Managing earthquake risk

Unreinforced Masonry Building Database

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Overview

→ Objective

- To create a geospatial database of unreinforced masonry (URM) buildings

→ Key Stakeholders

- Emergency management sector (QFD, SAPOL, DFES, FRS, GA)

→ Scope

- Nationwide
- Higher implied risk (population centres, older buildings,…)
- Advanced technologies (AI)

→ Expected outcomes

- Tools for risk mitigation through emergency preparedness and planning

Risk factors

→ Hazard

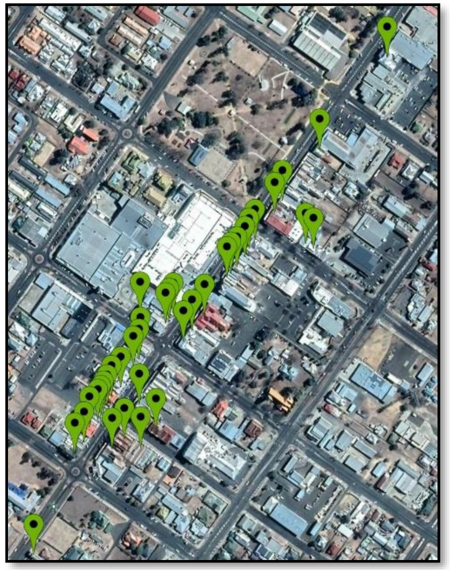
- Every 10 years one M6+ earthquake
- Potential for extensive building damage, e.g. 5.6 ML in Newcastle 1989

