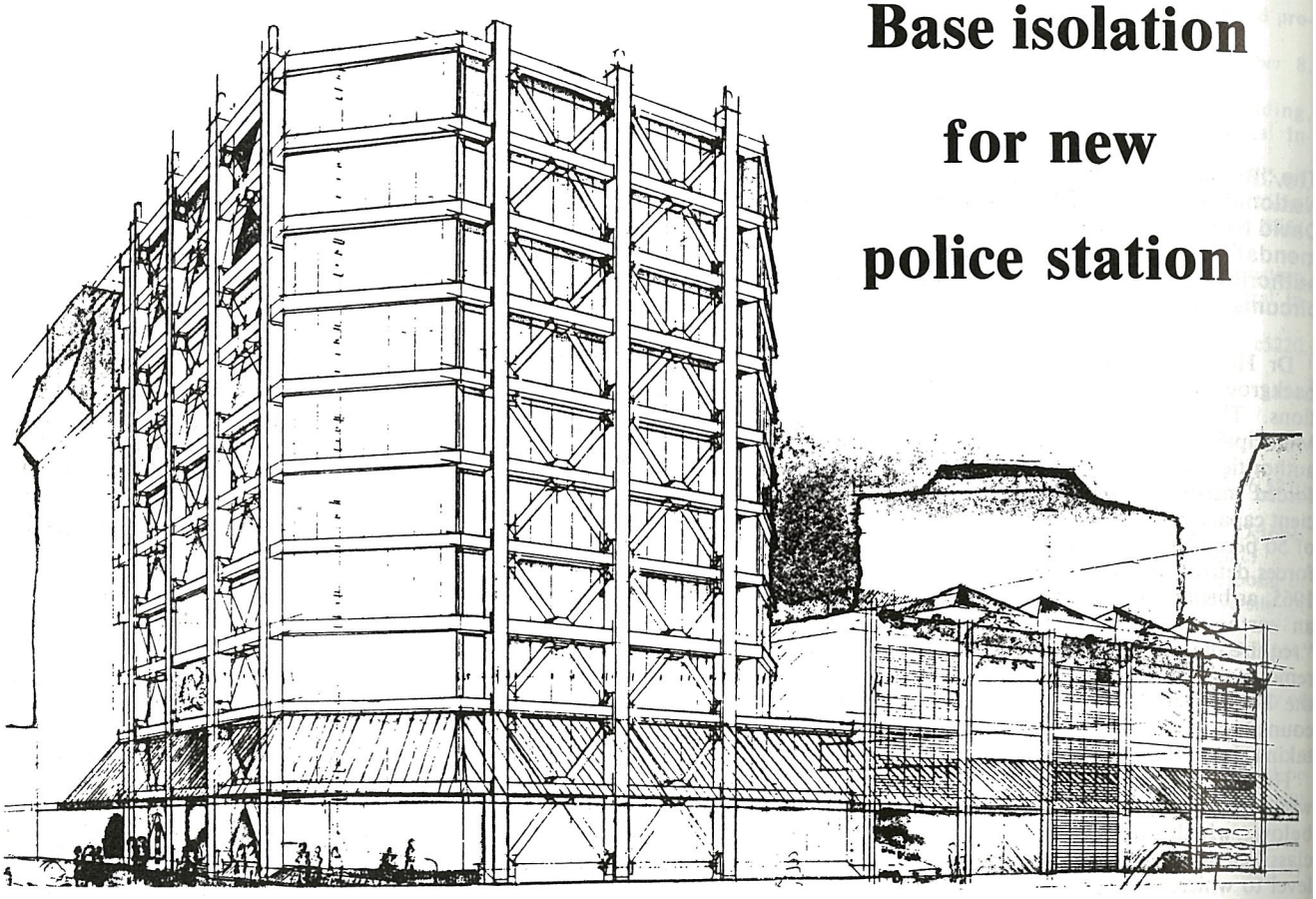
Base isolation for new police station



A base isolated cross-braced frame was selected by the designers of a new Wellington Central Police Station to ensure the high seismic performance required for an essential facility. The 10 storey tower block with a four storey car parking building alongside was designed by the Ministry of Works and Development and construction should begin early next year.

A paper outlining the reasons for the decision to use base isolation and the subsequent analysis and design of the building was presented at the Pacific Earthquake Conference at Wairakei by A W Charleson (formerly MWD but now School of Architecture, Victoria University), P D Wright (MWD) and R I Skinner (DSIR).

To enable essential facilities to continue to function after a major earthquake the NZ loadings code requires the use of a risk factor R = 1.6 to increase the strength of the building.

The three options considered for the structural system were a cross-braced frame, a moment resisting frame and a base isolated cross-braced frame. The first option was discarded because of the very large member sizes required and the difficulty of achieving a reliable post-elastic deformation mechanism. The perimeter moment resisting frame was considered in detail. As there were only two frames in each direction relatively large members were necessary to satisfy the code strength and deflection requirements. Finally, the base isolated cross-braced frame was considered. As piling was already indicated by the foundation conditions, which consisted of several metres of reclamation fill and marine deposits overlying weathered greywacke rock, it was decided to isolate the superstructure by placing it on long flexible piles and connecting it to the ground with horizontally functioning energy dissipating devices.

It was found that there was a 10 percent saving in structural cost with the base isolated option, considerably enhanced earthquake resisting performance and reduced repair costs after a major earthquake.

The building has been designed to remain fully functional after a major earthquake of approximately a 450 year return period and sustain only minor non-structural damage. Some yielding of the superstructure will occur when the building is subjected to a 1000 year return period earthquake but damage levels will be low and easily repairable. In an extreme earthquake of very low probability resulting in the isolation clearance being exceeded, the superstructure will be arrested in a controlled manner without collapse but with some damage.

The building is expected to be completed in 1991.