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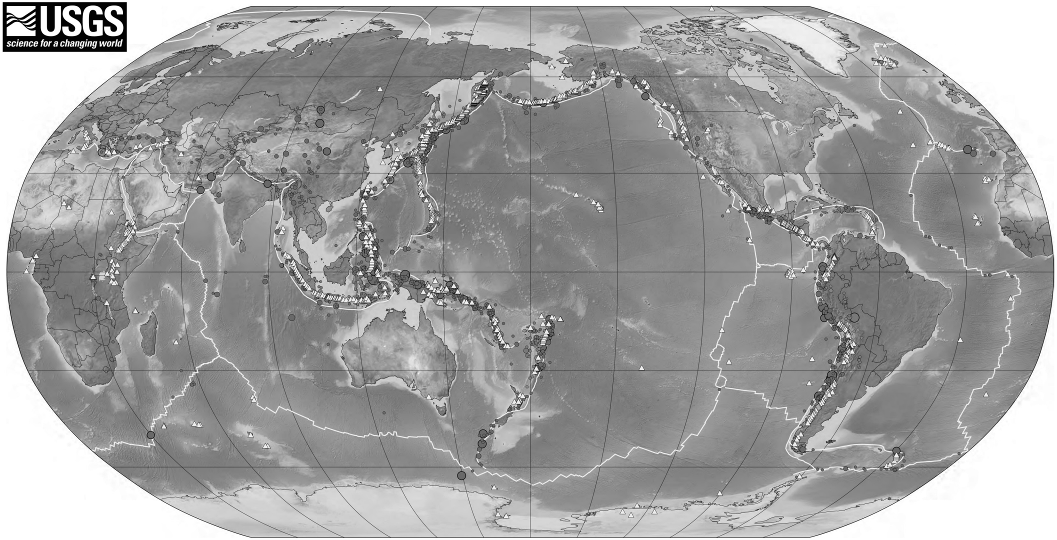

Figure 2.1 World seismicity between 1900 and 2012. (From United State Geological Survey – USGS.)

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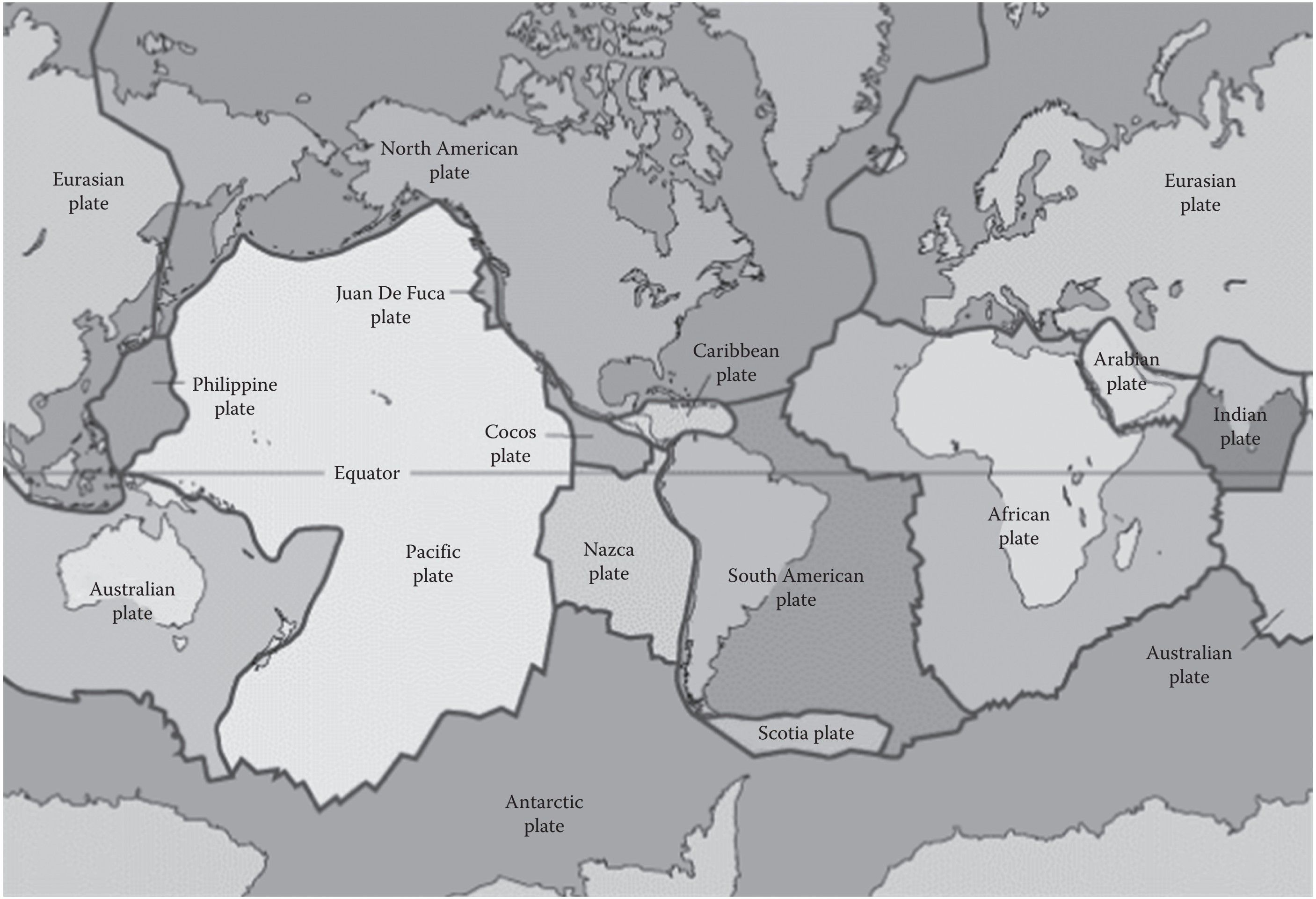

