This 23rd edition is shaping up to be the strongest program in the history of International INRO Users Conferences. We have introduced lightning talks this year as a shorter format in which to share your work and your thoughts. We hope that these will spark just as much discussion during the breaks and social events as the rest of the program.

I would like to recognize the participants who have travelled from Australia, Hong Kong, Singapore, Israel, Sweden, Spain, the Czech Republic, United Kingdom, Colombia and Brazil. Their attendance, together with the North American colleagues from the U.S. and Canada, makes this conference truly international.

I extend our appreciation to PSRC for hosting this event. It is a privilege for INRO to hold this conference in different cities and local support makes this possible.

I wish you all a great conference!

Mike Florian
President, INRO
### Thursday, October 16

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:30-8:30</td>
<td>Conference Registration and Continental breakfast at the Bell Harbor Conference Center</td>
</tr>
<tr>
<td>8:30-10:00</td>
<td>Session 1 - Keynote, Part 1</td>
</tr>
<tr>
<td>10:00-10:30</td>
<td>Break</td>
</tr>
<tr>
<td>10:30-11:10</td>
<td>Session 2 - Keynote, Part 2</td>
</tr>
<tr>
<td>11:10-12:00</td>
<td>Session 3 - Integrated Models</td>
</tr>
<tr>
<td>12:00-13:00</td>
<td>Lunch</td>
</tr>
<tr>
<td>13:00-14:40</td>
<td>Session 4 - Model Updates</td>
</tr>
<tr>
<td>14:40-15:00</td>
<td>Break</td>
</tr>
<tr>
<td>15:00-15:50</td>
<td>Session 5 - Emme Applications</td>
</tr>
<tr>
<td>15:50-17:00</td>
<td>Session 6 - Lightning Talks</td>
</tr>
<tr>
<td>18:00-18:30</td>
<td>Cocktails at the World Trade Center Seattle</td>
</tr>
<tr>
<td>18:30 -</td>
<td>Banquet at the World Trade Center Seattle</td>
</tr>
</tbody>
</table>
Friday, October 17

7:45-8:30  Continental breakfast at the Bell Harbor Conference Center

8:30-10:10  Session 7 – Activity-Based Models chaired by Craig Helmann (Puget Sound Regional Council)
  • Advanced Modeling Practice at CMAP - Kermit Wies (Chicago Metropolitan Agency for Planning)
  • Transitioning from Enhanced 4-Step Trip Based Model to a Disaggregate Tour Based Model at the City of Calgary
    - Kristina Hill (The City of Calgary)
  • Tel Aviv Activity Based Model Implementation: Experience and Progress
    - Leonid Kheifits, Shlomo Bekhor, Boris Shmulyian, Michael Sorani (Netivey Ayalon Co.)
  • Activity-Based Model Development at PSRC
    - Stefan Coe, Suzanne Childress, Brice Nichols (Puget Sound Regional Council)

10:10-10:40  Break

10:40-12:00  Session 8 – Dynameq Applications chaired by Michael Mahut (INRO)
  • Development of the Seattle Center City DTA Model and Its Application on Tolling Analysis
    - Andrew J. Natzel, Laura Wojcicki (Parsons Brinckerhoff)
  • Dynameq studies at SFCTA - Dan Tischler (San Francisco County Transportation Authority)
  • Application of DTA to Evaluate Network Traffic Impact during Bridge Closure in Edmonton - Peter Xin (City of Edmonton)

12:00-13:00  Lunch

13:00-14:15  Session 9 – Features Coming Soon chaired by Daniel Florian (INRO)
  • Coming soon - Daniel Florian, Kevin Bragg, Isabelle Constantin, Calin Morosan, Michael Mahut (INRO)

14:15-14:45  Break

14:45-16:25  Session 10 – More Emme Applications chaired by Brice Nichols (Puget Sound Regional Council)
  • Testing and Evaluation of PToll: a Sydney case study
    - Daniel Harney, Premraj Dorai Rajoo, Scott Wilkinson (Jacobs Australia)
  • Modelling Toronto Transit Fares - Peter Kucirek, Eric J. Miller (Travel Modelling Group, University of Toronto)
  • Transport models – are they really that important? - Christian Nilsson (WSP Group)
  • Portland Metro’s favorite Emme Features! - Richard Walker (Oregon Metro)

16:25-17:00  Session 11 – More Lightning Talks / Closing Session chaired by Shane Velan (INRO)
  • Strategic model results in 3-D using Google Earth - Daniel Harney, Premraj Dorai Rajoo (Jacobs Australia)

18:00 - ...  Pub Night at Kells Irish Pub

Bell Harbor Conference Center Floorplan
1 Main Entrance
2 Breakfast / Coffee Breaks
3 Lunch
4 Sound Conference Room

Locations for World Trade Center Seattle & Kells Irish Pub are located on the back of the program.
After spending the first 20 years of his career quietly working on progressively more detailed travel models and simulations Rick found himself having to defend not only his work, but those of colleagues, to politicians, investors, lawyers, and judges. His experiences have caused him to question whether the field is heading in the right direction, what we’ve done right, and where the bold new world of pricing might take us. Ironically, that quest has brought him back to many of the tools he used earlier in his professional life. Rick will share where this odyssey has taken him, where he expects it to go to over the next decade, and its implications for how our tools will evolve to meet the challenges.

