Using an Agent-Based Model Approach to Power Outage Restoration

Tara Walsh PhD Candidate Department of Civil and Environmental Engineering



Eversource Energy Center



Project Development

- Increasing storm severity leading to more widespread damage during storms.
- Restoration based on emergency managers' experience.
- Limited models exist for storm restoration.



Utility crew working after Hurricane Sandy.



Percentage of Connecticut Light and Power (now Eversource) customers without power after Hurricane Irene.

How can we accurately simulate the decisions emergency managers make during storm restoration?

Agent Based Models



Agent based models are most commonly used for complex systems.



The goal of an ABM is to find emergent behavior.



Only simple rules are assigned to agents.









How does it work?





Results

More Important	Less Important
Number of outages	Travel speed
Individual repair times	Start location
Number of crews	Outage location

The search strategy has shown inconclusive results.

There are differences between strategies, but it varies from storm to storm.



Small Storm



Time to Arrival, days



Time to Arrival, days



Time to Arrival, days

01

Restoration does not strictly follow one strategy.

02

Restoration is controlled more on a smaller scale.

03

The model does not include power flow considerations.

Model Limitations

01

Increase the granularity of the model down to area work centers.

02

Develop a web-based decision support tool for emergency managers.

Ongoing Work

Thank you!

tara.walsh@uconn.edu

Walsh, T., Layton, T., Wanik, D., Mellor, J., 2018. Agent Based Model to Estimate Time to Restoration of Storm-Induced Power Outages. Infrastructures 3, 33.https://doi.org/10.3390/infrastructures3030033.















Time, hours











Max Repair	Time, hours
	1
	2
	3
	4
-	5
	6
	7
	8
	9
	10
	11
	12
_	13
_	14
	15
	Actual

Storm 5



Large Storm





Extreme Storm





Time, hours



Large Storm







Time, hours

Extreme Storm





Time, hours



Nearest within Radius



Most Customers Affected





Time, hours

Small Storm

Large Storm



Extreme Storm



150 Added crews



Time to arrival, days

2 days to arrival

