Geophysical Research Abstracts
Vol. 13, EGU2011-9090, 2011
EGU General Assembly 2011

Methodology for creating the priority list of actions for the reduction of hydrogeological risks on the road network of the Autonomous Province of Bolzano (Project Paramount)

Claudia Strada (1), Federico Rupi (2), Matteo Mottironi (3), Ludwig Nössing (4), Guido Rossi (5), Paolo Montagner (6), and Antonio Danesi (7)

(1) Department of Civil Engineering – Autonomous Province of Bolzano,Bolzano, Italy (claudia.strada@provincia.bz.it), (4) Department of Civil Engineering – Autonomous Province of Bolzano,Bolzano, Italy (ludwig.noessing@provincia.bz.it), (6) Department of Civil Engineering – Autonomous Province of Bolzano,Bolzano, Italy (paolo.montagner@provincia.bz.it), (2) Department of Transport Engineering (DICAM) - University of Bologna , Bologna,Italy (federico.rupi@unibo.it), (5) Department of Transport Engineering (DICAM) - University of Bologna (guido.rossi@unibo.it), (7) Department of Transport Engineering (DICAM) - University of Bologna (antonio.danesi@unibo.it), (3) Freelance engineer – Autonomous Province of Bolzano , Bolzano, Italy (matteo@mottironi.eu)

The main target of this methodology is the creation of the priority list of actions for the reduction of hydrogeological risks on the road network of the Autonomous Province of Bolzano.
Originally this methodology was only used for two geological phenomena, toppling and rock fall but it can be extended to other natural hazard phenomena.
The term “risk” involves the possibility of damages caused by a hydrogeological event, like:
R = P x V x E

R = risk, P = hazard level, V = vulnerability, E = exposure

The hazard level can be calculated basing on a combination of detailed field investigations and data from past events. In both cases the volume of a mass movement event, the terrain surface (morphology), the probability of a break-off and the existence and condition of protection measures have to be combined to calculate a hazard level.
Link exposure is estimated as a function of the average daily traffic along the link under consideration and of the value of asset corresponding to the local road infrastructure. On the other hand, link vulnerability has been considered indirectly, through the application of well-established reliability theories: probabilities are regarded as inputs and consequences are simulated in terms of variations of connectivity and generalised trip costs. As reliability decreases, vulnerability will increase. In particular, a set of bi-directional links are assumed to be successively and completely closed, which forces all travellers on those links to take other, less advantageous routes. Consequences are increases in travel times. The vulnerability index of one link is mainly based on the difference between the cost of travel between two nodes when the link fails and the total cost of the initial undamaged network. The vulnerability measure based on increased travel cost must be limited to the non-cut links and so a measure based on unsatisfied demand, which is well-defined for all links, has been taken into consideration as well. Indeed the network may be divided into several disconnected parts, so that the travel costs between nodes in different parts become infinite. Thus, a parameter has been defined that is proportional to the number of trips that are unable to reach the destination from their origin, due to the closed link. This parameter has been calculated relative to the total demand. The simulation of the interaction between transport demand and supply in different conditions has been performed under the hypotheses of Deterministic User Equilibrium (DUE) models. These models can assign an origin-destination matrix to the network, by taking into account the variation of travel times with link flows. As in this case study no origin-destination matrix was known, traffic counts have also been used in order to obtain a sound estimate of such matrix, by applying a special updating procedure to a test matrix. The test matrix itself had to be calculated through the application of a gravity model.