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TOSHKENT DAVLAT TRANSPORT UNIVERSITETI
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The “Journal of Transport” publishes the most significant results of scientific and applied research carried out in universities of transport profile, as well as other higher educational institutions, research institutes, and centers of the Republic of Uzbekistan and foreign countries.

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Tashkent State Transport University had the opportunity to publish the scientific-technical and scientific innovation publication “Journal of Transport” based on the Certificate No. 1150 of the Information and Mass Communications Agency under the Administration of the President of the Republic of Uzbekistan. Articles in the journal are published in Uzbek, Russian and English languages.

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New constructive decisions lining of tunnels of metro

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Abstract: In the present work statement of a problem and realization of received results and decisions were caused proceeding from practice of designing and construction of responsible objects, as tunnel constructions. Received results represent the big economic value: the further development of a scientific direction in the field of tunnelling by creation and improvement of designs and introduction in practice of designing and construction of results of the lead researches. Thus, the kind of design and its constructive elements, the form and the geometrical sizes of a design, presence of lateral tunnels, top and return arch of an average tunnel and distance between columns is considered. Proceeding from principles designing and constructions of tunnels are created new constructive decisions of station of underground of the open way of works and transported a tunnel of a circular outline of the closed way of works with antiseismic joint.

Keywords: tunnel, design, underground, arch structure, construction

1. Introduction

Level of industrialization tunnelling is characterized by degree prefabricability and modularity applied designs [1, 2]. Receptions of designing transport tunnel lining basically are connected with observance of the general requirements and principles of aseismic construction [3]:

- principle of uniform distribution of seismic forces;
- principle of decrease in size of inertial seismic forces;
- principle of decrease in deformations along a tunnel;
- principle of increase of rigidity in plane of cross-section section of a tunnel. At use in seismo- perilous areas of modular designs an obligatory condition is the device of corresponding communications between the modular elements, allowing to reach reliability lining as a whole. Thus the separate elements are larger, the greater reliability possesses lining as modular joint even at high-quality grouting will always differ on the rigid parameters from modular elements. Optimum designs are modular completely closed parts lining for the open way of works. Monolithing joints of combined concrete lining are the main condition of reliability of their work. At monolithic rigid overlapping there is more rational distribution of the seismic loadings acting to lining. First of all the principle uniform strength designs should be observed. i. e., durability of units and joints of connected elements in a combined lining should provide transfer of longitudinal compressing and extension forces and bending moments. Seismic stability of a tunnel construction on adverse sites of a line is recommended to provide with constructive measures, namely longitudinal both cross-section constructive reinforcing and application of a material, stronger than others, more favorable sites. It is expedient to increase some dimensions of lining, considering expected amplitudes of vibrations of a ground and possible displacement in this connection lining concerning designed axis of tunnel. Ferried and station tunnels of undergrounds have interfaces; besides on ferried way construct various chambers of special purpose, ventilating trunks, adjunctions. In railway tunnels also is available many cross-section chambers, galleries, niches [4]. Sizes of bearings places for beams and plates of overlapping should be increased. The design of joints and units should be simple that simplifies manufacture of works and raises their quality. Seams between separate elements and after welding parts should be closed up places of high-strength concrete with lowered shrinkages, and bottlenecks - a cement mortar. For plate and box-shaped slab designs are to exclude opportunity of their shear or failure from places of bearing in any direction [4]. Author during of some years taught discipline “Designing and construction of tunnels” in the Tashkent automotive and road institute on faculty “Bridges and Transport Tunnels” and directly was engaged in improvement of existing designs of tunnels of underground. Considering the above-stated principles and requirements, working together with institute of “Design and Construction” he has advanced and received new constructive decisions of stations and ferrying tunnels of underground and their constructive elements. Now designers are used alternative designing of structures of underground lining which component is the preliminary choice of type of lining. Subsequent calculation lining, entering on the basis of calculation of necessary corrective amendments in a design and recurrence these operations allow to achieve desirable effect - provision of durability, stability and reliability under rational expenditure and the best use of materials.

