Truck monitoring in Eastern and Southern Africa

SSATP

Outline

- Background and objectives
- Methodology and Scope
- Choke points
- Routes
- Next steps

Background and objective: data as public goods

Rationale for corridor performance monitoring

- If you can't measure it, you can't improve it
- Standard approach: ad-hoc data collection campaigns to identify choke points and get the correct diagnosis
- Two problems with that:
  - Only reactive, not a pro-active approach
  - No sustainable data collection
- That is precisely the rationale for the development of corridor transport observatories

Focus on trucking challenges in Eastern and Southern Africa

- Large and untapped source of information: truck fleet management GPS data (proof of concept by TMSA)
- Web-based corridor performance monitoring system (CPMS): reports and indicators measuring border crossing time and route time for several corridors in Eastern and Southern Africa

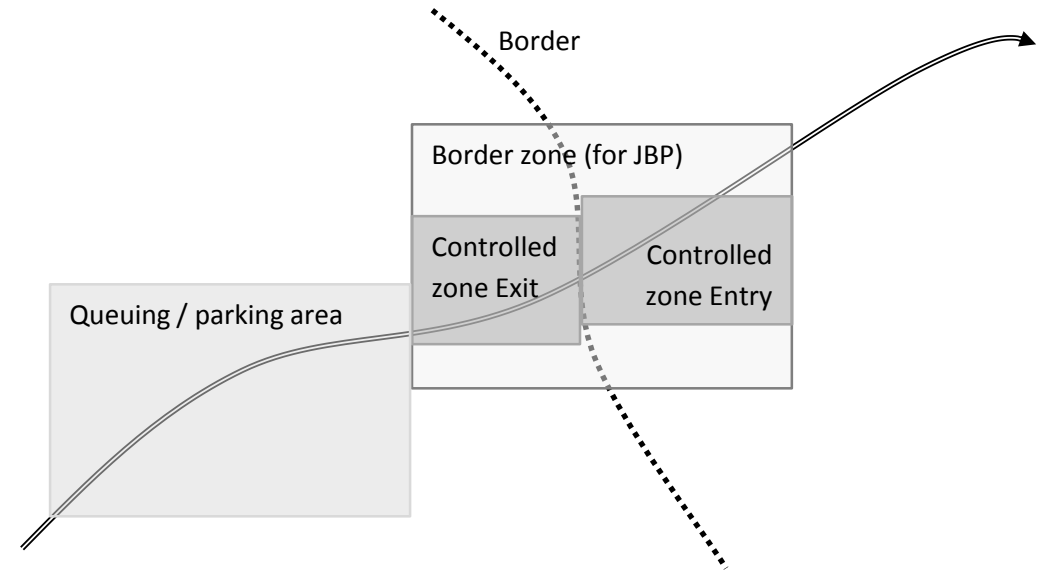# First look at methodology: geo-fencing and timing

- Principles
  - GPS units on board of trucks send positioning information every few seconds (or in batch when connectivity is an issue):
    - GPS unit number (unique identifier for the tractor)
    - Date and time (frequency varies, but on average, one blip every few seconds)
    - GPS coordinates
    - Speed
  - Clock starts when the first positioning information falls within a defined geo-zone
  - Clock stops when the position falls outside of the zone
  - Layers of geozones (region, site, area and activity point) enables advanced analysis
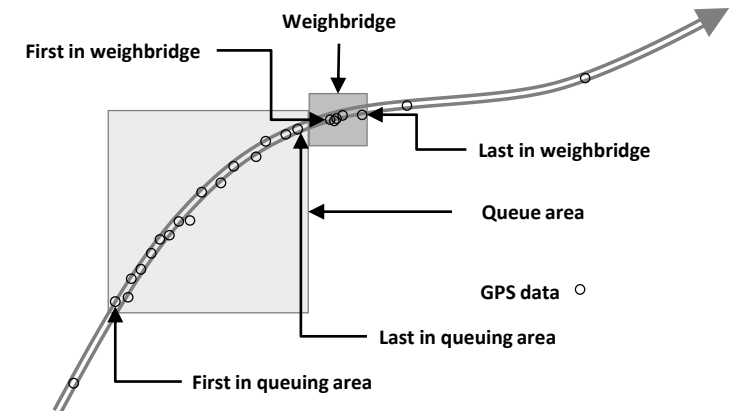
Second look at methodology:

