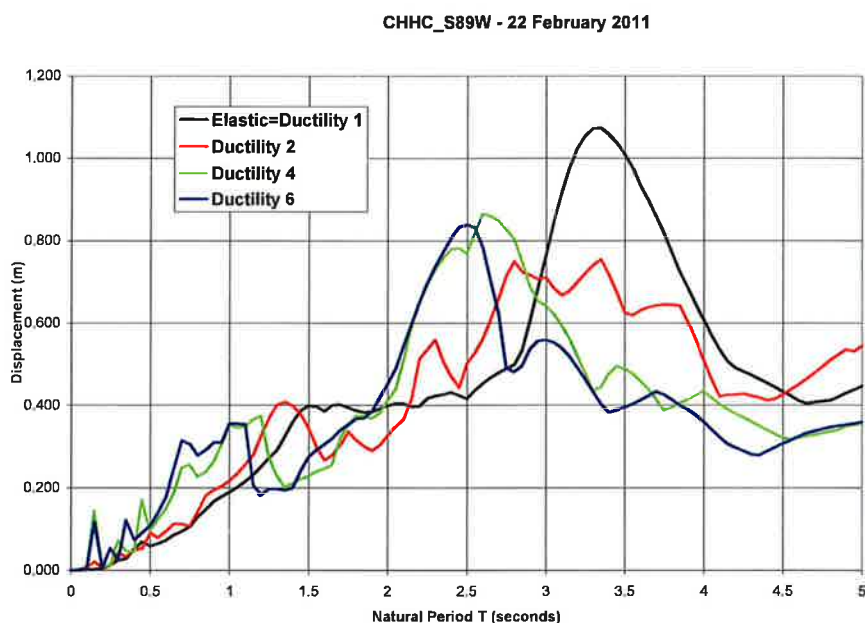


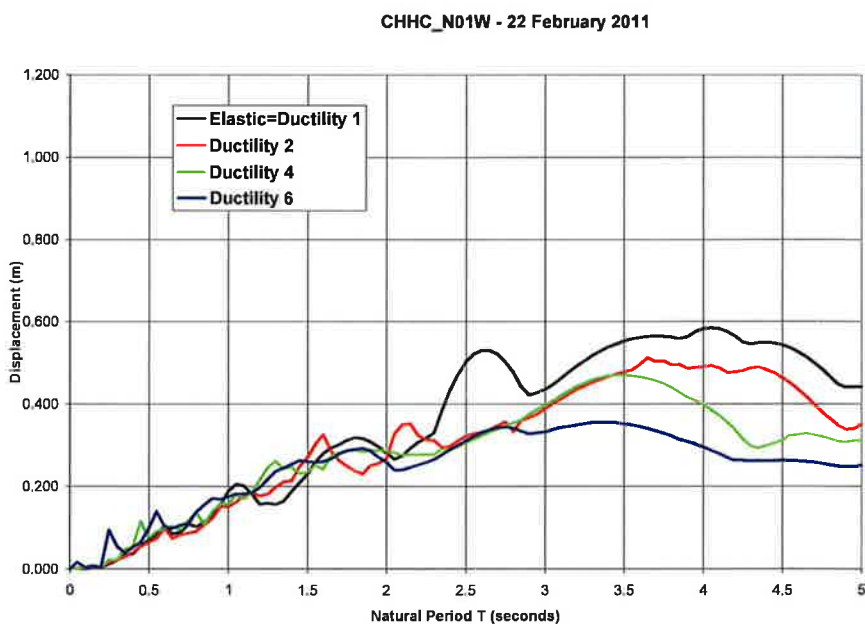
Appendix C

22 February 2011 Earthquake Horizontal Components

The inelastic displacement and acceleration spectra for the 22nd February 2011 earthquake components are shown here.

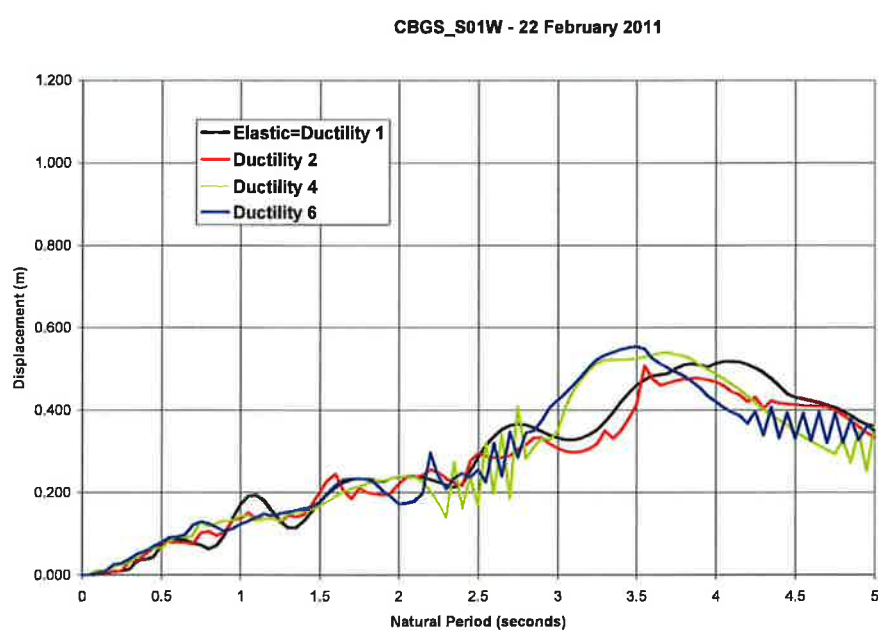
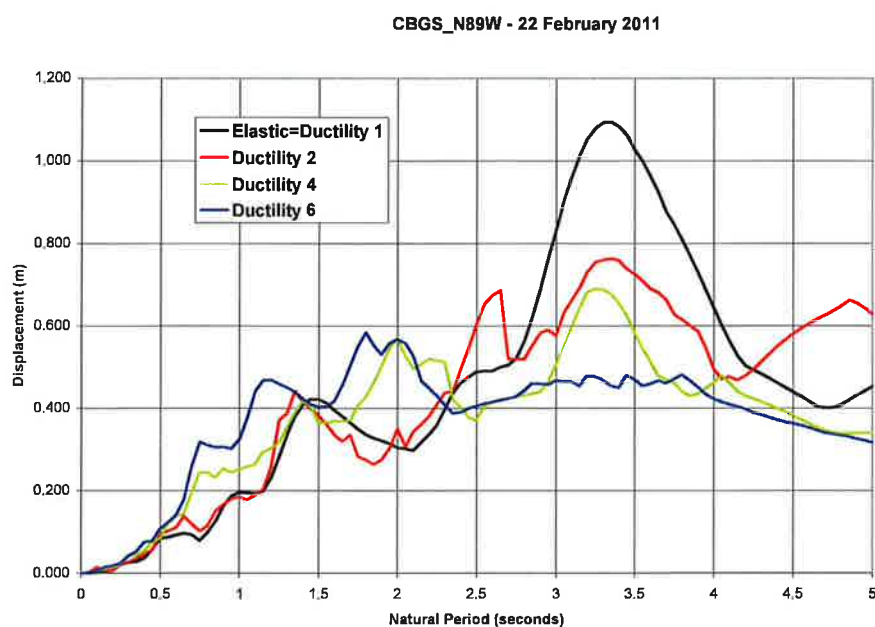


**Figure C-1. Displacement Response Spectra
Christchurch Hospital 22 February 2011- South 89° West Component**



**Figure C-2. Displacement Response Spectra
Christchurch Hospital 22 February 2011- North 01° West Component**

Inelastic Response Spectra for the Christchurch Acceleration Records



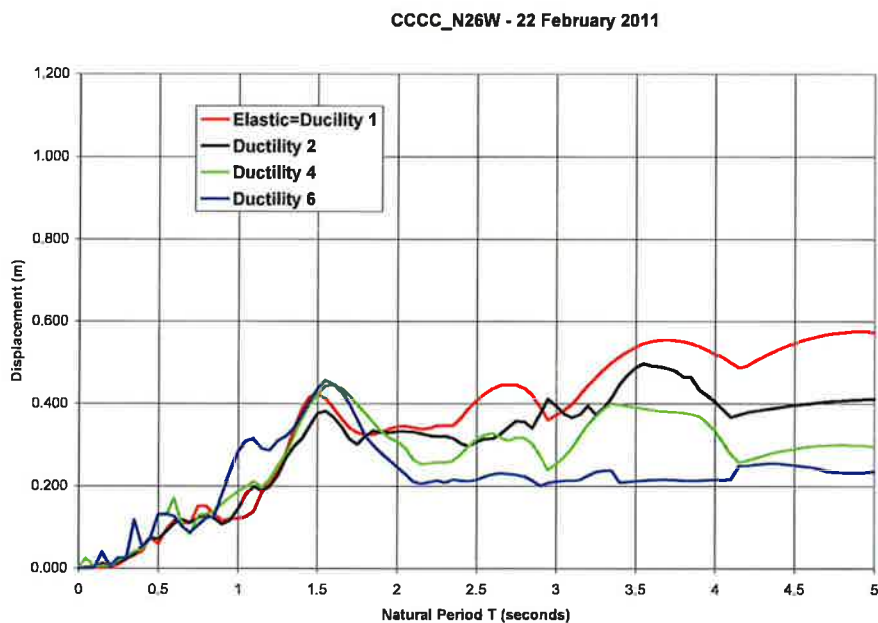


Figure C-5. Displacement Response Spectra
Christchurch Cathedral College. 22 February 2011- North 26° West Component

