# Assessment of Leaching from Construction & Demolition Waste Concrete

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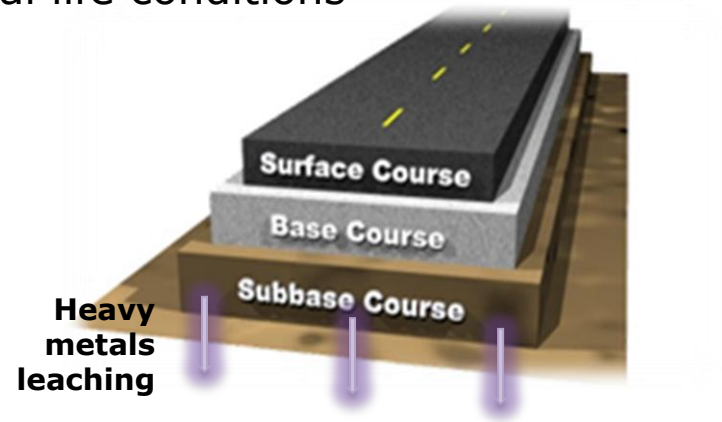
# Introduction and background

- Construction & Demolition Waste (C&DW) concrete reused in road sub-bases:
  - Unbound applications

- Potential for leaching of heavy metals: need for assessment of emissions
  - Different experimental approaches
  - Often unrealistic compared to real life conditions



# Objectives

- Implement a modified approach for assessment of metal leaching from concrete
  - Designed to mimic real life conditions in road sub-bases scenarios
  - Non-standard column (modified from CEN/TS 14405)
- Present preliminary results of Cr leaching
  - Critical element (van der Sloot, 2000; Kayhanian et al., 2009)
- Results will be used to assess the actual potential for soil and groundwater pollution in a broader perspective.

# Materials
# Crushed concrete

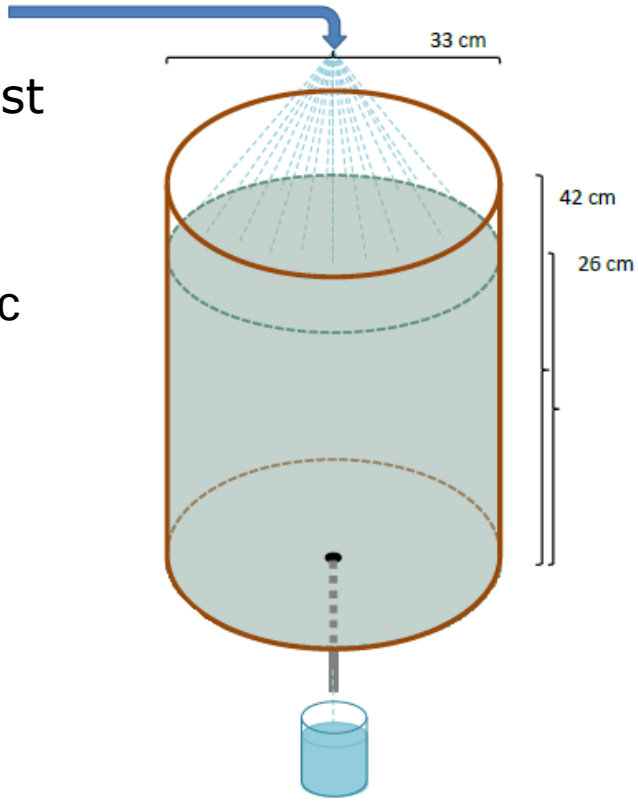
- Four crushed concrete samples
  - C2 and C4: pure crushed concrete from recycling facility, Copenhagen area
  - C6 and C7: leftovers from construction, central Denmark

