

A Proposed Tool for Transit Fare Structure Evaluation: Integration of Smart Card Data with Regional Demand Models

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Background and Motivation

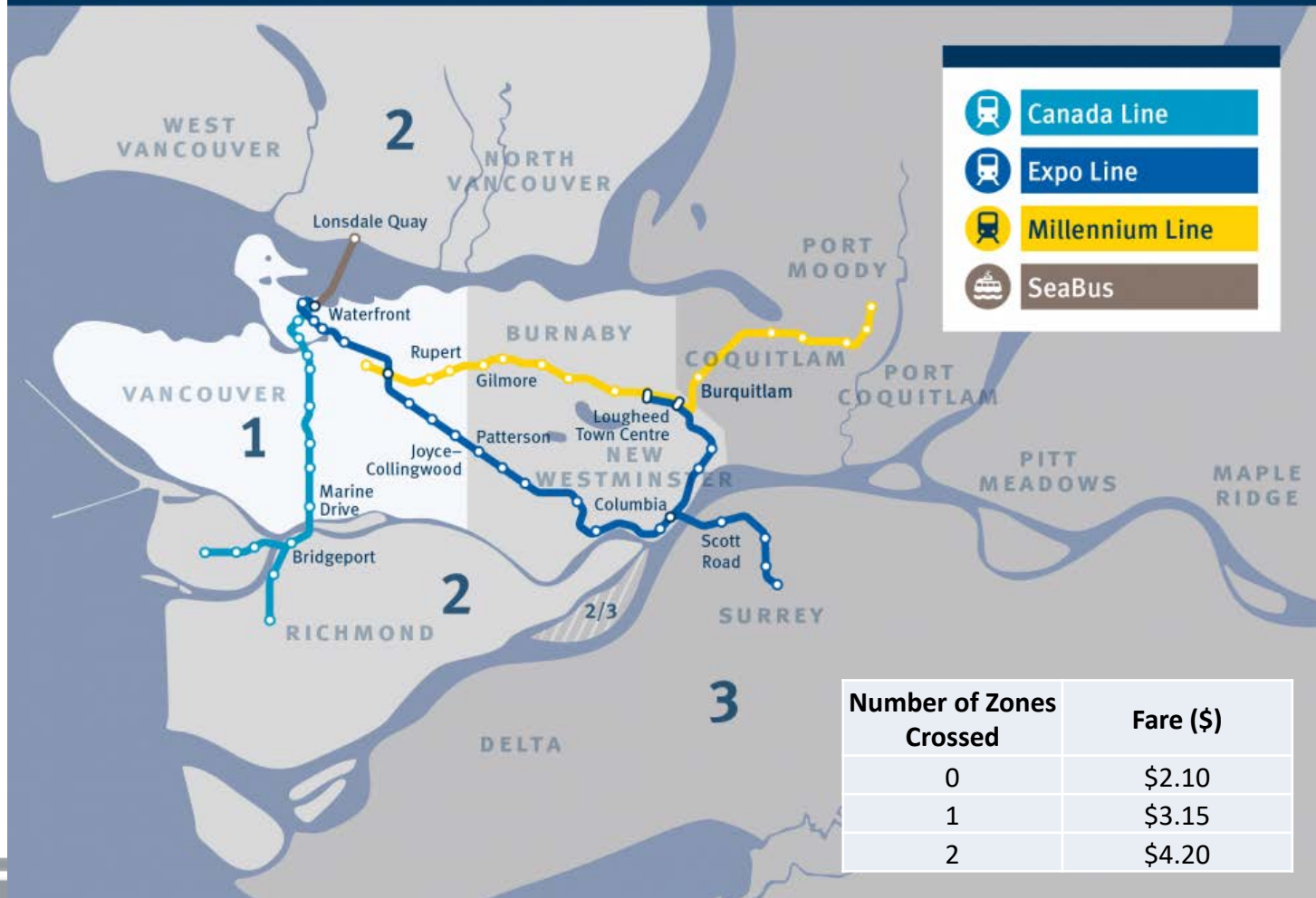
- In 2016, TransLink migrated to Compass



