

GIS@LTA – Bringing Maps to Life

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Abstract

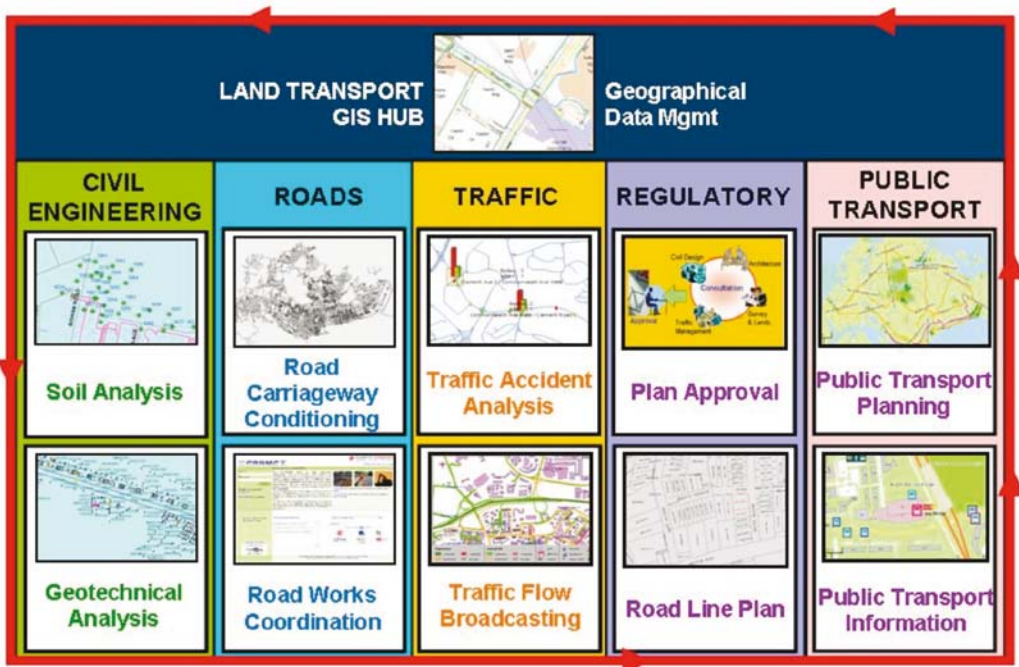
The Land Transport Authority (LTA) has brought Geographic Information System (GIS), a means to visualise and analyse intelligent information through digital maps, a step closer to the pulse of businesses and the community. Through the innovative use of GIS, maps have come alive in strategic land transport planning, in ensuring public safety, in becoming more pro-enterprise and in strategic information dissemination.

Introduction

The Land Transport Authority (LTA) has brought Geographic Information System (GIS), a means to visualise and analyse intelligent information through digital maps, a step closer to the pulse of businesses and the community. Building on its extensive and comprehensive digital

knowledge of land transport infrastructure information, LTA has conceptualised and developed a Land Transport GIS Hub (Figure 1) for the enterprise, capable of meshing engineering drawings and geotechnical readings together with traffic management schemes and public transport planning, to aid improvements in construction safety,

Figure 1: Land Transport GIS Hub



road safety, as well as, provide new services for commuters and motorists. Through the innovative use of GIS, maps have come alive and given new meaning to location-based services which cater to engineers, construction professionals, planning regulators and the man-in-the-street.

Geography In Action

Strategic land transport planning

Singapore faces increasing population and travel demand, changing demographics and expectations, all against a backdrop of limited land space. This brings great challenges to LTA in integrating land use and transport planning to guarantee quality of life for everyone and create sustainable communities.

Decision-makers are able to visualise things as they really are, or will be, resulting in improved efficiency and accuracy when developing transport proposals for road and rail improvements and expansions.

The Concept and Master Plans are 40-year and 15-year horizon plans, respectively, on land use and transport planning. LTA uses GIS technology to lay down medium to long-term transport plans, including the road and rapid transit networks, on these strategic plans. Multiple environmental criteria are “layered” on top of one another to identify areas that require facelifts, and to predict travel demand on our roads and rail network. Decision-makers are able to visualise things as they really are, or will be, resulting in improved efficiency and accuracy when developing transport

proposals for road and rail improvements and expansions.

LTA uses GIS extensively for strategic studies, transportation modelling and network travel demand projection. LTA’s geometry and business data are meticulously tagged and consolidated in enterprise databases, allowing the quick creation of GIS maps that integrate a medley of different parameters specific to each analysis. This facilitates the study of changes from current and future planning quantum for scenario comparison.

