Assessing the performance of base-isolated buildings designed according to the NZ Base-Isolation Guidelines

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CHRISTCHURCH NEW ZEALAND

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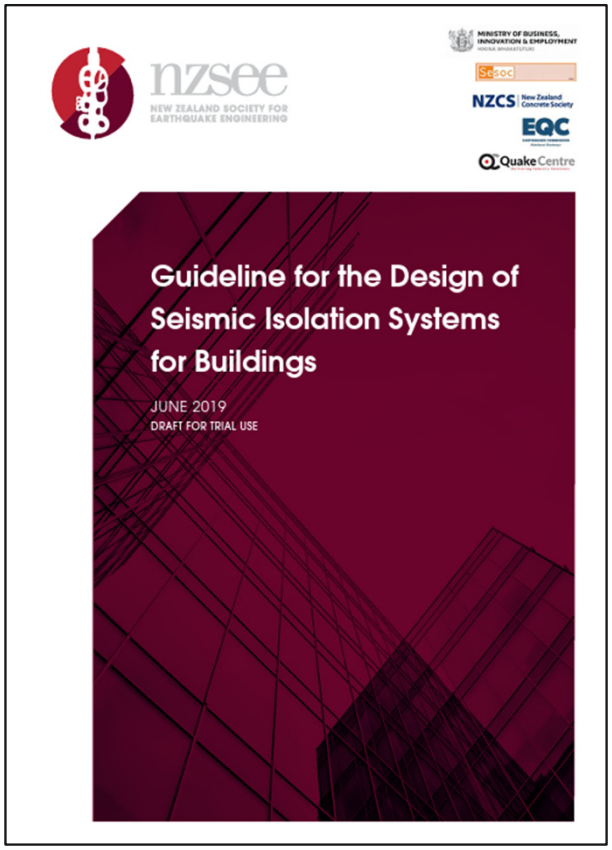
New Zealand base isolation design guidelines

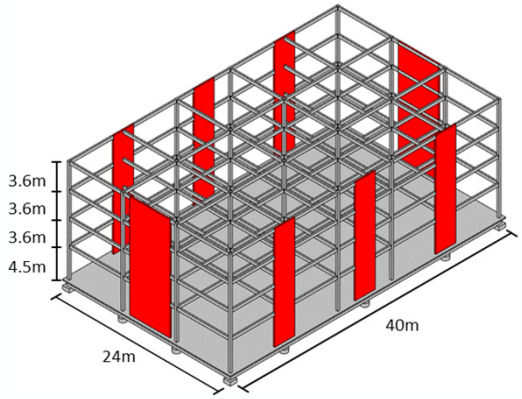


(NZSEE/MBIE, 2019)

1. Compared the performance of the base-isolated buildings with fixed-base buildings

2. Impacts of design parameters:
- Importance level
- Superstructure design ductility

Case study buildings



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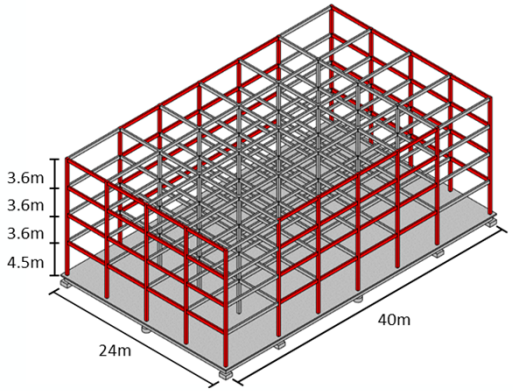


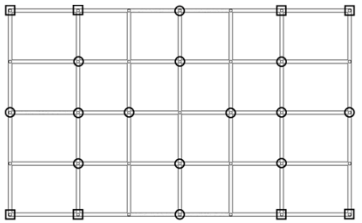
Importance level 2

...

