



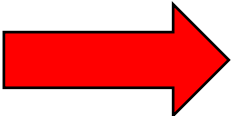
I - Joint Studies of Specialist Concrete in view of Radiation Protection Aspects

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II - Assessment of Concrete Core and Seating Mortar Samples from CERN UXC55 Cavern Base Slab

1st CERN Baltic Conference (CBC 2021)
28.06.2021

PrīmX technology

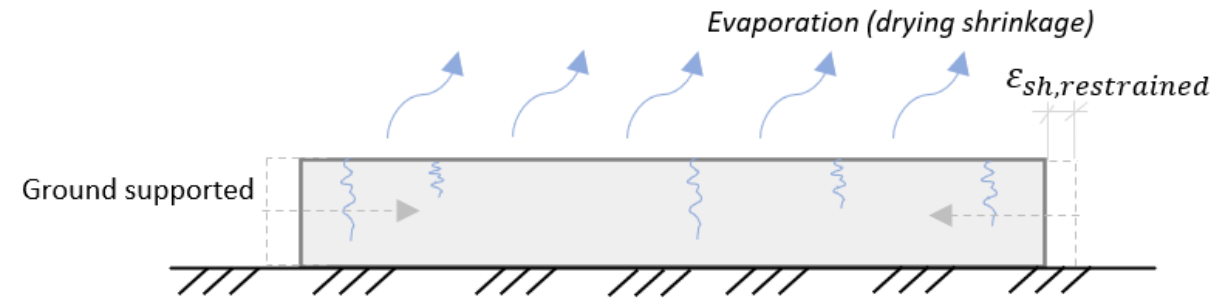


Concrete drying shrinkage
= ca. 0.6 mm/m



PrīmX technology

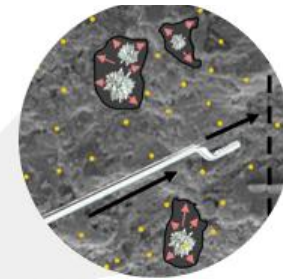
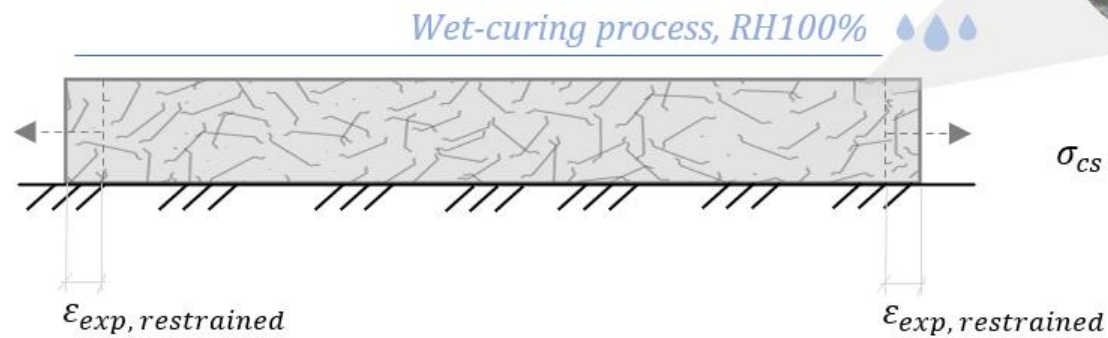
1.



$$\sigma_t > f_{t, concrete}$$

If tensile stress > tensile strength of concrete = slab cracks

2.



$$\sigma_{cs} = (\epsilon_{exp, free} - \epsilon_{exp, restrained}) \cdot E_c$$



Primekss: about company

| | |
|---------------------|----------------|
| FOUNDED | 1997 |
| TURNOVER in 2020 | >56.3 Mln. EUR |
| EMPLOYEES | >300 |
| LICENSING PARTNERS | 22 |
| SATISFIED CUSTOMERS | 1000 + |



