

Foreword



Dr. Lars Heselius
LHH Consulting, Finland

The European product standard EN 14509 which was published at the end of 2008 covers most of the basic properties of panel as they are commercialised but does not regulate any of the aspects relating to their use. CE mark for sandwich panels has now been in force since October 2010 and is still largely untried and as such it does leave many basic questions open for panels users.

The EASIE project which will have completed its work programme at the end of this year will provide much additional information on the use of sandwich panels. This will be in particular the case for a number of very important topics and including openings in wall and roof panels, window and door connections without additional supporting structures, guidelines for good panel joints, wall panels subjected to axial loads and in situ repair methods for repairing damaged panels without having to replace them.

Areas in which the project has made great strides such as new design approach (design by testing), improved understanding of the ageing process of panels and of the supports and the interaction between panels and substructures are all giving greater confidence to users of sandwich panels and some of the results will most probably find their way into future revisions of the European standard.

The e-learning part of the project is already acting as a powerful tool for promoting the use of sandwich panels especially through a series targeted at SMEs which have been organised across the European Union.

My own contribution to this project has been mainly in the field of openings in panels acting as coordinator of the work package WP1 in cooperation with Professor Jörg Lange and Mrs Felicitas Rädels from the Technical University Darmstadt in Germany.

The EASIE project has also had an important positive impact on the cooperation between industry and research providers, including universities and research institutes and as such is a good model for future projects focused on the R&D needs of SMEs although of course there is always room for improvements in strengthening contacts between research institutions and to a broader part of industry.



Test rig at KIT

WP₁

Improvement of thermal and structural behaviour in openings and joints

WP₂

End user Focused Design Strategy

WP₃

Use of sandwich technology to optimise the global resistance of buildings

WP₄

Retrofitting, durability and maintenance

WP₅

Holistic, elearning based education on sandwich construction

WP₆

Training, skill development and dissemination

WP₇

Management and Governance

Use of sandwich technology to optimize the global resistance of buildings

Traditionally sandwich panels are used as unidirectional spanning flexural members transferring loads to a substructure. The results of EASIE's work package 3 "Use of sandwich technology to optimize the global resistance of buildings" show how sandwich panel's high resistance to in-plane shear and axial forces can be utilized to improve the structural behavior of steel structures:

The high in-plane stiffness of sandwich panels can be taken into account for bracing (diaphragm action) or stabilisation (beams, columns) if the characteristics of such systems are taken into account. These characteristics are determined by the high degree of pre-fabrication. The state of the art in the calculation of the stiffness and the load-bearing capacity of sandwich panels under in-plane loading shows the dominating influence of the fastenings. The stiffness of the fastenings is smaller than the stiffness of the panel. Therefore for the stiffness of diaphragms made of sandwich panels not the stiffness of the panel, but the stiffness of the fastenings is decisive. So for design of shear diaphragms knowledge of the stiffness of the fastenings is mandatory. WP3 developed generalized calculation procedures for the stiffness of fastenings of sandwich panels.

Sandwich panels can also reduce the problem of lateral torsional buckling of their substructure by providing stabilisation by torsional restraint. A mechanical model including the effects of creep and elevated ambient temperature was developed in WP3, ending up in a design formula. This design formula is based on experimental investigations and parametric finite element analyses. The formulae apply for sandwich panels with



Buckling test

facings made of steel, aluminium or GFRP and with cores made of polyurethane, EPS or mineral wool.

As a recent development, sandwich panels are used to design small buildings without substructure. In this

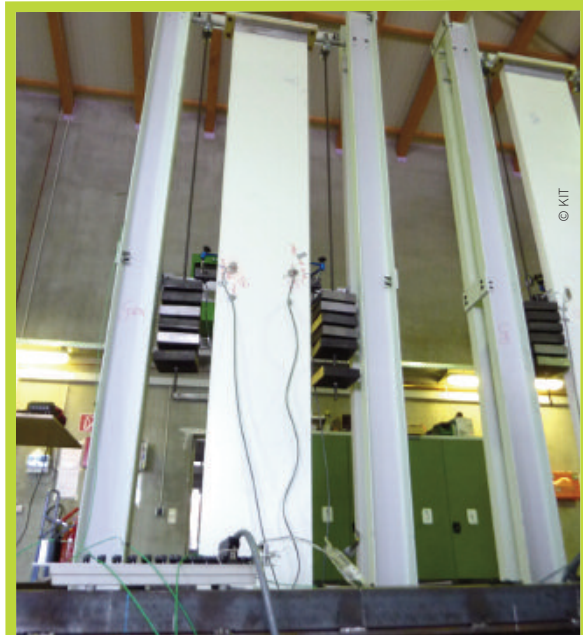
application the panels are not only used as cladding element but also for load transfer and bracing of the building. A design model for axially loaded sandwich panels was developed in WP3. This design model also considers creep effects under long-term loading.



