applied sciences

MDPI

Editorial

Special Issue "Reinforced Concrete: Materials, Physical Properties and Applications"

Alexey N. Beskopylny [1,*], Anatoly Lavrentyev [2], Evgenii M. Shcherban [3] and Sergey A. Stel'makh [4]

[1] Department of Transport Systems, Faculty of Roads and Transport Systems, Don State Technical University, 1 Gagarin Square, 344003 Rostov-on-Don, Russia
[2] Department of Electrical Engineering and Electronics, Don State Technical University, 1 Gagarin Square, 344003 Rostov-on-Don, Russia
[3] Department of Engineering Geology, Bases, and Foundations, Don State Technical University, 1 Gagarin Square, 344003 Rostov-on-Don, Russia
[4] Department of Unique Buildings and Constructions Engineering, Don State Technical University, 1 Gagarin Square, 344003 Rostov-on-Don, Russia
* Correspondence: besk-an@yandex.ru; Tel.: +7-8632738454

1. Introduction

The Special Issue is devoted to reinforced concrete in terms of materials used, physical properties and application possibilities. Several interesting prescription, technological and design features related to the latest developments in this direction are considered. The works of scientists from all over the world devoted to the study of recipe and technological factors, design factors, features of the calculation and design of reinforced concrete structures, as well as structures consisting of new types of concrete, are presented.

Special attention is paid to geopolymer concretes as a new word in building materials science and an actual direction in building science about the use of industrial waste.

The interest is also focused on road concretes and their resistance to cyclic influences, which make it possible to create communication routes between different regions, including hard-to-reach ones.

Of course, all developments will be useful for new modern unique buildings and structures of a new type, since most research is aimed at the formation of concretes with high physical properties, with smart characteristics that allow these concretes to be used in reinforced concrete structures, buildings, and structures of a unique type, and for high-rise and large-span buildings and structures.

Thus, the studies were mainly distributed according to their approach.

Regarding the design aspect of concrete structures, designers, new methods for calculating reinforced concrete and concrete structures were investigated.

From another point of view, a considerable amount of attention was paid to technological and prescription factors related to composition, technology, and the search for fundamental and applied dependencies between input factors and output parameters of new types of concrete.

2. Time-Dependent Behavior of Reinforced Concrete Beams under High Sustained Loads

An important problem is touched upon in [1]. The impact of long-term loads can, with a high degree of probability, lead to premature failure of commonly used reinforced concrete elements. This, consequently, can cause the collapse of the entire building or its part. Design mistakes, construction, and material wear errors can cause concrete elements to be subjected to high, long-term loads that are well in excess of the standard. The authors present the results of experimental tests of freely supported reinforced concrete beams with controlled shear under high long-term loads. Test results show that high continuous loading can finally lead to destruction (collapse). "However, the load level should be very

check for updates

Citation: Beskopylny, A.N.; Lavrentyev, A.; Shcherban, E.M.; Stel'makh, S.A. Special Issue "Reinforced Concrete: Materials, Physical Properties and Applications". *Appl. Sci.* **2023**, *13*, 1826. https://doi.org/10.3390/app13031826

Received: 10 January 2023
Accepted: 28 January 2023
Published: 31 January 2023

close (~98%) to the short-term power" [1]. During long-term loading, all samples had an increased displacement, with more than half of the increase in deflection occurring in the first 24 h. The deflection at shear failure during continuous loading increased by an average of 190%. An increase in deflection of reinforced concrete beam can lead to redistribution of load in redundant type of structural systems. It is important to note that the instant deflection increase caused by creep occurred during a short time (~2 min) before beam failure, which is usually interpreted as a warning of impending failure.

Thus, the authors of this work present a very important study, because large long-term loads on reinforced concrete beams create a special threat of collapse of buildings with the most massive crowds of people. In addition, the concepts of unique high-rise large-span buildings and structures are applicable to such beams and structures. That is, it concerns security issues applicable to all densely populated metropolitan cities, and such studies can be recommended and applicable in all regions of the world.