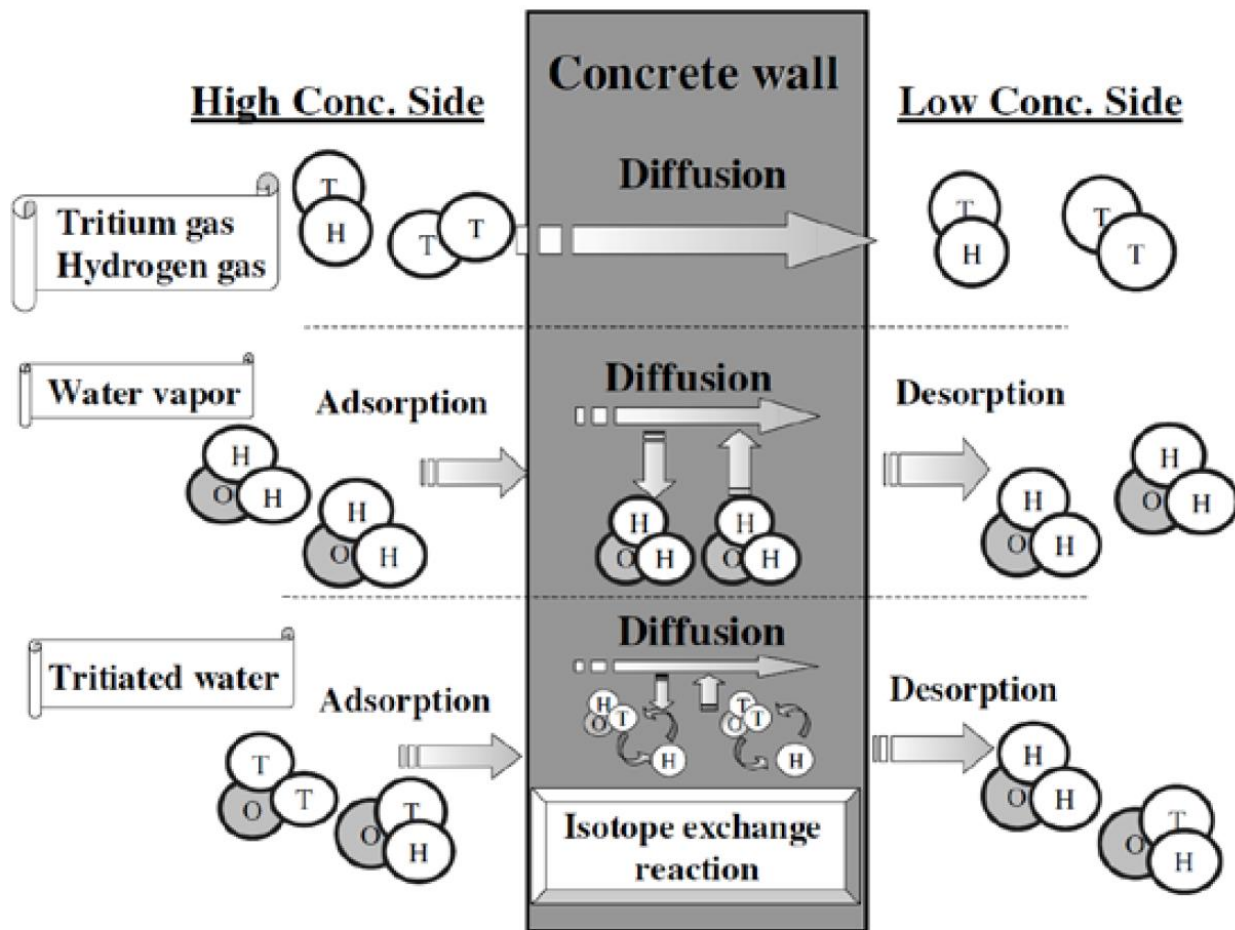
Already more than

15 000 000 m²

of indoor and outdoor slabs

Latvia • Lithuania • Estonia • Sweden • Norway • Denmark • Finland • Israel • Germany • UK • Netherlands • Poland
• Belgium • Bulgaria • Serbia • Belarus • Russia • Kazakhstan • Azarbaijan • India • US • Canada • Portugal
• Nigeria • South Africa • China • Romania

