

DYNAMIC RESPONSE OF TUNNEL UNDER BLAST LOADING AND BLAST MITIGATION USING LIGHTWEIGHT PROTECTIVE BARRIER

S. Phulari¹ and M. D. Goel^{2*}, Department of Applied Mechanics,
Visvesvaraya National Institute of Technology (VNIT) Nagpur, Maharashtra, India

In last decade, increased terrorist activities throughout the world lead to loss of life and major infrastructures. Tunnels are underground structures used for many purposes and their collapse will lead to complete chaotic situation for any nation. Hence, it becomes utmost importance to safeguard such structures under extreme loading conditions such as resulting from blast/explosion. In the past, limited research had been reported on underground tunnel subjected to blast loading as compared to other structures. Blast effect on underground tunnel causes severe effect on human life apart from property loss. To minimize this, it is crucial to understand the response of underground tunnel under blast loading. Herein, numerical investigation of underground tunnel is carried out using FE package ABAQUS/Explicit®. The soil, tunnel and air inside the tunnel is modelled using CEL (Coupled Eulerian and Lagrangian) volume fraction method as per ABAQUS/Explicit®. First of all, FE analysis is validated with the available experimental small scale results and then parametric investigation is carried out. Herein, tunnel structure is investigated under varying charge weight and standoff distances to understand its dynamic response. Further, metal sandwiched lightweight polymer syntactic foam is used as a protective barrier between blast waves and structure to mitigate the imparted blast energy. Based on this investigation, it is observed that tunnel structural damage is significantly reduced by employing lightweight polymer syntactic foam as protective barrier.