



2018 AWARDS FOR ENGINEERING EXCELLENCE

Award of Merit

Seismic Upgrade Using External Buckling Restrained Bracing



Consultant

Ausenco Engineering Canada Inc.

Owner/Client

City of Vancouver

Category

Buildings

For more information, please contact:

John Sherstobitoff, P.Eng.
Ausenco Engineering Canada Inc.
☎ (604) 684-9311
john.sherstobitoff@ausenco.com

The City of Vancouver carried out a seismic upgrade of the first of their self-owned buildings deemed to have high seismic risk. The 1975-vintage building at 515 West 10th Avenue is very unconventional: a two-directional four storey steel moment frame over two storeys of basement constructed with precast concrete.

The seismic upgrade was achieved using the following unique solution and materials:

- 'new' buckling restrained bracing (BRB) – a high energy dissipation system; first in Canada to use externally in a seismic upgrade; only 5th use in Canada for upgrades
- BRBs and steel modifications limited to ground floor; no work in upper three floors
- extensive use of fibre-reinforced polymers (FRP) to reinforce weak precast floors and connect them to new concrete shear walls
- first in Canada FRP-to-steel load transfer connections

The scheme enabled all 400 staff/tenants to continue regular operations throughout construction.

Ausenco, the structural/seismic engineering specialists carried out:

- direction of testing of steel/welds, crucial to develop 'performance limits' for existing steel components
- performance-based non-linear analyses, to 'tune' the BRBs to existing steel member capacities
- detailed design and essential liaison with BRB and steel detailers
- construction-related services to resolve site challenges, due to incomplete existing drawings

The computer analyses were another Canada-first following new provisions for buildings with supplemental energy dissipation. This involved 30 earthquake ground motion records related to different earthquakes.

This upgrade achieves life-safety performance for full code seismic requirements (beyond 75% per City bylaw) at a cost of only 1/3 of industry average.