The 1906 earthquake and Hurricane Katrina

Similarities and differences – Implications for the insurance industry

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The earthquake caused huge fissures in the streets.

Contents

Executive summary

The Great San Francisco Earthquake and Fire was one of the first major catastrophes to hit the insurance industry. The total damage was in excess of US$ 500m in 1906 values, of which roughly US$ 180m was insured. Munich Re paid claims amounting to around 13% of the Company's net annual premium revenue. 99 years later, Hurricane Katrina was the biggest natural disaster in the USA since the 1906 earthquake.

On 29 August 2005, Katrina made landfall south of Buras, Louisiana, on the US Gulf Coast. Total economic losses from Katrina are now estimated at about US$ 125bn, of which US$ 45bn is insured in the private market. In the first days after the event, its full dimension and the extent of losses – both insured and uninsured – were seriously underestimated. In consequence, many questions have been raised about risk assessment. Was Katrina a unique case or are there lessons to be learned with regard to large disasters in general? The 100th anniversary of the San Francisco earthquake of 18 April 1906 and the 70% odds of a large earthquake striking the Bay Area within the next 30 years (WGCEP, 2003) provide an urgent reason to address this question. Total economic losses from Katrina amount to about 1% of the US GDP, and insured losses represent about 10% of the annual property premium written in the US market. This compares to the 1.8% of the GDP lost as a result of the San Francisco earthquake of 1906. A comparison of insured losses is not possible as figures for the annual market premium are not available.

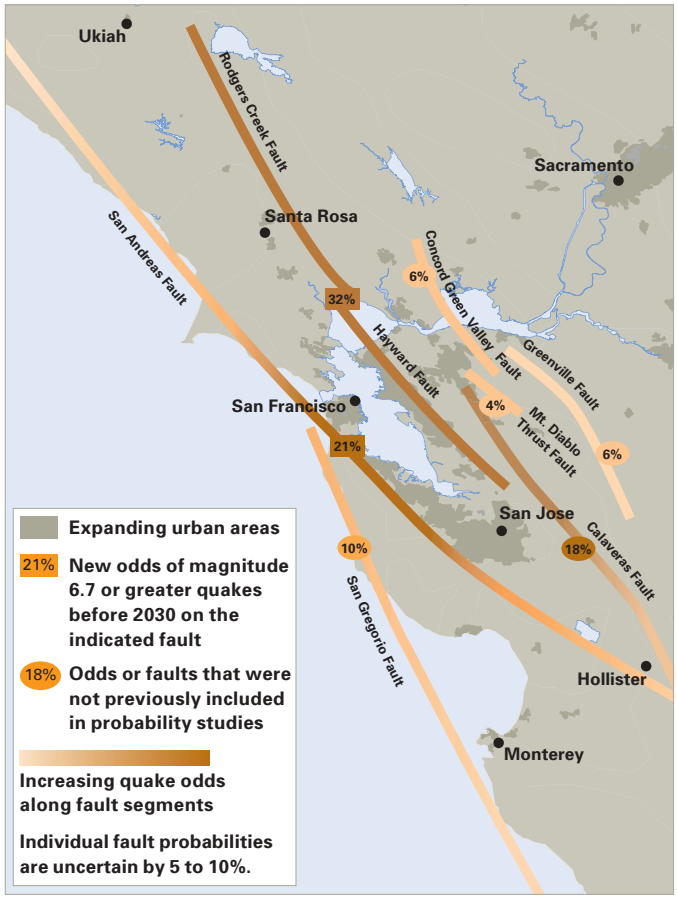
Several analogies can be drawn between Hurricane Katrina and the 1906 earthquake. But there are differences, too. Factors which have amplified the losses from Katrina could also have an effect after a great earthquake in the San Francisco Bay Area:

– Fire following earthquake
This consequential hazard could be the equivalent of the storm surge caused by Katrina. Although less probable than in 1906, it could still play a critical role under unfavourable circumstances. For the insurance industry, the problem is exacerbated by the fact that fire exposure is six to seven times higher than earthquake exposure due to the low penetration of earthquake insurance.

– Demand surge and claims handling
The extent of losses due to a San Francisco earthquake would quite probably exceed Katrina losses. Repair cost inflation is inevitable after events of this size, and the huge number of claims leads to problems in claims handling. Separating wind losses from water losses was a challenge after Katrina, and the same may apply to earthquake and fire losses in a future San Francisco earthquake.