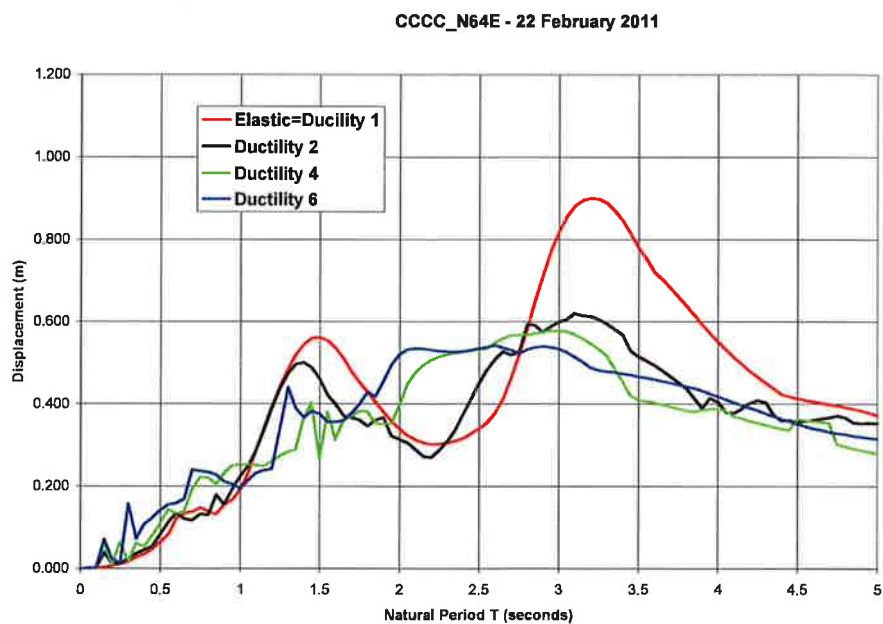
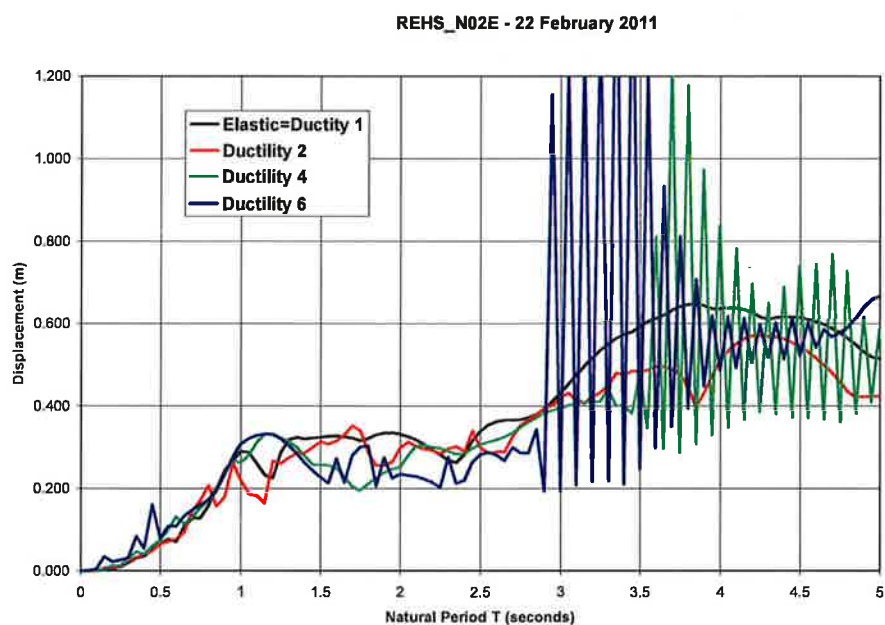
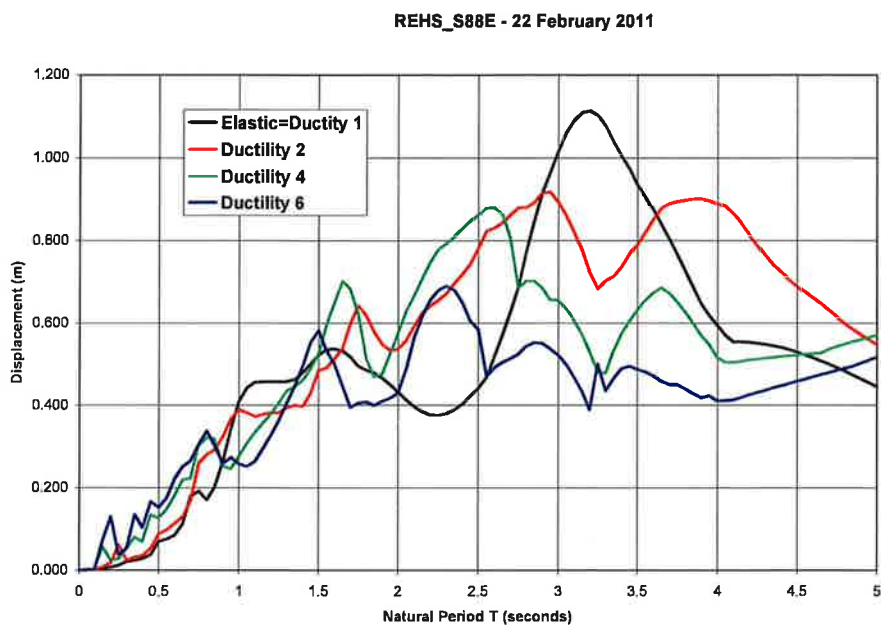
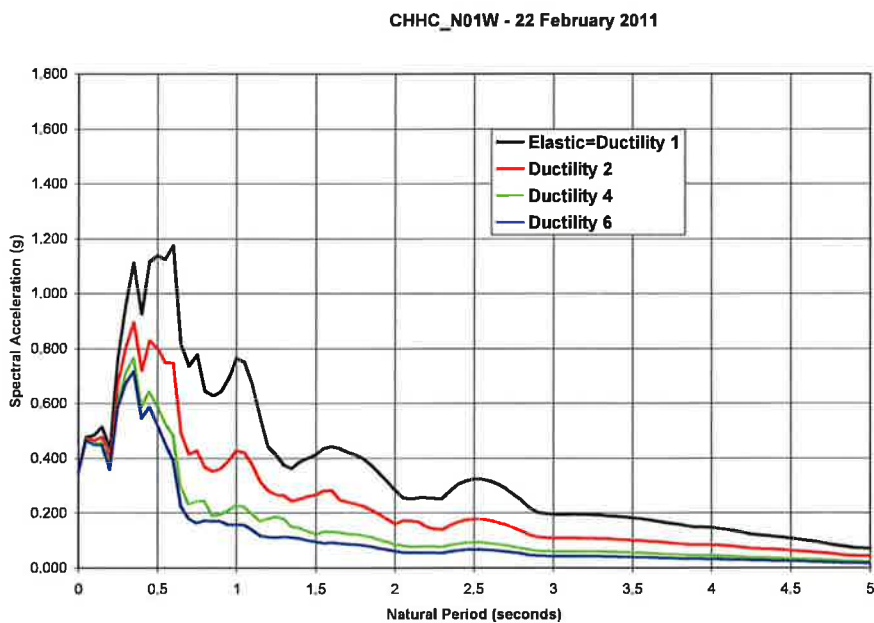
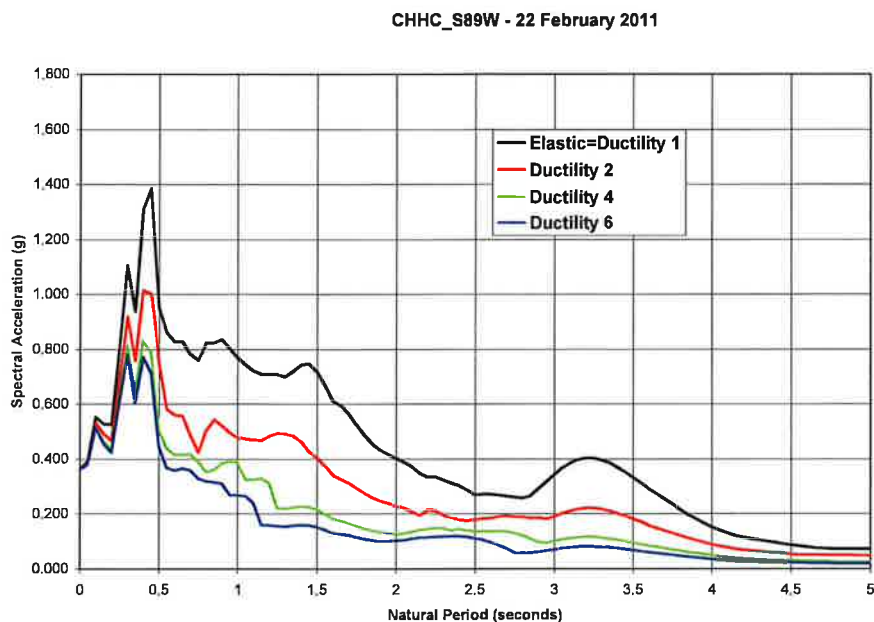
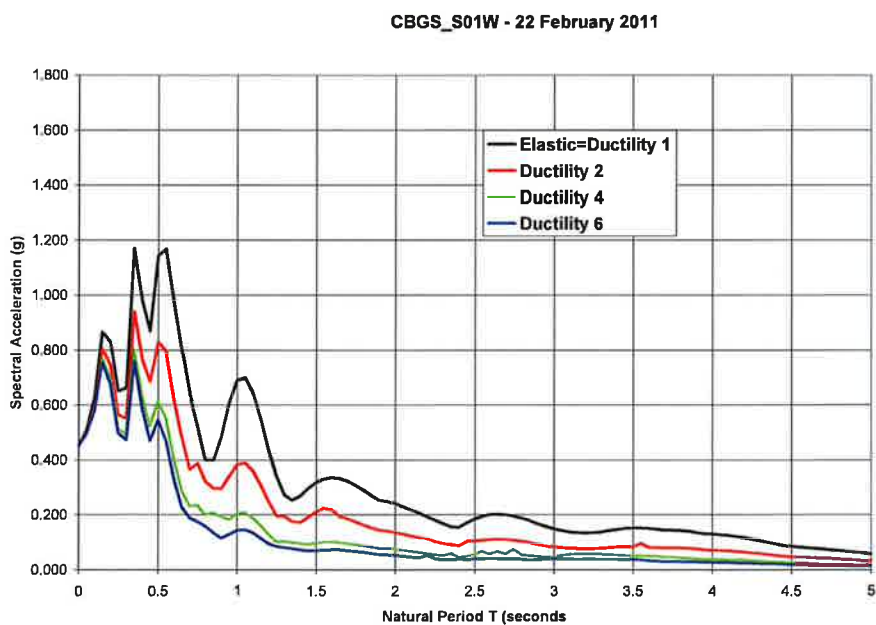
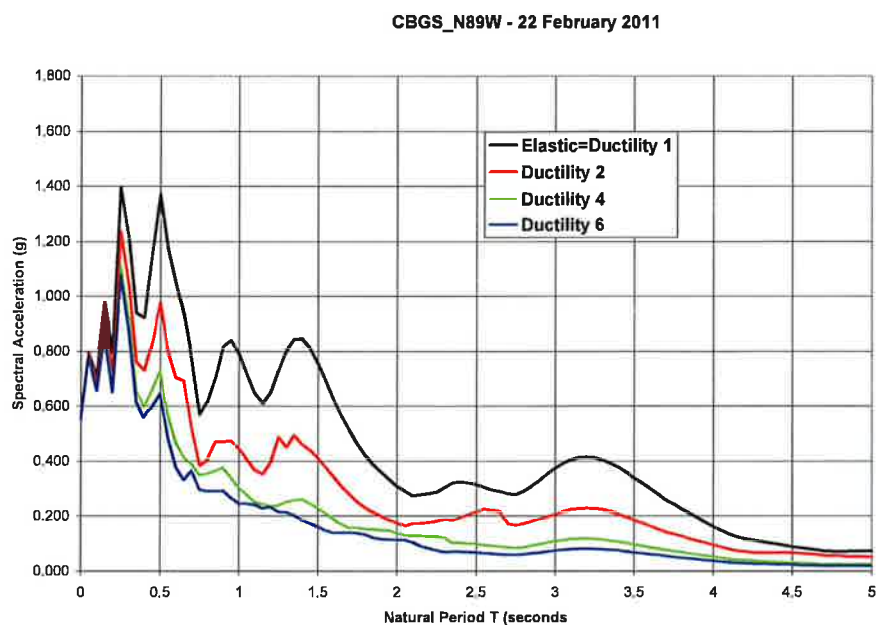
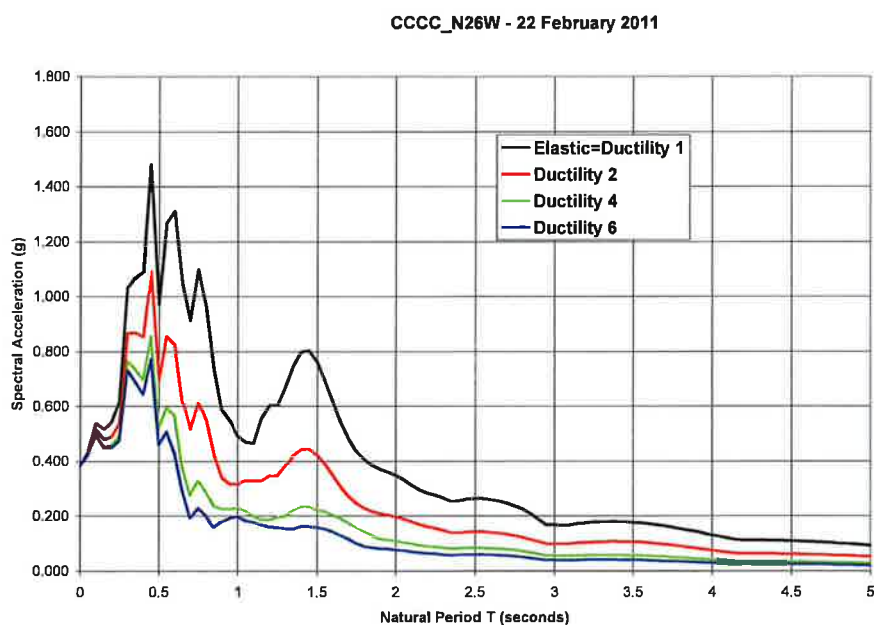


