

# Modelling paratransit in low data environments in Africa

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# Project team

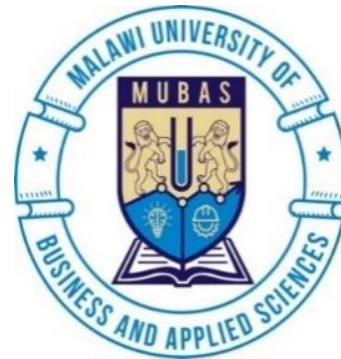
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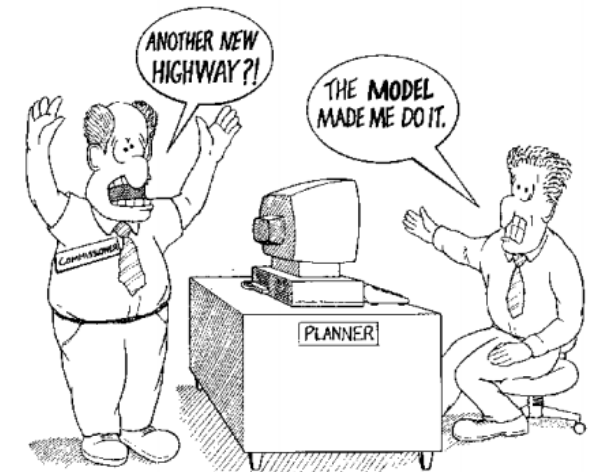


Karel Martens

# Background

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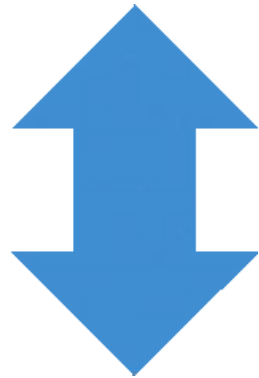
- Current transport planning methods are implemented in proprietary, as well as open-source, software.
- These tools are designed to analyse the functioning of transport systems, resulting in a focus on road congestion and solutions to ease congestion.
- This worsens transport-related social exclusion, in communities where the majority population is dependent on walking, cycling and informal public transportation to access their activities.
- Most informal public transport systems are typically not represented in these models at all.



# Are we planning for people or the transport system?<sup>4</sup>

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*Most people walk or cycle in SSA*

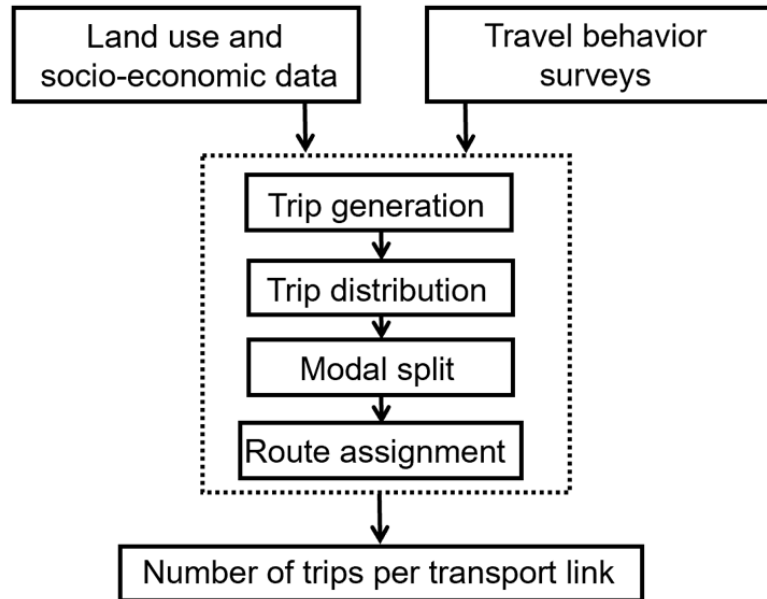


*The main focus of transport planning has been on congestion*



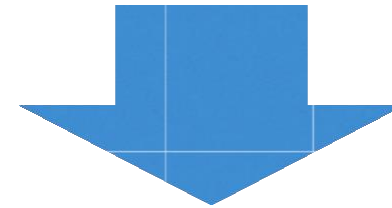
# Are we planning for people or the transport system?<sup>5</sup>

