Air Quality Monitoring Along Cycling Infrastructure

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Alternate Title:
Mapping Pollution Exposure Along Detroit's Cycling Network

20C: Co-op Himmelblau and Hans Hollein

This is a DIY Pollution Exposure Project in Detroit.

Keywords / Topics:

— Monitoring **urban air quality**
— Auditing **cycling** infrastructure
— Citizen **activism and advocacy**
— Urban design **environmental justice**

Currently in the Pilot / Baseline study phase.

Research Goals

— Document **pollution exposure** while cycling (PM 2.5, carbon)
— **Visualize** relationship b/n pollution exposure + infrastructure
— Uncover anomalies, outliers, and **alternate routes**

Research Question

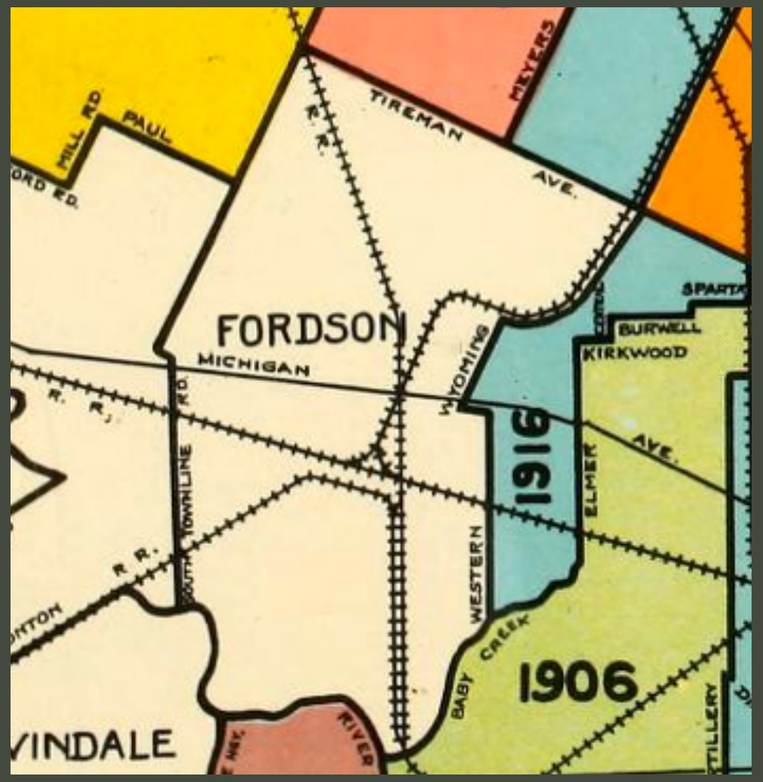
Given Detroit's air quality is a public health crisis[1,2,3], can our cycling network be modified to limit risk and ultimately influence urban form?

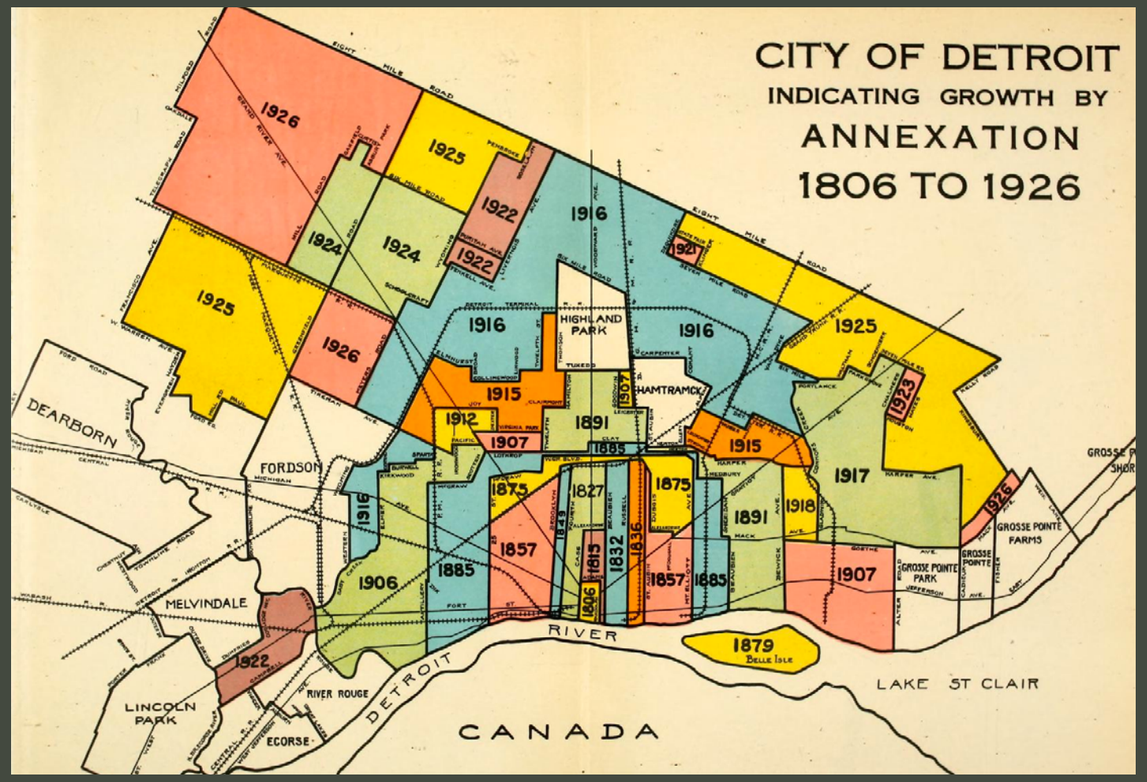
1. "Air Quality in Southwest Detroit: A Public Health Crisis." n.d. Accessed January 10, 2025. https://info.primarycare.hms.harvard.edu/perspectives/articles/air-quality-southwest-detroit.

2. Association, American Lung. n.d. "Detroit Metro Area Ranks 13th Worst in Nation for Annual Particle Pollution, According to the 2024 'State of the Air' Report." Accessed January 10, 2025. https://www.lung.org/media/press-releases/detroit-sota-fy23.

