Monitoring the Performance of Rural Roads Using GPS Surveys

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GPS Monitoring of Rural Road Performance
Overview

- Why we need new ways to measure rural road performance.
- How financing agencies' requirements differ from those of roads agencies.
- The set of Indicators which measure those aspects of rural road service of greatest value to users.
- The use of GPS monitoring for consistent, efficient and reliable data collection.
- The way forward to expand the application of the approach.

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Need for New Monitoring Instruments

- The primary objective for rural roads networks is to provide basic accessibility
- Most indicators focus on road condition and do not measure accessibility
- Road Funds, financing agencies, and other stakeholders need simple, consistent measures of how well rural roads satisfy the needs of users.

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What Rural Road Users Value

- Main vehicles are pick-ups, vans and small trucks carrying passengers and goods and traveling at slow speeds.
- Rupture points or sections of very low speed discourage transporters and reduce accessibility.
- Rural road users value roads that are transitable, permit reasonable speeds, and have few very slow sections.
- Roughness or ability to travel at high speeds are of secondary importance.

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Why Not Use Road Condition Surveys?

- Roads agencies collect road condition data for engineering purposes, to plan and design maintenance.
- Visual condition assessments tend to be subjective
- Mechanized condition assessments are expensive and complex
- Condition survey results are often not reported regularly enough or comprehensively
- Condition survey results may focus on the paved road network
- Condition surveys are under the control of the roads agencies, leading to a conflict of interest

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Requirements for Monitoring

- Data collection should be inexpensive, not require specialized skills, based on objective measures, and capable of being implemented independently of the roads agencies to reduce possible conflicts of interest.
- The indicators should generate simple and easily understood measures of accessibility.
- The indicators should be measurable at various levels of aggregation (road, class, province, network) permitting useful comparisons.
- The results should be consistent and robust
- The results should permit year-on-year and geographical comparisons.

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Coefficients of Rural Roads Accessibility

- **Speed Efficiency Coefficient (SEC)**

  Extent

  How much of the network is substandard?

- **Time Efficiency Coefficient (TEC)**

  Intensity

  How bad is the problem?

- **Road Accessibility Coefficient (RAC)**

  Reach

  How much of the network is made inaccessible?

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Thresholds and Rupture Points

- **Threshold speed**: the minimum acceptable speed for a low-volume rural road
  - Most users of rural roads don't need to go fast
  - Threshold speeds should usually be lower than design or legal speeds
  - Use of thresholds eliminates the influence of potential faster sections of road.
- **Rupture Point:** an impediment in the roadway that prevents normal traffic from passing
  - Many rupture points result from the absence of water-crossing structures
  - Rupture points may in fact be longer sections that are impassable.

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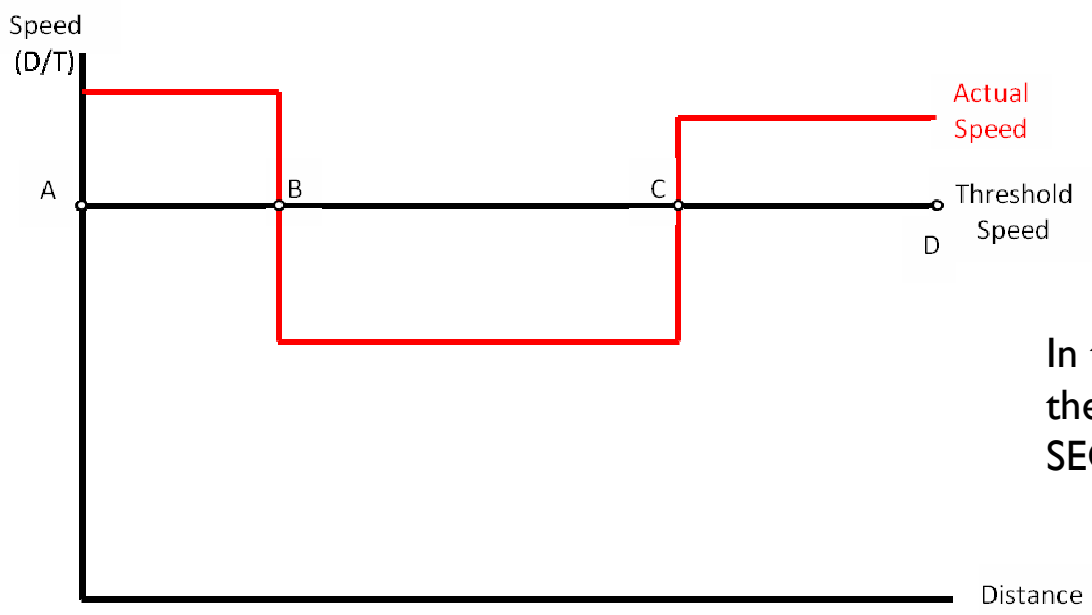
Speed Efficiency Coefficient