Importance level 4

Fixed-base ×1

Base-isolated ×3 (various ductility)



Numerical model (RC wall superstructure)

Floor

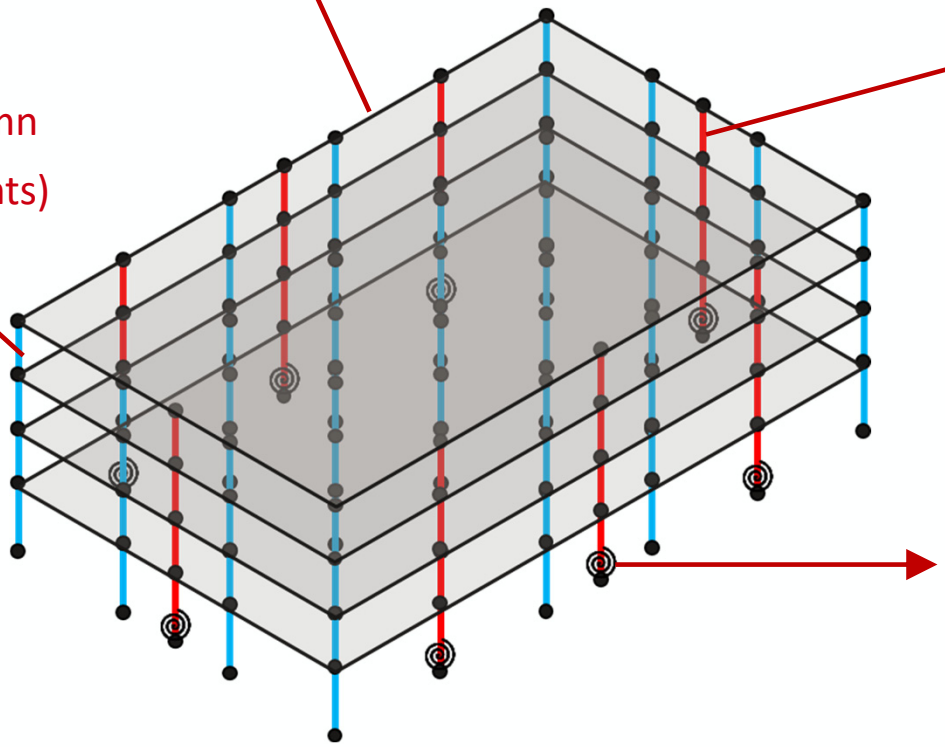
(Rigid diaphragm)

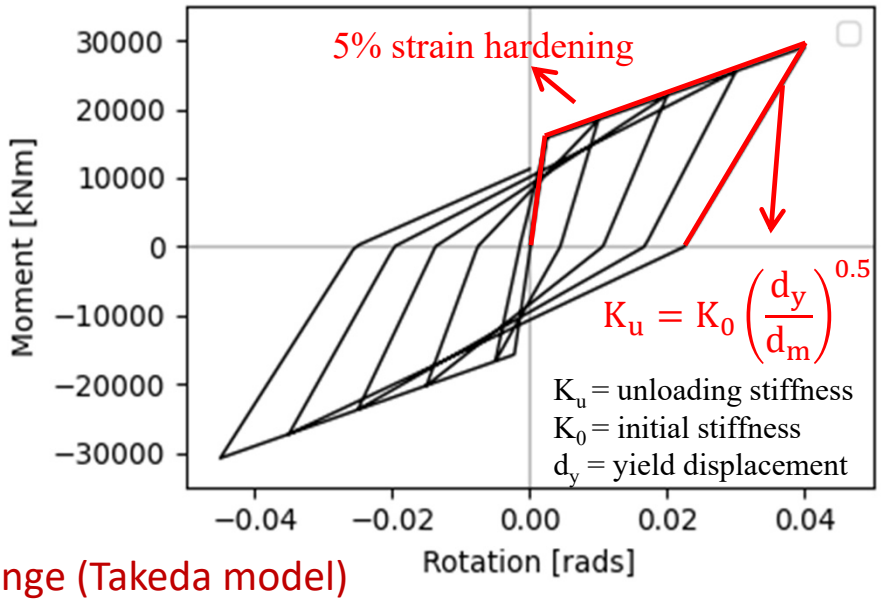
RC wall

(Elastic Timoshenko beams, effective stiffness Priestley et al. 2007)