The widening gap between models and forecasts

After spending the first 20 years of his career quietly working on progressively more detailed travel models and simulations Rick found himself having to defend not only his work, but those of colleagues, to politicians, investors, lawyers, and judges. His experiences have caused him to question whether the field is heading in the right direction, what we’ve done right, and where the bold new world of pricing might take us. Ironically, that quest has brought him back to many of the tools he used earlier in his professional life. Rick will share where this odyssey has taken him, where he expects it to go to over the next decade, and its implications for how our tools will evolve to meet the challenges.

Emme and Dynameq: Product update

Get up to speed with the latest and greatest developments. INRO staff will present highlights from recent releases of Emme and Dynameq, demonstrate recent software features, offer guidance on the best way to use the latest procedures, and share tips and tricks.
Tours-Based LUTI Modelling – Leicester and Leicestershire Integrated Transport Model

The Leicester and Leicestershire Integrated Transport Model (LLITM) is a multi-modal, tours-based, fully integrated Land-Use Transport Interaction (LUTI) model developed in Emme. LLITM uses 973 zones and represents 19 demand segments. LLITM represents car, bus, rail, walk/cycle and freight modes, and three levels of car ownership.

With Emme 3, the model structure and dimensions required use of 19 databanks for the demand modelling to accommodate the necessary matrices. This allows for up to 10 demand segments to be run in parallel, using 10 parallel instances of Emme, exploiting multi-core processing. Additional innovations include:

- Public transport model tours estimation: An adaptation of INRO’s matrix estimation process allows several time periods to be estimated simultaneously at a two-leg tour (outbound and returning trip) level.
- Automated synthetic calibration: A process to calibrate synthetic gravity models for highway demand was developed in Emme to automatically adjust synthetic model parameters to produce a close fit to observed trips.
- Simplified highway modelling: The LLITM highway model uses SATURN, but to reduce runtimes and improve convergence, the SATURN model was converted to a topologically identical Emme network without SATURN’s detailed junction simulation, resulting in consistent forecast changes in generalised cost produced in the Emme model.
- MSC pricing: A process is currently under development (previously used in other Emme models) to calculate Marginal Social Costs in Emme at a highway link level and apply these to road users as charges. Users then pay for the total social cost of their journey, including the negative externalities of delay, air quality, noise, accidents and carbon emissions.

Integrated ABM-DTA Approach – Travel Model of the Future

Travel demand models are undergoing a global transition to more advanced paradigms. New travel demand models for major cities throughout the U.S. are based on the innovative principle of microsimulation of individual activity and are frequently referred to as Activity-Based Models (ABMs). The CT-RAMP (Coordinated Travel and Regional Activity Modeling Platform) developed and applied by PB for such cities as Columbus, Atlanta, San Francisco Bay Area, Chicago, San Diego, Miami, and others represent one of the successful examples. These models are still integrated with conventional aggregate static network procedures. Recent advanced and successful applications of Dynamic Traffic Assignment (DTA) models opened a way for an integrated ABM-DTA approach. Dynameq can potentially replace static assignments in the regional travel model with DTA.

The ongoing CT-RAMP-Dynameq integration project for Jerusalem, Israel is one of the first experiences to create a complete microsimulation model for a large region. This integration required many innovations on both ABM and DTA. In particular, the CT-RAMP ABM required an enhanced level of temporal resolution and more elaborate methods for conversion of the person trips into vehicle trips. Dynameq required a modification of the route choice model to address individual Value-of-Time, occupancy, and other user characteristics. Each individual trip trajectory is tracked in time and space with a full consistency between the activity and trip schedules. We believe that the integrated ABM-DTA model represents a prototype of a travel demand model that will be widely applied in practice in the near future.
Implementing the Sydney Strategic Transport Model in Emme 4

The Sydney Strategic Transport Model (STM) is the primary multi-modal strategic modelling tool used for all future road and public transport infrastructure projects in New South Wales, Australia. The STM has a long history and the previous version 2 has been implemented using Emme 3 macros.

A new extended version of the model has been estimated in 2013-14 and is now being implemented using a combination of Emme 4 API and Python platforms. This presentation will first give a brief outline of the history of STM, and describe the model structure. Then it will highlight the key features of the model, and the enhancements added to version 3, including separate modelling of toll road users and non-toll users and car access to rail stations. The main section of the presentation will focus on the implementation of the model. A key issue for the implementation was to minimise the model run time. Using the Emme 4 API and various Python modules such as NumPy and Bottleneck, a significant reduction of the run time was achieved, but further improvements are being investigated, including parallel processing of some model processes. The presentation will end with a summary of the lessons learned and a list of issues for further investigation.

Riyadh transport model update

The paper describes the update process of the Riyadh transport model. The original model was developed in 2004, using the data collected from a big household survey and some additional data sources (such as stated preference surveys, traffic counts, etc.).

A large population growth and a plan to dramatically improve the public transport network (with 5 new metro lines and several BRT and conventional bus lines) compelled Arriyadh Development Agency (ADA) to update the model in order to have a better understanding of the changes in the city mobility. The work was based on a limited number of new surveys, due to the time constrains and the practical difficulties of a big household survey. Also a new set of specific surveys (Stated Preference) were designed to adjust a modal split model.

A new set of models where developed and implemented in Emme to forecast the network performance once the new public transport system was in place. The paper describes the process and also some details of model implementation, such as an incremental distribution model, the use of SOLA algorithm to improve the overall running time of the model and the validity of small samples to update the models.
Wee Liang Lim
Land Transport Authority

Wee Liang manages the Transport Modelling team at the Land Transport Authority, Singapore. The Transport Modelling team is responsible for the development and maintenance of the transport model. Wee Liang oversaw the Household Interview Travel Surveys and Stated Preference Surveys in 2008 and 2012. He also supervises and provides crucial future transport demand forecast to assist transport planning studies and infrastructure viability studies.