- In practices, there are a few additional tricks to transform data into information:
  - Careful definition of the zones to match functions, and not only locations
  - Slice the continuous movements of the trucks into trips:
    - Information on routes identified as succession of nodes
    - Direction counts (3 way borders & borders on multi routes is a challenge)
    - Get a sense of the border procedures (transit / import)
  - Information from different providers is not consistent and therefore granular data extracted and built form ground up (billions of data points per month and tens of billions of calculations)

Border

Border zone (for JBP)

Controlled zone Exit

Controlled zone Entry

Queuing / parking area

A few numbers: data sources

- Data Source
  - Specific fleets
  - Bulk depersonalized
- Truck fleet:
  - MixTelematics
  - Cartrack
  - Globaltrack (in negotiations)
  - Skygistics
  - 8 more OBC providers potential
- Countries:
  - Basically everywhere the truck fleet moves
  - Most customers of the GPS service providers are in RSA

| Number of countries	Vehicles
1	77577
2	4387
3	1788
4	1336
5	73
6	29
7	2

A few numbers: geographic scope

- Catalogues of geo-fenced areas, so far, the zones cover:
  - 11 sea ports
  - 15 economic areas, usually the capital city (when not a port)
  - 2 dry ports
  - 3 lake ports
  - 24 inland borders (with each side of the border, and for 5 of them, additional sub-zones)
  - 186 areas of interest to date

| Border	Observations
Beitbridge	7,002
Kasumbalesa	5,043
Chirundu	4,452
Martins/Groblersburg	4,391
Kazungula	1,450
Forbes/Machipanda	1,225
Gatuna/Katuna	888
Busia/Malaba	771
Oshoek/Ngwenya	763
Nakonde/Tunduma	740
Nyampanda/Cuchamano	657
Kopfontein	618
Lebombo/ R Garcia	514
Vic Falls/Livingstone	426
Trans Kalahari/Mamuno	275
Vioolsdrif/Noordoewer	126
Maseru/Ladybrand	92
Bwera/Kasindi	62
Songwe/Kasumulu	29
Bunagana	24
Mgabi/Kachebere	22

Choke points: borders (1)