I - Joint studies of specialist concrete in view of radiation protection aspects



European Organization for Nuclear Research
Organisation européenne pour la recherche nucléaire

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Primekss SIA
76 Gustava Zemgala gatve
Rīga, LV-1039

Our reference: HSE-RP/DFW/jm/2017-002

Geneva, 6. October 2017

Re: Possible Joint Studies of Specialist Concrete in View of Radiation Protection Aspects

Dear Sirs,

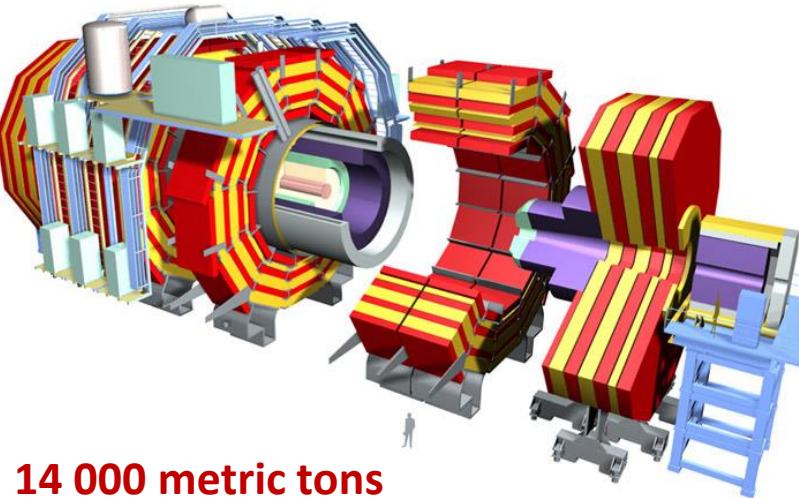
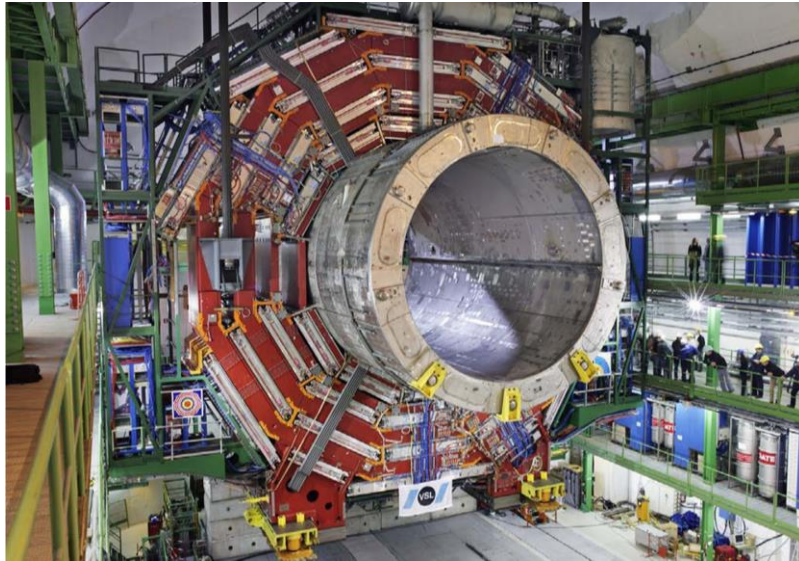
This letter refers to the various exchanges between CERN, Riga Technical University, the University of Latvia and Primekss SIA, as to possible mutual benefits resulting from various, radiation protection related studies on concrete.

As discussed with the Latvian stakeholders, I am pleased to confirm our willingness to explore the possibility of defining a joint program of radiation protection related studies, which, in principle, would be hosted by CERN. In application of requirements under the CERN Convention, the results of such studies should be applied exclusively to non-military purposes.