2. Methods and materials

2.1. One arched type of underground concrete structure (Certificate №77 of official registration in Uzbek patent office, Registered 15. 03. 93)

Formulation of the invention is increase of seismic stability of station and decrease material capacity. Problem put by invention is solved that the pallet is executed in supported places on semivaults with cavities and the sockets located on their bottom, where cavities and the bottom end faces of semivaults have semi-cylindrical form, and semivaults are executed ridge with output part at the bottom end faces, established by the last in cavities of tray on a

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cement mortal-sandy and connected to it through joint. On Fig. 1.1 the aseismic station of underground of one-vaulted (arched) type is represented. It contains the arch 1 formed of two ridge s semivaults 2 which are rigidly connected among themselves at the end of the top hand 3 and at joint through reinforcement output part 5, monolithic concrete 6.

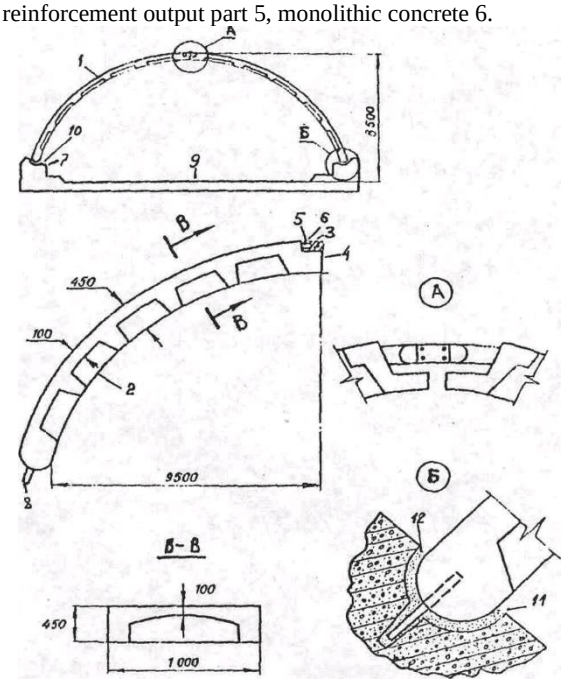

Figure. 1 One arched type of underground concrete structure

Bottom end faces of 7 semivaults 3 have semi-cylindrical form and output part 8. Tray 9 is executed in places of supporting with arched cavity bottom 10 semi-cylindrical form at the bottom of which sockets 11 are formed. Semivaults 2 are connected to a tray 9 by joint due to installation from the bottom end faces 7 in sockets 10 trays 9 on cement and mortar-sand 12 and of pins 8 of semivaults 2 in cavities 11 of tray 9.

2.2. Two arched type of underground concrete structure (Certificate № 3838 of official registration in Uzbek patent office, Registered. 08. 07. 1996)

This invention concerns to area of underground construction and can be used at erection of underground by the open way in areas with high seismicity. The two-vaulted design of station of the underground, executed of pig-iron blocks [2] is known. Such station is used at construction of underground deep laying. Aim of invention is development of a design of station of underground with raised seismic stability, allowing to lower expenditures of labour at its erection.

