Resilience and Earthquake Engineering

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Resilience and Earthquake Engineering

- Introduction to Yanev – EQE; Recent projects
- Introduction – History of earthquake engineering
- Learning from earthquakes
- Seismology and resilience, or the lack of it
- The building codes and resilience, or the lack of it
- Building a better case for additional resilience and quantifying it
- Conclusion – What can engineers do now?

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Yanev-EQE - Recent Projects

Panama Canal – all natural hazards

Los Angeles World Airports (LAX+) - earthquake

Yanev-EQE - Recent Projects

So. American Energy Company –earthquake, tsunami, flood:
50+ Sites. Over $13bn in value:
Hydro, Thermal, Combined Cycle, LP, Wind, Solar, 3000km Gas pipelines, 4000km Power transmission lines

EDF (France, Nuclear):
Post-Fukushima earthquake response and strategy

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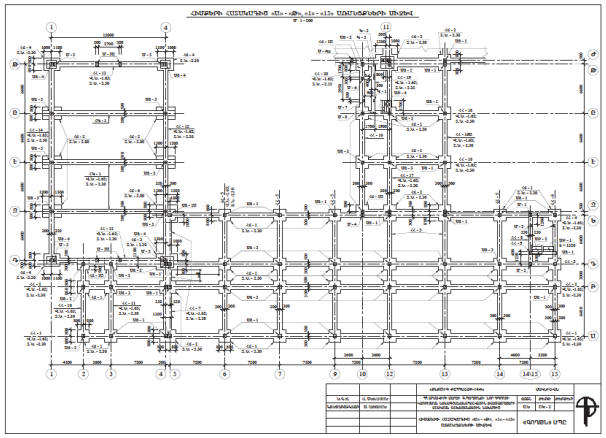
Yanev-EQE - Recent Projects

Large-scale risk mgmt., economic impact and life-safety: World Bank, Asian Development Bank, Council of Europe Bank

Albania
Armenia
Bulgaria
China
Republic of Georgia
Istanbul Metro Area
Manila Metro Area
Romania
Turkey

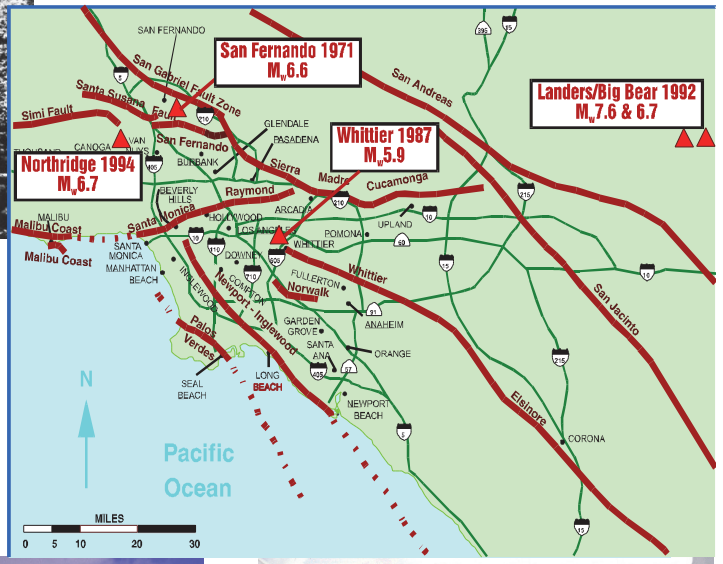
New hospital in Istanbul

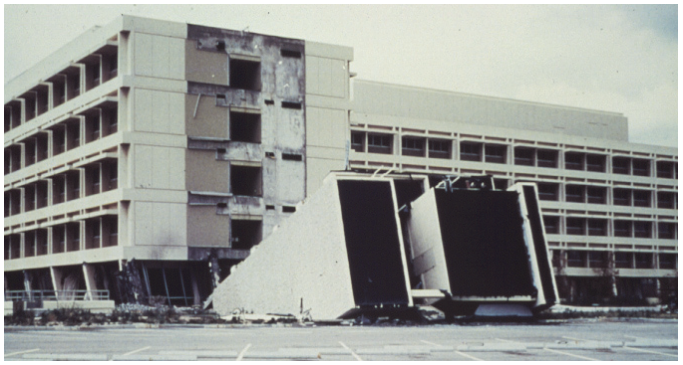
Retrofit of a school in Istanbul



Proposed new school design in Armenia

Introduction - History





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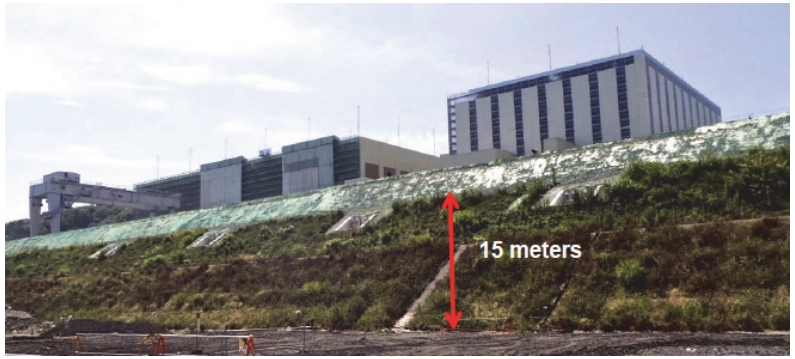
Learning from earthquakes



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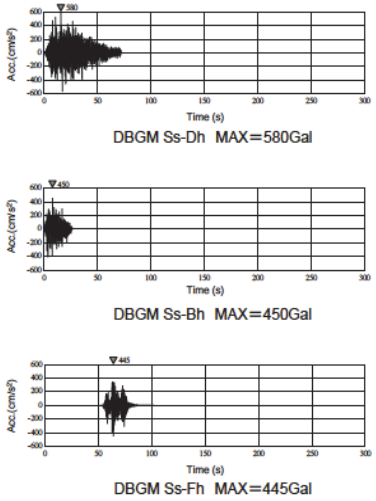
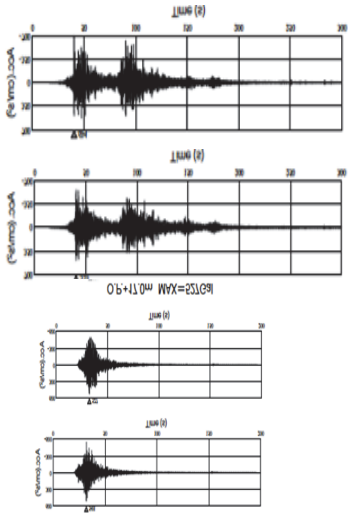
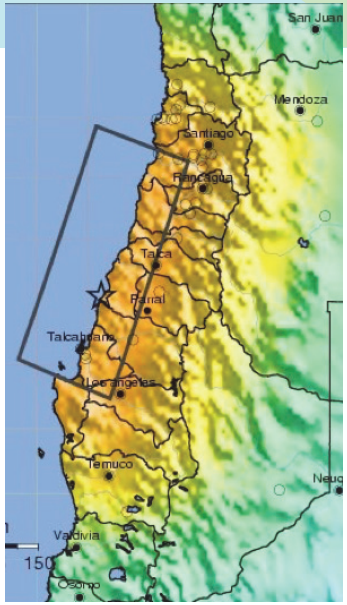
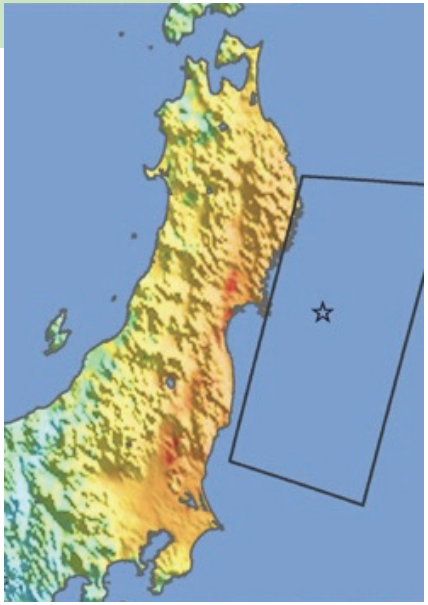
Seismology and resilience, or the lack of it









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The building codes and resilience, or the lack of it






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The system is stacked against resilience and risk management

Overreliance on existing design philosophy (life safety):

Always playing catch up to new developments. Always updated and improved after catastrophes.

Codes are driven by structural engineers and their clients with a narrow view to the structure. Where is the public?

Lack of understanding of natural hazards by the design professions.

Manipulation of the codes, especially with “independent” review panels, engineering software, optimization……

Do we really understand the legal ramifications?

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Building a better case for additional resilience and quantifying it

1. Determine the acceptable damage….
2. Determine the additional cost….
3. Determine the cost-benefit
    - Reduced direct damage,
    - Reduced down-time (reduced business interruption),
    - Reduced injuries or life-loss,
    - Reduced cost of property and casualty insurance and earthquake insurance (direct damage and business interruption),
    - Reduced reputational damage,
    - Reduced security costs,
    - Reduced litigation costs, etc.
4. Communicate the results
    - Resilience is not a structural issue. It is an investment issue.
    - It is our fault that the public does not understand that.

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Conclusion – What can engineers do now?

I agree with John Heintz's conclusions:

- "As community leaders seek to develop long-term resilience plans that satisfy all interest groups, and researchers continue to advance our analysis and design technologies, engineers should use engineering principles (although not necessarily engineering language) to simplify the design challenges and help implement near-term steps leading to resilience."
- "Since we know the desired outcome, it is time for engineers to take a leadership role, and once again make decisions on behalf of society to help it achieve what we know it wants."

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