3. Bearing Capacity near Support Areas of Continuous Reinforced Concrete Beams and High Grillages

The authors of research [2] present a calculation method based on experimental data for bearing capacity of load-bearing reinforced concrete monolithic continuous sections of strip beams that connects depressed or driven reinforced concrete piles into a single foundation structure. Experimental study results, experimental tensile shear force comparison with the calculation results obtained by the methodic of design codes, as well as the stress–strain state of a continuous-beam system under extreme load conditions modelling was the rationale for the authors' method. The paper shows "the physical aspect of the phenomenon and significantly refines the physical shear model. The authors evaluated the influence of structural factors in solid research elements, and on the basis of this" [2], the Lira-SAPR PC simulated the work of the studied elements under the action of a transverse load to investigate the stress–strain state and confirm their failure pattern, adjusted in the physical model by the finite element method in non-linear setting. A calculation-bearing capacity model, which can more accurately determine their strength, is proposed for continuous reinforced concrete beam sections near the supporting and high grillages.

The authors thus present a very important study in terms of structural mechanics and building structures. Engineering solutions are outlined, supported by fundamental scientific new knowledge that relate to reinforced concrete beams and grillages, and a considerable step is taken towards studying the operation of reinforced concrete structures.

4. Simplified 2D Finite Element Model for Calculation of the Bearing Capacity of Eccentrically Compressed Concrete-Filled Steel Tubular Columns

The authors of [3] create a simplified two-dimensional numerical FEM model for calculating the loading capacity of eccentrically compressed steel tubular columns with concrete filling. "Steel Tubular Concrete Columns (CFST) are widely used in construction due to their effective resistance to compression and bending at the same time. However, at present, there is no generally accepted effective calculation method that considers both the materials nonlinearity and lateral compression. A finite element method for the analysis of RCSTC in a physically nonlinear setting is proposed by reducing a three-dimensional problem to a two-dimensional one based on the flat sections hypothesis" [3].

From the point of view of structural mechanics, a lot of work has been conducted on numerical and analytical studies. In addition, it should be emphasized that pipe-concrete columns are of particular interest—these are unique structures that, due to the resulting clip effect, are of particular interest due to the large reduction in working sections and the possibility of obtaining columns with a very high bearing capacity. This makes them applicable to objects of any level of responsibility.

5. A Method for the Design of Concrete with Combined Steel and Basalt Fiber

In [4], a method for calculating concrete with a combined steel and basalt fiber is proposed. Combining different types of fibers can improve the mechanical properties

of fiber-reinforced concrete. The present study is focused on the study of hybrid fiber-reinforced concrete (HFRC) with steel and basalt fiber. The mechanical properties of fiber-reinforced fine-grained concrete have been studied. The results obtained show that the use of optimal ratios of reinforcement makes it possible to avoid delamination of concrete mixtures and improve their uniformity. Concrete with combined reinforcement has a higher strength. An efficient methodology for the correct design of HFRC compositions has been proposed. It is based on the method of mathematical planning of the experiment. The proposed method makes it possible to optimally dose a mixture of high-performance concrete with combined reinforcement.

A very interesting approach of the authors to the concept of concrete with combined reinforcement is provided in this article. It is important that the authors not only reflect on the prescription and technological features of such a combination, but also provide methods for their calculation, thus rendering this study interesting for both designers and developers.

6. Ultimate Compressive Strains and Reserves of Bearing Capacity of Short RC Columns with Basalt Fiber

Paper [5] presents experimental studies of the ultimate compression strains of basalt concrete columns with short fibers and offers recommendations for increasing its bearing capacity by using high-strength steel rods. Increasing the bearing capacity of reinforced concrete structures is of decisive importance in contemporary construction. Experimental studies have shown that basalt fiber in an amount of 10% increased the ultimate compressibility of concrete containing ordinary crushed stone up to 20%, and on expanded clay concrete, the increase was more than 26%. The strain hardening of concrete in compression increased by 9.0% and 12%, respectively. Ultimate compressive deformations of short fiber-reinforced concrete columns with combined reinforcement increased almost 1.5 times when using light aggregate, and almost 1.2 times when using heavy aggregate. Increasing the compressibility limit of concrete makes it possible to manufacture structures with less raw material consumption and greater bearing capacity.

