Data tools for the bottom-up city

with SharedStreets

NACTO Designing Cities 2019: Toronto | 10 Sept 2019 | Mollie Pelon McArdle & Emily Eros

What is SharedStreets?

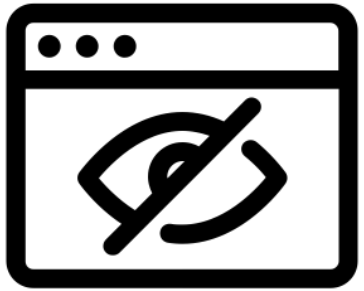
SharedStreets is a nonprofit organization.

We build free **open source software** and **digital infrastructure** to support new ways of managing and sharing data that **keep cities moving**.

All tech has embedded values. Here are some of ours.

City-owned and operated workflow

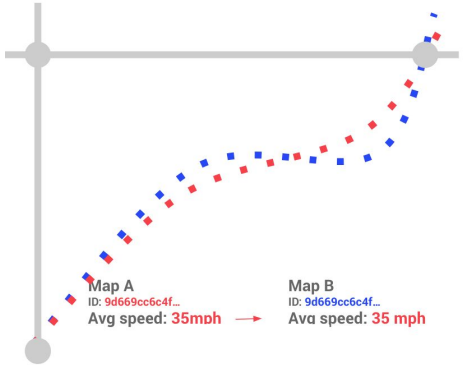
Explore questions we have about new mobility in ways that are **open** and **transparent**



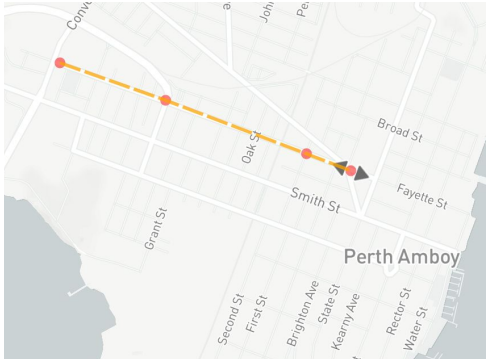
Work with data while limiting privacy risks

SharedStreets areas of work

Map conflation



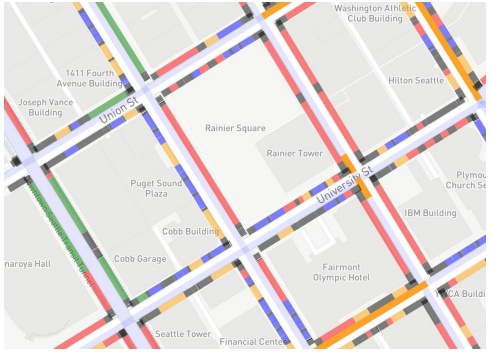
Construction & Closures



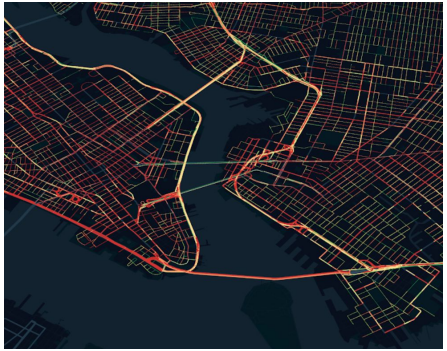
TNC Pick-up & Drop-off

Mobility Metrics

Curb Inventory



Speeds & Safety

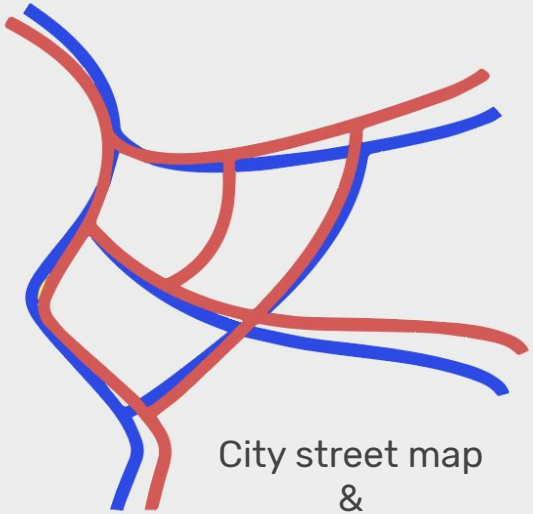


Referencing system

The SharedStreets referencing system is a **shared language for the street**.

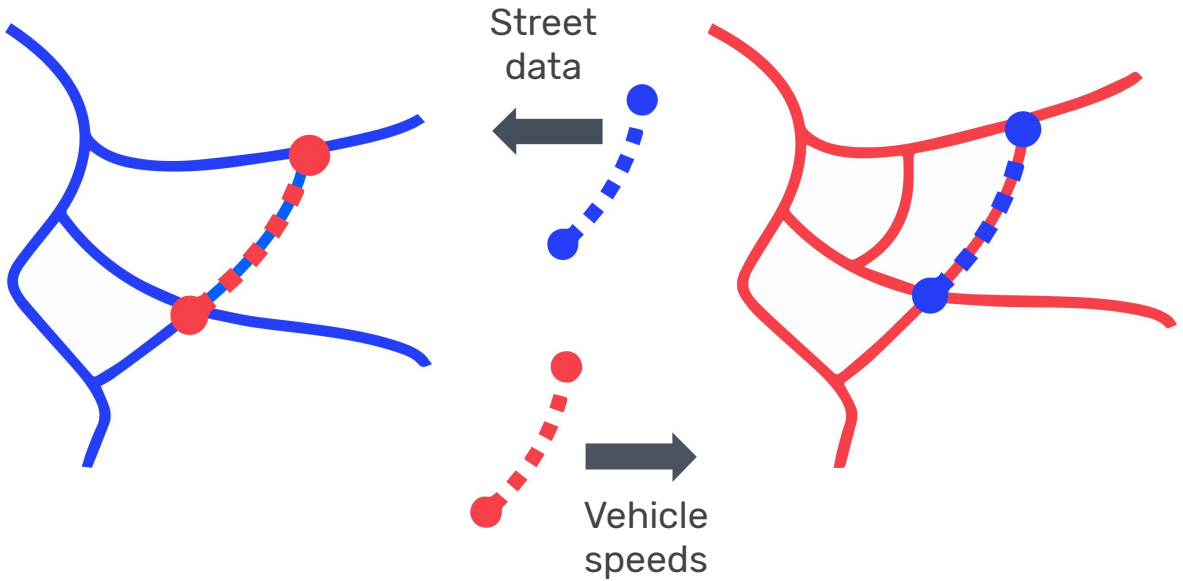
It lets maps talk to each other.

Even though these maps don't match...



City street map
&
Third-party
street map

...SharedStreets enables data to be exchanged between them



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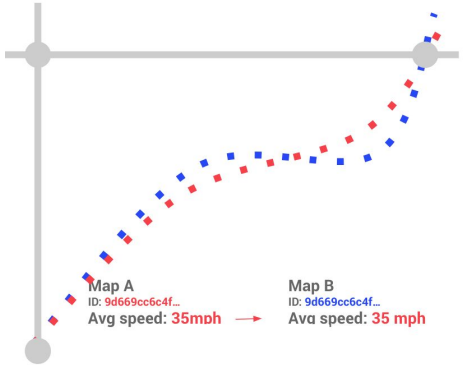

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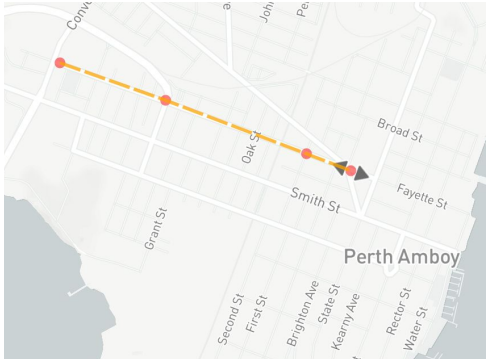

TNC Pick-up & Drop-off

Mobility Metrics

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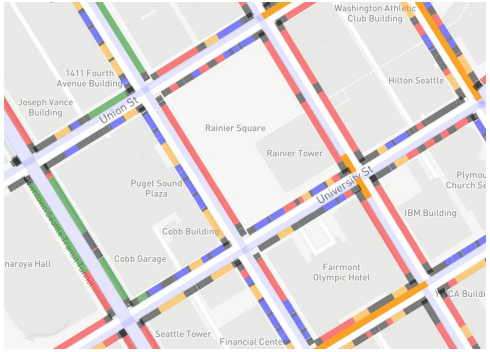

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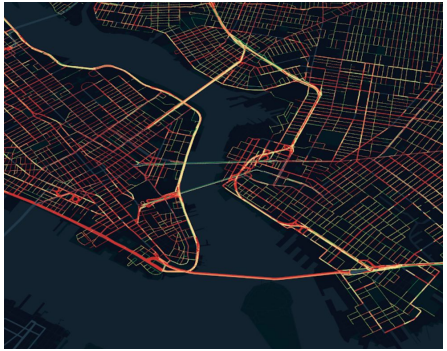

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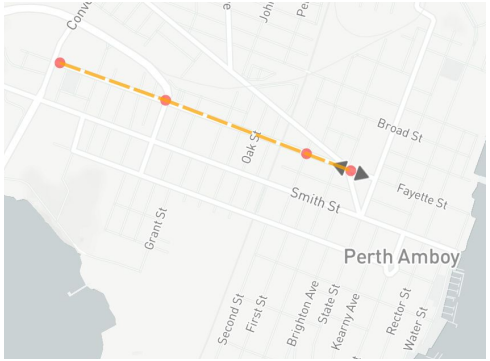

TNC Pick-up & Drop-off

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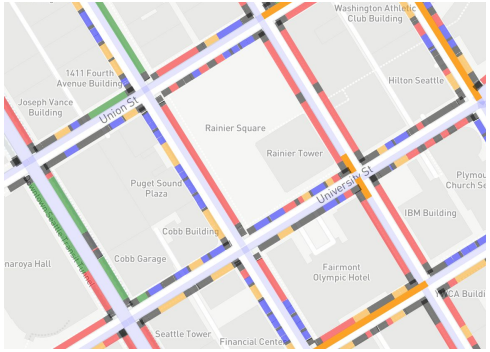
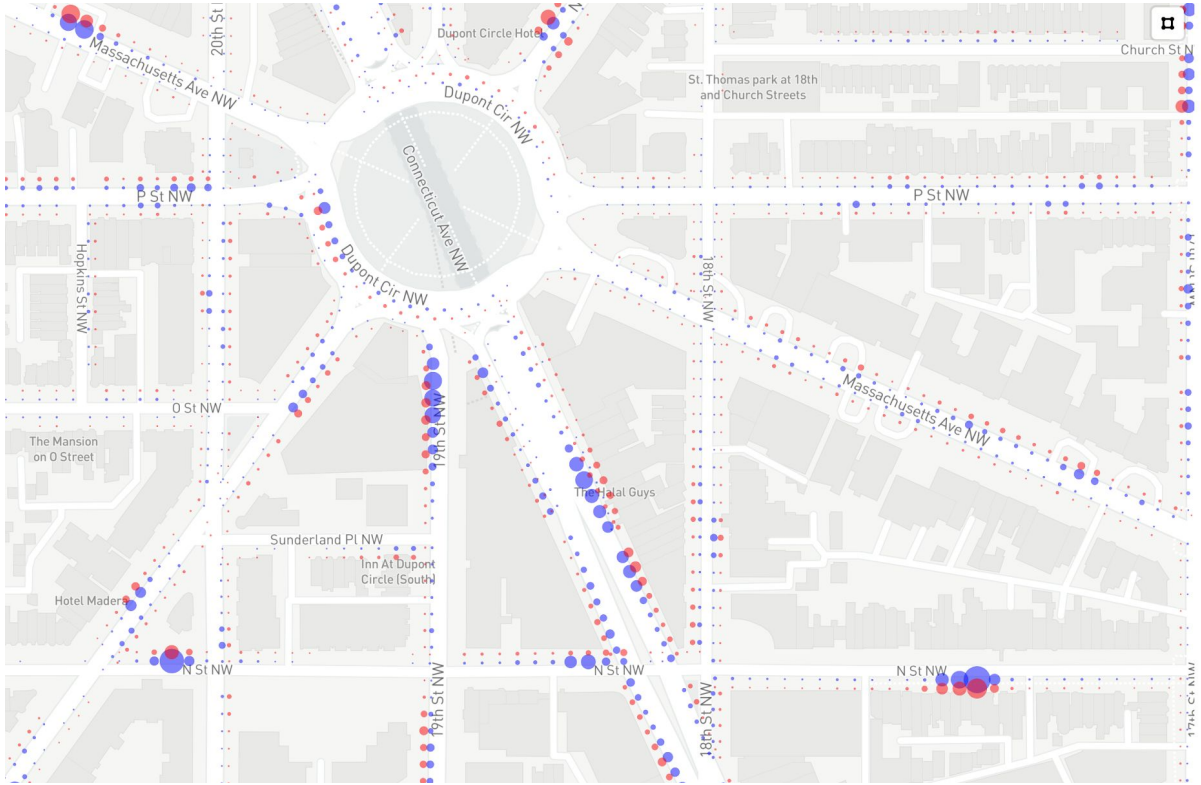