- TransLink, commissioned a comprehensive review of its transit fare system

Metro Vancouver Fare Map

Fare Zone Map



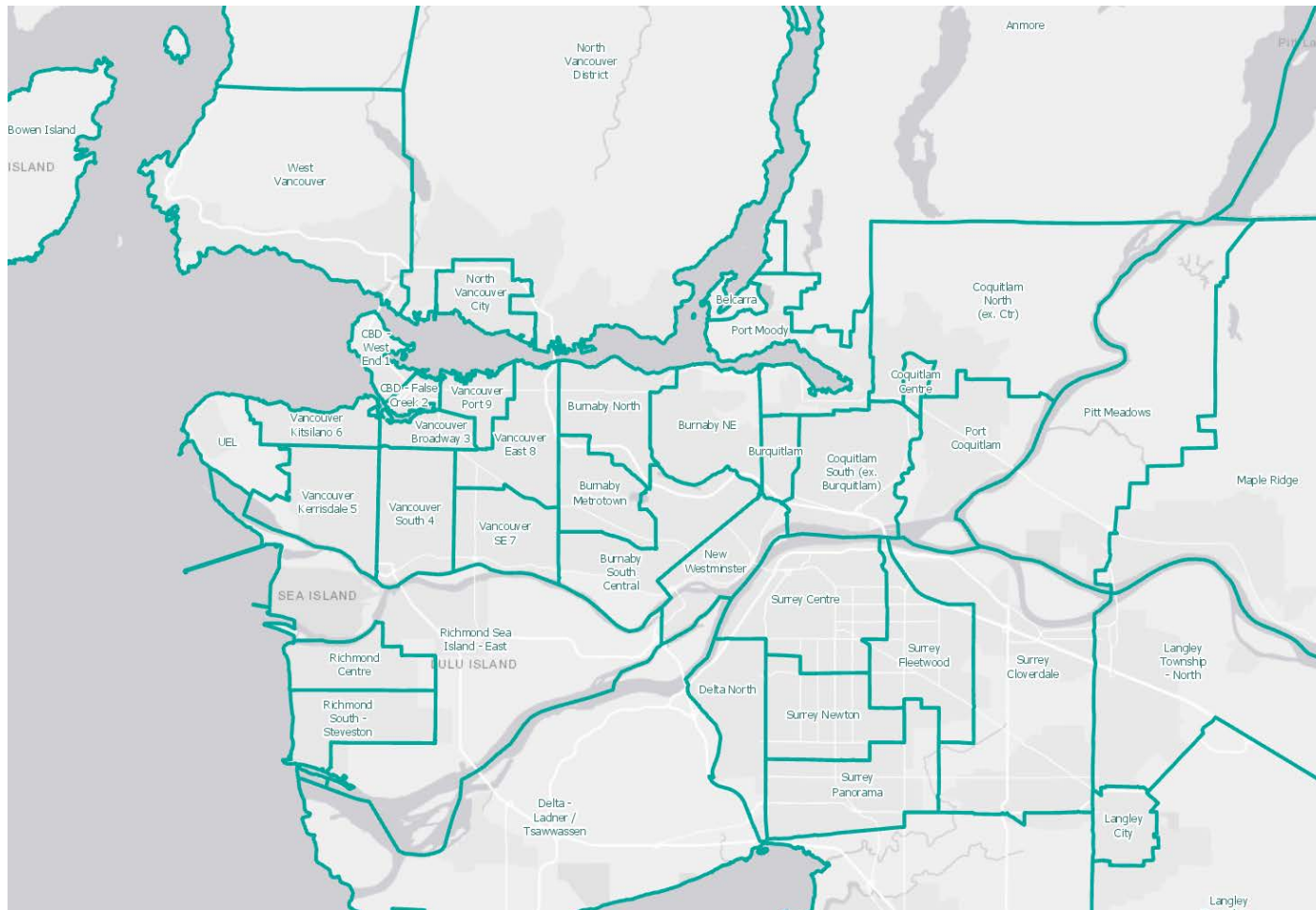
Background and Motivation

- A stand-alone NL mode choice model was estimated from the travel diary
- In parallel we developed another model/tool for triangulation combining:
 - Regional demand model
 - Compass data

