Canister Retrieval Test

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Ann Dueck
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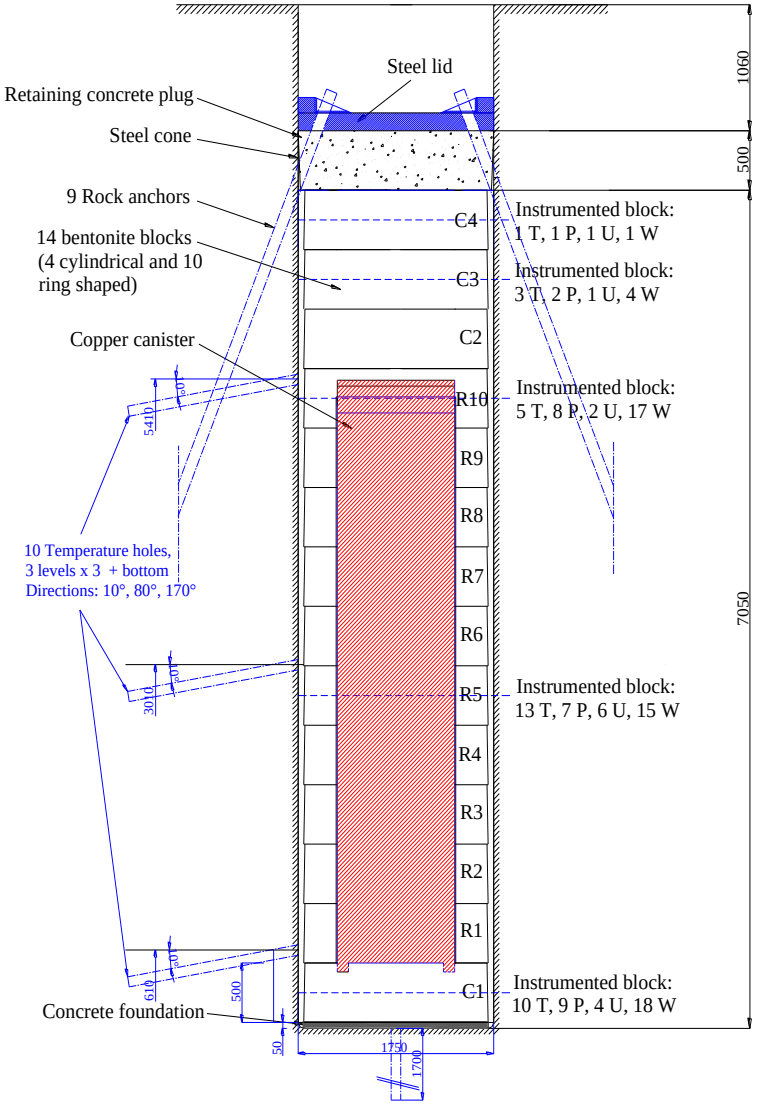
Layout CRT


Steel lid
Retaining concrete plug
Steel cone
9 Rock anchors
14 bentonite blocks
(4 cylindrical and 10
ring shaped)
Copper canister
10 Temperature holes,
3 levels x 3 + bottom
Directions: 10°, 80°, 170°
Concrete foundation
C4
C3
C2
R10
R9
R8
R7
R6
R5
R4
R3
R2
R1
C1
Instrumented block:
1 T, 1 P, 1 U, 1 W
Instrumented block:
3 T, 2 P, 1 U, 4 W
Instrumented block:
5 T, 8 P, 2 U, 17 W
Instrumented block:
13 T, 7 P, 6 U, 15 W
Instrumented block:
10 T, 9 P, 4 U, 18 W
1060
500
7050
5410
610
3010
500
50
1750
1700

