DRAGON

DEVELOPMENT OF RESOURCE-EFFICIENT AND ADVANCED UNDERGROUND TECHNOLOGIES

The Challenge

Future tunnelling projects in Europe are expected to generate around 800 million tonnes of excavated material, which is usually disposed of in landfills.

Efficient use and recycling of this material would substantially reduce the demand for primary mineral resources, thereby improving resource efficiency, reducing environmental impacts and sending less material to landfill. Finding a solution to this challenge is therefore of great economic and environmental interest.

The DRAGON Approach

DRAGON (Development of Resource-efficient and Advanced Underground Technologies) sets out to solve this challenge by developing a **system for the automated bypass analysis, online classification and in-stream sorting of excavated material**.

All units are **directly integrated into the tunnel boring machine (TBM)** so that the entire processing chain from analysis to sorting takes place underground. This novel approach maximises the use of excavated material from underground infrastructure projects. The sorted material can be used as aggregates on site or in other industrial sectors such as the cement, steel, ceramic or glass industries, thus significantly increasing resource efficiency in tunnelling.

Life Cycle Assessment (LCA) and mass flow analysis will be carried out to quantify and compare different scenarios of use and disposal. This will help to determine the potential environmental benefits for future European tunnelling projects and provide a sound basis for decision making by authorities.

The Benefits

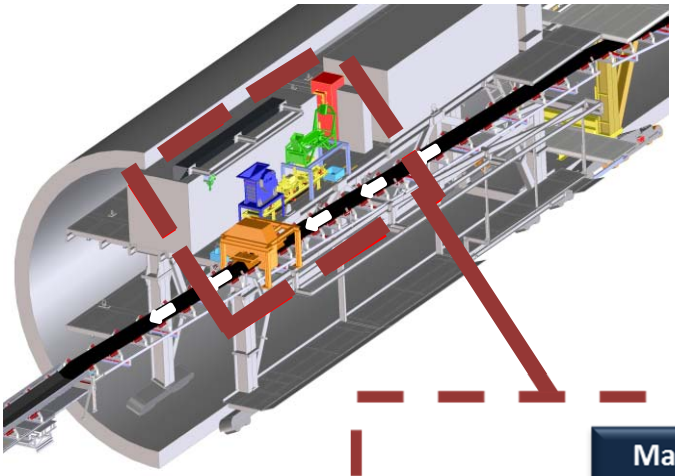
- **Development of breakthrough technologies** to secure innovation leadership for the European tunnelling and underground construction industry.
- **Sustainable domestic supply of mineral resources** within the EU by maximising the use and recycling of excavation materials, generating an estimated direct annual value of around EUR 150 million.
- **Substantial reduction in environmental pollution, CO2 emissions and land use** for the disposal of excavation material by greatly reducing waste from underground construction.

Resource efficiency in underground construction

The DRAGON System

Advanced photo-optical, x-ray and microwave technologies will be used to analyse the continuous mass flow of material directly behind the cutter head.

The **automated online sampling and characterisation of physical, chemical and mineralogical properties** provides the basis for assessing the suitability of the excavated material for different end-use options. A downstream underground separation plant will handle the material based on the online test results and requirements for intended use.



The process steps in detail:

Excavation process: Excavation of material at the heading face by the TBM's cutting wheel, including characterisation of rock properties using a disc cutter load monitoring system

