Work Unit 4.1: Projection of evacuation zones under climate change

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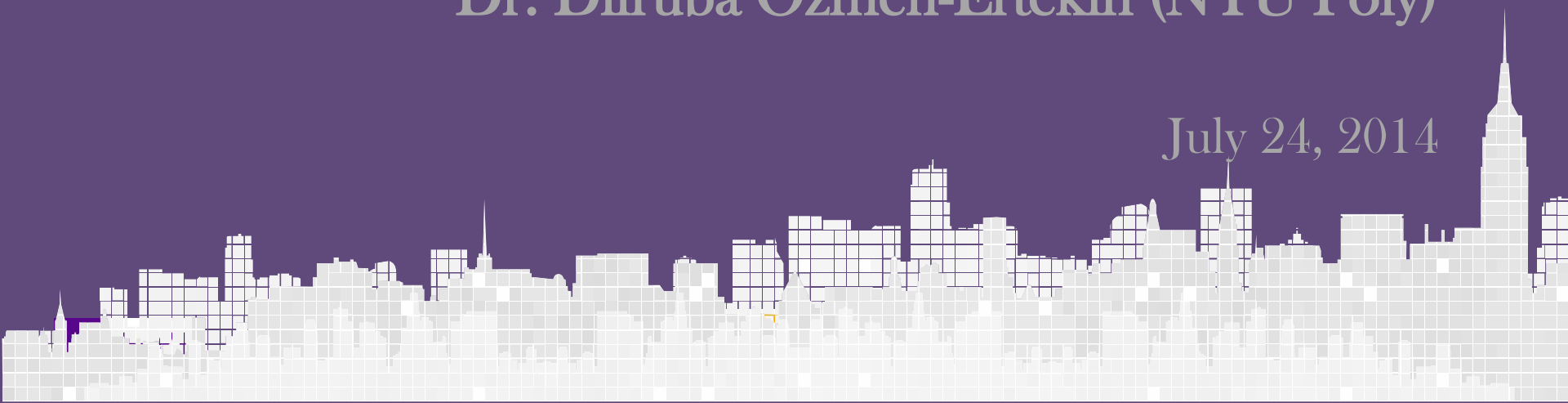
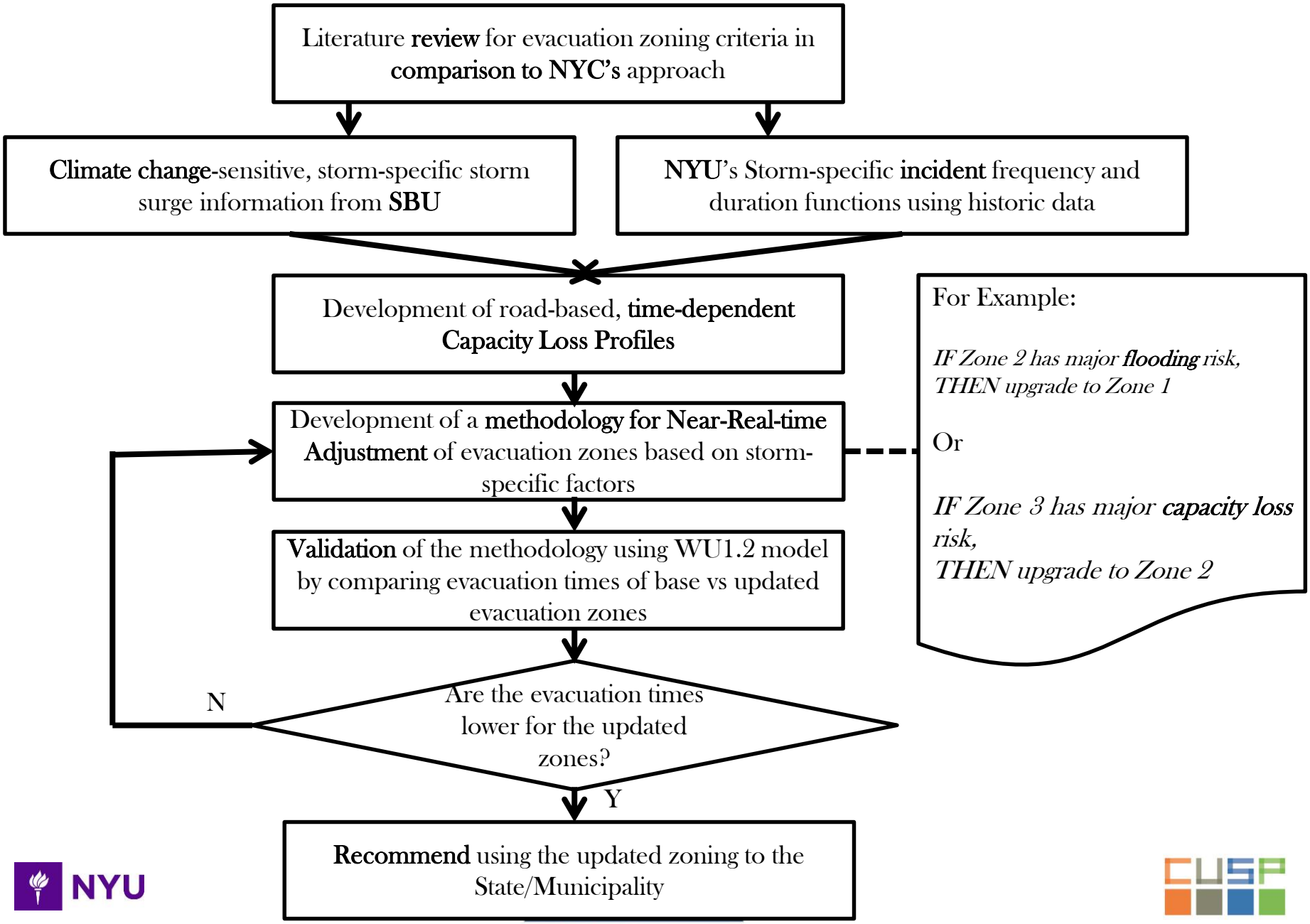