Gravity column

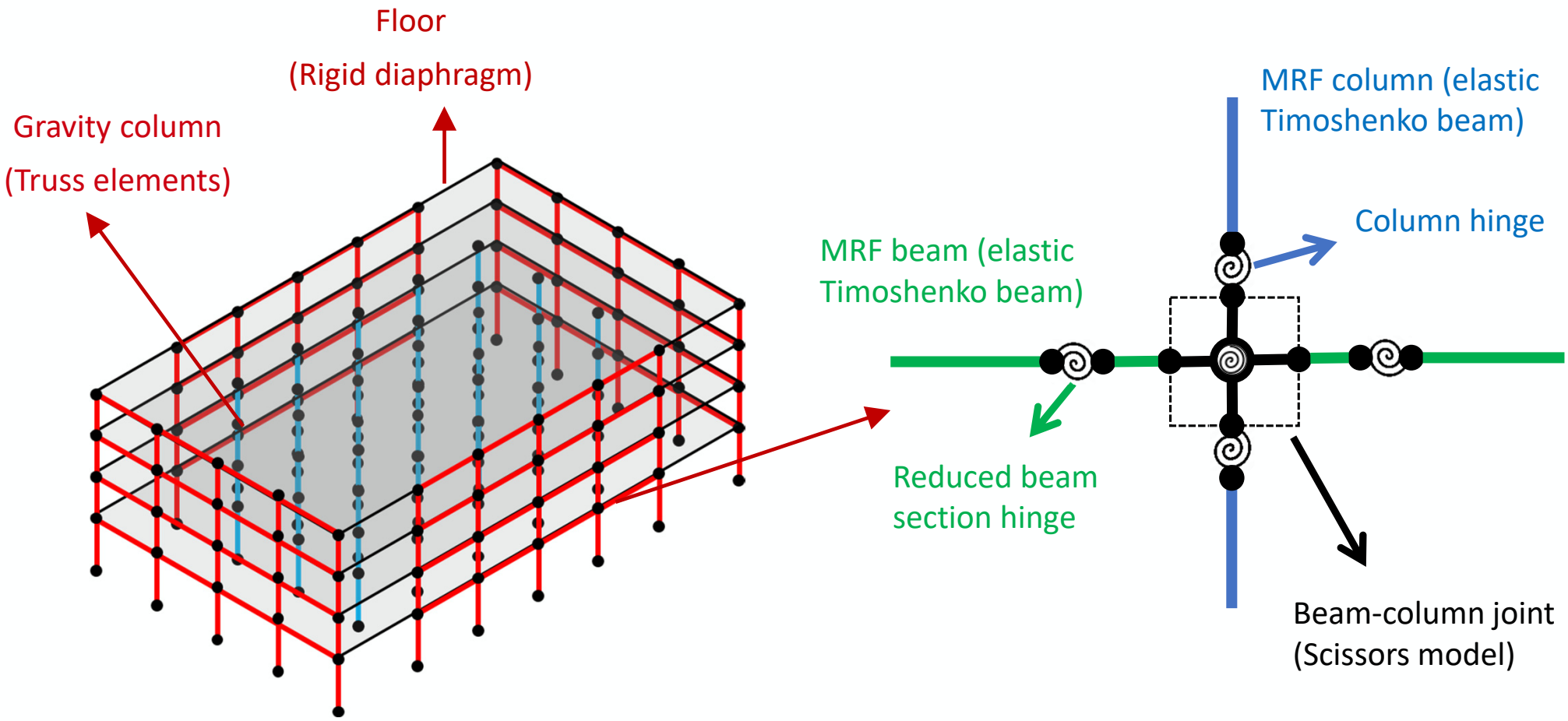
(Truss elements)





Wall hinge (Takeda model)

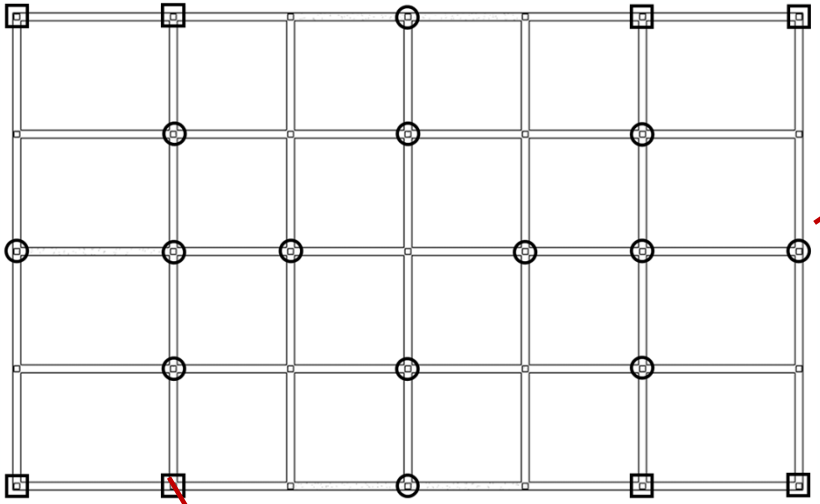
Numerical model (SMRF superstructure)