- There is usually a wide variance of crossing times
- Several consequences:
  - Median, top 5% and bottom 5% are far better descriptions than averages, min and max
  - Consider different scenarios and crossing patterns in the analysis, for instance:
    - What if truck arrives in the morning compared to afternoon?
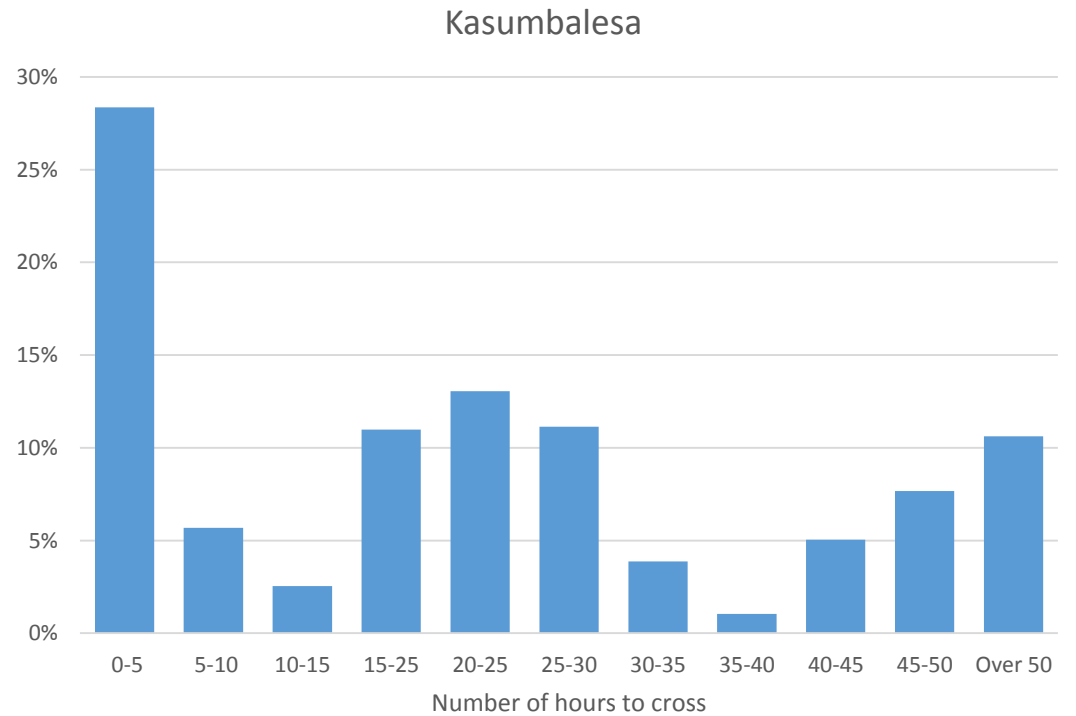   - Transit versus clearance
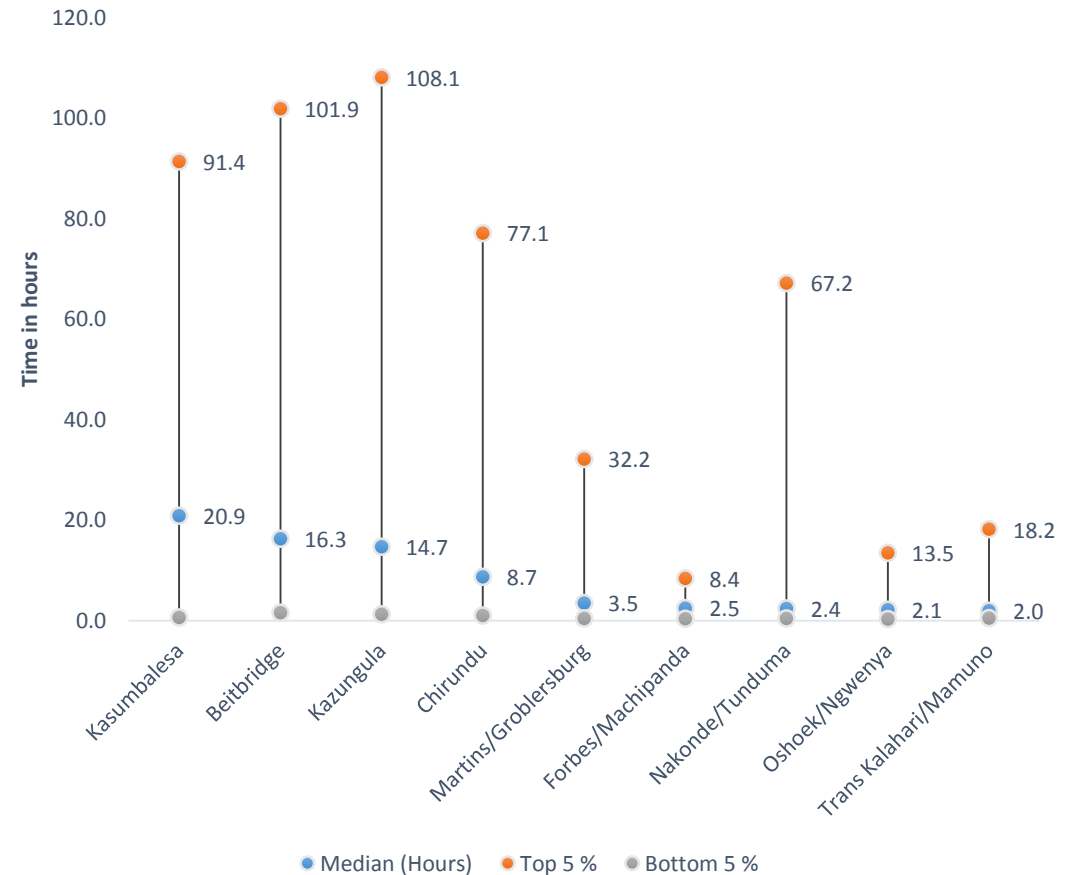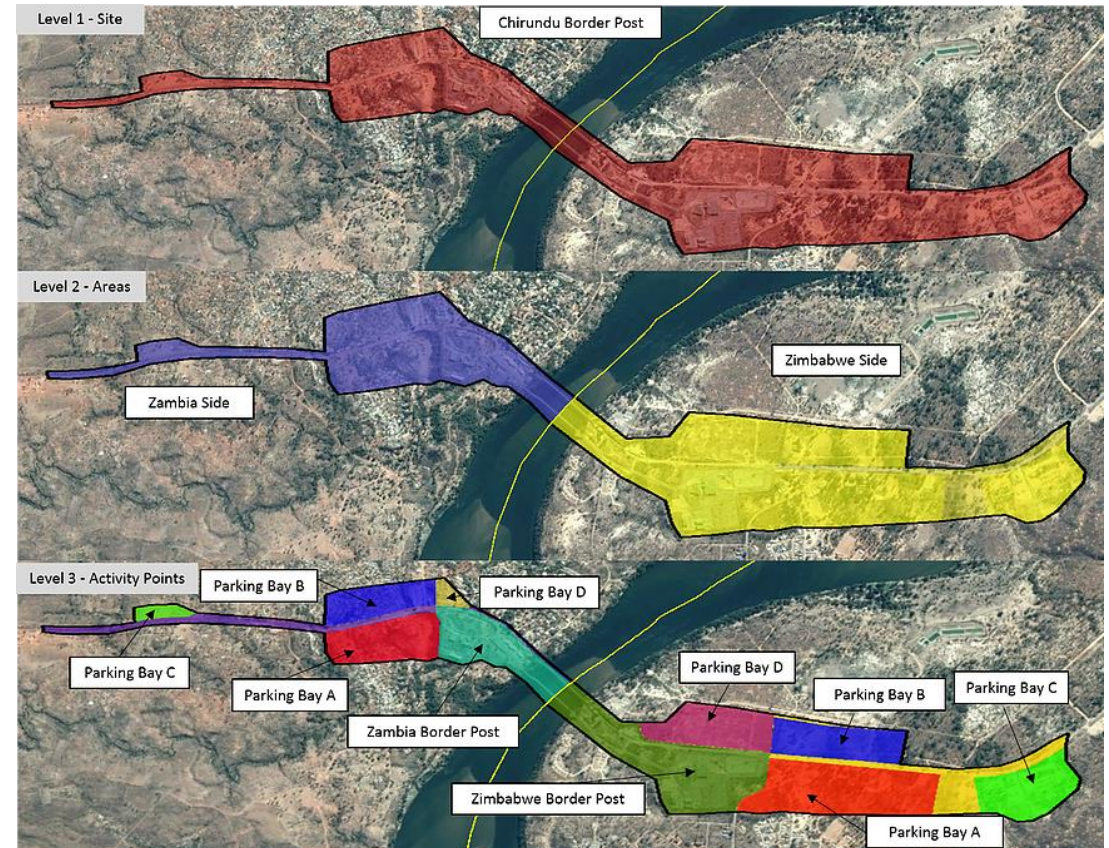
Choke points: borders (2)

