3rd International Symposium on

Connections between Steel and Concrete

September 27th – 29th, 2017
Stuttgart, Germany

Final Program

organized by:
Institute of Construction Materials
Department of Fastening and Strengthening Methods
Symposium Location

University of Stuttgart
Pfaffenwaldring 47
70569 Stuttgart

Rooms:
47.03
47.05
47.06

Special Events:

Welcome Reception

Tuesday 26th, 18:00 - 20:00
Location: Pfaffenwaldring 4

Symposium Dinner

Wednesday 27th, 19:00 - 23:00
Location: Hotel Le Meridien, Willy-Brandt-Straße 30, 70173 Stuttgart
Opening Session V47.03

9:00 Introduction and Welcome
J. Hofmann
O. Röhrle
A. Sharma

9:30 Potential in connections between Steel and Concrete with special emphasis on temperature influences
G. Balazs, É. Lublóy, V. Hlavička

10:00 Recent developments in composite structures
U. Kuhlmann, A.M. Pascual, J. Ruopp, J. Schorr

10:30 - 10:50 Coffee Break

Session Codes and Regulations 1 V47.03

10:50 Design of fastenings for use in concrete construction: new EN 1992-4 - current status, commentary and background
T. Sippel, A. Ignatiadis

11:10 Crack movement test - differences in European and American Standards
P. Schillinger, A. Bucher

11:30 New design approaches of metal injection anchors in masonry
G. Welz

11:50 Design of column base in EN 1993-1-8:2020
F. Wald, M. Cochaux, M. Vild, M. Kurejkova, M. Bajer

12:10 Design of moment resisting reinforced concrete connections using post-installed reinforcing bars
G. Genesio, S. Nerbano, R. Piccinin

Session Connections under Special Loadings: Fire, Elevated Temperature V47.05

10:50 Background on the fire evaluation of post installed reinforcement bars in concrete
N. Pinoteau, T. Guillet, S. Rémond, P. Pimienta, R. Mège

11:10 A numerical method to evaluate the pull-out strength of bonded anchors under fire
H. Lakhani, J. Hofmann

11:30 Qualification of bonded anchors in case of fire
M. Reichert, C. Thiele
**Wednesday 27th**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>11:50</td>
<td>Recent developments in design of post-installed rebar connections under temperature</td>
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<tr>
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<td>G. Muciaccia, A. Consiglio, G. Rosati</td>
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<tr>
<td>12:10</td>
<td>Concrete edge failure of fasteners after fire exposure: experimental and 3D FE study</td>
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<td>K. Tian, J. Ožbolt, J. Hofmann</td>
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<td>12:30</td>
<td>Chemically-bonded post-installed steel rebars in a full scale slab-wall connection subjected to the standard fire (ISO 834-1)</td>
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<td>A. Lahouar, N. Pinoteau J.-F. Caron, G. Forêt, T. Guillet, R. Mège</td>
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**Session Composite Structures 1**  

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<thead>
<tr>
<th>Time</th>
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<tr>
<td>10:50</td>
<td>Characterization of load transfer mechanisms at the steel-concrete interface in reinforced concrete elements strengthened with steel profiles</td>
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<td></td>
<td>D. Dragan, A. Plumier, H. Degée</td>
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<tr>
<td>11:10</td>
<td>Experimental investigation on precast column connections under cyclic loading</td>
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<td>E. Camnasio, P. Kriakopoulos</td>
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<tr>
<td>11:30</td>
<td>Shear connections in composite girders with corrugated webs</td>
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<td>A. Pascual, J. Raichle, U. Kuhlmann</td>
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<tr>
<td>11:50</td>
<td>Experimental assessment of an innovative corbel</td>
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<td>J. Bujnak, S. Matiasko, M. Böhm, W. Roeser</td>
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<tr>
<td>12:10</td>
<td>Influence of structural steel arrangement on resistance of composite members</td>
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<td>T. Yanweerasak, W. Janwaen, W. Pansuk, P. Pheinsusom</td>
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</table>

