BESPOKE RESEARCH AND CONSULTANCY FROM HSE

Shared Research Project

Industry learnings from decommissioned composite repairs in safety-critical applications

The recent decommissioning of a series of safety critical composite repairs provides a unique opportunity to improve our knowledge of long-term performance and integrity management. As such, HSE is seeking co-sponsors to fund a project focused on Engineered Composite Repairs (ECR2).

In 2020, a Shared Research Project (ECR1) sponsored by HSE, operators and repair suppliers was completed. ECR1 focused on a number of key areas such as: quality assurance and integrity management; inspection; in-service performance; and human factors. This resulted in the release of an industry-leading Good Practice Guide.

Whilst ECR1 represented a significant step forward, both HSE and industry recognise that there are still knowledge gaps associated with the long-term integrity of composite repairs.

ECR2 will seek to build on the learnings of ECR1 through a detailed evaluation of recently decommissioned repairs from a safety critical application.

The proposed project offers a rare opportunity to study the safety critical offshore application of carbon fibre reinforced plastic (CFRP) ECRs. The repairs were applied to a high pressure (90 bar) 30" diameter line and remained in service for over 10 years. The project aims to further our understanding of the lifecycle management of such repairs, including a more informed decision-making process and optimised approaches to initial and ongoing integrity, ultimately resulting in fewer failures and reduced downtime.

Overview of Technical Work Packages

This shared research project will be delivered as a series of distinct but interrelated work packages. The specific details will be defined and agreed on a collaborative basis via the steering committee. The work will be led by scientific and engineering specialists at HSE supported by their regulatory colleagues, using sub-contractors where appropriate.

Work Package 1: Lifecycle Management and Quality Assurance

The aim of this work package is to review documentation / data to identify key milestones and lessons learned from a repair lifecycle perspective.

It is envisaged that this will include:

- understanding the rationale for the installation of the repairs;
- the associated decision-making processes employed and the repair design considerations;
- installation aspects including QC/QA;
- in service inspection (initial and ongoing integrity management);
- decommissioning.

Deliverables

- Report providing summary for each repair – identification of areas of interest for future analysis / empirical work.
- Report that outlines, in the form of a case study, the process from initial degradation to decommissioning – from a lifecycle perspective.

Work Package 2: Inspection and Non-Destructive Testing

The aim of this work package is to trial non-destructive testing techniques with a view to establishing their capabilities and limitations.

Non-destructive testing techniques will be trialled with a view to establishing the condition of the substrate, bond and laminate at key locations. The NDT techniques employed in the trials will be pre-selected, informed by any in-service NDT performed (WP1) and the good practice guide from ECR1.

Samples will be selected according to NDT indications and the repair quality examined at points where there are geometries to incorporate.

The opportunity also exists to consider the incorporation of artificial defects on the inner bore, widening the scope for trials to be conducted for the detection of internal mechanisms.

Deliverables

- Report providing summary of NDT findings and their comparison with actual measurements post sectioning and from in-service data.

Work Package 3: Durability and Residual Property Assessment

The aim of this work package is to undertake destructive testing to establish residual properties.

The decommissioned repair samples will be assessed, and an experimental programme developed. Comparing as-received test data with qualification test data and against newly manufactured repair samples will permit residual properties to be established.

The focus will be the repair system, with particular emphasis on laminate properties and adhesion performance.

Deliverables

- Report outlining the remnant properties of the installed repair system and context of any observed property loss compared with qualification data and / or results from newly manufactured repair samples.

Work Package 4: Key Learnings and Dissemination

The aim of this work package is to identify the key learnings from Work Packages 1 - 3 and prepare project dissemination outputs.

The key learnings from the technical work programme (Work Packages 1-3) will be identified and collated.

Key learnings will be presented both in the form of a case study of the project as well as the preparation of a more detailed annex to the Good Practice Guide from ECR1.

Deliverables

- Case Study
- An annex to the Good Practice Guide

PRICE AND PROJECT DURATION

The total funding required for this shared research project is estimated to be £500k depending on the exact scope of work. It is therefore anticipated that with financial support from HSE, each sponsor would need to contribute £50k over 2 years (£25k pa). The project is anticipated to commence in Q3 2024 and take 24 months to complete.

For further details, please contact Chris Scales: +44 7799 071959 or christopher.scales@hse.gov.uk

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