Arrival time at the border
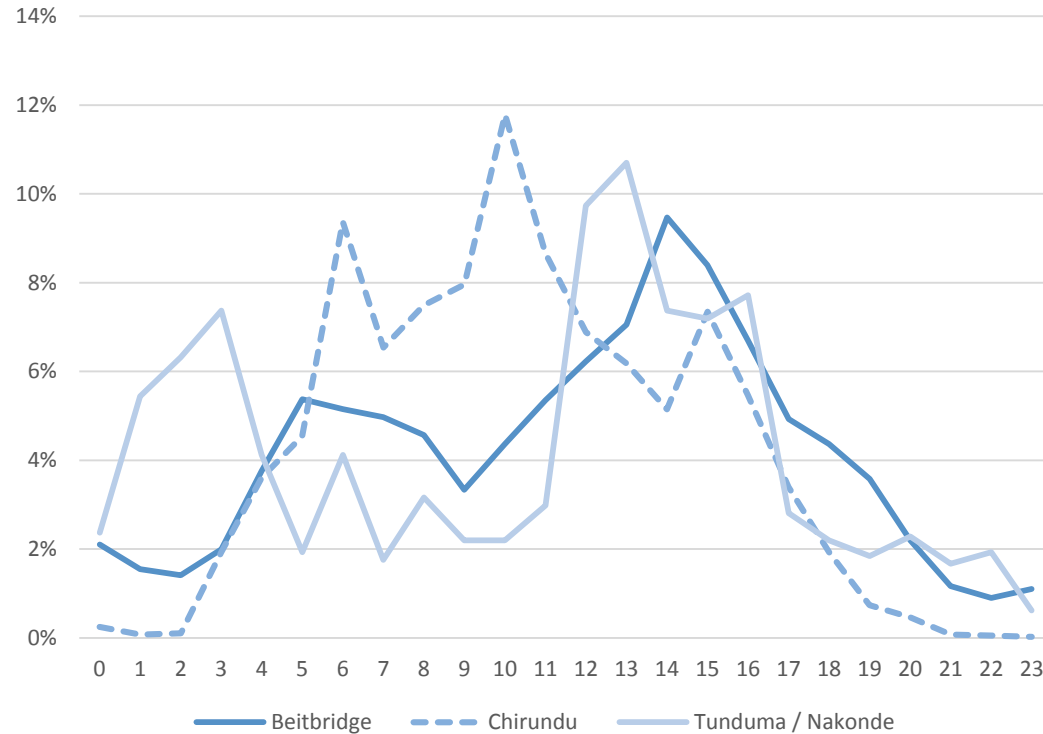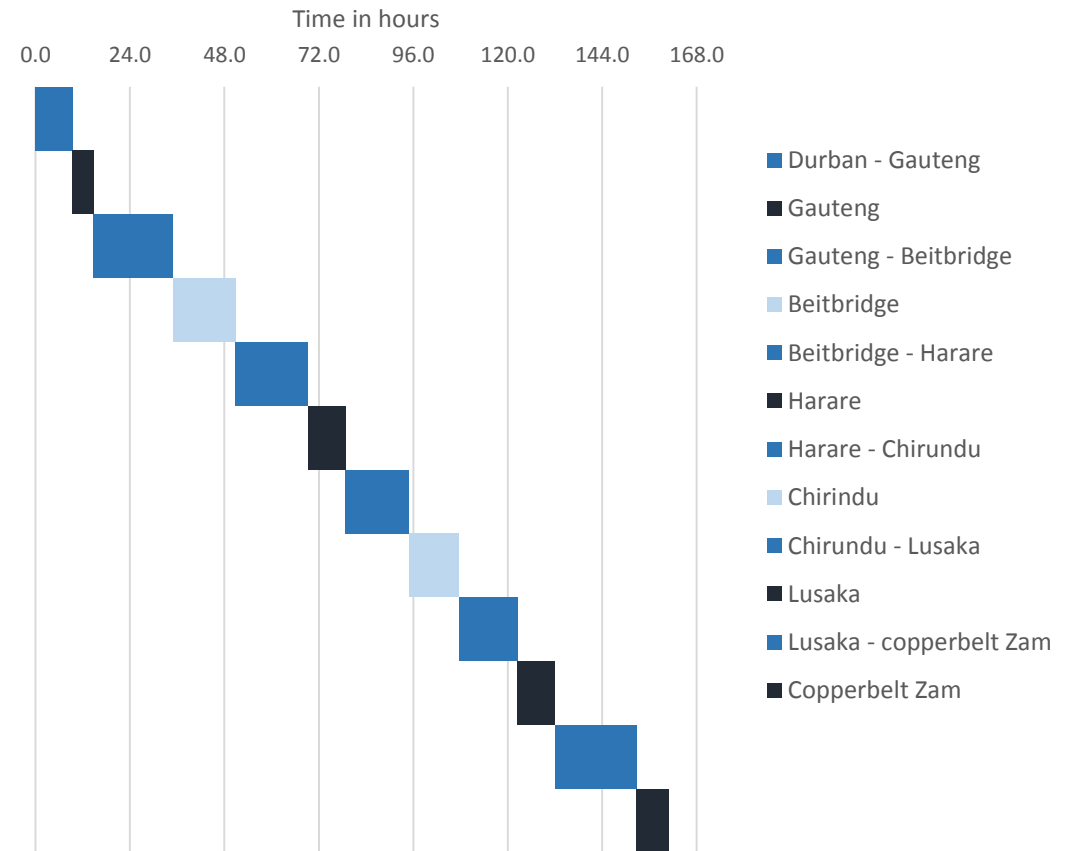
Distribution of crossing time

