Durability of Steel Fibre Reinforced Concrete (SFRC) exposed to acid attack – A literature review

Steel Fibre Reinforced Concrete (SFRC) is increasingly used in the construction of civil infrastructure. There is particular interest in the behaviour of SFRC under chemical and bio-chemical exposure, since it can be utilized, among others, for the construction of waste-water and agricultural infrastructure. However, the applicability of SFRC exposed to acidic environments is hindered by inconsistencies among international regulations. This paper reviews the published literature concerning the durability of SFRC exposed to acid attack. Research suggests that the exposure to acids of uncracked SFRC results in damage similar to what would occur in Plain Concrete (PC). There is insight into the non-critical corrosion of steel fibres embedded in the neutralized concrete layer, not entailing corrosion-induced cracking or spalling and steel fibres have been reported to limit secondary damage by bridging cracks and restraining the progress of the chemical-erosion front. However, there is limited data regarding the residual mechanical performance of cracked SFRC that has been exposed to acids. Published research suggests the existence of a critical crack width, below 0.3 mm, where the corrosion damage to the steel fibre is non-critical and there is a limited loss of fracture toughness. However, it has been observed that the exposure of cracked SFRC to acids leads to a larger deterioration of its residual mechanical performance compared to other exposures.
Quantitative analysis of the influence of synthetic fibres on plastic shrinkage cracking using digital image correlation

The plastic shrinkage cracking behaviour of restrained mortar overlays on a concrete substrate was studied with the aim of quantifying the influence of commercially available polypropylene (PP) fibres and recycled polyethylene (R-PE) fibres obtained from discarded fishing nets. The use of R-PE fibres was investigated with a view to creating a more eco-friendly construction material. The plastic shrinkage behaviour was evaluated on the basis of a non-contact 2D digital image correlation (DIC) technique that enables the automated detection of surface displacements and strains with high precision. Based on the DIC data, the degree of surface cracking was quantitatively analysed using a MATLAB post-processing procedure and presented in detailed histograms showing the crack width distribution of the entire specimen surface. Using this data, the effect of fibre reinforcement on crack control was objectively quantified and evaluated. The results indicate that while the addition of 2.0% of R-PE is effective in controlling shrinkage cracking in the mortars, the commercial PP fibres perform better even at volume fractions as low as 0.1%. These findings show that the recycled fibres can be used to reduce plastic shrinkage cracking behaviour compared to unreinforced materials, while a waste material is being reused, though, a much larger volume fraction of R-PE fibres than of commercially available PP fibres is necessary to achieve a similar effect.

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Web of Science (2018): Indexed yes
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Web of Science (2017): Impact factor 3.485
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BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.77 SJR 1.511 SNIP 2.37
Web of Science (2016): Impact factor 3.169
Web of Science (2016): Indexed yes
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Scopus rating (2015): CiteScore 3.24 SJR 1.503 SNIP 2.237
Web of Science (2015): Impact factor 2.421
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.98 SJR 1.539 SNIP 2.55
Web of Science (2014): Impact factor 2.296
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.07 SJR 1.837 SNIP 2.957
Web of Science (2013): Impact factor 2.265
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 3.12 SJR 1.656 SNIP 3.3
Web of Science (2012): Impact factor 2.293
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
A Comparison Between the Accuracy of Two-Dimensional and Three-Dimensional Strain Measurements

This investigation determined the effect of specimen out-of-plane movement on the accuracy of strain measurement made applying two-dimensional (2D) and three-dimensional (3D) measurement approaches using the representative, state-of-the-art digital image correlation (DIC)-based tool ARAMIS. DIC techniques can be used in structural health monitoring (SHM) by measuring structural strains and correlating them to structural damage. This study was motivated by initially undetected damage at low strains in connections of a real-world bridge, whose detection would have prevented its propagation, resulting in lower repair costs. This study builds upon an initial investigation that concluded that out-of-plane specimen movement results in noise in DIC-based strain measurements. The effect of specimen out-of-plane displacement on the accuracy of strain measurements using the 2D and 3D measurement techniques was determined over a range of strain values and specimen out-of-plane displacements. Based upon the results of this study, the 2D system could measure strains as camera focus was being lost, and the effect of the loss of focus became apparent at 1.0 mm beam out-of-plane displacement while measuring strain of the order of magnitude of approximately 0.12%. The corresponding results for the 3D system demonstrate that the beam out-of-plane displacement begins to affect the accuracy of the strain measurements at approximately 0.025% strain for all magnitudes of out-of-plane displacement, and the 3D ARAMIS system can make accurate strain measurements at up to 2.5 mm amplitude at this strain. Finally, based upon the magnitudes of strain and out-of-plane displacement amplitudes that typically occur in real steel bridges, it is advisable to use the 3D system for SHM of stiff structures instead of the 2D system.

General information
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Organisations: Department of Civil Engineering, Section for Structural Engineering, Aarhus University, Purdue University
Contributors: Desai, N., Poling, J., Fischer, G., Georgakis, C. T.
Number of pages: 14
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Peer-reviewed: Yes

Publication information
Journal: Journal of Nondestructive Evaluation, Diagnostics and Prognostics of Engineering Systems
Effect of out-of-plane specimen movement on strain measurement using digital-image-correlation-based video measurement in 2D and 3D

This study determined the effect of specimen out-of-plane movement relative to the sensor, on the accuracy of strains measured made applying 2D and 3D measurement approaches employing the state-of-the-art digital-image-correlation (DIC)-based tool iMETRUM. DIC provides a convenient and inexpensive non-contact approach to monitor structural health by measuring strains in structural systems and linking them to structural damage. This investigation was motivated by initially undetected damage at low strains in connections of a real-world bridge, whose detection would have prevented its spread, resulting in lower repair costs. This study builds upon an initial investigation that concluded that out-of-plane specimen movement reduces the accuracy of DIC-based strain measurements. Consequently, the effect of specimen out-of-plane displacement on the accuracy of strain measurements using the 2D and 3D measurement techniques was determined over a range of strain values and specimen out-of-plane displacements. It was concluded that the 2D system could measure strains as camera focus was being lost due to specimen out-of-plane movement, the effect of which became noticeable at about 0.025% strain and 2.5 mm displacement. The corresponding value for the 3D system was 0.06% strain at 0.5 mm out-of-plane displacement. Furthermore, it was concluded that the 2D system can measure strains in a real bridge, but it would be challenging to use the 3D system for this task. Furthermore, the 2D iMETRUM system is easier and less costly to implement in monitoring localized strains in steel bridges.

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Scopus rating (2015): CiteScore 0.93 SJR 0.29 SNIP 0.924
Scopus rating (2014): CiteScore 1.07 SJR 0.495 SNIP 1.857
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Scopus rating (2012): CiteScore 0.5 SJR 0.171 SNIP 1.201
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Research output: Research - peer-review ; Journal article – Annual report year: 2018
manufactured. The textile fabric assembly (1) is arranged around the form (8), and a curable material (9) is filled into the at least one inner space (4) between the textile layers (2). The form (8) may be inflatable. Alternatively, the method may comprise arranging the textile fabric assembly (1) around an initial structure and/or mechanically fastened to a surface of an initial structure to be reinforced and then filling it with a curable material (9).

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Contributors: Fischer, G.
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Publication information
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Priority number: EP20150199307
Original language: English
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Source: espacenet
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Research output: Research › Patent – Annual report year: 2017

Corrosion resistance of steel fibre reinforced concrete - A literature review
Steel fibre reinforced concrete (SFRC) is increasingly being used in the construction of civil infrastructure. However, there are inconsistencies among international standards and guidelines regarding the consideration of carbon-steel fibres for the structural verification of SFRC exposed to corrosive environments. This paper presents a review of the published research regarding carbonation- and chloride-induced corrosion of SFRC, and proposes a deterioration theory for cracked SFRC exposed to chlorides and carbonation, based on the damage at the fibre-matrix interface. The review confirms an overall agreement among academics and regulators regarding the durability of uncracked SFRC exposed to chlorides and carbonation. Contrariwise, the durability of cracked SFRC is under discussion at the technical and scientific level, as there is a large dispersion on the experimental results and some of the mechanisms governing the corrosion of carbon-steel fibres in cracks and its effects on the fracture behaviour of SFRC are not fully understood.

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Organisations: Department of Civil Engineering, Section for Structural Engineering, COWI AS, VIA University College
Contributors: Marcos Meson, V., Michel, A., Solgaard, A., Fischer, G., Edvardsen, C., Skovhus, T. L.
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Scopus rating (2017): CiteScore 6.08 SJR 4.223 SNIP 3.191
Web of Science (2017): Impact factor 5.43
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.15 SJR 3.462 SNIP 3.2
Web of Science (2016): Impact factor 4.762
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.54 SJR 3.549 SNIP 3.162
Web of Science (2015): Impact factor 3.48
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.44 SJR 4.128 SNIP 3.583
Web of Science (2014): Impact factor 2.864
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 4.54 SJR 4.219 SNIP 3.873
Web of Science (2013): Impact factor 3.848
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 3.92 SJR 3.54 SNIP 3.875
Web of Science (2012): Impact factor 3.112
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 3.77 SJR 2.079 SNIP 3.397
Web of Science (2011): Impact factor 2.781
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.549 SNIP 2.785
Web of Science (2010): Impact factor 2.187
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.361 SNIP 2.577
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.433 SNIP 1.95
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.606 SNIP 1.841
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.149 SNIP 1.949
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.875 SNIP 1.672
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.976 SNIP 1.678
Scopus rating (2003): SJR 0.672 SNIP 1.68
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.732 SNIP 1.308
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.727 SNIP 1.143
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Scopus rating (2000): SJR 0.512 SNIP 1.418
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Mechanical evaluation of self-healed cementitious material

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Research output: Research - peer-review - Conference abstract for conference – Annual report year: 2018

Tensile capacity of loop connections grouted with concrete or mortar
This paper presents a study of grout failure in symmetric U-bar loop connections loaded in tension, with focus on the performance of two grouting materials – concrete and mortar. The study contains an experimental investigation as well as a rigid-plastic modelling of the tensile capacity. The test specimens consisted of symmetric ‘2-on-2’ loop connections transversely reinforced with a double T-headed rebar. The amount of transverse reinforcement was varied, including the limiting cases of specimens with no transverse reinforcement, as well as connections with sufficient transverse reinforcement to allow yielding of the U-bars. The experimental work showed that connections grouted with concrete performed better than the connections grouted with mortar. In the theoretical models, the difference in tested capacity is explained by the difference in the internal angle of friction and in the softening behaviour of concrete as compared with mortar.

