

Transportation and the Social Resilience of a Community

William Al Wallace

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Rensselaer Polytechnic Institute



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Objective



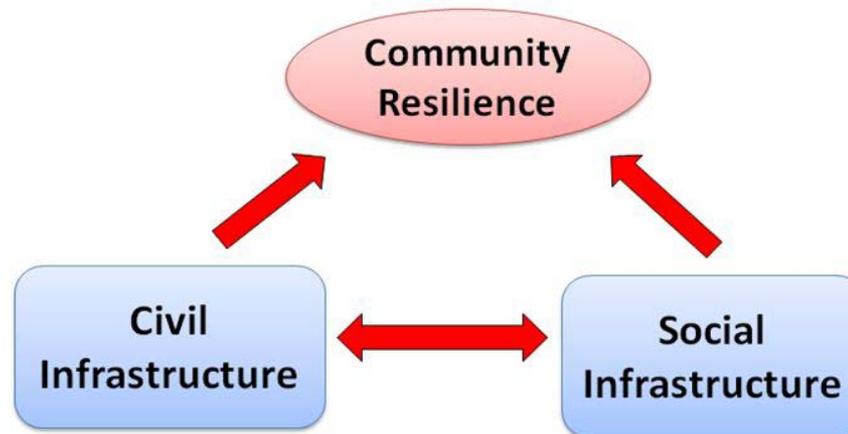
3 million Americans evacuate during Hurricane Rita in 2005



Restoration efforts after tropical storm Hanna in 2008

Community Resilience

- Defined as the ability of a community to withstand and recover from external shocks to their social infrastructure as well as their civil infrastructures.



Social Infrastructures

- Any infrastructure where the service is provided by the people for the people and is supported by physical facilities.



Overview shot of Baton Rouge River Center shelter after Hurricane Katrina

Examples of Social Infrastructures

- Agriculture and Food, Banking and Finance, Commercial Facilities, Manufacturing, Emergency Services, Healthcare and Public Health



NYSE floor- Banking & Finance



Agriculture Farm

Civil Infrastructures

- Any infrastructure in which physical structures and facilities provide the service but are managed by social organizations



