



PENANG

Traffic simulation models and smart mobility solutions converge in a heritage-filled city



PROJECT SNAPSHOT

PROJECT NAME	Penang Smart Mobility Micro-Simulation Model Development
COUNTRY	Malaysia
SECTOR	Transport
MAIN GOVERNMENT BODY SUPPORTED	City Council of Penang Island
SMART SOLUTION	Calibrated Vissim micro-simulation model
PROJECT PERIOD	May 2021–March 2024; August–December 2025
ADB PROJECT OFFICER	Elizabeth Jung, Urban Development Specialist
MAIN PROJECT OBJECTIVE	To implement a smart mobility solution in the heritage district of George Town in central Penang to reduce traffic demand and congestion and to allow road spaces to be given back to pedestrians and cyclists

Penang, a bustling center of commerce and culture in Malaysia, is well-known for its vibrant street art, charming shophouses, and iconic street food. Its state capital, George Town, is a UNESCO World Heritage Site that draws thousands of tourists every day. By 2030, George Town aspires to become a smart, livable city.

The Penang Smart Mobility Micro-Simulation Model Development project is a step toward this vision, as it helps the city address congestion, improve public transport, and enhance public spaces, to ultimately preserve Penang's storied past while cultivating its progressive atmosphere.

THE CHALLENGE

Muddled Mobility Hampers Livable City Dreams

Popularity has come at a cost. A Penang resident often has to contend with traffic jams, unreliable public transportation, and roads with double-parked vehicles that cause an unsafe mix of pedestrians and vehicles. Infrastructure has also lagged behind, with substandard walkways and intersection designs, as well as inadequate bike lanes.

The City Council of Penang Island (MBPP), Seberang Perai City Council (or MBSP, the local government that manages the mainland half of Penang state), and Digital Penang (the state's digitalization agency) have noted that there are several studies seeking to improve mobility and manage traffic in George Town. However, despite these plans, MBPP has encountered difficulties in gathering support for these improvements. They needed a tool that could quantify the benefits and impacts of proposed interventions.

Enter the Penang Smart Mobility Micro-Simulation Model Development project of the ASEAN Australia Smart Cities Trust Fund (AASCTF). Through collaboration with the government agencies, AASCTF developed a micro-simulation model using the PTV Vissim software, the world's leading simulation modeling package.



“Most evaluations were done manually based on the data submitted by Traffic Impact Assessment consultants, which made it difficult to independently verify traffic performance and simulation results. The growing number of new developments often caused traffic issues, and without an in-house simulation tool, traffic studies had to be carried out by external consultants to assess the impacts.”

Ir. Nur Adilah Binti Mohamed Daud
Assistant Engineer,
Majlis Bandaraya Pulau Pinang



Better planning and inclusive design

Penang lacked the ability to simulate mobility scenarios, hindering strategic planning. With the right tool, the city can also cater to the diverse needs of commuters (i.e., youth, women, the elderly).



Addressing inefficient public transport

Routes and schedules are not optimized; by removing inefficiencies, ridership and service provision can be improved.



Enhancing health and safety

Traffic-related pollution affects air quality, while accident-prone areas increase safety risks. A micro-simulation model can contribute to agile response to traffic challenges.



Minimizing wasted resources

Investing in infrastructure projects that are not cost-effective or do not adequately address actual needs leads to wasted resources. Testing scenarios beforehand can make investments more impactful.

THE SOLUTION

A Micro-Simulation Model for Better Streets

The micro-simulation model, essentially a digital replica of George Town, was developed in two stages, each with four main steps: data collection, model development, model calibration, and scenario testing. The first stage covered a small pilot area in George Town to demonstrate the proof of concept, including how the model could assist with evaluating transport solutions and benefit master planning. The second stage expanded the model to the city's full historic center. This would not only allow a more comprehensive assessment of transport policies and interventions but also determine the effects of development plans in the World Heritage Site.

The project also delivered the following key outputs to supplement the model:

- **Data collection.** This is a crucial part of the pilot project. It involved traffic, parking, and origin-destination surveys, as well as an inventory of road layouts and transportation facilities, among others, to ensure that the model is based on real-world situations for accurate analysis.
- **Micro-simulation model reports.** These captured the progress of the model development and presented findings from the calibration and scenario testing. In Stage 2, the scenarios included providing bus priority measures along main bus corridors and removing selected on-street parking.

- **Training superusers.** Five superusers from MBPP and MBSP were trained (using an accredited PTV Vissim course) to ensure usage and maintenance of the model for the long term. The training was aligned with the superusers' government function and gender balance was also considered in the selection of the superusers.
- **Providing post-training materials.** While the capacity building was deemed successful (from the workshops to the training), guiding documents and resources were given for continued reference and to train new users.
- **Recommendations for transport guidelines.** Studying the mobility conditions of George Town enabled the project team to share suggestions for the Traffic Impact Assessment guidelines and strategies for implementing transport improvements.



