M7 Student Pass Project Update

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MIT Transit Lab

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MBTA

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10:22

Goodbye Yellow School Bus: BPS 7th And 8th Graders To Ride T Next Fall

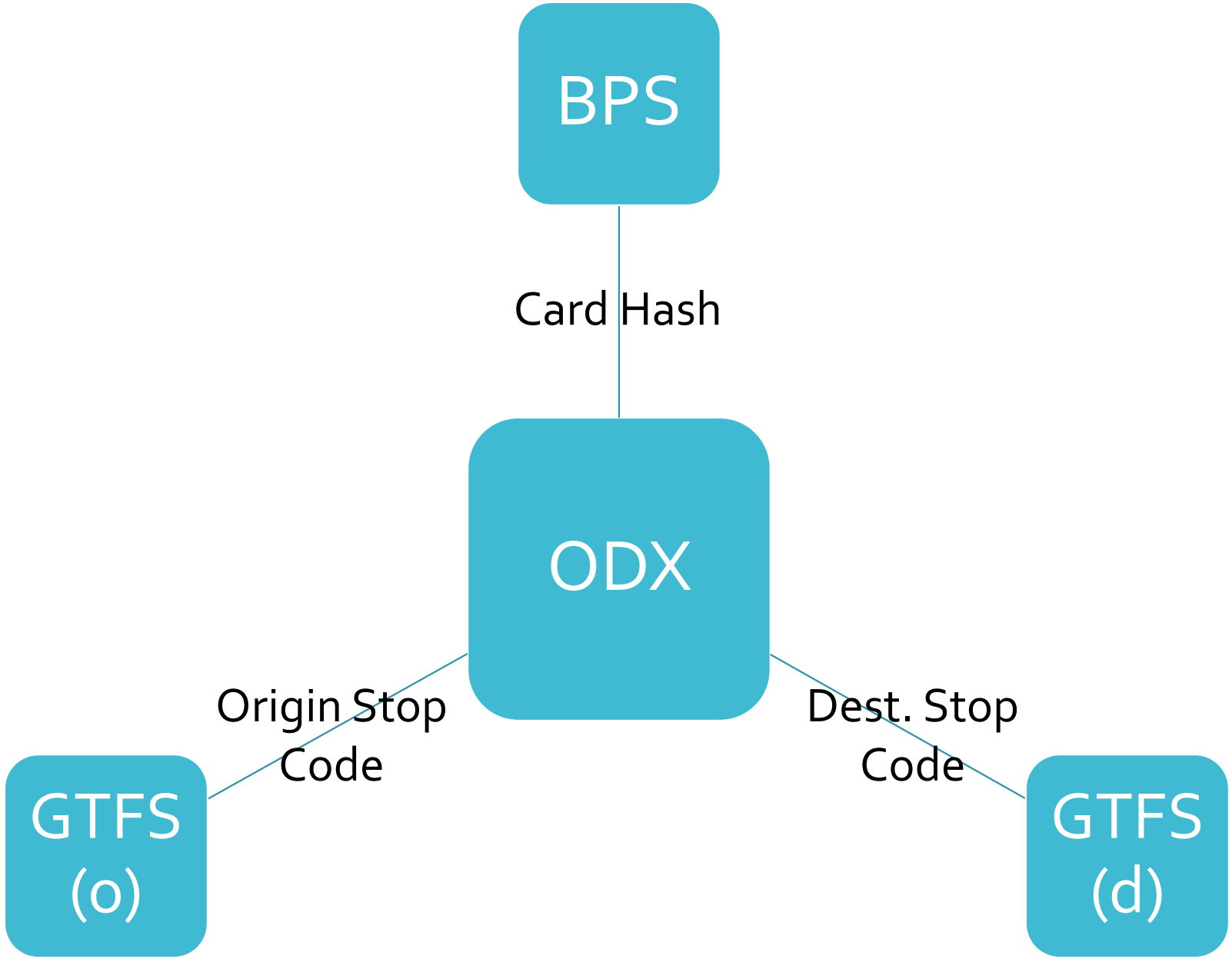
June 23, 2014

WBUR/Ted S. Warren/AP

Trips

Retrieving, aggregating, and exploring the journeys of BPS CharlieCard holders.

Joins to Retrieve Stages



From Stage to Journey

Card	Type	Tap Time	Journey	Stage	Origin	Origin Y	Origin X	Dest.	Dest Y	Dest X
007BxvQ...	m7	12/09/2018 07:05	1	1	Morton St @ Evans St	42.280886	-71.084654	Forest Hills	42.300479	-71.11363
007BxvQ...	m7	12/09/2018 07:31	1	2	Forest Hills	42.300523	-71.113686	?	?	?