Choke points: borders (3)

- All borders are split between the two countries, for instance:
  - Chirundu Zambia
  - Chirundu Zimbabwe
- A few borders (5 currently) have additional zoning, linked to functional areas within the border:
 - Parking yard
  - Customs controls

Routes

- A route is identified by a succession of nodes (the geofenced areas) and their links

- For instance, Durban to Zambia copperbelt route is defined by Durban – Gauteng – Beitbridge – Harare – Chirundu – Lusaka – Zambia Copperbelt

- Indicators are calculated for the trucks passing in succession to all the nodes for a route
  - Beitbridge will be a transit crossing
  - Chirundu will be an import crossing

- Route time decomposed by segment: links, economic areas, and borders

Time in hours

0.0   24.0   48.0   72.0   96.0   120.0   144.0   168.0

- Durban - Gauteng
- Gauteng
- Gauteng - Beitbridge
- Beitbridge
- Beitbridge - Harare
- Harare
- Harare - Chirundu
- Chirindu
- Chirundu - Lusaka
- Lusaka
- Lusaka - copperbelt Zam
- Copperbelt Zam

Route time

- Distribution of route time is important: how reliable is the delivery time?

- Example Durban – DRC Copperbelt:
  - Median time for northbound is 10 days
  - Median for southbound is 8 days
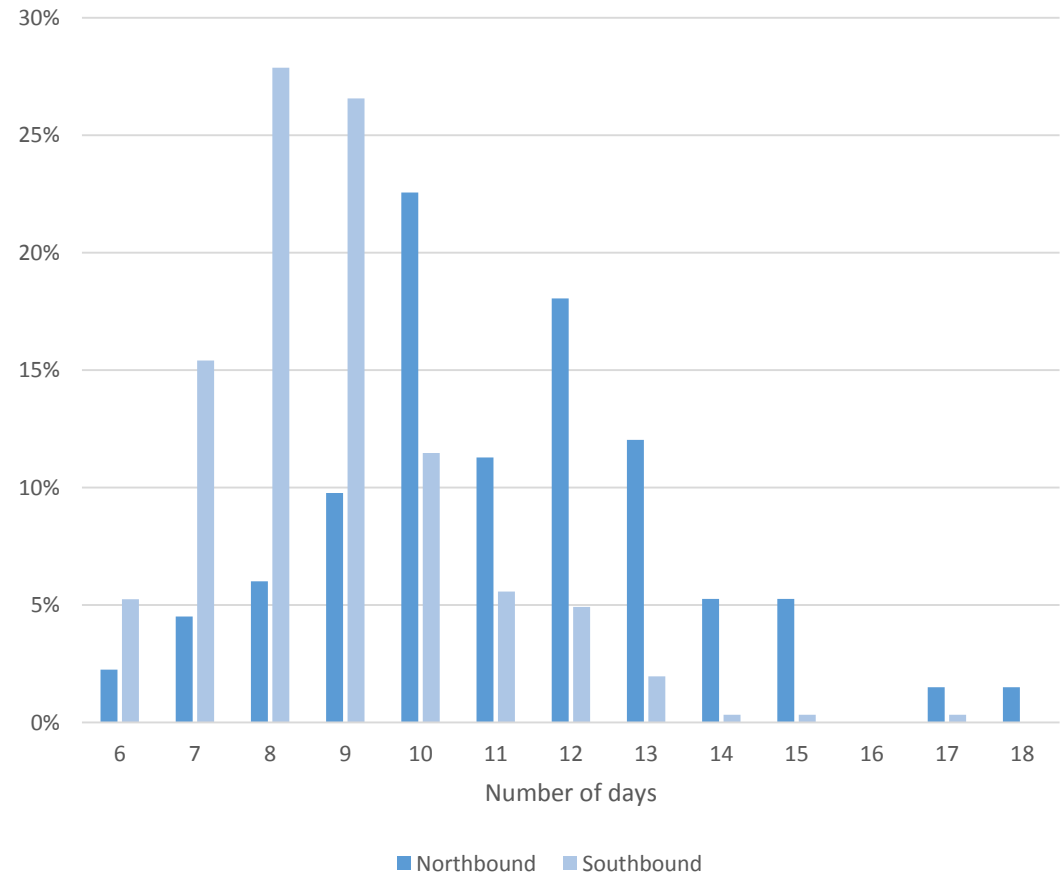
Route idle time: Durban - DRC

- Idle measures the time the truck is not moving, either due to intermediate stops on the links (weighbridges, rest stops, etc.), or at borders, or while crossing major urban areas

