Analysis of Water Main Breakages and nearby Roads

City of Madison Report

May 17th, 2021

Gautam Agarwal, Wen Ye

Overview

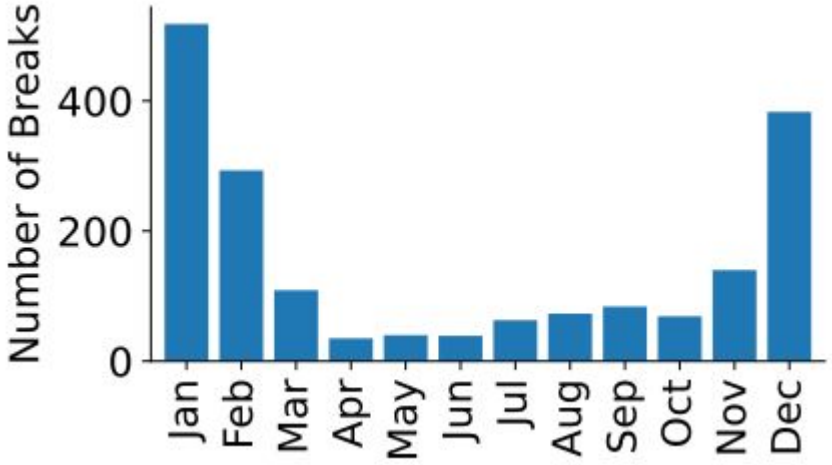
- Water Main Breakage Factor Analysis
  - Universal Factors
  - Pipe Characteristics
  - Geographics

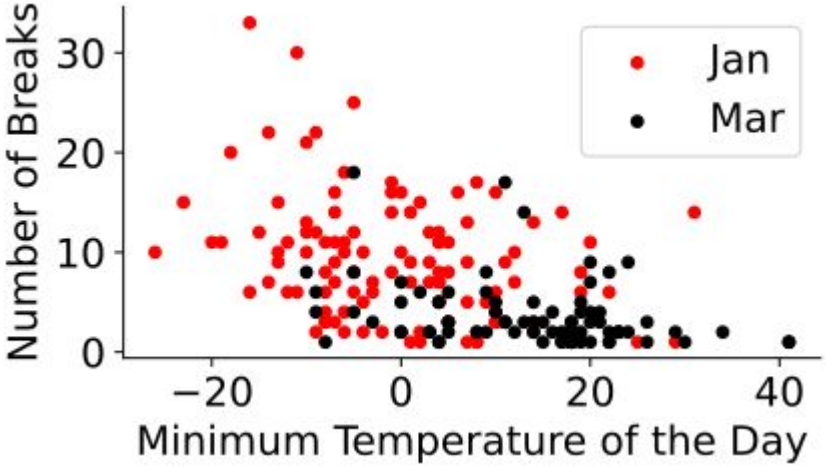
- Forecasting Future Breaks and assess risk levels water mains in the context of road segments