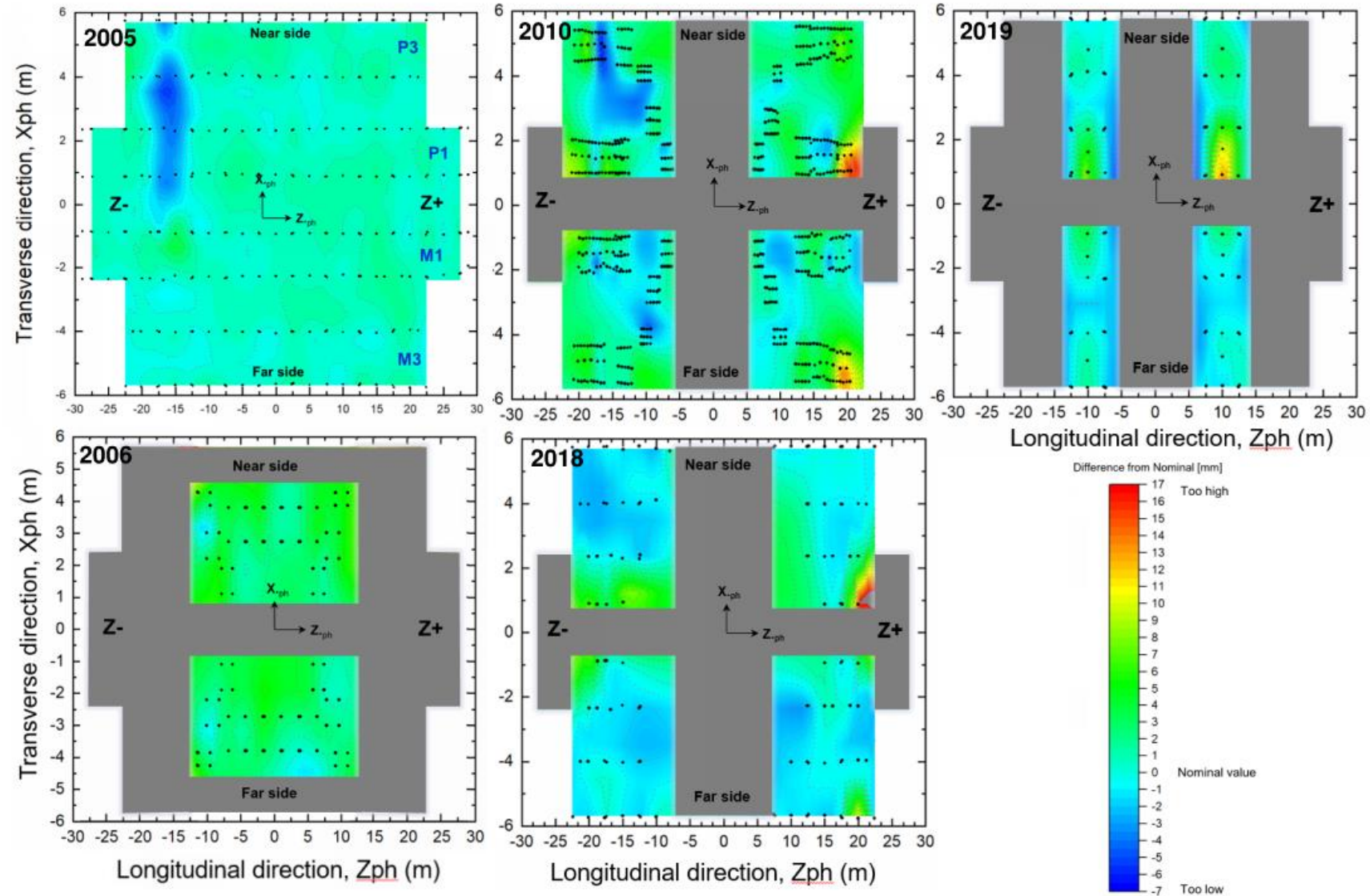
It is understood that any specialist concrete to be used in such studies would be sourced from Primekss SIA. Possible tests on samples of such concrete could serve, inter alia, to:

- Establish the characteristics of the specialist concrete with respect to radiation hardness and activation of its chemical components
- Establish the characteristics of the specialist concrete with respect to gas emanation, in particular with respect to Tritium gas;
- Establish whether the concrete with alternative reinforcements other than steel (e.g. glas fiber) is able to match the performance of steel reinforced concrete – in view of a possible reduction of radioactive waste by activated steel; and
- Establish whether a crack free specialist concrete is able to prevent liquid infiltration, in particular water infiltration.

