Chapter 14: Strong-motion recordings and data analysis for applications in earthquake risk mitigation, seismology and engineering (Gary Gibson).

(Note: * Means references to already existing chapters in the Manual)

14.1. HAZARD, VULNERABILITY AND RISK

14.1.1. Definitions of hazard, vulnerability and risk

14.1.2. Earthquake hazard, vulnerability and risk

14.1.3. Risk Mitigation

Past events

Hazard studies

Present events

Warnings and alarms

Future events

Alerts, forecasts and predictions

14.1.4. Earthquake Risk mitigation

Past earthquakes

Earthquake hazard studies

Present earthquakes

Earthquake warnings and alarms

Future earthquakes

Earthquake alerts, forecasts and predictions

Ground motion recurrence

14.1.5. Acceptable and Unacceptable Risk

14.1.6. Earthquake Risk Criteria

Probability of exceedence per year

Return period

Design life of structures

Probability of exceedence in design life
Specified risk criteria

*Maximum Design Earthquake*

*Operating Basis Earthquake*

14.2. **SEISMICITY MODELS**

14.2.1. **Earthquake source parameters**

Location

Magnitude *

Fault types

Focal mechanisms *

Fault rupture models

Rupture dimensions *

Rupture duration

Strong motion duration

14.2.2. **Earthquake clustering**

Foreshocks and aftershocks

Earthquake swarms

Precursory earthquakes

Adjustment earthquakes

Earthquake cycles

Triggered and induced earthquakes

Declustering for recurrence estimates

14.2.3. **Earthquake catalogues**

Parameters

Uncertainties

Independent or dependent

Earthquake effects

Historical earthquakes

*Estimating source parameters*
14.2.4. **Geological Data**

- Structural geology
- Neotectonics
- Palaeoseismology
- Calibration of methods using recent earthquakes

14.2.5. **Earthquake Magnitude Recurrence**

- Gutenberg-Richter

  *Seismicity b-value*
14.2.6. Maximum credible magnitudes

14.2.7. Use of earthquake source zones
   Volume or area source zones
   Active faults

14.2.8. Quantification of source zones
   Catalogue completeness
   Maximum likelihood, least squares

14.3. GROUND MOTION MODELS

14.3.1. Source, travel path, site and structure

14.3.2. Source
   Magnitude and attenuation
   Magnitude scales
   Variations depending on rupture size and orientation

14.3.3. Travel Path
   Q(f)

14.3.4. Site Response
   Impedance effects
   Resonance effects
   Basin effects
   Other site phenomena
   Methods for considering site response

14.3.5.

14.3.6. Attenuation

14.3.7. Ground Motion Models

14.3.8. Next Generation Attenuation

14.4. HAZARD, AS DEFINED BY GROUND MOTION RECURRENCE

14.4.1. Measures of ground motion
   Intensity *
Displacement, velocity and acceleration

*Time series*

*Peak values and their limitations*
Fourier spectra

Response spectra

14.4.2. **Deterministic and probabilistic Methods**

14.4.3. **Extreme value methods**

14.4.4. **Cornell Method**

14.4.5. **Choice of ground motion models**

Limits applicable to ground motion models

14.4.6. **Computation of Ground Motion Recurrence**

Minimum considered magnitude

14.4.7.

14.5. **TIME SERIES ANALYSIS**

14.5.1. **Engineering models of structures**

14.5.2. **Engineering site/structure models**

14.5.3. **Selection of representative time series**

14.5.4. **Spectral scaling**

14.5.5. **Spectral matching**

14.6. **STRONG MOTION MONITORING**

14.6.1. **Data required for earthquake risk mitigation**

Global, regional and local monitoring

High resolution seismology

*Location*

*Magnitude*

*Focal mechanisms*

*Attenuation*
14.6.2. Instrumentation

Original analogue accelerographs

Digital accelerographs

14.6.3. Strong motion databases