Numerical model (isolation plane)

Grillage beam

(elastic beams with an effective width from the slab)

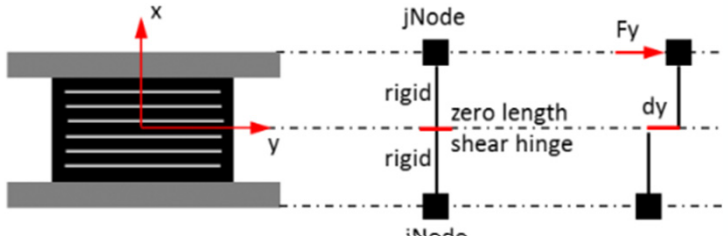


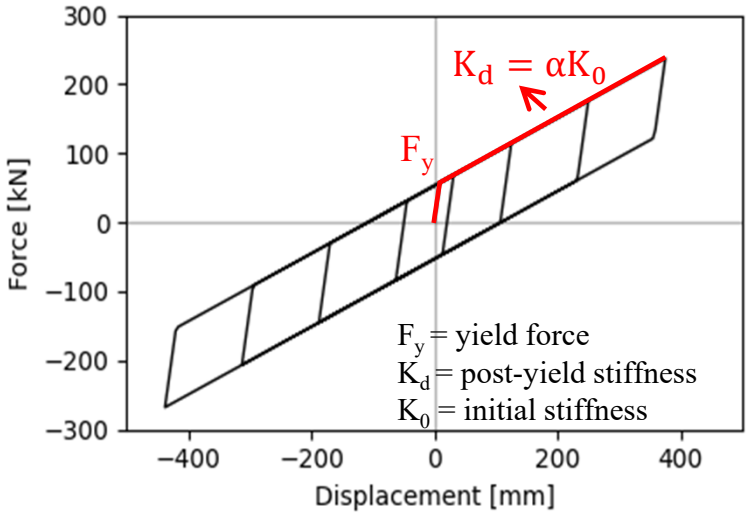
Flat slider

(Coulomb friction model, μ=4%)

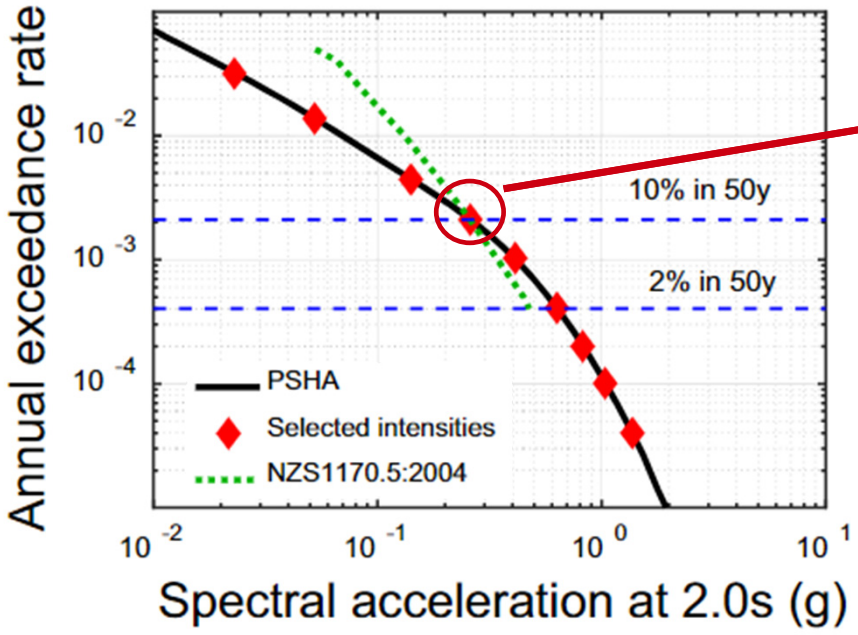
Lead rubber bearing

(Elastomeric Bearing Plasticity Element)

