

Prioritisation strategy for seismic retrofitting of reinforced concrete buildings in Australia

Research aims

Developing a methodology, specifically suited for Australian buildings, for the evaluation and prioritization of existing vulnerable RC buildings, in order to propose suitable cost-effective retrofitting strategies.

Three-tiered methodology

The methodology will provide significant time-savings in the vulnerability assessment of RC buildings. Retrofitting Strategies will be proposed for the different vulnerable buildings identified

Research significance

The development of simple framework to assess the potential risk and identify the need of retrofitting for the existing RC buildings in Australia. Rapid seismic evaluation of existing Australian RC buildings, as performing detailed nonlinear analysis is computationally expensive when a large amounts of buildings need to be assessed.

Proposed future application

In addition, it can be used as a preliminary study for the development of Australian seismic evaluation and retrofit standards of the existing RC buildings

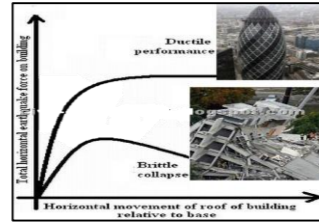


Figure 1: Earthquake loading vs Displacement graph for a ductile and limited ductility building

Vulnerable features : Category B	
High axial load	Inadequate load path for mezzanine structure
Undersized column	Deterioration of structural materials
Shear critical failure column due to low aspect ratio	Inadequate redundancy of seismic-force-resisting system
Non-ductile detailing	Redundancy of seismic-force-resisting system
Vertical irregularities	Inadequate foundation dowels for the RC wall
Onerous site class D or E	Topping slab with less than 65mm thickness
Horizontal irregularities	

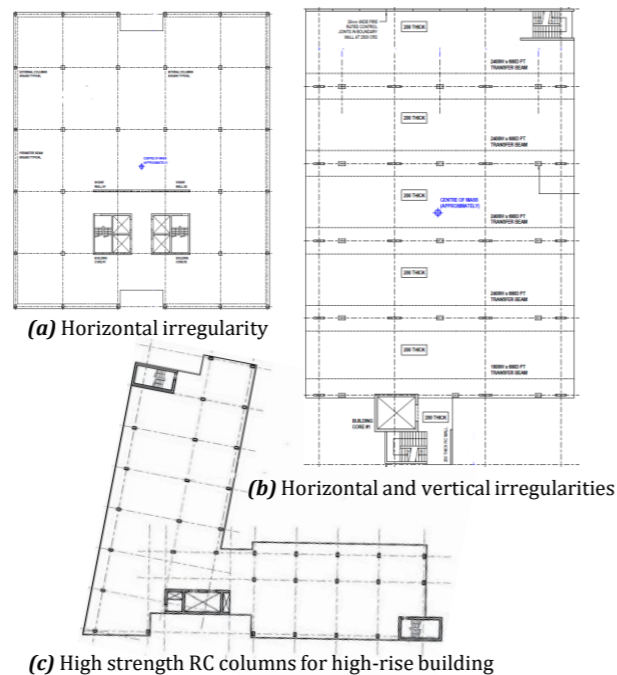
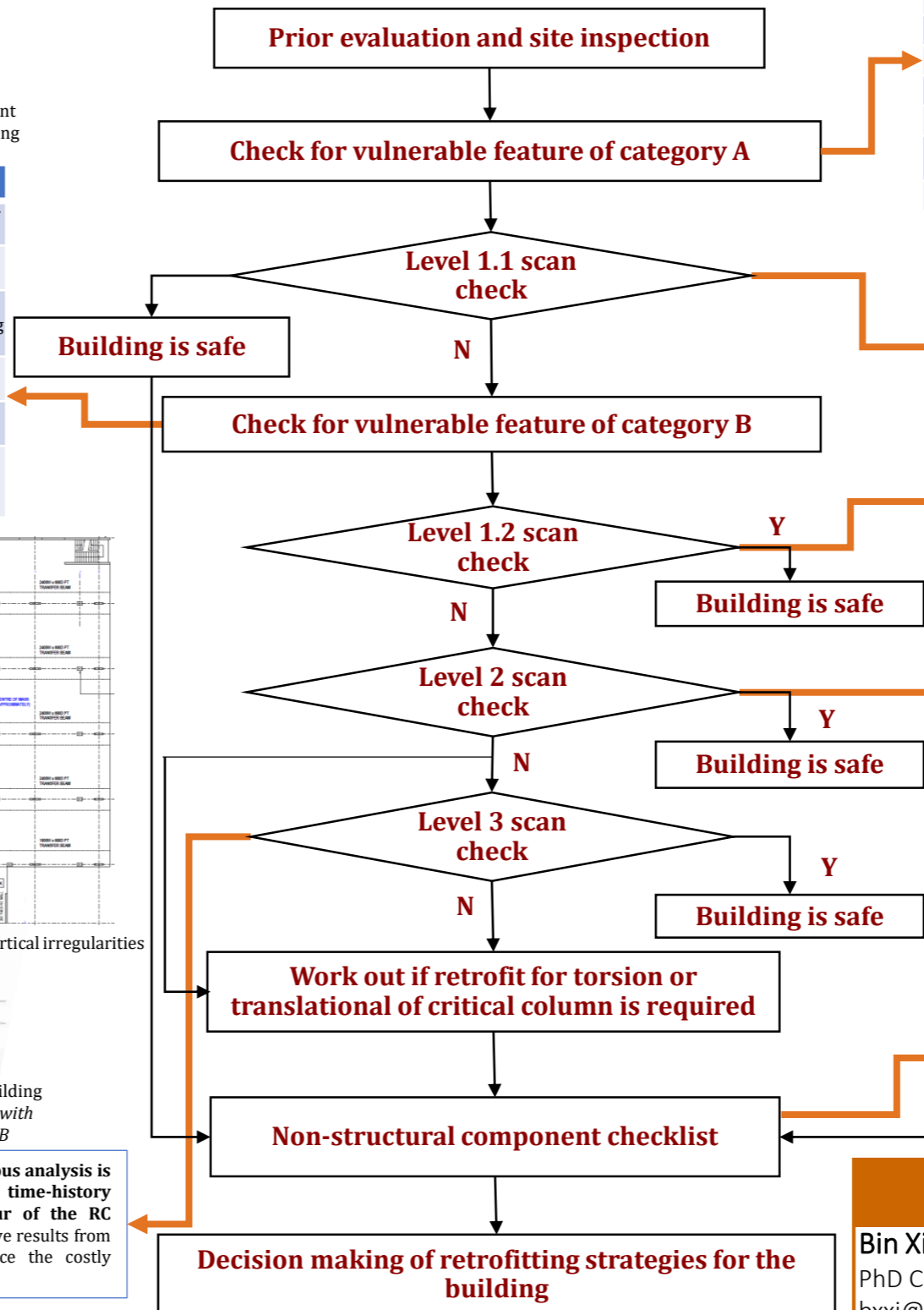