- Recommendations

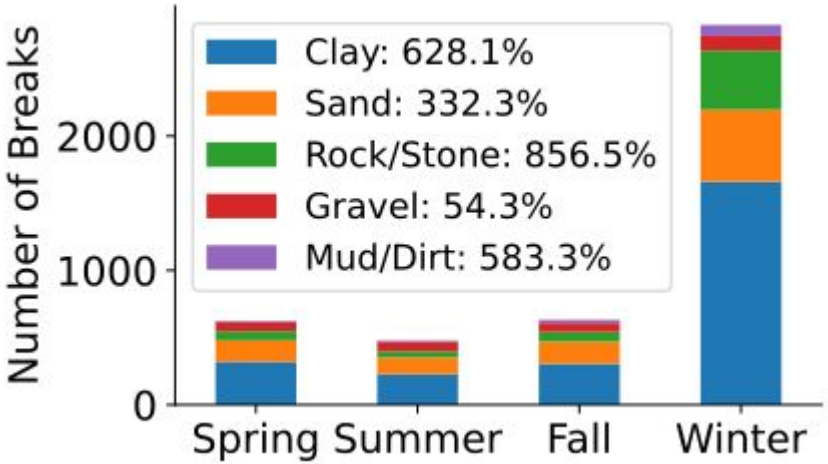
Season & Temperature

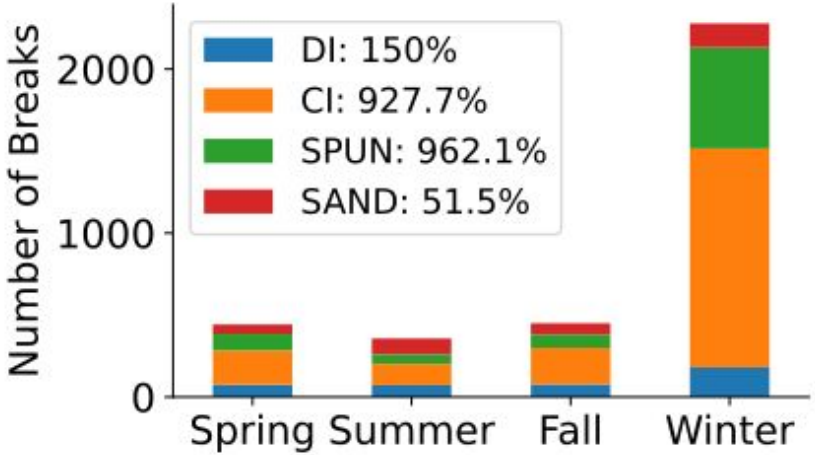
- Low temperature in general has more breaks
- Winter exacerbates the problem





How does season affect pipes laid in different soil types and pipe made of different iron type materials





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  -
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  -
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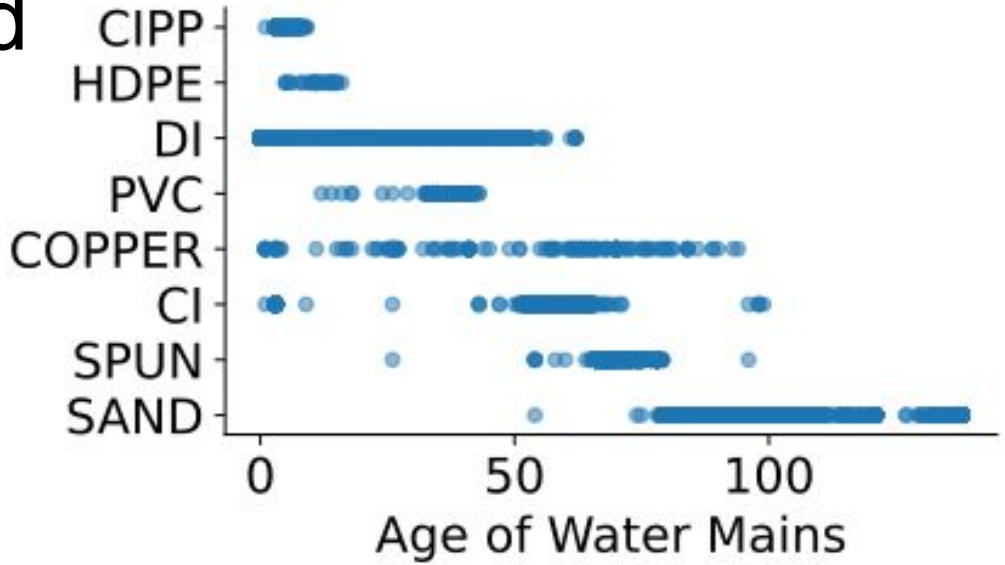
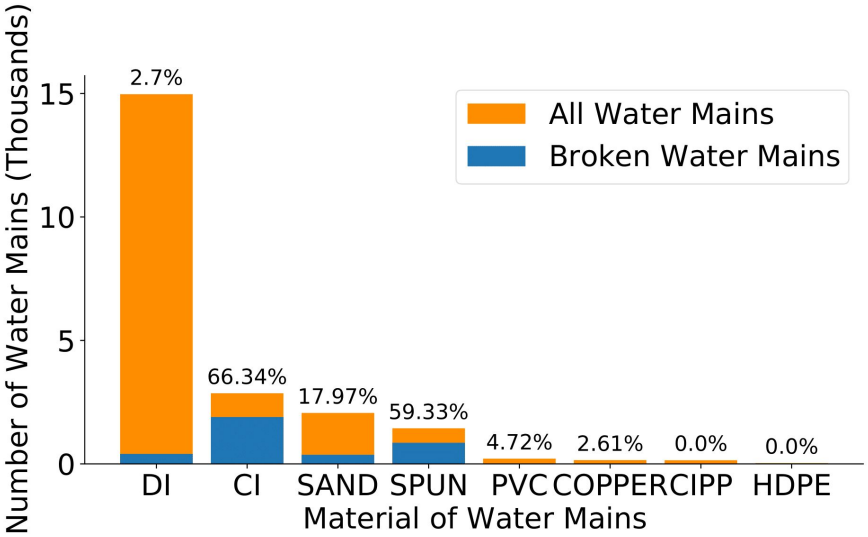
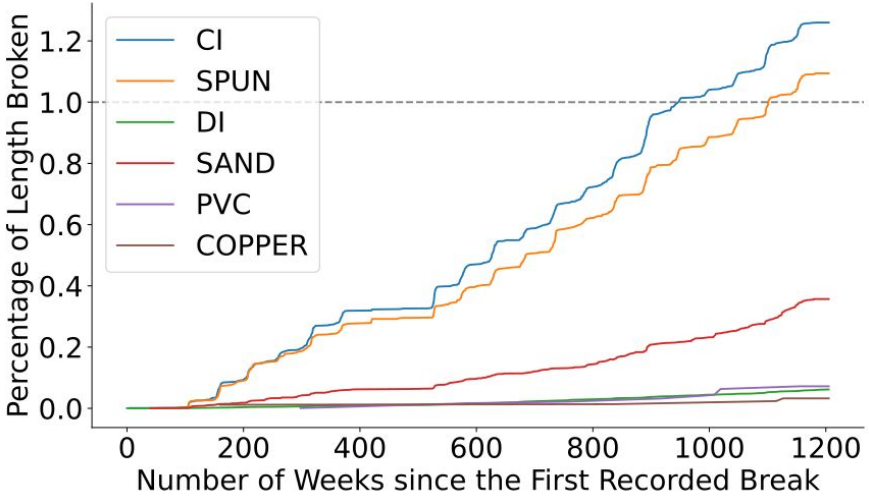
When were water mains of different materials installed



