

# DEVELOPMENT OF NEW SUSTAINABLE CONSTRUCTION MATERIALS USING BY-PRODUCT SULFUR AND OTHER INDUSTRIAL BY-PRODUCTS IN KAZAKHSTAN

J.R.Kim\*, D.Saliyev, G.Zhumabekov, D.Bakhtiyarov

Department of Civil Engineering, School of Engineering, Nazarbayev University, Astana, Kazakhstan \*jong.kim@nu.edu.kz

## INTRODUCTION

The growing oil and gas industry in Kazakhstan generates significant quantities of excess by-product sulfur from the production and refining of petroleum and natural gas. Because of limited resources and the required infrastructure to manage resulting toxic and hazardous wastes, this by-product sulfur has little commercial or social benefits and is currently being treated as waste. This leads to the challenge of dealing with huge volumes of sulfur for its better handling, transport, and storage. The objectives of this project are: 1) to develop new sustainable construction materials using the by-product sulfur and other industrial by-products with special emphasis on long term production of the modified sulfur concrete; and 2) to investigate its potential for use in concrete with satisfying both fresh and hardened properties and providing satisfactory durability performance with respect to deterioration mode of sulfur concrete structure exposed to Kazakhstan's severe environmental condition such as the combination of freeze-thaw (F-T) and chloride ion diffusion conditions.

## METHODOLOGY

The project is organized into nine tasks; Task 1: Literature Review and Synthesis, Task 2: Identification and Collection of Materials, Task 3: Material Characterization and Selection, Task 4: Mortar Testing, Task 5: Concrete Testing, Task 6: Recommendation for the Promising Modified Sulfur Concrete, and Task 7: Documentation of Research Report.

The systematic approach will be conducted in order to determine the availability of by-product sulfur (BPS), sulfur modifiers (SMs), and mineral fillers (MFs) in Kazakhstan and establish a test protocol that investigates their potential for use in sulfur concrete. A large number of all possible sources of SMs and MFs will be identified in Task 2 and promising materials will be collected in Task 2. One innovative idea proposed by the research team is to characterize candidate materials by using methods that are closely related to the performance of SMs and MFs in sulfur concrete (Task 3).

## EXPECTED RESULTS

The potential economic benefits of the utilization of modified sulfur concrete as construction materials may consists of (i) saving of conventional materials and (ii) a considerable improvement in the mechanical properties and durability of normal sulfur concrete, which can open up new markets to modern construction material engineering.