Sampling technique

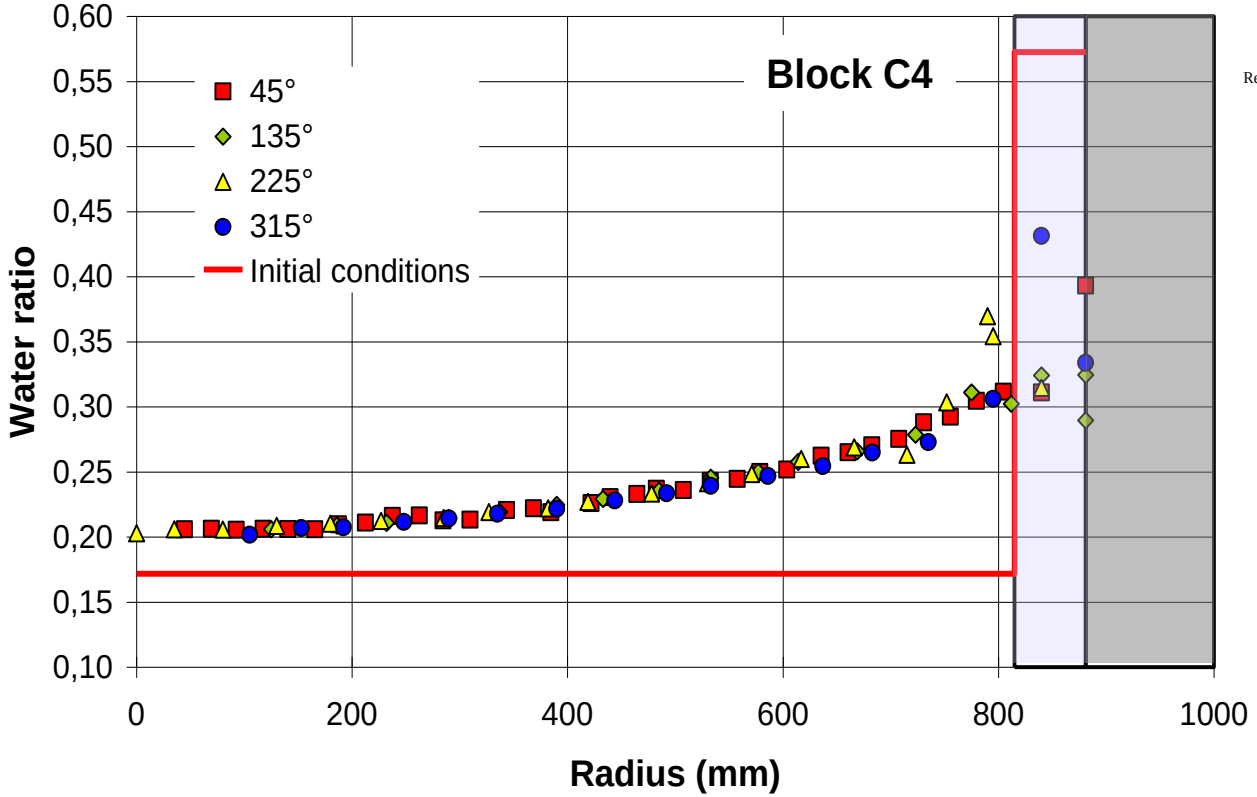
Sampling technique

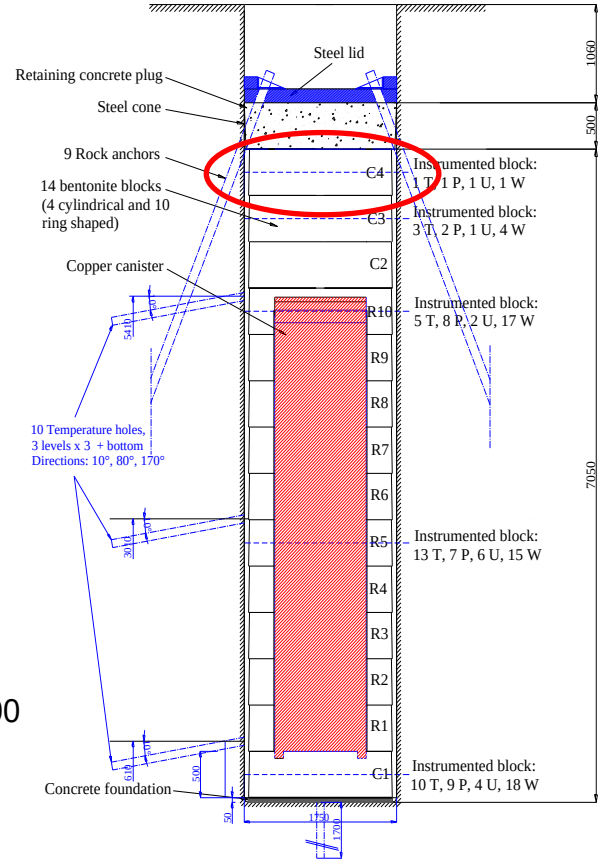
Analyses of the samples taken from the buffer

The analyses were made in two steps:

- The water ratio and density were determined directly after the samples were taken from the buffer. About 1500 determinations of water ratio and density were made on the taken samples. Reported in IPR-07-16
- More advanced tests on the samples for determining the swelling pressure, hydraulic conductivity, mechanical properties and geochemical analyses have been performed. To be published in Clays and Clay Minerals: "Hydro-mechanical and chemical-mineralogical analyses of the bentonite buffer from full-scale field experiment simulating a high level waste repository." and will also be published as SKB Technical Report TR-11-07

Determination of water ratio and density





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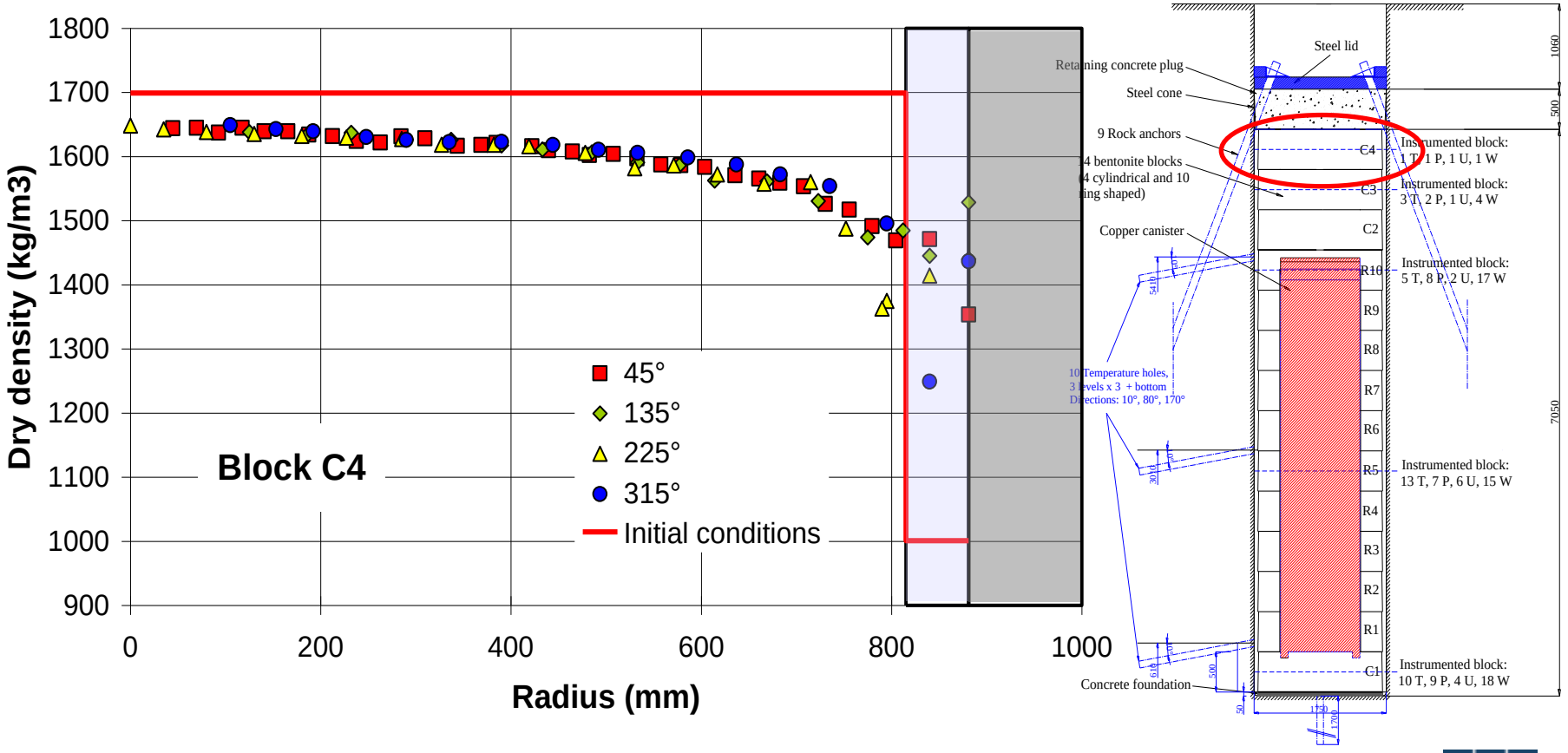

