



Study of the Mechanical Properties of High Strength Concrete Obtained With the Help of Chemical Additives

Kurbanov Zavkiddinjon Khamidulloevich ¹, Rasulova Nargiza Botirkulovna ²,
Komila Narzullayeva ³, Ortikulov Davron ⁴

^{1,2} Professor of the Jizzakh Polytechnic Institute

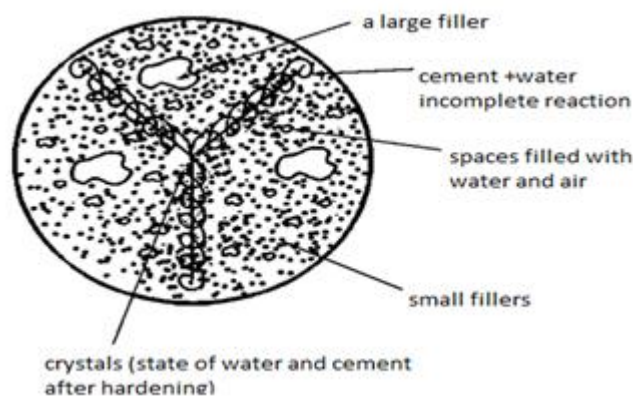
^{3,4} Students of the Jizzakh Polytechnic Institute, Department "Building materials and structures"

Abstract: This paper examines the mechanical properties of high-strength concrete using a chemical additive super plasticizer (POLIMIX x2-222), achieved through chemical additives in increasing the strength of concrete and reinforced concrete structures.

Keywords: super plasticizer (POLIMIX x2-22), water / cement ratio, mobility, concrete structure, deformation, mechanical properties, cubic strength.

It is known that the construction of modern residential, public and industrial buildings being built today cannot be imagined without concrete and reinforced concrete structures. The role of factories producing reinforced concrete products and enterprises supplying building materials in the construction and reconstruction of buildings and structures that adorn the cities of our republic is considered to be special [1].

Currently, about 70...80 % of the total volume of building materials and products is occupied by concrete and products and structures made on their basis. Concrete and reinforced concrete, due to their physical and mechanical properties, durability, technical and economic efficiency of their production and sufficient reserves of raw materials, today and in the future will remain the material with the greatest potential in capital construction [1].



Pic. 1. Concrete structure

Concrete is a complex material and its properties can change significantly over time and during use. Only with deep knowledge of the nature of this material, the formation of its structural structure, can it be used in building structures for various purposes and effectively used [4, 5].

- ✓ $W/C=0,15...0,2$ – the amount of water necessary for the reaction of boron cement;
- ✓ $W/C=0,3...0,4$ – thick mixture (mainly used in factory conditions);
- ✓ $W/C=0,5...0,7$ – plastic mixture (mainly used at the construction site);

The advantages of concrete are its reliability, long-term durability, resistance to atmospheric and other influences, simplicity of product preparation, and the possibility of giving different shapes to the products being prepared. The demand for cement used in concrete and reinforced concrete works is increasing every year [4, 5].

In order to control the rheological properties of concrete and concrete mixture, as well as to save cement consumption, various additives are added to concrete. It is recommended to add chemical additives to the concrete mixture in the amount of 0.1...2% by weight of cement. Today, in our country and other developed countries, more than 300 types of chemical additives are produced in the composition of the concrete mixture [3, 4, 5].

Analysis of scientific works carried out on the research: Scientists of foreign countries who have made a great contribution to the technology of concretes prepared on the basis of chemical additives and superplasticizers and hyperplasticizers Bazhenov Yu.M., Ratinov V.B., Rozenberg T.N., Batrakov V.G., Izotov V.S., Ibragimov R.A. and many other researchers conducted scientific research on chemical additives of various composition.

Also in this regard, researchers and scientists who have conducted and are conducting a number of scientific studies in the Republic of Uzbekistan can be cited as an example. prof. Samiev N.A., prof. Jalilov A.T., prof. Among them Gaziev U.A., prof. Turapov M.T. and many other scientists.

Research scientific innovation. Selection of high-quality concrete composition based on superplasticizer using local raw materials (POLIMIX x2-222) and recommending the optimal option is the main scientific innovation of the article.

In recent years, high-performance polycarboxylate superplasticizers have become the most widely used in construction practice in the development of new generation concretes. In foreign literature, superplasticizers of this group were named "Hyperplasticizers".

