

2.9 Robustness of car parks under localised fire: Tests on joints subject to thermal and mechanical loading


Haremza C., Portugal

ROBUSTFIRE PROJECT

**Robustness of car parks under localised fire:
Tests on joints subject to thermal
and mechanical loading**

Cécile Haremza, Aldina Santiago
University of Coimbra, Portugal

Action TU0904 Meeting: Barcelona Workshop, WG2, 5 July 2010





1

ROBUSTFIRE Project - Robustness of open car parks under localised fire | Cécile Haremza | 2

PURPOSE and SCOPE OF THE PROJECT

- EUROPEAN RFCS ROBUSTFIRE PROJECT**
 - NEW DESIGN CRITERIA of car parks WITH SUFFICIENT ROBUSTNESS UNDER LOCALISED FIRE
 - PRACTICAL DESIGN GUIDELINES
- 4 MAIN OBJECTIVES**
 - State of the art** (behaviour of joints and columns under fire; design of open car parks subject to a localised fire)
 - Behaviour study of the frame elements directly affected by the localised fire (Experimental tests and numerical models)**
 - Numerical models** and simplified **analytical models** of the fire response of critical structural components (Columns, connections, composite beams)
 - Robustness assessment approach** for steel composite open car parks under localised fire

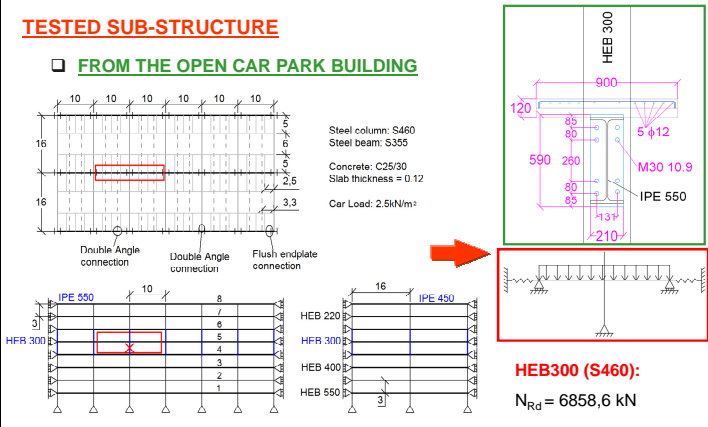



2

ROBUSTFIRE Project - Robustness of open car parks under localised fire | Cécile Haremza | 3


TESTED SUB-STRUCTURE

FROM THE OPEN CAR PARK BUILDING



Steel column: S460
Steel beam: S355
Concrete: C25/30
Slab thickness = 0.12
Car Load: 2.5kN/m²

HEB300 (S460):
 $N_{Rd} = 6858,6 \text{ kN}$

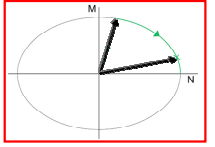



3

ROBUSTFIRE Project - Robustness of open car parks under localised fire | Cécile Haremza | 4

OVERVIEW OF THE 7 EXPERIMENTAL TESTS ON JOINTS

- 7 EXPERIMENTAL TESTS**
 - 1 REFERENCE TEST** at ambient temperature
 - 5 TESTS** at high temperatures (500°C and 700°C)
 - 1 DEMONSTRATION TEST** under fire (increase of temperature up to the failure of the joint)
- OBJECTIVE**
 - To observe the **COMBINED BENDING MOMENT and AXIAL LOADS** in the heated joint when catenary action developed in the frame after the loss of the column


4

ROBUSTFIRE Project - Robustness of open car parks under localised fire | Cécile Haremza | 5

OVERVIEW OF THE 7 EXPERIMENTAL TESTS ON JOINTS

STUDY CASES	Axial Restraint	Temperature	Objective
TEST n°1 (REFERENCE TEST)	Spring	20°C	Joint M-N curve
TEST n°2/TEST n°3	X	500/700°C	Joint properties
TEST n°4/TEST n°5	Total	500/700°C	Joint M-N curves
TEST n°6	Spring	700°C	
TEST n°7 (DEMONSTRATION TEST)	Spring	>700°C	

- 4 STEPS**
 - Initial load
 - Localised fire
 - Loss of the column
 - Max load capacity

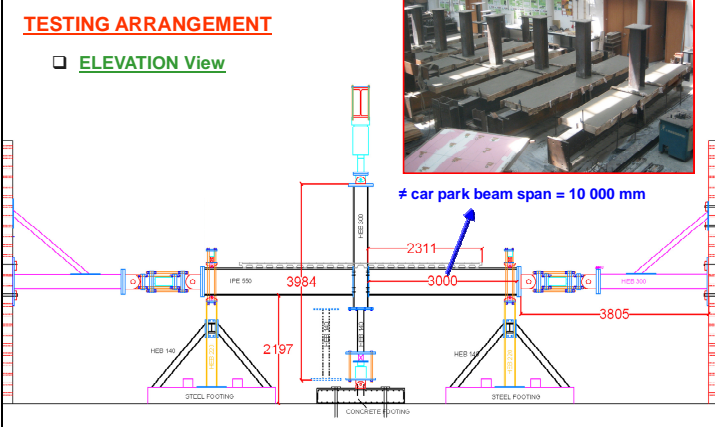


5


ROBUSTFIRE Project - Robustness of open car parks under localised fire | Cécile Haremza | 6

TESTING ARRANGEMENT

ELEVATION View



car park beam span = 10 000 mm



6