- SAND is the oldest
- DI is the youngest, mostly being installed in the recent 50 years or so

Which material breaks the most often

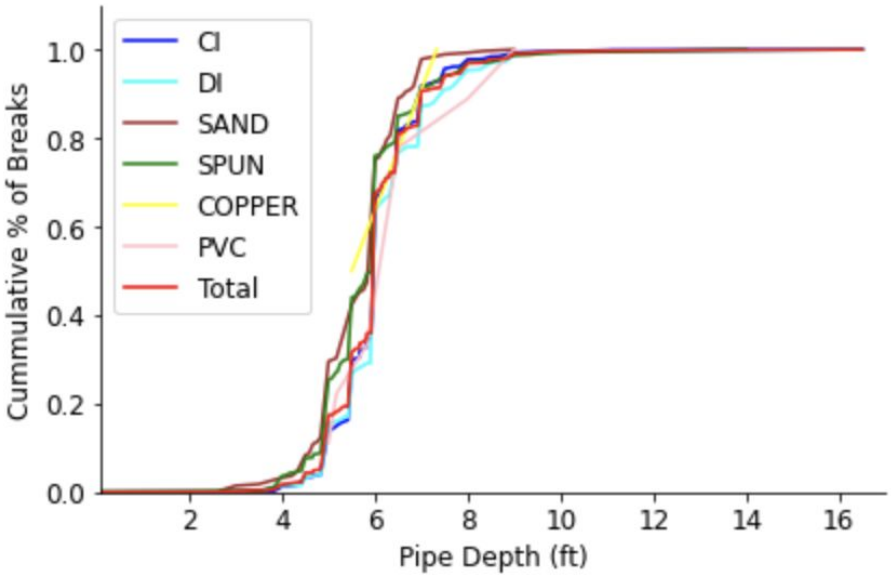




- CI and SPUN have a high percentage of breakage and many of them broke multiple times

