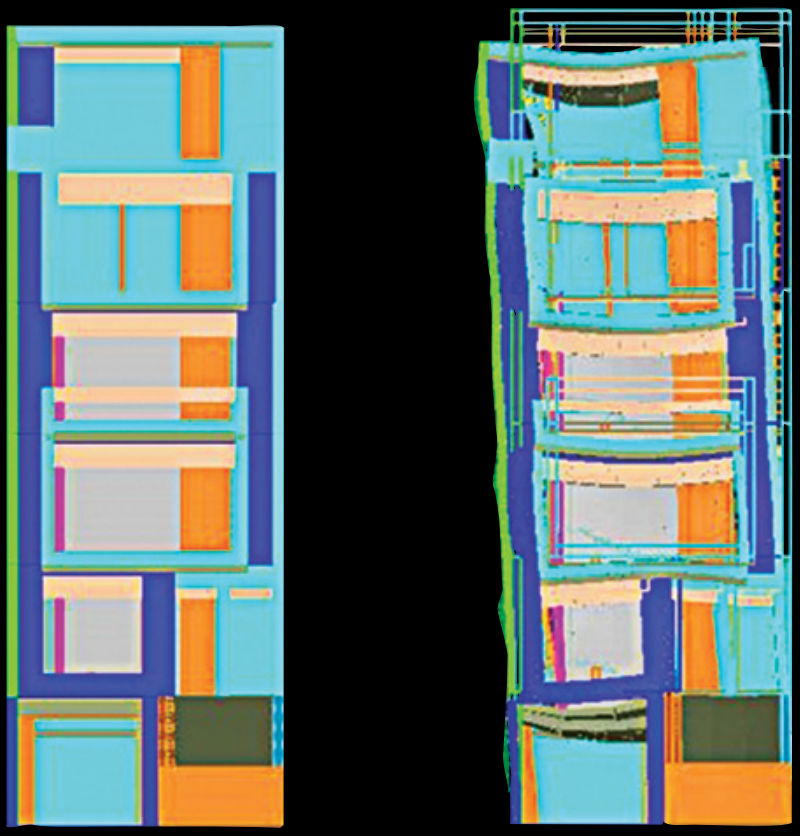
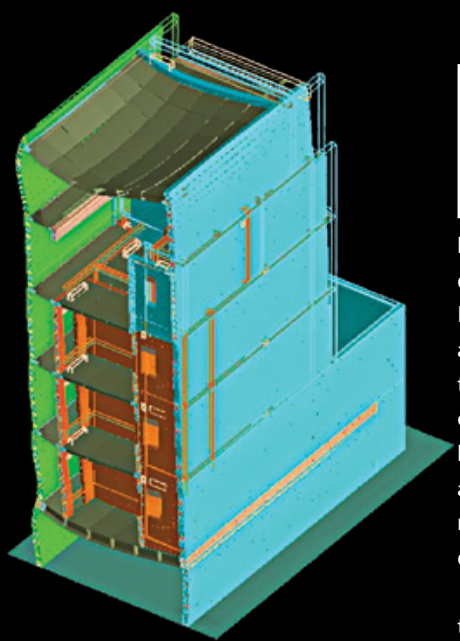


RUMBLE, RUMBLE, TOIL & TUMBLE

Parking is a high priority for Maltese homeowners and, as a result of this, garages are becoming compulsory in new buildings. What does this have to do with earthquakes? ***Dr Claude Bajada*** *meets earthquake engineers* ***Dr Marc Bonello***, ***Dr Reuben Borg***, *and* ***Perit Petra Sapiano*** *to find out.*

Dr Marc Bonello, Dr Reuben Borg, Perit Petra Sapiano and Prof. Alex Torpiano. ***Photo by Edward Duca.***



Rumble, rumble, tumble, crash! An earthquake has hit. It is a big one. The epicentre is closer to the island than it has ever been before. Buildings are crumbling, leaving destruction in their wake. The Civil Protection Department is formulating a response. What tools can they use to ensure that their intervention is as effective as possible? How can they know which of the standing buildings are most at risk from damage? They must respond quickly to save lives but do not have the information to do so.

Hopefully, this is all set to change thanks to the members of a team of earthquake engineers at the Faculty for the Built Environment (University of Malta) who are creating a toolbox for the Civil Protection Department. Their work forms part of a multidisciplinary, EU funded, international project called SIMIT. The project is vast in scope but the team's remit is straightforward. The group wants to study the effect of earthquakes on Maltese buildings and to provide a quick and effective way to assess the seismic risk of every building on the Maltese Islands. This will have two outcomes. First, the authorities will have an evidence-based picture of Malta's seismic risk, which should in turn guide policies. Second, it will provide the Civil Protection Department with a tool to be able to identify which areas are most at risk if the worst case scenario happens.

