RSG Journey data used in Collision Investigation

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In 2004/5 there were 44 deaths from 43 incidents involving police vehicles, 32 of these deaths were pursuit related. Of the 43 incidents recorded, the police vehicle was physically involved in a collision in 8 incidents. (Teers, R., Bucke, T., 2005)

In 2005/6 there were 48 deaths from 42 incidents involving police vehicles, 23 of these were pursuit related. Of the 42 incidents a police vehicle was directly involved in a collision in 4 incidents. (Teers, R., Menin, S., 2006)

Research showed that the pursuits lasted for a mean of 5.7 minutes, but spanned a time from less than a minute to 68 minutes and spanned distances between 0.01 miles to 100 miles. (Best, D., Eves, K., 2003)

The RSG Gemini Explorer data logger is the device fitted to Cleveland Police vehicles and records Incident data at 20 readings per second for a period of 40 seconds prior to and 20 seconds after a trigger event, for example harsh braking or a collision. In addition to this information the unit records Journey data which provides a record of road and engine speed together with the use of monitored items, blue lights, sirens, flashing headlamps, braking and other items specified by the end user. When downloaded from the vehicle unit into the RSG software this Journey data is recorded in RAW form and will remain in this unprocessed state. When the user wishes to view the results the software uploads a copy of the RAW data for examination, the record produced displays the values at the rate of one reading per second. The original RAW data will remain unprocessed in a secure section of the software.

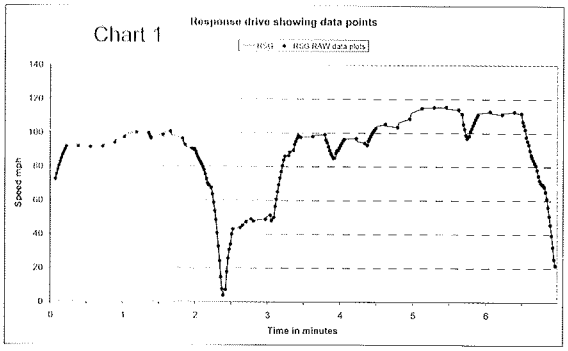
How this Journey data may be used in Collision Investigation is explored and discussed here.

The speed value recorded in Journey data has been calculated from the distance the wheels have rotated in a time, the speed is therefore an average speed over this period of time. The period of time between each reading can vary depending upon use of monitored items and the manner in which the vehicle is being driven. Where a vehicle is driven at a uniform speed or with only slight acceleration the recorded readings may be as far apart as ten seconds. When the information is downloaded from the logger and viewed on the RSG software, the information is automatically processed and the viewer sees information displayed on a second by second basis. What can not be seen is the time interval between each actual recorded values and therefore the period over which the averaging has taken place. It should be remembered that the vehicle is actually measuring real distance by its wheel rotation and real time by its clock and so the calculated speed value should be precise.

When using the Journey data for collision investigation purposes, where such results could be presented in court, it is desirable to be able to identify the time between readings and where those readings fell along the route under examination. In a response to a request for this information RSG developed a software programme that would allow the extraction of a copy of the RAW data, RAW data being the actual number of pulses received per second used for speed and engine revolutions calculations. From this information the user has to enter the calibration values in order to calculate, speed, distance and engine revolutions. The use of monitored items is also displayed.

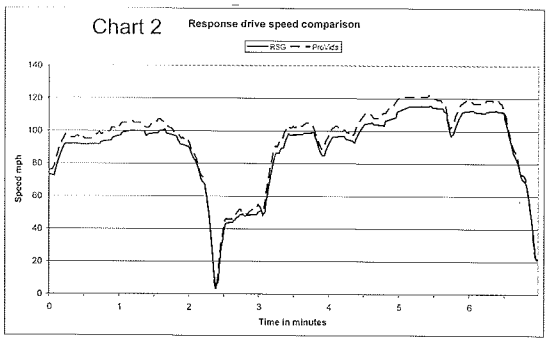
A comparison was conducted using a Volvo patrol car fitted with the RSG data logger and a digital ProVida recording direct to a hard drive. The patrol vehicle responding to an incident provided the information for analysis. A section of 11 miles was taken from the journey which included speeds from approximately 4 mph to 121 mph, the route was on arterial dual carriageways with one roundabout negotiated.

The RSG data logger was downloaded and the information exported to spreadsheet. The hard drive from the ProVida was copied to compact disc for examination. The processing of the ProVida information was time consuming, requiring each frame of each second of the journey to be noted and averaged in order to compare similar data, the averaged value being entered on a spreadsheet with the RSG information. The RAW data was extracted and plotted with calculated speed trace, the location of the actual data recording points along the journey are highlighted in Chart 1 below.



