# Faculty of Construction of GTU, Department №101 of Engineering Mechanics and Technical Expertise of Construction
## Scientific-research projects financed by ShotaRustaveli National Science Foundation

Appendix

| № | Project name, by indicating the field of science and scientific direction | Principal in vestigator | Years of project start and end | volume (amount) | Status completed/in progress | Grant code |
|---|---|---|---|---|---|---|
| 1 | Criterial conditions of static slope stability. Mathematical modeling, forecasting and protection measures of avalanche-like currents. State scientific grant for fundamental studies. | Tariel Kvitsiani | 05.05.2015-05 .05.2018ww . | 150000 lari | finished | Grant contract№ FR/139/9-151/14.http://rustaveli .org.ge |
| 2 | Complex mineral admixture for concretes, production - confirmation of applicability by testing in an industrial environment | Tamaz Batsikadze | 2023-2025 | 276000 lari | Current | N AR-22-2064 |

**1) Abstract:** The criteria of static stability and instability of natural and artificial slope are obtained; The formula to calculate the reserve of shift resistance; Complete formulas and methodology to calculate the parameters of avalanche currents; With the help of differential equations of hydrodynamics the issues of mathematical modeling of dynamic processes of landslides and snow avalanches, caused by loss of stability of slopes are studied. The methods to

assess the slope stability, and engineering measures necessary to control and stabilize the slopes are given.

1.-Specific results:-in order to solve problems of stability-unstability of mountain slopes, first of all, the dependence of the prismatic arrays of the slope on the dangerous sliding surface from the curvilinear surface was obtained in a purely analytical way. The proposed method does not require preliminary graphical construction of this surface and specifies the results obtained by the graphical-analytical method, which has the smallest reserve of static stability. 2..-The degree of stability of the slope is estimated by the stock coefficient of stability. For a small area of each point of the sliding circle, a calculation formula for the shear stability stock coefficient is obtained. Also, the formulas for calculating the coordinates of the radius of curvature and the center of curvature at the point of consideration of the dangerous swimming circle;

3.- In order to obtain the possible sliding mass of the slope, the complex natural factors and loads acting on the slope are taken into account. The analysis of the obtained results determines the location of the surface of the dangerous slip, which represents the greatest danger from the point of view of loss of stability, and which, in order to ensure stability, requires the maximum total magnitude of the modulus of grip forces to narrow the contour of the slip;

4.- A functional dependence is obtained for the shift stock coefficient, the minimum value of which is a true measure of the static stability of the area in question.

1.- Recommendations: for the drainage of slopes and quarry fields, it is desirable to use the established drainage principle schemes, during which the stability of the slopes is achieved with minimal costs.

2. In the process of mining works on a sloping slope, protective constructions for the descent of the slope should be implemented according to the developed schemes and the technology provided for the implementation of safe production of mining works. Schemes of protective structures and technologies for the safe production of mining works.

2) concrete result - the creation of several tons of work performed during the piloting of the new, improved T4 technology - a composition product containing an experimentally selected ratio of inert, pozzolanic and technogenic components - under "CCMAFfC" production conditions. Countable indicator according to delivery list is LOD no. 27 (sample).

- Recommendations - the research provided by the grant project is in progress

## Faculty of Construction

## Department of Hydrotechnics and Civil Engineering No. 104

## Projects received by the Shota Rustaveli National Science Foundation grant

| № | Grant Name | Coordinator of the project | Project start and end years | Volume (amount) | Status completed/in progress | Grant code |
|---|---|---|---|---|---|---|
| 1. | Impact of the construction of the new Poti Sea Port on the morphodynamic processes of the coastline and measures to protect against erosion - YS 21_108. Direction. 2. Engineering and Technologies: 2.7 Environmental Sciences.16.12.2021-16.12.2023 | Prof.Eduard Khuchalashvili | 2021-2023 | | In progress | YS 21_108. |
| 2. | Theoretical researchofvulnerableinfrastructuresecurity riskduringformationofpredictabledisasters(EnvironmentalEngineering - EnvironmentalandGeologicalEngineering) | Prof.Givi Gavardashvili | 2018-2022 | | completed | FR-615 2018-2022 |
| 3. | Investigation of concrete deformation using the method of holographic interferometry". | Prtof. Giorgi Dalaqishvili | 2018-2021 | | completed | FR-18-11671 |
| 4. | Flow regulation elastic barrage Natural sciences,scientific direction: 2.1.5 Earth and related environmental sciences | Prof. Eduard Khuchalashvili | 2018-2023 | | In progress | AR-18-1244 |

1. Abstract: Within the framework of the project, the change of the coastline of Poti was studied in the last decades. The general trends of the current morphodynamics and development of the coastline of Poti of the Black Sea will be studied, as from the period after the artificial intervention on the Rion River. The final version of the project, which was corrected in 2018 and commissioned by the ENKA company, was revised. Implementation of this project will increase our country's energy independence, which is important for economic and social development. However, this project, like other hydro-constructions, changes the hydrological regime of the river, reduces the transport of solid sediments to the estuary, which causes erosion of the shoreline near the estuary. In this case, it is possible that the annual volume of sediment introduced by the city canal to the beach south of Poti harbor, where it is now located, will not be enough to maintain the stability of the banks. Along with this event, the expansion of the port to the north, the construction of a new breakwater will lead to changes in the hydrological and hydrometric regimes of the sea in the coastal zone of Poti, which will be directly reflected in the changes in the existing regimes of sediment transport brought by the southern branch of the Rion River's Nabadi channel

