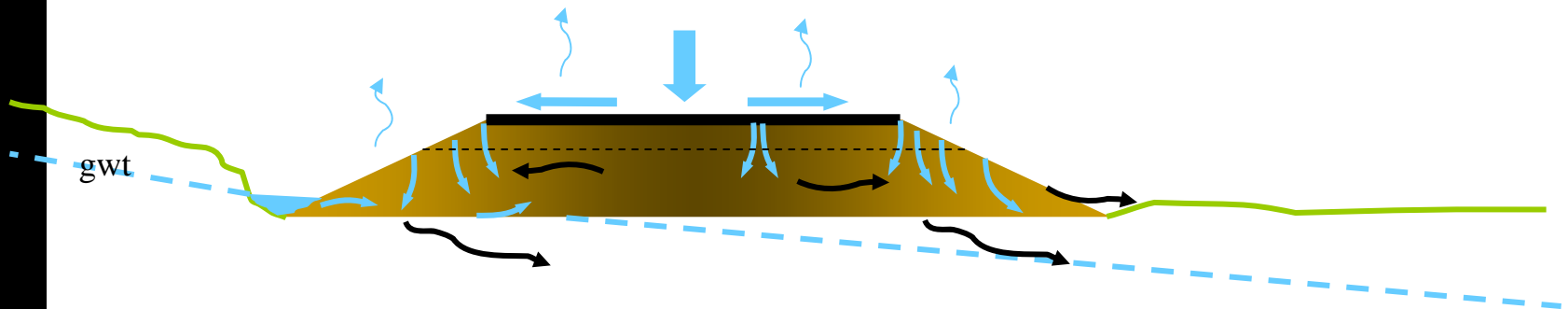


The accumulated effects of long-term leaching of MSWI bottom ash in a sub-base layer in a test road



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Objectives

- Investigate the effects of exposure to atmospheric conditions and aging on the leaching behavior of MSWIBA under field conditions
- Investigate the impact in the subgrade¹⁾
- Investigate the effects of traffic load and aging on the geotechnical properties (falling weight deflectometer, triax etc.)

The test road in Linköping Sweden

- Paved
- Sub-base: 40-55 cm of bottom ash
- Fresh bottom ash (pH=11.1-11.7)
- Built in 1987, 16 years old at the time of this study
- Previous studies: Lundgren and Hartlén, 1991; Andersson et al, 1998, Flyhammar and Bendz, 2006.

Longitudinal cracks



Photo: VTI Safwat Said, 1999

The test road in Linköping Sweden

- Paved
- Sub-base: 40-55 cm of bottom ash
- Fresh bottom ash (pH=11.1-11.7)
- Built in 1987, 16 years old at the time of this study (excavation)
- Previous studies: Lundgren and Hartlén, 1991; Andersson et al, 1998, Flyhammar and Bendz, 2006.

