Use of data to improve the efficiency of Disaster response & recovery plan carried out by city agencies

Identifying the Sensitive infrastructure by the use of data methods and prioritizing the rescue operations by improving interactions between city agencies

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***Abstract* – The disaster response and recovery planning in the past has been based on experiential learning and post analysis of the effect of disaster. With data being recorded and organized in every City agency, the use of data for disaster recovery and mitigation plan would be an ideal way to forecast and organize rescue activities. The main operational challenge lies behind in organizing the data from different city agencies and interfacing them to a common platform. This would not only improve the response time but will also reduce the resources to tackle disasters and the economic loss of infrastructure. To achieve this, it is necessary to identify and classify the infrastructure based on their sensitivity to the disaster and plan the mitigation strategies accordingly.**

Keywords—Response & Recovery Plan. Interfacing City agency data, Mitigation Strategies, Resource Optimization

I. Introduction

The Brooklyn Queens Tornado was a fatal tornado that struck New York City on the 16th of September 2010. [1] It hit the boroughs of Brooklyn and Queens at speeds over 100mph causing severe damage to the infrastructure and surroundings in the region. There were over a thousand trees uprooted and one fatality reported. This was not the first tornado of the year as there was already a tornado that struck the city on the 25th of July 2010, less than two months ago from the Brooklyn Queens Tornado.

The tornado touched down at two location, Park Slope at Brooklyn at 3:33 p.m. and Flushing Meadows Corona Park at the Flushing region in Queens at approximately within the next 10 minutes. The winds hurled sand and debris in the air, downed multiple trees and power lines, moved cars and damaged property.

The Subway Lines L, M and 7, Long Island Railroad & Amtrak train services were temporarily suspended in the region. The Tornado was classified as an EF1 tornado in the Queens region and EF0 in the Brooklyn Region. This means that the wind blew at speeds as high as 110 mph. [2]

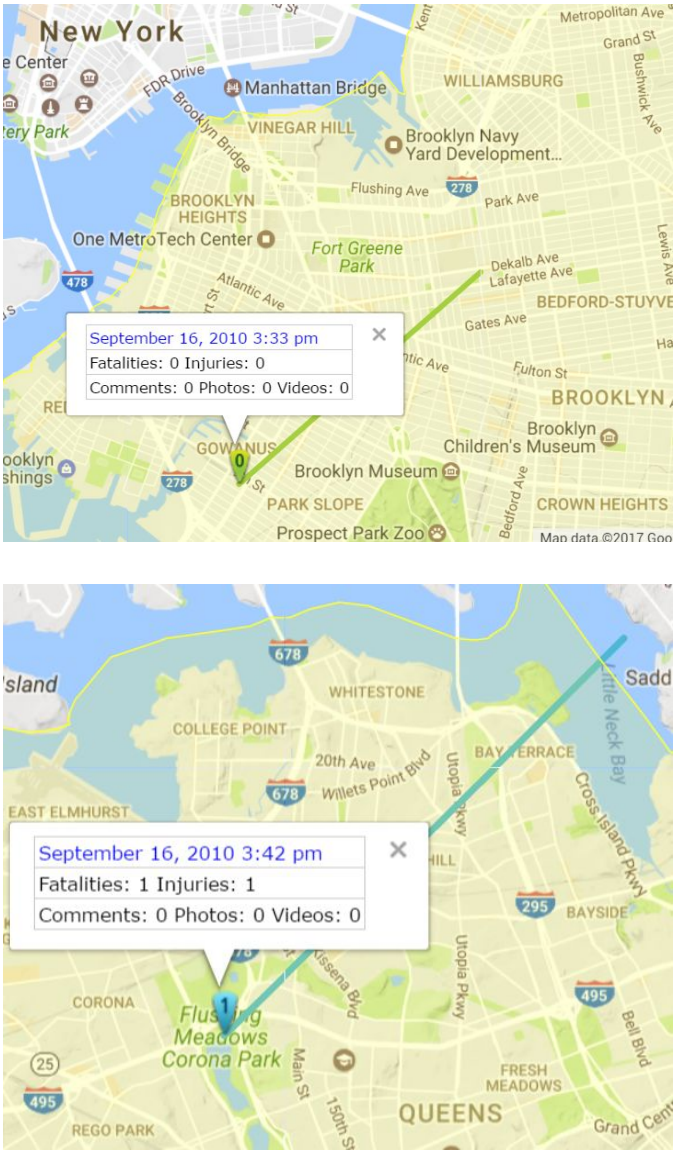

Figure 1 The path of Tornado in Brooklyn and Queens[3]

