Application on sandwich panels
Installation of PV-systems and curtain walls on sandwich panels
Content

• Introducing iS-engineering GmbH

• PV-Systems and curtain walls on sandwich panels – examples

• Tasks and special features for tests and design

• Formal aspects and design procedure

• Details (mounting etc.) of the project Niedernberg
Research

Development

Engineering

certification, approvals, CE-marking, EPAQ, expertise's, consulting, seminars, SandStat, industrial research, statical calculations, parametric studies

in co-operation with

- Institut für SANDWICHTECHNIK
  - basic research
  - industrial research

- Amtliche Prüfstelle für Baustoffe
  - Material testing authority

- TU Darmstadt
  - Inst. für Stahlbau und Werkstoffmechanik

- and others ...
  - IMA Dresden, CSTB, TNO, TU Karlsruhe, ZAG etc.
Services (1)

• Civil Engineering (extract)
  - statical calculations and design
  - building physics and design in fire for
  - buildings (industrial and civil buildings)
  - cold stores, light weight constructions out of
    - concrete, steel or other metals
    - wood and timber
    - composite structures
Services (2)

• Expertises for
  – sandwich panels
  – plastics components
  – composite structures
  – light weight constructions

(for DIBt, EPAQ, CE-Marking ...)

• Member of CEN/ECCS/DIN/EPAQ/IFBS/iS-mainz/...
Services

- Certified Experts
  (e. g. experts for court/justice, private clients)
• Industrial Researching or sensitivity analysis (parametric study) in the field of sandwich panels, lightweight and composite structures
• Span tables and allowable loads for lightweight products
• Software author for lightweight structures and sandwich panels

### Sample-Roof-Panel $d = 80$ mm, $t_N = 0,60 / 0,50$ mm

<table>
<thead>
<tr>
<th>System</th>
<th>Colour-group</th>
<th>0,75</th>
<th>1,00</th>
<th>1,25</th>
<th>1,50</th>
<th>1,75</th>
<th>2,00</th>
<th>...</th>
<th>4,50</th>
<th>5,00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-span</td>
<td>I, II, III</td>
<td>4,89</td>
<td>3,96</td>
<td>3,29</td>
<td>2,78</td>
<td>2,40</td>
<td>2,11</td>
<td>...</td>
<td>1,06</td>
<td>0,99</td>
</tr>
<tr>
<td>Single-span (Deflection)</td>
<td>I, II, III</td>
<td>4,25</td>
<td>3,70</td>
<td>3,29</td>
<td>2,78</td>
<td>2,40</td>
<td>2,11</td>
<td>...</td>
<td>1,06</td>
<td>0,99</td>
</tr>
<tr>
<td>2-span</td>
<td>I, II, III</td>
<td>3,10</td>
<td>2,63</td>
<td>2,32</td>
<td>2,09</td>
<td>1,91</td>
<td>1,77</td>
<td>...</td>
<td>1,06</td>
<td>0,99</td>
</tr>
<tr>
<td>3-span</td>
<td>I, II, III</td>
<td>3,46</td>
<td>2,93</td>
<td>2,57</td>
<td>2,32</td>
<td>2,12</td>
<td>1,97</td>
<td>...</td>
<td>1,06</td>
<td>0,99</td>
</tr>
</tbody>
</table>
Examples – Curtain Walls (1)

Project:
Logistic-Center
GDC/DEPOT Niedernberg (Germany)
Architect: Netzwerkarchitekten
Firms: Franzengroup / Kalzip / Fischer Profil

Photos: © Netzwerkarchitekten, Darmstadt
Examples – Curtain Walls (2)

Project:
Logistic-Center
GDC/DEPOT Niedernberg (Germany)
Architect: Netzwerkarchitekten
Firms: Franzengroup / Kalzip / Fischer Profil

Photos: © Kalzip
Examples/Details – Curtain Walls (3)

Project:
Logistic-Center
GDC/DEPOT Niedernberg (Germany)
Architect: Netzwerkarchitekten
Firms: Franzengroup / Kalzip / Fischer Profil

Photos: Kalzip
Examples – Curtain Walls (4)

Project:
Logistic-Center
Higher Broughton Community Hub
Kingspan Karrier Panel
Photo/Pictures: © Kingspan, „Black-Book One“
Examples – PV on roofs (5)

Photos: © Raabe

Picture: © Fischer Profile
Examples – PV on roofs (6)

Photos: © Raabe
„Application on sandwich Panels“

Fixation only on the outer sheet of the panel!
Fixation on outer sheet

Principle tasks for tests and design:

1. **Safe load impact into**
   **base material = sandwich panel**
   - outer sheet of sandwich panel (profiling, material, thickness)
   - risk of the (local) damage/delamination of the outer sheet from the core material
   - Predamage of the sandwich panel

2. **load transfer in the sandwich panel**
   - Single-, Point- and/or Lineloads instead of