Short reinforced concrete columns have a number of advantages due to their lack of flexibility, and, of course, they need to be strengthened in ways other than those of standard traditional reinforcement, which has several disadvantages. The approach of the authors to the dispersed reinforcement of compressible elements is very interesting. In this case, a certain synergistic effect arises regarding the deformation of simultaneously short reinforced dispersed compressed elements, which, in general, makes such structures very effective.

7. Optimization of Composition and Technological Factors for the Lightweight Fiber-Reinforced Concrete Production on a Combined Aggregate with an Increased Coefficient of Structural Quality

In [6], "the influence of the composition of lightweight fiber-reinforced concrete and the method of distributing its components in the preparation of a fiber-reinforced concrete mixture on the mechanical properties of concrete on a combined aggregate was studied. The method of planning a mathematical experiment calculated the optimal grain size of the porous filler. The effective recipe solutions proposed by the authors made it possible to achieve an increase in compressive strength up to 25%, tensile strength up to 34%. The reduction in deformations in compression was 10%, in tension—12% in comparison with the control compositions. The coefficient of increase in strength in relation to the density of concrete on the combined aggregate was increased to 33% in comparison with the control composition without fiber and lightweight aggregate" [6].

The coefficient of structural quality is a very interesting indicator proposed by the authors. It characterizes both the weight of the structure and its bearing capacity, which emphasizes the need to achieve the optimum in these concepts. This is a very interesting engineering direction that should be developed.

8. Improving the Structural Characteristics of Heavy Concrete by Combined Disperse Reinforcement

In [7], the development of promising concrete mixtures capable of withstanding external loads is carried out. The influence of various types of fibers (steel, basalt and polypropylene) on the mechanical characteristics of concrete is considered. The regression dependences of the mechanical characteristics of concrete on the combination of fiber and its various dosages are obtained. The conducted research and the method of mathematical planning of the experiment reveals the most effective prescription solutions regarding the dosage of various types of fibers and their combinations in concrete.

Combined dispersed reinforcement, which the authors describe, is the most important key to finding optimal formulation and technological solutions for ordinary concrete due to the worldwide trend towards moving away from traditional reinforcement and towards polymer composite rods, as well as dispersed fibrous reinforcement.

9. Investigation of the Behavior of Steel–Concrete–Steel Sandwich Slabs with Bi-Directional Corrugated-Strip Connectors

The authors of [8] investigate the steel–concrete–steel sandwich panels with bidirectional corrugated strip connectors behavior. The scientific deficit is that most of the research on steel–concrete–steel (SCS) sandwich panels is aimed at controlling "concrete core cracking along with weight loss and shear connector type. In this paper, the behavior of SCS boards with corrugated bi-directional strip shear connectors (CSC) is studied. One of the main practical problems in SCS plates is the lack of access for another end welding to the second steel faceplate. The authors of this study propose an electric rivet welding to provide partial welding of the other end of the SCS to the steel sheet. For this reason, three slabs are constructed using a conventional concrete core as a reference and a lightweight concrete (LWC) core with and without steel fibers. The behavior of these slabs is compared with the behavior of SCS slabs with J-hooks and studs from previous studies. The samples are tested both under a concentrated block load" [8] and in a quasi-static mode. In general, SCS system slabs show stable behavior according to the parameters of destruction, the ratio of load and displacement in the center, load capacity, energy absorption and plasticity.

The decision proposed by the authors of the article is both a design and a technological decision. The scientific and practical prerequisites for new sandwich panels proposed by the authors are described. Of course, this curious finding needs further development.

10. Assessment on the Properties of Biomass-Aggregate Geopolymer Concrete

The authors of the study [9] evaluate the properties of geopolymer concrete from biomass and aggregate. Part of the cement is replaced with crushed granulated blast-furnace slag and fly ash, and part of the aggregate is replaced with coconut shells in lightweight concrete. Through the use of recycled biomass aggregate (SBRAC), it is possible to achieve a reduction in thermal conductivity of more than 200% compared to concrete with natural aggregate and almost 20% than that of concrete with crushed coconut shell aggregate, respectively. The economic efficiency of the solutions proposed by the authors is also presented.

Geopolymer concrete is a modern and relevant word in building materials science. Of particular relevance to this article is an interesting approach to the choice of raw materials.