In Park slope alone there was a significant tree damage estimated at over $8.5 million. There were also several residential houses that lost the rooftops and were severely damaged. In Queens there was an estimated damage of $17.2 Million. The recovery for this disaster was funded by the federal government (DR-1943) for $17.9 Million including $11.3 Million for public assistance and $6.6 Million for Permanent recovery. [4]

II. Literature review

A tornado is a brutally pivoting section of air, pendant from a cumuliform cloud or underneath a cumuliform cloud, and frequently noticeable as a channel cloud. Tornadoes are nature's most rough tempests. They originate from Thunderstorms. They show up as a pipe or cone-formed cloud with winds that can reach up to 300 miles for each hour. They cause harm when they touch down on the ground. They can harm a region one mile wide and 50 miles in length.

Tornadoes begin with a thunderstorm but not just any thunderstorm. These are especially powerful, towering thunderstorms called supercells. Reaching up to over 50,000 feet, they bring high force winds, giant hailstones, sometimes flooding and great flashes of lightning, too. These are the kinds of storms that breed tornadoes, but only if there are also very specific conditions in place, clues that we can measure and look out for when we're trying to forecast a storm. Rising air is the first ingredient needed for a tornado to develop. Any storm is formed when condensation occurs, the byproducts of the clouds. Condensation releases heat, and heat becomes the energy that drives huge upward drafts of air. The more condensation and the bigger the storm clouds grow, the more powerful those updrafts become. In supercells, this rising air mass is particularly strong.[5]

As the air climbs, it can change direction and start to move more quickly. Finally, at the storm's base, if there is a lot of moisture, a huge cloud base develops, giving the tornado something to feed off later, if it gets that far. When all these things are in place, a vortex can develop enclosed by the storm, and forming a wide, tall tube of spinning air that then gets pulled upwards and this is called a mesocyclone.

Outside, cool, dry, sinking air starts to wrap around the back of this mesocyclone, forming what's known as a rear flank downdraft. This unusual scenario creates a stark temperature difference between the air inside the mesocyclone, and the air outside, building up a level of instability that allows a tornado to thrive. Then, the mesocyclone lower part becomes tighter, increasing the speed of the wind. If, and that's a big if, this funnel of air moves down into that large, moist cloud base at the bottom of the parent storm, it sucks it in and turns it into a rotating wall of cloud, forming a link between the storm that created it and the Earth. The second that tube of spinning cloud touches the ground, it becomes a tornado. Most are small and short-lived, producing winds of 65-110 miles per hour, but others can last for over an hour, producing 200 miles per hour winds.[6]

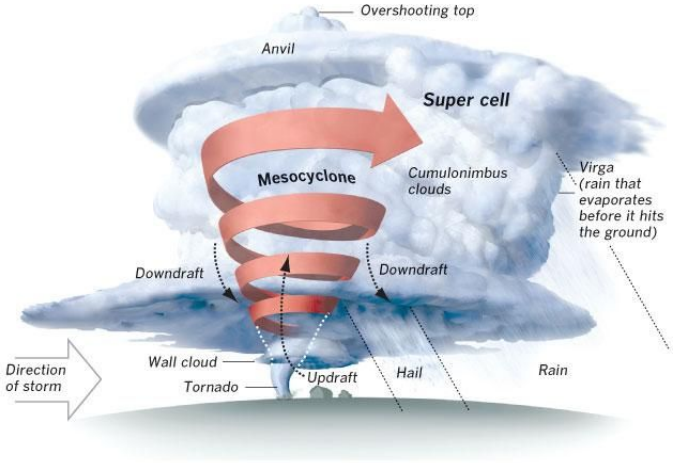

Figure 2 Formation of Tornado

Classification of tornado is a challenging task as the measurements device needs to be highly durable and reliable to be not torn apart during a tornado. Anemometer is used to measure the wind speed of a tornado. The speed is measured using cups that spin around vertical axis due to wind. Anemometer is a relatively fragile device and hence remote methods such as Doppler radar are utilized.[7] Tornadoes are classified using Fujita scale developed in 1971 by Dr.Theodore Fujita. This method categorizes tornadoes on the basis of the damage caused by them and then the wind speed is estimated based on the damage. [8]

Classification of tornadoes is done based on the Fujita Scale that ranges to five categories, F-0 through F-5. F-0 being the lowest and the F-5 tornadoes being the most riskiest and are the most dangerous (and the rarest).

- F-0: 40-72 mph, Light damage, chimney damage, tree branches broken
- F-1: 73-112 mph, Moderate damage, mobile homes pushed off foundation or flipped over
- F-2: 113-157 mph, Considerable damage, mobile homes demolished, trees uprooted
- F-3: 158-205 mph, Severe damage, roofs and walls torn down, trains overturned, cars thrown around
- F-4: 207-260 mph, Devastating damage, well-constructed walls leveled
- F-5: 261-318 mph, Violent damage, homes lifted off foundation and carried considerable distances, autos thrown as far as 100 meters.

However in 2007 the Fajita scale was revised by meteorological engineers and to form Effective Fajita Scale that is in use currently.[9]

OPERATIONAL EF SCALE	
EF Number	3 Second Gust (mph)
0	65-85
1	86-110
2	111-135
3	136-165
4	166-200
5	Over 200

Figure 3 EF Scale used for Classification of Tornadoes[10]

New-York has a wide history of Tornadoes. There were no tornadoes from 1950-1974. Post this there has been quite frequent touch downs of tornadoes. The New York state homeland security and emergency services issues warning for tornado watch. The National Oceanic and Atmospheric Administration of the United States updates the state of tornado and the potential affected areas of the tornado.

Data is collected from all the tornadoes that occur in the region and then prognostication tools such as numerical cloud modeling and theoretical analysis are used to study and analyze the tornado. Based on this the recovery activities are carried out for tornadoes.

Role of the agencies of the Government in Tornado Response:

It is highly essential for all the city departments of the city to work together and to coordinate the response and recovery activities during and post tornadoes. It is the responsibility of the Mayor of the city to designate suitable responsibilities to the departments and to preside over the recovery measures. The agencies need to be aware of the sequence of activities they need to carry out and the responsibilities imbibed in them. To assign the responsibility to a city agency it is primarily necessary to understand the expertise they provide and the resources they possess.

Identification of sensitive infrastructure is very critical to reduce the impact of the disaster. This would not only enable the city administration to send rescue forces and maintenance workers to the location where there is a high likelihood of impact but also help to reduce the damage of the impact. The interaction between city departments is very much essential to identify the sensitive infrastructure and prioritize the sequence of activities to be carried out. The following city agencies would play bear the responsibilities and play a major role in rescue operations of a disaster.

Department of Buildings

The New york city DOB has a very primary role in the identification of critical infrastructures in the city. The department of buildings controls and regulates all the construction work carried out in the city.[11] DOB maintains the databases of the list of buildings in the city and we would be able classify the infrastructure based on the following parameters:

Age of the Building: Higher the age of the building higher the sensitivity of the infrastructure.

Location: If the building is located on a low lying area or an elevated area, the effect of the tornado on the infrastructure varies. The sensitivity of the infrastructure would be higher for elevated areas for a tornado however if there is a flooding as an effect of thunderstorm then the low lying areas would be higher sensitive areas.

No. of Floors: The taller the building the higher it is prone to damage of the tornado. It is susceptible to higher damage as the number of floor increase in the building.

No. of Exits: This information available with the DOB might be helpful in planning the rescue operations in a sensitive infrastructure. If the number of exits/fire exits are lesser in the building then the building becomes a high sensitive building attributing to the increasing rescue timings.

Similarly a few other information such as the type of roof, construction type, shutters availability would also play an important role in identification of critical infrastructure. DOB also has the list of buildings that are under construction which might be highly sensitive to tornadoes.

Department of City Planning

Similar to the DOB, DCP has the information of the projects that are completed and are ongoing in the city. [12] However the information that the DCP has is related to the infrastructure investment carried out by the city government.So the LAnd use information and zoning information from DCP would be very helpful in identifying the critical infrastructure. Since the DCP is the agency responsible for providing advice to the government agencies and the public by providing policy analysis, technical assistance and data on housing, zoning, urban design, community facilities, transportation, demography, waterfront/public/open space data to inform strategic and capital planning decisions their input on identifying sensitive information would be very valuable. DCP also maintains an data related to land use, housing and population data, as well

as other planning resources.

