CIHT Dubai Evening Seminar (Online)
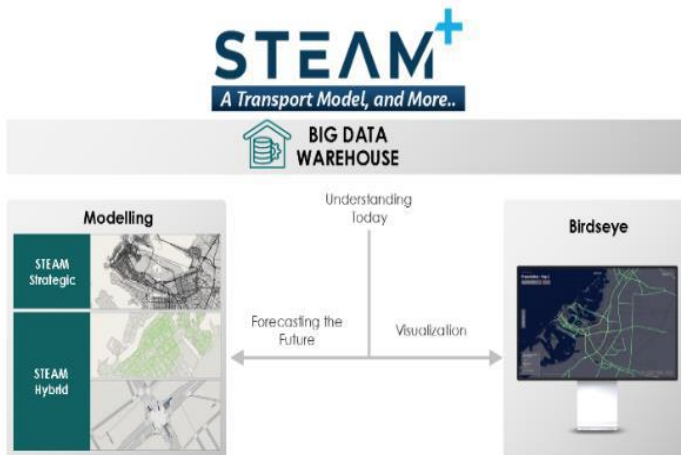
Stephen Bennet Abdallah Abdelgader	Abu Dhabi's New Approach to Transport Modelling – STEAM+

About the Event

A data revolution has impacted multiple industries over the past 10 years, but this data has not always been available to transport planning experts until recently. At the Abu Dhabi Integrated Transport Centre (ITC), new data has driven rapid change for the current Strategic Transportation Evaluation and Assessment Model (STEAM) over the past 18 months.

The ITC is developing a ground-breaking Transport Modelling Framework called STEAM+. Adding to traditional four step modelling approaches, the new framework now covers Meso, Micro Models and near Real-Time Simulation. The ITC is linking big datasets including day-to-day anonymized mobile phone tracking, water/electricity consumption by household, live tracking of bus and taxi fleets, building and plot level municipal data, as well as a comprehensive population and employment datasets. This is a hugely ambitious project and nothing of this scale has yet been undertaken by other transport authorities. The STEAM+ Framework will place Abu Dhabi's Transport Modelling Program among the best in the world and pioneers as the next big thing in modelling.

The new STEAM+ Framework is multi-tiered, allowing assessment of schemes ranging from specific intersections to large infrastructure studies, transit corridors and policy tests, be it for a single CBD block or across the whole Emirate. It complements perfectly the current regional strategic model for more detailed, dynamic assessment of flow metering at junctions, traffic queuing, ITS and emerging technologies, bus priority schemes and LRT delays at junctions, to mention but a few.

This seminar discussed the development of the STEAM+ Framework, including its three pillars, the big data warehouse, the multi-tiered model, and the visualisation tool. The seminar will also discuss some of the interesting applications that the ITC has been developing through the Framework.

About the Speakers

Stephen Bennett is a Consultant Transport Modeller at the Integrated Transport Centre Abu Dhabi, focused on big data and modelling. He has more than 20 years of experience working in transport modelling in UK, Europe, and Middle East. He has worked on several projects related to Transport Demand Models and is responsible for development of the ITC STEAM+ Modelling Framework.

Abdallah Abdelgader El-Shabani is a Senior Modeller at the Integrated Transport Centre Abu Dhabi. He has more than nine years of experience in transport modelling, simulation, automation and analytics in the UAE, Jordan and Canada. Recently, he has led the development of the Emirate-wide Hybrid Simulation Model, the award-winning visualization tool 'Birdseye' and is developing existing condition analysis using Big Data Analytics.

Presentation

Stephen Bennet began his presentation by giving a general overview of STEAM (Strategic Transportation Evaluation and Assessment Model). STEAM is the Abu Dhabi ITC's official forecasting tool covering the Abu Dhabi Emirate. It has been used in a wide variety of projects covering different master plans like CAPSTMP, infrastructure projects, TIS/TMP's and for various policy studies to test road user charges and other interventions. Stephen stated that STEAM is typically used for about 50-60 internal projects every year and more than 12,000 scenarios have been tested since its launch. After its initial release in 2011, STEAM was constantly updated every year taking into consideration various feedback. Ongoing major model updates will enable the release of STEAM+ in the coming year.

Core inputs into STEAM include population, land use, transport networks, policy measures and traffic surveys. STEAM gives a wide range of outputs like traffic volumes, PT ridership, mode share, total travel distance, levels of congestion and travel time. STEAM is an enhanced four-stage model with various key items tailored for Abu Dhabi, for example an airport model, car ownership model, freight model, car parking model, special trip generators like oil and gas, and tourism. All these allow incorporation of additional data and the testing of sector specific scenarios. The model also takes into account different market segments (288 segments) like nationality, car availability, household income, gender, household size, age. This market segmentation is analysed further in the distribution model and trip purpose.