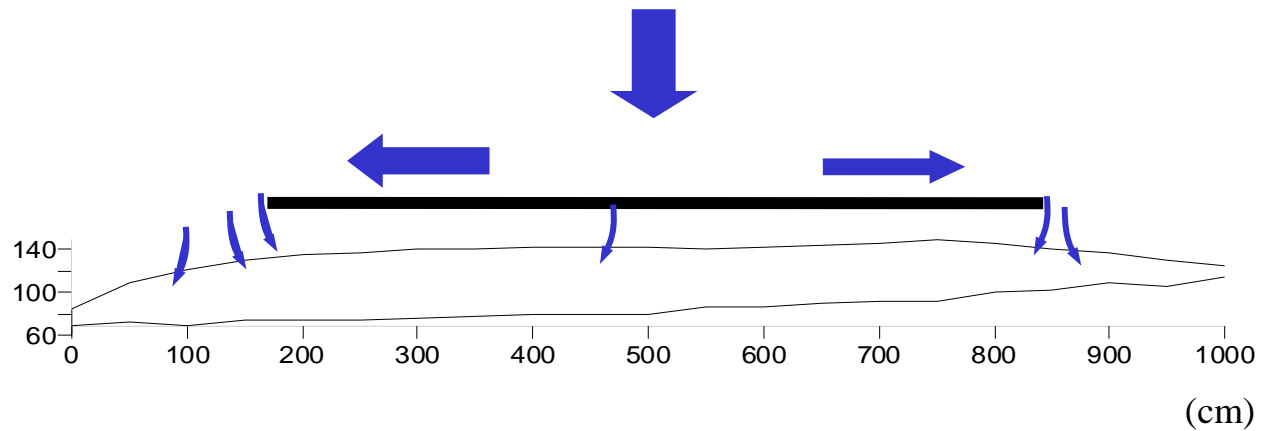
Excavation



Sampling



Boundary conditions sub-base



Results

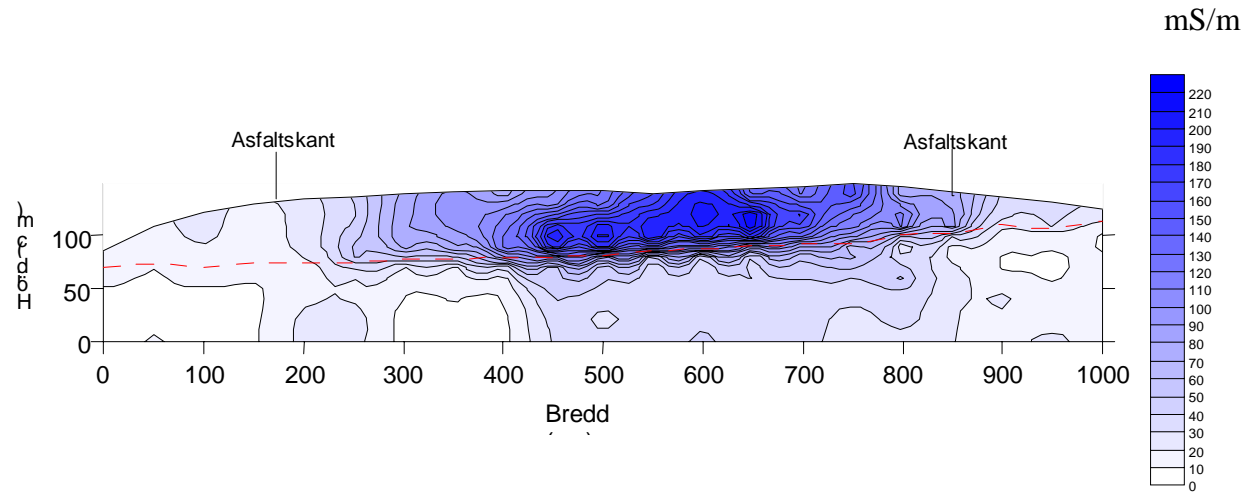
Spatial patterns (n=53) of leachable content (EN12457-2) reflect:

I. Leaching (exposure to intruding water)

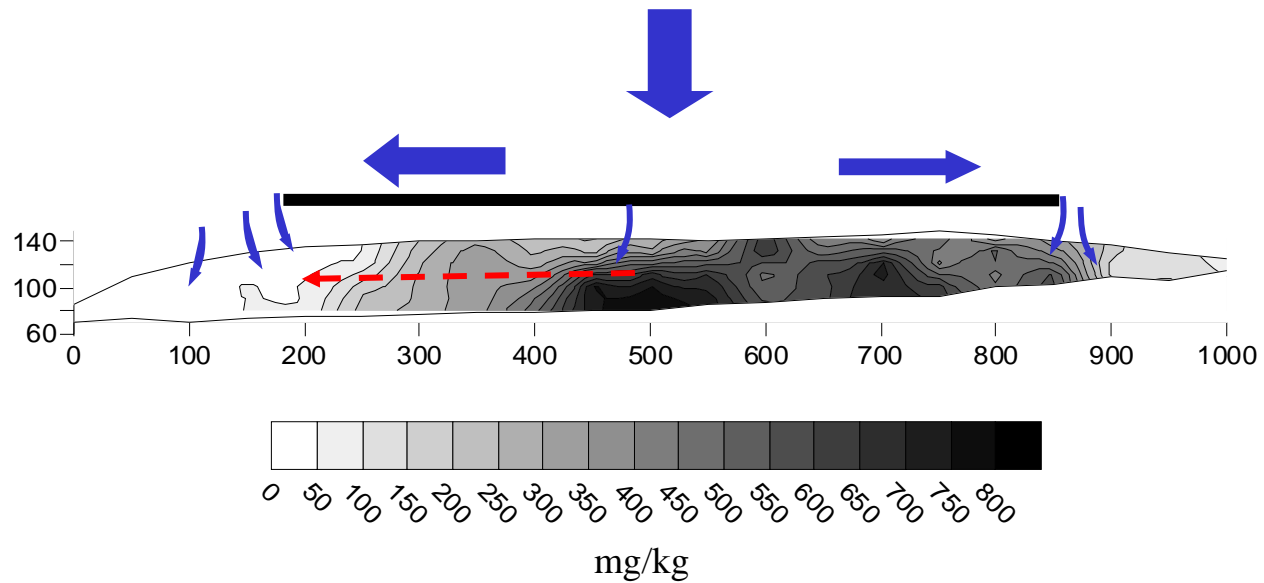
II. Aging (+ leaching)