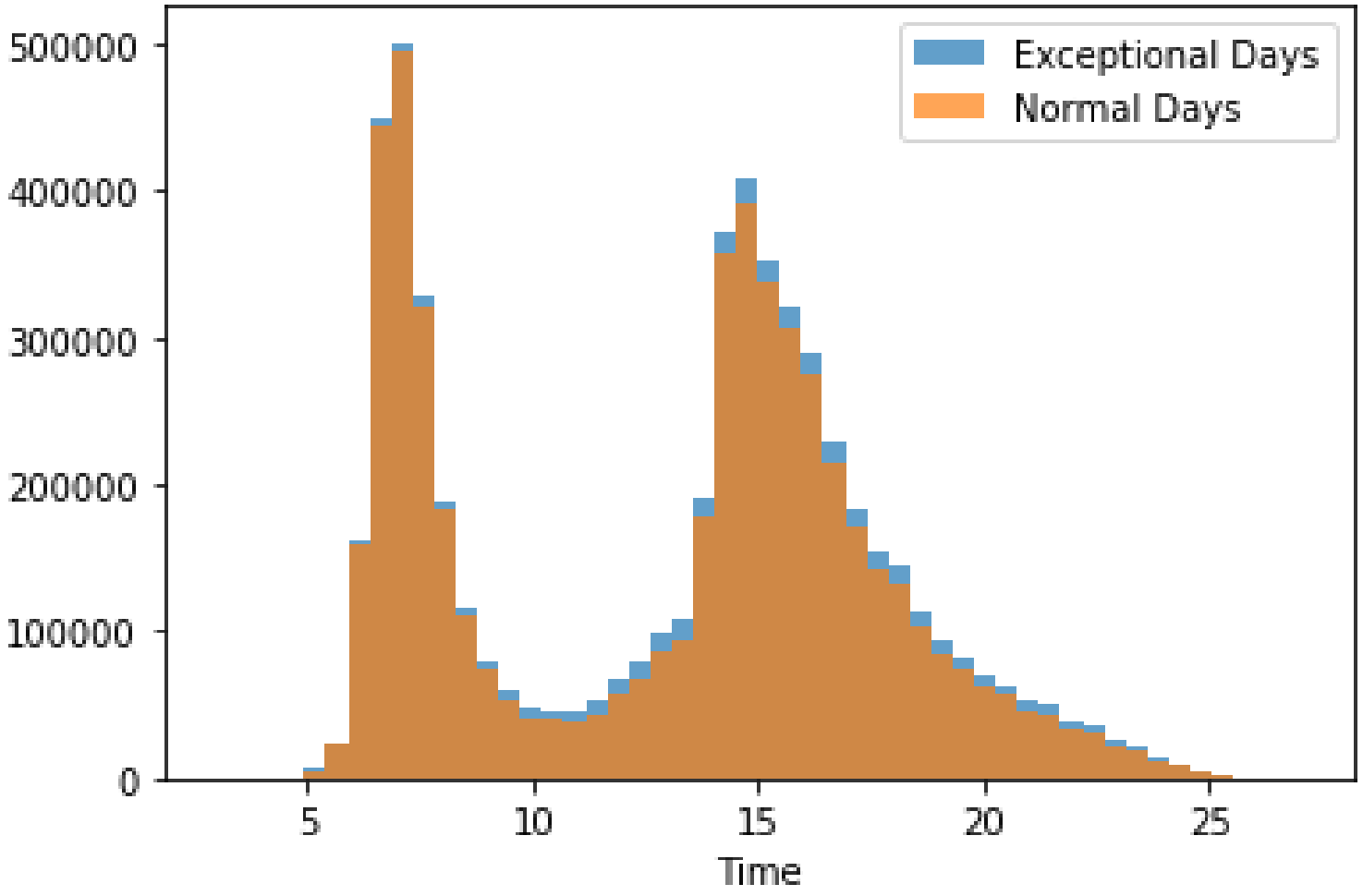
Card	Type	Tap Time	Journey	Origin	Origin Y	Origin X	Dest.	Dest Y	Dest X
007BxvQ...	m7	12/09/2018 07:05	1	Morton St @ Evans St	42.280886	-71.084654	?	?	?

ODX Data Filtering

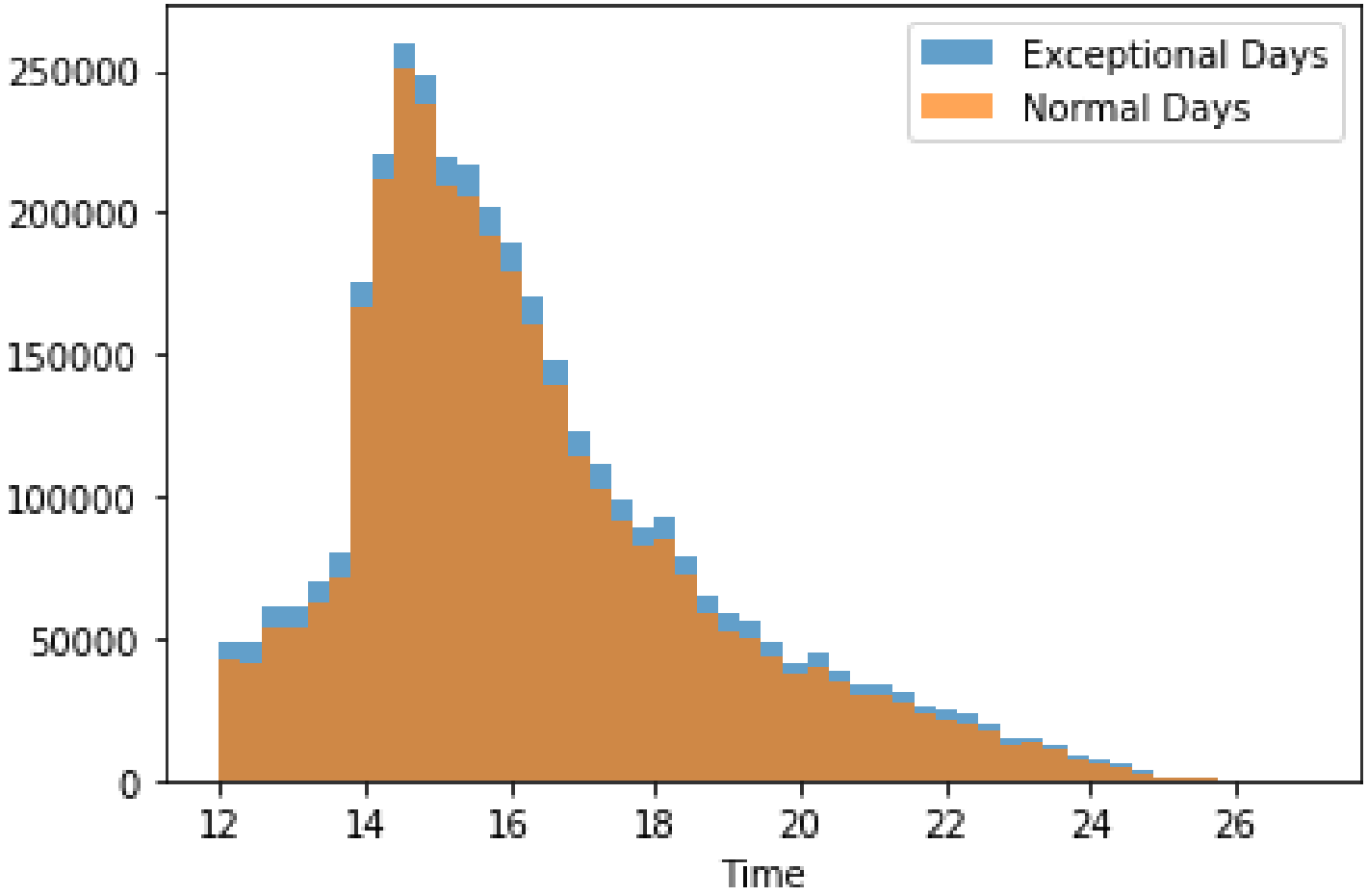
Query: From Sep 1, 2018 to latest. Origin is not null.