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Travel demand model

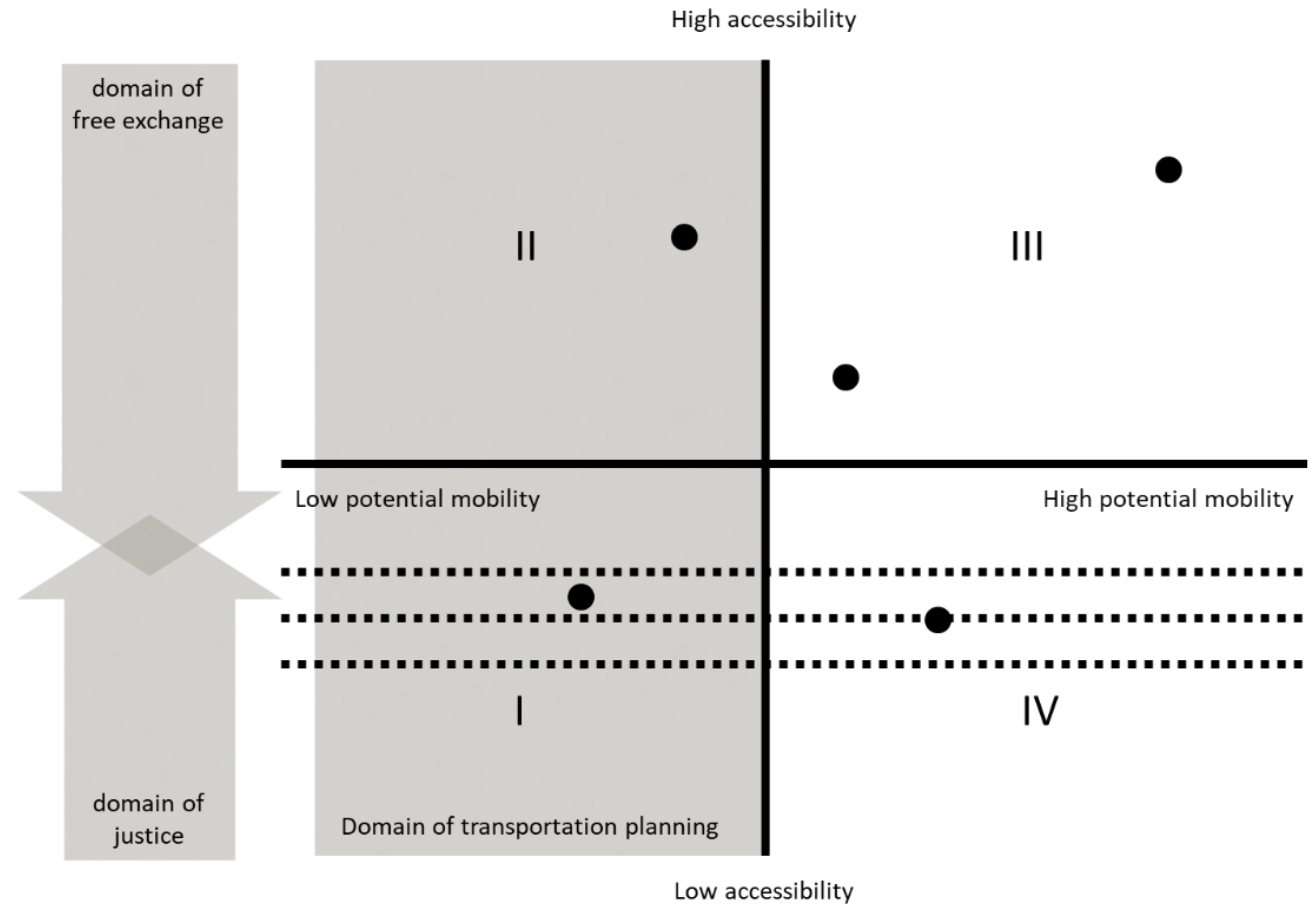
- Typically includes only motorized modes
- **Often ignores informal transport (paratransit)**
- Typically uses large zones ignoring short trips



So lack of supply for short trips remains an issue

# Transport justice

- Is it possible to undertake transport planning differently?
- Every person is entitled to a sufficient level of accessibility