3. Yang, Zhiyi, Md Kamrul Islam, Tian Xia, and Stuart Batterman. 2023. "Apportionment of PM2.5 Sources across Sites and Time Periods: An Application and Update for Detroit, Michigan." Atmosphere 14 (3): 592. https://doi.org/10.3390/atmos14030592.

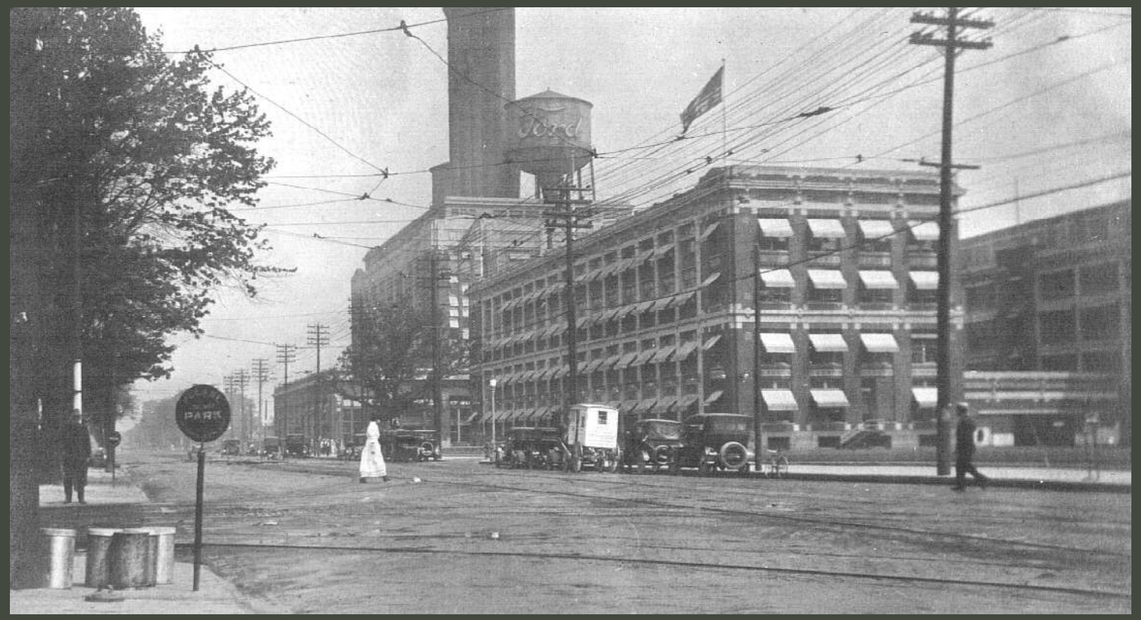
Background





Automobile Annex: Enclaves of manufacturing and influence

Background



Wikimedia Commons

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The Motor City: Highland Park & Single Family Homes in Detroit

Background

THE GREAT

"E. & D."

BICYCLES.

We are now having all our orders for these wheels (both Ladies' and Gentlemen's) filled promptly. The demand up to the present time has far exceeded the supply, but with increased facilities all orders can now be filled. Intending purchasers should at once send for an ARTISTIC CATALOGUE which will better explain the new and very important improvements of the E. & D, which make it the perfect wheel—a Bicycle built to last a lifetime. Mechanical experts and Bicycle enthusiasts go into ecstacies over this graceful, substantial, strongly constructed wheel. Its every point is suggestive of the thoroughbred, and its riders are the aristocrats of the cinder path and the tourist roads.

THE IRA CORNWALL CO., Ltd., Gen'l Agents for Maritime Provinces, 68 King Street, St. John, N. B.

A SPLENDID

Canadian Bicycle.

The Canadians seem to be coming to the front in new lines every day. This time it Bicycles. The Canadian Typograph Co. of Windsor, Ontario have established a large factory at that town for the manufacture of what is known as the Evans and Dodge wheel which is fully claimed as the "best in the world."

This explains why the "E. & D." can be driven as easily with a 6 1-2 INCH CRANK AND GEARED TO 80 as any other wheel with a 7 INCH CRANK GEARED TO 66.

It is Dust and Oil Proof Throughout.

It has the Morse Chain, which requires no oil and develops 98 per cent of efficiency.

If readers will examine the accompaning cut they will at once see a practical demonstration of the reason for this.

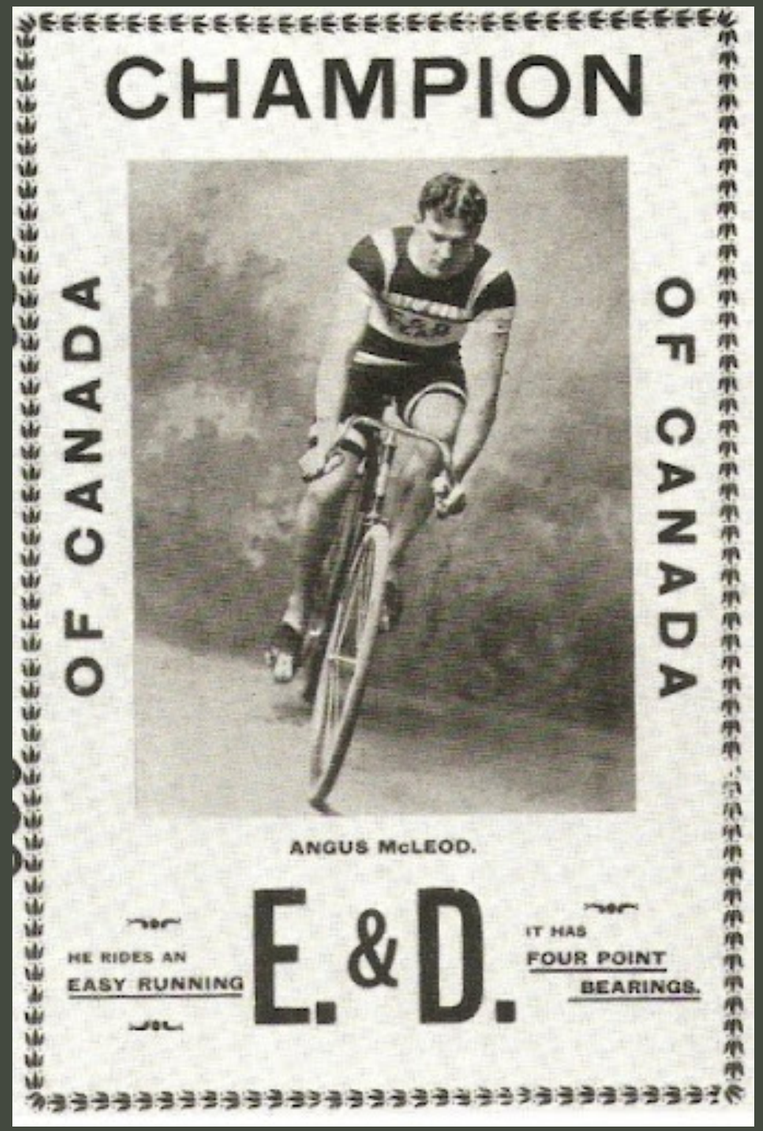
The bearings are so constructed that the balls revolve in precisely the same direction as the hub, and for this reason all of the cutting and grinding is done away with as well as the friction of the ordinary bicycle bearing, and it will therefore be seen that this bicycle will wear ever so much longer than any other wheel produced. The weak point in bicycles has always been the bearings, which, after a years riding, were completely cut to pieces and useless.

Of the great 80 gear roadster of this company it is the boast it is a thorough Canadian, Invented in Canada, Patented in Canada, Introduced in Canada, Built by Canadians, with Canadian capital.

First, we wish to impress clearly on the minds of the dealers that "E & D" bicycle is not an experiment, or in any way an untested or untried wheel. The manufacturers have been working on the improvements of this bicycle for more than a year. Last May a wheel was fitted up with the bearings complete and has been running regularly throughout the season of 1895 as a test. It was fitted up with 80 gear, making 20 feet, 3 inches for every revolution of the pedal and has been put to the severe test of climbing hills alongside of other wheels with 63 and 66 gears and it is the universal opinion that our wheel with the 80 gear will climb a hill as easily as any other wheel with a 63 and 66. This is not idle talk. A wheel was taken to Toronto in the month of October and handed over to the riders of the Toronto Athletic and Toronto Atheneum Clubs, who were asked to test it in this respect, and there is not a man of them who rode it who was not amazed at the ease with which he could climb the hills with a machine geared so high.

We learn that contracts have been made for the whole output of the factory this year and only a limitted number have been allotted to this district.

The Ira Cornwall Company (Limited) of this city have been appointed general agents for the Maritime Provinces and Newfoundland and are now opening agencies at all important points.



CHAMPION

OF CANADA

OF CANADA

ANGUS McLEOD.

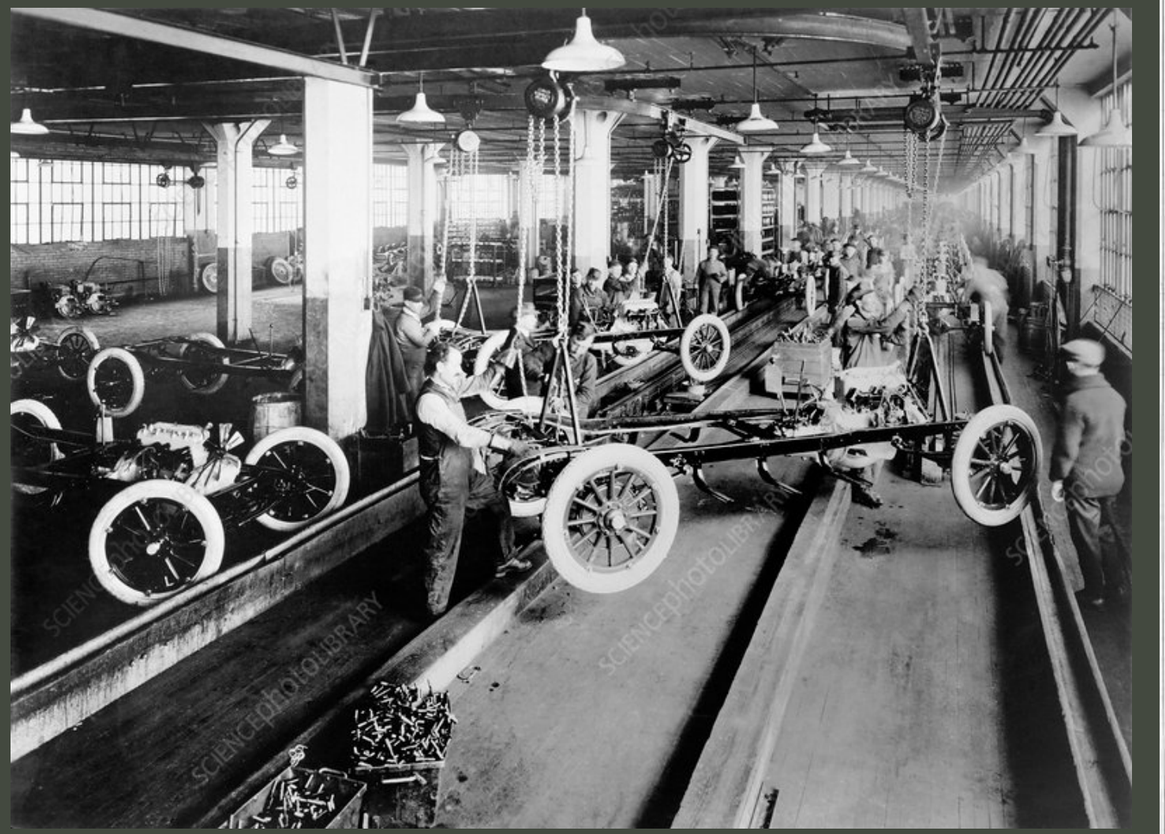
HE RIDES AN EASY RUNNING

E. & D.

IT HAS FOUR POINT BEARINGS.

