

Development of Inflatable Systems for Infrastructure Protection: Resilient Tunnel Concept

J.F. Davalos, E.J. Barbero, J. Martinez, E.M. Sosa*, W. Huebsch, K. Means, L. Banta, G. Thompson and D. Martinelli

West Virginia University, College of Engineering and Mineral Resources
611C Engineering Sciences Building, PO Box 6103, Morgantown, WV 26506, USA

In the past three decades the use of inflatable structures for protection has become a common practice in the automobile industry where airbags have demonstrated to reduce the risk of severe injuries of drivers and passengers. Aerospace industry uses inflatable structures for protecting their unmanned explorers such as the landing system used for the Mars Pathfinder. However, the concept of inflatable structures has not been extensively used for protection of civil infrastructure where they have been used mostly for sealing small diameter sewage pipes. Most recently, tunnel safety has been of rising concern for transportation and government agencies. Fires, toxic fumes and gasses, and flooding threats have occurred in major transportation systems of highly populated cities around the world and these situations triggered the need of research on protection systems such as inflatable structures. But tunnel protection using an inflatable structure brings new challenges, due to the large scale of the problem and the complex geometry to which the inflatable has to conform. Founded by Department of Homeland Security, researchers at West Virginia University in a collaborative effort with rail-transit officials are developing the Resilient Tunnel Concept which involves an inflatable structure that is currently being designed using a gradual approach to the final solution. Numerical techniques, such as FEA and CFD, and experimental techniques at different scales are being used to simulate different scenarios of an inflatable system built with state-of-the-art materials and representing the geometric complexities of tunnel sections.

*Corresponding and presenting author:

E-mail: Eduardo.Sosa@mail.wvu.edu

Tel: 304-293-5742