→ Exposure

- URM Concentration in town centres
- Heritage value, business activity

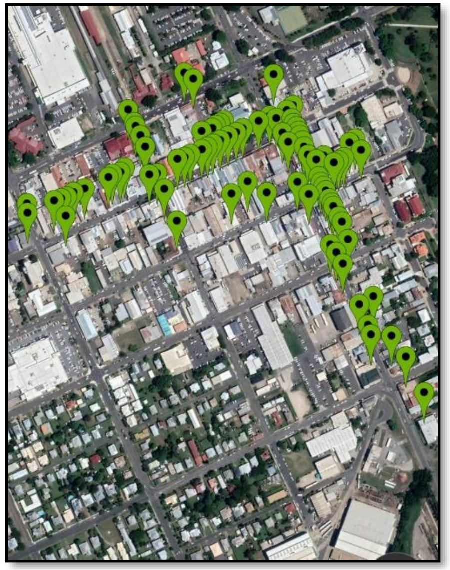
→ Vulnerability

- Lack of seismic design
- Low tensile strength



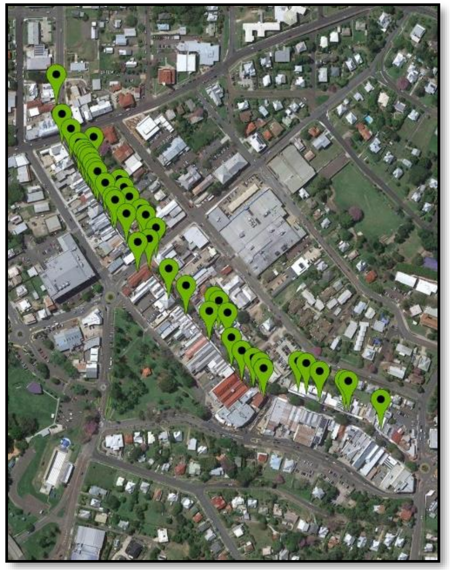
Warwick, QLD
Established: 1850

Toowoomba, QLD
Established: 1849

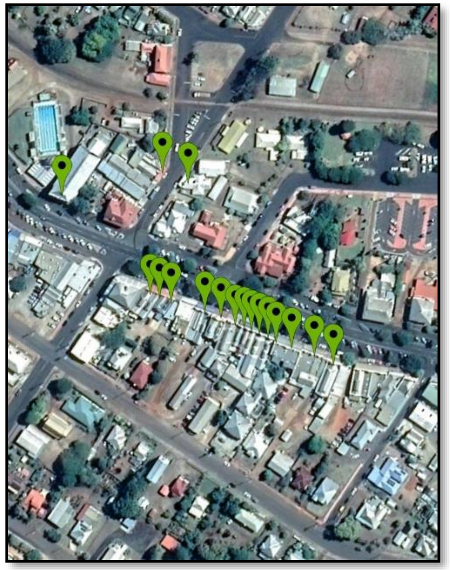


Maryborough, QLD
Established: 1847

Ipswich, QLD
Established: 1843



Gympie, QLD
Established: 1867

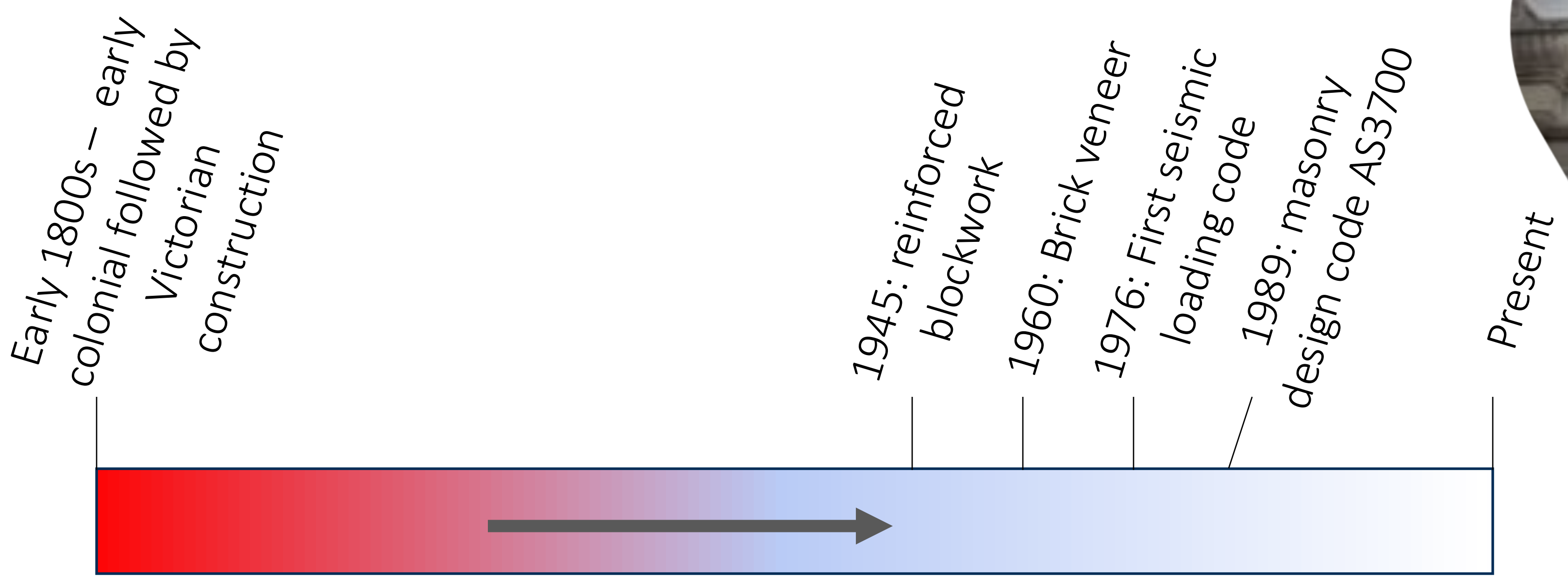


Childers, QLD
Established: 1885

Masonry as building material

→ Legacy buildings

- High-risk architectural styles (e.g. roof-top cantilevers, pediments, figurines, turrets)
- Earthquakes were not understood well



Greater understanding of seismic risk; development of new building types; design codes

