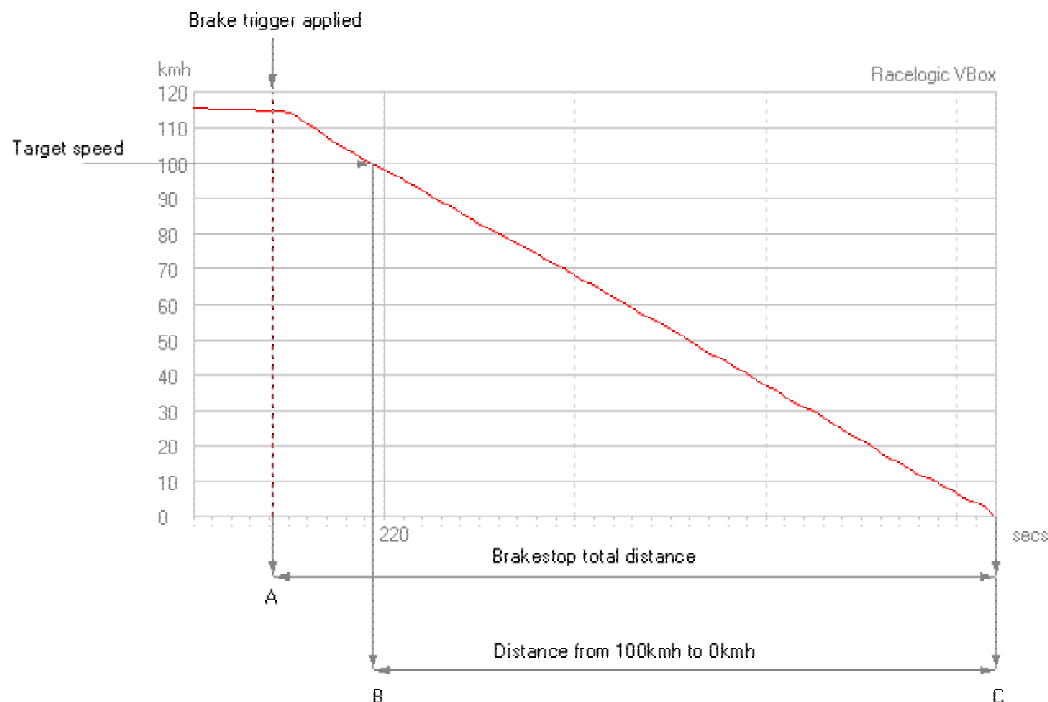


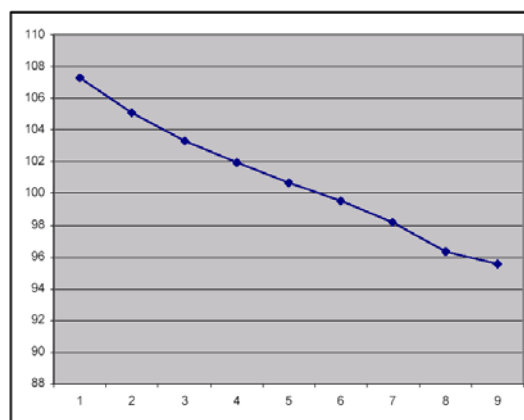
## Brake testing – Application note

A brake test is a deceleration test carried out between two speeds. Data taken during the test is used to calculate the time taken and distance travelled. A trigger can be used to measure the point of activation of the brake pedal.



In the example above, the aim of the test was to examine the braking performance between 100 km/h and 0 km/h. A brake pedal trigger was used, and showed a Trigger activation speed of 116 km/h. The “Target range 1” (see section 7.3.1) was set to start at 100 km/h and finish at 0 km/h.

The most repeatable and accurate result from such a brake test is the distance from 100 km/h to 0 km/h. As the VBox samples every 50ms, the precise point at which the speed hits 100 km/h will not be known. This can be seen by looking at the following graph showing the speed samples around the 100km/h target speed. The first sample before 100 km/h is 100.8 km/h and the next sample is 99.7 km/h



The VBOX software calculates the precise time at which the car passed through 100 km/h by linear interpolation, and also calculates the distance at this point. This method eliminates a lot of errors, such as caused by any speed latency (no external reference means the errors cancel each other out), and also the effect of vehicle pitch has little influence, because most of the pitching has already taken place before the target speed is reached. The settling of the car after the stop is ignored in the calculations, because this is detected by the software as a “bump” in the speed trace at the end and removed. The distance calculated using this method is very accurate and repeatable.