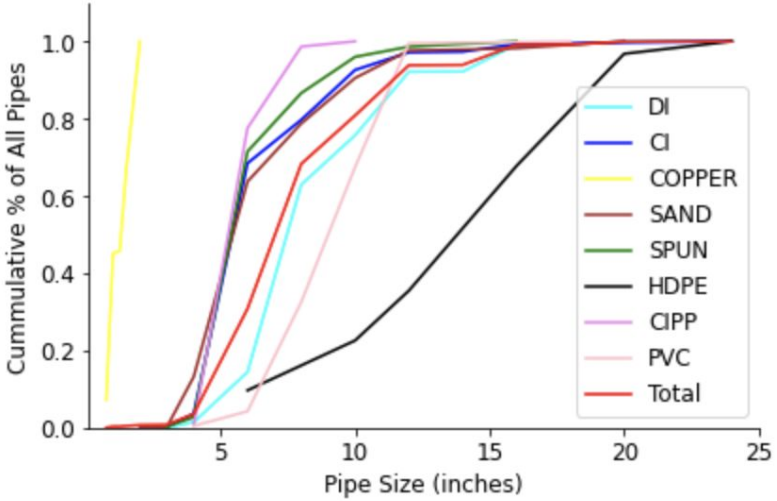
Pipe Depth

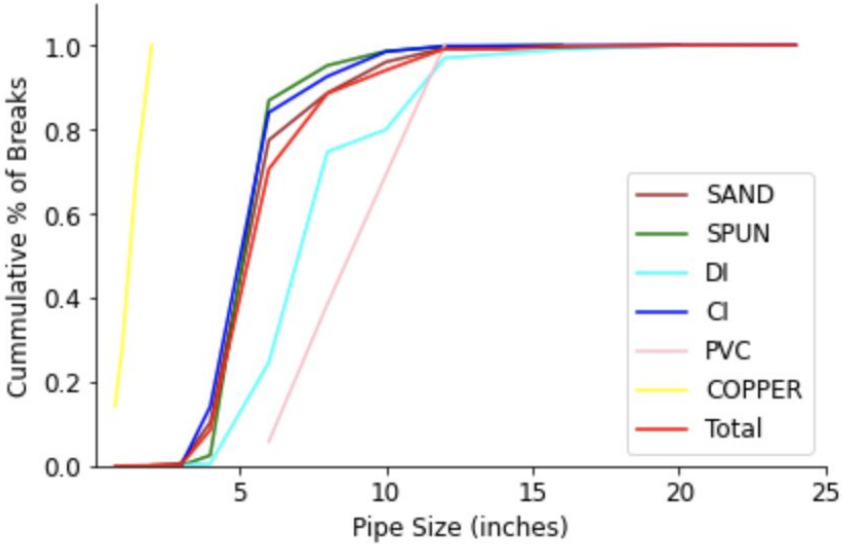
- Pipe's laid between 5 to 7 feet deep break most often



Pipe Size

- Pipe's 4 to 6 inches in diameter break most often
- Only 35% of the pipes have a diameter in this range





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  - Winter and low temperature exacerbates the number of water main breakages
  - Pipes made of CI and SPUN are particularly prone to break
  - Pipes of diameter between 4 & 6 inches break more often
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Location