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BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.28 SJR 0.858 SNIP 0.858
Web of Science (2017): Impact factor 1.488
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.18 SJR 0.892 SNIP 1.068
Web of Science (2016): Impact factor 1.156
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.22 SJR 0.862 SNIP 1.053
Web of Science (2015): Impact factor 1.227
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.13 SJR 0.933 SNIP 1.1
Web of Science (2014): Impact factor 0.912
BFI (2013): BFI-level 1
Test and Analysis of a New Ductile Shear Connection Design for RC Shear Walls

This paper presents a new and construction-friendly shear connection for assembly of precast reinforced concrete shear wall elements. In the proposed design, the precast elements have indented interfaces and are connected by a narrow zone grouted with mortar and reinforced with overlapping U-bar loops. Contrary to the classical shear connections, the planes of the U-bar loops are here parallel to the plane of the wall elements. This feature enables a construction-friendly installation of the elements without the risk of rebars clashing. The core of mortar inside each U-bar loop is reinforced with a transverse double T-headed bar to ensure transfer of tension between the overlapping U-bars. Push-off tests show that a significantly ductile load-displacement response can be obtained by the new solution as compared to the performance of the conventional keyed shear connection design. The influence of the interface indentation geometry was investigated experimentally and the failure modes in the push-off tests were identified by use of digital image correlation (DIC). For strength prediction, rigid plastic upper bound models have been developed with inspiration from the observed failure mechanisms. Satisfactory agreement between tests and calculations has been obtained.

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BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.56 SJR 1.031 SNIP 1.513
Web of Science (2017): Impact factor 1.384
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.74 SJR 0.99 SNIP 1.684
Web of Science (2016): Impact factor 1.424
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.1 SJR 0.836 SNIP 1.111
Web of Science (2015): Impact factor 1.023
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.17 SJR 1.153 SNIP 1.636
Web of Science (2014): Impact factor 1.492
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 0.82 SJR 0.772 SNIP 1.418
Web of Science (2013): Impact factor 0.857
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.36 SJR 0.313 SNIP 0.771
Web of Science (2012): Impact factor 0.289
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 0.37 SJR 0.547 SNIP 1.152
Web of Science (2011): Impact factor 0.27
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.451 SNIP 0.709
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.385 SNIP 1.038
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.246 SNIP 0.813
Scopus rating (2007): SJR 0.23 SNIP 0.384
Scopus rating (2006): SJR 0.153 SNIP 0.664
Scopus rating (2005): SJR 0.13 SNIP 0.634
Scopus rating (2004): SJR 0.387 SNIP 0
Scopus rating (2003): SJR 0.188 SNIP 0
Scopus rating (2002): SJR 0.101
Original language: English
Keywords: Keyed shear connections, Ductility, Robustness, Concrete plasticity, Digital image correlation
Testing and modeling dowel and catenary action in rebars crossing shear joints in RC

This paper presents a detailed study of the shear behavior of two-sided dowel joints, which includes initiation of dowel action at small shear displacements and development of full catenary action in the reinforcement at large displacements. In addition to experimental results, the paper also presents a simple, second order plasticity model to describe the nonlinear regime of the load-displacement relationship. In the model, kinematic relations and the normality condition of plastic theory are utilized to establish a unique link between the imposed shear displacement and combinations of moment and tension that develop in the rebar(s) crossing the joint. Interface friction is included in a consistent manner based on clamping stresses induced by the tension of the rebar(s). Comparison of experimental results with the model predictions shows satisfactory agreement. The model has, due to its simplicity, potential for practical applications related to assessment of structural robustness, where estimation of the available energy (area below load-displacement curve) is important. (C) 2017 Elsevier Ltd. All rights reserved.

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Scopus rating (2017): CiteScore 3.32 SJR 1.69 SNIP 2.165
Web of Science (2017): Impact factor 2.755
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.93 SJR 1.547 SNIP 2.037
Web of Science (2016): Impact factor 2.258
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.59 SJR 1.631 SNIP 2.15
Web of Science (2015): Impact factor 1.893
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.4 SJR 1.701 SNIP 2.488
Web of Science (2014): Impact factor 1.838
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.69 SJR 1.967 SNIP 2.799
Web of Science (2013): Impact factor 1.767
ISI indexed (2013): ISI indexed yes
Catenary Action in Rebars Crossing a Casting Joint Loaded in Shear

Reinforcement crossing a casting joint loaded in shear exhibits catenary action as the shear displacement increases. The load carrying capacity of such a joint is in practice often calculated by use of empirical methods to account for shear friction effects or by a first order plastic analysis if dowel action is included. The strength increase/reserve due to catenary action in the rebars is often neglected; however in some cases it may be necessary to utilize the effect in order to ensure overall structural robustness. This paper presents results of a study, where the increased shear capacity due to catenary action was investigated experimentally in a simple push-off setup and theoretically by a second order plastic analysis. The model captures the combination of dowel and catenary action with increasing shear displacement and satisfactory correlation between the S-shaped test results and theory is found when reasonable material properties are assumed.

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Organisations: Department of Civil Engineering, Section for Structural Engineering
Contributors: Sørensen, J. H., Hoang, L. C., Olesen, J. F., Fischer, G.
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Corrosion resistance of steel fibre reinforced concrete – a literature review

Steel fibre reinforced concrete (SFRC) is increasingly being used in the construction of prefabricated segmental linings for bored tunnels, since it entails simplified production processes and higher quality standards. However, international standards and guidelines are not consistent regarding the consideration of steel fibres for the structural verification of SFRC elements exposed to corrosive environments, hampering the development of civil infrastructure built of SFRC. In particular, the long-term effect of exposure to chlorides is in focus and under discussion. This paper reviews the existing literature concerning chloride-induced corrosion on steel fibres, as well as the impact of steel fibre corrosion on the residual-tensile strength of SFRC. The review confirms the agreement among academics and regulators regarding the superior durability of un-cracked SFRC exposed to chlorides, relative to conventional reinforcement. However, the durability of cracked SFRC is still under discussion, as the mechanisms governing the corrosion of carbon-steel fibres in cracks and its effects on the fracture behaviour of SFRC are still unclear. Nevertheless, there is insight among several researchers concerning the existence of a critical crack width, below 0.20 mm, where corrosion of carbon-steel fibres is not critical and the structural integrity of the exposed SFRC can be ensured over the long-term. A doctoral project investigating chloride-induced corrosion of steel fibres on cracked SFRC has been initiated, in order to explore the governing deterioration mechanisms.
Cracking and load-deformation behavior of fiber reinforced concrete: Influence of testing method

The characterization of the tensile behavior of cementitious materials has been a long-standing research topic and a general consensus on how to accomplish this task has not yet been reached. Many standardized tests are available but each with different test set-up and prescriptions on the definition of measured and derived parameters, including toughness, elastic properties and strength. This paper discusses a number of test procedures for selected material properties including tension and flexure. A comparative experimental study was carried out using two distinct fiber reinforced cementitious composites with strain hardening and strain softening behavior. Digital Image Correlation was utilized in the experimental program to detect and quantify the formation of cracks. Results show that the different test methodologies valuate specific aspects of material performance. The outcome of these evaluation procedures is compared and critically analyzed.

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Contributors: Paegle, I., Minelli, F., Fischer, G.
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Scopus rating (2017): CiteScore 5.66 SJR 3.146 SNIP 2.889
Web of Science (2017): Impact factor 4.66
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.96 SJR 2.751 SNIP 2.866
Web of Science (2016): Impact factor 4.265
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.23 SJR 2.848 SNIP 2.741
Web of Science (2015): Impact factor 3.399
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.14 SJR 3.016 SNIP 3.194
Web of Science (2014): Impact factor 3.33
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 3.74 SJR 3.036 SNIP 3.233
Web of Science (2013): Impact factor 2.76
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 3.49 SJR 2.809 SNIP 3.433
Web of Science (2012): Impact factor 2.523
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 3.12 SJR 1.995 SNIP 3.77
Phenomenological interpretation of the shear behavior of reinforced Engineered Cementitious Composite beams

This paper describes an experimental investigation of the shear behavior of beams consisting of steel Reinforced Engineered Cementitious Composites (R/ECC). This study investigates and quantifies the effect of ECC's strain hardening and multiple cracking behavior on the shear capacity of beams loaded in shear. The experimental program consists of R/ECC beams with short (8 mm) randomly distributed Polyvinyl Alcohol (PVA) fiber and conventional Reinforced Concrete (R/C) counterparts for comparison with varying shear reinforcement arrangements. Beams were loaded until failure while a Digital Image Correlation (DIC) measurement technique was used to measure surface displacements and crack formation. The shear crack mechanisms of R/ECC are described in detail based on findings of DIC measurements and can be characterized by an opening and sliding of the cracks. Multiple micro-cracks developed in a diagonal arrangement between the load and support points due to the strain-hardening response of ECC in tension. The strain-hardening response strongly influenced the shear response of the beam specimen.

