Challenge for the Engineering Cup

STABLE WASTE DUMP

Focus Area

Solutions in the field of open-pit mining, slope stability, and engineering geotechnology.

Objective

To develop an engineering solution that improves the stability of waste dump masses and enhances the quality of haul roads by using ash and slag waste (ASW) as an efficient component of an engineered mixture.

Company Overview

SUEK (Siberian Coal and Energy Company) is one of the largest coal and power producers in Russia.
The company supplies energy to millions of consumers, implements programmes to strengthen industrial safety and sustainability, and actively introduces digital and engineering solutions across its operations.

Context and Relevance

At many coal mining enterprises, dump stability is a critical factor for safe mining operations. Low strength of overburden rocks leads to risks of landslides, slope deformation, and forced equipment downtime.

At the same time, SUEK is seeking efficient ways to utilise ASW — a by-product of thermal power plants.
These materials can serve as a promising component for engineered mixtures that improve the stability of waste dumps and increase the bearing capacity of haul roads.

Using ASW makes it possible to solve two key tasks:
• improving the safety of waste dump formation;
• reducing waste volume and environmental impact.

Problem Statement

The existing dump parameters (slope angle, strength characteristics of the rock mass) do not ensure the required level of stability.
It is necessary to increase the slope angle of the dump bench and enhance the bearing capacity of haul roads using available materials — ASW.

Task for Participants

Develop an engineered mixture based on ASW that will allow:
• increasing the dump slope angle;

• improving the stability of the dump mass;
• enhancing the bearing capacity of haul roads at the site;
• evaluating the economic efficiency of using the mixture;
• presenting an implementation roadmap for 2026-2030.

Participants must propose a technology for applying the mixture, calculate its effect, and substantiate its advantages for the enterprise.

Input Data

• Dump bench height: 10 m
• Bench slope angle: 21°
• Safety berm width: 40 m
• Groundwater conditions: no water accumulation
• Overburden rocks: siltstones, argillites
• Internal friction angle of the dump mass: 13°
• Ash and slag waste: available in required volumes (composition and properties may be specified by participants for modelling purposes)

Constraints

• The solution must be feasible under the operating conditions of the active open-pit mine without halting production.
• The mixture must be safe and environmentally acceptable.
• Materials must be suitable for transport and placement.
• Any increase in slope angle must be justified through stability calculations.
• The economic efficiency must be confirmed by calculations (cost reduction, ASW utilisation, work optimisation).

Expected Deliverables

1. A design of an engineered ASW-based mixture (structure, composition, properties).
2. Slope stability calculations reflecting the effect of the mixture (increase in slope angle).
3. Explanation of the mixture's impact on haul road bearing capacity.
4. Economic justification (costs, benefits, payback).
5. Implementation roadmap for 2026-2030.