- Crushed to 0-40 mm: typical for road construction

# Methods
# Column test

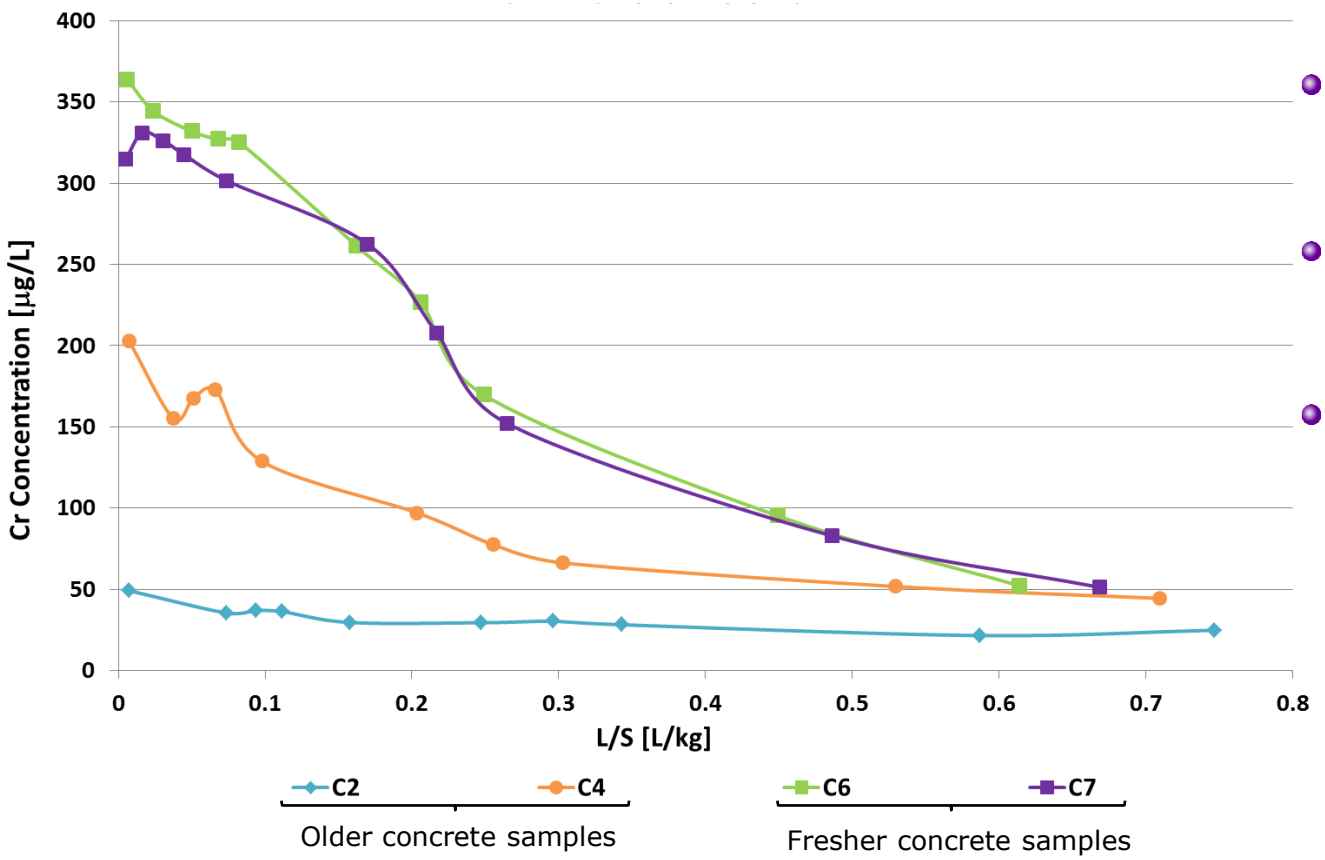
- Modified version of standard percolation test (CEN/TS 14405)
  - Particles size: as in road sub-bases
  - Downflow, intermittent watering
  - Non saturated conditions
  - Leachant flow rate ≈10 times lower
  - Final L/S= 10L/kg (≈ 13 months)

