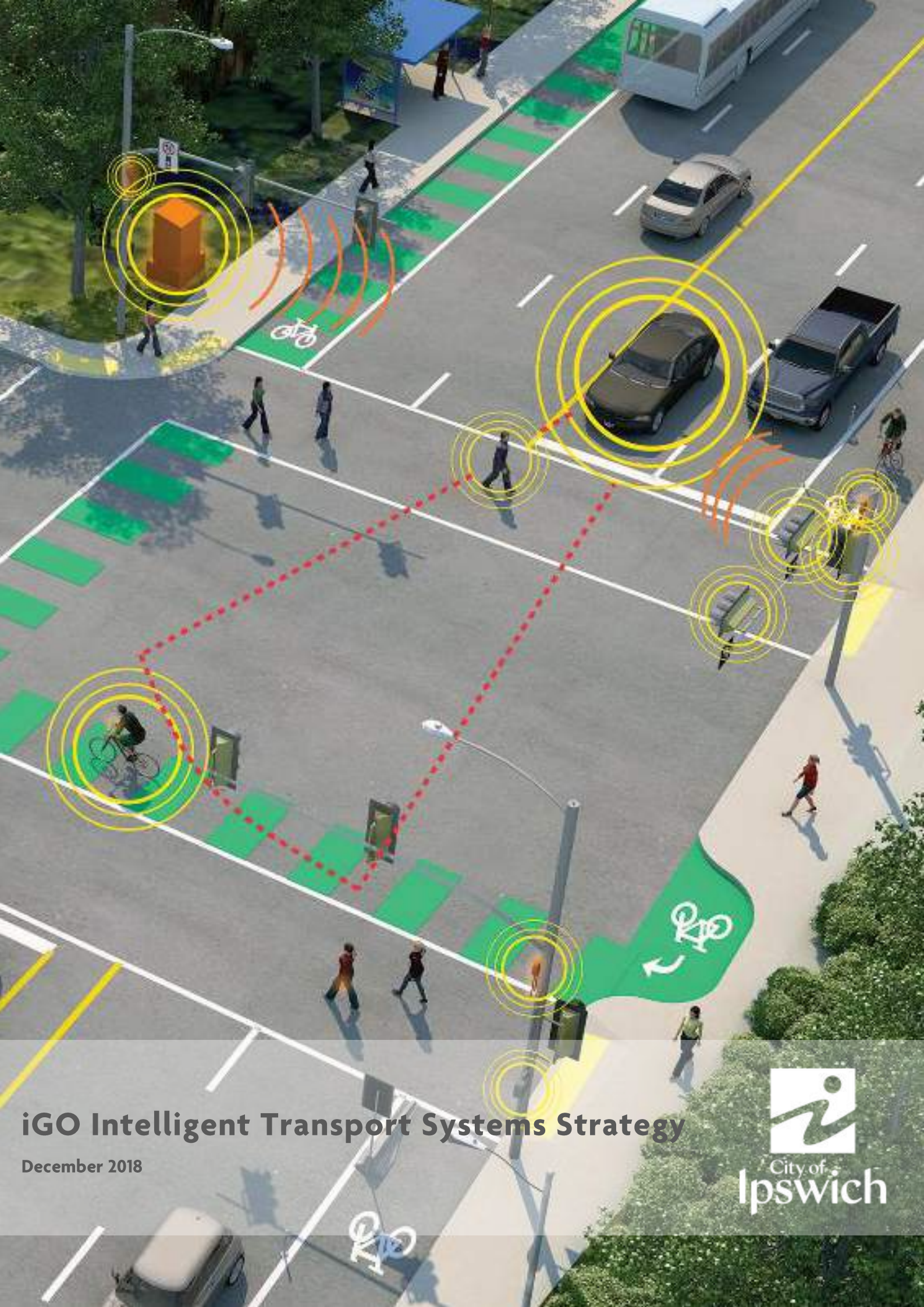


iGO Intelligent Transport Systems Strategy

December 2018

City of Ipswich

PREFACE

In 2016, Ipswich City Council released the **'iGO' City of Ipswich Transport Plan** - our transport blueprint for the city. iGO sets Council's longer-term agenda to advance Ipswich's transport system in a sustainable manner in response to forecast population growth. Its key mantras are *"proper investment"* and *"clever new thinking"*.

With the emergence of smart phones and new technology platforms, transport in our cities is on the verge of an extraordinary revolution - from connected, driverless and electric vehicles, car and ride sharing schemes, intelligent traffic and parking networks and interactive travel information systems. Ipswich can be at the forefront of this revolution to dramatically change the way we travel, delivering significant safety, reliability and environmental benefits for transport users and help delay or even eliminate the need for expensive transport infrastructure.

As part of Council's **Smart City Program**, we are actively seeking opportunities for investment and resourcing partnerships to make Ipswich a truly smart city. The roll out of intelligent transport system (ITS) initiatives is an intrinsic part of this goal.

As such, Council has developed the **iGO Intelligent Transport Systems Strategy**. It outlines Council's tactical approach for the deployment of ITS to Ipswich's transport system over the next decade or so to assist in meeting the sustainability outcomes of iGO from an environmental, social, economic and financial perspective. The Strategy is visionary and recommends a way forward to resource, advocate, trial, support and execute in partnership with other levels of government, industry, businesses and the community.

Signature projects for delivery in the short term are to establish a road operations team driven by technology and a smart parking solution for the Ipswich City Centre. These initiatives will be delivered in stages using trials, evaluation, awareness and partnerships as implementation tools.

Front Cover Graphic Source: Stantec (2017)

EXECUTIVE SUMMARY

Over the next few decades, Ipswich will experience significant change. Alongside extensive population growth, urban renewal and shifts in demographics, emerging technologies, including shared mobility services and automated vehicles will revolutionise the city's future transport system.

This is Council's tactical blueprint for *Intelligent Transport Systems* to help achieve our transport aspirations for Ipswich as outlined in **iGO**. It contains prospects to ensure Council is ready for a transport future driven by technology.

CITY OF IPSWICH TRANSPORT PLAN

Intelligent Transport Systems (ITS) are the deployment of advanced and digitally enabled information, communication and sensor technologies to the transport system to enhance connectivity between users, vehicles and infrastructure.

Key Messages

We recognise that technology will influence an extraordinary degree of change to Ipswich's transport future. But the unknown extent of what transport technologies, how they will be deployed and their level of uptake, is also significant.

Given the evolutionary nature of technology, with the continual emergence of new and updated platforms, Council will position to be **future ready** by enhancing our **expertise**, developing **protocols,** establishing **investment** frameworks, advocating for government policy and regulatory **reform** and creating strategic **alliances**.

Council will take the following approach to ITS.

AGILITY

We will be agile by being **open to market led proposals** that align with city aspirations, and short-term investment on projects that will provide tangible benefits to our core local functions of **roads, safety** and **parking.**

TRIALS

We will use trials to **test reliability** and **measure performance** before wider deployment including the support of industry proposals using Ipswich as a **'testbed'.**

ENABLER

We will be an 'enabler' not just a provider. Council may be a project **leader, supporter** or **sponsor.**

Success will require **collaboration** and **partnerships** with government, innovators and the community. The Strategy will help us **advocate** for funding and sponsorship deals.

Action Plan

- Suite of 73 prioritised actions
- 10-year delivery timeframe
- Includes **projects**, **protocols** and **partnerships**

SIGNATURE PROJECTS

Our resource focus over the next two years:

Intelligent Road Operations Team

- Driven by technology
- Data analytics
- Performance monitoring
- Central road data portal

Smart Parking Solution

- Key activity centres
- Monitoring sensors
- Pricing and payment methods
- Customer navigation systems

Electric Vehicles

- Support uptake and schemes
- Alternative parking codes and development incentives
- Dedicated parking spaces and infrastructure

Connected Vehicles (C-ITS)

- Actively support the Queensland Government with their C-ITS initiative

GLOSSARY & ABBREVIATIONS

TERM	ACRONYM	DEFINITION
Advanced Driver Assist Systems	ADAS	A category of ITS where vehicle technology applications help the driver with the driving process. This includes speed control, lane and object warnings and rear parking sensors and cameras.
Advanced Traffic Management Systems	ATMS	A category of ITS that improves road user safety and traffic flow.
Automatic Crash Notification	ACN	An ITS application that uses sensors inside a vehicle to determine when a serious crash has occurred, and then provides emergency services with the exact location of the crash by transmitting data over the mobile phone network.
Automatic Number Plate Recognition	ANPR	An ITS application that uses optical character recognition to read vehicle registration plates. It is used for law enforcement, toll collection and for tracking traffic movements.
Advance Ipswich		Council's long-term community plan that provides an overarching vision for the City's future and a framework for how this vision will be achieved. It is a statutory requirement of the Local Government Act 2009 for every local government in Queensland to develop and implement a long-term community plan.
Bluetooth		A wireless technology platform for exchanging data over short distances using short wavelength UHF radio waves. Invented in 1994, it is now widely used as a default application on many devices including smart phones, televisions, speakers and vehicles.
Brisbane City Council	BCC	The local government of the City of Brisbane.
Civil Aviation Safety Authority	CASA	The Australian national authority for the regulation of civil aviation responsible for monitoring civil air operations in Australia, issuing appropriate licences, enforcing safety requirements and protecting the environment from the effects of aircraft use. The Authority reports to the Federal Minister for Infrastructure and Transport.
Central Business District	CBD	The principal economic activity area of city or town with a concentration of employment and commercial, retail, health and educational land uses.
City of Gold Coast	CoGC	The local government of the City of Gold Coast. Sometimes referred to as Gold Coast City Council.
City of Ipswich		The local government area that makes up Ipswich as a city
City of Ipswich Transport Plan	iGO	Council's long-term multi-model transport strategy developed in 2016. It outlines Council's aspirations to sustainably advance the city's transport system in response to forecast population growth. It contains a suite of policy focus areas and over 200 actions.
Connected and Automated Vehicle/s	CAV	A category of ITS where vehicles can sense their environment and navigate with some, little or no human input.
Connected and Automated Vehicle Initiative	CAVI	A Queensland Government trial of CAVs to help prepare for the arrival of new vehicle technologies with safety, mobility and environmental benefits on Queensland roads. The largest component of the CAVI is a pilot of C-ITS applications in Ipswich
Cooperative Intelligent Transport System/s	C-ITS	A category of ITS that use wireless technologies to enable real-time communication between vehicles, road infrastructure, mobile devices and back-office systems.
Department of Transport and Main Roads	TMR	The Queensland Government agency that operates the transport system in Queensland including major roads, public transport and vehicle and driver regulation.
Electric Vehicle	EV	A vehicle that uses one or more electric motors for propulsion.
Governance		Processes of formal decision-making among a group based on collective interaction, problem solving and tactics with the view of providing transparency, accountability and consistency.
Infrastructure Planning Branch		The Council organisational entity responsible for the forward planning of the city's transport and drainage infrastructure including strategic transport planning, traffic operations, road safety and ITS. Custodian of the Strategy.
In-kind		Goods, services and transactions not involving money or not measured in monetary terms.
Integrated Corridor Management	ICM	An ITS concept that focuses on maintaining the greatest mobility benefits along a road corridor or series of corridors in the same geographical area through the application of innovative technologies that maximise network safety and reliability.

TERM	ACRONYM	DEFINITION
Intelligent Transport System/s	ITS	The deployment of advanced and digitally enabled information, communication and sensor technologies to the transport system to enhance the dynamic connectivity between users, vehicles and infrastructure.
In Vehicle Monitoring System	IVMS	A form if ITS where an electronic device that is located within a vehicle that records and a range of information about the vehicle including location, performance and driver behaviour. They can also measure the recorded data against a set of criteria.
International Association of Public Transport	UTIP	A European based advocacy organisation for the development of public transport and sustainable mobility.
Ipswich Central		The area that makes up the Ipswich CBD, Not formally a suburb but the term is used by TMR and ICC on direction signs to differentiate the central part of Ipswich from the City of Ipswich.
Ipswich City Centre		The economic activity area of Ipswich. It is made up of the traditional CBD core and some inner suburbs that have with a concentration of commercial, retail and health land uses.
Ipswich City Council (Council)	ICC	The local government of the City of Ipswich
Key Performance Indicator	KPI	A type of performance measurement that evaluates the success of an organisation, project, program, product and/or initiative) in which it undertakes. Success can be an achievement of a goal and working towards a strategic outcome.
Li-Fi	Li-Fi	Technology for wireless communication between devices using light to transfer data at high speeds.
Light Detection and Ranging	LiDAR	A land surveying method that measures distance to a target by illuminating the target with pulsed laser light and measuring the reflected pulses with a sensor. Difference in laser return times and wavelengths can then be used to make maps, 3D representations and inform the design of infrastructure. It has terrestrial, airborne and mobile applications.
Light Emitting Diode	LED	A type of light source that is energy efficient. It is now commonly used in traffic signals, road signs, street lights and vehicle head lamps.
Local Area Traffic Management	LATM	An integrated scheme where infrastructure such as signs, lines and islands are installed on local streets across a residential area to discourage non-local traffic use and to better control vehicle speeds.
Local Government Area	LGA	The administrative area and boundary of a local government.
Local Government Infrastructure Plan	LGIP	Identifies a local government's plans for trunk infrastructure (roads, parks, water, sewer and community facilities) that are necessary to service urban development at a desired standard of service in a coordinated, efficient and financially sustainable manner.
Land Use and Public Transport Accessibility Index	LUPTAI	A spatial analysis tool developed by TMR in 2006 to help state and local transport agencies evaluate the level of accessibility people have to public transport and walking in different areas.
Memorandum of Understanding	**MoU**	A type of agreement between two (bilateral) or more (multilateral) parties. It expresses a convergence of will between the parties, indicating an intended common line of action. It is often used either in cases where parties do not imply a legal commitment or in situations where the parties cannot create a legally enforceable agreement. It is a more formal alternative to a 'gentlemen's agreement'.
Mobile Device		A computing device small enough to hold and operate in the hand, take me readily moved from place to place and can connect to the internet and other devices. This includes smart phones, tablets, laptop computers and smart watches.
Mobility as a Service	MaaS	An ITS concept where various transport services are integrated into a single mobility touchpoint on a mobile device.
Mobility on Demand	MoD	Another term for MaaS (refer above).
National ITS Architecture	NIA	A specification framework for the development and design of ITS applications in Australia to ensure consistency and interoperability across agencies and providers.
National League of Cities		A United States based advocacy organisation representing 19,000 cities and municipalities.

TERM	ACRONYM	DEFINITION
National Transport Commission	NTC	An Australian independent statutory body created in 1991 by inter-government agreement to develop regulatory and operational reform for road, rail and intermodal transport. The aim is to improve the productivity, safety and environmental outcomes of the Australian transport system and enhance consistency across state agency jurisdictions. Recommendations and advice are presented to the TIC for approval. State and territory governments contribute 65 percent of the NTC's funding and the Australians Government provides 35 percent.
Original Equipment Manufacturer	OEM	A company that produces parts and equipment that may be used and marketed by another manufacturer. When referring to auto parts, OEM refers to the manufacturer of the original equipment, that is, the parts assembled and installed during the construction of a new vehicle. In contrast, aftermarket parts are those made by companies other than the OEM, which might be installed as replacements after the car comes out of the factory.
Partnership		An arrangement between two or more entities that agree to cooperate to advance their mutual interests either formally (through a legal contract) or informally via a verbal or written understanding.
Penalty Infringement Notice	PIN	Financial penalty (fine) for an offence prescribed by legislation.
Procurement		The process of finding, agreeing terms and acquiring goods, services or works from an external source, often via a tendering or competitive bidding process. The process is used to ensure the buyer receives goods, services or works at the best possible price, when aspects such as quality, quantity, time, and location are compared.
Queensland Government		The parliament of the state of Queensland and its associated operational departments and agencies.
Radio Detection and Ranging	Radar	A detection system that uses radio waves to determine the range, angle, or velocity of objects. Radio waves (pulsed or continuous) from the transmitter reflect off the object and return to the receiver, giving information about the object's location and speed. It can be used to detect moving objects such as vehicles, weather formations and terrain.
Resource		A source or supply from which a benefit is produced. This can be a product, asset, human skills and money. Typically, resources can be a product, asset, service, staff, skills, knowledge or money.
Safe City Program		A network of over 200 cameras across the Ipswich City Centre and ten other suburbs that are actively monitored 24 hours per day, seven days per week to deter crime and anti-social behaviour.
Service Level Agreement	SLA	A commitment between a service provider and a client usually in the form of a contract. Aspects of the service – quality, availability, responsibilities – are agreed between the service provider and the service user.
Society of Automotive Engineers	SAE	A global professional association for automotive engineers and practitioners.
Smart City		An urban area that uses digital and communication technologies to improve business operations and productivity, share information with the public, enhance community safety, enrich customer experiences and reach municipal goals.
Smart City Program		Council's strategy and program for Ipswich to be Smart City.
Smart Phone		A class of multi-purpose mobile computing device. They are distinguished from feature phones by their stronger hardware capabilities and extensive mobile operating systems that facilitate wider software, internet and multimedia functionality (including music, video, cameras, and gaming), alongside core phone functions such as voice calls and text messaging. Smartphones typically include various sensors that can be leveraged by their software, such as a magnetometer, proximity sensors, barometer, gyroscope and accelerometer, and support wireless communications protocols such as Bluetooth, Wi-Fi, and satellite navigation.
Telematics		Telematics is an interdisciplinary field that encompasses telecommunications, vehicular technologies, road transport, road safety, electrical engineering (sensors, instrumentation, wireless communications, etc.), and computer science (multimedia, Internet, etc.).