- SEC – the **extent** of road or network that performs at least as well as the target or threshold speed



In this case the value for the coefficient is:
SEC = (AB + CD)/AD

Figure : Speed Profiles: Actual Versus Target

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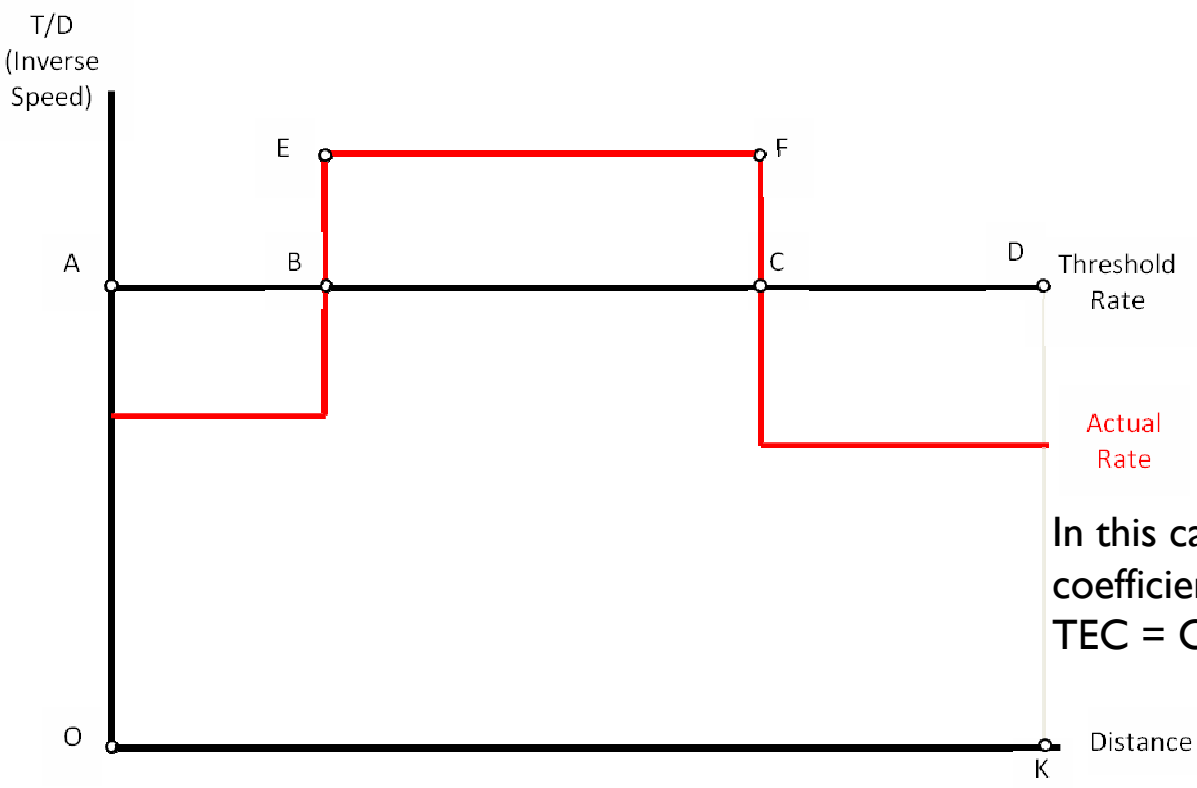
Time Efficiency Coefficient

