VALIDATION OF AN ADVANCED CALCULATION MODEL FOR THE DESIGN OF COMPOSITE STEEL-CONCRETE COLUMNS

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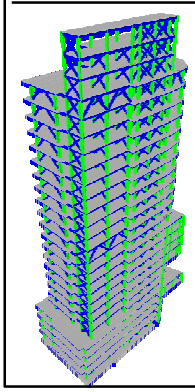
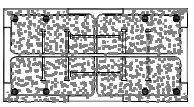
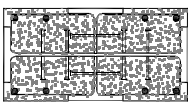
Composite steel-concrete structure

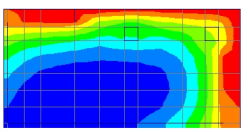
Bucharest Tower Centre Building

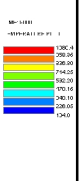


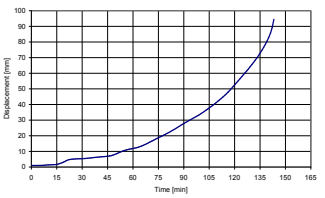
Composite steel-concrete columns
Fire resistance demand of 150 minutes











Ground floor: 143 min

Floor I >: over 189 min

SR EN1994-1-2:

4.4.4. Validation of advanced calculation models

- (1)P The validity of any advanced calculation model shall be verified by applying the following rules (2)P and (4)P.
- (2)P A verification of the calculation results shall be made on basis of relevant test results.
- (3) Calculation results may refer to deformations, temperatures and fire resistance times.
- (4)P The critical parameters shall be checked, by means of a sensitivity analysis, to ensure that the model complies with sound engineering principles.
- (5) Critical parameters may refer to the buckling length, the size of the elements, the load level, etc.

Validation of advanced calculation model SAFIR through a relevant test

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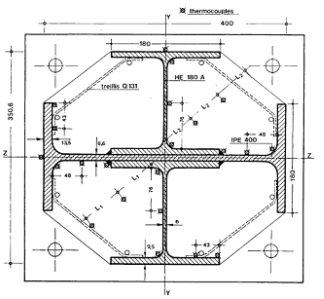
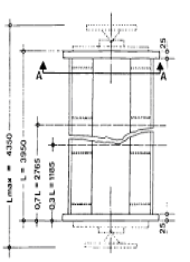
Octogonal column - fire resistance 172 minutes





N = 1600kN

Standard fire ISO-834

Initial measured imperfection 0 mm (1 mm for numerical simulation)

Resultant emissivity (experimental):

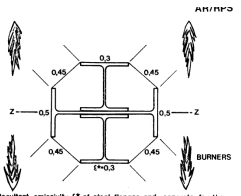
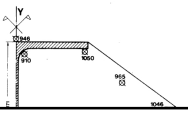
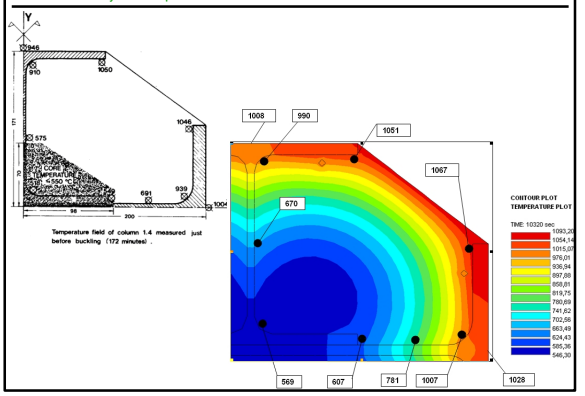


Fig 32 : Resultant emissivity (ε* of steel flanges and concrete for the numerical simulation of column 1.4

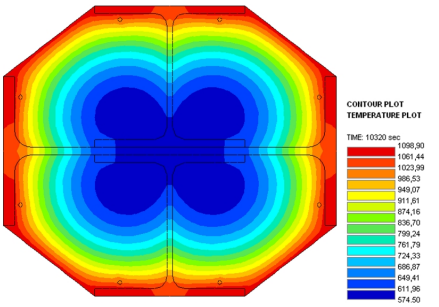


Thermal analysis – comparison at 172 minutes of ISO fire



Temperature field of column 1.4 measured just before buckling (172 minutes) .

Thermal analysis



Mechanical analysis – sensitivity analysis

Critical parameter	Fire resistance [min] Test = 172 minutes
Buckling lengths	
Lf = L	132
Lf = 0,7L	164 (reference) Imperfection 1mm, Emissivity from test
Lf = 0.5L	188
Load ratio	
75%	190
125%	144
Initial imperfection	
1/1000	156
1/200	140
Resultant emissivity	
Eurocode values	152

Conclusions

- **SAFIR gives good results, in the safe side, in comparison with the results obtained from the fire test**
- **the sensitivity analysis showed that the computer program SAFIR gives appropriate results in accordance with the engineering principles: the fire resistance time increases with the decrease of the buckling length of column, of the load ratio, of the initial imperfection and of the resultant emissivity**
- **the values of the buckling lengths, initial imperfections and of the resultant emissivity, considered in the advanced calculation model SAFIR for the assessment of fire resistance of the columns of Bucharest Tower Center building, were in the safe side for the calculation results**