- Increased number of pipes in the center of the city as well as outskirts

- Most recent pipes installed indicate an increase in DI pipes

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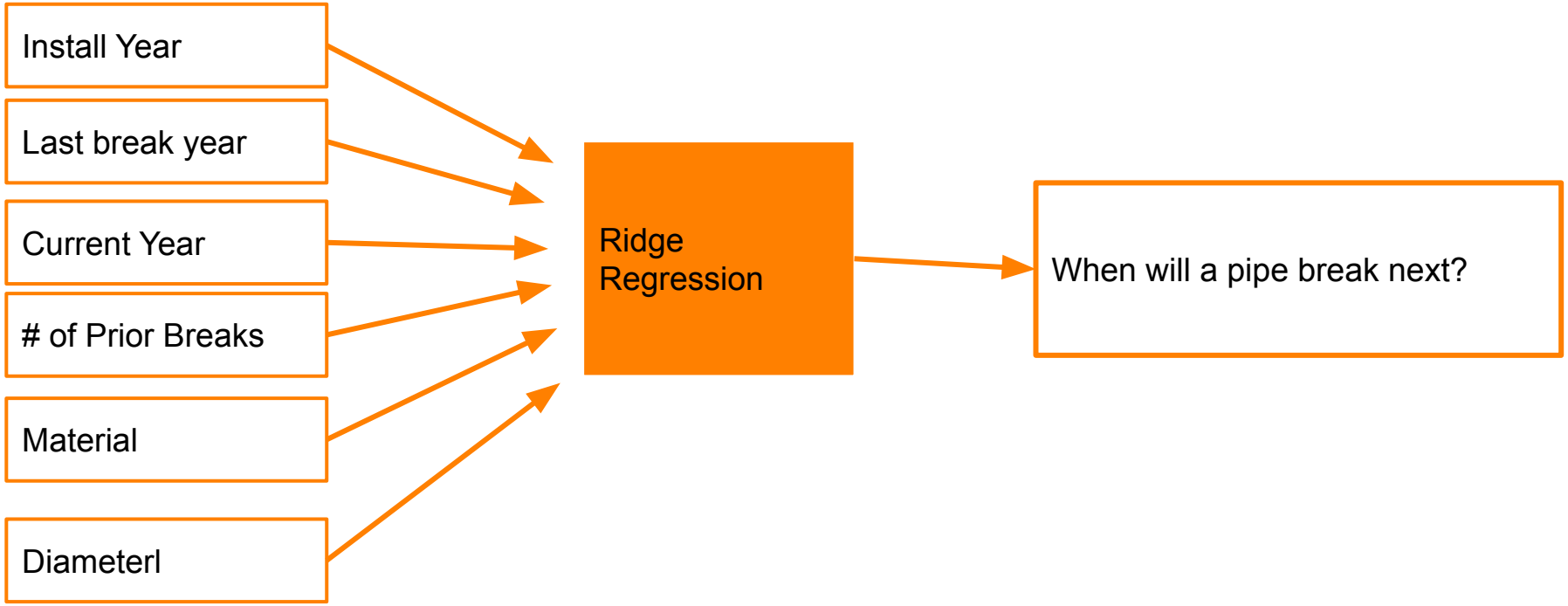
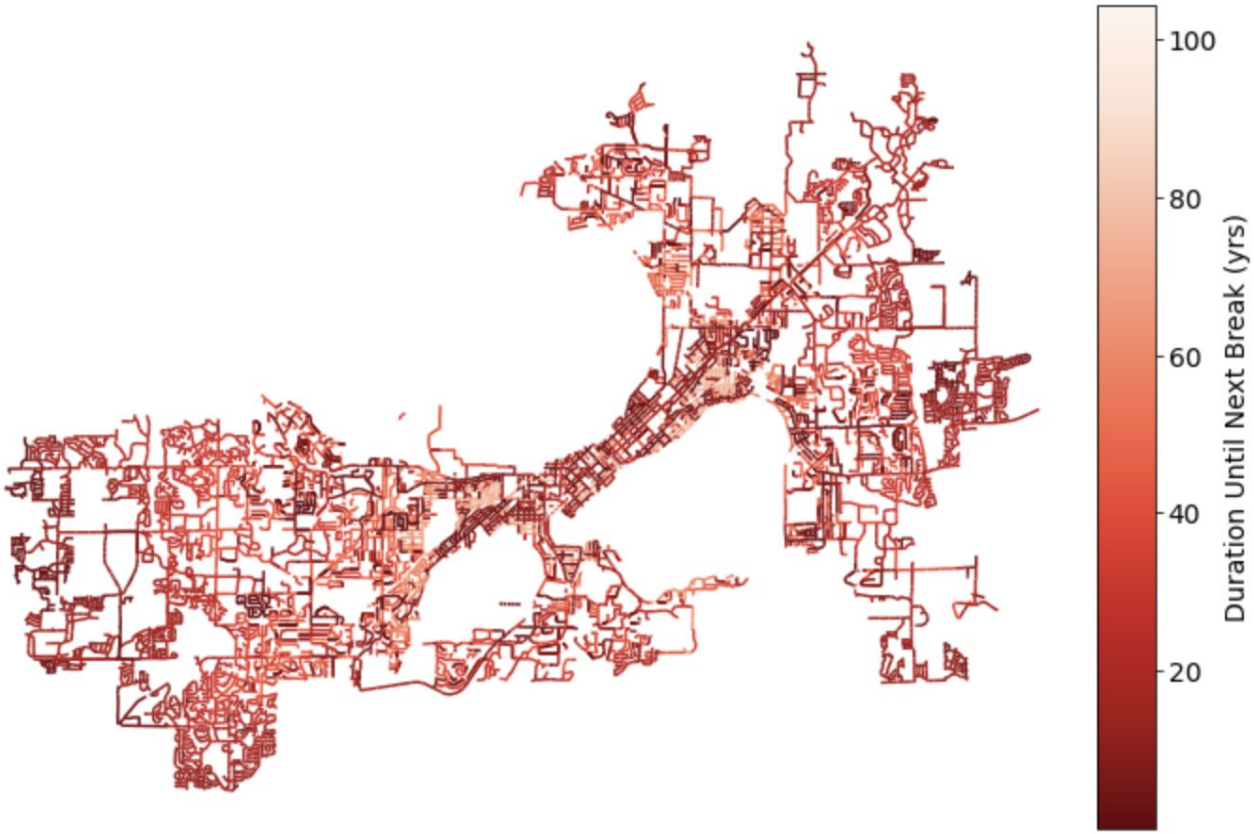
Predicting the future breakages