– Key industries
In Katrina, the oil industry was severely affected. The equivalent in a San Francisco earthquake would be the software industry. Tourism is as important for San Francisco as it is for New Orleans and would also suffer as a result of an earthquake.

San Francisco Bay Area earthquake probability



70% odds (+/– 10%) of one or more magnitude 6.7 or greater earthquakes from 2000 to 2030. This result incorporates 9% odds of quakes not on shown faults.

– Economic disruption
Transportation and supply lifelines are heavily exposed in the Bay Area. Although prevention measures are definitely better than in New Orleans, this does not mean that there would be no serious disruption of economic activity, with corresponding effects in terms of business interruption insurance claims.

In order to manage the risk from large natural disasters like Katrina or a future San Francisco earthquake, all stakeholders must work together and share the risk. Under the principle of risk partnership, the roles of private citizens, local/state/federal government, and the insurance industry in preparing for and responding to such disasters must be clearly defined beforehand. It is not a question of whether the 1906 earthquake will be repeated, but when. It is in everyone's interest to prepare accordingly in order to make California more disaster-resilient.

Hurricane Katrina – An unusual event?

Katrina has demonstrated how an unfortunate concatenation of circumstances can inflate losses to an unexpected degree. There are physical loss drivers like the storm surge, non-physical loss drivers like demand surge and economic disruption, and insurance-specific loss drivers like loss adjustment problems and the excessive scope of cover-age in business interruption policies.

In order to evaluate the experience from Katrina, it is necessary to analyse the various loss components. This is more easily said than done. The difficulty starts with the need to distinguish between wind- and water-related losses (which has much in common with the required separation of earthquake- and fire-related losses in 1906), but the more serious problem revolves around what a risk-modelling firm has called the "large loss amplification factor" following Katrina (RMS 2005). This refers not only to demand surge – an extreme increase in repair costs due to a lack of supplies and manpower – but also to prolonged inaccessibility and ensuing economic disruption, and eventually to ripple effects which may spread around the globe, as exemplified by the temporary shortage of oil supplies after Katrina.

Which loss drivers can be identified in connection with Katrina? In general, a distinction can be made between loss drivers of a physical and a non-physical nature. In addition, there are certain insurance-specific loss drivers.

Physical loss drivers

Levee breaks

The levee breaks on the south shore of Lake Pontchartrain and along water channels within New Orleans which caused the flooding of the city are peculiar to this event and probably do not need to be considered in other regions. There is only one country in the world that is to a large extent below sea level: the Netherlands. The level of protection in the Netherlands, however, is considerably higher than it was in New Orleans.

Storm surge

The Katrina surge exceeded 10 m in some places and was the highest surge since the beginning of modern record-keeping (in 1850). Estimates of the contribution made by the storm surge to total insured losses range between 20% and 50%. This percentage cannot be applied to other areas along the US coast because storm surge damage is influenced by numerous factors of a highly local nature. These factors include the effect of geographical latitude on maximum wind speeds and tides, the orientation of bays with respect to the storm track, the topography inland, and the varying concentration of values in the coastal strip, which is most susceptible to storm surge damage. A tsunami is – in a literal sense – the earthquake equivalent to storm surge. But tsunamis do not truly pose a serious threat in terms of earthquake risk in the US, although there may be some risk of tsunamis caused by landslides from earthquakes located in the Santa Barbara Channel. But there is another analogy: fire following earthquake, which will be discussed in the subsequent section on the 1906 earthquake.

Vulnerability

The 2004 hurricane season had shown that commercial risks were generally more vulnerable to wind damage than most catastrophe risk modellers had previously thought. To what extent this is confirmed by the 2005 season will depend on detailed damage and loss evaluations – which have to duly take account of the role of non-technical loss drivers like demand surge. There is a fairly high probability, however, that vulnerability to storm surge and wave action will have to be revised as a consequence of the extreme losses to coastal properties caused by Katrina and by Hurricane Ivan in 2004.