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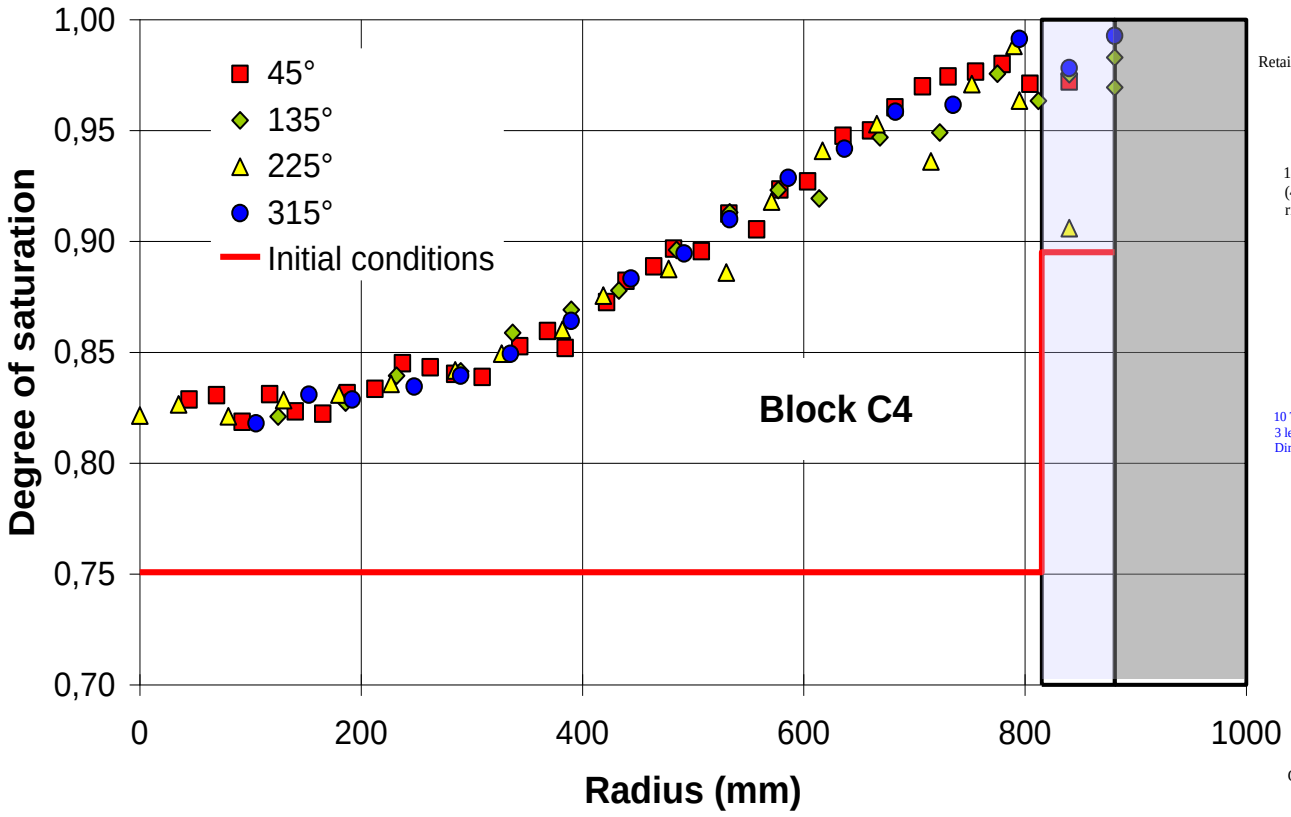

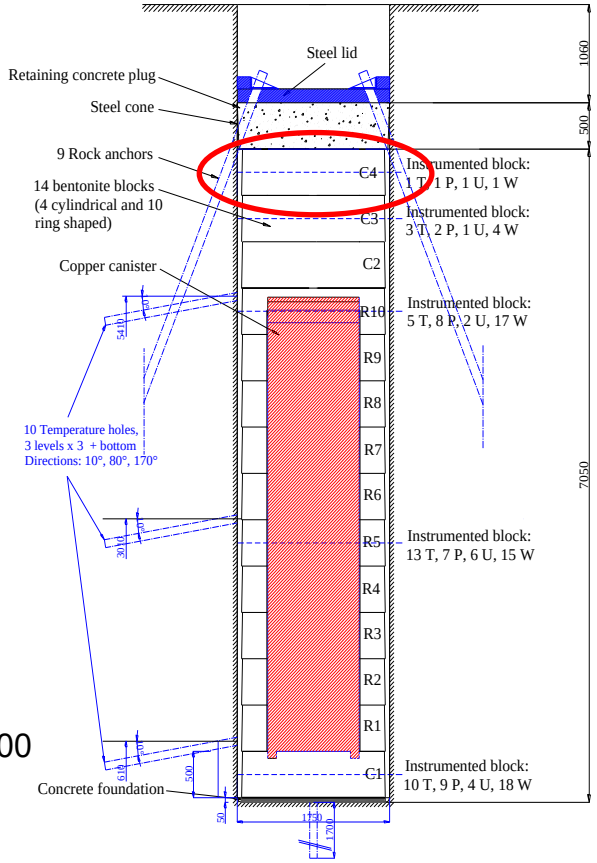

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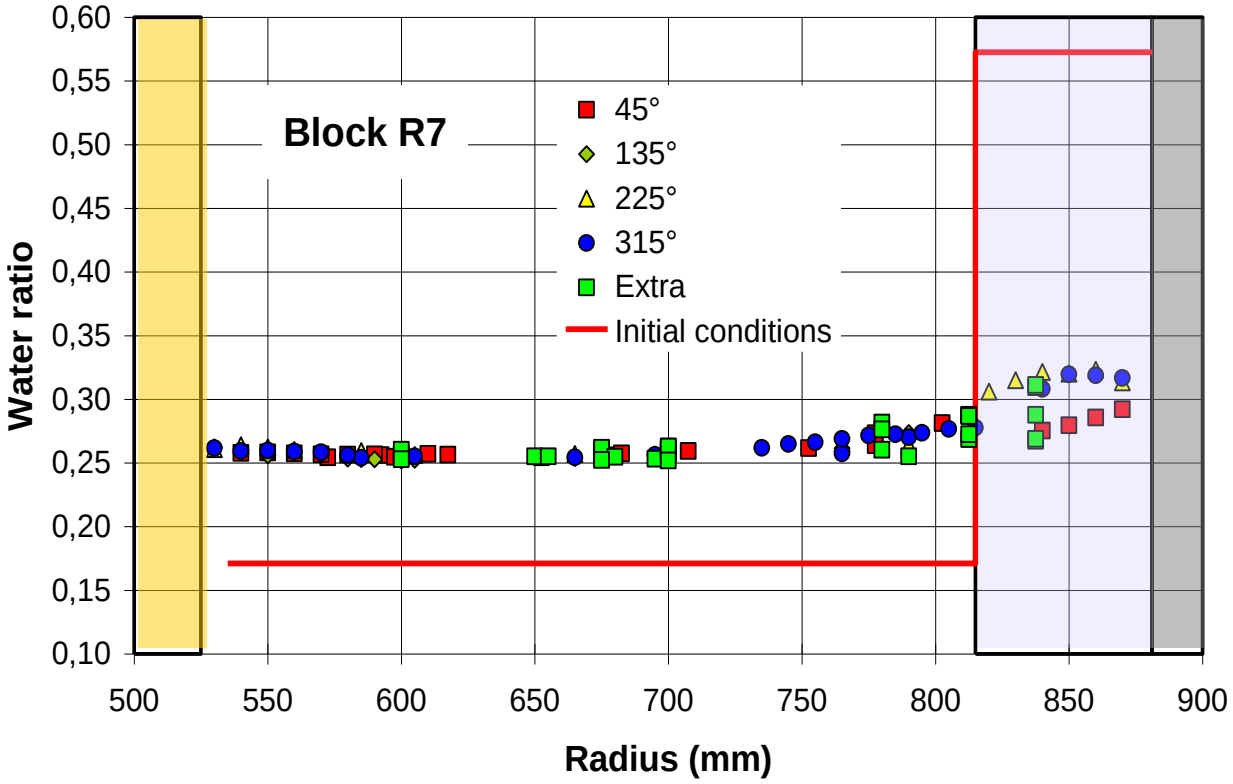