TERM	ACRONYM	DEFINITION
Telemetry		An automated communications process by which measurements and other data are collected at remote or inaccessible points and transmitted to receiving equipment for monitoring. Although the term commonly refers to wireless data transfer mechanisms (e.g. using radio, ultrasonic, or infrared systems), it also encompasses data transferred over other media such as a telephone or computer network, optical link or other wired communications like power line carriers.
Testbeds		A platform for conducting experimental testing and trials of new technology products in a rigorous, transparent and replicable manner.
Transport Disruptor		New technologies, platforms and applications that change and revolutionise traditional ways in providing transport services.
Transport and Infrastructure Council	TIC	A collective body of Commonwealth, State and Territory transport and infrastructure ministers and the Australian Local Government Association to coordinate national reforms to improve efficiency, productivity and consistency of Australia's infrastructure and transport systems.
Variable Message Sign	VMS	An electronic sign that displays changeable messages to transport system users about incidents, special events, route guidance and items of public interest.
Unmanned Aerial Vehicle	UAV	An aircraft without a human pilot aboard. Commonly referred to as a 'drone', components include a ground-based controller and a system of communications between the two. The flight of UAVs may operate with various degrees of autonomy: either under remote control by a human operator or autonomously by onboard computers.
Ultra-High Frequency	UHF	Radio frequencies in the range between 300 megahertz (MHz) and 3 gigahertz (GHz) that mainly broadcast by line of sight (i.e. they are blocked by hills and large buildings although the transmission through building walls is strong enough for indoor reception. They are used for television broadcasting, cell phones, satellite communication including GPS, personal radio services including Wi-Fi and Bluetooth, walkie-talkies, cordless phones and numerous other applications.
Vehicle-to-Infrastructure	V2I	A C-ITS application that wirelessly connects vehicles with road infrastructure in real time.
Vehicle-to-Vehicle	V2V	A C-ITS application that wirelessly connects vehicle with each other in real time.
Wi-Fi		Technology for wireless communication between devices using UHF radio bands of 2.4 GHz and 5.8GHz. Wi-Fi compatible devices can connect to the internet via a WLAN and a wireless access point. Such an access point (or 'hotspot') has an indoor range of about 20 metres indoors and a greater range outdoors by using multiple overlapping access points.
Wireless Local Area Network	WLAN	A wireless computer network that links two or more devices to form a network within a limited / local area such as a home, school or office. Most modern WLANs are based on Wi-Fi standards.
	3D	An element represented with three dimensions (length, width and depth) on a two-dimensional product (map, design plan, monitor, television screen etc).
	5G	The fifth generation of mobile device communications with high data rates, reduced latency, energy saving, cost reduction, higher system capacity and massive device connectivity over the current 4G platform.

CONTENTS

INTRODUCTION

PREMISE

With the advent of smart phones, Wi-Fi and Bluetooth connectivity, digital technology continues to become a more integral part of daily life and will continue to shape our future. Advancement in technology will have a greater influence on the way decisions are made, the way we interact, and the way services are consumed. This is especially true with transport where the way we travel, and how our transport network is designed and operated, will increasingly be influenced by technology.

The recent growth in Intelligent Transport Systems (ITS) has the potential to dramatically change the way we travel and deliver significant safety, reliability, resilience and environmental benefits for transport users that in turn can help delay or eliminate the need for expensive transport infrastructure outlay.

There is considerable evidence collected from within Australia and globally that transport technology adoption can deliver substantial reductions in road crash rates and improvements in transport system reliability and productivity. There are also strong indications that reductions in crashes and improvements in reliability of the transport network will produce significant financial savings to the community, largely through the more focused use of existing transport infrastructure and reducing the need to build more road space.

Ipswich is ideally positioned as a place to live, work and play and a desirable location for businesses due to its proximity to Brisbane with regional road and rail networks and a readily available labour force. As part of the its **Smart City Program**, Council is actively seeking opportunities for investment and resourcing partnerships to make Ipswich a truly smart city. The roll-out of ITS is an intrinsic part of this goal.

As such, Council has developed the **iGO Intelligent Transport Systems Strategy** ('ITS Strategy' or 'Strategy') that outlines Council's tactical approach for the deployment of ITS over the next decade to assist in meeting the outcomes of iGO. The Strategy is visionary and recommends a way forward to resource, advocate, trial, support and execute in partnership with other levels of government, industry, businesses and the community.

BACKGROUND

Transport plays a fundamental part of our daily lives with a large role in economic transactions, social interactions, educational activities and leisure pursuits. In a rapidly growing city such as Ipswich, getting transport right is the foundation for ensuring future sustainability and liveability.

A good portion of Council's human and capital resources are dedicated to operating, maintaining and improving the local transport system. Whilst investment in the traditional local government transport functions of roads, traffic management and footpaths will need to continue, Council are now expanding their focus to include other transport elements into their portfolio to ensure sustainable transport future for the city. This includes the provision of safe and quality facilities for pedestrians, cyclists and public transport users and implementing smarter, more cost-effective ways of funding and delivering transport infrastructure and services.

In this regard, Council are investigating opportunities to use ITS across Ipswich's transport system. ITS is digitally enabled applications that provide better connections across and between the three elements that form the transport system: **Users, Infrastructure** and **Vehicles** (refer to Figure 1).

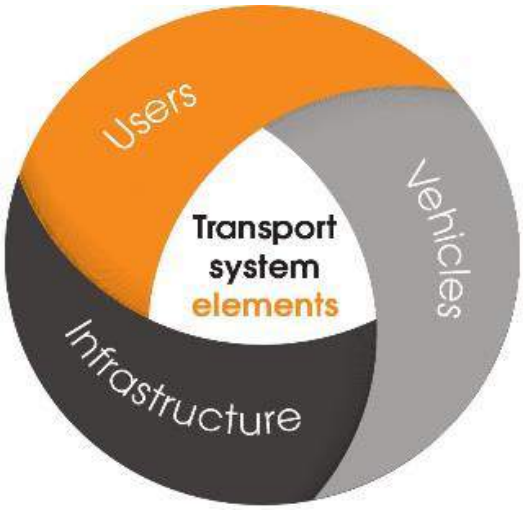


FIGURE 1
The three elements of the transport system
Source: Stantec (2018)

The introduction of traffic signals on the road network over 50 years ago is a good example of an ITS application. Traffic signals provide improved connections between road infrastructure and road users to improve public safety and traffic flow. In more recent years, authorities have introduced variable message signs (VMS) onto the road network to advance connections between the road and motorists.

Over the last decade, new ITS applications (such as connected sensors, integrated traffic coordination centres, in car satellite navigation), digital platform opportunities (such as 'smart' phones, broadband internet, Bluetooth and GPS satellite connectivity) and transport 'disruptors' (such as Uber) have appeared on the market and are now readily accepted as a normal part of our lifestyles.

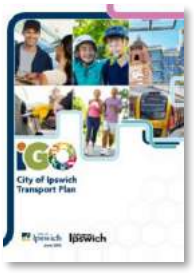
With massive global investment in research and development of advanced technologies (not just in the transport space), the growth of an incipient middle class in highly populated countries (particularly in Asia), and the emergence of a generation of young people whose positive uptake of, and confidence in using, new technologies in their daily routines, will see exponential growth in ITS over the next 20 years. In fact, the next two decades are predicted to see a significant shift away from established lifestyle values such as house and car ownership, the need to hold a driver's licence for mobility and the need to travel to/from work during traditional peak hours (if at all).

This document describes, and brings together, the different ITS elements and opportunities that could enhance Ipswich's future transport system and provides a coordinated way forward that is conducive to Council's aspirations for the city and the community as outlined in *Advance Ipswich.*

DRIVERS

The drivers behind the development, and subsequent execution, of this Strategy are related to Council's strategic transport planning and smart city initiatives. These two drivers are outlined in further detail below.

iGO City of Ipswich Transport Plan



iGO was released in 2016 and sets Council's longer-term aspirations to advance the city's transport system towards a sustainable future. iGO outlines a series of policy focus areas that Council will pursue and a suite of over 200 prioritised actions.

Revolving around the mantras of *proper investment* and *clever new thinking*, the key ideas of iGO are outlined in Table 1.

TABLE 1: Key Ideas of iGO

	IDEA	COMMENT
	**Safe, reliable & resilient road network**	The provision of a safe, reliable and resilient local road network for all road users, but one that may not necessarily be efficient for traffic movements during peak times. Cars will continue to play an essential role in how people travel but Council will not be able to afford to continuously add more and more road space to meet the travel demand generated by the city's forecast population growth.
	**Facilitating travel mode choices**	Reducing Ipswich residents' dependency on their cars by facilitating competitive, attractive and sustainable travel mode choices through the provision of quality transport infrastructure and incentives/disincentives.
	**Transport and land use integration**	Fostering the development of strong, compact and connected mixed-use activity centres, complete communities and providing job opportunities close to where people live. This revolves around the philosophical idea of giving Ipswich residents the land uses, transport infrastructure and economic and social opportunities that will offer the: • *"10-minute neighbourhood"* – residents can access their basic daily goods and services such as schools, parks and groceries within a 10- minute journey time • *"20-minute city"* – residents can commute to their jobs and access higher order goods, services and leisure pursuits within a 20-minute journey time.
	**Culture shift**	Clever new thinking and strong civic leadership to make sustainable decisions. This includes new non-traditional attitudes such as: • Promoting travel behaviour changes for certain trips • Taking a demand management (as opposed to demand satisfaction) approach to car use, parking, road network performance and traffic congestion • Balancing the needs of all users in the design and management of roads • **The development and uptake of new transport-related technology** • Influencing institutional frameworks (i.e. employee core work hours and locations) • Using innovation regarding the cost, affordability, funding and financing of new infrastructure

Source: iGO City of Ipswich Transport Plan, Ipswich City Council (2016)

A key policy focus area of iGO is to support and enable technology and transport infrastructure innovations. The plan also encourages the embracing of technology and partnerships to drive network reliability, promote sustainability and improve safety.

> "Sustainable, inclusive, prosperous and resilient cities depend on transport that facilitates the safe, efficient and pollution-free flow of people and goods, while also providing affordable, healthy and integrated mobility for all people."
>
> **Ashok Sridharan**
> Mayor - Bonn, Germany
> President - International Council for Local Environmental

Use

iGO is used for the following purposes to:

- **Guide** transport related policy, planning, investment and resourcing decisions;
- **Advocate** for government funding and private-sector partnerships; and
- **Promote** travel choices and a sustainable and healthy transport culture.

Delivery Structure

The delivery structure of iGO is outlined in Figure 2. It includes elements and mechanisms that will be used by Council to assist with executing the outcomes and actions of iGO.

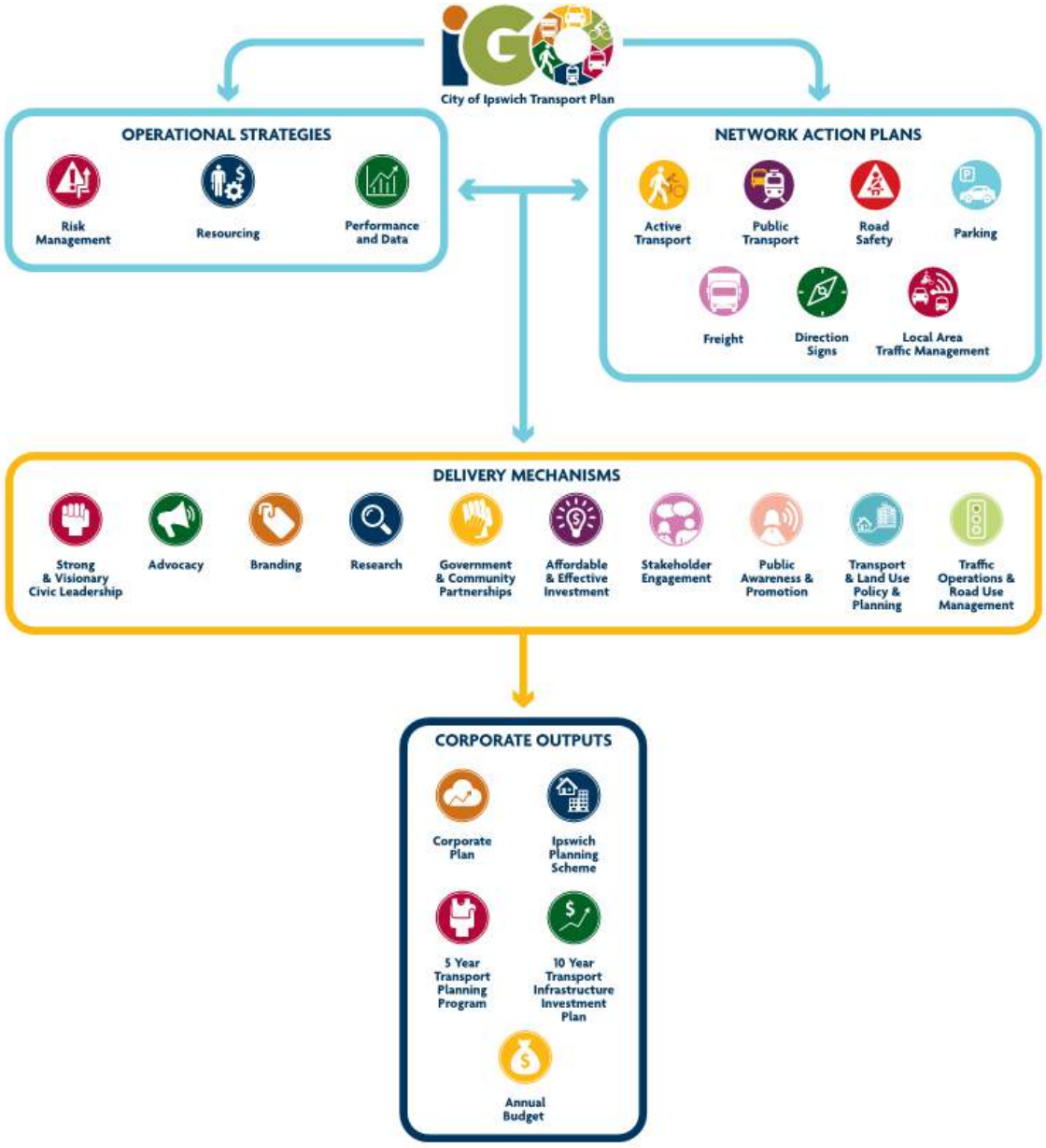


FIGURE 2: iGO Delivery Structure

Source: iGO City of Ipswich Transport Plan, Ipswich City Council (2016)

iGO Action Plans

The iGO delivery structure (refer to Figure 2 previous) includes the development and implementation of several detailed action plans relating to the following transport elements:

- Active Transport (endorsed by Council in November 2016)
- Public Transport
- Road Safety
- Parking
- Freight
- Direction Signs
- Wayfinding
- Local Area Traffic Management

The ITS Strategy will inform the development and implementation of these network action plans.

iGO Operational Strategies

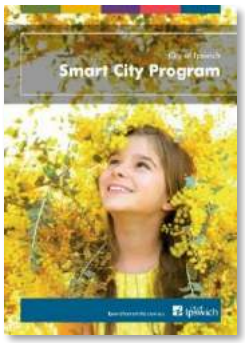
The iGO delivery structure (refer to Figure 2 previous) includes the development and implementation of three detailed operational strategies relating to the following elements:

- Risk Management (endorsed by Council in November 2018)
- Resourcing (human, operational and capital)
- Performance Monitoring and Data

The ITS Strategy will inform the development and implementation of these operational strategies.

Further information on iGO can be found at *www.ipswich.qld.gov.au/igo*

Smart City Program



In 2017, Council released its *Smart City Program*. Going beyond just digital technology, the Smart City Program embraces new ways of working, learning, living and the capture and use of data to make Ipswich a truly connected community full of ideas and innovation.

The Smart City Program is used to drive innovations, build knowledge and promote investment.

Council is actively seeking partnerships for the deployment of devices, applications and platforms that will support the smart city principles outlined in Table 2.

TABLE 2: Smart City Program Principles

PRINCIPLE	COMMENT
Jobs, Growth & Liveability	Every Smart city initiative must deliver on at least one of these outcomes and everyone involved in the initiative must always be clear on what outcome is being pursued. If the potential for improved jobs, growth or liveability is not obvious the initiative must be reviewed and realigned or deprioritised and shelved.
Business as Usual Innovation	Many of the Smart City initiatives are advancements of current Council business in the running of a city. Therefore, the Smart City initiatives and innovation in general is seeded across the organisation and integrated into business as usual for departments, business units and staff at all levels.
Open and Interoperable	Council does not own the Smart City Program, it has simply created the framework for Ipswich to prosper from. Many of the initiatives must be wholly community or industry lead. Therefore, the Smart City Program platforms, enablers, data and infrastructure must be as open and interoperable as possible. Potential partners and vendors wanting to engage with Council must agree to an open and interoperable platform. In this regard, Council has established a **Smart City Data Platform.**

Source: Smart City Program, Ipswich City Council (2017)

Council is current investigating and implementing pilot projects across the city. While open to all proposals, the key priority areas of the Smart City Program are outlined in Table 3.

TABLE 3: Smart City Program Priority Areas

INITIATIVE	DESCRIPTION	TRANSPORT OPPORTUNITY
Unmanned Aerial Vehicles 	Use of UAV (e.g. drones) to collect data, monitor remote areas and aerial mapping.	• Traffic monitoring • Road design surveying • Parking and road reserve compliance • Micro deliveries (parcels, groceries etc.) • Passenger transport
Application Studio 	Provides a formal rapid application development vehicle for Council, partners and community to collaborate on solutions.	Development of applications for home based, hand-held and in-vehicle devices for: • Travel information • System use data collection • Asset management • Parking management
Digital Skilling 	Establishes a framework for communication education and training programs.	Providing residents with awareness and training on the capabilities and use of transport technologies.
Connected Transport 	Aims to create an intelligent transport system focusing on electric, connected and autonomous vehicles. Ipswich is established as a testbed for transport technologies relating to different modes of transport and traffic management and enabling a variety of partners to research and develop better informed, safer, more coordinated and smarter transport technologies.	The basis for this Strategy. Council has committed to transitioning sections of its fleet to hybrid and electric vehicles.
Healthy Living Lab 	Studies human health and wellness behaviours at the city level and pushes the boundaries of health research through using advanced technologies such as big data, analytics and the Internet of Things.	• Reduced need for travel to and from medical appointments and for health worker commuter trips. • Better and more user-friendly community based public transport services
Sustainable Living 	Advances new neighbourhoods to be more sustainable through collaboration and incentives between developers, utility providers, technology vendors and Council. The initial stages of this initiative will focus on the trial and deployment of technologies such as rooftop solar with integrated battery, micro-grids with power trading and integrating distributed generation with home automation.	• Solar power on bus shelters and other passenger transport facilities. • Home based proactive travel information • Car, bike and ride sharing programs
Smart Parks, Buildings & Facilities 	Trialling and deployment of digital technology in public spaces and municipal assets to achieve operational or community benefit. This includes investigating: • Remote operations • Water, waste and lighting management • Solar energy, integrated batteries and micro-grid technology • User engagement and urban furniture	• Infrastructure for electric, connected and automated vehicles • Infrastructure for car, bike and ride sharing programs • Predictive & automated road maintenance • Video analytics for Safe City Program and traffic management • Parking meters & management
Connected City Lighting 	Advances in the provision and management of public lighting to better management of costs and operations.	• LED illuminance • Connected street and bikeway lighting for better operation
Digital Service Standard 	Utilising digital technologies to streamlining Council services making it easy for people to manage their local government needs.	• Traffic and road incident management • Transport related customer enquires • Transport data collection & surveys
5D Data Modelling 	The 5D Data Modelling initiative brings together streams of data from across Council to build a five-dimensional view of city infrastructure. Starting with a 3D digital model of above and below ground city infrastructure, dimensions of data and time are overlayed to produce the 5D Data Model. Will provide innovative planning, development and compliance outcomes.	A conduit for the above.