Particularly vulnerable structures are of special importance. In Katrina, casino barges, which are not found in other coastal regions, produced astounding losses. Another example is oil exploration and production facilities offshore, which are ubiquitous along the Gulf Coast west of Florida but not off Florida or the Atlantic coasts. Up to 20% of Katrina losses may result from damage to these facilities. It appears imperative to consider such particularly vulnerable or important structures, businesses, or industries when assessing the loss potential of other scenarios, be it hurricanes or other perils.

Non-physical loss drivers

Demand surge

Previous efforts to quantitatively model demand surge appear insufficient for the sort of unprecedented loss amounts encountered in Katrina and for the combined effect of a series of events like the one that struck the state of Florida in 2004. Demand surge in the 30–40% range has been recommended for Katrina. There seems to be some logic behind assuming that demand surge is more a function of the extent of the initial losses – or of the number of claims, for that matter – irrespective of whether claims and losses arise from a single event or from a series of events.

Economic disruption

There is no doubt that New Orleans' distinctive geographical situation greatly aggravated the losses from Katrina. Proper supplies of power and water and intact sewage systems are necessary for a modern society to function, but they are also necessary for economic activities to flourish. Katrina caused significant disruption to these systems for weeks. In addition, roadways, bridges, airports, and seaports were closed or inaccessible, thus severely hindering search and rescue efforts as well as economic recovery. For example, the Port of New Orleans, which serves the entire central part of the United States and is the country's largest seaport (i.e. before Katrina, in terms of tonnage shipped), was completely closed to commercial traffic for more than two weeks, and was only operating at approximately 50% of its pre-Katrina capacity by mid-December. As a result, economic activities were disrupted completely for several weeks and are only now slowly picking up momentum.

But notwithstanding the special features of New Orleans, Katrina demonstrated the level of business interruption that truly large disasters are capable of generating. Even if facilities escape significant physical damage, production can be halted for weeks or even months by lack of manpower because employees are evacuated, or have to take care of their private matters, or are involved in public rescue and recovery operations before they can resume work. Conversely, numerous people can suddenly become unemployed if their place of work is wiped away or if tourists stay away from the area after the disaster (both New Orleans and San Francisco, for example, are to a great extent economically dependent on a booming tourism industry). Supply shortages can also contribute to the problem – for example, the oil production facilities in the Gulf were seriously affected by Category 5 winds and left the refineries on land without supplies for weeks.

There is no reason to believe that the general situation caused by the economic disruption in the wake of Katrina would be materially different to the situation following any other kind of large disaster affecting a major urban centre in the USA or anywhere else in the world.

Insurance-specific loss drivers

Claims handling

The exceedingly large number of claims played an important role in Hurricane Andrew in 1992 and in the 1994 Northridge earthquake. Since then, contingency plans have been designed to allow for more professional handling of a large volume of claims. Nevertheless, the approximately 1.8 million claims from Katrina, combined with the restricted access to or even complete inaccessibility of the affected area definitely contributed to inflated indemnifications. A key feature here is the way in which disaster insurance is provided in the USA. In the residential sector, flood (including surge) is insurable only under the National Flood Insurance Program, which is a federal scheme, whereas wind is generally covered in the private sector. Sorting out how much damage was caused by wind and how much by water is an almost hopeless undertaking given the number of claims and has led to payouts by the private sector for damage which was not insured as per the policy wording. There is a legitimate interest on the part of clients to have their losses of whatever origin indemnified, but there is also a legitimate interest on the part of insurance companies to pay only for the portion of losses for which a premium has been calculated and charged. This is a basic principle of insurance, and violating this principle ultimately renders insurance unfeasible. The only clear-cut solution is to redesign the way in which disaster losses are apportioned between the public and the private sector with the aim of avoiding unnecessary and unintentional overlaps.

These circumstances are not restricted to Katrina or to damage from wind and water in hurricanes. This situation finds its equivalent in respect of earthquakes too. In California, and US-wide, the earthquake endorsement of an ordinary homeowners' policy covers only damage from earthquake shock, whereas fire following earthquake forms part of the basic fire coverage.

Oil-producing and processing facilities were severely affected by the winds and the surge from Katrina, offshore and onshore.

The levee breaks caused by the storm surge caused the inundation of large parts of the city of New Orleans and left them inaccessible for several weeks.

