CASE STUDY

Singapore | Intelligent Transport Systems

Tapping Tech for Smoother Traffic

As Singapore progresses towards its vision of a smart and car-lite nation, *Urban Solutions* looks at how it has capitalised on technology to ensure safe and smooth road traffic over the decades.

The Challenge

Land-scarce Singapore faces the perennial challenge of balancing density with liveability. For transport, the island state needs to constantly innovate for better urban mobility.

After Singapore gained independence in 1965, its fledgling transportation system struggled to keep up with a growing economy and population. Disorganised bus services and severely congested roads led to further traffic delays and air pollution.

From the 1970s to the early 1990s, the government tackled these issues by building more roads and expressways, overhauling public transport to introduce a Mass Rapid Transit (MRT) train system, and reducing car ownership. To regulate road usage, the 1975 Area Licensing Scheme (ALS) required drivers to purchase passes for high-traffic areas.

Despite improvements in the road situation, Singapore needed more sophisticated traffic management measures by the turn of the 21st century to deal with a rising vehicle population and a larger and more complex road system. Existing initiatives remained manpower-intensive and inefficient—the ALS needed constant monitoring and strict enforcement to prevent motorists from entering the city centre multiple times with one ALS pass.

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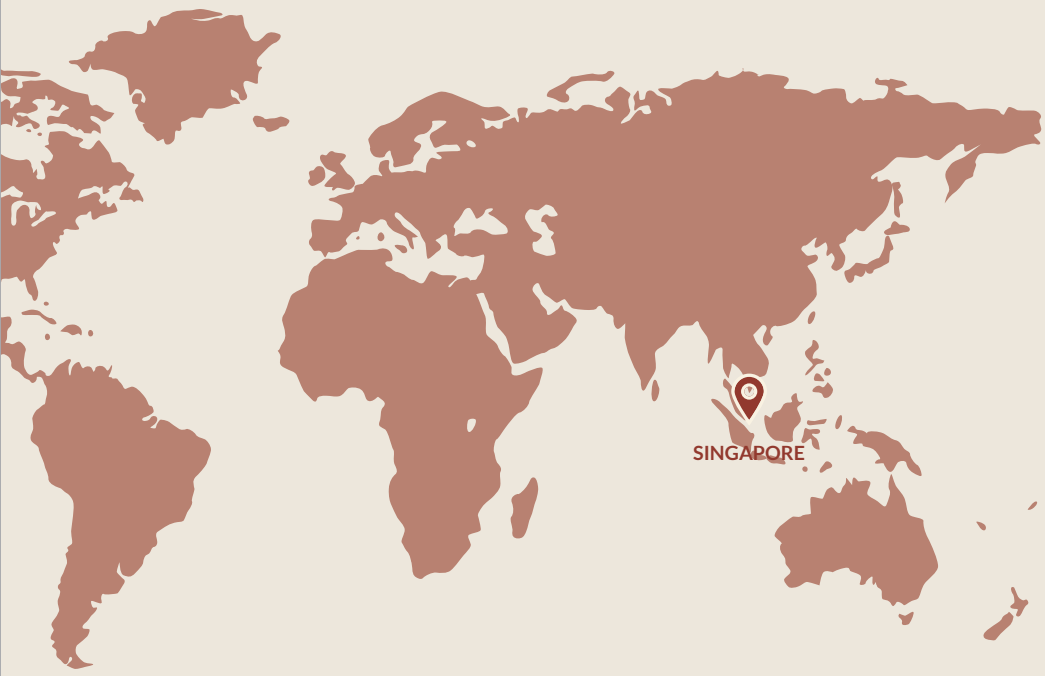
Under the 1975 Area Licensing Scheme, traffic police were stationed at gantries to monitor every vehicle entering the city area.



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The Solution

In line with the emergence of transportation technology from the 1980s to 1990s, Singapore's Land Transport Authority (LTA) started drawing on technology to improve traffic efficiency and safety. Collectively called Intelligent Transport Systems (ITS), the measures aimed to automate processes and collect data not just to improve traffic coordination and control, but also provide real-time traffic information to help users plan smoother journeys.

One major development was the Electronic Road Pricing (ERP) system, which replaced the ALS in 1998. Instead of requiring officers to check for passes on windscreens, the ERP deducts a charge from each vehicle's smart card device as it passes through a gantry. The fees are adjusted according to demand, with higher rates during peak hours. This system was expanded to high-traffic roads and expressways beyond the city centre.

The Green Link Determining (GLIDE) system also improves traffic flow by adjusting the green time at traffic signals islandwide according to real-time vehicle and pedestrian volume. Wire sensors under the road surface detect vehicles, while push buttons on traffic signal poles inform the system of orphan.

> **"Wire sensors under the road surface detect vehicles, while push buttons on traffic signal poles inform the GLIDE system of pedestrians."**

Other ITS contribute to safety. Started in 1998, the Expressway Monitoring & Advisory System (EMAS) features cameras along expressways to detect obstructions and monitor speed. The footage is sent to a central command at the ITS Centre. When operators detect an accident or vehicle breakdown, they activate a recovery crew and alert motorists of the situation via electronic signboards along expressways.

01 An electronic signboard displays estimated travel times to the key expressway exits based on real-time vehicle volume, to help drivers make informed route choices.