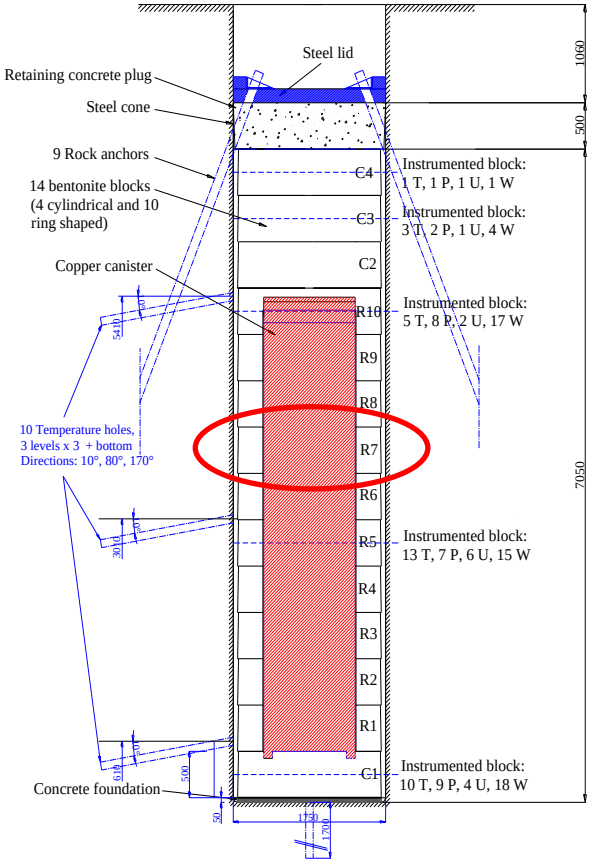

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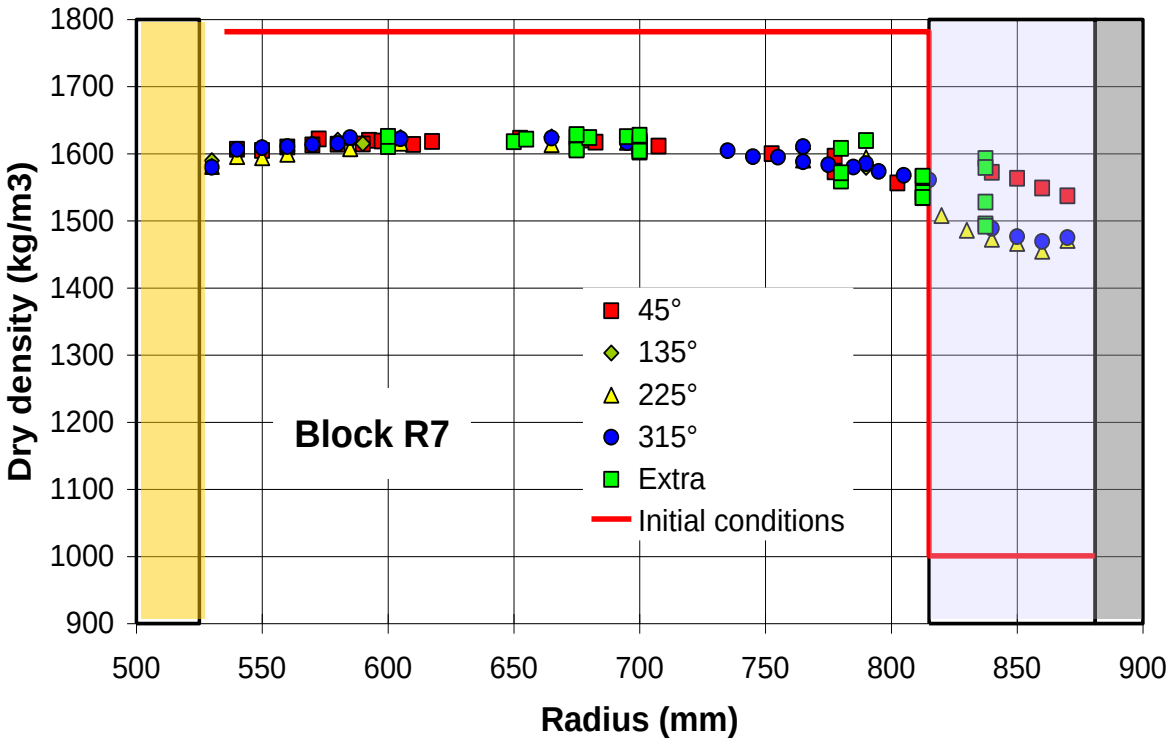