12:50 - 13:30 Lunch

**Session Codes and Regulations 2 / Certification and Approvals 1**  

<table>
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<tbody>
<tr>
<td>13:30</td>
<td>Towards a unified design provisions for steel strength of anchors in stand-off base-plate connections</td>
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<td>K. McBride, R.A. Cook</td>
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<td>13:50</td>
<td>EN 1992-4 - the long route to a European standard for fastening to concrete</td>
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<td>W. Fuchs, R. Eligehausen, J. Hofmann</td>
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<tr>
<td>14:10</td>
<td>On the limitations of the current provisions of PREN 1992-4 for design of anchor groups subjected to tension loads</td>
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<td>B. Bokor, A. Sharma, J. Hofmann</td>
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<tr>
<td>14:30</td>
<td>Accepting new concrete connection developments in the USA</td>
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<td>B. Gerber</td>
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</tbody>
</table>
Wednesday 27th

14:50  **Assessment of performance, free trade and use of fastenings systems within the European Economic Community (EEC)**  
A. Bucher, P. Schillinger

15:10  **Assuring quality adhesive anchor installations in the Americas**  
M J. Morrison, D.F. Meinheit, N. S. Anderson

**Session Cast-In Anchors 1**  
V47.05

13:30  **The influence of edge bearing on the front edge shear breakout capacity**  
N. S. Anderson, D. F. Meinheit

13:50  **Pryout failure capacity of anchorages: experimental and numerical investigation**  
J. Ožbolt, K. Jebara, J. Hofmann

14:10  **Behaviour of mono-stud plates in cracked concrete under shear loading**  
G. Muciaccia, G. Di Nunzio, A. Consiglio

14:30  **Comprehensive experimental investigations on anchorages with supplementary reinforcement**  
A. Sharma, R. Eligehausen, J. Asmus

14:50  **Comprehensive analytical model for anchorages with supplementary reinforcement**  
A. Sharma, R. Eligehausen, J. Asmus

15:10  **Experimental Assessment of headed anchors with supplementary reinforcement**  
J. Bujnak, M. Farbak, F. Bahleda

**Session Retrofitting / Punching**  
V47.06

13:30  **Anchorage inelasticity as an important factor affecting the response of reinforced concrete frames with steel bracing**  
V. Mahadik, A. Al Assadi, A. Sharma, J. Hofmann

13:50  **Structural strengthening with post-installed reinforcement and innovative anchor systems**  
N. Randl, J. Kunz,

14:10  **Punching strength of RC footings with shear reinforcement - evaluation of code provisions and comparison with test results**  
P. Schmidt, D. Kueres, J. Hegger

14:30  **Punching shear strength of plate dowels in concrete industrial ground floors**  
F. Moeinaddini, A. Barraclough
Wednesday 27th

14:50  Slab-column connection with effective lattice shear reinforcement
       J. Furche

15:30 Coffee Break

Session Bond 1  V47.03

15:50  Experimental investigation on the local strain field in a RC pullout test
       O. Leibovich, A. N. Dancygier, D. Yankelevsky

16:10  The research on bonding between concrete and reinforcement
       M. Sugar, D. Gombosuren, Y. Duinkherjav

16:30  Anchorage of large-diameter reinforcing bars
       J. Schoening, J. Hegger

16:50  Analysis of factors influencing bond behaviour between reinforcing steel
       bars and FRC under monotonic loading
       M.A. Aiello, G. Centonze, G. Metelli, G. Plizzari

Session Anchor Channels 1  V47.05

15:50  Comparison of design rules for anchor channels with channel bolts
       C. Mahrenholtz, A. Sharma

16:10  Concrete breakout strength of anchor channels in edge and corner
       situations under perpendicular shear loading
       D. Konertz, G. K. Kocur, F. Häusler, P. Mark

16:30  Anchor channels under shear load acting in the longitudinal direction of
       the channel axis
       J. Hofmann, T. Schmidt

16:50  Experimental study of fastenings for curtain wall applications -
       comparison between headed anchors, welded embeds, bonded anchors
       and anchor channels
       N. Bede, P. Grosser, J. Ožbolt

Session Test Methods  V47.06

15:50  On the EOTA corrosion resistance test for post-installed rebar
       connections
       C. Fischer

16:10  The beam end test as a test specimen for the bond of
       reinforcement bars in concrete
       T. M. Sippel, J. Hofmann
Wednesday 27th

16:30 Investigation of a test method for the characterization of undercut anchors
F. Zhu, A. Bucher

Thursday 28th

Session Bonded Anchors V47.03

8:30 Background, regulations and latest developments of post-installed adhesive anchors and rebars
P. Mahrenholtz, J. Olsen