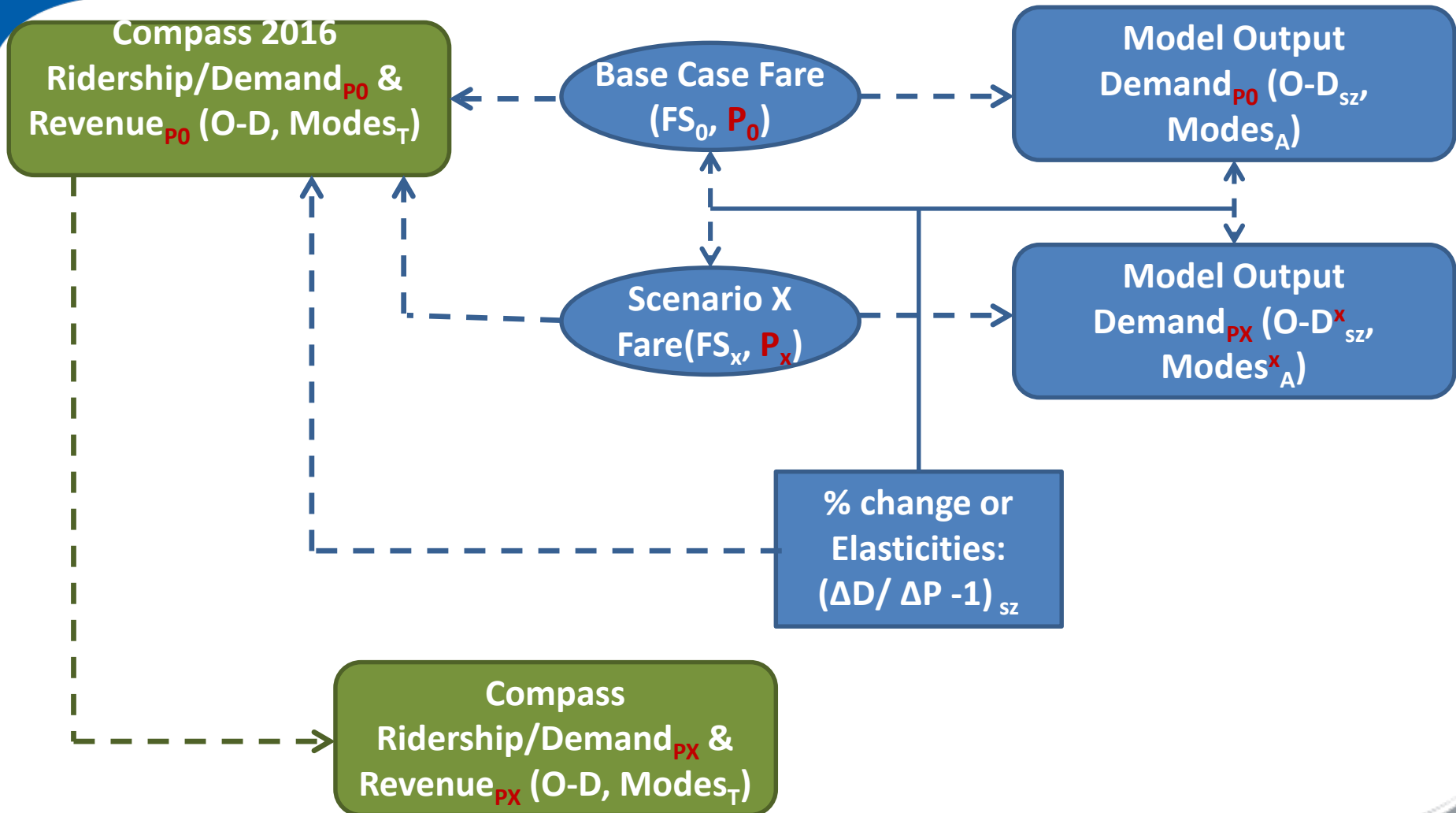
What does the tool bring to the table?

- Takes advantage of observed, real and stable dataset
- More than two years worth of data
- Visualize (Tableau) impact of fare policies by various dimensions:
 - Geography
 - Equity

Tool Description



Tool Description



Scenarios Tested

By distance

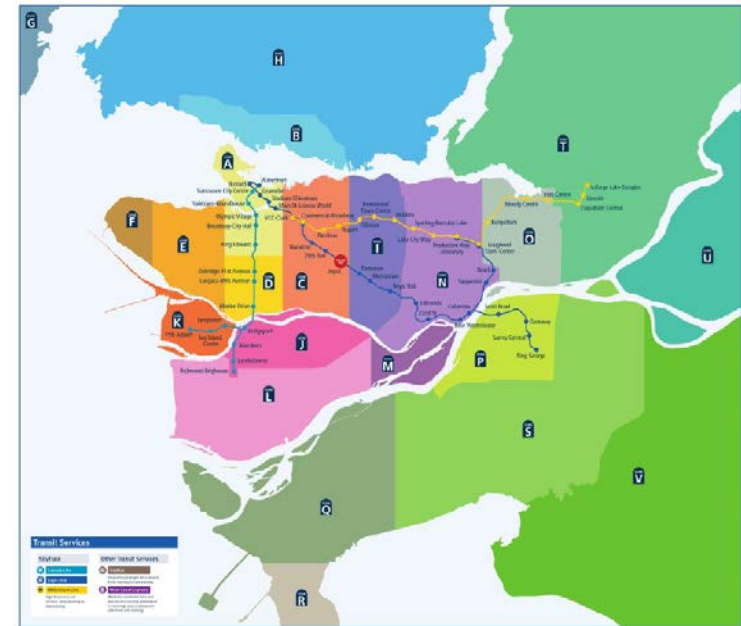
Total Distance Travelled	Adult Stored Value	Concession Stored Value
0-5km	\$1.90	\$1.60
6	\$2.08	\$1.74
7	\$2.26	\$1.88
8	\$2.44	\$2.02
9	\$2.62	\$2.16
10	\$2.80	\$2.30
11	\$2.94	\$2.41
12	\$3.08	\$2.52
13	\$3.22	\$2.63
14	\$3.36	\$2.74
15	\$3.50	\$2.85
16	\$3.64	\$2.96
17	\$3.78	\$3.07
18	\$3.92	\$3.18
19	\$4.06	\$3.29
20	\$4.20	\$3.40
21	\$4.32	\$3.49
22	\$4.44	\$3.58
23	\$4.56	\$3.67
24	\$4.68	\$3.76
25	\$4.80	\$3.85
26	\$4.92	\$3.94
27 +	\$5.00	\$4.00

By distance (rail only)