- **Stages:** 11 million rows
- **Journeys:** 7.7 million rows
- **School-year only (6 Sep 2018 to 19 June 2018):** 7.1 million rows
- **Weekdays only:** 6.3 million rows
- **M7 Cards only:** 5.8 million rows
- **Excluding holidays, vacations and early release days:** 5.4 million rows

Trip Distribution



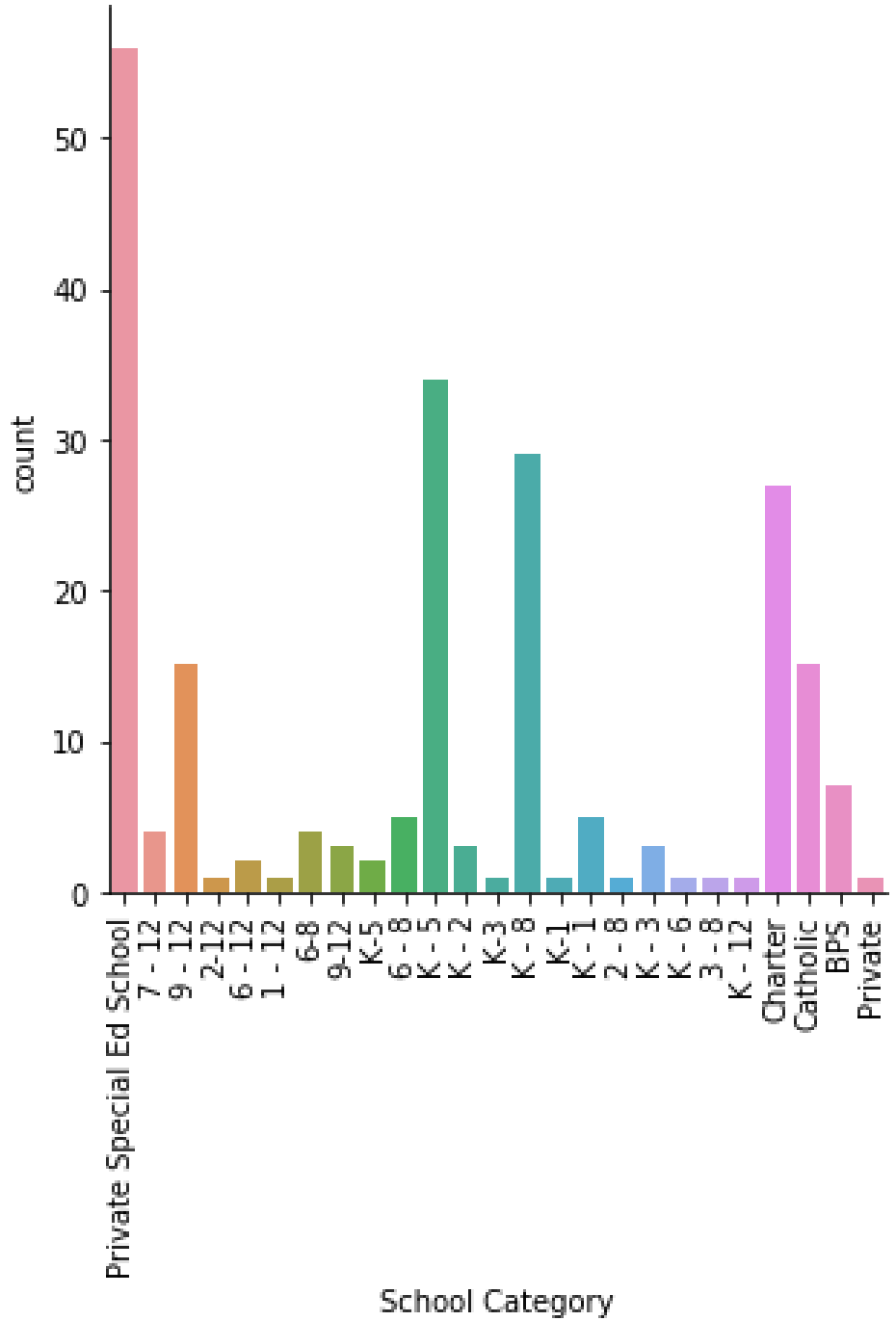
PM trip data is more useful



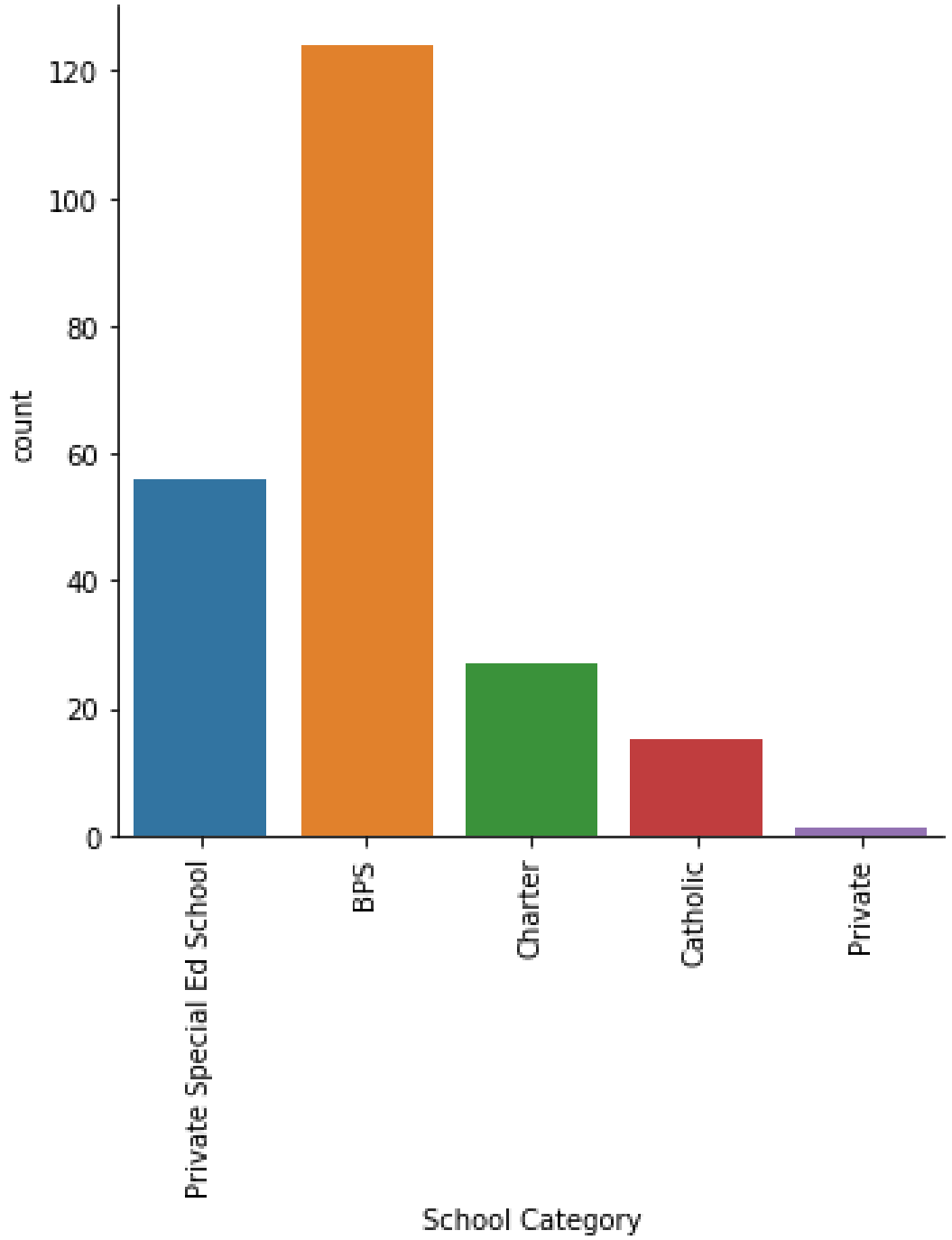
Schools

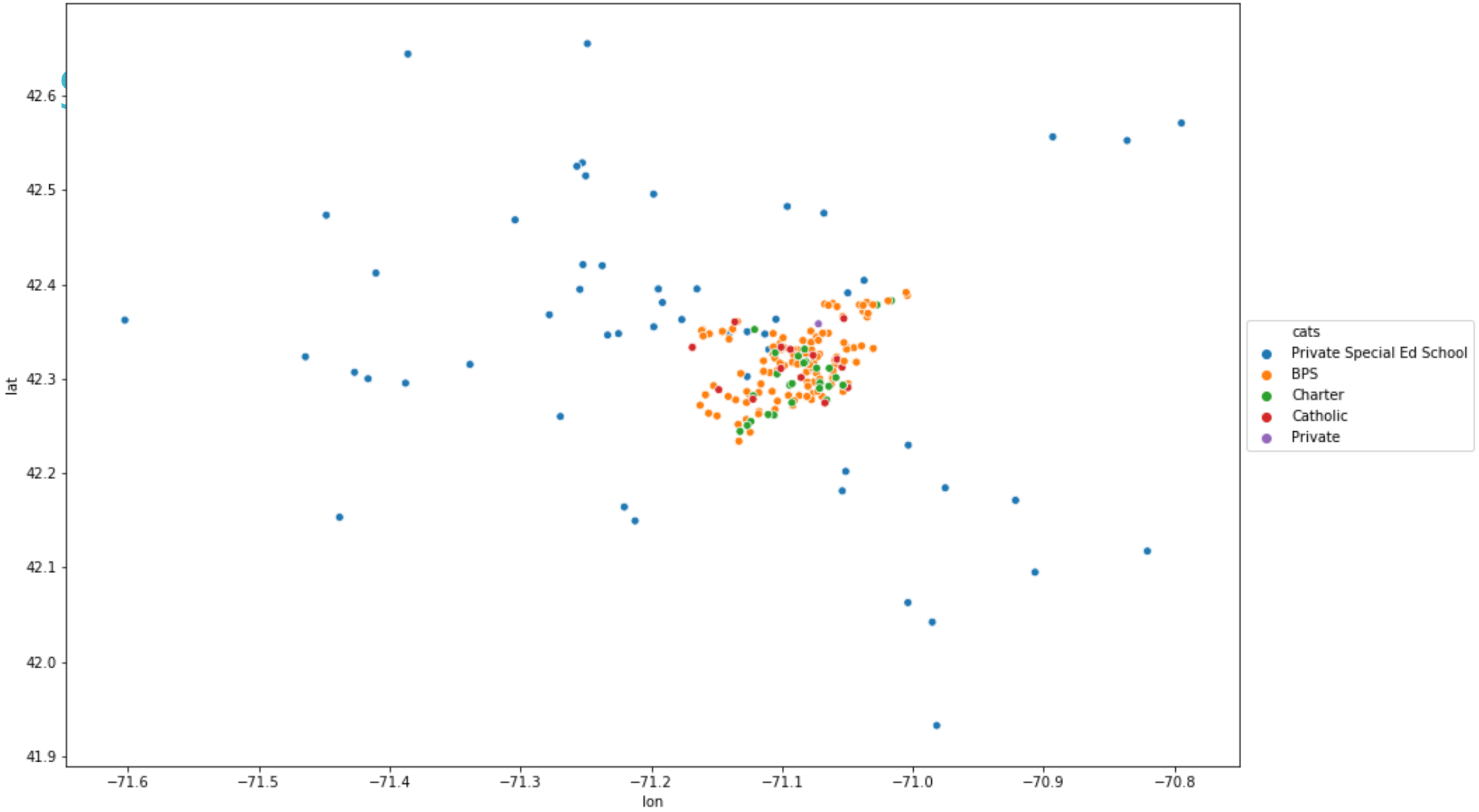
How are the schools divided and where are they located?