Figure 2.2 Plate boundaries.

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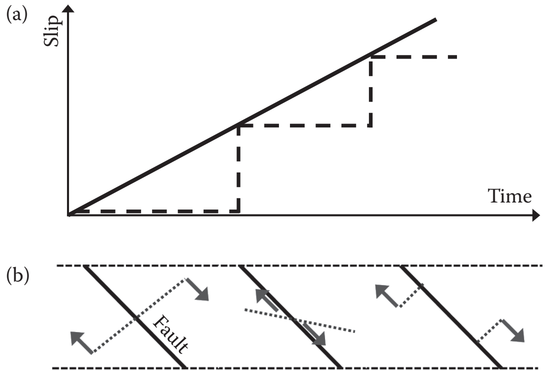

Figure 2.3 Elastic rebound theory: (a) slip as a function of time; (b) from left to right: initial stage, straining before earthquake, after earthquake.

002x003.eps

Figure 2.4 Fence offset in Hollister, California.

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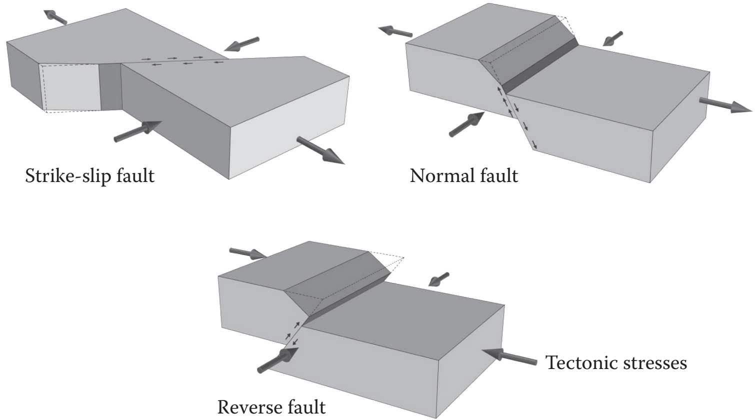

Figure 2.5 Fault types.

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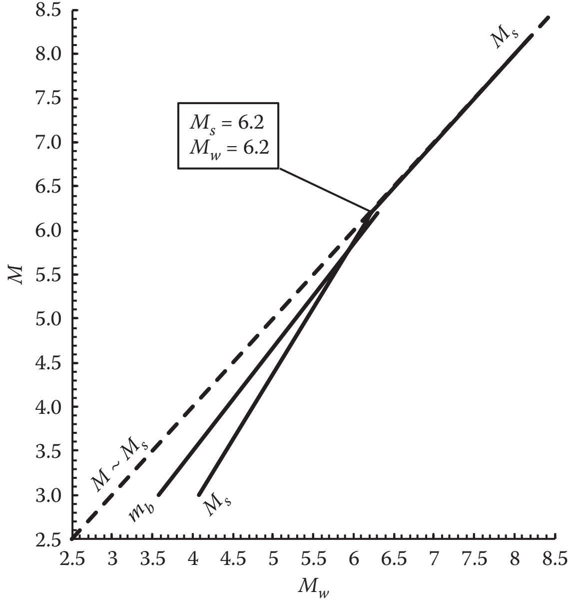

Figure 2.6 Relationship between magnitude scales.

