Thales RSG

Experiment 1: Playing with data

Part A: Playing with one random chosen loop

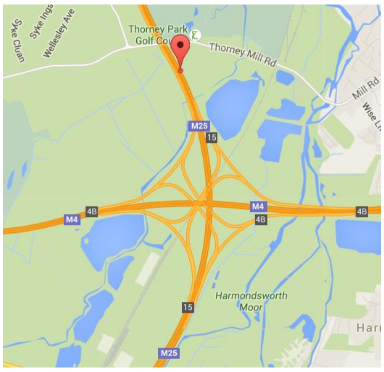
1. **Choose a lane/loop from a M25 site in a given date to analyse traffic jams.**

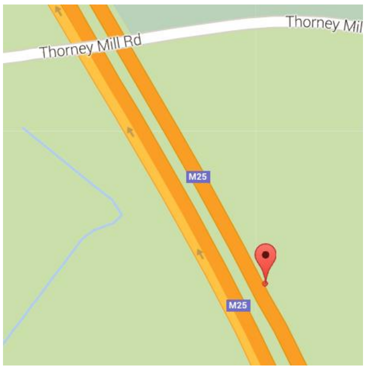
Date: Tuesday March 29th, 2016

Site ID: 5C1C8A5FA9544CD8A2CCE2D93726C1B4 --- M25/4959B (Anti-Clockwise)

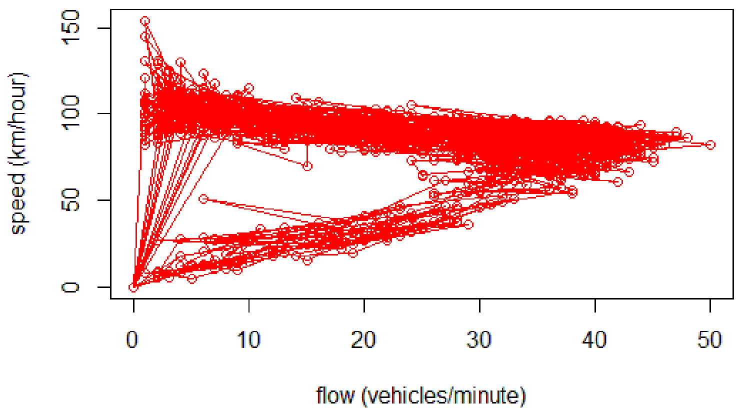
Lane: number #1, outer lane

Location 51.5026 -0.497031



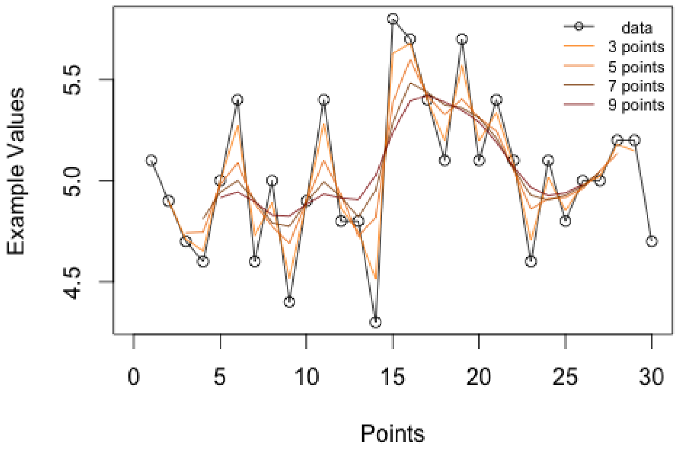


2. **Make table of [Time, Speed, Flow] in a .csv file for all minutes of the day [0 to 1439]. Then make a graph of Speed vs. Flow for the whole day.**



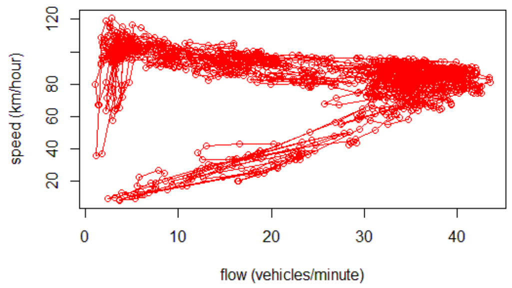
3. Design a Gaussian filter for flow and speed data. Determine the filter's optimum number of points N_{op}.

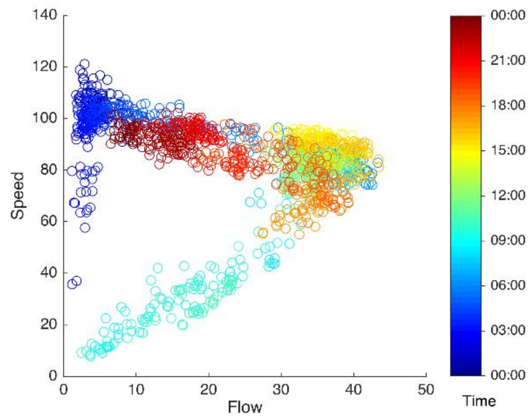
The following graph shows the application of the filter for different N points to random data. Based on it, we heuristically choose $N_{op} = 7$ (3 points before and 3 points after).



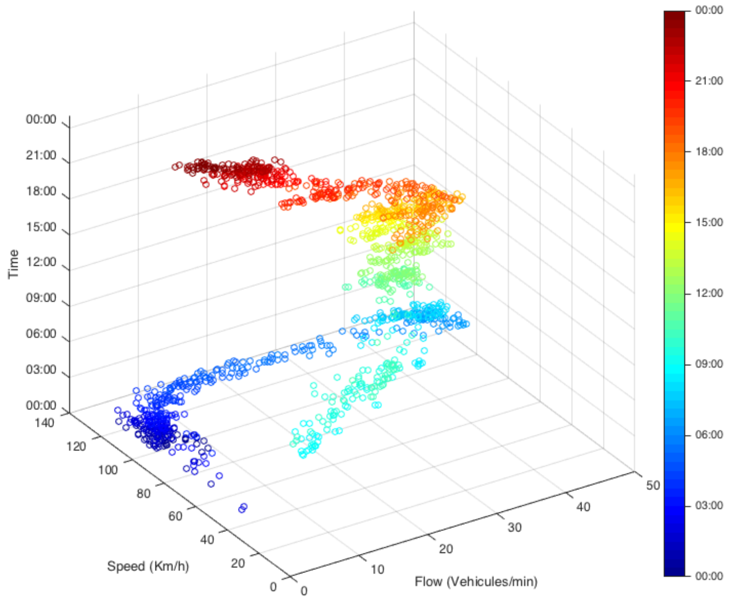
4. **Filter data using Gaussian filter of $N_{op} = 7$ points and make the graphs of Speed vs. Flow, Flow vs. Time and Speed vs. Time for the whole day (1440 minutes).**

