

Vulnerability Assessment of Rail Network in the Face of Terrorist Attacks using Geographic Information System

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In recent years, rail networks have become the target for terrorists and provide convenient opportunities to seriously affect lifestyle and economy of the region. London tube train bombing shows the necessity of understanding rail network vulnerability in the face of terrorist attacks. Understanding rail network vulnerability with reference to manmade attack can help to save life, improve protection, mitigation, and recovery strategies and improve the performance of rail network systems especially during emergency situations.

The investigation of rail network vulnerability involves the identification and analysis of the evaluation criteria responsible for vulnerability. The analysis of vulnerability needs to consider heterogeneous data that are in qualitative and quantitative form. Considering the heterogeneous data, a methodology is developed in this study to analyse the rail network vulnerability based on the analytical hierarchy process (AHP) with fuzzy logic method.

To analyse vulnerability, the developed methodology is implemented on the rail network of the Perth region, Western Australia. The geographic information system (GIS) is utilised for data capturing, building a network, incorporating network criteria, and determining vulnerability. Suitable vulnerability values are calculated using fuzzy membership function for each rail segments and stations based on the degree to which each criterion property indicates the vulnerability. These vulnerability values are combined using the AHP method to show the relative vulnerability of rail network components within the network.