

Appendix 7

*Section 7 European Laboratory For Structural Assessment
(ELSA) by F. Taucer*

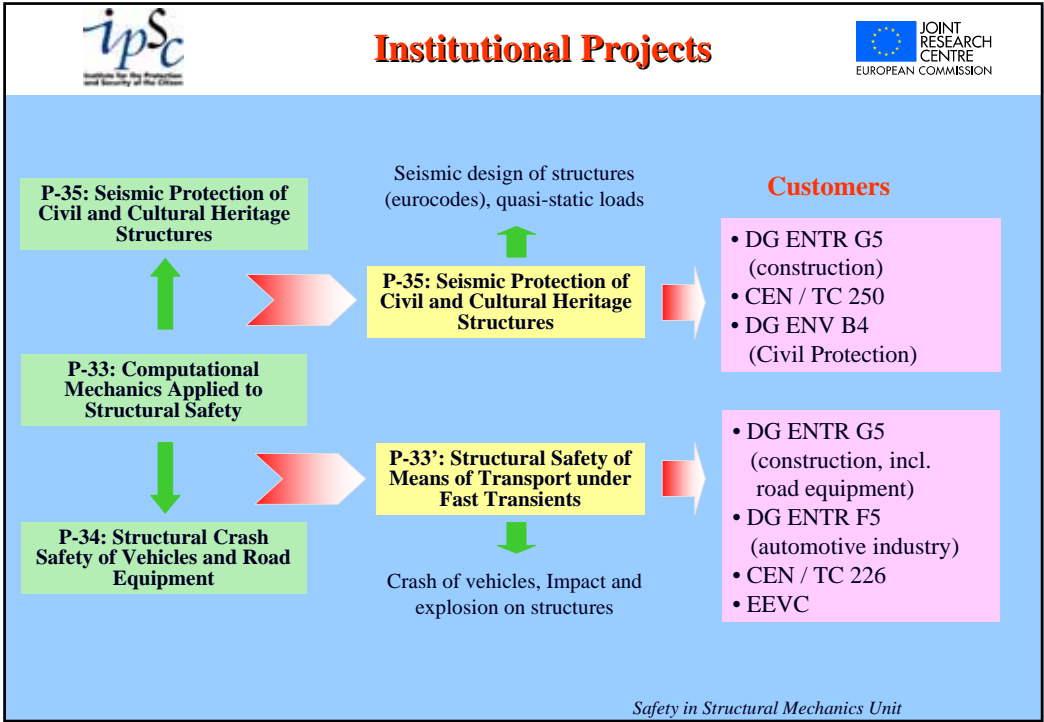
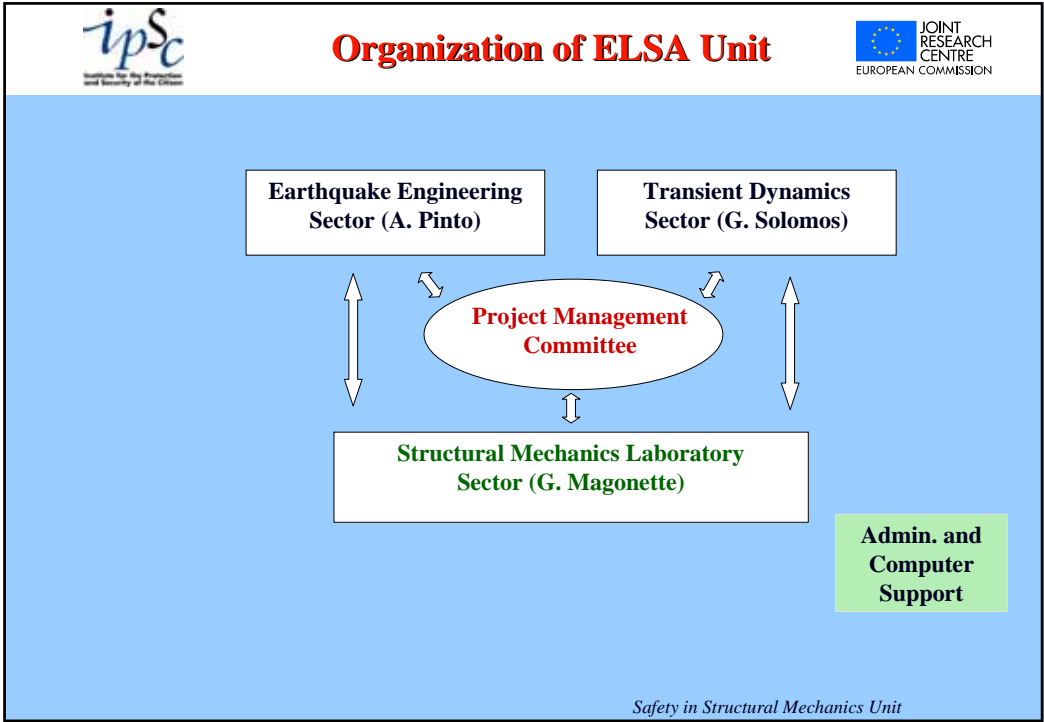
presented by F. Taucer



