



OPPORTUNITIES UNDER RFCS: SUCCESS IN PROJECTS OF COAL AND STEEL

Luís Simões da Silva



Licenciatura Engenharia Civil
MSc in Structural Steel Design
PhD in Structural Mechanics
Prof. Catedrático na Universidade de Coimbra

Universidade de Coimbra, Coimbra, Julho 1984
 Imperial College London, London, Julho 1986.
 Imperial College London, London, Março 1989.



- Teaching
- Research
- University Management

1983 - ...



- Founding Member
- Vice-President
- President

1997 - ...

LUÍS
SIMÕES DA SILVA



- Designer
- Software Dev.
- Entrepreneur
- Industry

1990 - ...



- Member TC8/TC10/TC14
- Member BD ECCS
- President TMB (2007-2013)
- President ECCS (2011-2013)

1999 - ...

University of Coimbra

- ❑ Founded in 1290 by King D. Dinis, University of Coimbra is the 5th oldest in Europe with approx. 23.000 students
- ❑ Located in Coimbra with 3 campuses
- ❑ Faculty of Science and Technology
 - 8000 students, 600 lecturers
 - 11 departments
- ❑ Department of Civil Engineering (2014 world rank **100-150** (QS), top in Portugal and best at UC)
 - 1000 students in 2 Integrated MSc's (Civil and Environment, 5 years)
 - Advanced MSc's: Erasmus Mundus European Master SUSCOS, MSc in Steel Construction and MSc in Fire Safety Engineering
 - Doctoral Programs: Steel Construction; Fire Safety Engineering; Civil Engineering; Environmental Eng.



KEY FACTORS FOR SUCCESS

(19 RFCS PROJECTS SINCE 2006,
TOTAL 25.2 M€, 3.8 M€ FOR ISISE)

- ADV. EDUCATION
 - RESEARCH
- INTERFACE WITH
INDUSTRY



ADVANCED EDUCATION IN STEEL CONSTRUCTION IN PORTUGAL



OFFER IN EDUCATION IN STEEL CONSTRUCTION AT THE CIVIL ENGINEERING DEPARTMENT

INTEGRATED MSc in CIVIL ENGINEERING (5 years)

STEEL STRUCTURES (compulsory course Y4S2, 6 ECTS)
SPECIALIZATION IN STRUCTURAL MECHANICS (Y5, 60 ECTS, strong emphasis on STEEL STRUCTURES)

ADVANCED MSc in STEEL CONSTRUCTION

Professionally oriented MSc (condensed teaching on fridays and saturdays).
(120 ECTS, 2Y, including 42 ECTS MSc thesis)

ERASMUS MUNDUS EUROPEAN MASTER SUSCOS

Full-time advanced MSc in consortium of 6 top European universities
(90 ECTS, 1Y1/2, including 30 ECTS MSc thesis)

DOCTORAL PROGRAM IN STEEL CONSTRUCTION

(1Y, 60 ECTS of courses + PhD thesis)

MSc in STEEL CONSTRUCTION

- ❑ MSc in **STEEL CONSTRUCTION** that is unique in Portugal.
- ❑ Led by **UNIVERSIDADE DE COIMBRA**, supported by cmm – Portuguese Steelwork Association, with the cooperation from leading Professors from other Portuguese Universities: IST, UM, UP and UA.
- ❑ **30** students in edition 2005-2007
- ❑ **27** students in edition 2007-2009
- ❑ **33** students in edition 2009-2011
- ❑ **24** students in edition 2011-2013



**Dep. Engenharia Civil
FACULDADE DE CIÊNCIAS E TECNOLOGIA
DA UNIVERSIDADE DE COIMBRA**

CONSTRUÇÃO METÁLICA E MISTA

CURSO DE MESTRADO

(duração de 2 anos)

CURSO DE PÓS-GRADUAÇÃO

(duração de 1 ano)

2007 - 2009
Candidaturas abertas

INFORMAÇÕES:
Isabel Cristina Caroline
Tel. 239 792 247
isabel@dec.ucp.pt
www.dec.ucp.pt

CANDIDATURAS:
FCUC, Polo II
Rua Luís Reis Gomes
3003-789 Coimbra - Portugal
(candidaturas online: www.fcuc.pt)

COM A COLABORAÇÃO DE:

constálica
Associação de Indústrias Metálicas, Lda

MARTIFER
Associação de Indústrias Metálicas, Lda

cmm
Associação de Indústrias Metálicas, Lda

UF
Universidade de Fátima

www.dec.ucp.pt

MsC STEEL AND COMPOSITE CONSTRUCTION - Editions

	Edition 1	Edition 2	Edition 3	Edition 4	Edition 5	Edition 6a	Edition 6b
Academic years	2005-07	2007-09	2009-10	2010-11	2012-14	2013-15	2013-15
Type	CMM - Pt	CMM - Pt	CMM - Pt	CMM - Pt	SUSCOS - En	CMM - Pt	SUSCOS - En
Schedule	PLF	PLF	PLF	PLF	SF	PLF	SF
Language	Portuguese	Portuguese	Portuguese	Portuguese	English	Portuguese	English

SF – Standard format

PLF – Post-labour format (thursday, friday and saturday)

Application 2011

July 2011: approval by EACEA for **5 editions**
out of 177 proposals 29 were selected

September 2012: 1st edition



□ Master Course Structure

3 semesters, each with 30 ECTS (total of 90 ECTS)

1^o semestre: September – January

2^o semestre: February – June

3^o semestre: September – January



PARTNERS

 "Politehnica" University of Timisoara

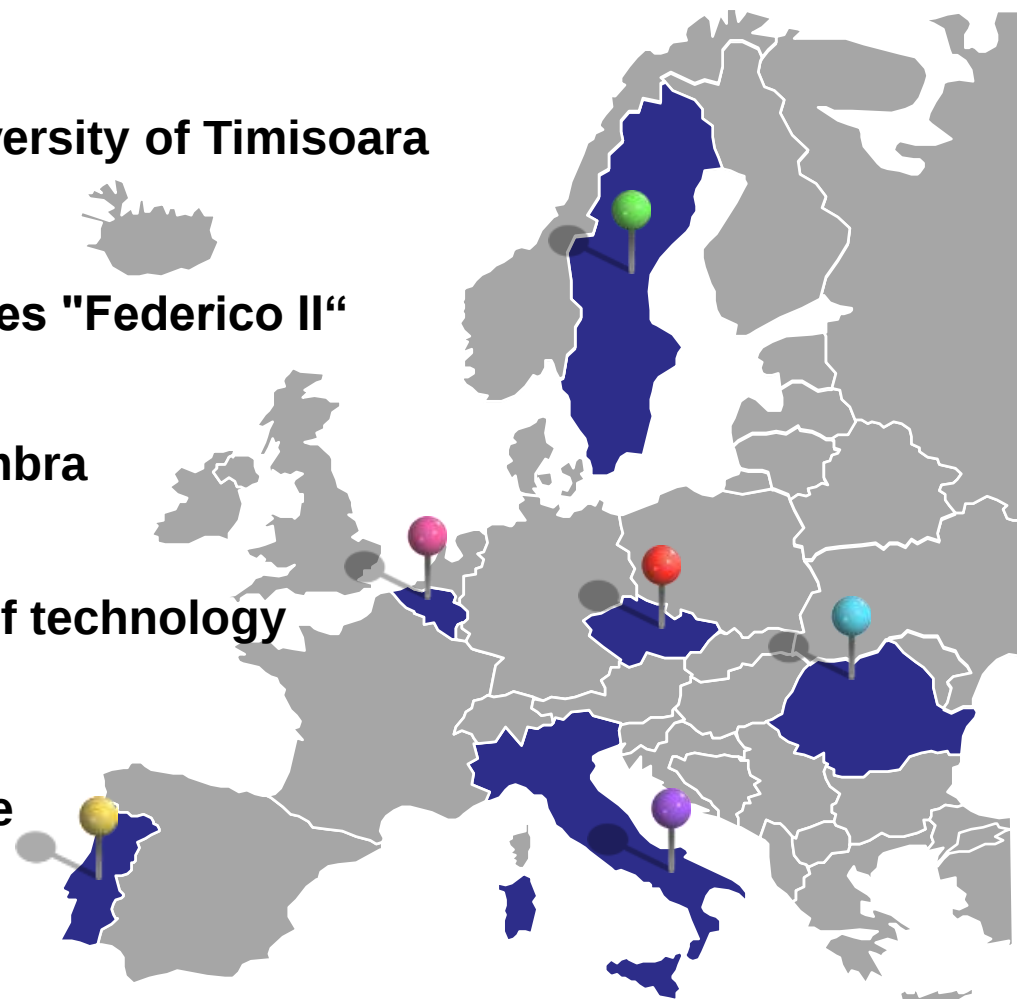
 University of Naples "Federico II"

 University of Coimbra

 Lulea University of technology

 University of Liège

 Czech Technical University in Prague
(coordenador)



Parceiros Associados - Indústria

ECCS

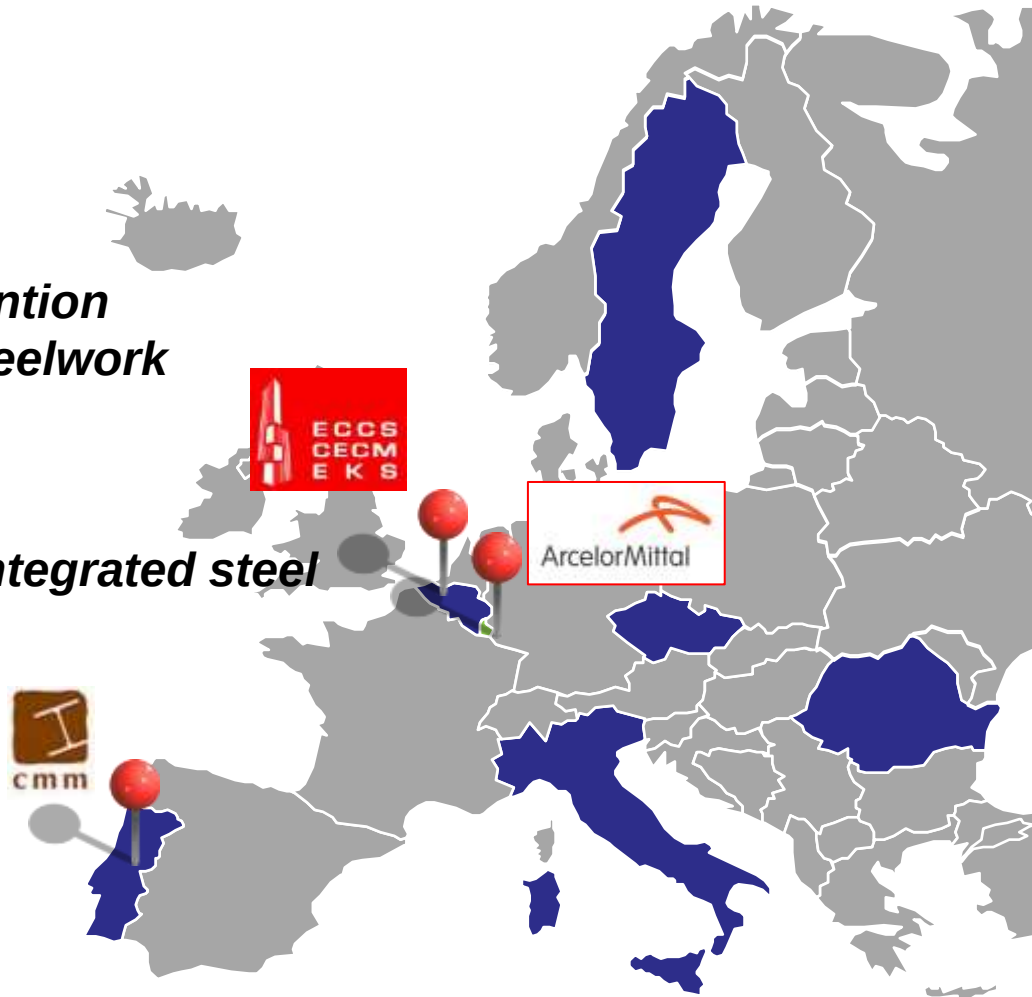
*The European Convention
for Constructional Steelwork*

ArcelorMittal

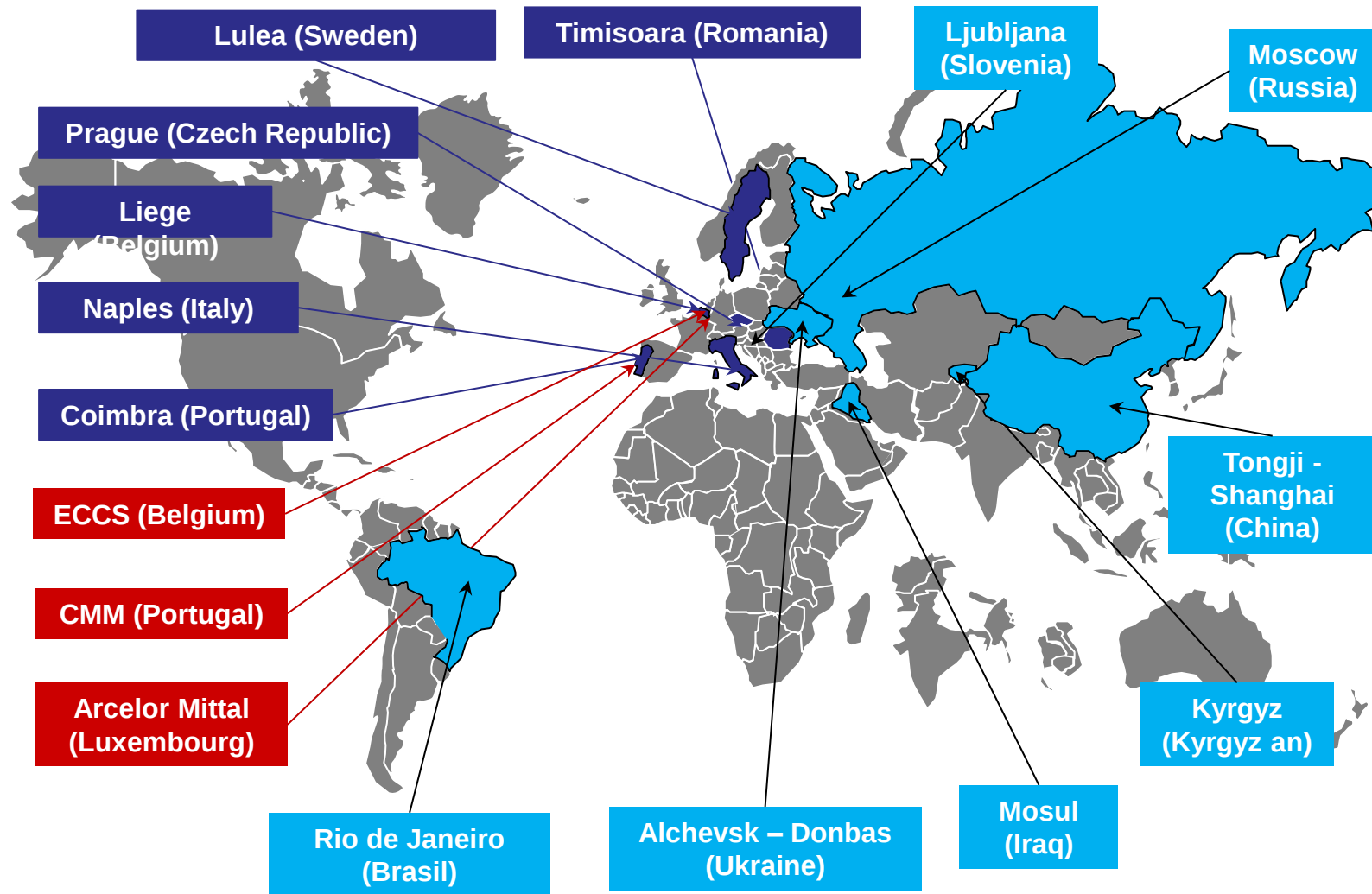
*the world's leading integrated steel
and mining company*