II - Assessment of concrete core and seating mortar samples from CERN UXC55 cavern base slab



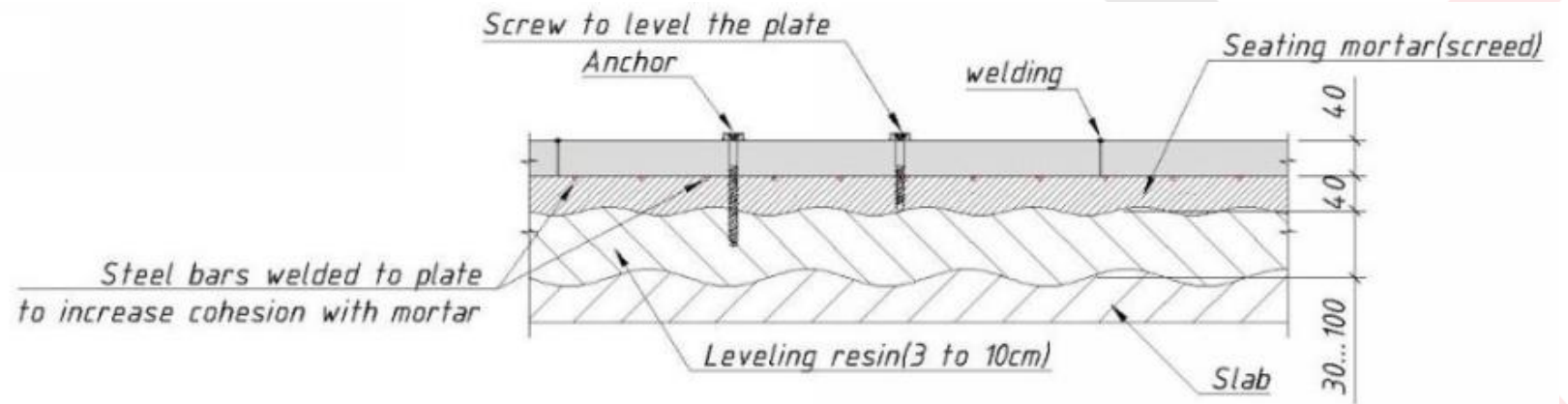
14 000 metric tons



II - Assessment of concrete core and seating mortar samples from CERN UXC55 cavern base slab

