

Foreword



Dr. Lars Pfeiffer
ThyssenKrupp Steel Europe AG

Being one of the initial organizers of the EASIE project together with Professor Klaus Berner, Daniel Spagni and the great support of Paavo Hassinen I am delighted to see the incredible impact the project has.

It is impressive how an idea starts with a blank sheet of paper and then continues to a project like the EASIE project. Changing sides during the course of the project by changing from university to an industrial partner I have the possibility to look at the project from two angles. It is important for me to see that I can find subjects of great impact from both sides. The work packages contain very hands on subjects such as panel repair or e-learning modules. These aspects are a straight forward benefit for the industry. At the same time the project deals with important theoretical questions such as the lateral torsional buckling problem or the design by testing methods. The project from my point of view particularly runs very well in terms of dissemination of the results. This was one of the prime concerns of the European commission when commenting on the proposal. I can in particular see the benefit of this now as we are approaching the last third of the programme. Conferences and workshops together with the newsletter make the project visible all over Europe. I come across it in literally any meeting that I attend. If there is no presentation from the project at least the results are discussed. If I compare the EASIE project to other European funded projects of which I experienced several, I can clearly say that the EASIE project is already now a great success. I am now looking forward to the rest of the project time and I would like to take the opportunity to wish all partners a Merry Christmas and a Happy New Year 2011 in which we will finalize the project.



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

Presentation of the design by testing at the joint congress Pan and Pro - EPAQ

September 16th and 17th 2010, Porto

90 participants from 18 countries attended the presentation on design by testing, a complementary method to design by calculation.

For memory, the design by testing concepts are issued from the French experience and standards and from the works of The TC128 SC11 WG5.

David IZABEL, Technical Manager of SNPPA is mandated by the SNPPA board for the EASIE project research and works on design by testing for the creation of several background documents as a base for expansion of the next draft of EN 14509 and for use in practice.

Following the presentation of Professor Bernd Naujoks, IS Mainz on the design by calculation, David IZABEL presents the design by testing to the participants at a congress

There are three approaches for the design of sandwich panels on a building:

- Design by calculation « tests on 2 supports + annex E, stresses approach → EN 14509 » all the cases are calculated
- Design by testing « large scale tests on 2 and 3 supports, loads



David Izabel presents the behaviour of sandwiches panels with and without thermal gradient.

approach → Easie → EN 14509 » Loads tables and some principles following annex E and the EN 14509.

- Design mixte by testing and by calculation « large scale tests + calculation » → EASIE → EN 14509

Design by testing is a simple and pragmatic method. There are 4 steps to follow:

- **Step 1:** Carry out the tests + statistic analyse function of the number of tests
- **Step 2:** Determine the bending and shear rigidities (from the tests or by calculation)

- **Step 3:** Determine the strength capacities (Bending moments, shear forces, compression on support, assembly capacities) following simple strength of material rules that take into account of the bending and shear deformation of the product.

- **Step 4:** Determine the load tables (comparison of each strength capacity loads with the correspondent combination actions)

→ An Excel software based design tool is on development and will allow to easily realize all the four steps.

Several tests were done on :

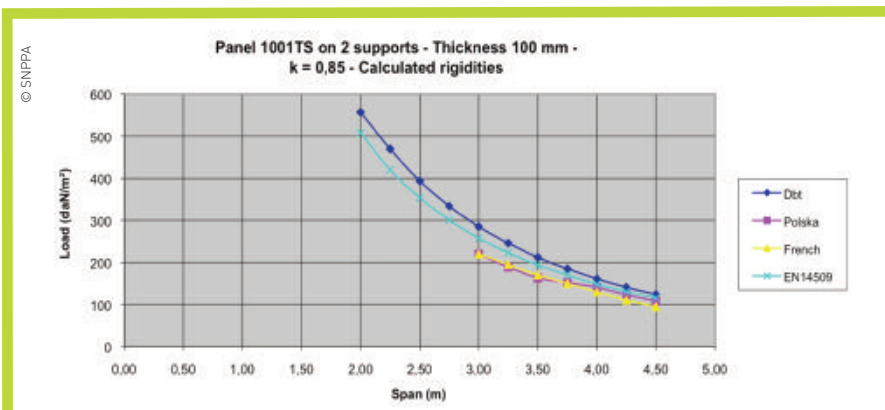
- cladding and roofing panels (AMC Polska, TyssenKrupp, Isocab, Panelco)
- small; medium and maximum spans
- 2 and 3 supports
- polyurethane and mineral wool core
- with and without thermal gradient (Thermal test not mandatory, k1 of EN 14509 can be used)

In all the cases there is a good correlation with actual capacities of the panel and with the EN 14509 principles.



