

Transit Equity Score: A Novel Framework Combining Socioeconomic, Accessibility, and Reliability Data

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Transit Equity Score

- Vulnerable populations often face poorer transit service
- Inspired by the Tree Equity Score (American Forests, 2024), creates a single score from 0–100
- Identifies areas where transit investment can have the greatest impact
- Combines multiple dimensions of equity into **one interpretable metric**

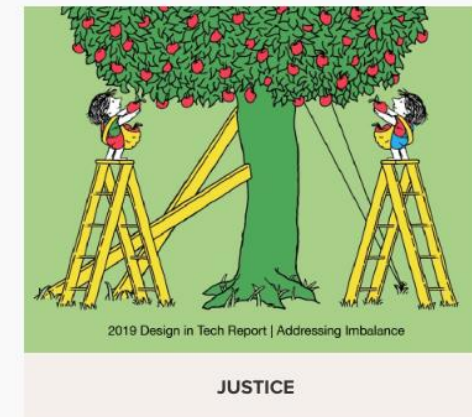
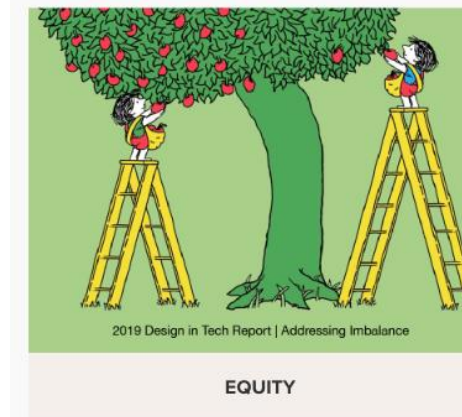
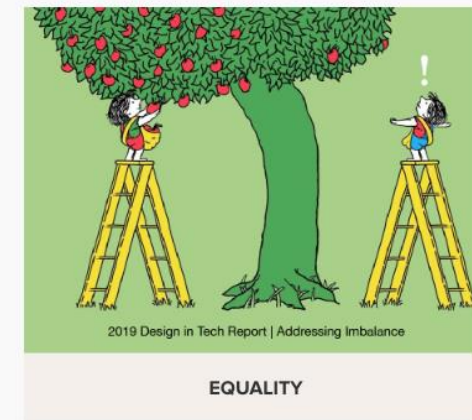
Accessibility

Social Priority

Reliability



Transit Equity Score



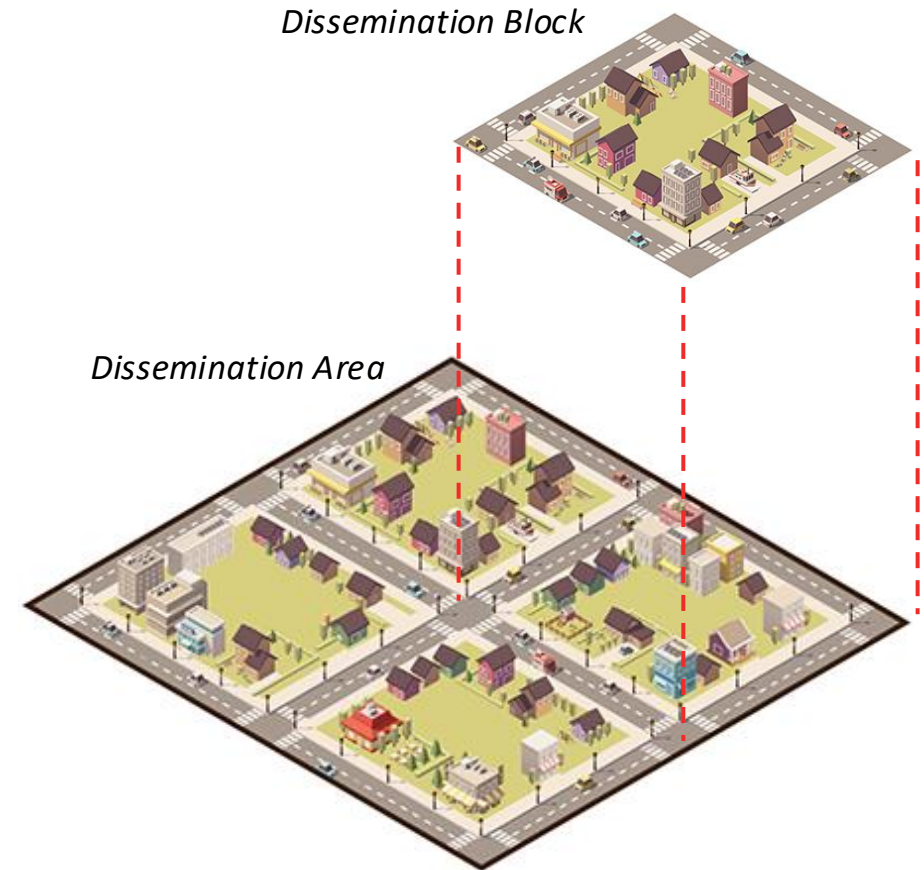
Source: <https://onlinepublichealth.gwu.edu/resources/equity-vs-equality/>

