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Capability Project

Report on the analyses of component testing and the algorithms correlating tag position before and after blast event

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ABBREVIATIONS AND ACRONYMS

ABBREVIATION	DESCRIPTION
2D	Two-dimensional
3D	Three-dimensional
CompB	Composition B
C-J	Chapman-Jouguet
CSCM	Continuous surface cap model
FE	Finite element
FEA	Finite element analysis
FSI	Fluid structure interaction
HE	High explosive
I	Impulse density
JWL	Jones-Wilkins-Lee
N/A	Not applicable
P	Pressure
PCCDN	Post crisis needs assessment tool in regards to construction damage and related needs
PETN	Pentaerythritol tetranitrate
RDX	Research department formula X (i.e. Cyclotrimetylenetrinitramine)
SOAP	Simple object access protocol
TNT	Trinitrotoluene

EXECUTIVE SUMMARY

This document is the first deliverable 'D3.1' of work package 3 in the RECONASS project, and it contains a description of the simulations performed to estimate blast impact on two different structures, as well as, a comparison of these results with experimental results obtained within RECONASS. The purpose of this work is to validate the simulation methodology, and also draw conclusions to be better prepared for the full scale final test of the RECONASS system.

In the work presented here, non-linear finite element (FE) simulations have been performed to analyse the response of the tested single members and a multi-node structure subjected to air blast. These were performed to determine the blast loads and the structural displacements prior to the model scale component testing. The FE simulations predicted the response of the components used in the model scale test with a good agreement, both regarding deformations and failure modes.

Simulations of the blasting of high explosives have been performed to predict the blast load on two types of structures. Structural analyses were then performed to predict the response of the reinforced concrete components to these blast loadings, for the instrumentation and setup of model scale tests.

The FE analyses have been verified by comparison with the obtained results from the model scale air blast high explosive testing of the reinforced concrete components. The FE analyses predicted the failure modes for the concrete structures. However, the magnitudes of the displacements were overestimated for the analyses of the slabs with three supports, and underestimated the deformations for reinforced concrete frame. Overall best performance was obtained for the FE analyses of the reinforced concrete frame, with a good agreement between the results from the component tests and from the FE analyses.

The results from the model scale reinforced concrete component testing, and the presented FE analyses, provide data for a reliable design of the setup for the full scale structural testing of the planned as the final test of the RECONASS system.

As an additional and separate task in this report, the development of algorithms correlating tag position before and after blast event have also been performed.