Besides the problem of distinguishing between shock and fire damage after a major disaster which produces hundreds of thousands or even millions of claims, there is an additional moral hazard in a situation where only a small fraction of consumers have taken out earthquake insurance – i.e. probably less than 15% in California today. And even if earthquake coverage is in force, the high earthquake deductibles are a temptation to assign as much loss as possible to fire. The solution in this case is easy and one that is practised all over the world except in North America. Fire following earthquake is excluded from the basic fire coverage and covered only under an earthquake endorsement.

Scope of coverage

The key terms here are contingent business interruption and customers' and suppliers' extension. What is meant by these technical terms is that loss of production may be covered not only under the precondition of material damage at the affected site but also in consequence of an interruption of power, water, and material supplies, or publicly declared denial of access, or the inability of workers to get to the workplace. The extent to which this factor has inflated business interruption claims still needs to be evaluated, but it will certainly have played an important role. Again, this is a general lesson which is independent of the peculiarities of Katrina and the peril itself.

Here a final comment seems appropriate regarding the challenge of addressing the above-mentioned observations in probabilistic loss modelling. To handle such effects as economic disruption or even demand surge deterministically on a scenario basis is challenging enough, but to develop an adequate probabilistic approach appears almost impossible, especially as the empirical loss data are deficient in the sense that it is extremely difficult to sort out the various loss components, as described above.

The 1906 San Francisco earthquake

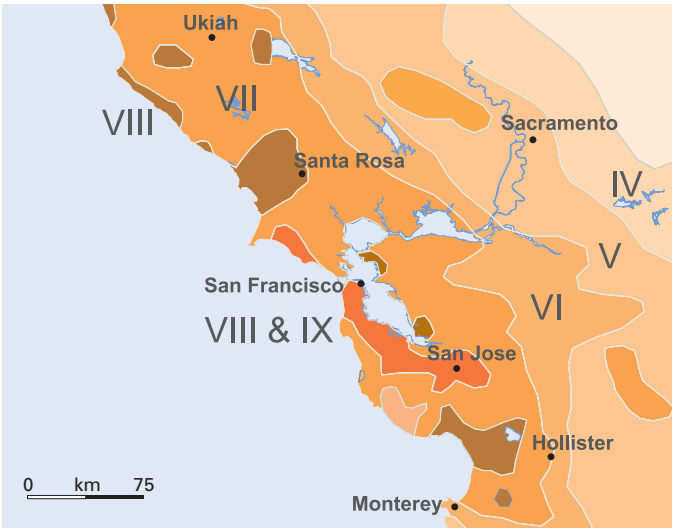
By far the biggest portion of the losses resulting from the 1906 San Francisco earthquake was caused by the ensuing fires. A repeat of the 1906 earthquake today would set a new record, in terms of both total losses and insured losses. Although less probable than in 1906 due to advanced prevention measures, fire following earthquake could still play an important role.

A look back

It is well known that Katrina was not an unexpected event. The scenario which materialised on 29 August 2005 and the following days had already been described in an article in the journal Civil Engineering (Brouwer 2003), for example. The 1906 San Francisco earthquake was not an unforeseen event either, at least as regards the conflagration which followed it. In the year before the disaster, the National Board of Fire Underwriters (NBFU) wrote the following in an evaluation of the efficiency of the San Francisco Fire Department: "... In fact, San Francisco has violated all underwriting traditions and precedent by not burning up. That it has not done so is largely due to the vigilance of the fire department, which cannot be relied upon indefinitely to stave off the inevitable."

The NBFU formulated detailed recommendations on how to make the city safer against the risk of fire, but it was too late. On 18 April 1906, "the earth shook and the sky burnt". Even if the earthquake as such had not been anticipated, the most important loss component had. And in general it was well known that San Francisco was built on shaky ground. After the Great Hayward Earthquake of 1868, the editor of the San Francisco Real Estate Circular said: "Only the best built and anchored houses are safe on 'made ground'.... If we neglect the precautions which have been so strongly urged upon us, we may feel reasonably certain that the day of reckoning for such neglect is not more than a very few years distant, and, what adds to its terror, it always comes upon us like the thief in the night." As to the "made ground", the author referred to the fact that the shoreline of the city had been pushed further and further into the Yerba Buena Bay by the creation of reclaimed land. In 1906, about one-sixth of the population lived on reclaimed land. As documented in the quotation above, the danger of "made ground" was well known long before the 1906 earthquake, but this knowledge was simply not taken into account in city development. This may sound familiar in the light of recent earthquake disasters worldwide.