Co-author:
Chian Chiew Tan

Amanda Mo
Arup

Amanda Mo is an Associate Director of Arup who leads the traffic modeling team responsible for all traffic modeling related projects in Hong Kong, Macao and mainland China. She has over 20 years experience on strategic model development. She successfully migrated the Hong Kong CTS model from FORTRAN programs to Emme in 2005-2008. Amanda is currently calibrating the CTS model to updated survey data and improving model performance and capability.

Model Updates in Hong Kong

The Comprehensive Transport Study Transport Model (CTS Model) is is the prime basis for the Government to formulate and evaluate Hong Kong’s overall transport strategies and infrastructure planning. The next round of model enhancement is being undertaken to re-calibrate the CTS Model based on the most up-to-date travel characteristics revealed from a recent comprehensive household interview survey.

Owing to its high population density and geography, Hong Kong has one of the most comprehensive and complex public transport systems in the world, comprising a multitude of public transport modes providing different types of services. Passengers interchanging between public transport modes and services are commonplace. The situation is further complicated by a range of fare structures applicable to different public transport modes including inter-modal fare rebates. These pose a challenge to replicate the choice behaviour of passengers. The CTS Model adopts a multinomial logit formulation in the public transport sub-modal split model. This involves five public transport ‘favour’ modes to be defined in a hierarchical setting, followed by incremental favoured path assignments for each mode.

Another new feature of the enhanced model is the development of a logit-based highway assignment model for three tolled cross-harbour tunnels calibrated against a combination of stated preference and revealed preference data collected in the household interview survey.

The presentation gives an overview of the CTS Model enhancement; discusses the challenges faced and how they were overcome, particularly with respect to fare simulation, public transport choice modelling, and the logit-based highway assignment model.

Singapore Transport Planning and Model

Singapore is one of the most densely populated cites with a total land area of about 715km² and a population that steadily increased from 4.0M in 2000 to 5.4M in 2014. The estimated population in 2030 is 6.9M. To ensure adequate infrastructure planning, Singapore has implemented a comprehensive planning process that includes a Concept Plan Review that focuses on long term (40-year planning horizon) planning scenarios, and the Master Plan Study, which highlights potential developments in the next 10-15 years.

The Transport Model plays a vital role throughout the entire planning process. Since 1997, a Strategic Transport Model has been developed with inputs from various land-use planning agencies. The model subscribes to a conventional 4-step structure and is calibrated with various data sources, such as travel patterns from a travel diary and responses from Stated Preference Surveys. The model includes different mode choice models based on vehicle ownership trends. It is calibrated using detailed public transport boarding and alighting information based on the ticketing system. The transport model is used to study the impacts of different public transport schemes (e.g. more subway lines, bus routes) and transport policies (e.g. vehicle ownership projections, congestion pricing and parking cost). Every infrastructure project must undergo cost benefit analysis evaluation and key information required for the evaluation is derived from the model results.

This presentation will discuss Singapore’s planning process and the role of the transport model, the model structure and development, and different applications. We will also touch on the future enhancement for the transport model and regional model that is currently under development using Dynameq.
Eduardo Germani
TTC

Eduardo is Director of TTC, a leader in sustainable mobility in Brazil and Latin America. Eduardo began his career two decades ago specialising in modelling and travel demand forecasting for analysis of impact of new systems, feasibility assessment and supply optimisation. He has broadened his skills through managing projects including BRTs, Metro lines, urban trains, toll roads and traffic planning, in both Latin America and China.

German Lleras
Steer Davies Gleave

German Lleras is the regional director of Steer Davies Gleave for Latinamerica. He is a Civil Engineer and holds master’s degrees in transport engineering and urban planning. He is also an instructor in Universidad de los Andes (Bogota). He was part of the team that developed the model to support the development of a congestion charging scheme for Bogota.

Complex transit fare modelling in the metropolitan area of São Paulo

Metropolitan area of São Paulo is the eighth largest urban agglomeration in the world and consists of 39 municipalities with over 20 million people. Public transportation is done by 17 lines of urban trains and metro, around 1600 municipal bus lines and over 500 metropolitan bus lines.

Bus operation is given to private companies through concession of areas. In the case of metropolitan bus lines, there are five concession areas.

Fare policies vary from municipalities and modes, and there are many terminal specific exceptions to the general rule. For example, in the city of São Paulo, on municipal buses one can board up to four times within 3 hours, and use any rail line paying a fare complementation. In the city of Osasco, fares are flat in the streets and free on some bus terminals. In the metropolitan buses, each line has a different fare and there is no fare integration on the streets, but some lines have fare reduction inside specific terminals.

These elements add quite a challenge to the transit modelling process.

This presentation uses the work done for the Metropolitan Bus Agency, EMTU, which intended to introduce a new fare policy to their bus lines and measure the impacts on bus revenue in each concession area, to illustrate the techniques used to model such huge network system with complex transit fare, and the analysis that could be obtained using Emme.

Congestion charging model for Bogota

The government of Bogota, the capital of Colombia, appointed Steer Davies Gleave as technical advisor of the joint venture that was created to study and design a congestion charging scheme for the city. One of the fundamental tools used for the project was a transport network model developed in Emme 4 and built on a platform that has been under development and use by the city administration for the last 15 years.

