Novel Rescue and Restoration Technologies

**Project C7 within the German Collaborative Research Centre 461:
„Strong Earthquakes: A Challenge for Geosciences and Civil Engineering"**

The main research objective of the project C7 is to develop models and tools to support the field personnel during and after earthquakes. In the first six years (1999 - 2004) the project C7 performed investigations concerning the technical rescue of trapped victims from collapsed buildings. Since beginning of 2005 the research of building state evaluation methods is a further aim.

Objectives 1999 - 2007

1. Development of an expert and information system to support onsite rescue personnel.
2. Development of a geometry-based model to estimate the casualties and the demand for search and rescue resources.
3. Development of a method for the fast execution of building evaluation measures in large areas after earthquakes.
4. Integration of the models and tools in the Disaster Management Tool (DMT).

## 1. Expert and Information System for Rescue Works

Based on the analysis of experiences from past rescue operations in collapsed buildings, collected by an international expert survey and from published after action reports, an expert and information system was developed to support onsite rescue personnel at rescue operations in collapsed buildings. It consists of the three components: on-line manual, expert system and computation component. It can be used for training purposes and to support the rescue operations in a real case. After input of information related to a certain situation, the expert system poses context sensitive subsequent questions, gives assistance for the site inspection and generates advice concerning suitable procedures and equipment for the given situation. Additionally basic information, check lists as well as calculation components are offered as support. The expert and information system was tested and further developed in cooperation with specialists of the German governmental disaster relief organisation (THW) and the Romanian Civil Protection Command. It will be integrated in the Disaster Management Tool (DMT) and connected to its central database to allow constant information exchange between the emergency operation centre and the on-site rescue teams.
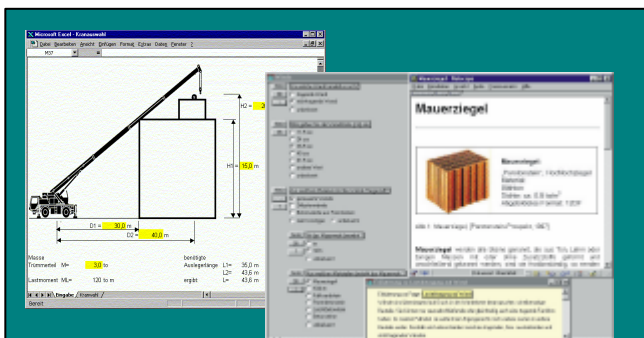
Expert and information system
for the support of the rescue works

2. Geometry based Estimation Models

Development of a novel casualty estimation model and of a method to assess the demand for search and rescue resources using as input the determination of collapsed buildings in large urban areas based on laserscanning data. This novel reconnaissance technique, developed by our partners from Institute for Photogrammetry and Remote Sensing, offers the possibility to detect very quickly and reliably the collapsed buildings and their

Geometry based estimation models for casualties and rescue resources
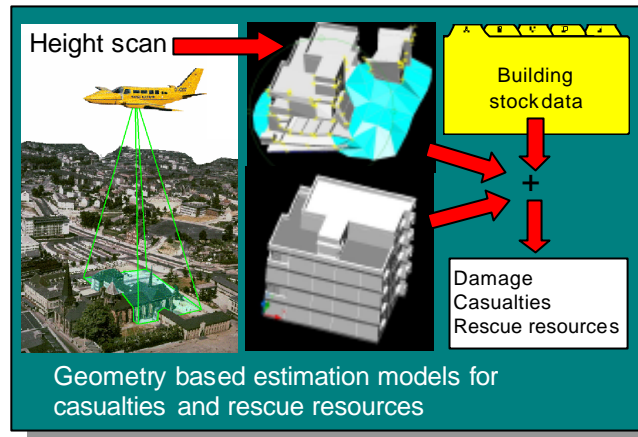
collapse type. Therefore a new classification method of collapsed buildings was necessary. For this reason, observations and reports of building collapses were analysed leading to the required new classification and the definition of the so-called damage catalogue. This is a compilation of different damage types of entire buildings typically occurring after earthquakes and contains the observed dimensions of the geometrical characteristics like e.g. volume reduction for each damage type. Based on this classification of collapsed buildings two models were developed: a novel casualty estimation method to assess especially the trapped victims and a method to assess the SAR resources for each collapsed building. Latter allows a better allocation of the limited SAR resources of the whole affected area. Both models will be integrated in the Disaster Management Tool and will support in this way both the work of the emergency operation centre and of the on-site rescue teams after an earthquake.

3. Building State Evaluation

In this project period (2005-2007), the fundamentals are to be created to support engineers and architects in evaluating fast and reliably damaged buildings after earthquakes in a large damage area regarding their further usability. The buildings state evaluation method, that is to be developed based on these fundamentals, will support engineers and architects, who have different experience levels in the evaluation of seismically induced damage. The method will be implemented with an expert and information system, comparable with the expert system for the rescue works presented above and will also be integrated in the Disaster Management Tool.

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