CMM

*The Portuguese
Steelwork
Association*



Parceiros associados - Universidades

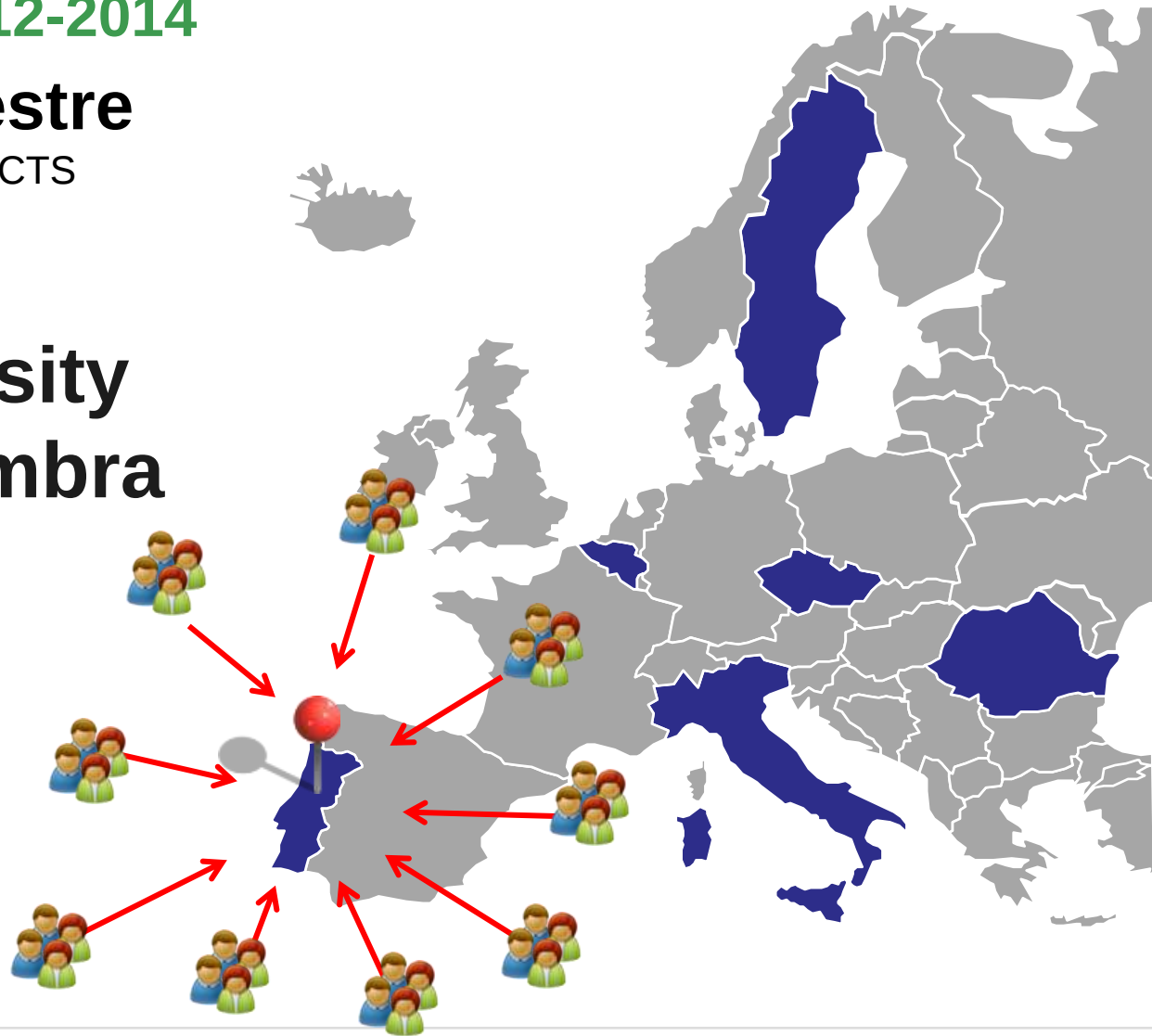


Primeira edição 2012-2014

1º semestre

Courses, 30 ECTS

**University
of Coimbra**

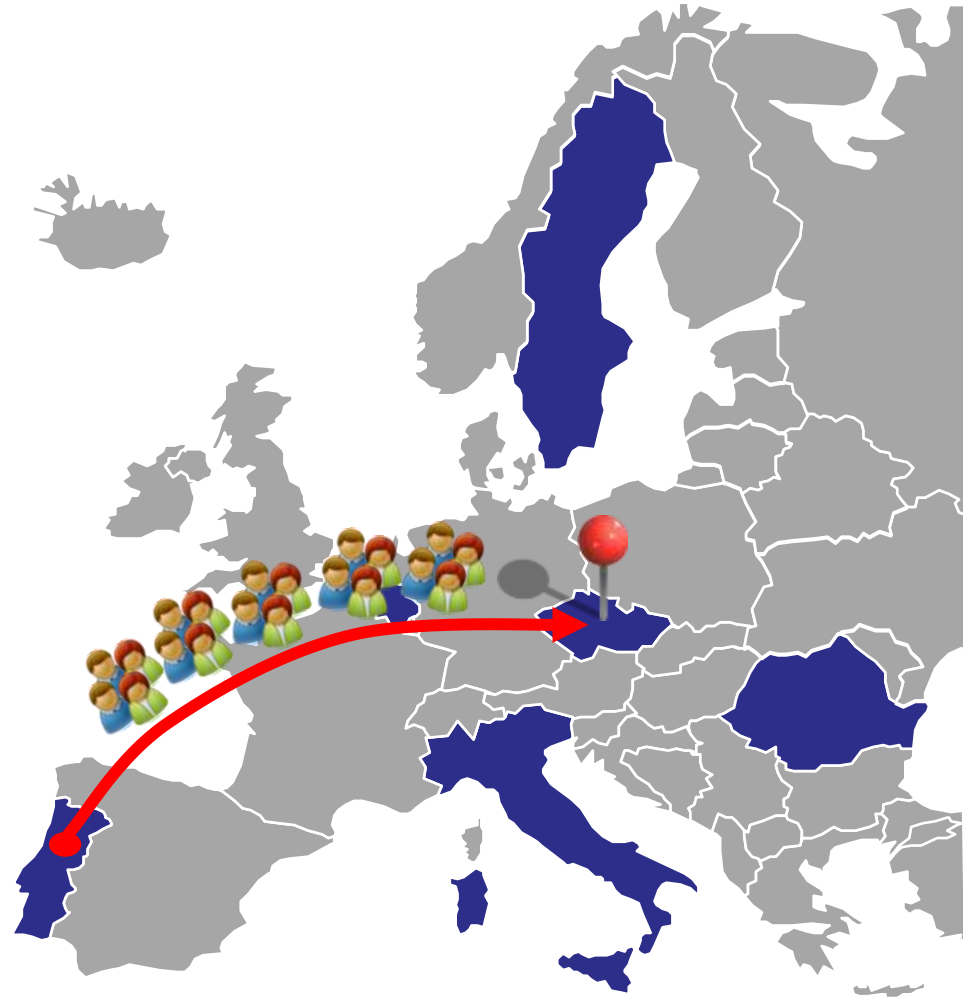


Primeira edição 2012-2014

2º semestre

Courses, 30 ECTS

Czech Technical University in Prague



Primeira edição 2012-2014

3º semestre

Thesis, 30 ECTS

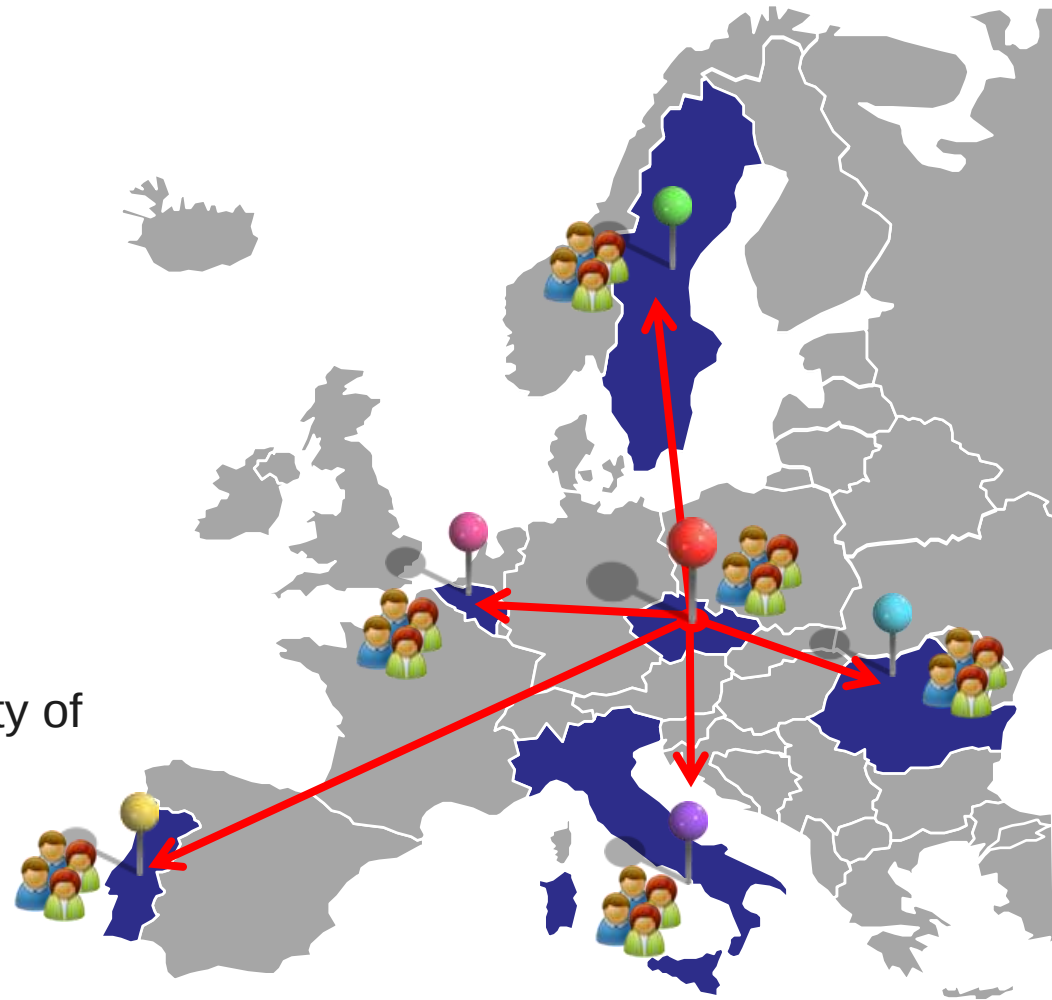
Czech Technical
University in Prague
University of Coimbra

Lulea University of
Technology

University of Liège

"Politehnica" University of
Timisoara

Univeristy of Naples
"Federico II"