Speeds & Safety

Pilot: Pick-up and drop-off analysis

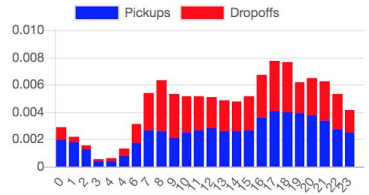
Partnership with TNCs to share aggregated data



SharedStreets

Pickup/Dropoff Analysis

Query by drawing polygon using the selector tool in map.



Display:

Hourly Average Count

Hours: 0-23

(hours as range e.g. 0-23 or 18-02)

Days of week:

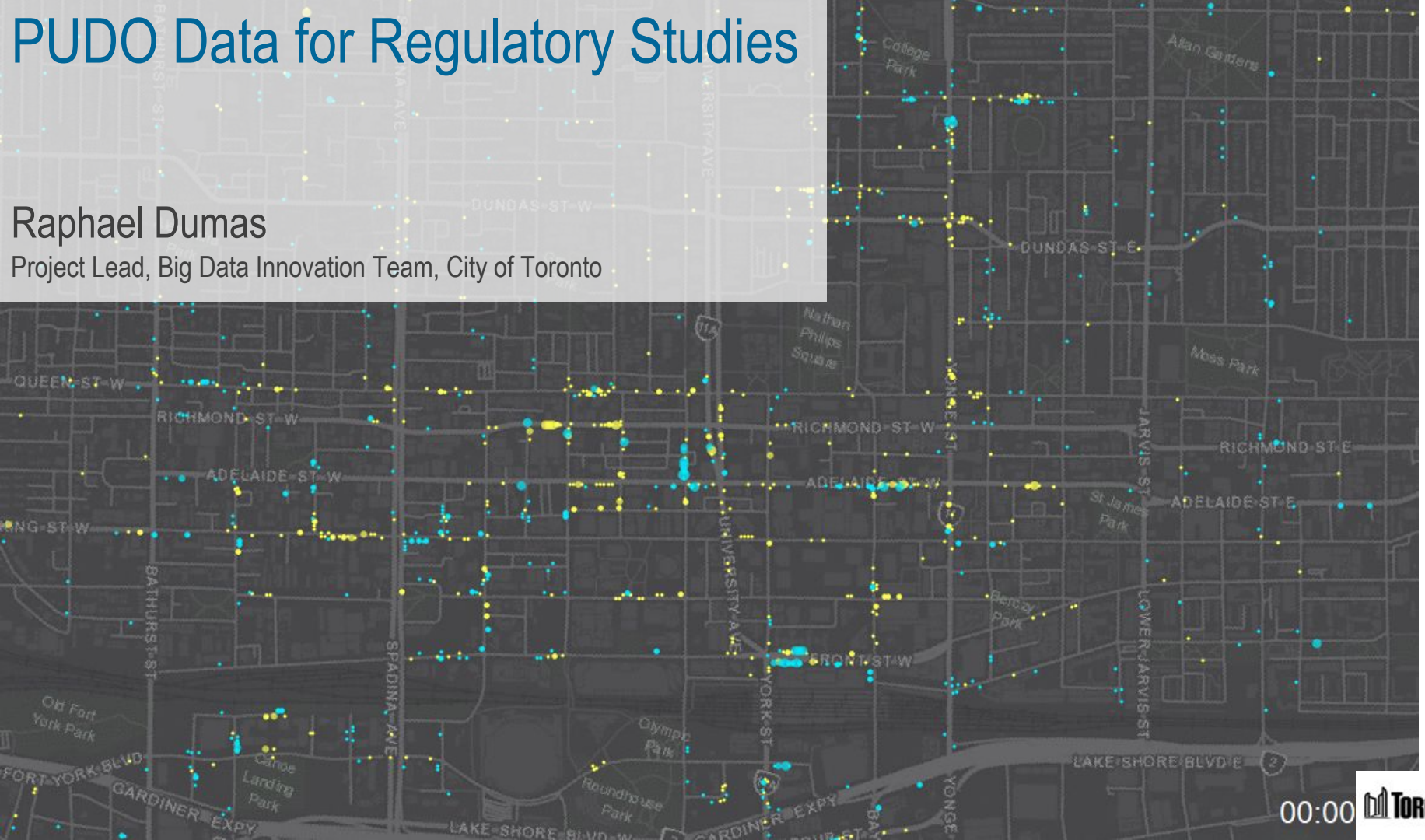
☑ Mon ☑ Tue ☑ Wed ☑ Thu ☑ Fri ☑ Sat ☑ Sun

Weeks:

☐ 2017-09-11 ☐ 2017-12-11 ☐ 2018-01-29
☐ 2018-03-12 ☐ 2018-04-30 ☐ 2018-06-11
☐ 2018-07-30 ☑ 2018-09-10

PUDO Data for Regulatory Studies

Raphael Dumas
Project Lead, Big Data Innovation Team, City of Toronto



Transportation Impact Study of Vehicle-for-Hire

- The Big Data Innovation Team worked with MLS and the University of Toronto Transportation Research Institute on the VFH by-law review, which regulates taxicabs, limousines, and private transportation companies such as Uber and Lyft.

- The purpose of this report was to explore:
  - What are the trends and patterns in vehicle-for-hire travel?
  - How has this travel impacted the transportation network?
  - What are the impacts on travel demands and travel choices?

Assessing the Curbside Impacts of VFH

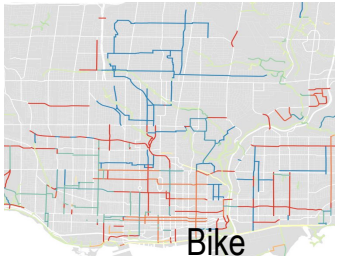
- We wanted to answer the following questions on curbside impacts:
    - Where are the hotspots of activities around curbside regulations?
    - What are the policy implications on curbside management?
    - What are the localized impacts of pick-up and drop-off activities?

Pick-up & Drop-off (PUDO) data

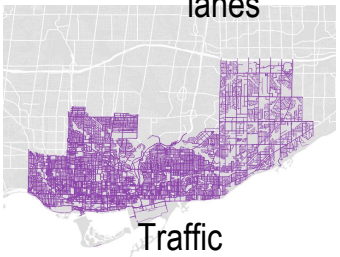
- Curbside pick-up and drop-off data were acquired using SharedStreets as a broker in partnership with Uber and Lyft
  - Temporal Resolution: minimum 1 hour (9 weeks in 2018 from Jan – Sep)
  - Spatial Resolution: 10m
  - Extent: City of Toronto

- Threshold for number of trips to avoid this data being personally identifiable
- GPS signals are not precise enough to determine side of street on one-way street, all pick-up and drop-off activities on either side of those streets will be aggregated to the right hand side

How We Use PUDO Data



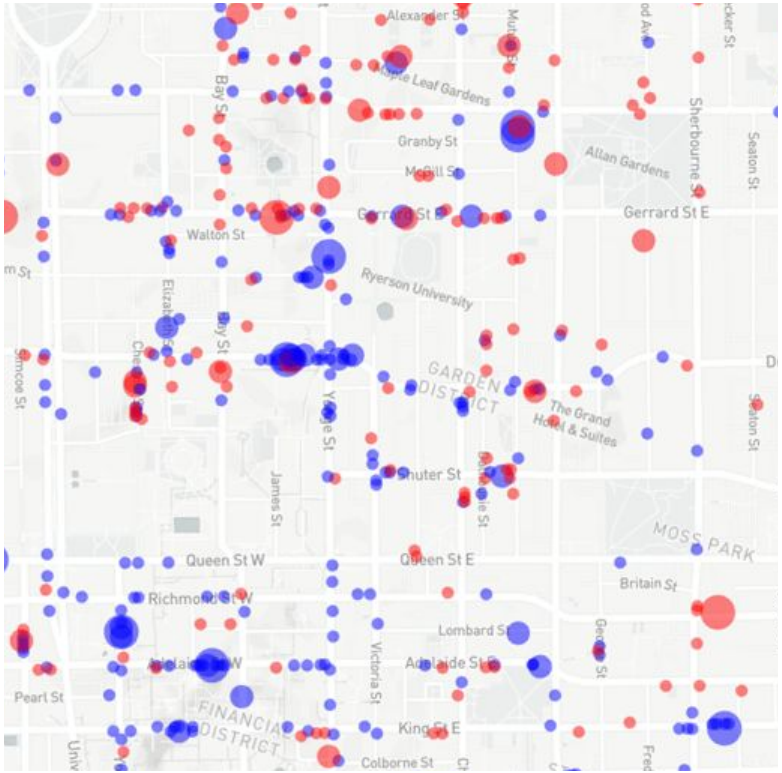
Bike lanes



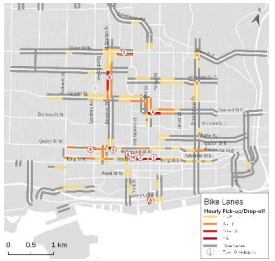
Traffic By-law

date	time	day	station	code	min_delay
date	time without time zone	text	text	text	integer
2018-01-01	00:29:00	Monday	SHEPPARD WEST STATION	MUATC	10
2018-01-01	01:07:00	Monday	DUNDAS STATION	MUNCA	0
2018-01-01	01:22:00	Monday	MUSEUM STATION	MUSC	0
2018-01-01	01:28:00	Monday	BAY LOWER	EUOE	0
2018-01-01	01:39:00	Monday	MUSEUM STATION	MUO	6
2018-01-01	02:00:00	Monday	BLOOR DANFORTH SUBWAY	MUBD	0
2018-01-01	02:09:00	Monday	KIPLING STATION	MUSAN	3
2018-01-01	02:32:00	Monday	UNION STATION	MUIS	0
2018-01-01	02:42:00	Monday	COLLEGE STATION	SUDP	7
2018-01-01	02:48:00	Monday	KIPLING STATION	SUDP	0
2018-01-01	03:06:00	Monday	WARDEN STATION	MUI	3
2018-01-01	03:12:00	Monday	WILSON BRD	EUOE	0
2018-01-01	04:38:00	Monday	[illegible]	TMVS	0
2018-01-01	07:55:00	Monday	DONLANDS STATION	TUNOA	4