Dr Marc Bonello explains that in Malta 'architects *(periti)* tend to follow international design codes when it comes to designing reinforced concrete and steel structures, but when it comes to masonry buildings [...] the construction is usually based on tradition and experience.' The

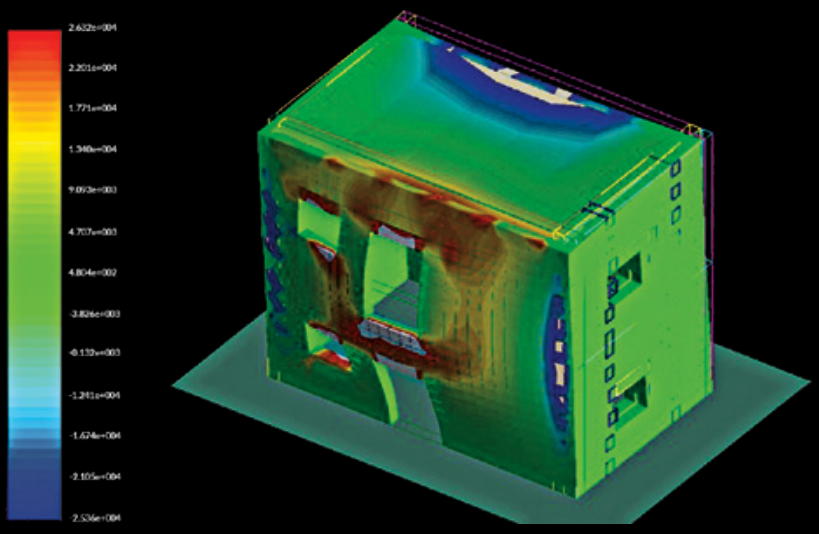
team members explained that as a result of the ever growing parking problems on the island, underground parking facilities are being designed into most new structures. 'Parking requires column-free space because otherwise drivers cannot manoeuvre their cars properly. This results in situations where the basements are devoid of any internal vertical [support],' leaving the buildings vulnerable to earthquake damage.

Despite the risky building practices, there is still not much information about how these buildings will react to an earthquake—the core research question. The last recorded major earthquake in Malta was in 1693. There is no rigorous data about how that earthquake affected buildings so the engineers have to rely on numerical simulation. These simulations are performed on virtual buildings. The problem is simulating the entire island which needs too much computational time.

To solve this problem, the group has devised a survey that can quickly be applied to a building. The survey is based on similar ones that the Italian Civil Protection Department use for assessing their buildings' seismic risk. These must then be adapted and calibrated, which is the team's current aim. They are comparing the results from the numerical simulations to survey data. Bonello explains that 'we cannot cover all areas of Malta at once, so we chose two specific sites which, in our view, have geological characteristics that would render their seismic vulnerability to be quite high.'

Once the surveys are pared down to give accurate results, the team can use them on every building

Architects (periti) tend to follow international design codes when it comes to designing reinforced concrete and steel structures, but when it comes to masonry buildings [...] the construction is usually based on tradition and experience.



WHAT CONTRIBUTES TO SEISMIC RISK?

'When we talk about seismic risk, there are three important components', says team member Dr Ruben Paul Borg. 'One is the seismic hazard, or earthquake intensity; the second is exposure, or population size and property number; the third is the building's vulnerability'. Property vulnerability to earthquakes is reduced by earthquake resistant construction and better disaster resilience. The earthquake of 1693 devastated south-eastern Sicily and caused extensive damage in Malta. Research suggests that a similar earthquake on the same fault could occur every few hundred years. Today, Malta has a much larger population than in 1693, with a third of the Islands built up and the 8th highest population density in the world.

WHAT IS SIMIT – WHO TAKES PART?

SIMIT is a European Union funded project that enables collaboration between the universities and Civil Protection Departments in Malta and Catania. The universities involved are the University of Malta, the University of Catania, and the University of Palermo. The entities at the University of Malta that contribute to the project are the Faculty for the Built Environment, the Faculty of Science, the Faculty of Arts and the Institute for Climate Change and Sustainable Development.

More information about the contribution from the Seismic Monitoring and Research Unit (Department of Geosciences, Faculty of Science) can be found in *Rocking the Islands* (Issue 11, p.33).

on the Island. Their vision is a map of Malta where every building is coloured according to its seismic risk. They hope that this evidence will convince policy makers to introduce mandatory building regulations to ensure that new structures are built with minimal seismic risk.

The team faces substantial problems. The data collection involves enormous time investment. 'We would like to [...] complete the seismic vulnerability maps for the entirety of the Maltese Islands. That will take years!' exclaims Bonello. 'You would need lots of people gathering and analysing that information.' The analysis needs powerful computer systems that can cope with the large amount of data. Funding is another problem. '[SIMIT wasn't] an end in itself, it was the beginning of a process.'

The year is 2150. Hardly anyone slept last night. The earthquake was a big one. The new stations report that it was the biggest in recorded history. The rumbling was intense but the destruction was minimal. A few buildings fell, mostly older ones. The Civil Protection Department intervened quickly and effectively because they could pre-empt which areas would be hit hardest. Much loss of life was prevented. Experts are attributing the minimal damage to the Maltese government's foresight in the early years of the last century. They put a university research project on high priority and funded it heavily. The project gave an in-depth account of the island's seismic vulnerability and as a result building regulations were tightened. Every new structure was built with a seismic event in mind. The Civil Protection Department was also equipped with a map that shows which buildings are most vulnerable to earthquakes. Malta was lucky. The Government had taken scientists seriously.

FURTHER READING

- Montanaro Gauci, G. (2015) Mdina cathedral destroyed in the 1693 earthquake. The Sunday Times of Malta. [Online] 11 January. Available from http://www.timesofmalta.com/articles/view/20150111/life-features/Mdina-cathedral-destroyed-in-the-1693-earthquake.551625