SUSCOS GRADUATION CERIMONY FEB 2014 in PRAGUE



Segunda edição 2013-2015

1º semestre

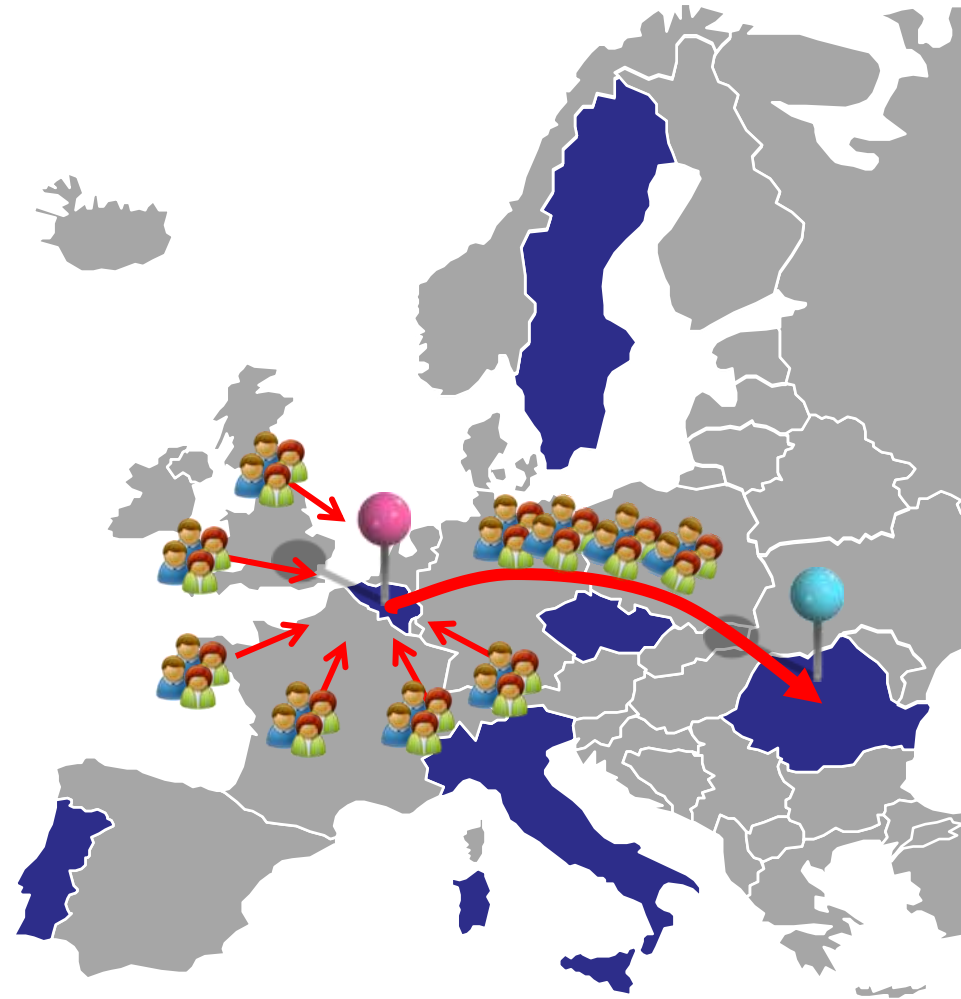
Courses, 30 ECTS

University of Liège

2º semestre

Courses, 30 ECTS

"Politehnica" University
of Timisoara



Terceira edição 2014-2016

1º semestre

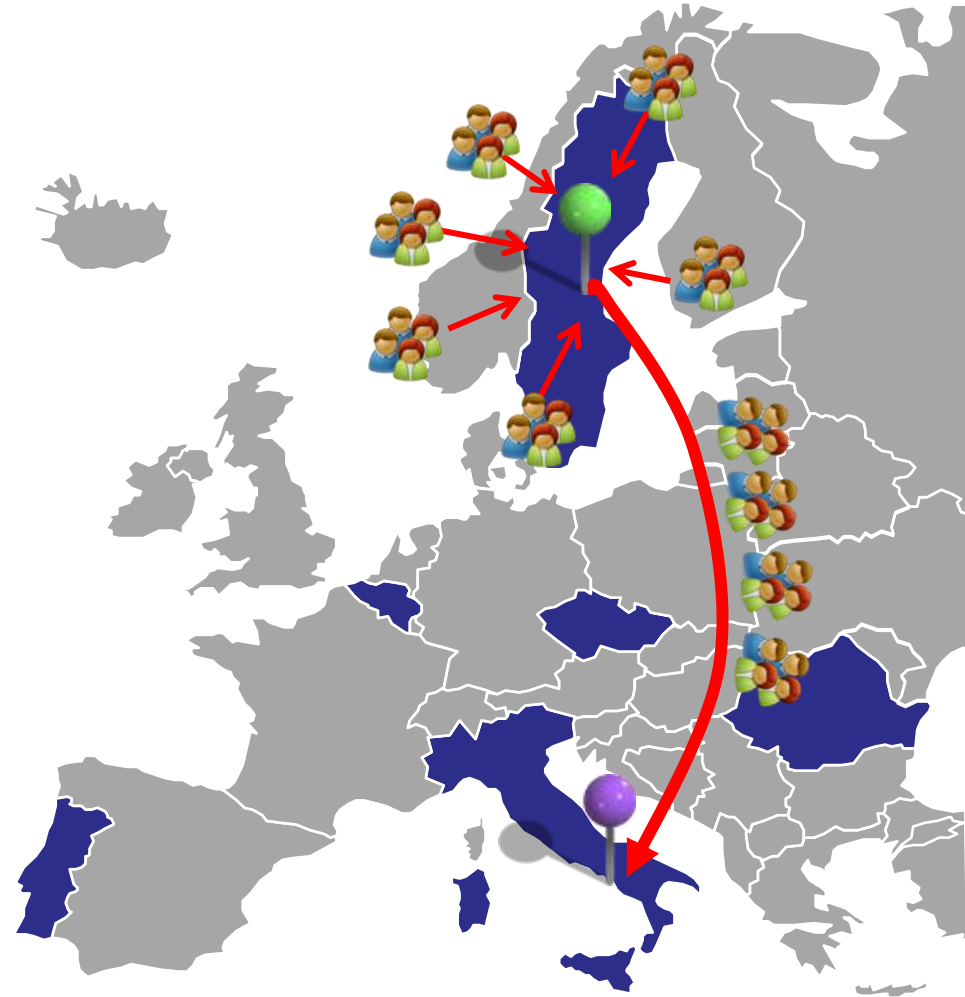
Courses, 30 ECTS

Lulea University
of Technology

2º semestre

Courses, 30 ECTS

University of Naples
Federico II



isise

R&D IN STEEL CONSTRUCTION



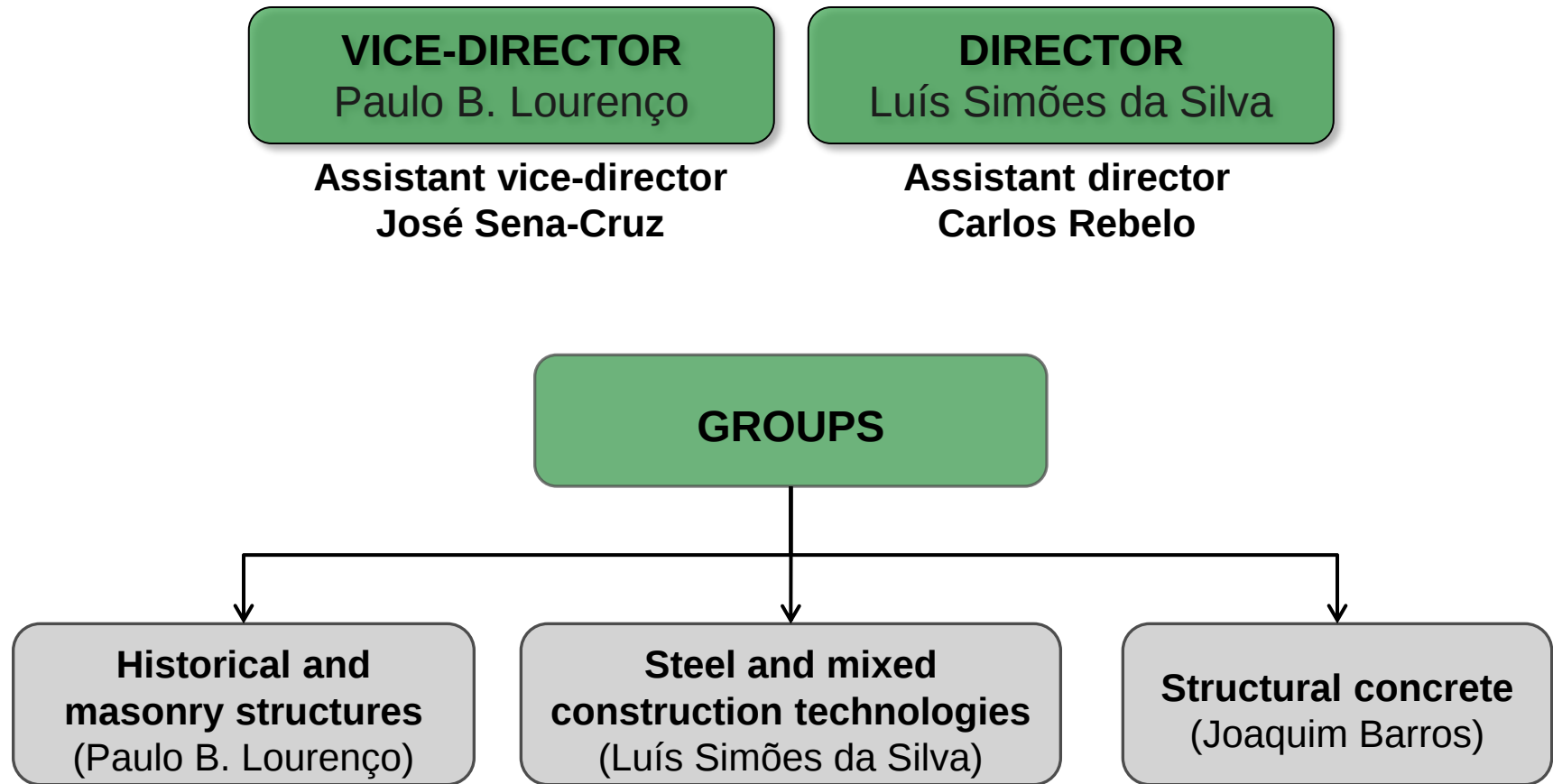
FCTUC FACULDADE DE CIÊNCIAS E TECNOLOGIA
UNIVERSIDADE DE COIMBRA

What is ISISE?

- ❑ ISISE is a Research, Development & Innovation Unit formed in 2007 and involving the Structural Groups from the Civil Engineering Departments of the Universities of **Coimbra** and **Minho**.
- ❑ In the last Research Assessment Exercise (2003-2007), ISISE was rated as **Very Good**, the maximum rank in the field of knowledge.
- ❑ 30 PhD members; 72 PhD students; 14 M€ of competitive funding currently granted ; 2 European Master Courses; International leadership.



Organization and Groups (2014)



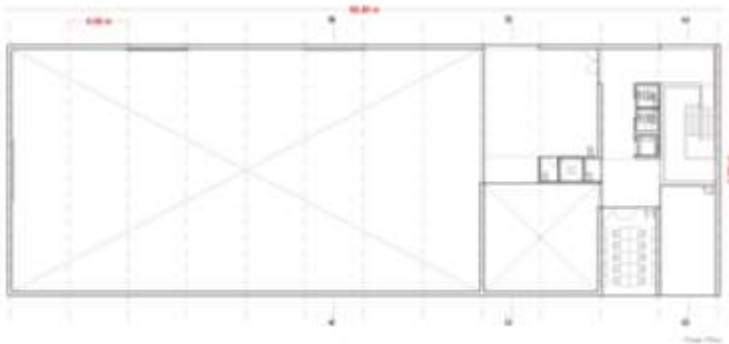
STEEL CONSTRUCTION LABORATORY

- 1500 m² of laboratories with a strong floor and 2 reaction walls
- Crane gantries
- Dynamic Actuators, reaction frames, load cells, LVDTs, Data Loggers and accessories
- Electric furnaces for testing for fire resistance
- Universal testing machines
- Compression and bending machines
- Climatic Chambers
-



FIRELAB – LABORATORY FOR FIRE ENGINEERING

- Modular electric furnace for beams
- Modular electric furnace for columns
- Natural Fire testing rigs
- Universal Testing Machine 600kN
- Rigid loading frames
- Data acquisition systems
- Hydraulic Jacks up to 3000 kN
- Horizontal and vertical gas furnaces
- Universal Fatigue Testing Machine 1000 kN
- Impact and blast equipment



**2.3 M€ to build
FIRELab (ongoing)**



UC

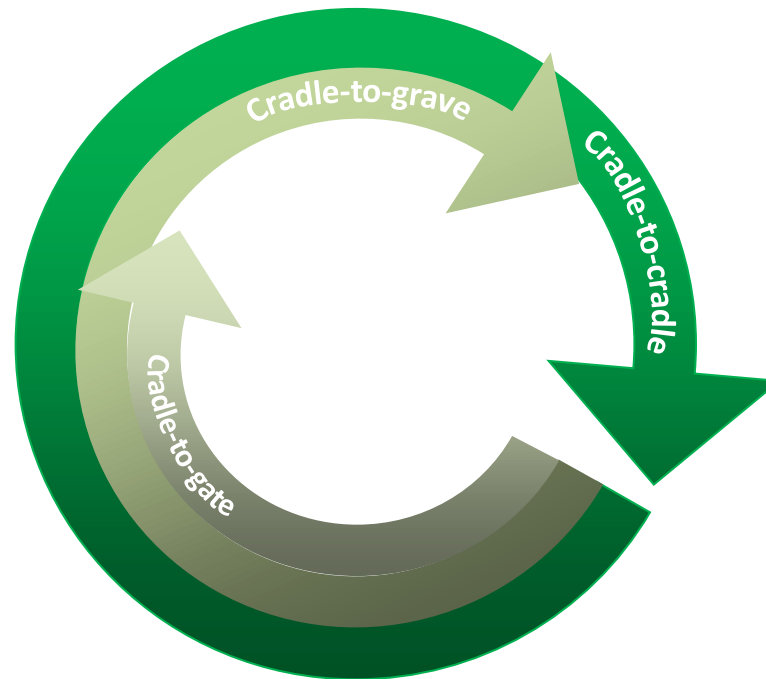
Departamento de Engenharia Civil
Faculdade de Ciências e Tecnologia
Universidade de Coimbra
Rua Luís Reis Santos – Pólo II
3030-788 Coimbra, Portugal
email: isise@dec.uc.pt

UMINHO

Departamento de Engenharia Civil
Escola de Engenharia
Universidade do Minho
Campus de Azurém
4800-058 Guimarães, Portugal
email: isise@civil.uminho.pt

VISION ISISE-SMCT

Development of an integrated, risk-based, sustainability framework with a life-cycle vision (covering all phases, from feasibility, design, construction, operation and dismantling) that addresses safety, functionality and the environment



RESEARCH CLUSTERS

R&D in ISISE-SMCT is organized in the following clusters:

A	RESEARCH CLUSTER FIRE SAFETY	
B	RESEARCH CLUSTER	EARTHQUAKE ENGINEERING
	<i>B.1</i>	<i>SUB-RESEARCH CLUSTER DYNAMICS & MONITORING</i>
C	RESEARCH CLUSTER	BLAST AND IMPACT
D	RESEARCH CLUSTER	CONNECTIONS
E	RESEARCH CLUSTER	NONLINEAR DESIGN AND STABILITY
F	RESEARCH CLUSTER	COMPOSITE AND MIXED CONSTRUCTION
	<i>F.1</i>	<i>SUB-RESEARCH CLUSTER STEEL-CONCRETE COMPOSITE</i>
	<i>F.2</i>	<i>SUB-RESEARCH CLUSTER STEEL & GLASS</i>
	<i>F.3</i>	<i>SUB-RESEARCH CLUSTER STEEL & TIMBER</i>
G	RESEARCH CLUSTER	SUSTAINABILITY
	<i>G.1</i>	<i>SUB-RESEARCH CLUSTER ENERGY EFFICIENCY</i>
	<i>G.2</i>	<i>SUB-RESEARCH CLUSTER INTEGRAL LIFETIME DESIGN</i>
	<i>G.3</i>	<i>SUB-RESEARCH CLUSTER ARCHITECTURE</i>
H	RESEARCH CLUSTER	ENERGY
	<i>H.1</i>	<i>SUB-RESEARCH CLUSTER WIND TOWERS</i>
	<i>H.2</i>	<i>SUB-RESEARCH CLUSTER OFFSHORE CONSTRUCTION</i>

INTEGRATED MEMBERS

	Name	Position	
1	Luís Simões da Silva (UC)	Professor	STEEL
2	Carlos Alberto da Silva Rebelo (UC)	Assistant Professor	STEEL
3	Rui António Duarte Simões (UC)	Assistant Professor	STEEL
4	Isabel Valente (UM)	Assistant Professor	STEEL
5	Sandra Jordão (UC)	Assistant Professor	STEEL
6	João Paulo Rodrigues (UC)	Assistant Professor	STEEL
7	Aldina Santiago (UC)	Assistant Professor	STEEL
8	Helena Gervásio (UC)	Visiting Assistant Professor	STEEL
9	Paulo Santos (UC)	Assistant Professor	STEEL
10	Liliana Marques (UC)	Post-doc	STEEL
11	António José Moura Correia (IPC)	Adjunct Professor	STEEL
12	Filippo Gentili (UC)	Post-doc	STEEL
13	Maria Constança Simões Rigueiro (IPCB)	Adjunct Professor	STEEL
14	Cristina Calmeiro dos Santos (IPCB)	Adjunct Professor	STEEL
15	Ashkan Shahbazian (UC)	Post-doc	STEEL
16	Luís Laim (UC)	Post-doc	STEEL

COLLABORATORS (other R&D Units)

	Name	Position	
1	Altino Jesus de Roque Loureiro (UC)	Assistant Professor (Mech Eng)	Welding
2	António Gameiro Lopes (UC)	Assistant Professor (Mech Eng)	Fluid mech. (CFD)
3	Vitor Murtinho (UC)	Associate Professor	Architecture
4	Gilberto Cordeiro Vaz (IPC)	Adjunct Professor (Mech Eng)	Fluid mech. (combustion)
5	Luís Bragança (UM)	Associate Professor	Build. Physics
6	Diogo Mateus (UC)	Assistant Professor	Build. Physics
7	Dulce Rodrigues (UC)	Assistant Professor (Mech Eng)	Welding
8	José Miguel Castro (UP)	Assistant Professor	STEEL
9	José Joaquim da Costa (UC)	Assistant Professor (Mech Eng)	Fluid mech. (heat trans.)
10	Martin Pircher (UC)	Visiting Associate Prof.	Bridge Designer
11	Luis Borges (UC)	Visiting Professor	STEEL
12	José Alexandre Henriques (Coolhaven)	Visiting Prof.	STEEL
13	António Bettencourt (UC)	Assistant Professor	Architecture
14	Adelino Gonçalves (UC)	Assistant Professor	Architecture
15	Paulo Jorge de Sousa Cruz (UM)	Professor	Architecture

