RepaiRed Reinforced Concrete Walls and Lower-Damage Modifications

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Introduction:
As a result of the Canterbury earthquake, over 90% of the concrete buildings in the Christchurch Central Business District have been demolished. This experience has highlighted the need to provide guidance on the residual capacity and repairability of earthquake-damaged concrete buildings. Experience from 2010 Chile indicates that it is possible to repair severely damaged concrete elements (see photo at right); although limited testing has been performed on such repaired components. The first phase of this project is focused on the performance of two lightly-damaged concrete walls that are being repaired and re-used after damage sustained during previous testing.

Tensile Testing of Reinforcement Connections:

Failure did not occur at weld; except for lap splices.

Damage after testing
Hydro demolition of concrete
Removal of existing reinforcement
Reinforcement of new reinforcement
Reinforcement of new reinforcement

Performance of Original Walls:

Test Results (Wall R1):

Damage after testing
Hydro demolition of concrete
Removal of existing reinforcement
Reinforcement of new reinforcement

Repair of Wall R2 (ongoing):

Cross-Section of Wall R1 and R2:

Next steps:
- Concrete reinstatement
- Crack injection

Test Setup:
- Axial load = 0.035A₀
- Shear span ratio (b/h) = 2.1
- Reversed-cyclic testing protocol same as original walls

Ongoing/Future Study – Modelling of Lower-Damage Concepts:
Goal: Explore simple modifications of conventional designs to reduce damage and improve repairability after significant earthquakes.

Repair of Wall R1:

- Hydro demolition of concrete
- Removal of existing reinforcement
- Reinforcement of new reinforcement

Cross-Section of Wall R1 and R2:

Test Results (Wall R1):

Lateral Drift (%)

Damage Modifications:
- Tension longitudinal bars around critical
- Compression horizontal bars around critical
- Reinforced bar buildings involved

Service-critical wall:
- Compression controlled wall:
- Load on column adjacent to wall to induce
- Boundaries columns carry gravity load
- Boundary element
- Critical section
- Shear wall carries lateral load

Acknowledgements: