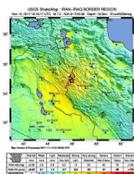
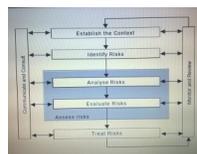


# INFLUENCE OF LARGE EARTHQUAKES ON THE SEISMIC HAZARD EVALUATION: CASE STUDY FOR THE GULF AREA CVETAN SINADINOVSKI (AEES, AUSTRALIA) AND FIRYAL BOU-RABEE (KUWAIT UNIVERSITY)

On 12 November 2017 at 18:18 UTC, magnitude 7.3 earthquake occurred on the Iran–Iraq border, with an epicenter approximately 30 km away from Halabja, at shallow depth of 20km. It was felt throughout the Gulf area and as far away as Pakistan and the United Arab Emirates. With more than 540 people killed and some 8,000 injured, as well as many more unaccounted for, it was the deadliest earthquake of 2017.



In Australia, Earthquake Hazard and Risk assessment projects lead by the Government are done for the major capital cities. The Cities Projects were established to undertake research directed towards the mitigation of the risks faced by Australian urban communities that are posed by a range of geohazards. The ultimate objective is to improve the safety of communities, and consequently make them more sustainable and prosperous. The assessment process is outlined in the following Figure.



## • DELIVERING BUSINESS CONTINUITY

• OasisPlus - Kinematics



### RESPONSE AND DECISION MAKING

Uninformed vs Well-Informed

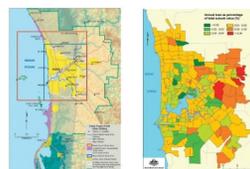
1. Earthquake occurs in the region
2. Shaking starts in your building

**Well-Informed Response**

3. Before occupants can ask what is happening, they get an Earthquake Alert and instructions. **Do Not Evacuate.**
4. Managers activate earthquake response plan. Appropriate resources are deployed, decision tree path followed, final decision on evacuation is quickly made and communicated.
5. **No evacuation occurs, unless warranted.**
6. If occupants have evacuated, an OK to re-enter can be sent.

With the epicenter of the earthquake being some 1,400 km away from the UAE, the quake was felt only by the residents of high-rise buildings and tall towers. In Kuwait, the quake was felt so strongly that people rushed out of their buildings and onto the streets, according to photos shared to social media.

The earthquake was located within the Zagros fold and thrust belt, part of the broad and complex zone of continental collision between the Arabian and Eurasian Plates where the relative convergence of the plates is about 26 mm per year. The maximum shaking in the epicenter was estimated to VIII on the Mercalli intensity scale.



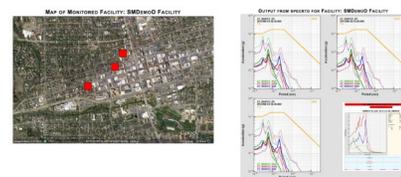
Perth Cities Project

## Real-time Continuous Structural Monitoring

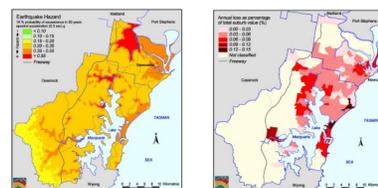
Monitor, study, and react to the spectral content of the acceleration

Engineering analysis tools

Antelope BRTT software



Statistically earthquakes of that size in the wider region of the Middle East occur about every 10 years.



Newcastle Cities Project

### RESPONSE AND DECISION MAKING

Uninformed vs Well-Informed

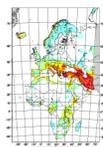
1. Earthquake occurs in the region
2. Shaking starts in your building

**Uninformed Response**

1. Occupants react. What is happening? What do I do? Other people run, so they run.
2. Managers activate general emergency response protocol.
3. Without proper guidance, an evacuation occurs based on emotional decisions.
4. Occupants ask, now what do we do?



Although the most intense shaking experienced during earthquakes generally occurs near the rupturing fault and decreases with distance away from the epicenter, the shaking at one site can easily be many times stronger than at another site equally far from the origin. It is assumed that the earthquake mechanism and the regional and local geologic conditions are the cause of that difference in shaking and supplementary research is needed to investigate which settings and parameters are the most responsible (e.g. GSHAP program)



Macroseismic data suggested that large earthquakes can cause wide scale damage and many hundreds of deaths and injuries. Further modelling work based on factors such as the size of the event, population density and what is known about the local construction practices is required for the Gulf region. Combining this information with estimates of where and how often earthquakes will occur would allow for better seismic hazard and risk calculation, building design and mitigation strategies for future large earthquakes.