TECHNICAL AND ADMINISTRATIVE STAFF

	Name	Position	
1	Maria Manuela Rodrigues (UC)	Secretary	Administrative
2	Luís Pedro Galvão Gaspar (UC)	Technician	Laboratory
3	Rui Jorge de Melo Ferreira (UC)	Technician	Laboratory
4	Ilídio Miranda dos Santos (UC)	Technician	Laboratory
5	Rafael Campos (UC)	Technician	Laboratory
6	Nuno Correia (UC)	Financial Manager	Administrative
7	Cristina Carolino	Secretary	Administrative
8	Edmundo Pais	Technician	Laboratory

PhD students and other researchers

	Name	Position	Research Cluster
	WAITING FOR PhD VIVA		
1			
	ONGOING		
2	Adriano Alves de Sousa da Costa Lopes	PhD Student	<i>NONL. DESIGN & STAB.</i>
3	Ana Carolina Fernandes Coelho	PhD Student	SUST / <i>EN. EFF./ARCH</i>
4	Ana Isabel Fernandes Craveiro	PhD Student	<i>SUST</i> / EN. EFF. /ARCH
5	André Tenchini da Silva	PhD Student	<i>SEISMIC</i>
6	Angela Sofia Leal Neves	PhD Student	<i>SUST</i> / EN. EFF. /ARCH
7	António Paulo Figueirinha Varela	PhD Student	<i>FIRE</i>
8	Carlos Miguel Serra	PhD Student	<i>NONL. DESIGN & STAB.</i>
9	Cécile Haremza	PhD Student	<i>FIRE+CONNECTIONS</i>
10	Cecília Pires Barra	PhD Student	<i>FIRE</i>
11	David Rocheta Cassiano	PhD Student	<i>SEISMIC</i>
12	Dirceu Fernandes dos Santos	PhD Student	<i>FIRE</i>
13	Eduardo Estevâm Camargo Rodrigues	PhD Student	<i>FIRE</i>
14	Fernanda da Rocha Carvalho Lopes	PhD Student	<i>FIRE+CONNECTIONS</i>
15	Guiomar da Silva Ferreira Vicente	PhD Student	<i>CONNECTIONS</i>

PhD students and other researchers

	Name	Position	Research Cluster
16	Helder David da Silva Craveiro	PhD Student	<i>FIRE</i>
17	Hugo Filipe dos Santos Caetano	PhD Student	<i>FIRE</i>
18	Hugo Renato Gonçalves Silva Augusto	PhD Student	<i>SEISMIC</i>
19	João Pedro Simões Cândido Martins	PhD Student	<i>NONL. DESIGN & STAB.</i>
20	Jocelyn Erandi Reyes Neto	PhD Student	<i>SUST /EN. EFF./ARCH</i>
21	José Pedro Godinho Oliveira Lopes	PhD Student	<i>FIRE</i>
22	Juan José Jiménez de Cisneros y Fonfria	PhD Student	<i>CONNECTIONS</i>
23	Luís Marinho Barbosa de Magalhães	PhD Student	<i>CONNECTIONS</i>
24	Mário António Fonseca Loureiro	PhD Student	
25	Nelson Miguel Lopes Soares	PhD Student	<i>SUST /EN. EFF./ARCH</i>
26	Nuno Claudio Ferreira Rosa	PhD Student	<i>SUST /EN. EFF./ARCH</i>
27	Pedro Miguel Ribeiro Barata	PhD Student	<i>FIRE+CONNECTIONS</i>
28	Raquel Sousa Costa Pardal	PhD Student	<i>MIXED CONST.</i>
29	Ricardo José Dias	PhD Student	<i>NONL. DESIGN & STAB</i>
30	Rui Manuel Maia Pinto de Matos	PhD Student	<i>ENERGY, OIL & GAS</i>
31	Rui Manuel da Cruz Oliveira	PhD Student	<i>FIRE</i>
32	Amir Chegini	PhD Student	<i>SUST /EN. EFF./ARCH</i>

PhD students and other researchers

	Name	Position	
33	Trayana Tankova	PhD Student	<i>NONL. DESIGN & STAB</i>
GRANT HOLDERS			
34	Claudio Miguel Oliveira Martins	MSc Student	<i>SUST /EN. EFF./ARCH</i>
35	João Luís Pinelo Esteves Canha	MSc Student	<i>NONL. DESIGN & STAB</i>
36	João Nuno Ribeiro	MSc Student	<i>FIRE+CONNECTIONS</i>
37	Marco Daniel Oliveira Pinho		<i>MIXED CONST.</i>
OVER 4 YEARS OF THESIS WORK			
38	Afonso Carlos Bonina de Mesquita	PhD Student	<i>CONNECTIONS</i>
39	António Alberto Lopes F. Duarte Correia	PhD Student	<i>SUST /EN. EFF./ARCH</i>
40	Helder José Vieira Ferreira	PhD Student	<i>SUST /EN. EFF./ARCH</i>
41	João José Guerra Martins	PhD Student	<i>NONL. DESIGN & STAB</i>
42	José Manuel Botas Pequeno	PhD Student	<i>MIXED CONST.</i>

Indicators SMCT (as of 31/12/2013)

	2003/07 (5 years)	2008/12 (5 years)	2013 (2014)
Patents	0	4	1
PhD members	7	15	12 (16)
Concluded PhD Thesis (+ ongoing)	11	16	5 (32)
Concluded MSc thesis	12	122	
Papers in International peer-reviewed Journals (ISI)	36	64	18 (10+9)
Organization of Events	6	12	
Papers in International Conferences	176	346	

2008/2012: Publications in IJ ISI / PhD member / year: >1.0

R&D projects (ongoing): 14.6 M€ (2012: 3 256 912 €)



R&D Projects	Completed Projects (2007-2012)	Ongoing Projects
National	9	6
International	8	16



RESEARCH CLUSTER: FIRE

ROBUSTFIRE Project

- Design philosophy for open car parks with sufficient ROBUSTNESS under localised fire
- Practical design guidelines



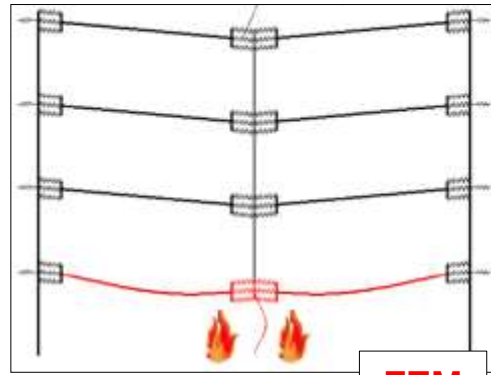


ROBUSTNESS OF CAR PARKS AGAINST LOCALISED FIRE - ROBUSTFIRE

Funding: 1.3 M€ 7 Partners Jul 2008 – Jun 2011



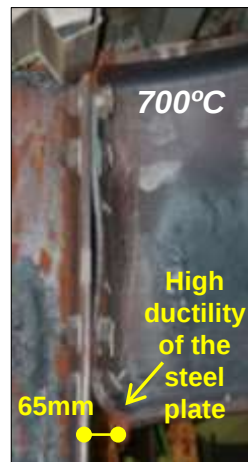
Experimental tests



FEM

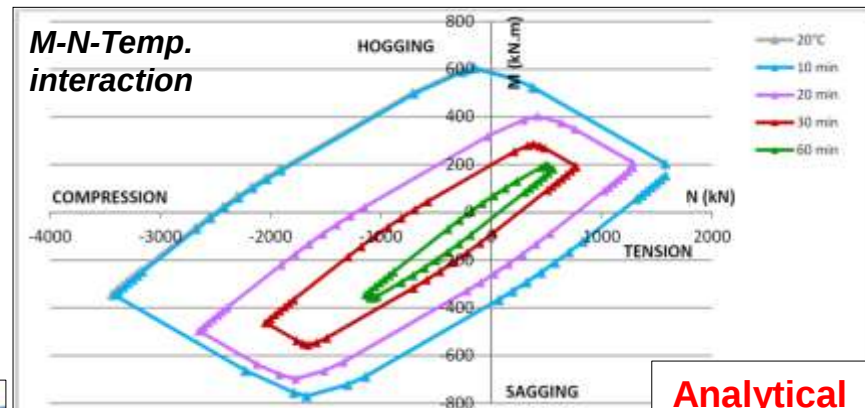
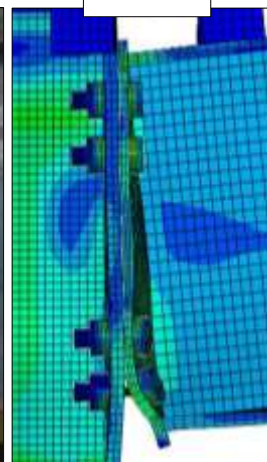


Column loss

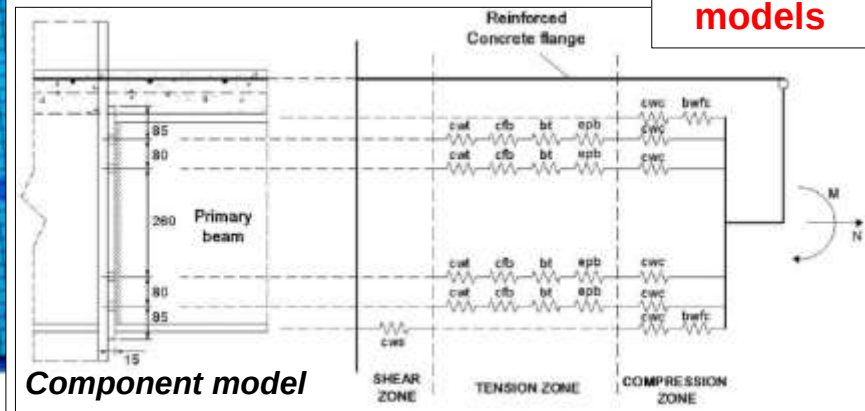


700°C

High ductility of the steel plate
65mm



Analytical models



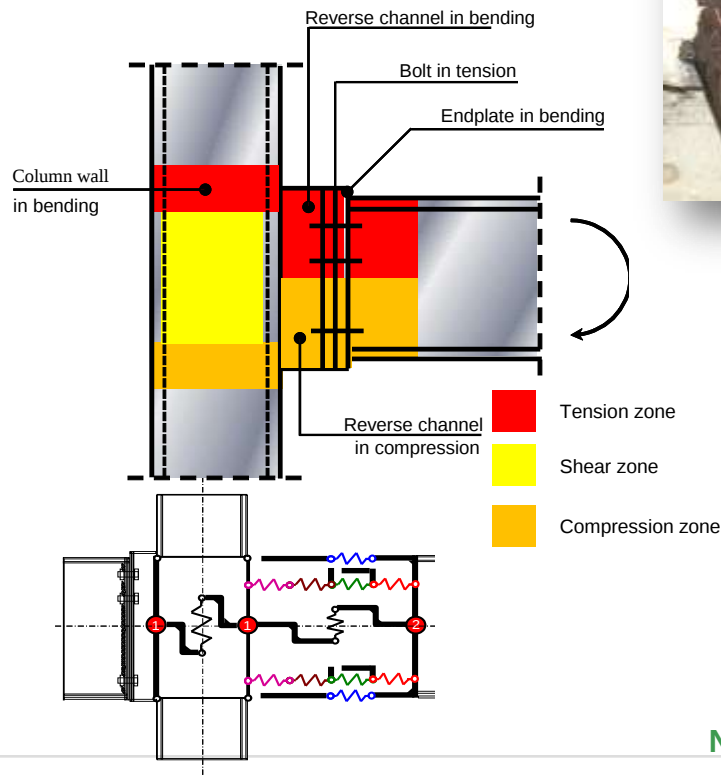
COMPFIRE Project

- Application of **performance-based design**.
- **Fire performance and robustness** of joints.
- Extend **component model** to composite joints.

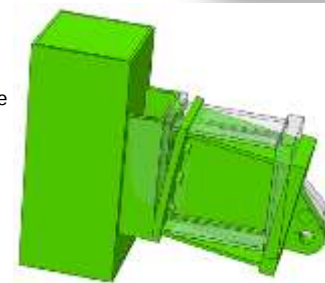


COMPFIRE - *Economical and safe design of steel joints under the natural fire*

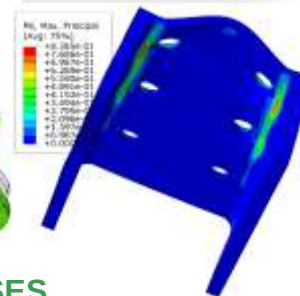
REVERSE CHANNEL JOINT COMPONENT MODEL



COMPONENT TEST



NUMERICAL ANALYSES



DEMONSTRATION FIRE TEST



FULL-SCALE FIRE TEST



SMALL-SCALE FIRE TEST



European Projects



CONDESA
GRUPO



FRISCC



UNIVERSITAT
POLITÈCNICA
DE VALÈNCIA



AIDICO
INSTITUTO TECNOLÓGICO
DE LA CONSTRUCCIÓN

**FIRE RESISTANCE OF INNOVATIVE AND SLENDER
CONCRETE FILLED TUBULAR COMPOSITE COLUMNS**

Funding: 1.7 M€

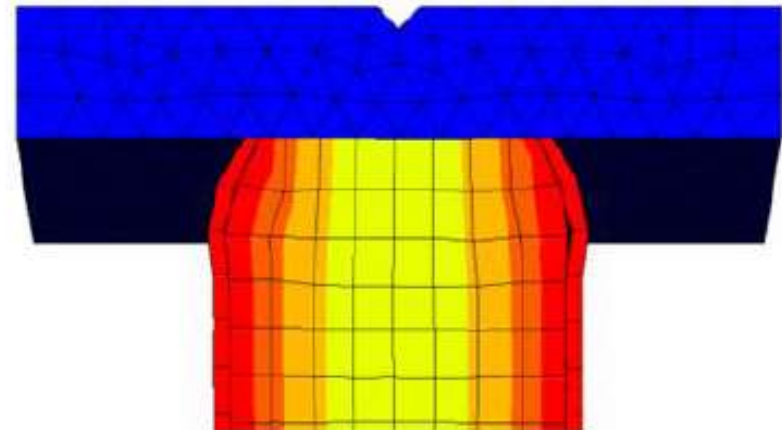
1/1
10/2
100/4

Leibniz
Universität
Hannover

Imperial College
London

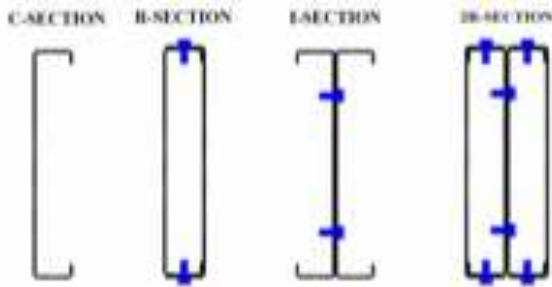
7 Partners

Jul 2012– Jun 2015



FIRECOLDSTEEL Project

Investigation of the behavior of cold-formed steel (CFS) structural elements, such as columns, beams and connections under fire conditions and to develop safe design methods.