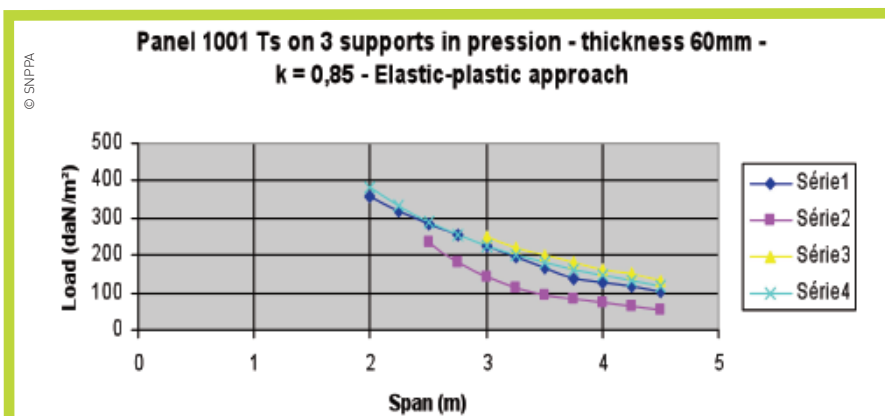
Participants at the congress





Comparison :

Design by testing and design by calculation on panel on 2 supports



Comparison :

Design by testing and design by calculation on panel on 3 supports

Legend:

- In dark blue Design by testing made by D Izabel,
- In light blue Design by calculation following EN 14509 made by IS mainz (Christian Berg and B Naujoks)

For information:

- in purple the national performances of the AMC Polska's panels tested
- in yellow the national performances of a French roof panel 1001Ts

Design by calculation means :

- Calcul case by case (engineer staff, software, note of design work site by work site, use of office of calculation).
- Loss of inside strength capacity for the 2 or more span panels (if no residual bending moment, and no 2 span tests taken into account)
- Assembly (suction) not included in the tests.

Design by testing means :

- Large scale tests (laboratory, number of tests important)/use of family approach
- Pragmatic approach
- Use of all the capacities of the panel
- Optimisation of the span
- Note of design by calculation only for the specific cases

The EASIE research programme developed an excel software to build the load tables

The conclusion is that design by testing and design by calculation are complementary methods.

The manufacturers will choose between the two methods according to their cultures, the countries and the complexity of the buildings.

Retrofitting of light-weight sandwich panels

by Paavo Hassinen



Modern facade of office building

Facades and roofs like all other components of buildings need retrofitting time to time. Facades made of light-weight components and of sandwich panels are not exceptions. Repairing actions may mean cleaning or painting of the surfaces, fixing of the joints and sealants or repairing of the structural parts of the façade and roof. The goal of the repairing actions is to improve the technical and visual properties, the functional behaviour and safety and to extend the service life of the structure.

Reasons to the repairing actions are normally the ageing of the materials or the faults and damages caused by the environmental effects or the human activities. Reasons to repairing may also be the need to improve the thermal insulation properties, the air and

water tightness or the mechanical resistance. A reason may simply also be the need to update the architectural appearance of the façade to correspond the style of the new time and place.

Retrofitting is a subject in EASIE project. The project opens questions, which arise in the design and execution phases of the renewal of a façade and roof made of light-weight metal-sheet faced sandwich panels and tries at the end of the project to give answers in essential points of the design and execution. The project is looking for the practical means and methods to repair local damages of the faces and core caused by the internal effects like blistering and imperfections and by different sort of external effects. The project studies also typical systems to

cover the panel in full with a new light-weight structure made typically of metal sheets, cassettes and purlins. Other possible solutions to cover a panel are the different boards, panes, composite laminates and even brick walls. The list of questions concerning the design and use of the new composite facade and roof panel may include following items;

- how does the external mechanical load such as a wind pressure and suction load distribute between the additional cladding and the face of the existing panel?
- how do the different parts of the new systems react to a rise and fall of the external temperature and which kind of additional stresses the non-uniform distribution of the temperature will result in?

