

# Earthquake Risk, Modelling & Insurance

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## Agenda

- Statistical Data about Marmara Region and İstanbul
- Possible Marmara/Istanbul Earthquake Scenario
- Measures taken after 1999 İzmit Earthquake
- Measures which should have been taken so far
- Marmara Earthquake and Insurance Sector in Turkey
- Reinsurance for Earthquake
- Main factors of PML
- Geographic Risk Modelling for Insurance Sector

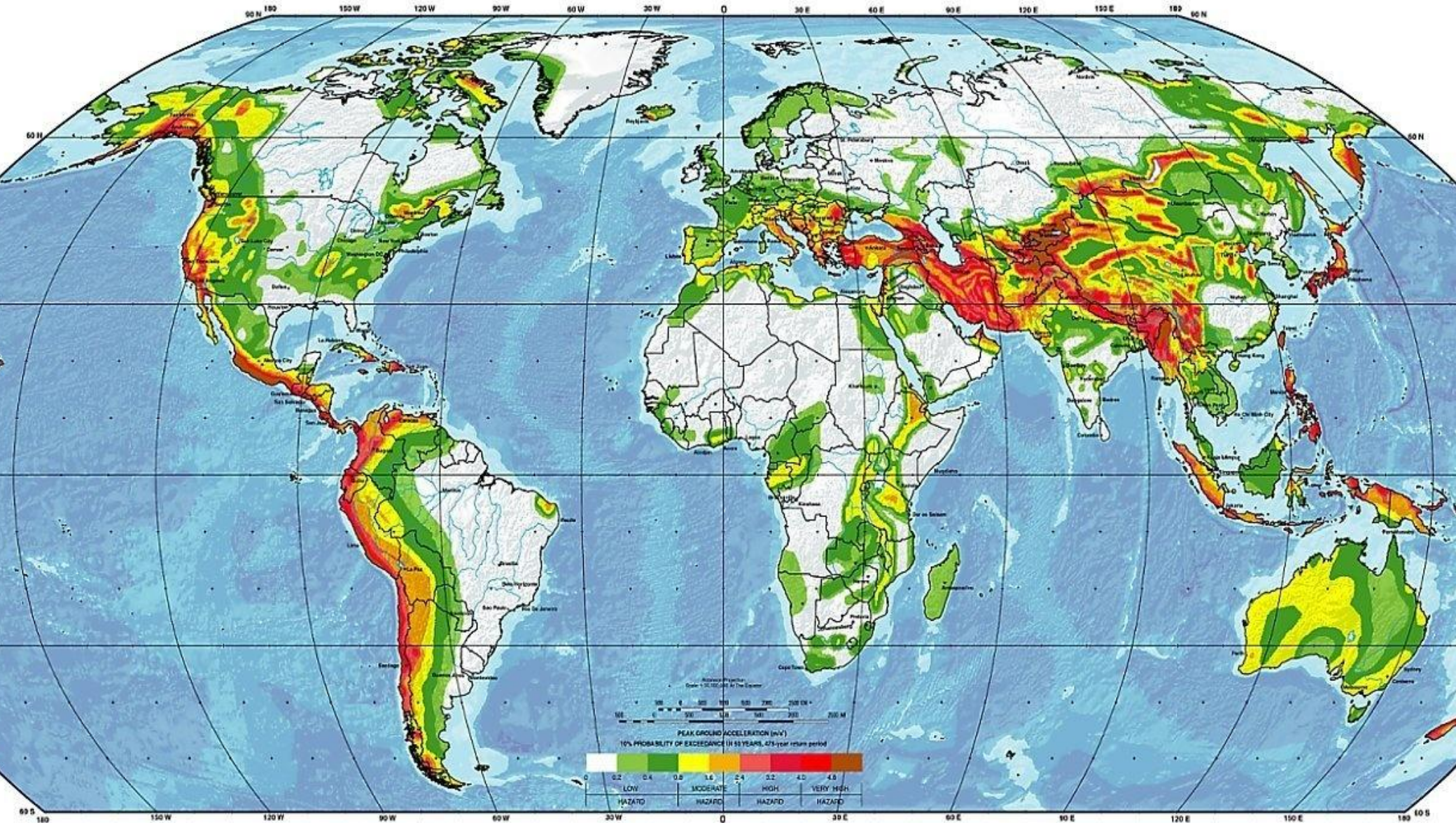




# GLOBAL SEISMIC HAZARD MAP

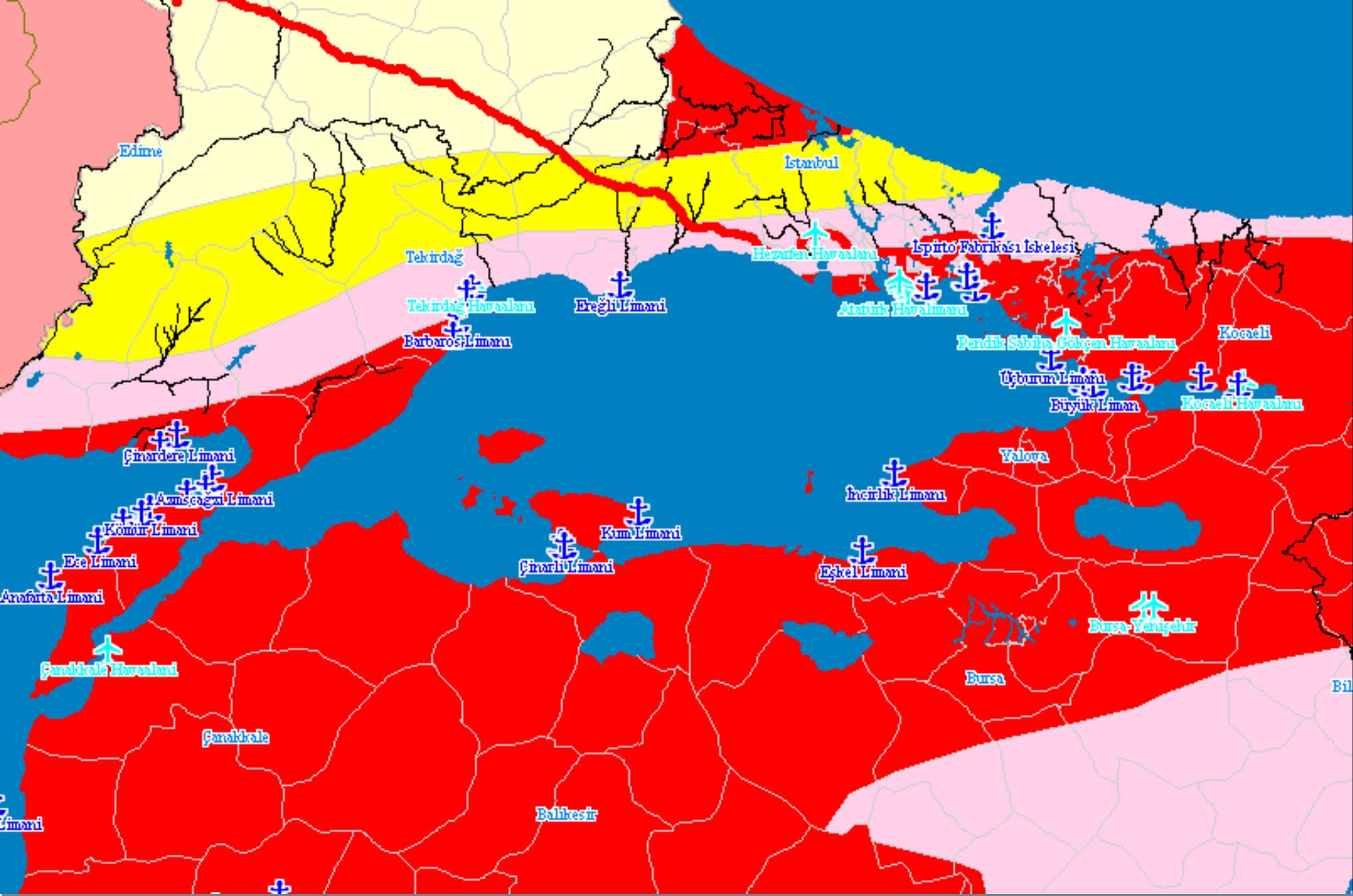
Produced by the Global Seismic Hazard Assessment Program (GSHAP),  
a demonstration project of the UN/International Decade of Natural Disaster Reduction, conducted by the International Lithosphere Program.