Safety in Structural Mechanics Unit

**To provide research
and contribute to European Standards
for risk mitigation
in construction, transport, and industrial installations
through integrated use of
experimental testing and numerical modeling
in Structural Mechanics**

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ELSA Personnel	A	B	C	D	GH	Aux.	END	Vis. Sc.	Total
Unit Management									
Earthquake engineering									
Transient Dynamics									
Structural mech. Lab.									
Admin. And Info. Support									
Total									

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**Earthquake
Engineering**

INSTITUTIONAL FP5	
SCA (15)	
TMR (4)	
TPW (2)	
TOTAL (22)	

**Transient
Dynamics**

INSTITUTIONAL FP5	
SCA (10)	
TPW (3)	
TMR (0)	
TOTAL (14)	

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Earthquake Engineering

- ELSA reaction wall
- Hardware implementation of the PsD method
- CASTEM 2000 FEM software (CEA)

- Electronics and Strain Gage laboratories
- Computer network and web site

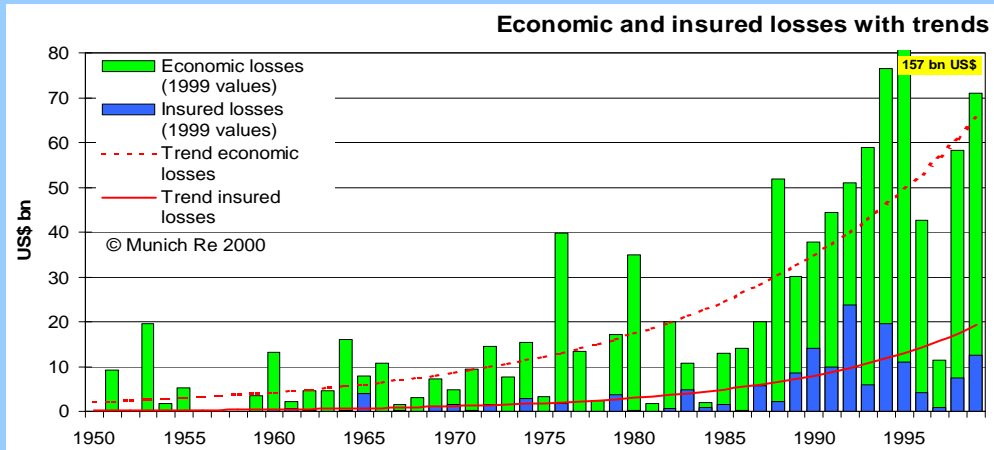
Transient Dynamics

- LDTF large Hopkinson bar
- Laboratory on Dynamics of materials
- EUROPLEXUS code (collaboration agreement with CEA)

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- **Citizen protection:** exponential increase of human and economic losses in modern society (increased complexity of infrastructures and networks), growth of population and land occupation, ...)
- **Role of the States and Authorities:** Only 10% of the capital insured. In spite of this, re-insurance proposes Risk Sharing (between industry, insurance, re-ins., State, Regions)
- **Industry development / competitiveness:** New materials, new technologies for both new and existing (retrofit) constructions
- **The need for harmonized and advanced norms and standards (e.g.: Eurocodes):** Open market, Acceptable safety levels, ...