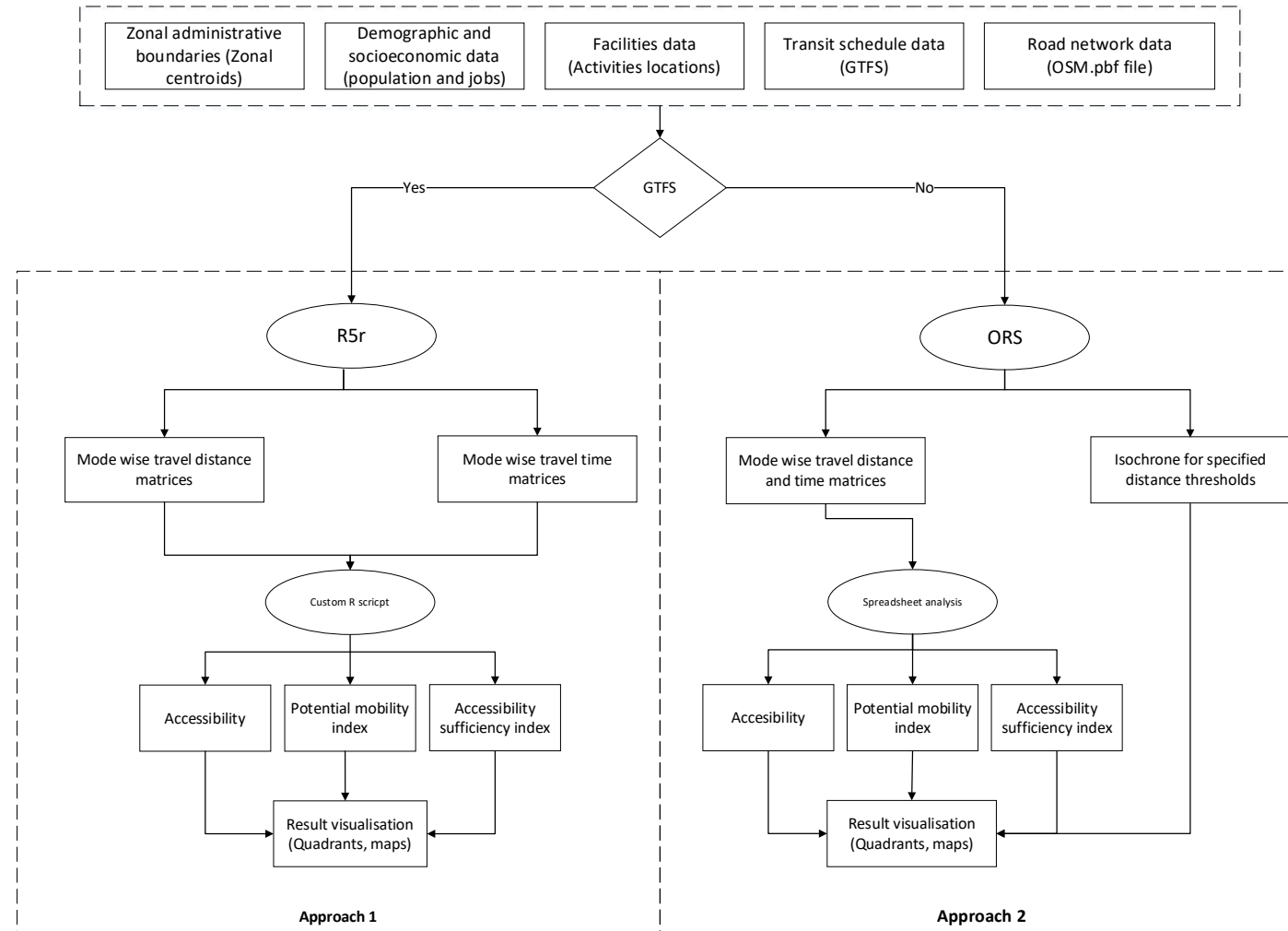


The domain of justice in transport planning (Martens, 2017)

# People centered transport planning

Steps in decision-making process	Conventional approach	Transport justice approach
Analyze the situation	<ul style="list-style-type: none"> <li>Travel demand modelling</li> </ul>	<ul style="list-style-type: none"> <li>Map accessibility patterns by population groups</li> </ul>
Identify problem	<ul style="list-style-type: none"> <li>Level of service analysis</li> </ul>	<ul style="list-style-type: none"> <li>Determine groups experiencing accessibility shortfalls</li> </ul>
Develop solutions	<ul style="list-style-type: none"> <li>Identify mainly transport related interventions</li> </ul>	<ul style="list-style-type: none"> <li>Transport interventions if transport is cause of accessibility shortfalls</li> <li>Land use and service delivery interventions if lack of destinations is cause of accessibility shortfalls</li> </ul>
Evaluate possible alternatives	<ul style="list-style-type: none"> <li>Cost-benefit analysis</li> <li>Environmental impact assessment</li> </ul>	<ul style="list-style-type: none"> <li>Cost-effectiveness analysis to assess solutions contribution to reduction in accessibility shortfalls</li> </ul>
Implement selected alternative	<ul style="list-style-type: none"> <li>Build, operate, and manage transport services</li> </ul>	<ul style="list-style-type: none"> <li>Build, operate, and manage transport services</li> </ul>

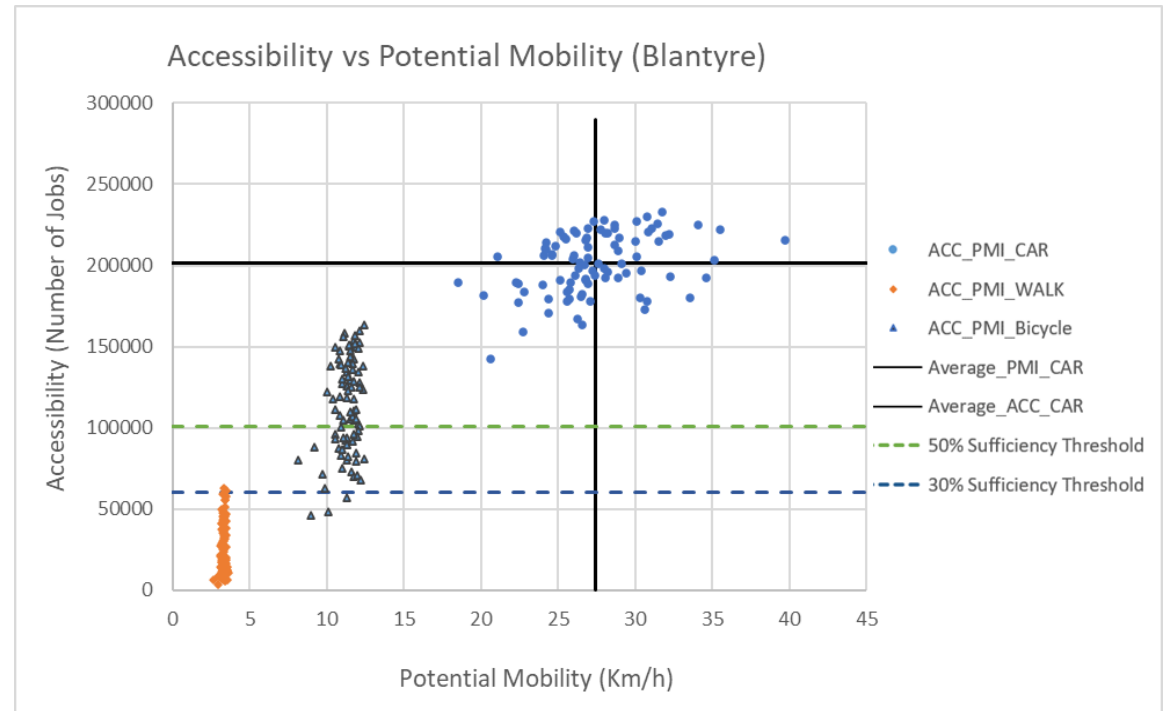
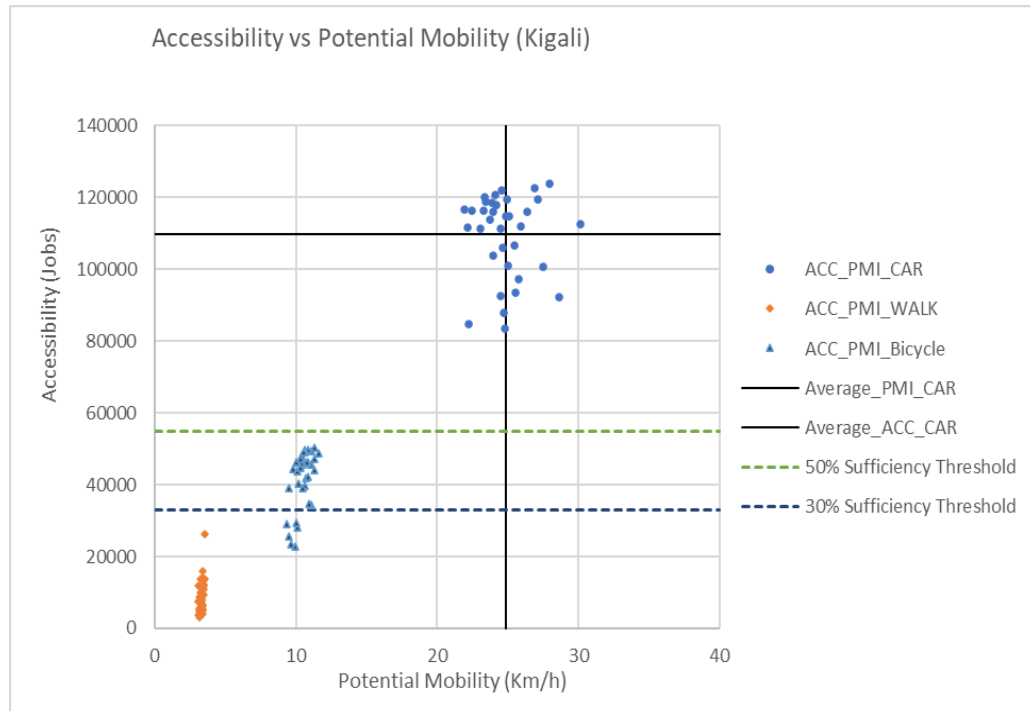
# Transport justice Challenges tools and perspective (EP-2020-MAC-04)