- **Multi-layered floor system, consisting of:**

- Steel plates
- Seating mortar
- Two concrete layers



- **Condition of interface varies:**

- Local gaps/delamination
- Other locations appear to maintain sound interface

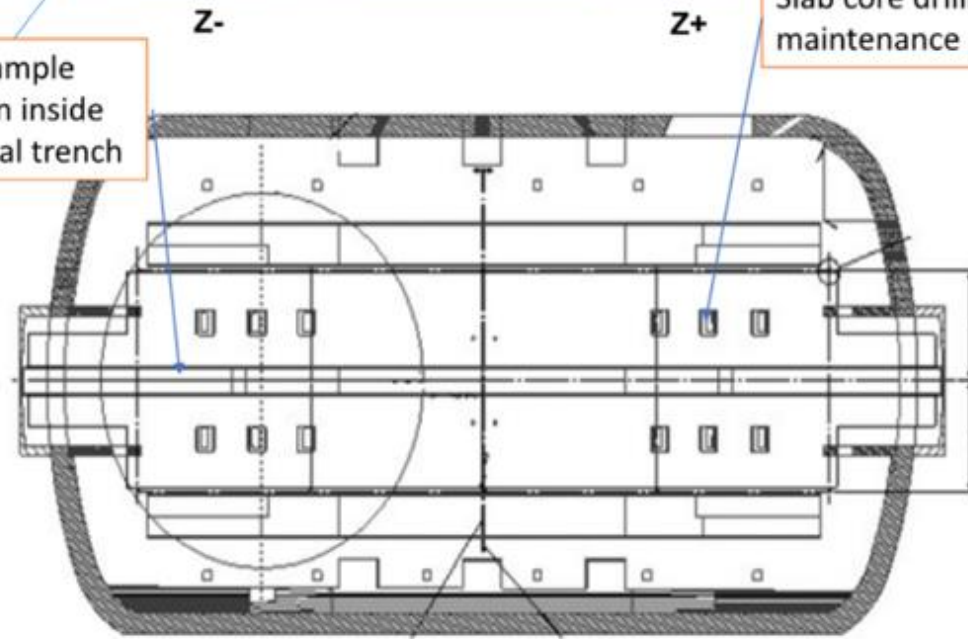


II - Assessment of concrete core and seating mortar samples from CERN UXC55 cavern base slab

- **Chemical deterioration processes in concrete causing expansions:**
 - Reinforcement corrosion
 - Sulfate Attack & DEF
 - Alkali-Aggregate Reactions
 - Sulfide-bearing aggregates
- **Primekss investigated provided samples for signs of ongoing deterioration in concrete and/or seating mortar and examined the mechanical properties**



