PROJECT TITLE: Novel metaconcrete against blast and impact loads

FIELD OF RESEARCH CODE: 0905

PROJECT SYNOPSIS:

With rising prevalence of terrorist attacks, accidental explosions and traffic collisions around the world, engineering structures are vulnerable to damages or failures from impulsive loadings, leading to significant economic losses and casualties. Therefore, achieving safer and more reliable mitigation strategy to protect critical civil structures and personnel are essential. Current designs are mainly based on enhancing the structural strength and ductility, which always lead to substantial increases in construction costs and bulky structures.

This project intends to employ the concept of wave stopping to make engineered metamaterials, which is a synthetic composite material exhibiting properties not usually found in natural materials, for innovative designs of structures to resist impulsive loads acting on the
structure. It uses the wave stopping characteristics to mitigate dynamic loading effects instead of increasing the structural strength and dimension to enhance the impulsive loading resistance. The novel designs will be proposed and numerical/experimental studies will be performed in this project to demonstrate the feasibility and effectiveness of the proposed metaconcrete. The project will lead to effective designs of structures to resist impulsive loads, resulting in robust and safer structures.

**FEASIBILITY AND RESSOURCING – DESCRIPTION OF THE SUPPORT THIS PROJECT WILL RECEIVE:**

The supervisory team including ARC Laureate Fellow and DECRA Fellow has extensive research experiences in structural dynamics, blast and impact engineering and will provide advice and research strategy on the project. The Structural Dynamics Lab at Curtin is equipped with all the standard structural testing equipment plus some specific dynamic testing facilities including four shaking tables, Long-Stroke actuators, two 100 mm SHPBs, pendulum impact test system and two high-speed cameras etc. The commercial software ANSYS, LS-DYNA, ABAQUS are also available for numerical simulation. The project is expected to finish in three-and-half years.

**THE SIGNIFICANCE OF THE PROJECT/ PROGRAM FOR THE ENROLLING SCHOOL OR INSTITUTION:**

The topic of the project falls into the research area of structural dynamics, which is the foci and strategic area of the School of Civil and Mechanical Engineering as well as Research Centre for Infrastructure Monitoring and Protection (CIMP). The project combines fundamental and applied researches. It will ensure the school is at the forefront in the research area of structure protections against impulsive loads, attract more local students devoting the cutting edge technologies, and maintain Civil Engineering discipline at "4" or pursue "5" in ERA ranking.

**PROJECT LEAD CONTACT:**

Name: Wensu Chen  
School: School of Civil and Mechanical Engineering  
Faculty: Science and Engineering  
Email: Wensu.chen@curtin.edu.au  
Contact Number: 08 9266 9468