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Towards a strategy of using remote sensing for post-earthquake damage assessment: practical considerations

K. Saito (1) and R. Spence (2)

(1) University of Cambridge, Department of Architecture, Cambridge, United Kingdom (ks269@cam.ac.uk), (2) University of Cambridge, Department of Architecture, Cambridge, United Kingdom (r.spence@carltd.com)

In the event of a major earthquake, various stake holders such as local, national governments, international aid agencies, rescue teams and insurance companies, require information on the effect the earthquake has had on the local area e.g. level of damage sustained to the buildings, lifelines and other infrastructure, number of casualties and displaced people. The timeframe in which the information is required varies. To date many studies have been carried out aiming to develop methods (manual and semi-automated) that allow the damage to buildings and infrastructure to be assessed using remotely sensed data. However, these methods are yet to be applied in real situations. This paper will look at the issues that need to be addressed for remote sensing to be a viable tool for damage assessment.

Since large earthquakes can affect a wide geographical area, the strategy should firstly assess and define the extent of the area that needs to be looked at using remote sensing. Methodologies developed to define this extent will be reviewed. The extents created using these methods, including the PAGER method by USGS and the PAZ method by Saito (2009) will be compared against earthquake intensity data from recent earthquakes to validate the results, as well as identify issues that are not taken into account, such as secondary hazards.

Once the extent is defined, the location of the settlements of interest within the extent must be identified. This is often a laborious task and is an area that requires a strategy. Again, depending on who the stakeholder is, the strategy would be different i.e. for insurance companies, locations where insured properties exits would be a priority, whereas for local authorities and aid agencies all settlements are relevant. Global population datasets such as Landscan or CIESEN data allows most of the populated areas to be identified. However the place names need to be assigned. Having a dedicated mapping team would be beneficial, who would ideally prepare such map before an event happens.

For the damage assessment of individual populated places, various semi-automated methods as well as manual interpretation methods have been proposed in the literature. In a real situation, the datasets that are available for the area will define the methodology that can be applied, hence in a real event, data availability assessment will be required at the very early stage of the emergency situation. An example of a semi-automated method is a texture analysis method developed by the author that only uses the post-event image. The textural characteristics of rubble pixels were defined using two texture descriptors, namely, Square Root Pair Difference (SRPD) (Lark, 1996) and Gi (Walder and Boots, 1998). Contrary to initial predictions that rubble would display high roughness, rubble features had medium roughness when using either of the descriptors.

The strategies for the use of remote sensing will be different for cases where near real-time damage assessment is required, and cases where a retrospective evaluation of the event is carried out several months afterwards. When retrospective investigation is carried out, the best data can be created using all available resources, whereas for near real-time evaluation of the damage, whatever data available will have to be used in the most time efficient manner. A summary of the type of data and the type of damage assessment that has been carried out in the literature, together with the expected results will be presented.