Department of Environmental Protection

Department of environmental pollution has the expertise and data pertaining to all the environmental resources handled by the city. They manage the drinking water, stormwater, wastewater, pollution control and building demolitions in the city.[13] The water treatment plants are very sensitive infrastructure as any damage or contamination to drinking water or wastewater treatment plants could cause a major havoc. Also they keep track of building demolitions and constructions activities to keep track of the pollution they cause and the threat they posses to the neighbourhood.

Fire Department of New York

Rescuing the trapped victims is one of the primary tasks to be undertaken immediately during a tornado. Due to severe damage caused due to the tornado there might be several households that would have collapsed, several trees uprooted and vehicles stranded. [14] Hence it is the primary duty of FDNY to rush to the location for rescue services. FDNY is one of the most important teams to react at the very beginning of a Tornado. Fires may also arise across the city due to shorting of power lines and mishap caused due to the tornado. It is the fire department that would take the lead to organize the command operations.

After the identification of sensitive infrastructure the FDNY has specialised equipments such as brush trucks and command vehicles, which are often equipped with four-wheel drive that helps the Firefighters to quickly areas inaccessible to larger apparatus and other two-wheel-drive vehicles. The fire department also possesses the tools necessary for victim extraction, such as chainsaws and prying tools, as well as other tools, such as wrenches, which will be needed to shut off gas meters. [15]

New York Police Department

New York Police Department are the first transponders for any disaster and are among the first of the city department to arrive at the location. They play a multifunctional role in these types of disasters. One of the most important role they do is to take up the perimeter control. Whenever there is a disaster then there is immediate movement of large crowds of people. This may lead to a huge commotion in the boundaries of the city causing heavy traffic which may cause further accidents to take place. It is the responsibility of the NYPD to control the people and to regulate the flow of crowd in an area without any havoc. They also play a very major role in spreading awareness about the disaster and educate on preparedness of the disaster.

The NYPD also has track of 911 calls coming in from which they identify the area that is most affected and they help identify the infrastructure that is put into the most stress.[16] They are the city agency who is responsible for the overall security for the city and they have a very important role to play in disaster response and recovery plan.

NYC Department of Health

Department of Health is responsible for immediate medical assistance to be provided to the affected people. They not only need to tackle physical health issue but also need to address mental issues of people who loss their family members, property etc. They have to manage the resources available to them to the maximum possible way and involve in full fledge operation of ambulances and rescue services. They also need to ensure that the hospital beds in the nearby areas where there is maximum damage should be made available for immediate response to patients. The data and expertise available at DOH would help locate the nearest health facility and also help in identifying whether the required resource is available in the location to treat the patient. This could be the availability of beds, doctors, equipments, ambulances etc.

Department of Homeless Services

Department of Homeless Services has the data pertaining to the percentage of people homeless in a given region in the New york city. They are the most vulnerable crowd who do not have shelter to protect themselves. So they would mostly shift to the public places such as the railway stations or other covered places that become sensitive infrastructure to manage. Hence the DHS would be helpful in locating such critical infrastructure and moving out people who would be vulnerable to a tornado.

New York City Department of Parks & Recreation

The major after effect of a tornado is uplifting of trees. In the Brooklyn Queens tornado alone around 2,50,000 trees were in the region of tornado that had high likelihood to be uplifted.[17] When there are more number of trees in a region, the chance of tree uprooting is high. The trees when they fall might tamper with the power lines that becomes a very sensitive infrastructure. The falling of trees on the roads could also mean blocking of the roadways creating congestion which could tamper with the rescue activities.

Department of Sanitation

Department of Sanitation is responsible for clearing the garbage and debris across the city. In case of the tornado when the sanitation department is unable to collect trash it becomes a sanitation issue which may lead to health conditions.

Department of Sanitation also has heavy vehicles that would be used to clear fallen trees and help in reaching inaccessible areas. The data available from the sanitation department would be useful to identify the locations where there would be highest trash accumulated. Also the debris needs to be collected immediately in locations that are sensitive for ease in movement of vehicles for rescue operations.

