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Physical Vulnerability Assessment during off-site transportation of Hazardous Material- a case of Vapor Cloud Explosion

Sagnika Chakraborty, Tarak Nath Mazumder, and Arup Das
Indian Institute of Technology Kharagpur, Architecture and Regional Planning, India (sagnika707@gmail.com)

Over the last few decades the number of freight carrying hazardous material (HAZMAT) is increasing at a rapid rate due to the unprecedented growth of Chemical Industries. It poses high health and environmental risk to the exposed population and properties in an urban set up. The urbanization process increases vulnerability to disasters through the concentration of people and assets. This study is an attempt to identify the physical vulnerability indicators and assess the amount of damage acquired by a building property if exposed to an explosion during a HAZMAT transportation incident. The vulnerability is calculated at three different levels namely building cluster level, building architecture level and building structure level. As a case study, the over pressure is calculated for the explosion of a tanker carrying Gasoline resulting into an Unconfined Vapor Cloud Explosion (UVCE). At macro level, from secondary research, the distance damage contour for physical damage of the built form are identified where the severity of damage decays with increasing distance. For a micro level analysis, the variables associated with the physical vulnerability of built forms are identified from a detailed literature review. A spatial decision support tool using the indicators is then developed which captures the variation in damage level of the exposed built forms for a given over pressure resulting from an explosion. Hence, the vulnerability score of individual building is generated on a GIS platform. This methodology can be extended for calculating the overall vulnerability of a link and thus for the entire network for identifying the least vulnerable route for transporting the HAZMAT. There has been no such study integrating three levels of built forms in a single framework. Hence, this study will open new avenues for effective risk management during the off site transportation of HAZMAT through efficient policy initiatives.