8:50 Experimental study on the behavior of bonded anchors in thermally-damaged concrete
V. Hlavička, É. Lublóy, G. Balázs

9:10 Investigation of bonded anchors by beam models in a discrete element framework
M. Marcon, K. Nincevic, J. Vorel, R. Wan-Wendner

9:30 Determination of critical edge distances for splitting failure of adhesive anchors
J. Asmus

9:50 Studies on anchorage mechanisms of inorganic-injection type post-installed bonded anchor
T. Tamura, S. Ando, K. Nakano

10:10 In-situ quality assessment tests of post-installed adhesive anchors in an existing building
Y. Fujii, K. Imai, T. Akiyama, T. Numata

Session Anchor Channels 2 V47.05

9:10 Determination of concrete breakout strength for cast-in channels with multiple anchors exposed to shear loads
G.K. Kocur, D. Konertz, P. Mark, A. Beer, F. Häusler

9:30 Enhancement of the calculation method for anchor channels to groups of anchor channels
A. Beer

9:50 Anchor channels with short embedment depth used in composite slab construction
P. Grosser, T. Dimitrova, B. Winkler
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<td>9:00</td>
<td>Opening Session</td>
<td>Bond 1</td>
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<td>10:30</td>
<td>Coffee Break</td>
<td>Bonded Anchors 1</td>
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<td>10:50</td>
<td>Codes &amp; Regulations 1</td>
<td>Anchor Channels 2</td>
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<td>12:50</td>
<td>Lunch</td>
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<td>13:30</td>
<td>Codes &amp; Regulations 2/Certifications &amp; Approvals 1</td>
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<td>Anchor Channels 1</td>
<td>Test Methods</td>
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<td>8:30</td>
<td>Bond 2</td>
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<td>10:30</td>
<td>Certification and Approvals 2</td>
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Rooms:
- Plenary Lectures in V47.03
- V47.05
- V47.03
- V47.06
- V47.04

Sessions:
- Opening Session
- Coffee Break
- Lunch
- Codes & Regulations 1
- Codes & Regulations 2/Certifications & Approvals 1
- Cast-in Anchors 1
- Cast-in Anchors 2
- Bond 1
- Bonded Anchors 1
- Anchor Channels 1
- Anchor Channels 2
- Test Methods
- Composite Structures 1
- Composite Structures 2
- Retrofitting / Punching
- Bond 2
- Certification and Approvals 2
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<td>12.30</td>
<td>Lunch</td>
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<tr>
<td>13.20</td>
<td><strong>Special Fastenings 1</strong></td>
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<td></td>
<td><strong>Connections under Special Loading: Seismic Materials</strong></td>
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<tr>
<td>15.40</td>
<td>Coffee Break</td>
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<td>16.00</td>
<td><strong>Special Fastening 2</strong></td>
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<td><strong>Advances in Construction and Development Methods</strong></td>
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<td>08.30</td>
<td><strong>Friday 28th</strong></td>
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<td></td>
<td><strong>Development for Design 1</strong></td>
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<td><strong>Bonded Anchors 2</strong></td>
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<td>10.10</td>
<td>Coffee Break</td>
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<td>10.30</td>
<td><strong>Development for Design 2</strong></td>
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<td><strong>Bonded Anchors 3</strong></td>
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<td><strong>Bond 3</strong></td>
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<td>11.50</td>
<td>Lunch</td>
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<tr>
<td>13.00</td>
<td><strong>Special Session: 75th Birth Anniversary Prof. Rolf Eligehausen 1</strong></td>
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<td>14.45</td>
<td>Coffee Break</td>
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<tr>
<td>15.05</td>
<td><strong>Special Session: 75th Birth Anniversary Prof. Rolf Eligehausen 2</strong></td>
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<tr>
<td>16.20</td>
<td>Plenary Lecture</td>
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</table>
10:10  Influence of static load level on the fatigue behavior of anchors channels  
T. Fröhlich, D. Lotze

**Session Composites Structures 2**

8:30  Effects of imposed deformations at the interface of end regions of steel-concrete composite beams  
C. Zanuy

8:50  Shear strength model for composite dowels in cracked concrete  
M. Classen, J. Hegger

9:10  Experiments on uplift behavior of perfobond rib shear connector in steel-concrete composite slab  
X. Xu, Y. Liu, X. Wang

9:30  Steel-to-concrete joints with large anchor plates under normal and constraining forces  
J. Scholz, W. Kurz