02 Electronic Road Pricing automates toll collection to reduce congestion on busy thoroughfares such as Orchard Road.

> **While Intelligent Transport Systems often feature cutting-edge technology, they must be user-centric.**

The ITS Centre also consolidates real-time data from other systems such as Junction Electronic Eyes—400 surveillance cameras at major intersections—and TrafficScan—a network of Global Positioning System-enabled taxis that act as probes for road conditions across the island. The range of information, from incident locations and estimated travel times to webcam road footage, is then disseminated to the public through electronic road signboards, radio broadcasts and online, to help them make informed travel decisions.

While ITS often feature cutting-edge technology, they must also be user-centric, shared Dr Chin Kian Keong, LTA's Chief Engineer who has worked on ITS for over two decades.

"Often, the challenge for ITS lies in getting the end-users to accept the system and use it correctly," said Dr Chin in an interview with *Urban Solutions*.

He added that the LTA made sure to introduce the ERP in a user-friendly way. Smart card in-vehicle units (IU) were installed for free for all 900,000 private vehicles, while drivers were educated on the new scheme through publicity campaigns. A test drive was conducted months before the launch to check if the IUs were working.

The LTA involves citizens and the private sector in improving transport. Many ITS were developed with technology firms such as NCS and ST Electronics, the electronics arm of ST Engineering. For LTA's Smart Mobility 2030 plan launched in 2014, extensive data sets such as real-time traffic conditions, bus arrival timings and taxi availability were published online for citizens to co-create solutions such as traffic information apps.

> **"Technology…is only one part of a holistic transport strategy grounded by 'sound and practical policies and processes'."**

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Although technology can improve Singapore's mobility services, Dr Chin emphasised that this is only one part of a holistic transport strategy grounded by "sound and practical policies and processes". The ERP, for example, was effective because it was complemented by public transport improvements and a vehicle quota system to support a car-lite shift.

The Outcome

With ITS now spanning over 164 km of expressways and roads, Singapore has improved both traffic safety and efficiency.

Complementing road safety campaigns and enforcement efforts, ITS such as the EMAS have contributed to a reduction in annual road accident fatalities, from around 210 in 2000 to 122 in 2017. Recovery crews start clearing vehicle breakdowns within 15 minutes thanks to the EMAS. The average 24 minutes saved per incident and shorter delays translate to annual cost savings of S$40 million.

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With the ERP, traffic volume on expressways dropped as much as 15% and average travel speed rose from 40 to 50 km/h. Smoother traffic reduces travel time for motorists as well as other road users on public buses. These commuters also benefit from traffic lights programmed to give priority to buses.

Singapore topped the 2017 Global Smart City Performance Index by Juniper Research, which praised its integration of mobility technology with strong policy curtailing car ownership. The country also shares its traffic management expertise with neighbours such as the Philippines, with which it signed a memorandum of understanding to ease Manila's gridlocked roads with ITS.

The city-state continues to upgrade its transport technology for greater equity and efficiency. Traffic lights were enhanced with a Green Man+ system from 2009 to offer the elderly and pedestrians with disabilities longer crossing times. An upcoming satellite ERP system will eliminate gantries and charge motorists based on distance travelled on congested roads, while trials on technology such as autonomous vehicles and shared on-demand transport services are underway.

This forward-looking approach, together with strong transport policies and a citizen focus, enables Singapore to continue pushing boundaries in improving urban mobility.

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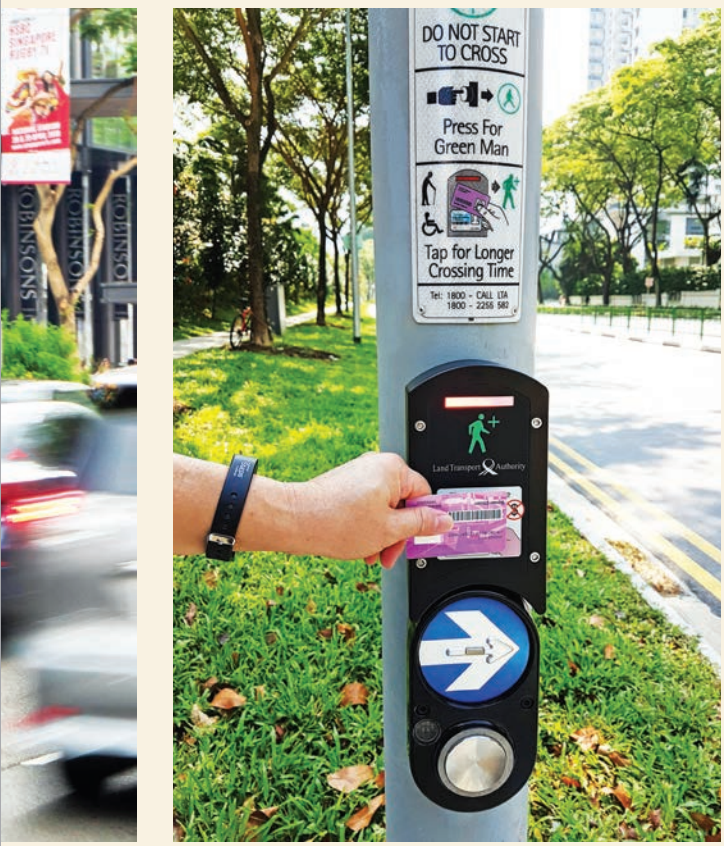

01 A display board shows the available lots in nearby car parks to assist drivers looking for a space to park.

02 By tapping their EZ-Link cards at Green Man+ traffic light posts, the elderly or pedestrians with disabilities get more time to cross roads.