Figure C-6. Displacement Response Spectra
Christchurch Cathedral College. 22 February 2011- North 64° East Component

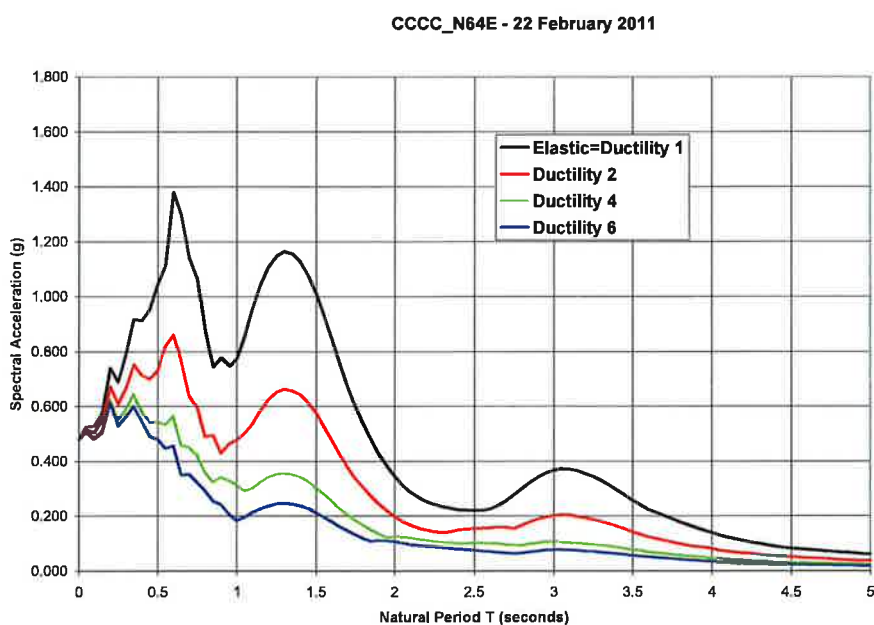




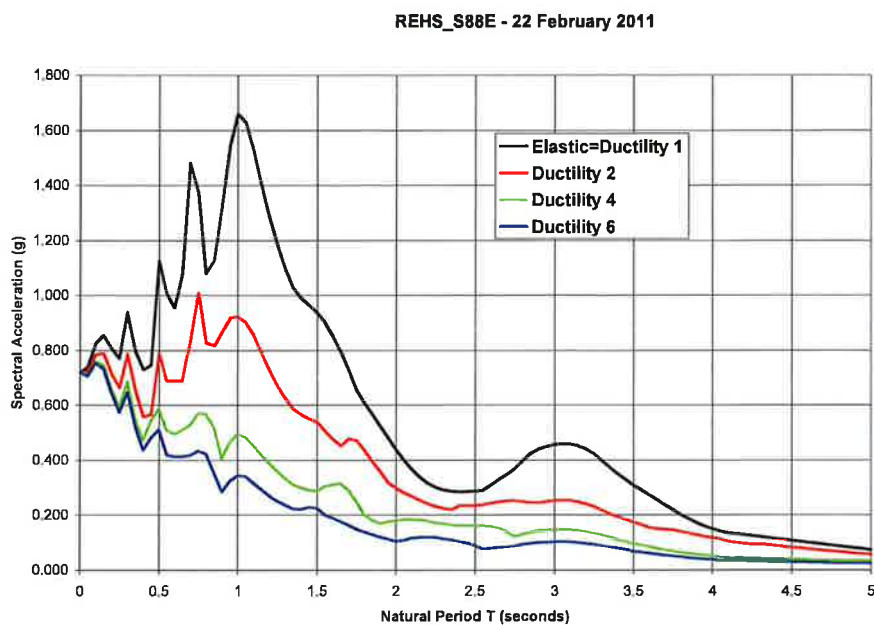




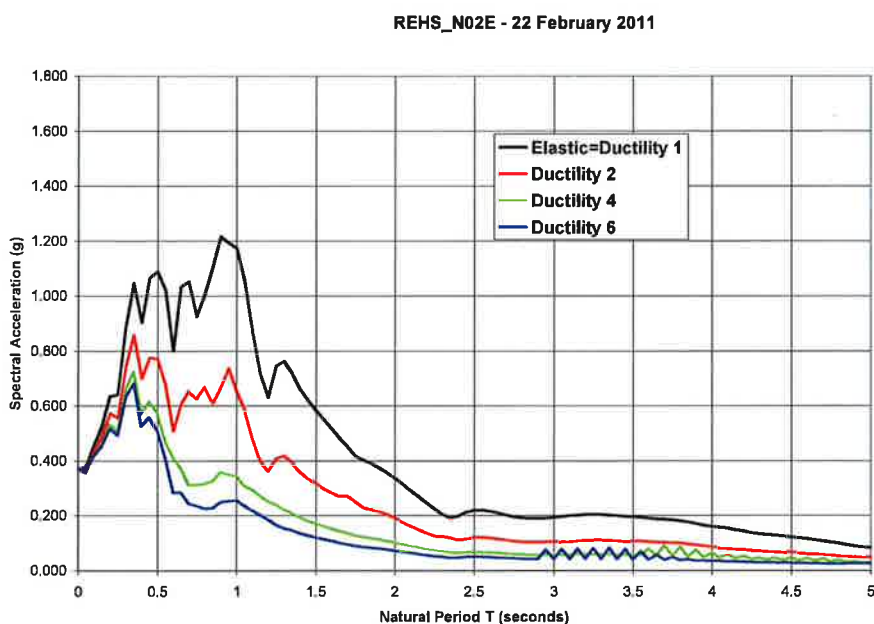
**Figure C-13. Acceleration Response Spectra
Christchurch Cathedral College. 22 February 2011- North 26° West Component**



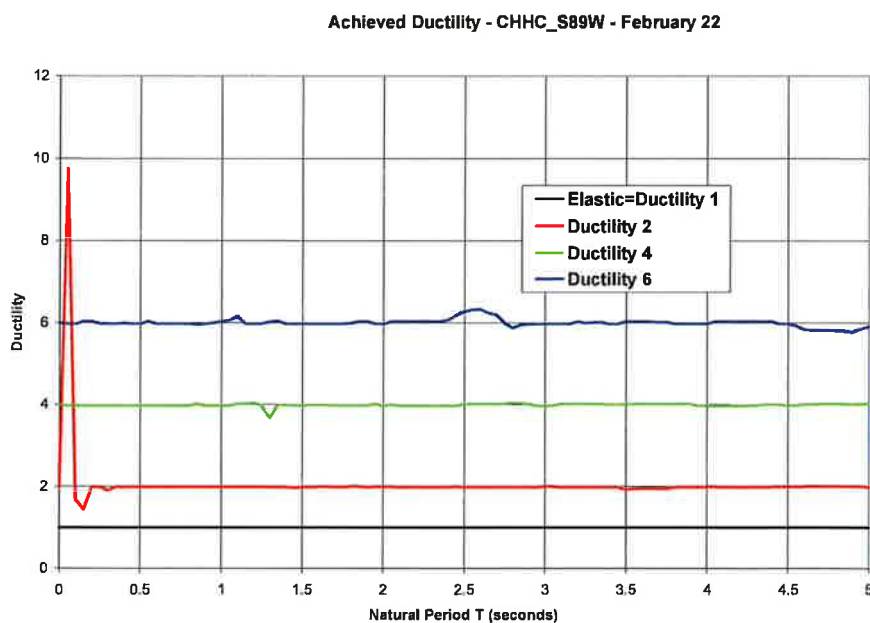
**Figure C-14. Acceleration Response Spectra
Christchurch Cathedral College. 22 February 2011- North 64° East Component**



**Figure C-15. Acceleration Response Spectra
Resthaven. 22 February 2011- South 88° East Component**

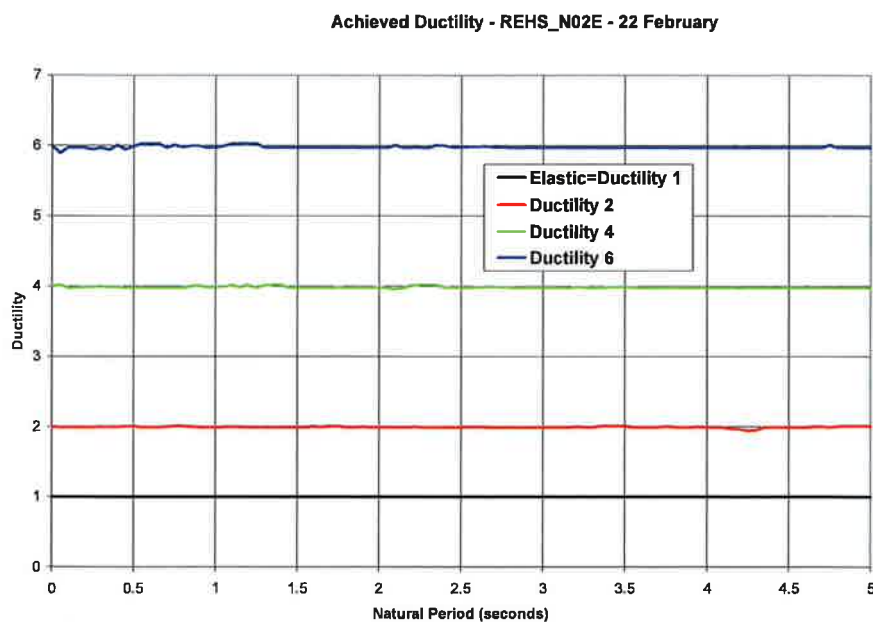


**Figure C-16. Acceleration Response Spectra
Resthaven. 22 February 2011- North 02° East Component**
Note: Sensitive acceleration responses for high ductility for longer natural periods



**Figure C-17. Achieved versus Target Ductility
Christchurch Hospital 22 February 2011- South 89° West Component**

Figure C-17 shows good convergence for most target ductility values except for the first natural period (0.05 seconds) for ductility 2.