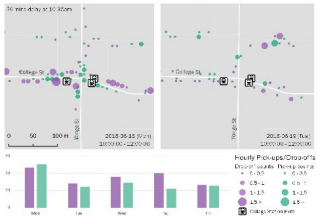
TTC subway delay



PUDO hotspots near bike lanes



PUDO hotspots near no-stopping zone



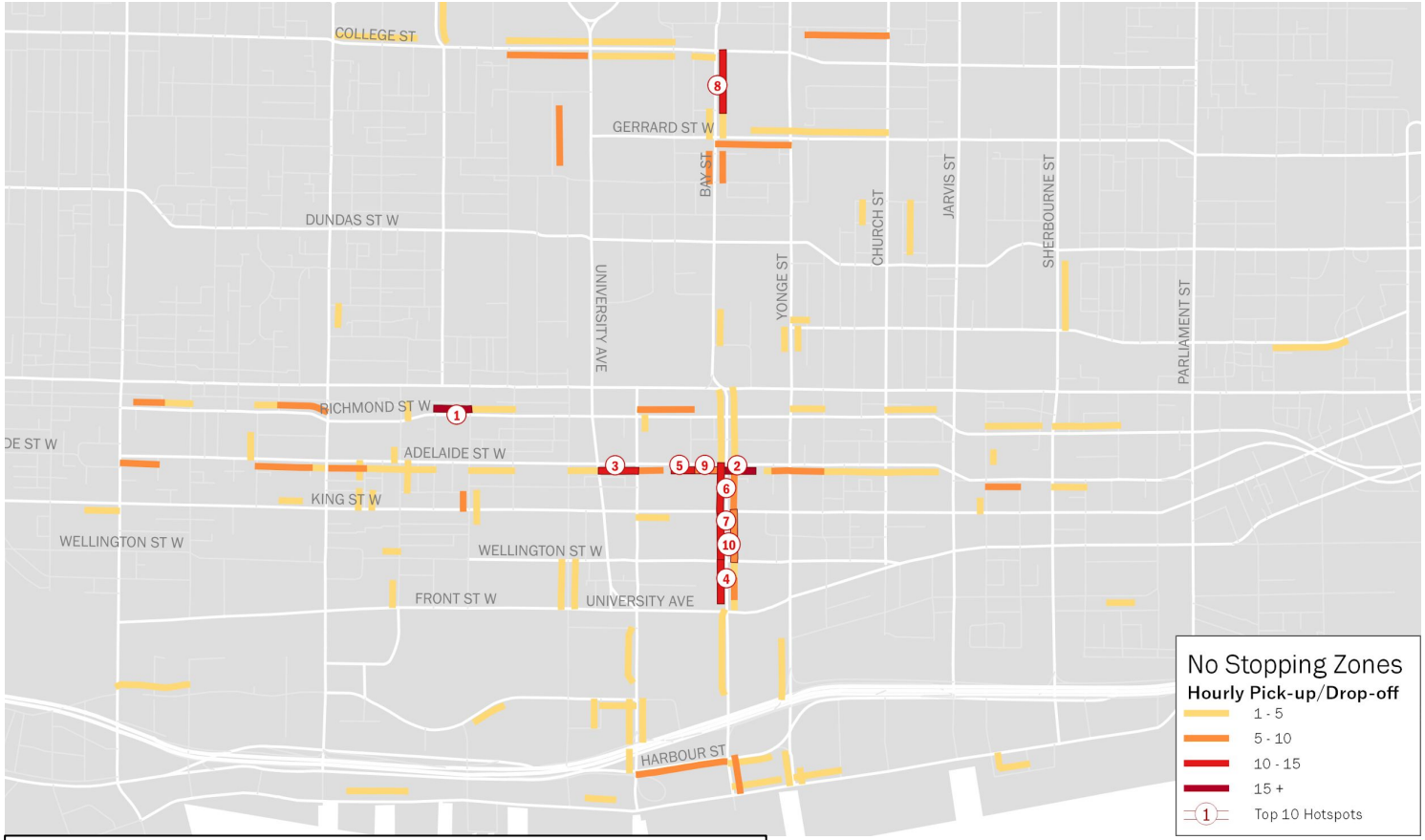
PUDO activity during subway delay

PUDO Activity Near Bike Facilities

Hotspots of Pick-up/Drop-off activity near Bike Lanes (7 A.M. to 7 P.M.)

TORONTO

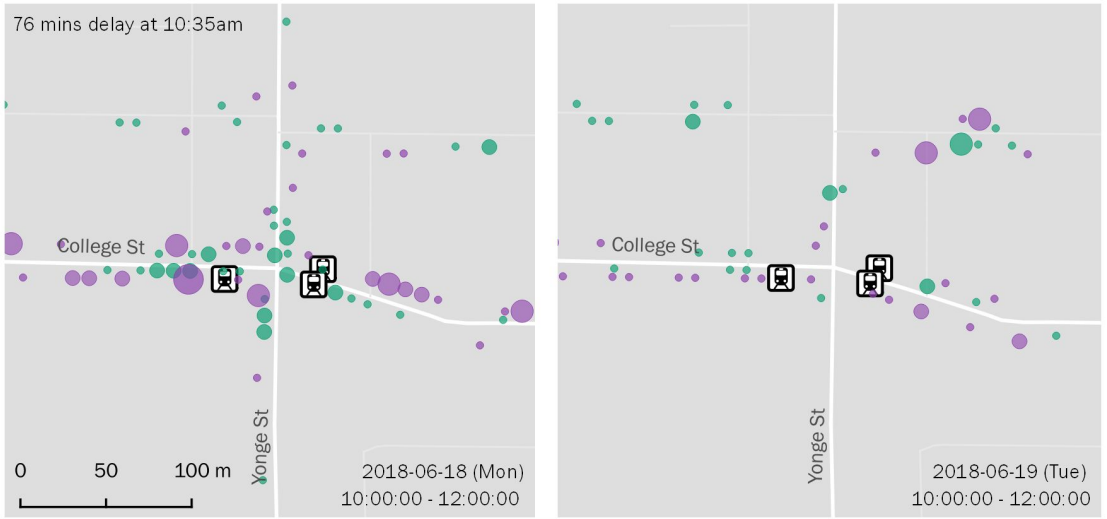
PUDO Activity in No-Stopping Zones

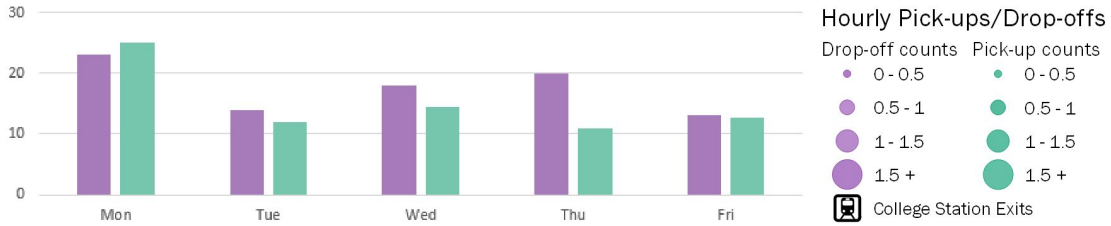


Hotspots of Pick-up/Drop-off activity in No-Stopping areas (7 to 10 A.M.)

TORONTO

PUDO During a Subway Delay





- PTCs are often an alternative to transit users during transit service disruption
- We can look at pudo activity during subway disruption to understand what extent this alternative is being utilized
- There is a large increase of pudo activity on June 18, 2018 at College Station after a 76 min delay relative to the same period the following day
- While PTCs services can increase the resiliency of the transportation network, when shuttle buses are dispatched for delays, the resulting increased PTCs activity may also disrupt their operation

TORONTO

Nightlife to Network:
Piloting “PUDO” Zones in the District of Columbia

Stephanie Dock, Research Program Administrator
District Department of Transportation

NACTO Designing Cities 2019

Connecticut Avenue Nightlife Restriction Pilot

Connecticut Ave./Dupont Circle is a well established nightlife destination

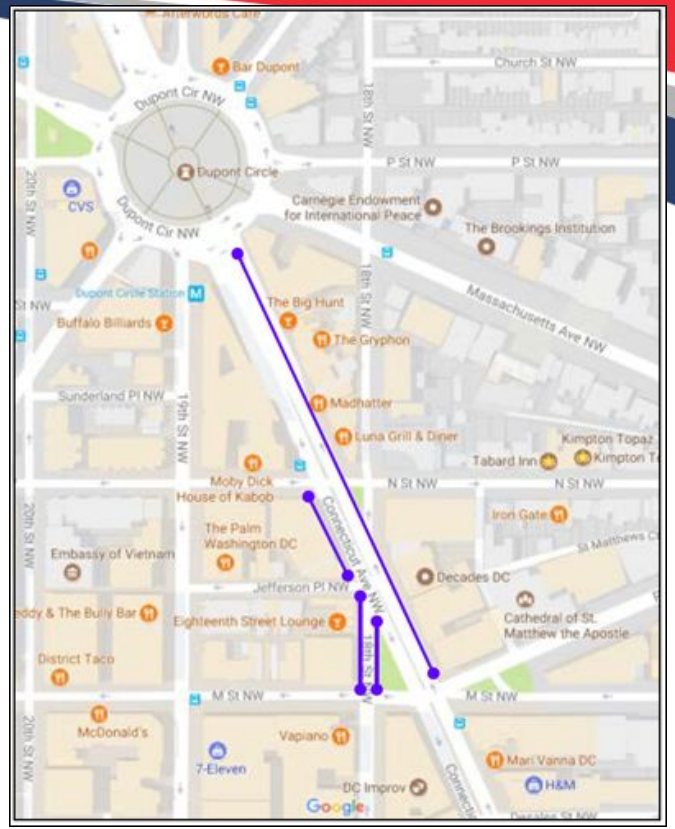
Key Concerns:

- ➔ Illegal/unsafe passenger loading and ride hailing from travel lanes
- ➔ Congestion and potential for crashes

Root Cause: Cheap and unrestricted parking along corridor

Solution: No Parking Thurs-Sat 10pm-7am

Pilot launched Oct. 2017, towing enforcement added later



Pick-up/Drop-off (PUDO) Zone Pilot

Success of the nightlife pilot → standardize the PUDO Zone concept

- Worked with Shared Streets to begin identifying high PUDO locations for TNCs.
- Collaborated with partners to develop new signage and enforcement protocol

Objectives

1. Safety: facilitate safe and efficient movement of people and goods to and from the curbside
2. Curbside Efficiency and Utilization: reduce curbside turnover time, decrease queue lengths, and increase trip completion
3. Traffic Control: make space for all modes to interact with the curbside while improving throughput

Pick-up/Drop-off (PUDO) Zone Pilot

New Considerations

- Complete removal of metered parking (clear curb)
- Simple, concise regulations and signage
  - Created new violation for parking in PUDO zones
  - Higher fine $35 □ $75
- Commercial loading allowed
  - OK in No Parking zone
- Use of “blades” (below) to make context-sensitive variations

