SIM CITY

IMPROVING INNER-CITY LIFE THROUGH SIMULATION MODELING

An exclusive group of key figures in the traffic software industry take time away from their desks to reveal some interesting emerging partnerships
Come Together

A well known and established software package is Quadstone Paramics. In the nine years spent working with this technology, technical director Ewan Spiers has played a prominent role in pushing product development beyond its common usage in traffic planning, breaking into markets including defense and Homeland Security. Such increasing diversity has opened up new partnerships for Quadstone Paramics, as Spiers explains: “The biggest thing to come out of this idea is pedestrianized simulation. Modelling pedestrianism is something we’ve been researching for years; it’s been a case of finding the right people to work with who had the right approach to the problem of integrating traffic and pedestrians.”

Spiers and his team established a partnership with Crowd Dynamics’ CTO, Dr Kirth Still, and his colleagues, who expressed a similar understanding of the use of analytics – the understanding of what’s going on, the cause and effect relationship with vehicles – to produce something that has some value beyond that breadth.” The partners are now almost ready to go to market with a brand new product currently known as Urban Analytics Framework.

Spiers describes the starting point of the Urban Analytics Framework as being “about the interaction of the two groups – pedestrians and traffic – share.” The aim is to be able to model that interaction in an environment in which it will be possible to accurately analyze the interaction between pedestrians and traffic, so much so that in the future, the tool could be viably used for accident analysis.

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It is about quantifying the effect of vehicles and people. One example of its use is in speed limit assessment: the software helps answer questions such as ‘what kind of benefits can you gain if a speed limit is reduced in an area?’ It’s about the probability of pedestrians and vehicles coming together.

Natural applications for such a tool include assessment of projects for installing pedestrian crossings on roads, and for existing everyday situations, such as bus terminals – places where there is already a substantial level of interaction between the groups.

The technology behind the new product is built up in layers: “We start by building a description of the traffic model, the basic Paramics model that deals with the road space,” Spiers explains. “We then add a new layer of information on top of that – the space on the model that pedestrians can use, sidewalks, crossings and so on. We then include a third layer, which is the areas where the two can overlap – the shared space. This would include things like crossings and places where pedestrians have a shortcut. These three layers allow us to bring the two sides of the problem together and look at the base that they share.”

 Spiers is amenable to all of the detail and analytics from Quadstone Paramics traffic capabilities with all of those from Crowd Dynamics’ pedestrian know-how: “The point is to try and give some sort of informed feedback on what the potential cause and effect of bringing these two groups of people together will be,” continues Spiers. “In the Paramics tool, our big thing is analytics – it’s about understanding why we want to take that same analytical approach and apply it to the idea of urban space.”

Still shares this view, although comes to it from a different perspective, having spent the past 20 years working on crowd and pedestrian models. He sees the partnership as a logical progression, noting that many pedestrian models are equipped with crude traffic modeling capabilities, while many traffic models possess crude pedestrian capabilities. He believes they have found an ideal way to integrate the two – the user gets the best of both worlds.

This has enabled the team to put into play three different modeling techniques: “One of these is network analysis, which is a way of using tools to look at wide area networks, flow and movement. Another is spatial analysis, which looks at the utilization, the value engineering of spaces – how to move people in the most economic way to determine where best to make investments. Then there is agent-based modeling. These sit within our software as three integrated tools that you can flip data between, allowing you to look at value engineering and safety in the same environment.”

Still’s understanding of pedestrian behavior is particularly important in the partnership with Paramics “People create mental maps of space,” he says “The routes and shortcuts they take give us an understanding of how space is used; that’s the science behind our particular spatial analysis technology. Understanding these various routes and paths gives us a better understanding of how people interact with the built and complex environment.”

Modeling for Management

Vassil Alexiadis, vice-president of Cambridge Systematics and a respected expert in the simulation field, has recently been working on new applications for modeling. “A traditional use of simulation has been to employ these tools to design new transportation facilities: for instance, when designing an interchange where a freeway meets a major arterial and you want to try different approaches. Simulation has proved highly capable in analyzing techniques such as ramp metering and HOT lanes. Previous tools, such as travel demand models, were not able to achieve this since they were too general. As a result, simulation tools (both microscopic and macroscopic) carved a niche. The future is to use simulation to help manage transportation in real time.”