Design guides will be prepared for the application of the design formulae. These will be available at the end of the project. But most of the results are already published or will be published soon:

- Käpplein, S., Misiek, Th., Ummenhofer, Th.: "Aussteifung und Stabilisierung von Bauteilen und Tragwerken durch Sandwichelemente (Bracing and stabilisation by sandwich panels)", Stahlbau, Vol. 79, No. 5, pp. 336-344, 2010 (in German).
- Käpplein, S., Ummenhofer, Th.: "Querkraftbeanspruchte Verbindungen von Sandwichelementen (Shear loaded fastenings of sandwich panels)", Stahlbau, Vol. 80, No. 8, 2011 (to be published in August 2011, in German).
- Misiek, Th., Käpplein, S., Dürr, M., Saal, H.: "Stabilisation of purlins by sandwich panels – new regulations and recent research results", CIB World Congress 2010. Proceedings (www.cib2010.org/post/files/papers/462.pdf).
- Misiek, Th., Käpplein, S., Saal, H., Ummenhofer, Th.: "Lateral torsional stabilization by sandwich panels", eurosteel 2011. Proceedings (to be published in September 2011).
- Käpplein, S., Ummenhofer, Th.: "Axial beanspruchte Sandwichelemente in rahmenlosen Konstruktionen (Axially loaded sandwich panels in frameless buildings)", Stahlbau, Vol. 79, No. 10, pp. 761-770, 2010 (in German).
- Käpplein, S., Ummenhofer, Th.: "Classification of stability failure modes of sandwich panels under compression loading: global and local buckling, crippling at support line", Proceedings of SDSS, International Colloquium Stability and Ductility of Steel Structures, pp. 1033-1040, 2011. (www.labciv.eng.uerj.br/sdss2010/files/sdss_rio_2010_11_17.pdf).

WP₃



Creep test



Fasteners

Interview

Saskia Käpplein
Research assistant

Dr. Thomas Misiek
Research assistant



structures is managed by Professor Thomas Ummenhofer. Since its foundation, the Versuchsanstalt has constantly adjusted itself to the requirements and tasks of science and research and applied its findings to practice. The chair of steel- and light-weight structures provides lectures in different subjects in civil engineering structures, for example steel structures, light-weight structures, glass in buildings, welding and plastics in buildings.

During its existence, the Versuchsanstalt has established a leading position as a nationally and internationally renowned research institution and testing centre, as well as a high performance partner to industry. This

Could you present KIT?

