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Estimation of vulnerability functions based on a global earthquake damage database

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Developing a better approach to the estimation of future earthquake losses, and in particular to the understanding of the inherent uncertainties in loss models, is vital to confidence in modelling potential losses in insurance or for mitigation. For most areas of the world there is currently insufficient knowledge of the current building stock for vulnerability estimates to be based on calculations of structural performance. In such areas, the most reliable basis for estimating vulnerability is performance of the building stock in past earthquakes, using damage databases, and comparison with consistent estimates of ground motion. This paper will present a new approach to the estimation of vulnerabilities using the recently launched Cambridge University Damage Database (CUEDD). CUEDD is based on data assembled by the Martin Centre at Cambridge University since 1980, complemented by other more-recently published and some unpublished data. The database assembles in a single, organised, expandable and web-accessible database, summary information on worldwide post-earthquake building damage surveys which have been carried out since the 1960's. Currently it contains data on the performance of more than 750,000 individual buildings, in 200 surveys following 40 separate earthquakes. The database includes building typologies, damage levels, location of each survey. It is mounted on a GIS mapping system and links to the USGS Shakemaps of each earthquake which enables the macroseismic intensity and other ground motion parameters to be defined for each survey and location. Fields of data for each building damage survey include:
· Basic earthquake data and its sources
· Details of the survey location and intensity and other ground motion observations or assignments at that location
· Building and damage level classification, and tabulated damage survey results
· Photos showing typical examples of damage.
In future planned extensions of the database information on human casualties will also be assembled.
The database also contains analytical tools enabling data from similar locations, building classes or ground motion levels to be assembled and thus vulnerability relationships derived for any chosen ground motion parameter, for a given class of building, and for particular countries or regions. The paper presents examples of vulnerability relationships for particular classes of buildings and regions of the world, together with the estimated uncertainty ranges. It will discuss the applicability of such vulnerability functions in earthquake loss assessment for insurance purposes or for earthquake risk mitigation.