General Methodology for the Work Unit



Evacuation Zoning in the Literature vs. Our Methodology

-We emphasize the idea of figuring out how long the roads will maintain their full capacity and safely and efficiently evacuating people under full capacity (by developing **capacity profiles**), rather than solely calculating how long it will take to evacuate a certain percentage of the population (by developing **response curves**). Studies such as ***Schnebele et al. (2013)*** assessed road damage after Sandy in NYC but not in combination with evacuation simulation models. Some studies such as ***Fonseca et al. (2013)***, ***Edara et al. (2010)***, ***Robinson et al. (2008)*** investigated impacts of incidents on evacuation time based on simulation of incident occurrence.

-We adjust our macroscopic evacuation simulation model parameters to account for storm-related incidents due to not only storm surge but also **climate change**, and then use our model results to make recommendations for future updates to the evacuation zones and evacuation process In the literature, SLOSH maps are used as the basis of determining the evacuation zones.

-We utilize **actual incident records** to evaluate existing zoning as well as to plan for the future storms and efficiently manage the emergency evacuation process.

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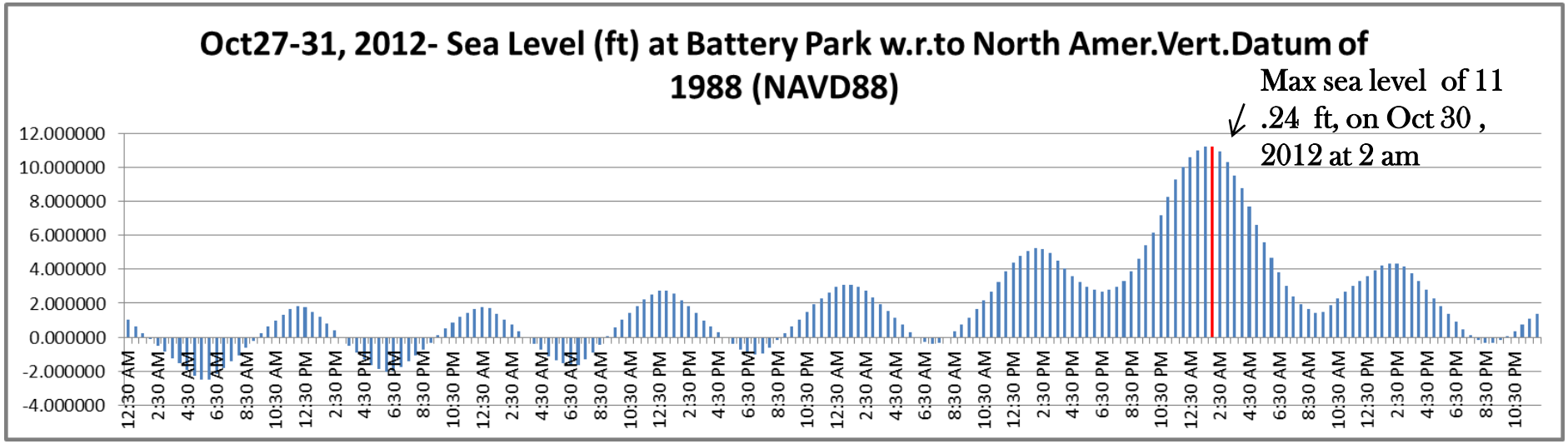
Main Collaboration with SBU

