

## Topic 2a - Vulnerability models

[Dickie Whitaker] Building vulnerability or damageability forms a vital component of catastrophe models. It's the element that allows us to take a natural hazard, be it an earthquake or a flood or a cyclone, and look at its impact on the built environment. That's equally as important for a residential building or indeed a high-rise like we have here behind us in the city of London.

[Dr Ben Lloyd-Hughes] Fragility, which is the study of how much damage a building is likely to exhibit in the face of a particular level of natural peril, has received tremendous amount of academic attention. And I think this is because it's intrinsically-- particularly when viewed from an engineering perspective-- a very exciting thing to do. We build structures and they're tested to destruction. And there's no doubt that this research has led to significant improvements in building safety and the construction of more resilient structures. However, the insurance industry has additional requirements which go beyond damage and consider the financial implications and the losses associated with that damage, and this is a much more difficult problem. And that leads us into the issue of vulnerability.

One of the particular difficulties is estimating the losses involved, particularly when the peril is over a widespread geographic area, which is typical for natural catastrophes. The clustering of natural catastrophes-- that's clustering in both time and space-- is of particular interest to both academics and insurers alike. The underlying issue is the processes which drive the perils which lead to catastrophe have a nasty tendency to get stuck in a bit of a rut, and this leads to an increase in the likelihood of seeing an event close on the heels of one you've just received. And this leads to significant problems when we attempt to price the risks associated with a particular event.

The influence of clustering on vulnerability comes from the fact that vulnerability models are typically based upon an understanding of the building structure when it's intact. However, if a building's been damaged by a previous event, subsequent damage is likely to be more extensive due to increased fragility of the building. However, assessing just what the increase in fragility is, is a particularly challenging task.