

Monitoring the Performance of Unpaved Roads Using GPS Surveys – Practical Exercise

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GPS Monitoring of Unpaved Road Performance

Overview

- ▶ Why we need new ways to measure unpaved road performance.
- ▶ Why use a GPS?
- ▶ What are the objectives?
- ▶ The Steps in the Process.

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Need for New Monitoring Instruments

- ▶ Rural road networks 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 Unpaved roads satisfy the needs of users.
- ▶ Monitoring units need reliable year on year measure to identify actual progress

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Why Use a GPS?

- ▶ GPS records the journey along the road
- ▶ Inexpensive
- ▶ Driving needs to be controlled in order to reduce inconsistencies between drivers
- ▶ Data can be analysed to extract information about the journey and hence the performance of the road

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Coefficients of Unpaved 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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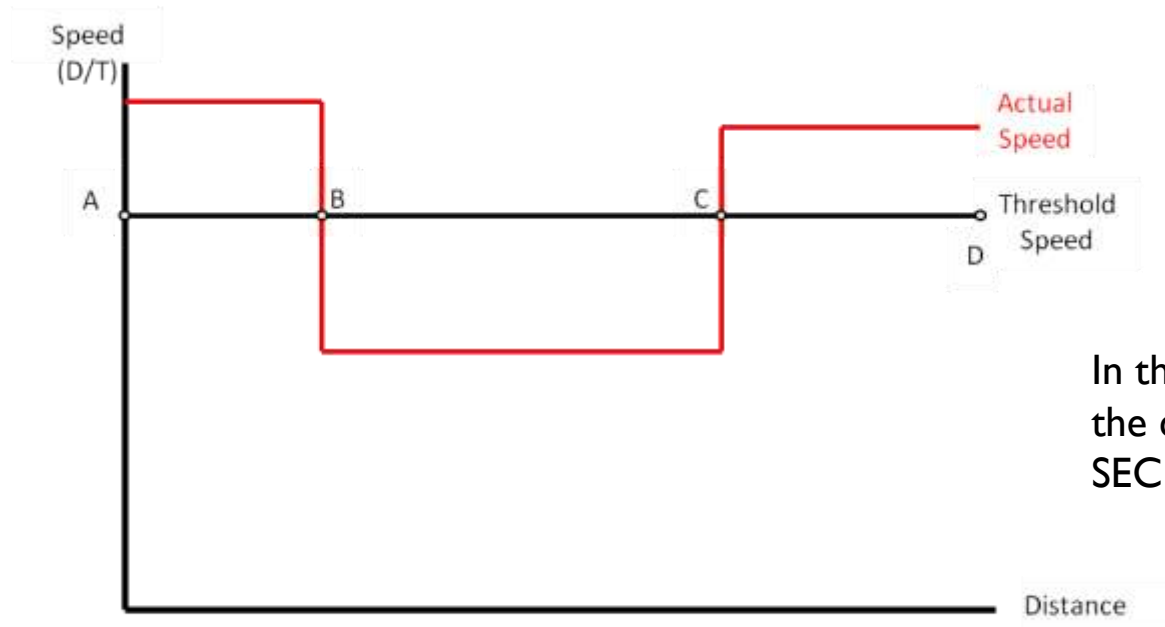
Thresholds and Rupture Points

- ▶ **Threshold speed:** the minimum acceptable speed for a low-volume Unpaved road
 - ▶ Most users of Unpaved 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

