MATHEMATICAL MODELLING Series 2

MACSI

STEPS ENGINEERS IRELAND

The maths behind the traffic jam!

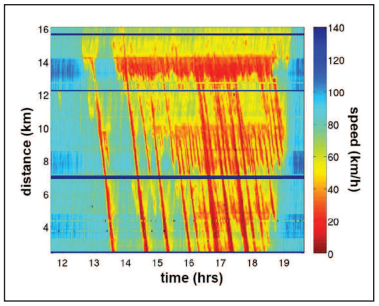
Mathematics and applied mathematics are used in everyday life. Stock markets, mobile phones, car manufacturing, Google, Hollywood special effects, digital TV and satellites all use cutting-edge mathematics tools in their basic functions. The Mathematical Modelling Series presents a number of applications of mathematics in domains as varied as the human body, volcanology, telecommunications or finance.

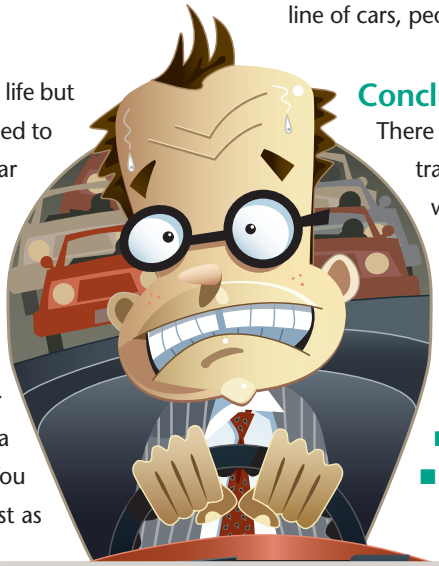
Have you ever been stuck in a traffic jam?

How often is your bus late? What's the quickest route across town? Delays due to traffic are a regular annoyance in day-to-day life, but the real problem is much bigger. The combined effect of people being late for work, goods being delivered after they're due and buses, trains and planes running behind schedule costs people billions of Euro each year. So do we know what causes traffic jams? Can we predict when and where they're going to happen? Is it possible to eliminate delays for good? These questions have interested scientists and engineers for decades, and the answers lie in mathematics.

How it works

Traffic is something we experience in everyday life but few people realise that mathematics can be used to explain many of its essential features. Similar phenomena occur in a range of applications, e.g., pedestrians on streets, the internet, schools of fish, or trails of ants. Traffic is everywhere! On busy roads, a strange phenomenon is plaguing motorists around the world. Picture yourself driving down a clear stretch of road. Suddenly you come to a complete standstill in a queue of traffic. You remain stationary for several minutes until, just as suddenly as you came to a halt, you move off again with a clear road ahead. There's no accident or any other cause, so what just happened? A phantom jam, that's what. The cause seems unlikely: suppose in heavy traffic someone brakes a little too hard. Imagine then that each person after also brakes a little too hard until somewhere further down the line of cars, people are forced to come to a complete stop.





Conclusion

There are many interesting and important aspects of transportation and traffic flow. Mathematics is essential if we want to increase the efficiency of our transportation systems. Mathematics will have a dramatic effect on the way we travel in the future.

Parts of the curriculum used in this project

- Matrices
- Linear equations
- Sequences and series
- Statistics
- Differential equations

ACKNOWLEDGEMENTS AND MORE INFORMATION

This research is supported by the Mathematics Application Consortium for Science and Industry (MACSI) funded by the Science Foundation Ireland Mathematics Initiative Grant 06/MI/005.

If you want more information about MACSI and this project:

- Contact Martina O'Sullivan (project facilitator) – martina.osullivan@ul.ie
- Visit the MACSI website – www.macsi.ul.ie.

UNIVERSITY of LIMERICK
OLLSCOIL LUIMNIGH

MACSI Mathematics Applications Consortium for Science & Industry

sfi Fondúireacht Eolaíochta Éireann Science Foundation Ireland