Bikes are Cars: The Dodge Brothers

Background



DODGE BROTHERS

CLOSED CAR

A convertible sedan such as you would expect from Dodge Brothers. A pleasing combination of smartness and comfort. Designed and built complete in Dodge Brothers works.

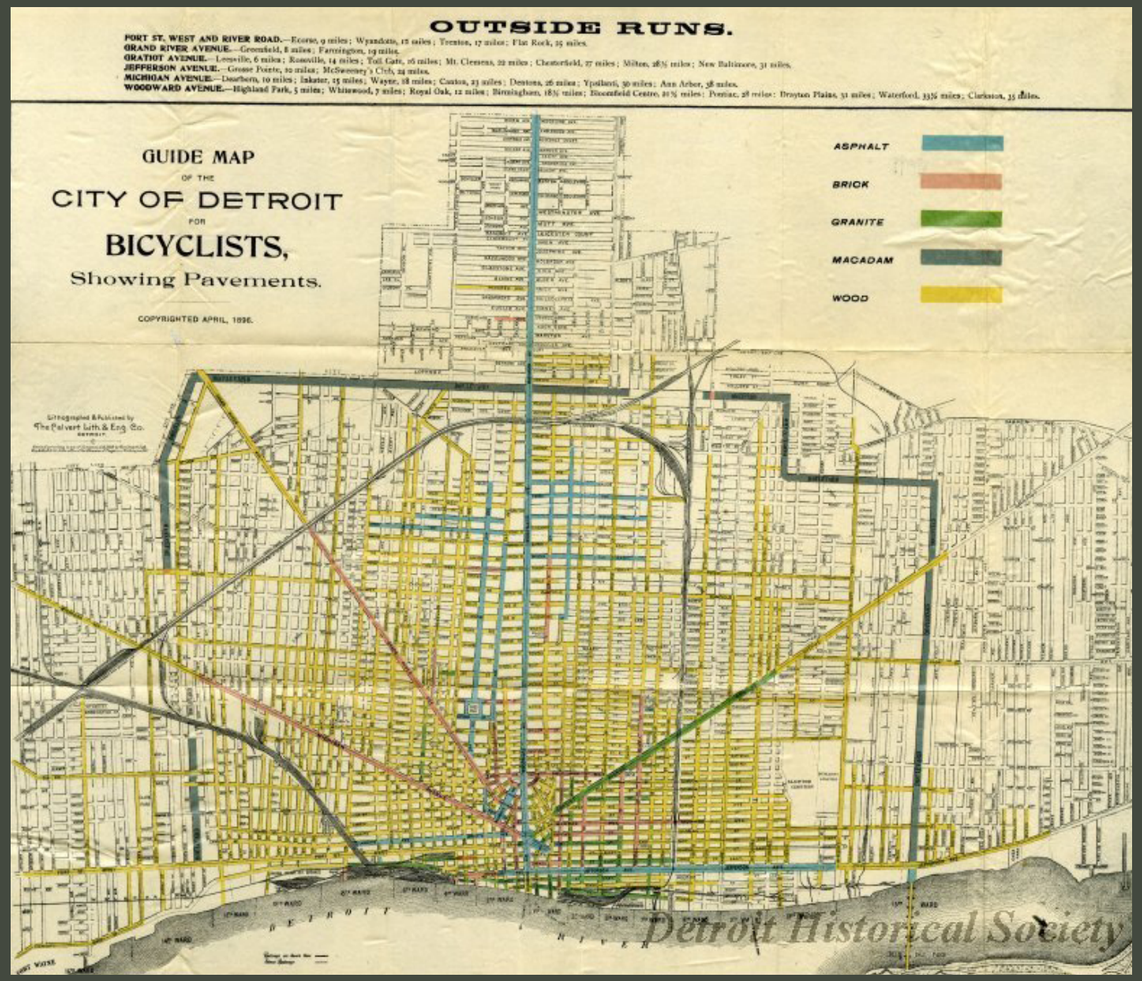
The price of the Sedan, complete, is $1185
(f. o. b. Detroit)
Canadian price $1685 (add freight from Detroit)