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**Kocaeli Earthquake
(Turkey, 1999)**

Deads: 17,000
 homeless: 600,000
 Reconstruction cost:
 10-20 Billion Euros
 35% of industry affected



Assisi, IT, 1997



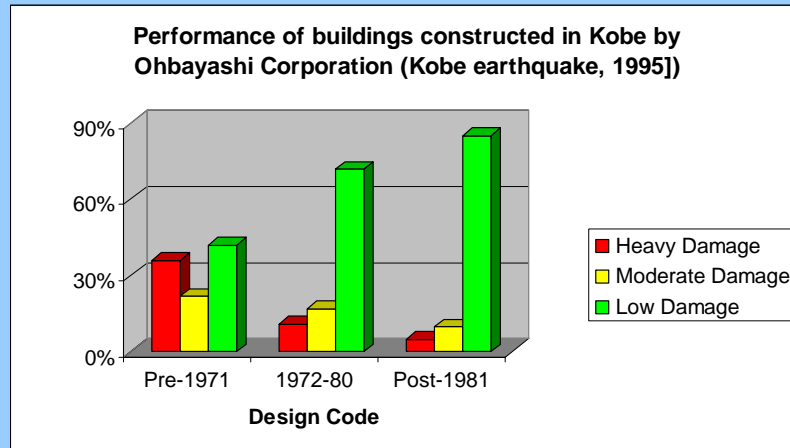
Azores, PT, 1998



Athens, GR, 1999



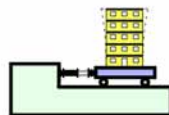
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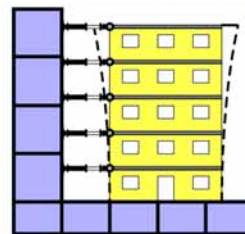
2 complementary approaches

Shaking Table



- dynamic test
- reduced scale
- open loop

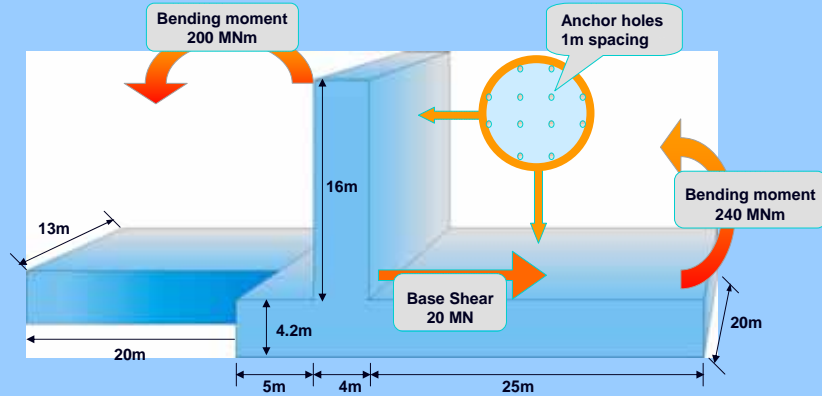
Reaction Wall



- pseudo-dynamic test
- full scale
- closed loop

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ELSA reaction wall

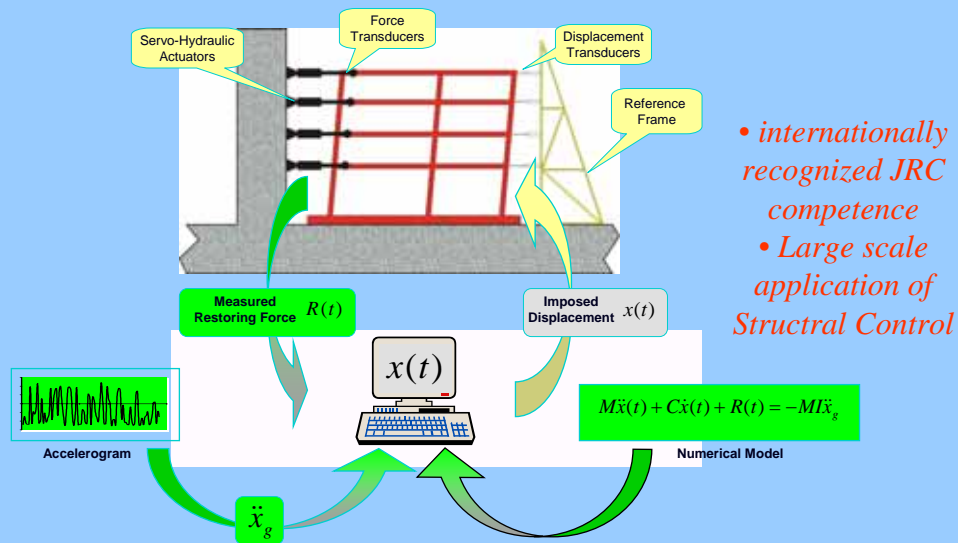


- 16 actuators 0.5 - 1 MN
- 2 testing platforms

- Unique test installation in Europe
- Allows pseudo-dynamic tests at full scale
- Integrated in European network of shaking tables

