



Auckland Art Gallery Toi o Tamaki -
integrating the new with existing heritage

Auckland Art Gallery Redevelopment

Strengthening options

Seismic assessments / non linear time history analyses

Continuum of securing / optimal strengthening / new systems

Auckland Art Gallery assessments

Auckland Art Gallery strengthening solution adopted

Auckland Art Gallery new portions



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Solutions - Strengthening Options

- establish existing strength accurately, to minimise strengthening
- supplement existing system with new elements
- provide total new system
- base isolate to reduce seismic impacts

These are generally in increasing order of cost of solution, and necessity with higher seismicity





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Solutions - Assessments

IEP – very crude
Hand checks
Computer assessments
Earthquake simulation



increasing cost and sophistication
- greater certainty of performance
- identify specific vulnerabilities
- targeted optimal solutions

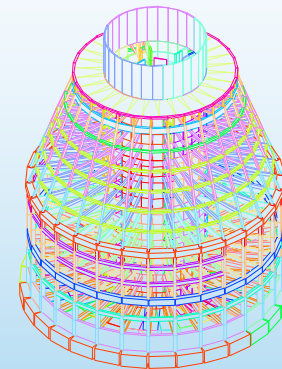




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Solutions - Non-Linear Time History Analysis

- takes a detailed computer model of the existing building
- models stiffness and non-linear material properties
- uses real, appropriate, scaled earthquake records
- applied one step at a time
- effects assessed (damage, stiffness changes)
- next step applied
- uses computer power readily available today





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Solutions - Securing

- Parapet braces / ties
- Chimneys
- Wall to floor connections
- Foundation connections
- Floor / Roof diaphragm plywood overlays / steel bracing



Use the strength of existing + hold together + remove / mitigate major hazards eg out of plane wall failures

Cost effective - minimal requirement for significant improvement



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Solutions - Strengthening

As for securing plus:

- composite overlays to strengthen existing
- concrete shotcrete overlays strengthening
- additional (compatible) structural systems
- “destiffening” measures

Supplement or replace the strength of existing systems

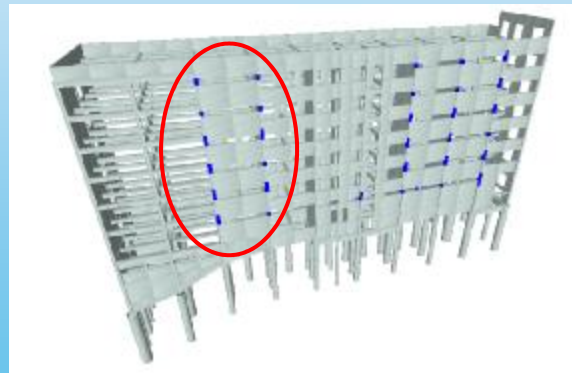
More expensive / extensive / intrusive - greater performance



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Solutions - Optimal Strengthening Strategy

- quantify existing strength as accurately as possible
- identify specific vulnerabilities, if any
- target strengthening directly to vulnerable areas
- use appropriate strengthening systems





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Solutions - New Strengthening Systems

- traditional approach is often to neglect existing strength (hard to quantify) and provide a total new system
- compatibility of new system with existing is critical
- comparative stiffness to existing to be effective
- can also be sympathetic to heritage fabric
eg composites, discretely located strength elements

Balance between degree of strengthening and intrusion



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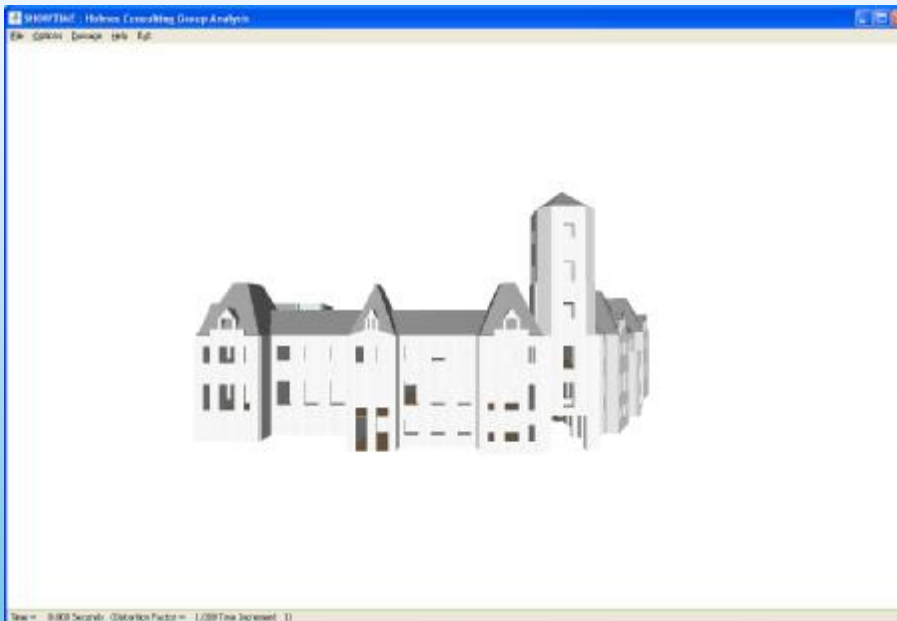
- in area of low seismicity
- existing buildings strengthened to >67% of IL3
- sophisticated analysis of existing heritage buildings for optimal solution
- minimal strengthening - new plywood / metal strap diaphragms, parapets
- preservation of existing heritage fabric