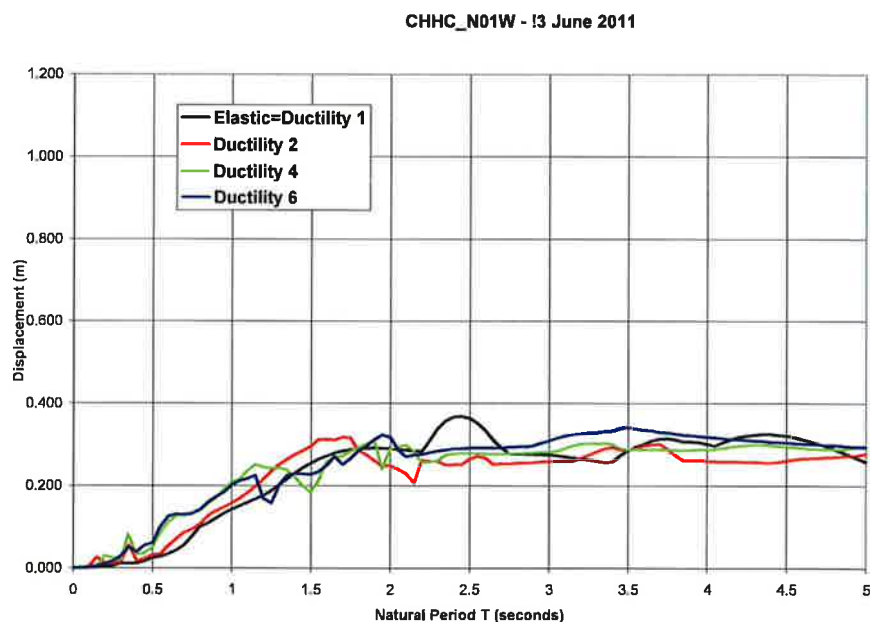
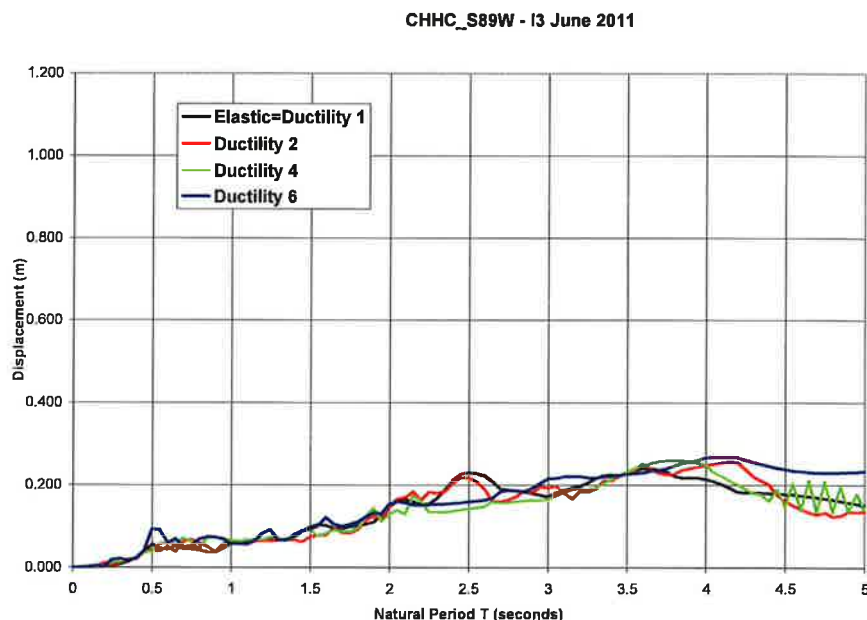
**Figure C-18. Achieved versus Target Ductility Ratios
Resthaven. 22 February 2011- North 02° East Component**

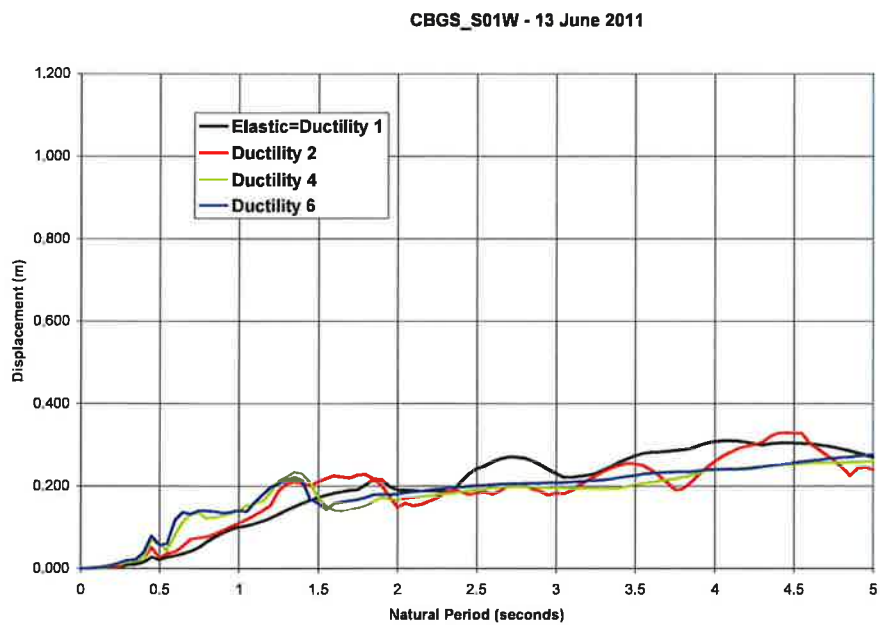
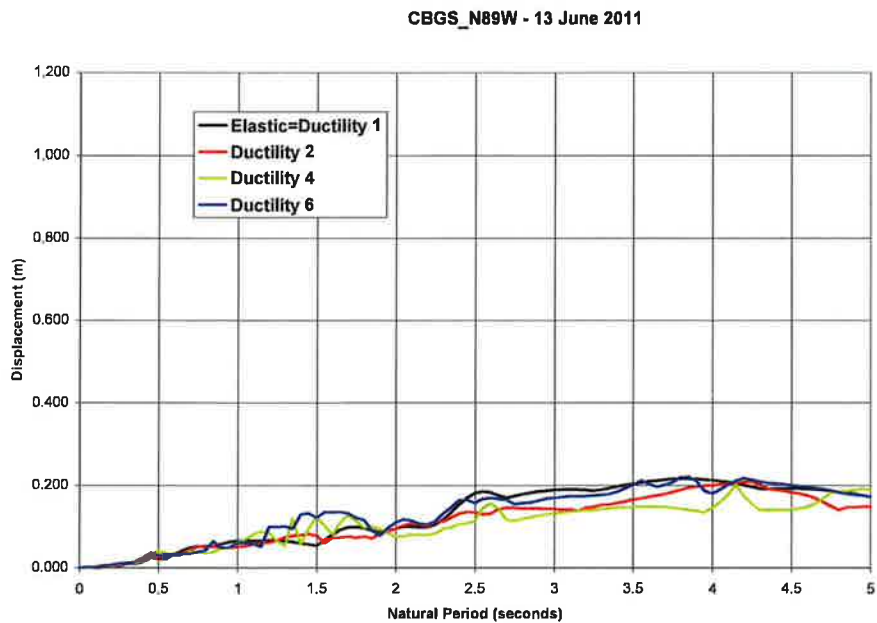
Figure C-16 shows that although the displacement spectra, and to a lesser extent the acceleration spectra show sensitivity with the Resthaven accelerogram for the larger ductility values the match to the target ductility is very good.