9:50  Steel-to-concrete joints with large anchor plates under shear loading  
J. Ruopp, U. Kuhlmann

10:10  Bonded overlay strengthening of hollow core slab with and without interface shearkeys connection  
P. Kankeri, M. Chellapandian, S.S. Prakash

**Session Certification and Approvals 2**

10:50  Anchoring into concrete - the Australian experience  
J. Lee, T. Pokharel, E. Gad

11:10  Product evaluation reports for anchors in the US  
A. Hoermann-Gast

11:30  Qualification of a system for post-installed reinforcing bars under the rules established by EOTA and ICC-ES  
G. Genesio, R. Piccinin, J. Silva

11:50  Systems without active drill hole cleaning / integration of hollow drill into ETAs  
O. Ernst
Session Cast-In Anchors 2  

10:50  Tension tests of headed stud anchorages in narrow / thin edge members  
N.S. Anderson, A.K. Tureyen, D.F. Meinheit

11:10  Design of anchorage of inserts for lifting and handling of precast concrete elements  
W. Fuchs

11:30  Supplementary reinforcement for cast-in fasteners  
T. Sippel, S. Fromknecht

11:50  Pull-out capacity of cast-in headed anchors in prefabricated concrete elements  
A. Barraclough, F. Moeinaddini

12:10  Influence of compressive load reversals on the fatigue life of headed studs in case of concrete cone failure  
M. Toth, J. Hofmann

Session Bond 2  

10:50  Effect of corrosion of reinforcement in concrete on pull-out capacity  
E. Sola, J. Ožbolt, G. Balabanic

11:10  A model for bond in concrete under corrosion conditions  
A. Cesetti, G. Mancini, F. Tondolo

11:30  Influence of corrosion of brass metallized plain steel bars on bond strength with concrete  
D. Citek, P. Pokorny, J. Kolisko

12:30 Lunch

Session Special Fastenings 1  

13:20  Pullout strength of L-bolt anchors  
A.E.N. Osborn, D.F. Meinheit, M.R. Krueger

13:40  Concrete screws as post installed reinforcement  
J. Feix, J. Lechner

14:00  Behavior and design of anchorages with shear lugs  
R.A. Cook, H. Michler

14:20  Fixing of windows with fall protection  
J. Küenzlen, J. Stork, E. Scheller
Thursday 28th

14:40  **Adhesive anchors on concrete surfaces**  
P. Schmieder, J. Hofmann

15:00  **Composite anchors to reduce thermal bridges in facades**  
W. Venter, A. Weber

15:20  **The DYWIDAG Ductile Connector - an ingenious connection method for precast structures in highly seismic zones**  
J. Gawlista, W. Brand, R.E. Englekirk

**Session Connections under Special Loadings: Seismic, Impact**  V47.05

13:20  **A review of existing provisions for seismic qualification and design of post-installed fasteners**  
G. Muciaccia

13:40  **Experimental behavior of real-size post-installed steel-to-concrete connections under seismic action**  
G. Muciaccia

14:00  **Influence of impact pre-loading on the residual concrete cone capacity**  
M. Toth, A. Sharma, J. Hofmann

14:20  **Effects of crack opening on the behavior of mono-stud plates under seismic conditions**  
G. Muciaccia, G. Di Nunzio, A. Consiglio

14:40  **Evaluation and design of post installed rebar under seismic actions**  
T. Guillet, N. Pinoteau, R. Mege

**Session Materials**  V47.06

13:20  **Performance of concrete incorporating silica fume and nano silica**  
S.C. Yaragal, U. Radhakrishnan,

13:40  **Inverse model for pullout determination of steel fibers**  
I. Kozar, N.T. Malic, T. Rukavina

14:00  **Influence of steel fiber content on the load-bearing capacity of anchorages in concrete**  
B. Bokor, M. Toth, A. Sharma

14:20  **Residual tensile capacity of post-installed anchors after exposure to fire**  
J. Bošnjak, A. Sharma

15:40  Coffee Break
Thursday 28th

Session Special Fastenings 2  V47.03

16:00  Anchorage of claddings with grouted anchors
       W. Fuchs
16:20  Response of flange-to-flange double tee connections subject to tranverse loading
16:40  Comparison of the cyclic shear behaviour of roughened reinforced interfaces of lightweight and normalweight concretes
       V. Palieraki, C. Zeris, E. Vintzileou
17:00  Development and application of a heavy duty anchor system
       S. Fromknecht