Addition of chemical additives to the concrete mixture - (POLIMIX x2-222) hyperplasticizer affects not only the rheological properties of the concrete mixture, but also the mechanical and operational properties of the concrete. It reduces the mobility (cone settlement) of the concrete mixture under the influence of chemical additives to 16-20 cm and the amount of water added to the composition of the concrete mixture. The decrease in water content has a direct effect on the physical and mechanical properties of concrete.

Materials and experimental results. PTs400 D20 portland cement of "HUAXIN CEMENT JIZZAKH" plant was used as a binder in the test works, crushed limestone from the "Koytash" quarry with a fraction of 5-20 mm was used as a filler, and sand (klines, limestone) with a coarseness modulus of 3.2 was used as a fine filler.

A superplasticizer (POLIMIX x2-222) was used as a chemical additive to the concrete mixture. The composition of the concrete mixture was calculated by Skramtaev's "Absolute volumes" method.

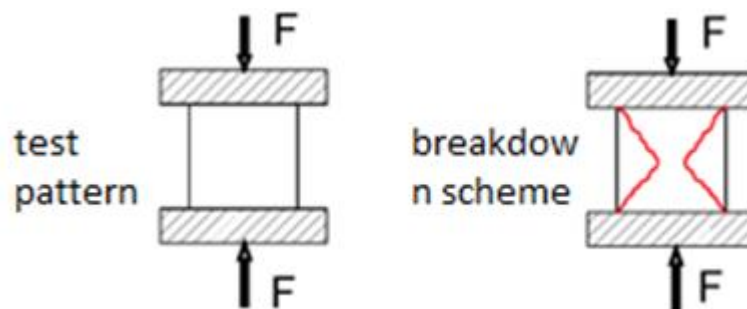
A cube with dimensions of **100x100x100 mm** is taken as a sample.

Cube strength is used to control the quality of concrete.

Cube strength depends on the dimensions of the cube. For example,

- in a cube with a rib of 100 mm - 0.95R;
- in a cube with a rib of 150 mm – 1R;

➤ in a cube with a rib of 200 mm – 1.1R [4,5].



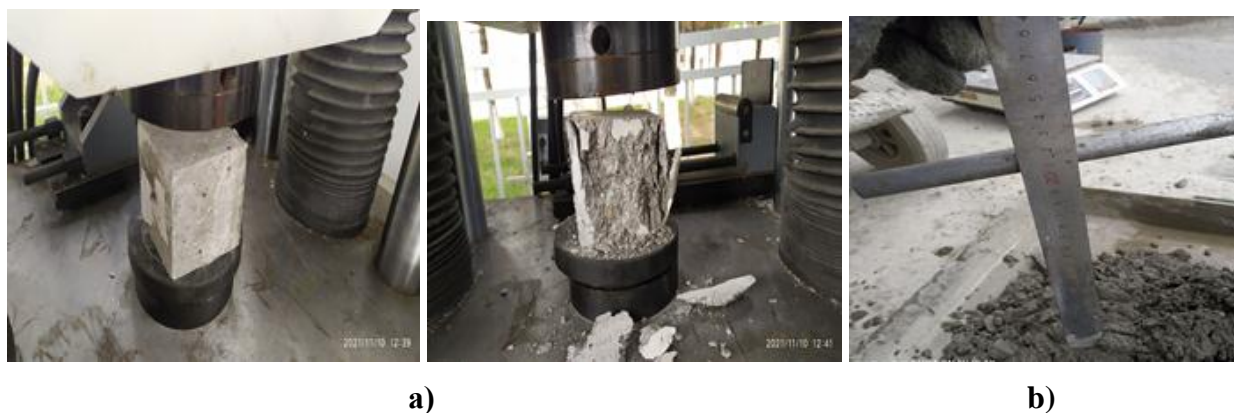
Pic. 2. Scheme of concrete cube failure during testing

Table 1. 1m³ of concrete composition selected for research work

№	Concrete brand (class)	CS (cone subsidence, cm)	Raw material for 1 m ³					Water, l	Mass, kg/m ³
			Cement, kg	Sand, kg	Gravel, kg	Polimix x2-222, кг			
1	B30 (M400)	M4(16-20)	435	1175	595	3.48	190	2398.48	
2	B35 (M450)	M4(16-20)	465	1145	610	3.72	190	2413.72	
3	B40 (M500)	M4(16-20)	500	1100	630	4.5	190	2424.5	

For the experiment, concrete class B40 (M500) was chosen. The samples were tested on a hydraulic press after 7 and 28 days.