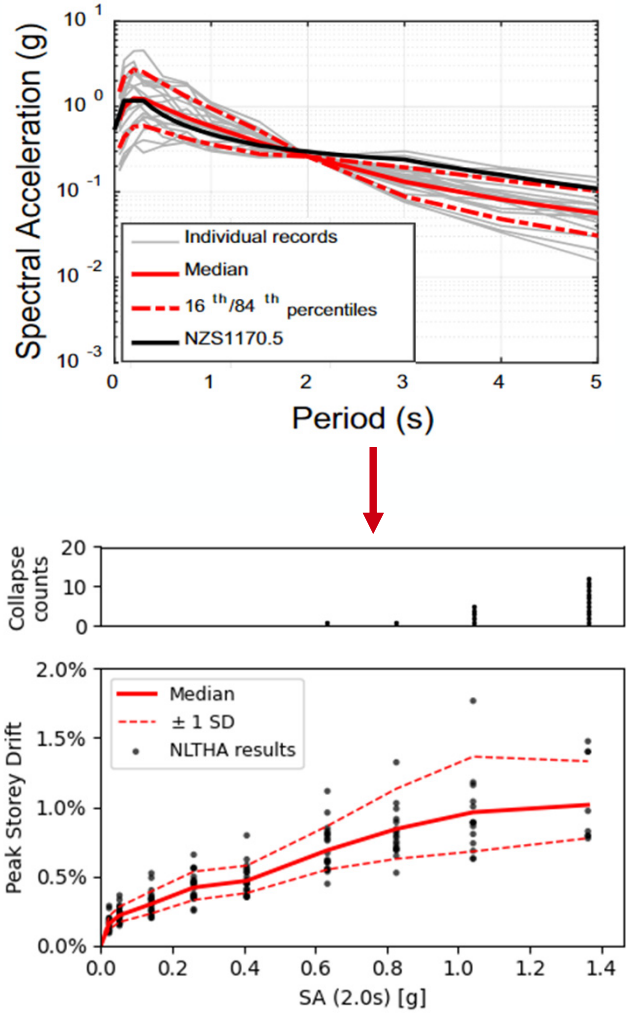




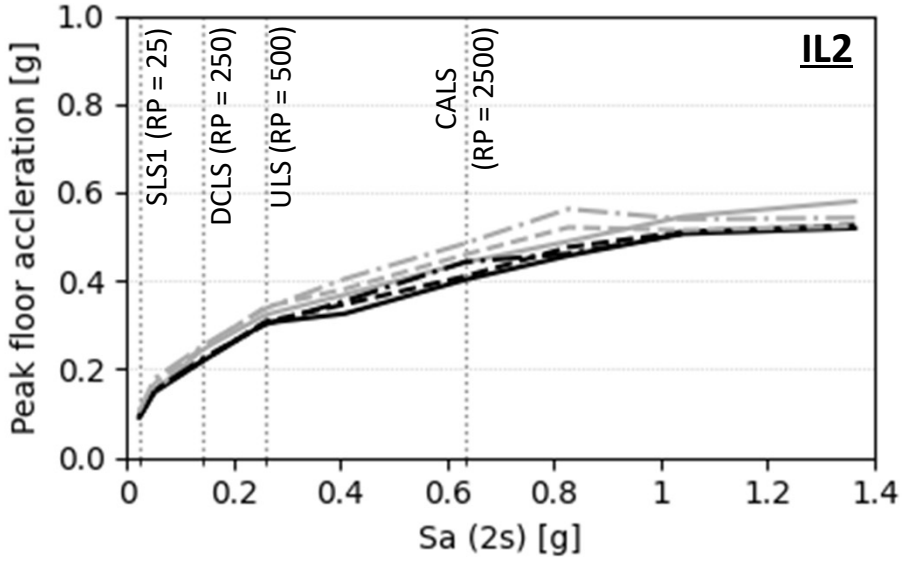
Ground motion & NLTHA



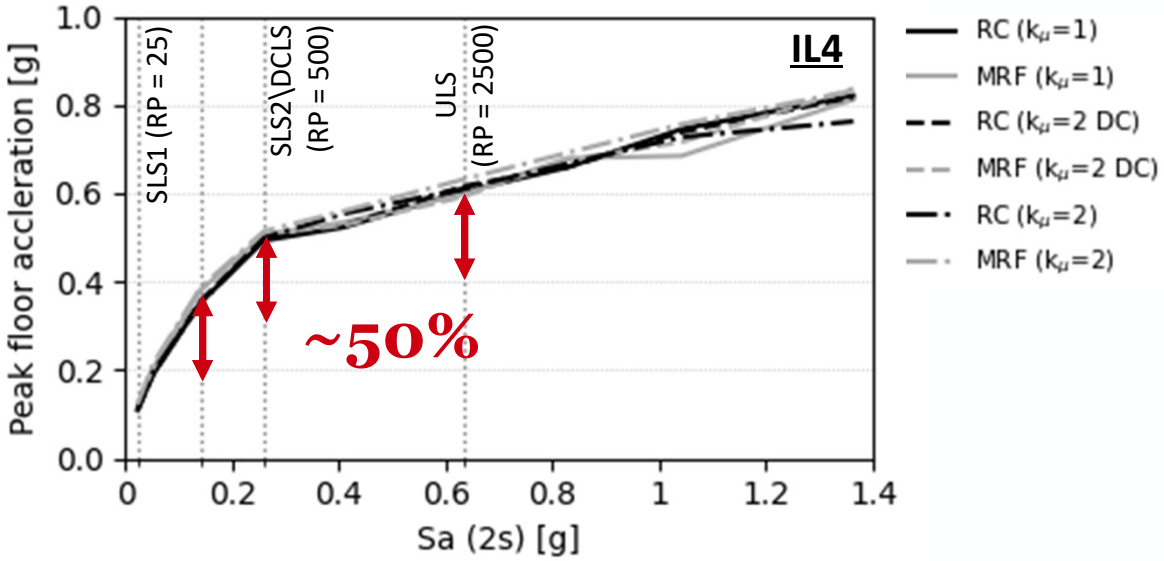
Wellington, site class C
(Yeow et al. 2018).