- Average speed is measured only when the truck is moving

- On the total route, the trucks are moving less than a quarter of the total route time

Segment	Average Speed	Median time	Idle time
Durban-Gauteng	41.4	12.2	50%
Crossing Gauteng	13.9	21.3	89%
Gauteng-Beitbridge	28.6	19.0	52%
Beitbridge border	9.8	18.8	91%
Beitbridge-Harare	50.2	10.8	34%
Crossing Harare	12.7	22.7	84%
Harare-Chirundu	40.6	14.2	57%
Chirundu border	8.3	9.6	96%
Chirundu -Lusaka	39.4	2.9	54%
Crossing Lusaka	10.6	3.5	69%
Lusaka-Kasumbalesa	31.0	21.6	60%
Crossing Kasumbalesa	3.0	28.4	97%
Kasumbalesa-DRC Copperbelt	61.1	1.1	5%
Corridor		186.1	74%

Mapping & GIS module

Truck giving up on Kazungula and going through Vic Falls instead

Truck en route to Copperbelt 'taking a break' in Gauteng
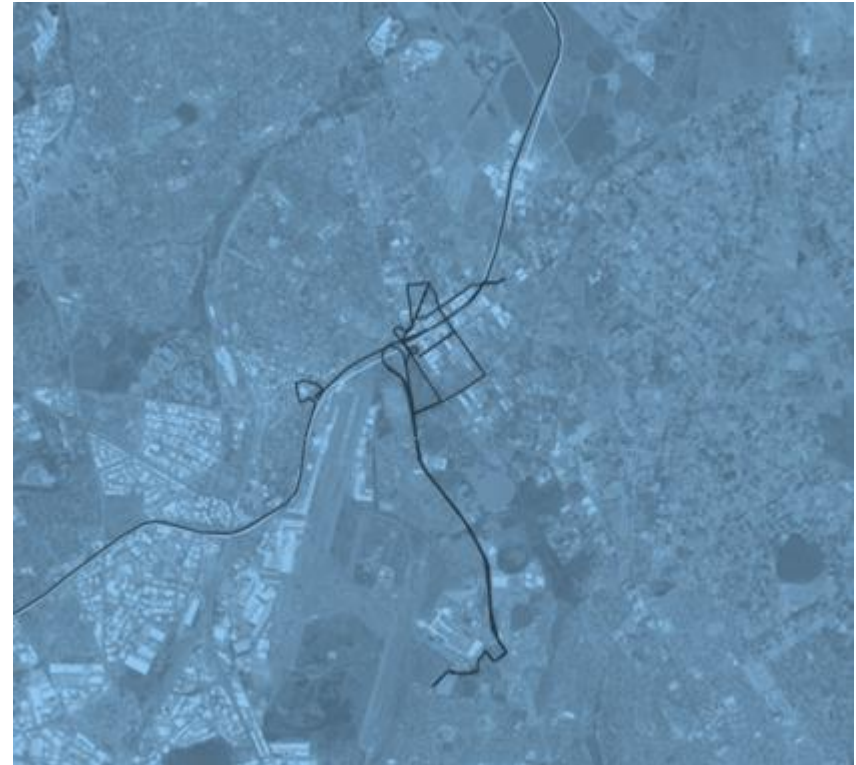
Immediate next steps

Data related

- Issue of truck nationality
- How far back historical data is relevant (cost versus interest)
- Diversification of the data sources:
  - Targeting specific countries for improved coverage?
  - Targeting specific industries?
  - Trucking companies with large fleet volunteering to contribute GPS data?

Internet tool related

- From beta-version to online tool:
  - Stabilize the dashboards: relevance of the indicators and reports?
  - Critical review of all the geo-zones:
    - Adding sublayers? For instance distinguish ports into terminal / port authority limits / metropolitan area
    - Diversifying interests? For instance fixed weighbridges, major rest areas
    - Limitation on the number of possible zones: prioritization

Mid-term next steps

Ensuring sustainability

- Hosting and updates are secured until February 2018
- Long term objective is to transfer the responsibility of the system to a regional institution or a consortium of regional institutions:
  - Trucking industry associations / FESARTA
  - SASTALC
  - Academia

Using information for advocacy and change

- Information is only the first step
- Once problems areas are identified, what type of advocacy is necessary to solve the problems?