11. Research of Strength, Frost Resistance, Abrasion Resistance and Shrinkage in Steel Fiber Concrete for Rigid Highways and Airfields Pavement Repair

The authors of [10] conduct a study of the strength, frost resistance, abrasion resistance and shrinkage of steel fiber-reinforced concrete for the repair of hard pavements of roads and airfields. A comprehensive study of the effect of the amount of steel anchor fiber and hardening accelerator on the properties important for the repair of hard concrete pavement properties such as strength, frost resistance, wear resistance and shrinkage is carried out. The studied concretes contained 400 kg/m^3 of cement and polycarboxylate plasticizer in an amount of 1.2% of the cement content. It is established that concrete compositions

with the amount of hardening accelerator Sika Rapid 3 from 1 to 2% of the cement content and the amount of steel fiber from 60 to 90 kg/m^3 are optimal. At the estimated age, the compressive strength of fiber-reinforced concrete is 85–90 MPa, the bending strength is from 15.5 to 17.5 MPa, frost resistance is F200, and abrasion is not higher than 0.24 g/cm^2.

Highways and airfields, due to their significant congestion and high degree of wear due to dynamic loads, require design, technological and recipe solutions. The authors present extremely interesting studies on the complex determination of a number of properties, and also offered the recipe and technological aspects of creating steel fiber concrete with a special application, namely in road and airfield pavements. This work deserves support and development in the direction of studying the applicability of such a material for even more critical road and airfield structures, as well as other structures with a similar operation pattern.

12. The Influence of Composition and Recipe Dosage on the Strength Characteristics of New Geopolymer Concrete with the Use of Stone Flour

The authors of the study [11] established the composition and dosage of the formulation influence on the strength characteristics of geopolymer concretes using stone flour. Analysis of setting time measurements showed that stone powder can accelerate the geopolymer composite curing. It is established that the addition of stone waste significantly increases the geopolymers compressive strength compared to a geopolymer composite containing only quartz sand. A microstructural geopolymer composite analysis is carried out, which confirms the effectiveness of the formulation technique implemented in this study.

Geopolymer concrete with the use of stone flour proposed by the authors is a method illustrating an important direction in the development of the general theory of geopolymer concrete. This theory is currently not fully formed and is of a diverse nature, which differs significantly in its approaches in various scientific schools. However, the use of stone flour creates certain prerequisites for obtaining geopolymer concretes of a new generation.

13. Influence of Concrete Strength Class on the Long-Term Static and Dynamic Elastic Modules of Concrete

Article [12] contributes to filling the gap in information about the concrete strength and its dynamic elastic properties. The dynamic elasticity modulus can be used to evaluate the static elasticity modulus, a key property used during the design phase of a structure, in a non-destructive manner. This article presents the long-term (6 years) laboratory test results of the concrete characteristics in terms of dynamic shear and longitudinal modulus of elasticity, dynamic Poisson's ratio, static modulus of elasticity, compressive and tensile strength in splitting, and their change depending on the strength class of concrete.

14. Experimental Investigations on the Long-Term Material Properties of Rubberized Portland Cement Concrete

In paper [13], authors present the research work results that aimed at assessing the rubber concrete long-term strength and its elastic properties. The parameters of the study are the rubber substitution of small aggregates and the age of the samples. The concrete cylinders compressive and splitting strength was obtained at the age of 5 years in combination with the static and dynamic elasticity modulus of all concrete samples. In addition, the damping factor of the material is evaluated using non-destructive testing. The density of rubberized concrete decreases with the percentage replacement of natural sand with rubber aggregates. When replacing natural sand with rubber aggregates, the density of concrete decreases. With the age of 5 years, rubberized concrete samples showed a significant drop in density. With an increase in the rubber content in concrete, both static and dynamic moduli of elasticity decrease. The same is true for compressive and tensile strength when splitting.

The authors present a very interesting approach to the creation of a new material-rubberized concrete on Portland cement. The durability of such a material plays a crucial

role in the creation of new building materials that will allow them to be used in difficult climatic conditions, as well as in difficult operating conditions. Such materials, which are combined, definitely occupy an important niche in modern building materials science and the production of building materials.