Two approaches to implement transport justice



# Transport justice Challenges tools and perspective (EP-2020-MAC-04)



# The new challenge?

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- To find suitable opensource methods and procedures for deriving GTFS data for paratransit needs.



# Project objectives

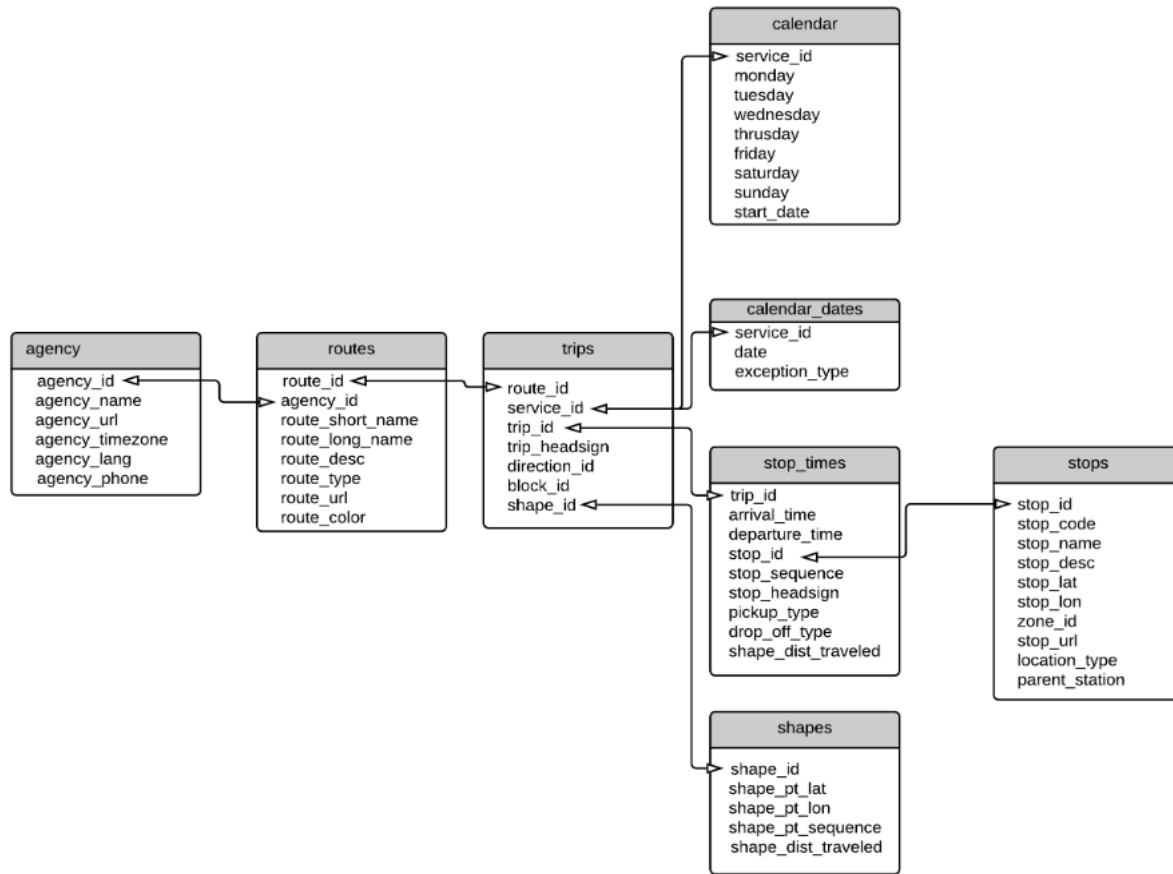
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- To provide an overview of existing approaches to modelling public transport and paratransit.
- To analyse variability of routing, stops and (notional) schedules from at least two different regulatory environments, thereby revealing different paratransit typologies.
- To develop GTFS feeds for paratransit services to be used for the accessibility.
- To integrate the GTFS in the transport justice analysis framework developed in EP-2020-MAC-04.
- To case-test and demonstrate the improved model for data situations in the context of Kigali, Rwanda and Blantyre, Malawi.