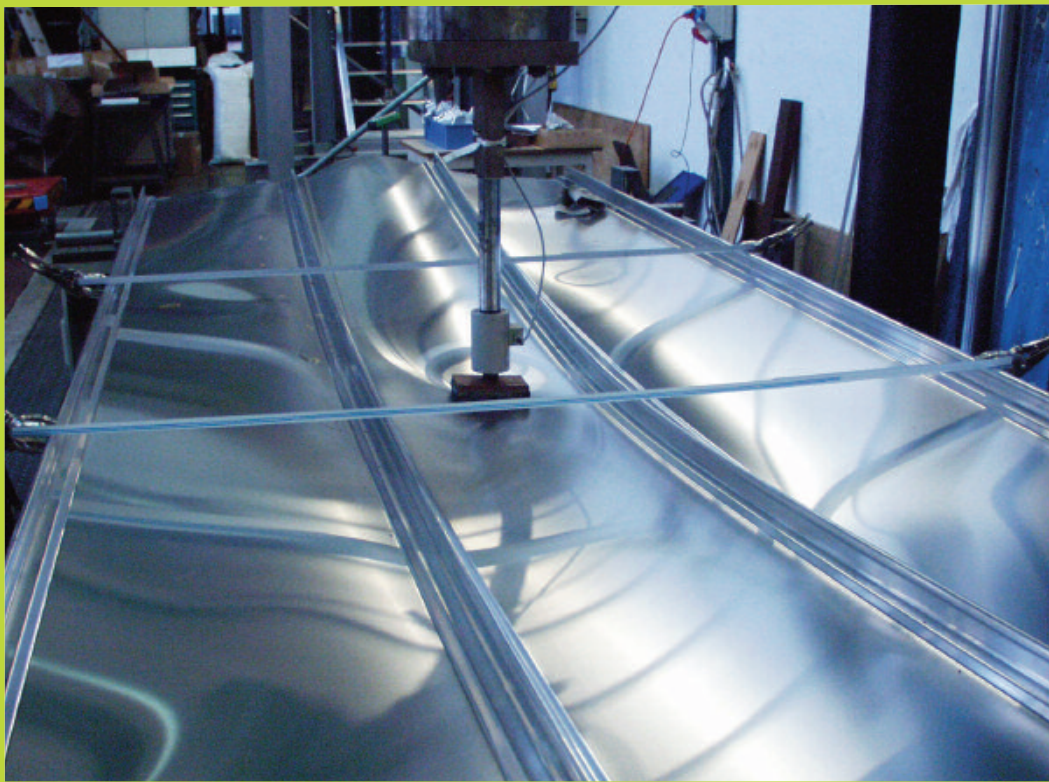
Karlsruhe Institute of Technology (KIT) is a public corporation and state institution of Baden-Württemberg. Resulting from a merger of the University of Karlsruhe and the Research Center Karlsruhe (Forschungszentrum Karlsruhe), it fulfills the mission of a university and the mission of a national research center of the Helmholtz Association. KIT is still divided into a university sector and a large-scale research sector with a number of

scientific facilities and organizational units rendering infrastructure and administration services.

The Versuchsanstalt für Stahl, Holz und Steine (Research Centre for Steel, Timber and Masonry) as a part of the former University of Karlsruhe is located on the southern campus (Campus Süd). It was founded in 1921 and consists of the departments of steel and light-weight structures, and timber and building construction. The department of steel- and light-weight



Aerial view of the campus



Test rig with profile



is proven by many scientific publications and dissertations. The collaboration of members of the Versuchsanstalt in national and international engineering standards committees, and the funding of their research projects by national and European establishments, industry, private companies and public authorities, emphasizes the qualifications of the Versuchsanstalt.

What are the main topics of research of the Institute?

Since more than 50 years, the history of the Versuchsanstalt is strongly

connected with the developments in thin-walled metal structures. Exemplarily the first investigations on trapezoidal sheeting by Professor Otto Steinhardt, the work of Professor Rolf Baehre as a chairman of the committees for the German standards and codes in thin-walled structures and the long-lasting accompaniment of the latest developments in sandwich panels and trapezoidal sheeting by Professor Helmut Saal and Professor Ulrich Schulz should be mentioned. Today, research and development in the field of light-weight structures is on of the main topics of the work done

at the Versuchsanstalt. Main aspect is an application-orientated research, aiming on further progress in the utilization of the possibilities in static, design and construction of light-weight structures. Other fields of work are for example conventional steel structures, fatigue of metal structures, hollow sections and off-shore structures.

Within the research project EASIE, KIT's main object is work package 3 "Use of sandwich technology to optimize the global resistance of buildings".

Interview

Dr Maciej Klósak
Development Engineer
ArcelorMittal Construction Polska



ArcelorMittal

new design methodologies for panels in which Design by testing could optimize sandwich panel design. I also represent my company in the Management Group.

Could you present the activities of your company in Poland?

ArcelorMittal Construction Polska has 4 units in which we produce sandwich panels with PUR/PIR foam, trapezoidal sheets and flashings. The most recent Rawa unit provides customers with PUR and PIR panels with aesthetics surfaces and good fire performances.

Our company also proposes façade systems with high fire performances and more sophisticated aesthetic facades. Floor systems based on steel sheeting Cofraplus and Cofrastra are for flooring.

What is your role in the EASIE project?

ArcelorMittal Construction Polska has provided a large amount of samples in

most testing programmes such as openings & joints, design by testing or for ageing tests.