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Pseudo-dynamic Testing Method

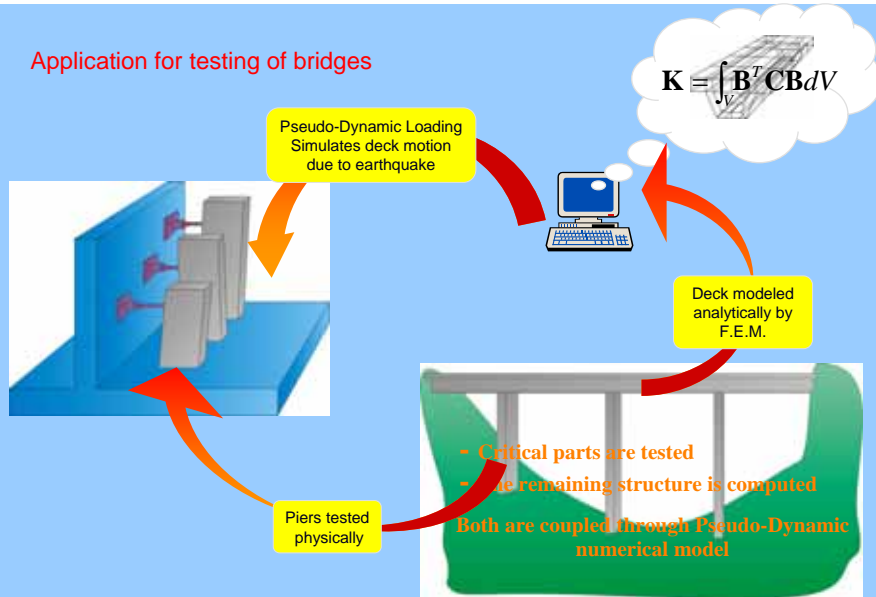


- internationally recognized JRC competence
- Large scale application of Structural Control