The results obtained are presented in table 2. Determination of the settlement of the prepared concrete samples and concrete mix is shown in pic.3.



Rice. 3. a) Samples prepared by adding superplasticizer (POLYMIX x2-222) to heavy concrete. b) cone draft

The strength properties of concrete are the normal and calculated compression and elongation of concrete and the interlocking of concrete with reinforcement.

Deformability of concrete refers to concrete's compressibility and elongation under load, shrinkage and sliding, swelling and deformation under the influence of temperature.

The physical properties of concrete include its waterproofness, cold-heat resistance, corrosion resistance, fire resistance, heat-cold resistance and acid resistance.

The physical and mechanical properties of concrete depend on the method of its preparation and the materials included, that is, binders, large and small fillers, water. They depend on concrete composition and hardening conditions [2, 5].

Table 2. Effect of ceperplasticizer B40 (M500) on the compressive strength of ordinary heavy concrete (POLIMIX [2-222])

№	Age of concrete	Width b_0 , MM	Total surface S , MM^2	Length l_0 , MM	Given force P_{max} , кН	Compressive strength $R_{сж}$, Мпа	Modulus of elasticity in compression E_c , Мпа
1	7 daily	100.000	10000.000	100.000	483.433	48.343	415.419
2	28 daily	100.000	10000.000	100.000	788.043	78.804	454.976