# Project work packages

Work Package	Description	Deliverable(s)
WP1	<ul style="list-style-type: none"> <li>An international literature review is being conducted on analytical approaches reported in the peer reviewed scientific literature</li> </ul>	<ul style="list-style-type: none"> <li>a literature review report and review paper targeting Transport Reviews</li> </ul>
WP2	<ul style="list-style-type: none"> <li>Data collection and statistical analysis of paratransit operations</li> </ul>	<ul style="list-style-type: none"> <li>A data collection protocol for paratransit models particularly focusing on the minimum data requirements</li> <li>A method description on how to convert existing GPS data into a stochastic model for GTFS</li> </ul>
WP3	<ul style="list-style-type: none"> <li>R5R extension for transport planning based on principles of justice</li> <li>we will now extend the existing R5R code base to allow representation of paratransit next to formal, scheduled, public transport services</li> </ul>	<ul style="list-style-type: none"> <li>An R5R extension that will be made available on Github.com</li> </ul>
WP4	<ul style="list-style-type: none"> <li>Updated case studies transport planning based on principles of justice in Kigali and Blantyre</li> </ul>	<ul style="list-style-type: none"> <li>Updated case studies transport planning based on principles of justice in Kigali and Blantyre</li> </ul>

# GTFS

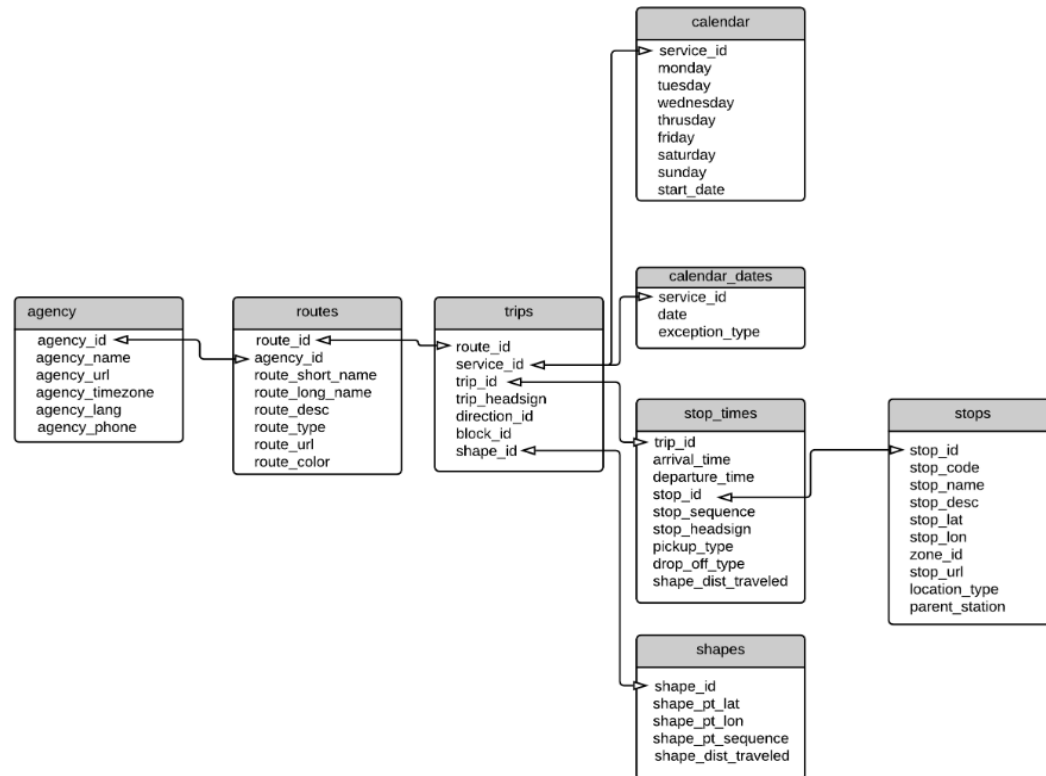


- General Transit Feed Specification (GTFS) is a uniform standard used globally to represent public transport operational data.
- However, these GTFS feeds contain only data for scheduled, formal, public transport services.
- Informal public transport represents between one-third to the entire public transport modal split in most African cities (Behrens et al. 2016).
- Without an accurate description of these informal modes in the analytical tools available to researchers on the African continent, chances are that these models will (again) exacerbate the misrepresentation of the urban poor in their transport forecasting and analysis.

Pereira, Rafael H. M. & Herszenhut, Daniel. (2023) Introduction to urban accessibility: a practical guide with R. Ipea - Institute of Applied Economic Research.

# GTFS Extensions

- Continuous Stops: Allows user to begin their trips at any point between the typical stop locations thereby allowing the capture of data for Demand Responsive Service (DRT) services.
- GTFS-Flex: Incorporates route deviation.



# GTFS Tools

README.md

## osm2gtfs

build unknown

Use public transport data from [OpenStreetMap](#) and external schedule information to create a General Transit Feed (GTFS).

The official source code repository is at [github.com/grote/osm2gtfs](https://github.com/grote/osm2gtfs).

### How does it work?

The script retrieves current data about public transport networks directly from OpenStreetMap via the Overpass API. It stores the data in python objects and caches on disk for efficient re-use. Then the data is combined with another source of schedule (time) information in order to create a GTFS file using the transitfeed library.

