UNIVERSITY OF Southampton

E-Lass Seminar

Piteå, 24 January, 2019

Composite Regulation: Case Study for Composite Repairs in the marine sector

Southampton Marine & Maritime Institute (SMMI)

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SMMI Industrial Liaison Manager

UNIVERSITY OF Southampton

SMMI Purpose

- Promote interdisciplinary cross-faculty research
- Create additionality – more than the sum of its parts
- Diversify engagement
- Maintain and enhance global distinctiveness

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Southampton Marine & Maritime Institute

A world-leading centre for research, innovation, business and education
… a focal point for industries, enterprises and government
to conduct leading edge research and technology application

- More than 350 academics from all Faculties of the University
- Four Principal Themes

Energy & Resources	Society & Government
Climate & Environment	Trade & Transport

- 60 SMMI PhD students – cross-faculty, multi-disciplinary

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Previous work, published April 2017

Simon Quinn, Janice Barton, Simon Gerrard,
Robert Veal, Mikis Tsimplis, Rob Stevens &
Ole Thomsen

Modernising Composite Regulations:
A Position Paper

Blackburn bus station
Courtesy of Millfield Composites Group
And Millfield Composites

www.southampton.ac.uk/CompositeRegulations

Intentions

- The market
  - Global market for composites 2013 (all sectors) ~US$ 68bn. Expected growth 6.5% CAGR over 7 years – 2020 forecast ~$106bn.
  - 2016 UK Composite Strategy predicts growth from £2.3bn in 2015 to £12bn in 2030
- Problem statement
  - Major inhibitor to the uptake of composite materials in new sectors; Regulations, codes and standards
- Study group
  - Formed at University of Southampton to consult with key industrial players and regulators, and report to BEIS
  - Limitations of current framework and issues
- Emergent proposals
  - The need for a harmonised, cross-sectoral, regulatory framework for composite materials (UK and international)
  - To boost GVA, skills, inward investment, exports and jobs, including repatriation of some manufacturing back to UK and other countries

Summary

- The absence of harmonised support for 'performance' or 'goal' based regulation and the proof of 'equivalence' in most manufacturing sectors (except Aerospace and Wind), is inhibiting growth and delivery of the long term strategic goals of the composites industry.
- It devalues composites research and gives other, more nimble material technologies a competitive advantage.
- Makes investment in composite manufacturing financially unattractive.
- There is a real need to create better integrated support to develop the codes, standards and best practice to facilitate a 'performance' based building block approach

And

- The assurance of composite materials needs to be harmonised and vested in one national/international authority

Composite Leadership Forum (CLF)

- UK group working to influence the Government and other bodies (including Industry, research centres, academia, skills provider) to bring together support for composites and ensure growth and industrial success, https://compositesuk.co.uk/leadership-forum/about-clf
- Regulation Codes and Standards Working Group is currently updating its 2016 strategy:
  - Work with regulators and standards bodies to adapt regulations to enable use of composites
  - Establish composites materials test and database capability
  - Develop standards for key topics; e.g. process measurements, FST
  - Non-destructive methods for thick sections and large scale manufacture
  - Implement design codes for structural applications

Current project activity at Southampton

- ‘Performance’ based qualification of advanced composite material structures used in the marine sector
- A case study to show how a load carrying structure made of advanced composite materials can be qualified within the existing regulatory systems
- The work will define any shortcomings of the current regulatory systems and propose alternative approaches
- Anticipated output, April 2019
  - Marine case study
  - Flow chart highlighting the key stages of the regulatory process, including the relevant stakeholders

Composite repair in the marine industry

- Working with Lloyd's Register
- Selection of case study: Repair of steel structures using composites
  - Primary load bearing, patch repair of deck
  - Dual purpose, considering design and repair at the same time
  - Definition of the methodology framework, for all stakeholders
  - Client feedback has raised the need to have a readily understandable process/flowchart indicating the approach for acceptance
  - Route to acceptance can be complex due to stakeholder liability/obligations and hence the case study will provide a good example of how proposals will be assessed
  - Additional barriers/issues?

Composite repair in the marine industry: case study details

- Typical material types and details (lay-ups and adhesives)
- Typical structural details and loading requirements
- Typical content of repair procedure, and manufacturing processes
- SQEP requirements, dependent on who is responsible for repair, e.g. OEM or repair yard

Composite repair in the marine industry: case study scope

- Other considerations, not in scope in the case study
  - Elevated temperature requirements, e.g. engine room repair
  - Environmental conditions, exposure to moisture, solvents, etc. depending on the repair location and if any protection is necessary (and the compatibility of any protection)
  - Inspection acceptance criteria, i.e. structural integrity of the patch. Assumed good bond exists, as part of the prerequisite for system qualification
- Generally composite technology is often well-established but durability and ability to inspect in-service are challenges