Source: Smart City Program, Ipswich City Council (2017)

Further information on the Smart City Program can be found at www.ipswichsmartcity.com.au

CONTEXT

Strategic planning and policy instruments in the context of the Strategy are depicted in Figure 3 and described further below.

FIGURE 3: Strategic Planning & Policy Context

Source: Stantec (2018)

AUSTRALIAN GOVERNMENT

The Australian Government has taken recent steps to provide meaningful policy leadership into urban transport affairs including ITS.

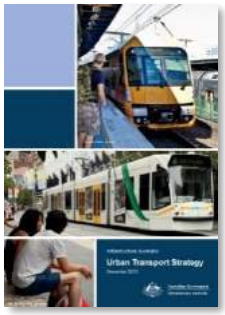
Smart Cities Plan

In 2016, the Australian Government released their *Smart Cities Plan* to support productive, accessible and liveable cities that encourage innovation and create jobs. The plan is based around the three pillars of smart investment, smart policy and smart technology and crosses over several portfolios including transport.

An initiative borne out of the Smart Cities Plan is the **Smart Cities and Suburbs Program** where the Australian Government has allocated funds to partner and support the delivery of innovative projects that will help achieve the outcomes of the Smart Cities Plan. This Strategy provides a robust and coordinated base to assist Council in securing a funding partnership with the Australian Government under the Smart Cities and Suburbs Program or another type of funding initiative.

Further information on the Smart Cities Plan can be found at *https://cities.infrastructure.gov.au*

Urban Transport Strategy



In 2013, the Australian Government released their *Urban Transport Strategy* that outlines principles and criteria to assist in the planning of urban transport systems and the identification, assessment and prioritisation of projects for inclusion on priority funding lists. It outlines that new ideas and methods relating to better use of existing assets, technological advances and new funding and financing mechanisms need to be factoring investment policy thinking. This includes ITS.

A copy of the Urban Transport Strategy can be found at:
http://infrastructureaustralia.gov.au/policy-publications/publications/files/InfrastructureAus_Rep_UrbanStrategy.pdf

Office of Future Transport Technologies

In October 2018, the Australian Government established the *Office of Future Transport Technologies* to help prepare for the pending arrival of automated vehicles and other transport innovations.

The new Office is part of the Department of Infrastructure, Transport and Regional Development and will provide strategic leadership, coordination and collaboration with other governments, agencies and industry to develop policy, regulation and infrastructure relating to transport technologies including ITS.

Transport Infrastructure Council

The *Transport Infrastructure Council* (TIC) is a collective body of Australian, State and Territory transport and infrastructure ministers and the Australian Local Government Association that makes strategic decisions on national reforms to improve efficiency, productivity and consistency of Australia's infrastructure and transport systems. With regards to ITS, the TIC's terms of reference include:

- Continuing a focus on transport safety while maintaining awareness of technological developments (positive and disruptive) that may impact safety and security; and
- Removing barriers to innovation and capitalising on new and emerging technologies.

Many of the activities of the TIC are led and undertaken by the National Transport Commission (NTC).

National Policy Framework for Land Transport Technology

In 2016, the TIC agreed to the *National Policy Framework for Land Transport Technology* that outlines a principles-based approach to facilitate the effective and consistent implementation and uptake of transport technology across Australia including ITS. The Policy Framework outlines the following four roles for government:

1. **Policy leadership:** Providing a clear and coordinated approach across different levels of government and being responsive to changes in the technological environment;
2. **Enabling:** Ensuring that the private sector can readily bring beneficial new technologies to the market;
3. **Supportive regulatory environment:** Ensuring that community expectations of safety, security and privacy are appropriately considered in new technology deployments; and
4. **Investment:** Investing in research and real-world trials that benefit the entire transport network customer base or provide a sound basis for government decision-making (including collaboration with the private sector).

A copy of the policy framework is available at http://transportinfrastructurecouncil.gov.au/publications/

National Transport Technology Action Plan (2016-2019)

The NPFLTT is supported by *National Transport Technology Action Plan (2016-2019).* It outlines short-term priorities for implementing new transport technologies across Australia (refer to Table 4).

TABLE 4: Short-term Priorities - National Transport Technology Action Plan (2016-2019)

	ACTION	LEAD
1	Establish a regulatory framework for testing automated vehicles	NTC
2	Develop national operational guidelines to support the on-road use of automated vehicles	Austroads
3	Undertake priority trials and research of ITS	NTC
4	Develop a connected vehicle (C-ITS) infrastructure road map	NTC
5	Publish a connected vehicle (C-ITS) statement of intent on standards and deployment models	NTC
6	Develop a nationally agreed deployment plan for the security management of CAVs	NTC / Austroads
7	Investigate options to provide enhanced geo-positioning information to the land transport sector	Australian Govt.
8	Improve the availability of open data in the transport sector	All governments
9	Explore options to increase the uptake of telematics and other technologies for regulatory and revenue collection purposes	NTC
10	Evaluate low–cost technologies to improve safety at rail level crossings	NTC
11	Explore how data from telematics and other ITS can be used to optimise operations and planning for port precincts and intermodal terminals	NTC
12	Investigate options for interoperable public transport ticketing	NTC
13	Investigate costs, benefits and deployment models for Automatic Crash Notification (ACN)	NTC / Austroads
14	Explore the merits of adopting Advanced Traffic Management Systems (ATMS) and Advanced Driver Assist Systems (ADAS) technologies.	NTC

Source: National Transport Technology Action Plan (2016-2019), Transport and Infrastructure Council

QUEENSLAND GOVERNMENT

The Queensland Government does not have a specific ITS planning document. However they have recently taken steps to incorporate smart infrastructure into their policy thinking and are undertaking significant regulatory reform to support a national goal of on-road deployment of connected and automated vehicles (CAVs) by 2020.

Smarter Infrastructure for Queensland

As part of the execution of the **State Infrastructure Plan**, the Queensland Government has established a *smarter infrastructure* policy agenda to bring together governments, community, industry and academia to drive innovation and help Queensland compete globally in the future. Smarter infrastructure is the intersection between traditional physical infrastructure and digital technology and innovation. The value of smart infrastructure is being able to intelligently respond to changing usage patterns, reduce costs, maximise capacity and minimise disruptions.

As part of this agenda, the Queensland Government released the *Smarter Infrastructure for Queensland Directions Paper* that outlines the key themes established after various collaboration forums (refer to Table 5) and describes a way forward.

TABLE 5: Smarter Infrastructure for Queensland Themes

THEME	DESCRIPTION
Being customer centric	Placing the customer at the heart of smart infrastructure
Reimagining the role of government	An enabler (not simply a provider)
Innovation from less prescription	Moving to an outcome-focused procurement approach
More from existing assets	'Sweating' and re-purposing the infrastructure we already have
Adopting agile thinking	Build trust, embrace challenges and learn from others
Data focus	Improving the collection, sharing & use of data between government, industry & academia
Collaboration across sectors	Improve cross-sector collaboration, showcase innovation, attract and retain skills

Source: Smart Infrastructure for Queensland Direction Paper, Queensland Government (2018)

Infrastructure Innovation Taskforce

As part of their Smart Infrastructure policy agenda, the Queensland Government plans to establish an *Infrastructure Innovation Taskforce* to examine and report back to government on a range of matters including:

1. The benefits of integrating technological solutions into infrastructure planning and delivery;
2. The efficiency of procurement processes; and
3. Whole-of-life cost modelling benefits to improve the use of existing assets.

Further information on the Queensland Government's smarter infrastructure agenda can be found at *www.qld.gov.au/smarterinfrastructure*

Strategic Planning

The Queensland Government is developing the following strategic planning documents that will provide policy direction and actions associated with ITS:

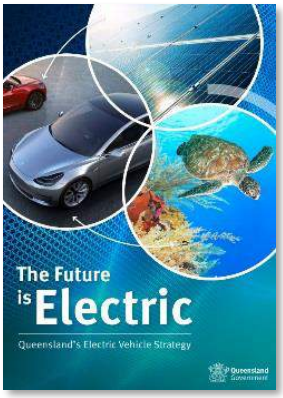
- **Digital Infrastructure Plan** (with a focus on using big and open data, data analytics and machine learning)
- **Queensland Transport Strategy** (future focussed)
- **Queensland Road Operation Strategy**
- **Queensland Freight Strategy**

Engagement with TMR as part of the development of this Strategy indicated that they are keen to partner with Council to develop and deploy technology initiatives as part of their road operations, particularly in the integrated corridor management space, to achieve a one network approach to the management of roads and traffic in the region.

Cooperative & Autonomous Vehicle Initiative

The Queensland Government is trialling cooperative and automated vehicle technologies to make roads safer through their ***Cooperative & Autonomous Vehicle Initiative*** (CAVI). A large component of the CAVI will be a pilot of Cooperative Intelligent Transport Systems (C-ITS) on public roads in Ipswich from 2019. Further information on C-ITS is outlined in Chapter 4 – Opportunities.

Further information on CAVI can be found at *www.qld.gov.au/transport/projects/cavi*



Electric Vehicle Strategy

In 2017, the Queensland Government released its ***Electric Vehicle (EV) Strategy*** that outlines 16 cost-effective initiatives to encourage the uptake of EVs. These initiatives aim to:

- Empower consumers
- Enable supporting infrastructure
- Explore cost-effective support programs
- Envisage future government actions.

The EV Strategy includes the deployment of the *Queensland Electric Super Highway*, a network of fast-charging stations across the state along major highway nodes and tourist routes.

Regional Planning

The following planning initiatives will inform and assist the Queensland Government in delivering their longer- term regional land use and transport plans:

- **State Infrastructure Plan** (2018 update)
- **Shaping SEQ** (SEQ Regional Plan 2017)
- **SEQ Regional Transport Plan** (currently under development)
- **Road Safety Strategy 2015-2021**

Road Planning and Design Manual

The Queensland Government's *Road Planning and Design Manual* (developed and administered by the Department of Transport and Main Roads) provides specifications for the consistent and safe planning and design of roads. Chapter 5 covers ITS and includes provisions relating to locating, positioning, configuration and installation of vehicle detection loops, vehicle counters, CCTV, road weather monitoring, variable and changeable message signs, variable speed limit and lane control signs, ramp metering, weigh-in-motion automatic number plate recognition and tunnel systems.

Guidelines for the Installation of Electric Vehicle Charging Station Signs

In 2017, the Queensland Government released a guide on installing signs for EV charging stations to ensure a consistent approach in their implementation and improve road user interpretation and awareness of EV charging stations.

IPSWICH CITY COUNCIL

Council's strategic planning framework is outlined in Figure 4.

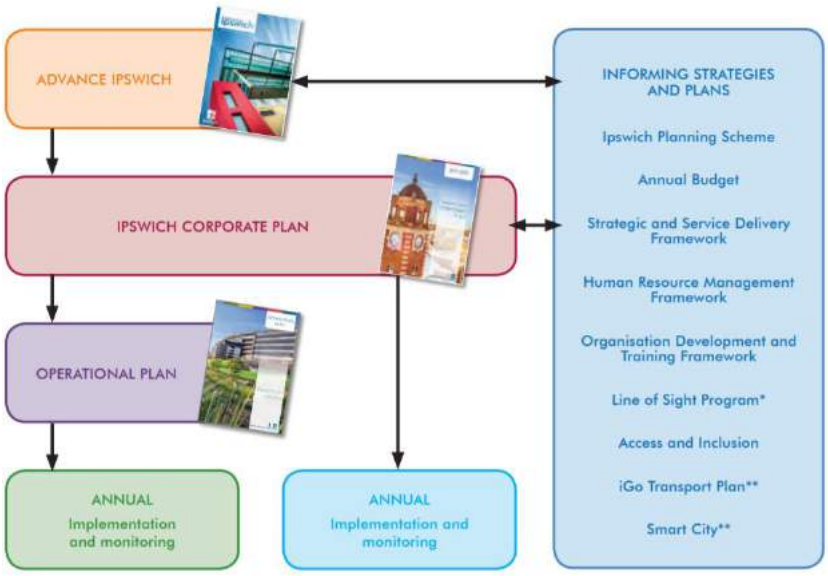


FIGURE 4: Council's Strategic Planning Framework

Source: Ipswich City Council Corporate Plan 2017-2022

Advance Ipswich

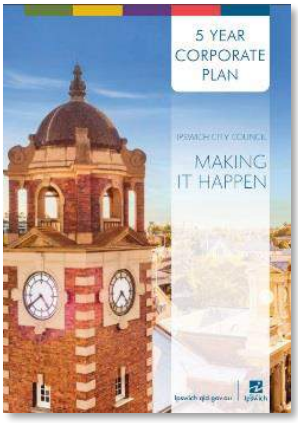
Advance Ipswich (2015) is Council's long-term community plan that provides an overarching vision for the city's future and a framework for how this vision will be achieved.

Based on community research and feedback, it includes a suite of aspirations and actions based around the following policy pillars:

- Strengthening our economy and building prosperity (jobs)
- Managing growth and developing infrastructure
- Caring for our community
- Caring for our environment
- Listening, leading and financial management

A key action of Advance Ipswich was the development of iGO.

Ipswich Corporate Plan



The Corporate Plan (2017-2022) establishes Council's five-year priorities and more specific outcomes in the delivery of Advance Ipswich. Corporate Plan Goal 1: Strengthening Our Local Economy and Building Prosperity outlines Council's priority for supporting the development of a strong and vibrant local digital economy through integration of the Smart City Program and the development and roll-out of a Digital Infrastructure Plan (Strategy 4) and for supporting technology, research and knowledge-based industries (Strategy 6).

Ipswich Planning Scheme

The Ipswich Planning Scheme articulates Council's land use planning framework and regulates the development of land across the city. iGO attempts to integrate transport outcomes with the intent of the Ipswich Planning Scheme (and vice versa).

Local Government Infrastructure Plan (LGIP)

The LGIP forms part of the Ipswich Planning Scheme that identifies Council plans for trunk infrastructure (roads, parks and community facilities) that are necessary to service urban development at the desired standard of service in a coordinated, efficient and financially sustainable manner and provides the framework to calculate infrastructure charges associated with development permits.

Standard Drawings

Council has a suite of standard drawings that provides reference parameters and specifications for the design and configuration of Council roads, drainage, parks and public lighting infrastructure. These are used by both internal and external practitioners for infrastructure items that will become registered as Council assets. The introduction of transport technologies, particularly ITS applications on Council roads, will need its own suite of standard drawings based on best practice, TMR Road Planning and Design Manual and Austroads guidelines.

INDUSTRY BODIES

The industry bodies that have dealings with ITS and have the potential to offer leadership, expertise and support for Council in the delivery of the Strategy are outlined in Table 6 (over). These organisations undertake research, share knowledge, provide industry connections between practitioners, consumers and suppliers and convene conferences, seminars and exhibitions.

TABLE 6: Industry Bodies

ORGANISATION	DESCRIPTION
Intelligent Transport Systems Australia (ITS Australia)	• Industry organisation established in 1992 • Membership includes ITS suppliers, government authorities, academia and transport businesses • Support members through knowledge, promotion and advocacy
Australian Road Research Board (ARRB)	• Research organisation for road agencies established in 1960 • Research areas include road safety and operations, pavements, heavy vehicle management and ITS.
Austroads	• Industry organisation for Australasian road agencies • Support agencies through shared knowledge and consistency • Activities include best practice research, publishing design guides, industry training and international collaboration • Currently developing the *National ITS Architecture* (refer below).
Australian Institute of Traffic Management & Planning (AITPM)	• Industry organisation for transport practitioners established in 1966 • Integrated activities involving traffic management and operations, transport planning, economics, freight, road safety and public and active transport.
Roads Australia	• Industry organisation to advance the development of roads including network development, safety, construction and asset management • Members include all of Australia's road agencies, major contractors and consultants, motoring clubs and service providers • Support members through knowledge sharing, networking, training and advocacy
Australian Smart Community Association (ASCA)	• Industry body for people that are moving to make communities more technologically empowered • Membership includes governments, businesses, universities and individuals.
National Transport Commission (NTC)	• Independent statutory body created in 1991 by inter-government agreement • Undertake activities to develop regulatory and operational reform for road, rail and intermodal transport to improve productivity, safety and environmental outcomes and enhance consistency across state agency jurisdictions. • Provide recommendations and advice to the *Transport and Infrastructure Council* (TIC) for approval. • State and territory governments contribute 65 percent of the NTC's funding and the Australians Government provides 35 percent.

Austroads

Austroads is preparing the *National ITS Architecture* (NIA) that will be a reference document for practitioners to use when planning and designing ITS applications to ensure they are deployed in a consistent and interoperable way.

> "The more we can do to accelerate the safe introduction of technology on our roads, the more lives we can save"
>
> **David Stuart-Watt**
> President, Roads Australia

Further information on the National ITS Architecture can be found at *www.austroads.com.au/road-operations/network-operations/national-its-architecture*

ITS Australia

The *ITS Australia Strategic Plan (2013-2018)* outlines the importance of finalising the National ITS Architecture to ensure a consistent and interoperable frameworks for agencies and provider to follow when designing and deploying ITS. ITS Australia is also leading industry dialogue on *Mobility as a Service* (MaaS) as the potential to drastically improve customer choices, reduce travel costs, increase network capacity and transport sustainability while improving social and environmental outcomes.