A recent project that Alexiadis has been involved with is Integrated Corridor Management, an effort by the USDOT to launch a new tool that features pedestrian modeling. VISSIM is PTW’s established platform, a tool designed for the short-term, whereas the program works on a social software model, a tool designed for the long-term. The tool is being developed by the system will test integration of these systems and help alleviate congestion and delay across the system, not just on its individual components.

The USDOT selected eight metropolitan areas to test the initiative and will select two or three on which the analytical tools will be tested. In the meantime, we tested the methodologies and tools on a single test corridor, and the results have just come out and will be made public in the first quarter of 2008.”

Alexiadis says that the results look promising, and reveals the project was both interesting and challenging. “We are not developing new software – we are using what already exists. To analyze all of these strategies one needs to combine the capabilities of existing tools. It doesn’t matter what software it is. Each tool has its own strengths and weaknesses, the idea is to use them in combination.

‘Microscopic tools are best for analyzing traffic control options, like ramp metering or traffic signal coordination. The advantage of macroscopic tools is that they can model a larger area within the same computer resources. They’re not as detailed a transportation simulation, but what they do is allow the client to look at the effects of, say, congestion pricing, or traveler information.’

Work began on the project in October 2000 and since it was decided to combine the different families of tools, Alexiadis and his team set about testing and developing post-processors and integration tools to allow the different packages to communicate with each other. He feels strongly that in 10 years’ time commercial simulation software companies will be offering products that combine several capabilities in one package. “The future is to be investing in whatever travel demand, microsimulation or mesosimulation tools work best for the task. But as these decisions are made by different departments or agencies they haven’t been coordinated. The trend that will push technological development forward is when they all start working together.”

Walk the Line

As interest in Amsterdam in April, PTW will launch a new tool that features pedestrian modeling. VISSIM is PTW’s established platform, a tool designed for the short-term, whereas the company needed an academic partner to create pedestrian modeling capabilities. Professor Dirk Helbing from the Institute for Economic Analysis and Traffic at Dresden University of Technology was brought on board.

Peter Vortisch, director of traffic engineering products, explains why Helbing’s assistance was valued: “He has worked for years on a Social Force Model for pedestrian traffic, so when we were searching for an academic partner we looked for a model that complements the approach we have with PTW, which is to try to
be as microscopic as possible. The Social Force Model fits well into this because it is a continuous model in space, there are no grids like in some other models.

Developing this new feature involved not only adding another behavior model to VISSYM, but also having to change the handling mechanics. “We had to extend VISSYM in many parts,” Vortisch says. “By integrating the pedestrian model directly – not just adding an interface to pedestrian models – we provided true interaction between vehicles and pedestrians.”

This proved particularly worthwhile during a recent project, when PTV was asked to model the pedestrian streams emerging from a train station and appearing rapidly on a road area. Although evacuation modeling is an obvious use for these new types of products, Vortisch believes PTV’s potential customers will more likely be those people trying to look at day-to-day events at locations such as bus terminals or stations. “Evacuation is in most cases a simple application compared to the ‘normal’ situations, because all pedestrians will do the same thing. In a normal scenario, you have many different groups doing many different things, which makes the simulation far more complex.”

For a number of years in a row, PTV has appreciated that for many of its customers moving between different models is invaluable. “With our last releases (VISUM 10.0 and VISSYM 3.0), we have the second generation of integration. The idea is that you have a strategic planning tool that is interested in the whole city. And you have a microscopic tool that typically models only a corridor within the city, in some projects you will want to move from one model to the other and back again, and keep all your development, but not the tradition of modeling that we’ve had in Europe over the past 30 years. So you start by building the models pretty much from scratch – you conduct the surveys, and build the network models for public and private transport. It is a very clean situation and you can use the modern tools without having any legacy issues. For us, the development, but not the tradition of modeling that we’ve had in Europe over the past 30 years. So you start by building the models pretty much from scratch – you conduct the surveys, and build the network models for public and private transport. It is a very clean situation and you can use the modern tools without having any legacy issues. For us, the

Qatar master plan is a good showcase of how to use VSUM and VISSYM in a combined way for large-scale planning projects.”

As well as integration, another trend predicted by Vortisch is the inclusion of certain telematics features that will eventually make it onto the roads. “As soon as these sytems appear on the road, we must be able to model them, otherwise we can’t claim to model real-world traffic.”