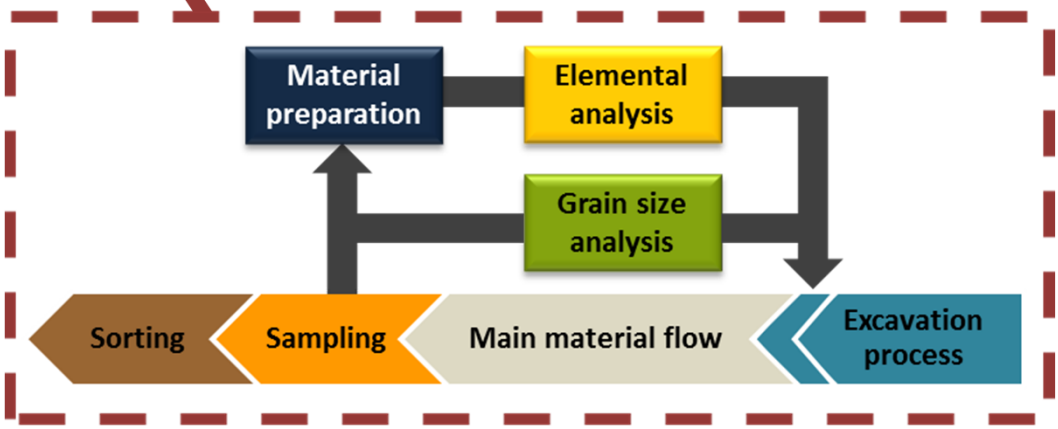
Main material flow: Discharge of the excavated material via the TBM's main belt conveyor

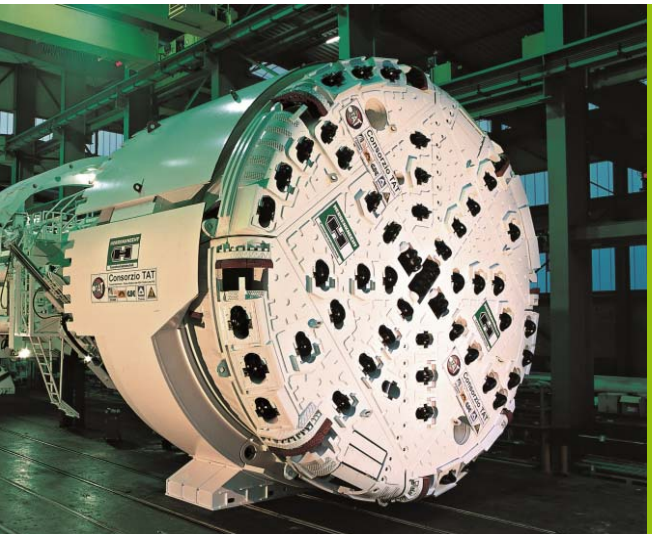
Sampling: Splitting off the bypass material flow using a hammer sampler

Elemental analysis: Material preparation by crusher and bypass belt conveyor, followed by high-precision microwave moisture measurement and online x-ray elemental analysis

Grain size analysis: Photo-optical analysis for parallel determination of grain size distribution

Sorting: In-stream sorting of the excavated material based on the online classification results





Development of automated analysis and processing units

Online classification and in-stream sorting on TBMs

Consortium

MONTANUNIVERSITÄT LEOBEN
Chair of Subsurface Engineering / Industrial Liaison Department
Austria
www.subsurface.at
www.ausseninstitut-leoben.at/

PORR Bau GmbH
Austria
www.porr.at

Herrenknecht AG
Germany
www.herrenknecht.de

B+G Betontechnologie + Materialbewirtschaftung AG
Switzerland
www.BplusG.ch

Jacques Burdin Ingenieur Conseil
France

PE North West Europe Limited
United Kingdom
www.pe-international.com

Indutech instruments GmbH
Germany
www.indutech.com

www.dragonproject.eu

Contact Details

Univ.-Prof. Dr. Robert Galler
Project Coordinator
Montanuniversität Leoben
Chair of Subsurface Engineering

Erzherzog-Johann-Straße 3
A-8700 Leoben, Austria
Tel.: +43 3842 402-3400
mail: robert.galler@unileoben.ac.at

Mag. Karin Rehatschek
Project Manager
Montanuniversität Leoben
Industrial Liaison Department

Peter-Tunner-Straße 27
A-8700 Leoben, Austria
Tel.: +43 3842 402-8411
mail: karin.rehatschek@unileoben.ac.at

This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 308389