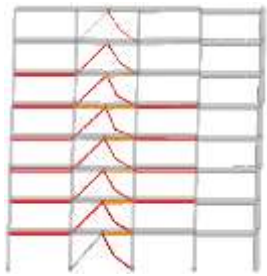
FIRECOLDSTEEL EXPERIMENTAL AND NUMERICAL ANALYSIS OF COLD FORMED STEEL ELEMENTS SUBJECTED TO FIRE

Funding: 0.13 M€

Mar 2012 – Feb 2015



***RESEARCH CLUSTER:
EARTHQUAKE
ENGINEERING***



HIGH STRENGTH STEEL IN SEISMIC RESISTANT BUILDING FRAMES

Funding: 2.1 M€ Jul 2009 – Jun 2013



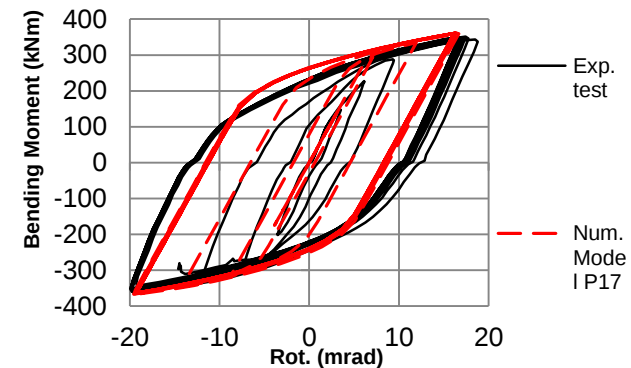
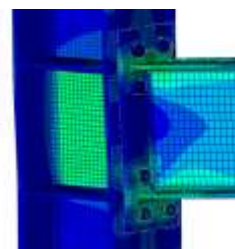
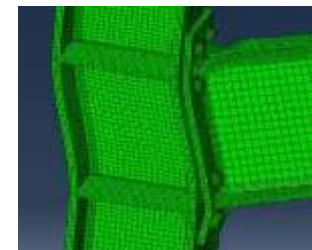
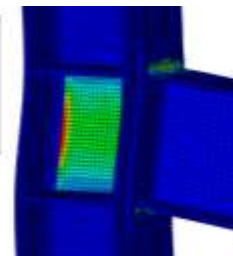
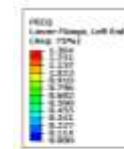
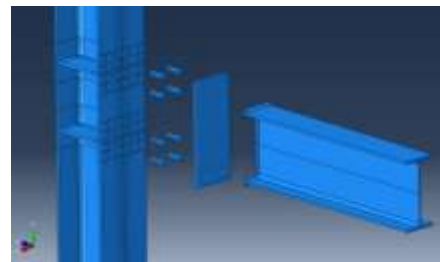
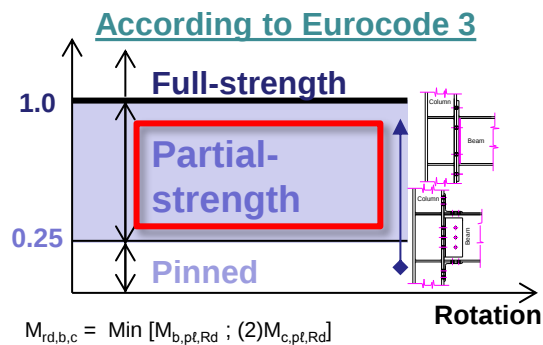
- ❑ To find reliable structural typologies and connection details for dual-steel structures;
- ❑ To develop design criteria and performance based design methodology for dual steel structures using high-strength steel;
- ❑ To establish relevant design parameters (q, Ω) for dual-steel structures to be implemented in further versions of EN 1998-1;
- ❑ To evaluate technical and economical benefit of dual-steel approach involving high strength steel



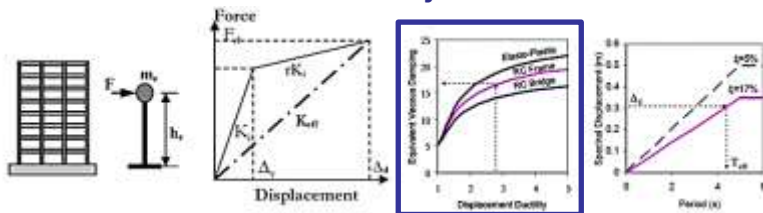
European Projects

OBJECTIVE:

To develop a set of practical performance-based design guidelines for steel moment-resisting frame structures that include performance criteria and a displacement-based design procedure capable of considering different beam-column joint typologies.



Main contribution to the Project



Fundamentals of Direct Displacement Based Design (adapted from Priestley et al, 2007)



- (i) EUCENTRE – European Centre for Training and Research in Earthquake Engineering (Italy),
- (ii) Consorzio Pisa Ricerche (Italy)
- (iii) Portuguese Constructional Steelwork Association (Portugal)
- (iv) University of Napoli, Federico II (Italy)
- (v) S.C. Britt S.R.L. (Romania).

Funding: 2,0 M€

5 Partners

Jul 2010 – Jun 2013

DiSTEEL

Displacement Based Seismic Design of STEEL Moment Resisting Frame Structures

European Projects

OBJECTIVE:

To test a full-scale 3 storey steel-framed building subject to seismic loading



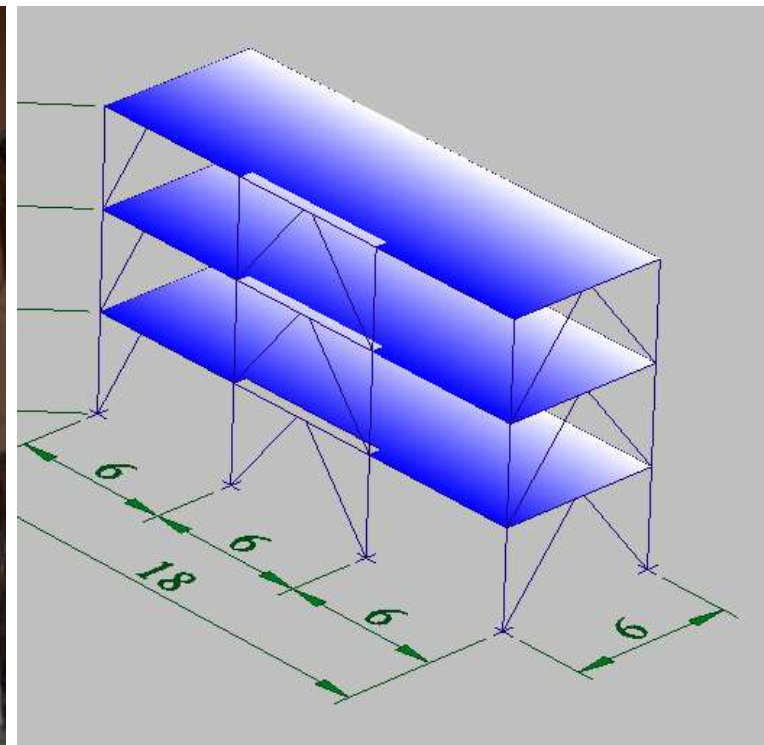
DUAREM

FULL-SCALE EXPERIMENTAL VALIDATION OF DUAL ECCENTRICALLY BRACED FRAME WITH REMOVABLE LINKS



Funding: 0.63 M€

July 2012 – June 2014



International Projects



**Imperial College
London**



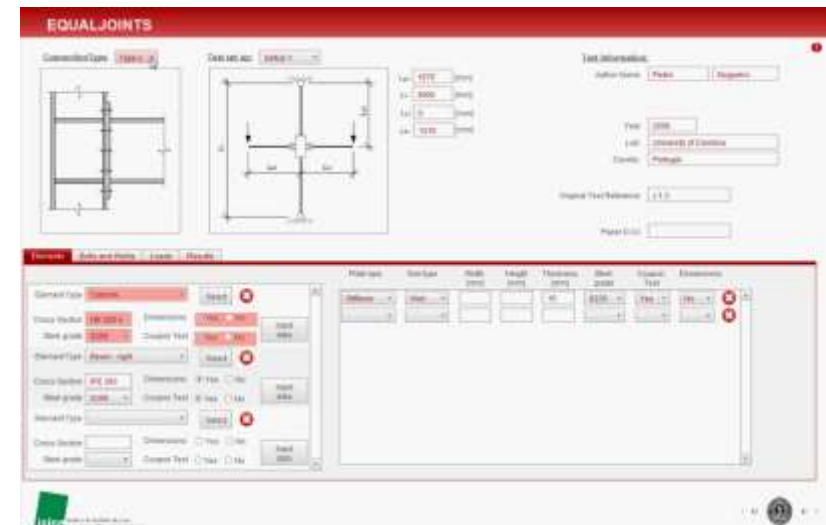
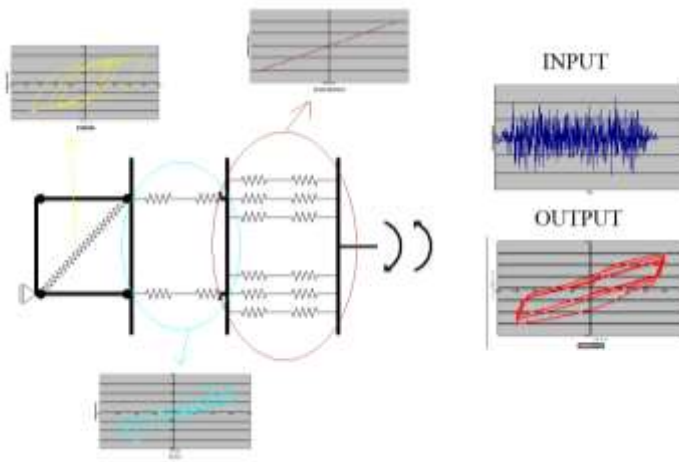
**Université
de Liège**

EQUALJOINTS – European pre-qualified steel joints

Funding: 1.6 M€ Jul 2013 – Jul 2016

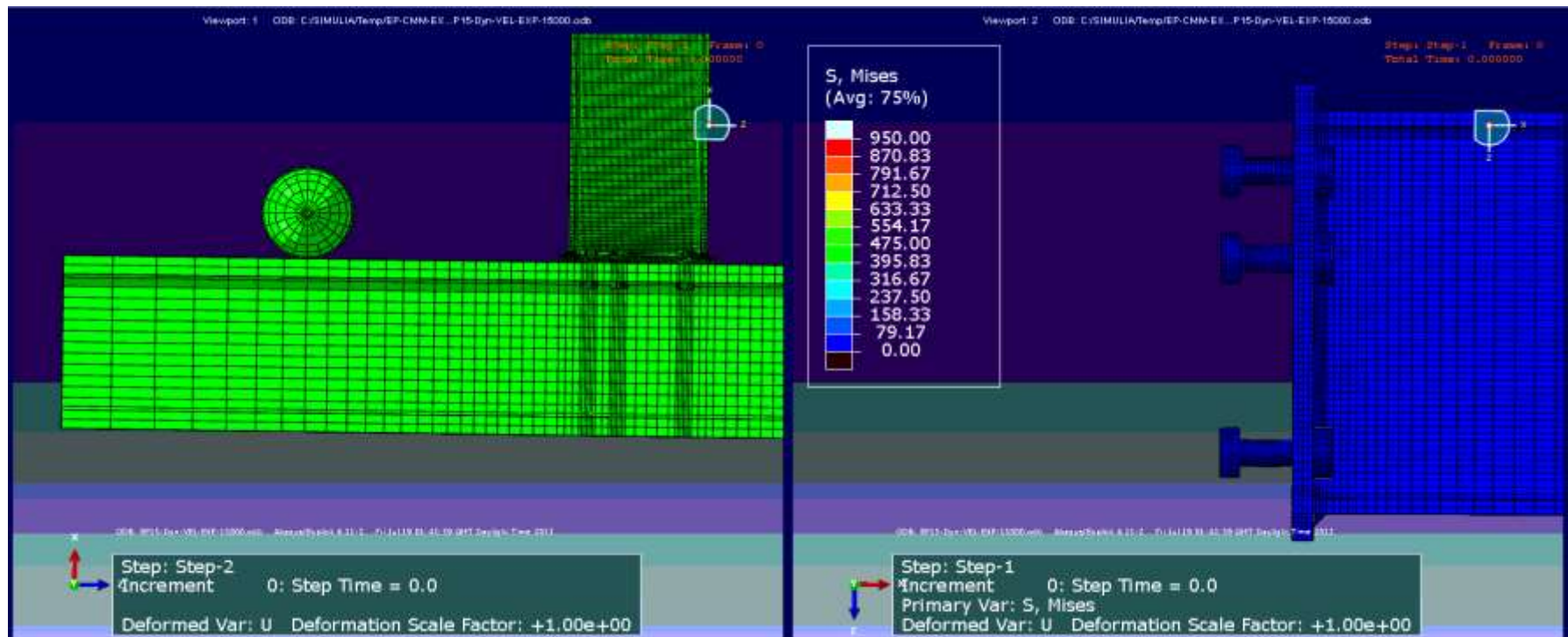
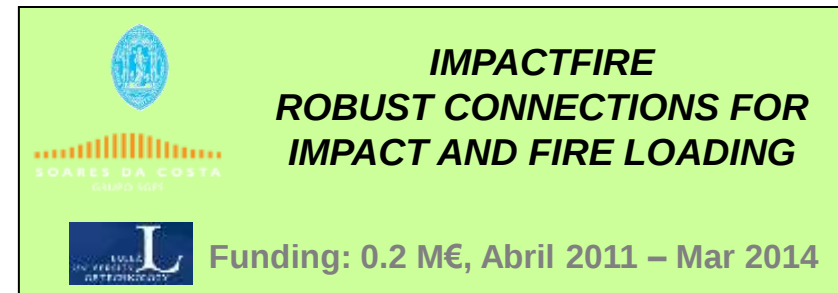
OBJECTIVE:

To introduce in the European practice a qualification procedure for the design of moment resisting connection in seismic resistant steel frames, in compliance with EN1998-1 requirements. Further aims of the project are to qualify a set of standard for all-steel beam-to-column joints, and to develop prequalification charts and design tools that can be easily used by designers. The project is also intended as a pre-normative research aimed at proposing relevant design criteria to be included in the next version of EN 1998-1.