We also participate in most of the working packages. We have been closely involved in Design by testing, provided information for Openings & joints WP or collaborated in the testing programmes, especially in Helsinki or Mainz.

Could you describe your personal experience of your participation in the EASIE project ?

My role in the project is to guarantee the best sample materials for testing as well as to discuss testing procedures.

I am in the working group to develop

What do you expect from the EASIE project?

EASIE is a big challenge for all scientists and industrial partners as we have defined very ambitious goals.

The results obtained in the project should help to improve assembling techniques (I count on userfriendly guidelines for openings), gain more information about our products, especially as they are tested in different conditions (thermal gradient and ageing), but most of all could help to obtain improved design rules that should quickly appear in EC codes.

Working with so many experienced persons is a perfect opportunity to exchange good practises of our profession which is beneficial for all of us.



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Event

Workshop

March 24th
2011

Col.legi oficial d'Enginyers Industrials de Catalunya - Via Laietana n°39 - Barcelona - Spain

Building with sandwich panels fast, safe and energy saving

Workshop Program

9:00	Introduction
9:15	Load bearing behavior; How is a sandwich panel working? <i>Prof. Dr.-Ing. Jörg Lange - Technische Universität Darmstadt - Germany</i>
10:00	Allowable span tables on the base of the CE-mark <i>Prof. Dr.-Ing. Klaus Berner - IS Engineering</i>
10:45	APIP'NA "Asociación de fabricantes de paneles sándwich de poliuretano de España" <i>Neus Comas, General Secretary</i>
11:00	Coffee
11:15	Sandwich panels and architecture <i>Michiel Cohen, architect - The Netherlands</i>
12:00	Sustainability in Sandwich Panel Construction <i>Dr.-Ing. Markus Kuhnhenne - RWTH University Aachen</i>
12:45	Repair and retrofitting <i>Paavo Hassinen - Aalto University, Finland</i>
13:15	Lunch
14:15	Thermal bridges and Air Tightness of Sandwich Construction <i>Dr.-Ing. Ralf Podleschny - EPAQ (European Quality Assurance Association for Panels and Profiles)</i>
15:00	Coffee
15:15	Experimental studies on durability of sandwich panels <i>Paavo Hassinen - Aalto University, Finland</i>
15:45	Thermal and structural behavior in openings and joints <i>Dipl.-Ing. Felicitas Radel - TU Darmstadt</i>
16:30	Final conclusions <i>Prof. Dr.-Ing. Jörg Lange - TU Darmstadt - Germany</i>
17:00	End

Participation form

Date of application _____

Company / affiliation _____
 First Name _____ Name _____
 Job position _____
 Address _____
 Postcode _____ Town _____ Country _____
 E-mail _____
 Telephone _____ Fax _____ Mobile phone _____

Registration

For registration, please email this application form or send a fax to APIP'NA :
apipna@apipna.com • Fax: +34 93 552 85 01

Registration fee: 150€
For APIP'NA and E.I.C members:
registration fee is only 50€

Registration fee must be paid by transfert:
Catalunya Caixa
Bank account: 2013 0205 11 0206189722
SWIFT code: CESCESBBXXX
IBAN No: ES492013 0205 11 0206189722

Venue

Col.Legi Oficial d'Enginyers Industrials de Catalunya (COEIC)
Via Laietana, 39 - 08003 Barcelona - Spain
Tel. COEIC: +34 93 319 23 00
Tel. APIP'NA: +34 93 416 16 51

Metro:
Linea 1 or Line 4: "Urquinaona Station"
Linea 1, L3, L6 or L7: "Catalunya station"
Linea 4: "Jaume I Station"
Bus:
n°17, 19, 40, 45

The workshop has received support from the European Community. As the number of participants is limited the seat will be filled up according to the date on participation form.



What's new on www.easie.eu?

■ 2 e-learning lectures were uploaded

"light weight sandwich panels with thin-gauge faces" by *Lassi Martikainen (presentation in Finish)*
" core material - mineral wool" by *Kimmo Rantala*

■ 1 article on the "Methods to measure the durability of structural sandwich panels"

Schedule for 2011

9th June

The third EASIE workshop will take place in Krakow, POLAND

22nd, 23rd Sept.

Concluding conference at the joint congress Pan and Pro Europe / EPAQ, Roma, ITALY

For more information : www.easie.eu