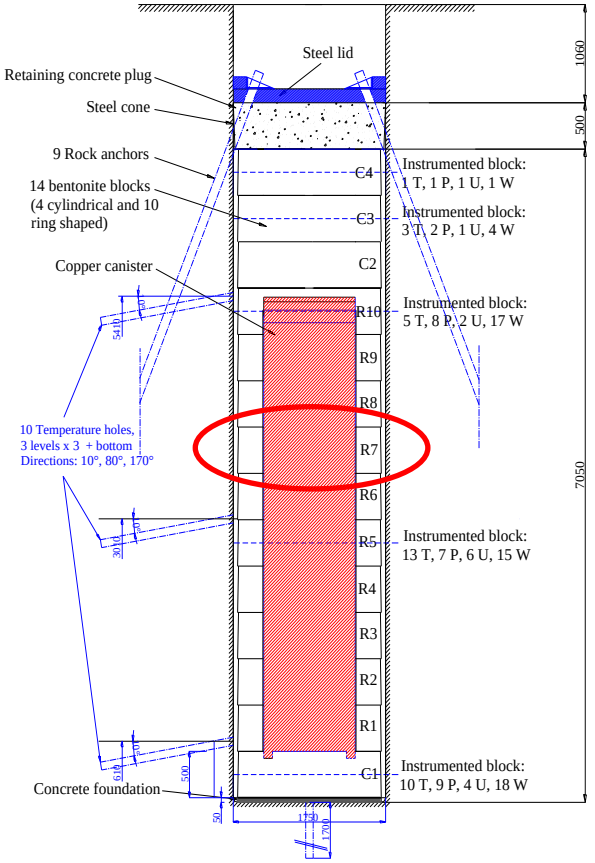

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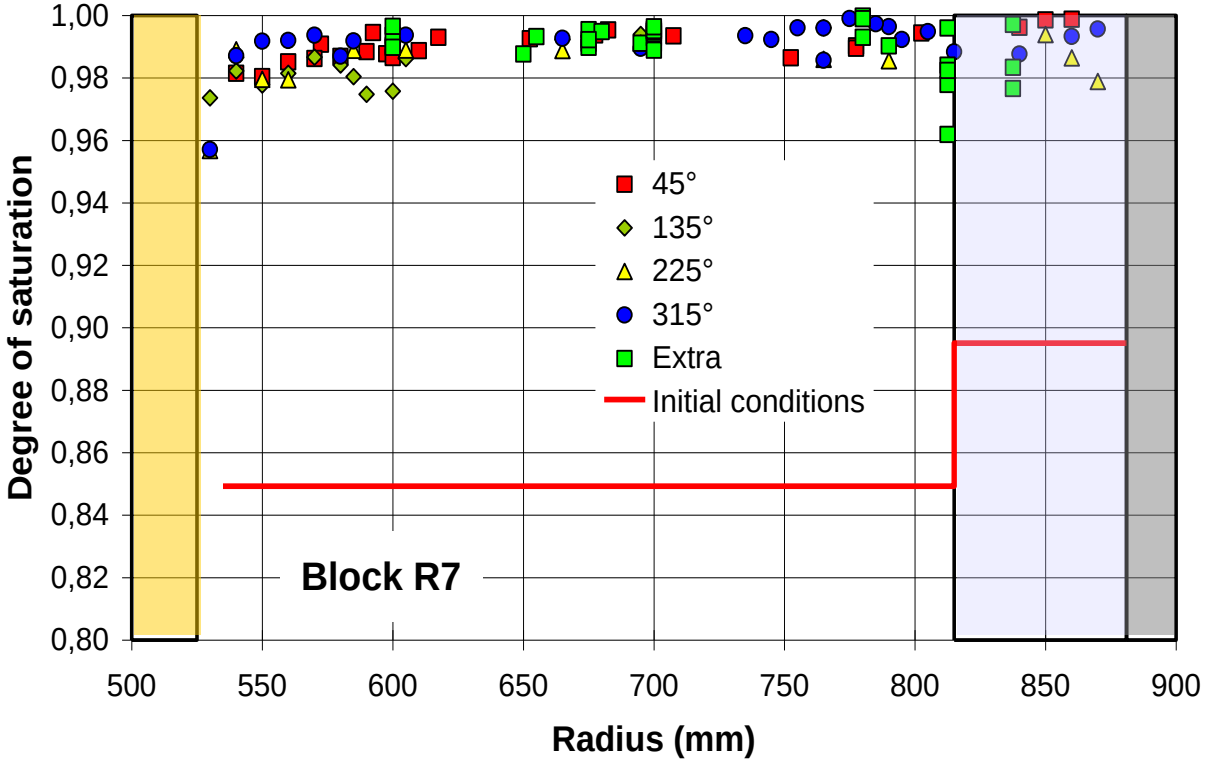

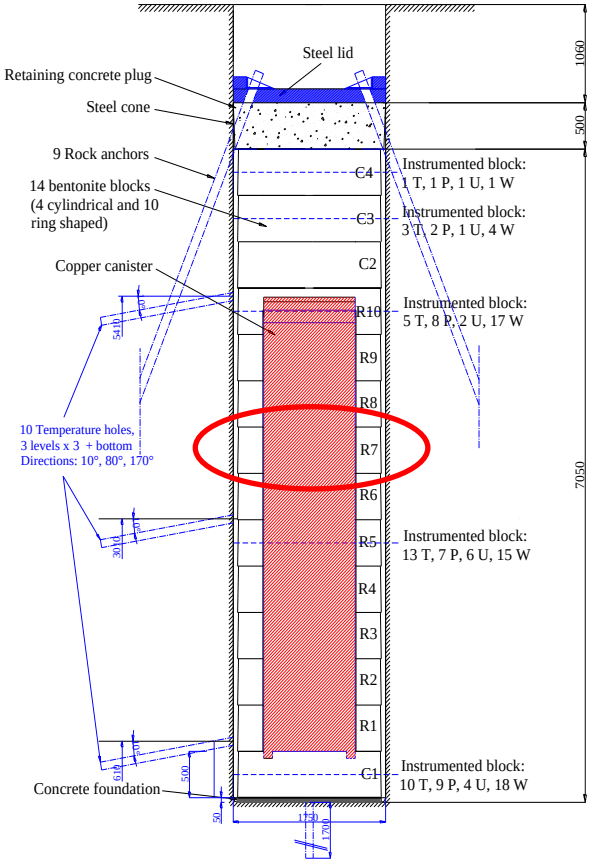

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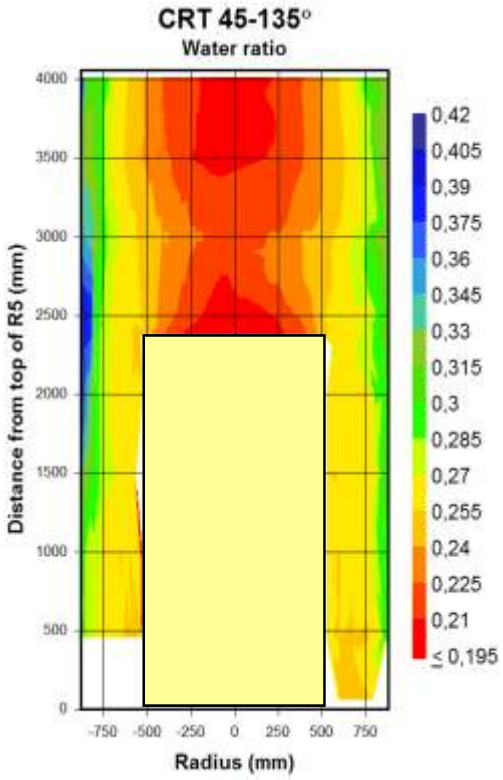