Examples of Civil Infrastructures

- Transportation, Power, Water, Wastewater, Telecommunications



Wastewater Treatment plant



Communications satellite



Transmission line towers

Hurricanes have catastrophic impacts on both civil and social infrastructures



Social Infrastructures



Civil Infrastructures

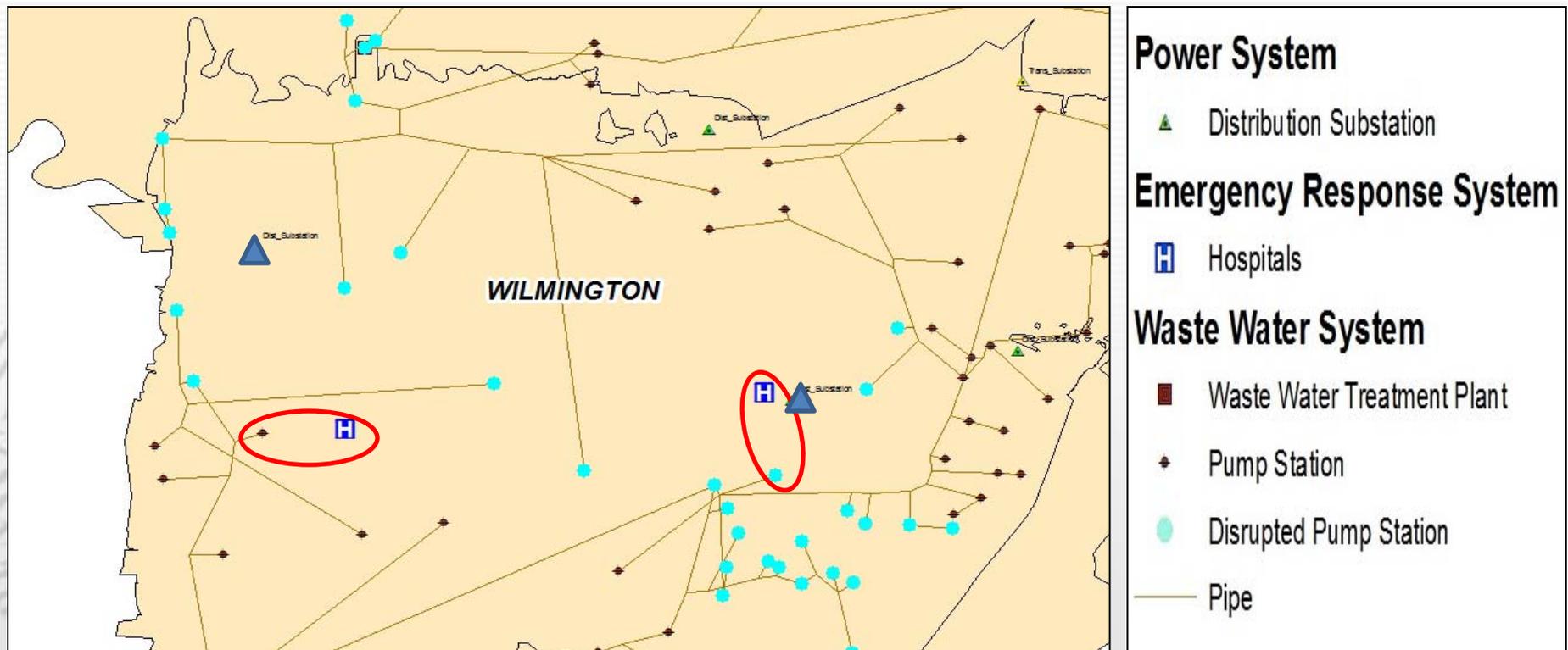


Response and Recovery

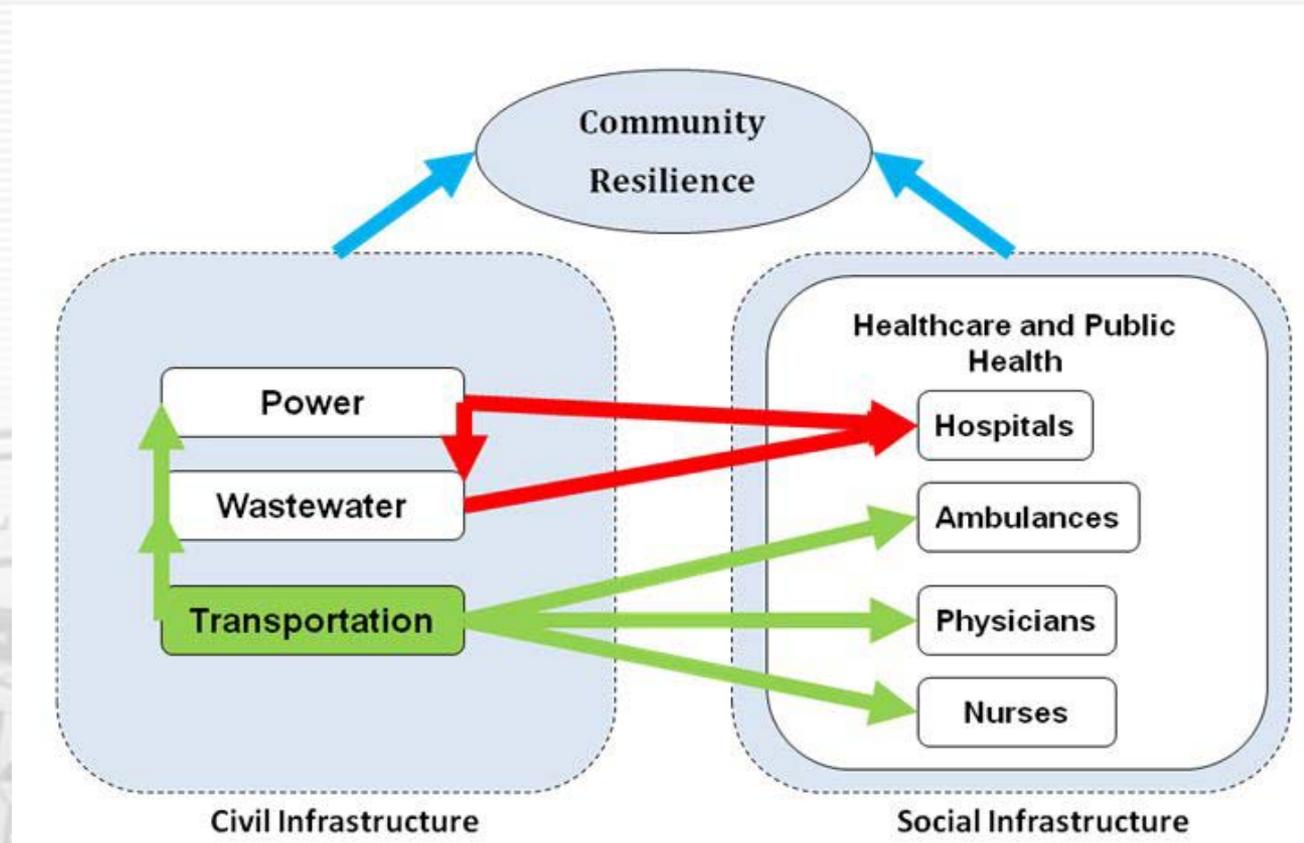