### ***Using a brake pedal trigger***

The distance from the point at which the pedal was pressed down to zero can also be measured, this gives an overall indication of the response time of the braking system, as well as the performance of the tyres. This method is heavily dependant on the speed and accuracy of telling when the brake pedal was pressed, and the speed latency of the speed measurement system.

The VBOX measures velocity every 50ms, and in this time the vehicle in the example above could have travelled 1.6m. To get better accuracy than this, the brake pedal trigger needs to be scanned much quicker than 50ms. The VBOX II can be set to record “Trigger event time”, which gives the small fraction of time between the pedal being pressed, and the next 50ms sample. This time can then be included in the calculation to add the extra distance covered during this small period of time (this is done automatically by the software).

In addition, there is a slight latency in the speed calculation in the GPS (about 50ms), which doesn't matter unless you are referencing it to an external source. In the case of a brake trigger, this is an external source, so this latency has to be taken into account. When the VBOX software uses a brake trigger to calculate this distance, and the “Event time” being logged, then this latency is taken into account. (Note : it is obvious from all of these additional factors that this method is not going to produce as consistent results as just measuring between two speeds, so bear this in mind when choosing which test to perform.)

### ***Brake testing – how to use the VBOX software***

There are a number of ways to carry out brake testing using the VBOX software, either in real time or afterwards in post processing.

### ***Using the Brake test screen***

One of the most convenient ways is to use the “Brake test” tab. In this screen you can configure the column headers by clicking on the top cell to show a number of different parameters, and then these appear in the table, and are saved to a text file.

For example, to carry out 10 brake stops between 100 km/h and 0 km/h, carry out the following ;

- Set the range by using the boxes under “Test layout” on the bottom left hand side of this screen, Start speed = 100, End speed =0.
- Click on the grey box on the top of the second column to the right of “Test number” in the table of results.
- Select “Trigger speed” from the menu that then appears. Do the same with the next two column headers and select “Time” and “Dist”.
- Drive to where you want to carry out the tests, and then press “F2” to start the test. Drive up to 110 km/h, and then do a brake stop.

You only need a brake trigger connected to monitor the trigger results, ie. Trigger speed, Distance from trigger to 0 km/h, and Time from Trigger to 0km/h. Without the trigger connected you can still measure distance between two speeds, and the time between two speeds.

A file will automatically be created using the filename in the bottom left hand corner of the screen. The index number of the file is increased every time a new test is started. If during the test one of the runs goes wrong, you can remove it from the table and also the file by pressing “F5”.

### ***Brake tests in post processing***

Using the VBOX memory or a flash card to store the data, brake stops can be analysed afterwards. Set the VBOX up to data-log by either inserting a compact flash card, or if you are using the RAM, clear the RAM by going into “VBOX Setup” and selecting “Clear RAM”.

Click “VBOX Setup”, and then check under “Options” that the VBOX is set to “Log only when moving”. Now check that the following channels are set under “Log channels”:

- Sats
- Time
- Latitude
- Longitude
- Velocity
- Heading
- Height
- Trigger event time

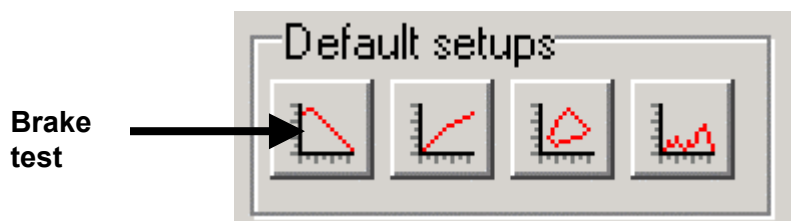
Not all of these channels are needed, but these are the ones recommended for almost any test, and means that extra analysis can be made if necessary. (For example, the satellite channel also contains data from the brake trigger.) Close the Setup screen to put the VBOX back into logging mode. Now the PC can be disconnected and the brake tests carried out whilst the VBOX logs the data.