3. **Compatibility of deformation/deflection**
   - between curtain wall an sandwich panel
2. load transfer in the sandwich panel

Stützmoment

\[ b_w = 20 \text{ mm} + 0,45 \cdot x \cdot (2-x/l) \]

Load bearing width \( b_w \) for bending moment \( (M_S \text{ and } M_D) \) at internal support
3. Compatibility of deformation/deflection
to be ensured by e.g.:

- Constraint free design (e.g. with long slotted holes, uncritical elongation of rails)
- Defined fixed point and flexible connection points (e.g. for rails)
- Design in accordance to the different elongation and deformation behavior acc. temperature
- Stiffness of the connected construction to the sandwich panel must be compatible
- Confirmed by testings
Parametric (extract) to find out the necessary tests

• **Types of sandwich panels**
  - Geometry of panels and faces (profiling)
  - Thicknesses of sheets
  - Grades of materials (sheets)
  - Core materials (PUR/PIR, mineral wool ...) ...

• **Kind of fixation**
  - Clamp / short rail / load transfer beam / ...
  - Definition of fix and flexible points
  - Geometry of rails and curtain construction

• **Fastener**
  - Producer, type (screw, blid rivet, ...)
Formal aspects

• Not covered by EN 14509!
• National regulations required?
  e.g. Germany:
  - Approval for load bearing sandwich panels
  - ZiE (Approval for one time, one building)
• Design on the base of evaluated test results
• Mounting only with the border conditions of the tested materials and (tested) constructive details
More Informations for sandwich panels with point and line loads

If \( \sigma_{W,L} \leq f_{Cv,L} \geq \sigma_{W}; f_{Cv} \Rightarrow b_w = b \)

If \( \sigma_{W,L} \leq f_{Cv,L} < \sigma_{W}; f_{Cv} \Rightarrow b_w = \frac{\sigma_{W,L}}{\sigma_{W}} b; b_w = \frac{f_{Cv,L}}{f_{Cv}} b \)
More Informations in approvals

Zulassungsnummern:
Z-10.4-585

Geltungsdauer:
bis 19. März 2019

Antwortgeber:
Kongsberg GmbH
Am Simmeringer 2
44366 Dortmund

Zulassungsgegenstand:
Tragende Sandwich-Wandelemente "BENCHMARK Karrierpanel" mit Stahldekkschichten und einem Kernwerkstoff aus Polyurethan-Hartstoff

Der oben genannte Zulassungsgegenstand wird hiermit allgemein baubehördlich zugelassen. Diese allgemeine baubehördliche Zulassung umfasst zwei Blätter und zwölf Blatt Anlagen.
More Informations in approvals
More Informations in approvals

23.10.2014, Treviso, Raabe
Example on Project Niedernberg (1)

Architectural design study

Photo: © FranzenGroup/Netzwerkarchitekten
Example on Project Niedernberg (2)

Architectural color concept

Photo: © FranzenGroup/Netzwerkarchitekten
Example on Project Niedernberg (3)

Substructure

Photo: © FranzenGroup
Example on Project Niedernberg (3)

Substructure

Photo: © Netzwerkarchitekten
Example on Project Niedernberg (4)

Layout drawings and Details

Photo: © Kalzip/franzengroup
Example on Project Niedernberg (6)

ZiE (approval for one time) and 1st page of statical calculation
Example on Project Niedernberg (7)

Load bearing sandwich facade

Photo: © FranzenGroup
Example on Project Niedernberg (8)

Sandwich panels

Photo: © Kalzip
Example on Project Niedernberg (9)

Sandwich Panels as Substructure and with additional distance-construction

Photos: Franzengroup
Example on Project Niedernberg (10)

Photos: © Kalzip
Example on Project Niedernberg (11)

Photos: © Kalzip
Example on Project Niedernberg (12)
Example on Project Niedernberg (13)

Photos: © Kalzip
Example on Project Niedernberg (14)

Photos: © Kalzip
Example on Project Niedernberg (15)
Example on Project Niedernberg (16)

Photo: © Kalzip
Example on Project Niedernberg (17)
Example on Project Niedernberg (18)

Photo: © Netzwerkarchitekten, Darmstadt
Example on Project Niedernberg (19)

Photos: © Netzwerkarchitekten, Darmstadt
Example on Project Niedernberg (20)

Photo: © Netzwerkarchitekten, Darmstadt
Application on sandwich panels

• More possibilities in design (architecture)
• New market for sandwich panels with applications
• Additional applications (solar system, curtain walls)
• Closing of the building in a fastest way and interior and facade construction follows parallel after closing
• Lot of possible materials and design (sidings, tiles, membranes etc.)
• Special tasks for testing and design (calculation)
• Special agreements, approvals necessary
• Close cooperation between sandwich panel manufacturer and application manufacturer/mounterer is necessary
Application on sandwich panels

Installation of PV-systems and curtain walls on sandwich panels