The general approach was a traditional-four stage trip based model that the city inherited from previous works. Upon that initial structure we developed extensive discrete choice surveys and models that were later embedded in Emme 4. Integrated with the discrete choice model we developed a network assignment process based on the standard assignment modules that the software offers and constructed a strategy of duplicated road network with differentiated access charges based on type of users (e.g. residents vs. non-residents). The key drivers of the integrated decision model (mode-route) where travel time (in very congested areas) and the charge. The calibration and validation of the model required analysis of a recent (2011) household survey data and a detailed evaluation of volume-delay functions and operations of junctions in many of the main streets of the city. The model was calibrated and validated both in terms of flows (automobile, motorcycles, loaded taxis, unloaded taxis, large trucks, small trucks, passengers in bus network) and speeds over the arterial network. An emphasis was put on travel time within the network acknowledging the difficulties of modelling highly congested networks in macro-models but also considering that a micro or meso-strategy for the entire city was not feasible in the given time frame. The tool was used to design the charge area (limits, through streets with no charge), evaluate impact of different tariffs and charge structure, identify by-pass streets and evaluate impact on those, produce financial and socioeconomic results among others.

The scheme is now being considered by the city government and has been submitted to the ministry of Transport and the city council for further technical and legal processes.
Building and Maintaining Support for Transportation Models

Successful transportation model implementation and application requires high levels of administrative support. Sustaining this support through difficult times can be a challenge for forecasting managers and staff alike. I’ll be presenting for your consideration some successful techniques that I have experienced in my career.

Tours-Based Public Transport Matrix Estimation

An innovative tours-based matrix estimation procedure was implemented in the Leicester and Leicestershire Integrated Transport Model (LLITM), a multi-modal and fully integrated Land-Use Transport Interaction (LUTI) model developed in Emme.

LLITM treats most travel demand as two-legged ‘tours’, with outbound journeys linked to return journeys later in the day. This data structure is valuable for modelling parking strategies and charges and prices with time-of-day variability, but interacts poorly with traditional matrix estimation methods for adjusting demand matrices to better match observed flows.

The adjusted OD trip matrices need to be reconciled back to a production-attraction (PA) tour format, which cannot be done unambiguously, because the estimation process typically adjusts each modelled time period separately. LLITM previously used additive ‘delta’ matrices to convert from the tours-based PA and the estimated OD assignment demand models. The main disadvantage of this approach was inconsistencies introduced between the demand and assignment models, with potential for unrealistic model responses.

A new public transport calibration process, adapted from INRO’s public transport matrix estimation macro ‘demadjt.mac’, estimates all three time periods, each with its own set of observed counts, by adjusting matrices at a tour level, taking account of the flows and constraints in all time periods simultaneously.

This process removes the inconsistency between the demand and assignment levels of the model and the need for “delta” matrices. Although the tours-based estimation process implies additional constraints over the standard trip-based variant, analysis of outcomes showed that similar levels of fit to count data could be achieved to a trip-based process tested in parallel, with similarly low levels of distortion to the prior matrices.
Transit analysis using Modeller's Extended Transit Assignment

Fehr & Peers recently completed a major regional transit project for Sound Transit, a local transit agency that plans, builds and operates express bus, light rail and commuter train services. The South King County High Capacity Transit (HCT) study was conducted to inform choices for the next phase of its system plan development.

The study area is characterized by strong transit markets fueled by supportive demographics, the presence of urbanizing nodes of development, and a strong focus of transit towards Downtown Seattle. Much of the transit service in the South King County HCT study area is focused in a north-south orientation, connecting residential areas to Downtown Seattle. However the HCT study evaluated an east/west connection on the south side of Lake Washington that crossed several existing north/south services, including Link Light Rail, Sounder Commuter Rail, and several express bus lines. The ridership on this east/west section was surprisingly strong. Our team used station-to-station analyses to verify the degree to which the ridership was based on transfers to the major north/south lines versus land use interactions along the corridor. The following procedures were used:

- Extended transit assignment performed to yield the optimal strategies, which saved the demand between transit stations.
- Created transit segment attribute to flag the transit line.
- Performed an extended transit traversal analysis.

The results confirmed that the east/west line is a strong performer because it better links the communities on the south side of the lake to the north/south transit lines, facilitating transfers that are not as easy under current conditions.

Using Emme for Feasibility Study of Pan European Railway Corridor in Slovak Republic

The upgrade of main west–east railway route across Slovak Republic, which is situated in the middle of Europe, is planned for a long time. The upgrade should increase the speed as well as better comfort for passengers and it should lead to modal shift from individual car transport to railways. The upgrade of totally 338 km long railway route (between cities Žilina, Košice and Cierna nad Tisou) should also improve the international railway connection, mainly with Ukraine and the Czech Republic. Planned upgrade involves new tunnels, bridges and route straightening and reconstruction of the superstructure.

As the important part of this feasibility study, we have been developing multimodal transport model with a help of Emme software. The development of transport model was a condition for future funding the railway reconstruction by the European Commission. The model will assess impact of three alternatives (and a few sub alternatives) of planned corridor on passenger shift and travel times.

Travel behavioral surveys are important part of the transport model. Following surveys are being done or planned: opinion survey of major relevant carriers and a sample of passengers, additional occupancy rate survey in bus/coach transport, preference survey and analysis of rail freight transport customers and survey and analysis of rail passenger transport customers.