Peak floor acceleration

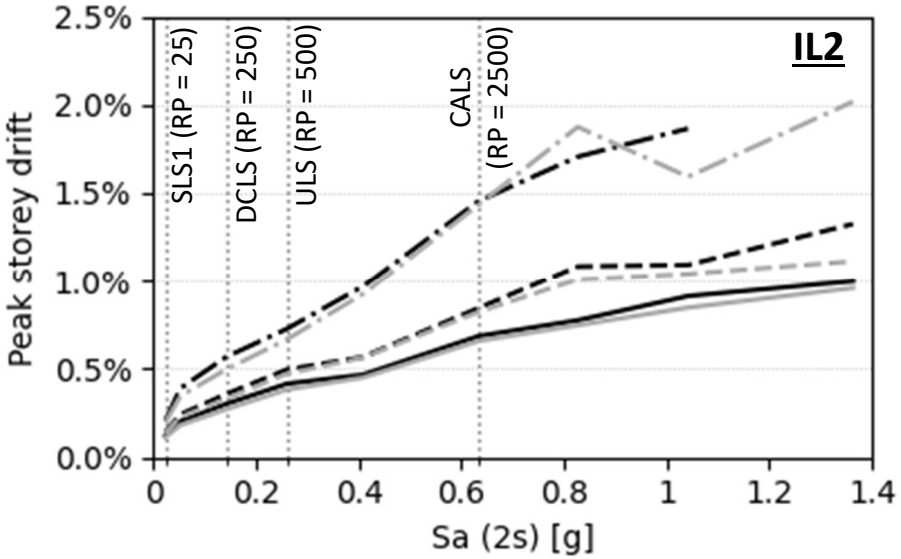


a) Importance level 2
base-isolated buildings

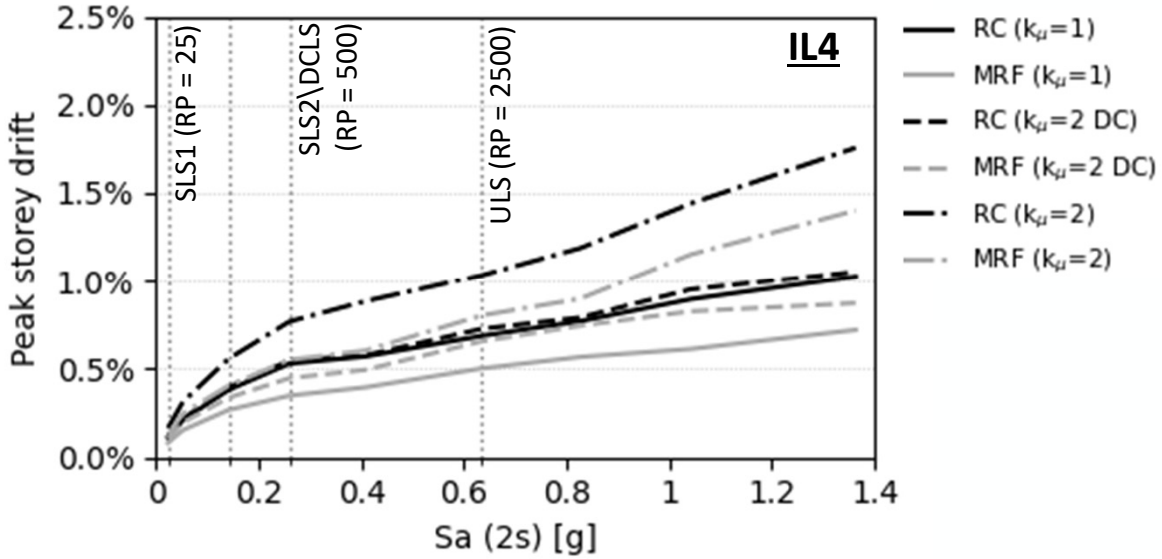


b) Importance level 4
base-isolated buildings

Peak storey drift

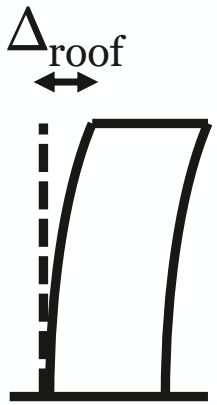


a) Importance level 2 buildings



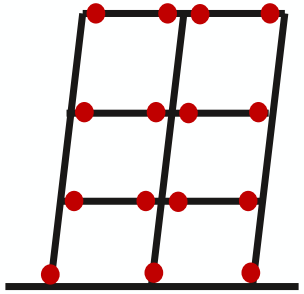
b) Importance level 4 buildings

Collapse definition



Roof displacement

or

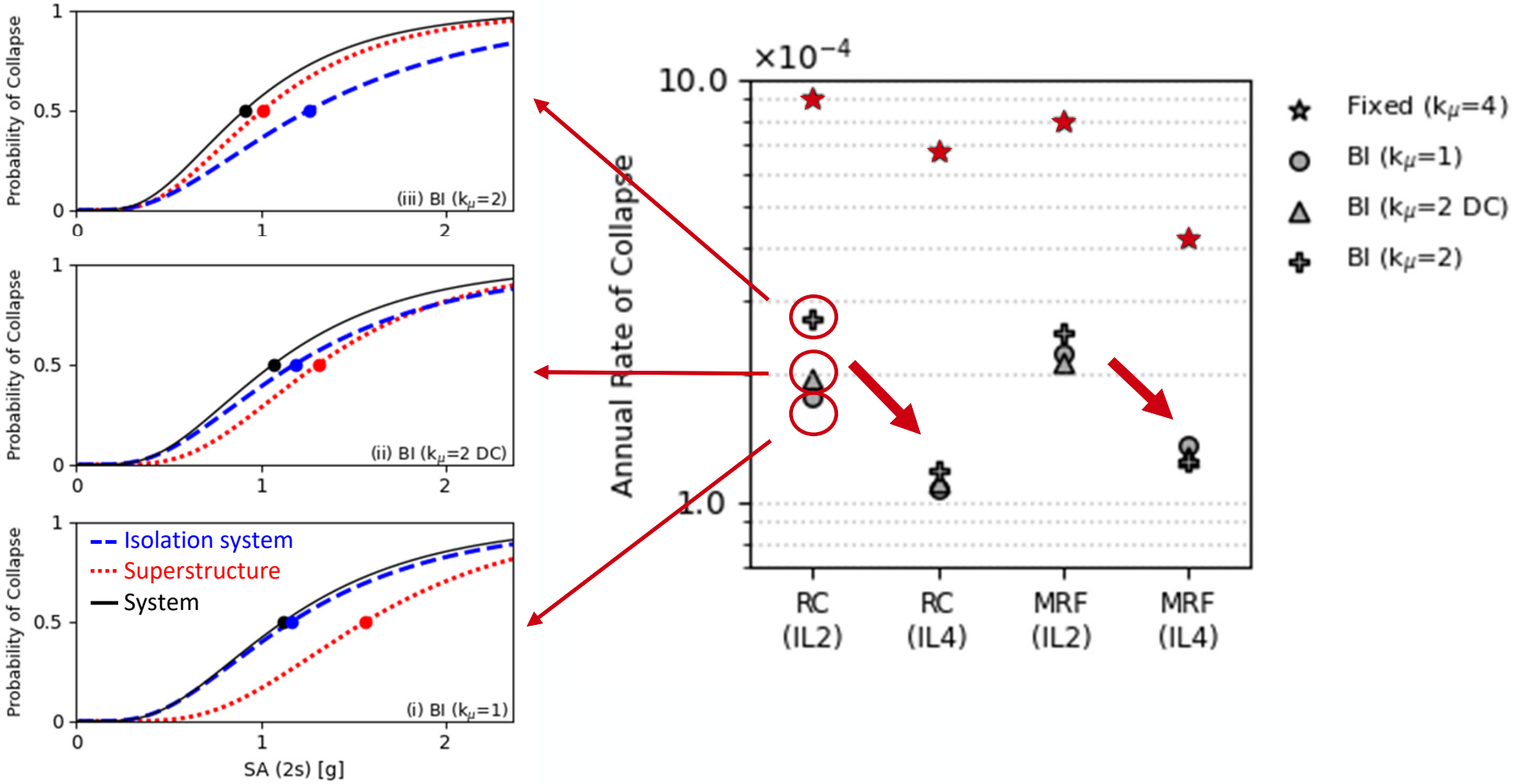


Beam plastic hinge rotation