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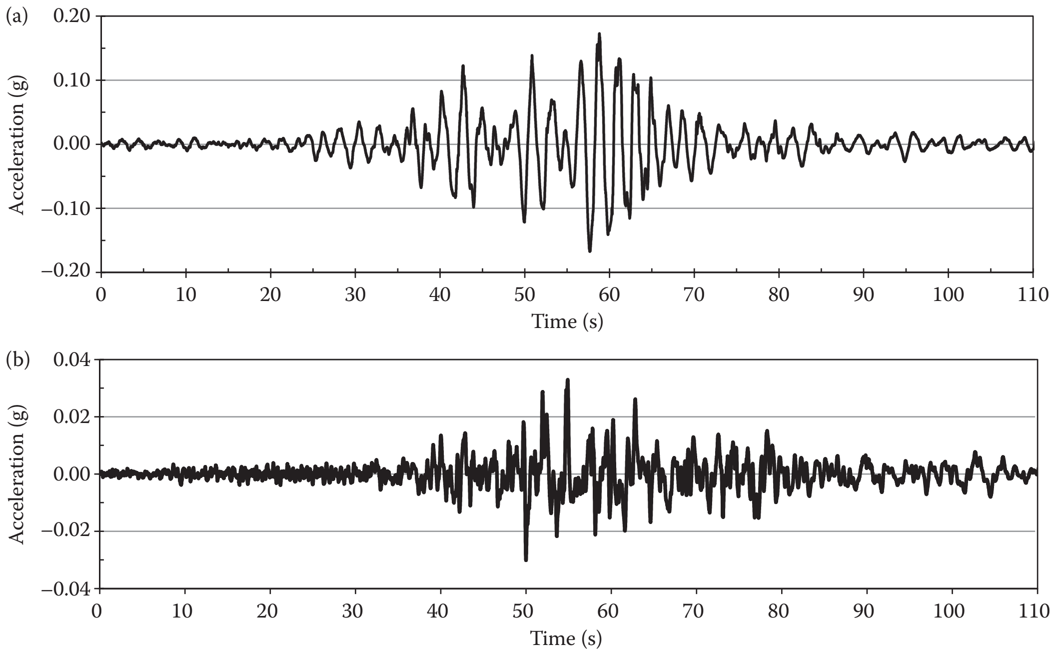

Figure 2.7 Records of the 1985 Michoacán Guerrero earthquake in Mexico City: (a) SCT (soft soil); (b) Tacubaya (rock).

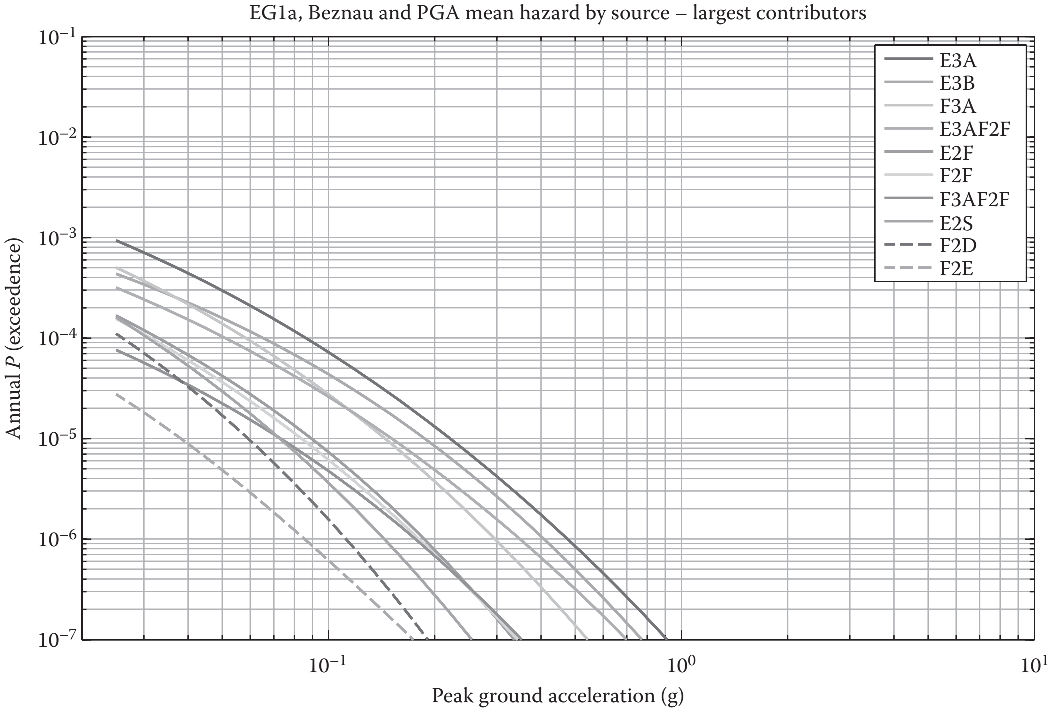

Figure 2.8 Hazard curves: each curve corresponds to a given seismic source.