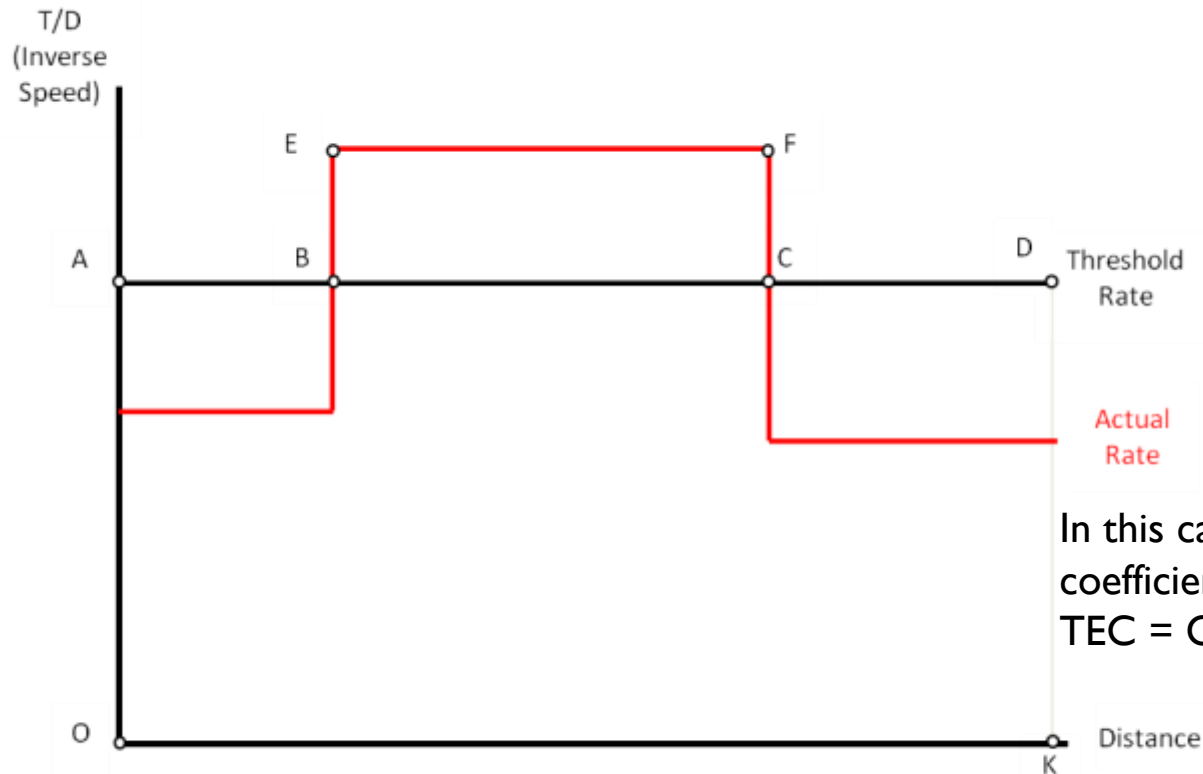
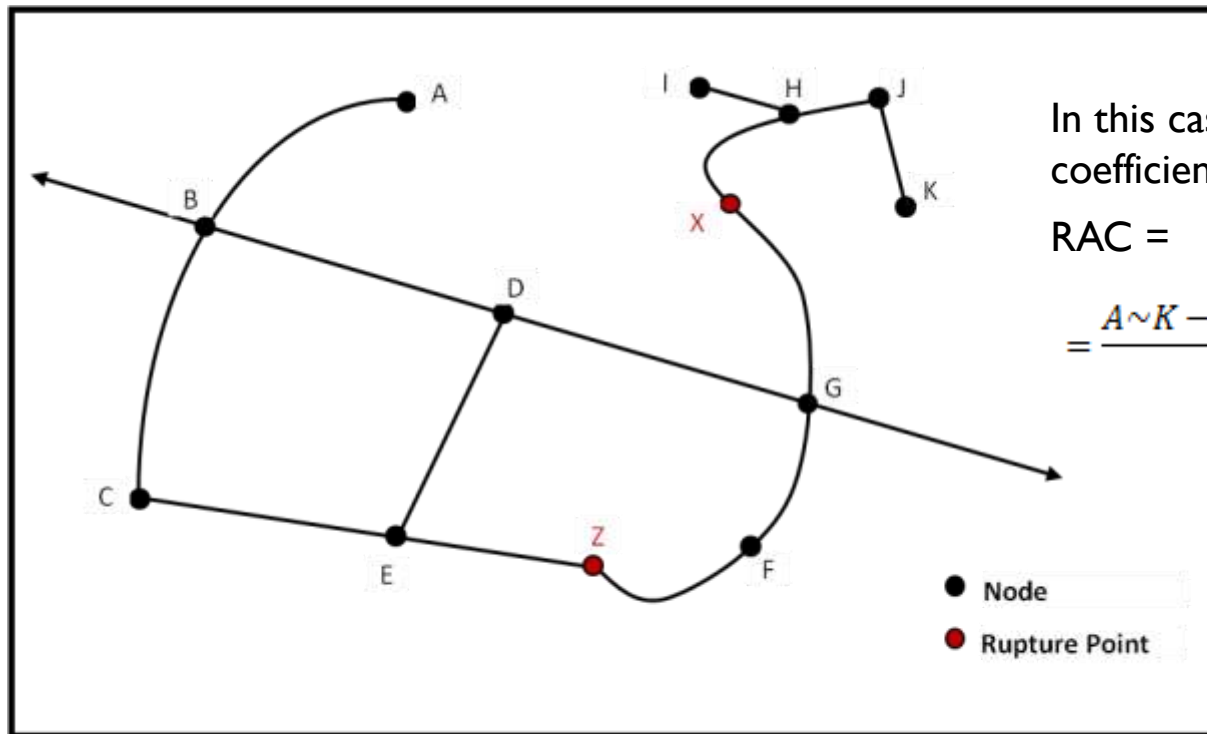