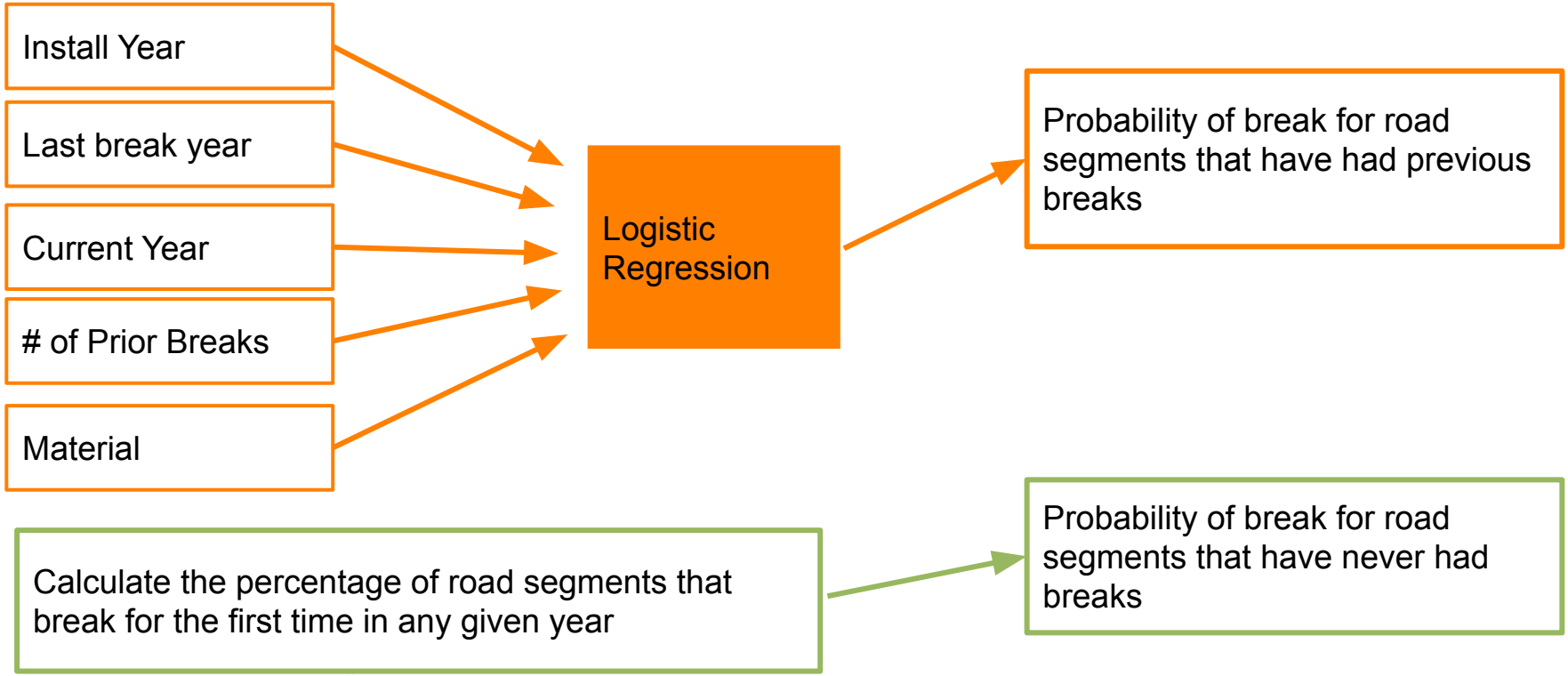


When is the next time a pipe will break

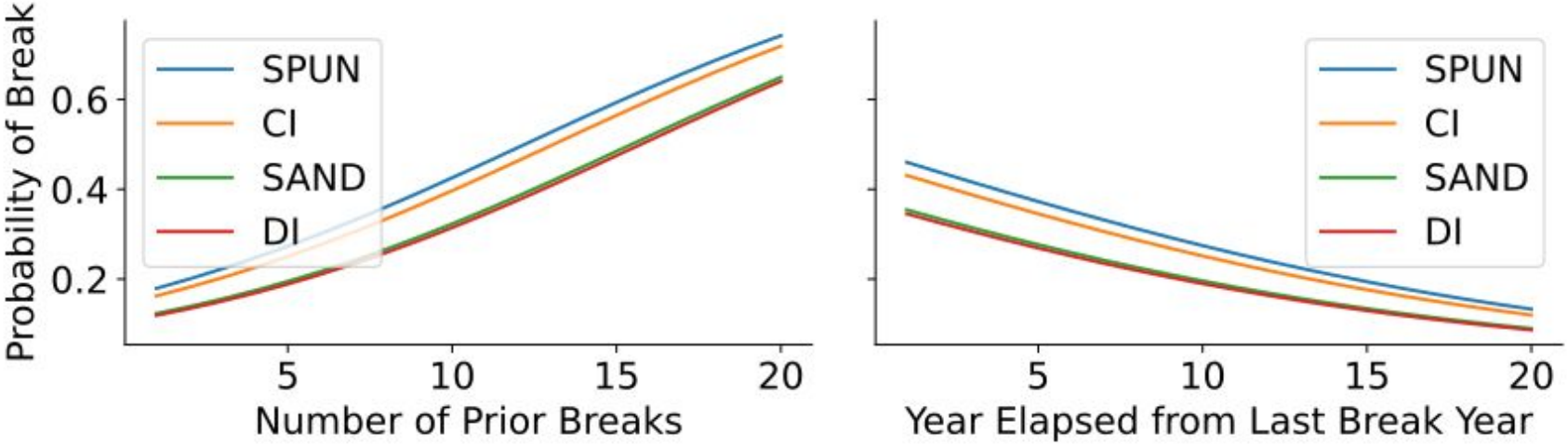


FacilityID
MAIN-6760-16495