More realistic



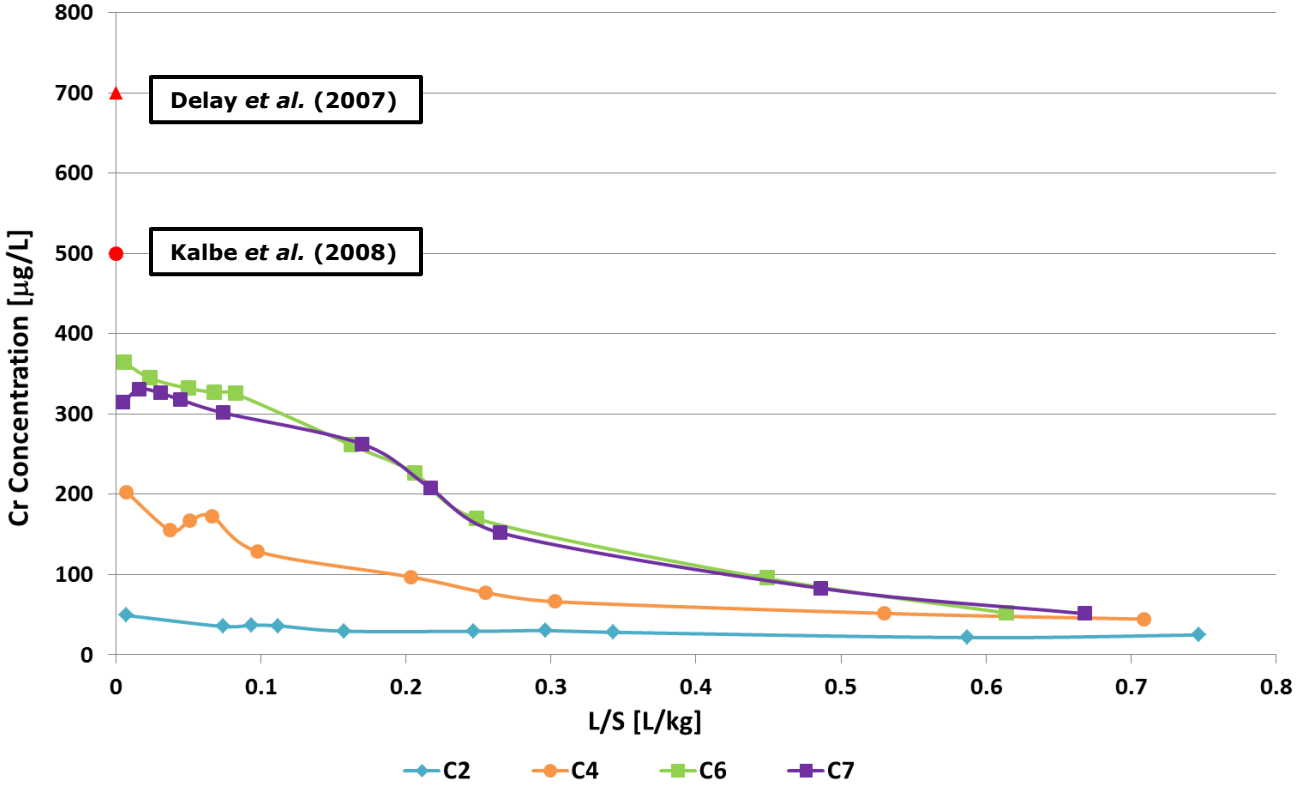

**Results available until L/S≈ 0.7 so far (≈ 3 weeks)**

# Preliminary results
# Chromium concentration in the leachate




- Relatively high initial concentration
  - Quickly decreasing
- C6-C7 (fresher concrete) has much higher release than C2-C4
- Large differences in concentration in initial phases
  - Especially for C2-C4: heterogeneous material
  - Decrease down to similar level