For every new city a new [configuration file](#) needs to be created. Additionally, schedule information should be provided. By-default the schedule information is expected to be provided in a [certain format](#). However other formats are supported through extending the code. For any city and schedule format the script can be easily extended, see the [developer documentation](#) for more information.



*static*

**Manager**

*An open source tool for managing and creating public transit schedules data in static GTFS format.*

National RTAP  
Rural Transit Assistance Program

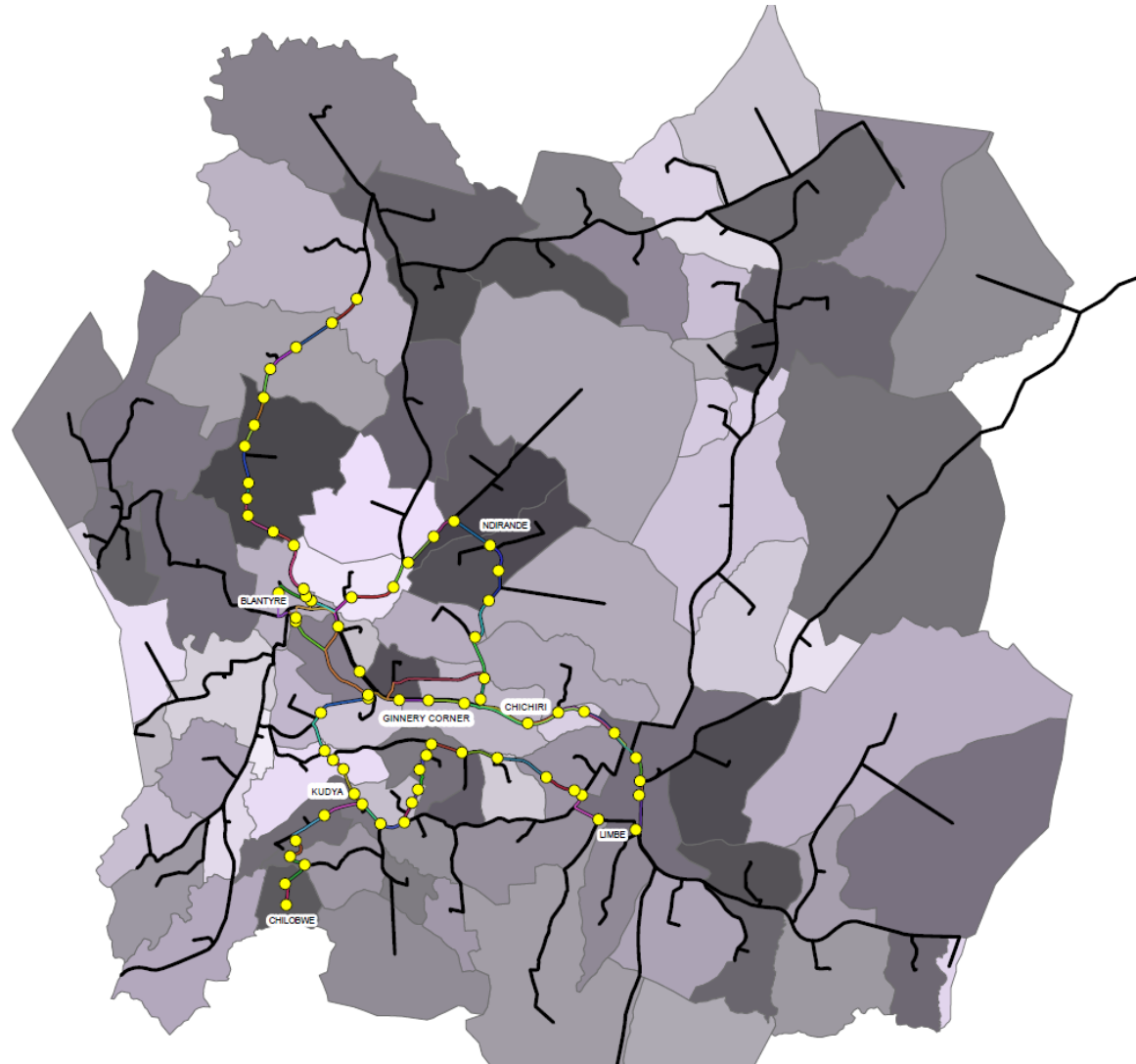
## GTFS Builder

Download

[Introduction](#) | [About GTFS Builder](#) | [Features](#) | [Before Beginning](#) | [Upload GTFS Feed](#) | [Technical Support](#)

# Blantyre case study

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# Data requirement

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- **Zonal data or zonal centroids:** Disaggregated spatial data like Traffic analysis zones (TAZ).
- **Demographic and socioeconomic data:** The population and opportunities data of an area by zones and socioeconomic characteristics.
- **Street network of the study area:** This comprises nodes and links in open street network format.
- **Transit schedule data:** Operational schedule data are organised in a format known as General transit feed specification (GTFS).

# Data collection

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- Field agents have been recruited to collect data at mini-bus ranks, on-board the vehicles and to perform spot observation of the paratransit operations along the routes.
  - Arrivals at destinations and departure at terminals.
  - Travel time between stops.
  - Observed frequency at a given point along the route.
  - Average travel time on the routes.
  - Sequential arrangement of route stops between terminals.