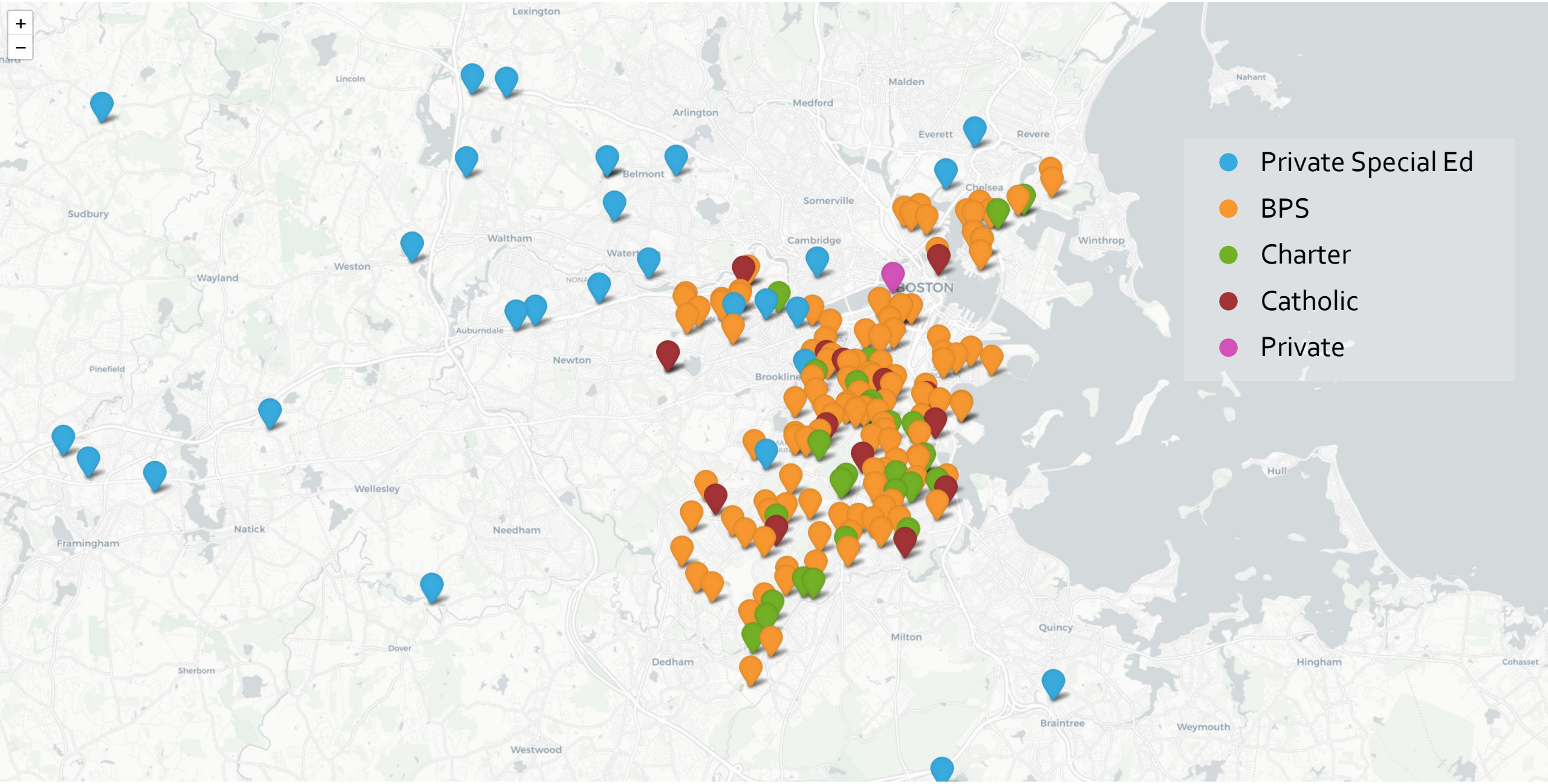
Schools


count
0
10
20
30
40
50
Private Special Ed School
7 - 12
9 - 12
2-12
6 - 12
1 - 12
6-8
9-12
K-5
6 - 8
K - 5
K - 2
K-3
K - 8
K-1
K - 1
2 - 8
K - 3
K - 6
3 - 8
K - 12
Charter
Catholic
BPS
Private
School Category

Schools


120
100
80
60
40
20
0
count
Private Special Ed School
BPS
Charter
Catholic
Private
School Category

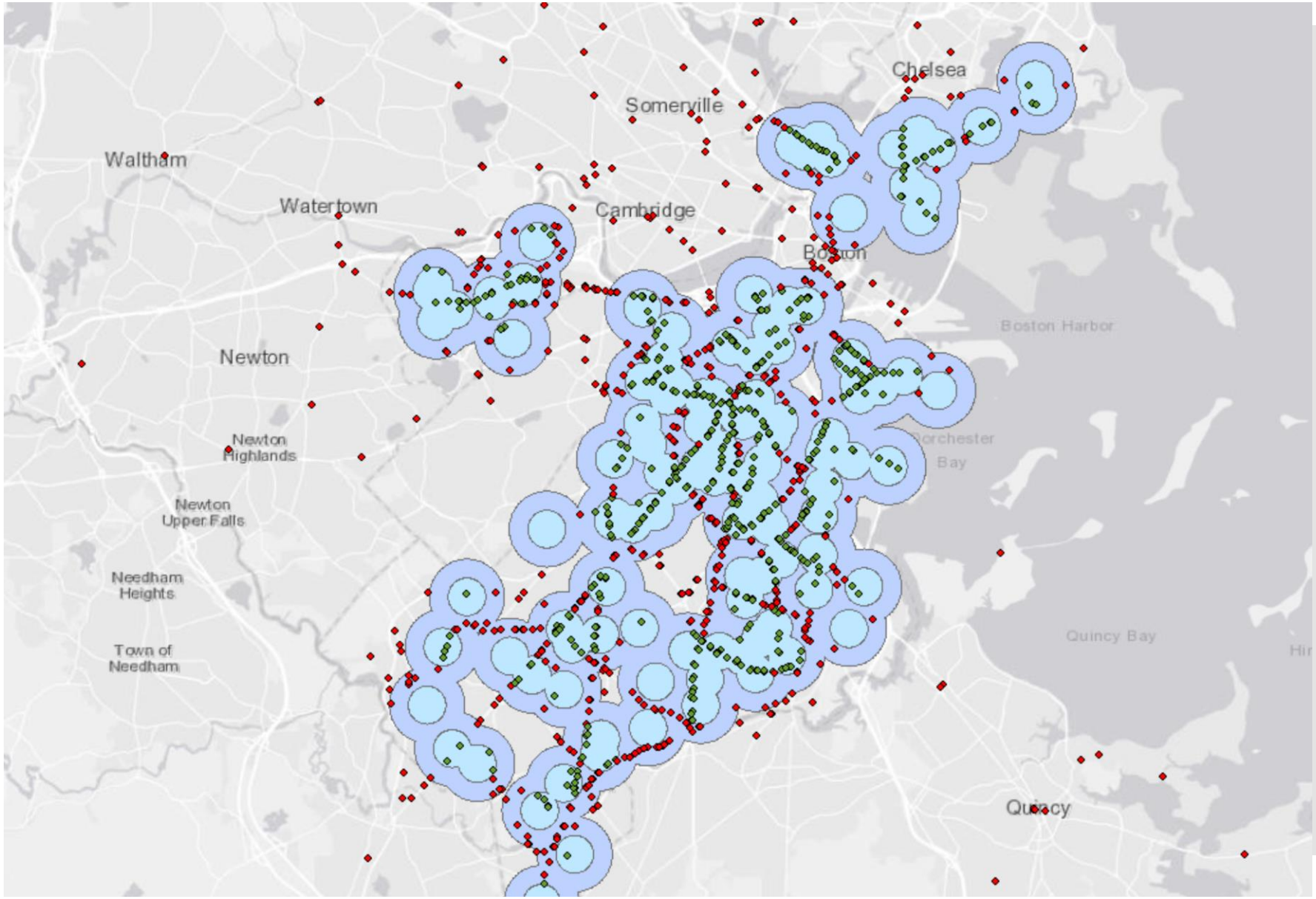

42.6
42.5
42.4
42.3
42.2
42.1
42.0
41.9
lat
−71.6
−71.5
−71.4
−71.3
−71.2
−71.1
−71.0
−70.9
−70.8
lon
cats
Private Special Ed School
BPS
Charter
Catholic
Private


Private Special Ed
BPS
Charter
Catholic
Private
Lexington
Lincoln
Malden
Medford
Arlington
Nahant
Everett
Revere
Belmont
Chelsea
Somerville
Sudbury
Waltham
Cambridge
Winthrop
Weston
Wayland
BOSTON
Auburndale
Newton
Brookline
Pinefield
Hull
Wellesley
Natick
Needham
Framingham
Quincy
Milton
Dover
Dedham
Hingham
Cohasset
Sherborn
Braintree
Weymouth
Westwood