15. Influence of Mechanochemical Activation of Concrete Components on the Properties of Vibro-Centrifugated Heavy Concrete

Article [14] is devoted to the development of a complex technology for the activation effect on concrete produced by various technological methods: vibration, centrifugation and vibro-centrifugation. Chemical water activation and mechanical cement activation are considered. The relevance and prospects of the double complex mechanochemical activation of the components of the concrete mixture are substantiated. In addition, a connection is established between the concrete production technology and its components activation technology. The most optimal manufacturing technology and activation parameters are determined, which result in the greatest increase in the strength characteristics of concrete.

An interesting approach to the creation of new variotropic concretes is offered by the authors. At the same time, the authors combine the engineering solution for creating layered structures with a smooth transition of properties along the section with technological solutions, which, in turn, are complex; that is, the authors present the mechanochemical activation of variotropic concretes, which in itself is of great interest and deserves special attention of readers.

16. Influence of Composition and Technological Factors on Variatropic Efficiency and Constructive Quality Coefficients of Lightweight Vibro-Centrifuged Concrete with Alkalized Mixing Water

Article [15] is devoted to a perspective technology for the manufacture of reinforced concrete structures with low energy, resource and labor intensity based on an improved variotropic configuration of vibro-centrifuged concrete using activated high-pH water. Synergistic effect from the joint use of the proposed new solutions is proven by experimental and theoretical research. Due to the recipe-technological methods proposed by the authors, it was possible to achieve an improvement in physical and mechanical characteristics of up to 20%, design and operational characteristics—up to 70%.

The approach of the authors on the chemical treatment of mixing water with the help of plant waste is interesting. This is very important, since the research is at the intersection of the sciences of agriculture, construction, design and technology of building materials.

17. The Rapid Chloride Migration Test in Assessing the Chloride Penetration Resistance of Normal and Lightweight Concrete

Corrosion caused by chlorides is one of the main causes of wear in reinforced concrete. The authors of [16] perform a chloride rapid migration test in assessing the resistance to chloride penetration in normal and lightweight concrete. One of the most commonly used methods for evaluating the resistance of concrete to chloride penetration is the Chloride Rapid Migration Test (RCMT). This is a quick and easy method which, however, may not reflect the behavior of concrete in real world transport of chlorides. Other methods, such as immersion (IT) and wet-dry testing (WDT), provide a more accurate approximation of reality, but are labor intensive and very time consuming. The purpose of this article is to analyze the capabilities of RCMT in evaluating the resistance to chloride penetration in conventional concrete produced with different types of aggregates (regular and light) and paste composition (variable binder type and water/binder ratio). RCMT is capable of grading concretes into different chloride penetration resistance classes under different exposure conditions, regardless of aggregate type and water/binder ratio.

The resistance of concretes of various densities to the penetration of chlorides is the most important indicator for their operational reliability. The authors review such research in relation to ordinary and lightweight concrete, which makes their developments extremely useful for various construction industries.

18. Assessment of the Permeability to Aggressive Agents of Concrete with Recycled Cement and Mixed Recycled Aggregate

The building industry's acceptance of recycled concrete as a sustainable alternative depends on a reliable assessment of its permeability to corrosive agents. Study [17] analyzes the transport mechanisms associated with chloride (Cl^-), oxygen (O_2) and carbon dioxide (CO_2) ions in cement concrete based on recycled concrete (GRC) alone or in combination with Recycled Aggregate (MRA) concrete mix. The data obtained show that, regardless of the type of aggregate, GRC concrete displays lower penetration resistance than conventional concrete due to its greater porosity. However, the O_2 permeability is consistently below 4.5×10^{-17} m^2 and the CO_2 infiltration is below 4 $mm/yr^{0.5}$, indicating the high quality of the concrete. On the other hand, the introduction of 25% GRC increases the penetration of CO_2 and Cl^- by 106% and 38%, respectively. In addition to these findings, under normal carbonization conditions, the passivity of the reinforcement will be guaranteed in such recycled materials for a 100-year service life.

The study of recycled cement is the most important direction in the field of waste disposal, as well as the most interesting scientific and engineering development in building materials science.