The model is multimodal. It contains car transport, road and railway public transport and road and railway freight transport. Since the model area (the railway corridor and its surrounding) occupies more than half of the Slovakia Republic and no national model is available, our model involves whole area of the Slovak Republic. This approach – to model corridor impacts on national level – also involves the different level of detail: zonal and network structure is much more detailed in the neighborhood of corridors and less detailed structure on remote areas. Model involves internal as well as external transport (international transport, export, import and transit.)
Using Emme's Path Analysis Tool to Compute Facility Specific Pure Travel Times and Costs

Transportation planning projects frequently require answering questions that go beyond the basic traffic assignment results like link level volumes, travel times, and level of service. WSDOT performed a toll evaluation of I-90. Such an evaluation requires computation of changes in travel times, travel costs, and average trip lengths on I-90 as well as parallel facilities including SR 520 Bridge. This presentation demonstrates a procedure developed for WSDOT that uses path analyses to calculate facility specific “pure attributes” (travel time, cost or trip length) under a generalized cost multi-class assignment.

The complexity of computing “pure attributes” on a specific facility using the path analysis primarily lies in:

1. The assigned paths at equilibrium between a given OD pair for each vehicle class represents paths with the same generalized cost but not the same travel time; and
2. Path analysis specification. For calculating the “pure attributes” of facility specific users, a link attribute tagged to represent the selected facility is used in computation and selection of path attributes, but a link attribute representing either travel time, cost or trip length needs to be used for computing the OD attribute.

The procedure established to address the above challenges requires progressively performing three sets of “path analyses” and combining the results to obtain the “pure attribute” OD matrix. Each of these three path analyses were performed with different link attributes, selection criteria, and type of OD attributes saved. Emme’s standard traffic assignment procedure (modules 5.11/5.22) will be primarily used in this demonstration, and a conceptual application using path-based traffic assignment procedure (modules 5.25/6.16) will also be presented.

Use of Emme in Brazil

Brazil lacks transportation infrastructure. Although this has been true for a long time, its economic advance and increasing importance in world scenario seeing in the last decade has put a tremendous pressure on this bottleneck for sustainable growth.

Strong public investments are been made in urban mobility, roads, railways, seaports and airports, most of them with support from private sector. FIFA World Cup this year and the Olympic Games in two years’ time also added an extra urgency in the development of many transportation systems and facilities in the country.

In this context, this presentation will summarize the use of Emme in Brazil and how it has been used to help transportation planning all around the country.
Simple customized tools created in Modeller for daily use

The use of python programming language associated with INRO’s APIs has added a great power to Emme. Now, just about anyone can create tools to automate tasks in their models, generating huge flexibility to what can be done in the software.

This presentation uses a few tools made for Modeller to exemplify how it can be used to make modeling simpler and quicker by automating all kind of tasks.

Building a Sub-Area Model: Applicability of Modeller

The presentation will focus on the process Fehr & Peers used to create a sub-area model for Snohomish County and the City of Federal Way using the Puget Sound Regional Council’s (PSRC) recently released four-step transportation demand forecasting (TDF) model. The PSRC TDF model, referred to as the “4K” model, was developed to make the structure of the PSRC TDF model more intuitive, simple and organized. The new model generally has the same core modeling components of the previous model, but has been updated with newer data from the 2006 PSRC Travel survey and 2010 Census data. The “4K” refers to a newly developed 4000 zone system.

The general overview will highlight the key features of the new model and the process used to create the subarea model. Some of the features highlighted will include the use of the PSRC’s new geo-data based networks, integration of legacy networks, enhanced transit coding techniques and revised highway and transit assignment procedures. Comparisons will be made of model structure and size, run time and validation findings.

In keeping with the intent of the conference, the presentation will conclude with an overview of where potential use of the tools found in the Modeller suite were used throughout the development of the subarea models. The conclusion will focus on both the benefits and challenges of using the Modeler tools and potential thoughts on better integrating the new tools into the modeling process.
Bicycle Modeling Techniques at PSRC

The Puget Sound Regional Council (PSRC) modeling team has developed a practical procedure to include bicycle impedance in an activity-based model and assign bicycle trips to a network with traditional assignment procedure. Thus, our model can estimate bicycle volume changes for new or improved bicycle facilities. As bicycling is increasingly important in the planning community, the team implemented a process that was feasible within time and budget constraints to be able to answer policy questions. The method first requires that additional bicycle network links be added to the traditional travel model network. Bicycle assignment parameters have been asserted using the literature to find the optimal paths on the network for each origin-destination pair. Using the Emme assignment software, the weighted impedance is used to find the best paths which are recorded in a bicycle skim. Next this weighted bicycle impedance skim is sent as a parameter into the bicycle alternative of the mode choice model. The activity-based model produces bicycle trip tables by time of day, which are assigned. The impedance coefficient and the bicycle constant are calibrated against a 2006 household travel survey and bicycle counts by hour. The impedance term is calibrated such that the model bicycle trip length frequency distribution matches the household travel survey distribution. The constant is calibrated so that the bicycle counts match the modeled bicycle volumes. The gold standard for bicycle route assignment has recently been through the building path size multinomial logit models using revealed GPS traces. Ideally, the skimmed parameters for impedance like travel time, grade, and facility type would then be used in bicycle logsums. The logsum coefficients would be estimated via mode choice estimation. The downside to this rigorous approach is cost to estimate the models, gather the data, and develop code. In the approach presented here, no additional data is required, no estimation is performed, and the code development is minimized.