NEED

Ipswich is a fantastic place to live, work and raise a family. The City's future is bright with many opportunities for prosperity and community development.

Source: Ipswich City Council (2018)

The population of Ipswich is forecast to more than double over the coming decades that will significantly increase demand for travel on the City's transport system. Special areas of future city prosperity include:

- Economic and civic revitalisation of the Ipswich City Centre;
- Continued urban growth of the greenfield master panned areas at Springfield and Ripley (including their town centres);
- Major job growth at the regional business and industry areas at:
  - Carole Park
  - Redbank / Bundamba / Dinmore / Riverview
  - Swanbank / New Chum,
  - Ebenezer / Willowbank and
  - Wulkuraka
- Expansion of the RAAF Base Amberley as Australia's premier defence facility;
- Extension of the passenger railway line to Redbank Plains and Ripley; and
- Inland rail project through southern Ipswich.

Whilst enhancements and expansions to Ipswich's road network, public transport services and active transport infrastructure will be required, Council will not be able to financially address the City's growing traffic issues by continually adding more road space just for cars. As such, iGO advocates for innovative methods to solve transport challenges. This includes taking a demand management approach rather than a demand satisfaction approach, integrating land use outcomes with transport outcomes to shorten trip lengths and having opportunities for more people to live closer to where they work, encouraging the use of sustainable travel modes and making better use of existing assets.

The deployment of ITS is also part of this clever new thinking paradigm to help Ipswich achieve a safe and sustainable transport future.

HORIZON

The Strategy has a horizon of 10 plus years and includes a suite of actions for implementation over the next five years plus a tactical framework to assist with informed decision making when considering longer term ITS initiatives.

Given the rapid pace of technology evolution and the disruptive nature of new services and applications, it will be necessary to frequently consider the relevance of the Strategy and how the direction and resources of Council can adapt to meet both consumer demand and industry capability.

SCOPE

The Strategy takes the outcomes and messages from both iGO and the Smart City Program and overlays an ITS filter to guide Council's policy, resource and investment decision making. It is an aspirational document aimed at the citywide level. It provides overarching direction and priorities for the formulation of more detailed initiatives and projects in the future. The Strategy deals with:

- **Land** transport only;
- **Local government functions** and responsibilities with a focus on road safety, traffic management and parking;
- The City of **Ipswich** local government area; and
- **Strategic, citywide** matters and opportunities.

The Strategy is not aimed at individual properties, will not provide answers to specific locality issues and does not deal with immediate or short-term operational matters on the existing transport network. The Strategy does not deal with innovations relating to transport infrastructure construction and maintenance (materials and procedures) and funding mechanisms. These will be subject to other policy, planning and procedural practices of Council.

ASSUMPTIONS

The future effect and uptake of ITS and transport related technologies are important considerations for Council but surrounded by much speculation and little certainty. It is largely unknown how transport will operate in Ipswich in the longer term and Council recognises there will be significant changes to transport in the future. Whilst Council's transport planning decision making is currently evidence based, there are some key assumptions that should be recognised as part of the Strategy as outlined in Table 7.

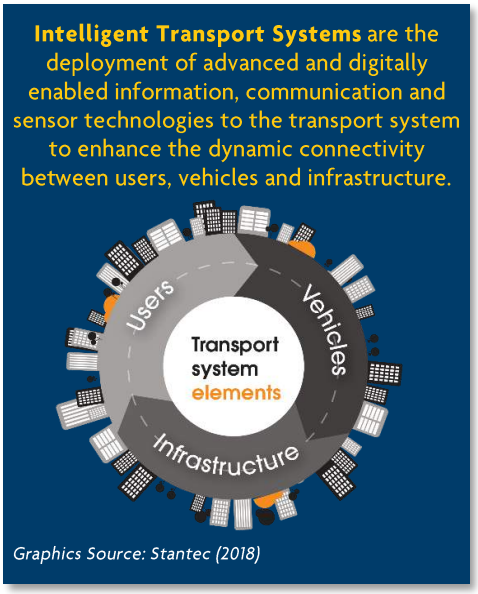
TABLE 7: Strategy Assumptions

ASSUMPTION	COMMENT
Agility	There will be many new transport related technology solutions that will come to market over the next two decades. Some of these technologies will have the potential for significant cultural and social change on how we all travel and our thinking and approach to travel. These are referred to as 'disruptors' to traditional market models and protocols. Given the evolutionary (and sometimes revolutionary) nature of technology with the continual development of new and updated solutions and services, Council will assume an agile attitude to the adoption of new ITS products and will be open to market led proposals and trials that align with the strategic outcomes of Advance Ipswich, iGO and the Smart City Program. Council will embrace this disruption and recognise where ITS can help to: • Enhance the transport experience for residents and business operators; • Improve and/or transform Council's service delivery; and • Better connect Council with the community. Council will cultivate an environment that quickly responds to change through an iterative, ongoing process that is cognisant of the evolving needs and expectations of customers.
Trials	With innovation comes uncertainty of market acceptance. Council assumes there will be a need to trial various ITS applications to test reliability and measure performance and uptake to enable informed decisions to be made to progress to wider and/or permanent implementation. This will be a good opportunity for Council to market and brand these initiatives to the community as 'pilot' projects with lower levels of funding input and thus appraise their effectiveness to justify further investment. There will be future opportunities for Council to support market led proposals for new ITS applications as 'test beds' in Ipswich. This could be indirect support by allowing the testing of ITS applications on the City's transport system or direct support through funding or sponsorships for start-up testing of new ITS technologies that align with the strategic outcomes of Advance Ipswich, iGO and the Smart City Program.
Enabler	Council does not have the financial capacity, resources or expertise to implement many of the outcomes of the Strategy by itself. Additionally, future ITS opportunities may not necessarily be a core local government responsibility for Council to lead. As such, Council assumes it will need to be an 'enabler', not just a provider. The successful delivery of the Strategy will require collaboration and partnerships with other levels of Government, innovators, industry, business operators, community groups and residents. Thus, Council will use the Strategy as a basis to advocate for external funding alliances and sponsorships of certain ITS initiatives. As an enabler, Council may be a lead partner, supporting partner or a sponsoring partner in future initiatives.

Source: Stantec (2018)

CHARACTERISATION

DEFINITION



ITS is the practical application of new tools, machinery and devices to the transport system based on scientific knowledge and innovation. Whilst this primarily includes the adjacent definition, it can also include:

- New ways of energy production for:
  - Vehicle propulsion and (e.g. electric vehicles); and
  - Infrastructure operation (LED street lighting)
- New platforms for undertaking vocational, economic and educational activities and social interactions without the need for travel (e.g. home shopping, work from home)

The aim of these applications is to enable transport system users and managers to be better informed and to make transport systems safer, more reliable and resilient as well as more user and environmentally friendly. The 'currency' of ITS is **data**. The data flow in technology applications is used by transport system managers and users to make timely and informed decisions.

CATEGORIES

For land transport, ITS can be broadly grouped into seven categories as outlined in the Table 8.

TABLE 8: Transport Technology Application Classifications

CATEGORY	DESCRIPTION
Traffic & Transport Management	Technology that monitors, manages and optimises transport system use, user behaviour and trip distribution, through sensors, travel data collection and performance monitoring, traffic signal control and dynamic road safety, routing, incident, speed management solutions.
Public & Shared Transport	Technology that makes public transport safer and more accessible, reliable and user friendly such as scheduling, real-time positioning, ticketing & payments, routing and on-demand dispatching. This also includes shared personalised transport systems.
Parking & Kerbside Management	Technology that monitors parking occupancy and duration of stay, notifies users of supply availability enables payment and offers dynamic timing, compliance and a range of pricing mechanisms. Can also include provision of infrastructure electric vehicle charging and car and ride sharing initiatives.
Traveller Information	Technology that provides real time information to engage, educate and influence transport users via digital communication tools such as websites, smart phone apps, social and digital signage and wayfinding.
Fleet & Freight Systems	Technology that advances fleet and freight vehicle management and user safety by providing better understanding of utilisation, scheduling, logistics and journey optimisation.
Connected & Automated Vehicles	Technology that advances vehicle communication with each other, road infrastructure and the user to share warnings, instructions and guidance and ultimately drive autonomously.
Road User Charging	Technology that automatically and remotely collects charges (tolls) associated with access to certain parts of a road network.
Electric Propulsion & Solar Power	Electric and solar technology to propel vehicles, bicycles and personalised mobility devices and power transport infrastructure and public lighting.

Source: Stantec (2018)

CURRENT SITUATION

Over the last several decades, many transport technology initiatives have been implemented across Australia ranging in complexity and cost. Some examples include:

- Dynamic traffic control systems (e.g. traffic signals) to better manage traffic movements and improve road user safety – refer *Figure 5*;
- Road and traffic monitoring systems (e.g. cameras, road side and road surface sensors and traffic coordination centres) to better respond to incidents to reduce delays for motorists;
- Vehicle monitoring and scheduling systems to better manage fleets, improve the efficiency and safety of heavy vehicle movements, measure traffic volumes, speeds and travel times and regulatory enforcement.
- Electronic fare and toll collection systems to improve user convenience and reduce system costs;
- In vehicle navigation systems to assist motorists with way finding and route selection;
- Advanced traveller information systems to improve system understanding and make more informed journey, timetabling and route decisions.
- *Variable Message Signs* (VMS) to deliver road information to motorists in real time. The types of VMS range from simple one or two-line message signs (advising motorists of excessive speed, poor visibility, or an upcoming road hazards) to fully variable signs that can include graphical displays pertaining to road and traffic conditions, current freeway travel speeds and safety messages.
- *Automatic Number Plate Recognition* (ANPR) systems to more effectively identify vehicles for better and more convenient parking management, measurement of traffic conditions, collection of tolls and regulatory enforcement.

In recent years, some vehicle manufacturers have introduced camera and sensor technologies into their new vehicles to improve safety for users, collectively known as *Advanced Driver Assist Systems* (ADAS). These technologies monitor, detect, control and warn the driver on possible safety matters such as the vehicle's speed, proximity to other vehicles and objects, lane departure and vehicle malfunction and maintenance issues.

STREAMS

STREAMS is an ITS tool used by Australian road authorities to monitor and manage 110,000km of roads and 1500 signalised intersections. STREAMS is developed and provided by Transmax, a wholly owned entity of the Queensland Government.

STREAMS services include motorway and arterial road traffic management, incident management, traffic signal management - adaptive coordination plan selection, adaptive movement control, public transport priority and VIP and emergency vehicle priority.

TRANSMAX

FIGURE 5: Traffic signals in Ipswich with radar technology to detect approaching vehicle speeds and adjust signal operations.
Source: ICC (2018)

The current use of ITS applications by Council is outlined in the Table 9 and is generally used for road, fleet and parking management purposes.

TABLE 9: Current Use of Transport Technology Applications by Council / Queensland Government in Ipswich

USE	APPLICATION
Road Management	• Speed Awareness Signs (60). • Parking meters in the Ipswich CBD – *refer to Figure 9.* • Enhanced School Zone Signs (22 sites) – *refer to Figure 6.* • Traffic Signals (113 sets) – *refer to Figure 5.* • Flood Warning Signs (2 sites). • Smart Lighting projects currently underway in Springfield and Ripley. • Move to take over ownership of all street lighting poles from Energex (i.e. Rate 3 type) to allow future 'smart' poles (currently undertaking NEMA testing - sending data). • Railway level crossing traffic control systems (Queensland Government). • Red light camera systems at five locations in Ipswich: - Chermside Rd / Brisbane Rd, East Ipswich - Limestone St / East St, Ipswich - South Station Rd / Blackstone Rd, Silkstone - Warwick Rd / Moffatt St, Ipswich - Warwick Rd / Cunningham Hwy, Yamanto. (Queensland Government) – *refer Figure 8.* • Speed camera program (Queensland Police Service) including 81 mobile sites across Ipswich (40 on state-controlled roads and 41 on Council roads), four parked sites and two fixed sites. • On-ramp metering and dynamic speed limit signs on the Ipswich Motorway at Riverview, Redbank and Goodna (Queensland Department of Transport & Main Roads) – *refer Figure 7.* • Variable message signs on the Ipswich Motorway, Warrego Highway and Cunningham Highway (Queensland Department of Transport & Main Roads). • CCTV cameras on motorways and key arterial roads in Ipswich linked to the Brisbane Metropolitan Transport Management Centre (Queensland Department of Transport & Main Roads). • Roll out of Emergency Vehicle Priority at signalised intersections in Ipswich over the next four years (Queensland Department of Transport & Main Roads).
Council Operations	• Regulatory Service Branch use a vehicle fitted with a camera for automatic number plate recognition (ANPR) to monitor parking compliance. • Waste Services Branch currently has an *In-Vehicle Monitoring System* (IVMS) system that records driver's route, times and speed in real time. • Fleet Service Branch is implementing an IVMS for Council's light vehicle fleet that will provide real time data on vehicle utilisation and bookings.

FIGURE 6: Enhanced School Zone Sign at Karalee State School in Ipswich *Source: Stantec (2018)*

FIGURE 7: Dynamic Speed Limit Sign on the Ipswich Motorway *Source: ICC (2018)*

FIGURE 8: A red light camera system deployed by the Queensland Government at an Ipswich intersection
Source: ICC (2018)

FIGURE 9: A Parking Meter in the Ipswich City Centre *Source: ICC (2018)*

MARKET SHARE

The global ITS market revenue by application type in 2015 is outlined in Figure 10. Traffic management and road user charging applications account for nearly half the market.

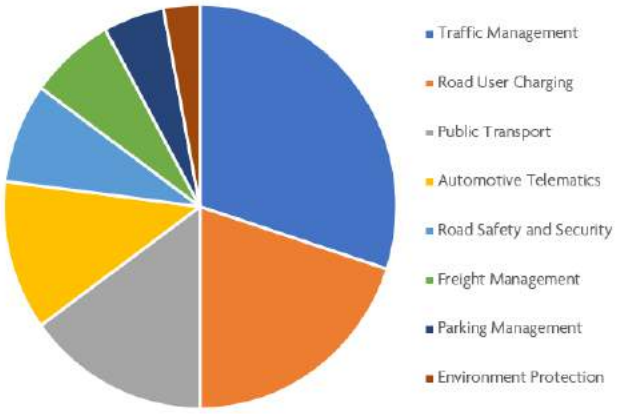


FIGURE 10: Global ITS Market Revenue 2015 (by application type) *Source: ITS Market Size Analysis, Radiant Insights Inc. (2015)*

DISRUPTIVE TRENDS

Transport is amid a generational shift where the advent of smart phone use has enabled consumers and businesses to drive forward new models within the transport sector. This revolution is evident through:

- Government policy direction;
- Investment on smart mobility initiatives;
- Car manufacturers focussing their efforts on next-generation vehicles; and
- Widening recognition that the "information everywhere" world will utterly disrupt the transport status quo.

For the first time, the transport user now has more information than the operator.

The proportion of the world's population who live in urban areas continues to rise faster than transport system capacities. This pressure on transport infrastructure is driving global capital investment, estimated at over a trillion dollars per year. However, building new infrastructure does not always sustainably create additional capacity and technology will play a crucial role in changing the way we travel.

"My smart phone is my preferred mode of transportation"

Sir Patrick McLoughlin
UK Member of Parliament (1986 –)
UK Secretary of Transport (2012 – 2016)

The digital age has begun, and technology has brought us smart phones, real-time planning, open traffic data and social customer service. This fundamental shift offers consumers real choice based on a picture of alternative routes, comparative pricing and current network status. As transport system providers adapt and fresh entities arrive on the market, new business models will transform the use of user information, payments, integration and automation.

Research undertaken by professional services consulting firm Deloitte, identified five emerging disruptive transport trends that will evolve over the next two decades setting the future of transport. These are outlined in Table 10.

TABLE 10: Disruptive Trends for the Future of Transport

TREND	DESCRIPTION
User centred	The smart phone has given access to more travel options and real time status and thus putting people in control and public transport services (e.g. Uber) becoming more personal. This will change the way transport providers design and deliver their services based on user choices and priorities, data flows and dynamic response to disruption.
Integrated & Intelligent	Connected transport networks will sense demand, measure performance and monitor the health of physical assets. Smart transport systems will respond in real-time to manage capacity and predict and avoid disruption.
Pricing & Payments	Flat-rate transport pricing and paper tickets are outdated. There will be a revolution in the way transport services are priced and paid for. The digitisation of payments will enable new ways to charge travelers based on a combination of their journey and other factors such as time of day, class of travel, discounts, previous travel patterns and special events and personal milestones such as birthdays. Pricing and payments will be revolutionised with digital tickets and payments for public transport allowing operators to follow airlines by adopting e-tickets. Beyond contactless payments, pay as you travel will be based simply on location.
Automation & Safety	Transport systems will benefit from the exponential potential of cognitive technology with vehicle to vehicle, and vehicle to infrastructure connectivity and automation likely to save millions of lives worldwide, particularly on roads. Increases in safety and changes to the nature of liability will have a fundamental impact on the insurance industry.
Public & Private innovation	Governments, corporations and community innovation will work together to meet the mobility challenges of the 21st century. The role of governments will be critical to stimulating transport technology advances whilst protecting citizens. New private sector entrants to the market will take advantage of peer-to-peer models, digital and mobile technology and lower costs to be transferable between countries and grow exponentially.

Source: Transport in the Digital Age – Disruptive Trends for Smart Mobility, Deloitte (2015)

LOOKING AHEAD

The speed of deployment and uptake of the disruptive transport trends outlined in Table 10 (above) will vary. The digital age will empower transport system users and disrupt the way providers operate and manage their services. This will put emphasis on the need for varied transport systems to integrate and join up passenger journeys. To achieve this, the public and private sectors must innovate and think differently, working together to ensure the growth and sustainability of transport for the future.

Transport in the longer-term future will be automated, intelligent and suit user needs with self-driving cars, shuttles and trains that will adapt to our needs and preferences. Ultimately, the stress of using traditional public and private transport will be eliminated by the advances we will see over the next few decades.

As part of their research, Deloitte predicted some things that are likely to happen to the transport system over the coming decades. These are outlined in Table 11.

