

Kazakh national research technical university named after K.I. Satpayev

UDK 691.32

On the rights of the manuscript

TOLEGENOVA AIGERIM KAIRATOVNA

Development of the composition of monolithic concrete using chemical additives

8D07305 – Civil engineering and production of building materials and structures

Dissertation for the degree of
Doctor of Philosophy (PhD)

Scientific supervisor:
Doctor of technical sciences,
Academician of the National Academy
of Sciences of the Republic of Kazakhstan
Professor K. Akmalaiuly

Foreign supervisor:
PhD, Professor, Vilnius
Gediminas Technical University, Lithuania
Gintautas Skripkiunas

Republic of Kazakhstan
Almaty 2025

CONTENT

REGULATORY REFERENCES.....	4
DEFINITIONS.....	5
DESIGNATIONS AND ABBREVIATIONS.....	6
INTRODUCTION.....	7
1 REVIEW OF THE CURRENT STATE OF RESEARCH IN THE FIELD OF CONCRETE MATERIALS AND THE NEED TO DEVELOP NEW FORMULATIONS WITH CHEMICAL ADMIXTURES.....	11
1.1 Monolithic concrete: properties, composition, application.....	11
1.2 Modern chemical admixtures: types and their functions.....	14
1.3 The effect of chemical admixtures on the technological properties of concrete mixtures.....	20
1.4 The effect of chemical admixtures on the operational properties of concrete.....	23
1.5 The effect of chemical admixtures on the rheological properties of concrete.....	26
1.6 Current trends in the development of concretes with chemical admixtures.....	30
Conclusions of Chapter 1.....	32
2 MATERIALS AND TESTING METHODS OF MODIFIED CONCRETE AND CEMENT COMPOSITES.....	33
2.1 Materials used in research.....	33
2.1.1 The characteristics of Portland cement.....	33
2.1.2 Fine aggregate.....	35
2.1.3 Coarse aggregate.....	35
2.1.4 The Characteristics of plasticizing admixtures.....	36
2.1.5 The Characteristics of air-entraining admixtures.....	37
2.2 The preparation concrete mortar and cement mortar composition with chemical admixtures.....	38
2.3 The characteristics of research methods.....	41
2.3.1 The study of consistency of cement mortar.....	41
2.3.2 The study of technological properties of concrete mortar.....	42
2.3.3 The study of the durability and porosity properties of cement mortar...	43
2.3.4 The study of rheological properties and water bleeding of cement mortar.....	45
2.3.5 The invesigation of microstructure and elemental analysis of modified concrete compositions.....	50
Conclusions of Chapter 2.....	52
3 COMPLEX EFFECT OF CHEMICAL ADMIXTURES ON TECHNOLOGICAL PROPERTIES OF CONCRETE AND DURABILITY AND POROSITY OF CEMENT MORTAR.....	53
3.1. The influence of both plasticizing and air-entraining effect on technological properties of concrete.....	53