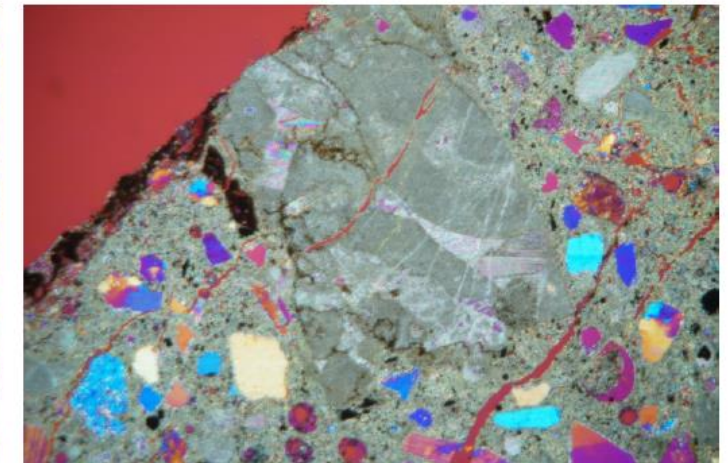
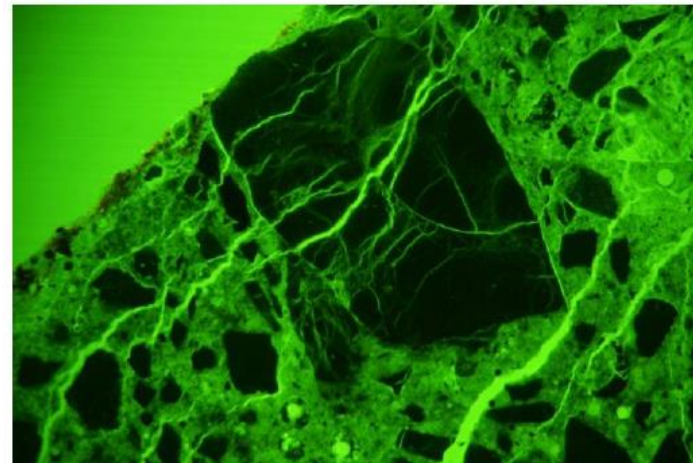
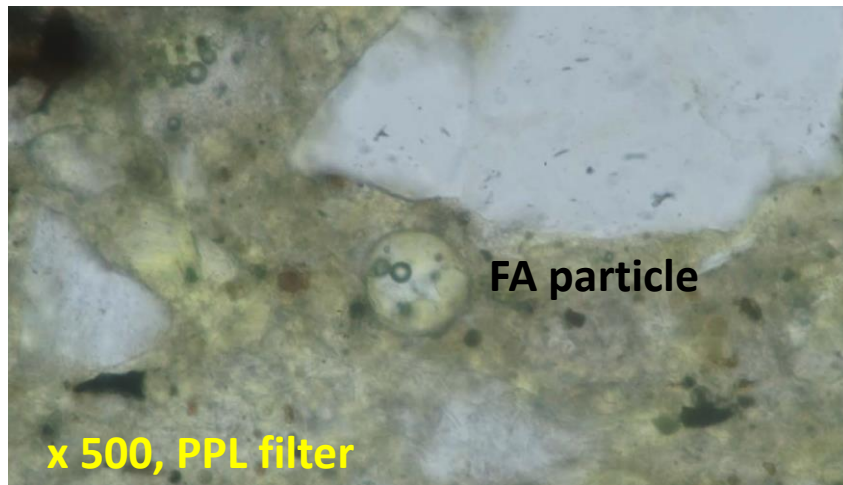
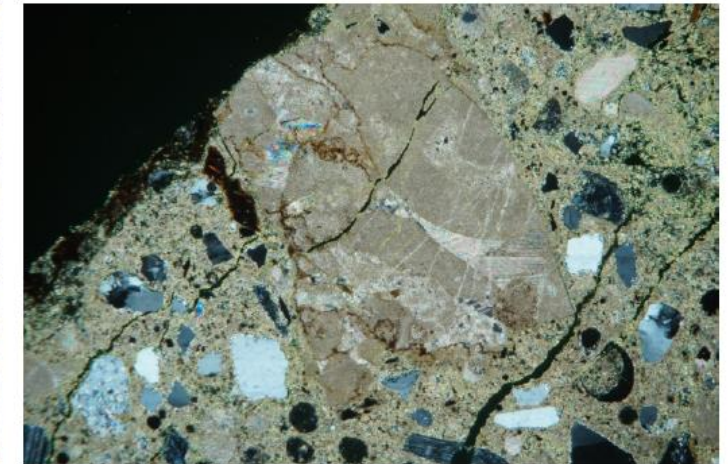
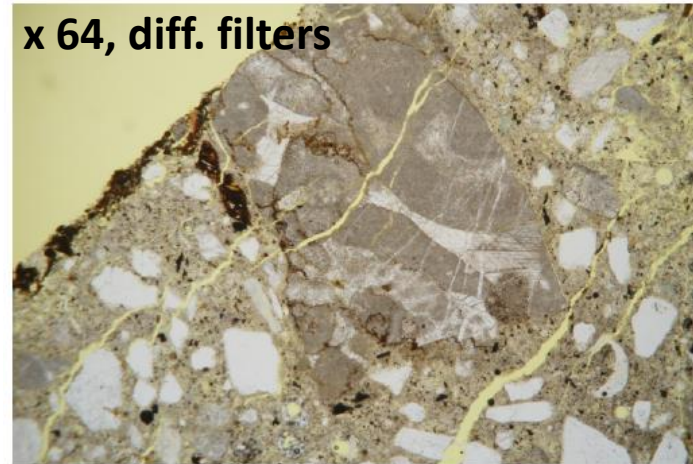
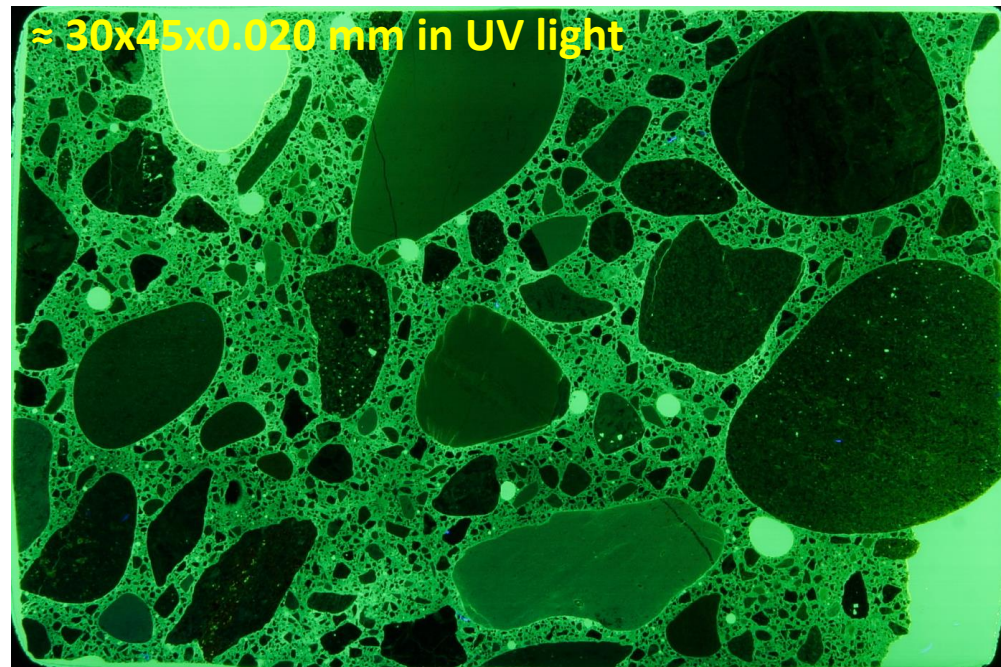
Screed sample extraction inside the central trench