19. Fracture Behavior of Concrete with Reactive Magnesium Oxide as Alternative Binder

Study [18] evaluates the fracture magnesium oxide (MgO) concrete behavior. Replacing cement with MgO is a high-potential option for the concrete industry due to the potential better stability and reduced shrinkage compared to plain concrete. At 28 days, the wedge split test shows that the fracture toughness intensity factor (KI) and stress–strain softening parameters are evaluated. The experimental results show that the cement replacement with MgO reduces the fracture energy by 13–53%. In addition, the fracture energy is determined to correlate with both compressive strength and elastic modulus. A clear relationship between these properties is important for detail prediction of the non-linear reinforced concrete structures behavior with partial replacement of cement with MgO.

Reactive magnesium oxide as an alternative binder for concrete is a new word in building materials science and in the creation of building composites. The methodological approach of the authors is very intriguing, as well as the depth of their scientific research and engineering developments.

20. Conclusions

Summing up the presented issue, we would like to once again emphasize and note the extraordinary scientific depth of the research carried out and the high degree of confirmation of these theoretical premises by real experimental and numerical studies, which together offers high-value results for both the engineering field and the continuation of scientific developments.

Author Contributions: Conceptualization, A.N.B., A.L., S.A.S. and E.M.S.; methodology, A.N.B., A.L., S.A.S. and E.M.S.; software, A.N.B., A.L., S.A.S. and E.M.S.; A.N.B., A.L., S.A.S. and E.M.S.; formal analysis, A.N.B., A.L., S.A.S. and E.M.S.; investigation, A.N.B., A.L., S.A.S. and E.M.S.; resources, A.N.B., A.L., S.A.S. and E.M.S.; data curation, A.N.B., A.L., S.A.S. and E.M.S.; writing—original draft preparation, A.N.B., A.L., S.A.S. and E.M.S.; writing—review and editing, A.N.B., A.L., S.A.S. and E.M.S.; visualization, A.N.B., A.L., S.A.S. and E.M.S.; supervision, A.N.B., A.L., S.A.S. and E.M.S.; project administration, A.N.B., A.L., S.A.S. and E.M.S.; funding acquisition, A.N.B., A.L., S.A.S. and E.M.S. All authors have read and agreed to the published version of the manuscript.