DODGE BROTHERS, DETROIT

Bikes are Cars: The Dodge Brothers

Background

Detroit Historical Society

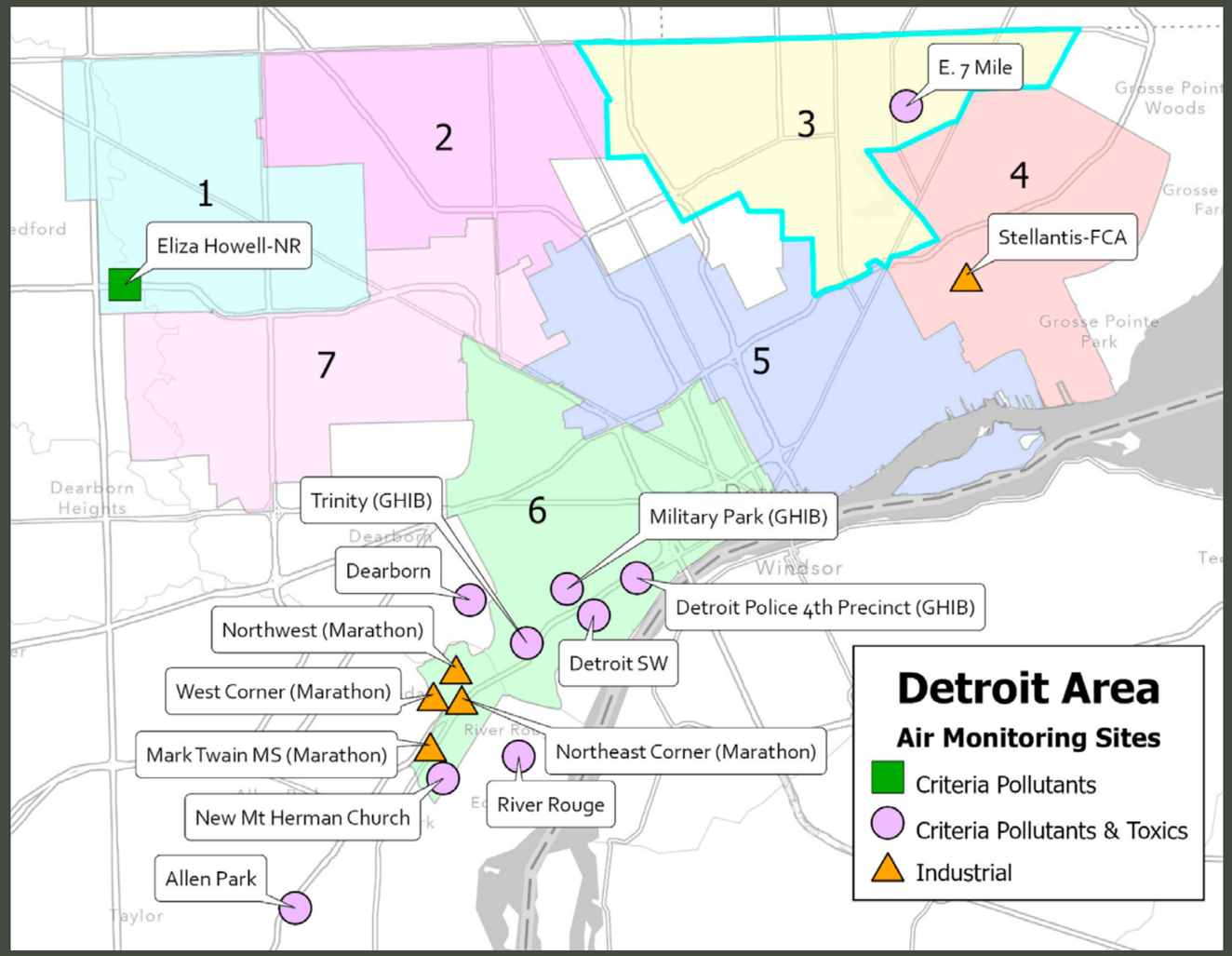


Bicycle Utopia? The Army of Detroit Riders and early paved streets

Background

Air Quality Report:
Greater Detroit Area

October 2024



Air Monitoring Sites

Background

Air on the Water: Industrial Sites (Zug Island)

Ambient vs Localized Air Quality Monitoring

Existing Ambient Studies:

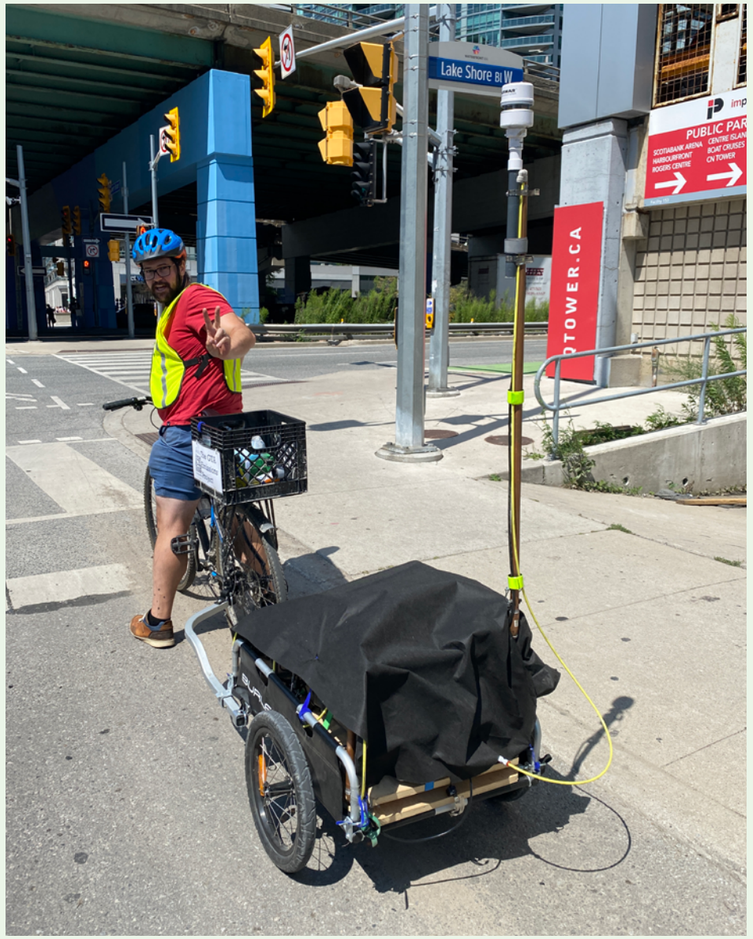
— Macro-scale **urban air quality**
— Emphasize exposure over months, **years**
— Restricted by **location** of monitors
— Focused on specific **industrial targets**