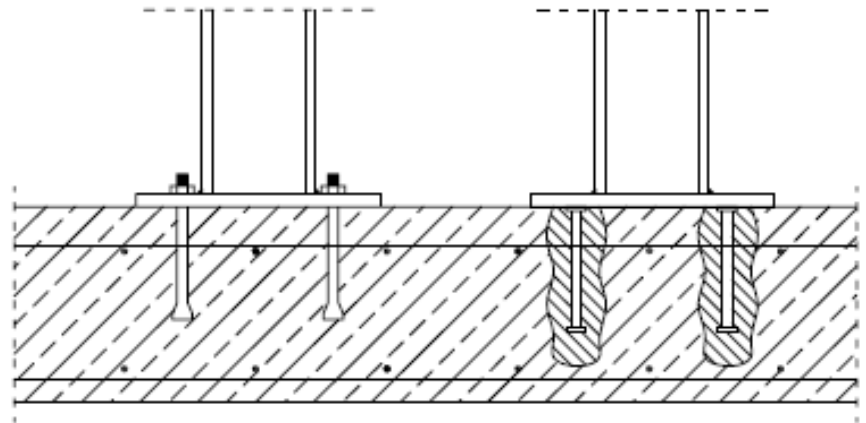
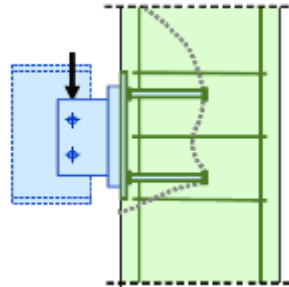
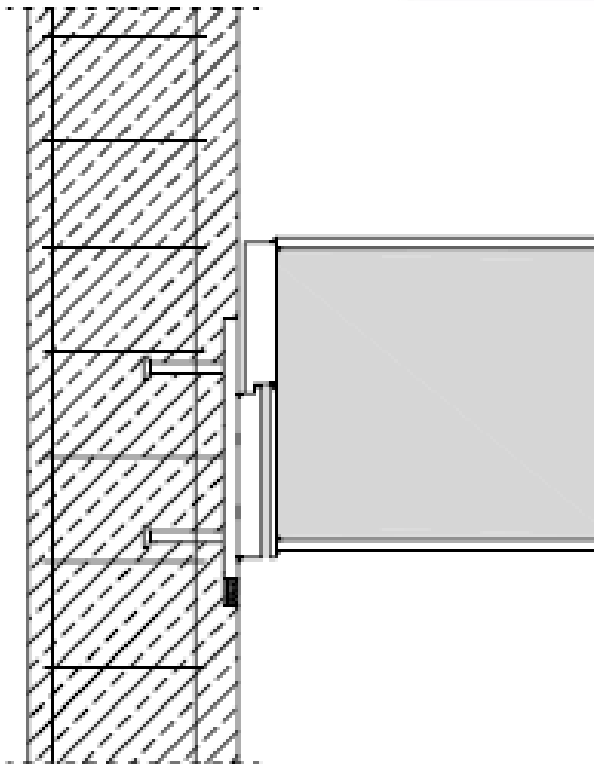
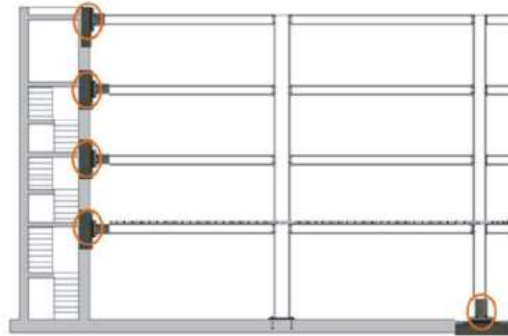
***RESEARCH CLUSTER:
BLAST & IMPACT***

- Acções excepcionais, regulamentação, comportamento material
- Avaliação experimental de ligações sujeitas a acções acidentais (impacto; fogo)
- Análise dinâmica não-linear de ligações
- Metodologia analítica de dimensionamento de ligações sujeitas a acções acidentais



RESEARCH CLUSTER: CONNECTIONS

European Projects



InFaSo



**NEW MARKET CHANCES FOR STEEL
STRUCT. BY INNOV. FASTENING SOL.**

Fund.: 0.8 M€ 5 Part. Jul 2007 – Jun 2010



INFASO+



**VALORISATION OF KNOWLEDGE FOR INNOVATIVE
FASTENING SOLUTIONS BETWEEN STEEL AND CONCRETE**

Funding: 0.63 M€

July 2012 – June 2014

National Projects



3DJOINTS

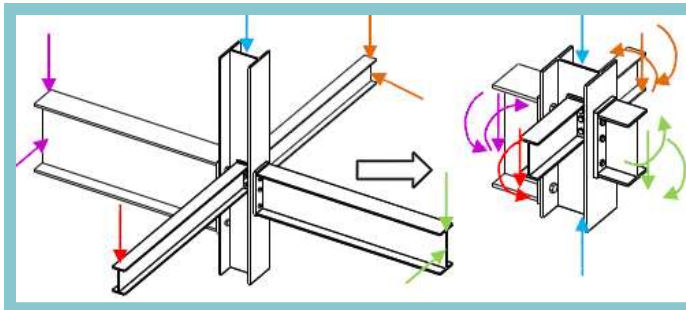
Three-dimensional behavior of steel joints

Funding: 0.13 M€

Apr 2012 – Mar 2015

→ Consistent design approach for the prediction of the three-dimensional behavior of steel joints under arbitrary loading.

→ Incorporation of the real joint behavior in the 3D structural model.



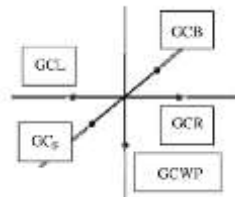
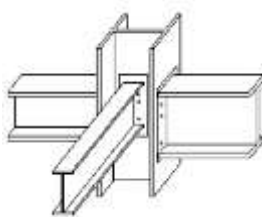
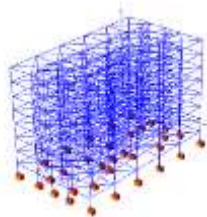
Why?

→ Steel joints under wide range of loading;

→ Robustness requirements
→ minimum level of resistance

for any type of loading;

→ Need to predict the 3-D behavior.



$$GJ = \begin{bmatrix} GC_R^{MJ} & 0 & 0 & 0 & 0 \\ 0 & GC_L^{MJ} & 0 & 0 & 0 \\ 0 & 0 & GCWP & 0 & 0 \\ 0 & 0 & 0 & GC_F^{MJ} & 0 \\ 0 & 0 & 0 & 0 & GC_B^{MJ} \end{bmatrix}$$

The development of a design methodology based on the component method for the 3D behaviour of steel joints constitutes a major advance in this field.



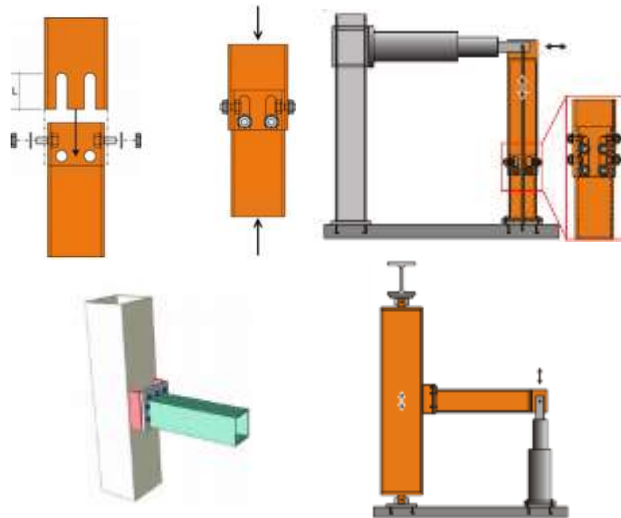
FRAME-UP

OPTIMIZATION OF FRAMES FOR EFFECTIVE ASSEMBLING

Funding: 1.5 M€

7 Partners

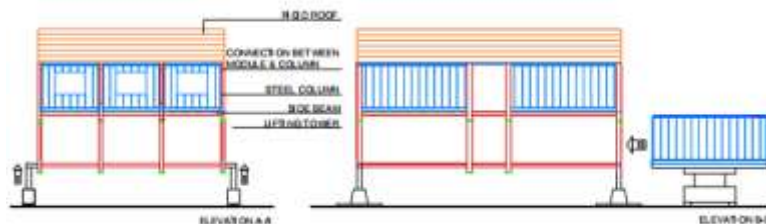
Jul 2011 – Jun 2014



Project objectives:

- 1** - Develop a new concept of execution technique of steel frame using jacks and lift towers in order to provide weather protection by starting assembling with the roof (TOP-DOWN CONSTRUCTION);
- 2** - Develop, test and establish the structural performance of new types of moment resistant joints for tubular cross sections of beams and columns;
- 3** – Reduce the time of construction and improve the final quality .When compared with existing building with steel skeletal system and 2D prefabricated walls it is expected to:

- reduce the use of material in 15%
- reduce the material waste in 50%
- improve the construction speed in 25%
- reduce the space of storage on-site in 25%
- improve the prefabrication of components in 25%



National Projects



IMPACTFIRE - Robust Connections for Impact and Fire Loading

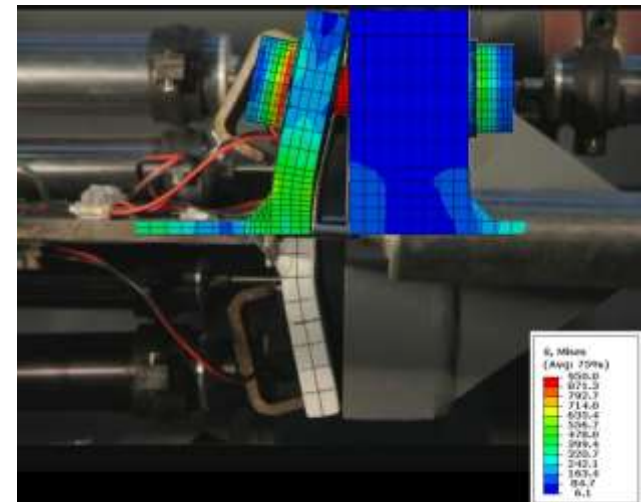
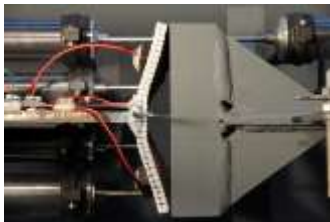
Funding: 0.2 M€

Jul 2011 – Jun 2014

Scope: Eurocode 1, Part 1.7, Accidental actions

→ **Connection behaviour characterization**

- **Connection tests**
 - Impact Loading
 - Fire situation
- **Finite Element Modeling (ABAQUS)**
 - Calibration & Parameterization



***RESEARCH CLUSTER:
NONLINEAR DESIGN
AND STABILITY***

International Projects



HILONG – High Strength Long Span Structures

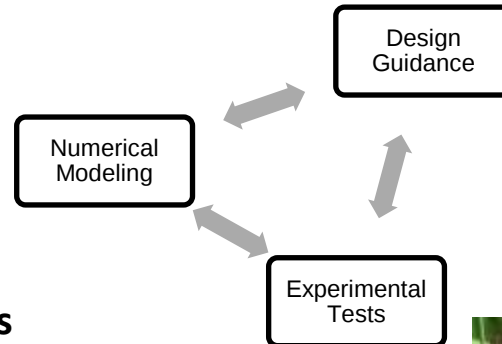
Funding: 1.6 M€ Jul 2012 – Jul 2015



OBJECTIVE:

To investigate innovative structural arrangements, design methods and cross-sections which enable the benefit of high strength to be maximised by suppressing buckling and reducing deflections.

- Cost Efficiency
- Prestressing Solutions
- Innovative Cross-Sections
- Comparative Design on Case Studies



National Projects



CoolHaven – Habitações Modulares e Eco-sustentáveis

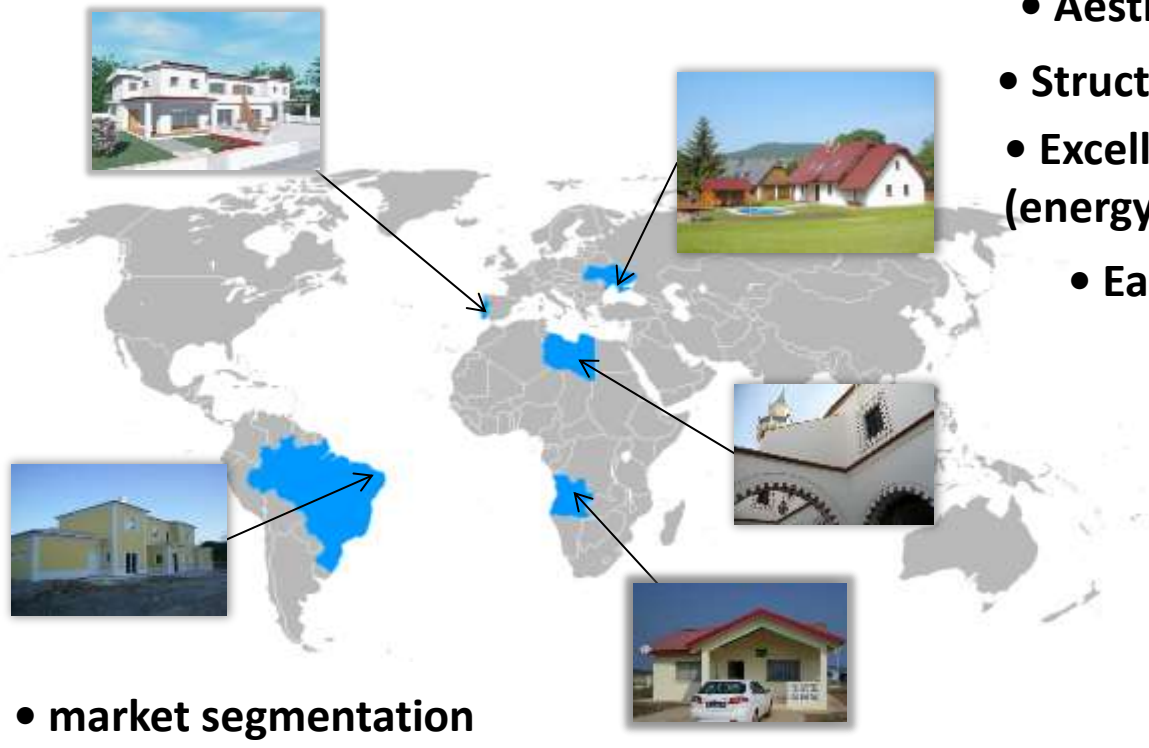
Funding: 0.86 M€

Mai 2010 – Out 2012



Development of a conceptual model and design for a low-rise residential building, with intensive use of steel, satisfying the following requirements:

- Aesthetic quality
- Modularity
- Structural safety
- Sustainability
- Excellent functional performance (energy efficiency and comfort)
- Ease of transport and erection



• market segmentation



National Projects

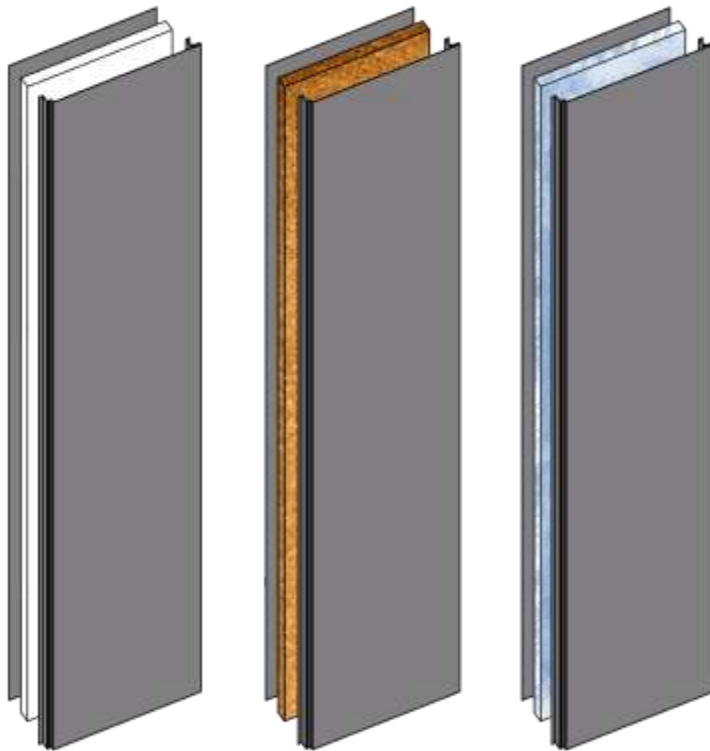
**EcoSteelPanel – development of multipurpose
façade panel system using novel joining
techniques**