Dependencies & Interdependencies

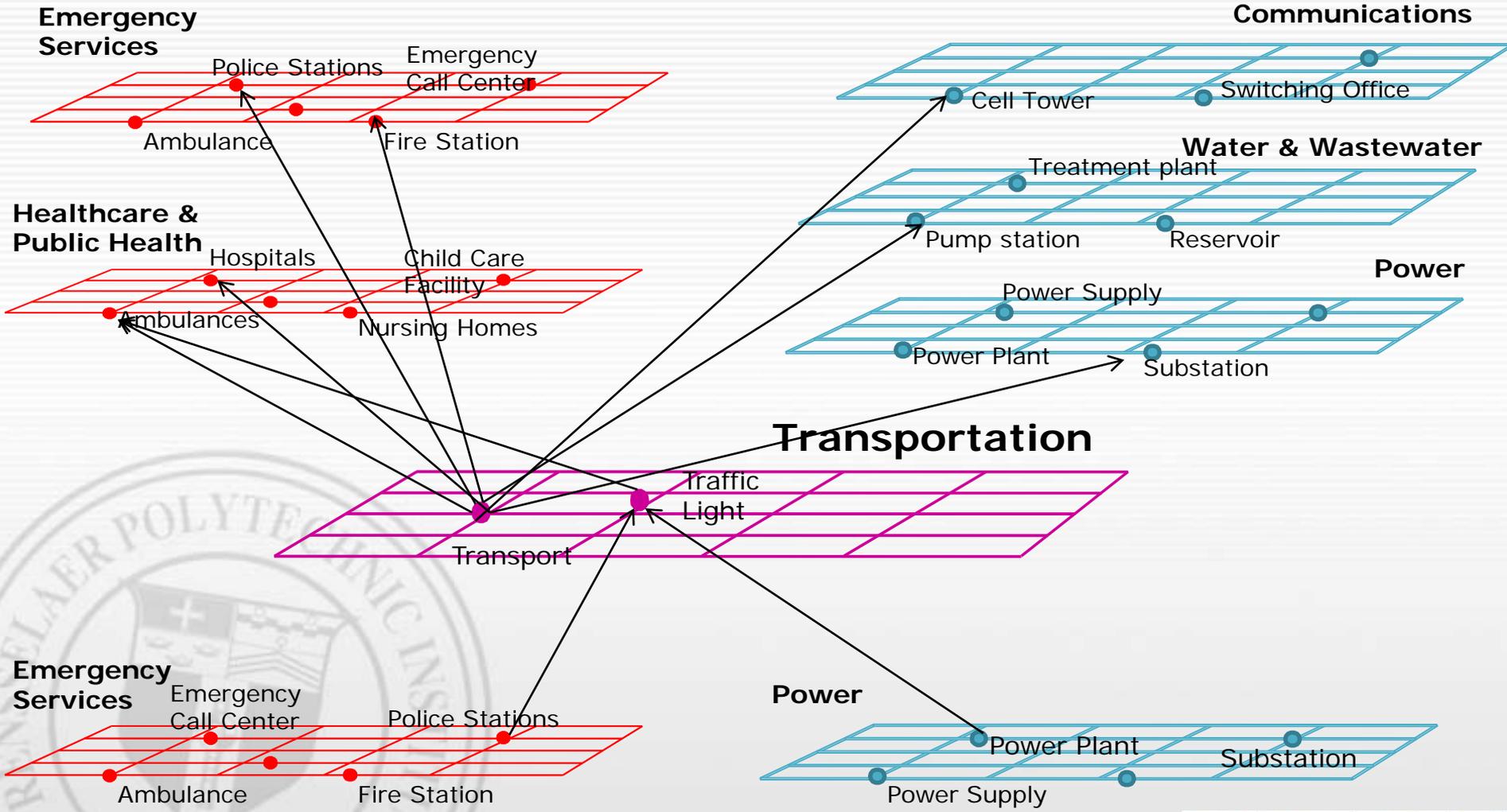
- Dependency: Social \longleftrightarrow Civil
- Interdependency: Civil \longrightarrow Civil, Social \longrightarrow Social