Acknowledgments: We thank all authors and reviewers for their valuable contributions to this Special Issue. The MDPI management and staff are also to be commended for their tireless editorial support and for the success of this project.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Shubaili, M.; Elawadi, A.; Orton, S.; Tian, Y. Time-Dependent Behavior of Reinforced Concrete Beams under High Sustained Loads. *Appl. Sci.* **2022**, *12*, 4015. [CrossRef]
2. Kos, Z.; Klymenko, Y.; Karpiuk, I.; Grynyova, I. Bearing Capacity near Support Areas of Continuous Reinforced Concrete Beams and High Grillages. *Appl. Sci.* **2022**, *12*, 685. [CrossRef]
3. Chepurnenko, A.; Yazyev, B.; Meskhi, B.; Beskopylny, A.; Khashkhozhev, K.; Chepurnenko, V. Simplified 2D Finite Element Model for Calculation of the Bearing Capacity of Eccentrically Compressed Concrete-Filled Steel Tubular Columns. *Appl. Sci.* **2021**, *11*, 11645. [CrossRef]
4. Dvorkin, L.; Bordiuzhenko, O.; Tekle, B.H.; Ribakov, Y. A Method for the Design of Concrete with Combined Steel and Basalt Fiber. *Appl. Sci.* **2021**, *11*, 8850. [CrossRef]
5. Shilov, A.V.; Beskopylny, A.N.; Meskhi, B.; Mailyan, D.; Shilov, D.; Polushkin, O.O. Ultimate Compressive Strains and Reserves of Bearing Capacity of Short RC Columns with Basalt Fiber. *Appl. Sci.* **2021**, *11*, 7634. [CrossRef]
6. Mailyan, L.R.; Beskopylny, A.N.; Meskhi, B.; Stel'makh, S.A.; Shcherban, E.M.; Ananova, O. Optimization of Composition and Technological Factors for the Lightweight Fiber-Reinforced Concrete Production on a Combined Aggregate with an Increased Coefficient of Structural Quality. *Appl. Sci.* **2021**, *11*, 7284. [CrossRef]
7. Mailyan, L.R.; Beskopylny, A.N.; Meskhi, B.; Shilov, A.V.; Stel'makh, S.A.; Shcherban', E.M.; Smolyanichenko, A.S.; El'shaeva, D. Improving the Structural Characteristics of Heavy Concrete by Combined Disperse Reinforcement. *Appl. Sci.* **2021**, *11*, 6031. [CrossRef]
8. Ghalehnovi, M.; Yousefi, M.; Karimipour, A.; de Brito, J.; Norooziyan, M. Investigation of the Behaviour of Steel-Concrete-Steel Sandwich Slabs with Bi-Directional Corrugated-Strip Connectors. *Appl. Sci.* **2020**, *10*, 8647. [CrossRef]
9. Liu, H.; Li, Q.; Quan, H.; Xu, X.; Wang, Q.; Ni, S. Assessment on the Properties of Biomass-Aggregate Geopolymer Concrete. *Appl. Sci.* **2022**, *12*, 3561. [CrossRef]
10. Kos, Ž.; Kroviakov, S.; Kryzhanovskyi, V.; Grynyova, I. Research of Strength, Frost Resistance, Abrasion Resistance and Shrinkage of Steel Fiber Concrete for Rigid Highways and Airfields Pavement Repair. *Appl. Sci.* **2022**, *12*, 1174. [CrossRef]
11. Beskopylny, A.N.; Shcherban', E.M.; Stel'makh, S.A.; Mailyan, L.R.; Meskhi, B.; El'shaeva, D. The Influence of Composition and Recipe Dosage on the Strength Characteristics of New Geopolymer Concrete with the Use of Stone Flour. *Appl. Sci.* **2022**, *12*, 613. [CrossRef]
12. Alexa-Stratulat, S.-M.; Mihai, P.; Toma, A.-M.; Taranu, G.; Toma, I.-O. Influence of Concrete Strength Class on the Long-Term Static and Dynamic Elastic Moduli of Concrete. *Appl. Sci.* **2021**, *11*, 11671. [CrossRef]
13. Toma, I.-O.; Alexa-Stratulat, S.-M.; Mihai, P.; Toma, A.-M.; Taranu, G. Experimental Investigations on the Long Term Material Properties of Rubberized Portland Cement Concrete. *Appl. Sci.* **2021**, *11*, 10868. [CrossRef]
14. Shcherban', E.M.; Stel'makh, S.A.; Beskopylny, A.; Mailyan, L.R.; Meskhi, B. Influence of Mechanochemical Activation of Concrete Components on the Properties of Vibro-Centrifugated Heavy Concrete. *Appl. Sci.* **2021**, *11*, 10647. [CrossRef]
15. Stel'makh, S.A.; Shcherban', E.M.; Beskopylny, A.N.; Mailyan, L.R.; Meskhi, B.; Butko, D.; Smolyanichenko, A.S. Influence of Composition and Technological Factors on Variatropic Efficiency and Constructive Quality Coefficients of Lightweight Vibro-Centrifuged Concrete with Alkalized Mixing Water. *Appl. Sci.* **2021**, *11*, 9293. [CrossRef]
16. Pontes, J.; Bogas, J.A.; Real, S.; Silva, A. The Rapid Chloride Migration Test in Assessing the Chloride Penetration Resistance of Normal and Lightweight Concrete. *Appl. Sci.* **2021**, *11*, 7251. [CrossRef]
17. Cantero, B.; Bravo, M.; de Brito, J.; Sáez del Bosque, I.F.; Medina, C. Assessment of the Permeability to Aggressive Agents of Concrete with Recycled Cement and Mixed Recycled Aggregate. *Appl. Sci.* **2021**, *11*, 3856. [CrossRef]
18. Forero, J.A.; Bravo, M.; Pacheco, J.; de Brito, J.; Evangelista, L. Fracture Behaviour of Concrete with Reactive Magnesium Oxide as Alternative Binder. *Appl. Sci.* **2021**, *11*, 2891. [CrossRef]