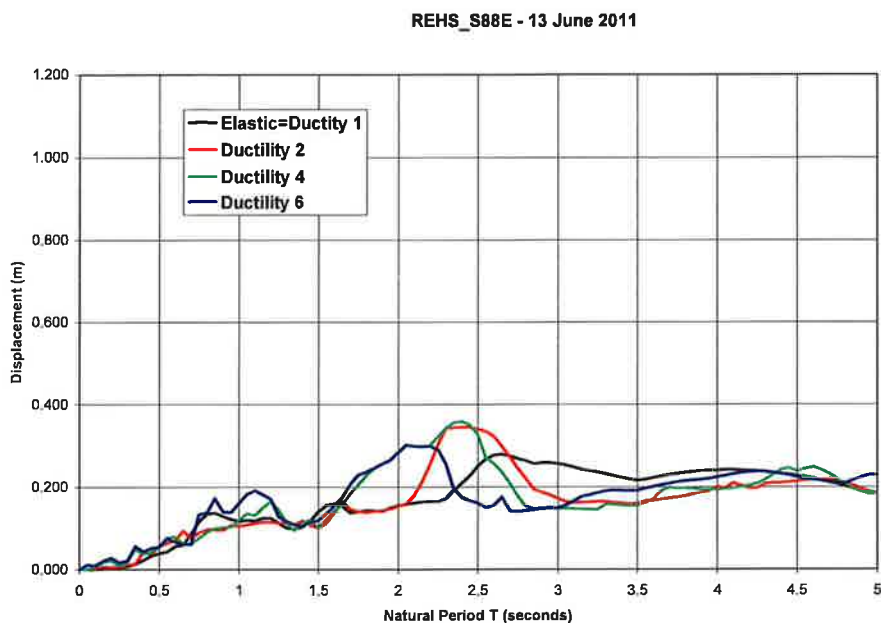
Appendix D

13 June 2011 Earthquake Horizontal Components

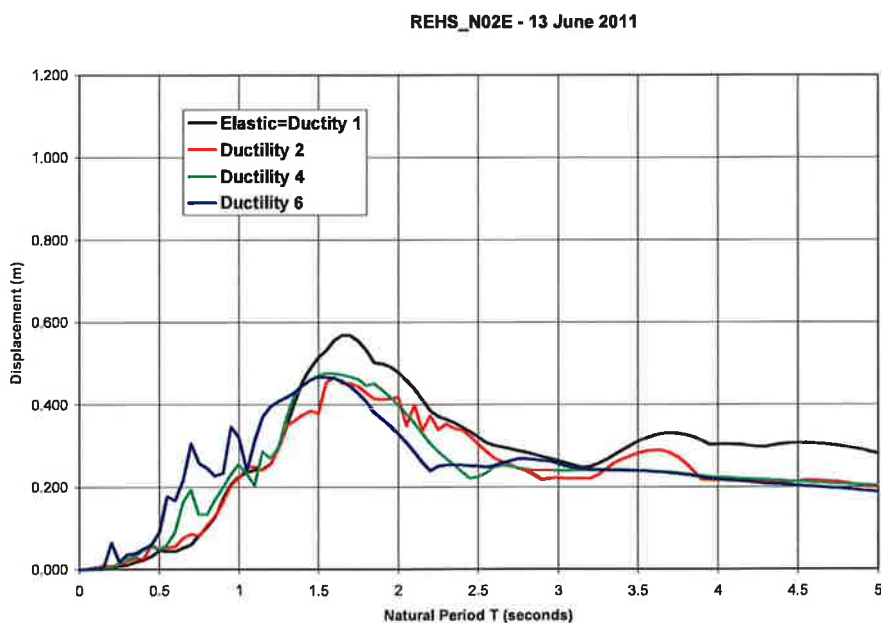
The inelastic displacement and acceleration spectra for the 13th June 2011 earthquake components are shown here.



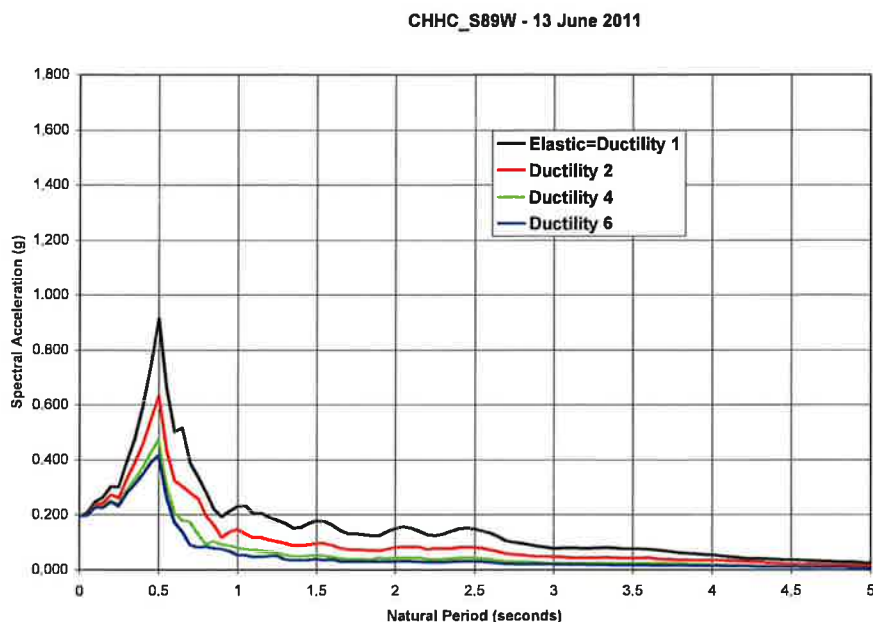




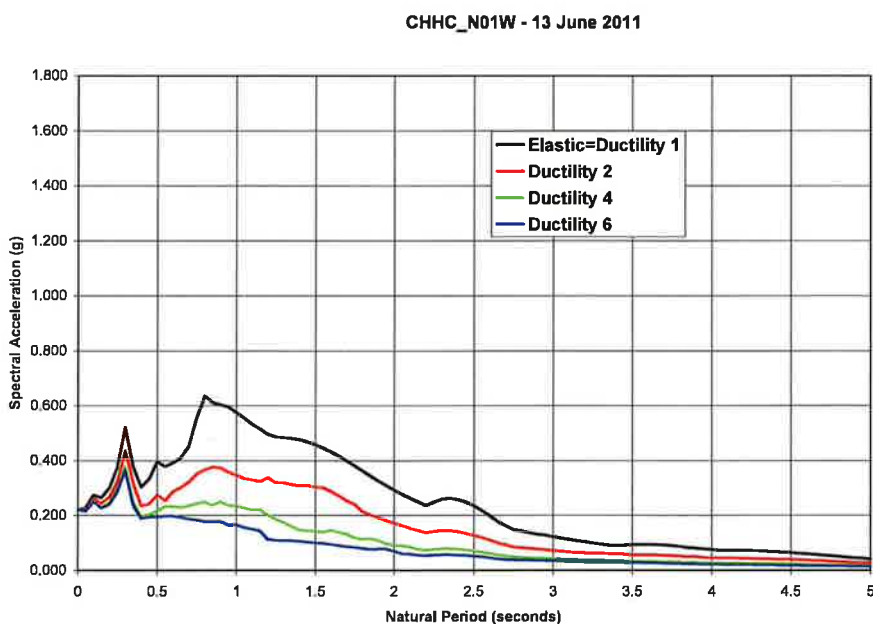
**Figure D-5. Displacement Response Spectra
Resthaven. 13 June 2011- South 88° East Component**



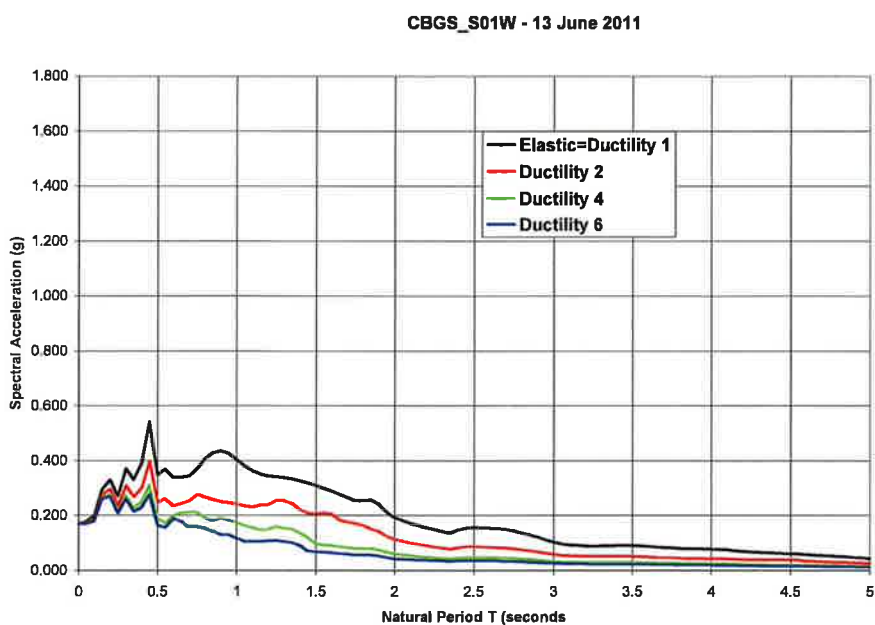
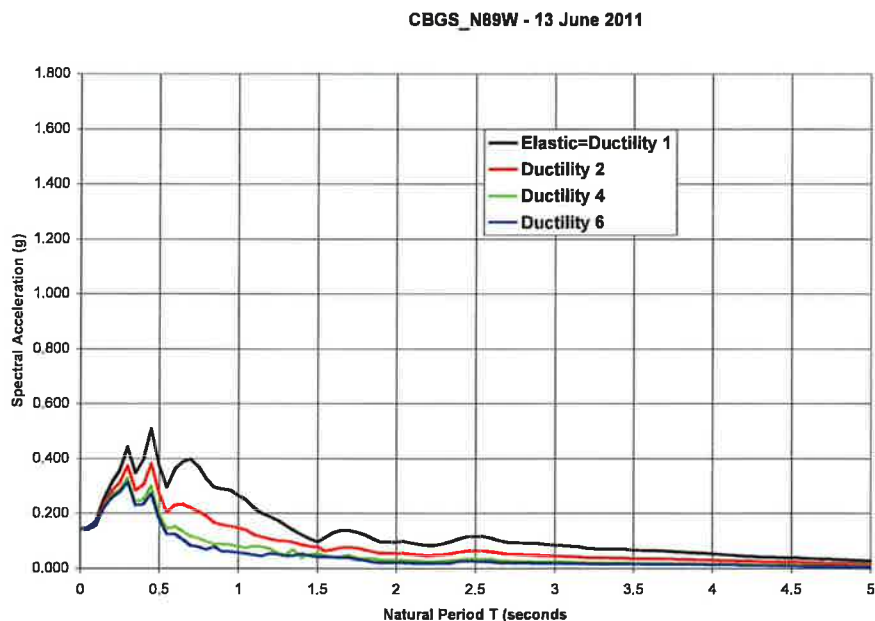
**Figure D-6. Displacement Response Spectra
Resthaven. 13 June 2011- North 02° East Component**