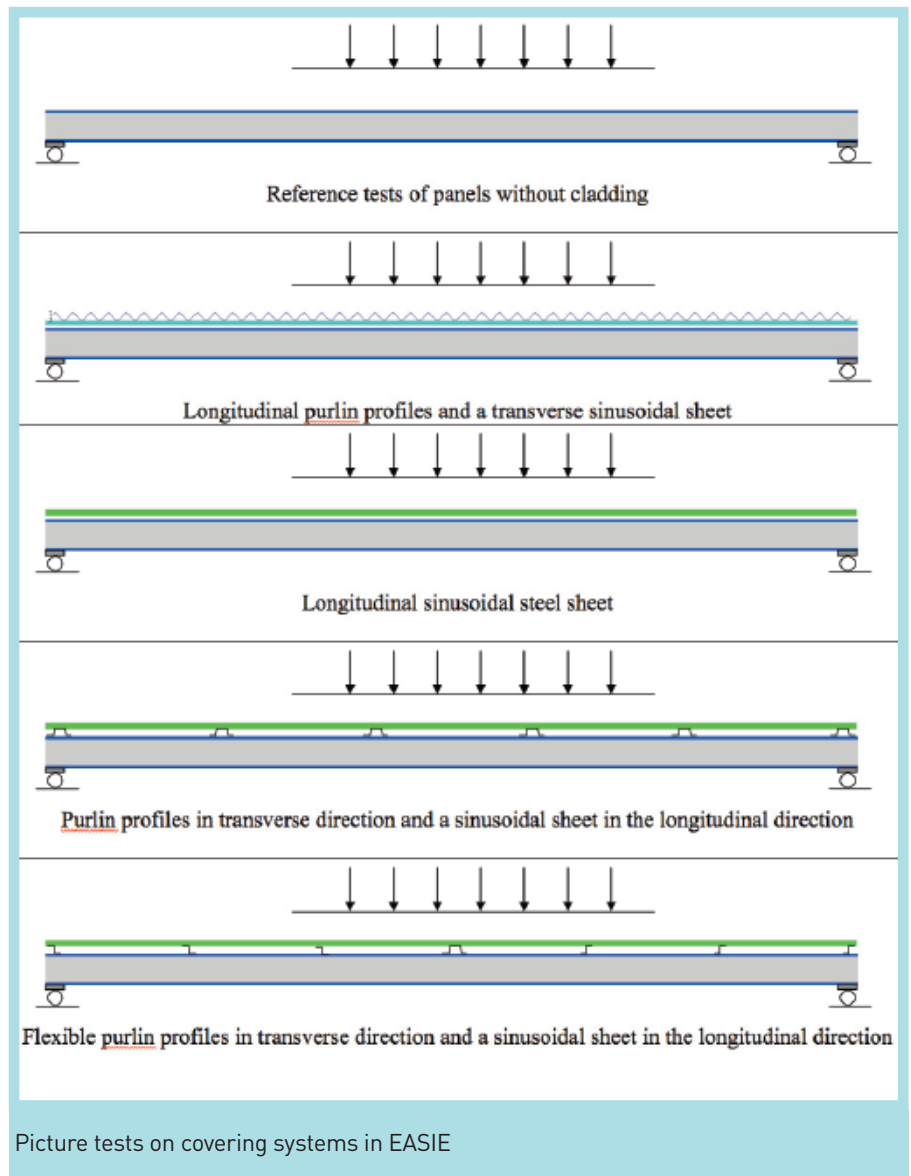




- what is the influence of the cladding on the thermal insulation power of the system?
- what are the local stresses and effects caused by the self-weight of the additional cladding and objects?
- how to utilize or avoid the static interaction between the existing panel and the additional cladding?
- what are the possible long-term effects caused by ageing and repeated loads?