STEAM can forecast up to 2040 and includes 16 different transport modes including the new public transport modes like hyperloop. After the mode choice, time choice modelling considers different peak demands in the AM peak and PM Peak with detailed definition such as the staggered start and end time for different sectors like school, government and private sectors. STEAM can also undertake the economic assessment and input into BCR values following the standard UK TAG approach.

Abdallah took over the presentation and introduced Birdseye, a visualization tool that automatically takes the STEAM model run outputs and loads them into a visualization server. Some of the example visualizations included land use information, trip pattern analysis including desire line at zonal or sector level, scenario comparison, bus ridership, tram boarding, etc.

The big data warehouse includes data owned internally by ITC, for example vehicle fleet information, bus ticketing data, origin and destination information for bus riders, taxi ridership data, traffic count data from the counters around Abu Dhabi. In addition, the big data warehouse also includes day-to-day anonymized mobile phone tracking, water/electricity consumption by household, building, and plot-level municipal data, as well as a comprehensive population and employment dataset. This enables billions of rows of data dynamically to be fed into the data warehouse, which is being used in the model updates as well as in the planning process. Abdallah shared examples of visualization using anonymized mobile data, including traffic speeds on the roads both live and historic, trip origin and destination, and population density.

Abdallah elaborated more on the traffic speed visualization of a bridge in Abu Dhabi; the visualization includes monthly profile, weekly profile and time period data. In the second example, population movement visualization was presented; the origin of movement from CBD to various locations and then it's integrated with other sources of information available internally like demographics, trip purpose. In the third example, data from water and electricity consumption data was presented. Utilization of occupied units will enable an estimation of the population and dynamically update if needed. Abdallah then moved on to presenting STEAM+ as a data driven modelling framework. He explained that the new framework will include Meso, Micro Models and near Real-Time Simulation, vehicle fleet modelling, and updates to Birdseye to include existing conditions. All the different layers of data from the big data warehouse are aggregated to generate OD matrices. Since the new modelling framework is based on data that is available for days of the week and year, patterns can be developed for a weekend, special events.
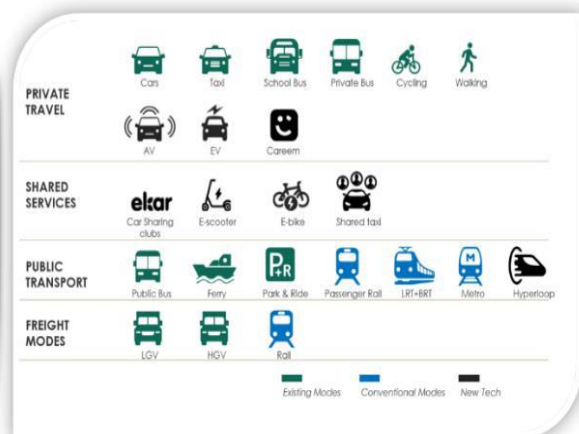
Abdallah then moved on to explain the different levels of models in the new modelling framework. Strategic models in the new modelling framework have been improved significantly considering the extensive road network updates. This modelling framework will categorise different models for different uses and guidelines are being prepared. For example, strategic models will be used for strategic master planning, policy testing, land use tests and PT long-term planning. At the next level, mesoscopic models will look into traffic queuing at a more detailed level such as 15 min intervals. Mesoscopic models will be used for feasibility studies, Traffic Impact Studies, congestion, and signal coordination, PT mid-term planning. Microscopic level models will look into junction level traffic analysis and can be used for detailed design and assessment, special events planning, detours, and construction phasing, and PT mid-term planning. In the new modelling framework, traffic count data from the automatic traffic counters placed across Abu Dhabi, and big data warehouse information like mobile data, speed, bus ridership, taxi data are all used for model calibration and development of key parameters.

Stephen presented the different modes that are being incorporated in the new modelling framework and provided details about the recent study completed to break down existing modes to include soft modes like E-Scooters, E-bikes as well as autonomous vehicles and electric vehicles. These modes are being modelled as hired services and owned vehicles.

Stephen then presented the vehicle fleet modelling tool that considers the vehicle type, age, motive power, engine size and emission

standards. This segregation is undertaken to enable emission modelling to help EAD for transport-related emission modelling. He then shared examples of different visualization examples using the data from the big data warehouse (Taxi origins, Bus desire line, traffic counts, accident distribution, etc).

Finally, Stephen summarised the presentation by giving an overview and difference between the STEAM and STEAM + as below.