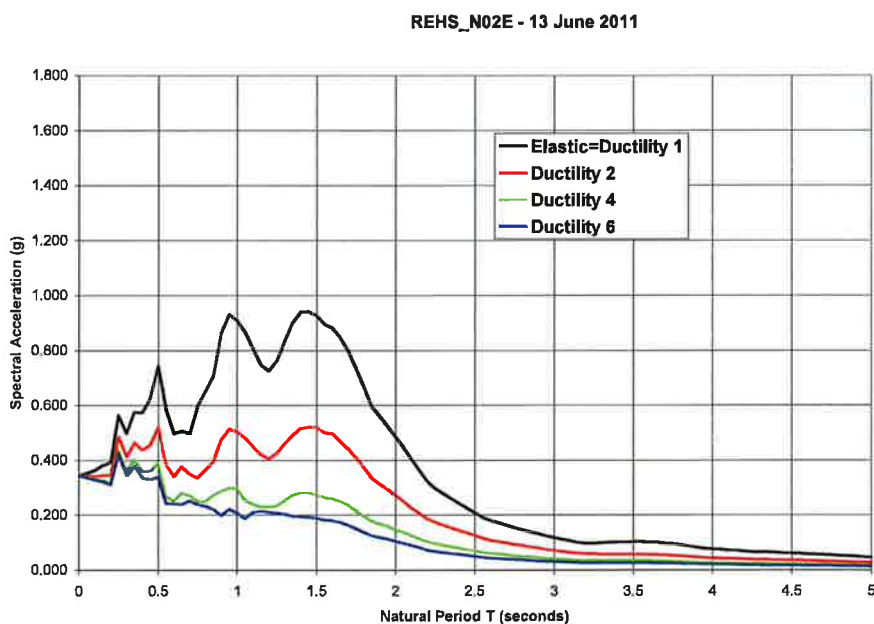
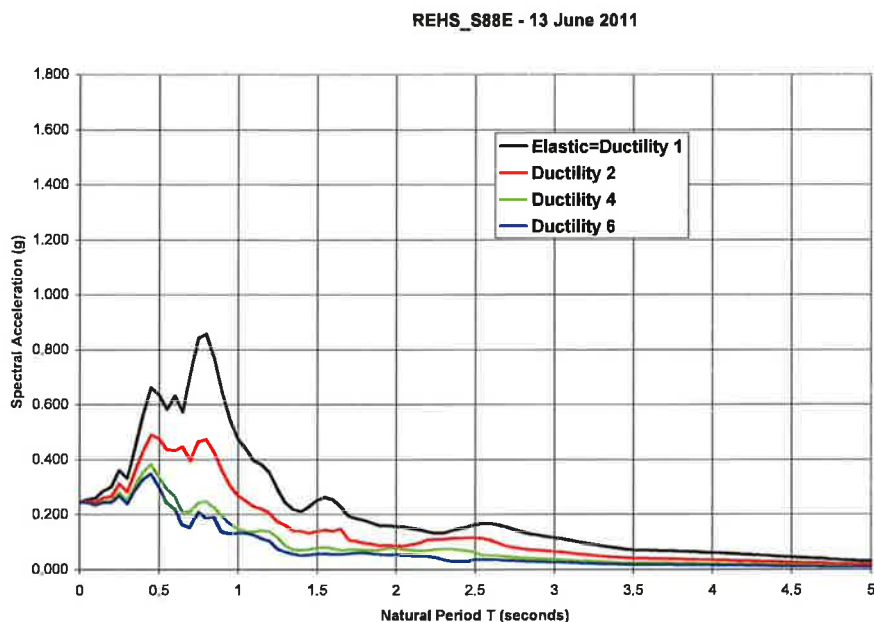


**Figure D-7. Acceleration Response Spectra
Christchurch Hospital, 13 June 2011- South 89° West Component**



**Figure D-8. Acceleration Response Spectra
Christchurch Hospital 13 June 2011- North 01° West Component.**

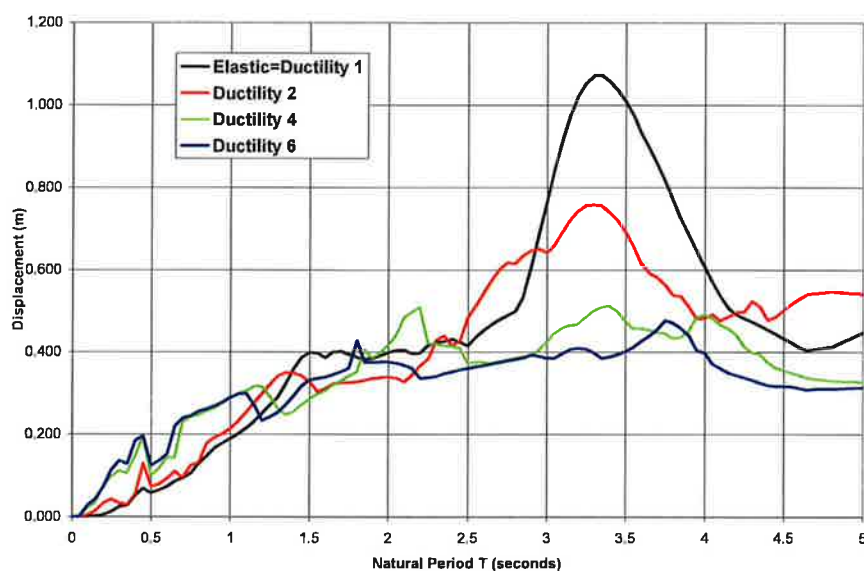




Appendix E

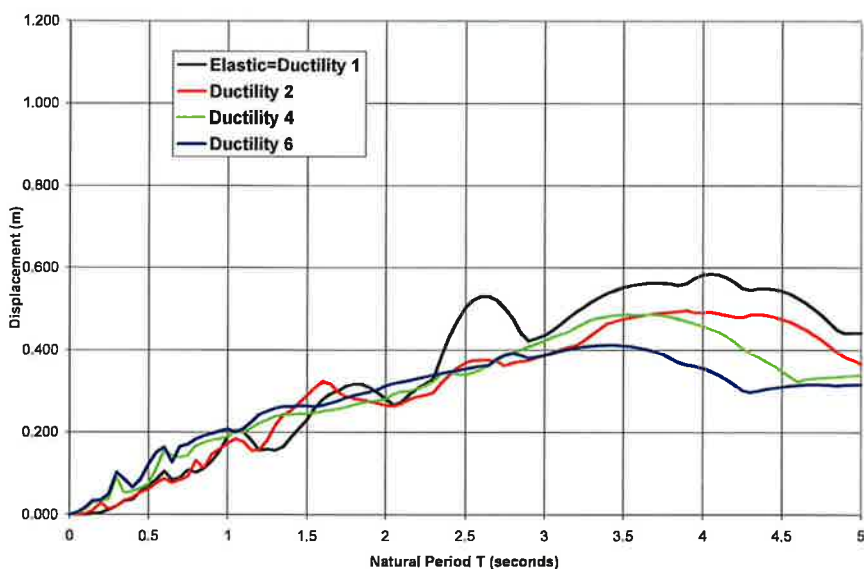
22 February 2011 Earthquake Horizontal Components – Modified Takeda Hysteresis

CHHC_S89W - 22 February 2011

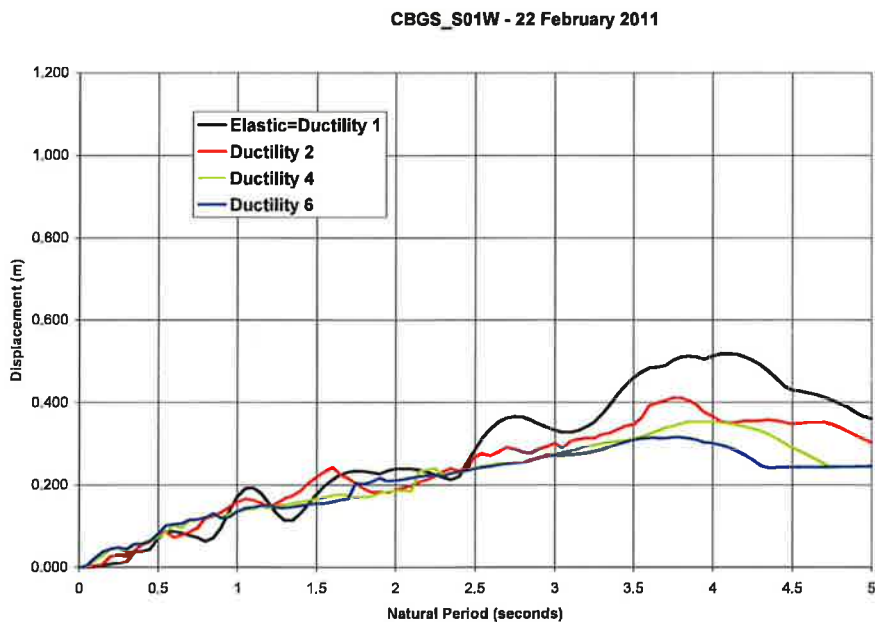
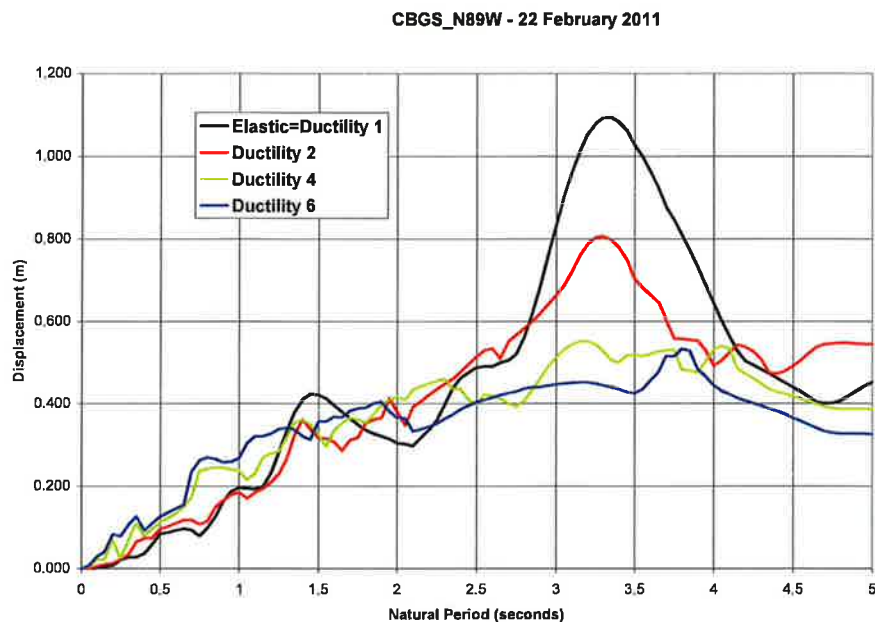


**Figure E-1. Displacement Response Spectra
Christchurch Hospital 22 February 2011- South 89° West Component
Modified Takeda Hysteresis**

CHHC_N01W - 22 February 2011



**Figure E-2. Displacement Response Spectra
Christchurch Hospital 22 February 2011- North 01° West Component
Modified Takeda Hysteresis**



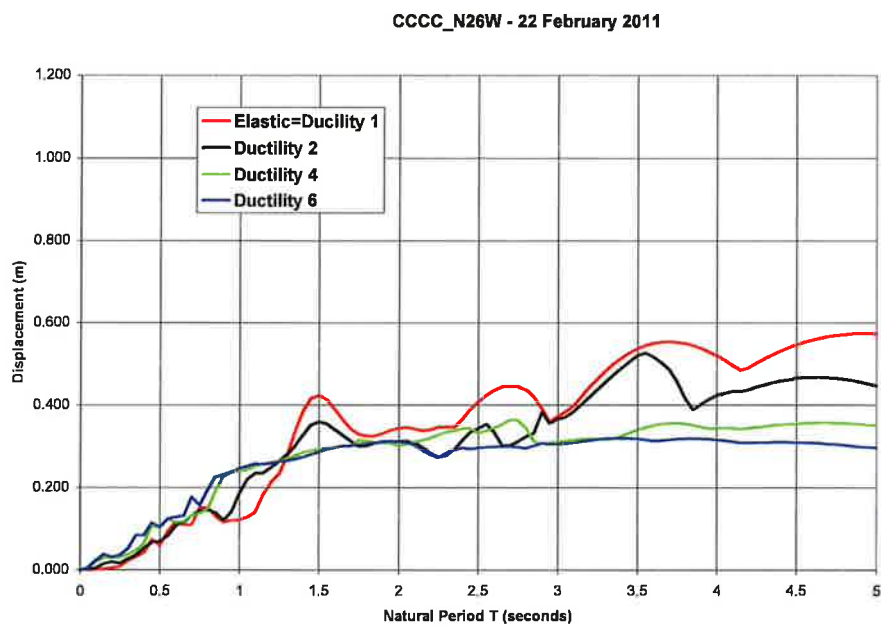


Figure E-5. Displacement Response Spectra
Christchurch Cathedral College. 22 February 2011- North 26° West Component
Modified Takeda Hysteresis