Global map assembled by D. Giardini, G. Grÿnthal, K. Shedlock, and P. Zhang  
1999



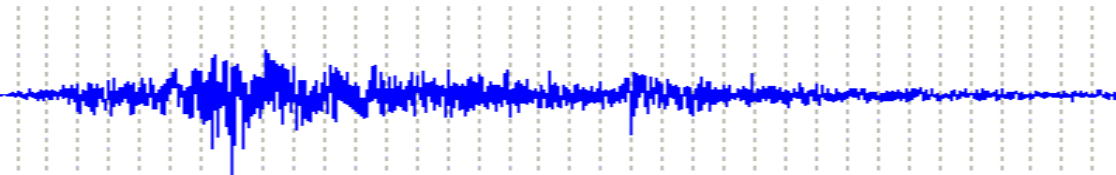






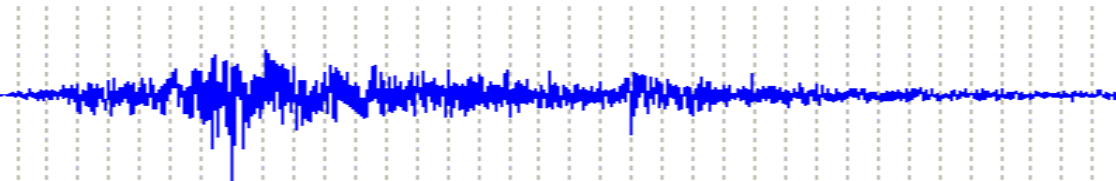
## Statistical Data about Marmara Region and İstanbul

- Marmara Region accounts for approximately 40% and İstanbul only accounts for approximately 22% of 1,1 trillion TL (total Turkish GDP Gross Domestic Product expected to be in 2009)
- 11% of all buildings, 15% of the population and 19% of industrial/commercial facilities (app.) of Turkey are located in İstanbul.
- 15% of all buildings, 13% of the population and 15% of industrial/commercial facilities (app.) of Turkey are located in the other cities of Marmara Region.
- The density of population in Turkey on regional basis is nearly 226 people per square km, whereas the density of population per square km is 1885 people in İstanbul.



## Possible Marmara/Istanbul Earthquake Scenario

- An earthquake with a magnitude of 7.5 is expected with a probability of 2% each year and with a probability of 68% for the next 30 years .
- Fault line passing through the Marmara Sea will cause damage to İstanbul and especially to buildings inappropriate for earthquake and constructed on unsound grounds.
- According to the same scenario, 1/3 of the buildings in İstanbul (400 thousand) will have light, moderate and severe damages. Loss of life figure will reach app. 30 thousand and re-construction of the damaged buildings will create a direct cost of 2-3 billion USD to the economy
- When social losses, unemployment, loss of tax and labor force, all costs to return to the life conditions prior to earthquake are taken into consideration, total damage of earthquake is expected to be approximately 40-50 billion USD.



## Measures taken after 1999 İzmit Earthquake

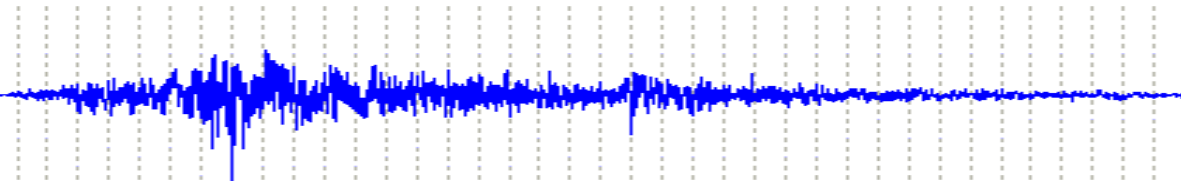
- The majority of buildings have been constructed earthquake-proof after 2000.
- Earthquake consciousness has developed, supervision on construction sector has been tightened.
- Improvement works have been carried out in underground and governmental premises
- Bridges and viaducts have been overhauled, improvement activities have been performed at schools and hospitals.
- The İstanbul Provincial Disaster and Emergency Directorate has been established aiming to protect rather than to rescue, to be prepared rather than to heal.
- Contractors started to pay more attention on using high quality materials in the construction phase.