III. Redox conditions (exposure to atmosphere) (+ leaching)

Pattern reflecting leaching: conductivity



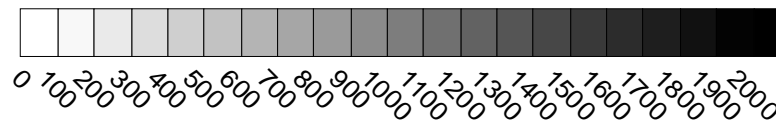
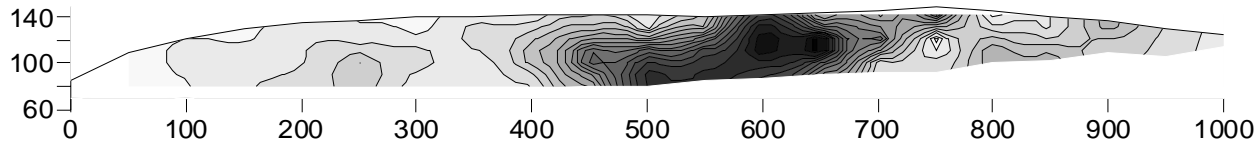
Pattern reflecting leaching: Cl⁻



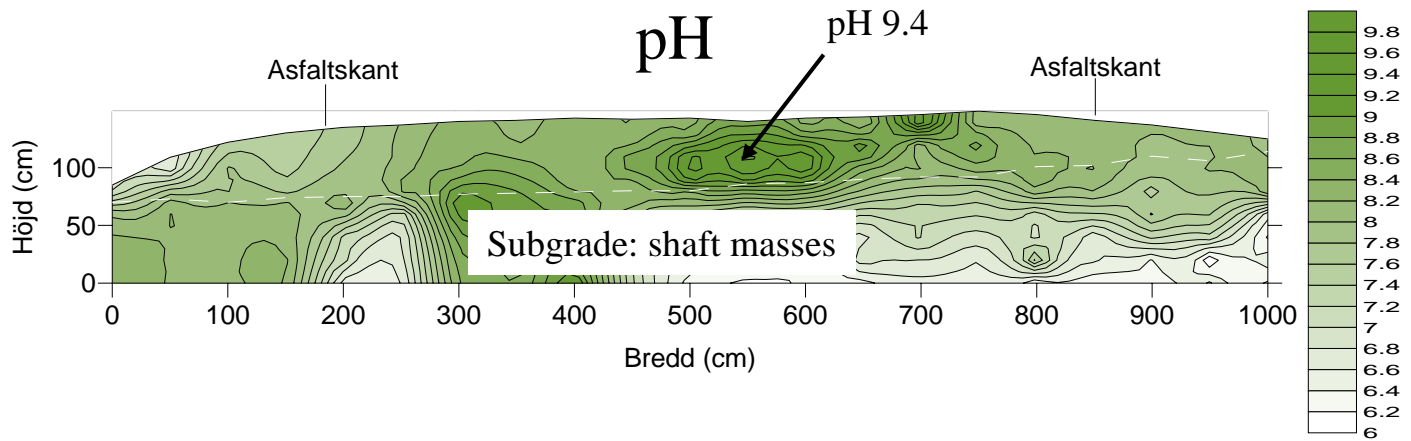
Integrating spatial data: 382 mg/kg

Patterns reflecting aging (and leaching)