Session Advances in Construction and Development Methods  V47.05

16:00  A survey on the initiation of computational methods in anchor development processes
       B. Kohlhaas, P. Mahrenholtz, T. Pregartner
16:20  An automated pre- and post processor for the analysis of steel column baseplate connections
       C. Trautner, T. Hutchinson, R. Piccinin
16:40  BIM in anchor industry
       J. Olsen, P. Mahrenholtz, T. Pregartner
17:00  Connected with BIM - a review of BIM for construction products like anchor channels
       C. Mahrenholtz, D. Neumann; G. Spijkers

Friday 29th

Session Development for Design 1  V47.03

8:30  Performance based approach for anchorage in concrete construction
     A. Sharma
8:50  Seismic anchor performance categories and performance based design
     P. Mahrenholtz, R.L. Wood
Friday 29th

9:10 Numerical investigations on circular anchorages with headed studs loaded in tension or shear towards the edge
N. Mishaxhiu, A. Sharma, J. Hofmann

9:30 Consideration for bending in case of high attachments
J. Braun

9:50 Influence of specimen geometry on anchor behavior in seismic crack movement tests
A. Marchisella, G. Muciaccia

Session Bonded Anchors 2

8:50 Long-term creep behavior of resin-based injection mortar systems for anchoring applications
J. Fischer, P.R. Bradler, D., Schmidtbauer, R.W. Lang, R. Wan-Wendner

9:10 Concrete creep effect on bond stress in adhesive fastening systems
I. Boumakis, M. Marcon, K. Nincevic, L.-M. Czernuschka, R. Wan-Wendner

9:30 Bonded anchors under sustained load: 3D finite element study
J. Ožbolt, S. Gambarelli, J. Hofmann

9:50 Studies on creep deformation of inorganic-type post-installed bonded anchor
S. Ando, T. Tamura, K. Nakano

10:10 Coffee Break

Session Development für Design 2

10:30 Development of slab-to-wall connections assisted by experiments and numerical simulations
A. Barraclough, V. Cervenka, F. Moeinaddini

10:50 Numerical analysis of seismic performance of beam-to-column post-installed rebar connections: pre-test simulations
V. Mahadik, A. Sharma, J. Hofmann

11:10 Determination of material properties for structural applications
L.-M. Czernuschka, I. Boumakis, K. Nincevic, R. Wan-Wendner
Numerical and experimental evaluations of influence of member thickness, anchor head size, and surface reinforcement on tensile breakout capacity of anchor bolts
R. Nilforoush, M. Nilsson, L. Elfgren, R. Eligehausen

Session Bonded Anchors 3

10:30 Bond capacity of adhesive anchor in boreholes with cavities
J. Asmus, J. Hofmann

10:50 Effect of decreased installation temperatures on the load bearing behavior of adhesive anchors
W. Fuchs, J. Hofmann

11:10 Chemical fastening systems go green - a contribution to more sustainability
M. Vogel, C. Schlenk, C. Weinelt, J. Grün

Session Bond 3

10:30 Bond performance of reinforcement in concrete after exposure to elevated temperatures
J. Bošnjak, A. Sharma, S. Bessert

10:50 Bond of GFRP bar and concrete: numerical approach
A. Veljkovic, M. Rezazadeh, V. Carvelli

11:10 Bond between steel and concrete under fire - from laboratory tests to fire performance
A. Sharma, J. Bošnjak

Special Session 75th Birth Anniversary Prof. Rolf Eligehausen

13:00 Introduction
A. Sharma

13:15 Two teams under one roof
H.-W. Reinhardt

13:30 From fastening to application - current activities of the IWB
J. Hofmann
Friday 29th

Invited Lectures:

13:45     K. Bergmeister
14:15     Role of fiber reinforcement on lap splices behavior
          G. Plizzari, G. Metelli

14:45 Coffee Break

15:05     Assessment of fasteners to concrete - a tribute to Rolf Eligehausen
          L. Elfgren, R. Nilforoush, M. Nilsson, U. Ohlsson
15:35     Numerical Simulation of Fastenings - Reminiscenes from IWB
          V. Cervenka

Honorary Presentation

16:05     R.A. Cook

Closing Lecture

16:20     Anchorages in concrete construction: past, present and future
          R. Eligehausen

17:00 Farewell