or

LRB shear strain

Annual rate of collapse



Loss assessment (PACT)

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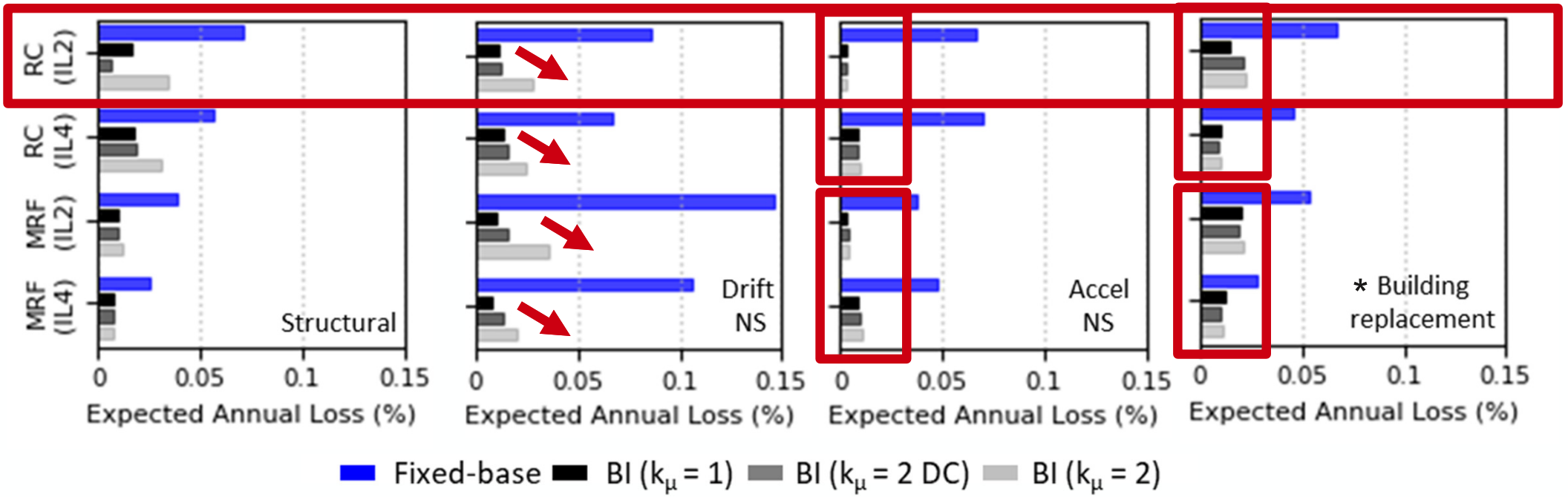
Performance groups	Repairable components	
Structural components	RC structural wall Reduced beam section connections Column base plates Lead rubber bearings	
Drift sensitive non-structural components	Exterior glazing partitions Precast cladding panels Interior glazing partitions Full height partitions Precast stairs	
Acceleration sensitive non-structural components	Suspended ceiling Braced ceiling Air handling units Traction elevator Water pipes Sanitary waste piping Chiller capacity	Droppers and diffusers Coils VAV boxes Independent pendant lighting Fire sprinklers and pipes Cooling tower capacity Ducts

Expected annual loss



* Includes collapse and cases when repair cost exceeds 50% of building replacement value

Thank you for your attention

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