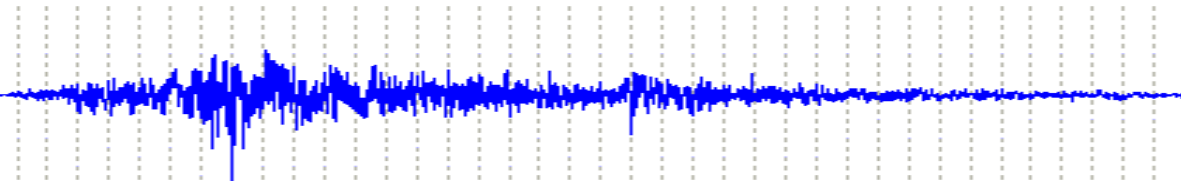
## Measures which should have been taken so far

- A big disorder and inadequate supervision is still observed in building and real estate sectors.
- Speedy, only profit based and low quality structuring results in disasters.
- Urgent changes concerning laws on disaster, ground plan and local administration have not been implemented.
- In order to design and construct earthquake-proof buildings to live in a safer and healthier environment, a national Earthquake policy should be implemented.
- Sanctions have not been applied properly to buildings constructed before 2000 and their resistance to earthquake is questionable (including many schools and hospitals)



## Marmara Earthquake and Insurance Sector in Turkey

- The expected big Marmara Earthquake will cause damage to the region where the majority of the big commercial/industrial facilities of Turkey are located.
- These facilities have earthquake coverages in their insurance policies and most of them have huge total sum insureds.
- Although such plants have buildings constructed suitable for a big earthquake or had betterments recently, accumulated indemnity figure to be demanded from Insurers will be very high due to both physical damage and business interruption.
- Consequently, such an earthquake would awaken the Turkish people concerning this disaster and necessity of insuring properties against earthquakes.



## Reinsurance for Earthquake

- Earthquake at the Reinsurance Treaties
  - Retention of The Insurer
  - Event Limit
- Catastrophic Excess of Loss (Cat XL) Reinsurance
  - Transferring Predetermined Earthquake Accumulated Risk To Reinsurance
- Are we sure that the true Cat XL Reinsurance Cover has been taken?



## Main factors of PML

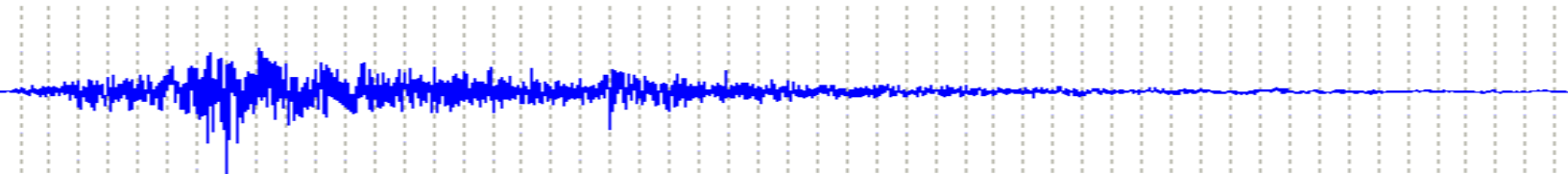
- Total Insured Values (approximately):
  - Marmara Region: 250 billion TL ( USD160 billion)
  - İstanbul : 200 billion TL ( USD130 billion)
  
- Calculation Methods of the Probable Maximum Loss for Earthquake :

What is a PML?

PML is a ratio, expressed as a percentage, initially developed by the insurance industry to quantify the expected insured loss after deductible for structural and contents damage from a large earthquake.

What Factors Contribute to Earthquake Risk?