TABLE 11: Transport System Predictions

TIMEFRAME	PREDICTION
By 2025	• All payments will be contactless (no using a ticket machine, paper tickets or swiping a card). • Personal devices will synchronise our travel plans with our calendars telling us step by step what to do next and when and how to do it. • Transport agencies will be monitoring traffic flow and passenger numbers in real time to predict congestion and work to avoid it. • Millions of sensors will start creating a "network of things".
By 2030	• Trains will be automatically controlled (no signals) with metro systems being driverless, mainline heavy rail services in driverless test phases and the status of track assets communicated in real time to a manned control centre. • Cars will be connected to a network of other vehicles and infrastructure that will inform it of impending delays and safety issues • Public and private sectors will be working together to push the integrated transport agenda to deliver tangible improvements to user experience and operational efficiency.
By 2040	• The transport sector will be completely transformed. • Fully automated vehicles where all users will be a passenger. • User's travel plans will be facilitated by their mobile devices. • Transport staff will dedicate all their time to customer service and will never be caught off guard by a customer who has more information than they do. • A revolution in public-private partnerships with governments promoting and facilitating the integration of transport modes. • Payment systems will be standardised, seamless and available to all.

Source: Transport in the Digital Age – Disruptive Trends for Smart Mobility, Deloitte (2015)

FIGURE 11: With its planned economic and civic revitalisation, the deployment and uptake of ITS applications will make travel to the Ipswich City Centre safer and more reliable and convenient. *Source: ICC (2018)*

ISSUES & CHALLENGES

Public safety, reliability and congestion on a modern city's transport system are big community issues that governments are expected to address. Financial, environmental, land use and social constraints have resulted in governments looking toward travel demand management techniques, maximising the use of existing infrastructure, low cost solutions and innovative financing methodologies to help solve these issues. The deployment of transport technologies is critical to achieving these elements.

As technology and computing becomes both cheaper and more powerful, more transport technology concepts will become technically feasible and will be deployed. It is important that governments are prepared for these technologies to ensure that regulatory and resourcing frameworks are future proofed, and that the community does not miss out on the benefits provided by transport technologies.

iGO outlines a few issues that will affect Ipswich's transport future. Some of these challenges are global in nature and affect many cities around the world. Others are more specific to Ipswich due to factors including the city's geography, socio-economic conditions and the nature of the existing transport network.

The key challenges and drivers of change for Ipswich's transport future are outlined in Table 12.

TABLE 12: Ipswich Transport Challenges & Drivers for Change

ELEMENT	DESCRIPTION
Car Dependence	High dependence on cars for all transport needs
Urban Growth	Significant urban growth (population and employment)
Urban Form	Low density and segregated urban form that is not conducive to trips by public and active transport
Public Transport	An uncompetitive public transport system that is designed for captive riders.
Parking	Management of community parking supply expectations in activity centres (particularly for long stay commuter use)
Freight	Growth in freight movements on the road network accessing the city's large industrial land uses and the conflicts between achieving economic outcomes with the sensitivity of residential amenity.
Public Health	Public health issues associated with physical inactivity due to a lack of walkable environments and concerns about personal security.
Constrained Funding	A constrained fiscal environment to adequately fund the timely delivery of new transport infrastructure and services.
Fuel Prices	Exposure to fuel price volatility and depletion
Limited Space	Limited space on road corridors within existing urban environments will make it hard to expand capacity and adequately provide for active and public transport facilities.
Legislation & Policy	Some government legislative and policy frameworks are not conducive to the effective technological advancement of the transport system including procurement processes, licensing and public liability insurances.

Source: iGO City of Ipswich Transport Plan, Ipswich City Council (2016)

The deployment of ITS applications, in conjunction with other transport initiatives and innovations, will help address, and potentially solve, some of these challenges.

DEMOGRAPHIC FEATURES

There are several key demographic features of Ipswich that will drive and/or shape the deployment and uptake of transport technology applications in the future.

Population Growth

The population of Ipswich is approximately 210,000 and is currently growing at four percent per annum, one of the highest growth rates in Australia for a local government area (LGA). It is forecast that the City's population will more than double over the next two decades, with the Ripley Valley Priority Development Area (PDA) forecast to house 120,000 residents.

Jobs

In 2016, there were approximately 73,000 jobs within the LGA. Ipswich contains two principal activity centres at Ipswich Central and Springfield Central, a large stock of existing and emerging regional business and industry areas, two large master planned communities at Springfield and Ripley and the RAAF Base Amberley which is expanding to include both air force and army functions to become Australia's premier defence and national security facility.

With these land uses, the number of jobs in Ipswich is also expected to grow substantially over the coming decades. From a transport perspective, it is important that jobs growth keeps pace with population growth to ensure greater containment of commuter trips within the city boundaries, to reduce commuter trip lengths and manage demands on the regional transport network.

Young People & Families

Ipswich is home to a young population. In 2016, the city had a median age of 32 in comparison to 38 for Australia. A younger population is much more receptive to technological change and are more likely to consider using public and active transport where competitive and practical.

Ipswich also contains a higher proportion of couples with children and households with a mortgage than the Queensland average. As such, Ipswich is an attractive place for young people to buy a house and raise a family.

Journey to Work

In 2016, the journey to work features of Ipswich were:

- 77% of residents who work commute by private vehicle (7% by public transport)
- 80% of people who work at a location in Ipswich commute via private vehicle (2% by public transport)
- 48% of working residents have jobs at locations outside the city
- 36% of people who work at a location in Ipswich are not Ipswich residents.

These features highlight that residents within Ipswich are likely to commute to and from work by private vehicles, with a significant portion of these trips crossing the city's boundaries to access jobs (predominantly in the Brisbane CBD and the industrial areas in the south-west of Brisbane).

CONNECTING & INFLUENCING THE USER

Developing a good understanding of the user is paramount to good design. When it comes to the testing and deployment of transport technology applications, Council will consider the needs of the Ipswich community and will aim to keep user outcomes front of mind. When developing targeted initiatives, the main user groups will be identified, and their needs and expectations recognised. Transport technology initiatives must meet these needs, ultimately enabling Council to deliver a safe, reliable and sustainable transport system for the future, whilst ensuring that these initiatives are well aligned with Council's Smart City goals and are financially sustainable.

People respond differently to change. Some are more adaptive and embrace new initiatives whereas others are slow movers and continue with behaviours they are used to. When an innovation is introduced onto the market, it generally takes time to 'diffuse' until the innovation is widely adopted – refer to the adoption segmentation outlined in Figure 12. When considering the introduction of new technology initiatives, Council will reflect upon the perceived value attributable to the end user and people's willingness to adopt such initiatives.

User behaviour is also dictated by the existing transport network and services that they have access to. Furthermore, their demographic and mobility needs have a strong influence on their responses to technology initiatives. It is important to ensure that initiatives aimed at influencing mode shift and behaviour change are done in a strategic and targeted way to ensure that they have the strongest possible impact.

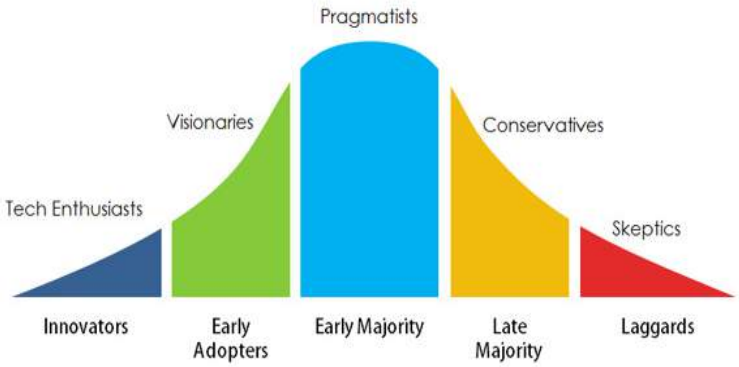


FIGURE 12: Generic Technology Adoption Segmentation

Source: "Diffusion of Innovation", Everett Rogers (1962)

SERVICE OWNERSHIP & AFFINITY

Technology driven initiatives are rarely shaped by a single entity or public authority.

Rather, successful outcomes often depend on several stakeholders coming together to deliver on a unified strategy. These stakeholders can be broadly categorised into three main segments, as outlined in Figure 13 - each with their own users and requirements.

PUBLIC SECTOR	COMMUNITY	BUSINESS
ICC	School transport users	Commercial / business travel
TMR	Leisure and shopping travel	Customer pick ups
BCC	Special events	Private transport schemes
Emergency Services	Commuters	Customer service
Translink	Active Travel	Freight and couriers
Other SEQ Councils	New mobility services	Private & public partnerships

FIGURE 13: Stakeholder Segments with Transport Technology Initiatives

Source: Stantec (2018)

To deliver a successful ITS program, Council will work together with other organisations and users within the public, community and business sectors. A shared vision between stakeholders is critical on such projects to ensure that service ownership and expectations are clearly outlined and understood between partners.

In many instances, Council will not be able to undertake projects in isolation and in other cases failing to work together with other important stakeholders could result in some missed opportunities and failed outcomes. The advent and fast-paced nature of such technological initiatives could also result in some user groups working on their own initiatives (such as on-demand mobility, UBER or school transportation services), leading to Council not having an opportunity to respond to such change. It is therefore important that Council is proactive in working positively in shaping such outcomes.

ASPIRATIONS

TACTICAL ALIGNMENT

The aspirations of the iGO Intelligent Transport Systems Strategy align with the overarching framework and charter of iGO as outlined in the Figure 14.

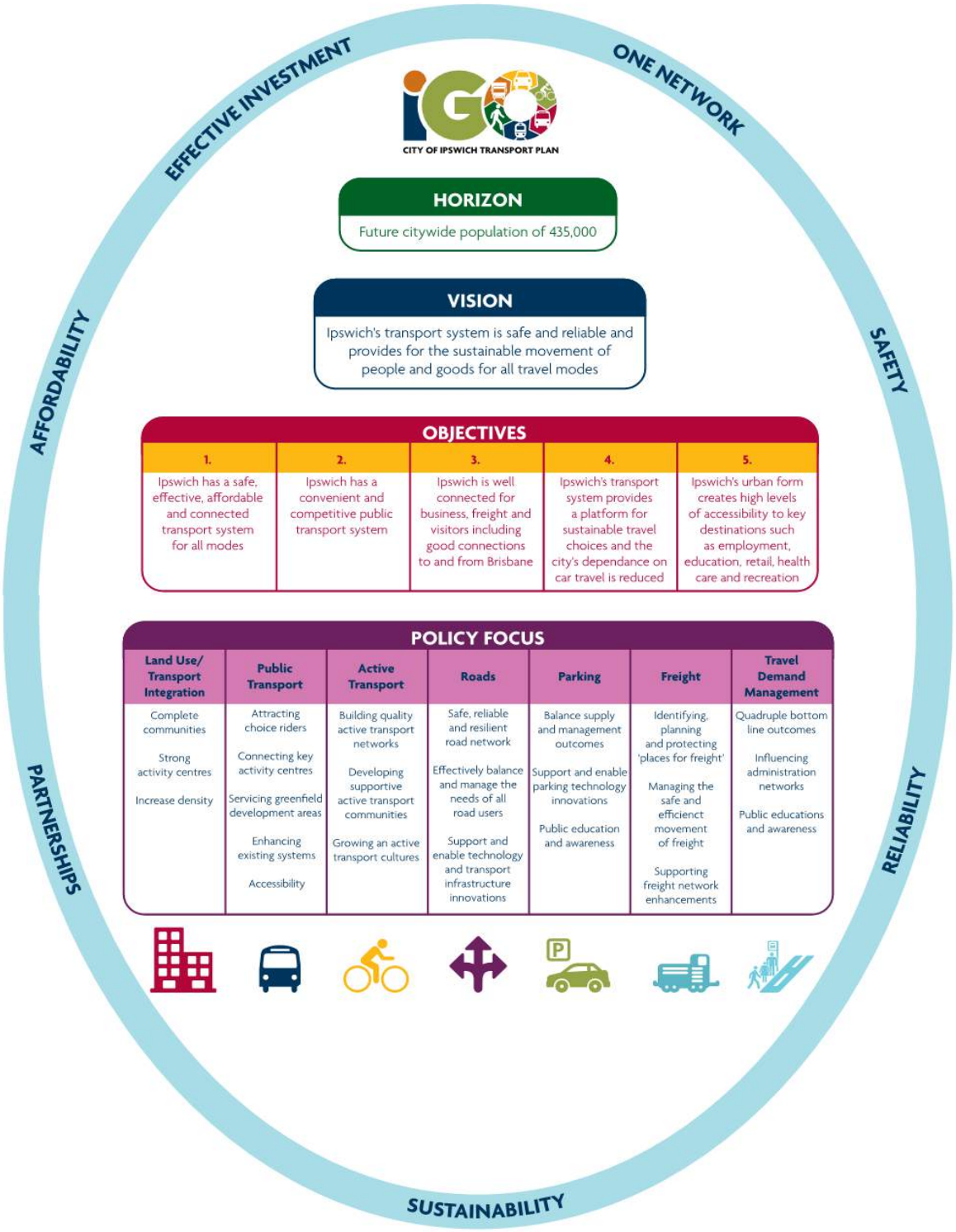


FIGURE 14: iGO Framework & Charter

Source: iGO City of Ipswich Transport Plan, Ipswich City Council (2016)

VISION

Council's vision for the deployment of ITS is outlined in the Figure 15 and aligns with the vision of iGO.

Ipswich City Council harnesses the **use of smart technology** to assist with achieving a transport system for Ipswich that is **safe** and **reliable** and provides for the **sustainable** movement of people and goods for **all travel modes.**

FIGURE 15: ITS Vision

OBJECTIVES

Council's objectives of the deployment of ITS are outlined in Table 13 and align with the objectives of iGO.

TABLE 13: Objectives

iGO Transport Objectives	**1**	**2**	**3**	**4**	**5**
	Ipswich has a safe, effective, affordable and connected transport systems for all modes.	Ipswich has a convenient and competitive public transport system.	Ipswich is well connected for business, freight and visitors including good connection to and from Brisbane.	Ipswich's transport system provides a platform for sustainable travel choices and the city's dependence on car travel is reduced.	Ipswich's urban form creates high levels of accessibility to key destinations such as employment, education, retail, health care and recreation.
ITS Objectives	Deploy and embed ITS technology and digital tools to deliver a safe, effective, affordable and connected transport system for all people and modes.	ITS technology is used to augment the awareness, accessibility and viability of public transport in Ipswich.	Partner with stakeholders to enable ITS to enhance opportunities for economic growth and inter-city and regional connections.	ITS and digital platforms are provided that promote and enable sustainable travel choices.	The planning and design of Ipswich's urban form is adaptable and responds to advances in technology and transport systems.

DESIRED OUTCOMES

The desired outcomes and values used to develop the Strategy, and its subsequent delivery, are outlined in Table 14 and align with the principles of iGO and the Smart City Program.

TABLE 14: Desired Outcomes / Values

iGO Transport Plan	
 **ONE NETWORK**	Using technology applications to manage the movement of people and goods based on an integrated, mode-neutral and bipartisan approach.
 **SAFETY**	Using technology applications to improve transport user safety.
 **RELIABILITY**	Using technology to improve dependability and resilience of travel within the network to deliver consistent travel times.
 **SUSTAINABILITY**	Using technology to reduce emissions and encourages more sustainable and active modes of transport.
 **PARTNERSHIPS**	Work with public and private sector partners and the community to enable efficient use of data and technology to deliver an affordable, reliable, efficient, accessible and seamless transport service in the region.
 **AFFORDABILITY**	Use of transport technology to deliver a more equitable and affordable transport system, lowering costs to transport authorities and providers.
 **EFFECTIVE INVESTMENT**	Use of the transport technology to assist with making sustainable investment choices at the right time to deliver on long term strategic objectives for the transport system.
Smart City Program	
 **JOBS, GROWTH & LIVIBILITY**	Use of transport technology applications to promote economic development and / or liveability outcomes.
 **BUSINESS AS USUAL INNOVATION**	Use of transport technology applications to enhance Council operations, business processes and customer services from a cost, time and convenience perspective.
 **OPEN & INTEROPERABLE DATA**	Use of data infrastructure underpinning transport technology applications must be open and interoperable across platforms and enable competition and innovation, while ensuring privacy, security and accountability.

OPPORTUNITIES

STRATEGIC PROSPECTS

Around the world, multiple cities and regions have set in place strategies and visions on how they plan to take advantage of the benefits enabled through the adoption of new technology solutions.

With a well-educated population, strong academic research focus and home to many successful technology-driven organisations, Australia has the building blocks to become a world leader in the development and deployment of ITS.

Several state and local governments in Australia are preparing to better cope with the anticipated change in mobility and transport. For example, the NSW Government has developed a *Future Transport Technology Roadmap* that outlines how emerging technologies will deliver better transport services in their region.

Similarly, Brisbane City Council (BCC) have set in place a connected strategy considering smart city initiatives where they use ITS to monitor traffic volumes, speeds and performance in real time to help residents get home quicker and safer with more travel options. No two strategies are the same and it important that Ipswich taps into its strengths as a city whilst also collaborating with its partners to ensure the regions' initiatives are well aligned and sustainable.

Ipswich is already the fastest growing city in Queensland and is recognised to have competitive start-up advantages and a younger population compared to the national average. Closer to home, Council is also delivering a bold, ambitious plan to become Australia's most liveable and prosperous Smart City. Ipswich is also leading the way in Australia when the city was chosen to be the home of the largest on-road test bed for C-ITS.

The quick pace of emerging technology means that implementers are often in a state of flux, with continual change often hampering more widespread adoption and benefits realisation. As a city, Ipswich cannot afford to wait for change to come upon it but must embrace an agile approach of encouraging and managing such change. This involves an approach to projects that is iterative, where requirements and solutions evolve as they are developed. It will be ever more important to focus on the outcomes Council are looking for and the values to drive forward. This will require Ipswich to reflect upon itself and set in place a roadmap to enable the building blocks required to get there.

OPPORTUNITY OUTCOMES

The opportunities presented by smarter infrastructure as identified through research by the Queensland Government are outlined in Figure 16. The biggest opportunities relate to better use of existing assets, improved decision making and keeping people connected.