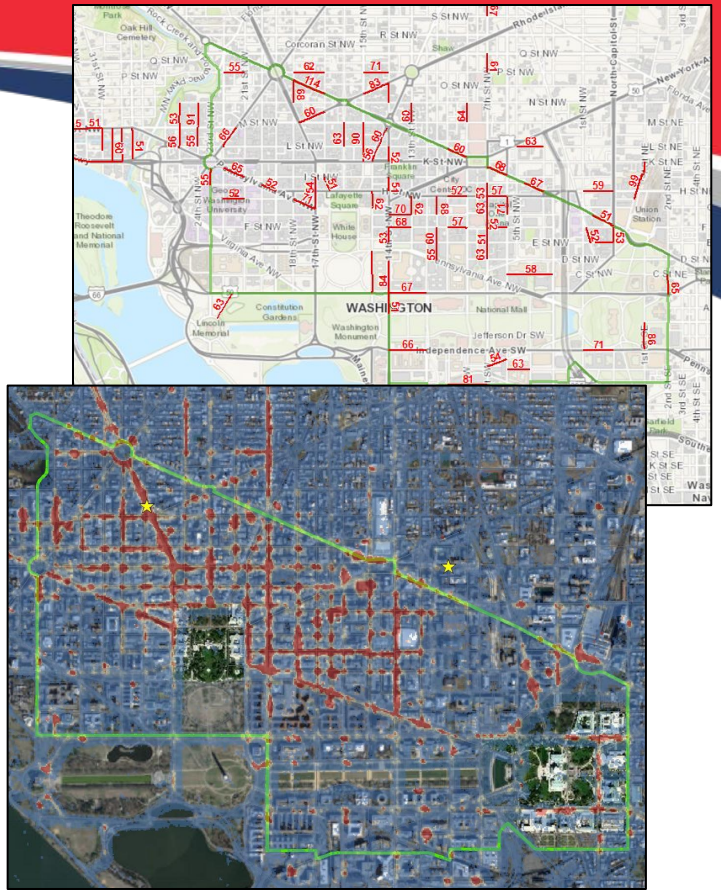
Pick-up/Drop-off (PUDO) Zone Pilot

Formalization of Site Selection Process

- Shared Street data is primary source for new locations
  - TNC activity was aggregated by block
  - Top 100 blocks in the District ranked by activity (8am-8pm)

- Additional Data

Quantitative data	Qualitative data
Taxi and TNC pick-up/drop-off	Land Use and Zoning
Crash data	Neighborhood Typology
Transit Availability	Development Plans
Parking Violations	Curbside Programming
Parking Meter Revenue and Turnover	Site Observation (illegal/dangerous activity such as blocking travel lanes)



Pick-up/Drop-off (PUDO) Zone Pilot

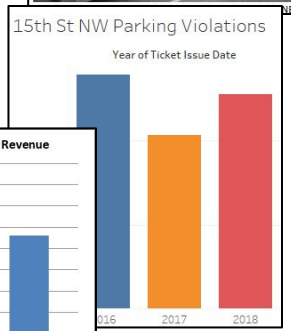
Formalization of Site Selection Process (cont.)

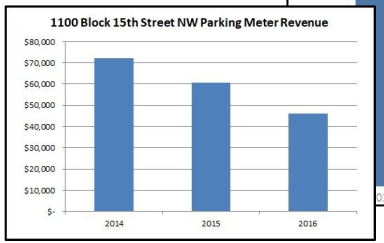
- DDOT developed an SOP with guidelines on evaluation of these locations.
- Site visits were conducted to confirm the curbside programming and observe pick-up/drop-off activity.
- Evaluations were produced in memos with recommendations about whether to deploy a PUDO zone

Existing Conditions

Land Use

This proposed pick-up/drop-off (PUDO) site is characterized as a "mixed-use/high-intensity" neighborhood, located near the edge of the central business district. The site is zoned for high-intensity commercial usage, and features a dense concentration of employers including CNN, Federal Energy Regulatory Commission, and World Resources Institute. The District of Columbia's Comprehensive Plan indicates future land use for this area will continue to be high-density commercial usage.





Summary Table

SOP Criteria	Data	Source
Neighborhood Typology/ Land Use	Mixed-Use/High-Intensity	DDOT Curbside Management Study
Daily TNC pick-ups/drop-offs	99	Shared Streets
Passengers per trip	**Undetermined**	Site Visit
Taxi/TNC dwell time	**Undetermined**	Site Visit
Annual Meter Revenue (block average, 2014-2016)	$14,072	Internal Data
Average Paid Parking Time (minutes, 2017-2019)	50.6	Internal Data
Average Annual Parking Violations (2016-2018)	342	Internal Data
Transit availability (1/4 mile)	2 Metro Stations, 2 DC Circulator stops, 12 Metrobus stops	Open Data DC
Current Curbside Programming	2 hour metered parking metered stands Monday-Saturday, 7am-6:30pm; No parking; No standing or parking	Site Visit
Illegal Activity (double-parking, blocking bike lanes)	Pick-ups in travel lane; double-parking	Site Visit
Street Furniture	Street trees; parking meters; lamp posts; trashcans	Site Visit
Lack of Assets (missing signs /meters)	On the 800 Block of 1st St NE, there is one parking meter for an area covering 3 car spaces. There clearly used to be another meter but it had been physically removed.	Site Visit
Stakeholders	Nearby commercial landlords; Union Station management;	Site Visit

Pick-up/Drop-off (PUDO) Zone Pilot

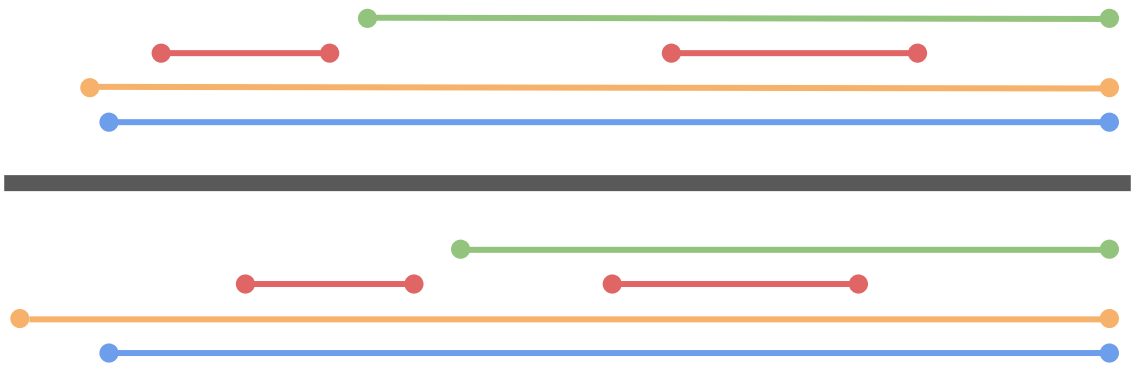
Findings

Evaluation and feedback from stakeholders confirmed that PUDO zones were successfully clearing the curb space and causing a reduction in illegal activities.

	Goal	Metric	Standard	Data Source
Ride hailing/Ridesharing	Lower dwell time at the curb during pick-up/drop-off	Dwell time (in seconds)	< 60 seconds	*DFHV or SharedStreets*
	Reduction in the number of empty TNC vehicles/taxies idling at the curb	Idling vehicles	0	*DFHV or SharedStreets*
	Improved average TNC/cab speed within a 3-block radius of the zone (under 20 miles/hour)	Travel speed (in MPH)	80 – 100 % of speed limit	*DFHV or SharedStreets*
	Improved uptake time* (*Data from TNCs*) * *time from vehicle arrival on pick-up block to arrival at the curbside*	Uptake time (in minutes)	< 120 seconds on streets with LOS of C or higher	*DFHV or SharedStreets*
Traffic Volume/Safety	Improved traffic flow in the area	LOS	At least one level improvement D or higher; at least two levels of improvement for E	TOSD
	Reduction in pedestrian/cyclist injuries	Injuries	0	MPD and Taras2 –Crash reporter data from WABA, Vision Zero Safety Map
	Decrease in illegal parking in the PUDO zone	Citations	10% reduction from previous quarter until 50% of historic average	DPW PEMA
	Improved bus on-time performance	On-time performance (in percent)	90% on time or better	TDD or WMATA

Pilot: Curb inventory

Mapping the curb



Difficulties: structured **regulation**, appropriate **geography**

Towards a “GTFS for the curb”

- Cities struggling to solve this problem
- Lots of companies and vendors springing up
- Proprietary methods in the absence of collaborative, open standards
- SharedStreets proposes an open standard (CurbLR)
  Developed with input from DC, Boston, Ford Mobility, civic tech

Start by mapping roadside assets, like signs and meters

● = **Resident permit parking,** Mo-Fr, 6pm-10am

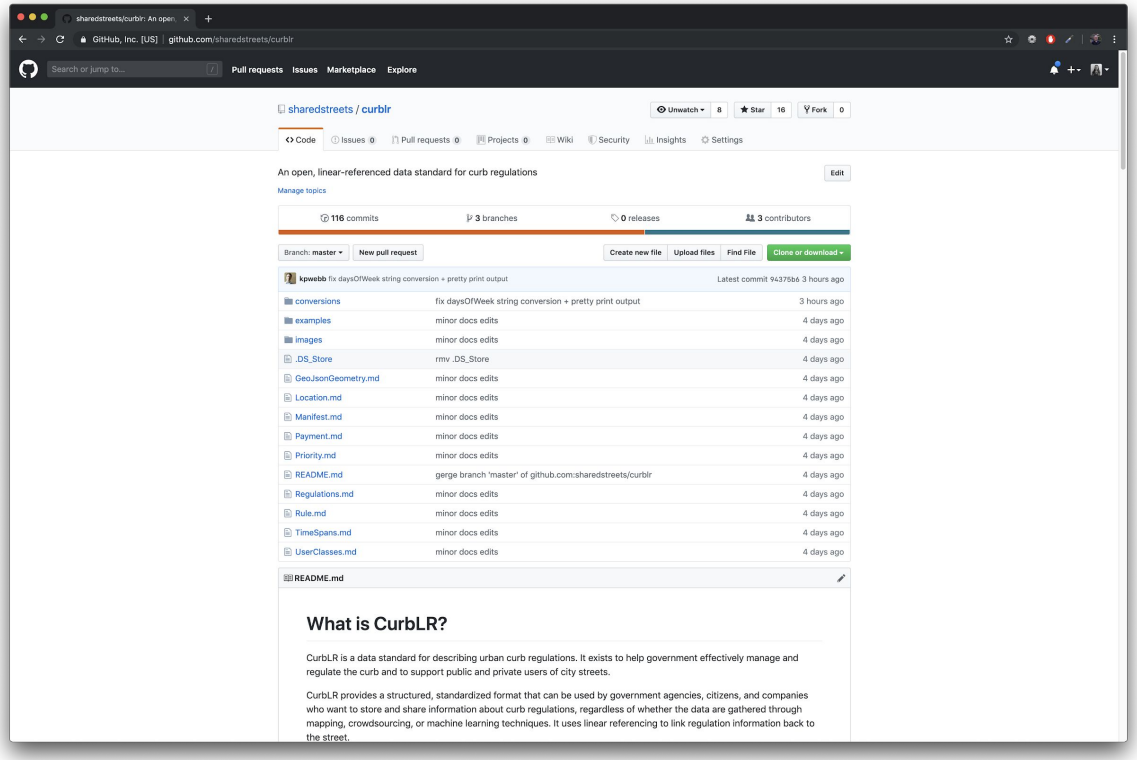
● = **Loading zone,** Mo-Fr, 9am-4pm; Sat, 9am-12pm

● = **Street cleaning,** 2nd & 4th Mo, Apr-Dec, 12-4pm

● = **Snow emergency zone**

Variety of ways to do this (high- and low-tech options)