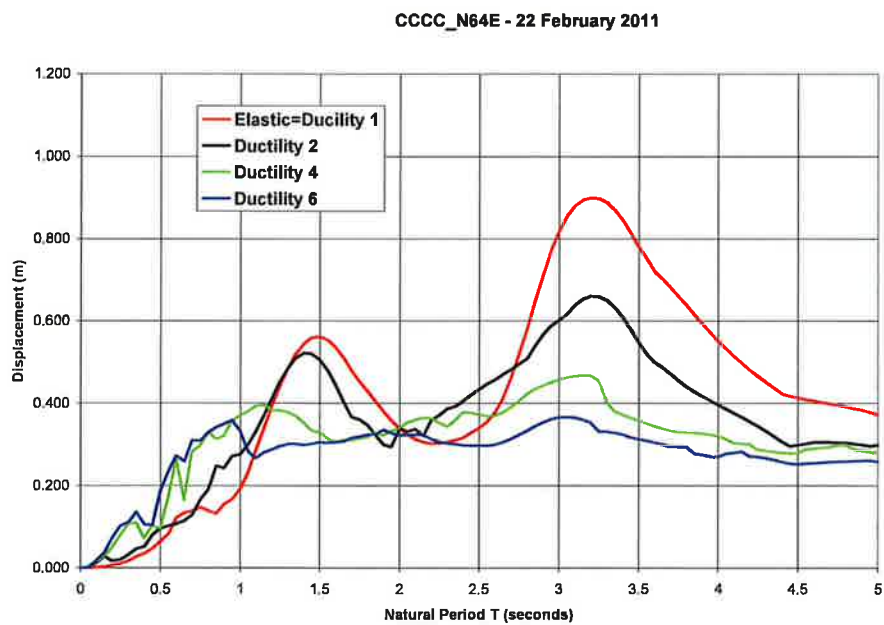
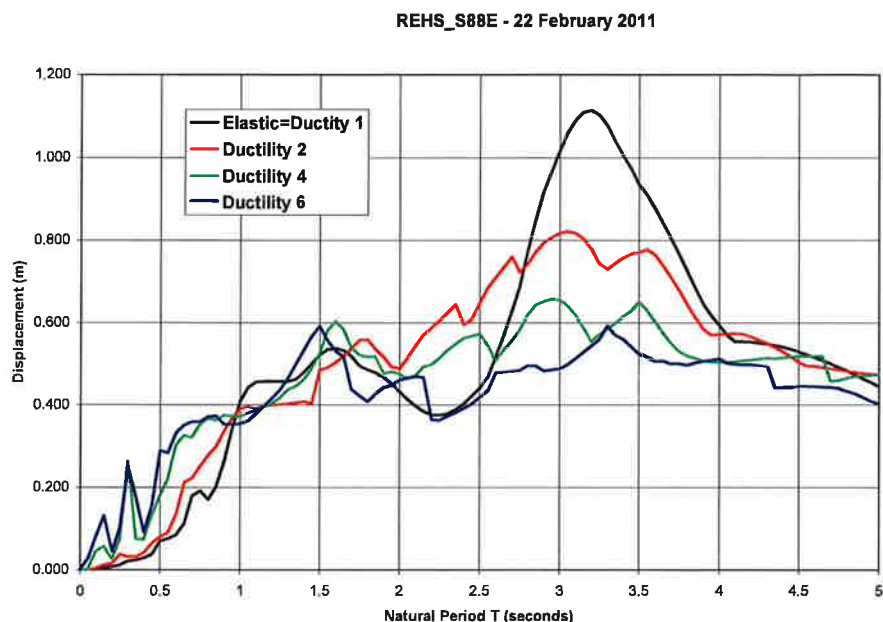
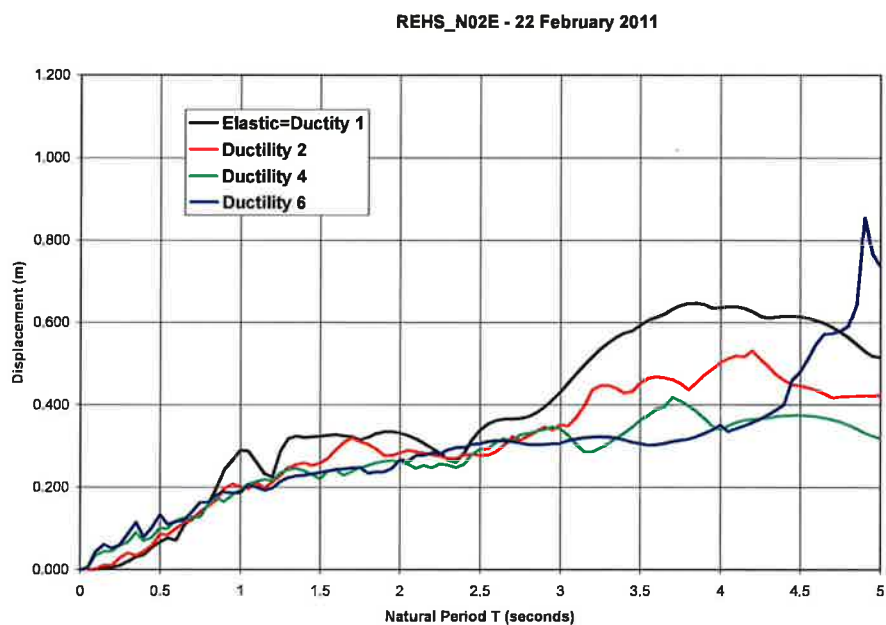


Figure E-6. Displacement Response Spectra
Christchurch Cathedral College. 22 February 2011- North 64° East Component
Modified Takeda Hysteresis

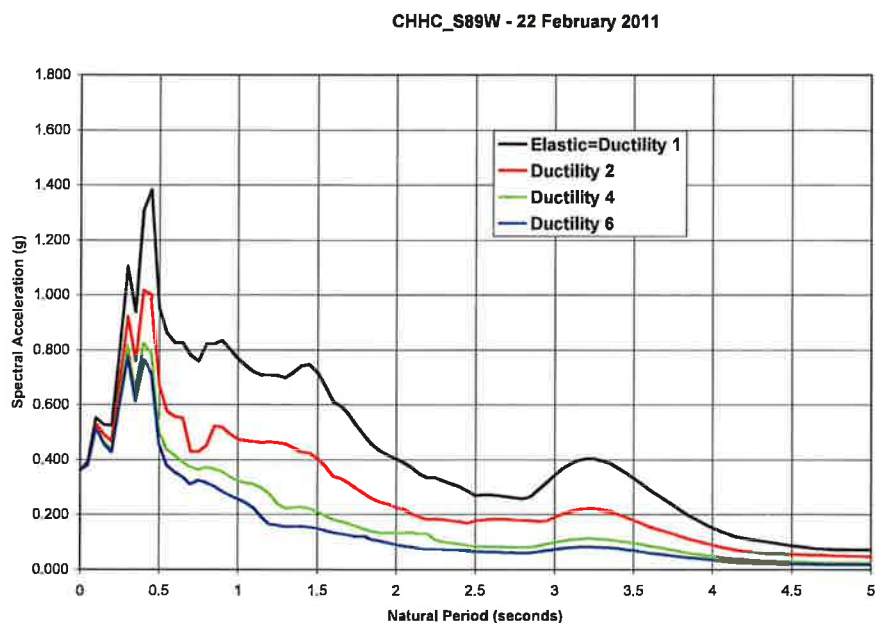


**Figure E-7. Displacement Response Spectra
Resthaven. 22 February 2011- South 88° East Component
Modified Takeda Hysteresis**

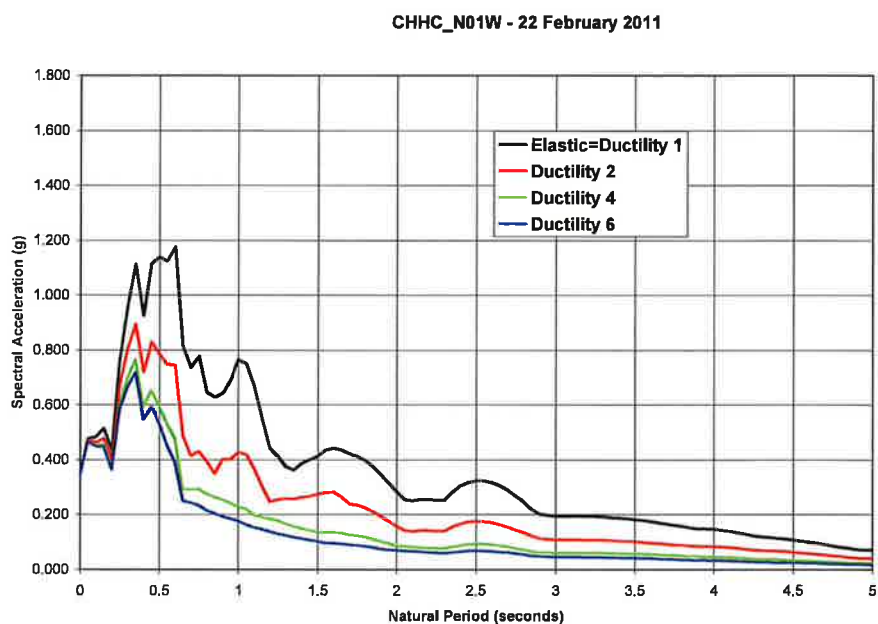


**Figure E-8. Displacement Response Spectra
Resthaven. 22 February 2011- North 02° East Component
Modified Takeda Hysteresis**

Note: The very sensitive responses for high ductility values for the longer natural periods no longer occur.