MAIN-6860-16497
MAIN-6860-16497
MAIN-6651-14860
MAIN-3059-4961

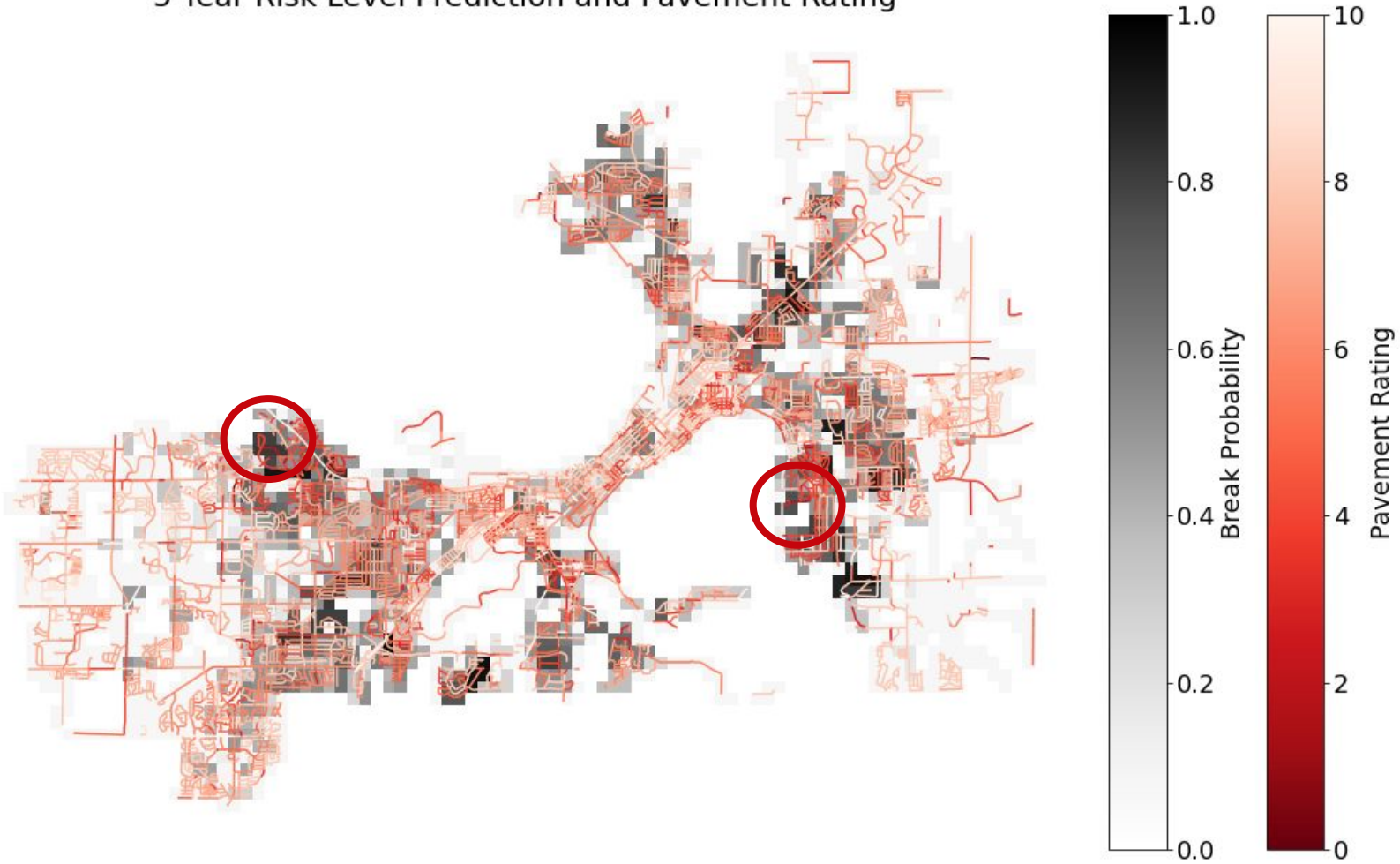
Assessing the risk level of road segments