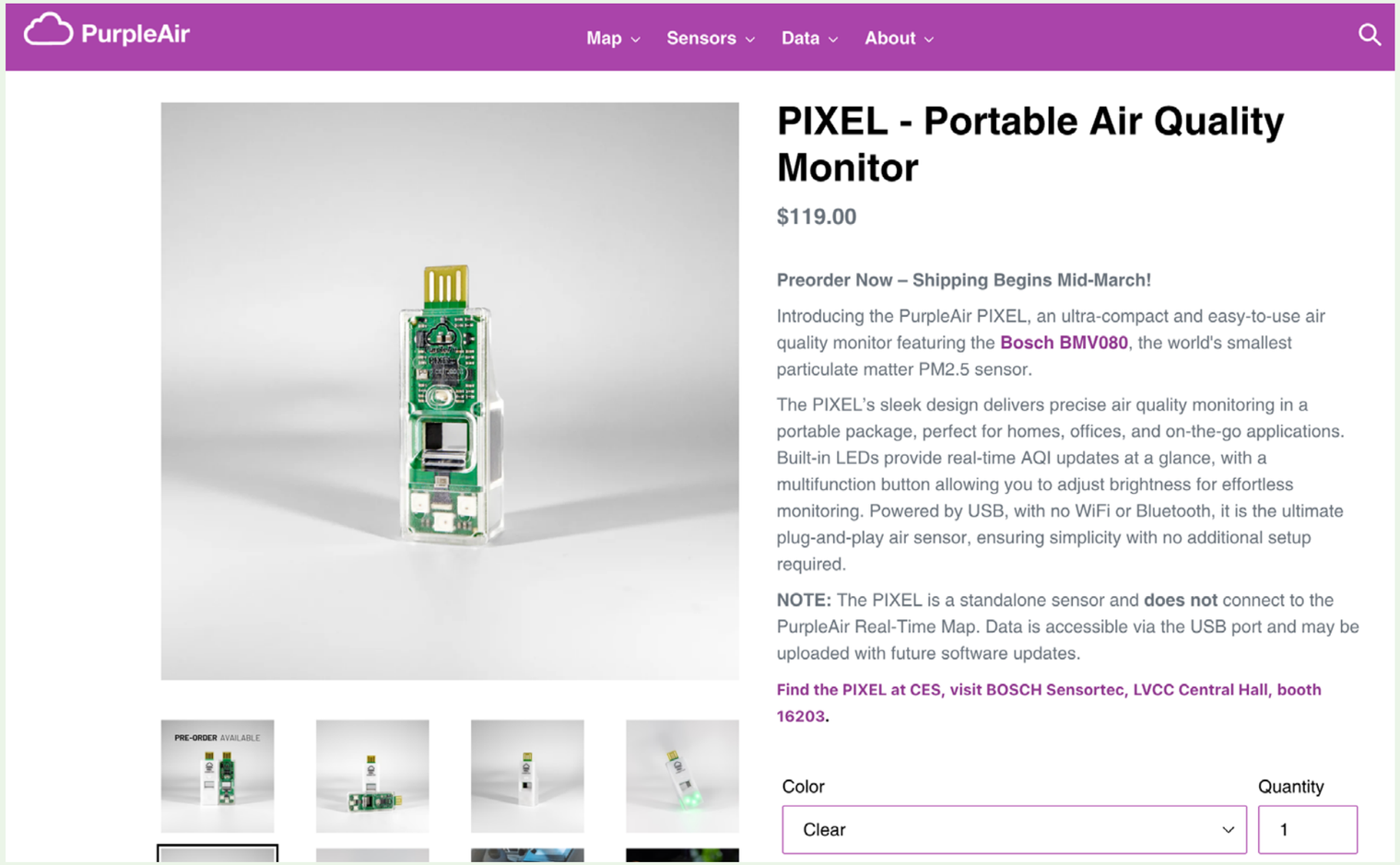
Ambient vs Localized Air Quality Monitoring

Proposed study:

— Focus on **embodied experience** of urban air quality
— Clarify exposure over time of **day, week** of year
— Define location relative to **cycling infrastructure**
— Clarify impact of **urban form** (automobiles, highways)

