

Earthquake-Resistant Building Innovation Using Isolation Bearings: QuakeResist Rollers – Yirei Zhou

My project introduces an innovative earthquake-resistant solution aimed at saving lives and reducing property damage. Traditional designs usually prevent collapse but fail to protect contents or withstand multiple or consecutive quakes, a crucial requirement in earthquake-prone areas like Vancouver and Victoria, which could face magnitudes up to 9. Inspired by a visit to an earthquake simulation lab, I set out to develop a cost-effective seismic isolation method.

Using 3D-printed components, I engineered a prototype with QuakeResist bearings: steel balls within curved, 3D-printed bowls placed between the foundation and ground. During earthquakes, these balls roll, isolating the structure from ground movements.

The tests comparing a model with a rigid foundation to one with QuakeResist bearings showed the latter had significantly less shaking. The design reduces buildings' inertial forces, adjusts to prevent ground resonance, and cuts forces from ground shaking by 2 to 4 times, enhancing structural integrity and reducing repair costs.

Suitable for 1-4 story buildings, this system can be used in new builds or retrofits. Although it might increase construction costs by 0-10%, the safety benefits are invaluable. The durable, cost-efficient steel components, already mass produced in the bearing industry, align with buildings' typical 50-100 year lifespan. Bearings can be installed or replaced in existing structures using a hydraulic jack, a method commonly used by building movers such as the BC-based company Nickel Bros.

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