Figure 4 (a,b,c): Example building plans with vulnerable features of category A and B
If the building does not pass level 2 check, rigorous analysis is required such as pushover or dynamic time-history analysis based on the non-linear behaviour of the RC building. This process is to check the conservative results from the level 2 scan check to significantly reduce the costly retrofitting.

Proposed flowchart for Assessment Framework



Vulnerable features : Category A
Improperly braced building frame including frame with soft or weak-storey
Fragile structural wall
Unsecured or unfilled floor support
No clear distance of setback
Lack of structural load path
Inadequate wall anchorage
Geohazards including liquefaction, slope failure, and surface fault rupture
Hollow-core floors



Figure 2: Soft storey building

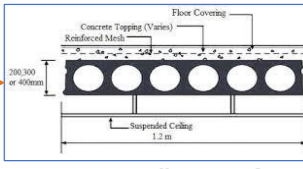


Figure 3: Hollow-core floor

Building height range	Acceptance criteria
Building height up to 8m	No features of category A
Building height up from 8m to 50m	Building with adequate bracings and not features of category A (symmetric building plan with minimum two major core walls and clear distance between two major core walls to be approximately width of the building)
Building height more than 50m	Buildings with adequate lateral bracings and no features of category A

Identify if there are any category A features and more than one category B feature. The check may require simple hand calculations.

Conservative check, including calculations to identify deficiencies found in Level 1 scan: torsional stiffness, eccentricity, and earthquake demand by applying linear elastic analyses such as generalized force method (GFM) or linear elastic dynamic analysis in accordance with AS1170.4.

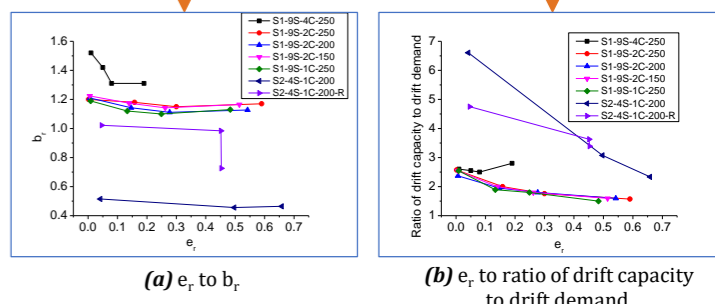


Figure 5 (a, b): Example of analysis results from level 2 scan check

Non-structural components checklist		
Partitions	Masonry veneer	Contents and furnishings
Ceilings	Parapet, appendages	Mechanical and electrical equipment
Light fixtures	Masonry chimneys	Piping
Cladding and glazing	Stairs	Ducts

More Information

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