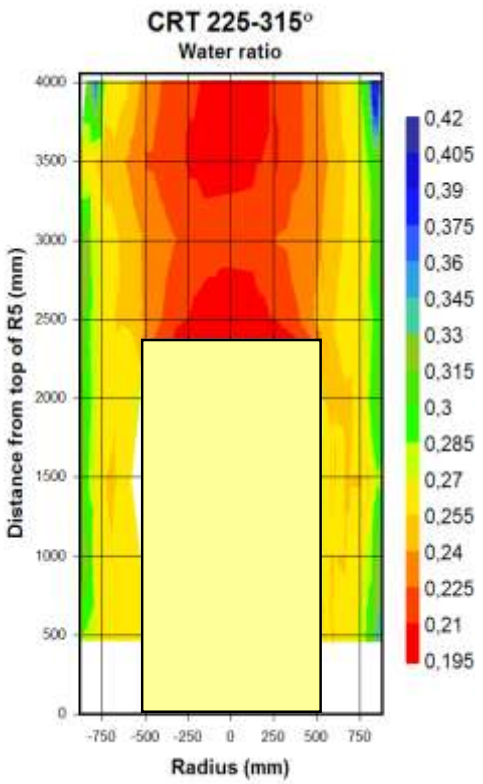

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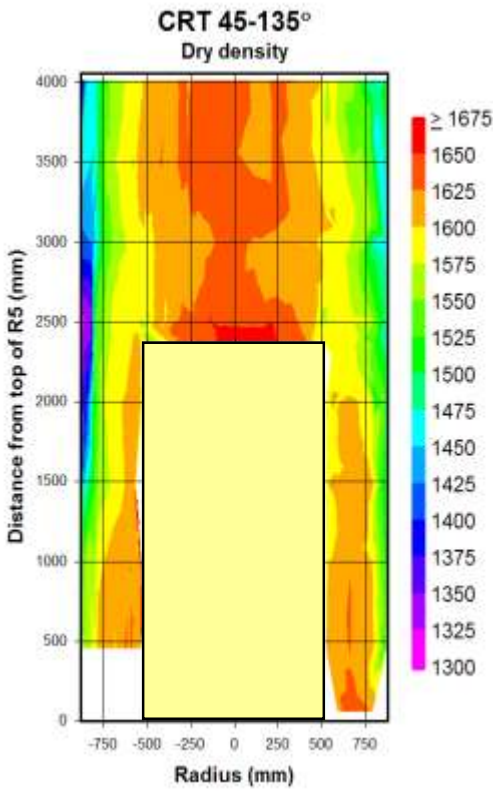

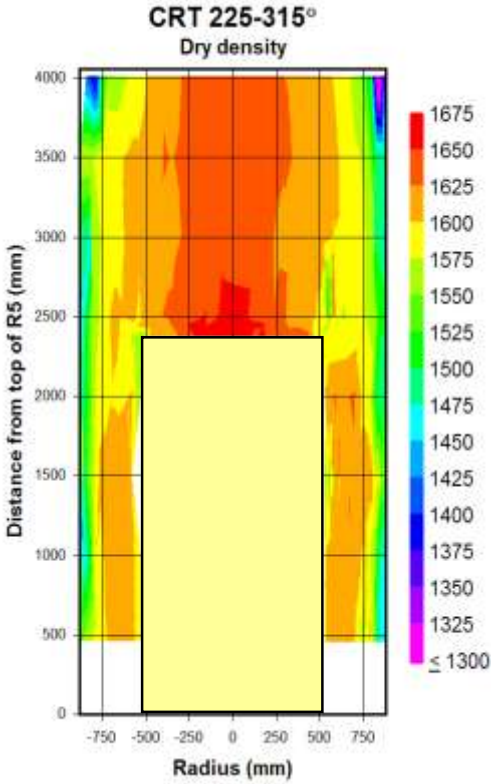

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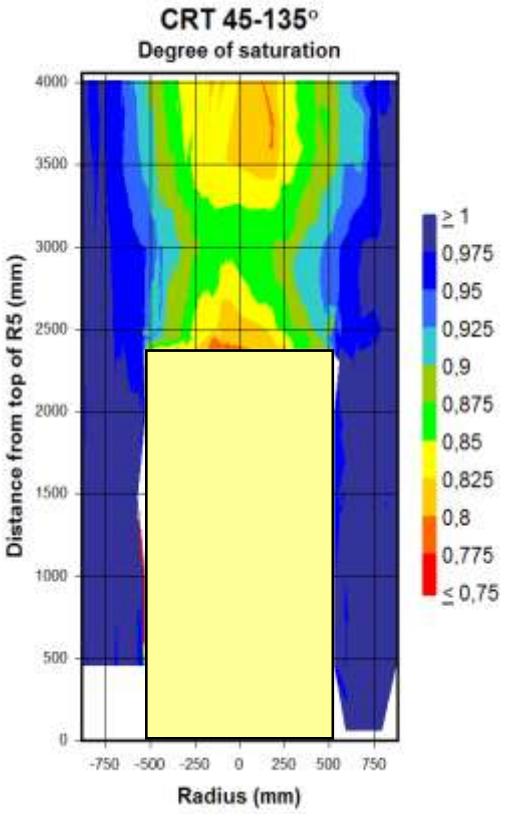
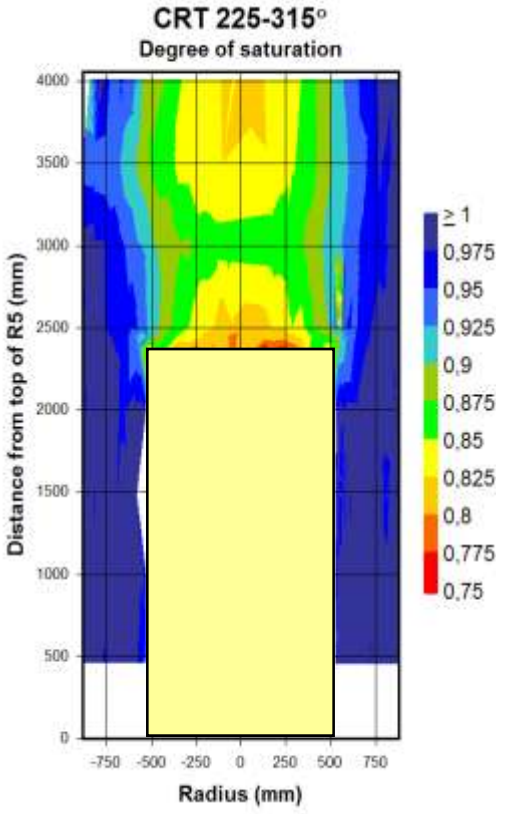