N|I|L = National Infrastructure Lab

Boldrewood Innovation Campus

Co-location with Lloyd's Register's Global Technology Centre

N|I|L total cost £47.4M - £26M from EPSRC/UKCRIC

Completion in March 2019

Part of the UK Collaboratorium for Research in Infrastructure and Cities - UKCRIC

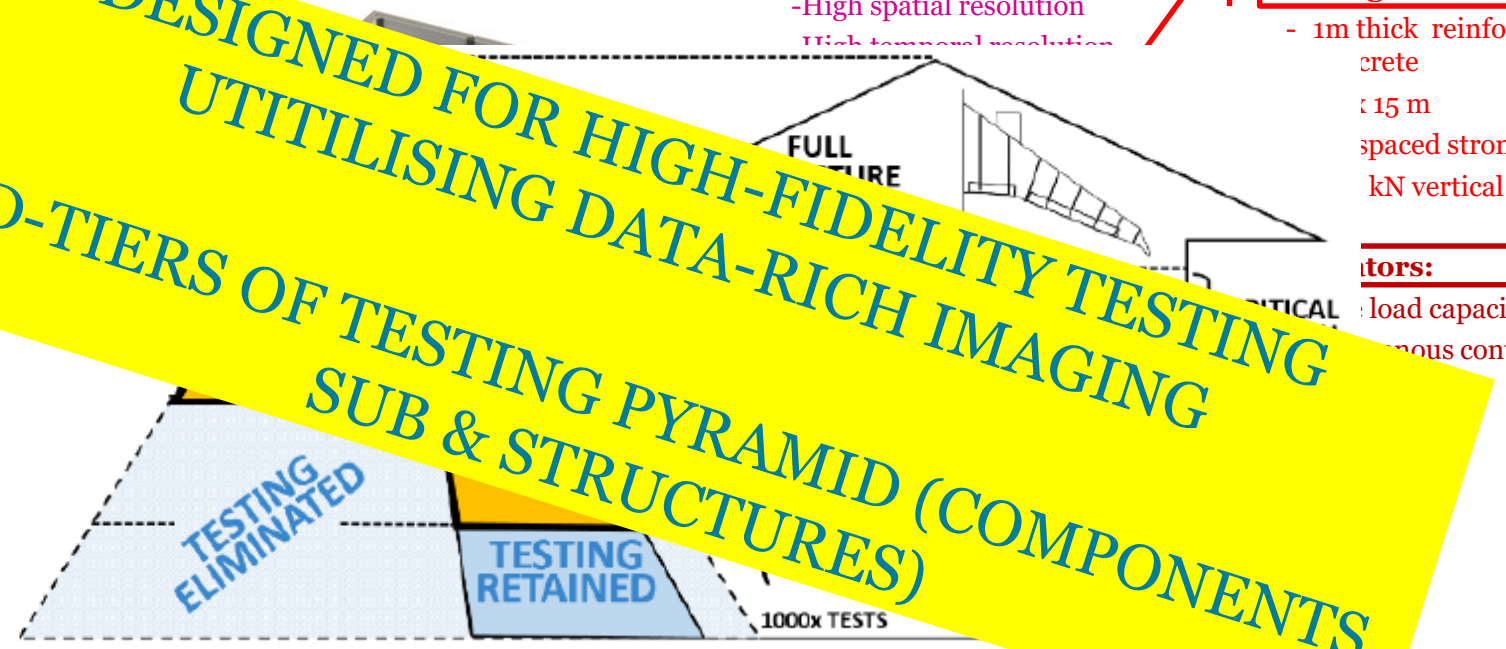
Multi-scale materials and stru[illegible]es testing centre: Str[illegible]

Imaging Systems
-Full-field data
-DIC
-TSA
-High spatial resolution
-High temporal resolution

Strong floor
- 1m thick reinforced [illegible]crete
- [illegible] 15 m
- [illegible]spaced strong points
- [illegible] kN vertical 250 kN

[illegible]tors:
- [illegible] load capacity
- [illegible]nous control

Hydrau[illegible]
- 1000 l[illegible]
- Large
- High l[illegible]
- 'Plug a[illegible]
- Complex loading



DESIGNED FOR HIGH-FIDELITY TESTING
UTITILISING DATA-RICH IMAGING
MID-TIERS OF TESTING PYRAMID (COMPONENTS, SUB & STRUCTURES)

New research project

- Programme Grant, funded by EPSRC (£6.9M over 5 years) to address the barriers to the design and manufacture of future composite aerostructures
- Led by University of Southampton (PI: Professor Ole Thomsen), working closely with the Universities of Bristol, Bath and Exeter, as well as industry partners
- The Programme Grant is titled 'Certification for Design: Reshaping the Testing Pyramid (CerTest)' and seeks to redefine the so-called 'testing pyramid', which is the backbone of current validation and certification processes

Acknowledgements

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