STSM Scientific Report
COST Action TU0904
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• Purpose of the STSM

The purpose of the STSM was to get acquainted with the current scientific research that is being carried out by the Fire research group at the University of Sheffield. More specifically, the researcher informed himself of the recent research developments of the software Vulcan for the analysis of structures exposed to fire. The mission included the education in basic modelling capabilities of Vulcan that is available in the commercial version as well as in its academic version.

Furthermore, the idea was to use Vulcan software in order to test the capabilities and possible limitations of the structural analysis software developed by the researcher. Comparison between the two programmes was based on the modelling of the fire tests carried out by the researcher's institution. As outcome, the results from the conducted numerical studies were used as benchmark tests for fire exposed steel members.

• Description of the work carried out during the STSM

During the period of two weeks the researcher was engaged in studying the capabilities of the commercial and the academic version of Vulcan. Basic modelling capabilities of the Vulcan code were thoroughly explained by the host, Professor Ian Burgess. A possibility of further research in development of Vulcan capabilities was discussed. More specifically, the development of steel creep model and heat transfer model for the Vulcan software. As a part of the STSM, the researcher was engaged in creating benchmark studies for partially heated simple steel beams.

• Description of the main results obtained

In order to create a benchmark study, a structural analysis of four different fire tests was carried out in a commercial version of Vulcan. A sensitivity analysis was done with respect to the total number of finite elements and the representation of the fire temperatures developed in the beams. Temperatures that were used in numerical modelling were based on the temperature measured during the fire tests. A total of four different benchmarks were created. Two of the benchmarks include partially heated simply supported steel beams loaded with a vertical force, and the other two benchmarks include partially heated simply supported beams loaded with a vertical and compressive force.

The main assumption for the creation of benchmarks is that they must contain enough data so that the numerical simulation can be re-applied by another researcher in full. In order to

do so, the easiest way to develop benchmark studies is to release them in a form of a spreadsheet.
Each of the benchmarks consists of four different spreadsheets. Spreadsheets contain basic input parameters for the numerical model (geometry, boundary conditions, loading type…), temperature input and representative results of the numerical simulation (i.e. displacements and inner forces). The benchmarks that were developed in the STSM can be used in testing the numerical models that deal with 3D heat transfer analysis and geometrically/materially nonlinear structural analyses. General guidelines for the creation of spreadsheets were provided by the host, prof. Ian Burgess. The benchmarks created during the STSM are to become a part of the global benchmark study package of the Fire research group at the University of Sheffield.

- **Future collaboration with host institution**

Collaboration with the Fire research group at the University of Sheffield is planned in the near future. More specifically, development of creep and heat transfer models for the academic version of Vulcan.

- **Foreseen publications/articles resulting or to result from the STSM**

A paper for the Action conference ASFE 2013 is planned, which is partially related to the STSM.

I would like to thank Ian for giving me the opportunity to learn and study from the experiences of the Fire research group, as well as giving me a warm welcome to the University and his department.

Split, 28. 02. 2013. Neno Torić, PhD