Priority

- Social priority of a geographic area based on socioeconomic or demographic factors
- Selection of variables that capture disadvantaged or equity deserving transit riders (Manaugh and El-Geneidy (2013))
 - Median Income, MI
 - Immigrated within 5 Years, IF
 - More than 30% Income on Rent, RT
 - Unemployment Rate, UR
- Use 2021 Census profile data at Dissemination Area (DA) level

$$Priority = 0.1 + (1 - 0.1) \left(\frac{MI_{norm} + IF_{norm} + RT_{norm} + UR_{norm}}{4} \right)$$

- Min-max normalize each variable, across all DAs
- Indicator has a value between 0.1 and 1 (American Forests, 2024)



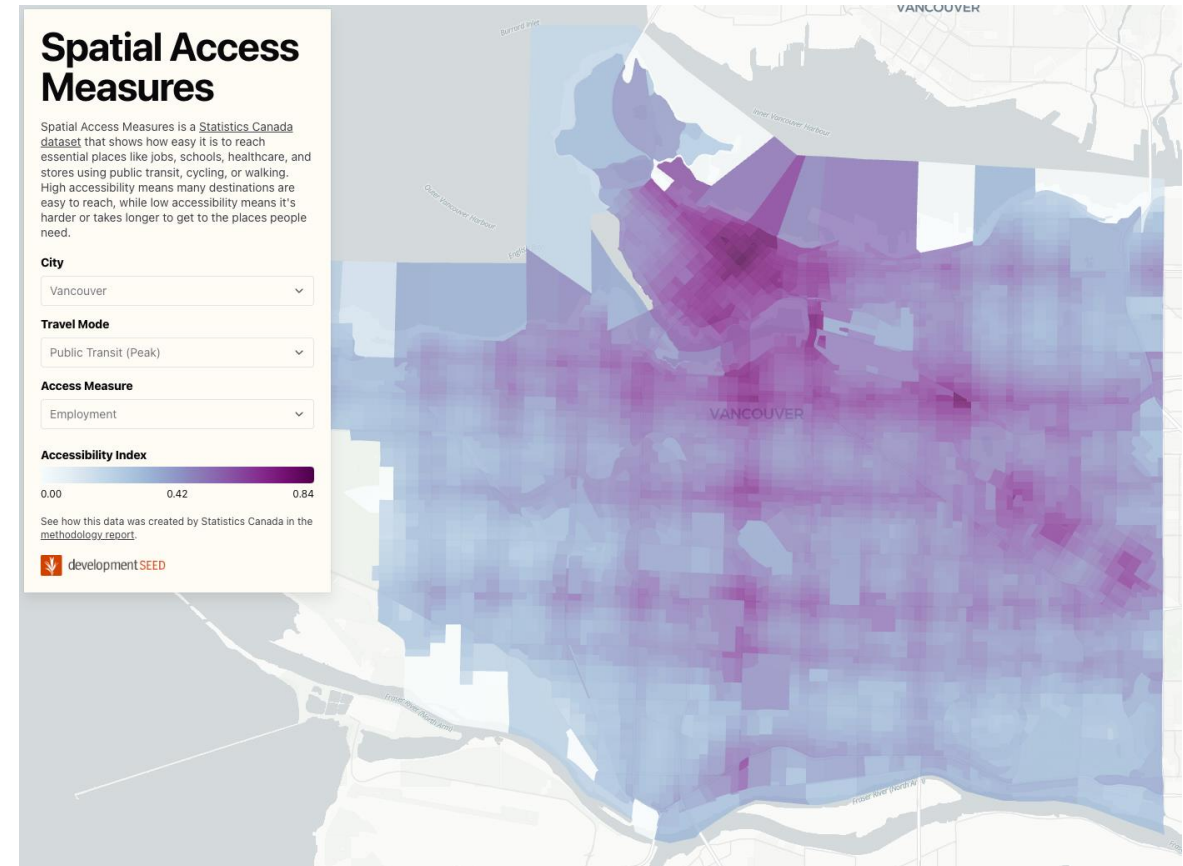
Source: <https://www150.statcan.gc.ca/n1/pub/92-195-x/2021001/geo/da-ad/da-ad-eng.htm>