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BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 5.66 SJR 3.146 SNIP 2.889
Web of Science (2017): Impact factor 4.66
Web of Science (2017): Indexed yes
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Scopus rating (2015): CiteScore 4.23 SJR 2.848 SNIP 2.741
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Scopus rating (2014): CiteScore 4.14 SJR 3.016 SNIP 3.194
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Scopus rating (2012): CiteScore 3.49 SJR 2.809 SNIP 3.433
Web of Science (2012): Impact factor 2.523
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Scopus rating (2011): CiteScore 3.12 SJR 1.995 SNIP 3.77
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Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.635 SNIP 1.985
Scopus rating (2006): SJR 1.489 SNIP 1.995
Scopus rating (2005): SJR 0.89 SNIP 1.403
Web of Science (2005): Indexed yes
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Scopus rating (2001): SJR 0.682 SNIP 0.708
Scopus rating (2000): SJR 0.397 SNIP 1.05
This paper describes an investigation of the tensile capacity of in-situ cast U-bar loop connections between precast concrete elements. The basic idea is to introduce a small precast cylindrical dowel of fiber reinforced mortar that fits into the bend diameter of the overlapping U-bars. The remaining part of the connection is cast in-situ with a regular mortar, which then encapsulates the precast dowel. Different dowel configurations have been investigated, including the use of steel or synthetic fibers with or without lacer bars placed within the precast dowel.

The experimental results show that use of a precast fiber reinforced dowel performs at a slightly lower load level, as compared to a connection grouted solely with regular mortar and reinforced with the same amount of transverse reinforcement. However, the load-displacement response of specimens with a fiber reinforced dowel is closer to ideal ductile behavior than that of the specimens grouted with regular mortar. The experimental results of the tensile tests are compared with calculations based on an upper bound plasticity model and satisfactory agreement has been obtained.

Characterization and modeling of fiber reinforced concrete for structural applications in beams and plates

Fiber reinforced concrete (FRC) with discrete, short and randomly distributed fibers can be specified and designed for structural applications in flexural members. In certain cases, fibers are used as the only reinforcement, while in other cases fibers are used in combination with a reduced amount of conventional reinforcement. While practical applications for FRC have been developed, shortcomings in test methods for determining mechanical properties and overly conservative design approaches limit the economic viability of FRC. The measured mechanical properties of FRC, determined through standard test methods, vary widely depending on the prescribed test method. These variations in mechanical properties impact the structural design, typically resulting in increased dimensions of the FRC structural element. To address these shortcomings in evaluation methods and how measured mechanical properties are considered in structural design, the work presented in this thesis analyzes in detail many commonly used test methods on three types of FRC, including Polypropylene Fiber Reinforced Concrete (PP-FRC), Polyvinyl Alcohol Fiber Reinforced Concrete called Engineered Cementitious Composite (ECC) and Steel Fiber Reinforced Concrete (SFRC). These materials are representative for the two main types of tension-softening and strainhardening FRC. The direct tension tests most realistically describe the tensile properties and result in a cohesive relationship between model parameters that can be used in the design of FRC structures. However, direct tension tests may be difficult to conduct in standard testing laboratories and may not be best suited for quality control purposes. For this reason, alternative test methods are needed to obtain the most relevant properties of FRC. The assessment of the mechanical properties through flexural testing is generally easier to perform than direct tension tests in conventional testing laboratories. Various standardized test methods, based on beams and plates in flexure, are typically used to characterize FRC. However, the suitability of these methods for FRC materials with tension softening and hardening responses is not fully understood, and therefore investigated in this thesis. Advantages, disadvantages and specific features of various test methods are evaluated in detail and recommendations for modifications in standardized test methods are given to characterize FRC either with softening or hardening post cracking responses in the most efficient way. Based on the findings in the characterization of FRC, a modeling approach to predict the flexural behavior of FRC elements is developed. The model predicts the flexural behavior of FRC by assuming a
the mode of shear failure in the shear keys. The upper bound models produce satisfactory results capturing the experimental tendencies and predicting the first peak load. Furthermore, an overall more ductile behavior of the joint is obtained. The solution is tested in a push-off experimental setup and the influence of important geometric parameters of the keyed shear joint is investigated. The first peak load carrying capacity is assessed using plasticity models, and the failure modes are identified by the use of digital image correlation. The upper bound models produce satisfactory results capturing the experimental tendencies and predicting the mode of shear failure in the shear keys.

Construction-friendly ductile shear joints for precast concrete panels

The scope of this paper is the shear capacity of in-situ cast joints between precast concrete panels. Current practice with vertical lowering of the wall panels experiences difficulties in the assembly phase, since the traditional U-bar connection requires an overlap in a horizontal plane to allow for the mounting of a vertical locking bar. Where limited space is available bending and subsequent straightening of the U-bars are required to assemble the adjacent panels, a procedure which imposes substantial ductility requirements on the reinforcement as well as some manual workload. This paper introduces a construction-friendly design with U-bars overlapping in the same plane as the panel itself. The design allows for a trouble-free vertical lowering of the panels without pre or post processing of the preinstalled reinforcement loops. Furthermore, an overall more ductile behavior of the joint is obtained. The solution is tested in a push-off experimental setup and the influence of important geometric parameters of the keyed shear joint is investigated. The first peak load carrying capacity is assessed using plasticity models, and the failure modes are identified by the use of digital image correlation. The upper bound models produce satisfactory results capturing the experimental tendencies and predicting the mode of shear failure in the shear keys.

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Construction-friendly ductile shear joints for precast concrete panels

The scope of this paper is the shear capacity of in-situ cast joints between precast concrete panels. Current practice with vertical lowering of the wall panels experiences difficulties in the assembly phase, since the traditional U-bar connection requires an overlap in a horizontal plane to allow for the mounting of a vertical locking bar. Where limited space is available bending and subsequent straightening of the U-bars are required to assemble the adjacent panels, a procedure which imposes substantial ductility requirements on the reinforcement as well as some manual workload. This paper introduces a construction-friendly design with U-bars overlapping in the same plane as the panel itself. The design allows for a trouble-free vertical lowering of the panels without pre or post processing of the preinstalled reinforcement loops. Furthermore, an overall more ductile behavior of the joint is obtained. The solution is tested in a push-off experimental setup and the influence of important geometric parameters of the keyed shear joint is investigated. The first peak load carrying capacity is assessed using plasticity models, and the failure modes are identified by the use of digital image correlation. The upper bound models produce satisfactory results capturing the experimental tendencies and predicting the mode of shear failure in the shear keys.
Engineered cementitious composites for strengthening masonry infilled reinforced concrete frames

The results of the second part of a comprehensive experimental program, aimed at investigating the behavior of masonry infilled reinforced concrete (RC) frames strengthened with fiber reinforced engineered cementitious composites (ECC) used as an overlay on the masonry wall, are presented in this paper. The proposed strengthening technique aims at increasing the lateral strength of infilled RC frames and maintaining the integrity of masonry infills during loading, which is an important seismic parameter for these elements. Material tests were conducted first for ECC in order to assess its distinctive mechanical properties such as tensile stress-strain behavior and multiple cracking. Thereafter, three 1/2 scaled one bay, one story RC specimens were constructed and tested under quasi-static lateral loading. The obtained results are presented and discussed in terms of the strength, stiffness, and the cumulative absorption capacity of the tested specimens. Furthermore, the obtained backbone curves are idealized and the drift limits usually considered in seismic design are specified. The obtained results indicate that the proposed ECC-strengthening technique can effectively increase the lateral strength and energy absorption capacity of the infilled frame, prevent brittle failure modes in the infill wall, and provide a reasonable system overstrength.
Fretting fatigue behavior of high-strength steel monostrands under bending load

In this paper, the fretting fatigue behavior of pretensioned high-strength steel monostrands is investigated. To measure the local deformations on the strands, a novel method based on the digital image correlation (DIC) technique was used to quantify the relative movement between individual wires along the length of the monostrand. Information about the monostrand bending stiffness and the extent of relative displacement between core and outer wires of a monostrand undergoing flexural deformations is provided. From the series of dynamic fatigue tests, a fretting fatigue spectrum is derived and compared with
the localized bending fatigue spectrum. The presented spectra can be used for the estimation of monostrand bending fatigue life. The results presented herein form the basis for the development of a fretting failure criterion for monostrand cables experiencing transverse displacements and are of special interest for the fatigue analysis of modern stay cable assemblies where fretting constitutes a major mechanism of the fatigue life reduction.

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Scopus rating (2014): CiteScore 2.74 SJR 2.096 SNIP 2.847
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Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.33 SJR 2.081 SNIP 2.828
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ISI indexed (2011): ISI indexed yes
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BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.85 SNIP 2.444
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Strengthening masonry infill panels using engineered cementitious composites

This comprehensive experimental study aims at investigating the behavior of masonry infill panels strengthened by fiber reinforced engineered cementitious composites (ECC). The experimental program included testing of materials, masonry elements and panels. Material tests were carried out first for ECC in order to assess its distinctive mechanical properties such as tensile stress–strain behavior and multiple cracking. To investigate the influence of a thin layer of ECC on plain masonry in terms of changes in stiffness, strength, and deformability, small scale tests have been conducted on masonry elements. Finally, a total of 10 brick panels including two control specimens and eight specimens with different ECC-strengthening configuration were selected. The specimens were subjected to diagonal compression loading under displacement control to evaluate their in-plane deformation and strength properties, including the post-peak softening behavior in view of seismic applications. The obtained results indicate that the proposed ECC-strengthening technique can effectively increase the shear capacity of masonry panels, improve their deformability, enhance their energy absorption capacity, and prevent the brittle failure mode. Furthermore, the superior deformability of ECC is clearly reflected by cracks development in the ECC layer, which was monitored by a high resolution camera and was analyzed using Digital Image Correlation (DIC) technique.

