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)
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

<table>
<thead>
<tr>
<th>Number of countries</th>
<th>Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>77577</td>
</tr>
<tr>
<td>2</td>
<td>4387</td>
</tr>
<tr>
<td>3</td>
<td>1788</td>
</tr>
<tr>
<td>4</td>
<td>1336</td>
</tr>
<tr>
<td>5</td>
<td>73</td>
</tr>
<tr>
<td>6</td>
<td>29</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
</tr>
</tbody>
</table>
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

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

Kasumbalesa

Number of hours to cross

Beitbridge  Chirundu  Tunduma / Nakonde
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
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.

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