Animal Control & Welfare Department

Animals that are on streets are affected heavily by a tornado. IT might be useful to identify the areas that have the maximum number of stray animals or animal farms and initiate immediate actions. A Stable or a farm with animals may be a highly sensitive area as the animals would be held up and they would be stuck in a tornado.

Con-Edison

Con-Edison is responsible for supply and maintenance of Gas and Electricity services in the Queens and affected parts of Brooklyn borough, When a tornado occurs one of the major issues that arise is due to the power outages because most of the power lines are damaged as a result of the tornado. The main reason for this was falling trees on power lines disconnecting the power lines. This resulted in open and short circuited faults that even further triggered faults. Con Edison knows where the sensitive infrastructure is located. For them sensitive infrastructure could be the main power/Gas transmission lines and also the lines that supply power /Gas to consumers like hospitals,old age homes, schools etc. Therefore, the data and input provided by Con Edison would be very helpful in identifying the sensitive infrastructure in the region.

Department of Transportation

The New york city department of transportation maintains and oversees all the critical connectivity infrastructures including roads, bridges and railway lines. The transportation infrastructure is the most affected when tornadoes hit the city. The bridges are highly prone to be affected by a tornado.[18] They are very sensitive to tornadoes as they tend to be mostly suspended and when tornadoes hit the links get broken that not only damages the bridge but also totally cuts out the connectivity. The department of transportation maintains a database of the overall connectivity link established in the city Also the DOT maintains the database of the entrances and exits of the Subway stations and also the details of railroads. whether underground or overhead which would be helpful to sensitize the infrastructure.

Office of Emergency Management

Office of Emergency Management (OEM) is an agency that is designated to manage emergency situations in the city. They lead the rescue operations of the city and play a critical role in deciding the responsibility and task to be assigned to each agency. OEM having thorough knowledge of and contact information for the technical rescue teams and logistical support across the region or state is well equipped to lead the rescue operations.
OEM works closely with community groups to perform rescue operations in the city. OEM acts as a coordination agency and has the expertise to identify the critical infrastructure and to phase the rescue operations accordingly.The OEM also closely works with the Federal agencies and performs analysis of the losses incurred due to the tornado. Federal Emergency Management agency's Hazus software is also utilized to calculate the Economic and societal losses of a disaster and this would be very useful in determining the sensitivity of the infrastructure.

III. Operational Question

Where is sensitive infrastructure located?

With limited time and resources, the city has to be strategic in how they respond after a natural disaster. After Hurricane Sandy, there was extensive damage, and the city was criticized for neglecting parts of the city over others [19]. During the snowstorm that occurred in January 21st, 2014, Mayor DeBlasio was especially criticized when the streets of the Upper East Side were within an appropriate amount of time [20]. In addition to affecting public confidence, Hurricane Sandy took a dramatic toll on the economic productivity of the city. Although most neighborhoods experienced very little damage, everyone was affected by damage to critical infrastructure. Almost all new yorkers were affected by the storm, as damage to the subway systems dramatically impeded mobility. The subways were both important infrastructure, because they serve so many New Yorkers and almost exclusively provide the function of a transportation. The subways were also especially sensitive, due to their low elevation and vulnerability for to flooding. An effective response to a natural disaster must prioritize the most important infrastructure to mitigate the impacts on the city as a whole.

Locating this important infrastructure is only a piece of the puzzle, however, since different infrastructure are susceptible to different natural disasters. Buildings and bridges are vulnerable to earthquakes. Subway stations are sensitive to

coastal flooding. Roads, above ground railroads, and power lines are all especially vulnerable during a tornado, where the strong winds can easily bring down trees and knock out power.

