STSM Scientific Report
COST Action TU0904
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• Purpose of the STSM

The purpose of the STSM was to create a contribution to WP4 Benchmark study package of the Action. A benchmark study for steel columns has been chosen to analyze the influence of creep strains on the level of column's critical temperature and on its general behaviour.
Two different creep models have been implemented in Vulcan research code during the first and the current STSM in order to enable creep modelling. The idea was to explore the influence of different heating rates on the reduction of columns critical temperature and to find a limiting heating rate at which creep has to be taken into account in structural fire analysis.

• Description of the work carried out during the STSM

As a starting point for the benchmark parameters, geometrical and loading data were adopted from a benchmark study no. 42 in which no creep analysis had been conducted. The adopted column was simply supported and different values of column slenderness were chosen for the analysis (20-120). Load ratios used in the study were varied in the range between 0.2-0.7. Three different heating rates were selected for the analysis ranging from 2.5-10°C/min including the ISO fire curve. Thus each of the analyzed columns (with particular slenderness and load ratio) was heated with the selected heating rates and their critical temperatures were recorded in the analysis.
Furthermore, during the STSM I was enabled to spend some quality time on face-to-face discussions about future research directions regarding the implementation of creep analysis in Vulcan research code.

• Description of the main results obtained

The results of the benchmarks have shown the reduction of column's critical temperature equals to approximately 10% if compared to critical temperature of a column determined without considering creep.
The influence of creep is more apparent in the case of columns with higher slenderness (80-120) where creep has more influence on the critical temperature. Furthermore, low heating rates (2.5-5°C/min) have the most influence on the reduction of critical temperature. High

heating rate (10°C/min) which is imposed on a column seems to reduce insignificantly critical temperature of a column.
Overall conclusion is that that creep strains act as an amplifier of the effect of geometrical imperfections which is more pronounced in slender columns.

• **Future collaboration with host institution**
Future collaboration with the Fire research group of the University of Sheffield is planned. More specifically, further development of creep analysis for the Vulcan research code including scientific research regarding creep (development of new material models and research of creep failure-modes in steel structures).

• **Foreseen publications/articles resulting or to result from the STSM**
Contribution in a form of a benchmark study for WP4 Benchmark study package is planned.

I would like to thank Ian for giving me the opportunity to expand my research interests regarding steel fire analysis, as well as giving me a warm welcome to the University and his department.

Split, 16. 12. 2013. Neno Torić, PhD