EQECAT
AN ABS GROUP COMPANY

Canada Quake Model

EQECAT released an updated version of its Canada Quake Model in July 2011. The Canada earthquake model resides in EQECAT's global multi-peril platform WORLDCATenterprise. 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 accurately capture physical phenomena while eliminating bias.

Key aspects of the model include:

- **Consistent Results Across the US Border:** EQECAT's Canada and US earthquake models 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 US model does not mean, however, that we exclusively apply US 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:** EQECAT goes one step beyond NGA and anticipates future scientific development by using soil-based attenuation (SBA)—a subset of NGA equations that assumes the seismic waves propagate through soil. EQECAT's SBA 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, EQECAT's use of SBA retains the improved confidence of the NGAs.
- **Time-Dependent Recurrence Rates:** Time dependence, incorporated in the EQECAT 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. EQECAT has used 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).

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- **Vulnerability:** The model incorporates vulnerability curves that are well-honed from thousands of seismic studies conducted by EQECAT and ABS Consulting over the last 30 years, and are additionally founded on first-hand observations of 90 earthquakes worldwide. For residential structures, EQECAT represents vulnerability 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:** EQECAT applies 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, EQECAT updates the supply-side database for demand surge with each release.

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. EQECAT integrates updated building codes and construction practices with the latest science and engineering to produce its state-of-the-art Canada Quake risk model.

MODEL SPECIFICATIONS

- **Importing Resolution:** Import and risk evaluation is geocoded at latitude/longitude, street address, and 3-and 6-digit postal codes levels. When input data is provided at aggregate levels, model calculations are based on a disaggregation weighted by daytime and nighttime distributions of population, adding back a degree of refinement to loss results.
- **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 Resolution:** For 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 within a tolerance of 40 feet.
- **Geographic Coverage:** The model covers all 13 Canadian provinces.
- **Lines of Business:** Residential, Commercial, and Industrial
- **Structure Types and Occupancies:** With 29 structure types specific to Canadian construction, and dozens of occupancy categories for each line of business, the model differentiates risk across hundreds of combinations. Our technical documentation provides guidance regarding appropriate modeled combinations, allowing only realistic pairings of occupancy and construction.
- **Model Output:** Risk metrics include loss exceedance curves including OEP and AEP, AAL, TVAR, as well as event-by-event losses with associated uncertainty for stochastic events, and simulations of historic events. Reporting of results supports multiple levels of refinement: total aggregate portfolio, postal code or province, and detailed output by policy and site.
- **Coverage Types:** The model calculates damage to structures (building damage), contents, and time element (business interruption or loss of use). Separate, independent vulnerability functions are used for calculating losses relating to each coverage type. Time-element vulnerability functions are a function of structural and contents damage.
- **Financial Modeling:** All major insurance policy structures and reinsurance treaty types are modeled, based on WORLDCATenterprise™ platform functionality.
- **Custom Reports for Streamlined Reporting:** Custom reports have been pre-defined for probabilistic results, leading to improved usability in meeting earthquake reporting requirements specified by the Office of Superintendent for Financial Institutions (OSFI).

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