Why it Matters

Penang Smart Mobility Micro-Simulation Model

- Empowers authorities to test strategies and scenarios
- Minimizes implementation costs by simulating solutions and developments first
- Improves review of developer proposals, enhancing urban planning
- Increases road safety for pedestrians and vehicle users
- Helps protect the unique architecture and cultural townscape

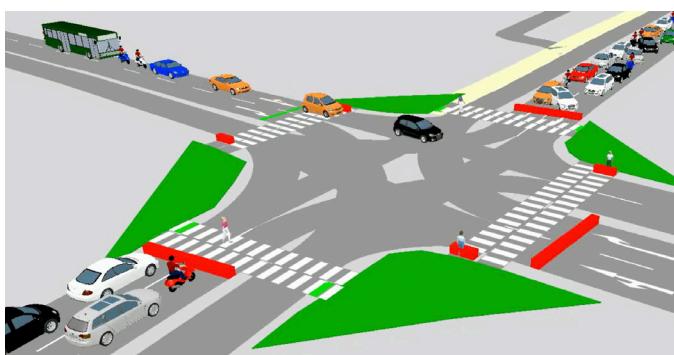
Early Changes and Impacts

Through the micro-simulation model, Penang now has the means to assess how policies, transport interventions, and developer plans can influence urban growth. *"This enables MBPP to compare options and find the best solutions, looking at the impacts, without investing capital or making changes on the road network,"* explained Richard Sprosen, Associate Director for Smart Mobility in Ramboll Singapore and AASCTF Penang project lead.

Since the handover of the micro-simulation model and AASCTF's provision of the software license in 2024, the superusers have been designated as the model's operations and maintenance (O&M) team. To date, they have been using the model to review development plan proposals from the private sector—validating the intention of this project.

In particular, because of this project, MBPP has updated its process. They now ask developers to submit a Vissim simulation model when applying for permissions for large-scale developments. MBPP currently receives one model per month for assessment. In 2024, for example, they evaluated a proposed mixed development around Mukim 12 (mukim means town or sub-district in Malay).





This change in their operations, according to MBPP, has allowed them to have a better understanding of the potential impacts of a planned development on the transport network. Now, they can identify areas that may need capacity or safety improvements, and overall, be more meticulous with their review. Using the simulation software supplements their traditional way of studying traffic, poring over traffic performance evaluations submitted by developers based on desktop calculations.

Beyond the agency, the AASCTF project has also influenced the design of better, greener streets. Some of the sustainable transport solutions tested in the micro-simulation model—based on existing transport plans—will be taken up under a grant project of the Adaptation Fund, the Nature-based Climate Adaptation Programme for the Urban Areas of Penang Island. This includes the recently launched road upgrade initiative for key corridors in George Town. MBPP's Ir. Cheah Chin Kooi, Director of the Engineering Department, shared that this will transform Weld Quay, Beach Street, and Gat Lebuh Chulia into pedestrian-friendly, climate-resilient roads.

Lessons and Pivots

Developing the micro-simulation model was not without its challenges and pivots. The project was met with the COVID-19 pandemic and movement restrictions, as well as severe flooding in the city, which affected the ability to do traffic surveys and analysis. The project also had to pivot between stages to realign local ownership. These prompted the project to adjust and refine its implementation, paving the way for more meaningful outcomes.

Mainstreaming of gender equality, disability, and social inclusion or GEDSI was considered throughout the project, consistent with the AASCTF GEDSI Strategy. The GEDSI context was assessed, focusing on disability access and inclusion in George Town, including the use of examples and related studies on disability and mobility. Building on the work done under Stage 1 and 2 to establish the model, there are strong opportunities for further targeted GEDSI interventions as the model is implemented.

To this end, AASCTF identified support for elevating and building capacity of local counterparts to consider GEDSI as key, in addition to sourcing and incorporating the use of disaggregated data within the model to support decision-making for more inclusive planning and service delivery.

Sustaining the Gains

In 2025, AASCTF reconnected with local authorities to assess the integration of the model and help maximize its use, including implementation of the Sustainment Plan that was previously issued.

The plan describes strategies to maintain the model's operational capabilities, specifically addressing the ongoing needs for capacity building, license provision, governance, system enhancements and adaptation, and budget and resource allocation. Critical among these is hiring dedicated personnel to form part of a larger O&M team. Having additional training sessions or refresher courses is also imperative; since while the superuser training was sufficient in empowering staff, more in-depth lessons and experiential learning will determine mastery of the model.

To this end, a two-day sustainment workshop was held with a mix of some superusers and new MBPP users. At this workshop, AASCTF provided advanced training on scenario management, evaluations, and visualization of traffic models that would enable them to confidently conduct their reviews of submitted proposals and models. They even brought a model submitted before as a test case to ensure their skills are up to par with verifying model coding elements and parameters.

To further ensure long-term use, the AASCTF team provided a Vissim model review checklist to help guide their process. Superusers shared that some models given to them by developers and their

consultants may not be reflective of actual site conditions. This training and checklist were deemed highly useful for them.