CurbLR: A data standard for curb regulations

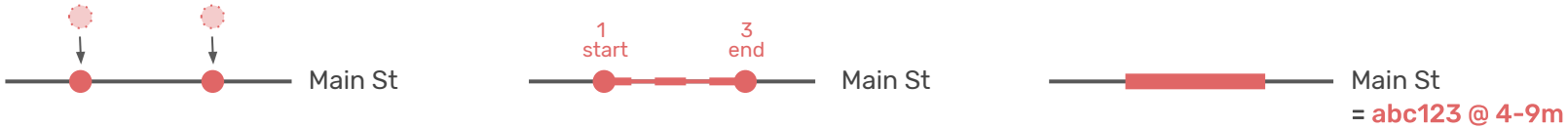


Available and fully documented on Github, with examples and sample data feeds

github.com/sharedstreets/curblr

Snap points to street, convert to street segments

Method 1: Sign relationships

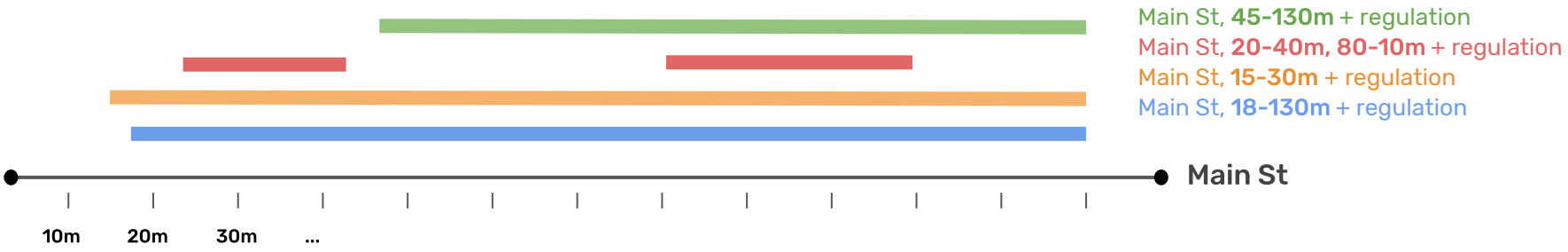


Method 2: Buffers

Processing tools available at: https://github.com/sharedstreets/sharedstreets-js

Output: Regulatory geometries

Street-linked, basemap agnostic



CurbLR: Towards a “GTFS for the curb”

Real world

CurbLR

```
{
 "type": "Feature",
 "geometry": {
  "type": "Point",
  "coordinates": [
    [-118.281634, 34.022709], [-118.281645, 34.022721]
  ]
 },
properties": {
  "location": {
    "shstRefId": "324af8ba918d9a2921b1fe6f9723d729",
    "shstLocationStart": 51.3,
    "shstLocationEnd": 65.1,
    "sideOfStreet": "left",
    "objectId": "23549",
    "derivedFrom": ["bw9d", "bd00", "ns93"],
    "marker": "meter",
    "streetName": "Lakeshore Dr"
    },
  "regulations": [
    {
      "rule": {
        "activity": "parking",
        "payment": true
      },
      "userClasses" : [
        {"classes": ["motorcycle"]}
      ],
      "timeSpans": [
        {
          "daysOfWeek": {
            "days": ["mo", "tu", "we", "th", "fr", "sa"]
          },
          "timesOfDay": [
            {"from": "09:00","to": "17:00"}
          ]
        }
      ],
      "payment" : {
        "fees": [0.25],
        "durations": [15],
        "methods": ["meter", "digital"],
        "operator": "City of Kelowna",
        "deviceIds": ["3820"],
      },
      "priority": 4
    }
  ]
 }
}
```

Geometry

Location

Regulations

Rule

UserClasses

TimeSpans

Payment

Priority

Signs Will Guide Your ~~Way~~ Curb

Stephanie Dock, Research Program Administrator
District Department of Transportation

NACTO Designing Cities 2019

Where Can I Park?

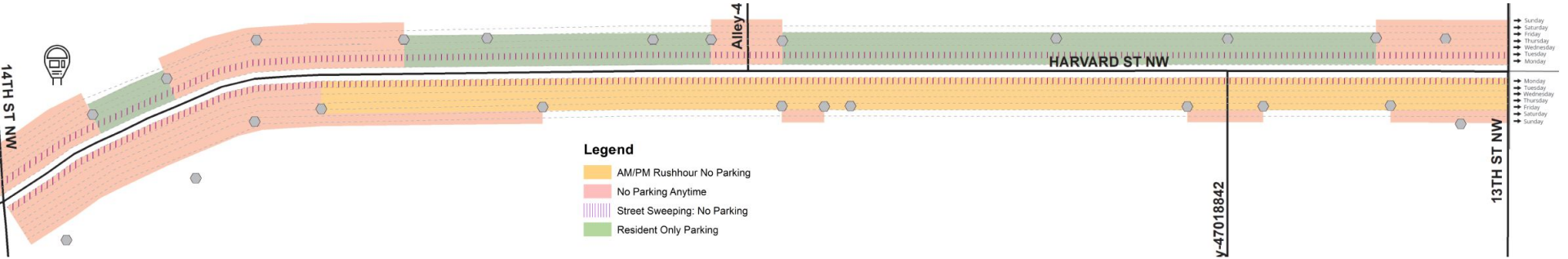
The Dream: a rich and detailed parking zone GIS

Our Approach: map the signs, not the zones

The Benefits:

1. Sign asset maintainers know exactly what their inventory is at any point in time.
2. Curb/parking zone data can be easily extracted.
3. Inform other analyses that interact with the curb.

The Result: Mapped Zones



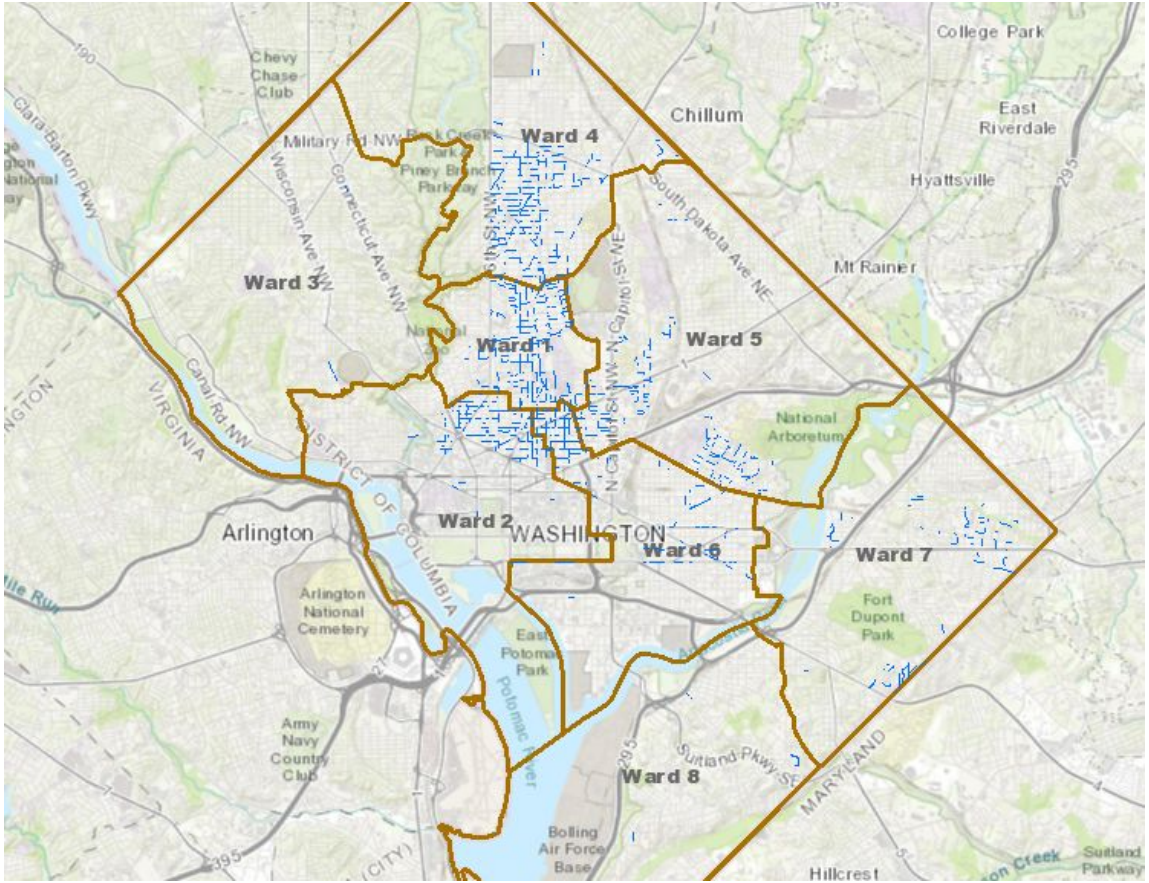
SignWorks: Keeping the Inventory Alive

Signworks is a GIS-based inventory management system built for managing signs.

Signworks Inventory is a simple, straightforward GIS web editing application that is intended for DDOT staff to update and correct the GIS sign inventory. Currently can explore our signage from your desktop.

Signworks Requests is a GIS-based sign inventory request system built for requesting signs. It is meant as a replacement to the manual 'Shop Order' with workflow processes notifies appropriate reviewers. Once complete, request is packaged up and sent to Cityworks for fabrication and installation in the field.