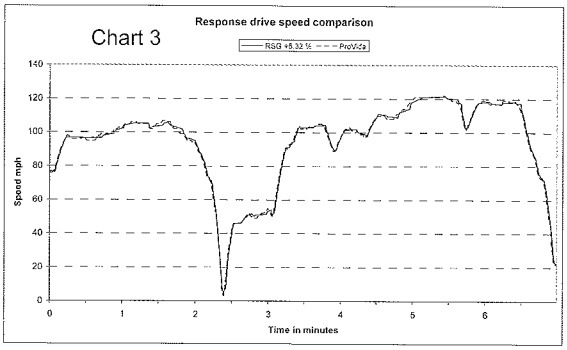
The distances recorded by the two units revealed a difference of 5.32%.

As the speeds are calculated from the distance each unit has moved in a time, both speed traces show averaged values. These are reproduced in Chart 2.



For the sake of comparison it was assumed the ProVida was the more accurately calibrated of the two units, the RSG speed was adjusted by this figure and the result is shown in Chart 3.

The alignment of the two speed traces was carried out by identifying the point where the sirens were activated, this being recorded by the RSG logger and by the audio side of the ProVida. A time difference between the units clocks was only 45 seconds. Once this point was established the placement of the ProVida speed values alongside the RSG values allowed them to be compared graphically.



The speed traces show that both of the devices were recording similar speeds throughout. In the majority of Cleveland Police vehicles there will only be an RSG logger and so only one set of speed data would be produced. The important point to consider is, how accurate is the data?

The accuracy of the recorded speed on a data logger could be retrospectively assessed by driving the vehicle over a known distance, using a measured mile or half mile that is present in most police areas would be suitable for this.

It would be necessary to be able to identify on the Journey data where this period of measurement took place on the record. In order to identify the start and end of the test, if the vehicle were stopped and the hazard warning lamps illuminated for two seconds and then turned off and the vehicle driven over the measured distance and the hazard warning lamps illuminated again, the use of the lamps would be indicated on the Journey data and a calculation to estimate the distance moved could be made.

As the vehicle has been driven over a known distance, the recorded distance can be compared and any difference calculated. As the recorded speed is a product of the recorded distance moved in a time any correction to the recorded speed can be made in the same manner as the RSG speed values in Chart 3.

The RSG unit has two items that are subject to calibration, the speed values and the engine revolution, these calibrated items are not linked and so one does not affect the other.

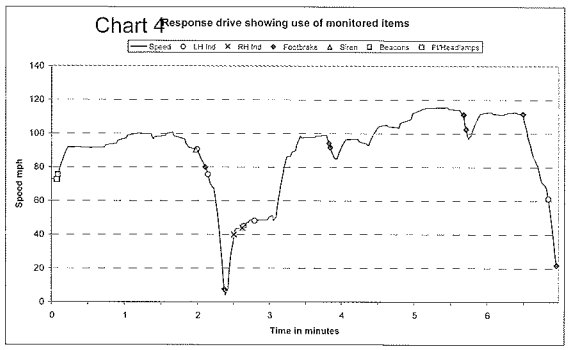
The use of the monitored items, typically indicators, flashing headlamps, beacons, siren, footbrake and handbrake will generate a record of use on the Journey record. When the monitored item changes its state, for example at the point where the footbrake is depressed, this is recorded and at the same time an actual speed reading is recorded. If the footbrake continues to be depressed, this will show on the recorded information as it has not changed its state from the last reading but an actual speed record will only be made at the point the pedal is released and it changes its state to off. In addition to this, data points are generated by rapid acceleration and in any case at ten second intervals.

The use of the monitored items has been identified along the speed trace for the response drive and on the engine revolutions trace, this chart includes only the point at which the item changed state so as to avoid over crowding on the chart. It can be seen that the flashing headlamps and beacons are switched on at the commencement of the journey, they do not re-appear as they remained on throughout the journey.

The siren is turned on and remains activated, at the time the siren was activated a left turn signal was used which remained on until just after the footbrake was applied. The footbrake remained applied till the vehicle had reduced its speed to a few miles per hour at the roundabout controlled junction of the A19 and A174.

The vehicle is then accelerated with engine revolution reaching about 5500 before a right turn indicator was activated for a short time as the vehicle passed under the A19 turning right towards the A174 eastbound carriageway. This was quickly followed by a left turn signal as the vehicle joined the A174. The start of this signal is partly hidden by the cancellation of the right hand indicator on the speed trace, it can however be seen on the engine revolutions graph. The vehicle is then accelerated to approximately 100mph before a very short footbrake application and release. Gradual acceleration is applied with the control of the vehicle speed being achieved by forward observation and use of the accelerator, the vehicle reaches about 115mph before a further application and release of the footbrake reduces the speed to just below 100mph. The vehicle is again gradually accelerated to about 112mph before the footbrake is applied and maintained to the end of the speed trace, this occurred on the A174 slip road approaching a roundabout controlled junction, during this time a left turn signal is activated and remains on to the end of the check.

The use of the monitored items plotted onto the speed trace is shown in Chart 4.