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Sub-structuring

Application for testing of bridges



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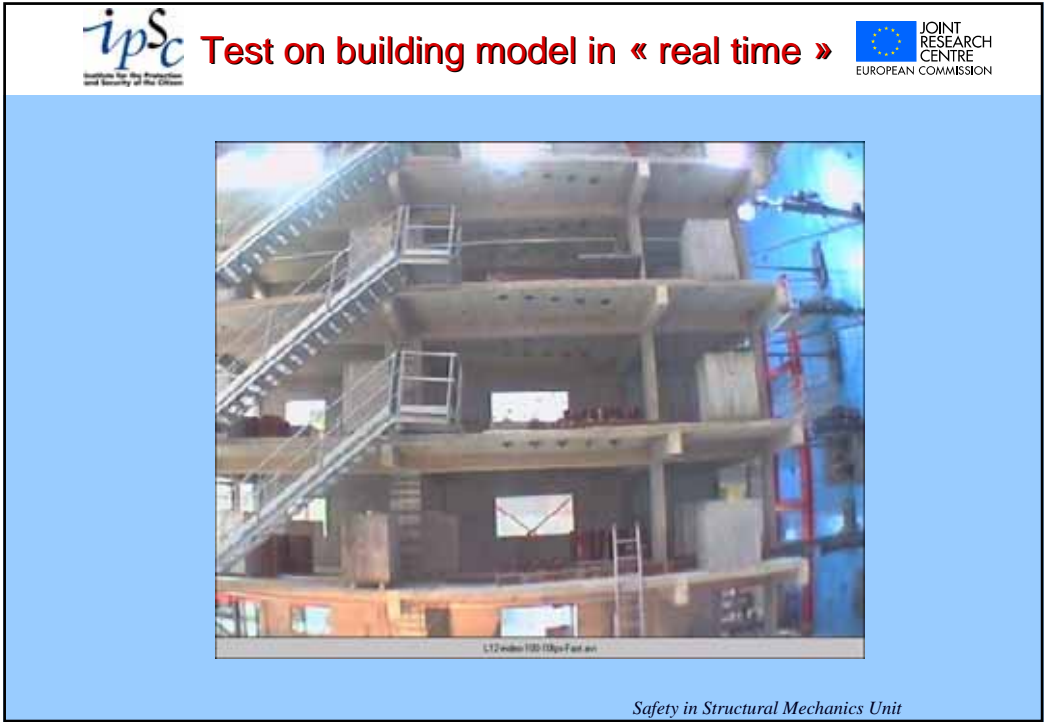
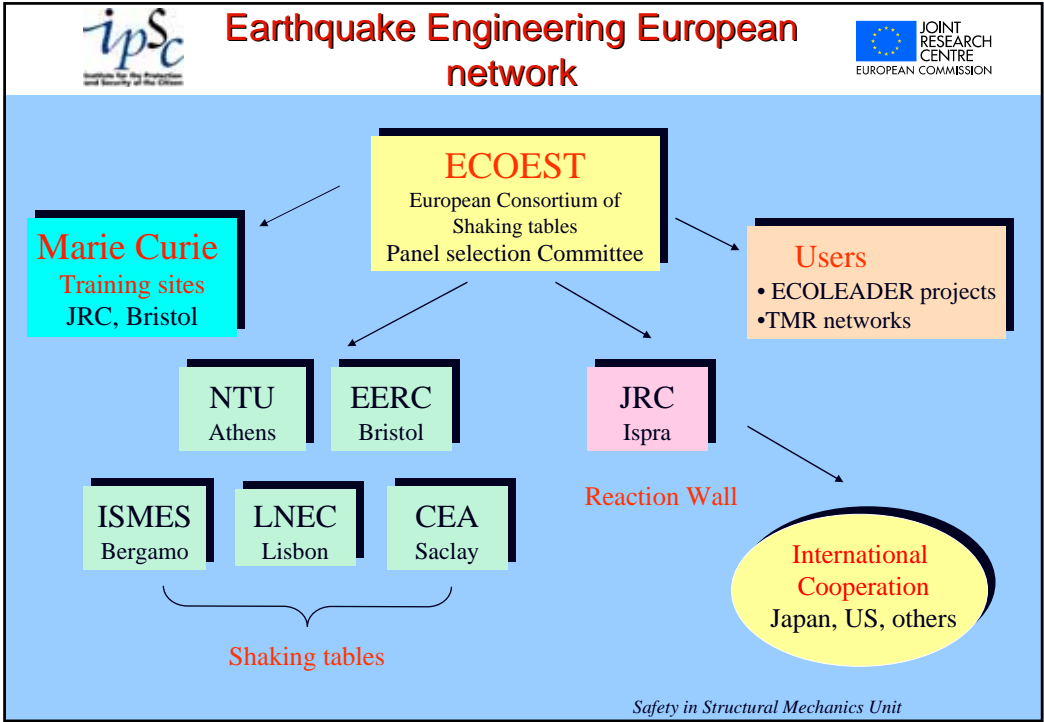
Seismic Engineering Applications

Strengthening and
rehabilitation

Construction norms
(Eurocodes)

Anti-seismic
Isolation

Preservation of
monuments





Partners:

▷ DGEMIN

▷ LNEC

▷ JRC



OBJECTIVES

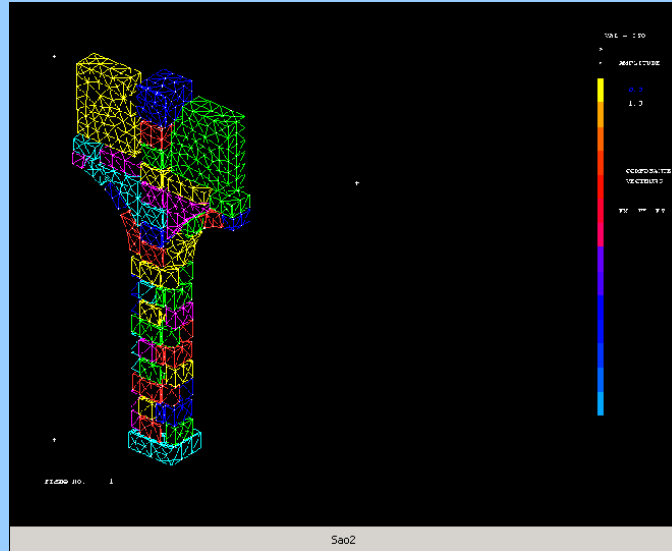
- ▣ *Mitigation of Seismic Risk of Monumental Structures*
- ▣ *Development of Methods and Tools for Seismic Vulnerability Assessment of Monuments*
- ▣ *Development of Retrofitting Techniques*
- ▣ *Application to the S. Vicente Monastery in Lisbon*

