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# **Simple Open Data Measures of Public Transit Service Availability**

**Usecases for Closeness Centrality and Isochrones**

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# 1 Introduction

In recent years, but for decades by now, the demand for a paradigm shift in transportation infrastructure and service has become louder and louder. While calls for a shift away from car centric mobility are nothing new and were a well established part of German Academic discourse in the 1990s already [1], it has become part of a widespread political discourse around the so called *Verkehrswende* [2]. With increased awareness and concrete experiences of climate change this discourse has reached states of heated debate. Benefits of

## 1.1 Transit Accessibility Equity and Equality

### 1.1.1 Terminology

### 1.1.2 Motivation

- Traditional transport planning centering on men?
  - German Transport Planning post world war 2?
- Transit planning and identifying demand in public transit networks is a complicated process, that takes into account a plethora of data that's hard to access or acquire [3].
  - statistical routing data based on conveyal engine [4]

### 1.1.3 Research Question

- How temporal variability in transit accessibility maps on to spatial usage patterns?

## 1.2 Related Work

- Network Centrality Measures
  - road networks
  - public transit networks
  - bipartite networks
- Transit Equity Studies
  - US
  - Network Planning [3]
- Traveltime Datasets such as [5] and [6]

## 1.3 Methodological Approach

### 1.3.1 Data Acquisition

- explorative data analysis

### 1.3.2 origins

- hexgrids from h3pandas [7] based on uber's implementation of them

#### 1.3.2.1 Transport Data

- osm files from geofabrik [8]
- gtfs files from various transit companies [9]–[12].

#### 1.3.2.2 Destinations

- Usage of openly available data, preferably from osm .. extracted with pyrosm [13]
- specific data if necessary, eg secondary school data not mapped in osm [14]

### **1.3.3 Data Processing**

- Isochrones
  - available from openrouteservice [15], as used in [16], not used because:
- travel time matrices
  - enough for basic reach analyses, isochrone itself not important
  - calculated with r5py [17] as used in [5], based on the conveyal engine [4], [18]

### **1.4 Geographic Case Studies**

- Selected based on data availability, personal familiarity.

## **2 Closeness or Reachability**

### **2.1 Closeness Centrality**

### **2.2 Reach**

#### **2.2.1 Isochrones as a Measure of Reach**

- ors [15]
- cumulative or individual accessibility measures from [6]

### **2.3 Temporal Variability**

- conveyal approach [18]
  - also used in [6] for metrics spanning the UK, but identified gap in temporal variability of transport choices

### **2.4 Comparison Cases**

#### **2.4.1 secondary schools**

- see [6]
- data from [14]

#### **2.4.2 sports clubs**

- osm data

#### **2.4.3 hexgrid cells**

- h3 pandas [7]

### **2.5 Methods**

#### **2.5.1 Available Data**

- school data from [14]
- sports data from osm

#### **2.5.2 Processing**

## **3 Results**

## 4 Discussion

### 4.1 General Limitations

- Lack of real world measures as Comparisons
- Focuses solely on door to door travel times and neglects
  - reliability Data
  - delay data both for cars and public transit
  - public transit fare structures [19]
- *inequality* being silly at times [20].

## 5 Conclusion

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