Application Of Big Data In Modeling Integration

To better understand and evaluate future improvement alternatives, an integrated modeling effort was carried out to support Interchange Justification Reports for the Washington State Department of Transportation. This ongoing modelling effort will inform alternative approaches to solve congestion including local connectors, transit improvements, and modifications of interchanges, in addition to mainline improvements. Three modelling components (Macroscopic, transit, and Mesoscopic) were included in the modeling integration. To provide a solid foundation for future alternatives analysis, information from big data was used to validate modeling integration under existing conditions given the complexity of the overall network. Big data within the integrated modelling effort into included INRIX speed data for speed validation, Bluetooth origin-destination analysis for travel pattern validation, and traffic counts for freeway and local street volumes. Highlights of the modeling effort included detailed calibration and the modelled network includes unique feature such as a military installation and gate operations, HOV lanes, freeway ramp metering, and rail crossings.
Advanced Modeling Practice at CMAP

In 2010, CMAP prepared its Strategic Plan for Advanced Modeling. This plan, prepared with the assistance of a cadre of five national leaders in modeling practice, established a framework for developing new CMAP models that are highly disaggregate and behavior-based. Also in 2010, CMAP adopted its GO TO 2040 Regional Comprehensive Plan including strategies for highway pricing, transit modernization and improved freight operations. In developing new activity- and agent-based transportation models, CMAP greatly expanded its use of Emme’s capability. This presentation will outline some of the challenges and successes in adapting existing travel modeling tools to these applications as well as the outlook for future development.

Transitioning from Enhanced 4-Step Trip Based Model to a Disaggregate Tour Based Model at the City of Calgary

The City of Calgary has maintained travel demand models to support transportation planning and projects since 1964. These models have been regularly updated to take advantage of new travel behaviour data and advances in modeling techniques. The latest update which will see the Calgary Regional Transportation Model (RTM) transform from an enhanced 4-step trip based logit model to a disaggregate tour-based model within the Emme Modeller framework.

The first phase, completed in March 2012, used the model framework from the California Statewide Short Distance Travel Model, adapting the inputs for Calgary. The model was roughly calibrated and validated to Calgary conditions using old survey data from 2001 as a feasibility test.

The second phase, expected to be completed by the end of 2014, uses new data collected in the 2012 Calgary and Region Travel and Activity Survey to estimate, calibrate, and validate a tour-based model using Calgary specific data. This model would include all of the features that exist in the current Calgary RTM as the California framework did not include features such as park and ride and peak spreading. The travel demand model will run in Python, create a list of trips made by every person in the model area, and then pass those trips into Emme for assignment to produce skims and conduct analysis.

The final phase, expected to be completed in 2015, adds functionality to the model to improve policy support and address issues that arose during model estimation. This will include identifying the improvements that have the most value to the City of Calgary and can be developed for implementation into a new forecast series.
Leonid Kheifits
Netivey Ayalon Co.,
Tel Aviv, Israel
Leonid Kheifits is independent consultant in the field of transportation planning and modeling, working primarily on the development and implementation of the national-wide and metropolitan transportation models in Israel and abroad (Africa, Central America, Eastern Europe).
Co-authors: Shlomo Bekhor
Boris Shmulyian
Michael Sorani

Stefan Coe
Puget Sound Regional Council (PSRC)
Stefan Coe is a senior GIS Analysis/Travel Modeler at PSRC. He works on all aspects of software development relevant to PSRC’s travel models as well as data integration between models. Prior to PSRC, He spent several years working at the University of Washington’s Urban Ecology Research Lab where he used GIS and Remote Sensing to support ecological modeling and research. He holds Master’s degrees in Urban Planning and Public Administration from the University of Washington.
Co-authors: Suzanne Childress
Brice Nichols

Tel Aviv Activity Based Model Implementation: Experience and Progress

The Tel Aviv Activity Based Model (ABM) is operational since 2009, and is currently in use by several public and private transportation planning companies. It became a primary tool for evaluation of various projects in the area, ranging from simple road improvements to the development of a new mass transit system. Many lessons were learned during years of model runs, both at methodological and practical levels. The presentation will address some of them.

The application of the Tel Aviv ABM includes numerous random draws reproducing the personal transportation behavior decisions. Accordingly, the run results contain random components, which complicate the analysis and evaluation of projects. An approach for obtaining stable model results is developed and discussed.

The Tel Aviv model evolved together with the development of the Emme package. The introduction of parallel computation and advanced assignment algorithms improved significantly the model performance. Further planned improvements will be discussed.

Activity-Based Model Development at PSRC

PSRC has recently developed an activity-based model called SoundCast. SoundCast runs via a single Python controller script that executes the stream of processes that comprise a full model run. This includes a Python script that performs assignment and skimming by leveraging the Emme APIs; Modeler in particular. The controller also runs the Daysim demand model which uses updated time, cost and distance skims to produce new demand that gets passed back to Emme in an iterative fashion. Assignment and Skimming is performed in parallel for 12 different time periods, which greatly reduces model runtime. SoundCast also uses efficient data storage techniques through open source libraries like “hdf5” to pass trips into Emme databanks. It employs a global feedback convergence method to monitor skim changes and terminate a model run at a given precision. SoundCast uses flexible, extensible code, and PSRC advocates sharing open-source code with state of practice code management and version control from programs like Git. PSRC hopes to provide some key technical lessons-learned from SoundCast’s development and present its most recent applications of Emme’s API toolkit.
Development of the Seattle Center City DTA Model and Its Application on Tolling Analysis

In the Seattle region, tolling and revenue studies have mostly relied on macroscopic travel demand forecasting models to predict the effects of various tolling strategies on traffic and revenue impacts. This traditional approach has worked rather effectively on freeway corridors with limited alternative paths. However, a dynamic traffic assignment (DTA) model of the Seattle Center City, conducted in Dynaeq, that considers the time-dependence of traffic congestion and the complexity of a highly-signalized multi-modal street network was effective in the analysis for a planned tolled tunnel in downtown Seattle.