IV. Data Sets

The datasets used to find the main pieces of infrastructure are:

- NYC Planimetric dataset
- NYC 2010 Census Tracts
- NYC Open Data - 311 complaints for downed trees
- NYC Open Data - Roadbed
- NYC Open Data - 2015 Street Tree Census

Planimetric dataset contain the infrastructure information that is going to be tracked and classified according to its importance and sensitivity later on in methodology part. The dataset maps every surface feature in New York City in a two dimensional plane. The planimetric dataset is available to download from the NYC open Data Set platform. The Department of Information Technology and Telecommunications created and maintains the data set using aerial photographs taken of New York City every two years. The original dataset was constructed in 2000 using aerial photographs taken of New York City in 1996. The dataset was updated with changes in 2004 using photographs taken in 2001 and 2002. Starting in 2006, updates were scheduled to occur every two years. This data set includes updates for Manhattan that were captured on June 24, 2014. The feature updates in the Bronx, Queens, Brooklyn, and Staten Island were photographed during the time period between April 1 and April 25, 2014. [planimetric]

To estimate the area that was impacted by the tornado, 311 Complaint calls related to downed trees were used. It is possible to see a clear complain "tornado path" and an abnormal increase in the number of calls related to that topic in September, 16th (figure 4). The census tracts colored in dark blue are the regions that were located in the immediate path of the tornado and the most severely affected. The lighter shade of blue distinguishes the census tracts that were outside of the tornado's path, but close enough to experience damage caused by the high winds. The lightest areas were subjected to higher than normal winds and above average storm conditions, but were spared the most damaging conditions wrought by the storm. The census tracts that presented at least one complaint related to Tornado issues are considered in this analysis and were used to filter the tracts where infrastructure will be taken in account.

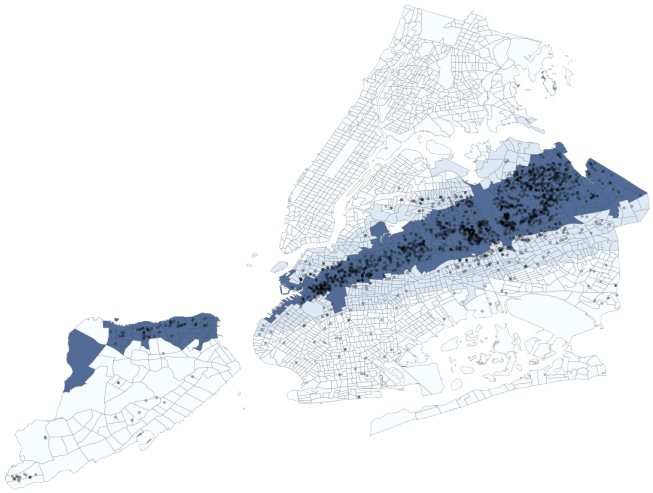

Figure 4: 2010 Tornado Path through Staten Island, Brooklyn, and Queens.

Census tract data guided the study as an index to merge all the features above. The operational question seeks to identify the location of all importance and sensitive infrastructure to inform the city's response to the tornado in an effort to mitigate the devastating impacts that damage to infrastructure can bring about. By aggregating the important and sensitive infrastructure to census tracts creates an index that ranks the census tracts that contain the most infrastructure that is both important and at risk.

From the literature review, one of the most impacting issue in tornado response actions are caused by trees blocking streets, roads and falling onto houses and cars. To help allocating resources on tree removal, NYC Parks and Recreation Tree map was merged with the areas that was impacted by the tornado and the trees that were intersecting to streets were counted.

After merging and wrangling process, we observed that from the 1539 census tracts in Brooklyn, Queens and Staten Island, the tornado impacted around 947. Inside these census tracts there are 9790 infrastructure points to take in consideration, these points include roads, subway stations, bridges, transportation hubs, etc.

V. Methods

The methods sought to locate the most important and most sensitive infrastructure (figure 5). Localities were prioritized based on the amount of important and sensitive infrastructure that is at the most risk of damage. To calculate