- TEC – a measure of how close to the target travel time the road performs, the **intensity** of the problem areas



In this case the value for the coefficient is:
TEC = OADK/(OADK+BEFC)

Figure : Time Profiles: Actual versus Target

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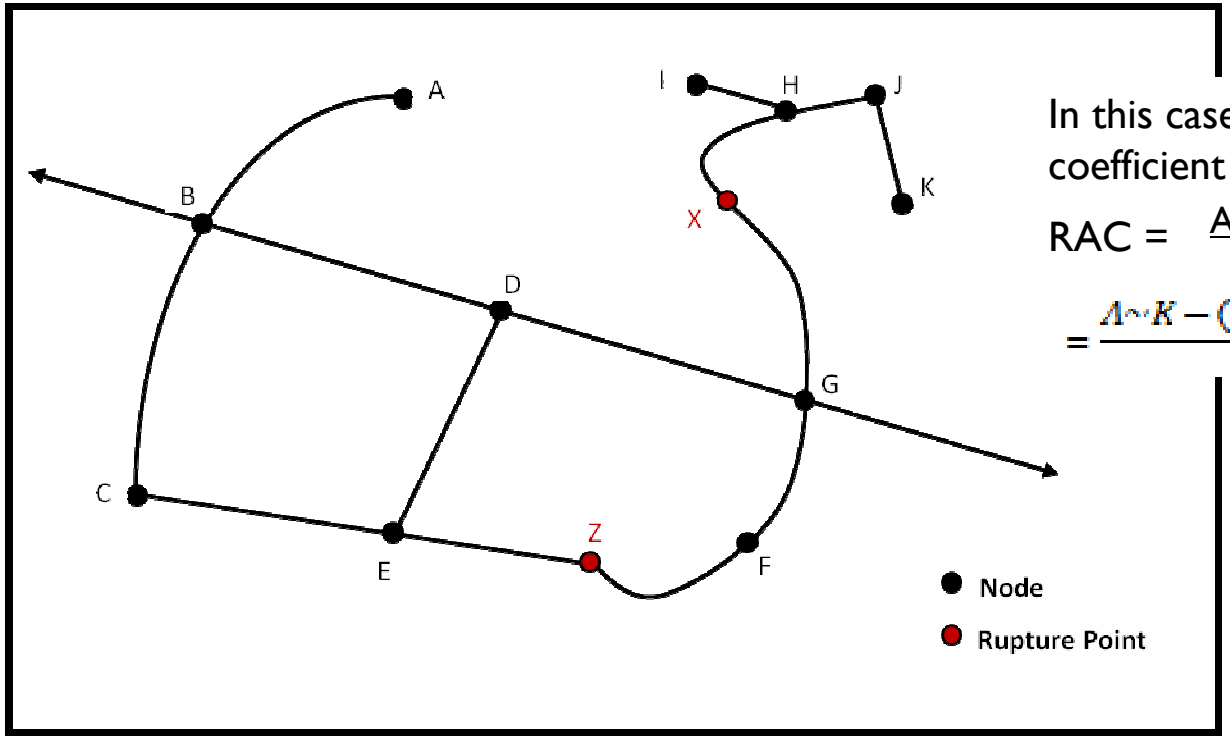
Road Accessibility Coefficient

- RAC - measures the share of the network that is accessible by normal vehicles, effectively the **REACH** of the network.



