UF Center for Infrastructure Protection and Physical Security (CIPPS)
UNIVERSITY of FLORIDA

NSF

ERDC
US Army Engineer Research and Development Center

INTELLIGENT EVACUATION, RESCUE AND RECOVERY

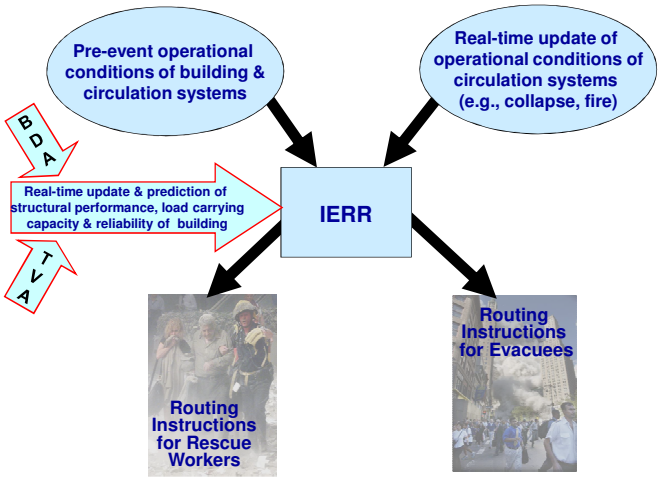
Damage assessment	Real-time assessment of extent of blast damage to building. Full-scale BDA & TVA tool.
Evacuation	Emergency preparedness planning and on-line dynamically updated instructions to evacuees.
Rescue	Dynamically updated instructions to rescue workers (paths to trapped evacuees & in seeking safe egress/refuge).
Recovery	Updated mitigation actions, optimal demolition/ construction actions, restoring functionality of building.

The IERR system will aid decision-making processes in emergency preparedness and post-attack ERR operations:

- **Will permit continuous assessment.**
- **Will provide dynamically updated instructions for on-line operations in response to evolving conditions.**

Functional System Description

Network representation is exploited in developing optimization techniques used to find best paths along which the evacuees and rescue workers are guided.



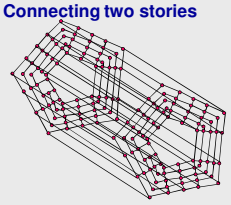
- **Communication between the system and the evacuees and rescue workers will be established by hand-held devices and changeable message signs,…**
- **On-line information will be provided to rescue workers to enable them to reach the areas where help is needed as quickly as possible.**

Network Representation

The building corridors are represented as a network of arcs whose attributes change over time

Simplified network representation of single story

Connecting two stories

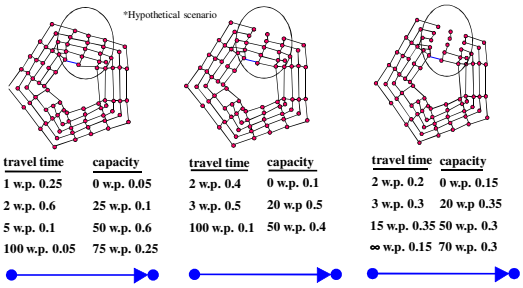


Pre-Attack

Post-Attack Stage 1

Post-Attack Stage 2

*Hypothetical scenario



travel time	capacity
1 w.p. 0.25	0 w.p. 0.05
2 w.p. 0.6	25 w.p. 0.1
5 w.p. 0.1	50 w.p. 0.6
100 w.p. 0.05	75 w.p. 0.25

travel time	capacity
2 w.p. 0.4	0 w.p. 0.1
3 w.p. 0.5	20 w.p 0.5
100 w.p. 0.1	50 w.p. 0.4

travel time	capacity
2 w.p. 0.2	0 w.p. 0.15
3 w.p. 0.3	20 w.p 0.35
15 w.p. 0.35	50 w.p. 0.3
∞ w.p. 0.15	70 w.p. 0.3

Arc attributes are uncertain and vary at each point in time

Arc capacities may decrease over time (as fire spreads…), traversal times may increase as conditions worsen.

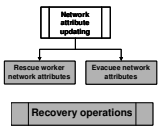
System Benefits

- **Enables processes with reduced labor intensity, increased consistency, increased speed of response.**
- **Enables effective and objective exchange of information and rapid planning and execution.**
- **Meets complicated variable emergency conditions with lower resource requirements.**
- **Permits recovery efforts to begin quickly.**
- **Explicitly considers inherent stochastic and dynamic nature of future conditions.**
- **Employs information on current and near-term performance of building and its circulation systems.**

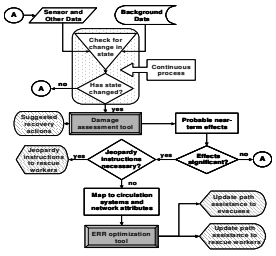
Enables robust and rapid decision-making.

Robust evacuation plans that are quickly updated in response to evolving conditions aid in avoiding potentially unnecessary imposed risk and unnecessary lost lives

System Overview



Enables prediction of future arc traversal time & capacity likelihoods.



Provide On-line Routing Instructions to Evacuees