the prioritization of the localities, as distinguished by census tract, we devised a formula that took into account the importance, sensitivity, and location of infrastructure relative to the tornado path. Importance is defined by the estimated impact that damage to this infrastructure would cause to the city. Subways are considered to be of high importance because so many people rely on public transportation, and damage to the subway infrastructure cannot be readily mitigated in the same way that a bus could be rerouted due to road damage. Importance was quantified by a coefficient of 2 to denote high importance and a value of 1 for low relative importance. Sensitivity is defined as being vulnerable to damage by a tornado due to exposure. A coefficient value of 1 was given to infrastructure that was below ground, since it is protected from the damaging wind-power of a tornado, but still at risk for flooding from the thunderstorms that typically co-occur with tornados. A coefficient of 2 was given to exposed infrastructure, like above ground railroads, that can be affected by fallen trees and debris. The formula counts each piece of infrastructure and multiplies it by its importance and sensitivity coefficients. There weighted infrastructure counts are then summed by census tract. The third and final means for prioritizing localities is based on the location relative to the tornado path, quantified by a location coefficient. All census tracts that are located in the immediate path zone, calculated by an estimation of downed trees complaints. Basically, the area was estimated following the path of downed trees reported to the 311. It can be seen that it is an existent area where the population of downed trees is denser to become more spread on the outside area. The idea behind the method is that stronger is the wind generated by the center of the tornado, more trees and branches are downed, and consequently, in the area where the tornado has a collateral effect, the wind generated is lighter and fewer trees, and branches are downed. Therefore, it was considered that that denser area is the path that the tornado followed and the sides area is collateral areas in the tornado path. To weighted correctly the estimation accounts for a coefficient of 5 in the high-density area, a coefficient of 1 in the collateral areas and the rest of New York City was assigned a factor of 0 meaning that the tornado has no impact on them. A comparison between planted trees and downed trees was made to ascertain that the reason that the collateral areas has less downed trees is not that there are not planted trees but the wind was weaker. Afterward, the summed weighted infrastructure counts for each census tract were then multiplied by the locality coefficient to obtain a priority index value. A heatmap shows the values.

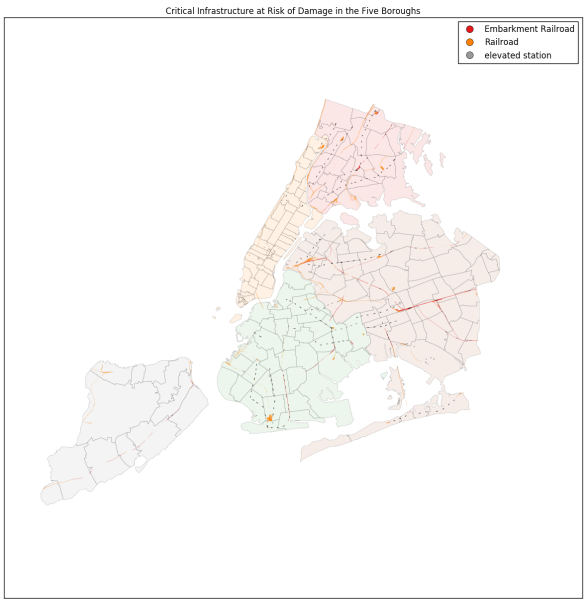

Figure 5 - Infrastructure of NYC to be considered in this study

Importance and Sensitivity Coefficients

Table 1: Importance and Sensitivity Coefficients

Infrastructure Type	Importance	Sensitivity
transit entrance	2	1
ventilation grate	2	1
emergency exit	2	1
railroad	2	2
embankment railroad	2	2

Analysis of Possible Tree Affected by the Tornado

A major problem that can cause by a tornado is the disruption of the roads due to trees blocking the roads and streets. To try to prevent that situation can happen, an analysis of the possible trees that can affect the roads is performed. The NYC Open Data - Roadbed and the NYC Open Data - 2015 Street Tree Census were used to carry out the analysis. It is assumed that 2015 Tree census is similar that the census of trees in 2010 when the Tornado hit the City of New York.

To assess the question, a geospatial method is used to see which trees are close enough to the roads and trees that they are possible to be pulled into them by the wind generated by the tornado. A buffer was created with a distance of 3m of every road, and the result was intersected with the census of

trees within the area affected by the tornado. As a result, some possible damaged trees is calculated.

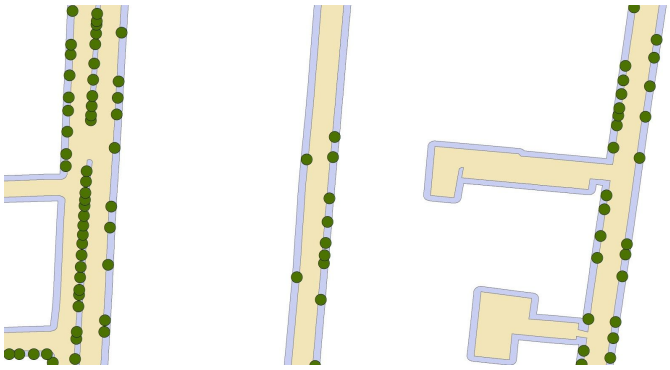

Figure 6. Image that shows the roads in brown and the area that are separated from them 3m in blue and the possible affected trees (dots).