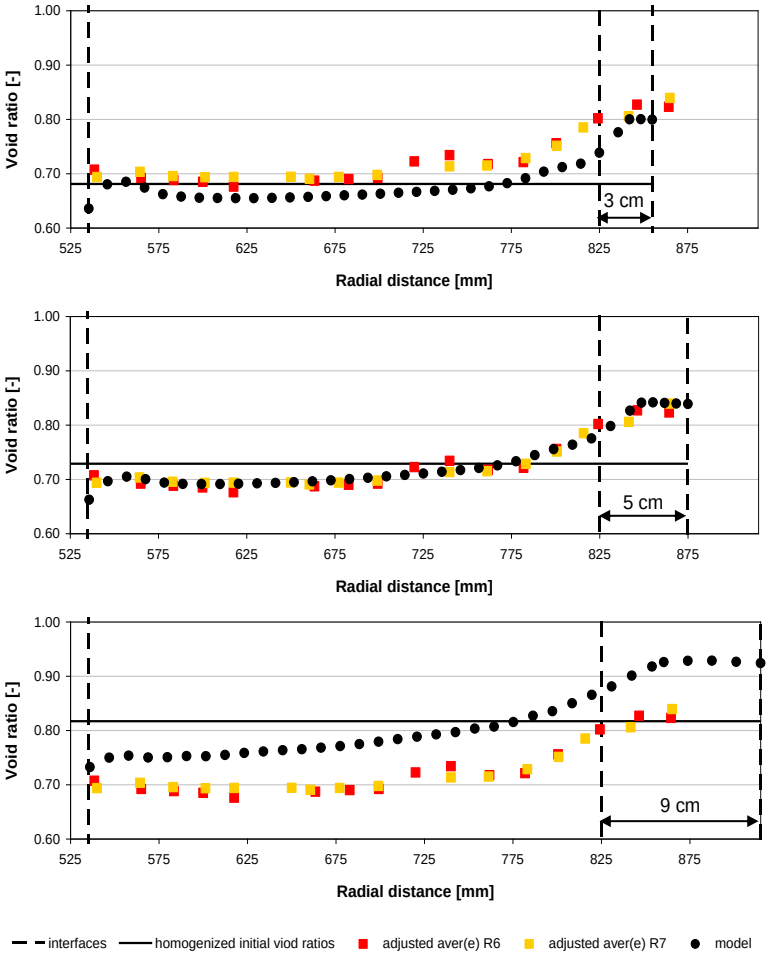
Conclusions from the measurements

- The saturation of the buffer was axi-symmetric.
- The central part of the buffer above the canister was not saturated.
- The buffer around the canister was saturated.

An example of how data was used in SR-site

Natural Buffer homogenization(Task 5)

FE model, different pellet slot width



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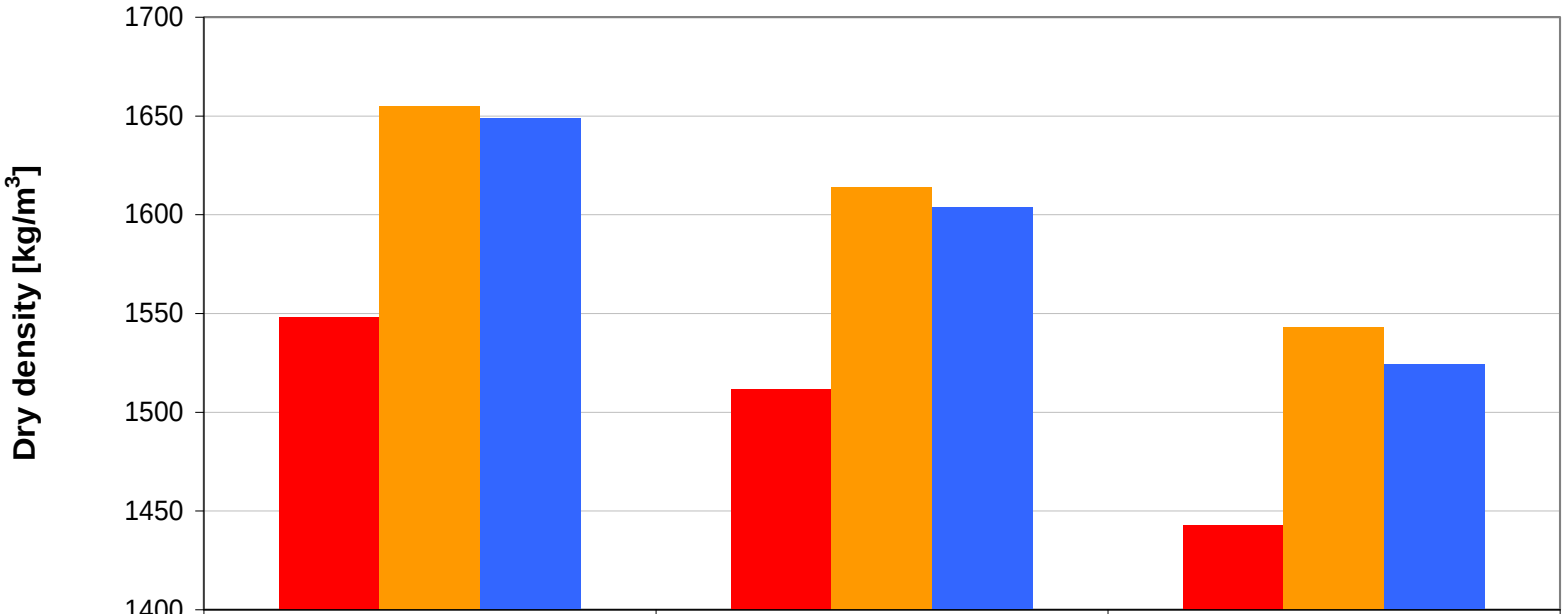

	w=3 cm	w=5 cm	w=9 cm
pellet slot	1548	1512	1443
block	1655	1614	1543
tot	1649	1604	1524