Concept 3C: Fares by Kilometer

Total Distance Travelled	Adult Stored Value	Concession Stored Value
0-5km	\$2.10	\$1.75
6	\$2.28	\$1.89
7	\$2.46	\$2.03
8	\$2.64	\$2.17
9	\$2.82	\$2.31
10	\$3.00	\$2.45
11	\$3.14	\$2.56
12	\$3.28	\$2.67
13	\$3.42	\$2.78
14	\$3.56	\$2.89
15	\$3.70	\$3.00
16	\$3.84	\$3.11
17	\$3.98	\$3.22
18	\$4.12	\$3.33
19	\$4.26	\$3.44
20	\$4.40	\$3.55
21	\$4.52	\$3.64
22	\$4.64	\$3.73
23	\$4.76	\$3.82
24	\$4.88	\$3.91
25+	\$5.00	\$4.00

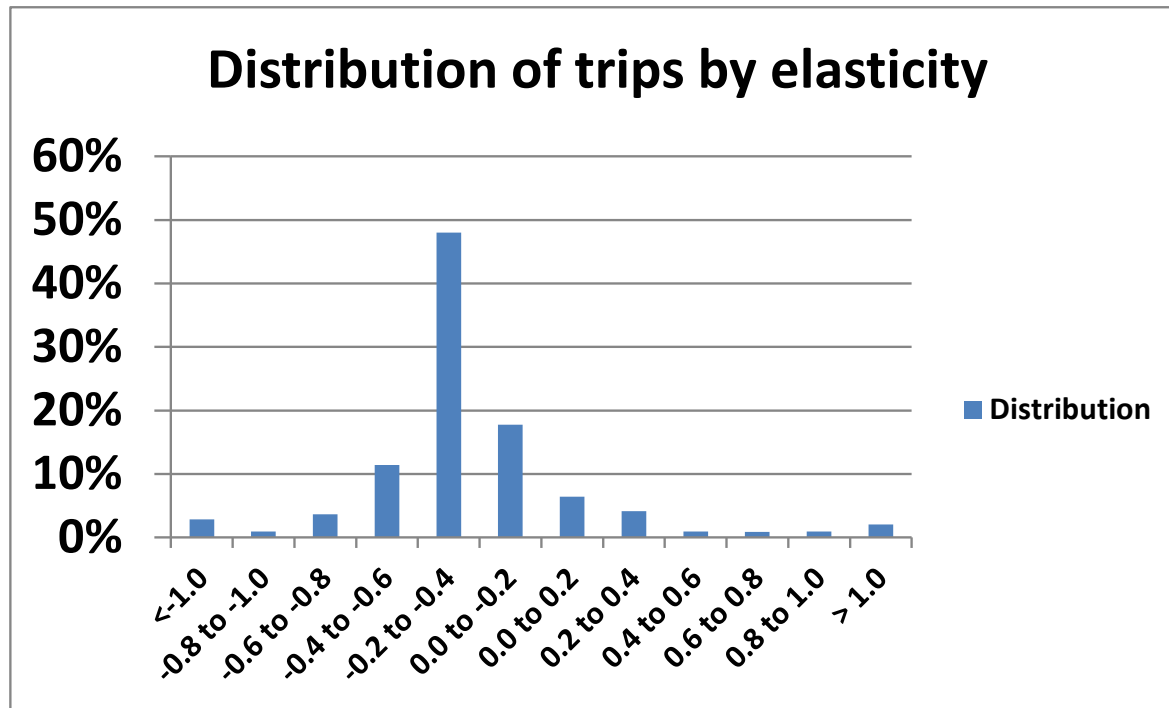
Many Fare zones



Results

	Many Zones	Distance-Based (all modes)	Distance-Based (rail-only)
Revenue Change (vs current fare structure)	8.1%	4.0%	-1.2%
Ridership Change (vs current fare structure)	-1.1%	-1.4%	0.14%