1. The Structure
2. Geology
3. Proximity to Faults
4. Probabilistic Considerations

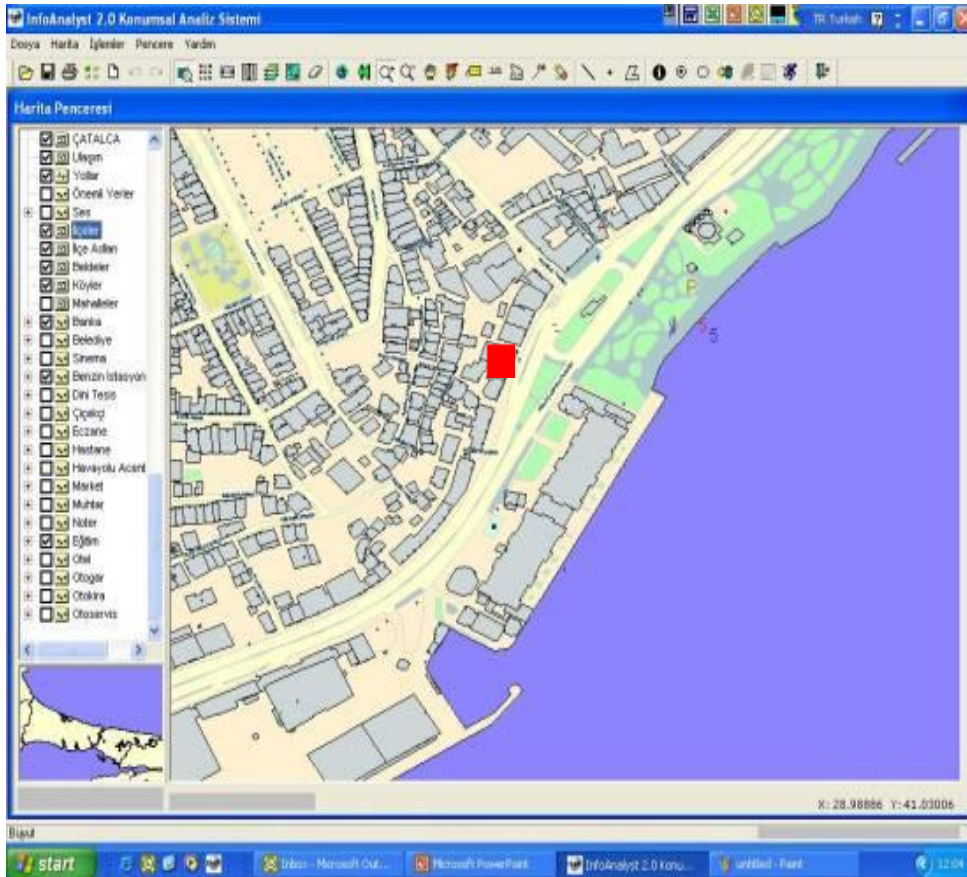




## Objectives of Geographic Risk Modelling for Insurance Sector

1. To develop deep understanding of geographic portfolio exposures, in particular concentrations of exposure, based on precise geographic information of the policies (latitude and longitude) for fire and engineering branches
2. To develop ability for PML analysis per exposure unit based on precise geographic location, respective risk data for the location and earthquake risk model
  - ✓ Less risk to insurance companies through a more precise understanding of catastrophe loss aggregates and exposure concentrations
3. To link location based rich risk data, risk scoring mechanism to insurance company u/w and pricing processes
  - ✓ More risk adequate pricing
  - ✓ Improved profitability through better risk selection and pricing
  - ✓ Growth in the fire and engineering book through more competitive pricing of better risks
4. To effectively monitor and manage portfolio risk aggregations linking it to target setting, performance evaluation and commissioning processes as well
5. To develop a solid base for strategic review of reinsurance needs

The modelling system is built on a geographic information system (GIS) and database...



Third-party address database

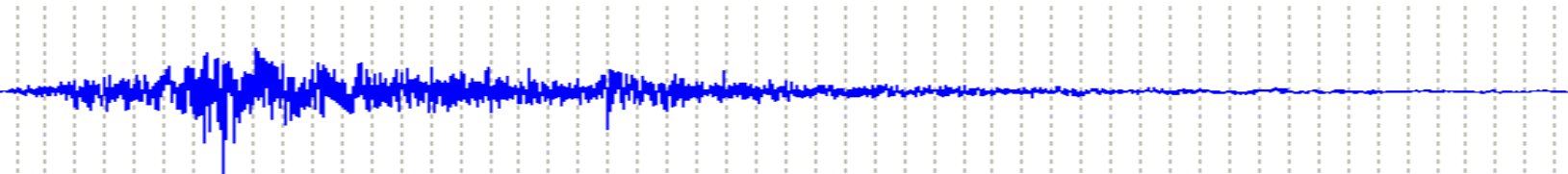
- Geocode information at building level for İstanbul
- Geocode information at street level for 78 city and 48 district (ilçe)

Third-party location based risk information

- Past earthquake damage information
- Ground classification maps
- Grid based analysis data