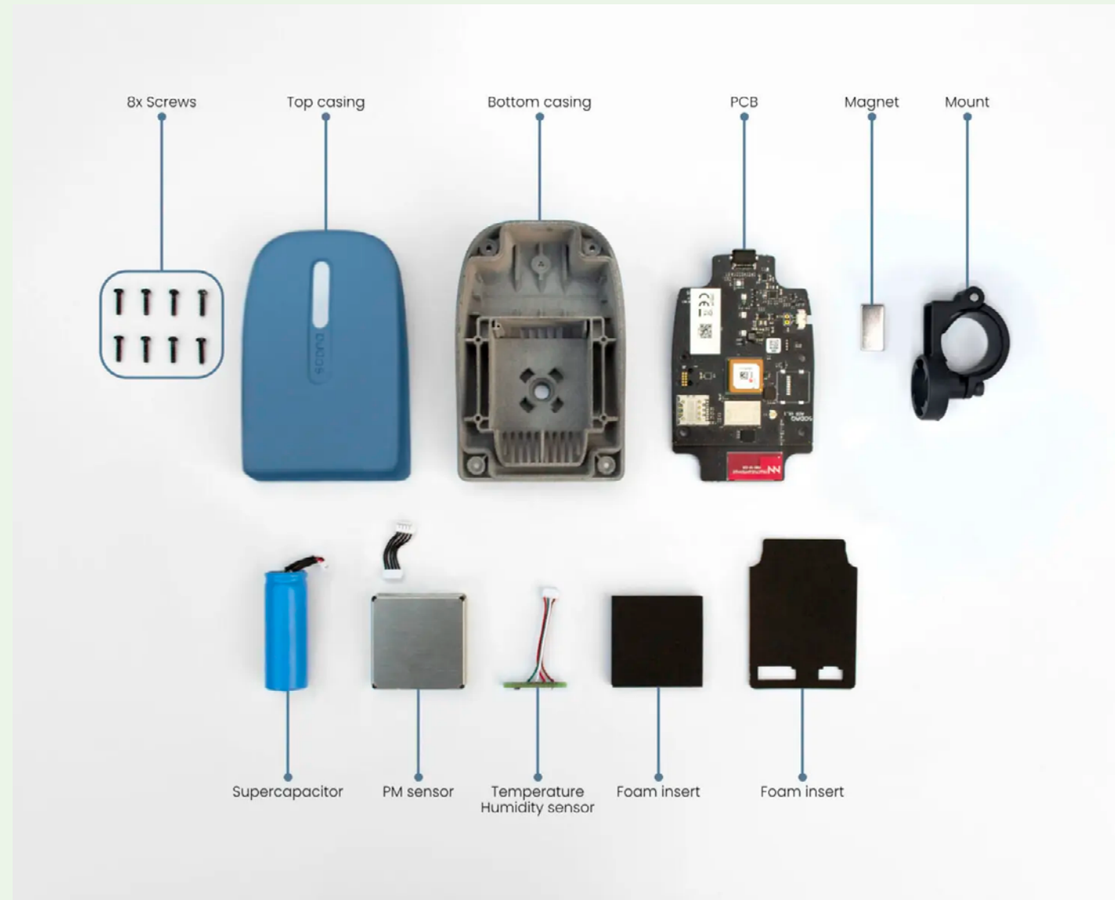
Research Design



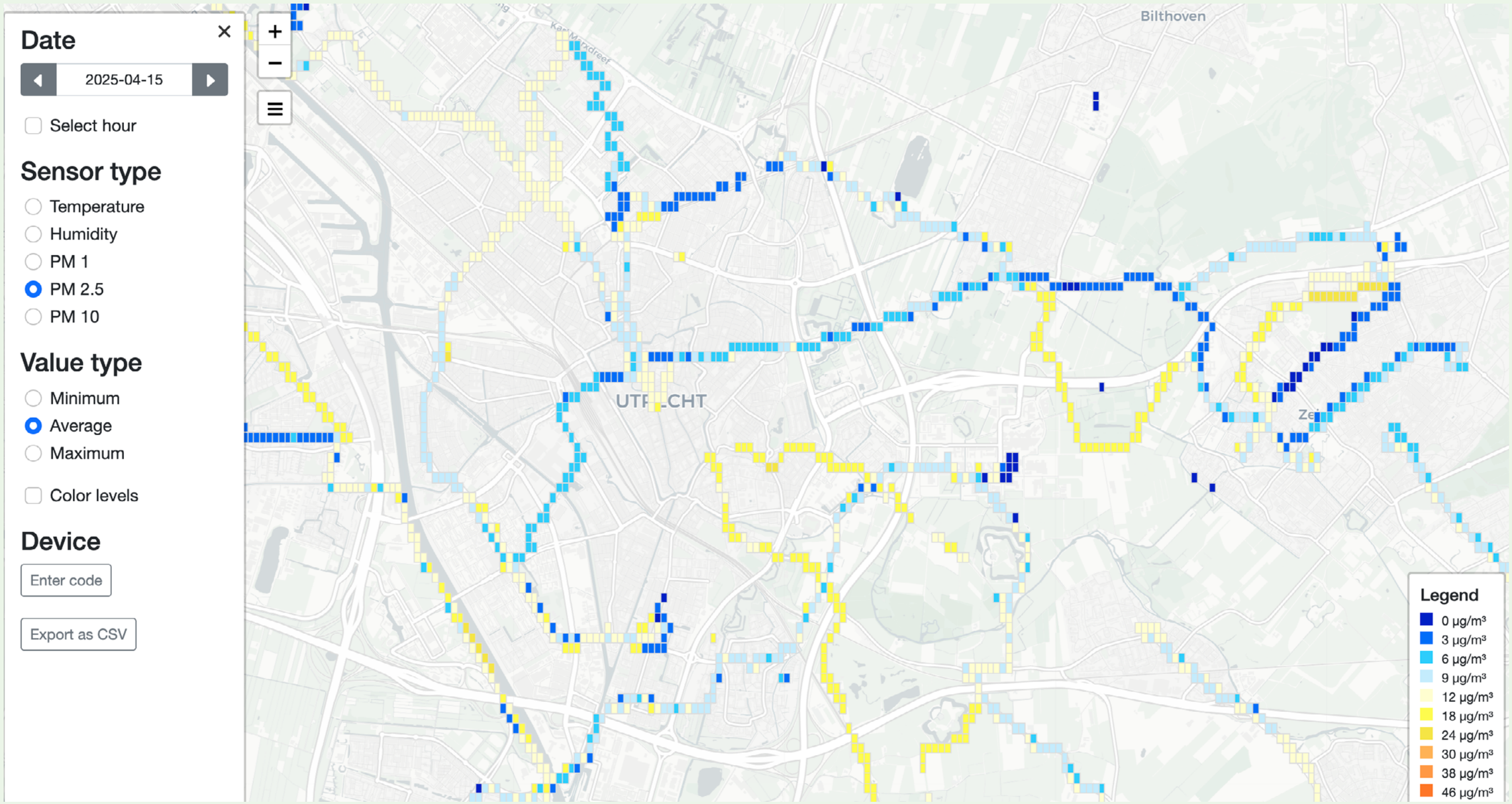


Options: U of Toronto's GTA Emissions Project & the PurpleAir Pixel

Research Design



SODAQ Air: Well-rounded DIY option



Know Your Air: Web-based, realtime tracking

lat	lon	temp_avg	temp_min	temp_max	pm_1_avg	pm_1_min	pm_1_max	pm_2_5_avg	pm_2_5_min	pm_2_5_max	pm_10_avg	pm_10_min	pm_10_max	hum_avg	hum_min	hum_max	date	hour
52.096	5.087	12.409844	12.235828	12.574959	5.7182956	3.153937	9.916045	6.053573	3.3351686	10.48584	6.061744	3.3351686	10.48584	63.066547	59.53917	69.53383	2025-04-18	0
52.105	5.124	16.3	16.3	16.3	2.68	2.55	2.81	2.76	2.63	2.89	2.76	2.63	2.89	49.5	49.0	50.0	2025-04-18	0
52.067	5.13	14.82	14.8	14.9	7.6260004	7.19	8.28	8.064	7.6	8.75	8.064	7.6	8.75	59.0	59.0	59.0	2025-04-18	0
52.063	5.141	11.558232	11.434729	11.693751	2.158778	1.6977785	2.9228563	2.2985127	1.7953371	3.0908103	2.317996	1.7953371	3.0908103	83.09274	81.692215	85.75722	2025-04-18	0
52.083	5.177	21.391048	20.754177	21.98787	0.35009858	0.15657549	0.5900988	0.4117633	0.18717551	0.68384904	0.46303213	0.19418308	0.7569374	42.18394	40.323486	43.006027	2025-04-18	0
52.083	5.178	22.30571	21.931791	23.488592	0.26207292	0.12142839	0.47890145	0.31409058	0.12840594	0.5757339	0.3532283	0.12840584	0.68987674	42.36808	34.003204	44.707397	2025-04-18	0
52.084	5.178	22.299839	21.889067	23.144121	0.27889237	0.057714503	0.46473134	0.32017285	0.06513663	0.56188333	0.3487726	0.0702499	0.65485585	41.681366	37.59517	43.42717	2025-04-18	0
52.12	5.192	19.458395	19.208055	19.731441	0.41926968	0.21525477	0.66667897	0.46158105	0.22762373	0.7049877	0.48407316	0.22762379	0.79932976	46.678993	43.324936	49.927505	2025-04-18	0
52.096	5.087	12.123229	11.896696	12.265201	5.5678635	4.2448554	6.9322424	5.8887215	4.4887743	7.3305845	5.8898416	4.4887743	7.3305845	61.116573	59.526962	62.775604	2025-04-18	1
52.067	5.13	14.78	14.7	14.8	6.012	5.21	7.13	6.358	5.51	7.54	6.358	5.51	7.54	55.4	53.0	58.0	2025-04-18	1
52.063	5.141	11.443851	11.239795	11.610971	1.9988313	1.3131524	2.6930344	2.123396	1.4953804	2.8477821	2.135452	1.6096176	2.8477821	81.936615	78.92117	84.41138	2025-04-18	1
52.083	5.177	21.331747	20.655375	21.961164	0.2388475	0.06211073	0.43474132	0.2717515	0.07992666	0.46337238	0.2954419	0.07992666	0.51412505	40.09759	38.41458	41.928726	2025-04-18	1
52.083	5.178	22.106009	21.91844	23.312351	0.21374434	0.08139433	0.32386866	0.26179826	0.09830706	0.6015343	0.30026066	0.098307095	0.97152793	42.003803	34.04593	43.851364	2025-04-18	1
52.084	5.178	22.046913	21.83299	22.222858	0.21992914	0.1420919	0.37001726	0.25201574	0.15222153	0.40519756	0.27314225	0.15222149	0.52376276	40.97695	39.813828	42.51468	2025-04-18	1
52.12	5.192	19.337454	19.08255	19.576563	0.34039184	0.2179386	0.460014	0.39270923	0.2820662	0.5888755	0.4331492	0.28206632	0.8029625	45.48803	42.37735	48.552673	2025-04-18	1