2.Abstract:With in the frame work ofthe project, the national security strategyan drisk management action planhas been    developed the risk so     fvulner able in frastructure have been assessed taking in to account the threats caused by naturaland an thropogenic (includingterroristacts) disasters. The active cooperation of governmental and non-governmental organizations in managing and realizing risks at a modern level is presented, which will allow us to create an effective, integrated and consistent national risk management platform for the prevention and decontamination of natural and anthropogenic disasters.

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3. Abstract: In this work, the goal is to study the nature of the development of shrinkage deformations and determine the role of individual factors in the development of these deformations. The goal was also to study the process of occurrence and development of shrinkage cracks and the influence of the type of cement on this process. Taking into account the above, in the study of the deformed state of cement stone, it was decided to use the method of holographic interferometry, depriving the indicated insufficiency - the need to include an optically sensitive material in the physical model under study.

4. Abstract:   Mudflow prevention buildings and their functions are complex, they include and overlook ecological balance, Landschaft infrastructure, the safety of populated areas, etc.  For a country that is mountainous and limited in landmass, in terms of economy, mudslide preventing infrastructure, their condition and reliability are critical. According to the latest history of usage, most of them are outdated or almost non-existent, which is why the level of effectiveness of environment protection measures is low. According to statistics, there are many cases of ecological imbalance, which leads to unfavorable economic and social problems in populated areas. Therefore, in order to regulate the floods and place regulatory measures in the pipelines and to specify the parameters of the project, clarification of regularities (laws) of change of hydraulic flow parameters are given; Methodology of conducting experiments to describe the diversity of mudflow and the possibilities of impact on buildings and to obtain polynomials for the assessment of impact regularities;  In case of regulation with pressure and non-pressure structures, hydraulic functions of connected floods and selection of calculation methodology; Prediction of energy characteristics for safe transit without violation of flood movement regimes and without the generation of obstacles/bottlenecks; Criteria for overflowing obstacles

encountered based on a combination of building and flood flow parameters; Taking into account anomalies of mudflows and developing innovative methods of combating them and refining existing constructions; Improving the methodology for calculating the impact of mudflows on buildings; Modeling buildings in a laboratory setting and deriving design parameters of copyrighted buildings

## Department №105

| № | Grant name | head | Project Start/end year | Amount (volume) of money | Status completed/in progress | Grant code |
|---|---|---|---|---|---|---|
| 1. | Prediction and preve-ntion of de-br is flow catastrophic im pacts on Hydraulic projects in mountain areas. | G. Jinjikhashvili | 2015-2018 | 150000 | completed | grant DI/14/3-109/14 |

abstract :

1. specific result-recommendations :

The results of mathematical modeling will allow us to quickly describe the complete process of extreme wave movement in the reservoir (wave generation, transformation-dispersion, reflection from the dam, superposition, etc.) as a result of computer calculations. The degree of their impact on the environment will be determined. These methods have an advantage over other methods, as they take into account a number of factors that characterize both hydrodynamic and flood processes. Modern computing technologies are used in the project, in accordance with the set goals. In particular, it was implemented: solving boundary problems of

non-stationary, impulse wave motion based on analytical and numerical methods. The new results of the project have significant potential for their practical application, in particular at the stage of planning, construction and operation of reservoirs and dams in mountainous, seismically active areas, as well as during monitoring of reservoirs, for predicting the impact of destructive waves on the surrounding environment. The use of the above-mentioned methods is also promising in other fields of hydrotechnical construction, in particular, in the case of testing and constructing new types of effectively functioning structures protecting sea and river banks.

### Department №106

| № | Grant Name | Head | Project start and end years | Volume (amount) | Status completed/in progress | Grant code |
|---|---|---|---|---|---|---|
| 1 | Application of probabilistic methods in discrete optimization and scheduling problems | **Project manager:** N. Vakhania **Project performers:** B. Mamporia **Z. Sanikidze** V. Berikashvili A. Chakhvadze **M. Kublashvili** M. Pkhovelishvili | 2018-2021 | 200900 GEL | completed | DI-18-1429 |

Abstracts:
1. -specific result-
- Recommendations

In accordance with the tasks determined by the schedule of the reporting year of the project, practically important cases from the theory of schedules are considered, when under certain conditions the delivery of orders is carried out in continuous batches. To minimize the total value of deliveries and corresponding delays, including in the online scenario, new structural-algorithmic schemes of the mentioned process are proposed, on the basis of which optimal algorithms faster than the existing ones are built to solve the given task.

Within the framework of the grant topic, results have been obtained, which concern the possibility of using certain types of probabilistic distributions in such scheduling tasks, where the processor's execution times are random values. The issues related to the mathematical processing of the process of efficient distribution of tasks on processors in the case of different times are studied.

