

GEM REQUEST FOR PROPOSAL: INVENTORY DATA CAPTURE TOOLS

Posting date: 18th January 2010
Submission deadline: 18th March 2010
Expected decision: July 2010
Target budget range: 750k Euros
Timescale: 30 Months

PREAMBLE

The Inventory Data Capture Tools RfP aims to provide the tools that will enable the capture of high-resolution inventory (and earthquake damage) data and will provide a means by which such data can be homogeneously fused into either the Global Exposure Database (DB) or the Global Earthquake Consequences DB. The data capture process envisaged involves merging building attributes collected using Remote Sensing with those acquired from Direct Observation with the combined results being merged with low resolution default datasets previously used to populate the Global Exposure DB. The tools should enable the capture of asset data that can be integrated with the Global Exposure DB such that the attributes provided enables each asset to be assigned to a specific vulnerability class. The tools are also expected to be used to collect post-earthquake damage and impact data in a form suitable for transfer into the Global Earthquake Consequences DB.

It is recommended that proposals should leverage and support already existing open source solutions to these challenges.

TASKS

Task 1. Remote Sensing

Within this component two levels of acquisition are anticipated resulting in capture by:

1. Interpretation of low or medium, but most likely high, spatial resolution satellite imagery
2. Capture and interpretation from aerial images

(Note: in both cases 'imagery' should be interpreted as being both of optical and of other wavelength (radar, infrared, etc.) images as deemed appropriate by the consortium to most suitably address the attributes being acquired.)

This task should address the use of automatic feature extraction alongside human assisted creation of vector data upon the imagery.

Task 1.1 Develop an image acquisition, processing, and interpretation capability that enables the determination of:

(a) geo-referenced building footprints along with as many additional attributes as practical (height, shape, roof and cladding materials, structure type.) (Note: Approximate period of construction and building use or occupancy can be estimated by inference either to earlier images or other means. As these are particularly useful indicative attributes for building condition and level of design, the consortium is encouraged to develop a methodology that can be applied in acquiring such inferred data.)

b) geo-referenced "footprints" of vegetation that may influence post-earthquake fire spread (with type, height), and

(c) geo-referenced infrastructure footprints/alignments (with e.g. road widths, road surface types, numbers of lines (rail & power), pylons, reservoirs) can be determined.

(d) distribution and characterisation of damage from a specific event to enable damage data to be acquired within the Global Earthquake Consequences DB.

The consortium should also work with the Global Exposure DB consortium to identify, develop and/or recommend proxy procedures, built-up area recognition tools and image processing techniques for the identification of human settlements from satellite imagery.

Task 2. Direct Observation

Within this component two types of tools for collecting the attributes of buildings through direct observation are anticipated:

1. Paper forms that allow a number of attributes of buildings to be captured, mindful of the need for electronic entry recognition of the data to the Global Exposure and Global Earthquake Consequences Databases;
2. Software that enables user-defined electronic inventory data and contents data collection and damage reporting forms to be prepared and loaded onto commonly available hand-held data capture devices (pda, mobile phones).

Task 2.1 Develop direct observation tools for capturing building attributes

The tools should allow for inventory attributes to be captured within representative sample areas on a building-by-building basis using direct observation. The attribute acquisition is expected to be collected either by street-front direct visual observation (assuming access onto the property cannot be assured) or by interpretation of street front photographs. Recording of the record is expected to involve entry into hand-held devices or by transfer from forms via desktop computers (only suitable for photograph interpretation).

The tools should allow for the capture of about 40 attributes for buildings, such as geo-referenced coordinates, one or more electronic images, approximate plan area, number of storeys, approximate age, building typology (foundation/structural form and material), cladding details, structural regularity (horizontal and vertical), occupancy (primary and secondary use), indicative condition, and some assessment of the degree of certainty in the attribute assignment. The floor elevation above surroundings, and roof material and complexity of shape, are also likely to be required. The possibility of recording the details of the contents of the building should also be considered. For post-earthquake damage studies, to enable population of the Global Earthquake Consequences DB, damage descriptors including photographs and residual damage state will be required.

The proposal should also consider that the tools will need to be used in the future for obtaining attributes for 'non-building systems' (e.g. infrastructural systems (pipes, roads, bridges), and industrial complexes and specialised facilities). Note: GEM will initially focus on buildings but is expected to extend to the damage evaluation of other structures with time.

A preferred means of extrapolating attributes collected from relatively small 'direct observed samples' into the neighbourhood or city/regional scale required for the regional loss modelling needs to be developed in recognition that statistical sampling of inventory is expected to remain an essential component of any global inventory catalogue.

Task 3. Integration of Acquired Data with the Global Exposure and Earthquake Consequences Databases

Task 3.1 Develop software that enables the fusion of data captured in Tasks 1 and 2 above firstly with each other and then once integrated, into the Global Exposure DB (for pre-event inventory assessment) or Global Consequences DB (for post-earthquake damage evaluation) in a manner that ensures the overall integrity of each dataset is maintained at all times.

Task 4. Guidelines and Applications

Task 4.1 Prepare an application guide and training program for each of the above methods. The application guide is to describe how the application is to be undertaken, the various sources of information that should be used to provide base data (or background imagery), the attributes that may be expected to be captured by each method (including the expected level of data resolution at which processing is to be undertaken), and the limitations implicit in each method. Specify the metadata required for each raw dataset that is used in the process of capturing the inventory data. The training guide is expected to provide step-by-step guidance as to how each approach could be implemented, the attributes acquired and the data transferred to either the Exposure and/or the Consequence databases.

Task 4.2 Undertake pilot studies in at least three culturally different communities to demonstrate the application of each of the above data capture methods, the expected applications from each and their respective limitation. The areas used for the case studies should be diverse in both building typology and population density.

PROJECT MANAGEMENT AND QUALITY ASSURANCE PLAN

The Project Management Plan should include:

- A sustainability plan for the future capture of exposure data within GEM.
- A dissemination and outreach plan to transfer the knowledge to the Regional Programmes so more detailed regional vulnerability assessment can be undertaken.
- A plan for training and capacity building within the potential GEM user community relating to the use and the data capture techniques developed and their interaction with both the Exposure DB and the Consequences DB.
- A detailed account of how the bidding consortium ensures quality in its execution of contractual obligations.