Once the test is over, either download the data from the VBOX using “Communicate with VBOX” and then save the data when prompted, or remove the flashcard from the VBOX and put it into a PC reader, and load this file into the software.

To display brake test results, use the main screen, go to the “Main results” tab, and select the “Brake test results”. Now select the brake stop range by using the “Target speeds” option on the top main menu, and select “Test range 1”. For a 100-0 stop, set the start speed as 100 and the end speed as 0.

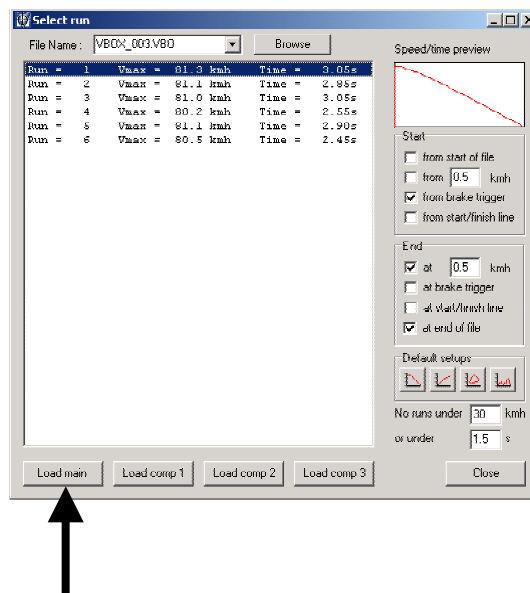
### Scanning the data

Each brake run can now be separated out from the main memory and analysed using the “Select run” option. If a brake trigger was used, use the following button on the Select run screen

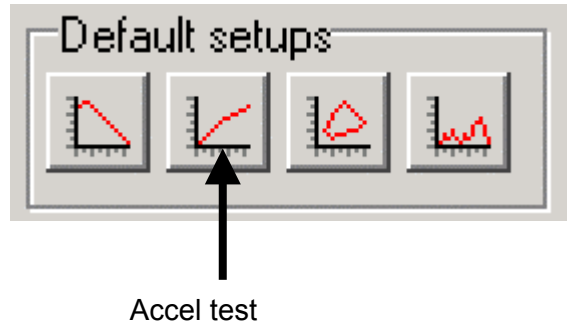


This will set the Select run parameters automatically to show only the brake stop from the trigger down to zero.

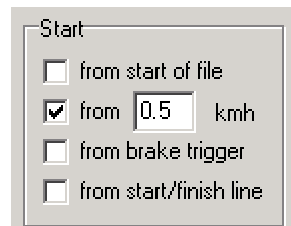
The following is an example where 6 brake stops from 80kmh to zero were carried out using a brake trigger, and then sorted using the Brake test button:



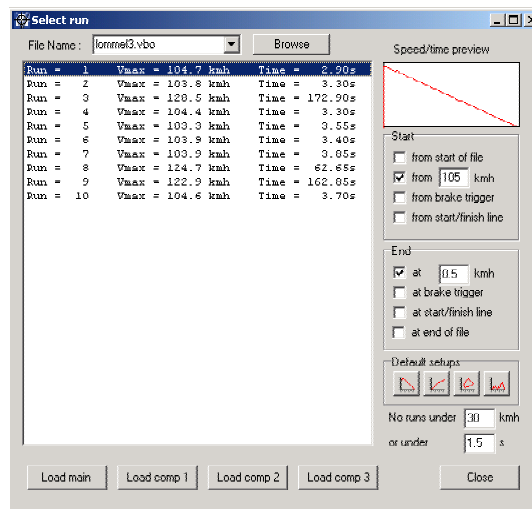
To load any of these stops into the Main memory, click on the run to highlight it, and then click the “Load main” button, then close the “Select run” screen. If you haven’t used a brake trigger, then you will have to sort from a set speed down to zero, to set this up quickly, use the Accel test button :



Then change the start speed of the test by changing the “from xx.x kmh” box :



If you had done the tests from 100kmh, then you can put 105 in here as the start speed :



To load this run into the main memory, click “Load main”, and then exit the Select run screen. You can return to “Select run” at any time and select any other of the recorded runs and change the selection criteria, as they stay in the background memory.