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INSURANCE INDUSTRY PERSPECTIVE ON THE IMPORTANCE OF GEOTECHNICAL EARTHQUAKE ENGINEERING FOR COMMERCIAL STRUCTURES

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ABSTRACT

Pricing in the commercial catastrophe insurance market is primarily driven by computer models. For the evaluation of commercial earthquake insurance risk, the majority of insurers, reinsurers and more recently, rating agencies, rely heavily on the output from models developed by a few software vendors. Insurers and reinsurers evaluate their total risk based on output from one or more of these models, and develop prices that depend on the loss estimate data from the models. In an effort to most accurately estimate loss potential, soil conditions and engineering practices are recognized by the model vendors and incorporated into the loss calculation algorithms.

When an insurer receives information from a building owner regarding quality seismic engineering of their structure, such as geotechnical engineering to mitigate risk caused by soils with a high susceptibility to liquefaction or seismic retrofit information, the insurer is able to input the data into the models and reduce the final loss estimate, thereby reducing the premium they charge for the risk. When premiums are affordable, a building owner is more likely to purchase adequate insurance.

The consequence for a commercial building owner of not purchasing insurance and not mitigating earthquake risk through seismic engineering could be financial ruin. In addition, the widespread consequences of a devastating earthquake involving many uninsured commercial entities, or inadequately engineered structures, could have a significant negative impact on the economy, in addition to loss of life. However, incorporating geotechnical engineering practices into the construction or retrofit of commercial structures benefits the building owner, insurance industry and the economy.

INTRODUCTION

Geotechnical engineers and professionals in the commercial catastrophe insurance industry rarely directly interact with one another. However, their professions are inseparably linked more than may be immediately apparent. When an insurer selects and prices risks, many factors are taken into account, including special engineering work that has been done to mitigate seismic hazards. Geotechnical engineers work to reduce potential damage to commercial structures caused by soil failures during an earthquake. The work the engineer does ultimately is factored into the risk selection and pricing process carried out by the insurer. The work the insurer does in underwriting and risk selection influences the commercial structure owner's decision to pay for special seismic engineering work, beyond what is required by code. Having their structure specially engineered makes the property more desirable to insurers, resulting in more affordable insurance premiums. What one does affects the other. This relationship between the engineering community and insurance industry should be mutually beneficial. However, lack of communication and sharing of data may be preventing ideal synergy.

OVERVIEW OF INSURANCE INDUSTRY PERSPECTIVE AND PRACTICES

Commercial earthquake insurers use well defined underwriting guidelines for risk selection. Computer models aid in the risk selection process and also play a key role in the determination of premiums to charge.

Computer Models

The primary computer models used in the catastrophe insurance industry all work in a similar way in general. For the peril of earthquake, they contain a geocoding engine to place a location address on a hazard map, detailed hazard information (such as descriptions of soils, susceptibility to liquefaction, etc.), and a statistical set of possible earthquake events. Potential losses are calculated from the damageability estimates based on the construction data input, local hazard information, and exposure to possible earthquake events. There is also a financial component that calculates the net losses after various insurance/reinsurance structures and deductibles.

The data that the insurer puts into the model can range from minimal to extensive. The goal is to always put as much accurate data into the model as possible, but it is often the case that the desired level of data is not available or unknown. Since the final loss numbers are completely determined by the data that is put into the model, the quality of the data entered is of utmost importance. Insurers are always on a quest for more complete and better quality data so that they can make more confident underwriting decisions, knowing exactly what they are insuring, and how much premium they should charge to adequately cover their exposures. Insurers need to charge enough premium to cover insured losses and operating expenses, but if they charge too much on their quote, they risk losing the account to another competing insurer.

How Insurers Select and Price Risks

Pricing in the commercial catastrophe insurance industry is driven by the modeled loss estimates. Every insurer and reinsurer has their own method of pricing risks based on the modeled losses. The methods can vary in sophistication, but the ultimate goal is to build a balanced portfolio of adequately priced risks that allows the insurer to achieve financial ratios that are required to operate with stability. The different types of numbers that come out of the model, for example, estimate the losses expected each year on average, the loss amounts expected for large events (such as a 250 year or 500 year event), and the amount of uncertainty in the loss estimates. The insurer calculates the amount of premium that would be required per dollar of loss amount from the model, and develops an account pricing methodology.

In addition to pricing, the models aid in the risk selection process. One goal of the insurer is to spread their risk so that in the event of a catastrophe, only a portion of their portfolio is affected. For example, a portfolio consisting only of downtown San Francisco buildings could be severely impacted by a large San Francisco earthquake, and it could take many years for the insurer to recover, if they were able to at all. Part of optimizing the financial ratios is minimizing the ratio of the loss potential given by the model to the premium collected, which is a natural result of spreading the risk. Another way the model is used for risk selection is the qualification of risks against underwriting guidelines. For example, there may be an underwriting guideline stating that buildings built on soft, artificial fill soils cannot be considered unless there is an engineering report on file detailing work that was done to mitigate the soil issues.