- STEAM earlier had one platform based in CUBE. STEAM + has two platforms,(CUBE, Aimsun) and they are automatically linked.

- Some other key statistics between two model includes the number of zones in STEAM+ can be scaled up to 6000 to incorporate the various levels in the new model, network updates have been tripled and use of the road network unified across ITC.

- The population data has been enhanced based on mobile data and other information.

- Validation criteria have been enhanced to 4500+ data points across the network.

Stephen then provided an overview of the future planned developments including dynamic linkage of data to select mode at different times of the day and short-term forecasting models for 1 to 4 years.

Stephen concluded his presentation with information regarding the various awards received by ITC for STEAM, including:

- Reddot Winner 2020 (App Design, Web design, Interface Design);

- MBRCGI Best Innovation in Government shortlisted;

- Innovation in Government Award, 2017;

- Best Technical Project, Abu Dhabi Government Excellence Award, 2015; and

- Best Technical Project DoT Excellence Award, 2014

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Questions and Answers

1.	Would you consider an open source, activity-based travel demand forecasting model platform, such as ActivitySim, see www.activitysim.org	We are open to investigating any tool, but we typically go through a comprehensive platform evaluation prior to committing to any software platform.
2.	Data available in big data warehouse is it being analysed and visualisation using Birdseye? or do you have another platform for visualisation of big data	Yes, it is visualised using Birdseye.
3.	Have you performed any outlier analysis on your speed data empirical observations?	Yes, it's done as part data processing.
4.	Is data warehouse analytic output to CUBE input automated or manual processing?	Lot of the processing is automated using data clustering and have in place data cleaning process and outlier analysis.
5.	Which modelling program was used here:	CUBE and Aimsun Next.
6.	Is the intention to maintain CUBE and Aimsun Next networks separately or move the strategic model to Aimsun Next?	Current platform with CUBE and Aimsun will be maintained for the next 3-4 years.
7.	Need further explanation on forecast modelling slide please? Please present the validation framework criteria used?	Modelling forecasting is a complicated topic. In short, absolute model is applied incrementally. New developments have absolute model approach and areas with existing trip generation information will apply the incremental model. In terms of model validation, model has been validated against multiple international modelling standards such as Victoria roads standard Australia, UK TAG.
8.	On STEAM+ - will ITC be providing guidance to capacity building and modeller qualification requirements to get access for example - as AIMSUN is in the modelling framework	Yes, we will provide training. The change will be gradual with necessary support and training.
9.	This is huge work. Wonderful. Is Birdseye program/API developed using a built-in coding program in CUBE or is it just an external python or Java or other coding?	Web based platform is developed using python, java. The exporting functionality that exports data from CUBE into the Birdseye is done using CUBE Voyager and Python. Existing conditions are based on SQL.
10.	Is there a live feed data for short term forecast	Yes, and it's been used internally.
11.	Looks like incredible detail. Any plans for scenario-based analysis to aggregate concepts under differing visions of the future?	Yes, we do have plans to do scenario-based analysis. Nut currently, as the prime focus is to finish the modelling framework.
12.	The modelling of e-bikes and e-scooters sounds very innovative? Can you tell us a little bit more about the sorts of applications you are considering here? Can you model demand and flows for new cycle tracks for example?	E-bikes and e-scooters have been incorporated into the mode choice modelling. The reason behind this approach is based on the evidence from data showing large increase in public hire and private e-scooters. We believe this will be one of the important access modes in future for the public transport. Demand is currently assessed in aggregate at a zonal level. We are not assigning cycle, walking flows to our network or in the simulation model as yet.
13.	Do you leverage a land use model, if so, is it fully integrated with your transport model?	Land use information is maintained by DMT, and we get building level information. We haven't done any land use modelling as yet.
14.	Has the model been used to support "predict and provide" or "vision and validate " approach to transport planning, especially when comes to new and emerging modes?	We are not looking to do predict and provide. We are looking to create a sustainable city.
15.	How long each scenario run will take after adding the number of zones from 2k to 6k?	Run time will remain the same.
16.	What is the typical modelling processing time for a new land use scenario to output in CUBE?	Typical model runs for around 18-24 hours.
17.	We all have recently seen the incident where someone was dragging a box with 100 phones in it which showed congestion and red link on google maps while the link was empty in reality!! Do you think depending on big data could be misleading or risky?	Data we are receiving has clustering information to remove these kind of outliers. In addition for each parameter, we also validate against different sources to maintain the quality of the model.
18.	Can we get more details on shared services please (new modes added to steam) how is it modelled, is it at aggregate level or segmented level?	Each mode is incorporated as an independent mode. It's a disaggregate, mathematical approach.