Building typologies

URM 1: Single storey residential houses

URM 2: 2-storey pubs

URM 3: 1-storey row buildings

URM 4: 2-storey commercial buildings

URM 5: 2-storey post office buildings

URM 6: 2-storey bank building

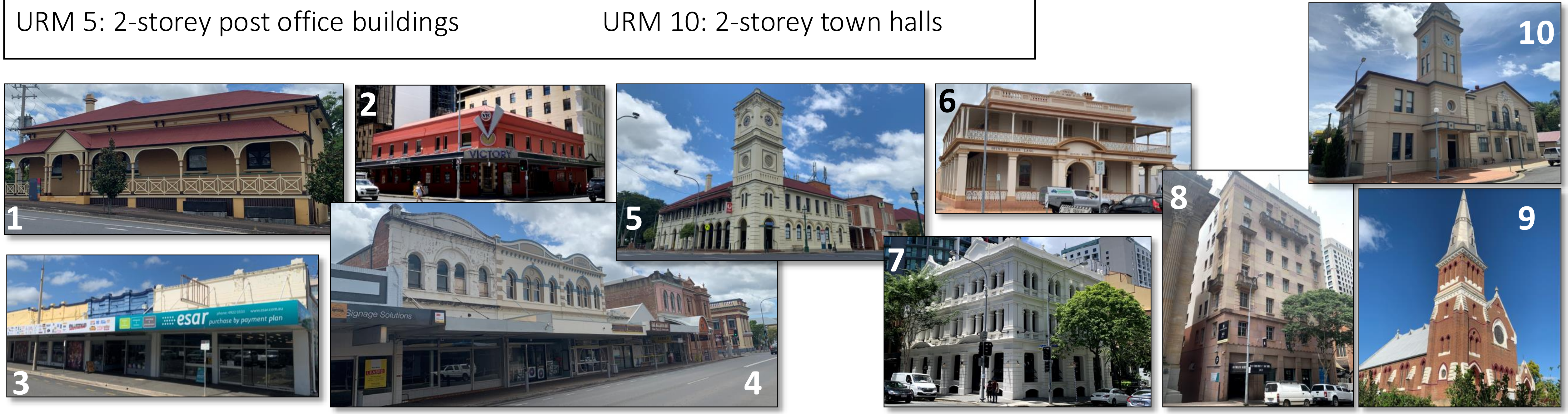
URM 7: 3-5 storeys commercial

URM 8: 6+ storey buildings

URM 9: Church

URM 10: 2-storey town halls

Possible other typologies for newer buildings subject to detailed scoping (ongoing)