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Auckland Art Gallery, unstrengthened



3 Category I heritage buildings

Kitchener Wing 1887

Wellesley Wing 1913

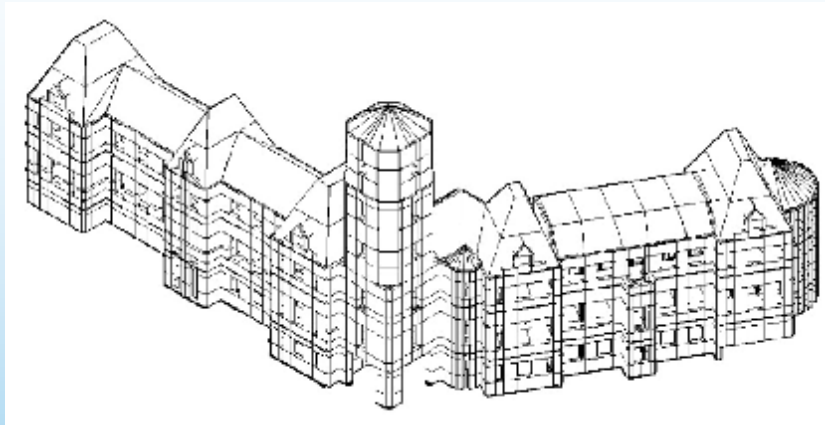
East Gallery 1916

Original seismic assessment in
2000 provided the basis for the
upgrade and refurbishment
project



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sophisticated analysis of the heritage buildings demonstrated existing walls had >67% of IL3 strength, but parapets and roof and floor diaphragms needed strengthening



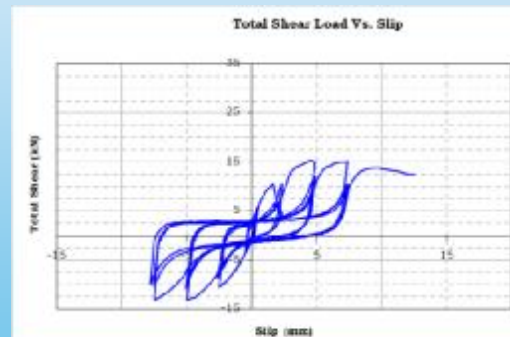


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new plywood / stapled sheet metal blocking diaphragms

- common in US, first application in NZ
- testing undertaken to verify cyclic performance
- ductility of 4 achievable



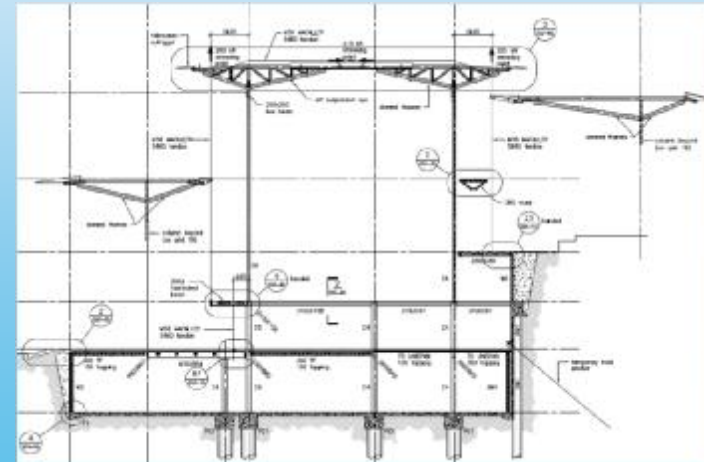
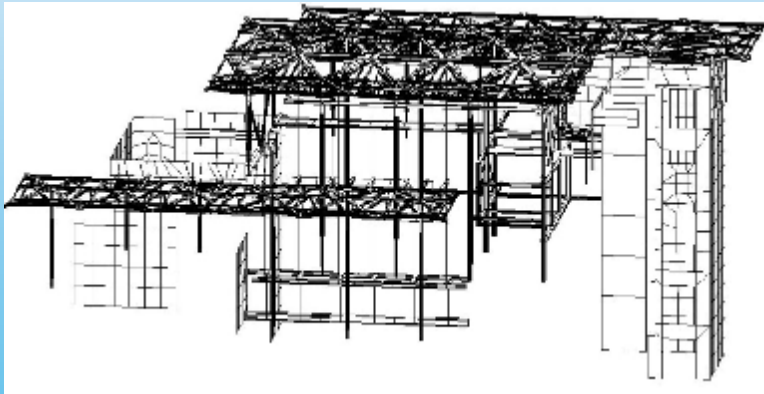


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For the new building portions - something equally special required

- separate from Wellesley and Kitchener Wings
- large hung glass facades / canopies
- fine roof structures
- extremely tight tolerances





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two basement levels excavated
for storage and curatorial space

required careful underpinning of
the existing heritage buildings

East Gallery reinstated to original
form - added floor removed



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fine floating roof with feature kauri ceilings

tensioned cables support the glass façade

additional mezzanine in Kitchener Wing - challenging to fit it



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- complementary high quality spaces
- new and heritage
 - fitting home for fine artworks
 - review of art support / sculptures