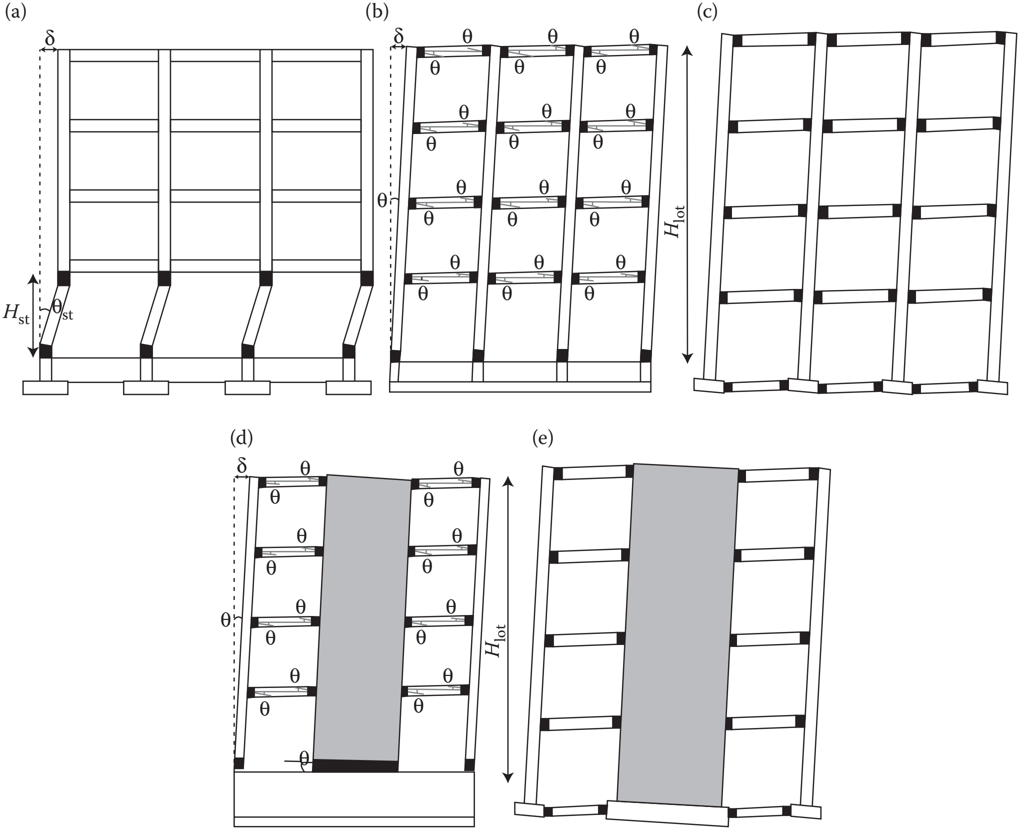

Figure 2.9 Side-sway plastic mechanisms in concrete buildings: (a) soft-storey mechanism in weak column–strong beam frame; (b), (c) beam-sway mechanisms in strong column/weak beam frames; (d), (e) beam-sway mechanisms in wall-frame systems.

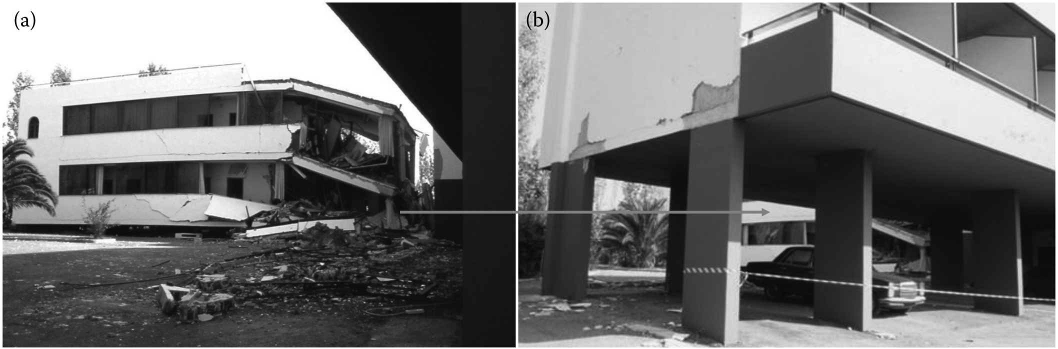

Figure 2.10 (a) Collapse of open ground storey building; (b) collapsed building shown at the background; similar building at the foreground is still standing with large ground storey drift.

Figure 2.11 Typical collapses of frame buildings with open ground storey; 'pancake' type of collapse shown on the right.

002x011.tif

(a) (b)

Figure 2.12 Role of walls in preventing pancake collapse of otherwise condemned buildings.

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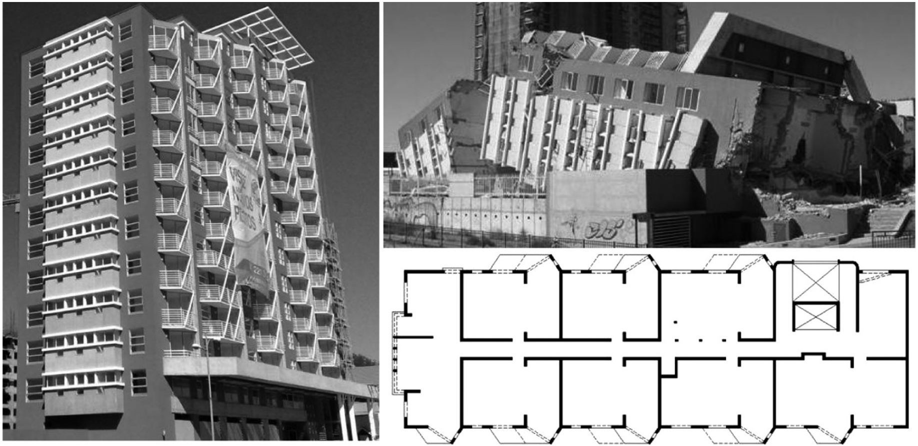

Figure 2.13 Collapse of Alto Rio wall building in Concepción, Chile; February 2010 earthquake (structural walls are shown in black in the framing plan).