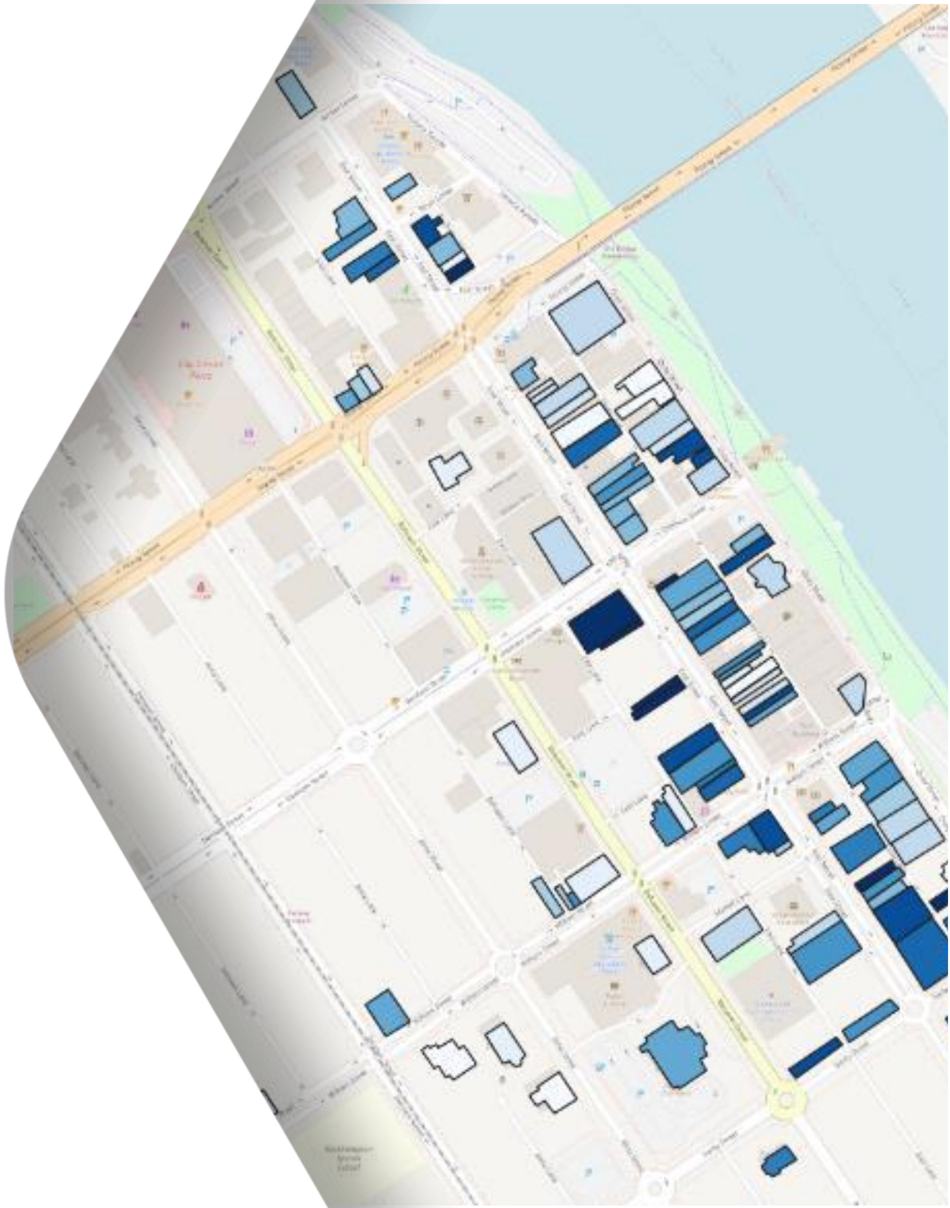
Gaps and Methodology

→ Previous studies and Gaps

- Foot surveys: Queensland study, GA/Adelaide BNH-CRC (Project A9) study
- No consistent national database

→ Methodology

- Based on computer vision
- Using Google Street Views (GSV) as data source
- Training of convolutional neural networks (CNNs) and application for façade detection
- Satellite views linked to façade views to identify building footprints
- GIS representation