In this case the value for the coefficient is:

$$RAC = \frac{\text{Accessible Network}}{\text{Total Network}}$$

$$= \frac{A \sim K - (EF + GH + HI + HJ + JK)}{A \sim K}$$

Figure : Measuring Intransitable Sections

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The GPS and the Data

- Affordable and available navigation tool
- Low training requirements
- Compatible with Excel and GIS

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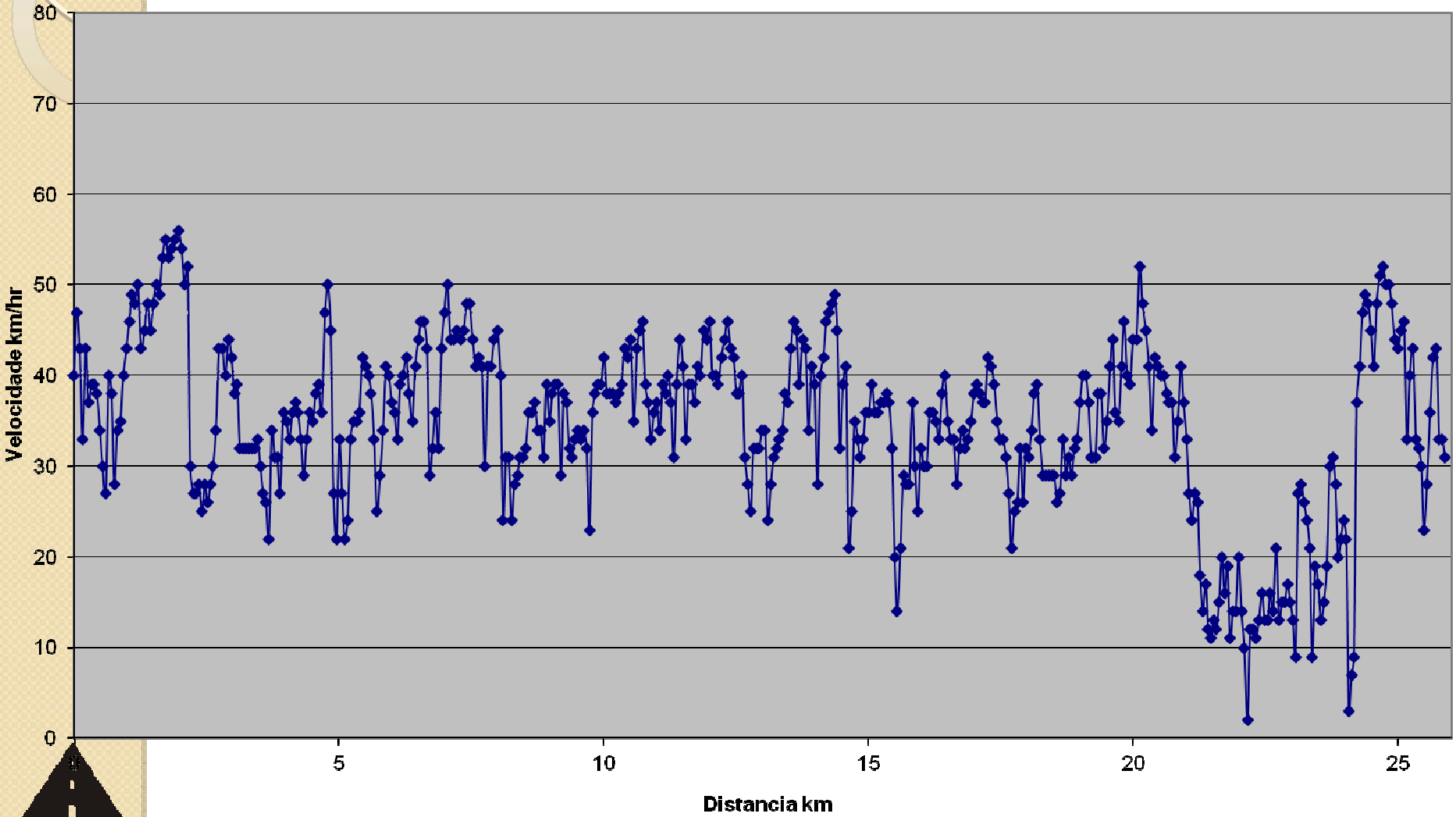
The GPS and the Data