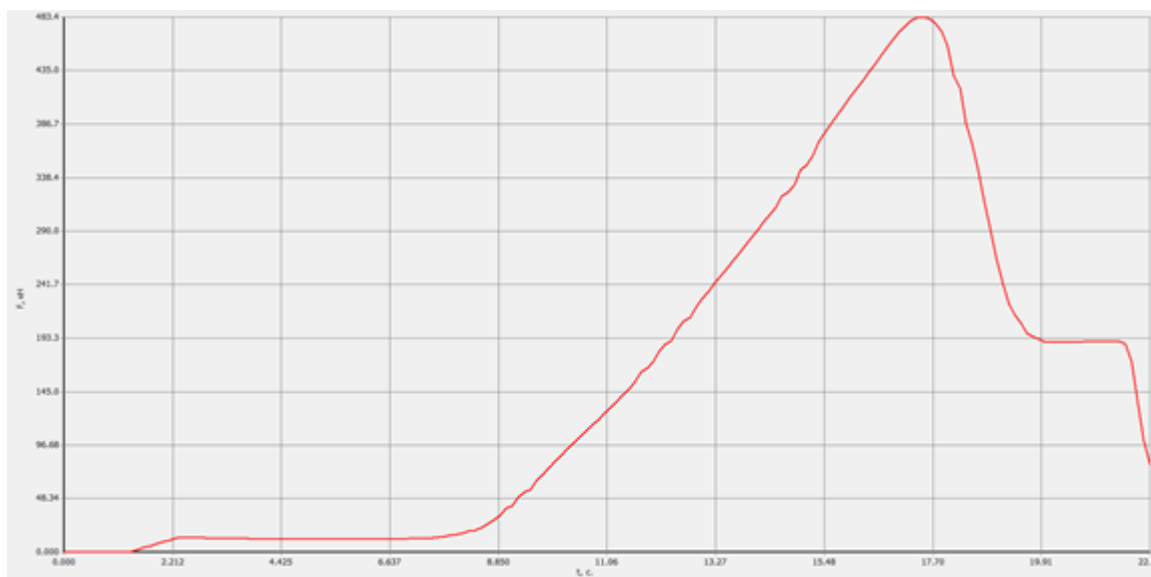


Fig. 4. Presented 7-day strength of ordinary heavy concrete B40 (M500) graph

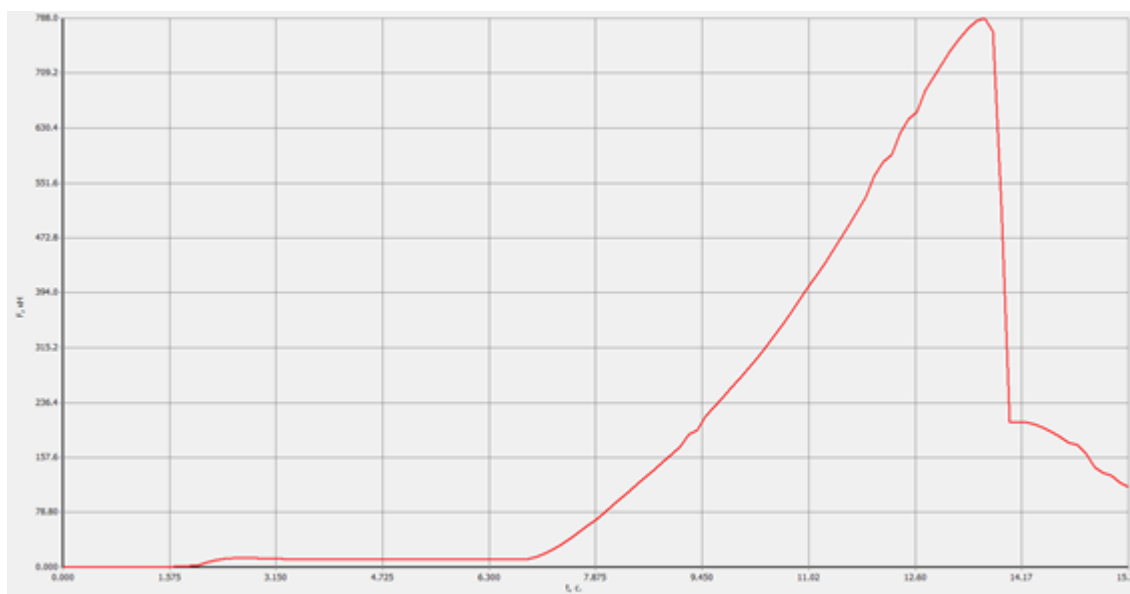


Fig. 5. Graph showing the 28-day strength of ordinary heavy concrete B40 (M500).

When 0.9% of superplasticizer (POLIMIX x2-222) is added to the concrete composition, the cone subsidence is 16 cm to 20 cm.

In conclusion, it was found that the strength of concrete obtained with (POLIMIX x2-222) cyperplasticizer, achieved at 28 days, is 61% higher than at 7 days.

List of used literature

1. Ўзбекистон Республикаси Президентининг 2019 йил 23 майда ПҚ-4335-сонли “Қурилиш материаллари саноатида жадал ривожлантиришга оид қўшимча чора-тадбирлар тўғрисида” Қарори.
2. Газиёв У.А., Кадирова Д.Ш. “Бетон ва қоришмалар учун қўшимчалар” Ўқув қўлланма. 2015.
3. Ҳ.А.Акрамов, Ҳ.Н.Нуридинов “Бетон ва темир-бетон буюмлар ишлаб чиқариш технологияси”. Тошкент 2011-йил.
4. Ҳ.Акрамов, Ш.Рахимов, Ҳ.Нуриддинов, М.Туропов “Бетон тўлдирувчилари технологияси” , Ўқув қўлланма, Тошкент, 2012.
5. Ҳ. Кулдашев “Бетон ва темирбетон технологияси” Дарслик, Тошкент “SАННОF” МЧЖ 2021 й
6. Парсаева, Н. Ж., Курбанов, З. Х., & Бобокулова, Ш. (2021). Исследование физико-механических свойств бетонных изделий используемые промышленные отходы. *Science and Education*, 2(5), 417-423.
7. Курбанов, З., & Ортиккулов, Д. (2023). ВЫСОКОПРОЧНЫЙ ГИПСОВЫЙ ВЯЖУЩИЙ НА ОСНОВЕ СУЛЬФАТСОДЕРЖАЩЕГО ОТХОДА. *Models and methods in modern science*, 2(2), 5-12.
8. Kurbanov, Z., & Parsaeva, N. (2022, June). Strong grinding based on local raw materials getting stones. In *AIP Conference Proceedings* (Vol. 2432, No. 1, p. 030104). AIP Publishing LLC.
9. Курбанов, З. Х., & Сулайманов, Ж. Ж. (2021). Подготовка зданий к отделке местными материалами из натурального камня. *Science and Education*, 2(5), 403-409.
10. Курбанов, З. Х., & угли Холбоев, С. О. (2021). Микроарматурализация сухих строительных смесей волластонитом. *Science and Education*, 2(5), 410-416.