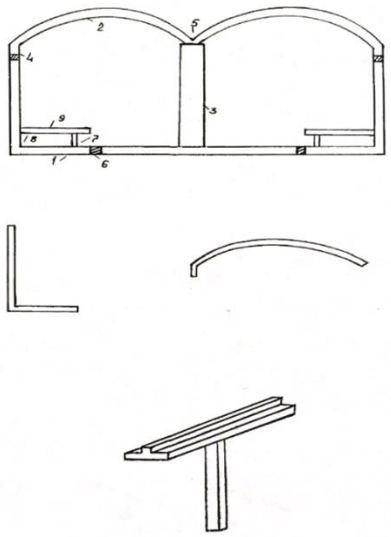

Figure. 2 Two arched type of underground concrete structure

Task is solved that in the aseismic station of underground is containing two tunnels divided by columns, each of which contains arched overlapping and wall part, they are executed from separate reinforced concrete elements and connected among themselves and to columns by means of a seismic seam. Wall part element is executed in the form of L- shaped section. Performance of station from modular elements and connection by their seismic seams allows to increase seismic stability and to reduce expenditures of labour under erection of station. The invention is explained by the drawing on which the design stations (cross-section, Fig. 2) is schematically represented. The station contains wall part elements 1, executed L-shaped section, arched slab 2 forming two tunnels, divided by a column 3. Elements are executed from reinforced concrete and connected among themselves by means of seismic seams 4, 5, 6. The L- element 1 is supplied by ledges 7 and 8 on which platform plates 9 are easily established. At erection of station separate elements 1,2 and 3 establish in the prepared tunnel or a foundation ditch and join among themselves by means of seismic seams. Seismic seams provide distribution of loading at various static and dynamic influences due to the fact that seismic stability of station increases. Use of modular elements considerably reduces terms of erection of station and the charge of a material. Such station can be used both with lateral, and with island platforms

2.3. New underground concrete structure in node of the underground line intersection (Certificate № 4386 of official registration in Uzbek patent office, Registered 24. 02. 1997)

Invention concerns to area of underground construction and can be used at erection of lines of underground by the open way in areas with high seismicity. Station of underground on crossing of lines ferrying tunnels which consists of two stations located one after another [4] is known. The closest on technical essence offered station is incorporated station in unit of crossing of the lines, containing arch in the form of frame design, platforms and the ways placed at different levels [6]. Lack of this construction is greater material inputs and duration of construction. However this given station is characterized by

insufficient seismic stability and greater material inputs on construction.

Problem of the invention is development of design of the station possessing raised seismic stability and profitability. The task in view is solved that in aseismic station in unit of crossing of lines of the underground containing arch, platforms and the ways located on different, levels, where the arch is executed in the form of a thin-walled dome-formation, and platforms and ways of one line are located in a direction, perpendicular to a direction of a platform and ways of other line, thus the place of crossing of ways is located in the centre of station. Performance of the arch of station in the form of a dome raises seismic stability of a construction and all station. The thin-walled spatial design of the arch and an arrangement of a point of crossing of ways in the centre of station raises profitability of construction (Fig. 3). The station contains the arch 1 executed in the form of a thin-walled dome with strengthened sole 2, of platform and a way of one line and a platform and a way of other line 3 which are crossed in the centre of station. 1/2 - 1/3 part of height of a dome leaves on a surface of a ground. Such constructive decision of station, on a line of crossing is economic and allows to diversify architecture of station, to use its internal space for accommodation of economic objects. The station of underground in units of crossing ferrying tunnels can be used also for construction of tunnels of underground deep laying.

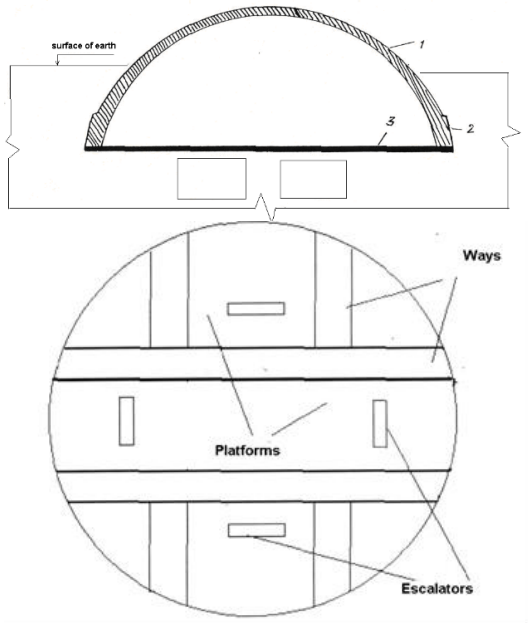

Figure 3. Station in units of crossing tunnel lines

2.4. Underground structure of tunnel ring (Certificate № 4387 of official registration in Uzbek patent office, Registered 24. 02. 1997)