- Get storm specific, time-dependent sea level data (**=water level + tide + storm surge +climate change effects**)
- Below is an example of SBU data (**predicted** from a surge model, driven by a tidal model and a best-prediction hindcast of the winds and air pressure for the storm, Sandy in this case):



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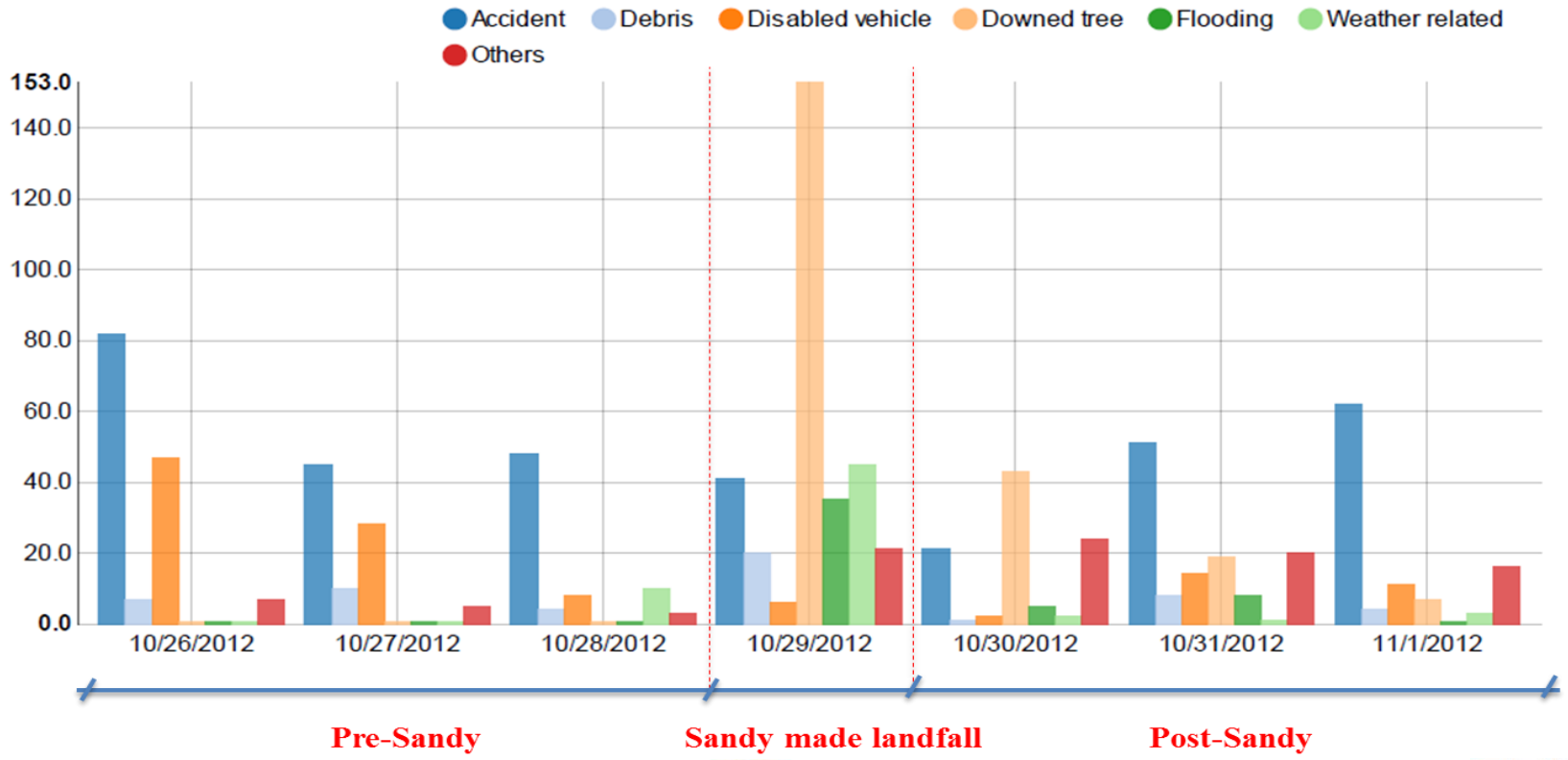
How to Utilize SBU Database