GPS output as a plot



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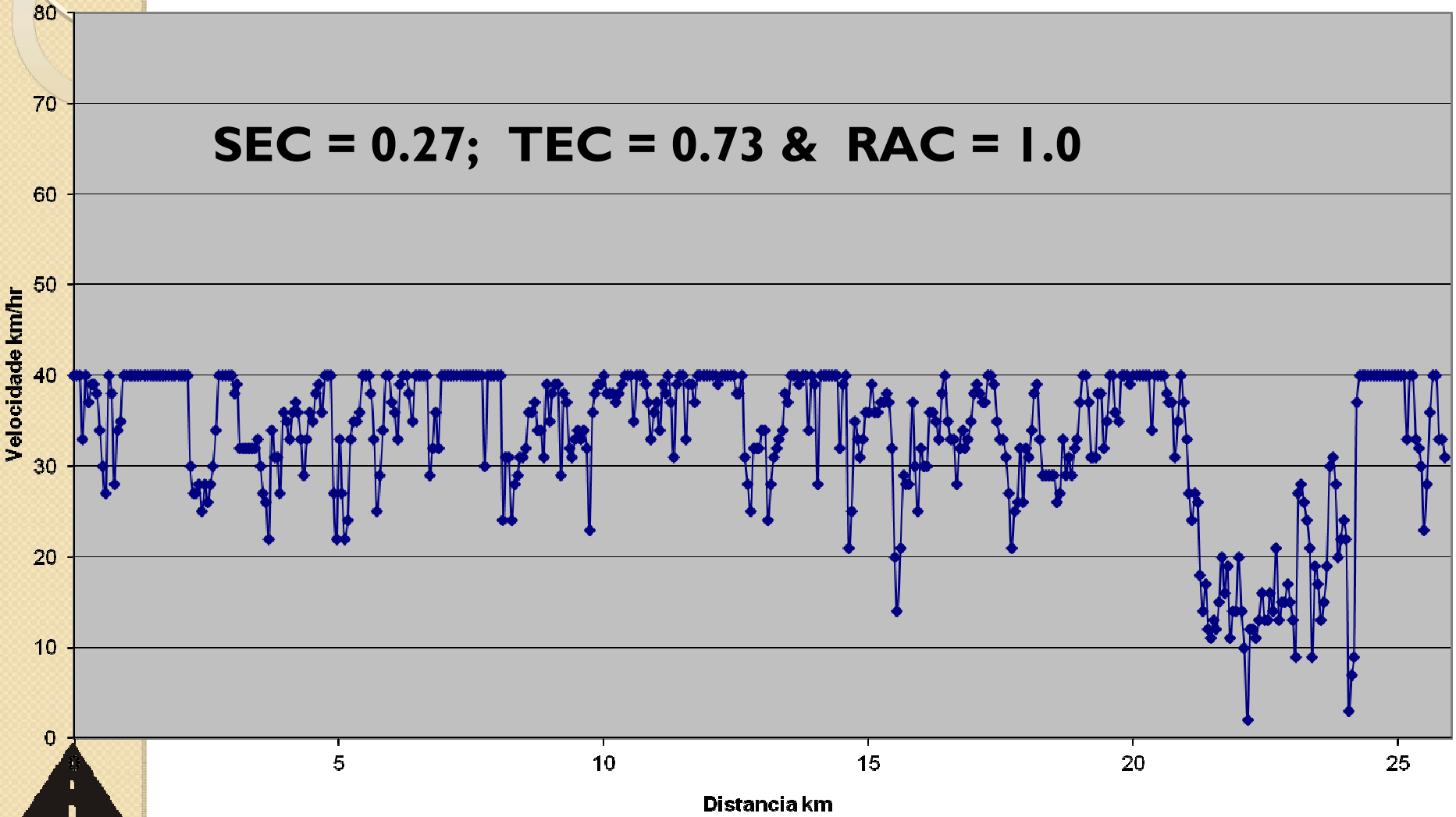
The GPS and the Data

GPS output as a truncated plot



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The Next Steps

- Tested in 2 Provinces on 14 roads
- Reproducibility tested
- Rationalize and publish the rules
- Create a baseline for the full network
- Create study sections for calibration so that realistic targets can be set for performance indicators
- Push the values up toward 1.0!

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THANK YOU!

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