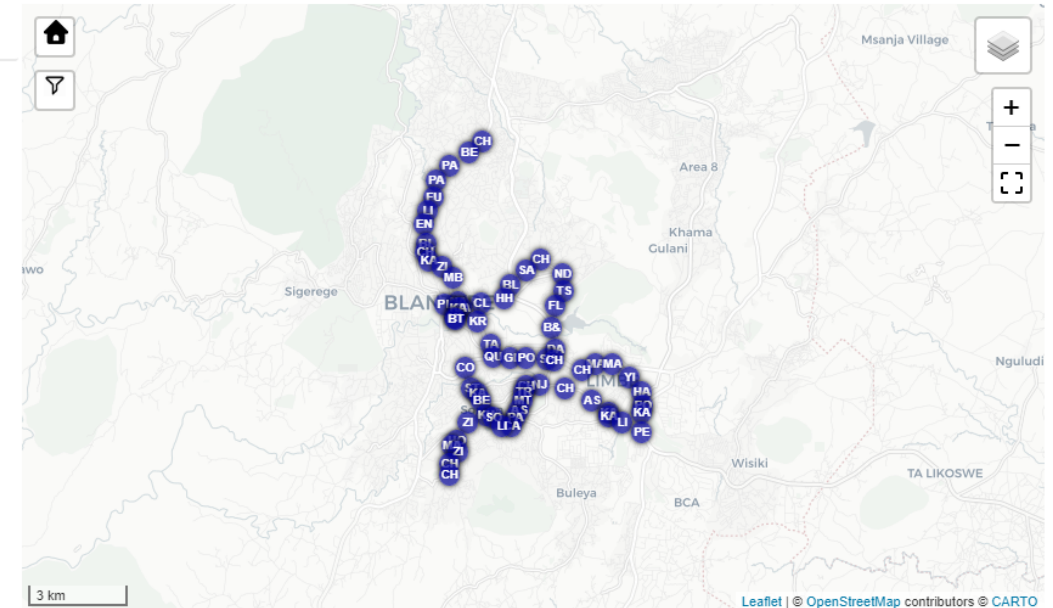
# GTFS development

## Stops

▸ Instructions

List Add / Edit

stop_id ▲	stop_name ▲	stop_lat	stop_lon	zone_id ▲	wheelchair_boarding
filter col	filter column...				
10	PLANTATION HOUSE	-15.78659	35.00527	10	1
28	MIBAWA	-15.79014	35.0079	28	
27	BT MARKET	-15.79064	35.00817	27	
29	KANDODO CORNER SHOP	-15.78755	35.01	29	
65	KANDODO CORNER	-15.78747	35.00911	65	
66	NATIONAL LIBRARY	-15.78598	35.00881	66	
67	MBAYANI	-15.7794	35.00743	67	
68	ZIKOMO	-15.77646	35.00464	68	
69	KABULA POLICE	-15.77459	35.00068	69	
70	CHEMUSA	-15.77253	34.99975	70	
71	BLACK BOX	-15.77018	35.00002	71	
72	ENGEN	-15.76473	34.99932	72	
73	LIKHUBULA	-15.76134	35.00033	73	
68 stops total					



Note: Auto-zooming-in or out is disabled because it was disorienting users while mapping. You can use +/- keys after clicking once on the map to quickly zoom.