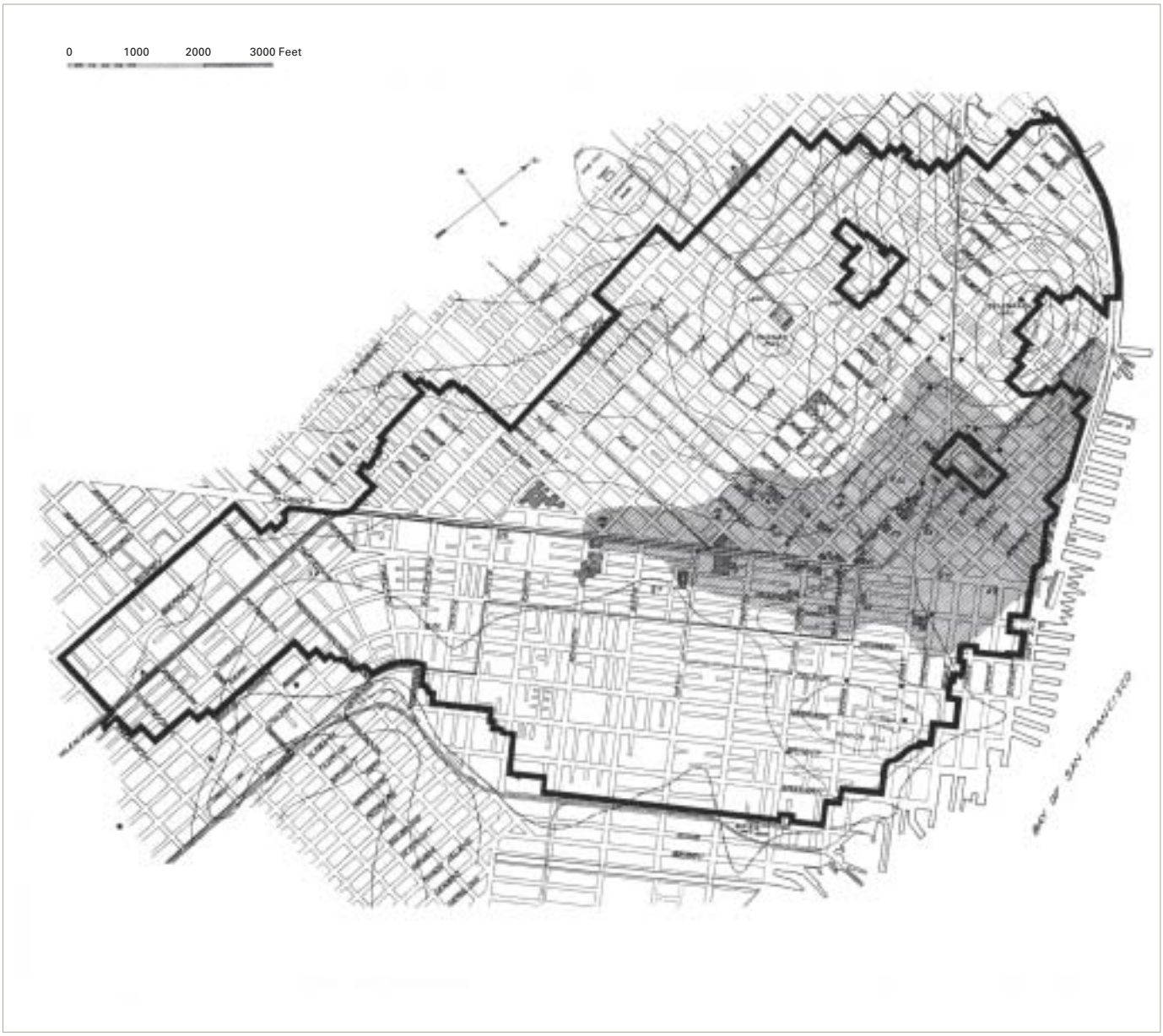
The 1906 San Francisco earthquake



Map of isoseismals. The affected area extended from Holister in the south up to north of Ukiah.