Work continued on finding probabilistic analogs of the set of optimal solutions for various scheduling problems. The obtained results show the possibility of selecting the best schedules under the conditions of determining the set and number of optimal solutions of the corresponding task.

## Department №108

| № | Project name, by indicating the field of science and scientific direction | Principal investigator | Years of project start and end | volume (amount) | Status completed/in progress | Grant code |
|---|---|---|---|---|---|---|
| 1 | Lightened inter-floor roofs in monolithic reinforced concrete high-rise buildings using composite cobiax systems | Tamaz Khmelidze | 2022-23 | | Current | PHDF 22-2256 |
| | | | | | Current | PHDF 22-1064 |
| 2 | Creation of a space defense system in Georgia by improving the tactical and tec-hnical parameters of the satellite complex | Elguja Medzmariashvili Tamaz Khmelidze | 2022-24 | | | |
| | | | | | Current | PHDF-22-852 |
| 3 | Investigation of Tensile Deformation Condition of Georgian Basalt Plastic | Gela Kipiani Tamaz Khmelidze | 2022-24 | | | |

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|---|---|---|---|---|---|
| 4 | Reinforcement with Concrete | Gela Kipiani | 2021-23 | | Current | PHDF 21-3812 |
| 5 | Calculation of bending of spatial structures with rectangular ridges by optimization Methods | Gela Kipiani | 2021-23 | | Current | PHDF 21-1399 |
| 6 | Stress analysis of thin-wall layer spatial constructions with holes using finite element methods | Gela Kipiani | 2020-23 | | Current | PHDF-21-2432 |
| 7 | Mathematical model and algorithm of elastic-plastic state of seismic thin-walled spatial systems with rectangular section | Demur Tabatadze Gela Kipiani | 2022-24 | | Current | PHDF-22-2127 |
| 8 | Monitoring of rivers/watercourses flowing through settlements and Flo-wing into the sea and development of recommendations for the Adjara region | Gela Kipiani | 2022-23 | | Current | PHDF-22-2724 |
| | Calculation of stability of reinforced concrete structures with irregularity during seismic impact | | | | | |

**Abstract:**

1. It is possible to reduce the mass of a high-rise building by using light materials in self-Supporting walls and partitions, by reducing the cross-section of reinforced concrete load-bearing structures through high-grade (B60-B80) concrete, by using rigid reinforcement, by introducing void-forming joints in monolithic reinforced concrete roofs between floors (bubble deck, Cobiax systems, etc.), Also in roofing with inserts of blocks of light material (perlite, foam plastic, foam polyurethane, polystyrene foam, fichaplast, peat, pumice) etc.

2. This topic includes improving the technical parameters of the artificial satellite introduced in the satellite complex. A satellite is an object that is intentionally placed into orbit. Following dissertation includes the study and design of the structural nodes of artificial satellites.

3. Discussed ossues of construction tendency of construction composite composite materials, including the creation, introduction and development of basaltplastic reinforcement, urgency of their use in construction, modern condition and perspectives.The main focus is on discussing the constructions required for construction, as well as on deepening theoretical knowledge

4. thin-walled spatial structures are widely used in the form of, tiles and shells in construction. Increasing their efficiency is related to the refinement of new reporting schemes and calculation methods. It is known that the study of each construction is based on certain simplifications which relate to both the displacements and the deformation magnitudes.

5. Nowadays plate and shell multilayer thin wall structures are used in most fields of engineering. The use of these types of structures in civil engineering is due to the demand for mechanical and physical properties like maximum strength and minimal weight. In some cases, this is due to the acoustic, thermal, and vibration isolation requirements.

6. The problem of calculating discontinuous thin-walled structures in elastoplastic conditions is rather complicated, relevant and requires the development of special calculation methods.
The aim of the investigation was to study the elastoplastic state of an anisotropic body with a wound. Creation of a methodology for calculating thin-walled structures that provides an accurate display of the elastoplastic state at any stage of loading with minimal calculation costs.

7. An assessment of the hydro resources of the region was carried out. Determination of discharge, turbidity and lactose-positive pollution in selected rivers. It is worth noting that a study of 300 large and small rivers in the Adjara region was carried out. After observing the studied rivers, those rivers were selected whose laboratory studies are needed to continue the research. The legislation related to the water sources and its sanitary norms in force in Georgia was studied, and the search for available information about the rivers flowing in the Adjara region was carried out to process the data obtained as a result of the planned laboratory studies.

8. The concept of restoration-reconstruction and strengthening reconstruction for large-block multi-storey buildings will be developed for the group to be strengthened relatively among mass-series groups (types) of capital buildings. Three methods of restoration-reconstruction of damaged large-block multi-story buildings are proposed: in the inner space of the building, metal indirect and system-variable rigid, in today&#39;s terminology- seismic isolators, with the arrangement of additional frames; with iron-concrete pylons built on the entire

height and perimeter of the building and arranging loggias in their space; By building pylons along the longitudinal facades of the building and building a floor/floors on top of the building, along with arranging additional frames with seismic insulators if necessary.