Transportation relationships



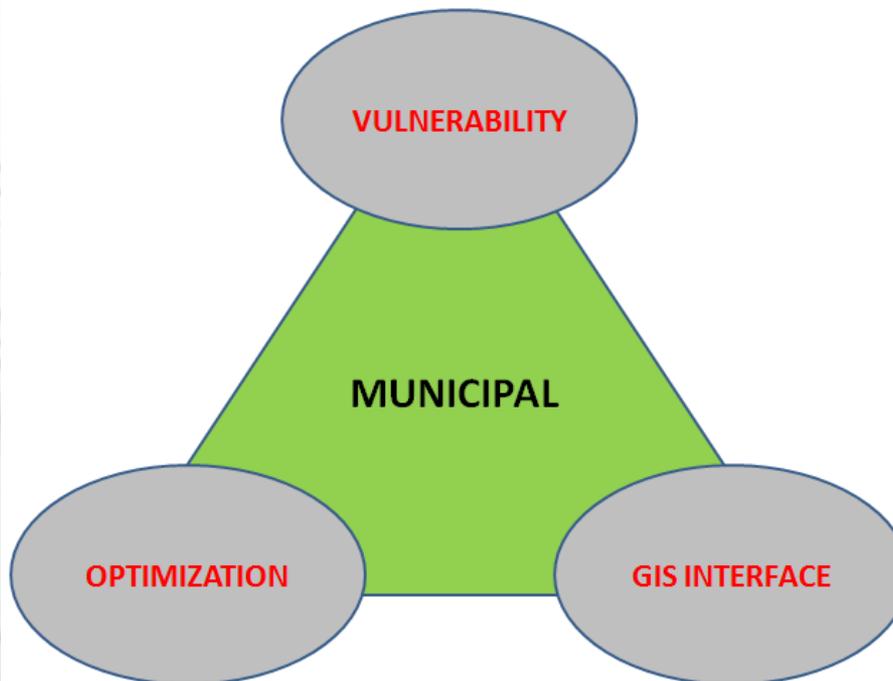
Transportation relationships Rensselaer



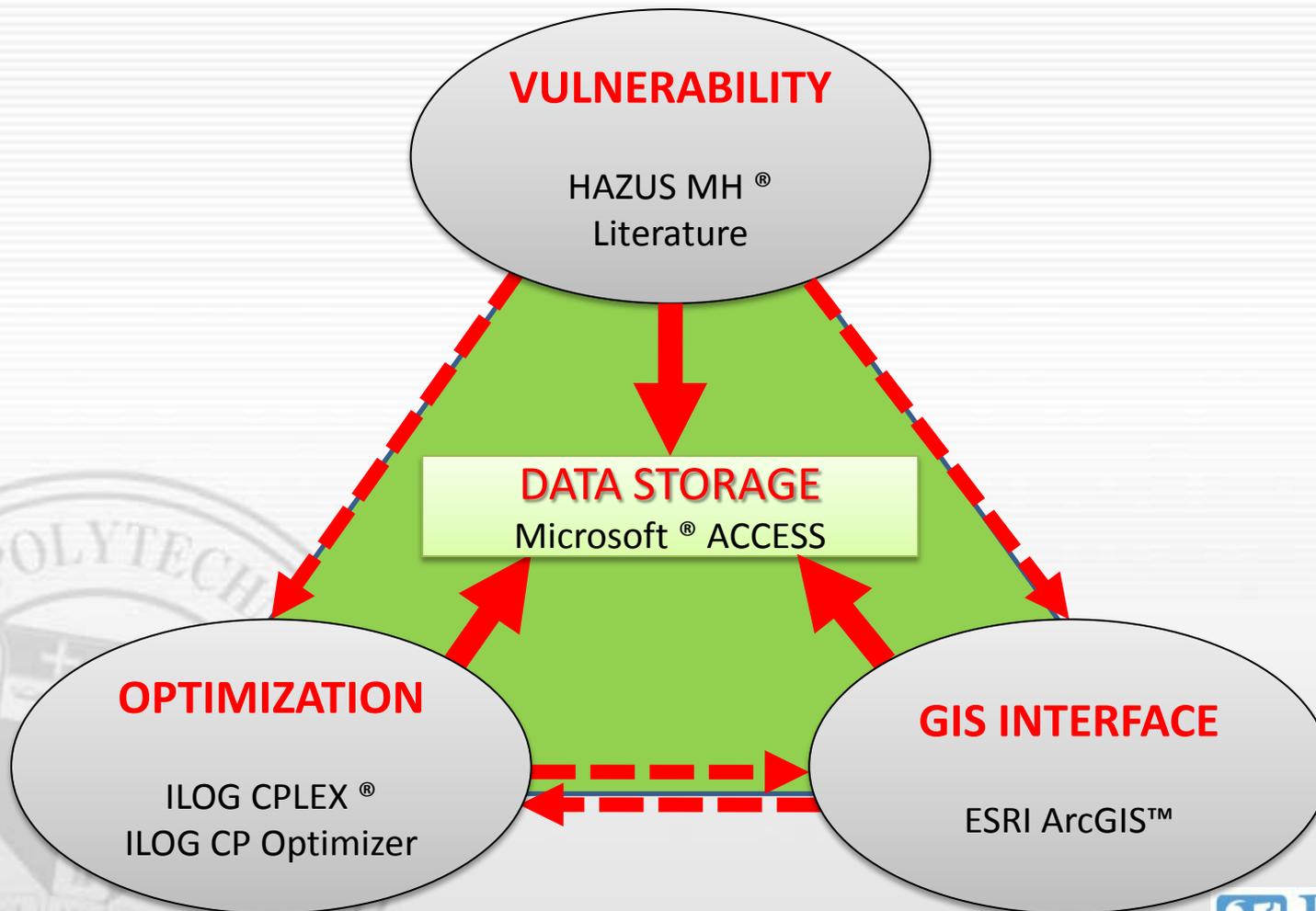
MUNICIPAL:

Multi-Network Civil Infrastructure Program for the Analysis of Lifelines

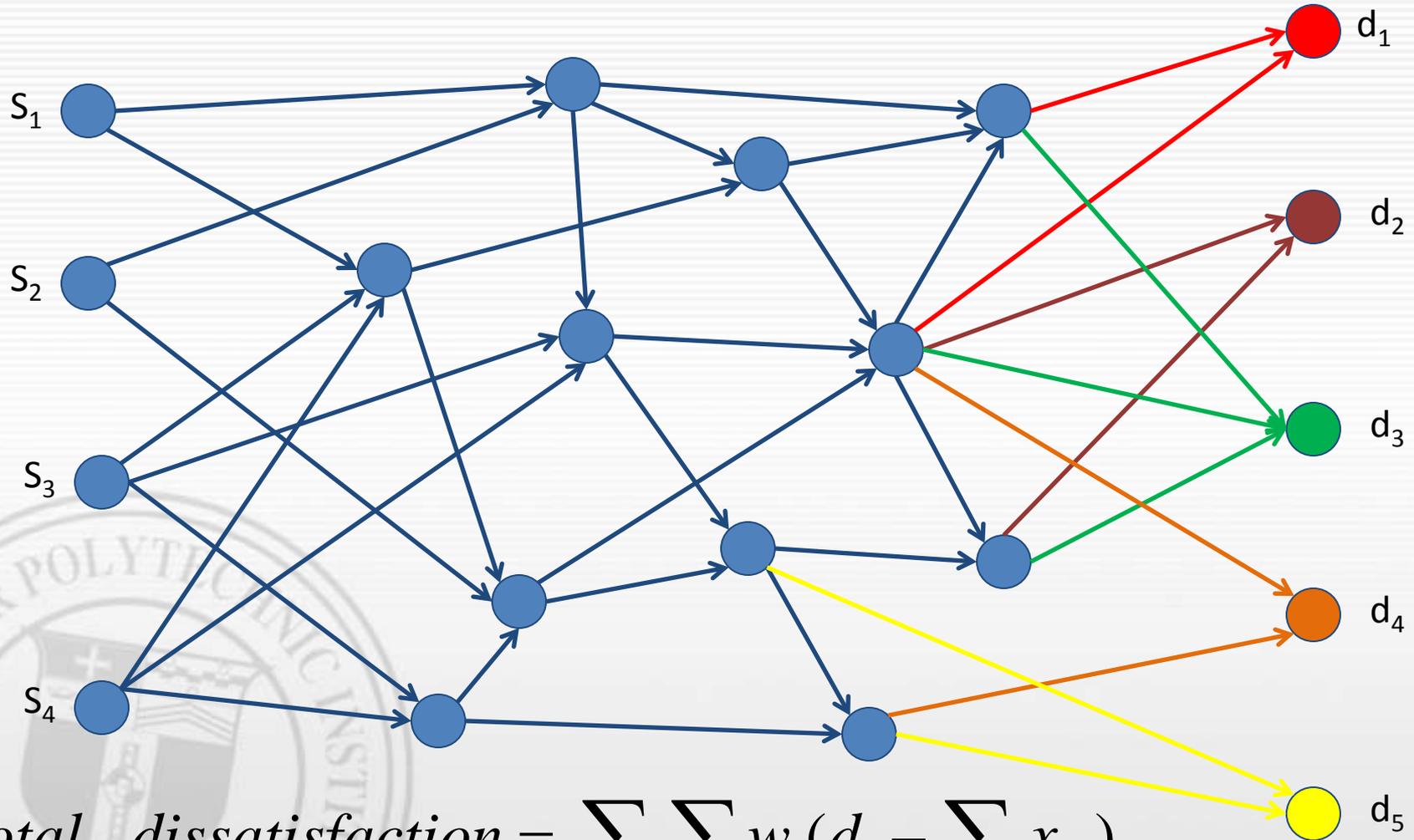
- A decision support tool currently being developed. It has 3 main components: the vulnerability module, the optimization module and the GIS Interface.



Description on MUNICIPAL components



Computing the effect of resilience



$$\text{Total dissatisfaction} = \sum_{t \in 1..T} \sum_{i \in D} w_i (d_i - \sum_{j \in A^i} x_{jt})$$

End Users

- Managers of federal, state and local emergency management departments
- Managers of critical infrastructures



NHC Emergency Management
Department during a county drill.

Conclusion

- Community resilience incorporates both social and civil infrastructures.
- Dependencies exist between infrastructures and interdependencies exist within social and civil infrastructures.

The **transportation network** is key for the restoration of services

Challenges

- How do we optimize the restoration of *civil* infrastructures to minimize the disruptions in *social* infrastructure?
- How do we optimize the restoration of *social* infrastructures to minimize the disruptions in *civil* infrastructure?

For a resilient community, disruptions to social and civil infrastructures *must be mitigated* and services *must be restored*.

Project Participants

- Faculty
 - William A. Wallace (**email:** wallow@rpi.edu)
 - Thomas C. Sharkey
 - John E. Mitchell
 - David Rosowsky
- Students
 - Burak Cavdaroglu
 - Erik Hammel
 - Sehrish Khan
 - Ryan Loggins
 - Sarah Nurre