MMI Intensity	Potential damage
X+	Very heavy
IX	Heavy
VIII	Moderate/heavy
VII	Moderate
VI	Light
V	Very light
IV	None
II–III	None
I	None

Map of affected area, City of San Francisco



The map shows the extent of the burnt area, along with the zone where brick construction prevailed and most of the shaking losses occurred.

Destruction by fire, with the Fairmont Hotel – still under construction at the time of the quake – in the background.

Panoramic view of the Great Fire.

About one-fifth of the city area, including the Central Business District, was destroyed in the earthquake and fire. It is not easy to make a reliable estimate of the breakdown into shock and fire losses, but based on the area where shock losses were concentrated, a relation of about 20% for losses from ground shaking to 80% for fire losses would appear to be roughly correct.

The loss statistics

Number of victims:	over 3,000
Building loss:	US$ 524m, of which US$ 180m was insured
Destroyed buildings:	28,000
Insurance claims:	90,000

It is worth mentioning again that the San Francisco earthquake represents the biggest single event loss to date from a natural disaster in the 125-year history of Munich Reinsurance Company. The CEO himself travelled to San Francisco and earned a great reputation for the company by his efficient handling of cash requests from clients.

All the figures above refer to the city of San Francisco only, losses outside of San Francisco are not included. This is an important factor when inferring the loss potential of a San Francisco earthquake today. Clearly, the share of shock losses would be higher for the whole region as compared to the city, although fires did also play a dominant role in Santa Rosa. There were long and intense debates about the share of shock versus fire damage when it came to paying out the indemnifications. Because of the low spread of earthquake insurance as compared to fire insurance, the insureds had an interest in assigning as much loss as possible to the fire – just as with Katrina, where as much damage as possible was assigned to wind rather than flood.

A look ahead – What if?

The situation regarding the take-up rate for earthquake insurance in California is not so different today when compared with 1906, at least in the residential sector, and the conclusions to be drawn regarding coverage issues and loss regulation problems in a future San Francisco earthquake are easy to imagine. But before addressing insurance and loss-regulation practice, we must discuss the question of whether a repeat of a disaster like the 1906 event appears possible at all. Both San Francisco and California are today completely different from what they were in 1906, and much has been done since in order to make California more resilient to disasters, especially earthquakes.

Fire in the Marina district of San Francisco after the Loma Prieta earthquake in 1989. It took more than three hours to overcome this one big fire.

The Bay Bridge was closed to traffic for about one month following the failure of a section of the upper deck.

Immediately after 1906, however, reconstruction was dictated more by short-term economic considerations than by a long-term perspective on risk reduction. It was not until after the Long Beach earthquake in 1933 that loss mitigation became an important part of the reconstruction effort.

But let us now take a look at some "loss-driving factors".

Fire following earthquake

Is a conflagration like in 1906 possible today? In principle, the answer is "Yes", but it is a matter of probability. This probability is definitely lower than in 1906 due to

– the installation of the Auxiliary Water Supply System (AWSS), which operates completely independently of the regular water distribution network, and the additional back-up provided by the Portable Water Supply System (PWSS) and
– the enhanced fire resistance of high-rise buildings due to emergency power and earthquake-resistive anchoring of the water reservoirs and pumps in their basements.

But notwithstanding the undeniable improvements, there are warning signs as well:

– The performance of the AWSS in the Loma Prieta earthquake in 1989 was quite unsatisfactory. It took more than three hours to get just the one great fire under control which broke out in the Marina district more than 100 km away from the epicentre. Without the PWSS, the fire department would have failed to cope with the Marina fire, which could then have easily developed into a major conflagration.
– Fires in high-rise buildings bind a large proportion of fire-fighting resources, as demonstrated by the fire in the First Interstate Bank building in Los Angeles in 1988 (which was not earthquake-induced). Given the large number of high-rise buildings, it cannot be ruled out that fires will break out in at least a few of them in spite of the significant improvements in fire resistance achieved in recent years.
– Much will depend on the wind conditions. In virtually all earthquakes of the last 20 years where fires occurred – Loma Prieta in 1989, Northridge in 1994, and Kobe in 1995 – the winds were quite calm, which helped to prevent fires from spreading and from merging and forming larger conflagrations.