Accessibility

- Measure of how easy it is to get access “potential opportunities for interaction” (Hansen, 1959)
- Gravity-based calculation: closer opportunities are more desirable than farther opportunities

$$Total\ Access = \frac{1}{N} \sum_i^N A_{norm_i}$$

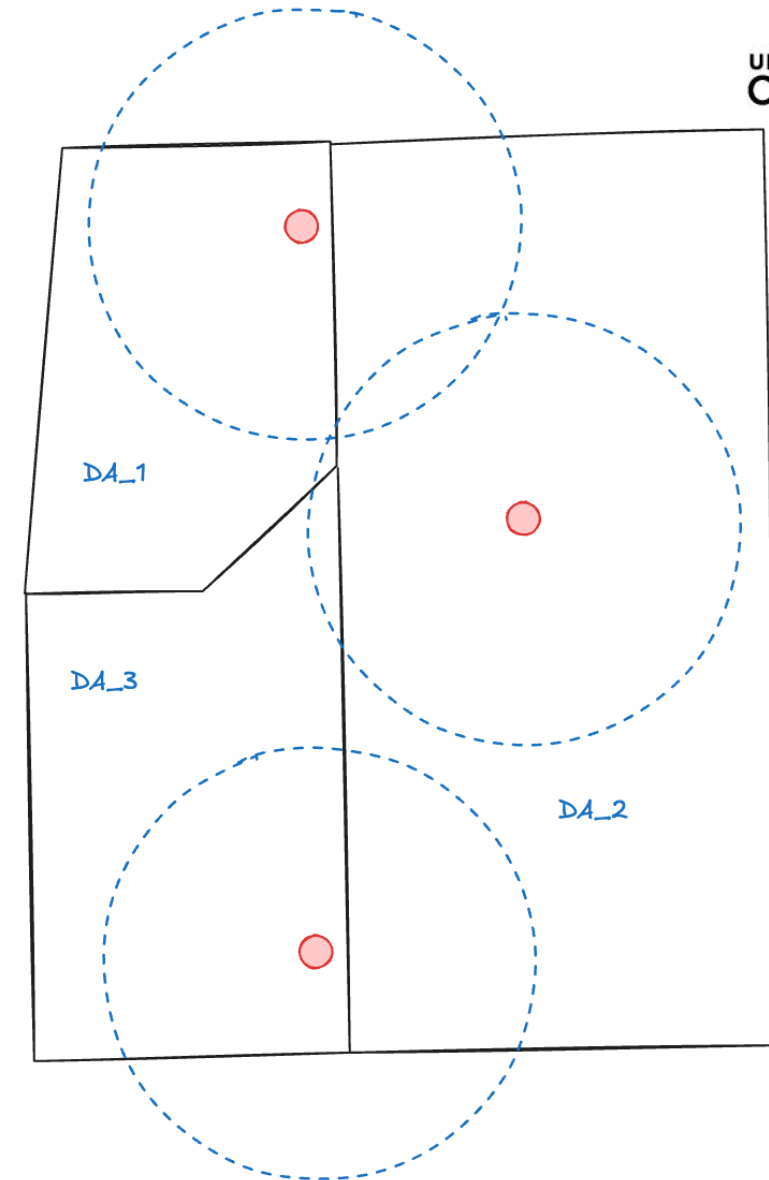
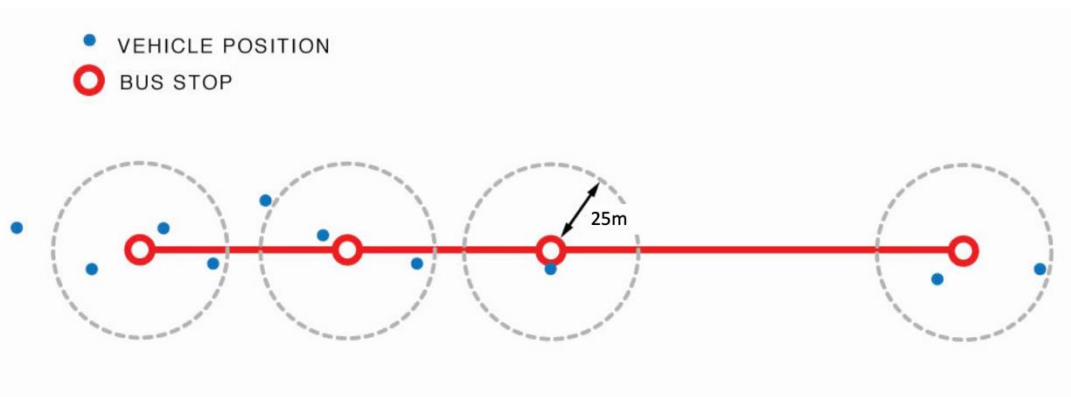
- Aggregate (average) Dissemination Blocks access scores across each Dissemination Area
- Min-max normalization of each access measure for the region, average all access measure for a single index