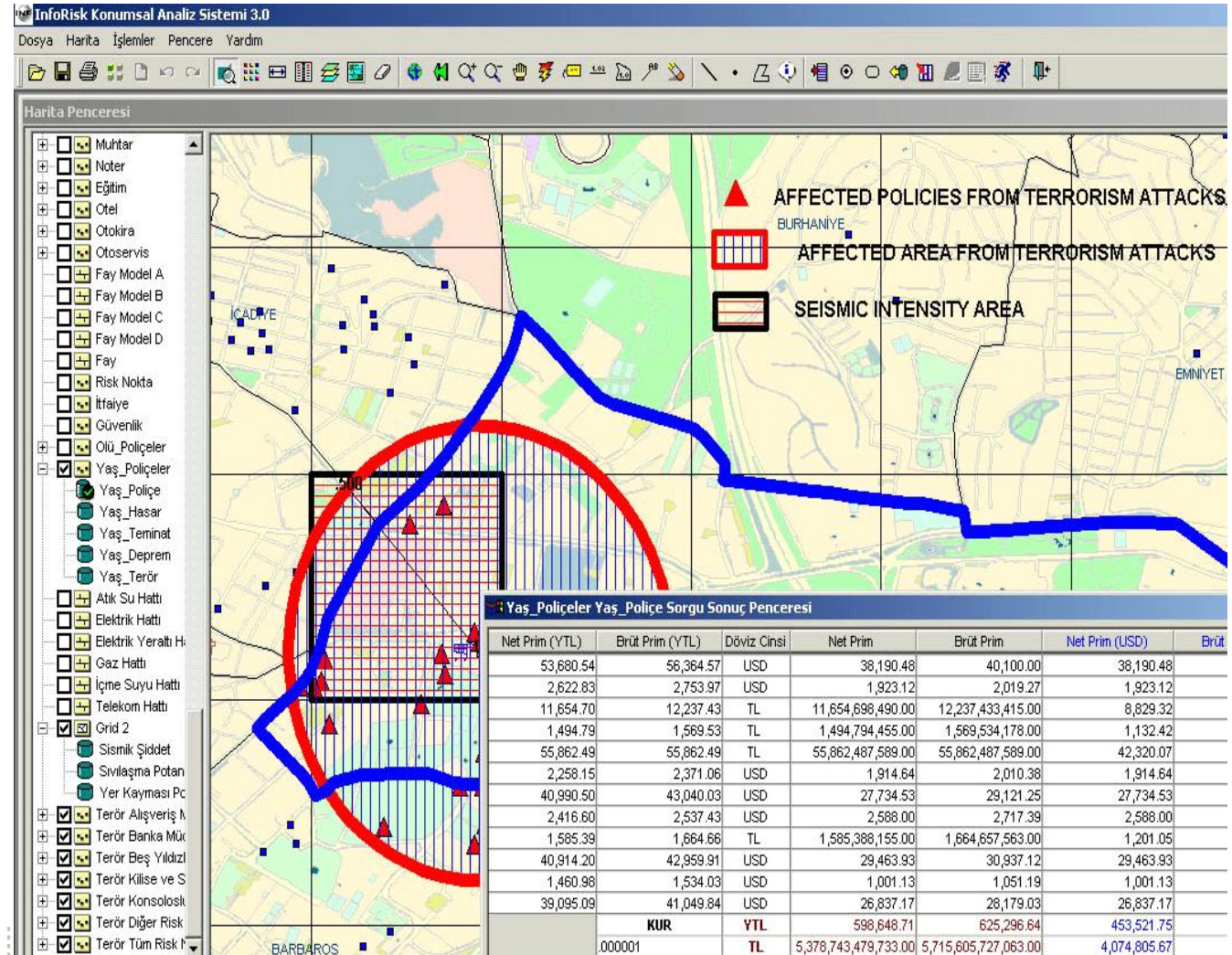
It is possible to analyze PML based on precise geographic information of a location (latitude and longitude) and location based risk data

Policy no	Risk address latitude and longitude	Risk type	Earthquake coverage	Fire coverage	Grid based damage %	Total cost of damage	M2	Subject to TCIP (Dask)	TCIP (Dask) coverage	PML after deductibles
1445972	X,Y	Civil	Building – 210.000	300.000	%10	30.000	200	Yes	110.000	0
			Content							
			Other							
14474611	X,Y	Civil	Building	300.000	%30	90.000	100	Yes	55.000	35.000
<b>Total</b>		Civil								



## Risk Information – Portfolio Aggregations

It will help monitor and manage our aggregations based on thorough location based analysis





**THANK YOU**