Ca

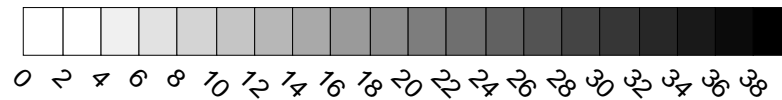
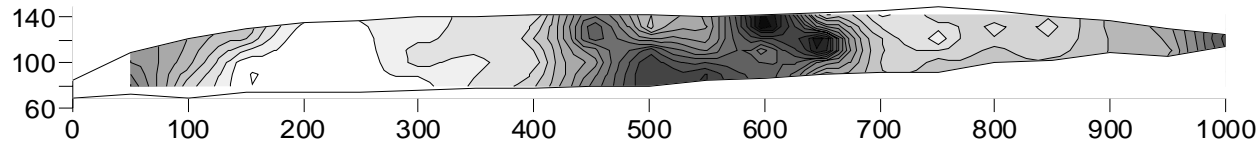


mg/kg

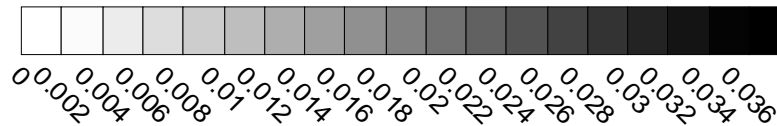
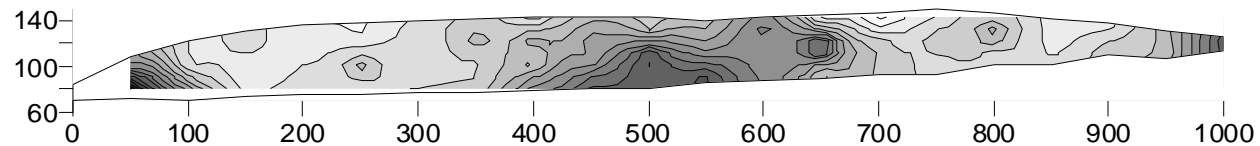


Cont. patterns reflecting aging (and leaching)