52.096	5.087	11.716895	11.400015	11.880674	9.228159	6.9304147	12.667538	9.820715	7.470046	13.395442	9.89679	7.534912	13.395442	66.62062	63.700302	69.501785	2025-04-18	2
52.105	5.124	15.25	15.1	15.4	6.62	5.94	7.3	6.81	6.11	7.51	6.81	6.11	7.51	56.5	55.0	58.0	2025-04-18	2
52.067	5.13	14.36	14.2	14.6	5.254	4.78	5.93	5.552	5.05	6.27	5.552	5.05	6.27	53.4	52.0	55.0	2025-04-18	2
52.063	5.141	11.058213	10.727092	11.28252	1.4328642	1.1607627	1.8022207	1.5446066	1.2681957	1.9265106	1.5811291	1.3127726	1.9522573	80.31421	77.5677	82.52841	2025-04-18	2
52.083	5.177	21.277672	20.655375	21.875715	0.28705642	0.041881606	0.5793529	0.32183143	0.044288203	0.6209446	0.34430534	0.044288203	0.6735629	39.128323	38.236053	40.024414	2025-04-18	2
52.083	5.178	22.024143	21.91844	22.126726	0.2390245	0.110023595	0.47107175	0.2902888	0.14903285	0.53215	0.3304076	0.14903289	0.6569467	41.12953	40.50049	41.713577	2025-04-18	2
52.084	5.178	21.99243	21.83299	22.153429	0.27663344	0.16722897	0.5422164	0.3274674	0.17683826	0.8313844	0.3630173	0.17683835	1.081961	40.04781	39.84282	40.34027	2025-04-18	2
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52.105	5.124	15.2	15.1	15.3	9.976666	9.77	10.22	10.28	10.06	10.55	10.286667	10.06	10.57	59.666668	59.0	60.0	2025-04-18	3
52.067	5.13	13.966667	13.9	14.1	9.285	7.72	10.66	9.82	8.17	11.28	9.82	8.17	11.28	58.333332	56.0	60.0	2025-04-18	3
52.063	5.141	10.731986	10.588235	11.007476	2.4900424	1.6942276	3.2873306	2.647868	1.7915819	3.5309613	2.6661775	1.7915819	3.6454096	82.07255	79.80925	84.52429	2025-04-18	3
52.083	5.177	21.217257	20.61532	21.776913	0.3987847	0.1648088	0.7159332	0.44782636	0.18939081	0.8101131	0.480025	0.19472383	0.87489486	39.943844	38.42984	40.98114	2025-04-18	3
52.083	5.178	22.006474	21.862364	22.182802	0.34706432	0.16569445	0.5289563	0.39509675	0.17521557	0.6951145	0.42411673	0.17521557	0.8917783	41.56913	40.390625	42.676422	2025-04-18	3

Know Your Air: Data export

Current Infrastructure

Identifying

Typologies: Missed Connections, Loose Connections

Routes: Official and Alternate

Ontario fast-tracks order to remove key Toronto bike lanes

JEFF GRAY > QUEEN'S PARK REPORTER
TORONTO
PUBLISHED NOVEMBER 1, 2024

While bike lanes on University, Yonge and a stretch of Bloor Street West running through Etobicoke have been installed in the last few years – other areas with long-established lanes now appear to be targeted. For example, in the Annex neighbourhood near Bloor and Spadina Avenue, bike lanes have been in place for almost a decade. A cyclist on Bloor near Christie Street on Sept. 20, 2023.

SARAH PALMER/THE GLOBE AND MAIL

Threats: Primary vs Secondary argument

Hypothesis:

Correlation between urban form + pollution

Discussion:

Are there opportunities for "noncar" development?

Conclusions and Phase 2:

+ Additional routing
+ DIY infrastructure
+ Greenway expansion
+ Strategic street closures

Thanks!

Shouts Out / Big Ups:

+ UDMPU Prof Development Fund ($1k)
+ UDMPU Research Award ($6k)
+ Co-panelists & UAA