

Chic, Green, and Resilient

“World-Class Resilience and Sustainability for Open Workspaces”

Precinct

Beca



MAURER



61 Molesworth Street is a new 13-storey commercial office building in the parliamentary precinct in Wellington, New Zealand. It features large open floorplates and an unobstructed façade, offering **market-leading seismic resilience** and **world-class sustainability**. With minimal floor drifts and **no seismic bracing** around the building perimeter, it ensures uninterrupted views.



Architects' render of 61 Molesworth Street on the side of Wellington Cathedral



Core wall during construction



Minimised Obstruction due to tuned Fluid Viscous dampers

Abstract

Beca's innovative **Performance-Based Design Optimisation** has led to an efficient, open-space office building in central Wellington, New Zealand. The lateral load-resisting system is among the first of its kind globally, featuring a non-classically damped reinforced concrete shear core. The lateral system is designed by optimising the reinforced concrete shear core while strategically quantifying and positioning viscous dampers to ensure that the non-classical shear core dynamic system meets targeted performance objectives in a cost-effective and environmentally sustainable way.

The design employs just 24 fluid viscous dampers: 16 are distributed around the concrete core wall, and 8 are strategically placed within the walls to enhance the efficiency of the larger dampers. This strategic placement reduces induced wall strains and absolute floor accelerations to targeted levels.

The system allows the building to withstand a **1-in-1000-year return period earthquake in Wellington**, New Zealand's highest seismicity region (~PGA 0.6g), **with an average drift ratio of less than 0.6%** and a **1-in-4000-year return period earthquake** with an average **drift ratio of less than targeted 1.1%** which is a **65% reduction from undamped response**. **Notably, this level of performance was achieved using the amount of concrete and steel typically required for constructing a conventional Reinforced Concrete shear wall structure designed in accordance with the New Zealand code assuming a structural ductility of 4.**

The design also ensures **peak drift ratio performance expectations** are met, with **1.3% for a 1-in-1000-year event and less than 3.5% for a 1-in-4000-year event**. **Even during a 1-in-4000-year event**, the devices are engineered to stay within their stroke limits, preventing any catastrophic behaviour that could compromise the gravity load-carrying capacity of the structure.

The structural system was designed using 45 historic earthquake records scaled to the site-specific spectra, including ground motions representing the anticipated 'near-fault' Wellington earthquake, which could experience ground velocities of ~3.5 m/s. The ground motion suite also contains long durations subduction zone earthquakes of the order of 150 to 200 seconds. The building site is located approximately 800 metres from the predominant Wellington Fault.

The designed building not only exceeds minimum code requirements but also achieves a more stringent standard tailored to the tenant's specific needs, whilst maintaining a 6-Star Green Star rating and a 5-Star NABERNZ rating for sustainability.

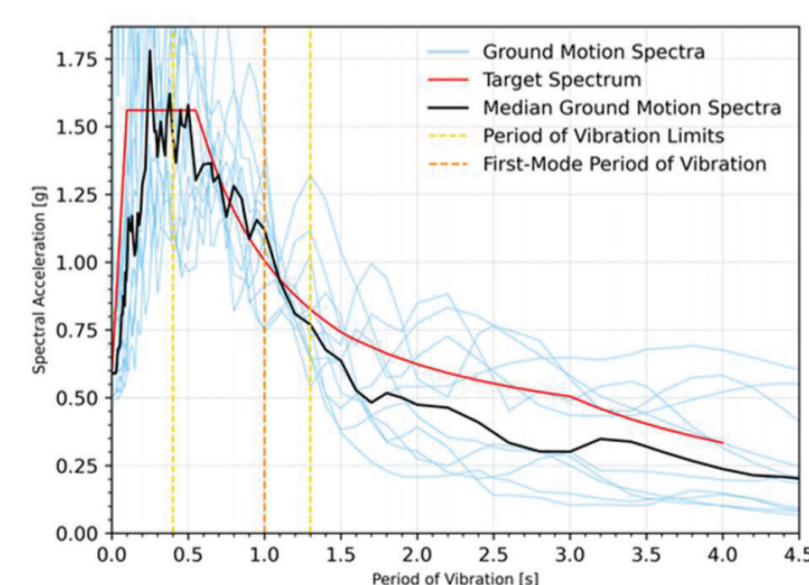
In addition, the optimised design, along with the use of Low Carbon Concrete and structural steel from an electric arc furnace, has significantly reduced the carbon footprint compared to traditional methods as well. Overall, compared to a conventional building meeting standard code, this highly resilient structure incurs 25% less carbon. Again, when compared to a building designed through conventional methods aiming for the same high standards as described above, this design achieves a 45% reduction in carbon emissions.