# Preliminary results
# Comparison with literature

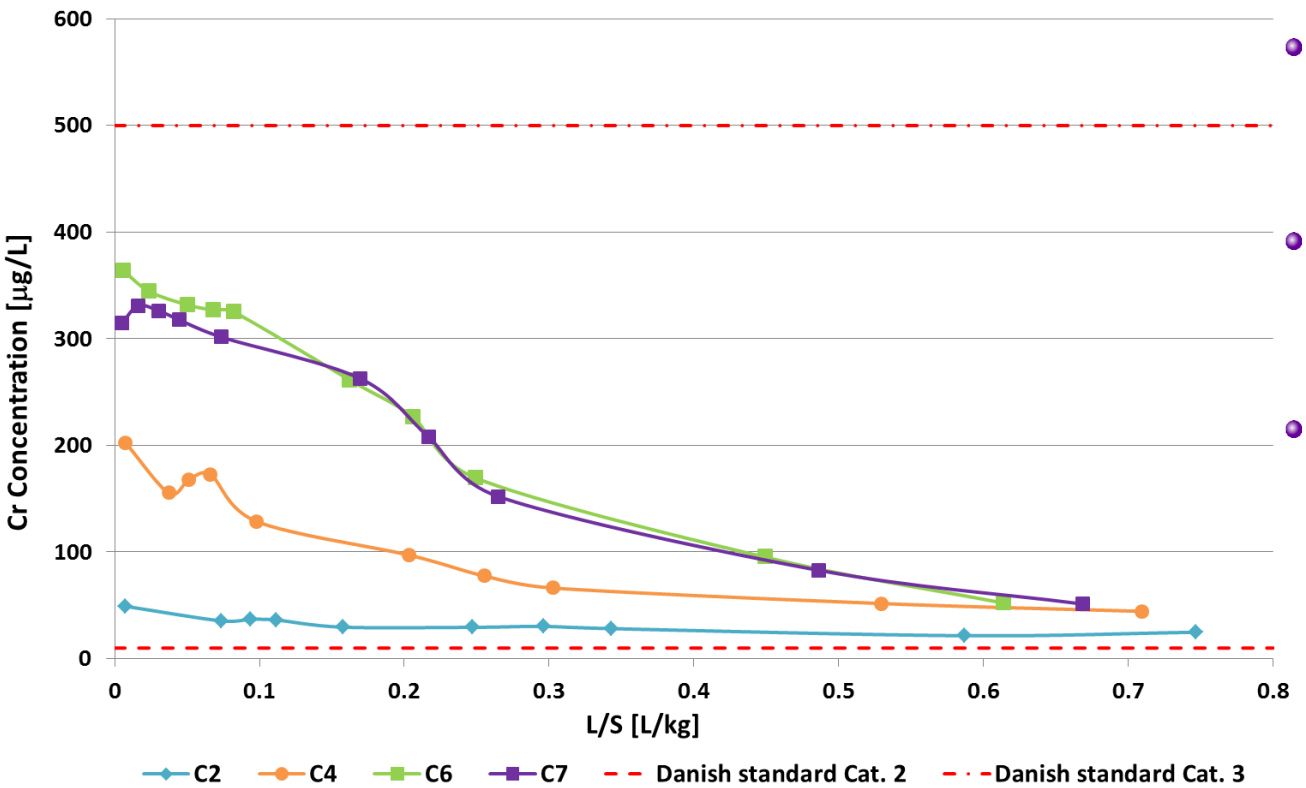



Comparison with literature data from standard columns

- Similar trend with high initial concentration and rapid drop
- Higher concentrations from standard column tests
  - Delay *et al.* (2007): initial concentrations ≈ 500 µg/L
  - Kalbe *et al*. (2008):initial concentrations ≈ 700 µg/L

**More realistic experimental approach → lower emission estimations**

# Preliminary results
# Comparison with limit values




- Danish limit values for reuse of soil and residues in construction (10 µg/L) largely exceeded
- Limit values for reuse in presence of drainage systems (500 µg/L) not exceeded
- Only as a reference
  - Refers to a batch test
  - Limits do not apply to C&DW

**Cr: critical element?**

# Discussion

- Cr leaching might represent an issue even after more realistic testing approaches

- How relevant is Cr leaching for soil and groundwater pollution?
  - Could it be reduced?
  - How long would it take?

- Need for broader, holistic perspective:
  - Alternative disposal is avoided
  - Resources are saved
  - Fate of Cr in the soil after release?

**Avoid unnecessary restrictions**

# Conclusions

- Modified version of percolation tests
  - More realistic estimation of emissions in road sub-bases reuse applications
- Cr concentrations initially relatively high, followed by a fast decrease
  - Cr might be critical from environmental point of view
- Measured concentrations lower than literature values from standard CEN/TS 14405
  - Standard test might overestimate emissions
- Actual hazardousness of the emitted Cr should be on focus:
  - Is Cr(VI) or Cr(III) emitted?
  - Is there capacity in the soil for Cr(VI) reduction into less mobile and non toxic Cr(III)?
  - These aspects might contain vertical movement of Cr
  - Cr speciation test, soil reduction capacity and kinetics test implemented

# Thank you for your attention!

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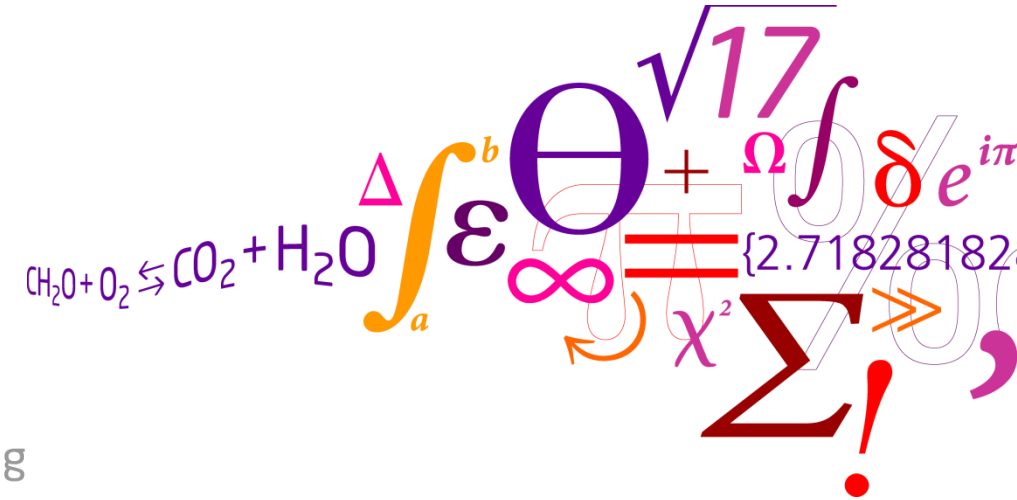


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# References


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