

COST Action ES1404 Short Term Scientific Mission
Scientific Report
Replication of road surface snow in cold laboratory

Name of the Candidate and Institution

Leena Leppänen
Finnish Meteorological Institute
Arctic Research
Sodankylä
Finland

Name of the host institute

Tibor Fülöp
GOODYEAR Innovation Center *Luxembourg
Colmar-Berg
Luxembourg

Period

17-25 January 2017

Purpose of the STSM

The support provided by the COST STSM was received for a visit of the Physical Testing Laboratories of Goodyear Innovation Center in Luxembourg. The aim was to supplement the field work started in Sodankylä, Finland. The visit was connected to a research project, running in the frame of a cooperation between Goodyear and FMI and focusing on the characterization of snowy road surfaces. The current visit was used to extend the dataset collected earlier and to collaborate on the writing of a scientific publication.

Description of the work carried out during the STSM

The work during this STSM started by the basic safety training and by familiarizing with the facilities and laboratory equipment used later during the work. The working plan for the full stay was finalized during the first technical meeting. Some surface samples, prepared earlier by the host laboratory allowed to get familiar with the measuring chain and the surface preparation itself.

The measuring chain suggested was built on the standard methods regularly used during field campaigns. Mainly visual techniques (visual appearance, grain size, grain type) and standard mechanical tests (hardness, penetration resistance) were considered. These methods were identical / very similar to those available in Sodankylä. The main laboratory work included preparation and measurements of several snow samples, and the work consisted of the following steps:

- Fresh snow from nature-identical snowflakes was readily available at the beginning of the session. Only snow matching the one observed in Sodankylä was considered, identified by the grain size and grain type recorded with macro-photography.
- The compacted snow blocks were manufactured in sample containers. To match the standard road conditions, the compaction step was preceded by the creation of an ice base and by sieving the flakes to

obtain a pre-defined thickness. The grain size and type was monitored through the process to ensure the quality and repeatability of the different samples.

- Different compaction methods were used, leading to differently packed snow. The goal of the tests was to compare the surface evolutions driven by natural processes under static load and under artificial impacts occurring during standard road surface maintenance. The experimental design was defined in a way which allowed a direct, one-to-one comparison of the different treatments. In order to better approximate the real life conditions, mixed treatments were also considered. The conditioning time was one of the principal parameters of the study.
- The snow microstructure and mechanical properties were quantified during different phases of the work. Regular grain size and type measurements were taken with macro-photography. The mechanical properties (hardness or penetration resistance) were recorded on larger intervals, considering the destructive nature of these tests.

Description of the main results obtained

The main results of the STSM were following:

- The Draft structure of the scientific paper, planed on the base of some field observations made in Sodankylä was defined.
- The controlled environment during the surface preparation allowed to identify several clear consequences of the loading process linked to road surface maintenance.
- Although the assignment was relatively short, the regular observation of the surface evolution allowed to identify several temporal evolution processes.

Future collaboration with the host institution

Future collaboration opportunities were identified during the STSM. The firsts, immediate step includes the finalization of the planned publication. Based on the results, additional joint field and laboratory sessions can be foreseeable. The visit resulted in a closer working relation with the host personnel, helping to improving the future collaboration.

Foreseen publications/articles resulting from the STSM

A publication based on field data measured in Sodankylä was drafted. The finalization of the paper and the submission is planned for Q2 2017.

Confirmation by the host institution of the successful execution of the STSM

The host appreciated the discussions and experiments made during the STSM and thus judged the visit successful.

Other comments

The STSM funding allowed to conclude a successful and valuable visit. It provided an excellent opportunity to visit an industrial research laboratory and to enrich my professional experience on the field. The visit helped to prepare an upcoming publication and to define future research steps. I would like to thank COST Action ES1404 for this STSM.