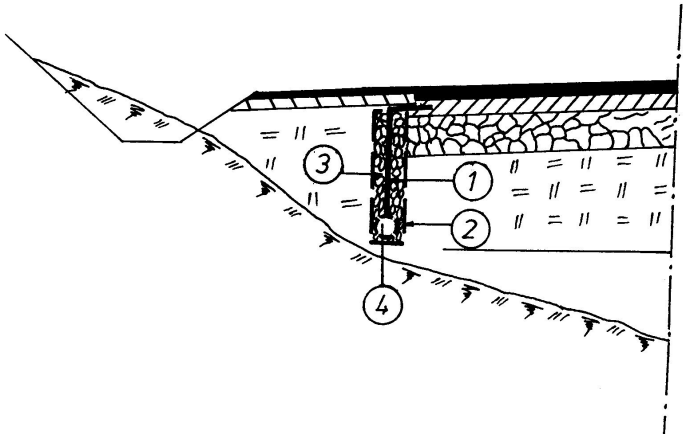

Fig. 2 *a* − Drenched screen for roads.

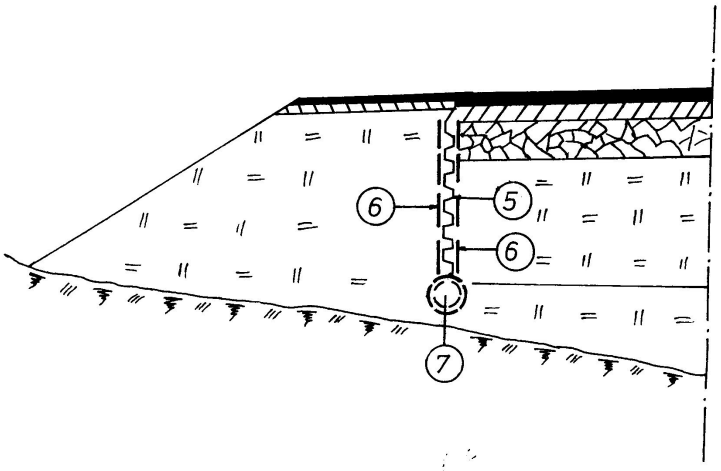

Fig. 2 *b* − Drenched screen for roads.

In order to drain the water that reaches the active area and the roads and highways, there are drains of different shapes and shapes, such as the longitudinal ones, provided under the trenches or under the marshals of the

roads, transverse drains to the road axis, drilled or dug at various depth, consisting of a reverse filter of mineral aggregates or geotextile filter, drained gravel body, crushed stone, raw stone or drenched prefabricated concrete, and from a concrete sink or perforated tube, plastics, which collects, transports and discharges water into the drain. These types of drainage have the disadvantage that they do not prevent the entry of water into the active area of roads and highways, which occurs mainly from the edges, as part of the water entering through the moorings moves towards the road axis, up to 2,…,2.5 m the edge of the garment and does not drain all the water in the active area of roads or highways.

The aim of the invention is to ensure that the edges of roads and highways are avoided by preventing water access from the moorings towards the axis of these communication paths. At the same time, the invention provides water drainage and filtration through cracks, cracks, other degradation of the garment or by longitudinal and transverse joints practiced in the garments. The invention solves the problem of stopping water access from the moorland, to the active area of roads and highways, and the problem of water drainage which eventually enters this active area from other sources.

The drainage screen removes the above disadvantages in that in order to avoid water entering from the moorings to the active area of the roads or highways and draining the water entering the active area of roads or motorways from other sources it is composed, a first version of a vertically-inserted geomembrane in the middle of a narrow drain, geotextile filter, drained gravel body and perforated plastic-filled collecting tube that receives, transports and dispenses the collected water, and in the second variant , is made up of a pre-fabricated geotextile prefabricated preform, which forms the prefabricated two drains and a perforated plastic tube which receives, transports and dispenses the collected water ; the drains being provided, in both variants, at the edges of road or motorway garbage, adjacent to the curbs, on the axles, for both directions of movement.

Compared to the drainage solutions of known roadways, the invention has the following advantages:

– ensures that access to water from the moorings to the active area of roads and highways is prevented;

– provide drainage of water that may be in the active area of roads and highways from various sources;

– ensures that the edges of traffic lanes, roads and highways are not wetted, which in many cases produces edges that are more strongly circulating as the road and motorway lanes, thus prolonging the operation time of these routes;

– provides drainage of water entering the vaults.

3. Conclusions

As noted, patent research involves several steps: identification, selection of technology and/or application of technology.

The technology transfer process is largely influenced by the development of technologies and technology-intensive technologies that rely heavily on science, especially in advanced technologies.

Technology transfer can be classified into two categories, depending on whether or not the technology provider intends the transfer to take place, these categories being the unintended transfer that does not bring the innovation to the innovator and the intended transfer, which is part of the competition strategy and brings benefits to the supplier.

Knowledge of new product and process technologies often crosses international boundaries through scientific and technical literature, conferences and congresses, or personal communication between researchers.

Innovative companies often try to protect themselves against the unintended transfer of technology by patenting their products.

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STADIUL ACTUAL AL CERCETĂRILOR DIN DOMENIUL MĂSURILOR PRIVIND REDUCEREA SENSIBILITĂȚII LA UMEZIRE A DRUMURILOR DIN LITERATURA DE BREVET

(Rezumat)

Brevetele de invenții în domeniul reducerii sensibilității la umezire a terasamentelor pe drumuri abordează o tematică legată de evoluția tehnologiei.

De o deosebită importanță este impermeabilitatea stratului rutier. O invenție (Iorgoiu & Velcea, 2011) se referă la o compoziție pentru pavat drumuri. Invenția descrisă mai sus face referire la o altă invenție despre un strat rutier din beton poros, realizată din ciment modificat cu polimer (Zhijian, 2009).

Stabilitatea taluzurilor drumurilor este importantă pentru reducerea sensibilităţii la umezire a terasamentelor, realizându-se prin ziduri de sprijin. Următoarea invenţie descrisă (Popescu, 2000) se referă la un zid de sprijin din elemente prefabricate care îmbină util şi elementele prefabricate recuperate.

De o deosebită importanţă privind reducerea sensibilităţii la umezire sunt tehnologiile de drenare. O invenţie (Strungă, 1994) se referă la ecranul drenant pentru drumuri care colectează, transportă şi evacuează apa infiltrată dinspre acostamente şi din zona activă a drumurilor.