Figure : Time Profiles: Actual versus Target

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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:

$$\text{RAC} = \frac{\text{Accessible Network}}{\text{Total Network}} = \frac{A \sim K - (EF + GH + HI + HJ + JK)}{A \sim K}$$

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 Survey Form

GPS Road Transitability Survey

Sheet _____ of _____

Road:	Date:	Start Time:
GPS Coordinates at Start:	GPS Coordinates at End:	
GPS Mode: (Auto/Distance...)	Road Surface: (Gravel/Soil)	

Low Velocity Sections

GPS Waypoint at start of section	Km at start	Km at End	Poor Condition or not?	Obstacle and comment

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Data Manipulation

▶ GPS sample output

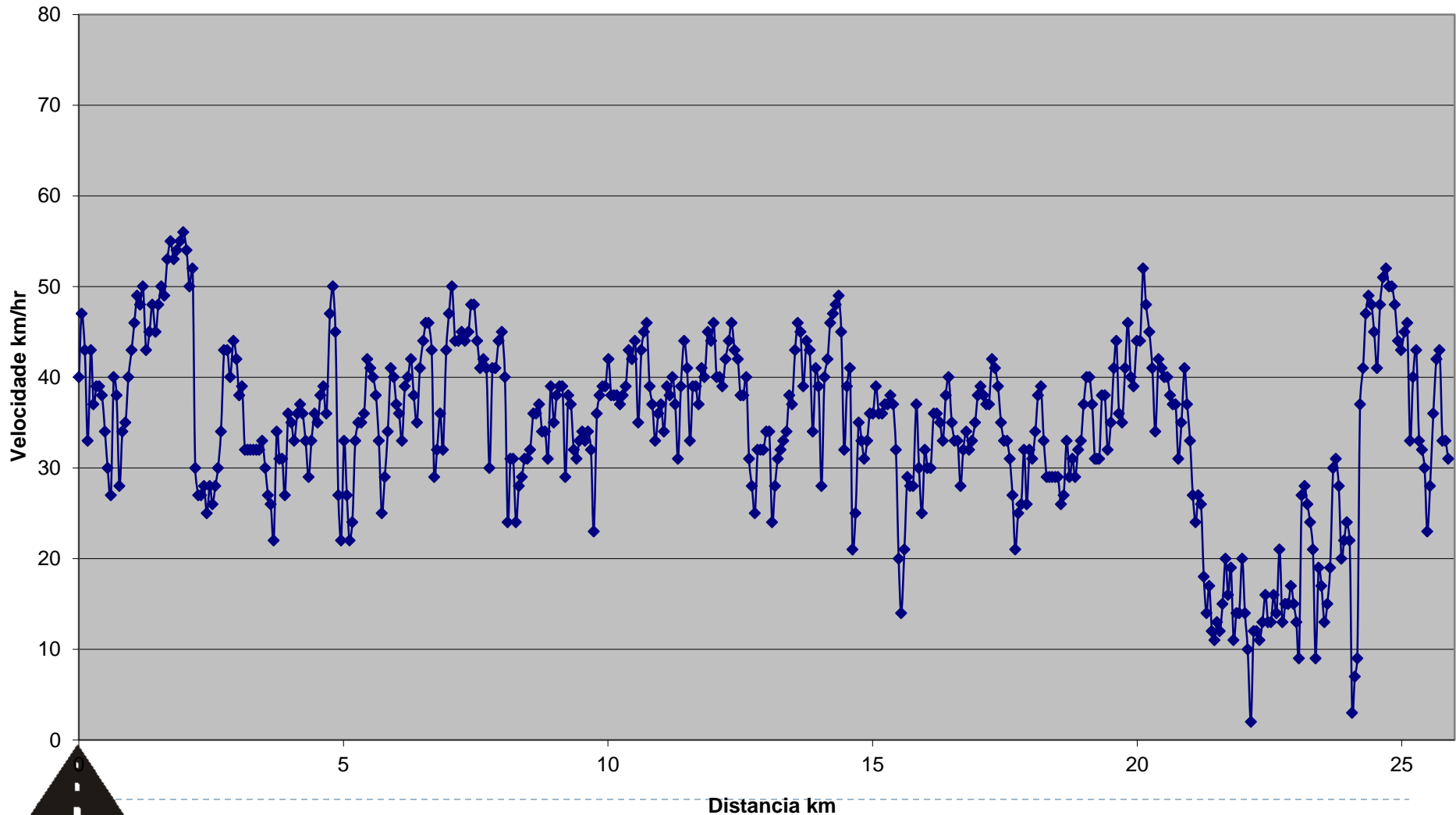
Index	Date and Time	Altitude	Leg length	Leg time	Leg speed	Bearing		
1	02/04/2009 07:13	7 m	55 m	00:06:21	0.5 km/h	172° true	S25 58.969	E32 33.505
2	02/04/2009 07:19	4 m	60 m	00:00:07	31 km/h	179° true	S25 58.998	E32 33.510
3	02/04/2009 07:19	4 m	61 m	00:00:06	37 km/h	177° true	S25 59.031	E32 33.511
4	02/04/2009 07:19	4 m	51 m	00:00:05	37 km/h	177° true	S25 59.063	E32 33.513