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Web of Science (2015): Impact factor 2.453
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BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.55 SJR 1.221 SNIP 1.579
Web of Science (2014): Impact factor 1.714
Web of Science (2014): Indexed yes
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Web of Science (2013): Impact factor 1.39
ISI indexed (2013): ISI indexed yes
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BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.63 SJR 1.489 SNIP 1.973
Web of Science (2012): Impact factor 1.184
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.41 SJR 1.031 SNIP 1.982
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ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
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Web of Science (2010): Indexed yes
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Scopus rating (2009): SJR 1.411 SNIP 1.311
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.993 SNIP 1.19
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.889 SNIP 0.934
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.632 SNIP 0.902
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.766 SNIP 0.955
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.801 SNIP 0.87
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.425 SNIP 0.764
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.738 SNIP 1.021
Scopus rating (2001): SJR 0.842 SNIP 0.835
Scopus rating (2000): SJR 0.677 SNIP 1.052
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Influence of bending test configuration on cracking behavior of FRC
This paper describes an investigation of the influence of the testing configuration for Fiber Reinforced Concrete in bending and aims at evaluating the influence of the test configuration details on the characterization of the material. Two different types of FRC, Steel Fiber Reinforced Concrete (SFRC) and Engineered Cementitious Composites (ECC), were tested and are described in this study. The materials were chosen so that one of them would be strain hardening (ECC) and the other tension softening (SFRC).
Notched and un-notched three- and four-point bending tests were carried out to determine the flexural load-deformation response of FRC. This research focuses particularly on the influence of the appearance and depth of the notch on the cracking behavior of FRC. For this purpose, several specimens, both un-notched and notched with different depths of the notch (25 mm and 45 mm), were tested. The results obtained in the various tests are compared to determine to what extent the notch can affect cracking behavior and the resulting evaluation of the material according to the method described in the standard. Formation of cracking and the crack development has been documented by means of a digital image correlation method.

Measurement of Local Deformations in Steel Monostrands Using Digital Image Correlation
The local deformation mechanisms in steel monostrands have a significant influence on their fatigue life and failure mode. However, the observation and quantification of deformations in monostrands experiencing axial and transverse deformations is challenging because of their complex geometry, difficulties with the placement of strain gauges in the vicinity of the anchorage, and, most importantly, the relatively small magnitude of deformation occurring in the monostrand. This paper focuses on the measurement of localized deformations in high-strength steel monostrands using the digital image correlation (DIC) technique. The presented technique enables the measurement of individual wire strains along the length of the monostrand and also provides quantitative information on the relative movement between individual wires, leading to a more in-depth understanding of the underlying fatigue mechanisms. To validate the proposed image-based measurement method, two different tests were performed, with the one correlation method showing good agreement. Data collected from the DIC technique creates a basis for the analysis of the fretting and localized bending behavior of the monostrand and provides relevant information on the internal state of displacement of the monostrand under bending load.
Parallel monostrand stay cable bending fatigue: Static and dynamic experimental investigations

This dissertation investigates the bending fatigue response of high-strength steel monostands and multistrand stay cables to cyclic transverse deformations. Increasing bridge stock numbers and a push for longer cable-supported span lengths have led to an increased number of reported incidents of damage and replacement of bridge stay cables due to wind and traffic-induced fatigue. The understanding of fatigue mechanisms in most steel structures is well established. However, in the case of cables composed of steel strands, many important aspects related with bending fatigue remain to be clarified. The thesis starts with a literature review of the state-of-the-art in the fields of stay cable fatigue testing and cable fatigue resistance. The study helped to systemize the understanding of the fatigue characteristics of bridge cables subjected to cyclic transverse displacements, failure mechanisms associated with variable loading, and different testing procedures. As most of the contemporary stay cables are comprised of a number of individual high-strength steel monostands, the research study started with an extensive experimental work on the fatigue response of a single monostrand to cyclic flexural loading. Initial analysis of the deformations showed that, depending on the anchorage type, the bending fatigue behavior of the monostrand may be controlled either by local bending deformations or by the interwire movement (fretting) of the helically wound wires. The experimental study involved a detailed description of the observed failure mechanisms. For this purpose, a digital image correlation (DIC) technique was employed as an efficient tool for quantifying the interwire movement and measurement of individual wire strains along the length of the strand. The novel application of the DIC technique for the measurement of local cable deformations provided relevant data on the internal state of displacement of the strand specimen under axial and transverse loading and led to a more in-depth understanding of the underlying fatigue mechanisms. The experimental data show that the interwire movement due to transverse deformations is the highest at the neutral axis of the monostrand. Moreover, the results indicate that the midspan and the anchorage of the monostrand are the two locations where the combination of tensile strains and the interwire movement is the most unfavorable. It was also shown that, in the absence of a guide, the high localized curvatures due to bending may cause yielding of the monostrand. From the conducted series of dynamic tests, the fretting and the localized bending fatigue spectra have been derived for the estimation of the monostrand fatigue life. Further analysis of mechanical aspects of monostrand wires under bending load provided information on the failure mode-dependent cross sectional stress distribution and aimed to explain differences in the observed fatigue models.

Finally, once the bending fatigue behavior of a single monostrand was described in detail, the experimental study focused on the response of a full-scale multistrand stay cable to transverse deformations. The experimental investigation performed on the parallel monostrand stay cable had three objectives. Firstly, a correlation between the bending fatigue behavior of the single monostrand and that of the multistrand stay cable was established through full-scale testing and data obtained from the DIC measurement. Secondly, it was studied whether the fatigue life of a multistrand cable can be predicted based on the fatigue spectra derived from the tests on single monostands. Thirdly, the relationship between the transversal stiffness and the tensile force variations (hysteresis) of a monostrand and that of a multistrand specimen was investigated. The results from the full-scale tests led to a better understanding of the structural response of a modern stay cable to cyclic transverse loading and resulted in significant insight in the flexural behavior of a multistrand assembly in critical locations with respect to bending fatigue, i.e. guide deviator and exit of the socket. The thesis ends with an example of how the outcome of the research work can be used in the estimation of the life-cycle performance of a cable stayed bridge. Characterization of a bridge monitoring data is shown and a generic method for the analysis of a cable fatigue in cable supported bridge structure is proposed.

With this research, one of the most basic oversights in the lifetime assessment of cable-supported structures, namely the bending fatigue resistance of parallel monostrand stay cables, is addressed.
Description of near-tip fracture processes in strain hardening cementitious composites using image-based analysis and the compact tension test

The cracking mechanisms assume a key role in the composite behavior of Strain Hardening Cementitious Composites (SHCCs). Due to their importance, in previous studies the mechanical behavior of SHCC materials, as well as of other strain softening fiber reinforced cementitious composites, was characterized under eccentric tensile loading using the Compact Tension Test (CTT). The present research further extends this investigation, with particular emphasis on cementitious composites reinforced with multiple types of fibers. The experimental tensile load-displacement results are discussed and compared to the numerically derived responses. Furthermore, the crack initiation and propagation at the early stages of the loading sequence are analyzed. The size of the specimens and the resolution of the digital images acquired allow the detection of relatively small displacements and crack openings. The results are discussed, with special emphasis on the topology of the cracks obtained near the crack tip and on the description of the fracture process zone.

Evaluation of test methods used to characterize fiber reinforced cementitious composites

This paper describes an investigation of fiber reinforced cementitious composites in terms of their behavior under tensile and flexural loading. Flexural testing and subsequent derivation of the tensile stress-deformation response from the flexural test data are preferred in the assessment of the tensile properties of Fiber Reinforced Cement Composites (FRCC) over the direct measurement of the tensile behavior because of the more convenient test setup and ease of specimen preparation. Three and four-point bending tests and round determinate panel test were carried out to evaluate the flexural response of FRCC. The assumptions made in the inverse analysis on the formation of cracking suggested in many standardized evaluation methods and established correlation methods have a strong influence on the results of the conversion from flexure to tension... In this paper, the formation of cracking and crack development has been quantitatively documented using a digital image correlation (DIC) system to investigate the validity of the commonly made assumptions.

Experimental evaluation of the fretting fatigue behavior of high-strength steel monostrands

In this paper, the fretting fatigue behavior of pretensioned high-strength steel monostrands is investigated. A method based on the digital image correlation (DIC) technique was used to quantify the relative movement between individual wires along the length of the monostrand. The experimental data indicate that the interwire movement due to transverse deformations is highest at the neutral axis of the monostrand. The results show that the midspan and the anchorage of the...
monostrand are the two locations where the combination of tensile strains and the interwire friction is the most unfavorable. Moreover, the paper provides relevant information about the monostrand bending stiffness and the extent of relative displacement between core and outer wires of the monostrand undergoing flexural deformations. The results presented herein are of special interest for the fatigue analysis of modern stay cable assemblies where fretting constitutes the main mechanism of the fatigue life reduction. © 2013 Taylor & Francis Group, London, UK.

Prefabricated floor panels composed of fiber reinforced concrete and a steel substructure
This paper reports on a study on prefabricated composite and modular floor deck panels composed of relatively thin fiber reinforced concrete slabs connected to steel substructures. The study focuses on the design, manufacturing, structural improvements and behavior of the floor systems during loading at the serviceability and ultimate limit states. The composite construction concept offers flexibility in the assembly process, the ability to adapt to various load and boundary requirements, and efficient utilization of material properties that result in a light weight prefabricated structural element. The activities described in this paper are an extension of previous work where composite floor panels composed of light gauge steel joists were integrally cast with a thin-walled Engineered Cementitious Composite (ECC) slab. The main focus of the present study was to revise and improve the design detailing of these integrally cast deck panels and to modify them by providing individually cast anchor points in the precast ECC slab, which are subsequently used to attach a steel truss substructure. Full-scale experiments were carried out to verify the structural behavior of the integrally cast panels and the modular panels with various substructure configurations along with comparison to analytical and numerical results.
Bond slip and crack development in FRC and regular concrete specimens longitudinally reinforced with FRP or steel under tension loading

The governing mechanism in the structural response of reinforced concrete members in tension is the interaction between structural reinforcement and the surrounding concrete matrix. The composite response and the mechanical integrations of reinforced cementitious members were investigated during tensile loading using high definition image analysis in two unique test setups. Two different types of cementitious materials, conventional concrete and highly ductile Engineered
Cementitious Composite (ECC), and two types of reinforcement bars, regular steel and Glass Fiber Reinforcement Polymer (GFRP), were tested. It was found that the ductile ECC in contrast to regular brittle concrete decreases crack widths significantly which effectively results in decreased bond slip between the reinforcement and surrounding matrix. Furthermore the use of elastic GFRP in comparison to elastic/plastic steel reinforcement seems to increase the number of cracks forming over a longer strain interval, especially secondary cracks.