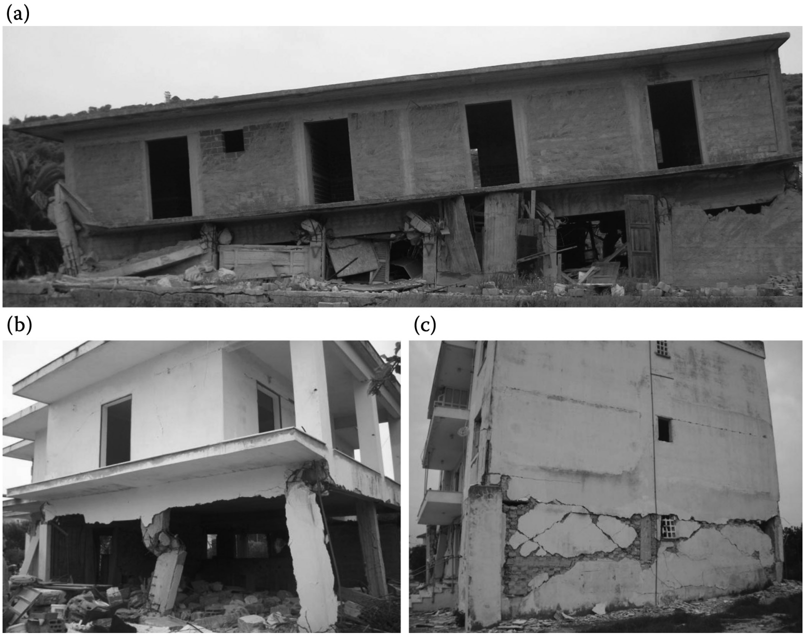

Figure 2.14 Typical concentration of failures or damage in ground storey (a), (b) with role and damage to infills shown in (c).

002x014.tif

Figure 2.15 Collapse of top floors in Mexico City (1985) or of an intermediate one in Kobe (1995).

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Figure 2.16 Collapse of flexible sides in torsionally imbalanced building with stiffness concentrated near one corner.

Figure 2.17 Shear failure of short columns on stiff side (inside rectangle) causes collapse of flexible side as well.

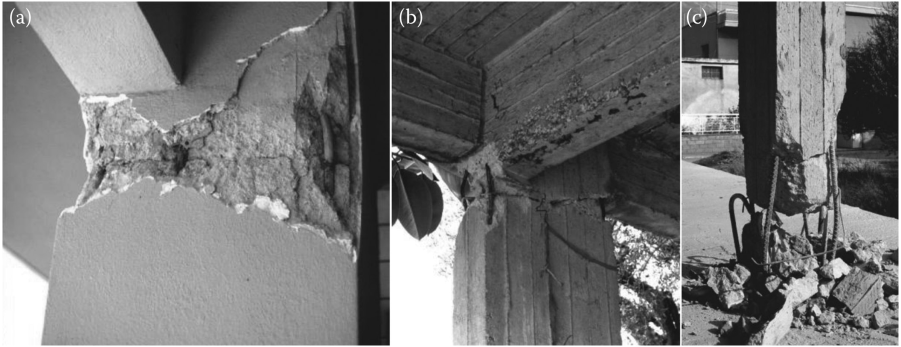

Figure 2.18 Flexural damage (a) or failure (b, c) at column ends.

002x018.tif

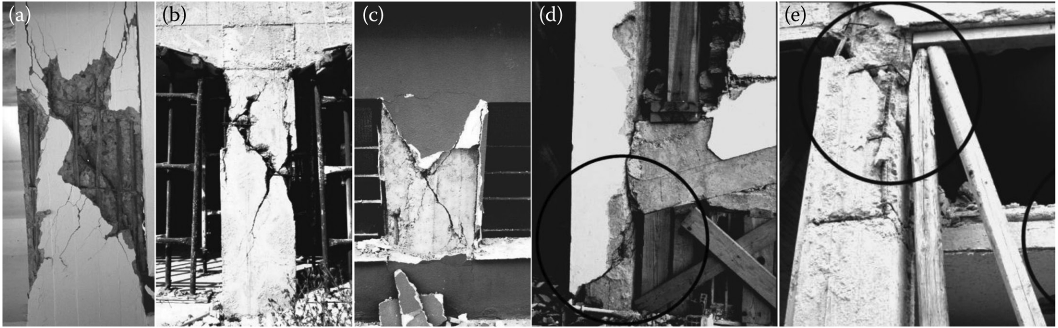

Figure 2.19 Shear failure of columns, (a)–(e), including a captive one between the basement perimeter wall and the beam (c) and short columns due to mid-storey constraint by a stair (d) or a landing (e) supported on the column.

Figure 2.20 Despite complete failure of columns across the ground storey, their residual axial load capacity still supports gravity loads.