Key Points

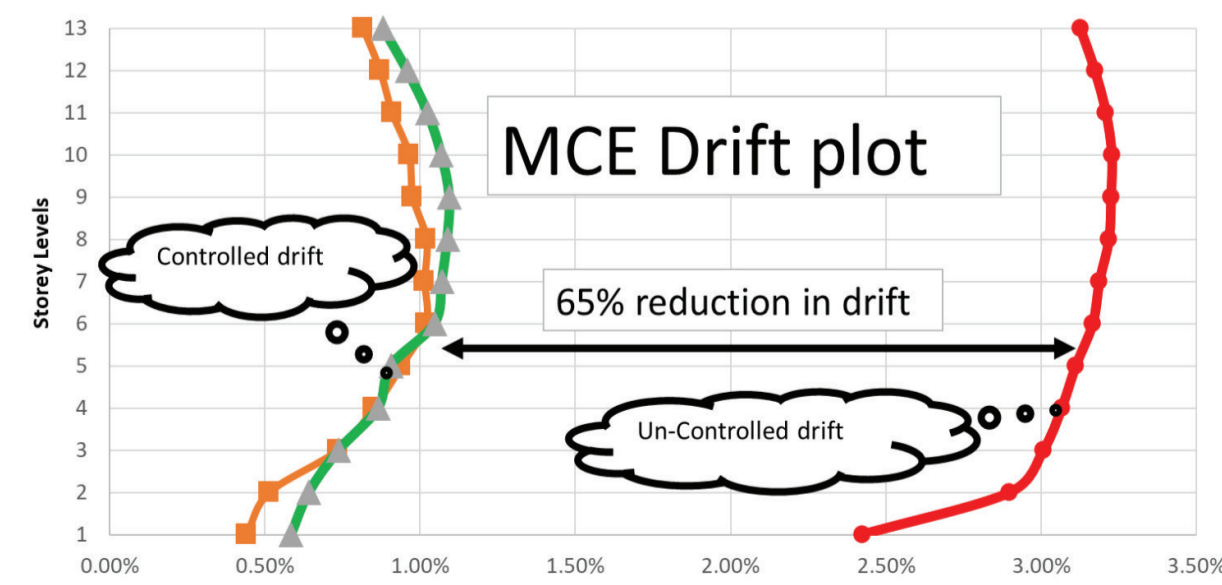
- 13-storey commercial office building featuring a 1,750m² open floor plate with 12.8m beam spans, and a 24,500m² gross floor area. It offers elevated 360-degree views of the city, harbour, and town green belt.
- The floorplate design features large, high-quality, flexible floor plates centred around a core. This layout maximises A-grade floor space, offering excellent natural light and views, while positioning the shear wall core in B or C-grade areas. These grade classifications are architectural, broadly based on natural lighting and outlook.
- **A key aspect of this development is achieving a high level of seismic resilience and structural low damage using quantity of materials equivalent to that of a conventional structure designed to a ductility of 4, in accordance with the New Zealand code.** We achieved 130% New Building Standard and controlled drift to meet the client and tenant's specific requests.
- Design of foundations included avoiding intersecting with the main existing sewer interceptor which crossed through the middle of the site.
- Compared to a conventional office building in Wellington achieving the same seismic resilience, this building saves 898 kgCO₂e/m², totalling 22,022 tCO₂e for the entire structure.

Conclusion

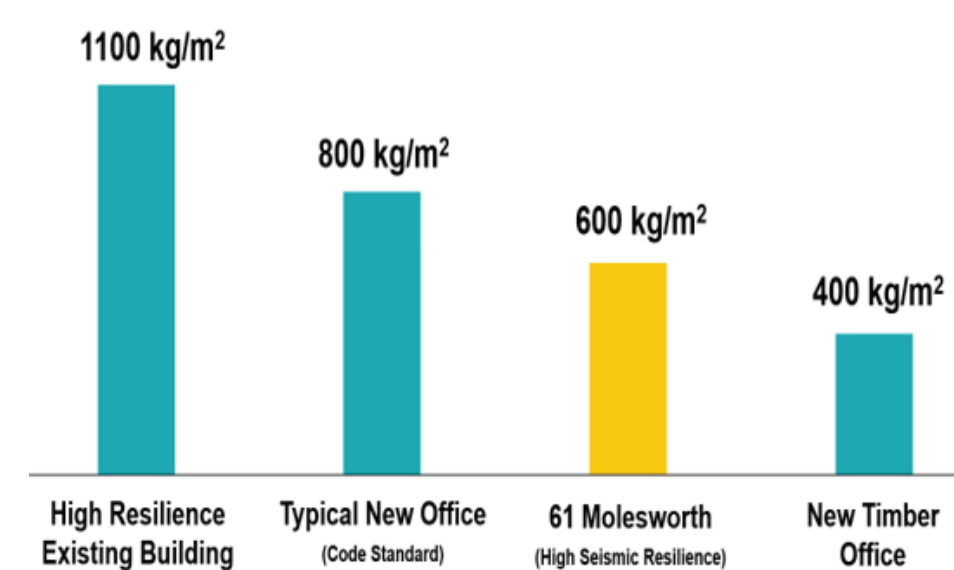
61 Molesworth Street offers market-leading seismic resilience, low structural damage, sustainability and exemplifies how, from design to construction, leveraging specialist knowledge and efforts can result in high-performing structures that are economically viable in near-fault areas under the most severe seismic conditions. The structural system ensures low floor drifts and accelerations, with an unobstructed façade that evokes the feel of a tower in London or New York, combined with the seismic resilience expected in California, Tokyo, or Wellington.



Ground motion response spectra compared to target spectrum for the site



Inter-storey drift ratio plot



World-class Embodied Carbon Performance

(1) Green Star is Australasia's largest voluntary sustainability rating system for non-residential buildings, fitouts and communities.

(2) NABERNZ is a system for rating the energy efficiency of office buildings. It is an independent tool, backed by the New Zealand government. <https://www.nabernz.govt.nz/>