

LOAD REDISTRIBUTION AND PROGRESSIVE FAILURES OF BATTEN TO RAFTER CONNECTIONS UNDER WIND LOADING

Korah Parackal

Cyclone Testing Station, James Cook University, QLD

AS-BUILT SINGLE NAILED BATTEN TO RAFTER CONNECTIONS WERE TESTED UNDER FLUCTUATING DYNAMIC LOADS DETERMINED FROM A WIND TUNNEL STUDY. USING CONNECTION TESTING DATA, NON-LINEAR TIME-HISTORY STRUCTURAL ANALYSIS WAS PERFORMED ON A SECTION OF A ROOF TO CAPTURE THE EFFECTS OF LOAD SHARING AND REDISTRIBUTION DURING NAIL SLIPS AND PROGRESSIVE FAILURES.

- ▶ Batten to rafter connection are vulnerable to failures under wind loads and are a common failure mode seen in damage investigations.
- ▶ Light framed timber roof structures are complex and as connections weaken or fail, loads are redistributed to neighbouring connections, potentially overloading them and causing a cascading or progressive failure to initiate.
- ▶ This study aims to understand the load redistribution and progressive failure mechanisms of these connections under wind loads
- ▶ Outcomes of this work include developing improved fragility curves and cost effective retrofitting methods that prevent failures from propagating.



Batten to rafter failure caused by Tropical Cyclone Marcia



Fig1. Wind tunnel model and recorded load fluctuations

■ Connection samples are tested under fluctuating loads



Fig2. Connection testing apparatus and connection response

■ Time history analysis is performed using wind tunnel data

■ Testing data are used to create virtual connections in a structural analysis model

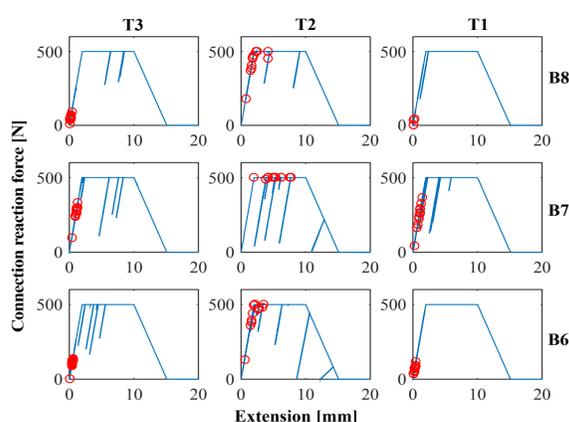


Fig4. Force-displacement behaviour of connections in the model showing nail slips and load redistribution

■ Model outputs include load sharing and progressive failure information

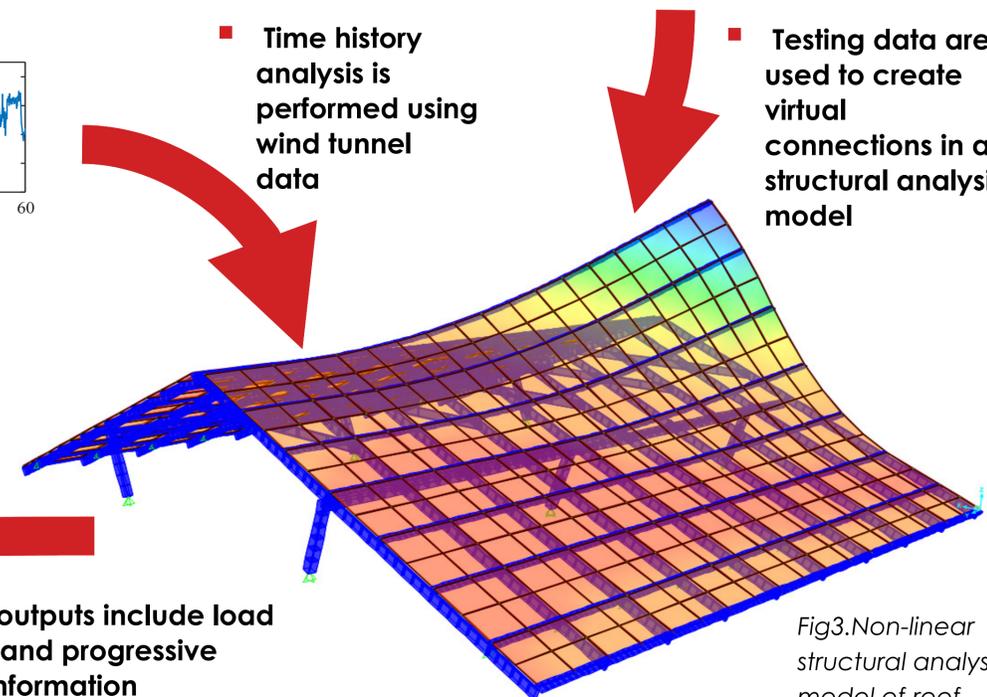


Fig3. Non-linear structural analysis model of roof structure