Probabilistic loss models for fire following earthquake have become available, but establishing a connection between the ground-shaking loss and a corresponding fire loss in the event set is not simple. The results for fire following earthquake are highly volatile in the low probability/high severity range. What makes the situation even worse is the fact that in consequence of the low take-up rate for earthquake insurance the fire loss can account for a quite significant portion of the insured loss.

Key industries

In a San Francisco earthquake, the concentration of high-tech plants and software firms in Silicon Valley and the Financial District in San Francisco will play the same part as the petroleum industry in Katrina. It is true, however, that most businesses have built up back-up centres in less hazardous areas in and outside California in recent years. Long-term and supra-regional ripple effects should therefore be unlikely even in the event of a strong earthquake – in theory at least. In practice, however, there is the additional factor of the often irrational reaction of the stock market even to non-events. In times when pure rumours or reports of a moderate earthquake in the Gulf of California are enough to make the share prices of insurance stock fall significantly, it is hard to imagine what would happen in the case of an event with losses substantially in excess of Katrina.

Economic disruption

The vulnerability of the transportation network was illustrated by the month's closure of the Bay Bridge after the Loma Prieta earthquake and three major failures in the roadway network in San Francisco and Oakland. The airports would probably be unusable for a few days at least, and port facilities are notoriously vulnerable to earthquake forces. In consequence of its location on a peninsula, San Francisco and the southern suburbs are and will remain exposed to lifeline failures in spite of all the remedial work which has been done. This does not deny the positive effect of such retrofitting and strengthening measures, and it is fair to say that the San Francisco Bay Area is better prepared for a big earthquake than New Orleans was for a hurricane, but this does not mean that serious disruption of economic activity would not happen. There are numerous reports describing the vulnerability of the region whose conclusions need not be repeated here (e.g. CDMG 1982).

Loss prevention

California is one of the world's leading regions as regards the quality of its building code and the supervision of construction practices. It may also be argued that the Loma Prieta earthquake eradicated a good portion of the most vulnerable building stock, e.g. in the centre of Oakland, or has at least led to seismic rehabilitation. There is a question mark over steel-frame buildings. The 1994 Northridge earthquake uncovered surprising deficiencies in steel-frame constructions which must be expected to materialise in earthquakes elsewhere in the USA. Another question mark relates to tilt-up structures, which have proven very vulnerable in past California earthquakes and are prevalent in the Silicon Valley business parks.

Insurance conditions/loss regulation

There is one distinct difference to the situation regarding hurricane risk in Mississippi and Louisiana: coverage conditions for earthquake in California are much tighter. Deductibles are higher – up to 15% for dwellings, and usually at least 5% in commercial policies –, earthquake sublimits are common practice, be it for commercial enterprises, for residential contents, or for additional living expenses, and the scope of coverage is restricted for business interruption. One major problem remains: all these loss-reducing factors apply to shock only, not to fire following earthquake!

In conclusion, it seems that such an unfortunate concatenation of circumstances as observed in the case of Katrina is definitely less probable but not impossible in a future San Francisco earthquake. The greatest uncertainty concerns fire following earthquake and it is indeed hard to constrain the probability of conflagrations. They could happen elsewhere in the Bay Area, in communities that are not as well prepared as the city of San Francisco. In addition, it is advisable to invest more effort in the investigation of economic disruption, starting with the evaluation of the structural reliability of key industry buildings and moving on to potential lifeline failures and ensuing shortages of basic services and production materials. Insurance conditions reflect the risk situation much better than in Louisiana and Mississippi – with the lamentable exception of fire following earthquake.

The principle of risk partnership

Coping with the risk from large natural disasters requires a clear definition of the role of each stakeholder. Instead of relying on the state to solve all the problems, the greatest possible use should be made of private resources combined with efficient mechanisms for proactive loss prevention.

Estimates of total economic losses from a repeat of the San Francisco earthquake run as high as about US$ 400bn. There is a case for arguing that such estimates should be revised in the wake of the Katrina experience. But even if the figure mentioned above is upheld, it is clear that coping with future losses of this size represents a formidable challenge which requires the cooperation of all parties involved. Each of these parties has its own tasks and responsibilities in managing the risk arising from natural disasters. Beyond the pure financing of future losses, which is a reaction after the event, much more effort than hitherto has to be invested in a proactive strategy, i.e. in reducing and preventing future losses. Such a strategy is not only a question of financial resources but also, and perhaps even more so, of good and foresighted planning and of coordination at all levels, from households and industrial companies to public institutions and authorities (Smolka 2004). What precisely are the tasks to be performed by these parties?