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Contributors: Lárusson, L. H., Fischer, G.
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Effect of hybrid fiber reinforcement on the cracking process in fiber reinforced cementitious composites

The simultaneous use of different types of fibers as reinforcement in cementitious matrix composites is typically motivated by the underlying principle of a multi-scale nature of the cracking processes in fiber reinforced cementitious composites. It has been hypothesized that while undergoing tensile deformations in the composite, the fibers with different geometrical and mechanical properties restrain the propagation and further development of cracking at different scales from the micro-to the macro-scale. The optimized design of the fiber reinforcing systems requires the objective assessment of the contribution of each type of fiber to the overall tensile response. Possible synergistic effects resulting from particular combinations of fibers need to be clearly identified. In the present study, the evaluation of the response of different fiber reinforced cementitious composite materials is carried out by assessing directly their tensile stress-crack opening behavior. The efficiency of hybrid fiber reinforcements and the multi-scale nature of cracking processes are discussed based on the experimental results obtained, as well as the micro-mechanisms underlying the contribution of different fibers to bridge cracks resulting from tensile loading.

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Scopus rating (2016): CiteScore 4.96 SJR 2.751 SNIP 2.866
Localized bending fatigue behavior of high-strength steel monostrands

In this paper, the localized bending fatigue behavior of pretensioned high strength steel monostrands is investigated. Furthermore, a new methodology using an optical photogrammetry system, which can quantify surface deformations on
the strand is presented. The system allows measurement of the strain distribution in the strand and helps in identifying potential failure mechanisms along the strand and at the wedge location. Initial analysis of the deformations shows that the bending fatigue behavior of the monostrand may be controlled either by local bending deformations or by relative displacement (opening/closing and sliding) of the helically wound wires. Moreover, the results are a step towards understanding the bending fatigue damage mechanisms of monostrand cables.

Measurement of localized deformations in high-strength steel cables

Shear crack formation and propagation in fiber reinforced cementitious composites (FRCC)
Knowledge of the mechanisms controlling crack formation, propagation and failure of FRCC under shear loading is currently limited. This paper presents a study that utilized photogrammetry to monitor the shear deformations of two FRCC materials and ordinary concrete (OC). Multiple shear cracks and strain hardening of both FRCC materials was observed under shear loading. The influence of fibers, fiber type, including polyvinyl alcohol (PVA) and polypropylene (PP) fibers, and shear crack angle were investigated. Based upon photogrammetric results, fundamental descriptions of shear crack opening/sliding and subsequent failure are presented.

Surface Wave Velocity-Stress Relationship in Uniaxially Loaded Concrete
The sonic surface wave (or Rayleigh wave) velocity measured on prismatic concrete specimens under uniaxial compression was found to be highly stress-dependent. At low stress levels, the acoustoelastic effect and the closure of existing microcracks results in a gradual increase in surface wave velocities. At higher stress levels, concrete suffers irrecoverable damage: the existing microcracks widen and coalesce and new microcracks form. This progressive damage
process leads first to the flattening and eventually the drop in the velocity-stress curves. Measurements on specimens undergoing several loading cycles revealed that the velocities show a stress-memory effect in good agreement with the Kaiser effect. Comparing the velocities measured during loading and unloading, the effects of stress and damage on the measured velocities could be differentiated. Moreover, the stress dependency of surface wave velocity proved to be direction-dependent. The velocity increases and decreases the most when measured parallel and perpendicular to the loading axis, respectively.

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State: Published  
Organisations: Department of Civil Engineering, Section for Structural Engineering, Bundesanstalt für Materialforschung und Prüfung  
Contributors: Shokouhi, P., Zoëga, A., Wiggenhauser, H., Fischer, G.  
Pages: 141-148  
Publication date: 2012  
Peer-reviewed: Yes

**Publication information**
Journal: A C I Materials Journal  
Volume: 109  
Issue number: 2  
ISSN (Print): 0889-325X  
Ratings:  
BFI (2019): BFI-level 1  
Web of Science (2019): Indexed yes  
BFI (2018): BFI-level 1  
Web of Science (2018): Indexed yes  
BFI (2017): BFI-level 1  
Scopus rating (2017): CiteScore 1.45 SJR 0.994 SNIP 1.045  
Web of Science (2017): Impact factor 1.252  
Web of Science (2017): Indexed yes  
BFI (2016): BFI-level 1  
Scopus rating (2016): CiteScore 1.43 SJR 0.886 SNIP 1.406  
Web of Science (2016): Impact factor 1.183  
BFI (2015): BFI-level 1  
Scopus rating (2015): CiteScore 1.55 SJR 1.309 SNIP 1.634  
Web of Science (2015): Impact factor 1.154  
BFI (2014): BFI-level 1  
Scopus rating (2014): CiteScore 1.37 SJR 1.22 SNIP 1.718  
Web of Science (2014): Impact factor 0.909  
BFI (2013): BFI-level 1  
Scopus rating (2013): CiteScore 1.34 SJR 1.583 SNIP 1.52  
Web of Science (2013): Impact factor 1.123  
ISI indexed (2013): ISI indexed yes  
BFI (2012): BFI-level 1  
Scopus rating (2012): CiteScore 1.07 SJR 1.109 SNIP 1.48  
Web of Science (2012): Impact factor 0.826  
ISI indexed (2012): ISI indexed yes  
Web of Science (2012): Indexed yes  
BFI (2011): BFI-level 1  
Scopus rating (2011): CiteScore 1.43 SJR 1.494 SNIP 2.023  
Web of Science (2011): Impact factor 0.803  
ISI indexed (2011): ISI indexed yes  
BFI (2010): BFI-level 1  
Scopus rating (2010): SJR 1.564 SNIP 1.888  
Web of Science (2010): Impact factor 1.023  
BFI (2009): BFI-level 1  
Scopus rating (2009): SJR 2.058 SNIP 1.805
The role of residual cracks on alkali silica reactivity of recycled glass aggregates

Despite its environmental and economical advantages, crushed recycled glass has limited application as concrete aggregates due to its deleterious alkali-silica reaction. To offer feasible mitigation strategies, the mechanism of ASR should be well understood. Recent research showed that unlike some natural aggregates, soda-lime glass undergoes ASR within cracks in the interior of glass particles and not at glass–paste interface. These cracks originate during bottle crushing and propagate further by ASR. This paper examines whether glass aggregates could become innocuous if these cracks are healed by annealing or when the crack widths are smaller than a critical size. The results confirm that glass annealed at 650°C for 40min or particles containing cracks smaller than approximately 2.5μm can be considered innocuous based on ASTM C1260. Also larger glass particles contain significantly higher percentages of reactive microcracks which may explain why ASR expansions are lowered by reducing the size of glass aggregates.

General information
State: Published
Organisations: Section for Structural Engineering, Department of Civil Engineering, Pennsylvania State University
Contributors: Maraghechi, H., Shafaatian, S., Fischer, G., Rajabipour, F.
Pages: 41-47
Publication date: 2012
Peer-reviewed: Yes

Publication Information
Journal: Cement and Concrete Composites
Volume: 34
Issue number: 1
ISSN (Print): 0958-9465
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 5.66 SJR 3.146 SNIP 2.889
Web of Science (2017): Impact factor 4.66
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.96 SJR 2.751 SNIP 2.866
Web of Science (2016): Impact factor 4.265
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
This paper presents the results of the experimental study on the bending fatigue resistance of high-strength steel monostrand cables. From the conducted fatigue tests in the high-stress, low-cycle region, a preliminary bending fatigue spectrum is derived for the estimation of monostrand cable service life expectancy. The presented preliminary bending fatigue spectrum of high-strength monostands is currently unavailable in the published literature. The presented results provide relevant information on the bending mechanism and fatigue characteristics of monostrand steel cables in tension and flexure and show that localized cable bending has a pronounced influence on the fatigue resistance of cables under...
dynamic excitations.

**A Preliminary Bending Fatigue Spectrum for Steel Monostrand Cables**

**General information**

State: Published
Organisations: Section for Structural Engineering, Department of Civil Engineering
Contributors: Winkler, J., Fischer, G., Georgakis, C. T., Kotas, A.
Publication date: 2011

**Publication information**

Journal: Journal of the International Association for Shell and Spatial Structures
Volume: 52
Issue number: 4
ISSN (Print): 1028-365X

**Keywords:** Bending fatigue spectrum, High-strength monostrand steel cable, Cyclic loading

Research output: Research - peer-review | Journal article – Annual report year: 2011
Evaluation of standardized test methods to characterize fiber reinforced cement composites

This paper describes an investigation of standardized test methods to characterize fiber reinforced cementitious composites in terms of their behavior under flexural loading and its relation to their tensile stress-deformation response. Flexural testing and derivation of the tensile stress-deformation response are preferred in standardized testing of Fiber Reinforced Cement Composites (FRCC) over the direct assessment of the tensile behavior because of the more convenient test setup and ease of specimen preparation. Four-point bending tests were carried out to evaluate the flexural response of FRCC and their results are compared to data obtained from direct tensile testing. The details of the formation of cracking are an important underlying assumption in the standardized evaluation procedures as well as in the established correlation models between flexural and tensile behavior. This detail has been documented in the present study using a photogrammetric image analysis system, which can be used to relate the flexural crack formation and resulting load-deformation response to the data obtained from direct assessment of the tensile stress-crack opening response of FRCC materials.