Another Example: Street Sweeping



https://arcg.is/qmqzX

Visualizing Curb Data

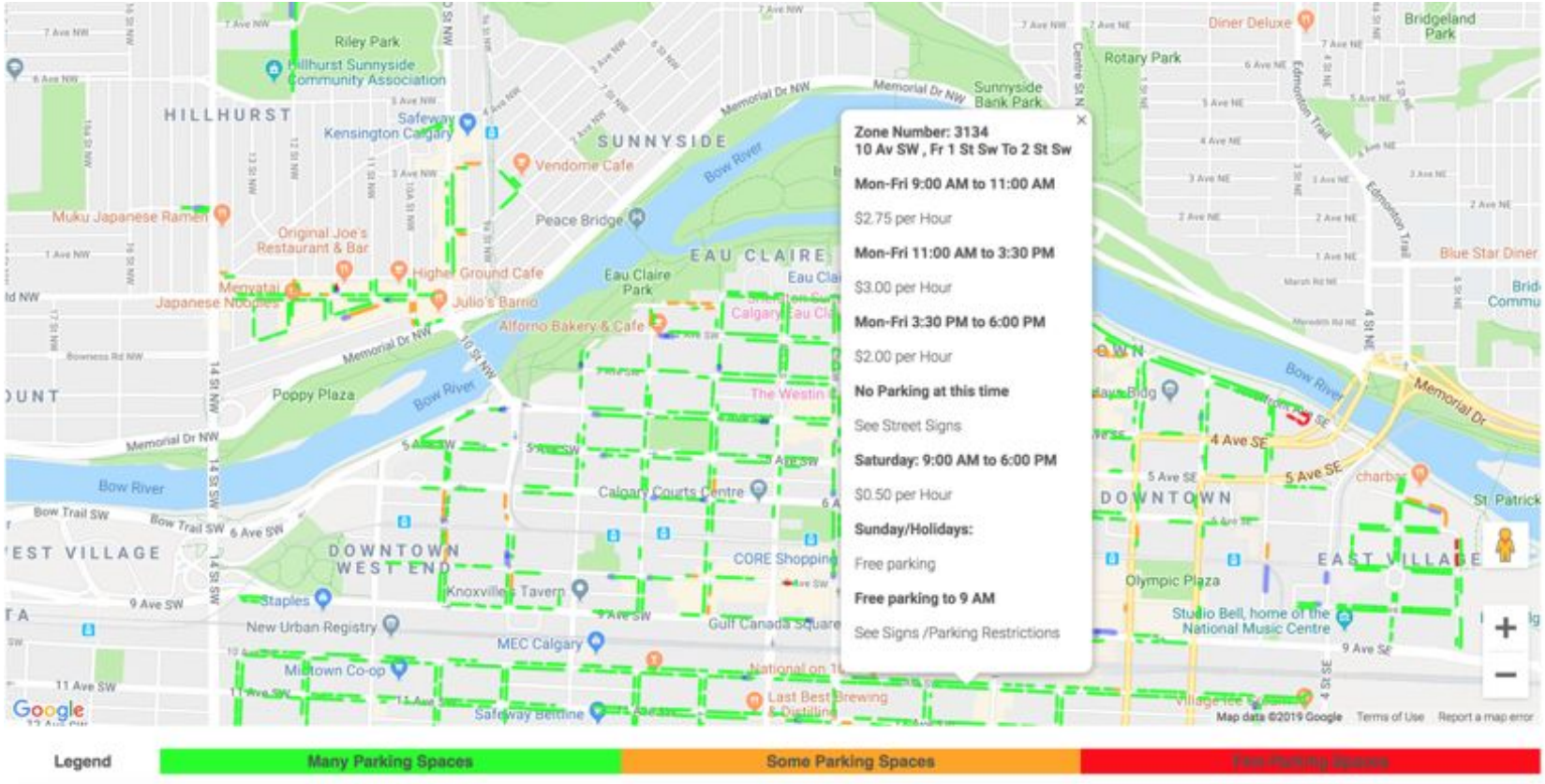
Saadiq Mohiuddin

Project Engineer, City of Calgary

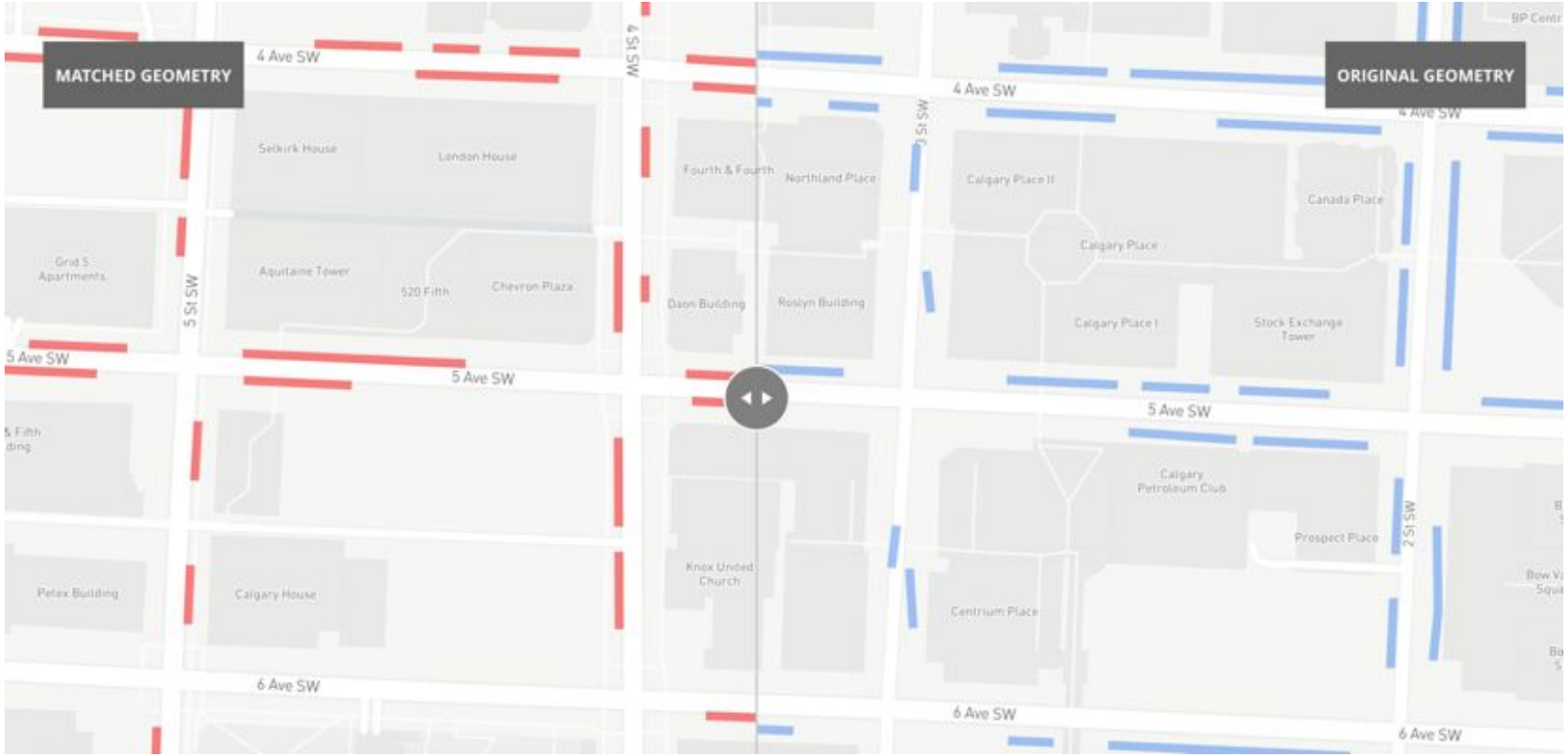
Objectives

- Explore how TNC pick up/drop off, taxi zone and vehicle ‘roaming’ interact with transit (bus) performance at certain intersections
- Inventory of curbs and rules to find potential problem areas and opportunities
- Quickly pilot CurbLR spec on existing dataset of on-street parking regulations
- Create curb rule database, API and visualization using open source tools

On-Street Parking Data



Matching to Shared Streets



Translating data to CurbLR Spec

```
"regulations": [
  {
    "rule": {
      "activity": "parking",
      "payment": true
    },

    "userClasses" : [
      {"classes": ["motorcycle"]}
    ],

    "timeSpans": [
      {
        "daysOfWeek": {
          "days": ["mo", "tu", "we", "th", "fr", "sa"]
        },
        "timesOfDay": [
          {"from": "09:00","to": "17:00"}
        ]
      }
    ],

    "payment" : {
      "fees": [0.25],
      "durations": [15],
      "methods": ["meter", "digital"],
      "operator": "City of Kelowna",
      "deviceIds": ["3820"],
    },

    "priority": 4
  }
]
```

Rule

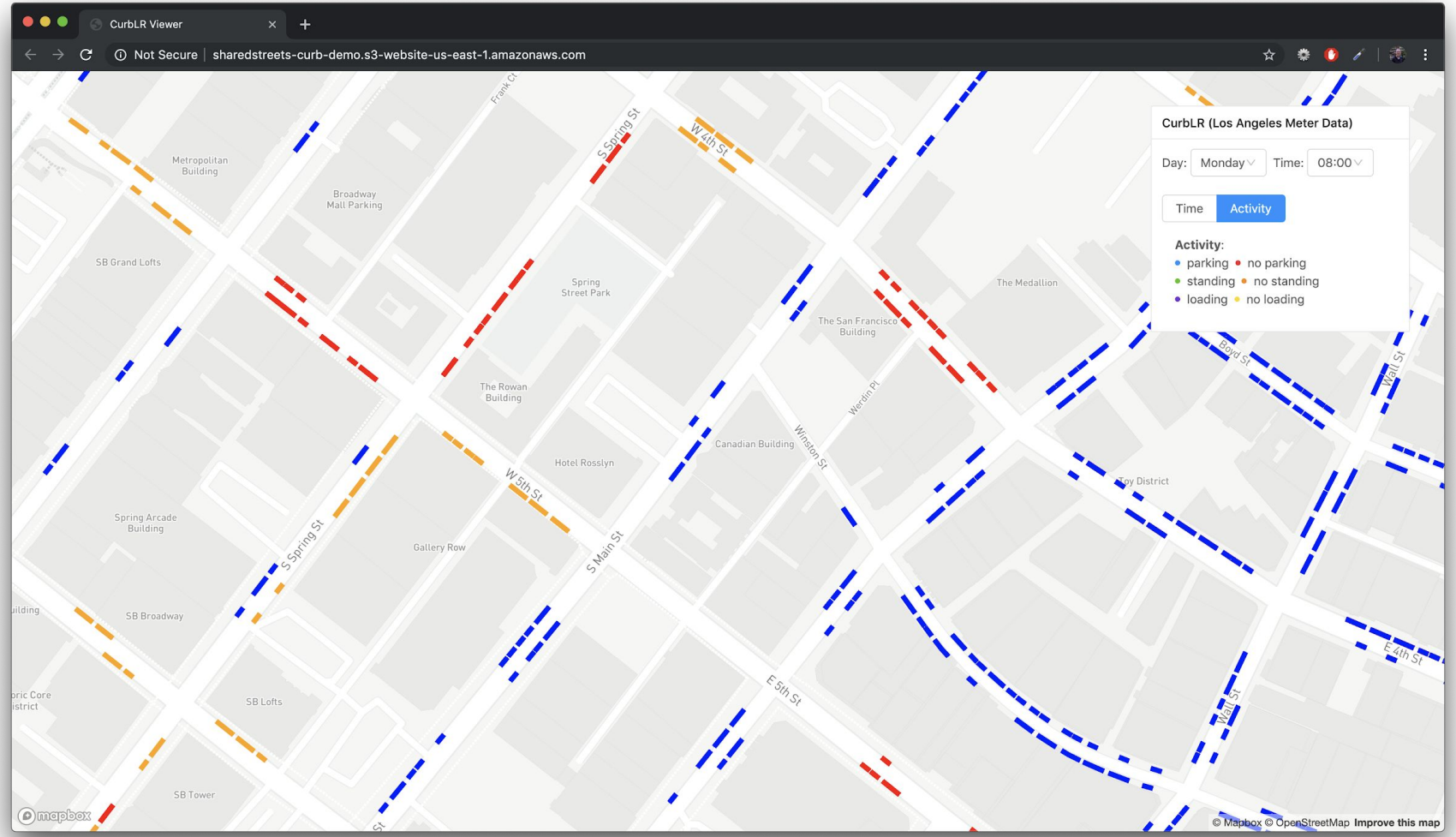
UserClasses

TimeSpans

Payment

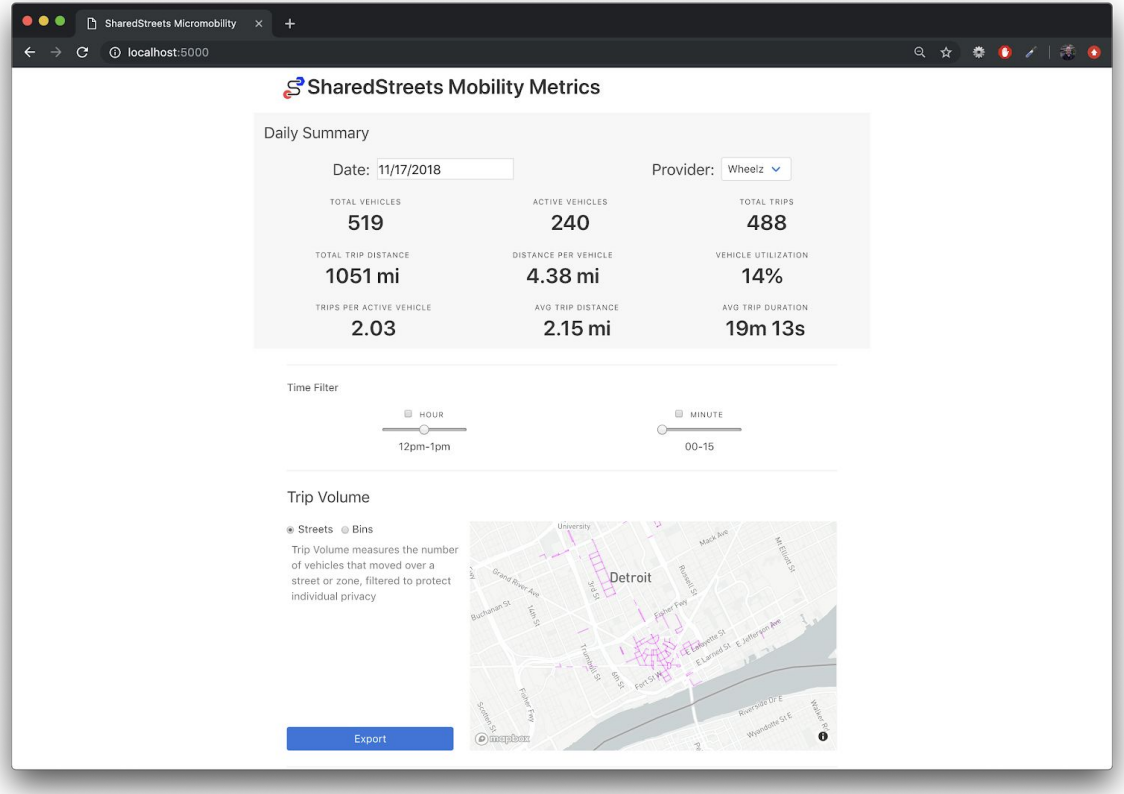
Priority

On-Street Parking Rules Map
Click on the filters below to see parking class type and rates in Calgary
Parking Class
Parking Rate
Monday
10:00
Passenger Vehicle
Loading Zone
Taxi Zone
Calgary Transit Access
Impark Lot 305
Sheraton Suites Calgary Eau Claire
Impark Lot 214
Eau Claire Manor
Shaw Court
Centennial Place — East Tower
The Old Spaghetti Factory
Regency Suites Hotel Calgary
Caesar's Steakhouse
The Westin Calgary
International Hotel Calgary
Sushi Hiro
Indigo Lot 226 — Pacific Parkade
Gyu-Kaku
Local 522
Redwater Rustic Grill
First Canadian Centre
2 Ave SW
3 Ave SW
4 Ave SW
5 Ave SW
6 Ave SW
1 St SW
2 St SW
3 St SW
4 St SW
5 St SW
6 St SW
7 St SW
mapbox
© Mapbox © OpenStreetMap