Trips and Schools

Combining trips and schools, switching to a card view, and preliminary results

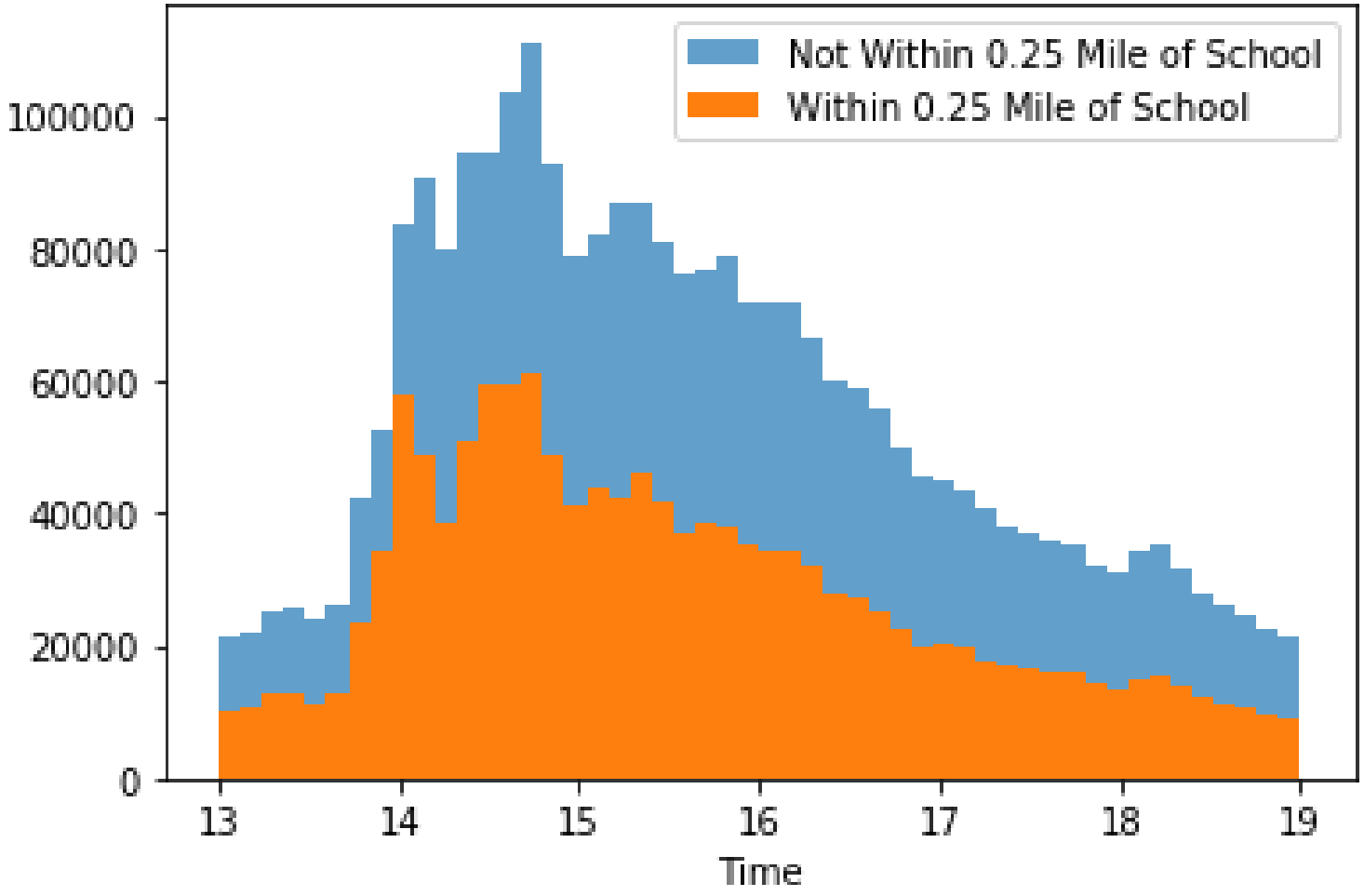
Buffers around schools



Trip distribution by buffer result

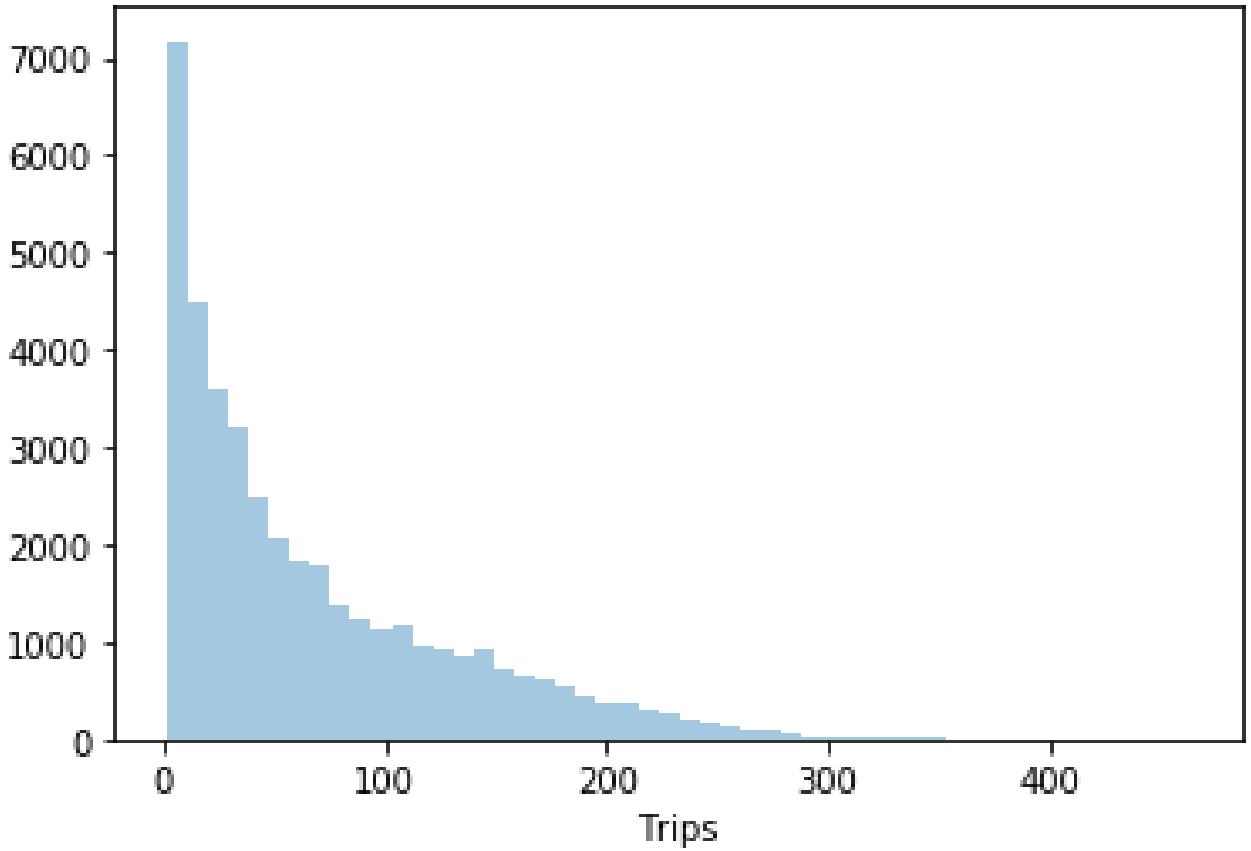
Out of 2.75 million journeys between 1 and 7 pm on 'normal' days:

- 1.39 million are within 0.25 miles of a BPS school.
- 1.36 million are not.



