Figure 1: Three component spectra for Gisborne 2ZG record

The ground motion record from the above station has been reduced to motion spectra in the E/W orientation (primary component PGA=0.25g) and the N/S orientation (secondary component PGS 0.2g) with the vertical spectral response also presented for completeness. (Note: the orientation selected are not necessarily the most severe from any orientation – work is ongoing on this aspect).
The location of the recorder is two blocks south of the CDB and approximately 3 blocks east of the river. Site soil classification is considered to be Class D, although it is close to being Class E).

**Notable Features**

- the sharp spikes present at around 0.35 seconds in the E/W component where $Sa(0.35)\approx 1.15g$.
- A less intense spike occurs in both records at approx $T=0.5$ sec with components $Sa(0.5)\approx 0.87g$ E/W and $Sa(0.5)\approx 0.93g$ N/S.
- Between the period ranges $T=0.25$ and $T=0.7$ both records indicate acceleration spectral levels generally in excess of 0.6g.
- Between $T=1$ and $T=1.5$ second, acceleration levels fall from 0.2g to 0.15g and rapidly continue to decline into the higher period ranges.

![Figure 2: Recorded vs Code](image)

The two components of the recorded record are compared with the Deep Soil ground motion spectra with $R=1$ (1/500), $R=0.67$ (1/150) and $R=0.5$ (1/100) (Note bracketed figures representing annual probabilities or exceedence).

**Notable features:**

- Within the period range $T=0.25$ to $T=0.8$, the measured response components are reasonably aligned with the $R=0.67$ ground motion projection, indicating that the motion could be considered to be approximately coincident with motions associated with a 1/150 annual probability or exceedence or motions approximately 2/3 those of ULS design level.
- The $Sa(0.35)$ peak value is exceptional in that it approaches the 1/500 design value although is limited to a very narrow period band.
- Beyond $T=1$ second motions approximately align to $R=0.25$ (1/25) being levels of motion at which the onset of damage could be expected (while recognising that few elements and components will experience significant excitation over that period band.
Figure 3: Recorded vs Modelled

The two component records are compared with those projected by running the event (location, depth, magnitude and earthquake type) through the NZ seismic hazard model.

Notable features:

- The recorded accelerations match relatively closely the 84% deep soil projections in the short period range $T<0.4$ seconds, exceed the projected motions over the mid period range $0.4<T<1$ second and are below projected motions for the long period range $T>1$ second.
- The stronger motions within the mid-period range are abnormal and not included in the model.
Figure 4: Recorded vs Hazard

The recorded motions have been superimposed over various hazard spectra for visual comparison.

Notable features:
- The recorded values are deficient in both short (T<0.4 sec) and long (T>1 sec) ranges, but relative strong within the mid-period range where motions align approximately with motions expected from an event with an annual probability of exceedence of 1/250.