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Test on monument model



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Construction of the large-scale bridge piers outside of the
ELSA Laboratory

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Physical piers in the lab



Numerical models for the substructured piers A20, A30

Numerical models for the substructured piers A50, A60

Numerical model for the deck and PSD master



Master experimental process and data acquisition



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Wet lay-up application of a quasi-isotropic carbon FRP on the shear walls of a reinforced concrete dual frame

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Context: Brite-EuRam III (1997 - 2000)

General objective:

*To control wind, rain and traffic vibrations of
long span cable-stayed bridges*

Partners:

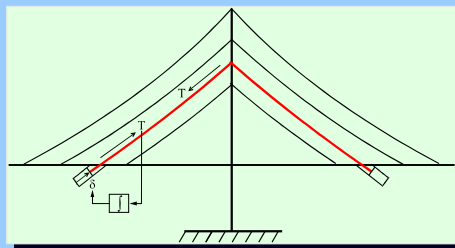
- Bouygues (F) - Coordinator
- DERA (GB)
- Newlands Technology (GB)
- Johs.Holt (N)
- Joint Research Centre (EU)
- Tech. Universität Dresden (D)
- Université Libre de Bxl (B)
- VSL (F)



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Aims of testing campaign at ELSA

- to improve understanding of induced vibrations
- to validate the numerical tools for prediction of cable dynamic behavior
- to verify the capability of the active system to mitigate induced vibrations
- to evaluate performance and reliability of the whole implementation.



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- Key contributions to Eurocode 8 through Reference tests allowing for approval by national standardization bodies
- Worldwide leading position on Pseudo-dynamic testing of large/full-scale structures.
- Internationally recognized expertise in numerical modeling of civil structures.
- Contribution to the position of the European Research in the International scene (Europeans are today preferential partners)

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- Large-scale Facility (HCM, TMR, IHP)
- Marie Curie Training Site (IHP)
- Research Training Networks (HCM, TMR, IHP)
- 19 SCAs during FP5 (\cong 18% of the total budget)
- More than 140 refereed publications (1999-2001)
- Referees in high-level research evaluation panels (e.g.: NSF-projects/infrastructures)

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- Eurocodes approval and maintenance (JRC/ELSA and DG ENTR)
- A key role in ERA
 - Training through research
 - Integrated projects
 - Networking of European experimental facilities
- Enlargement
 - Most of Candidate Countries are earthquake sensitive \bar{y}
Training, Adoption of Eurocodes, Participation in Integrated projects, ...

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- A ‘Reference Training Site’
- Integrated project for Earthquake risk mitigation in Europe (Belgirate, 2000 Workshop recommendations)
- ERA and information technologies (through networking)
 - Provide EE Facilities and Community with advanced platform/s for data storage, documentation and exchange and analytical developments (*essential for perennality of data and tools*)
 - Enhance experimental techniques and procedures by full exploitation of the electronic communication facilities
 - Establish appropriate collaboration with NSF - NEES (e.g.: JRC the European node of NEESgrid)

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- **Objective** Citizen protection through validation of the safety of various structural systems under fast transients, such as *crash, impact, blast* and *explosion*
- **Rationale** Structural safety under fast transients (including biomechanical aspects) is a major concern of the modern society since it concerns:
 - industry and energy production infrastructures; automotive, aeronautical and water transportation systems, civil structures under accidental or perpetrated attacks, etc.
- **Underlying physical principles** Under severe dynamic conditions, materials and structures exhibit very specific behaviour (*strain rate effect, fluid-structure interaction*)