Speed vs. Flow

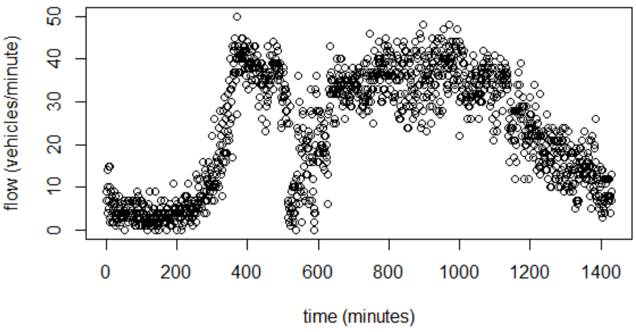




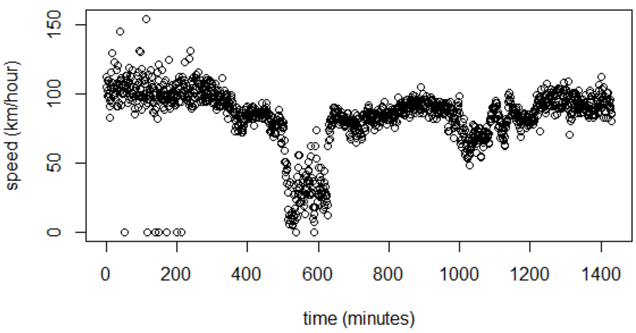
Speed vs. Flow in 3D



Flow vs. Time



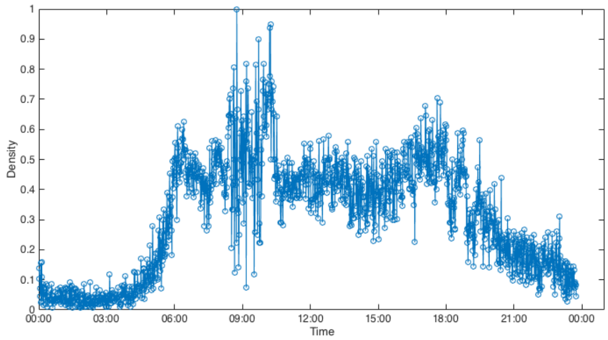
Speed vs. Time



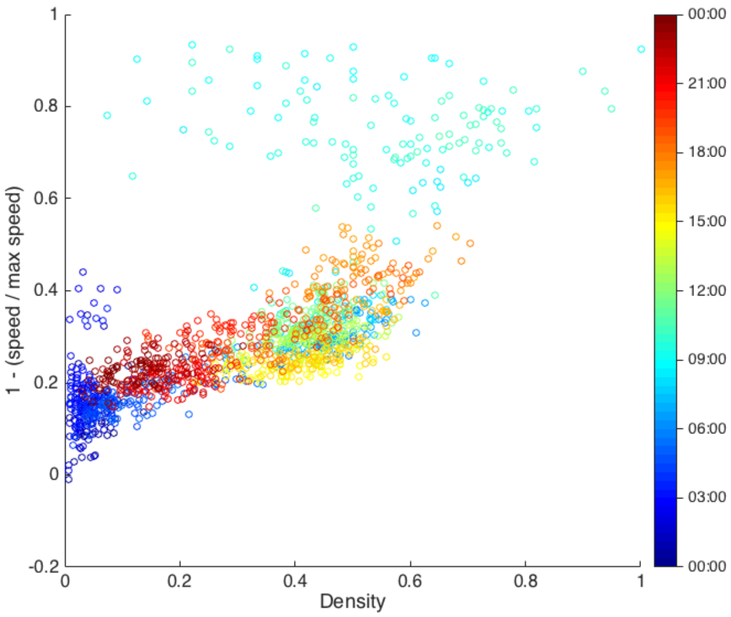
The traffic jam takes place mainly from 8:30 am to 10:30 am.

Density vs. Time

The congestion regime is characterized by high fluctuations or variance.



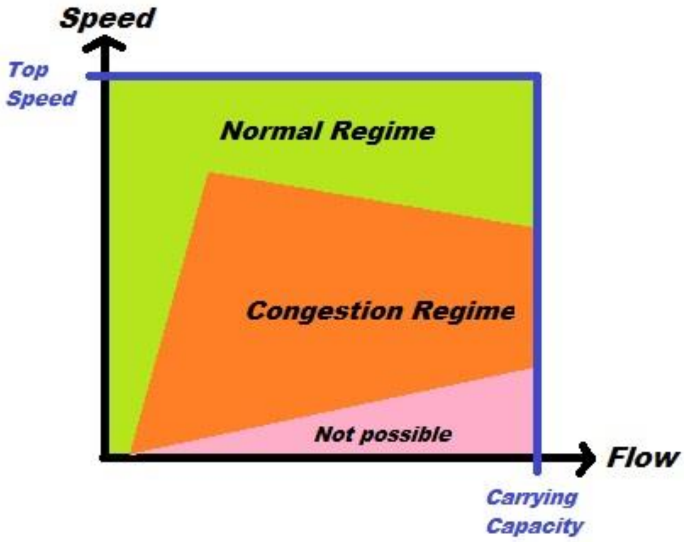
M vs. Density



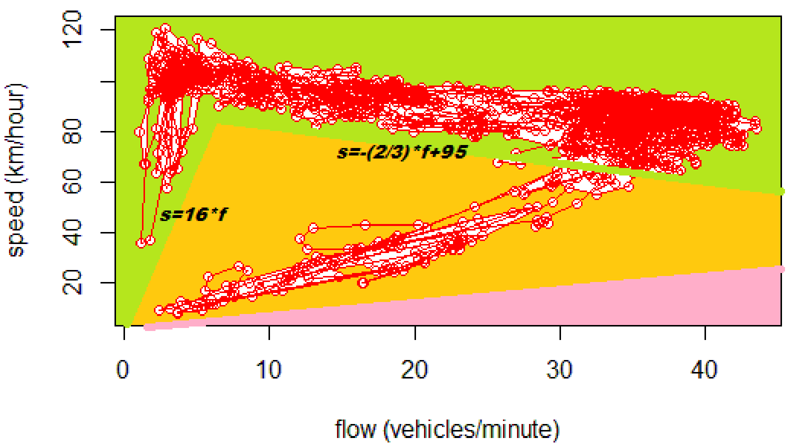
1 - (speed / max speed)
Density
1
0.8
0.6
0.4
0.2
0
-0.2
0
0.2
0.4
0.6
0.8
1
00:00
21:00
18:00
15:00
12:00
09:00
06:00
03:00
00:00

5. **Define normal and congestion regimes in the graph of Flow vs. Speed.**

The traffic can be in two regimes: normal regime (no traffic jam) or congestion regime (traffic jam). The generic shapes of the regimes are depicted in the following graph:



The frontiers of each regime vary according to each loop. For the defined loop in this experiment, the graph will look something like this:



The system is in the congestion regime if the coordinates (flow,speed) or (f,s) are below the lines $s = 16 * f$ and $s = -\left(\frac{2}{3}\right) * f + 95$. The latter line has a negative slope because there is sort of a linear relation between flow and speed in the normal regime.