Flexible concrete link slabs used as expansion joints in bridge decks

Deterioration of bridge structures with mechanical expansion joints between simply supported spans can cause repeated maintenance needs and high repair costs. Damage occurs due to accumulation of debris within the expansion joint, corrosion of deck reinforcement, spalling of concrete, leakage of water through the expansion joint and subsequent corrosion of girders and girder bearings. Investigations on joint-less superstructures using conventional steel reinforcement in so-called concrete link slabs indicate improved performance and economic feasibility. However, this concept requires relatively large amounts of steel reinforcement for crack control purposes and consequently provides a relatively large flexural stiffness and negative moment capacity at the joint between the spans. These contradicting requirements and effects in existing replacement concepts for damaged mechanical bridge joints are currently unresolved. In the proposed system described in this paper, a ductile cement-based composite section reinforced with Glass Fiber
Reinforced Polymers (GFRP) replaces the damaged expansion joint. The combination of this ductile concrete together with corrosion resistant GFRP reinforcement serves as a flexible concrete element between the adjacent deck segments. The use of an Engineered Cementitious Composite (ECC) material instead of conventional concrete significantly reduces crack widths under service conditions and prevents deterioration of the link slab in the tension stiffening process.

Flexible Fiber Reinforced Concrete Link Slabs used as Expansion Joints in Bridge Decks

Hybrid fiber reinforcement and crack formation in Cementitious Composite Materials

The use of different types of fibers simultaneously for reinforcing cementitious matrices is motivated by the concept of a multi-scale nature of the crack propagation process. Fibers with different geometrical and mechanical properties are used to bridge cracks of different sizes from the micro- to the macroscale. In this study, the performance of different fiber reinforced cementitious composites is assessed in terms of their tensile stress-crack opening behavior. The results obtained from this investigation allow a direct quantitative comparison of the behavior obtained from the different fiber reinforcement systems. The research described in this paper shows that the multi-scale conception of cracking and the use of hybrid fiber reinforcements do not necessarily result in an improved tensile behavior of the composite. Particular material design requirements may nevertheless justify the use of hybrid fiber reinforcements.
Image-based detection and analysis of crack propagation in cementitious composites

The initiation and propagation of cracking in concrete and other cementitious materials is a governing mechanism for many physical and mechanical material properties. The observation of these cracking processes in concrete is typically taking place at discrete locations using destructive methods after the cracking process has occurred. The alternative nondestructive methods are often either not precise enough or experimentally too demanding. In this study, the use of an image analysis procedure to capture the crack initiation and propagation process is described, which utilizes digital images of the concrete while undergoing the cracking process. The results obtained with this method have shown that it is possible to monitor relatively small displacements on the specimen surface independently of the scale of the representative area of interest. The formed cracks are visible at relatively small crack openings, allowing a thorough investigation and analysis of the cracking processes in concrete.

General information
State: Published
Organisations: Section for Structural Engineering, Department of Civil Engineering, University of Minho
Contributors: Pereira, E., Fischer, G., Barros, J.
Publication date: 2011

Host publication information
Title of host publication: Proceedings of International RILEM Conference on Advances in Construction Materials Through Science and Engineering
URLs:
http://www.ce.ust.hk/rilem2011/
Source: orbit
Source-ID: 316801
Research output: Research - peer-review > Article in proceedings – Annual report year: 2011

Mechanical interaction between concrete and structural reinforcement in the tension stiffening process

The interaction between structural reinforcement and the surrounding concrete matrix in tension is a governing mechanism in the structural response of reinforced concrete members. The tension stiffening process, defined as the concrete’s contribution to tensile response of the composite, has been investigated using an image-based deformation measurement and analysis system. This allowed for detailed view of surface deformations and the implications on the resulting response of the member in tension. In this study, conventional concrete and a ductile, strain hardening cement composite, known as Engineered Cementitious Composite (ECC), have been combined with steel and glass fiber reinforced polymer (GFRP) reinforcement to contrast the effects of brittle and ductile cement matrices as well as elastic/plastic and elastic reinforcement on the tension stiffening process. Particular focus was on the deformation process and transverse crack formation in the cementitious matrix at increasing tensile strain.

General information
State: Published
Organisations: Section for Structural Engineering, Department of Civil Engineering
Contributors: Lárusson, L. H., Fischer, G., Jönsson, J.
Publication date: 2011

Host publication information
Title of host publication: High Performance Fiber Reinforced Cement Composites 6
Publisher: Springer
Source: orbit
Source-ID: 316625
Research output: Research - peer-review > Article in proceedings – Annual report year: 2011

Shear crack formation and propagation in fiber reinforced cementitious composites (FRCC)

Knowledge of the mechanisms controlling crack formation, propagation and failure of FRCC under shear loading is currently limited. This paper presents a study that utilized photogrammetry to monitor the shear deformations of two FRCC materials and ordinary concrete (OC). Multiple shear cracks and strain hardening of both FRCC materials was observed under shear loading. The influence of fibers, fiber type, including polyvinyl alcohol (PVA) and polypropylene (PP) fibers, and shear crack angle were investigated. Based upon photogrammetric results, fundamental descriptions of shear crack opening/sliding and subsequent failure are presented.

General information
State: Published
Shear crack formation and propagation in reinforced Engineered Cementitious Composites

This paper describes an experimental investigation of the shear behaviour of beams consisting of steel reinforced Engineered Cementitious Composites (R/ECC). Based on the strain hardening and multiple cracking behaviour of ECC, this study investigates the extent to which ECC influences the shear capacity of beams loaded primarily in shear. The experimental program consists of ECC with short randomly distributed polyvinyl alcohol (PVA) fiber beams with different stirrup arrangements and conventional reinforced concrete (R/C) counterparts for comparison. The shear crack formation mechanism of ECC is investigated in detail and can be characterized by an opening and sliding of the crack. Photogrammetry was utilized to monitor the shear deformations of the specimens. Multiple shear cracking and strain hardening of ECC was observed under shear loading and based upon photogrammetric results fundamental descriptions of shear crack opening, sliding and subsequent failure are presented.

General information
State: Published
Organisations: Department of Civil Engineering, Section for Structural Engineering
Contributors: Paegle, I., Fischer, G.
Publication date: 2011

Host publication information
Title of host publication: Proceedings of the Sixth International Workshop on High Performance Fiber Reinforced Cement Composites
Electronic versions:
prod21325855669847.Paegle.pdf
Source: orbit
Source-ID: 316566
Research output: Research - peer-review › Article in proceedings – Annual report year: 2011
Crack formation and tensile stress-crack opening behavior of Fiber Reinforced Cementitious Composites (FRCC)

General information
State: Published
Organisations: Section for Structural Engineering, Department of Civil Engineering
Contributors: Pereira, E., Fischer, G., Barros, J. A., Lepech, M.
Publication date: 2010

Host publication information
Title of host publication: 7th International Conference on Fracture Mechanics of Concrete and Concrete Structures (FraMCoS 7)
Source: orbit
Source-ID: 272467
Research output: Research - peer-review › Article in proceedings – Annual report year: 2010

From Material Level to Structural Use of Mineral-Based Composites—An Overview

General information
State: E-pub ahead of print
Organisations: Section for Structural Engineering, Department of Civil Engineering
Contributors: Orosz, K., Blanksvaerd, T., Taeljsten, B., Fischer, G.
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Advances in Civil Engineering
ISSN (Print): 1687-8086
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.16 SJR 0.539 SNIP 0.897
Web of Science (2017): Impact factor 0.827
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.97 SJR 0.309 SNIP 0.805
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 0.76 SJR 0.335 SNIP 0.941
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 0.57 SJR 0.219 SNIP 0.753
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 0.58 SJR 0.225 SNIP 0.948
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.46 SJR 0.21 SNIP 0.496
ISI indexed (2012): ISI indexed no
Scopus rating (2011): CiteScore 0.4 SJR 0.231 SNIP 0.443
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 0.117 SNIP 0.12
Scopus rating (2009): SJR 0.228 SNIP 0.611
Investigating the Alkali Silica Reaction of Recycled Glass Aggregates in Concrete Materials

General information
State: Published
Organisations: Section for Structural Engineering, Department of Civil Engineering
Contributors: Rajabipour, F., Maraghechi, H., Fischer, G.
Pages: 1201-1208
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Journal of Materials in Civil Engineering
Volume: 22
Issue number: 12
ISSN (Print): 0899-1561
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.94 SJR 1.034 SNIP 1.307
Web of Science (2017): Impact factor 1.763
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.69 SJR 1.003 SNIP 1.445
Web of Science (2016): Impact factor 1.644
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.56 SJR 0.914 SNIP 1.427
Web of Science (2015): Impact factor 1.295
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.71 SJR 1.237 SNIP 1.764
Web of Science (2014): Impact factor 1.296
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.6 SJR 1.235 SNIP 1.798
Web of Science (2013): Impact factor 1.322
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.09 SJR 0.85 SNIP 1.597
Web of Science (2012): Impact factor 0.959
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.14 SJR 0.715 SNIP 1.749
Web of Science (2011): Impact factor 0.733
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.699 SNIP 1.632
Web of Science (2010): Impact factor 0.677
Macro-effect of Microcracks on Sonic Wave Velocity of Concrete under Compression

General information
State: Published
Organisations: Section for Structural Engineering, Department of Civil Engineering
Contributors: Shokouhi, P., Zoega, A., Wiggenhauser, H., Fischer, G.
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Transportation Research Record
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 0.83 SJR 0.589 SNIP 0.708
Web of Science (2017): Impact factor 0.695
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.75 SJR 0.557 SNIP 0.81
Web of Science (2016): Impact factor 0.592
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 0.6 SJR 0.612 SNIP 0.821
Web of Science (2015): Impact factor 0.522
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 0.58 SJR 0.562 SNIP 0.876
Web of Science (2014): Impact factor 0.544
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 0.76 SJR 0.635 SNIP 0.958
Mechanical interaction of Engineered Cementitious Composite (ECC) reinforced with Fiber Reinforced Polymer (FRP) rebar in tensile loading.