- Compare this **time-dependent** data with NWS's SLOSH maps which are the basis for the current evacuation zones
- Combine this data with actual incident data collected by TRANSCOM for Sandy (shown below):



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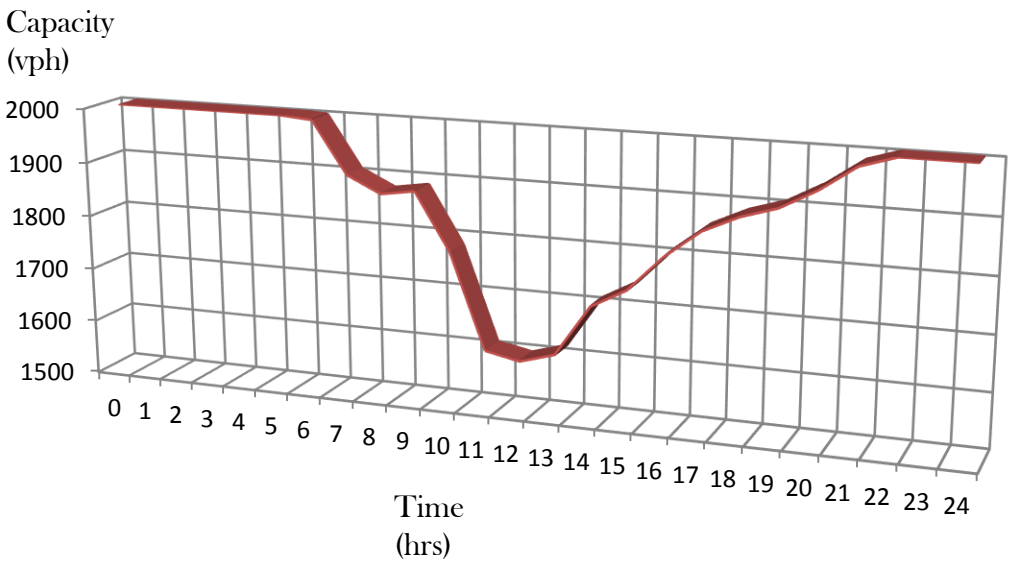
How to Utilize SBU Database (2)

- Using the combination of SBU data with actual incident database from TRANSCOM => Prepare **Capacity Profiles** for major links in the transportation system
- Below is a hypothetical example of a Capacity Profile for a certain road for certain storm and risk factors for a certain geographic region (e.g. LA vs NY=> an evacuation notice of 50 hours, staged as 50,40,30 hrs, vs 24 hours):



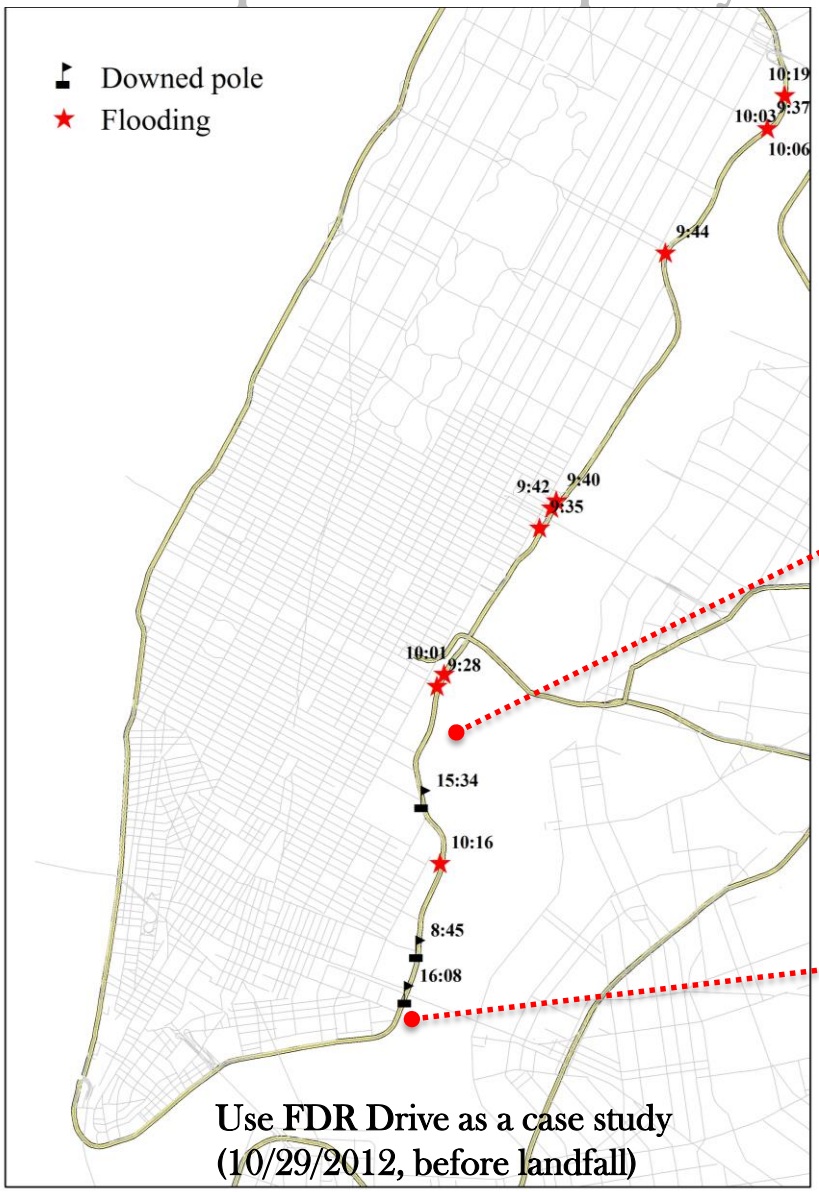
We need to note:

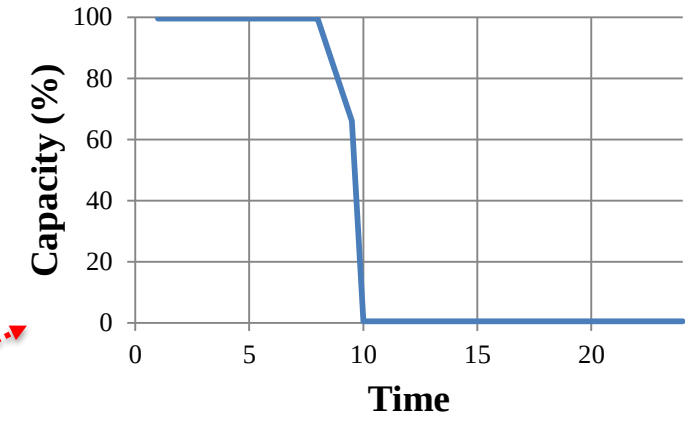
-when does capacity loss start?

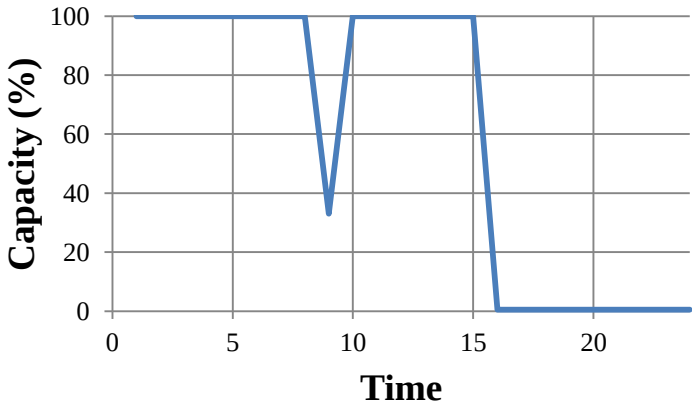
-when does the hurricane make a landfall?

-when does capacity recovery start?

Time-Dependent Capacity Profiles (More Realistic Example)