Model development included creation of trip tables and a new model network, which includes traffic control at several hundred intersections, numerous time-of-day parking and lane restrictions, and a congested parallel freeway. Calibration of the model also required detailed attribute adjustments to best reflect observed vehicle and driver behavior.

The validated model was then used to efficiently and accurately test and assess the effects of tolls on revenue generation and traffic network operations for the SR 99 Tunnel Project, which will replace the aging Alaskan Way Viaduct on Seattle's waterfront. Several tolling scenarios were tested to identify potential diversion rates and related revenue estimates. The impact of this diverted traffic on transit, freight, and general purpose traffic was evaluated to identify potential congestion hot-spots and areas for mitigation.

Results, findings, and lessons learned from the model development and study will be presented. Further applications of the DTA model will be discussed, including use of the model to evaluate construction traffic management and future tolling evaluations.

Dynaeq studies at SFCTA

The San Francisco County Transportation Authority developed the San Francisco Citywide Dynamic Traffic Assignment Model in 2012 to supplement the Transportation Authority’s activity-based model, SF-CHAMP, which is currently using static network assignment. The citywide DTA model allows the Transportation Authority to investigate aspects of driver behavior and traffic patterns not possible with SF-CHAMP. By understanding time dependent route choice, the effects of downstream congestion on upstream links, lane geometry and signalization, the San Francisco Citywide DTA Model allows analysis of traffic congestion impacts on transit operations, the effects of transit priority measures, and traffic diversions across wider geographies than would be practical to simulate using a microscopic traffic simulation model.

The Transportation Authority has used DTA models to study traffic diversions during temporary freeway construction and to evaluate bus rapid transit scenarios. In 2014 the San Francisco Citywide DTA model will be used to study traffic calming strategies for the Chinatown Community-Based Transportation Plan. The study considers a number of transportation network changes designed to improve traffic safety, while simultaneously avoiding significant traffic diversion impacts on other neighborhood streets. The presentation will explain the various traffic interventions under consideration, the measures of effectiveness designed for the project, and will assess the appropriateness and effectiveness of analysis using the Transportation Authority’s DTA model. The presentation will also provide a brief update of other current applications of the San Francisco Citywide DTA Model and plans for future development and application.
Application of DTA Model to Evaluate Network Traffic Impact during Bridge Closure - A Case Study in Edmonton, Alberta

Due to the lack of temporal variation of traffic flows and allowance of demand over capacity in static traffic assignments, the validity and reliability of traffic diversion estimates from major road/bridge closures are often subject to question. Dynamic Traffic Assignment (DTA) is a new and evolving technique that is sensitive to time dependent congestion and thus can properly estimate traffic diversion to alternate routes during temporal/spatial traffic flow shifts induced by network supply or traffic demand changes.

In summer 2013, the City of Edmonton closed the Stony Plain Road Bridge crossing over Groat Road for four months as part of its roadway rehabilitation program. A DTA model was developed using Dynameq to estimate traffic diversion and to evaluate network traffic impacts during the construction period. This model utilized the bridge open (pre-construction) traffic data for model calibration and the bridge closure data for model validation. Additionally, since traffic demand before and during the short-term bridge closure will likely be the same, the assessment of the model forecasting capability can be considered more credible.

This paper presents the DTA model development and traffic impact evaluation process, which covers data collection and analysis, traffic origin-destination demand adjustment, DTA model network preparation, as well as model calibration and validation using the traffic conditions observed before and during the Stony Plain Road Bridge closure. The findings and lessons learned from this study will inform practitioners about the capabilities and benefits of a DTA model in the application of traffic operational analysis. Recommendations on how to apply a calibrated DTA model to a short-term network supply change are also highlighted.
Testing and Evaluation of PToll: a Sydney case study

Daniel Harney
Jacobs Australia

Daniel Harney is an experienced traffic and transport planning professional with 15 years’ experience in the public and private sectors both in Australia and internationally working on a range of transport planning studies, traffic investigations and transport model development activities. Daniel manages Jacobs’ transport planning group in the Northern Australia and New Zealand region based in Brisbane. He has specialist skills in transport modelling and demand forecasting, with involvement in several significant model development projects in Australia and overseas.

In general, the forecasting performance for toll roads in the world has been found to be poorer than for toll-free roads. Forecasting errors can be caused by many factors including inadequate models, data limitations, uncertainties in socio-economic and land use forecasts, ramp-up risks, and optimism bias and/or strategic misrepresentation. Traditional static equilibrium traffic assignment algorithms are generally able to capture travellers’ responses to changes in generalised costs (vehicle operating and time costs) through shifts to lower priced routes given the chosen destination and mode. However, existing processes need to evolve as the complexity of tolled facilities increase to include combinations of entry and exit point tolls, distance-based tolls, toll capping, discounts for using multiple facilities and time-of-day based tolls.

In this paper the new PToll traffic assignment tool incorporating the Second-Order Linear Approximation (SOLA) traffic assignment is evaluated using a case study in Sydney, Australia. Results are presented for a range of scenarios for city-wide traffic assignment using 30 user classes, a distributed value of time methodology, explicit intersection delay and the application of perceived travel time weights based on recent stated preference surveys. PToll has provided a robust and comprehensive toll modelling capability which has already been used for forecasting patronage on a number of greenfield and brownfield tollroads in Sydney. The significant run time savings and convergence improvements have also resulted in project efficiencies and an increased ability to respond to client’s needs in option testing and project refinement.