The insureds

Householders and business owners can do a lot to reduce the risk to their property through proper maintenance and by securing sensitive items like equipment, electronic installations, and machinery. In industrial businesses, emergency planning can help to prevent or minimise losses from future disasters. Finally, a certain portion of the financial risk has to be borne by the insureds in order to keep the interest in loss reduction alive. Typical forms of self-participation are deductibles, preferably expressed as a percentage of the insured value, and/or coinsurance, i.e. a percentage participation in each and every loss. In commercial risks insurance, sub-limits for natural perils are common practice in the USA.

Primary insurers

Primary insurers have to provide and secure capacity by

– charging technically adequate rates,
– applying appropriate underwriting guidelines,
– conducting accumulation control and portfolio management,
– establishing reserves for natural perils,
– limiting their liability according to their financial strength by purchasing reinsurance protection.

Reinsurers

Reinsurers are the main risk carriers in the field of natural disaster losses, making proper risk management all the more a primary task which includes

– balancing the risk over time and regions,
– providing clients with technical support in rating considerations and assessments of probable maximum losses (PMLs),
– controlling and limiting liabilities (setting cession/occurrence limits, budgeting, retrocession).

Capital markets

They entered the scene only a few years ago. Capacity provided by the capital markets – often referred to as alternative risk transfer (ART) – must be seen as a supplement to rather than in competition with reinsurance. Their potential function is mainly to provide additional capacity for top-rank losses.

The government

In the insurance context, the government has to act as a reinsurer of last resort for very rare, extraordinary losses and/or uninsurable risks which exceed the capacity of the private sector. The government's main task, however, lies in the field of risk management and risk reduction and involves

– designing and enforcing land-use and building regulations,
– securing the serviceability of critical facilities and infrastructure,
– developing emergency plans that precisely define the responsibilities and coordination of the authorities involved,
– granting tax exemption for private insurers' catastrophe reserves.

Within this context, the role of the insurance sector is well established and confirmed. In contrast, the capital markets still have to prove that they are willing to provide reliable and continuous capacity when investors have lost their money after large disasters like Katrina, for example. But catastrophe perils can be considered a risk that is uncorrelated to other risks in an investor's portfolio, and this makes them attractive. There are no signs that institutional investors have lost their risk appetite since Katrina.

Eventually, the government should create an environment where the greatest possible use is made of private resources for disaster recovery, combined with the availability of protection for as many people as possible. Linking the availability of such protection to the observance of building regulations can provide an efficient mechanism for code enforcement, especially where new construction is concerned. Nevertheless, mechanisms aimed at code compliance may serve to encourage rehabilitation measures as well.

Final remarks

The hurricane seasons of 2004 and 2005 and Hurricane Katrina in particular have given new impetus to the debate about natural-disaster legislation which has been continuing in the USA since the early 1970s. There is a feeling that the management of the financial burden following Katrina was unsatisfactory, and therefore the existing mechanisms for distributing the risk between the private insurance sector, the state, and the federal government should be reconsidered. From the consumers' and the insurers' point of view, absolute transparency with regard to coverage conditions and what payments can be expected from which risk carrier – private company or a government entity – is a prime requirement when it comes to minimising the possibility of misunderstandings and bad feelings in the process of indemnifying losses after an event.

Two problem areas have been identified above which would merit reconsideration and revision: the distinction made between wind and water damage in hurricanes and between shock and fire damage in earthquakes. Both problems are amenable to an easy solution which involves amending current insurance practice as suggested above. Getting the conditions right is more important than government involvement in insurance. A situation like the current one, in which many consumers decide to do without insurance and can rely on the government to bail them out after a major disaster, renders any efforts aimed at proactive loss prevention almost futile. Insurance and reinsurance have a long tradition in managing and financing the risk from natural disasters, a tradition which indeed reaches as far back as the San Francisco earthquake of 1906. As in 1906, the insurance sector also plays an important role today in natural disaster risk management and can even extend this role by combining the coverage with incentives to take loss prevention measures.

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