Technical concerns aside, the following are other sustainment measures discussed that could mainstream the micro-simulation model into the government's operations:

Institutional. In addition to the positive impact of MBPP now requesting developers to submit models for major developments, sustainment could be solidified if the use of Vissim was defined in the Traffic Impact Assessment (TIA) guidelines and that developers are required to submit models using this software for accessibility and transparency.

Financial. Obtain a license for SIDRA (Signalized Intersection Design and Research Aid), another traffic engineering software, to support the review of smaller-scale TIAs. This will complement the use of Vissim, the maintenance and support license fee of which has already been included in MBPP's annual budget.

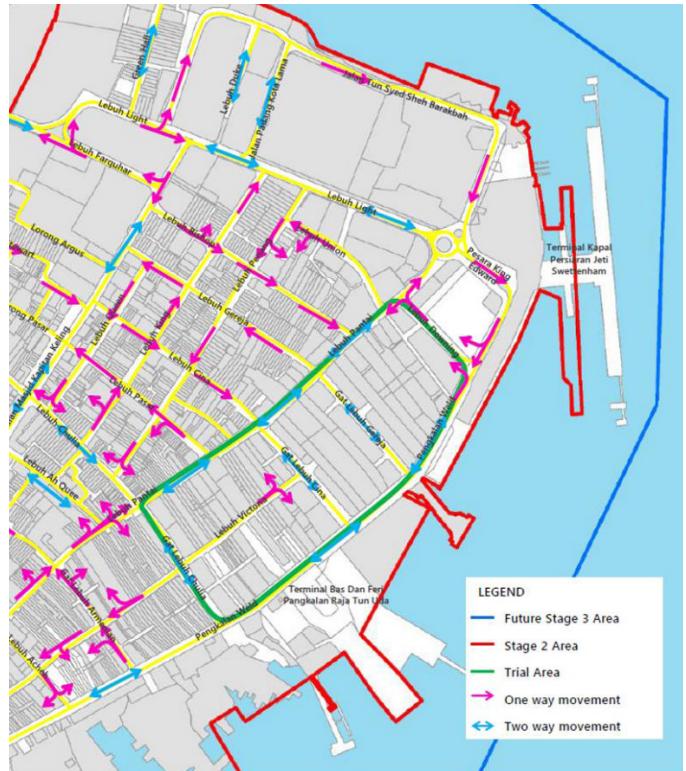
Human Resources. Add more staff or adjust existing roles to enable more dedicated time for modelling and review work, since the superusers or O&M team are primarily MBPP staff tasked with reviewing TIAs. Delineating responsibilities and the team structure will also help optimize the work.



AASCTF Ripple Effect

Through the micro-simulation model, capacity building, and sustainment efforts, interventions tested from the Penang Green Transport Plan and Penang 2030 Masterplan could become a reality, particularly since some are now embedded in the Adaptation Fund program.

Simulating traffic flows, pedestrian movements, and the like are projections of a better George Town and Penang as a whole. Evaluating these schemes will inform and improve decision-making. According to the government agencies, although precise figures are lacking, strengthening traffic management capacity and implementing new mobility solutions could significantly enhance urban mobility, reduce air and noise pollution, improve health of residents, create business opportunities, and raise quality of life. These may not be immediate, but these are results that would eventuate in city over the new decade and beyond.



BENEFITS OF THE MICRO-SIMULATION MODEL



Enhanced decision-making and urban planning



Optimized transport policies



Upskilled local planners



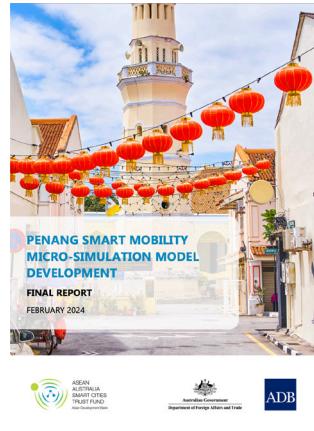
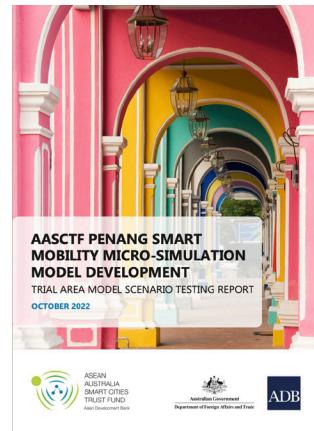
Improved traffic flows and public transport



Transparency and informed citizenry



LEARN MORE



For more information on this project,
check the Penang resources in the
AASCTF Data Room



ABOUT THE ASEAN AUSTRALIA SMART CITIES TRUST FUND

The ASEAN Australia Smart Cities Trust Fund (AASCTF) assists ASEAN cities in enhancing their planning systems, service delivery, and financial management by developing and testing appropriate digital urban solutions and systems. By working with cities, AASCTF facilitates their transformation to become more livable, resilient, and inclusive, while in the process identifying scalable best and next practices to be replicated across cities in Asia and the Pacific. AASCTF is supported by the Australian Government through the Department of Foreign Affairs and Trade, managed by the Asian Development Bank, and implemented by Ramboll.



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