Computer vision detection

→ Visual aspects that help detection

- Whole of façade view
- Arched windows
- Raised parapets
- Ornamental details

→ QUT computer vision team

- AI Training, detection, and quality controls

Arched windows

Ornamental details

Variation in building appearance, 1

Bundaberg, QLD

Childers, QLD

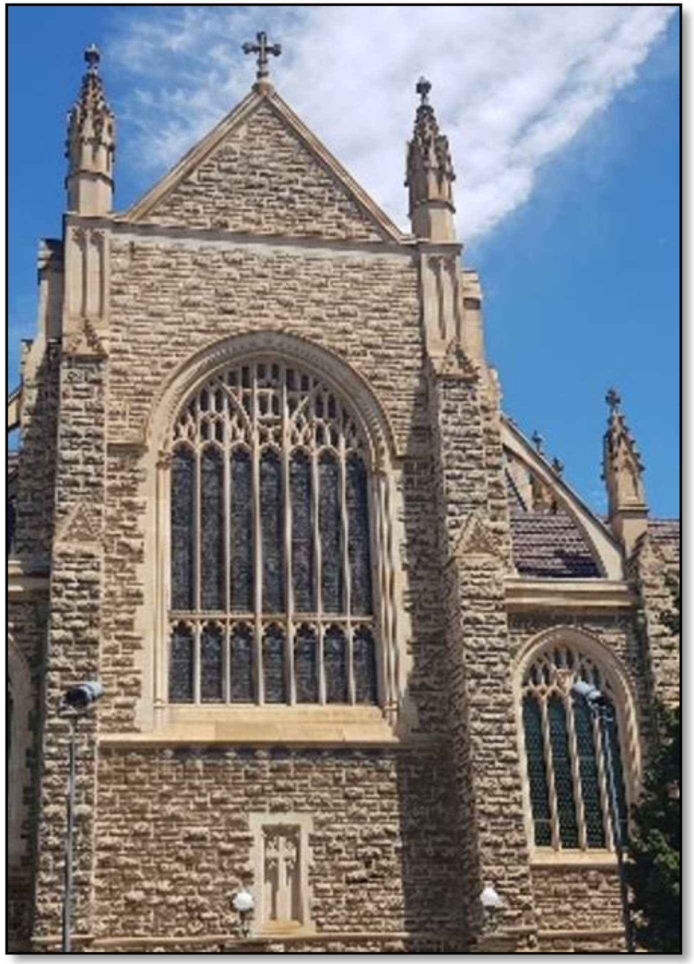
Gympie, QLD

Enmore, NSW

Newtown, NSW

Paddington, NSW

Variation in building appearance, 2

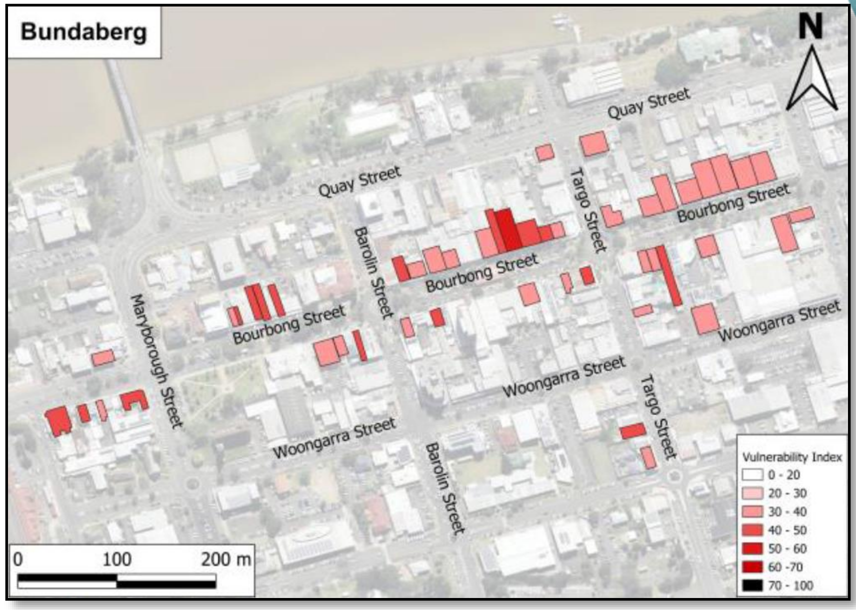


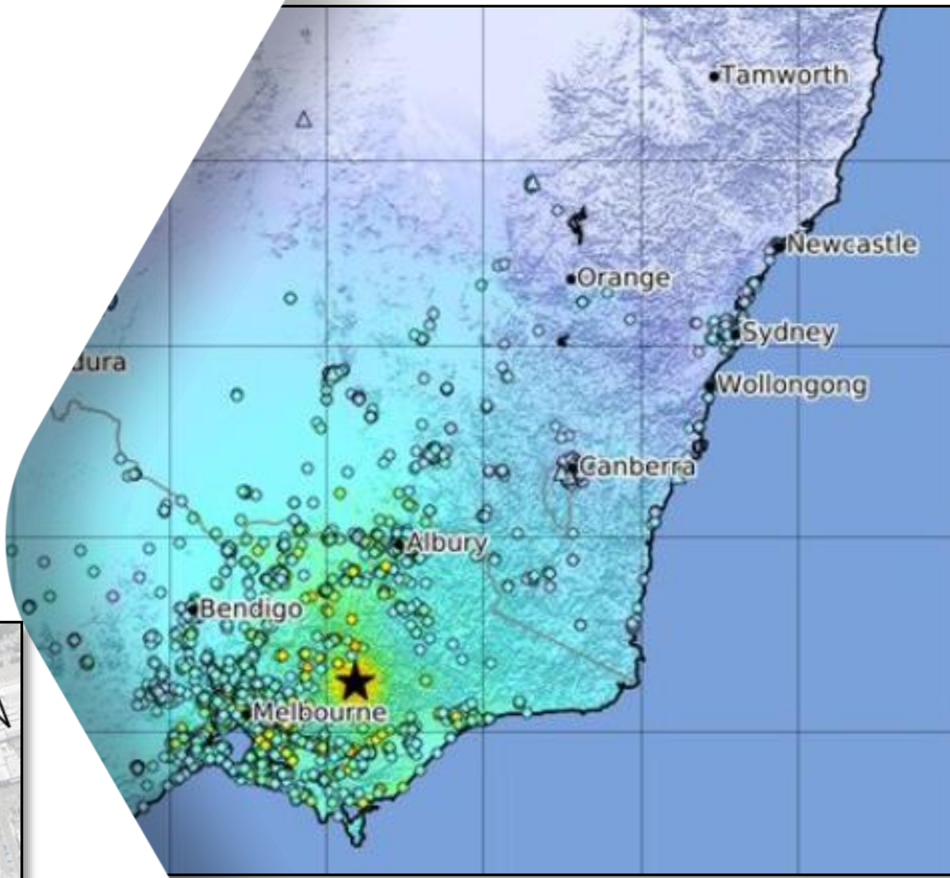
York, WA

Stakeholders and Impact

→ Emergency services (Key Stakehodlers)

- Utilisation projects for pre-event preparedness and training
- Data libraries integrated with hazard reports, e.g. ShakeMap
- or Impact reports (FeltGrid) ➔ to enhance post-event recovery efforts





ShakeMap generated by the 22 September 2021 Woods Point earthquake (Geoscience Australia 2021)

Stakeholders and Impact

→ State/local governments

- Comprehensive URM building exposure dataset
  ==> Risk-informed policy development

→ Researchers

- Foundation for further seismic research and
  retrofit strategies

Betty's Burgers Building damage in Woods Point earthquake; Credits: Gemma Bateman

Thank you for your attention!

Support from the NHRA and the Key stakeholders is greatly acknowledged!