Guidelines for evacuation plans by simulation of transport systems in emergency conditions

Linee guida per la redazione di piani di evacuazione mediante la simulazione dei sistemi di trasporto in condizioni di emergenza

Funding: National (Italy)
Duration: Nov 2004 - Nov 2005
Status: Complete with results

Background & policy context:

European and Italian legislation makes rules to reduce the probability that catastrophic events will happen and the vulnerability of systems exposed to such events. Vulnerability of different systems has been the subject of different studies and many quantitative methods have been developed, e.g. methods to test resistance of buildings to earthquakes. On the other hand, there is a need for quantitative methods for modelling exposure. In fact, reducing exposure to catastrophic events through evacuation procedures can produce many benefits at low cost.

The concept of general mobilisation of a city is expressed in the technical language by the word ‘evacuation’. It is essential to test how a transport system works in case of an emergency in order to plan at strategic and operative levels the best interventions in the case of evacuation of a city or an area which includes another city. To this aim it is important to develop quantitative methods which can support, with calculations, hypotheses which could only be otherwise verified at high social and economic costs.

Objectives:

The main objective is to draw up guidelines to assess the performances of a road transport system in emergency conditions with a view to reducing the risk of an event. Risk is defined as a function of the probability that an event will happen in a transport system, the vulnerability of a transport system, and the exposure in the transport system.

This project analyses methodologies, models and algorithms concerning:

- the definition of the probability that an event will happen in a territorial area in an emergency;
- the definition of the vulnerability of a transport system interacting with a territorial system in an emergency;
- the definition of the exposure of a transport system interacting with a territorial system in an emergency;
- experimentation on the interaction between supply and demand in case of evacuation using a pseudo-dynamic approach;
- experimentation on the interaction between supply and demand in case of evacuation using a dynamic approach.

Methodology:

Starting from the formulation of the problem, a definition of vulnerability exposure has been given, as well as a definition and classification of calamitous events. Events which have a direct or indirect impact on transport systems have been identified together with the relationships between exposure, vulnerability and probability that an event will happen in a territorial system for different levels of intensity of events, doing experiments in a testing area. An analysis of the intensity of events, the interaction between supply and demand in case of evacuation and the vulnerability of transport systems has been also been carried out. Finally, the project has provided the state of the art of mesoscopic dynamic assignment models.
Parent Programmes:  
PRIN calls 1999-2005 - Research projects of national relevance

Institute type: Public institution
Institute name: MIUR, Ministero Istruzione, Università e Ricerca (Ministry of Education University and Research)
Funding type: Public (national/regional/local)

Partners:

Italy:
Università degli Studi della Basilicata; Università degli Studi 'Mediterranea' di Reggio Calabria; Università di Pisa; Università degli Studi di Salerno

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Key Results:
Guidelines for evacuation plans with simulation of transportation systems under emergency condition have been developed concerning in particular:

- those aspects related to the definition of the probability of occurrence of an event;
- the vulnerability of a transportation and/or territorial system;
- methodologies for the management of an urban area in conditions of evacuation;
- those methodologies able to analyse the flow conditions of the network in emergency conditions and to evaluate evacuation times for different demand and/or supply scenarios.

Policy implications
These guidelines can be used during both the design phase (when looking for strategies for optimising the evacuation of systems), and the analysis phase (when simulating the functioning of a system given a certain configuration and constraints). The use of these guidelines supports the identification of possible instabilities concerning the localised evacuation flows in the network, as well as alternative solutions for implementing the necessary measures.

STRIA Roadmaps: Other specified
Transport mode: Road transport
Transport sectors: Passenger transport, Freight transport
Transport policies: Safety/Security
Geo-spatial type: Other