

Year 2: Executive summary

The TEAM project consortium, representing 7 EU countries, comprises 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 main 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.

A state-of-the-art report has been updated. The state-of-the-art report is now based on an extensive compilation of 216 papers on marble and limestone deterioration dating from late 1800s to 2001. The findings and theories have been discussed at TEAM-meetings the last year. However, the mechanisms are still not clear. Temperature variations, moisture and microstructure seem to be determining factors, but cannot explain all the observations in practice. There will be a continuous evaluation of the above findings (from the literature) along with the evaluation of the results from the detailed inspections and the laboratory testing.

The continued inspections and evaluations of selected buildings have confirmed that the phenomenon of bowing of marble is rather common. Many new objects have been identified in the last year. These new objects include for example bowed tombstones in a graveyard in Damascus, Syria and a bowed marble plate in Tripoli, Libya. These objects are very interesting in relation to climate conditions, because the summers are very hot and extremely dry, with air temperatures reaching 45 degrees and relatively cool nights; and the winters are dry or only moderately wet. The task to search for more buildings will continue throughout the entire project on a lower activity level.

Six buildings have been chosen for a detailed investigation and sampling. These buildings are situated in Copenhagen, Denmark; Nyköping, Sweden; Lünen, Germany; Göttingen (2), Germany and Magenta, Italy. The inspections have been finalised for four of the six buildings. The inspection of the fifth building (Nyköping City Hall) has been started and is also chosen as a test site. A first evaluation of the results from these inspections shows different patterns and reasons for observed bowing. The microclimate and its variation seem to be very important parameters. The inspection of the last building will be based on the experience from the already inspected buildings. Sampling, strength and screening tests have been started on 5 of these buildings.

The Danish National Bank, Copenhagen, Denmark; University Library, Göttingen, Germany and Nyköping City Hall, Nyköping, Sweden have been chosen for long-term monitoring of strength, amount of bow and climatic conditions. Monitoring equipment has already been installed at the Danish National Bank, Copenhagen and the University Library, Göttingen.

The first draft of a prediction model for risk analysis has been prepared. This task will be co-ordinated with other tasks focussing on anchoring systems, long term monitoring, impregnation and surface coating as protection and also installation of a field test site.

A form for stone sampling and description has been developed. A compilation of approx. 15 selected rock types provided for sampling has been done. Eleven marble blocks have been sampled, four Portuguese, two Norwegian, four Italian, one Swedish. In addition, one German limestone has been sampled. The blocks are provided for the work in other WPs. The selection of these stone types has been based on the inspection of buildings in WP2 and on the screening test in WP5. Thirty-three marble and two limestone types have already been tested in a newly developed laboratory draft test method for moisture and temperature-induced bowing. Also samples from 6 buildings have been tested. The samples tested show major variability in the behaviour from no bowing to severe bowing. The first evaluation of these tests, indicate that only a few marble types show bowing behaviour. However, a very important finding is that all marbles are likely to loose strength, when exposed to RH/T variations also without showing any bowing behaviour.

Rock stress measurements have been carried out in three quarries in the Carrara area. Blocks have been sampled from these quarries for comparison of laboratory tests, field exposure and rock stress measurements.

A first version of a database to compile information from building inspections and stone analyses has been developed. The database will serve as an internal project tool for the project.

A final version of a poster and a project-brochure have been produced and distributed among partners. A pdf version of the brochure has also been placed on the homepage of the TEAM homepage. The TEAM project has been presented e.g. during the EUROTHEN workshop in Stockholm, Sweden. The aims and results of the laboratory tests have been introduced to an audience of Italian stone producers during an internal workshop in Carrara, Italy and for a wider audience of producers, consultants and architects in Copenhagen, Denmark.