Indeed, this prompted PTV to take part in a research project in Germany where a car-to-car communication module was developed for VSUM and tested on a 20km corridor in Hessen. The trial ran from mid-2006 until October 2007 and the results were impressive. “We now have a new module for VISSYM that is able to model the communications processes between vehicles, and we will see a commercial version of this available by the end of 2008.”

PLAYMOBIL

An important force in traffic modeling in recent years has been Barcelona’s TSS Transport Simulation Systems. Its popular software product, Aimsun, is currently in its sixth incarnation.

Like others in the field, TSS recognizes the benefits for users to be able to model both traffic and people. As a result, the company has collaborated with the UK-based pedestrian modeling company, Legion. Alex Gerodimos, who spent five years as Legion’s modeler, now works at TSS. “For issues of planning and management of people movement in a wider sense, engineers, urban planners, and transport engineers would all like to have a single tool that’s capable of modeling any type of mobility in a city; whether you’re talking about regular journeys, things that create extra traffic such as holidays, or a combination of different modes of transport, or just ordinary movement.” Gerodimos refers to this as a “prelude of what is to come” and echoes some of the previous comments about integration. “Organizations will want to make integrated decisions that take into consideration all of the pertinent issues. So traditional divisions between pedestrian engineers and traffic engineers will no longer be as defined.”

The new product that has emerged from the partnership with Legion is Aimsun for Legion. Gerodimos is keen to point out that, for TSS, this is just the beginning. “The trajectory of the partnership will be threefold. The first to go live was the Aimsun for Legion package, designed to benefit Legion’s existing user base. These are customers looking primarily at pedestrian scenarios – people interacting with people – where there is an occasional interaction with an area of traffic. "These people,” he says, “are very interested in the model of the entire W1 area from a pedestrian point of view.”

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Two things struck TSS about real-time applications, the first of which was related to simulation performance: “If you cannot simulate a large area – as large as your area needs to be for the purposes of what you’re modeling, and you cannot do that much faster than real time – then you cannot talk about real-time decision support.” The second point was about integrated modeling: “For projects such as this that involve very large areas, the type of macroscopic models people used to is perfect for high-level analyses; for doing matrix adjustments or reassigning traffic after an incident. What we’ve been able to do by having an integrated platform is to use macroscopic aggregation tools to understand which areas would be affected at a high level. These analyses enabled us to assemble a worst-case scenario which defined the scope of the online simulation model.”

When TSS first started on this project, the company was not sure if microsimulation was enough on its own, or whether to use its mesoscopic simulator which the company has been developing for several years and is now available in Aimsun. “In Madrid we went with the micro-simulation and it ended up doing the job just fine, running 95 minutes of simulation in three minutes of real time.”

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However, the success of this project was also dependent on bringing Legion’s model, which was previously used in Aimsun Online, to a new group of people who want to perform integrated planning, “These users will want an integrated platform in which they define everything and get a high level of sophistication. So, if they want to build into that platform a model of the entire city of London from a traffic point of view, they can. Likewise, if they want to model every pedestrian in an area. What they might well be interested in is looking at areas where pedestrians impact on traffic – for instance pedestrian-activated lights.”

The third step in the vision is to produce a fully integrated TSS/Leegion platform to appeal to a new group of people who want to perform integrated planning. “These users will want an integrated platform in which they define everything and get a high level of sophistication. So, if they want to build into that platform a model of the entire city of London from a traffic point of view, they can. Likewise, if they want to model every pedestrian in an area. What they might well be interested in is looking at areas where pedestrians impact on traffic – for instance pedestrian-activated lights.”

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“Traditional divisions between pedestrian engineers and traffic engineers will not be as defined” purchases its Legion Studio and Legion3D products since October 2007.

This first version allows what software companies call ‘joint visualization’, where different facets of problems are looked at by their respective experts. TSS, however, is taking things to the next step – tailoring a product that will benefit its own users – when it launches a plug-in of Legion to go within Aimsun. “What has emerged from this effort is ‘Our users will usually conduct a series of surveys, and build the network models for public and private transport. It is a very clean situation and you can use the modern tools without having any legacy issues. For us, the development, but not the tradition of modeling that we’ve had in Europe over the past 30 years. So you start by building the models pretty much from scratch – you conduct the surveys, and build the network models for public and private transport. It is a very clean situation and you can use the modern tools without having any legacy issues. For us, the

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