VI. Results

The results of the priority indexing indicate that some census tracts contain more sensitive and important infrastructure than others. The results of the priority indexing are mapped in Figure 7. All of the prioritized census tracts fall within the zone of impact of the tornado, but not all census tracts are quantified as a priority under this methodology. The prioritized census tracts are listed in Table 2.

The number of trees which can be affected by the tornado and calculated by the geospatial method of buffering is in total 202.845, 60,400 in brooklyn, 8,568 in Staten Island and 133,877 in Queens. The number of trees in this condition by census tracts can be seen in figure 8 and the rank of census tracts on table 3.

VII. Discussion

The census tracts that were captured by the priority index were largely those that contained a high concentration of railroads, as shown in the map of above ground infrastructure (Figure 5). Although there is more infrastructure in those areas, the presence of so many railroads actually reduces the risk that they will be damaged in a tornado, since there are so few trees in a large railyard.

The methods could be improved by creating a metric for measuring the sensitivity and importance of the infrastructure to provide a quantified, and therefore objective, measure of those variables. Sensitivity could be calculated based on the likelihood of damage to a piece of infrastructure in a storm (which could be based on historical data of damage incidence). Additionally, importance could be calculated based on the magnitude of use. This could be obtained by subway swipe data and TLC pick up and drop off data. This would provide a more realistic analysis of importance and sensitivity. This methodology could also have been improved by incorporating additional infrastructure, such as powerlines and roads. The model could also be improved through testing against historical data.

For potential trees, the most trees dense areas are located on the northeast of Queens in regions Whitestone, College Point and Bay Terrace (Dark Green on figure 8).

The tree buffer analysis captured a ubstanitlaly greater number of trees than were reported in the 311 downed tree complaint dataset. This could be explained by the fact that not every tree that is at risk of falling will be blown down in a tornado. Selection could be improved by selecting trees that are larger than a specific size, and therefore most likely to cause disruptive damage.

VIII. Outputs

Table 2: Ranking of Priority Index by Census Tracts

	Census Tract 2010	Weighted_ Counts	Location_ Coeff	Priority_Index
1	4061301	596.0	5.0	0.000392
2	5000300	300.0	5.0	0.000364
3	3022700	187.0	5.0	0.000361
4	3012902	90.0	5.0	0.000328
5	3015300	84.0	5.0	0.000259
6	3003500	72.0	5.0	0.000251
7	3015100	78.0	5.0	0.000243
8	3018100	87.0	5.0	0.000239
9	3019900	96.0	5.0	0.000236
10	3019700	84.0	5.0	0.000230

Figure 7: Priority Index map by Census Tracts (min = 0, max = 0.000392)

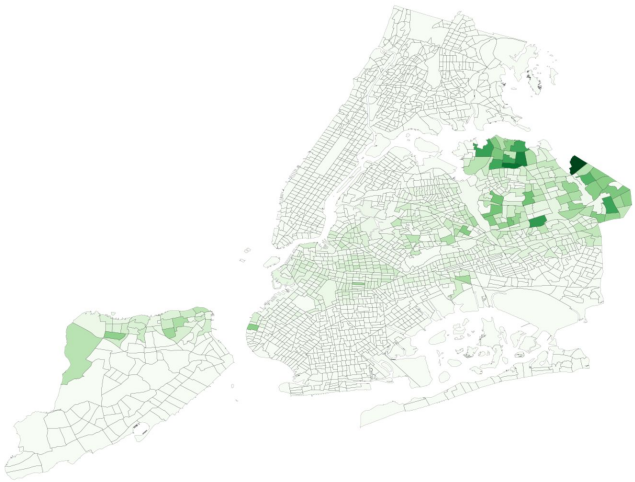

Figure 8: Number of Trees close to streets by Census Tracts. (min=0, max = 463)

Table 3: Ranking of number of trees close to streets

	Census Tract 2010	Number of Trees
1	4148300	463
2	4105900	389
3	4101700	368
4	4127700	319
5	4094500	306
6	4157101	301
7	4103300	300
8	4099100	297
9	4104700	294
10	4150701	268

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