

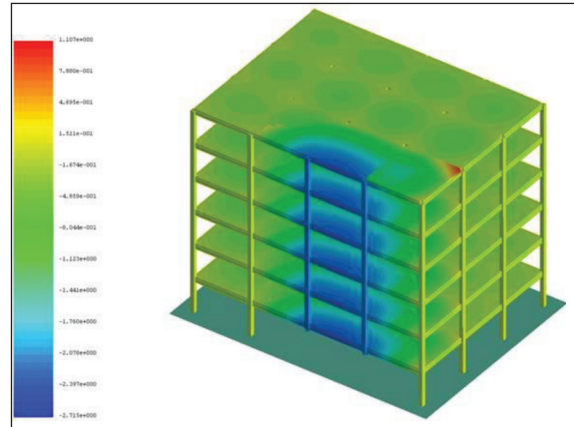
**Goal of the project:** Development of design requirements and guidelines for mitigation of progressive collapse; Development of more robust structures that can resist progressive collapse under extreme actions (natural or man-made)



Oklahoma City bombing, 1995

#### Short description of the project:

The project aims at defining, evaluating and modeling hazards, and at developing models for characterization of the material properties under different conditions, methods for structural evaluation and intervention strategies for mitigating the probability of collapse in case of extreme load events. Research activities will include advanced numerical analyses and full scale tests to determine the likely failure mechanisms and the extent of damage in response to the extreme load events. A consortium of five institutions is involved in the project, from which two are high ranked technical universities (UP Timisoara, UT Cluj Napoca), two are national institutes for research and development (INSEMEX Petrosani, INCERC Cluj Napoca) and one is a major construction company (ACI SA Cluj Napoca).



Resistance against progressive collapse by  
two way span systems

**Project implemented by:** The Research Centre for Mechanics of Materials and Structural Safety (CEMSIG), Department of Steel Structures and Structural Mechanics, Faculty of Civil Engineering.

**Implementation period:** 2013-2015

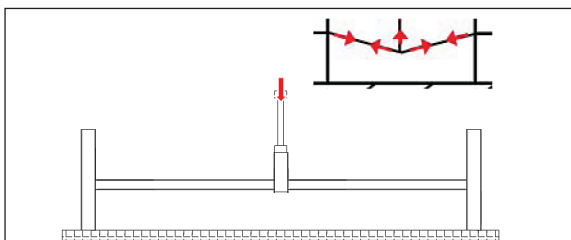
**Main activities:** The work plan is based on 7 phases and 16 scientific tasks. The scientific activity is divided into 3 main parts, which will be developed during the 3 years of the project, with the goals of yielding significant advances in the field of improving the robustness of multi-story frames in case of extreme load events.

Phase 1: Preliminary investigations; Phase 2: Design of experimental program and numerical program. Second part deals with the experimental and numerical testing; Phase 3: Experimental program on materials, weld details and macro-components; Phase 4: Experimental program on joints; Phase 5: Experimental program on sub-assemblies; Phase 6: Numerical program. The last part is devoted to the elaboration of recommendations for collapse control design of multistory frame structures: Phase 7: Design guidelines and recommendations.

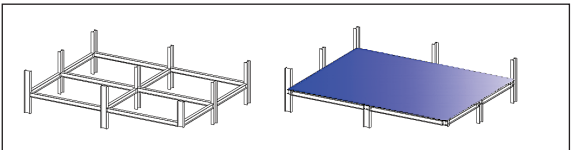
"Proportion is the heart of beauty."



*Experimental facilities at PU Timisoara*



*Test set-up for experimental investigation of joints*



*Sub-assembly specimens for corner column loss test: steel only structure (left) and steel structure with composite floor (right)*

#### **Expected results:**

- A procedure to ensure general structural integrity of multi-story frame buildings will be developed. The method can be used for design of new buildings and for the upgrading of the existing ones.
- Recommendations for best practice in selection of structural system, fabrication and material requirements for improving the robustness.

#### **Fields of interest:**

- progressive collapse design of multi-storey buildings
- reduction of the vulnerability of existing structures against accidental actions
- structural reliability.

**Research centre:** The Research Centre for Mechanics of Materials and Structural Safety (CEMSIG)

#### **Financed through/by:**

The Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI), Romania, in the frame of the Partnerships Program Joint Applied Research Projects.

#### **Research team:**

Politehnica University of Timisoara (Coord.); Technical University of Cluj-Napoca; The National Institute for Research and Development in Mine Safety and Protection to Explosion INSEMEX Petrosani; National Institute for Research and Development in Construction, Urban Planning and Sustainable Development "URBAN-INCERC"; S.C. ACI CLUJ S.A. (Industrial Partner)

#### **Applicability and transferability of the results:**

The output of the project addresses the needs of several target groups and end users:

- The academics and researchers, working within the structural engineering profession
- Technical regulations and codification drafters
- Relevant authorities, building authorities and insurance companies
- The professional engineers from design and consulting offices, constructions companies and construction materials fabricators, technical managers and decision makers from urban development and protection of building stock and urban facilities.

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"Proportion is the heart of beauty."

Ken Follett