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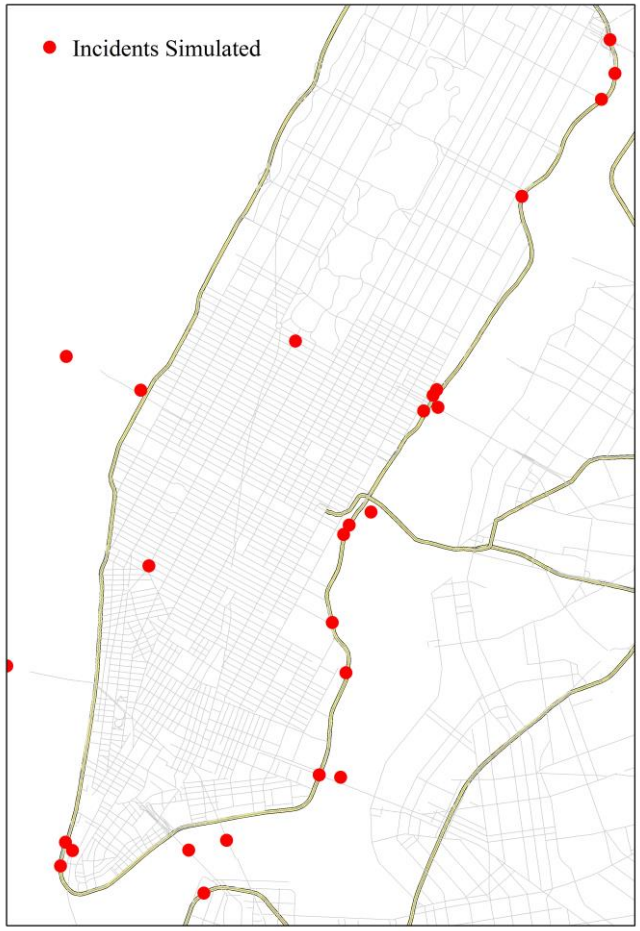
Future Work: How to Utilize Developed Storm Dependent Capacity Profiles

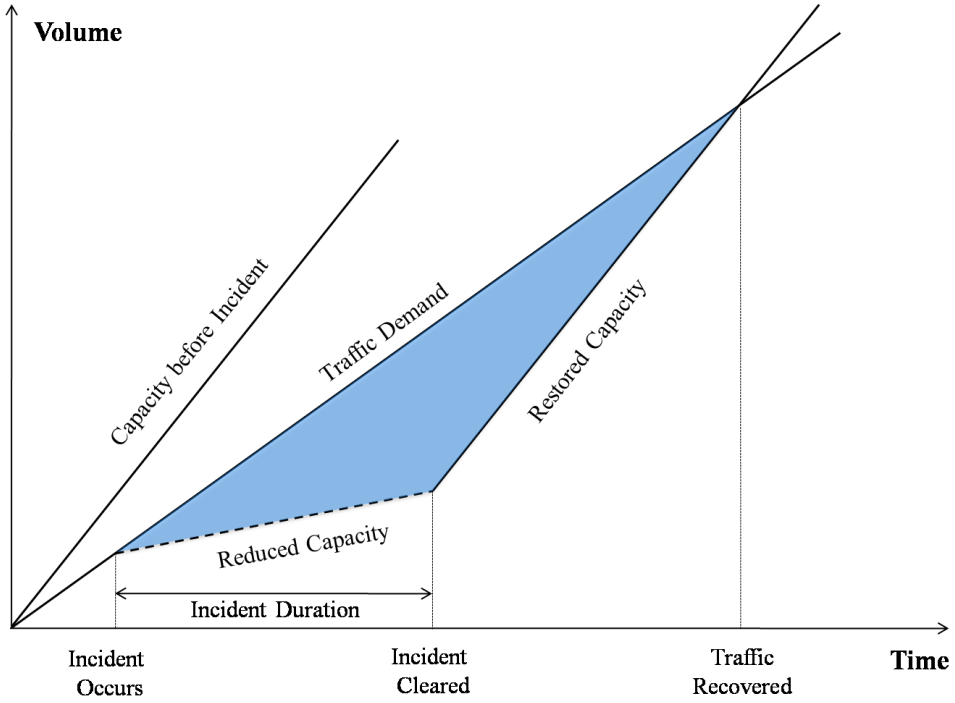
- Determination of **non-viable links** and adjusting evacuation model parameters accordingly in WU1.2
- Comparison of the effectiveness of the storm specific zone determination methodology based on the evacuation times estimated using the "proposed methodology in WU1.2"
- Determination of the **most vulnerable evacuation zones** in terms of the functionality of the transportation system
- **Phasing** of evacuation warnings (based on the knowledge of how long the full capacity will be maintained on major roads in critical areas) for future storm **Emergency Planning** efforts
- **Based on the storm-specific information from SBU, Near Real-Time Adjustment of Evacuation Zones** as shown in the General Methodology flowchart on Slide#2

How to Utilize Incident Models for Developing Capacity Profiles (A Realistic Example)



Step 1: Generate incidents in evacuation routes from incident frequency models

Step 2: Generate duration for each incident using incident duration models



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Thank You!