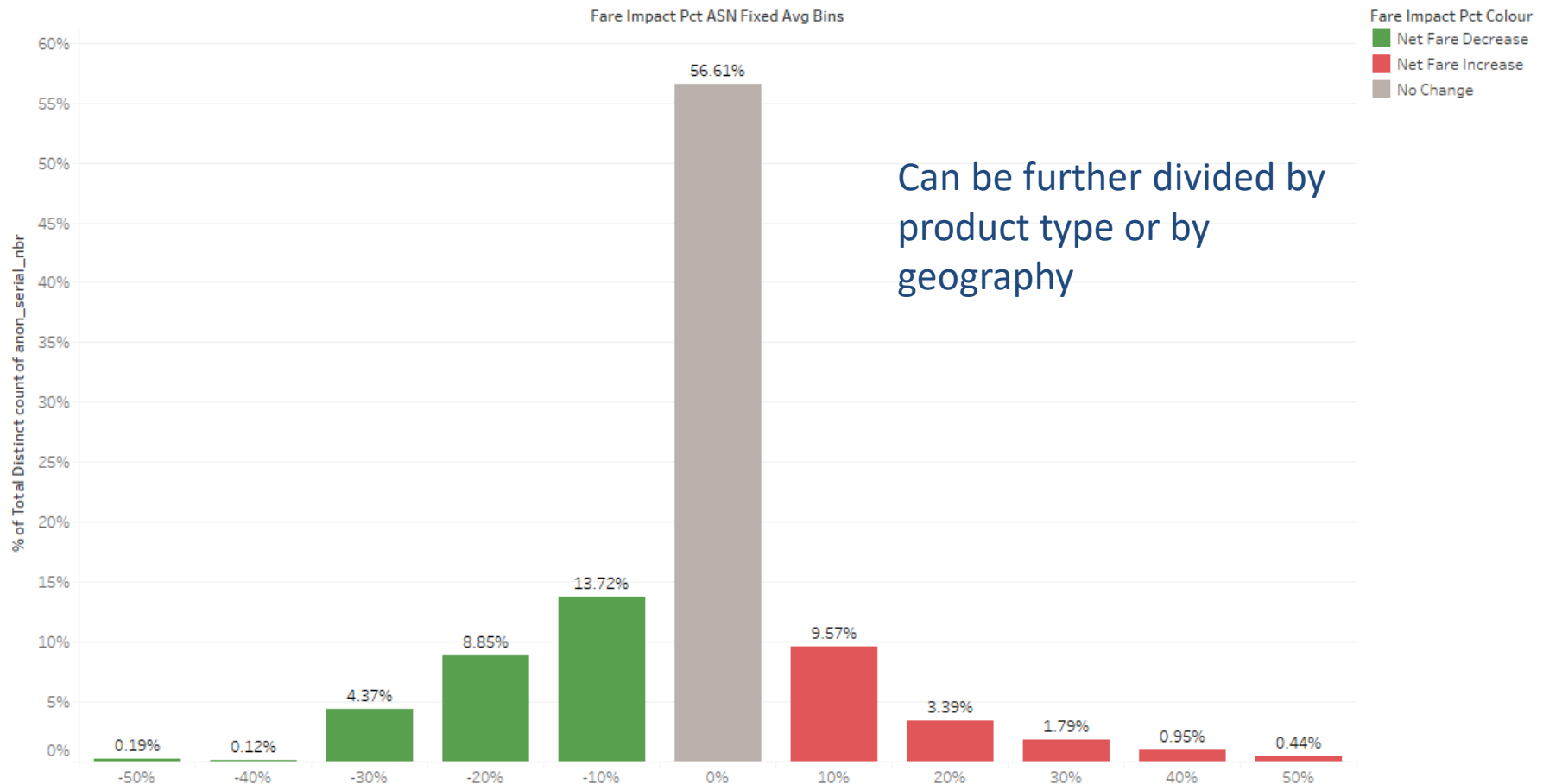
Full Measured Distance Example



- Elasticity ranges are within expectation.
- Almost 50% of the trips have elasticities between -0.2 and -0.4

In a month, which fare cards faces a fare increase vs. a decrease?

Distribution of Change in Monthly Fare for Individual Fare Cards



% of Total Distinct count of anon_serial_nbr for each Fare Impact Pct ASN Fixed Avg Bins. Color shows details about Fare Impact Pct Colour. The marks are labeled by % of Total Distinct count of anon_serial_nbr. The data is filtered on Fare Impact Pct ASN Fixed, Journeys per ASN dimension, Journeys per ASN Category, Action (Journeys per ASN Category), Fare Prod Category Name (Dim Fare Product) and Fare Prod Name (Dim Fare Product). The Fare Impact Pct ASN Fixed filter ranges from -0.5 to 0.5. The Journeys per ASN dimension filter keeps all values. The Journeys per ASN Category filter keeps 8 of 8 members. The Action (Journeys per ASN Category) filter keeps 8 members. The Fare Prod Category Name (Dim Fare Product) filter keeps Monthly Pass and Stored Value. The Fare Prod Name (Dim Fare Product) filter keeps A.Mon.1Z, A.Mon.2Z, A.Mon.3Z and A.Stored.Value.

Easily change fare parameters and test scenarios

Scenario	1	2	3	4	5
Base fare	\$2.10	\$1.80	\$2.10	\$2.10	\$2.10
When distance charge applies	5 km	5 km	0 km	5 km	5 km
Distance charge constant?	Yes	Yes	Yes	No, increasing	No, decreasing

What it is average change in fare paid for different areas?