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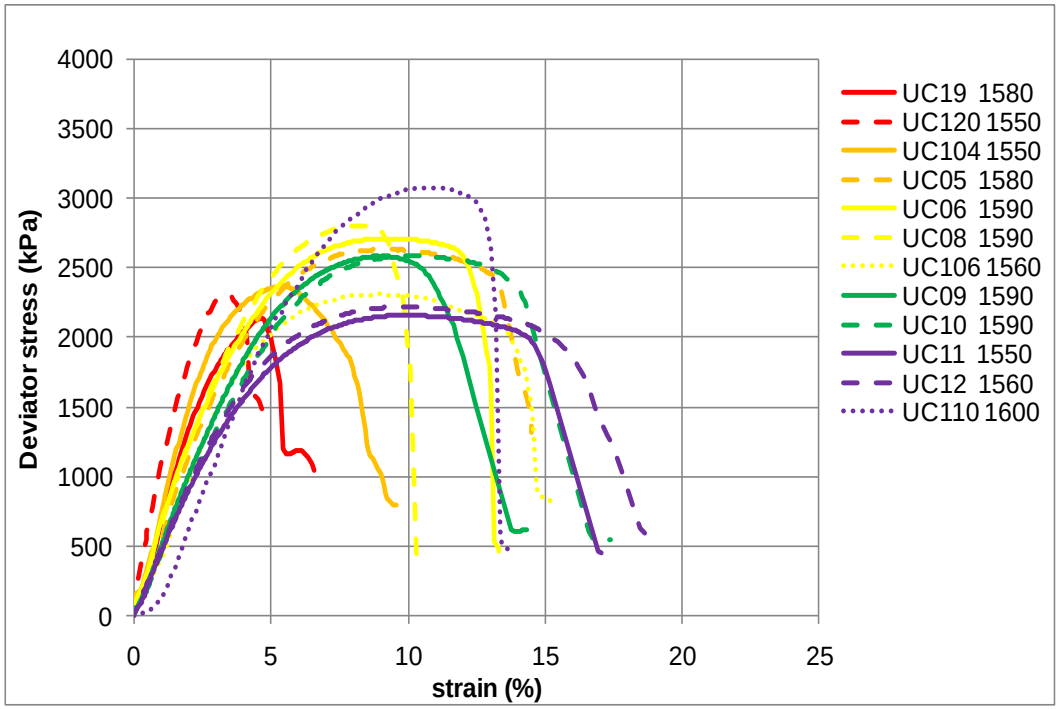
Unconfined compression test

- Sample preparation
  - Small samples, sawn
  - Cylindrical samples with H=D=20 mm
  - Saturation for 2 weeks

- Test procedure
  - Unconfined uniaxial shearing
  - Undrained conditions
  - Rate 0.16 mm/min
  - Determination of w and r

- Data evaluation
  - Deviator stress $q = \frac{F}{A_0} \cdot (1 - \varepsilon)$
  - Strain $\varepsilon = \frac{\Delta l}{l_0}$

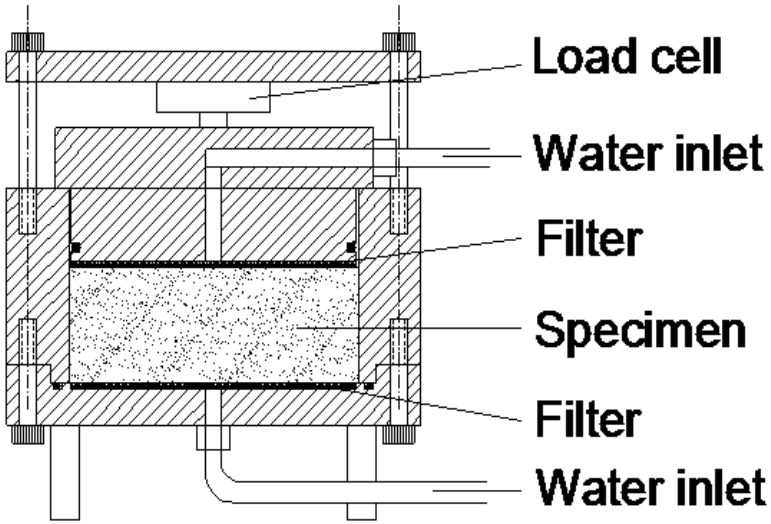
Unconfined compression test



Deviator stress versus strain on short specimens from ring R7 (Series CRTUC) in the dry density interval 1551-1600 kg/m^3. The colors red, orange, yellow, green, blue and purple represent distances from the canister and the temperatures 93˚C, 87˚C, 83˚C, 78˚C, 74˚C and 69˚C, respectively. The labels show test ID and dry density (kg/m^3).

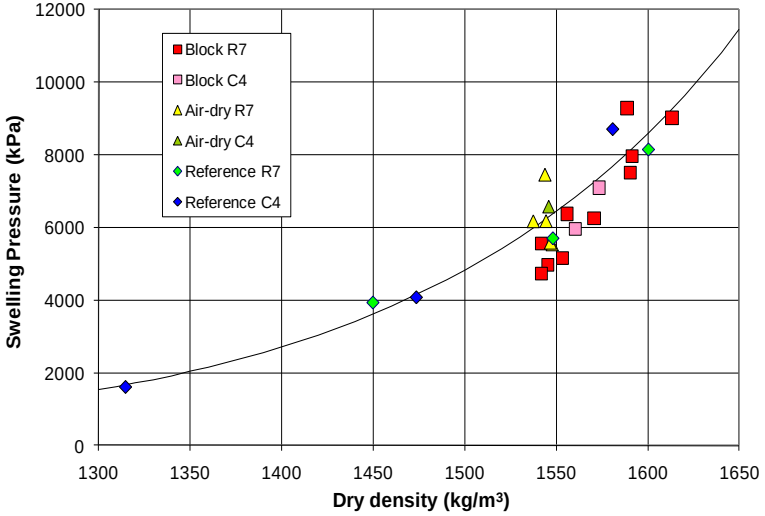
This supports the conclusions about cementation in SR-Site

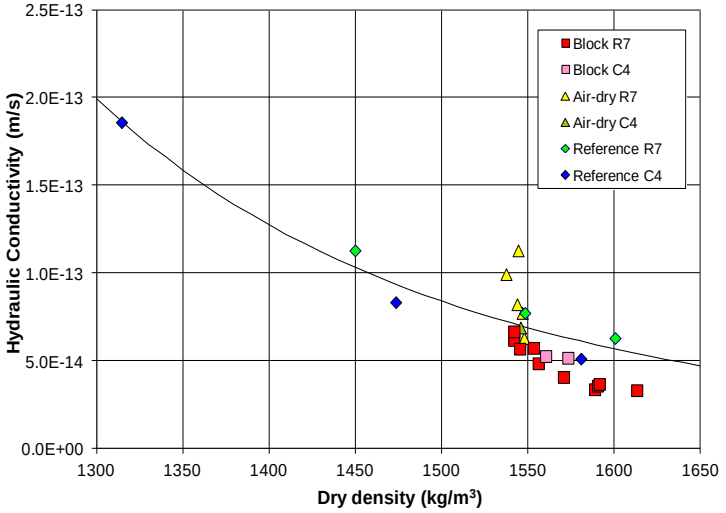
Hydraulic conductivity and swelling pressure



A schematic drawing of an oedometer.

Hydraulic conductivity and swelling pressure





The determined swelling pressure (left) and hydraulic conductivity as function of the dry density of the samples (right).

Preliminary conclusions

- the swelling pressure of the field test material was in the same range as that of the reference material
- the hydraulic conductivity of the trimmed specimens taken from the field experiment was somewhat lower than that of the reference tests, especially at higher densities.
- reduced strain at failure was observed on material from the innermost part of the material from the field experiment compared to the reference material
- no change in deviator stress at failure was seen on field experiment material compared to the reference material

Thank you!