

Year 1: Executive summary

The TEAM project consortium comprises 7 EU countries and 14 partners, such as stone producers and trade associations, testing laboratories, standardisation and certification bodies, consultants, building owners and care-takers and producers of fixing and repair systems.

The objectives of the project are to find the mechanisms of bowing façade claddings of marble, the expansion of marble and limestone and the connected loss of strength. In addition site investigation and monitoring systems shall be developed and various solutions to the problem will be tried. Drafts of laboratory test methods shall be delivered to the European Standardisation of Natural Stone: CEN TC 246.

The first year has focussed on producing an updated State-of-the-art over various Deterioration Mechanisms Hypotheses. More than 200 papers have been compiled in an attempt to extract their essence with particular emphasis on the causes and mechanisms responsible for the bowing of natural stone cladding. Despite the existing copious numbers of publications about the behaviour and deterioration of limestone and marble – particularly the bowing phenomenon, as yet no conclusive explanations exist concerning the influencing causes or mechanisms. However, two key parameters are agreed on: temperature variations and moisture. The latter has only recently been acknowledged as a key factor.

In order to gather information and to map the extent of the problem, about 140 buildings have been selected for classification and/or investigations. The buildings are situated in Northern, Central and Southern Europe, and there are buildings with bowed slabs in all countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom). Many of the buildings with problems have been visited and a preliminary investigation has been conducted. During this investigations several different marble types from Greece, Italy, Portugal, Spain, Norway and USA have been identified showing durability problems in terms of bowing. The task will continue throughout the entire project on a lower activity level. In connection with the preliminary investigation a draft for site investigation has been produced and an equipment for precision measuring of the amount of bow has been developed, the BOW-meter.

Six of the selected buildings have been chosen for a detailed investigation and sampling. Two of these buildings have been chosen for long-term monitoring of strength, amount of bow and climatic conditions. The purpose is to produce a model for risk assessment. The task that has just started and will be co-ordinated with another task focussing on impregnation and surface coating as protection and also installation of a field test site.

The sampling from the selected buildings shall be followed by sampling in the quarries where the façade materials originate from. For this purpose a sampling instruction has been prepared. The first part of a state-of-the-art concerning sampling and production is ready.

It has been found necessary to start the laboratory research earlier than originally planned. About 30 marble types have already been tested in a newly developed laboratory draft test method for moisture and temperature induced bowing. The samples will also be tested for petrographic composition and structure and flexural strength. So far a clear difference in the bowing properties have been found. This screening will continue with at least 60 marble types in total and serve as a basis for the subsequent selection of different marble types for a full characterisation.

Finally, a project web site has been installed: www.sp.se/building/team, where the composition, objectives and progress of the project can be followed.