QREN – SI I&DT 24804

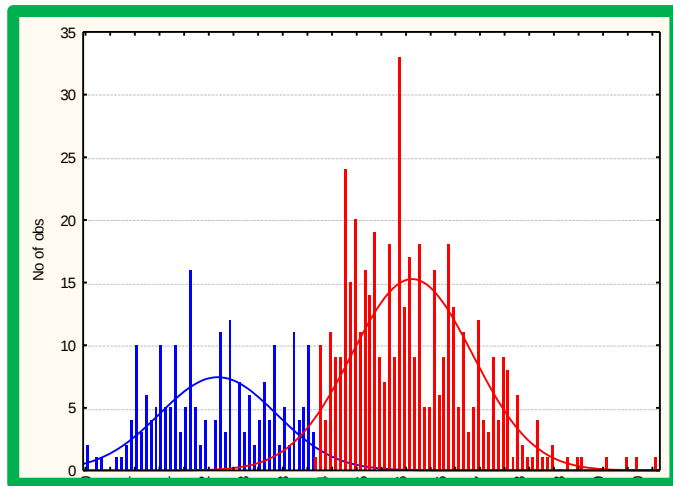
Funding: 0.69 M€

Nov 2012 – Out 2014



- **Objective:** achieving better thermal insulation and/or acoustic performance of the facades.
- **Technological solution:** stir friction welding of two layers of metal plating, filled with air, water or layers of insulation in mineral wool, cork, among others.
- **Possibility of storing rain water.**
- **Thermal control by circulation of stored water.**
- **Development of decorative façade panels, using 3D effects, chromatic variations, effects of low and high relief.**

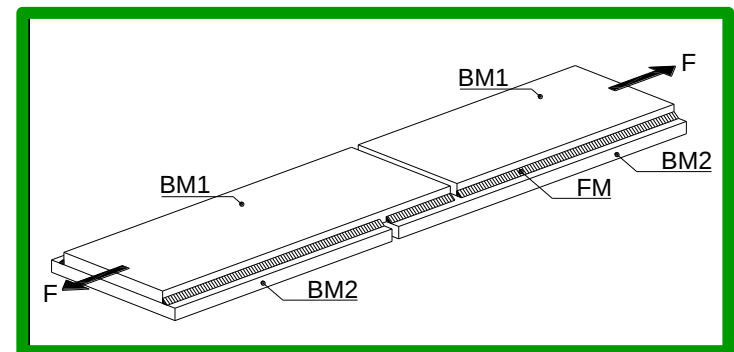
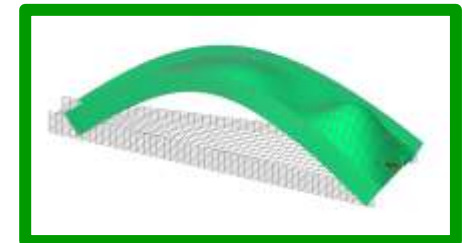
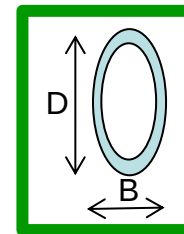
International Projects



Development of consistent procedure for **safety assessment** of the various failure modes relevant for steel structures is developed, covering **ductile, semi-ductile and brittle modes**, respectively driven by plasticity, stability and fracture.

RFCS SAFEBRITILE July 2013 – June 2016

STANDARDIZATION OF SAFETY ASSESSMENT PROCEDURES
ACROSS BRITTLE TO DUCTILE FAILURE MODE



National Projects

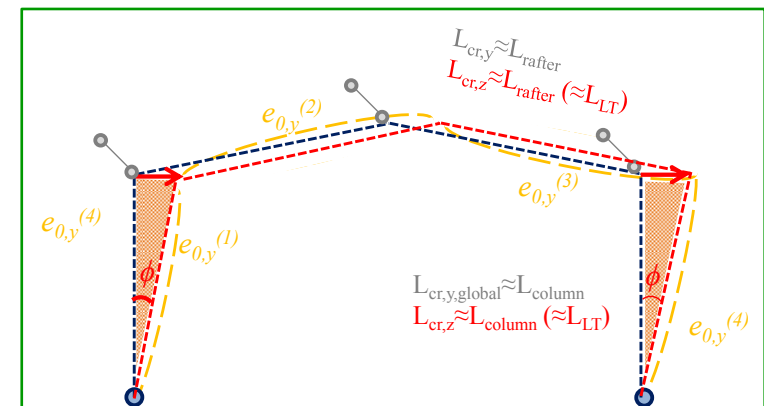
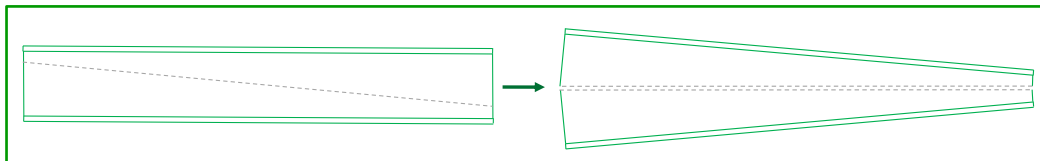
TaperSteel

July 2013 – June 2015

Stability design of non-uniform steel members



- To develop new stability rules for a wide range of non-uniform members on the basis of a general methodology in which the buckling phenomena is accounted for by a generated imperfection factor.
- To have a straight forward procedure, nevertheless with mechanical consistency.
- To accomplish this, not only extensive parametric study will be carried out, but also tapered elements are considered for an experimental program.
- The outcomes of this project will be consistent with existing rules for uniform members, i.e., at the limit, proposed rules lead to the existing ones.

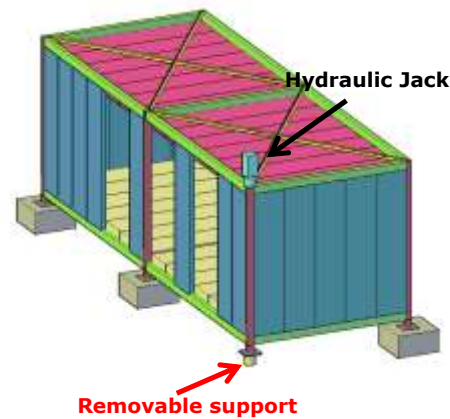


SME-2012-1-315274 - MODCONS:
*Development of Modular
 Construction for Sustainable
 design, stability and seismic
 applications*

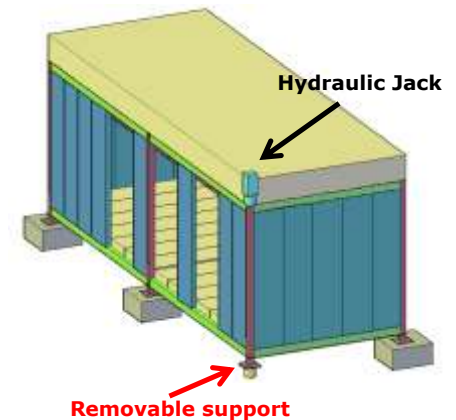
Funding: 1.4 M€ 8 Partners
 Jan. 2013 – Dec. 2014



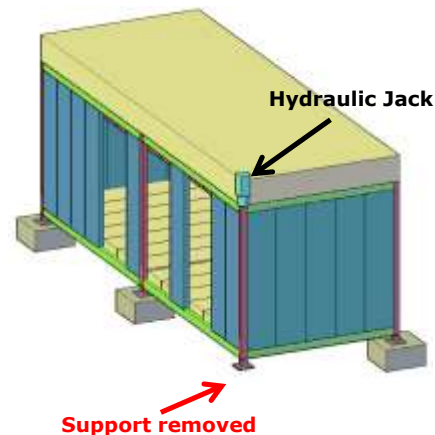
European Projects



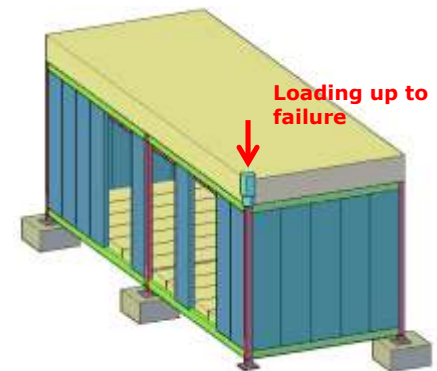
Step 1: Construction of Module



Step 2: Loading of module with sand bags



Step 3: Column support removed



Step 4: Concentrated load applied by the hydraulic jack up to failure



***RESEARCH CLUSTER:
MIXED CONSTRUCTION***



Project outline:

1 – Characterization of the experimental behaviour of a small scale laminated glass beams considering the parametric variation in table 1 (except reinforcement);

1 – Characterization of the experimental behaviour of a full scale laminated glass beams considering the parametric variation in table 1;

2 – Preparation of numerical models, calibrated with the experimental results. The results are expected to bring in important information on the behaviour of the laminated glass beams;

3 - Definition of design formulations and technical guidelines for the use of reinforced laminated glass beams, when subjected to thermal and cyclic loading.



S-GLASS



DEVELOPMENT AND VALIDATION OF DESIGN METHODS FOR STRUCTURES SUBJECTED TO EXTREME ACTIONS

Funding: 0.13 M€

Abr 2012 – Mar 2015

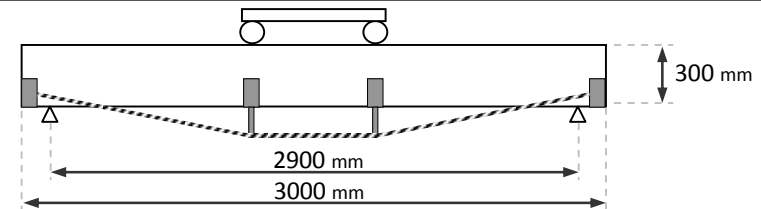


Fig. 1: Four point bending test set-up: reinforced glass beam

Table 1: Parametric variation considered in the experimental full scale beam tests

Interlayer	Loading	T [°C]	Reinforcement
PVB	Monotonic	20	Yes / No
		50	Yes / No
	Cyclic	20	Yes / No
		50	Yes / No
	Monotonic	20	Yes / No
		50	Yes / No
SentryGlas	Monotonic	80	Yes / No
		20	Yes / No
	Cyclic	50	Yes / No
		80	Yes / No

***RESEARCH CLUSTER:
SUSTAINABILITY, ENERGY
EFFIC. & ARCHITECTURE***

European Projects






AFFORDABLE HOUSES
 Low cost
 Residential lightweight
 buildings

Funding 2009: 0.5 M€

8 Partners

Jan 2009 – Dec 2009



Sustainable Bridges 

FP6-PLT-001653 - Sustainable Bridges: Assessment for future traffic demands & longer lives

Funding: 6.9 M€ 32 Partners

Dec. 2003–Nov. 2007



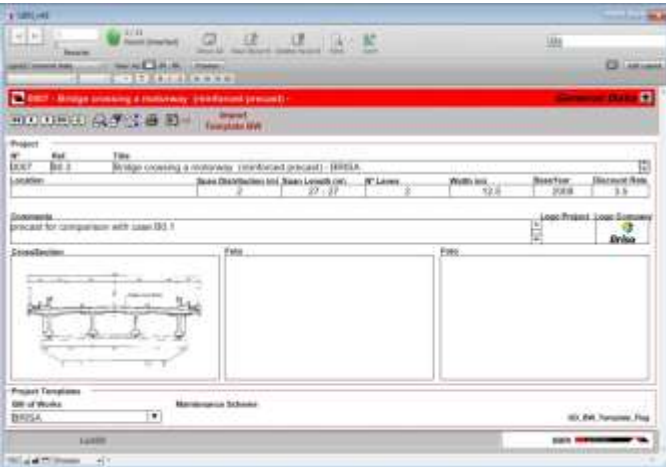



MAINLINE

MAINTenance, renewaL and Improvement of rail transport iNfrastructure to reduce Economic and environmental impacts

Funding: 4.5 M€ 19 Partners Oct 2011 – Set 2014

European Projects












SBRI - Sustainable Steel and Composite Bridges in built environment

Funding: 1.5 M€

9 Partners

Jul 2009 – Jun 2012








OPTIBRI - Optimal use of High Strength Steel grades within bridges

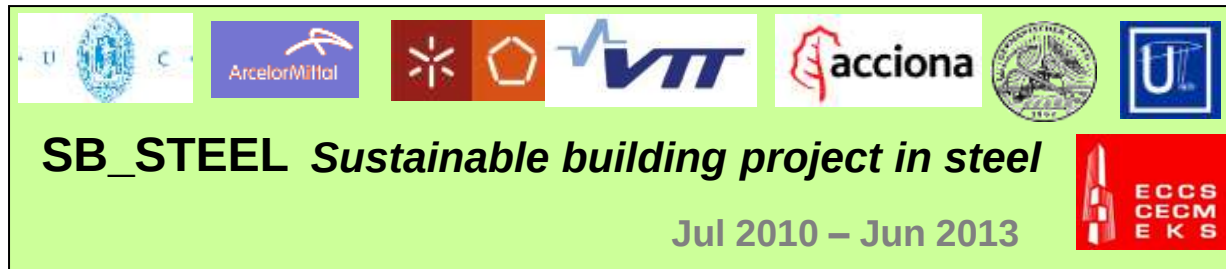
Funding: 1.8 M€

6 Partners

Jul 2014 – Jun 2017

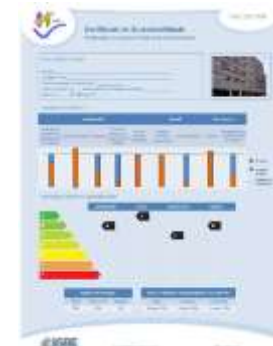
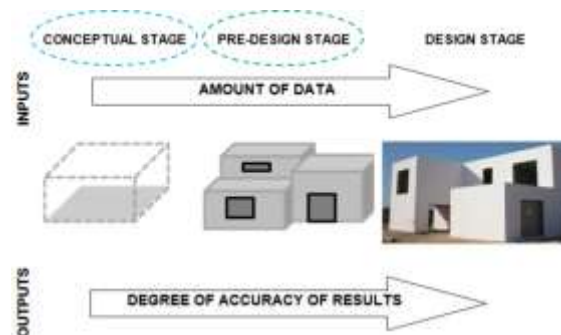


European Projects



MAIN OBJECTIVES OF THE SB_STEEL R&D PROJECT:

- Strengthen the competitiveness of steel-intensive construction;
- Provide key concepts of sustainable steel building since the early stages of design (new and renovation build);
- Develop a web-based tool to guide building designers towards optimized sustainable designs.