<https://developmentseed.org/spatial-access-measures/>

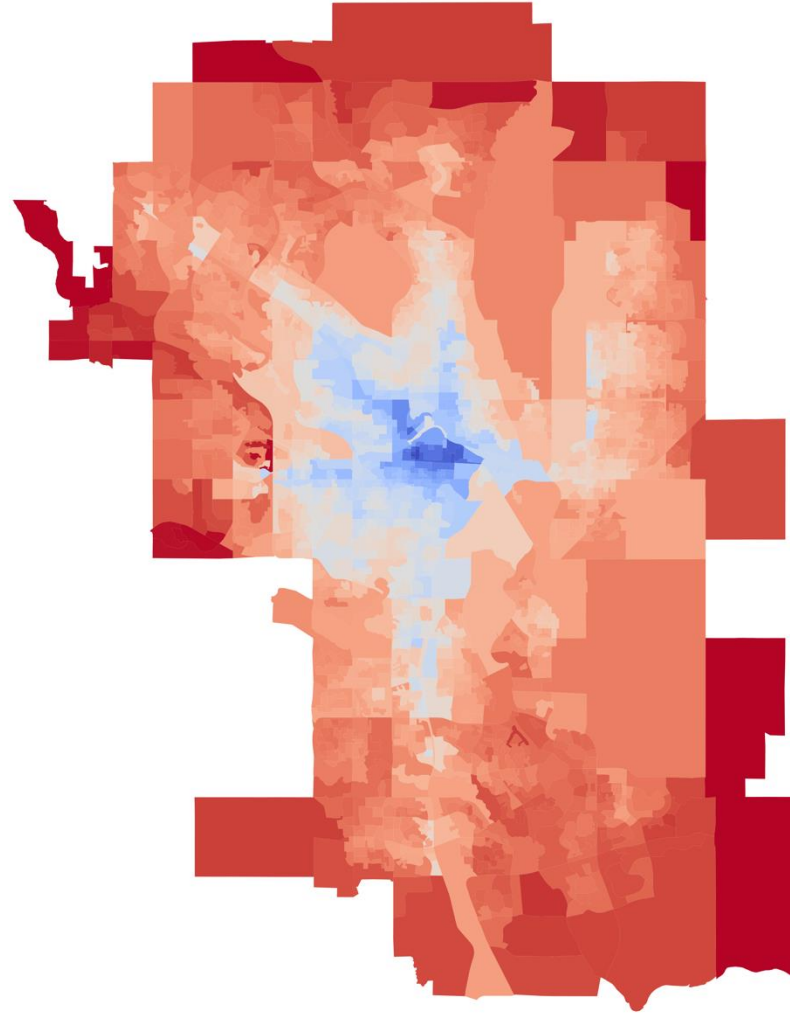
Reliability

- Collected GTFS Realtime position data for six Canadian cities over six months, aggregate on-time performance for each stop
- Use stop arrival time to find schedule deviation and then on-time performance (-1 to 5 min)
- Aggregate (average) stop level on-time performance at the DA level, buffer each stop by 250m representing walkshed