This paper introduces a preliminary study of the composite interaction of Engineered Cementitious Composite (ECC), reinforced with Glass Fiber Reinforced Polymer (GFRP) rebar. The main topic of this paper will focus on the interaction of the two materials (ECC and GFRP) during axial loading, particularly in post cracking phase of the concrete matrix. The experimental program carried out in this study examined composite behavior under monotonic and cyclic loading of the specimens in the elastic and inelastic deformation phases. The stiffness development of the composite during loading was evaluated as well as crack widths and crack distributions in the ECC. Results indicate that the interaction of the ductile ECC together with the elastic brittle behavior of the GFRP make a highly compatible ductile composite. The combination of multiple cracking and limited crack width of ECC insures good stain distribution which in terms results in less mechanical deterioration during loading.

General information
State: Published
Organisations: Section for Structural Engineering, Department of Civil Engineering
Contributors: Lárusson, L. H., Fischer, G., Jónsson, J.
Shear behavior of reinforced Engineered Cementitious Composites (ECC) beams

This paper describes an experimental investigation of the shear behavior of beams consisting of steel reinforced Engineered Cementitious Composites (ECC). Based on the strain hardening and multiple cracking behavior of ECC, this study investigates the extent to which ECC can improve the shear capacity of beams loaded primarily in shear and if ECC can partially or fully replace the conventional transverse steel reinforcement in beams. However, there is a lack of understanding of how the fibers affect the shear carrying capacity and deformation behavior of structural members if used either in combination with conventional transverse reinforcement or exclusively to provide shear resistance. The experimental investigation focuses on the influence of fibers on the shear carrying capacity and the crack development in ECC beams subjected to shear. The experimental program consists of ECC with short randomly distributed PVA (polyvinyl alcohol) fiber beams with different stirrup spacing and reinforced concrete (RC) beams for comparison. Displacement and strain measurements taken using the ARAMIS photogrammetric data acquisition system by means of processing at high frame rate captured images of applied a high contrast speckle pattern to the beams surface. The multiple micro cracking resulting from the strain-hardening response of ECC in tension develop in a diagonal between the load and support point. The formation of multiple micro cracks is highly dependent on the tensile stress-strain behavior of the ECC. The shear crack formation mechanism of ECC is investigated and found to be characterized by an opening of the cracks prior to sliding. Several analytical models on shear design of ECC and concrete beams are evaluated and compared to the experimentally obtained results. The provisions of the Eurocode and ACI Code are found to be over-conservative but can be modified by utilizing the tensile strength of ECC. An expression for the load carrying capacity is proposed by expressing the ECC shear strength in terms of the crack angle.

General Information
State: Published
Organisations: Department of Civil Engineering, Section for Structural Engineering
Contributors: Paegle, I., Fischer, G.
Number of pages: 313
Pages: 75-82
Publication date: 2010

Mechanical Interaction of ECC with Fiber Reinforced Polymer (FRP) rebar in tensile loading

General Information
State: Published
Organisations: Section for Structural Engineering, Department of Civil Engineering
Contributors: Lárusson, L. H., Fischer, G., Jönsson, J.
Publication date: 2009

Host publication information
Title of host publication: Advances in cement-based materials
Place of publication: Leiden
Publisher: CRC Press
Editors: van Zijl, G. P. A. G., Boshoff, W. P.
ISBN (Print): 978-0-415-87637-7
Keywords: ECC, shear
Source: orbit
Source-ID: 256157
Research output: Research - peer-review › Article in proceedings – Annual report year: 2009
Prefabricated floor and roof panels with engineered cementitious composites (ECC)

General information
State: Published
Organisations: Section for Structural Engineering, Department of Civil Engineering
Contributors: Fischer, G., Lárusson, L. H., Jónsson, J.
Publication date: 2009

Host publication information
Title of host publication: ASCE Structures Congress
Source: orbit
Source-ID: 256478
Research output: Research - peer-review › Article in proceedings – Annual report year: 2009

Recycling and Utilizing Waste Glass as Concrete Aggregate

General information
State: Published
Organisations: Section for Structural Engineering, Department of Civil Engineering, University of Hawaii, Technical University of Denmark
Contributors: Rajabipour, F., Fischer, G., Sigurdardottir, T., Goodnight, S., Leake, A., Smith, E.
Pages: 09-2195
Publication date: 2009
Peer-reviewed: Yes

Publication information
Journal: Transportation Research Board. State-of-the-Art Report
ISSN (Print): 0892-6891
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
Source: orbit
Source-ID: 256473
Research output: Research - peer-review › Journal article – Annual report year: 2009

Shotcreting with ECC

General information
State: Published
Organisations: Department of Civil Engineering, Section for Structural Engineering, University of Michigan, Stanford University
Contributors: Li, V., Fischer, G., Lepech, M.
Publication date: 2009

Host publication information
Title of host publication: Spritzbeton-Tagung Alpbach
Editor: Kusterle, W.
Source: orbit
Source-ID: 256477
Research output: Research - peer-review › Article in proceedings – Annual report year: 2009

Application of Engineered Cementitious Composites (ECC) in modular floor panels
This paper describes the design, manufacturing, and structural behavior of a prefabricated floor panel consisting of a modular assembly of a thin-walled ECC slab and steel truss girders. The features of this composite structure include lightweight, the modular manufacturing process with adaptability to various loading requirements, and the efficient utilization of material resources and industrial byproducts. The work described in this paper is a continuation of previous activities on composite floor panels in which light gage steel joists were integrally cast with the ECC slab. The modular concept introduced in this paper aims at improvements in the manufacturing process of the panels by casting the ECC slab separately and subsequently joining it with the steel trusses. The focus of this paper is on design and manufacturing of a
prototype modular panel and on its structural behavior under service conditions and at ultimate. The modular floor panel concept is introduced, modeled, and verified with experimental tests of various configurations.

**General information**
State: Published
Organisations: Section for Structural Engineering, Department of Civil Engineering
Contributors: Lárusson, L. H., Fischer, G., Jönsson, J.
Publication date: 2008

**Host publication information**
Title of host publication: BEFIB 2008: 7th RILEM International Symposium on Fibre Reinforced Concrete
Source: orbit
Source-ID: 232929
Research output: Research - peer-review › Article in proceedings – Annual report year: 2008

**Review of Japanese recommendations on design and construction of different classes of fiber reinforced concrete and application examples**
The development of concrete and cementitious composites with fiber reinforcement to improve the tensile load-deformation behavior has resulted in three distinct classes of materials. These include conventional Fiber Reinforced Concrete (FRC) with tension softening response, High Performance Fiber Reinforced Cement Composites (HPFRCC) with strain hardening and multiple cracking behavior, and Ultra High-strength Fiber Reinforced concrete (UFC) with increased tensile strength. The recommendations on the design, production, and application of these classes of fiber reinforced concrete have been established in Japan. This paper will review and compare these documents with the aim of outlining distinctive and common features of these different classes of cementitious composite materials. Examples of structural applications of HPFRCC and UFC will be described.

**General information**
State: Published
Organisations: Department of Civil Engineering, Section for Structural Engineering, Gifu University, Kajima Technical Research Institute, Tokyo Institute of Technology
Contributors: Uchida, Y., Fischer, G., Hishiki, Y., Niwa, J., Rokugo, K.
Publication date: 2008

**Host publication information**
Title of host publication: 8th International Symposium on Utilization of High-Strength and High-Performance Concrete
Source: orbit
Source-ID: 232924
Research output: Research - peer-review › Article in proceedings – Annual report year: 2008

**CFRP strengthening with Mineral Based Composites loaded in shear**

**General information**
State: Published
Organisations: Section for Structural Engineering, Department of Civil Engineering
Contributors: Orosz, K., Täljsten, B., Fischer, G.
Pages: 642-643
Publication date: 2007

**Host publication information**
Title of host publication: Proceedings of the 8th International symposium on fibre reinforcement for concrete structures
Source: orbit
Source-ID: 207626
Research output: Research - peer-review › Article in proceedings – Annual report year: 2007

**Crack development in CFRP reinforced mortar - an experimental study**

**General information**
State: Published
Organisations: Section for Structural Engineering, Department of Civil Engineering
Contributors: Täljsten, B., Orosz, K., Fischer, G.
Publication date: 2007

**Host publication information**
Title of host publication: APFIS 2007
Effect of Fiber Reinforcement on the Response of Structural Members

This paper describes a series of investigations on the effect of fiber reinforcement on the response of structural members in direct tension and flexure under reversed cyclic loading conditions. The design approach of the fiber reinforced cementitious composite is based on fracture mechanics principles, which will be described in the first part of the paper along with an introduction of the relevant material properties of the resulting engineered cementitious composite (ECC). This class of composites is characterized by strain hardening and multiple cracking properties in uniaxial tension and an ultimate tensile strain capacity on the order of several percent. Subsequently, the synergistic effects of composite deformation mechanisms in the ECC and structural members subjected to large shear reversals are identified. Beneficial effects observed in the reinforced ECC structural members as compared to conventional reinforced concrete include improved composite integrity, energy dissipation, ductility, and damage tolerance.
Fiber Reinforced Concrete for Precast Applications – an Overview on Recent Developments and Applications

General information
State: Published
Organisations: Department of Civil Engineering, Section for Structural Engineering
Contributors: Fischer, G.
Publication date: 2007

Host publication information
Title of host publication: International Concrete Conference & Exhibition Cape Town
Source: orbit
Source-ID: 209709
Research output: Research - peer-review › Article in proceedings – Annual report year: 2007

Initiation and development of cracking in ECC materials
Measurement of Properties of Fiber Reinforced Concrete: ACI Committee 544 on Fiber Reinforced Concrete

General information
State: Published
Organisations: Section for Structural Engineering, Department of Civil Engineering
Contributors: Naaman, A., Fischer, G., Krstulovic, N.
Publication date: 2006

Publication information
Original language: English
Source: orbit
Source-ID: 194163
Research output: Research › Report – Annual report year: 2006

Simulation of Tensile Stress-Strain Behavior of Strain hardening Cementitious Composites

General information
State: Published
Organisations: Section for Structural Engineering, Department of Civil Engineering
Contributors: Yang, J., Fischer, G.
Publication date: 2006

