



# Public Road Vulnerability in Massachusetts: Structural Condition and Flood Risk

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## BACKGROUND

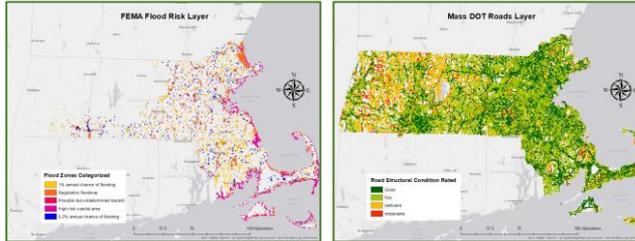
Infrastructural vulnerability is a growing concern in the state of Massachusetts. The American Society of Civil Engineers reported in 2017 that at least 30% of all publicly maintained roads in the state are deemed to be in poor structural condition (ASCE 2017). Poor structural conditions which pose major safety threats on public roads include cracks and potholes, inadequate guardrails and medians, and other obstructions to roadways (Pajcic 2017). Concurrently, flooding rates have been regularly rising, the coastline and near-coast interior of the state becoming increasingly vulnerable. Coastal Massachusetts is particularly at a heightened risk of flooding, which is predicted to grow as sea levels rise and storm severity enhances; the coast's 100-year flooding event – which has in recent years condensed into an approximate 60-year flooding interval – is projected to have been recurring every 1 to 2 years by the year 2100 (Massachusetts Climate Adaptation Partnership 2015).

## OBJECTIVES

The purpose of this project is to: **determine the vulnerable segments of Massachusetts roads based upon flood risk and structural deficiency.** This study analyzes the juncture at which flooding risk and structural condition overlap and pose both public safety and environmental risks. Structural vulnerability is already proving to be an inconvenience in many parts of the state, yet it will turn disastrous as flooding rates heighten, creating severe transportation issues through susceptible regions of the state. Determining where roads are both structurally deficient and highly vulnerable to flooding is necessary for maintaining safety standards and for mitigating climate change effects.

## SPATIAL DATA

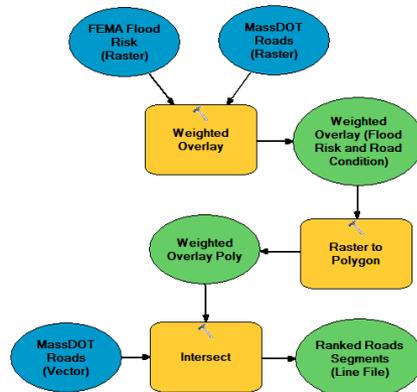
### Data Layers



### Flood Zone Ranking Definitions<sup>4</sup>

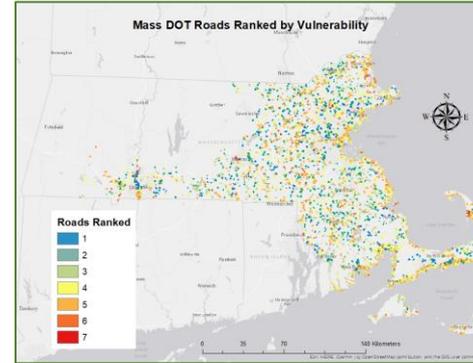
Risk Level	Flood Zone Category
High Risk	VE, AE, A
Moderate to Low Risk	X
Undetermined Risk	D

## METHODOLOGY



## RESULTS

### Intersect with Mass DOT Roads Layer



### Resulting Attribute Table (Sample)

	A	B	C	D
	STREET NAME	STRUCT CONDITION	TOWN NAME	RANKING
1	RABBIT RUN ROAD	3	NANTUCKET	5
2	GREAT POND ROAD	2	EASTHAM	6
3	PROSPECT AVENUE	2	SCITUATE	5
4	41ST STREET	3	NEWBURY	6
5	ATWOOD STREET	2	REVERE	5
6	HILL CREEK ROAD	4	BARNSTABLE	5
7	CENTRAL STREET	1	WINTHROP	5
8	PARIS COURT	4	BOSTON	7
9	PLEASANT STREET	2	DENNIS	5
10	MONTGOMERY PLACE	1	GLOUCESTER	5
11	KENDRICK ROAD	3	CHATHAM	6
12	ROCKVIEW ROAD	3	HULL	6
13	RIVERDALE TERRACE	1	HAVERHILL	5
14	SAKONET AVENUE	2	FAIRHAVEN	5
15	BOULEVARD	4	PLYMOUTH	7
16	HEMEON DRIVE	1	YARMOUTH	7
17	DAMBROSIO WAY	1	WENHAM	6
18	HIDDEN COURT	1	NORTH ANDOVER	5
19	INTERSTATE 93	2	BOSTON	5
20	MASSACHUSETTS TURNPIKE	2	NEWTON	5
21	66TH STREET	3	NEWBURYPORT	6
22				

## CONCLUSION

The results of this analysis display the most susceptible public roads in Massachusetts regarding structural deficiency as well as proximity to high-risk flood zones. On the right are images depicting a sample of road segments which appeared on the table above, indicating that proximity to the vulnerable coastline appears to correlate to structural condition and integrity. This data will only become increasingly important as we transition to an age of unprecedented sea levels and storm magnitude. Determining which structures are already in poor condition and are in regions of high flood risk will ultimately help in allocating resources to improve and maintain infrastructure in these areas. This information is vital to the protection of our citizens and communities.

## AERIAL IMAGERY

### Highly Vulnerable Road Segments<sup>5</sup>



## REFERENCES

- Data Sources: MA Roads Layer – MassGIS (Mass DOT); MA Flood Risk Layer – FEMA
- References: [1] ASCE Massachusetts Infrastructure Overview, 2017. <https://www.infrastructurereportcard.org/state-item/massachusetts/>. Accessed on January 10, 2020. [2] Massachusetts Climate Adaptation Partnership, 2015. Massachusetts Wildlife Climate Action Tool. <https://climateactiontool.org/>. Accessed on January 10, 2020. [3] Seth Pajcic, 2017. Potholes, Other Hazardous Road Conditions Cause Many Auto Accidents. <https://www.pajcic.com/potholes-other-hazardous-road-conditions-cause-many-auto-accidents/>. Accessed on January 20, 2020. [4] FEMA Flood Maps, 2015. FEMA Flood Map Research. <https://floodpartners.com/flood-zones/>. Accessed on February 9, 2020. [5] Google Earth Images, Accessed January 20, 2020.

## ACKNOWLEDGEMENTS

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