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Figure 2.21 Shear failure of beam–column joints.

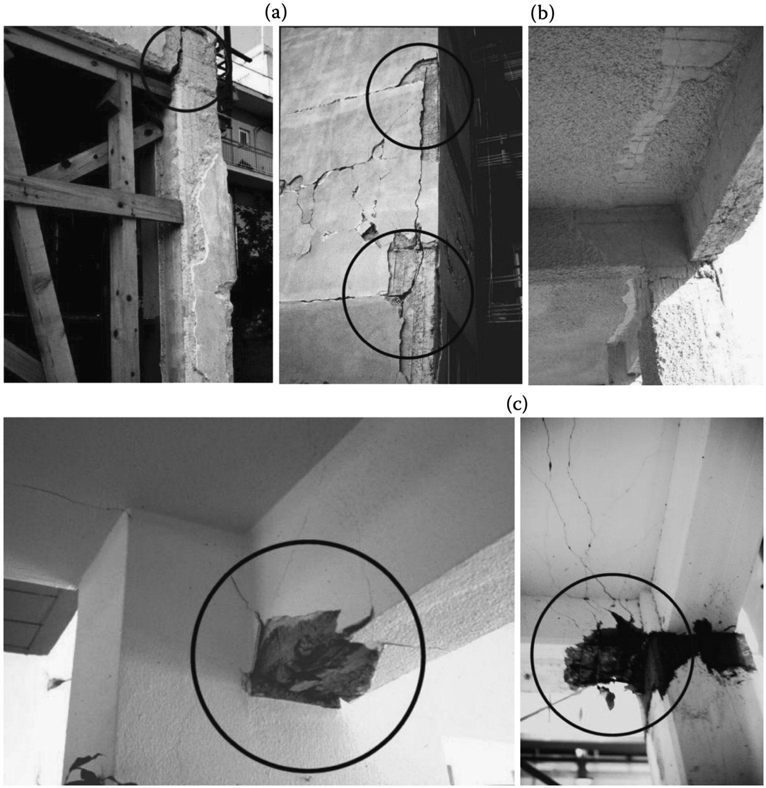

Figure 2.22 Typical features of beam behaviour: (a) pullout of beam bars from narrow corner column, due to short straight anchorage there; (b) wide crack in slab at right angles to the beam at the connection with the columns shows the large participation of the slab as effective flange width in tension; (c) failure, with concrete crushing and bar buckling at bottom flange next to the column.

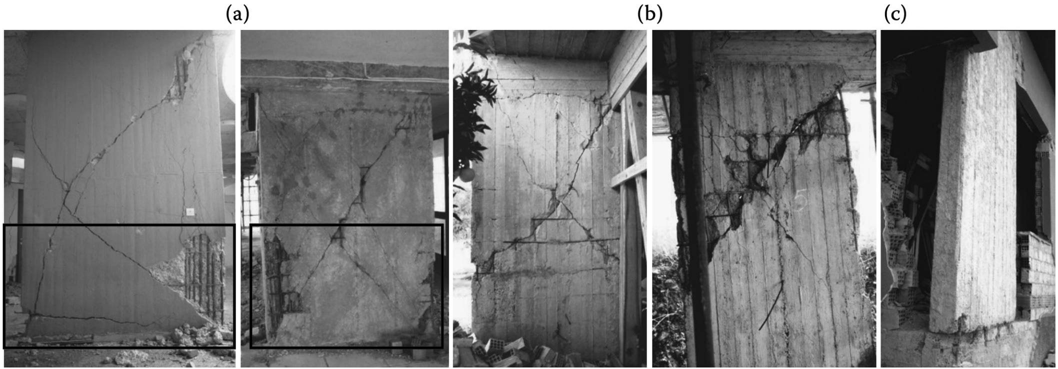

Figure 2.23 Typical failures of concrete walls: (a) flexural, with damage in shear; (b) in shear; (c) by sliding shear.

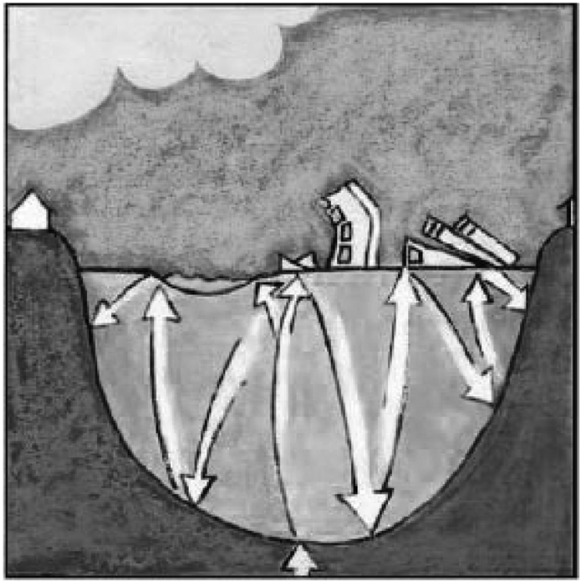

Figure 2.24 Illustration of wave trapping in sedimentary basins.