Repairing of sandwich walls and roofs is made today using case by case tailored systems. The systems of retrofitting depend very much on the local needs and the local practice and way of building. Because of the increasing interest to improve the functional behaviour and to extend the service life, more industrial methods and systems are needed, however, keeping in the mind the requirements to the technical and visual flexibility of the system. The door has to be open to a continuous development of the systems as well.

Systematic studies are needed to develop repairing systems to local damages and to complete coverings of the panel in order to base the design and use on known verified methods. The complete covering can also be applied to new facades made of industrial sandwich panel products if there are needs to change the architectural appearance or the technical properties already at the beginning of the service life. EASIE project takes first steps to fulfill the need of information in practice. Project will produce instructions to find trouble-free systems and to avoid systems with high risks to technical problems.



Interview

Philippe Calland
Managing Director
Panelco



Could you present your company?

Employing 85 people, we are a French SME located in Vonnas at the heart of the fields of la Bresse. Our customers evolve to environments where there are increasingly stronger sanitary constraints on manufacturing.

For instance, our company manufactures sandwich panels and doors for the food processing industry where the environment is considered aggressive – up to Al6.

We can offer the pharmaceutical sector high-tech design systems for clearrooms which are airtight, easy to

clean up and disinfectable.

One of our greatest assets is our « customized » manufacturing capacity. The flexibility of our high performance production tool indeed allows us to perform very small specific production runs thus precisely meeting our customers' requirements.

What do you expect from the EASIE project?

It was the SNPPA (National Association of Flat Steel Product Profiling) who asked us to take part in EASIE. We immediately accepted this proposal as we were highly motivated to extend our

knowledge of panel behaviour. Our SME needs to make a considerable effort to finance the tests required and we are most grateful to the Commission for their financial assistance as this has given us a huge boost!

We were also very interested in taking part in EASIE because of all the research work required on bays and panel ageing.

The amazing thing about this is that we have very rapidly been able to use some of the results from the EASIE project. For instance, I have already changed the shapes of some of the elements I integrate into sandwich panels thanks to some work published by the consortium. Prior to EASIE, I also used to add a lot of materials in order to achieve a more robust product. EASIE has shown me that this was wrong and has taught me how to optimize materials.



View of the factory, Vonnas (France)

What's new on www.easie.eu ?

7 e-learning lectures were uploaded

- **Load Bearing Behaviour**
Prof. Dr.-Ing. Jörg Lange [TU Darmstadt]
- **Actions and loads**
Prof. Dr.-Ing. Klaus Berner [IS engineering]
- **Sustainability in Sandwich Construction**
Dr.-Ing. Markus Kuhnhenne [RWTH Aachen]
- **Connections of Sandwich Panels**
Dr.-Ing. Thomas Misiek [KIT, Karlsruhe]
- **Fabricating and designing sandwich panels for Fire**
Dr. Maciej Klosak [ArcelorMittal, Poland]
- **Erection from the factory to the final building**
Dr.-Ing. Ralf Möller [Pöter & Möller, Siegen]

Sandwich Panel European collaborative project

Seventh Framework Programme

Ensuring Advancement in Sandwich Construction through Innovation and Exploitation

The EASIE project has received financial support from the European Community's Seventh Framework Programme FP7/ ANP3-06-2508 under grant agreement No 213262.

Sandwich panels are modern lightweight building components used to cover walls and roofs of buildings and to isolate spaces inside buildings. They are typically made of two thin metal sheets with an insulating core between the faces.

The use of sandwich panels is continuously increasing and new application areas are opened in industrial, residential and office buildings. The European Standard for sandwich panels EN 14509 has a lack of rules or requirements for many important areas like fastening of the panels, openings in panels, axially loaded panels and panels stabilizing frame structures. Despite there is a lot of knowledge in different countries on these subjects, no common rules

- **Thermal bridges and Air tightness of Sandwich Construction**
Dr.-Ing. Ralf Podleschny [EPAQ]

4 new deliverables

- Design the joints against thermal losses
- Design guidelines for good panel joints and joints sealing openings focussing on air and water tightness"
- Design by testing
- Thermal test method

Schedule for 2011

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| 24th March | The second EASIE workshop will take place in Barcelona, Spain |
| 25th March | Sixth meeting of the Management Committee |
| 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 |

For more information : www.easie.eu