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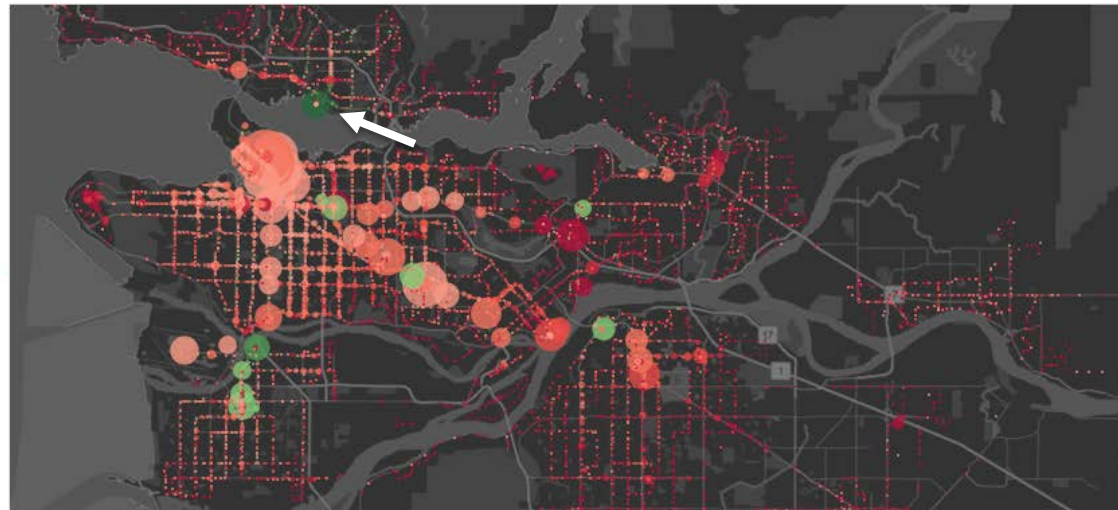
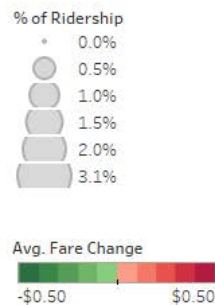
Fare by Distance



Summary of Key Impacts

Revenue Impact	4.81%
Ridership Impact	-1.58%
PKT Impact	-3.45%

Average Fare Change by Journey Origin



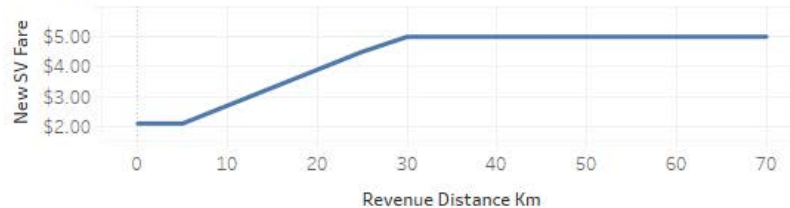
Base Fare	Price 0 to 5 km	Price 5 to 10 km	Price 10 to 15 km	Price 15 to 20 km	Price 20 to 25 km	Price 25 to 30 km	Price 30 to 35 km	Price 35 to 40 km
2.1	0	0.12	0.12	0.12	0.19	0.1	0	0

Distance fares only applied on weekday service before 6:30 pm

Easily change fare parameters and test scenarios

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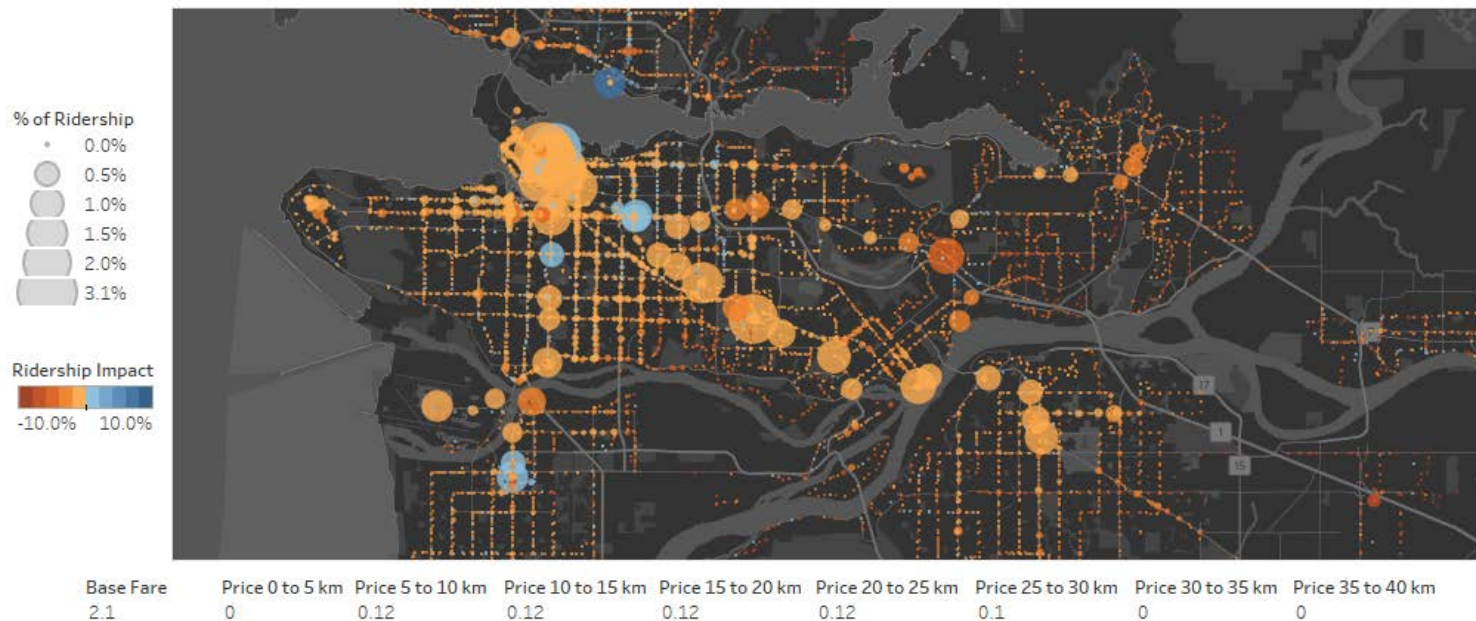
Fare by Distance