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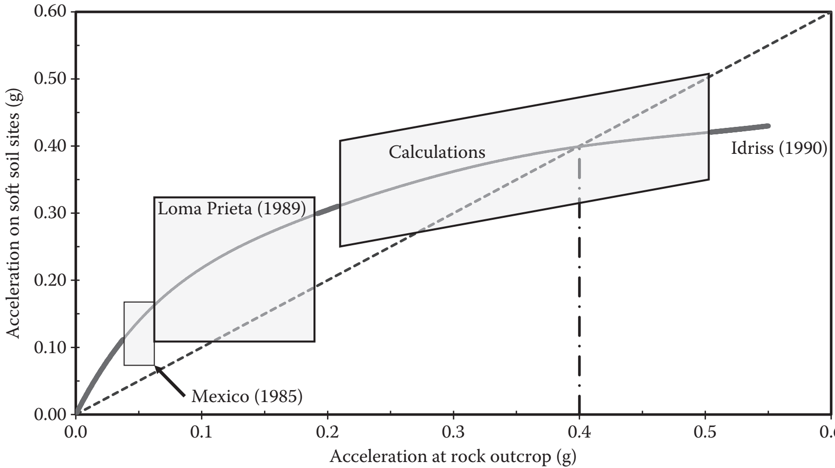

Figure 2.25 Relationship between PGA on rock and PGA at ground surface.

002x025.eps

Figure 2.26 Lateral spreading (El Asnam, 1980).

Figure 2.27 Liquefaction-induced settlement in Marina district (Loma Prieta earthquake, 1989).

Figure 2.28 Bearing capacity failure due to liquefaction (Hyogo-ken Nambu earthquake, 1995).

Figure 2.29 Slope failure on State Highway 17, California (Loma Prieta earthquake, 1989).

Figure 2.30 Bearing capacity failure in Mexico City (Michoacán Guerrero earthquake, 1985).

Figure 2.31 Earthquake-induced foundation settlement (Michoacán Guerrero earthquake, 1985).

Figure 2.32 Settlement of a poorly compacted backfill (Moss Landing, Loma Prieta earthquake, 1989).

Figure 2.33 Settlement of a pipeline trench adjacent to a building (Mexico, 1985).

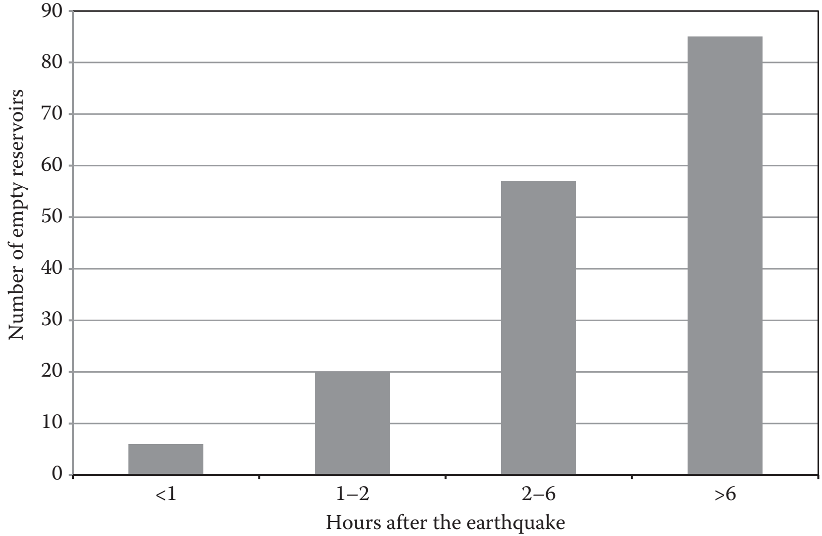

Figure 2.34 Loss of reservoirs after the 1995 Hyogo-ken Nambu earthquake. (Modified from O'Rourke, T.D. 1996. Lessons learned for lifeline engineering from major urban earthquakes. Paper no. 2172. *Eleventh World Conference on Earthquake Engineering.* Acapulco, Mexico.)

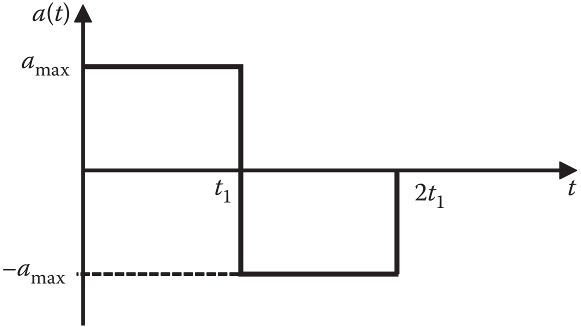

Figure 2.35 Ground acceleration for Question 2.1.