OVERVIEW OF COMMERCIAL PROPERTY OWNER'S PERSPECTIVE AND PRACTICES

The commercial property owner is constantly faced with financial decisions. Protection from infrequent catastrophes may not be a top priority for them, but failure to be adequately prepared could mean financial ruin, should an event occur.

A building owner is sometimes required by their lender to purchase earthquake insurance. However, this is often not the case, and the owner must decide whether or not to purchase insurance, and if so, how much. Suppose one owns a steel frame structure valued at $10,000,000, and they have an annual budget of $30,000 to spend on earthquake insurance. They may seek a quote for earthquake insurance for the full $10,000,000, and find that the cost is $100,000 for one year of coverage. Now the owner has a few options to consider. The owner can consider the risk of not purchasing insurance. In this example, neglecting valuation changes, inflation, etc. it would take 100 years of insurance premiums to equal the cost of the building. It would seem preferable to purchase insurance rather than trying to set aside $100,000 a year and count on a major earthquake occurring less frequently than every 100 years. Such a long term plan does not make sense for most practical purposes, since a major earthquake could occur in the first year the owner chooses to not purchase coverage.

Alternatively, the owner may feel that since the structure is of steel frame construction, it is not likely to be completely destroyed in a major earthquake, and therefore, $10,000,000 of insurance coverage is more than is needed. When a building owner reaches this conclusion, they will typically hire an engineer to conduct a PML (Probable Maximum Loss) study. In this example, suppose it is determined that the PML for the structure is $5,000,000. The owner then requests a quote for only $5,000,000 of coverage, which is priced at $75,000 a year. Now, the owner may feel they can be adequately insured, at only a portion of the cost they originally considered. However, even at the reduced cost, $75,000 a year is not within the budget, and the owner may still decide not to purchase insurance at all.

Lastly, suppose that the owner of the building had been made

aware through an engineering study, or perhaps through the insurance company (and hence, the seismic model the insurer uses) that the structure is on poor soils. The insurance premiums and the PML estimate have already taken the poor soil conditions into account, so there is room for improvement in the numbers if the owner can do something to mitigate the soils hazard. It may be the case that if the owner pays for special engineering work on the structure, specifically to adequately reduce the soil hazard, a new study reduces the PML estimate from $5,000,000 to $1,000,000. Now, the owner can share the information detailing the engineering work with the insurer, and request a revised insurance quote. The insurer might offer $1,000,000 of coverage for $10,000 or a full $10,000,000 of coverage for $25,000. Because of the information regarding the engineering work that was completed, the insurer was able to significantly reduce the price and offer two coverage options, both of which are now within the owner's budget. The owner must carefully weigh the cost of the engineering work against the potential savings in insurance premiums over several years. This example may be exaggerated, but it illustrates the type decision making process a commercial property owner must go through when their structure is in a high earthquake hazard area.

IMPORTANCE OF GEOTECHNICAL ENGINEERING

For the insurer, knowing that a commercial structure has had quality geotechnical engineering work done may make the difference between being able to offer coverage or not if the structure has been built on poor soils that would be excluded by underwriting guidelines. If insurance is offered, reliable information about the engineering may reduce the premiums to affordable levels.

Lack of Communication

A problem arises when there is a lack of communication between the building owner and the insurer. The data regarding construction and engineering of a structure must be shared with the insurer so that the insurer can enter accurate data into the computer models and offer affordable premiums. Often, the building owner never interacts with the insurer, but instead works only through an agent who has contact with the insurers. Improvement in communication of data will ultimately cause the building owner to be more aware of the benefits of considering geotechnical engineering as a part of their risk management plan because the insurer at "the end of the line" will be more within sight, and the financial benefits will be more tangible. If communication is not improved, the building owner may unfortunately be underinsured or completely uninsured in the event of an earthquake. The consequences could be devastating. The highest concern would be loss of life resulting from the failure of an inadequately engineered structure. In addition, inadequate insurance protection could result in financial ruin for the building owner. On a larger scale, the cumulative effect of many inadequately engineered or insured commercial structures being affected by a major earthquake event could have a significant negative impact on the local economy.

Improving Communication

One solution that could aid in the sharing of data between the building owners and engineers and the insurers would be the creation of a central, online, public database of detailed engineering information by location address. This could be displayed in a uniform format that would be useful to the computer modelers of the insurance community, and organized and maintained by an administrator. Building owners and risk managers could submit data for their buildings, and engineering firms could submit data for projects they have completed. The database could eventually become widely used and recognized as a prime source for all to access detailed data. There may be components of this solution existing today, but they are not well known, centralized, searchable and easy to view.

SUMMARY

The lack of communication and sharing of data may be preventing ideal synergy between the geotechnical engineers and professionals in the commercial catastrophe insurance industry. Both of their roles are connected in an important way since the work the engineer does affects the insurability of a structure and the premium the insurer charges, and the risk selection and pricing performed by the insurer affects the building owner's decision as to whether or not it is financially beneficial to consider engineering in their risk management plan. The creation of a public, centralized, online database of detailed engineering info by location address could significantly improve the communication of data between the engineers and building owners and the insurance community. This could eventually become an important resource, widely used by the computer modelers of the insurance community, and the importance of geotechnical engineering could be better understood by the general public.