Summary of Key Impacts

Revenue Impact	3.98%
Ridership Impact	-1.41%
PKT Impact	-3.02%

Ridership Impact by Journey Origin



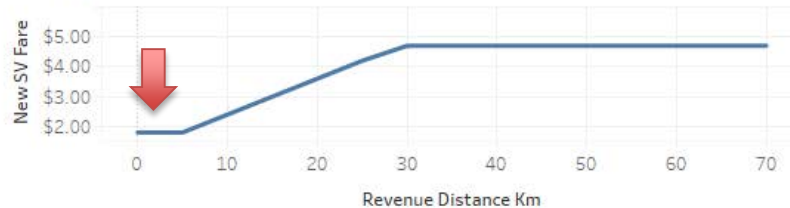
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Scenario 1

Easily change fare parameters and test scenarios

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Fare by Distance



Summary of Key Impacts

Revenue Impact	-2.51%
Ridership Impact	0.12%
PKT Impact	-1.77%

Ridership Impact by Journey Origin



Base Fare
1.8

Price 0 to 5 km	Price 5 to 10 km	Price 10 to 15 km	Price 15 to 20 km	Price 20 to 25 km	Price 25 to 30 km	Price 30 to 35 km	Price 35 to 40 km
0	0.12	0.12	0.12	0.12	0.1	0	0

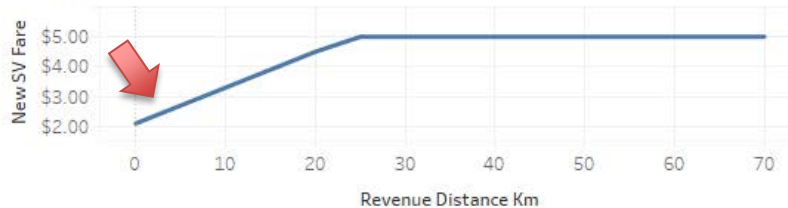
Distance fares only applied on weekday service before 6:30 pm

Scenario 2

Easily change fare parameters and test scenarios

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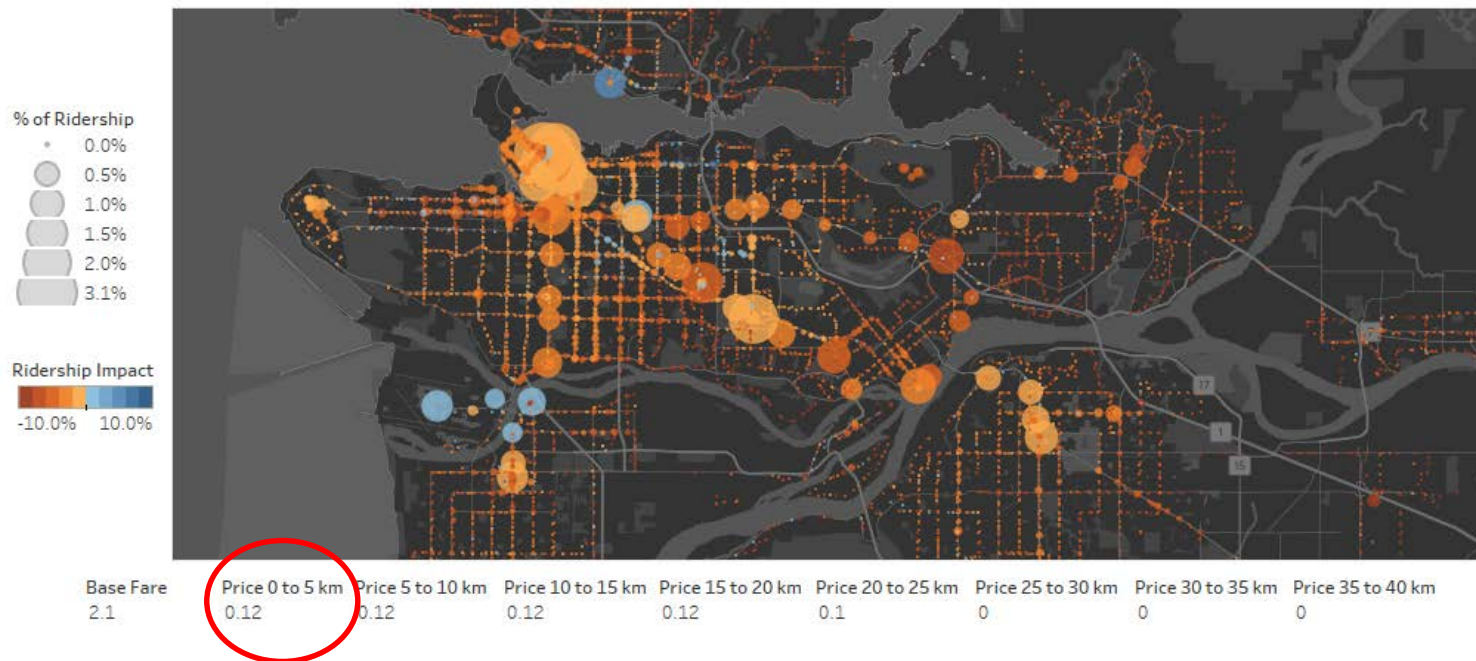
Fare by Distance