DOC

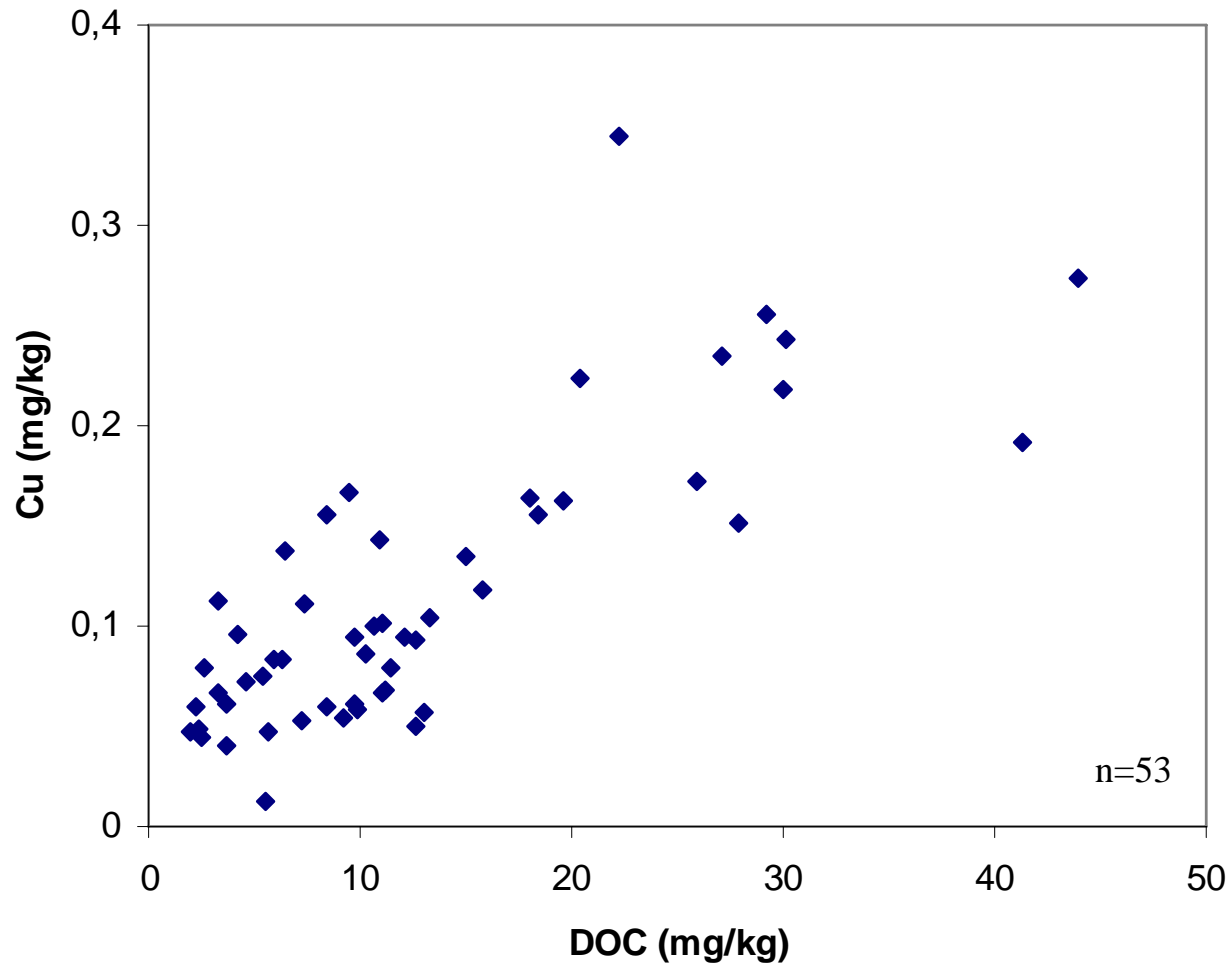


Cu



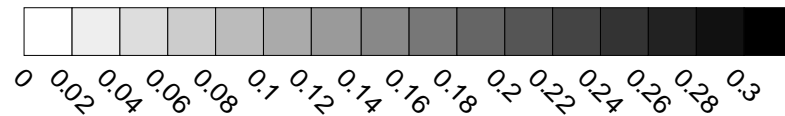
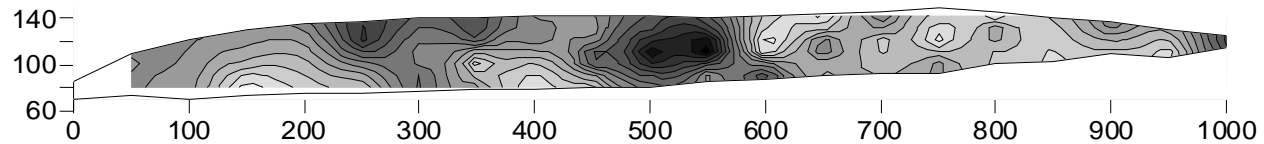
mg/kg

Cu - DOC

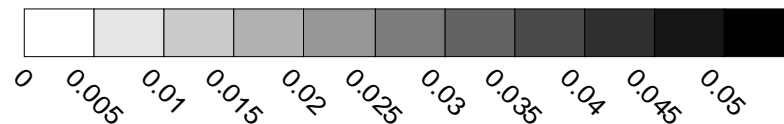
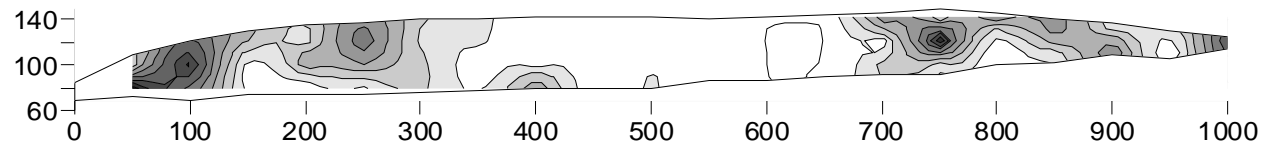


Patterns reflecting redox conditions

As



Cr



Conclusions

- The boundary conditions at the road shoulders control the leaching process under field conditions
- Horizontal migration by diffusion and capillary transport is the major transport process for dissolved substances in a paved road construction
- Carbonation takes time for bottom ash enclosed in a road construction, after 16 years the sub base is still in progress to a final (?) state
- Chemical heterogeneity evolves with time due to spatially varying boundary conditions. This has implications for:
 - risk assessments (applying lab-scale results to field/scenario calculations)
 - developing effective (lumped) modeling parameters