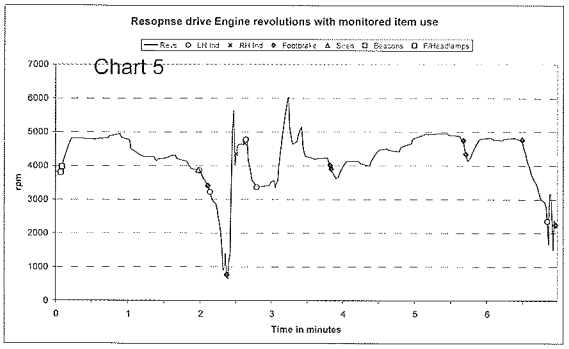
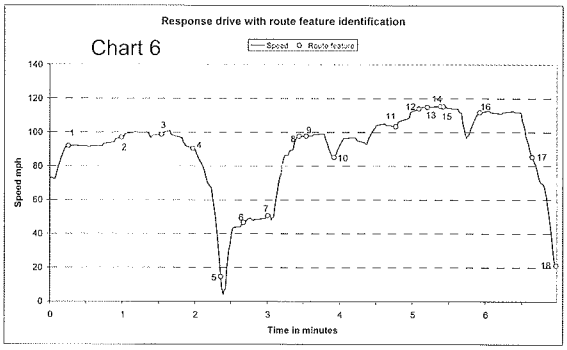


Chart 5 shows the use of the monitored items overlaid onto the engine revolutions at the same time scale. This allows an examination of the speed and revolutions traces and the driver's use of forward observation and 'accelerator sense'. This can be seen in the steep gradient of the engine revolutions trace as the vehicle is accelerated from approximately 4mph to 40mph as the roundabout is negotiated and again after the right and left turn signal as it joins the dual carriageway. Once on the dual carriageway, the engine revolutions trace mirrors the road speed with gradual accelerations, positive and negative. The location of the changes in engine and road speed can be seen in Chart 6.

A route examination can be carried out by measuring the distances between points of interest to the investigation and aligning them to the speed and engine revolutions traces. For this journey an example is shown in Chart 6.



Feature Key	
1	A19 northbound carriageway
2	overbridge
3	A19 northbound carriageway
4	overbridge
5	A19 northbound carriageway
6	overbridge
7	Siren turned on
8	A19/A174 Give Way lines
9	A174 under A19 on roundabout
10	A174 eastbound carriageway
11	overbridge
12	A174 eastbound carriageway
13	overbridge
14	A174 eastbound carriageway
15	overbridge
16	A174 eastbound carriageway
17	overbridge
18	A174 eastbound carriageway overbridge A174 eastbound carriageway

Where a police vehicle pursuit results in a collision with fatal or serious injury the Independent Police Complaints Commission will conduct an investigation. If the vehicle is fitted with ProVida the event can be watched and the vehicle speeds will be shown. It does not however show the use of indicators, footbrake or beacons and in addition to this depending upon the focal length the zoom lens is set at, it may provide a distorted view of events, distances may appear compressed or expanded.

The Journey logger will provide a second by second record of the event from the moment the engine was started till it was switched off. By detailed examination of this record a lot of information can be obtained. The ability to identify where emergency warning equipment was used, the use of indicators at junctions, braking points and the engine revolutions provides detail of how the vehicle was being driven. All this information is available to help an investigation and it is all independent of the driver and of the Police. Because the RAW data is never changed it can always be examined by third party collision investigators. The Journey data then is more than a series of speeds and times.

The response drive has been examined and the use of the monitored items has been plotted against the speed trace and against the engine revolutions. These charts show the points on the journey when these items were used and they also demonstrate driver behaviour, the use of acceleration and deceleration to control vehicle speed, the use of indicators are all indications that the driver is taking the presence of other road users into account and conducting a dynamic risk assessment whilst making progress through traffic. The intelligent use of engine speed and forward observation skills are evident in the absence of harsh acceleration followed by harsh braking.

The successful production and presentation of the information discussed relies upon the collision investigators ability to prove the accuracy of the data recorded. This can be achieved by driving the vehicle over a measured distance to facilitate retrospective calibration of the information. The utilisation of the measured half mile or mile used for calibration of other devices is perhaps the most suitable. If the vehicle is unable to be driven it may suffice to calibrate a vehicle of the same type and year and with the same calibration values. In the event of any incorrect calibration values having been entered on the database, these errors will be identified and can be corrected. The RAW data will remain the same, that is, the number of pulses that are recorded per second, the calibration or any re-calibration takes place after this phase and so does not interfere with of alter the original data.

The research mentioned in the introduction to this article indicates that in 80-90% of police road fatalities, the police vehicle is not involved in a collision and so no Incident data will exist.

The Journey data will not provide the fine detail to reconstruct the moments of a collision but it will provide a good balanced assessment of events leading up to such an event from the moment the engine was started.

References

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[accessed 20th July 2007]

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