The fire scenario is significantly affected, among other things, as regards the evaluation of ventilation conditions.

References and Guideline

Case Study: Car Parks of C.A.S.E. Project for L’Aquila

The C.A.S.E. Project for L’Aquila was developed in L’Aquila (province of Abruzzo, Italy), after the seismic event of 06/04/2009, in response to the housing emergency. It was characterized by the construction of several seismically isolated buildings.

Case Study: Car Parks of C.A.S.E. Project for L’Aquila

The structural safety during the fire exposure, in the lack of protective coatings on steel columns, was evaluated through the application of performance-based approach.

Technical References and Guideline

CIC Agreement 7215 - PP/025 “Demonstration of Real Fire Tests in Car Parks and High Risks” by CTEM (France), PROFIL-ARBED Recherche (Luxembourg) e TNO (Netherlands), closed 2001

INERIS Guideline “Parc de stationnement en superstructure largement ventile. Avantages et inconvénients”, Final Report 2001 by INERIS (Institut National de l’Environnement Industriel et des Risques) and by CTEM (Centre Technique Industriel de la Construction Métallique).


Case Study: Design Fire Scenarios

Localised Fire Scenarios - Pre-flashover

SCENARIO L1: 7 vehicles, of which 1 central VAN and 6 cars, that burn with a fire propagation time from car to adjacent one equals to 12 min from the VAN.

SCENARIO L2: 4 vehicles, of which 1 central VAN and 3 cars surrounding a column, that burn with a fire propagation time from car to adjacent one equals to 12 min from the VAN.

Propagation time 12 min.

Generalized Fire Scenarios - Post-flashover

SCENARIO D1: 34 vehicles, of which 2 central VAN and 32 cars, that burn with the fire propagation time from car to adjacent one equals to 6 min from the VAN.

Propagation time 6 min.
The exposure is about 2.6 \( m \) differential vertical displacement (between two adjacent analyses below the substructure Case 16mm with limit value of 5.0 \( \times 10^{-2} \)).

For each fire scenario, the axial load at the top of column, corresponds to the axial load obtained by the global structural analyses.

Checks in terms of resistance and limitation of damage (differential vertical displacements in the columns).

**Conclusions**

- The FSE application to car parks is facilitated by the information about the possible fire scenarios provided by the European Research Project CEC agreement 7215/PP/035 (2001) and from INERIS (2001) guideline.
- The substructure extension has allowed assessing in an appropriate way both the thermal field and the hyperstatic effects induced by different thermal expansions of steel columns and bending of the concrete reinforced slab.
- In addition to the global analysis, for each fire scenario, in order to calculate more accurately the thermal field and stresses distribution in the capitals above the columns and to assess the possible local buckling, detailed 3D thermo-mechanical analyses have been conducted with reference to the more stressed and heated column.
- The thermo-mechanical analyses in fire situations for the described case study showed that the structures, and in particular the steel columns considered unprotected, satisfy the performance level set to the design fire scenarios, also thanks to an overstrength in normal condition design.

**THANK YOU FOR YOUR ATTENTION**