Slab core drilling in a maintenance pit



II - Assessment of concrete core and seating mortar samples from CERN UXC55 cavern base slab



II - Assessment of concrete core and seating mortar samples from CERN UXC55 cavern base slab

| | |
|---|---|
| <div><div><div><div>PRIMEKSS SIA</div><div>Reg. No. 40003328876</div><div>Gustava Zemgale gatve 76,</div><div>Rīga, LV-1039, Latvia</div><div>O +371 67801120 M +371 26461021</div><div>info@primekss.com</div><div>www.primekss.com</div></div></div><div><div></div><div></div></div></div> | |
| Sweden / Norway / Finland / Latvia / Estonia / Lithuania / Denmark / Israel | |
| <div>PROJECT</div> <div>Assessment of Concrete Core and Seating Mortar Sample from CERN UXC55 Cavern Base Slab</div> | <div>DATE</div> <div>2019-12-20</div> |
| <div>CLIENT</div> <div>Tristan Loic Loiseau CMS Technical Coordination CERN</div> | <div>TEL</div> <div>+41 75 411 24 26</div> |
| <div>YOUR REFERENCE</div> <div>Dr. Rolands Cepuritis</div> | <div>RESPONSIBLE</div> <div>Dr. Rolands Cepuritis and Dr. Brad J. Pease</div> |
| <div>SUMMARY</div> <p>Time-dependent vertical deviations in the topmost layer of the UXC 55 cavern floor system (i.e., steel plates) have been observed by CERN at specific locations. These vertical deviations have prompted an investigation by CERN into the potential source(s) of the local changes in floor level. Aims of CERN's investigation include understanding the cause of the issue and gaining insight on whether the deviations may continue to increase in magnitude with time.</p> <p>This report presents findings from laboratory analyses of samples of a concrete and a seating mortar extracted from the floor (i.e., base slab) of the UXC 55 cavern. The aim of the analyses was to assess whether the sampled materials present any indication of any of several possible chemistry-related deterioration processes in concrete; including delayed ettringite formation, alkali-aggregate reactivity, reinforcement corrosion or other possible deteriorations; that may result in an increased volume (i.e., expansion) of the material. Mechanical deterioration processes (e.g., damage due to excess or cycles of loading, etc.) were outside the scope of the laboratory analyses. Laboratory works presented herein were completed by a third-party accredited laboratory.</p> <p>It is noted that a visual inspection by Primekss was not possible for this report and findings presented herein are based on laboratory results from a highly limited number of samples and review of background documentation provided by CERN. The original laboratory reports and background documentation from CERN are appended to this report.</p> <p>The results from the laboratory analyses of a highly limited number of samples did not show signs of a chemical-related deterioration of the concrete or the seating mortar. Further, no significant signs of such deterioration process were observed in the site photographs furnished by CERN. While a chemical-related concrete deterioration cannot be excluded (due to the limited number of samples investigated), the observations presented herein do not support this as a cause for the time-dependent vertical deviations in the steel plate as observed by CERN.</p> | |