CurbLR Viewer
Not Secure | sharedstreets-curb-demo.s3-website-us-east-1.amazonaws.com
CurbLR (Los Angeles Meter Data)
Day: Monday
Time: 08:00
Time
Activity
Activity:
parking
no parking
standing
no standing
loading
no loading
Metropolitan Building
Broadway Mall Parking
SB Grand Lofts
Spring Street Park
The Rowan Building
Hotel Rosslyn
Spring Arcade Building
Gallery Row
SB Broadway
SB Lofts
SB Tower
The Medallion
The San Francisco Building
Canadian Building
Toy District
S Spring St
W 4th St
W 5th St
S Main St
Winston St
Werdin Pl
Boyd St
Wall St
E 5th St
E 4th St
Frank Ct
mapbox
© Mapbox © OpenStreetMap Improve this map

Pilot: Mobility Metrics

Turns micromobility data into useful metrics and maps



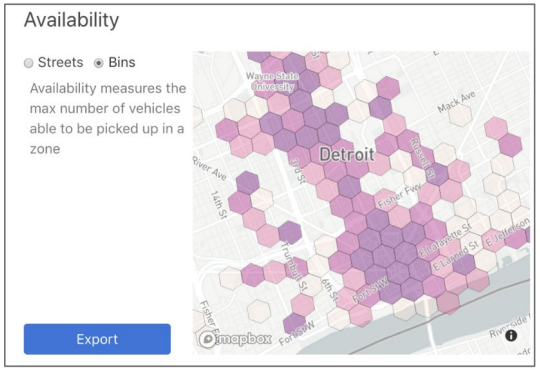
Open source, free,
locally-hosted tool

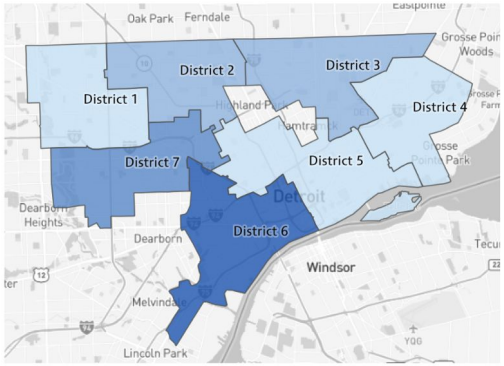
Can be set up and used today

Interactive demo:
https://awesome-newton-0de91b.netlify.com/

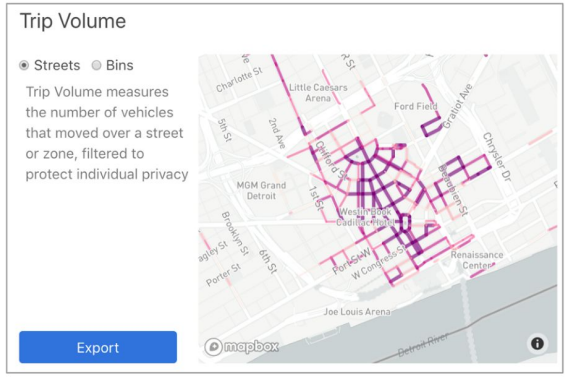
Software code:
github.com/sharedstreets/mobility-metrics

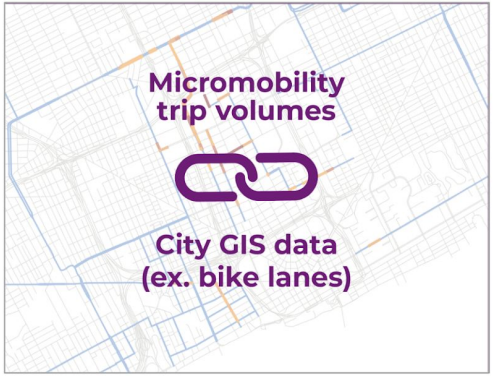
From raw MDS data: → To area-based metrics: → To custom areas:



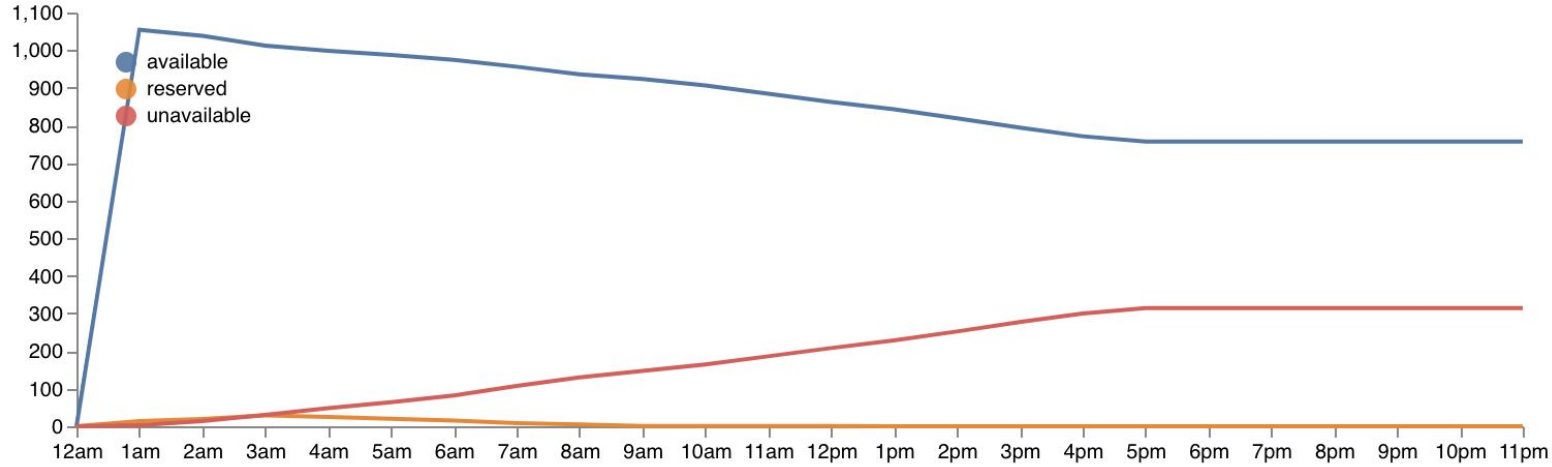


From raw MDS data: → To street-based metrics: → To linked GIS layers:





Fleet Size


1,100
1,000
900
800
700
600
500
400
300
200
100
0
available
reserved
unavailable
12am
1am
2am
3am
4am
5am
6am
7am
8am
9am
10am
11am
12pm
1pm
2pm
3pm
4pm
5pm
6pm
7pm
8pm
9pm
10pm
11pm

City of Sacramento's Shared Scooter & Bike Management Using Data

Monitoring and fees

Number of devices (fee)

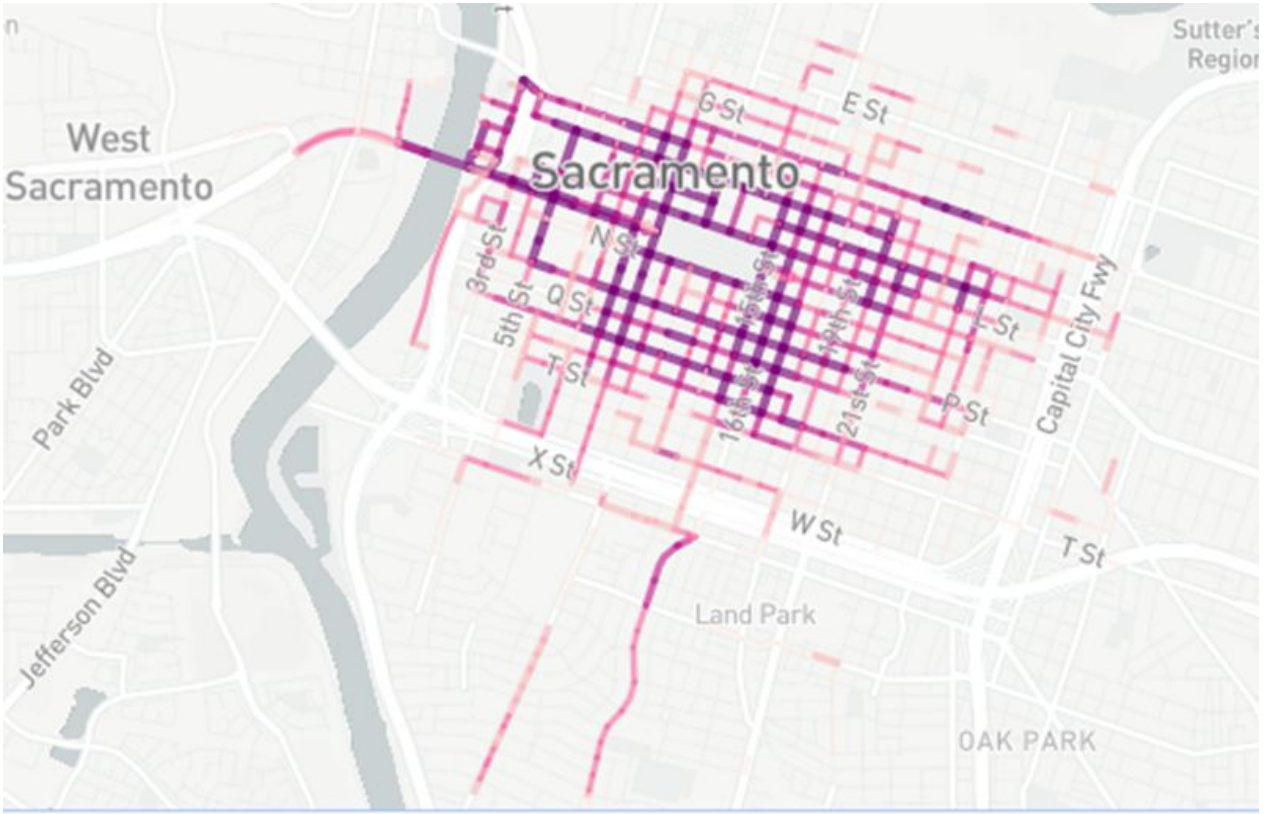
Number of trips (fee)

Where trips start/end (parking)