Figure 2: RTS Catchment Areas



GIS is also applied in studying the behaviour and characteristics of consumers living in various bus and rail catchment areas. It allows us to analyse the sensitivity of the consumers to different parameters. Each bus stop and Rapid Transit Station (RTS) along the corridor is mapped using GIS technology. By modifying the radius of the catchment area (*Figure 2*), GIS can easily show us patterns, relationships and trends that help us understand the attributes and underlying factors within the catchment areas, so that we can choose the best modal option for the population living in the catchment area. It helps us plan for changes

in the transportation network design for the future. This will in turn yield considerable commuter satisfaction.

LTA’s transport planners exploit the complementary strengths of transportation models and GIS systems to develop a comprehensive bus route network, fulfilling our role as the central bus planner. The graphical maps enable us to better understand the viability of various routes. By integrating data and layering with maps, we can easily see the demographics of the area being served by the bus network. It also helps us to better connect train and bus services, allowing train passengers to easily transfer to bus services and vice versa.

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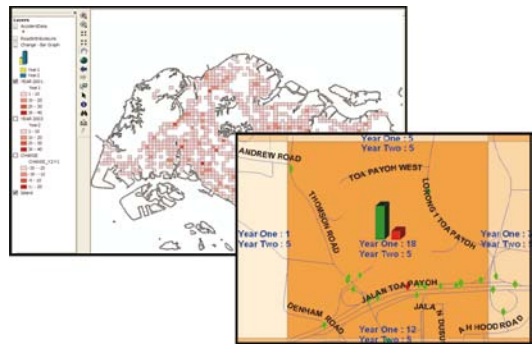
With GIS, we can display ridership counts for different services and compare service ridership volumes. This comparative analysis can be used to check the coverage of the existing bus stop or RTS station. By combining historical ticketing data with a change of bus route, the model is able to highlight changes in ridership patterns and hence determine the feasibility of the proposed revised route.

Public safety and road planning

In the area of road safety, LTA leverages on GIS technology to significantly reduce the number of traffic accidents, fatal or otherwise, at accident-prone areas in Singapore to protect

motorists and pedestrians. GIS makes the visualisation of collision incidence distributions and patterns more intuitive than statistics, charts and tabular data. Through collaboration with Singapore Traffic Police, traffic accident locations and collision patterns can be easily visualised and analysed geographically in a process known as “Black Spot Analysis” (Figure 3). Trouble spots can be pin-pointed for our road safety engineers to implement mitigating traffic improvement schemes. This has yielded significant reduction in accidents over a two-year period in treated areas; specifically, 66% at traffic junctions and 90% at expressways. LTA’s approach to road safety improvement garnered the Prince Michael International Safety Award 2007 for outstanding achievements in its collaborative efforts to promote road safety through innovations in engineering and active public education.

Figure 3: Black Spot Analysis



By harnessing GIS technology, our road safety engineers are able to validate the effectiveness of the implemented treatments over a two-year period and further refine improvements for proactive maintenance of road carriageways across Singapore. Through predictive forecasts of road

surface deterioration, road carriageways are maintained at an optimum level of roughness and skid resistance to prevent possible skidding during wet weather.

At construction sites, GIS is used to enhance the safety of construction workers and the community in the environs. Specialised sensing instruments are enabled with GIS technology to monitor construction activities that may affect the integrity of structures and buildings in the vicinity. The United Kingdom-based Royal Society for the Prevention of Accidents (RoSPA) has named LTA in its annual honour roll of organisations committed to occupational safety and health in 2008 for achieving a high level of safety performance underpinned by good management systems.

Being pro-enterprise

Business communities and industry partners also enjoy greater convenience and a more seamless experience when transacting with LTA. Leading an online inter-agency system that leverages on GIS to coordinate road construction works, LTA has reduced the processing time for approval of road works applications from 2 – 3 months to within 2 weeks. The duration for approval of plans for civil and structural works is also reduced by 50%. Surveyors, real estate developers, lawyers, architects, and engineers can also obtain online road line plans instantaneously, whereas previously they had to wait up to 10 days.