Host publication information
Title of host publication: International Symposium on Measuring, Monitoring, and Modeling Concrete Properties
Source: orbit
Source-ID: 194158
Research output: Research - peer-review › Article in proceedings – Annual report year: 2006

Konstruktive Anwendungen von duktilem Faserbeton

General information
State: Published
Organisations: Section for Structural Engineering, Department of Civil Engineering
Contributors: Fischer, G.
Publication date: 2005

Host publication information
Title of host publication: Hochduktile Betone mit Kurzfaserbewehrung – Entwicklung, Prüfung, Anwendung : Proceedings
Publisher: ibidem Verlag
Editor: Mechtcherine, V.
Source: orbit
Source-ID: 194164
Research output: Research › Article in proceedings – Annual report year: 2005

Prefabricated Modular Structures using ECC Technology

General information
State: Published
Organisations: Section for Structural Engineering, Department of Civil Engineering
Contributors: Fischer, G.
Publication date: 2005

Host publication information
Title of host publication: Third International Conference on Construction Materials : Proceedings
Source: orbit
Source-ID: 194165
Research output: Research - peer-review › Article in proceedings – Annual report year: 2005

Projects:

Optimised constructions using semi-automated designing and manufacturing tools for minimum resource consumption
Christ, J., PhD Student, Department of Civil Engineering
Koss, H., Main Supervisor, Department of Civil Engineering
Fischer, G., Supervisor, Department of Civil Engineering
Ottosen, L. M., Supervisor, Department of Civil Engineering
Pedreros, J. F., Supervisor, Department of Civil Engineering
01/12/2018 → 30/11/2021
Project: PhD

Circular Ocean
Bertelsen, I. M. G., PhD Student, Department of Civil Engineering
Ottosen, L. M., Main Supervisor, Department of Civil Engineering
Belmonte, L. J., Supervisor, Department of Civil Engineering
Schmidt, J. W., Supervisor, Department of Civil Engineering
Fischer, G., Supervisor, Department of Civil Engineering
Kirkelund, G. M., Supervisor, Department of Civil Engineering
Samfinansieret - Andet
01/10/2015 → 15/02/2019
Award relations: Circular Ocean
Project: PhD

Corrosion resistance of steel fibre reinforced concrete structures
Marcos Meson, V., PhD Student, Department of Civil Engineering
Fischer, G., Main Supervisor, Department of Civil Engineering
Edvardsen, C., Supervisor
Michel, A., Supervisor, Department of Civil Engineering
Solgaard, A. O. S., Supervisor, Department of Civil Engineering
Industrial PhD
01/09/2015 → 20/07/2019
Award relations: Corrosion resistance of steel fibre reinforced concrete structures
Project: PhD

Design and Modeling of Structural Joints in Precast Concrete Structures
Sørensen, J. H., PhD Student, Department of Civil Engineering
Hoang, L. C., Main Supervisor, Department of Civil Engineering
Fischer, G., Supervisor, Department of Civil Engineering
Olesen, J. F., Supervisor, Department of Civil Engineering
Brincker, R., Examiner, Department of Civil Engineering
Hegger, J., Examiner
Ruiz, M. F. R., Examiner
Hegger, J., Examiner
Ruiz, M. F. R., Examiner
Institut stipendie (DTU)
15/06/2014 → 01/02/2018
Award relations: Design and Modeling of Structural Joints in Precast Concrete Structures
Project: PhD

Aerodynamics and icing of bridge cables with concave fillets
Burlina, C., PhD Student, Department of Civil Engineering
Koss, H., Main Supervisor, Department of Civil Engineering
Georgakis, C. T., Supervisor, Department of Civil Engineering
Larsen, S. V., Supervisor, Department of Structural Engineering and Materials
Fischer, G., Examiner, Department of Civil Engineering
Hansen, S. O., Examiner
Jakobsen, J. B., Examiner
Hansen, S. O., Examiner
Industrial PhD
15/10/2014 → 13/02/2018
Award relations: Aerodynamics and icing of bridge cables with concave fillets
Project: PhD

Parallel Mono-strand Stay Cable Bending Fatigue
Winkler, J. P., PhD Student, Department of Civil Engineering
Georgakis, C. T., Main Supervisor, Department of Civil Engineering
Fischer, G., Supervisor, Department of Civil Engineering
Understanding of bridge cable vibration mechanisms under varying meteorological conditions
Matteoni, G., PhD Student, Department of Civil Engineering
Georgakis, C. T., Main Supervisor, Department of Civil Engineering
Arentoft, M., Supervisor
Koss, H., Supervisor, Department of Civil Engineering
Ricciardelli, F., Supervisor, Department of Civil Engineering
Fischer, G., Examiner, Department of Civil Engineering
Jakobsen, J. B., Examiner
Macdonald, J. H. G., Examiner
ErhvervsPhD-ordningen VTU
01/05/2010 → 23/06/2014
Award relations: Understanding of bridge cable vibration mechanisms under varying meteorological conditions
Project: PhD

Understanding of bridge cable vibrations and the associated flow-field through the full-scale monitoring of vibrations and wind
Acampora, A., PhD Student, Department of Civil Engineering
Georgakis, C. T., Main Supervisor, Department of Civil Engineering
Arentoft, M., Supervisor
Ricciardelli, F., Supervisor, Department of Civil Engineering
Fischer, G., Examiner, Department of Civil Engineering
Brincker, R., Examiner, Department of Civil Engineering
Jakobsen, J. B., Examiner
ErhvervsPhD-ordningen VTU
01/12/2009 → 12/12/2013
Award relations: Understanding of bridge cable vibrations and the associated flow-field through the full-scale monitoring of vibrations and wind
Project: PhD

Application of Fiber Reinforced Concrete in Civil Infrastructure
Solgaard, A. O. S., PhD Student, Department of Civil Engineering
Stang, H., Main Supervisor, Department of Civil Engineering
Geiker, M. R., Supervisor, Department of Civil Engineering
Fischer, G., Examiner, Department of Civil Engineering
Gehlen, C., Examiner
Polder, R. B., Examiner
ErhvervsPhD-ordningen VTU
01/05/2008 → 24/01/2014
Award relations: Application of Fiber Reinforced Concrete in Civil Infrastructure
Project: PhD

Analysis and development of Advanced Sandwich Elements for Sustainable Buildings
Hodicky, K., PhD Student, Department of Civil Engineering
Stang, H., Main Supervisor, Department of Civil Engineering
Schmidt, J. W., Supervisor, Department of Civil Engineering
Fischer, G., Examiner, Department of Civil Engineering
Nielsen, C. V., Examiner
Seracino, R., Examiner
Institut, samfinansiering
01/07/2011 → 30/09/2015
Award relations: Analysis and development of Advanced Sandwich Elements for Sustainable Buildings
Project: PhD
Structural design of Light Weight Composite Floor and Roof Panels
Paegle, I., PhD Student, Department of Civil Engineering
Fischer, G., Main Supervisor, Department of Civil Engineering
Jönsson, J., Supervisor, Department of Civil Engineering
Hoang, L. C., Examiner, Department of Structural Engineering and Materials
Kabele, P., Examiner
Plizzari, G., Examiner
Kabele, P., Examiner
Plizzari, G., Examiner
Institut, samfinansiering
01/09/2009 → 30/11/2015
Award relations: Structural design of Light Weight Composite Floor and Roof Panels
Project: PhD

Development of flexible concrete joints for deck structures with deteriorated mechanical joints and corrosion damage
Lárusson, L. H., PhD Student, Department of Civil Engineering
Fischer, G., Main Supervisor, Department of Civil Engineering
Stang, H., Supervisor, Department of Civil Engineering
Georgakis, C. T., Examiner, Department of Civil Engineering
Lepech, M., Examiner
Plizzari, G. A., Examiner
Institut, samfinansiering
01/10/2008 → 27/05/2013
Award relations: Development of flexible concrete joints for deck structures with deteriorated mechanical joints and corrosion damage
Project: PhD

Modeling of Liquid and Ion Transport Mechanisms in Carcked Reinforced Concrete Structures
Pease, B. J., PhD Student, Department of Civil Engineering
Geiker, M. R., Main Supervisor, Department of Civil Engineering
Stang, H., Supervisor, Department of Civil Engineering
Weiss, J., Supervisor
Fischer, G., Examiner, Department of Civil Engineering
Nilsson, L., Examiner
Raupach, M., Examiner
DTU-lønnet stipendie
15/08/2005 → 02/02/2011
Award relations: Modeling of Liquid and Ion Transport Mechanisms in Carcked Reinforced Concrete Structures
Project: PhD

Integration of CFD in Structural and Architectural Wind Engineering
Jørgensen, N. G., PhD Student, Department of Civil Engineering
Koss, H., Main Supervisor, Department of Civil Engineering
Bennetsen, J. C., Supervisor
Georgakis, C. T., Supervisor, Department of Civil Engineering
Jensen, L. B., Supervisor, Department of Civil Engineering
Fischer, G., Examiner, Department of Civil Engineering
Franke, J., Examiner
Höffer, R., Examiner
Institut stipendie (DTU)
01/11/2009 → 30/09/2015
Award relations: Integration of CFD in Structural and Architectural Wind Engineering
Project: PhD

Cable Aerodynamic Control
Kleissl, K., PhD Student, Department of Civil Engineering
Georgakis, C. T., Main Supervisor, Department of Civil Engineering
Koss, H., Supervisor, Department of Civil Engineering
Fischer, G., Examiner, Department of Civil Engineering
Larose, G., Examiner
Larsen, A., Examiner
Institut stipendie (DTU)
01/10/2009 → 27/08/2013
Long-span, light-weight composite floor and roof panels
Development of light-weight cementitious composite panels for long-span roof and floor structures
Fischer, G., Project Manager, Department of Civil Engineering
Jönsson, J., Project Manager, Department of Civil Engineering
Gaver, Private danske Fonde: DKK2,500,000.00
01/01/2009 → 31/12/2012
Award relations: Long-span, light-weight composite floor and roof panels
Project: Research