Modelling Toronto Transit Fares

Peter Kucirek
Travel Modelling Group, University of Toronto

Peter Kucirek has a B.A.Sc. and an M.A.Sc. in Civil Engineering (Transportation) from the University of Toronto. He has been working for the Travel Modelling Group (TMG) as an Emme specialist since August of 2012.

The effect of transit fares on riders’ path choice is particularly important in the Toronto region, where cheaper local buses complete with premium commuter rail lines. The price discrepancy is so great that riders make real behavioural choices to avoid paying extra to the point that such behaviour cannot be modelled without incorporating fares. Theoretically, modelling such behaviour is a straightforward matter of applying a parameter to convert the fare into generalized cost; however, in practice, determining the appropriate fare incurred by a path through the system is a challenging exercise. This presentation reports on work done by the Travel Modelling Group (TMG) in developing and calibrating a “fare-based transit assignment” procedure for Emme 4; with a specific focus on the technical implementation in Python. This was accomplished by developing a tool to generate a “hyper-network,” in which different transit agencies were given their own “layer” of links and nodes. The tool uses a broad range of Emme Modeller features: the Network API, the Shapely library, JQuery, and XML file I/O. Finally, parameters for the assignment procedure were estimated using a Particle Swarm Optimizer (PSO) genetic algorithm, utilizing distributed computing supported by XTMF.
Transport models – are they really that important?

Since 1984, Emme has been the key modelling software for the official transport demand tool Sampers or its predecessor. Developed by WSP, Sampers is used by consultants and planning authorities for demand forecasts and cost-benefit analyses for both road and public transport projects. This presentation describes several studies performed with Sampers.

Project 1 – upgrade of the rail link “Svealandsbanan” – demand forecast success!

This study of ridership forecasts predicted a six-fold increase in travellers following the rail link upgrade. The management of the planning authority and the rail company questioned the forecast and did not plan investments accordingly. Once the rail link opened, the actual ridership was close to the forecast carried out a decade earlier, and major crowding was experienced during peak hours.

Project 2 – upgrade of the rail link “Ostkustbanan” – demand forecast failure!

This study showed that the ridership would increase by 165% after the rail link upgrade was completed. However, the observed ridership change was much lower at 41%. An after study showed that changes in model input data were the source of the discrepancy.

Project 3 – Stockholm congestion charging – demand forecast success!

Transport models were used to study various concerns during the planning of the Stockholm congestion charging system. The actual change in road use after implementation in 2006 was very close to the observed changes.

Project 4 – Changes in the Stockholm congestion charging system – success or failure?

In 2016, the congestion charge in Stockholm will increase, and the only by-pass route will be priced. The study revealed a surprising change in travel patterns.

Portland Metro’s favorite Emme Features!

Modeling used to be so easy!! Auto and transit assignments, skim tables, accompanied by an occasional select link or line – that is all the modeler needed. But times have changed. Today’s modeler is tasked with a myriad of challenges in trying to address the needs of his/her clients. Results need to be produced faster, better supported through data, and more comprehensive. This presentation will highlight some of Metro’s favorite new features that have helped keep this agency in sync in the fast changing world of modeling.

Metro’s needs span a variety of areas. Project schedules require fast processing and “instant” analytical capabilities. Assignment methods must be able to address the ever increasing saturated conditions found in our current and horizon years. The feds desire transit assignment criteria that are consistent with mode share parameters. Rich networks are required in active transportation analysis. Emerging activity based models, bursting with data, require tools to manage the execution and orchestrate the query of results.

The INRO team has provided tools to keep up with these requirements. Path-based assignment, SOLA, DYNAMEQ, transit routing enhancements, network size selection, Emme modeler, and other features are proving to be invaluable. The presentation will showcase Portland Metro’s current (and planned) use of these tools.
Strategic model results in 3-D using Google Earth

There are many ways to show transport model results. For example, results can be shown within the modeling software interface itself, within a spatial software interface like MapInfo or ArcGIS or even analysis interfaces such as Microsoft Excel. The downside of all these methods are that the viewer would need some form of license to access the software.

To improve the accessibility for users who just wish to view and analyse model results, Jacobs has developed a tool that converts these results into the Google Earth software platform. Link and node based results can be shown seamlessly and interactively in a three dimensional form with an imagery background.

The Google Earth output process can be customized to the client or end-user’s preference where needed and can be further developed to display additional information. Once set up, producing the Google KMZ files can be done automatically through the model build and run process.

Thanks to all the organizations for contributing to the INRO Model City 2014 program!
Reception in the Edgewater Hotel’s Six Seven. An informal gathering to renew old acquaintances and make new connections.

Cocktails at the Seattle World Trade Center. Enjoy the sunset over Puget Sound.

Pub Night at Kells Irish Pub. Relax with a pint of brew or a glass of vino in the heart of Seattle, above the historic Pike Place Market. Carry on at any of dozens of nearby restaurants and bars.

Banquet at the Seattle World Trade Center. Northwest cuisine with a waterfront view.

Bell Harbor Conference Center
2211 Alaskan Way
Reception in the Edgewater Hotel’s Six Seven. An informal gathering to renew old acquaintances and make new connections.

World Trade Center Seattle
2211 Elliot Ave.
Cocktails at the Seattle World Trade Center. Enjoy the sunset over Puget Sound.

World Trade Center Seattle
2211 Elliot Ave.
Banquet at the Seattle World Trade Center. Northwest cuisine with a waterfront view.

Kells Irish Pub
1916 Post Alley
Pub Night at Kells Irish Pub. Relax with a pint of brew or a glass of vino in the heart of Seattle, above the historic Pike Place Market. Carry on at any of dozens of nearby restaurants and bars.