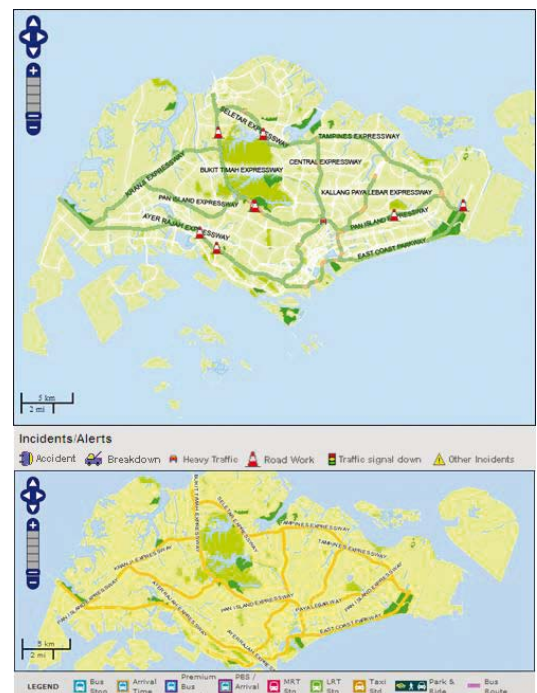
Strategic information dissemination

LTA shares data from our GIS@LTA initiative with various agencies in the government

sector. Our data is used by the government agencies in areas such as strategic planning, operations management, research studies, homeland security, crime prevention and risk management. LTA also supports the development of the National Spatial Data Infrastructure (SDI). This is the national strategy for information sharing.

Strategic partnerships are formed with the likes of Google, Nokia and local start-ups, such as, Quantum Inventions, a company that processes LTA's raw traffic data to provide real-time traffic information, dynamic routing and navigation solutions, to further exploit its enterprise geospatial data to benefit end users. These collaborations have brought about an array of innovative services that

Figure 4: Interactive traffic and public transport maps on LTA portals



directly benefit the public and transform the way Singaporeans use the land transport systems, as well as helped to fuel the growth of new commercially-viable services. Through these partnerships, LTA has sought to extend its reach through new media channels, such as, the mobile Internet to disseminate GIS@LTA's data.

By placing GIS-enabled transport information right at the fingertips of commuters and motorists, we empower them to effectively plan their journeys and reduce overall travel time and travel anxiety.

Citizens can also freely access LTA's GIS data at the One.Motoring (www.onemotoring.com.sg) and PublicTransport@SG (www.publictransport.sg) Portals. Motorists can be informed of road accidents and travel speeds of the routes they are planning to take, before they embark on their journeys. They may even query regarding the availability of car parking spaces at their destinations, so that they can make alternative arrangements to avoid long waits. Commuters can locate the nearest bus-stops using mobile telephones equipped with location based services (LBS), and even find out when their next bus will arrive. By placing GIS-enabled transport information right at the fingertips of commuters and motorists, we empower them to effectively plan their journeys and reduce overall travel time and travel anxiety.

International Recognition *ESRI Special Achievement in GIS 2008*

LTA received the Special Achievement in GIS (SAG) Award at the 28th Annual Environmental Systems Research Institute (ESRI) International User Conference 2008 in San Diego, California, from among 100,000 user organisations worldwide, for demonstrating vision and leadership in using GIS technology to better serve the world.

CIO Asia Awards 2009

LTA has won the annual CIO Asia Award three times in seven years, for its adoption of GIS technologies for decision-making and information dissemination within the organisation and across other government agencies. The Award recognises the top five Asian organisations that have made use of information and communications technology to obtain the greatest returns for their key operations and businesses.

The next generation of GIS@LTA will support more LBS to benefit end-users, while planners will have access to a myriad of geospatial data at their fingertips to make effective and timely business decisions.

IDC Enterprise Innovation Awards 2009

LTA was among the top 10 institutions for its innovative approach in using emerging GIS technologies and IT processes to rejuvenate, sustain and empower business growth. The IDC Enterprise Innovation Award 2009 was

presented at IDC's Asia Pacific CIO Summit on 14 July 2009.

Moving Forward

With the Land Transport Masterplan setting the stage to double today's 138 km Rapid Transit System (RTS) network to 278 km in the future, and expand road networks to serve new developments and support economic growth, GIS@LTA will play a pivotal role in supporting land transport planning and development efforts.

LTA's GIS framework needs to remain agile and nimble, yet be robust enough to respond to the fast changing business needs. The next generation of GIS@LTA will support more LBS to benefit end-users, while planners will have access to a myriad of geospatial data at their fingertips to make effective and timely business decisions.

Acknowledgements

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Rosina Howe is the Group Director of the Innovation and InfoComm Technology Group in the Land Transport Authority, Singapore. She is also the Chief Innovation Officer at LTA where she plays a significant role in charting strategic directions through value innovation and technology breakthroughs to meet LTA's vision of providing a people-centred land transport system. Mrs Howe spearheads the Innovation Steering Committee in formulating and implementing LTA's Vision and Strategy for Innovation. She also chairs the Land Transport Innovation Fund Committee which catalyses LTA's collaborative efforts with its local and overseas partners in land transport research and development to realise the Singapore Urban Transport Solution initiative.