Commercial Real Estate Portfolio Loss Analysis

EQ LOSS MODELING TERMINOLOGY

Total Insured Value (TIV): The total of the insured values (typically based on replacement costs) for buildings and contents, as well as annual Business Interruption (BI) values, for all buildings in the portfolio.

Primary Characteristics (of a Building): Features such as the type of construction and lateral system, year built and number of stories, that determine the "baseline" vulnerability of a building.

Secondary Characteristics: Specific features such as plan irregularities and soft stories, that increase (or decrease) a particular building's vulnerability.

Ground Up Loss: The total amount of the loss without consideration of any insurance coverage.

Gross Loss: The portion of the loss that is covered by insurance, after application of a deductible and any limits in coverage.

Demand Surge: The short-term regional increase in construction material and labor costs that often occurs following a large earthquake or other catastrophic event.

CASE STUDY

A client owns 100 office buildings located in California, Oregon and Washington states, with a Total Insured Value (TIV) of approximately $3.6 billion. The client has had single site "PML" reports performed for most of the properties, but wants to understand the potential losses to the overall portfolio, to help decide how much earthquake insurance to buy and/or to meet a lender requirement. Recognizing that each portfolio loss analysis model uses different assumptions, the client would like results developed using two models, a typical "insurance" model and an "engineering" model.

For this study, the structural engineer prepares data for each of the 100 properties, using the existing single-site reports where available, supplemented by additional site visits and drawing reviews where needed. For properties in high liquefaction zones, available geotechnical reports are reviewed. Other secondary seismic hazards such as fault rupture, landslide and tsunami are also reviewed for each building location. The key primary and secondary characteristics for each building are collated in a format or coding suitable for the models being used. For the engineering model, building response parameters such as the fundamental period, base shear coefficient and system ductility are also used to explicitly capture the specific features of each main building.

Each model is then run to develop loss estimates for each building, and for the overall portfolio of properties. As part of this process, the engineer compares the portfolio model's initial results for each individual building with

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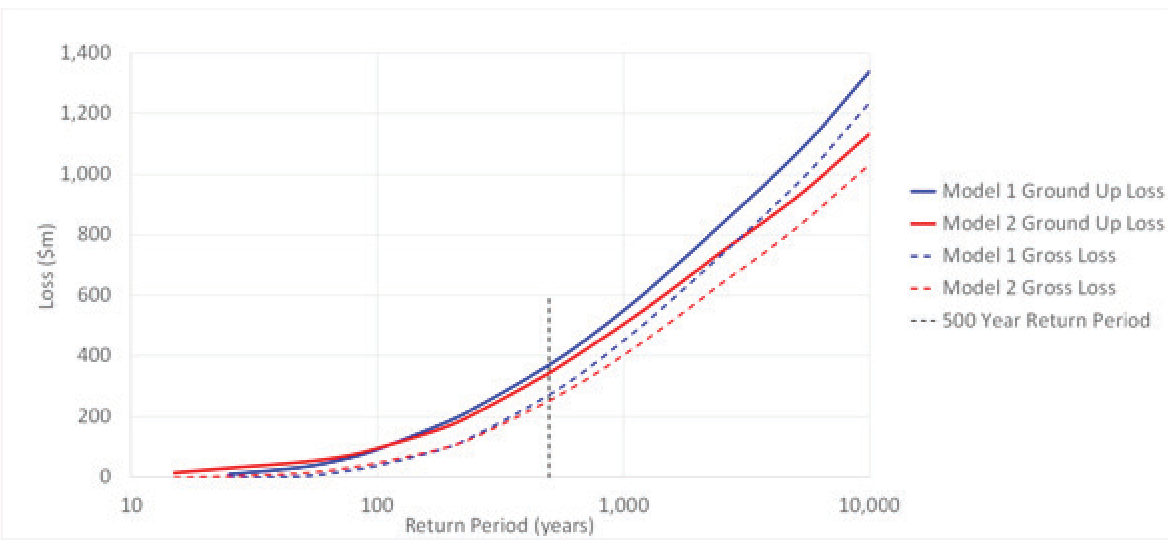
the results from the single-site PML reports, or from the engineer's own drawing reviews and evaluations. Any significant inconsistencies are examined; these may be due to model assumptions regarding building vulnerability, or secondary hazards such as liquefaction, or other underlying data differences. Adjustments to the data are made where warranted and final analyses are run.

Example results for the overall portfolio are shown below, including both ground up losses (i.e. without any consideration of insurance) and gross losses (i.e. the insured loss after the deductible, which in this case is assumed to be 5% of TIV per building). Demand surge has been included, as well as contents losses and business interruption.

RETURN PERIOD (YEARS)	GROUND UP LOSS ($ MILLIONS)		GROSS LOSS ($ MILLIONS)	
	Model 1	Model 2	Model 1	Model 2
50	33	51	4	14
100	91	95	38	47
250	228	211	137	122
500	370	343	272	251
1,000	549	504	450	402
2,500	835	744	734	635
5,000	1,063	920	962	819
10,000	1,338	1,132	1,235	1,031
AAL	4.96	5.58	3.48	3.82



From the above results it can be seen that for low return periods, Model 2 produces higher loss estimates than Model 1. Whereas for high return periods, Model 1 produces higher loss estimates. This is not uncommon, and is generally related to several factors, including differing assumptions in the models about the level of ground shaking at which damage begins to occur, and/or how uncertainty is accounted for in each model.

Working with their insurance broker, the client can utilize the above results to assist in making decisions about earthquake insurance coverage. Model 1 estimates the 500-year loss as $370 m ground up and $272 m gross, whereas Model 2 estimates the 500-year loss as $343 m ground up and $251 m gross. The client may for example desire to buy $275 m of insurance to cover the 500-year gross loss using the more conservative model 1 estimate of $272m. Or if this is prohibitively expensive, they may decide to buy $200 m of insurance, which covers the 250-year gross losses estimated by both models.

Note that Average Annual Loss (AAL) values are also calculated using each model. The AAL can be thought of as the sum of all earthquake losses that would occur over a very long period of time (many thousands of years), divided by the number of years. This measurement of average loss per year can be used to estimate the "loss cost" on an annual basis, and can also be separated into "layers" associated with insurance coverage. These AAL values by layer can be compared to the insurance premiums, the latter typically include allowances for expenses and other increase factors applied to the AAL.

Note also that, if desired, the building data developed by the engineer can be provided to insurers (generally via the broker), in a format compatible with insurance models, to enable this "best available" data to be used by the insurers also for their loss modeling. This may help avoid a situation where an insurer is using generic data that may result in conservative or lower confidence loss estimates.

RETURN PERIOD VS. ANNUAL PROBABILITY

The return period of an event or loss is the inverse of the annual probability of exceedance (e.g. a 500-year loss has an annual probability of exceedance of 0.2%).

This can also be expressed as a probability of exceedance in a specified number of years. For example, the 500-year loss has approximately 2% chance of exceedance in any 10 year period and 10% chance of exceedance in any 50 year period.

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KEY TAKEAWAYS

- Including a structural engineer in the portfolio loss analysis can provide transparency and increased confidence in the results.
- It can also help ensure that the best available building vulnerability data is being used in the portfolio analysis.
- Using multiple models can provide further understanding of the potential losses.