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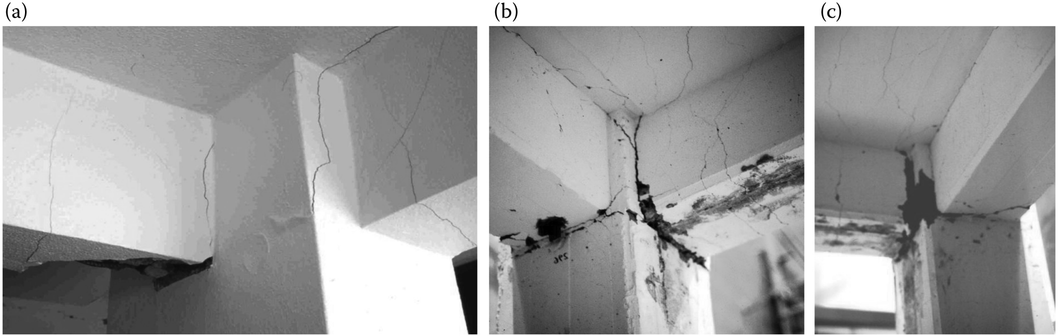

Figure 2.36 (a–c) Beams of Question 2.3.

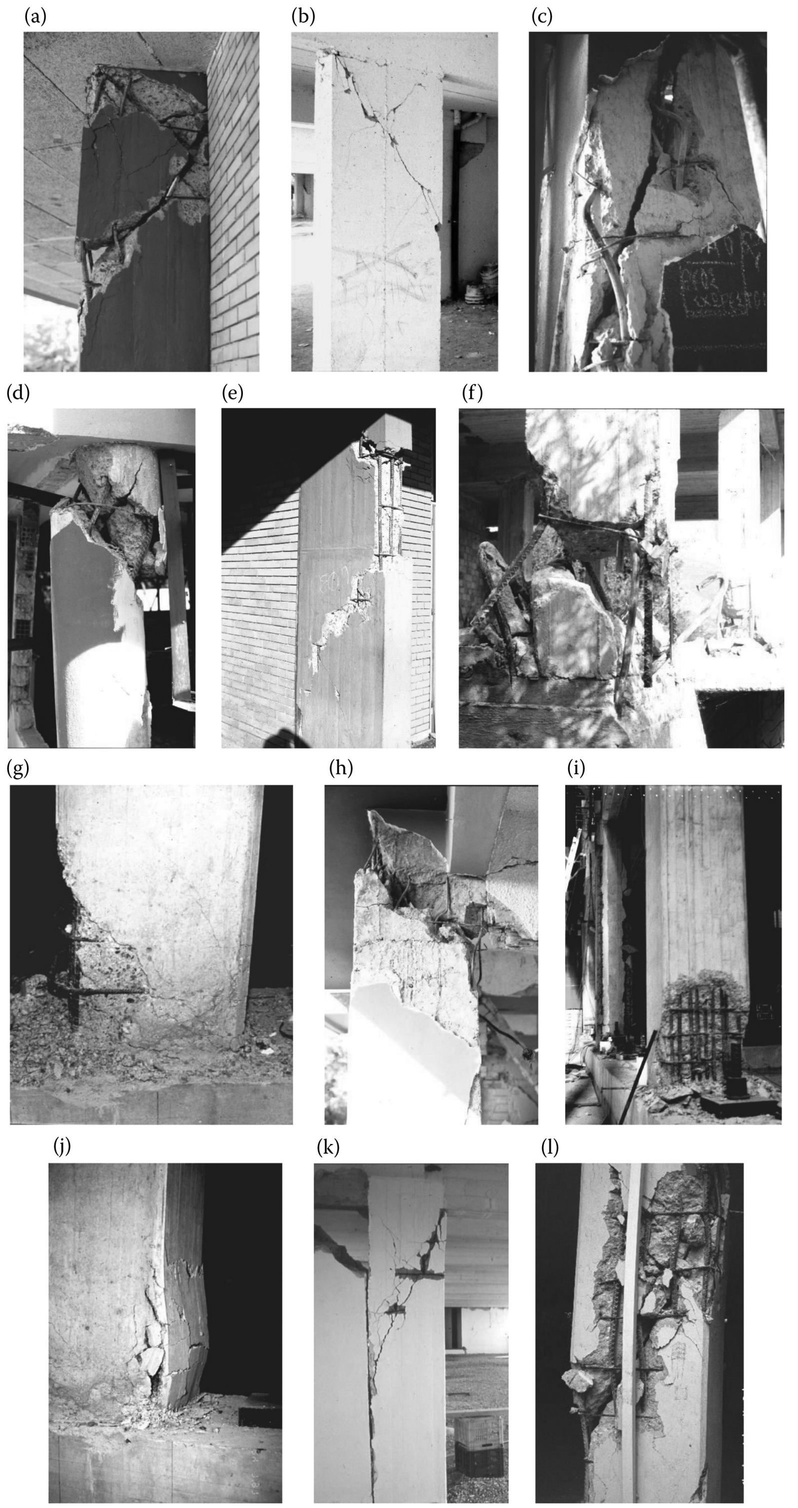

Figure 2.37 (a–l) Columns of Question 2.4.

Figure 2.38 (a–f) Walls of Question 2.5.