International Projects



LVS3 – Large valorisation on sustainability of steel structures

Funding: 1.6 M€ Jul 2013 – Jul 2015

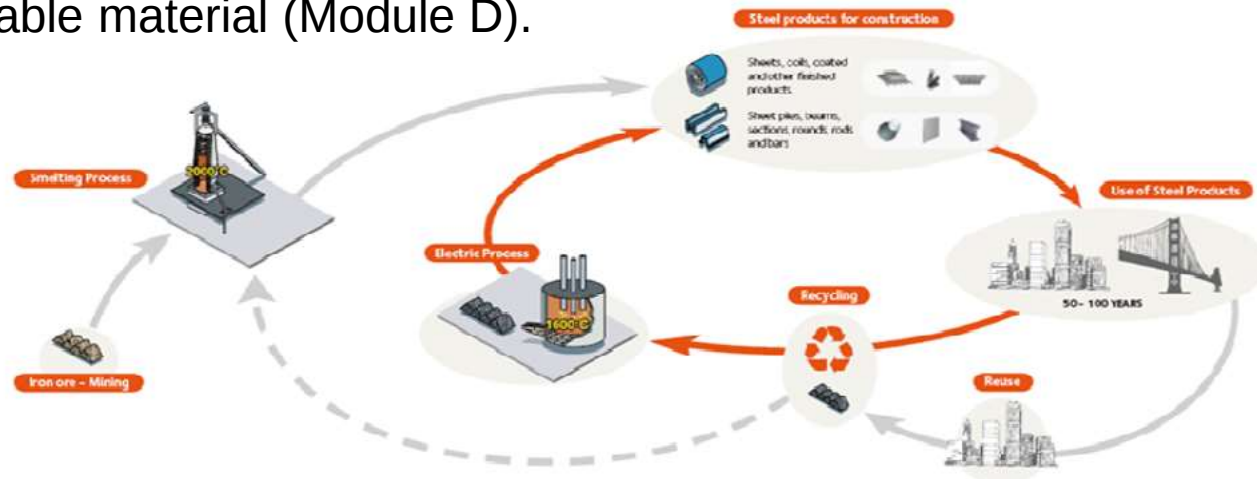




OBJECTIVE:

The technical objective is to disseminate the knowledge acquired in the recent years about the environmental impact assessment of steel and composite buildings. During the last decade, a lot of research projects have been funded to develop methodologies, systems and products aiming at improving the thermal efficiency as well as the global environmental footprint of steel buildings. The new standard EN15804 intended for environmental calculation of buildings takes now into account the fact that steel is a recyclable material (Module D).

Within this project, documents such as leaflet and design guides and software will be created and disseminated amongst Europe by the organisation of workshops.



***RESEARCH CLUSTER:
ENERGY, OIL & GAS***

European Projects





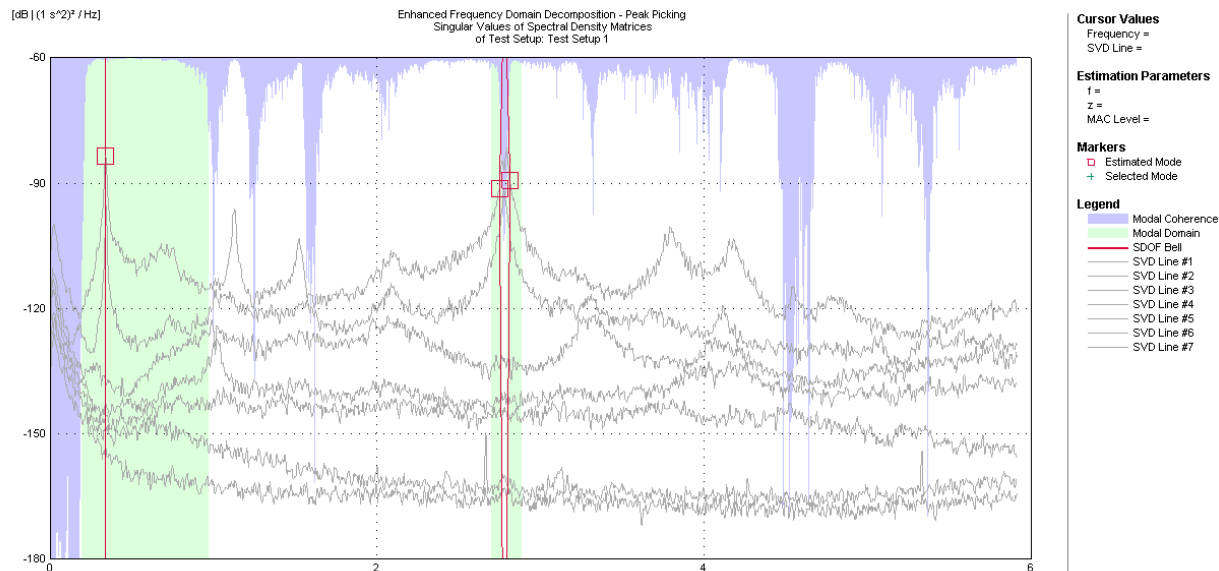






HIGH STRENGTH STEEL TOWER FOR WIND TURBINES – HISTWIN

Funding: 1.4 M 7 Partners Jul 2006 – Jun 2009







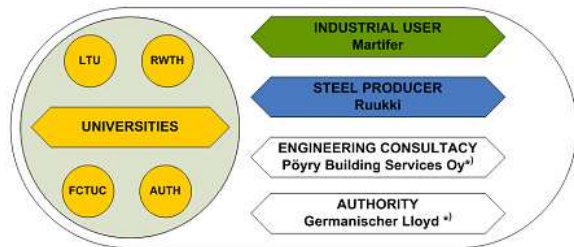




HISTWIN+ - HIGH STRENGTH STEEL TOWER FOR WIND TURBINES

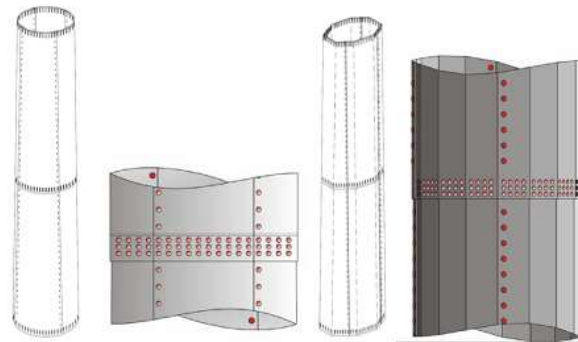
Funding: 0.5 M€ 7 Partners Jul 2014 – Jun 2016

Main Objectives: Produce competitive high steel tubular towers of modular segments; improve foundation solution; analyze stability issues related to friction connections; assess LCA data related to the towers

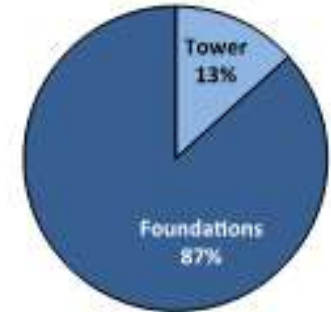


HISTWIN 2 -HIGH STRENGTH STEEL TOWER FOR WIND TURBINES

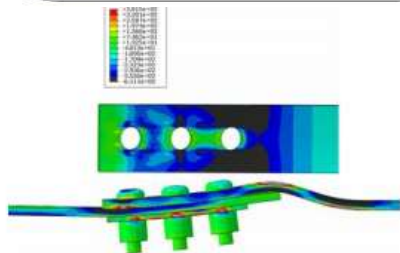
Funding: 1.3 M€ 7 Partners Jul 2010 – Jun 2013



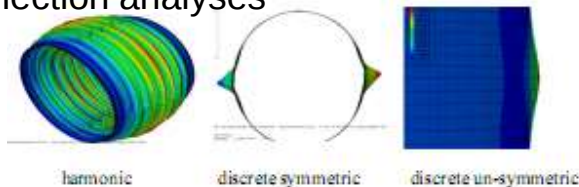
Modular tower



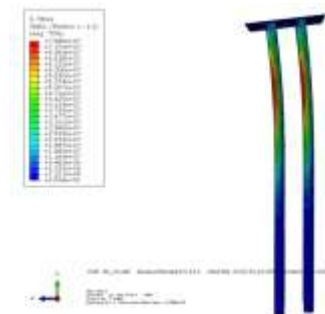
Foundations relative cost



Friction connection analyses



Stability analysis



Numerical and experimental analyses of steel micropiles

isise

INTERFACE WITH INDUSTRY



KEY ASPECTS

- ❑ Interaction with **INDUSTRY** forces us to focuss
- ❑ Cooperation with **INDUSTRY** is essential for **INNOVATION**
- ❑ Interaction with **INDUSTRY** is essential to reach a **CRITICAL DEVELOPMENT SPEED**
- ❑ Cooperation with **INDUSTRY** creates new opportunities for **EDUCATION.**



INTERFACE WITH INDUSTRY

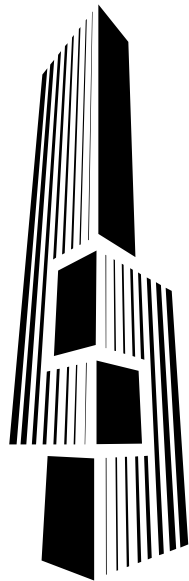


cmm

Portuguese
Steelwork
Association



CMA
CONSTRUÇÃO METÁLICA
EM ÁFRICA



ECCS

Setting-up a global
European platform to
promote construction
with steel



cmm

III CONGRESSO LUSO AFRICANO DE

**Construção
Metálica
Sustentável**

Julho de 2014

LUANDA, ANGOLA
www.cmm.pt/



IX CONGRESSO DE
**Construção Metálica
e Mista**

I CONGRESSO
Luso-Brasileiro de
**Construção Metálica
Sustentável**

24 a 25 Outubro 2013

Porto, Portugal
Expositor: Centro de Congressos
www.ccm.pt/congresso/

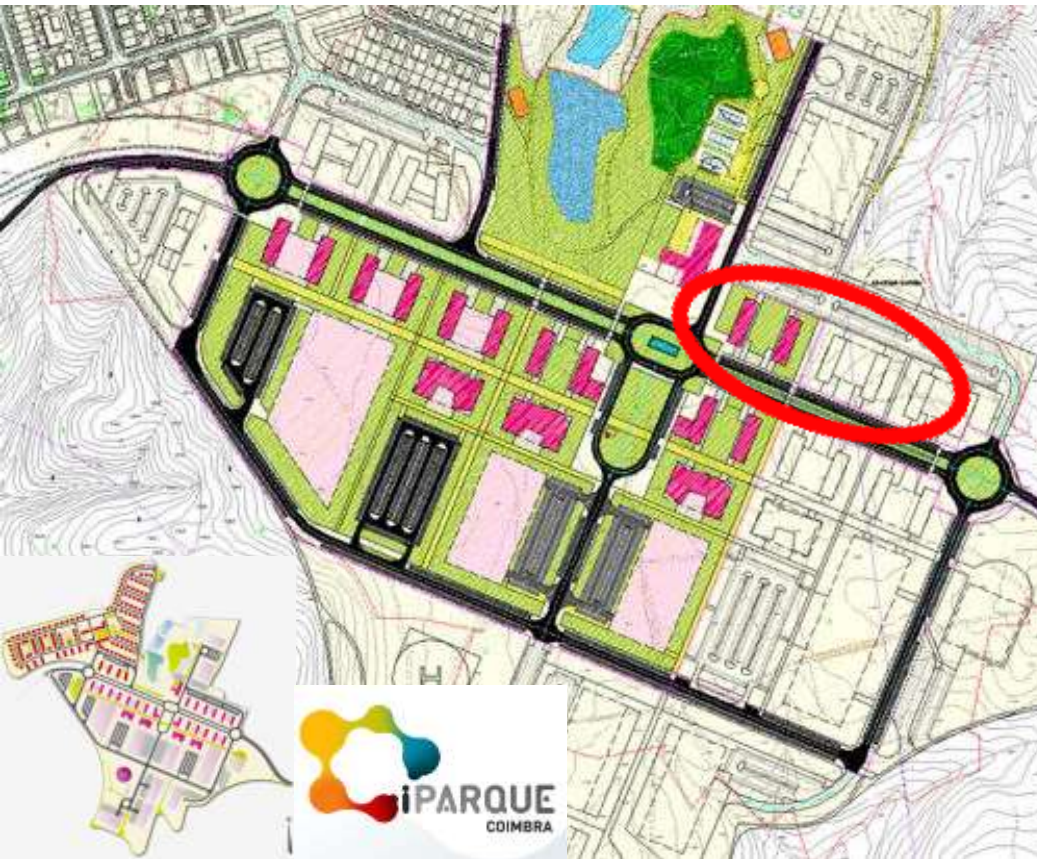


COOL HAVEN – THE COMPANY



iPARQUE – Technological Park of Coimbra

- COOL HAVEN
INSTALLATIONS

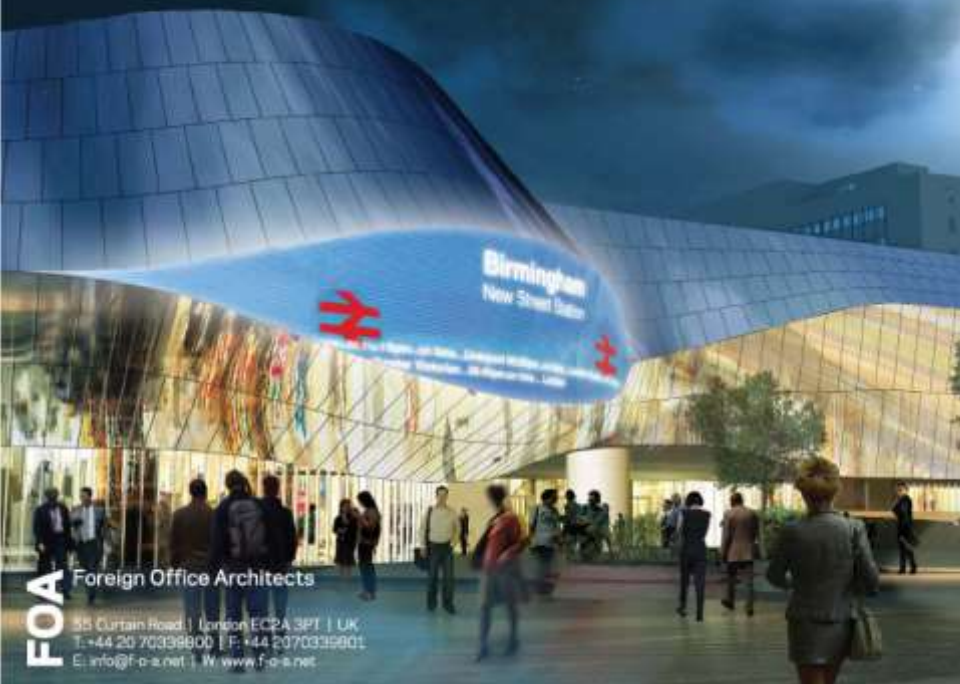


ArcelorMittal International Network of Scientific Partners for Steel Construction



University of Liege (Liege, Belgium)
 Earthquake Research Institute (Istanbul, Turkey)
 University of Navarra (Spain)
 Tongji University (Shanghai, China)
 Universidade Estadual do Rio de Janeiro (Rio de Janeiro, Brazil)
 University of S. Paulo (S. Paulo, Brazil)
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