Summary of Key Impacts

Revenue Impact	12.00%
Ridership Impact	-3.23%
PKT Impact	-4.52%

Ridership Impact by Journey Origin



Distance fares only applied on weekday service before 6:30 pm

Scenario 3

Easily change fare parameters and test scenarios

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Fare by Distance



Summary of Key Impacts

Revenue Impact	7.88%
Ridership Impact	-2.14%
PKT Impact	-3.95%

Ridership Impact by Journey Origin



Base Fare	Price 0 to 5 km	Price 5 to 10 km	Price 10 to 15 km	Price 15 to 20 km	Price 20 to 25 km	Price 25 to 30 km	Price 30 to 35 km	Price 35 to 40 km
2.1	0	0.2	0.16	0.1	0.06	0.04	0.04	0.02

Distance fares only applied on weekday service before 6:30 pm

Scenario 4

Easily change fare parameters and test scenarios

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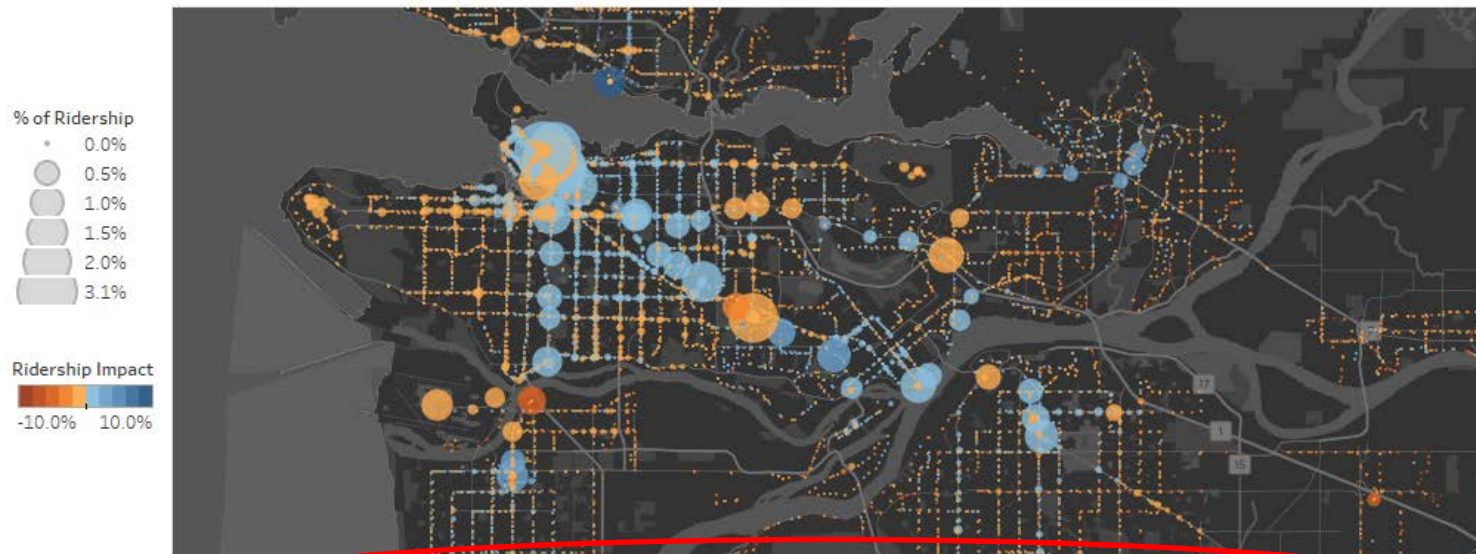
Fare by Distance



Summary of Key Impacts

Revenue Impact	-4.29%
Ridership Impact	0.01%
PKT Impact	-0.91%

Ridership Impact by Journey Origin



Base Fare	Price 0 to 5 km	Price 5 to 10 km	Price 10 to 15 km	Price 15 to 20 km	Price 20 to 25 km	Price 25 to 30 km	Price 30 to 35 km	Price 35 to 40 km
2.1	0	0.02	0.04	0.07	0.1	0.16	0.2	0

Distance fares only applied on weekday service before 6:30 pm

Scenario 5

Limitations

- Does not have a fare product component
- Best used for short term projections