

## **Disaster Management & Impact Response**

### **REVIEW OF TOOLS TO ESTIMATE THE RISK IN CIVIL INFRASTRUCTURE DUE TO THE IMPACT OF SPACE OBJECTS ON LAND OR WATER**

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#### **ABSTRACT**

Generally when one performs a risk analysis of a civil infrastructure, in engineering projects, the risks are associated with climate change, seismic activity, differential deformations, subsidence, volcanic activity, floods, droughts, landslides, among others to name. Each of the above risks has a common element that relates them, which represents that the risk is associated with a behavior of the earth's surface and its atmosphere, due to the alteration of factors inherent to its own nature and the interaction of the same with the anthropic actions. To date, this risk analysis has been developed mainly from this perspective.

However, an interesting effort has been developed lately, in which for the first time a risk analysis is being carried out considering various perspectives or associated holistic approaches, as represented by the Quick Risk Estimation (QRE) tool.

The QRE tool uses the hazard classification outlined by the United Nations Office for Disaster Risk Reduction (UNDRR). The hazard indicators included in the QRE tool are aligned with the Sendai Framework for Disaster Risk Reduction 2015 - 2030 and the Sustainable Development Goals.

The tool allows a qualitative risk assessment, in which the family of extraterrestrial hazards is found, classified according to a) impact on land and water or b) space weather, and as hazard events there are the following categories: 1) collision, 2) radio disturbance, 3) airburst, 4) shock wave, 5) energetic particles, and 6) geomagnetic storm. It is estimated that the hazard events described in items 1, 3 and 4 are grouped into the hazards classified according to item a, while items 2, 5 and 6 are grouped according to the hazards classified according to item b.

In the present investigation, some scenarios are proposed to assess the risk in a qualitative way, according to the data recorded in various sources of information as represented by Sentry: Earth Impact Monitoring, for an assessment of the global impact, according to the risk classifications provided. .

Also, the probability of impact, consider the data set of The Meteoritical Society, which contains information on known meteorite impacts, table merged by Javier de la Torre. However, such information is relative in many regions, such as Bolivia, since it collects few possible impact events of some cataloged meteorites in Bolivia. In Bolivia, the crater best analyzed by NASA is Iturralde in the Bolivian Amazon.

Such information is important to analyze the qualitative aspects of risk, even without considering space debris; however, for a quantitative context, the tools should contribute to the definition of possible impact regions and their effects on the infrastructure, to establish sizing criteria. of infrastructures, mainly in dams to be designed and built.

The research raises important methodological aspects to be defined, the correlation of the tables proposed by the authors of the QRE tool, and those provided by NASA and ESA, as part of the incipient nature of these new risk assessment guidelines in civil infrastructures.

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