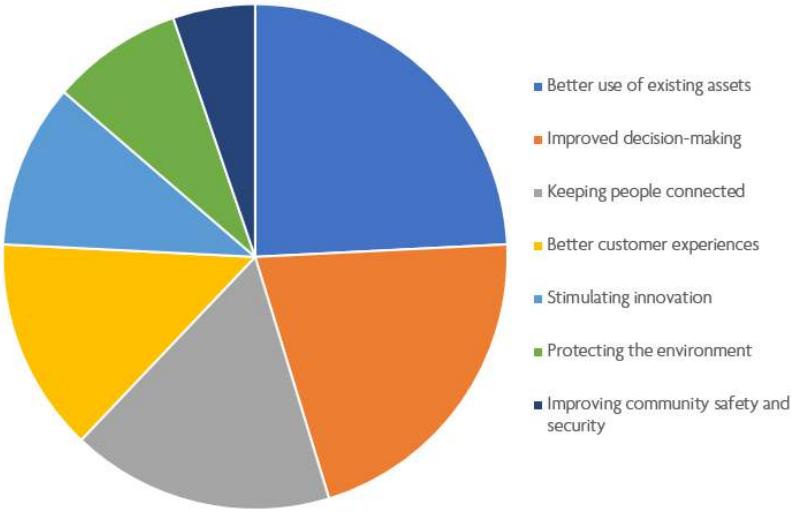


FIGURE 16: Smarter Infrastructure Opportunities

Source: Smarter Infrastructure for Queensland Directions Paper, Queensland Government, May 2018

PLATFORMS OF POSSIBILITY

There are many ITS applications currently available or emerging onto the market. Listed below are some possible opportunities worthy of further consideration that could provide Council, residents and business operators of Ipswich with tangible benefits in achieving the outcomes of iGO and the Smart City Program. It should be noted that this list is not exhaustive but rather provides ideas that help frame the Strategy.

TRANSPORT NETWORK OPERATIONS

The operation of Ipswich's local road network is a core responsibility of Council. This includes the management of, and investment in, the following portfolio elements:

- User safety and mobility (cars, freight, bicycles, people walking and other mobility devices)
- Network performance reliability;
- Traffic flow resilience during incidents and special events;
- Access to road reserves and adjacent land uses / properties;
- Streets as 'places' for social and economic interactions, civic pride and leisure pursuits;
- On-street parking and the loading of passengers and goods;
- Strategic asset management and rehabilitation; and
- Routine maintenance;

In terms of ITS initiatives, Council's short-term attention will be on exploring prospects around the smart operation of the Ipswich's road system including traffic, parking, data analytics and performance monitoring. Focussed around the elements outlined above, there are ITS solutions that could help Council to more effectively perform its road network operation.

This includes the establishment of a central road operations team driven by technology to intelligently manage all aspects of the road network including traffic flow, bus services, and incident responses. A framework for Council's potential future intelligent road operations portfolio is outlined in Figure 17.

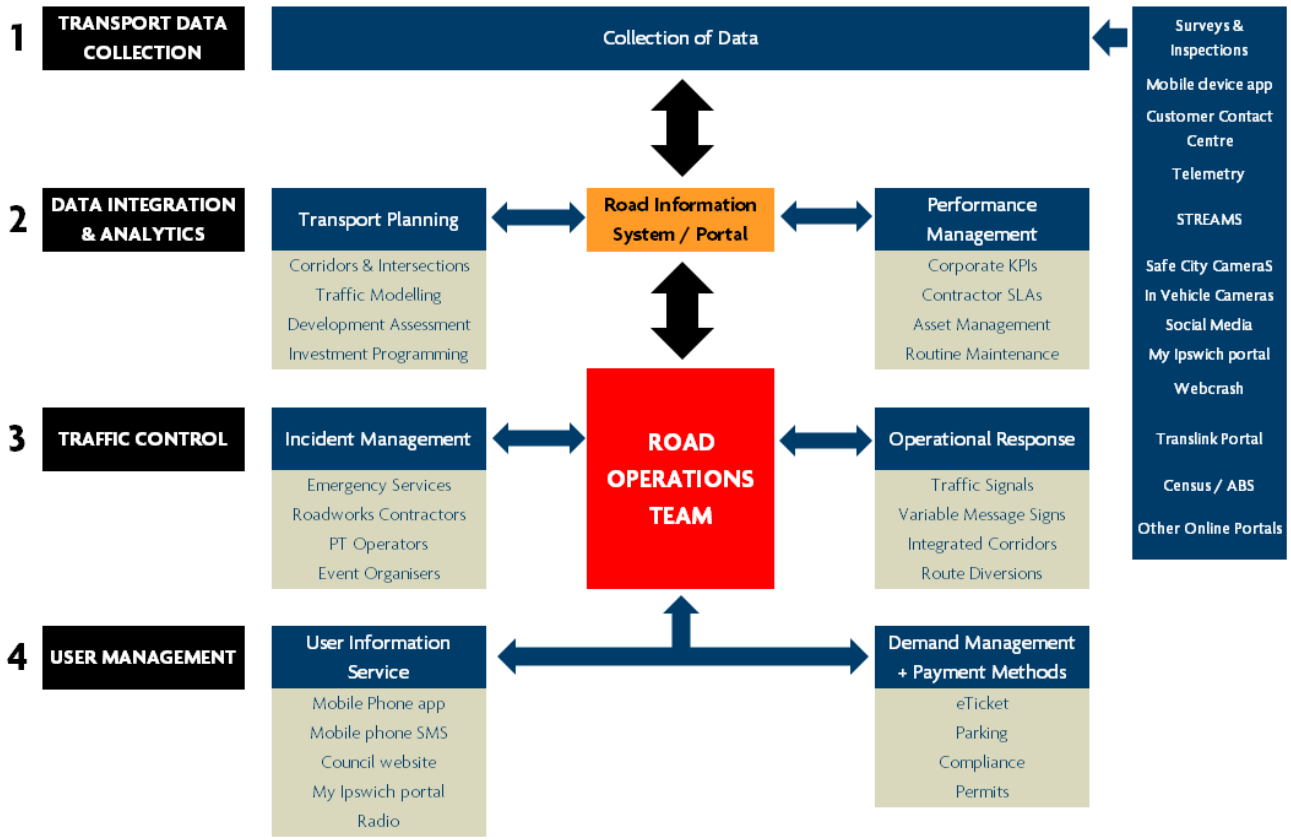


FIGURE 17: Council's Future Intelligent Road Operations Framework

Road Operations Team

The vision of cities where everything is connected and operated with maximum efficiency is on the near horizon. Holistic citywide transport monitoring and control systems are evolving rapidly, and the individual component parts are available today.

Opportunities exist for Council to pursue the latest generation of ITS applications to establish an Ipswich 'scale' road operations team that is driven by technology and works collaboratively with the TMR regional scale *Brisbane Metropolitan Transport Management Centre* (BMTMC).

Council's smart road operations team could have the following characteristics:

- **Master planned** in accordance with the framework outlined in Figure 17 and the ***National ITS Architecture;***
- **Staged** in its deployment over a several years with an initial focus on road use data collection and analysis and performance monitoring;
- Originally funded in **partnership** with a higher level of government and/or with private sector sponsorship;
- Based around a central **road information system / data portal** (that could be incorporated as part of a corporate data repository) using a single over-arching system handling all feeds from and to the monitoring and control (and potentially even enforcement) systems. Not only does this single joined-up system approach allow a complete city-wide overview, it will also allow Council to drill-down to check and adjust individual components of the road network;
- Located at **Council premises** within a regular office space as part of an integrated transport function;
- Development of a **'Concept of Operations'.**

Integrated Corridor Management (ICM)

The ICM concept focuses on maintaining the greatest mobility benefits along a road corridor or series of corridors in the same geographical area through the application of innovative technologies that maximise network safety and reliability.

As outlined in Figure 18, ICM includes changeable electronic signs, alternate route signs and coordinated and adjustable traffic signal and motorway on-ramp meters.

"Now traffic management decisions are based on both current and predicted traffic conditions, a capability that has created one of the most comprehensive and intelligent decision support tools in the industry today"

Alex Esrella
Project Manager
San Diego ICM System

FIGURE 18: Integrated Corridor Management Concept
Source: San Diego Association of Governments (SANDAG)

The ICM concept:

- Enables multiple platforms and service providers to communicate with each other to coordinate operations and detect incidents in real time regardless of who owns or operates the infrastructure or system.
- Monitors changing conditions and congestion based on real-time information;

- Generates automated response plans and re-evaluates and generates new response plans as traffic conditions change.
- Travelers receive actionable multi-modal information on their mobile device or in-car navigation system resulting in more personally efficient mode, time of trip start and route decisions.

ICM projects have been trialled and implemented in many locations across the world including Germany, Ontario in Canada and California and Texas in the United States.

Opportunities exist for the Queensland Government, in partnership with Council, to trial an ICM project in Ipswich for the corridor / journey between:

(1) Ipswich and Brisbane ;

(2) Ipswich City Centre and Springfield Town Centre; and

(3) Ipswich City Centre – Yamanto - Ripley

This will include using technology to dynamically manage demand, redistributing travel to less congested times or routes and next-generation traffic control, including predictive analytics dynamic speed management, dynamic signal control and managed lanes.

PARKING MANAGEMENT

A core responsibility of local governments is the provision and management of parking in activity centres and at municipal facilities, primarily on-street parking but also emerging off-street amenities, with the objective of facilitating quality city life for residents and business operators (economic activity, social interactions, leisure pursuits and access to jobs, education, goods and services).

The use of kerbside allocation for various forms of on-street parking (passenger and goods loading, short stay, long stay and special needs) and associated time, duration, vehicle type and permit restrictions and the use of parking meters is the traditional form of parking management used by local governments. Through smart technology and data, there is an evolution in the way that local governments can manage city parking going forward.

With a focus on delivering user-centric services, it is important that Council recognises the pain-points in the existing parking experience and how a technology solution could make it a more seamless interaction, whilst still using pricing to manage demand.

FIGURE 19: On-street Parking Sensors

Source: www.energyin.gr

Sensors

Sensor-based innovation heralds the future of public parking (at least for the short to medium term before the full deployment of connected vehicles) and is the fundamental element of modernising parking management processes for local government.

Infra-red and magnetic sensors can be flush mounted on the road surface (refer to Figure 19) or kerb at individual parking spaces, or intelligent video analytic sensors using cameras, that then detect whether the space has been occupied by a vehicle. Real time data is sent back to a main system (preferably one that is integrated with a road operations centre) that informs a motorist of nearby parking availability via a mobile device app, in-vehicle navigation system and electronic signs around the city. There are also examples where additional user identification (e.g. Bluetooth tiles) can be used to verify eligibility to park in certain zones, such as disabled bays, carshare bays or loading zones.

Utilisation and transactional data can also be used to identify vehicles that have overstayed or not paid, 'hot spots' of non-compliance and areas with high or low demand that would benefit from adjustments to time and duration restrictions and pricing.

Demand Responsive Parking

The City of Gold Coast (CoGC) is trialling demand responsive parking in Burleigh Heads and Broadbeach. The utilisation data from the sensors is used to inform a quarterly review of parking pricing that is adjusted up or down to achieve an average utilisation of between 60% and 80%.

Payment

Council's current parking meters use a 'pay and display' type system. Other local governments use a pay by plate' system. Both systems have their positives and negatives. Mobile device apps have now entered the market that allow motorists to pay electronically. In fact, mobile device apps are likely to make parking meters redundant in the longer term. It is also likely that vehicles will act as an "e-wallet" in the foreseeable future, removing the need for apps or parking meters altogether.

Compliance

It is always a negative experience for customers to receive a parking fine and it causes much angst toward Council and its staff. Parking enforcement is always seen as inequitable by the public because:

- The fine amount is the same irrespective of the extent of the infringement. For example, an overstay of five minutes receives the same fine as an overstay of 30 minutes.
- A Penalty Infringement Notice (PIN) is only issued if a parking officer happens to be in the vicinity. Since most local governments cannot afford 100% coverage of their boundary or even their activities centres, there is a high probability that most parking infringements won't result in a PIN being issued.
- The public often perceive parking enforcement as a 'revenue raising' exercise that unfairly targets motorists based on subjective and illogical time limits.

The customer experience of enforcement can be significantly improved by implementing measures to increase the ease with which motorists can comply with parking regulations and avoid parking fines.

Some local government now provide smart parking solutions through dynamic time and duration restrictions in activity centres and during special events (based on performance data collected from sensors) and a mobile device app that allows users to pay for and extend their parking duration remotely.

Customer Information

Surveys of on-street parking and some off-street parking facilities in 2013 and 2015 across the Ipswich City Centre have indicated that the average parking space occupancy is around 60-70 percent regardless of the time of day. Contrary to what people might believe, the Ipswich City Centre has enough parking resources, it is just that people can't always find it. Technology can rectify that.

Smart parking solutions include the provision of real time information to customers on the location, type and availability of on-street and off-street parking services. This will allow customers to plan their trip, find and pay for a parking space, reduce vehicles circulating in activities centres and ensure customers arrive at the destination or appointment on time. The medium through which the information is communicated, and the time at which people consume that information, needs further research to make sure people are made aware of availability at the right points on their journey (e.g. VMS, in-vehicle, in-app).

Data Collection & Analytics

Council undertakes regular parking surveys of the Ipswich City Centre that provides data that can be cumbersome to analyse and soon becomes out of date. With the use of sensor technology, real-time data on parking utilisation and duration of stay as well as analytics to predict availability and scenario testing of altered time restrictions and demand-pricing can be introduced. The use of a mobile device app can also be used to undertake regular qualitative surveys to obtain customer feedback and thus tailor better parking solutions that meet user needs and manage travel demand.

Opportunities exist for Council to take the next step in modernising its parking management services by the **staged trialling and deployment** of an integrated **smart parking solution** in the Ipswich City Centre to:

- Improve the customer experience,
- Enhance economic development and social interaction opportunities in activity centres and
- Provide more effective monitoring and compliance capabilities.

It is recommended that any smart parking solution for Ipswich have the following characteristics:

1) Integrated with an update to Council's overall **Parking Strategy** (2011) and subsequent **parking hierarchy** and **Precinct Plans;**
2) Incorporated as part of Council's **road operations team** (refer above);
3) **Interoperable** with Council's existing systems;
4) Open technology resembling a broker architectural pattern (**interchangeability**);
5) Aligns with **Australian National ITS Architecture**;
6) Can work with independent management modules across **multiple vendor technologies**;
7) Provides a real-time **performance monitoring** platform in a 'dashboard' format;
8) Offer a **variety of payment methods** that can possibly lead to a reduction or even removal of parking meters in the future;
9) Be able to implement Council's preferred parking management arrangement (e.g. via mechanisms such as **dynamic pricing** and **variable timing and duration** capabilities);
10) **Mobile device app** to find and pay for parking;
11) **Customer information** abilities including on-line and outdoor guidance; and
12) **Intuitive parking permit issuing** and management of (e.g. residents, disability, special events).
13) More **transparent issuing of PINs** and subsequent user-friendly payment

SAFE CITY PROGRAM

Council's Safe City Program is a network of over 200 cameras across the Ipswich City Centre and ten other suburbs that are actively monitored 24 hours per day, seven days per week to deter crime and anti-social behaviour. Additionally, the monitoring facility has contact with a range of other services in Ipswich to assist in addressing strategies for community safety and policing.

Opportunities exist to expand the capabilities of Council's **Safe City Program** to monitor road operations, traffic conditions, pedestrian and cycling movements and parking surveillance both in terms of technology capabilities and geographical reach.

REAL TIME TRAVELLER INFORMATION

The effective provision of information between the three elements of the transport system (users, vehicles and infrastructure) provides the platform for smart mobility in the future.

The provision of real time information to users about travel conditions, route selection, travel times and duration, journey start and end times, and even whether to travel at all, is paramount to a successful transport technology system. There are many applications available in this space, from mobile device apps to dynamic roadside signage and display boards (refer to Figure 20).

Opportunities exist for Council to **partner** with the Queensland Government, bus service providers and the private sector to **test** and **deploy digital passenger information solutions** such as wireless and solar powered screens and displays at **key bus stops, major destinations** and **places of employment** located across the city (e.g. Bell Street, shopping centres, universities and railway stations).

FIGURE 20: A dynamic real time passenger information screen at a bus stop at Sydney airport.

Source: Stantec (2018)

CONNECTED and AUTOMATED VEHICLES

Connected and automated vehicles (CAVs) include all types of vehicles such as cars, trucks, buses, trains and unmanned aerial vehicles that can sense their environment and navigate with some, little or no human input. CAVs are sometimes referred to as driverless or self-driving vehicles but also include driver assist and connected vehicles.

CAVs combine a variety of techniques to perceive their surroundings, including radar, LIDAR, GPS, odometry and computer vision and recognition. Advanced control systems in CAVs interpret sensory information to identify appropriate navigation paths, obstacles, speed limits, signage and others traffic control devices.

Levels of Autonomy

The five levels of vehicle autonomy, as defined by the Society of Automotive Engineers, are outlined in Figure 21.

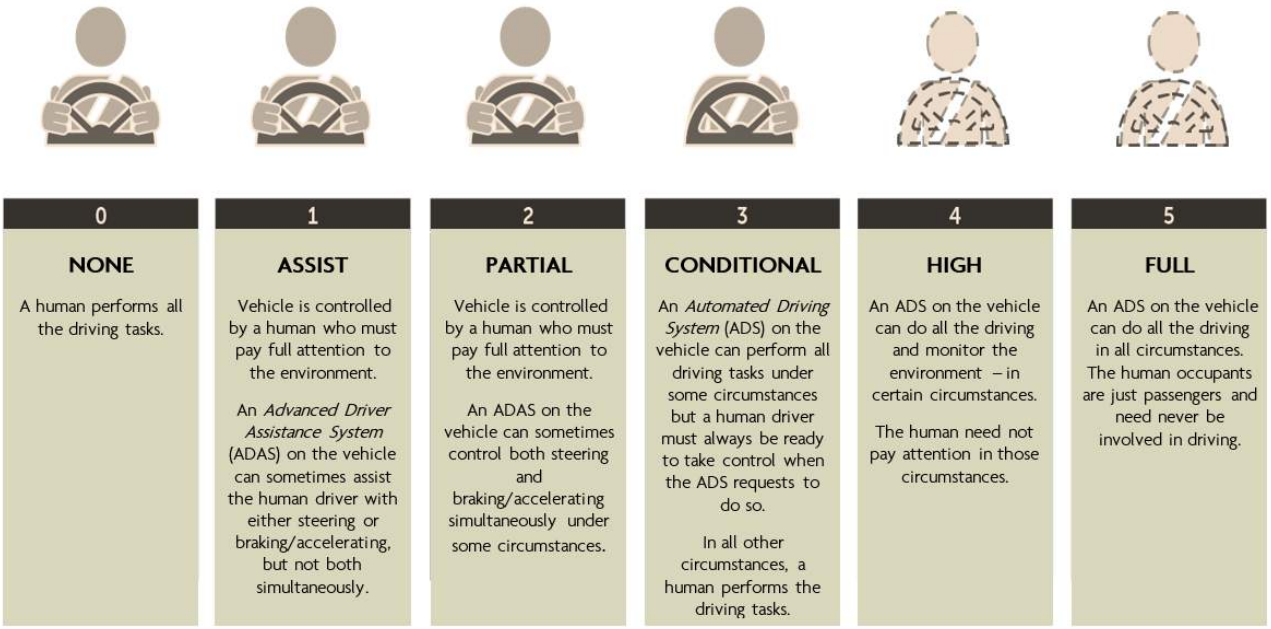


FIGURE 21: Five Levels of Vehicle Autonomy

Source: "Taxonomy and Definitions for Terms Related to On-Road Motor Vehicle Automated Driving Systems", Society of Automotive Engineers (2014)

Fully automated (Level 5) train systems have been in operation across the world for many years in cities such as Singapore and Hong Kong.