Safety in Structural Mechanics Unit

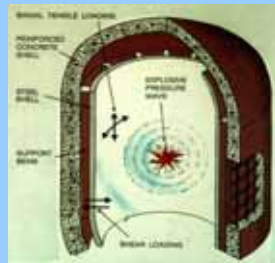
- Existence of the unique experimental facility **LDTF** (impact testing)
- FEM simulation code **EUROPLEXUS** (jointly developed with CEA)

validated code simulations via precision impact testing



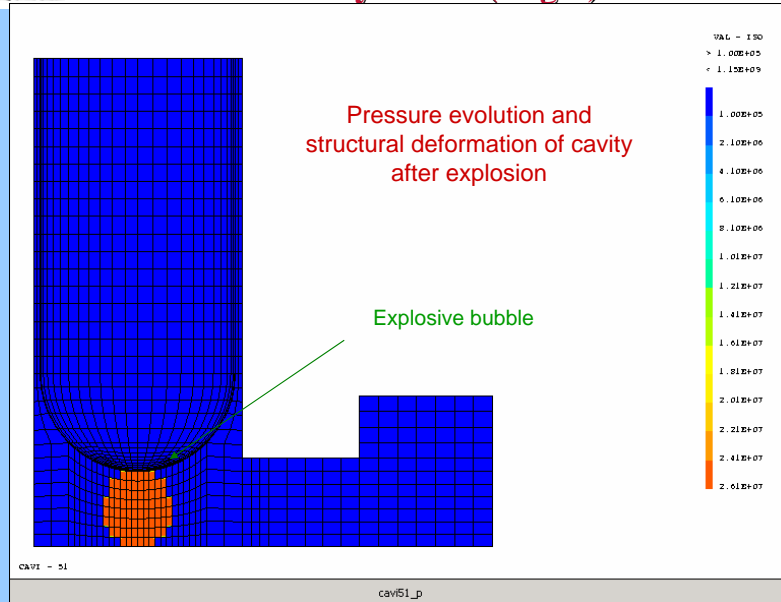
- Long experience and numerous collaborations with EU research institutions (CEA, FZK, FRAMATOME, MPA, EDF, SIEMENS, ENEA, ENSA, ENEL, SNECMA, CRF...)
- Small but high-yield group, well recognized in Europe and internationally

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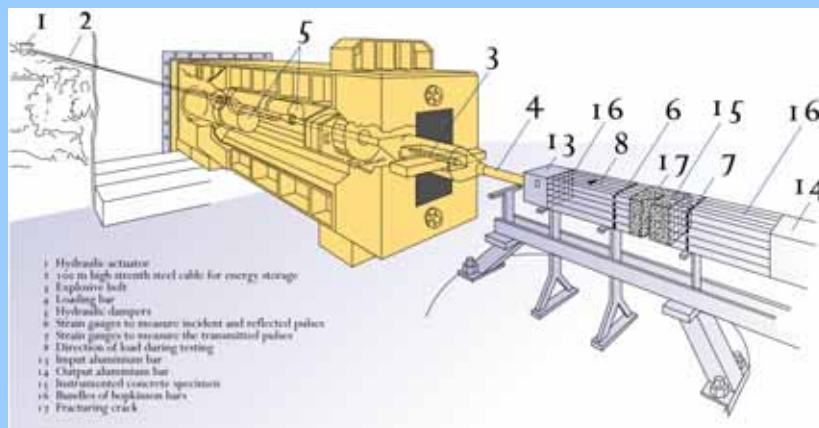
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Transient Dynamics Activity Areas (origin)



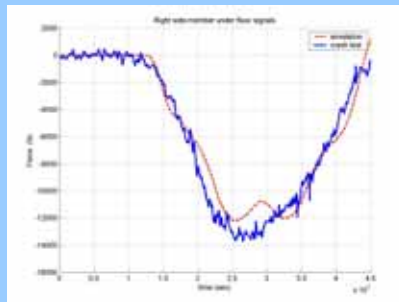
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Principle of LDTF Installation





*force
transmitted
to the right
side-
member
under floor*



- Independent expertise in support of the Commission policies (DG ENTR):
 - directives EC 96/27 and 96/79 on crashworthiness of vehicles
 - standards EN1317 1,2 on road safety barriers (CEN/TC226)
 - ongoing normative action on pedestrian safety
 - concrete and anchors construction standards
- European networking of users for EUROPLEXUS code (collaboration with CEA and SAMTECH)
- Reference measurements in crash / impact testing and modeling techniques; materials dynamic characterization
- Suitable to play a leading role in ERA/FP6; training and networking with European impact laboratories