Design Earthquakes for the Southeast Area of the Canal Basin

Diseños Sísmicos para el Área Sureste de la Cuenca Canal

Hugh Cowan

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Resumen Ejecutivo

Design Earthquakes for the Southeast Area of the Canal Basin, Panamá.

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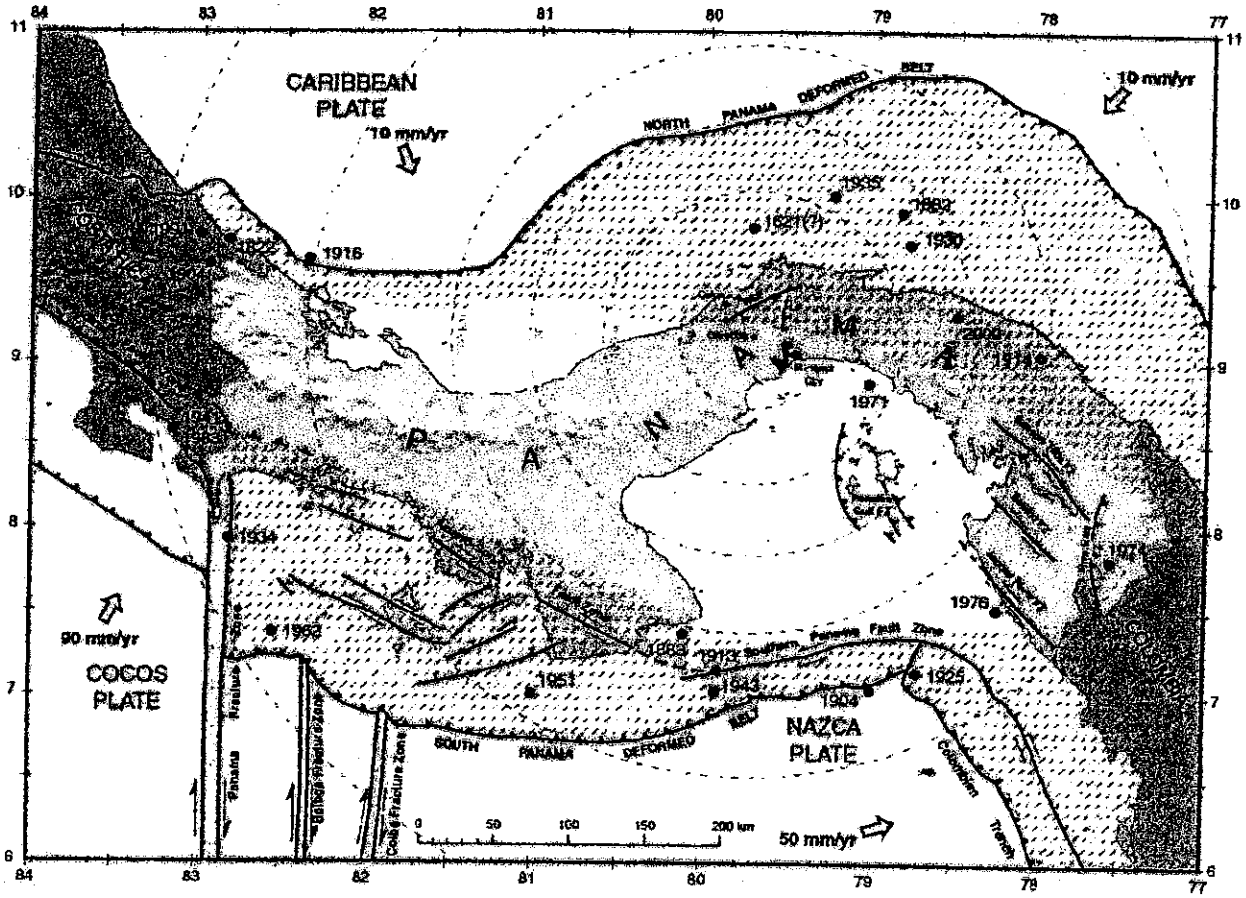

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1.0 Executive Summary

This report describes the major active geological fault zones and large historical earthquakes of Panamá and adjoining offshore regions, for the purpose of reviewing the selection of design earthquakes in the southeast of the Panamá Canal Basin.

Particular emphasis is placed on earthquake sources of the Pacific margin of Panamá, to determine whether or not additional design earthquakes to those of Schweig et al. (1999) are required for engineering design. The locations considered for the design earthquakes of this study include the Pacific Locks area (Miraflores and Pedro Miguel), and the Madden dam on the upper Río Chagres.

Data for the review of fault sources and seismicity were compiled from published reports, recent conference proceedings and international data archives, supplemented by unpublished data on the regional tectonics of Panamá, collected by the author during the previous five years. On the basis of this review and consideration of other requirements for estimating ground motions in the Panamá Canal Basin, the following conclusions are presented:

- There are major active faults associated with the Pacific margin of Panamá, but all are located at greater distances relative to sites of engineering interest than those selected for design earthquakes by Schweig et al. (1999).

- The largest seismic source of engineering interest in the Canal Basin remains the North Panama Deformed Belt, and the interface of the subducted Caribbean plate beneath the Panamá Block.

- The Río Gatún fault remains the principal, shallow crustal fault for hazard modelling in the Canal Basin.

- Based on the conclusions listed above, the design earthquakes of Schweig et al. (1999), are adopted with minor adaptation as follows:

  - Source 1: A moment magnitude (M) 7.7 thrust earthquake located at the Caribbean plate-Panamá Block interface:

    50km from Madden Dam
    70 km from the Pacific Locks

  - Source 2: A M6.8 earthquake on the Río Gatún fault

    12km from Madden Dam
    40km from the Pacific Locks

The Source 1 earthquake will continue to dominate the hazard assessment, but uncertainties about the source and path effects associated with this event emphasize the need for caution in the selection of ground motion attenuation models or time histories. The attenuation model of Dahle et. al. (1995) derived from Central American and Mexican strong motion data provides a useful basis for comparison with other attenuation relationships. Sensitivity analysis with attention to the effect of extreme data values for different attenuation models should provide a guide to the appropriate level of conservatism for engineering design in the Canal Basin.