In recent years, some manufacturers have released new on-road vehicles onto the market with Level 1 levels of autonomy. These vehicles include camera and sensor technologies to control vehicle speeds (cruise control), detect and warn the driver on possible safety matters such as the vehicle's speed, proximity to other vehicles and objects, lane departure and vehicle malfunction and maintenance issues and control the vehicle when parking.

On-road CAV's with higher levels of automation are currently being tested but full deployment of Level 5 CAVs on public roads is still some time away as there are unresolved issues around technology reliability and integration, insurance and liability, public safety perceptions and a general resistance of people (particularly motoring enthusiasts) forfeiting the control of their vehicle. Figure 22 outlines a possible growth scenario for the growth in CAVs over the next few decades.

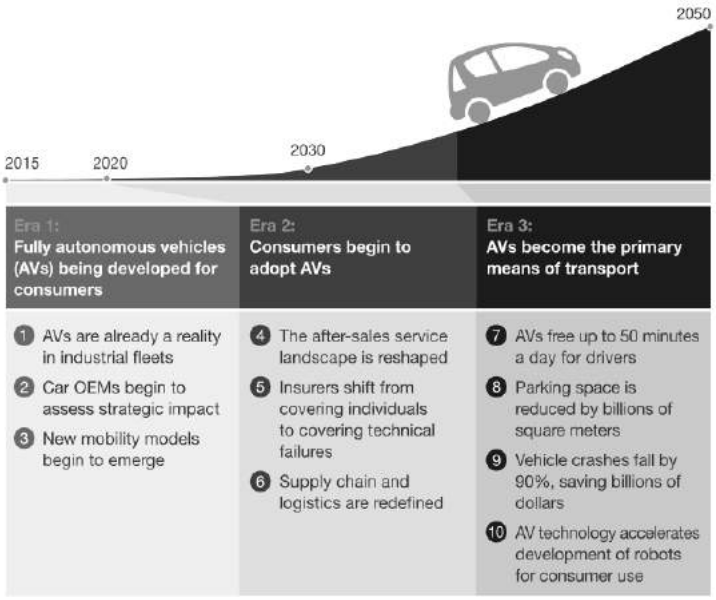


FIGURE 22: Self Driving Vehicles – Timeline of Potential Growth in Uptake *Source: McKinsey & Company (2018)*

Benefits

The biggest benefit of CAVs will be improvements to public **safety** with the ideology that removing human error and inattentiveness will reduce crashes and road trauma. For this reason, governments are focusing their attention to the safety outcomes of CAVs.

Along with the safety benefits, CAVs might also:

- Reduce traffic congestion (they will be able to travel much closer together than human controlled vehicles and predict and avoid incidents);
- Improve user convenience (on-demand, no need to find and pay for parking and passengers can pursue leisure activities when travelling);
- Lower transport costs (no need to own and operate a car if the CAV is part of the shared mobility service and no need to pay for a driver); and
- Promote efficiency and productivity gains (a CAV can always be in use [24/7] if part of a shared mobility platform without the need for a driver and associated fatigue issues).

Risks

If not managed properly, CAVs have the potential to promote urban sprawl and very low density living in Ipswich as travel will become less costly and time consuming so people may choose to live in rural and outlying areas and in bigger houses on larger parcels of land.

If not part of a shared fleet, privately owned CAVs may also cause more trips on the road network by through 'dead running' (when the CAV is travelling with no passengers back to its 'base)'.

Council Position

Council supports CAVs as a major way of travel, lifestyle and productivity for Ipswich residents and business operators in the future much like the introduction of motorised vehicles did to the world in the early 1900s.

But due to their transformational potential, it is essential that all CAVs are part of shared mobility services and fleets, are well-regulated and have zero emissions. Shared mobility services and fleets will:

- Provide more affordable access to all;
- Maximise public safety, emission and data benefits;
- Ensure that maintenance and software upgrades are managed by trained professionals;
- 'Dead running' is minimised; and
- See a reduction in vehicles, parking and traffic congestion in line with iGO's policy goals.

CAV's as part of shared mobility platform also have the potential to form part of a diversified and integrated public transport system as outlined in Figure 23 and will fill the gaps in the current system from both a network and accessibility perspective.

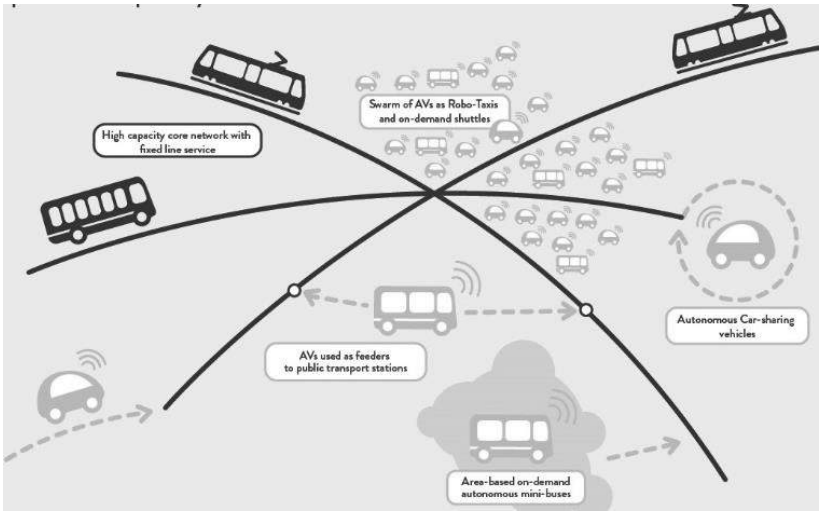


FIGURE 23: Possible application of CAVs as part of a diversified public transport system. *Source: UITP(2017)*

Cooperative Intelligent Transport Systems Pilot

The largest component of TMR's Cooperative and Autonomous Vehicle Initiative (CAVI) is the *Cooperative Intelligent Transport Systems (C-ITS) Pilot* that is planned to take place on public roads in and around Ipswich from 2019.

The Department of Transport and Main Roads (TMR) and Council have signed a Memorandum of Understanding (MoU) to work together to bring the pilot to fruition. Council is providing in-kind support to TMR for the project through road access permits, use of Council road and fleet assets, knowledge sharing, employee time and public engagement and education.

The Pilot will include testing vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) applications – in essence, Level 2 autonomy as outlined in Figure 21). This will include retrofitting technologies to 500 public and fleet vehicles and roadside devices on major roads in Ipswich. These devices will allow vehicles and infrastructure to talk to each other to share real-time information about the road and to generate safety-related warnings and messages for drivers as outlined in Table 15 (over).

TABLE 15: C-ITS Pilot Warning Types

WARNING	TYPE	DESCRIPTION
Emergency braking	V2V	Alerts drivers to a cooperative vehicle braking hard some distance ahead.
Speeding	V2I	Provides drivers with information about active, static or variable speed limits and alerts them if they are exceeding that speed limit.
Cyclists and pedestrians	V2V	Alerts drivers to pedestrians or bicycles crossing at an upcoming signalised intersection.
Back of queue	V2I	Alerts drivers about an upcoming traffic queue
Red light violator	V2I / V2V	Alerts drivers that another cooperative vehicle is likely to run a red light across their path at the signalised intersection ahead.
Red light	V2I	Alerts drivers if it's likely that they'll drive through a red light ahead, unless they brake.
Stopped or slow vehicle	V2V	Alerts drivers of an impending rear-end collision with another cooperative vehicle ahead of them.
Hazard warning	V2I	Alerts drivers to upcoming hazards, such as water on the road, road closures, or a crash.

Source: www.tmr.qld.gov.au

Turning Impacts into Opportunities

The emergence of CAVs, combined with e-commerce and the shared economy, will have major impacts on cities and society at large. CAVs are likely 'game changers' for urban mobility that will disrupt traditional approaches to our daily commute to jobs and education and how we access goods and services. But CAVs will not simply be a transport issue. They will affect land use planning, real estate, property values, parking, house and building design, urban form, public domain design and road configurations (refer to Figure 24).

FIGURE 24: CAVs have the potential to impact a variety of urban elements.
Source: Stantec (2018)

CAVs will also affect a large range of industries, business models and jobs ranging from insurance and financial lending, energy, vehicle manufacturer, maintenance and repair, parking, house design and driver licencing. In urban areas, land and facilities used for parking will need to re-purposed and road areas reconfigured to make way for pedestrian friendly zones because CAVs, if part of a shared fleet) will reduce the need for parking and road space.

Along with the uncertainty as to when Level 4 and 5 CAVs will be fully deployed, these implications could end up being the largest obstacles to their deployment, particularly regarding the disruption and the direct backlash their deployment will create. This highlights the importance of all levels of governments to be on the front-foot with regards to their CAV standards, service and regulatory frameworks and policy responses.

With regards to CAVS, the ***National League of Cities*** recommends that local governments do the following now with regards to CAVs:

- Participate – Do not wait;
- Baby Steps – Plan infrastructure needs, build data and computing capacity to position your agency;
- Experiment and test;
- Track Federal and State government developments and make your voices heard; and
- Gain stakeholder and public confidence.

As such, Council acknowledges that its operating frameworks, policy positions and land use planning instruments relating to CAVs need to be examined and hypothesized in the short term to ensure Ipswich can be at the forefront of these transport revolutions when they come to market and thus turn impacts into opportunities.

Opportunities exist for Council to undertake **scenario testing** and **uncertainty planning activities** to prepare for the upcoming revolutionary nature of CAV deployment and thus position Ipswich at the forefront and better position Council's functional responsibilities and service delivery.

This includes elements such as transport and land use planning, traffic and parking operations, urban design, economic development, community development and investment prioritisation.

SHARED MOBILITY

Shared mobility includes all modes of travel that offer short-term access to a vehicle to transport people and/or goods on an as needed / on demand basis. This can include buses, taxis, cars, vans, bikes and other personalised mobility devices such as Segways and scooters (sometimes referred to as 'rideables').

Shared mobility services have started to disrupt our traditional approaches to travel and have the potential to change urban form and transport system design. As such, Council acknowledges that policy positions, standards and land use planning instruments relating to shared mobility services should be established in the short term to ensure Ipswich is at the forefront of the shared transport revolution.

Imagine a future Ipswich where Council offers or supports a subscription to a fleet of vehicles ranging in size and types that are shared between multiple owners.

For a small investment, drivers buy into shared ownership or mobility as a service membership and can customise their ride by selecting from an array of connected car features and services offered as a software package. With a smart phone app, drivers can select the vehicle of their choice, preferred entertainment features, favoured services providers and specify the level of concierge support they would like to receive.

This outcome will radically improve Ipswich's sustainability and transform the city's transport system with fewer cars on the road, optimised traffic patterns and shared rides in addition to shared vehicles.

FIGURE 25: Car sharing schemes can include many types of vehicles including small and large cars, vans, utes and light trucks.

Source: Go Get

Car Sharing

Car sharing (sometimes referred to as 'car clubs') is a car rental scheme where people can hire cars for short periods of time, often by the hour. They are attractive to people who only need an occasional use of a motorised vehicle, as well as others who would like occasional access to a vehicle of a different type than they use day-to-day (e.g. removal van – refer to Figure 25).

Car sharing schemes can be operated by a commercial business (e.g. Go Get), as a cooperative (e.g. run by a body corporate of an apartment complex for residents to use) or as a corporate fleet.

The functionality and accessibility of these services is key to their success. The scale and distribution of the fleet, and the type of operating model will dictate adoption levels. Whether the service operates "base-to-base" or free-floating will need careful planning.

Opportunities exist for Council to encourage the deployment and uptake of car sharing schemes through the inclusion of **alternative parking codes** in the Ipswich Planning Scheme and the provision of **dedicated on-street parking spaces** for car sharing vehicles in activity centres and in medium and higher-density residential areas (refer to Figure 26).

FIGURE 26: An on-street parking space for car share scheme vehicles outside an apartment complex in Redfern, Sydney *Source: Stantec (2018)*

Ride Sharing

Ride sharing (sometimes referred to as 'ride sourcing' and 'ride hailing') is an evolution of the traditional taxi model, and to some degree car-pooling. The user hails a ride in real-time or pre-booked and is allocated the most appropriate vehicle. Uber is the market leader in ride sharing services in Australia however there are new global entities entering the market such as Ola, Lyft and Grab. Ride sharing schemes have disrupted the taxi industry and have forced governments to adjust insurance, licencing and training regulations accordingly.

The traditional carpooling model is also evolving. The traditional off-line model was very community-based and hard for individuals and organisations to manage and scale. Smartphone enabled solutions match riders with drivers and can be tailored to only provide access to known contacts, thus mitigating some of the safety concerns of travelling with random people.

Opportunities exist for Council to encourage the deployment and uptake of ride sharing schemes through the provision of **codes** in the Ipswich Planning Scheme and **on-street kerbside allocation** in activity centres and in medium and higher-density residential areas.

On-Demand Bus Services

Like on demand movies, food delivery and taxis, there are now on-demand bus services (sometimes referred to as 'micro-transit') being trialled across the world with the aim of filling gaps in the public transport network that standard buses and trains services do not fill.

On-demand bus services do away with a timetable with passengers using an app on their mobile device to book and pay for a bus that comes to or near their place of residence and connects them with a nearby activity centre, transport hub or health / education precinct. Some on-demand bus programs typically centre on improving 'first mile / last mile' connections by using smaller vehicles and mini-vans ('shuttles') that pick up multiple passengers going in the same direction as opposed to traditional train and bus services that run on a fixed route. They are particularly useful for improving mobility options for older residents and people with disabilities.

The vehicles associated with the service are usually new, dedicated and branded and have many innovative features such as Wi-Fi and mobile device charging points as well as being easily accessible for a wide variety of patrons. Users can plan their journey accordingly by booking a service for a window of time (including near real-time) and know exactly when the bus will arrive to pick them up through information provided by the app.

This is particularly relevant in servicing new greenfield urban growth suburbs and urban fringe / semi-rural areas where the introduction of traditional bus services is not operationally practical and meaningful and/or economically feasible.

The NSW Government has recently launched its first permanent on-demand bus services in Sydney (refer to Figure 27) and the Queensland Government are currently undertaking a demand responsive transport trial in Logan using shuttle buses and maxi-taxis.

Opportunities exist for Council to investigate the merits, and advocate for, the introduction of on-demand bus services in Ipswich in:

- Greenfield development areas such as Ripley and Deebing Heights and in
- Growing urban fringe areas such as Chuwar, Karalee, Kholo, North Tivoli and Pine Mountain.

Users of such a service could be linked to activity centres in Ipswich, Springfield and Yamanto and to transport hubs at Springfield Central, Ipswich Central and Dinmore and major employment generators such as the RAAF Base at Amberley.

FIGURE 27: The NSW Government recently launched its first permanent On Demand bus service in Sydney to fill gaps in the PT network

Source: Transport for NSW (2017)

Bicycle Hire Schemes

FIGURE 28: Bicycle at Waterloo, Sydney as part of privately-run Bicycle Hire Scheme
Source: Stantec (2018)

Bicycle hire schemes are a service where members of the public can hire a bicycle for a short period of time. They are usually located in principal activity centres and use technology to connect the user with the bicycle including access and payment. Some schemes are organised by local governments using contractors to provide the service (e.g. Brisbane, Gold Coast) and other schemes are fully privately operated (e.g. Sydney – refer to Figure 28, and Melbourne).

The Brisbane 'City Cycle' scheme uses a suite of docking stations located across the Brisbane CBD using an on-line system for access and payment. The Gold Coast 'Mobike' scheme uses a dock-less system with a mobile phone app for access and payment. There have been problems with litter and clutter associated with the privately-run bicycle hire schemes in Sydney and Melbourne that are causing community amenity and operational issues for councils.

There has been recent backlash against some schemes, but this is more down to poor planning and service operation than a lack of market demand.

Opportunities exist in the future for Council to **deploy** or **support** a **bicycle hire scheme** in the Ipswich City Centre and Springfield Town Centre. Careful consideration of the scale, service type and vendor support will ensure that any scheme will be a success.

With reducing prices and better battery technology, the advent of the electric bicycle (referred to as 'e-bikes' for short) is the next evolution of personalised transport – refer to Figure 29. With assisted torque power whilst the rider pedals, e-bikes will encourage more people to cycle more often with less effort. E-bikes are ideal for the hotter climate and hilly terrain of Ipswich.

FIGURE 29: Electric bikes are being come more assessible for everyone. An e-bike can be purchased from around $1000 with batteries lasting up to 60 kilometres.
Source: Stantec (2018)

Opportunities exist for Council to purchase a **small fleet of E-bikes** for staff to use when making small trips to test and showcase their capabilities and benefits.

DATA

"In the past, ITS were often infrastructure reliant. Today, greater emphasis is placed on data collection, analytics and the availability of relevant information on the move.

Chew Hock Yong
CEO
Singapore Land Transport Authority

The 'currency' of transport technology is information/ data. This is evident for ITS applications that link vehicles, infrastructure, users and transport system managers to make timely and informed decisions.