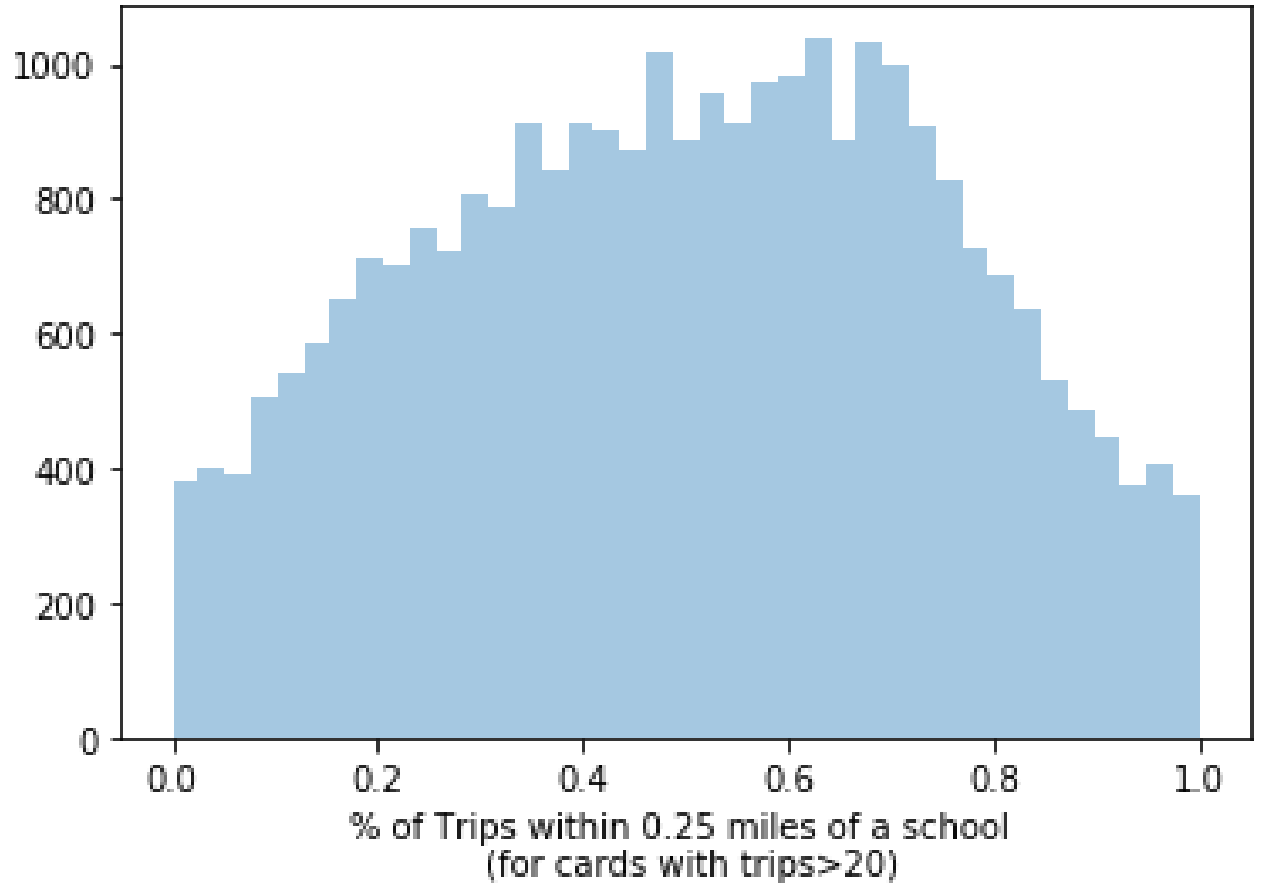
The view by card

- 40,586 unique cards
- Mean: 68 trips
- Std dev: 66 trips



Card distribution by buffer result

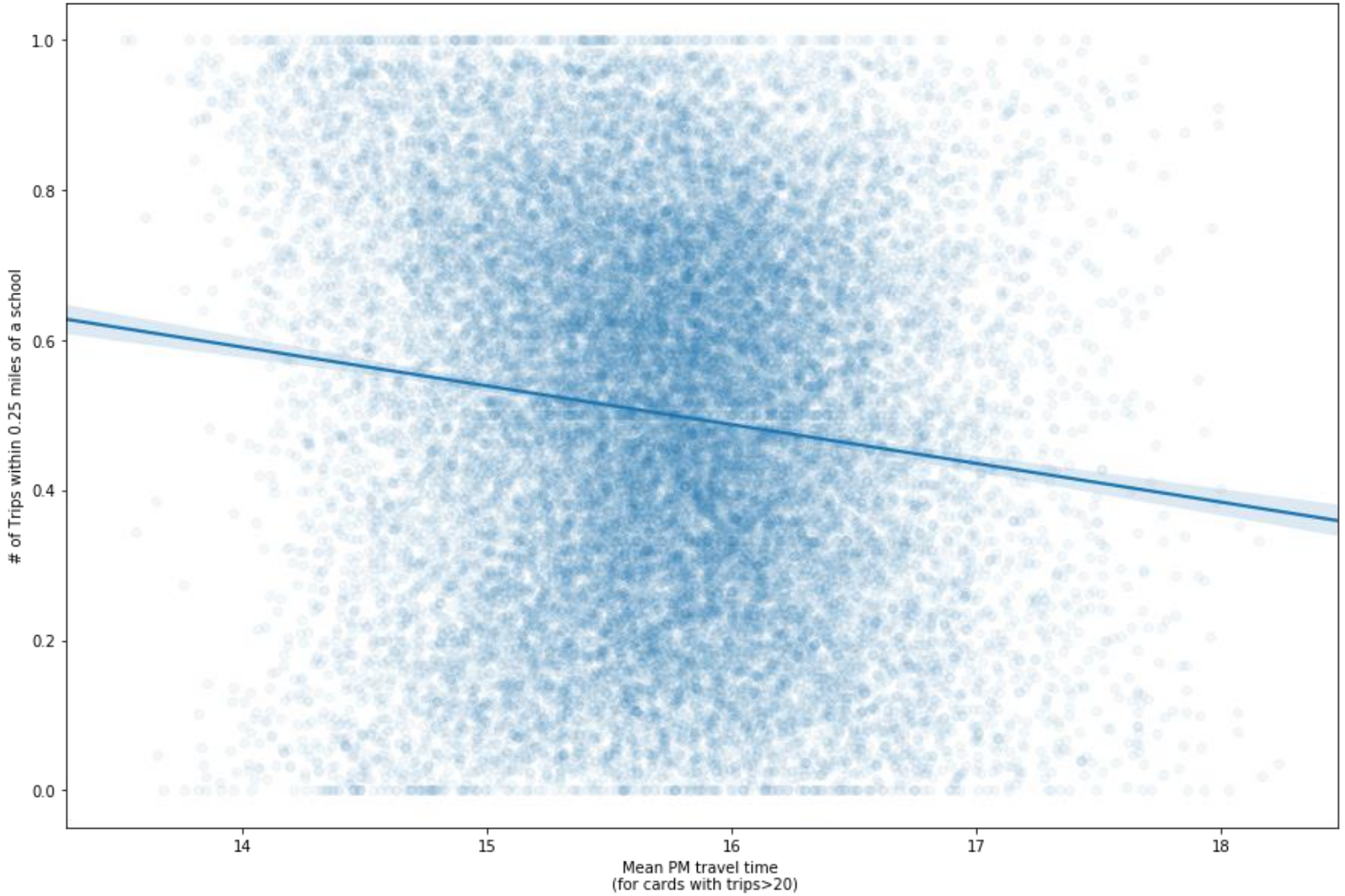
- Is 0.25 miles too conservative? Would 0.5 miles capture too many non-school trips?



Are tap time and proximity to schools correlated?

A slightly negative correlation between the probability that a given card taps near a school and the average time of that same card's taps.

99.99% confidence interval is shown.



Classifying Cards

Out of 28,471 cards with 20+ trips	Mean tap time before 5 pm	Mean tap time after 5 pm
Half of taps or more near a school	50.95%	0.91%
Less than half of taps near a school	46.73%	1.4%

Conclusions

- Vast majority of cards' PM travel is consistent with school schedules.
  - 98% of cards have a mean tap time before 5 pm.
  - 68% of cards have a mean tap time before 4 pm.
  - The mean tap time is 3:42 pm with a ~38 minute standard deviation.
- Proximity to school more difficult to measure and overall less certain.
  - 0.25 mi buffer might be too restrictive, but 0.5 mi covers most of the city centre.
  - Uncertainty as to which schools should be included in buffer.
  - 52% of cards tap half the time or more within a quarter mile radius of schools included in analysis.
- Potential future steps:
  - Get more specific about geographic criteria.
  - Clustering of cards based on spatiotemporal variables.

Jupyter Notebook
tinyurl.com/yywu475m