How do some factors affect the probability of break predicted by the model



5 Year Risk Level Prediction and Pavement Rating



	OBJECTID_r	segment_id	segment_na	from_segme	to_segment	pvmt_ratin	prediction	geometry
2249	15748	03860	N HIGHLANDS AVE	HILLSIDE AVE	S HIGHLANDS AVE	2.0	0.812889	LINESTRING (794270.415 485008.319, 794256.855 ...
2539	18693	02106	E DEAN AVE	MONONA DR	TYLER CIR	3.0	0.755290	LINESTRING (836688.991 480863.065, 836734.143 ...
2031	6250	06724	PINECREST DR	BURKE AVE	E WASHINGTON AVE	3.0	0.753342	LINESTRING (834574.950 494946.939, 834545.116 ...
2067	6776	05572	MEDICAL CIR	S WHITNEY WAY	ODANA RD	3.0	0.733552	LINESTRING (797296.497 473391.095, 797178.160 ...
779	2985	08124	SOUTH ST	MIDLAND ST	549 FT S OF MIDLAND ST	3.0	0.727429	LINESTRING (817593.291 475387.172, 817602.573 ...
799	3032	08124	SOUTH ST	W WINGRA DR	APPLETON RD	3.0	0.714163	LINESTRING (817522.359 474494.368, 817509.868 ...
1484	4716	08254	STARKER AVE	NATIONAL AVE	ELLEN AVE	3.0	0.708037	LINESTRING (846351.401 483736.612, 846744.976 ...
1146	3823	02106	E DEAN AVE	TYLER CIR	LANCE LN	2.0	0.659853	LINESTRING (837387.591 481028.578, 837438.411 ...
2077	6904	00424	E BADGER RD	RIMROCK RD	NOB HILL RD	3.0	0.656902	LINESTRING (822562.255 469566.609, 822772.581 ...
1438	4647	02154	DEMPSEY RD	DAVIDSON ST	PARK CT	3.0	0.576335	LINESTRING (839316.209 485863.714, 839318.572 ...

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Recommendation

- The reduction of CI and SPUN pipes (Project #11892)
- The avoidance of installing pipes of 4-6 inches in diameter if they are not necessary
- Installation of new water mains in gravel when possible
- Prioritize an integrated road repair work and water mains replacement work in the area between Stonefield and Spring Harbor in West Madison and the area around La Follette High School in East Madison by Lake Monona.

Key Takeaways

- Better knowledge of when a water main will break
- Recommendation on prioritization

Goal

- Facilitate a healthier network of water infrastructure
- Reduce the emergency repair cost and inconvenience for nearby residents
- Publish results

Thank You !

- Is it duable to install new water mains in soil types that is of a mixture with gravel?
- Are 4-6 inches in diameter pipes necessary?