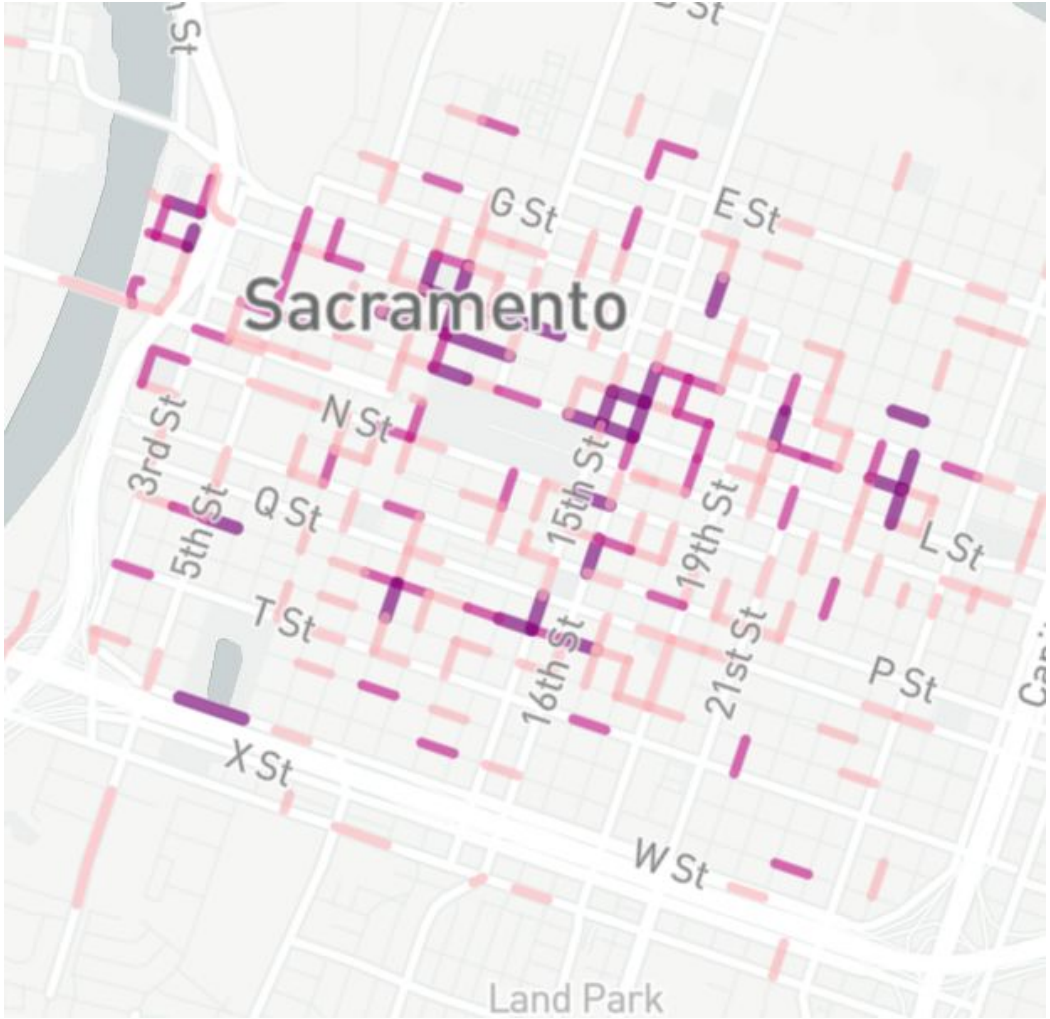
Ensure 20% equity (equity!)

Evaluate:

- Length of trip
- Start/end at Transit



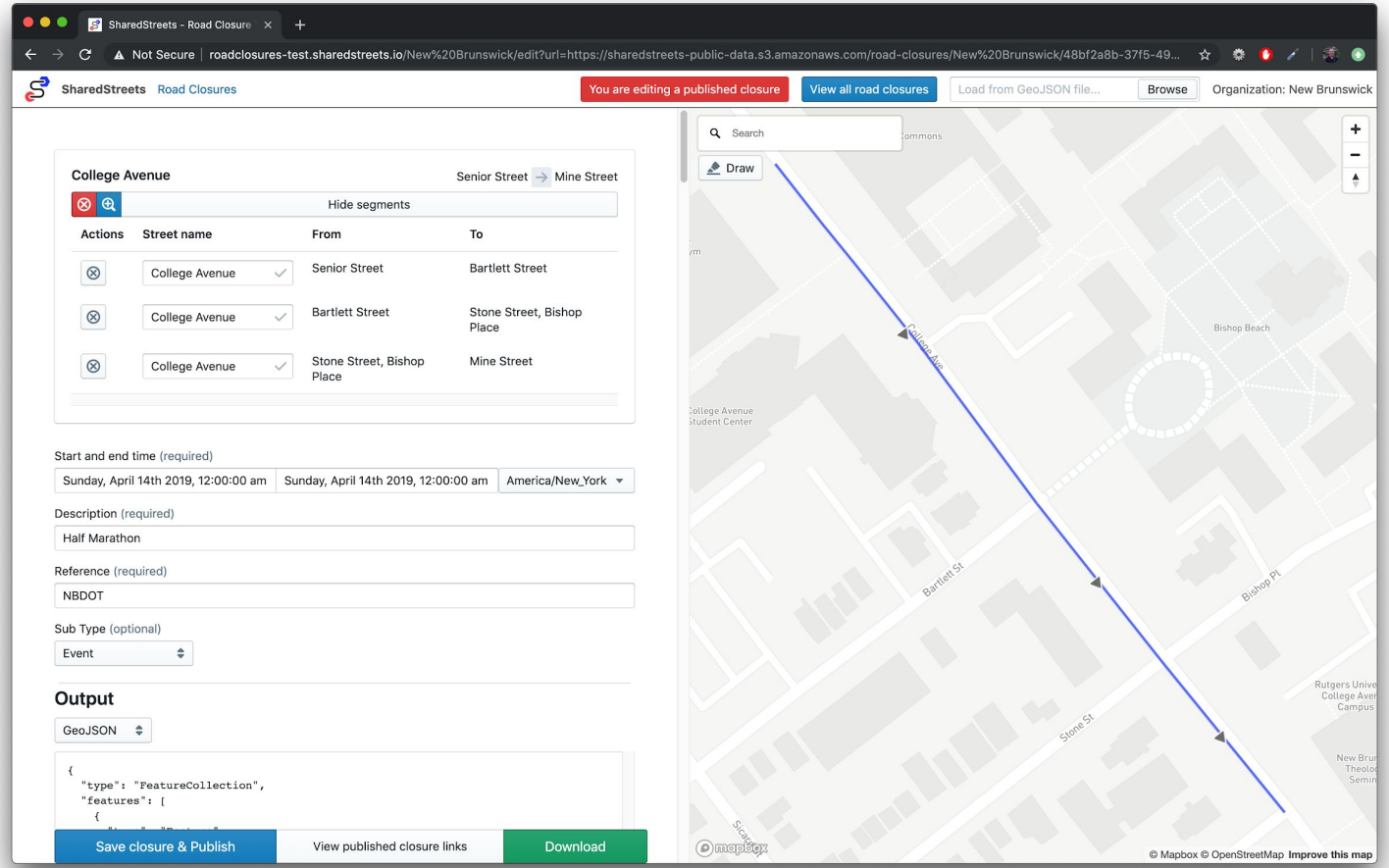
Number of Trips
Trip Activity



Trip End Locations

Respond To Need

Pilot: Construction and closures



SharedStreets Road Closures

Load from GeoJSON file... Browse

Start and end time (required)

Friday, September 6th 20 | Monday, September 9th 2 | America/Chicago

Schedule (optional)

Set a specific schedule for this closure within the specified range

Description (required)

SOTMUS Parad

Reference (required)

Enter the name of your organization here...

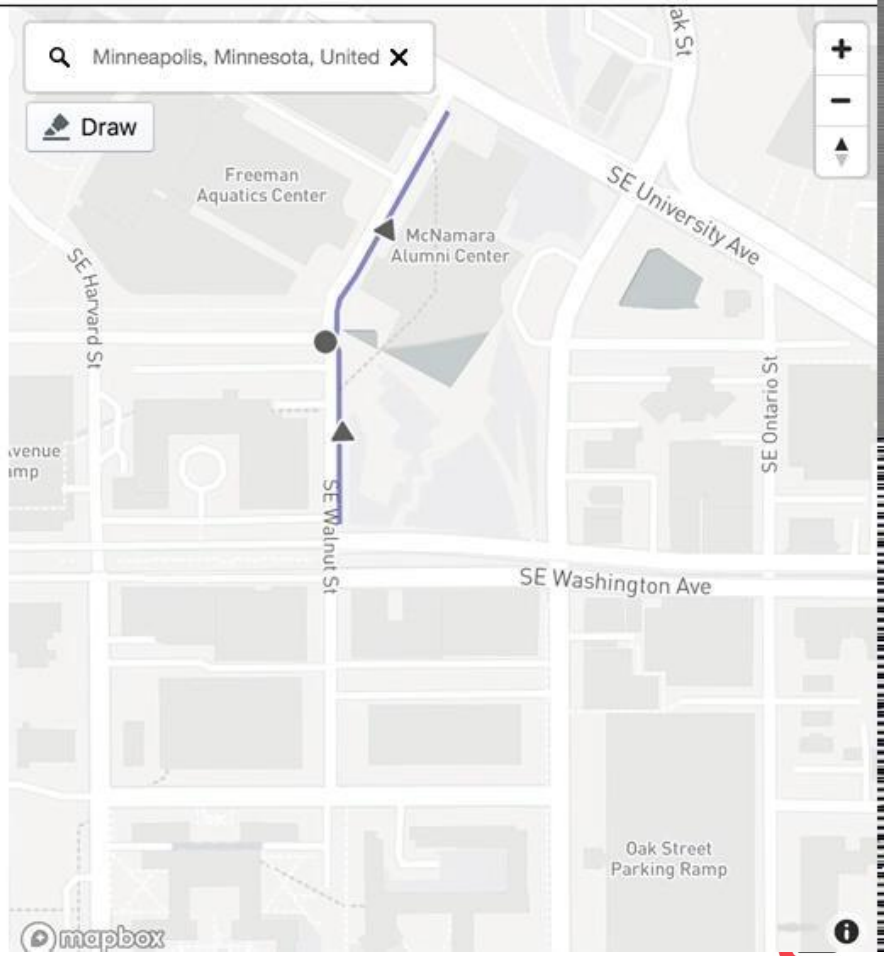
Sub Type (optional)

- ✓ Choose a subtype...
- Hazard
- Construction
- Event

Pedestrian

Bicycle

Download

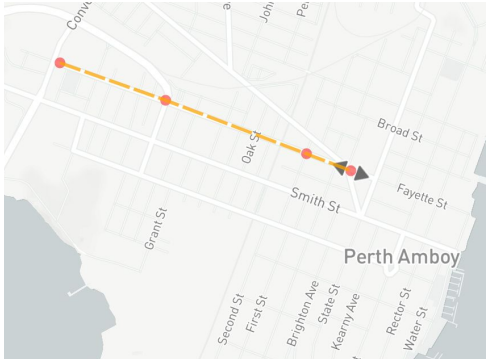


Breakout groups

SharedStreets areas of work

Map conflation

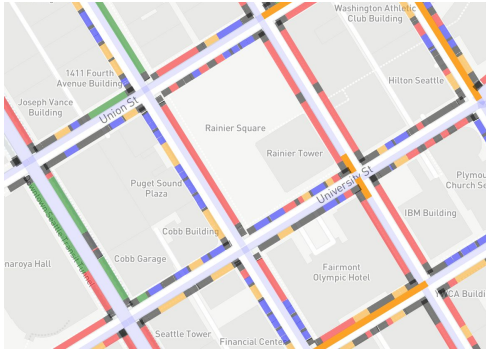
Construction & Closures



TNC Pick-up & Drop-off

Mobility Metrics

Curb Inventory



Speeds & Safety

Thanks!

@sharedstreetsio
mollie@transportpartnership.org