

# Milk tankers and traffic flows

**Jenny Rankine explores some of the topics discussed at the 2005 NZIMA Workshop on Mathematical Models for Optimising Transportation Services.**

Milk tankers are such a regular feature in the life of dairying regions that few people give them a second thought. Farmer Smith expects one every morning, but every morning her herd produces a slightly different amount of milk. By the time the tanker gets to the Wihongi farm at the end of the road, it may not have enough space for the output of their cows, and the scheduler may have to send another tanker.

Arranging the collection of an unknown amount of milk from 12,000 farms and delivering it to more than 30 factories, without many such backtracks, is a constant headache for Fonterra's schedulers. They face it twice a day, every day of the year. Fonterra's milk collection consultant, Simon Harrison, presented the problem to the workshop and was heartened by the results.

He introduced the company's internal debate between stochastic and deterministic optimisation approaches. "A deterministic solution will always be at the boundary of existing constraints," he says, "and therefore has the biggest risk of being wrong on the day. The question is whether you can design a stochastic optimisation approach to reduce the risk of being wrong on the day at minimal cost to the mathematically optimal solution. For a business like Fonterra, that is the crux of the argument." At the time of the conference, Fonterra was evaluating software using the different optimisation models.

The workshop brought together a group of local and international scheduling experts to debate the issues in a Fonterra-sponsored panel session. "It was quite fruitful," says Harrison. "What we got from the workshop was a much better understanding of the issues, a set of questions to ask our prospective

suppliers, and better tools to make sure that the path we're on is going to give us the results we're looking for." He says Fonterra would be interested in taking part in a similar session on a high priority maths problem again.

An unexpected result was that Fonterra's schedulers heard "all those brainy people struggling to model 150 pickups and went away thinking they do a really good job".

The workshop also included a stream about regional transport models, with a presentation by the Auckland Regional Transport Authority. Another expert panel considered transport models as tools for evaluating regional transport policies; how to increase Auckland public transport's share of travel time at reasonable cost; and how to plan for travel growth when forecast data is uncertain.

Workshop co-organiser Professor Andy Philpott says that traffic system models look at many individual drivers going from their origin to their destination and aiming for the quickest trip. "The models seek to construct an equilibrium where each driver is travelling by the route that gets them where they are going in the shortest time accounting for the similarly optimal choices of all the other drivers." The models allow researchers to explore the likely effect on traffic flows of changes such as expanding the capacity of a main road or motorway.

At the time, the introduction of tolls for Auckland central traffic was being debated. Professor Mike Florian from the University of Montreal told television viewers that tolls work only if there are alternative untolled routes that could then get more congested. They may not have any effect on drivers when there are no alternative routes.

A third theme of the four-day workshop was transport pricing and revenue management. The event was attended by more than 80 people from Australia, Canada, Chile, China, Denmark, Germany, India, Israel, the Netherlands, Norway, Singapore, Spain, Sweden, USA and New Zealand. It was hosted by the Department of Engineering Science at the University of Auckland and funded by NZIMA and the University's Operations Research Group.

See [www.esc.auckland.ac.nz/Transportation](http://www.esc.auckland.ac.nz/Transportation).