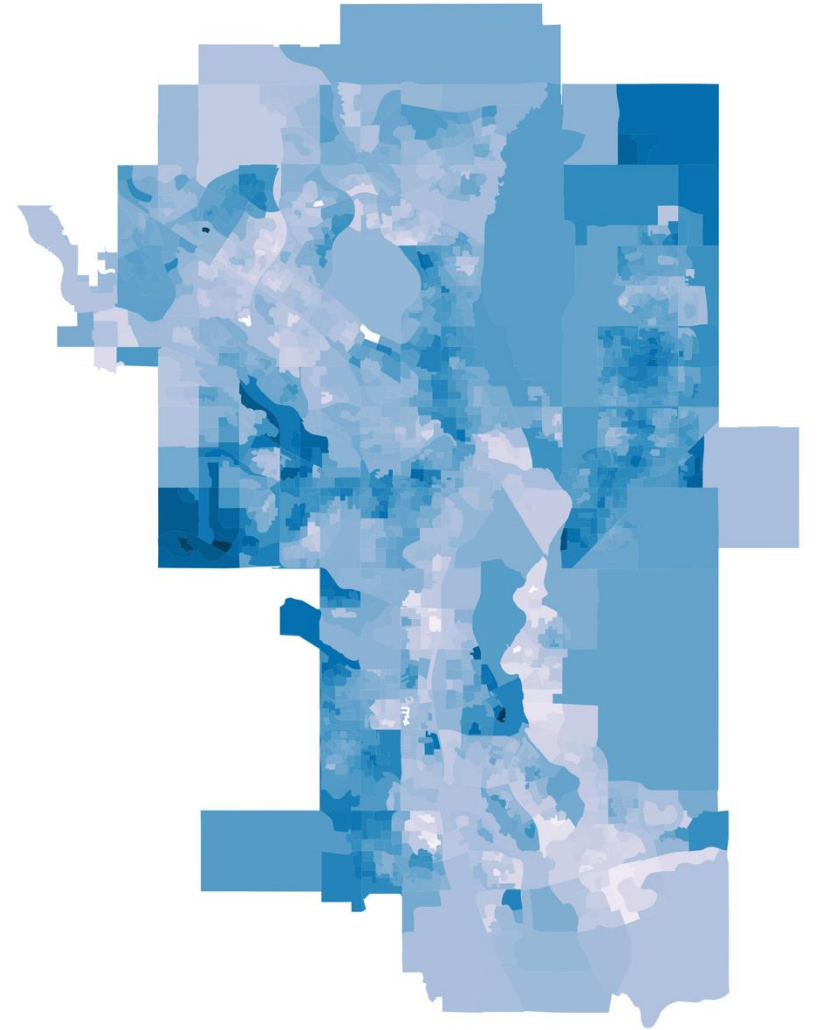




Priority



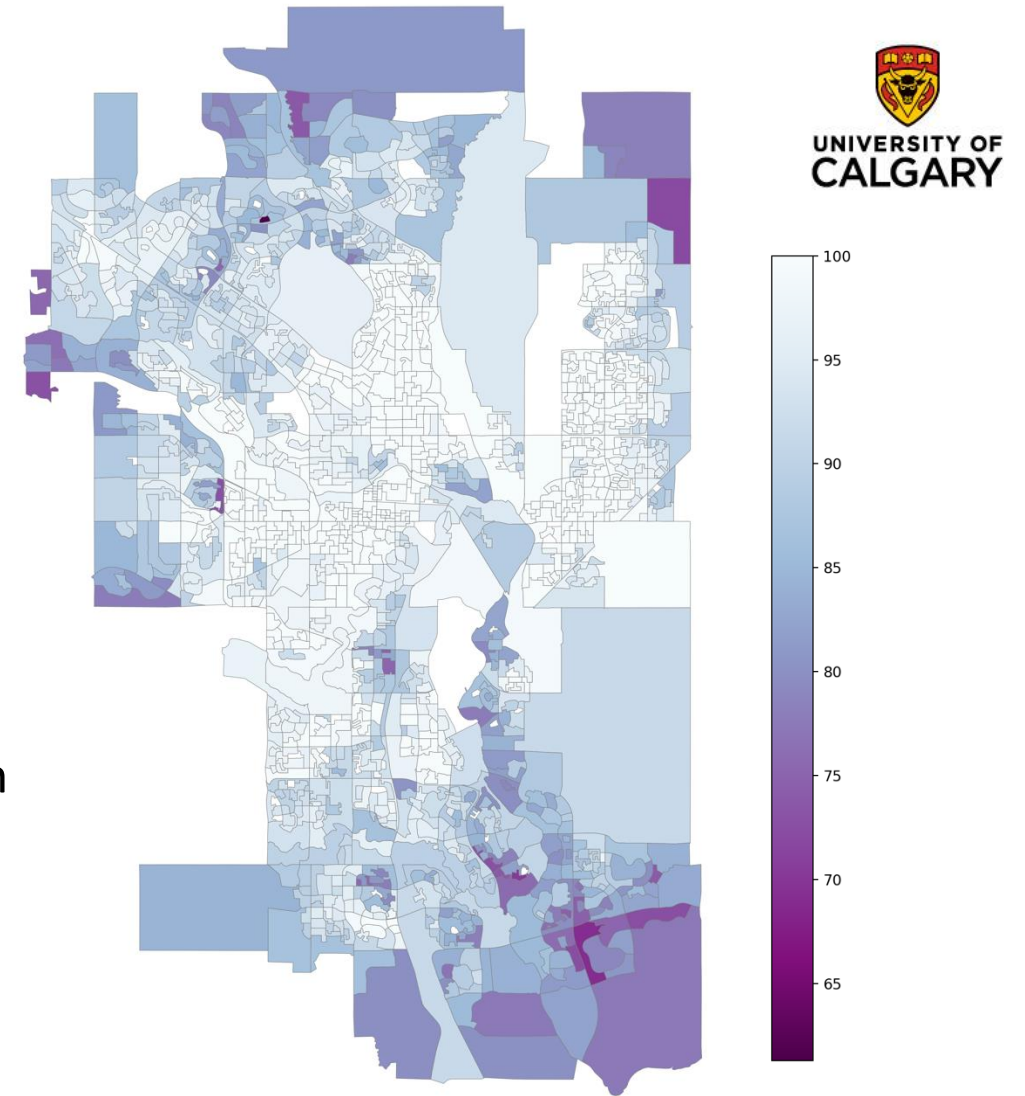
Access



Reliability

Transit Equity Score

- Need target Reliability and Total Access Scores that we measure each DA against
 - Choose either 25th quantile or median
- Find gap:
 - $Reliability_{GAP} = Reliability_{median} - DA_{reliability}$
 - $Access_{GAP} = Access_{median} - DA_{Access}$
- If $GAP < 0$, assign value of 0 to DA, normalize across region by dividing by GAP_{max}



$$\text{Transit Equity Score} = 1 - \left(\frac{Reliability_{GAP_norm} + Access_{GAP_norm}}{2} \right) \times Priority$$

Thank You



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