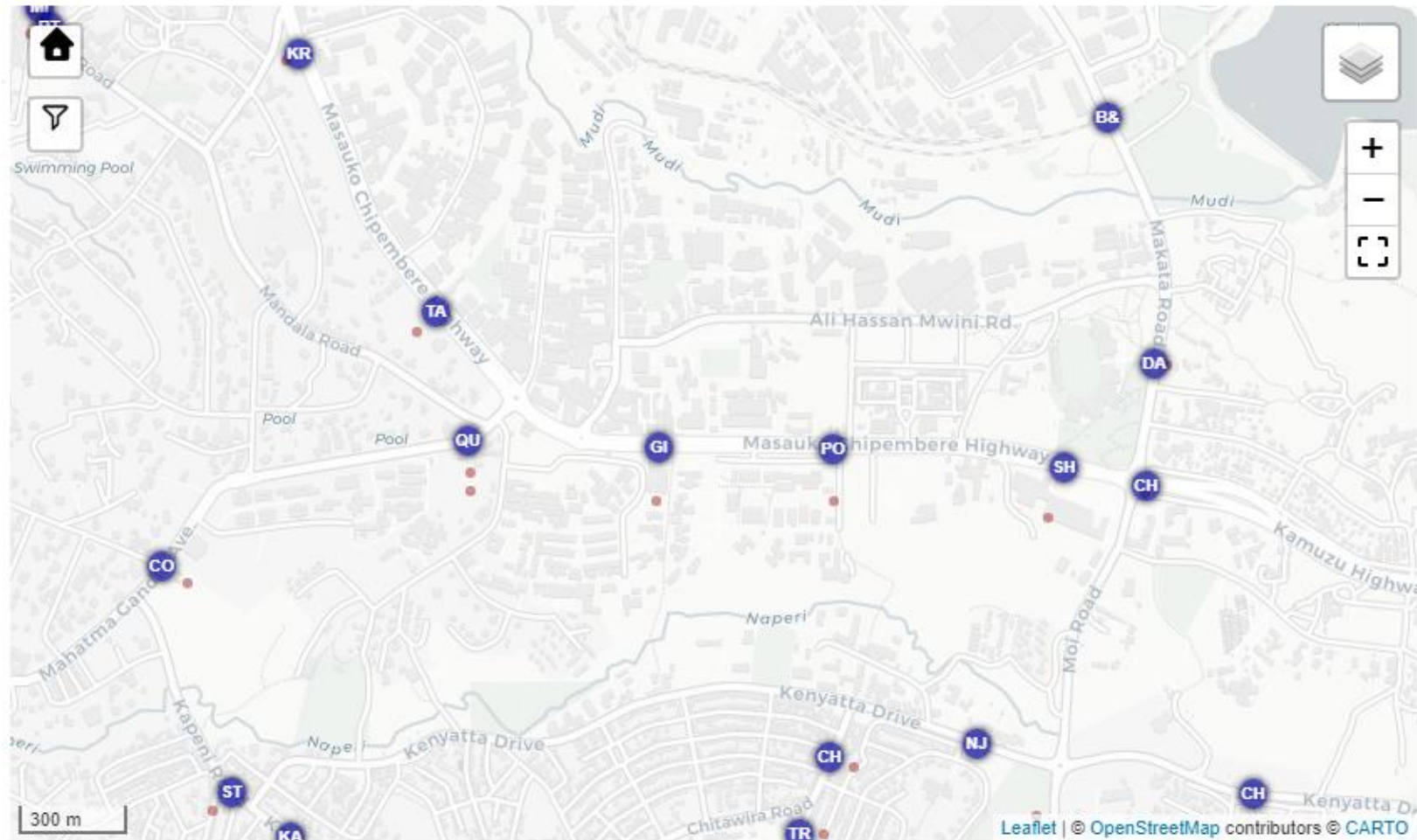
Once all edits are done,

Got another data source of point locations?

No file chosen

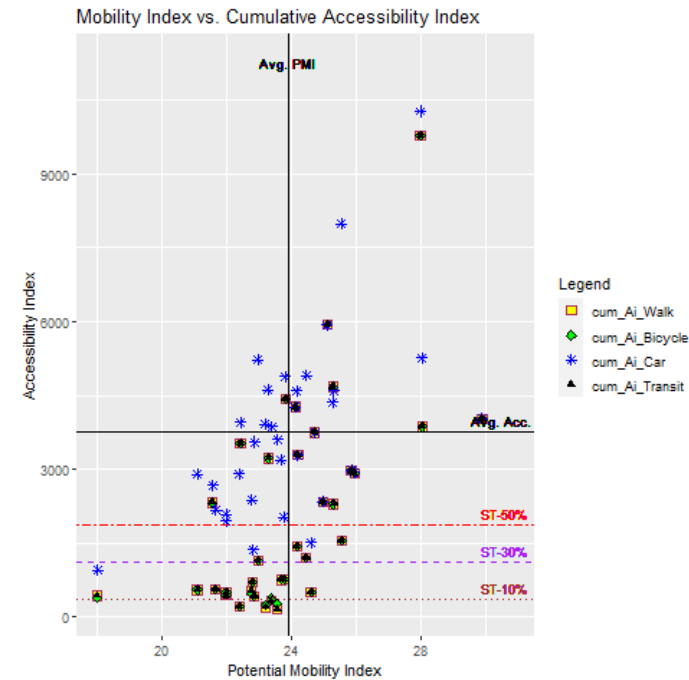
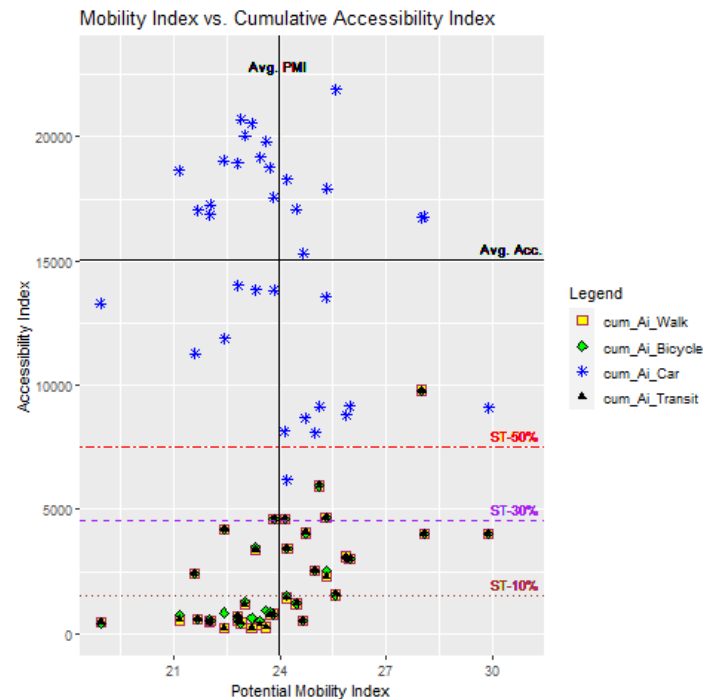
Will appear as small brown points. The CSV databank file needs to have at least a stop\_name, stop\_lat and stop\_lon column.

# GTFS development



# Next steps

- Finalise data collection in Blantyre and Kigali.
- Finalise development of the paratransit GTFS.
- Refine the initial transport justice model and results to reflect public transport (paratransit).
- Submit final project report.



# Reflections

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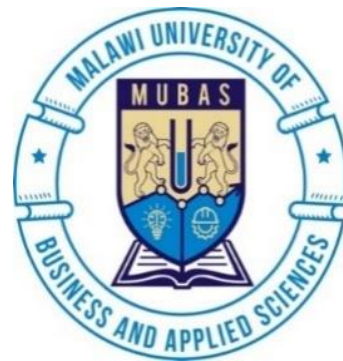
- It is important to avoid building transport systems and land use patterns that give preference to the private car over other modes of transport.
- Transport justice in Sub-Saharan Africa requires a distinct approach from the approach so far developed for conventional transport planning.
- The systematic mapping of the population groups that are not served well remains a key component of this approach, as it is essential to shift the discourse from a concern over congestion to the more important goal of delivering accessibility to all.

# Acknowledgement

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# VREF

VOLVO RESEARCH & EDUCATIONAL FOUNDATIONS



**Thank you!**