6. **Find congestion events.**

A congestion event is a set of adjacent minutes where the system is in a congestion regime. There are two congestion events:

Traffic Jam #1: minutes 504 to 630

Traffic Jam #2: minutes 1003 to 1075

7. **Classify traffic jams as spontaneous (i.e. caused by cars changing lanes) or non-spontaneous (i.e. caused by accidents or bad weather), based on weather, accidents and other events on that day.**

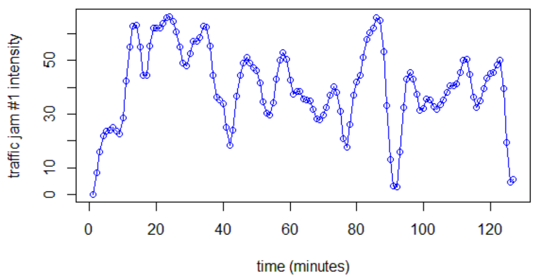
For the moment we assume that both traffic jams were spontaneous.

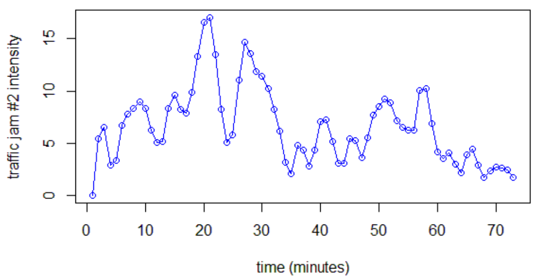
8. **For each spontaneous congestion event, determine the coordinates (flow,speed) located on the frontier between normal regime and congestion regime where the system got IN and OUT of the congestion regime. Are the coordinates of IN and OUT very different? In that case explain why.**

In both cases, the IN and OUT coordinates were very similar.

9. **For each spontaneous congestion event, plot a traffic jam intensity metric over time. The find out the location of the peak intensity. Were the peaks located in the middle? (which means time for congestion equals time for decongestion assumed by Thales)**

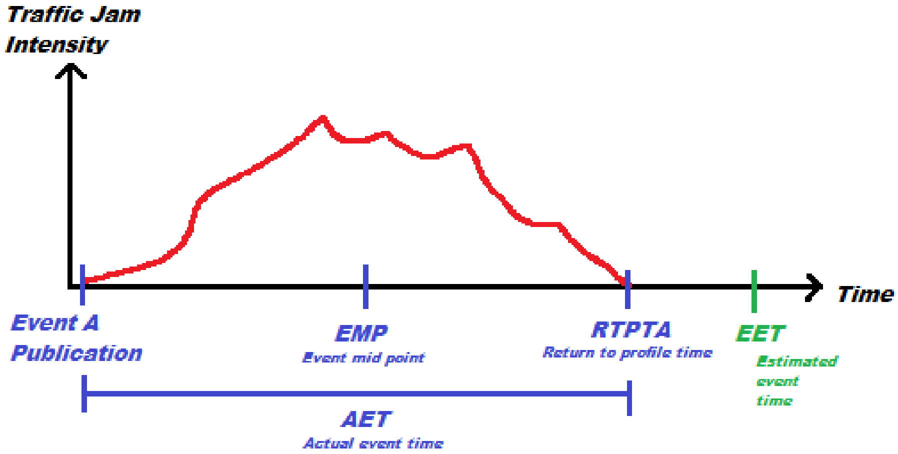
A traffic jam intensity metric can be defined in many ways. One way (for this specific case) is to define the intensity as the shortest distance from the current coordinate (flow,speed) to the coordinate where the system got inside the congestion regime. The traffic jam intensities for the two traffic jam events are:





10. Find out in the data provided by Traffic England the predicted time for a congestion to clear. Determine if their predictions were accurate.

Thales algorithm seems to work this way:



Still we haven't found the EET estimations in the data.