Combined circular tunnel lining mounted in rings from reinforced concrete blocks is known. Each block is executed with chamfers all four corners and supplied by loops. Loops of adjacent blocks are done by plates, connected of bolts communication and filled through cement mortar [5]. However, this given design is characterized by insufficient seismic stability, labour inputs of installation. The closest on technical essence to offered is circular tunnel lining mounted by tubing blocks connected among themselves by bolts under the cross scheme by means of plates which have been built in the bases of pins, executed on corners of the block [2]. Lack this structure is complexity and labour inputs of installation because of discrepancy of manufacturing of special pins and accommodations it in their basis. A problem of the invention is development of a lining design, labour input providing decrease at installation. Task in view is solved that in aseismic circular lining from the modular reinforced concrete elements, containing tubing blocks connected by bolt connection under the cross scheme by means of board established on the docking probe placed in bottom, located on corners of the block, probes are placed in end faces of bottom and rods are executed as П shaped form. Accommodation of probes in end faces of bottom and connection of blocks by means of П shaped form which allows more quickly and with smaller labour input to carry out installation circular lining. On Fig. 4 is shosn combined reinforced concrete lining. Invention is explained by the Fig. 5 where lining contains tubing blocks 1, on corners of the block 2 are executed sockets, in end faces of sockets 2 docking probe s 3 are placed.

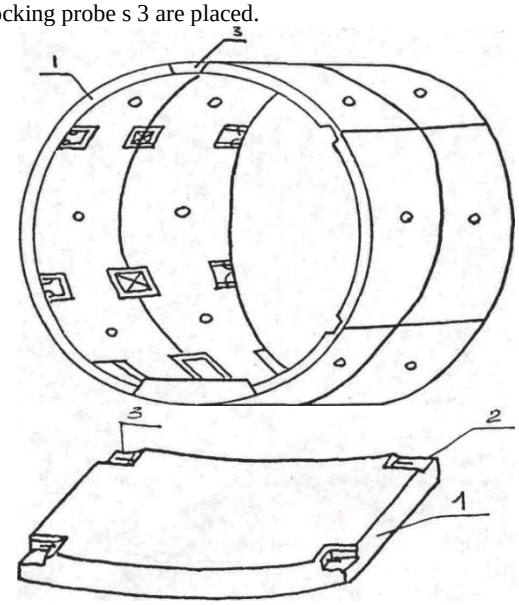

Figure 4. Circular concrete lining of underground constriction

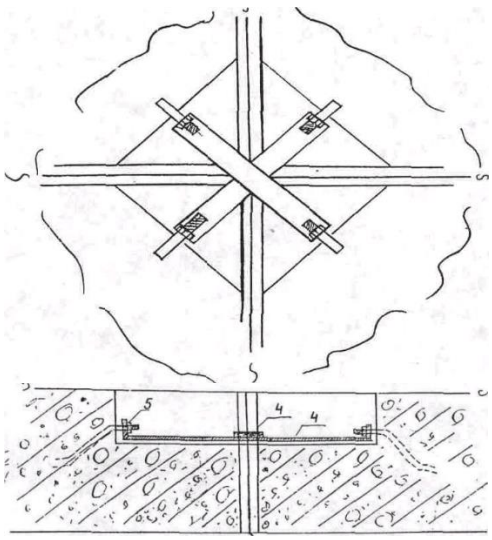

Figure 5. Place of connections

At installation carries out by rods of П shaped form and fix them with bolts 5. Blocks connect under the cross scheme. Connection providing reliable work lining of tunnel in seismic areas.

3. Conclusion

It is known, that antiseismic joints intended for strengthening of rigidity, in a longitudinal direction of an axis of a tunnel, keeping thus its integrity, puts into operation not only at influence of longitudinal seismic waves, but also at cross-section deformations tunnel lining. Such joint undergoes greater static and dynamic loadings. Therefore, joint of connection of blocks in tunnel lining should be fixed an establishment reinforcement pins in section of the concrete block. Here were development designs, in view of increase of degree prefabricability, decrease material capacity with simultaneous maintenance of durability. Thus, its constructive elements, the form and the geometrical sizes of a design, presence of lateral tunnels, the top and return arch of an average tunnel, distance between columns were considered kind of design. The offered new constructive decisions of tunnels are registered in the State register of inventions of Patent Department of Republic Uzbekistan and used at designing, the third Unusabadskoy lines of the Tashkent Metro.

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