CoreLogic®

CATASTROPHE RISK MANAGEMENT

Canada Earthquake Model

Region specific innovations in both hazard and vulnerability

Earthquake Risk in Canada

All Canadian provinces have some degree of earthquake risk. Areas of highest risk are within British Columbia, but the June 23, 2010 earthquake in Ontario served as a reminder of the non-trivial risk that also exists in eastern Canada. The model integrates updated building codes and construction practices with the latest science and engineering to produce its state-of-the-art Canada Quake risk model.

Key Features

CONSISTENT RESULTS ACROSS THE U.S. BORDER

Canada and U.S. earthquake models from CoreLogic use identical event definitions for events affecting both countries to expedite analysis of international portfolios, while retaining efficient run-time and number of events for each model individually.

PERILS COVERED

In addition to calculating losses from ground shaking, the model covers associated perils, which can be included or excluded from analysis. Results for each peril are reported separately.

- **Fire Following Earthquake**: Conflagration—widespread, uncontrollable fire that is initiated by an earthquake—can be the primary agent of damage. The model incorporates a ground-up methodology to model the physical mechanism of conflagration, ignition, spread, and suppression.
- **Sprinkler Leakage:** Water damage to contents from sprinkler leakage can exceed shaking contents damage. The model explicitly accounts for the resulting sprinkler leakage losses.

HAZARD DEFINITION

Consistency of results with our U.S. model does not mean, however, that we exclusively apply U.S. science to our model for Canada. Maintaining our principle of incorporating specialized local knowledge when available, our Canada hazard module integrates the latest fourth-generation hazard model update from the Geological Survey of Canada (GSC). The model additionally captures recent insights, including use of the globally-developed and globally-applicable "next- generation"' attenuation (NGA) functions.

SOIL-BASED ATTENUATION FUNCTIONS

Going one step beyond NGA and anticipates future scientific development, the model uses soil-based attenuation (SBA)—a subset of NGA equations that assumes the seismic waves propagate through soil. This approach more closely represents the vast majority of insured exposure located on soil sites and reduces the modeling uncertainty introduced by applying soil amplification factors to the more conventional rock-based equations. By requiring far less adjustment for site conditions, use of SBA by the model retains the improved confidence of the NGAs.

The Canada Earthquake Model is part of the suite of products by Catastrophe Risk Management from CoreLogic® that resides in the global multi-peril platform RQE® (Risk Quantification & Engineering). Both the hazard and vulnerability components of the model offer unique modeling innovations, including multi-parameter vulnerability for residential structures and soil-based ground motion functions that capture physical phenomena while eliminating bias.

Key Features (cont'd)

TIME-DEPENDENT RECURRENCE RATES

Time dependence, incorporated in the model for the Cascadia subduction zone, represents the definitive scientific consensus while portraying risk within the foreseeable future, not just the theoretical "long-term" risk. The Canada Earthquake model has incorporated time- dependent recurrence frequencies since 1997 because they reflect the scientifically-accepted physical mechanism of frictional stress build-up at the tectonic plate interface (the fault plane). Deep within the earth, where rock is molten, faults glide smoothly relative to each other, but at the surface, rocks are solid, thus "locking" the fault. An earthquake occurs when strain from continuous plate motion at depth overcomes frictional resistance of the interlocked surface. An earthquake is more likely to occur on a fault that is "late in its seismic cycle," relative to the average time between large quakes, and less likely in a fault where an earthquake has occurred "recently" (in geologic time).

VULNERABILITY

Vulnerability curves in the model are well-honed from thousands of seismic studies conducted by CoreLogic over the last 30 years, and are additionally founded on first-hand observations of 90 earthquakes worldwide. For residential structures, Vulnerability is represented using a three-dimensional surface that accounts for the long duration of earthquake shaking, which is characteristic of the Cascadia subduction zone. Three-dimensional vulnerability captures the phenomenon of "damage acceleration"—the more damage that occurs during a given quake, the more damageable a building becomes—and reduces uncertainty by more closely reflecting the reality evidenced by data from thousands of claims.

DEMAND SURGE

The model incorporates a rational approach to demand surge, based on the demand and supply for construction materials and labor in the affected region. Since economic factors undergo constant change, CoreLogic updates the supply-side database for demand surge with each release.

Model Specifications

IMPORT RESOLUTION

Exposure data is accepted at resolutions of latitude/longitude, street address, and 3-and 6-digit postal codes levels. When input data is provided at aggregate levels, the model adds refinement to loss results by disaggregating exposure to a resolution consistent with the hazard generation. The disaggregation scheme is weighted by population distribution.

MODEL VALIDATION/EXPERT REVIEW

The hazard and vulnerability modules have undergone stringent peer-review by internationally-recognized scientific experts. The residential vulnerability module has been reviewed and consented to by the Pacific Earthquake Engineering Research Center (PEER).

HAZARD ANALYSIS AND SOIL DATA RESOLUTION

Variable resolutions of hazard generation are based on population density and range between 0.01 and 0.1 degrees. Soil condition mapping, one of the most sensitive components of earthquake modeling, uses eight layers of soil map data, each with increasingly fine resolution. Soil maps in high hazard regions with dense population are mapped with a tolerance of 40 feet.

GEOGRAPHIC COVERAGE

The model covers all of Canada's 10 provinces and three territories.

LINES OF BUSINESS

Residential, Commercial, and Industrial.

STRUCTURE TYPES AND OCCUPANCIES

With a full suite of structure types representative of Canadian construction, and dozens of occupancy categories for each line of business, the model differentiates risk across hundreds of combinations, and allows only realistic pairings of occupancy and construction. A common set of structure types and occupancies is available worldwide. Our technical documentation provides guidance on structure type selection.

MODEL OUTPUT

Risk metrics include OEP and AEP loss exceedance curves, AAL, TVAR, and simulations of historic events. In addition, RQE's year loss table (YLT) uniquely features three-dimensional output: simulation year, events, and sample outcomes. Instead of reporting mean losses with standard deviations, each loss in the YLT represents one possible outcome for the associated event. This allows users to retain the full distribution of uncertainty when using model output in dynamic financial analysis and capital modeling. Conventional event loss results and other risk metrics can be derived from the YLT with arithmetic or simple database queries. YLT and event loss results are supported at the portfolio level. Other risk metrics are supported at multiple levels of refinement: from total aggregate portfolio results, to detailed output by policy and site.

COVERAGE TYPES

The model calculates damage to structures (building damage), contents, and time element (business interruption and additional living expenses). Separate, independent vulnerability functions are used for calculating building and contents damage. Time-element vulnerability is a function of both building and contents damage.

FINANCIAL MODELING

All major insurance policy structures and reinsurance treaty types are modeled.

STREAMLINED REPORTING

RQE streamlines earthquake reporting requirements as specified by the Office of Superintendent for Financial Institutions (OSFI). Custom reports have been pre-defined for reporting probabilistic results to meet guideline B-9, and technical guidance is provided on event selection to meet guideline E-18.

FOR MORE INFORMATION, PLEASE CALL 866-774-3282
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