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# MECHANICAL AND CHEMICAL RELIABILITY OF MINE WASTE MATERIAL FOR ROAD EMBANKMENT AND SUBGRADE

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# OUTLINE



- Introduction
- Scope
- Experimental studies
- Results
- Summary

# INTRODUCTION

## ❑ **Alternative materials**

- Availability
- Material type

## ❑ **Environmental safe**

- Leaching properties

## ❑ **Mechanical properties**

- Laboratory tests
- In site validation

## ❑ **Guide lines**

- Construction procedures
- Controls

# SCOPE

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- ❑ **Evaluate chemical properties**
- ❑ **Study mechanical behaviour**
  - Laboratory
  - Experimental embankment
- ❑ **Develop guidelines**

# COAL MINE DEBRIS

## ❑ Coal mining by-products:

- Large quantities of residual wastes most part earth- or rock-like in nature.
- 50% of the extracted material

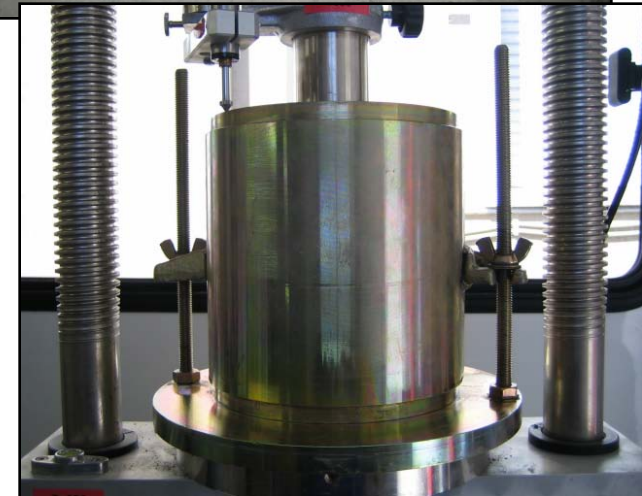
## ❑ Chemical Composition:

- Sedimentary rocks
- $\text{SiO}_2$  40-70%
- $\text{Al}_2\text{O}_3$ , small quantities of  $\text{Fe}_2\text{O}_3$ ,  $\text{K}_2\text{O}$  e  $\text{Na}_2\text{O}$
- Small amount of coal(10-20%)



# TEST ORGANIZATION

- ❑ Leaching tests
  - ❑ Laboratory
  - ❑ In situ
- ❑ Grading test
- ❑ Quality tests
  - ❑ Los Angeles
- ❑ Bearing capacity
  - ❑ CBR Index
  - ❑ LFWD
  - ❑ Static Plate
- ❑ Improvement tests
  - ❑ Chemical stabilization



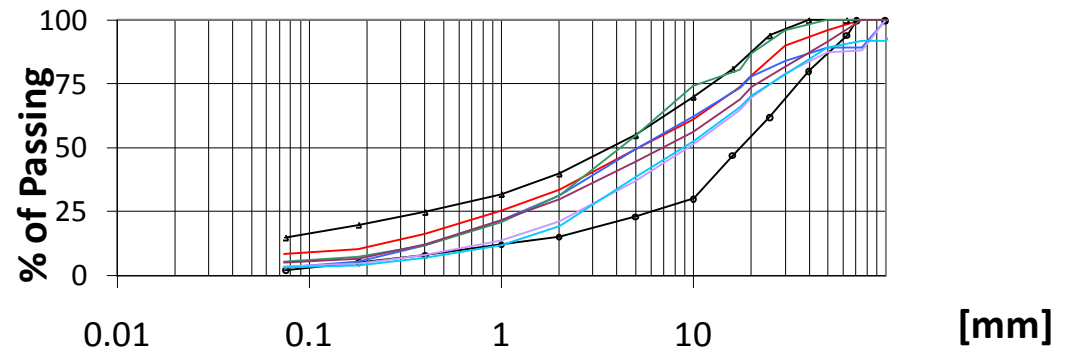
# HARMFUL COMPOUNDS

□ No potenzial risk

CHEMICAL PARAMITERS	U.M. S.S.	measured		Limits D.L: 152/2006	
		Min	Max	A	B
(As)	mg/kg	< 1	1,4	20	50
(Sb)	mg/kg	< 1	7,7	10	30
(Be)	mg/kg	< 1	< 1	2	10
(Cd)	mg/kg	< 0,5	< 1	2	15
(Co)	mg/kg	< 1	4,12	20	250
(Cr)	mg/kg	7,26	43,4	150	800
(Cr IV)	mg/kg	< 0,5	< 1	2	15
(Hg)	mg/kg	< 0,5	< 1	1	5
(Ni)	mg/kg	32,12	49,41	120	500
(Pb)	mg/kg	7,96	31,95	100	1000
(Cu) total	mg/kg	23,81	38,24	120	600
(Se)	mg/kg	< 1	< 1	3	15
(Sn)	mg/kg	< 1	< 1	1	350
(V)	mg/kg	43,67	63,55	90	250
Zinco (Zn)	mg/kg	42,1	61,57	150	1500

# LABORATORY TESTS

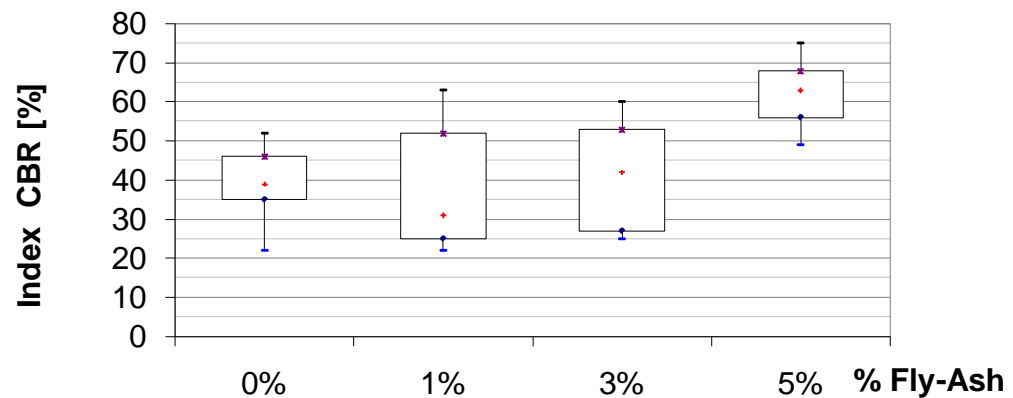
## □ Grading curve



## □ LA tests

41,80%	44,00%	37,47%	36,48%	36,79%	38,02%
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## □ CBR



# IN SITU TESTS

## ❑ Experimental Embankment



## ❑ Leaching test

## ❑ Plate test



(MPa/m)	Min	Max	(MPa)	Min	Max
LFWD	57	62	Static	43	70

# SUMMARY

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- ❑ Low concentration harmful compounds
- ❑ good quality for embankment and subgrade
- ❑ Mechanical behaviour improved with stabilization



**THANK YOU  
QUESTIONS?**