- ▶ Identifying the section of road
 - ▶ Converting to numerical data where text is included
 - ▶ Calculating the SEC and TEC
 - ▶ Calculating the RAC (network value)
-

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The GPS and the Data

GPS output as a plot

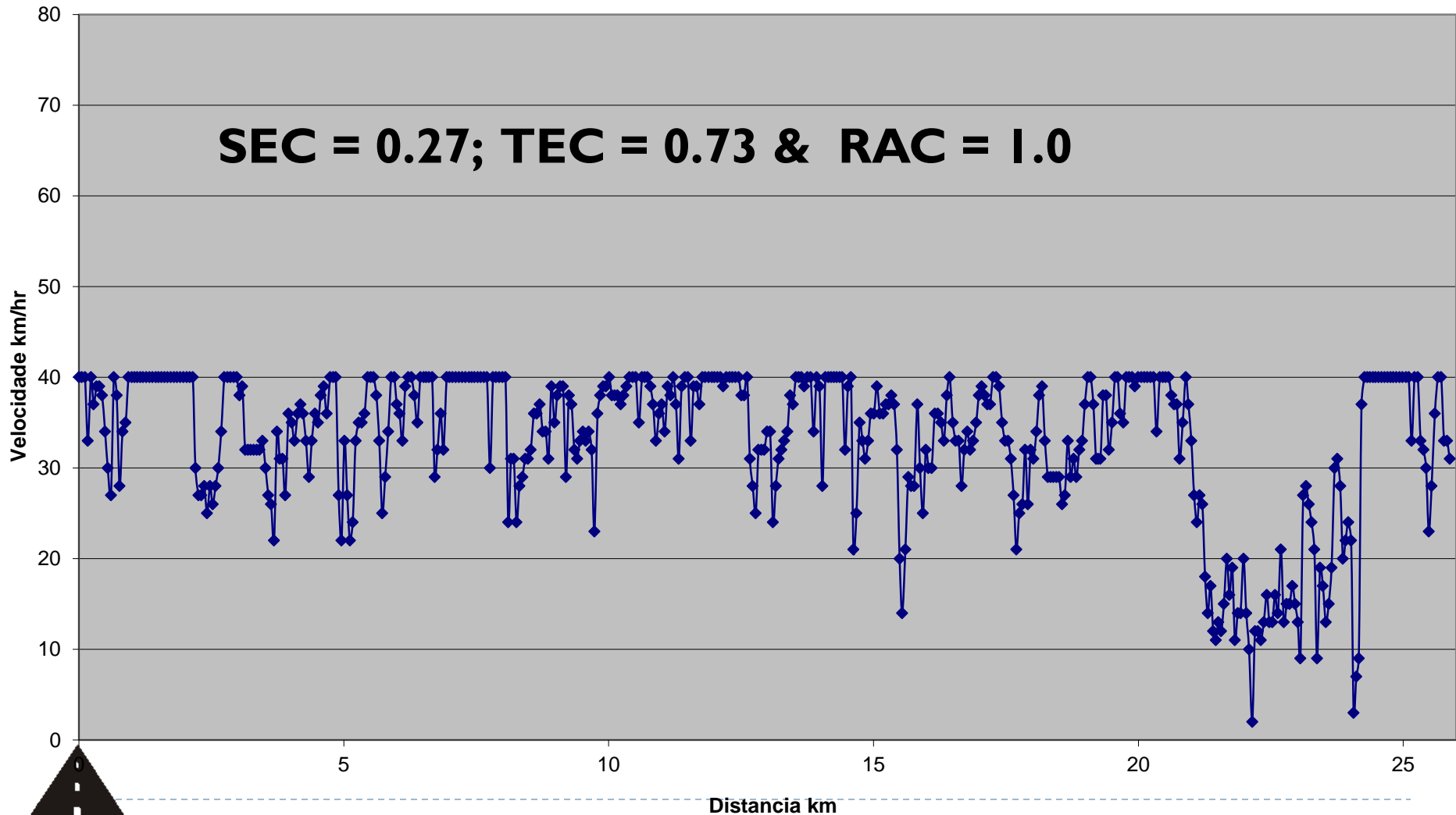


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The GPS and the Data

GPS output as a truncated plot

SEC = 0.27; TEC = 0.73 & RAC = 1.0



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THANK YOU!