**Figure E-9. Acceleration Response Spectra
Christchurch Hospital 22 February 2011- South 89° West Component
Modified Takeda Hysteresis**



**Figure E-10. Acceleration Response Spectra
Christchurch Hospital 22 February 2011- North 01° West Component.
Modified Takeda Hysteresis**

CBGS_N89W - 22 February 2011

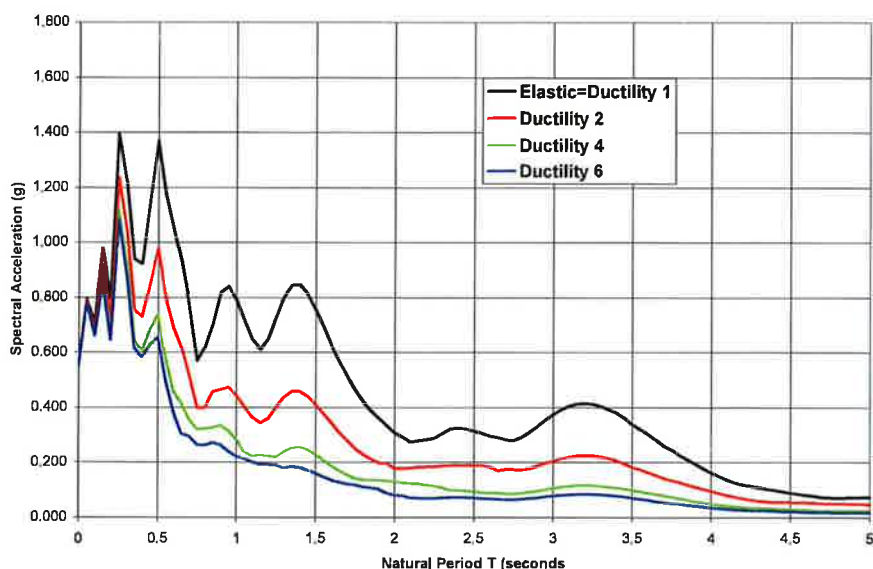


Figure E-11. Acceleration Response Spectra
Christchurch Botanic Gardens. 22 February 2011- North 89° West Component
Modified Takeda Hysteresis

CBGS_S01W - 22 February 2011

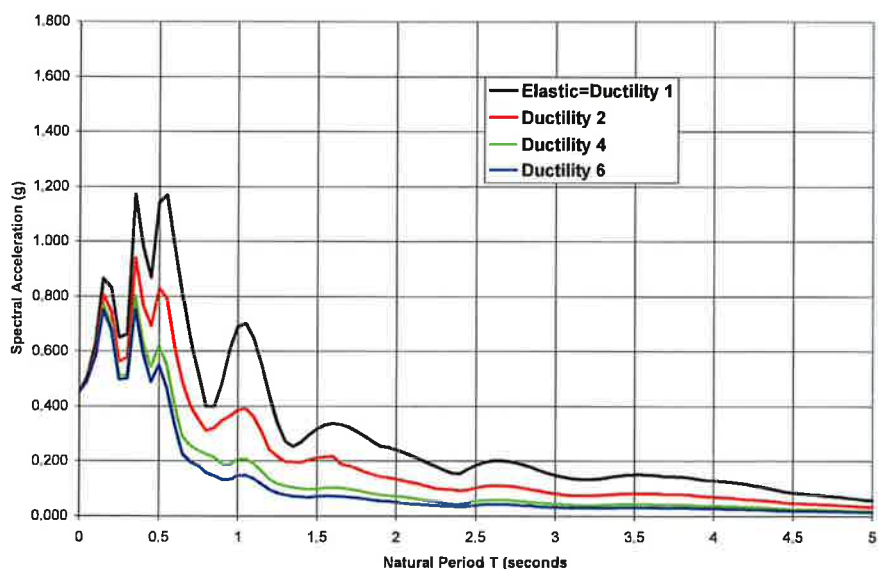
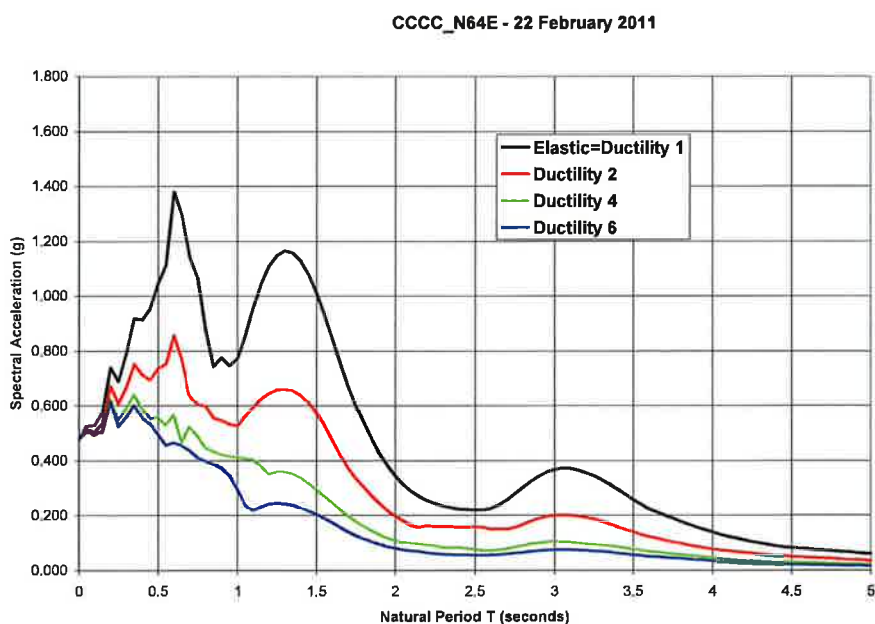
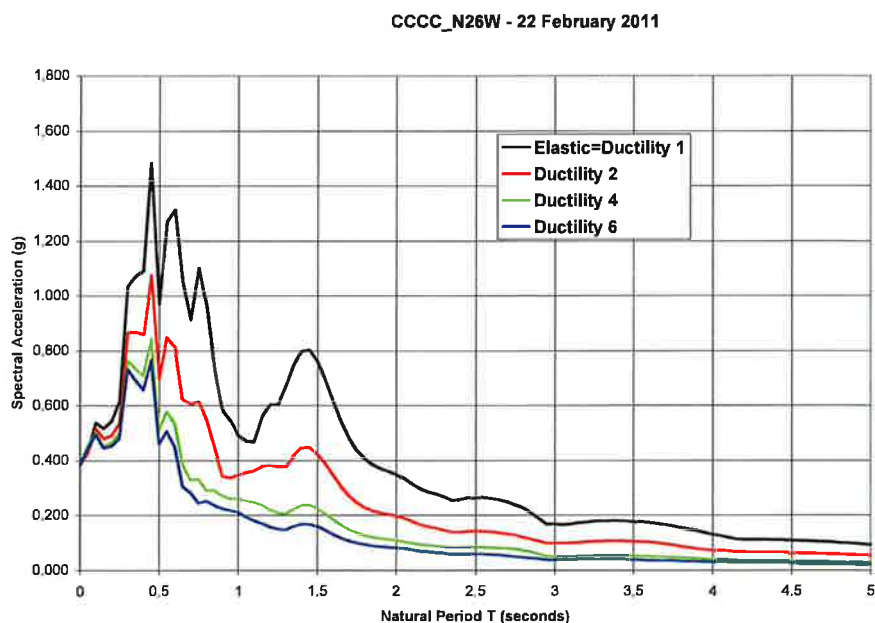
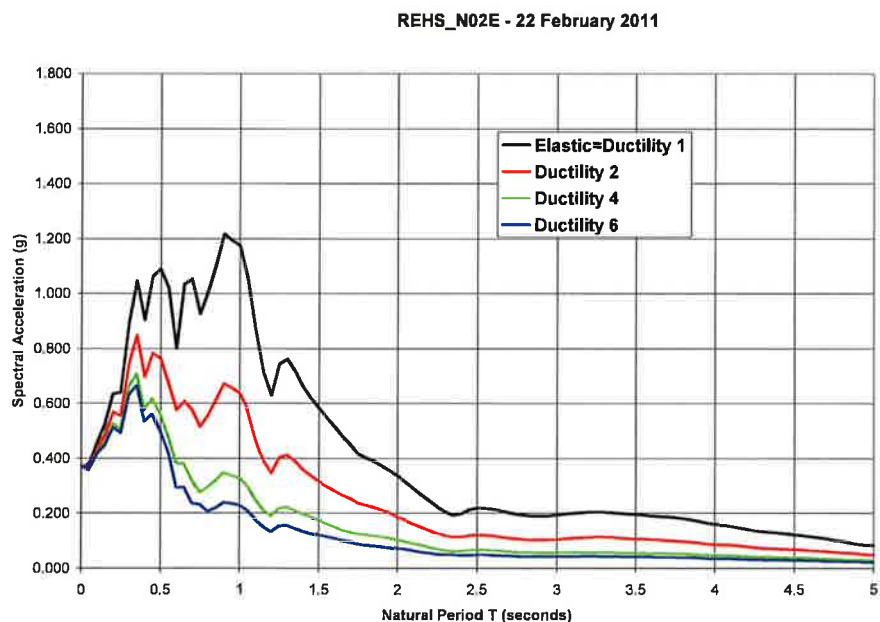
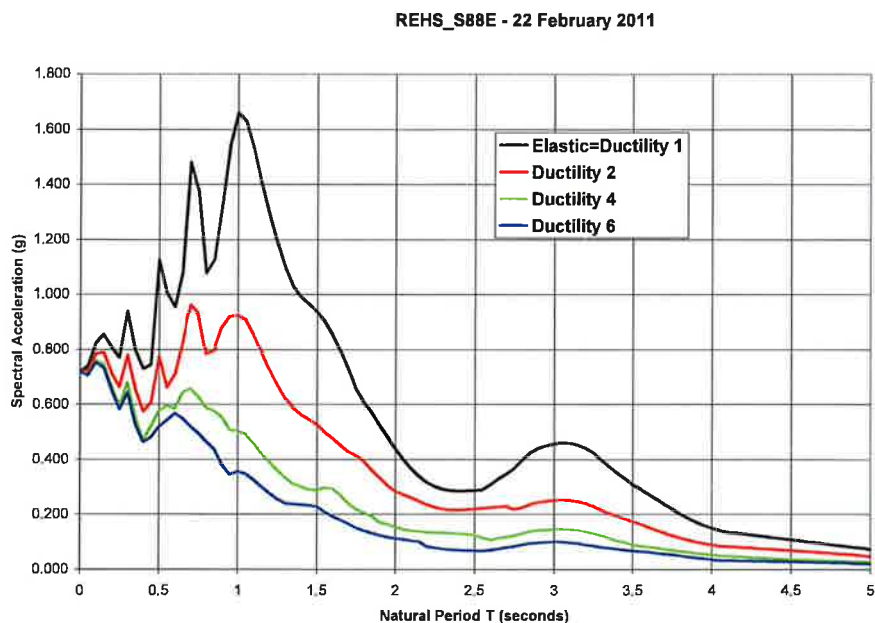


Figure E-12. Acceleration Response Spectra
Christchurch Botanic Gardens. 22 February 2011- South 01° West Component
Modified Takeda Hysteresis





Note: The very sensitive responses for high ductility values for the longer natural periods no longer occur.