A core value of Council's Smart City Program is that the use of data infrastructure underpinning smart city and transport technology applications must be open and interoperable across platforms and enable competition and innovation, while ensuring privacy, security and accountability.

Open Data

Open Data is where government data assets are made publicly accessible, for interrogation and monetisation with limited restrictions such as copyright.

Historically governments, corporations and individuals alike have held their data close to themselves, disclosing as little as possible with others. Privacy concerns and fear of security breaches have far outweighed the perceived value of sharing information.

"A modern transport system that does not stream data is inconceivable. He who wants to build the world's most modern infrastructure must envisage, plan and build roads, rails and digital capability all as one"

Alexander Dobrindt
German Minister for Transport
& Digital Infrastructure (2013 – 2017)

However, a key enabler of Smart Cities is that all participants in the complex ecosystem share information so informed decisions can be made in real time. Multiple transport sectors need to cooperate to achieve better, sustainable outcomes through the analysis of contextual real time information that is shared among government transport authorities, service providers and the travelling public.

The objective of Open Data is to use Council information to:

- Create opportunities for local business operators, schools, entrepreneurs and policy makers to innovate and enable new business models and services
- Foster an open and collaborative culture within Council, breaking down silos and enabling better information sharing and decision making; and
- Deliver better and more efficient services for the people of Ipswich.

Not all data held by Council can be made available as open data. Some data sets may contain personal information, information that is commercially sensitive or information that is owned by a third party. In addition, Council may have access to data sets owned by third parties which have been licensed to them. These data sets can only be shared in accordance with the conditions of the licence they've been made available to the Council under.

However, Council has made available, through a public portal, 72 data sets. These primarily relate to geography and land use data.

Opportunities exist to include transport related data sets onto the Council open data portal in the future.

Interoperability

Interoperability is the ability of different information technology systems and software applications to communicate, exchange data, and use the information that has been exchanged. There are three levels of technology interoperability as outlined in Table 16.

TABLE 16: Level of Technology Interoperability

LEVEL	DESCRIPTION
Foundational (low)	Exchange of data between one application / system and another No interpretation of data
Structural (intermediate)	Exchange and interpretation of data between one applications / system and another
Semantic (high)	Ability of two or more systems to exchange information and to use the information that has been exchanged for a meaningful result. Takes advantage of both the structuring of the data exchange and the codification of the data including vocabulary so that the receiving information technology systems can interpret the data.

Source: https://innovatemedtec.com/digital-health/interoperability

Data Collection & Analytics

An important use of technology is the collection and analysis of travel related data to discover useful trends and patterns and support decision making.

There are a variety of location intelligence solutions now available to collect and analyse transport system data to help transport authorities optimise traffic flow and make important investment prioritisation decisions.

For example, Bluetooth sensors have been deployed by BCC to recognise individual Bluetooth devices as they pass by and provide accurate real time information such as travel time and speeds across the road network. This information is used by BCC transport practitioners to locate traffic congestion 'hot spots' and then scope, plan, prioritise and measure mitigation works.

Service providers such as Google, Here, Inrix and TomTom also have transport data products that present anonymised, aggregated trends of transport performance, leveraging smartphone location services and data coming from navigation and fleet management platforms.

Council recently installed permanent pedestrian and cyclist user counters on the Brassall Bikeway and has plans to expand these to other commuter bikeways and key pedestrian links in Ipswich.

Opportunities exist for Council to establish better capabilities in road use data collection and analysis to inform decision making, respond to incidents and provide better services. As part of the initial rollout of a road operations centre, this includes:

- Implementation of a network of permanent traffic counters on strategic roads
- Deployment of a travel time / speed measuring solution on roads and bikeways
- Establishment of a dedicated data analytics and performance monitoring function with Council's transport and traffic team.

Opportunities also exist for Council to expand the use of permanent pedestrian and cyclist counters and install real-time public facing user counter 'panels' (refer to the example in Figure 30 & 31) on key commuter bikeways to promote their use, active lifestyles, sense of community pride and ownership.

FIGURE 30: User counter display on the Bicentennial Bikeway in Brisbane

Source: Brisbane City Council (2018)

FIGURE 31: Public facing user counter display on a bikeway in Seattle, USA

Source: Seattle Times (2018)

Data Integration / Aggregation

The key element of Council's future intelligent road operations framework (refer to Figure 20) includes the development of a central **Road Information System / Portal** where road and travel data from disparate sources is aggregated into one common operating picture (sometimes referred to as a 'data fusion engine') using an exchange network and decision support tool to provide road users and managers enhanced situational awareness and the ability to make more informed decisions (refer to Figure 32).

This not only includes Council information but data from the Queensland Government (e.g. TMR, Queensland Rail, Queensland Police Service and Emergency Services) and service providers (bus, taxi, ride share and tow truck operators, Royal Automobile Club of Queensland).

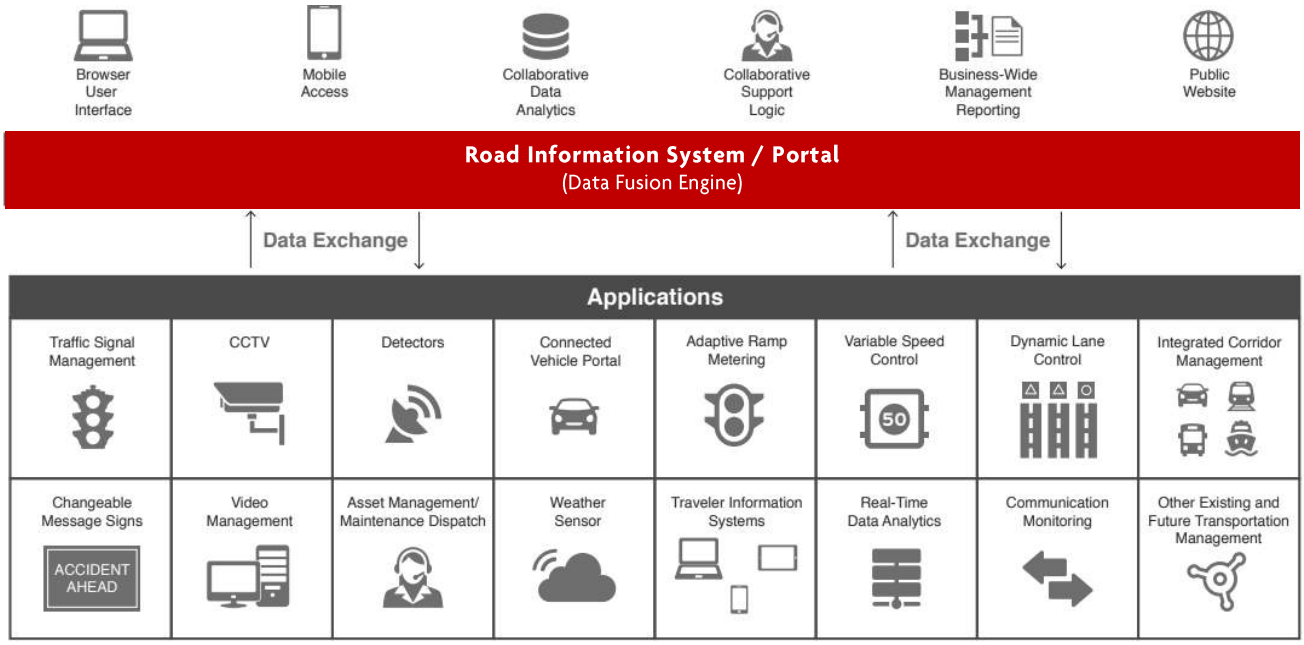


FIGURE 32: Road Information System / Portal

Source: Cubic (2018)

FLEET MANAGEMENT

Company and government fleets (light vehicles, trucks, small and heavy plant) is a form of shared mobility that is being modernised with transport technology applications.

Council has commenced the deployment of a GPS based in-vehicle telematics system to better administer its vehicle fleet in terms of utilisation and fuel tracking, booking, driver, speed and security management and maintenance diagnostics. Workplace health and safety, productivity and cost reductions are the key drivers behind this.

Newer fleet management platforms can lead to more sustainable outcomes and present opportunities for Council to leverage their own fleet and the operators in the region to share their data, creating a comprehensive data asset that can provide network performance, safety and asset condition insights (refer to Figure 33).

FIGURE 33: Technology applications can help with the tracking and reporting of a variety of fleet management activities. *Source: Bhutan Telecom (2018)*

INTEGRATED & CONTACTLESS PAYMENT

Public transport ticketing is being revolutionised across the world with patrons able to seamlessly pay for their trips via a range of media, including mobile devices across various modes and service providers.

The Queensland Government is updating the Go Card system to enable open loop payment, meaning users can pay for access to public transport services using mobile phones, smart watches (refer to Figure 34), debit / credit cards as well as allow greater use of the existing Go Card across various platforms, operators and applications. Trials are expected to begin in 2019 after $371 million was committed over four years to refine the service.

Opportunities exist in the future to incorporate access to Council related transport services (e.g. payment of parking fees, bike hire scheme, shared and fleet vehicles) via both the Queensland Government's Go Card system as well as an app on a personal mobile device.

FIGURE 34: Public transport patrons in Queensland will soon be able to pay for their trip using a variety of options including smart watches. *Source: www.iotgadgets.com*

MOBILITY AS A SERVICE

Mobility as a Service (MaaS), sometimes referred to as *Mobility on Demand* (MoD), is a concept where various transport services are integrated into a single mobility touchpoint on a mobile device (as conceptualised in Figure 35).

To meet a customer's request, a MaaS operator facilitates a diverse menu of transport options from public transport, ride / car / bike-sharing, taxi or car rental/lease or a combination thereof. MaaS offers the user a seamless "one experience / one payment" approach to transport services and will help solve the inconvenient parts of individual journeys as well as the entire system of mobility services.

Opportunities exist for Council to advocate for the Queensland Government to lead and promote MaaS and explore prospects for new MaaS business partnerships and functional models that will complement their line haul public transport offerings currently operated by Translink and Queensland Rail.

A successful MaaS service also brings new business models and ways to organise and operate the various transport options, with advantages for transport operators including access to improved user and demand information and new opportunities to serve unmet demand. The aim of MaaS is to provide an alternative to the use of the private car that may be as convenient, more sustainable, help to reduce congestion and constraints in transport capacity, and can be even cheaper.

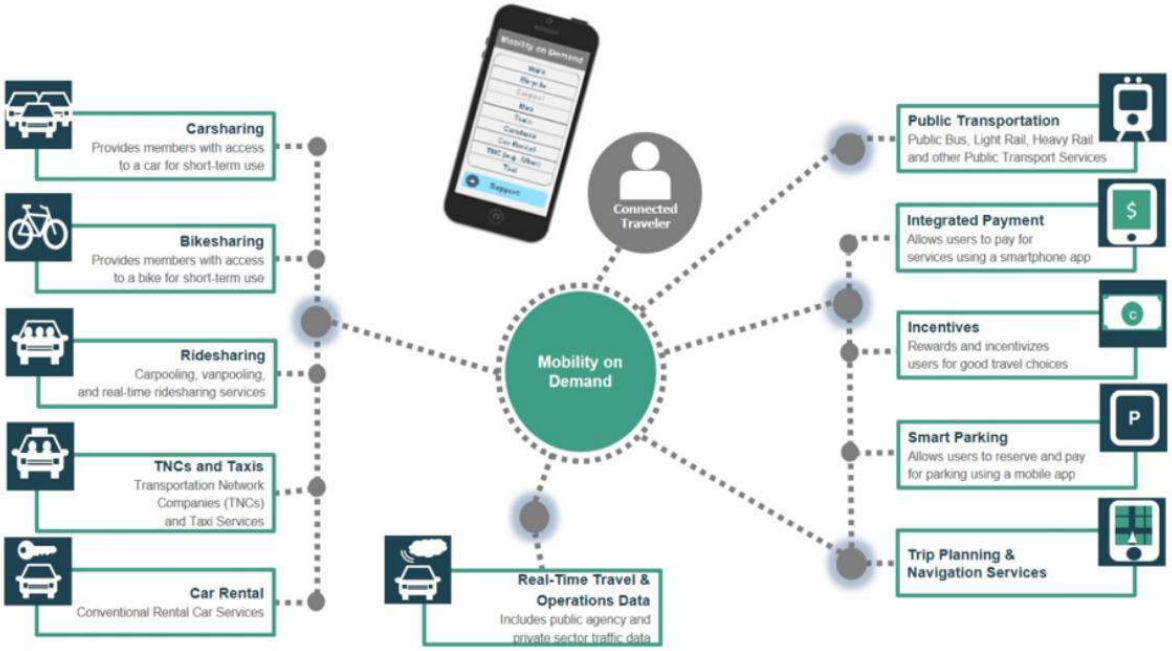


FIGURE 35: MaaS / MoD is the integration of user-centric travel options

Source: USA Department of Transportation (2018)

MOBILITY HUB

A *mobility hub* is a concept of places where people can make seamless connections between a range of public, shared and active transport options in areas where there is a concentration and mixture of activity (employment, retail, commercial, educations, health and leisure). They provide an integrated suite of mobility services, amenities and technologies to bridge the gap between high-frequency public transport services and an individual's origin or destination.

As conceptualised in Figure 36, the services, facilities and technologies of a Mobility Hub include:

- Enhanced passenger waiting areas and loading zones;
- Real-time traveller information;
- Bikeshare, carshare and neighbourhood electric vehicle hire schemes;
- Bicycle parking stations and cycle centres;
- Dynamic parking management and flexible kerb space allocation;
- Real-time ridesharing, shuttle / micro PT services;
- 'Rideables' (scooters and Segways);
- Cycling and pedestrian improvements;
- Electric vehicle (EV) charging stations;
- Dynamic wayfinding, signage, route markers and information kiosks;
- Urban design enhancements; and
- Universal contactless payment systems.

These features help travellers connect to/from inter-city and suburban public transport services and make short trips within the activity centre and beyond. Integration of information technology helps travellers find, access and pay for services. In the future, connected and automated transport services may enhance mobility for travellers of all ages and abilities while fostering a safer environment for all mobility hub users.

Mobility hubs may result in several benefits including increased transport choices, promote the use of sustainable modes of transport and reduced traffic congestion and parking demand in major activity centres.

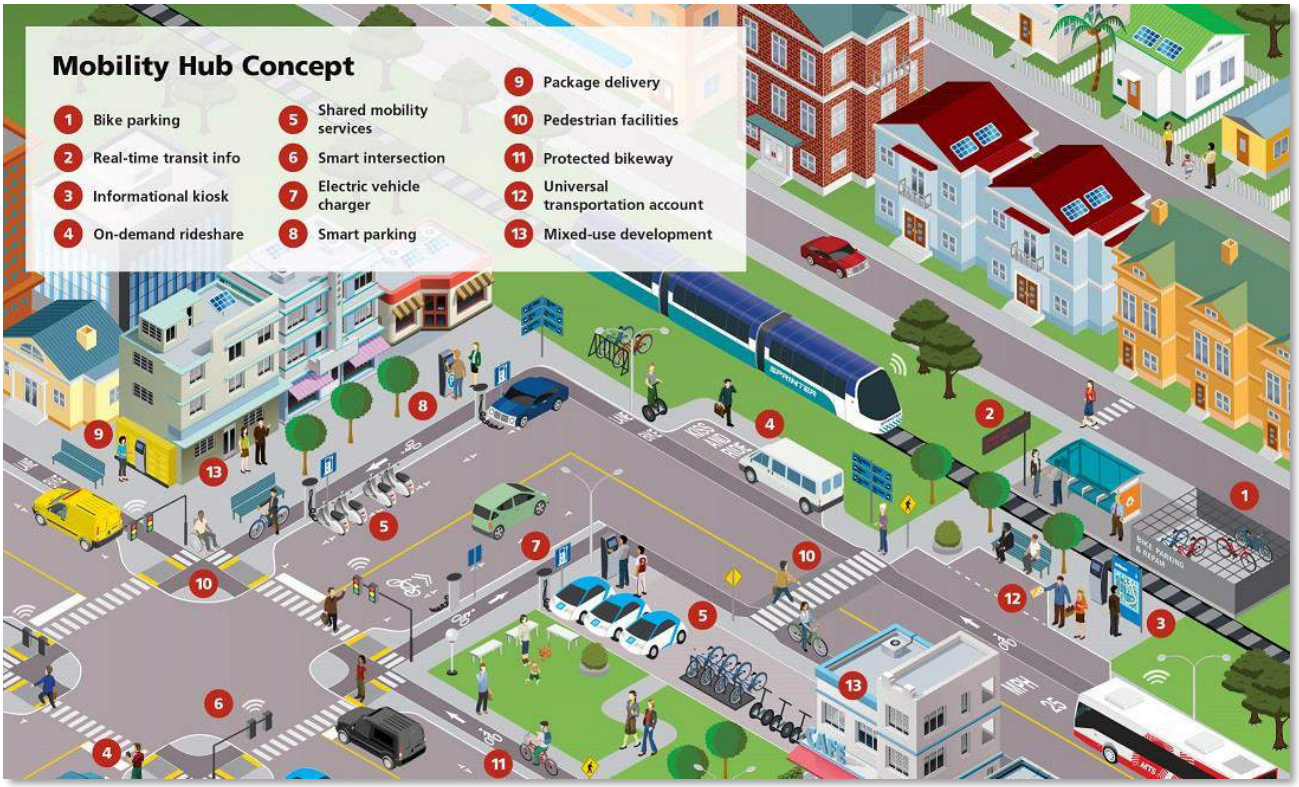


FIGURE 36: Mobility Hub Concept

Source: San Diego Forward – Regional Plan 2019-2050, San Diego Association of Governments (SANDAG)

Each mobility hub can be designed specifically for the activity centre it serves and can include not just the major public transport node itself but all those services and destinations that are accessible within a five-minute drive, walk or ride (refer to Figure 37).

Opportunities exist for the staged design, trial and delivery of the **mobility hub** concept as part of the economic and civic revitalisation of the **Ipswich City Centre**. The mobility hub concept could also be looked at for the **Springfield Central**, **Ripley** and **Goodna** town centres.

FIGURE 37: Mobility Hub Service Area

Source: San Diego Forward – Regional Plan 2019-2050, San Diego Association of Governments (SANDAG)

ELECTRIC VEHICLES

An *electric vehicle* (EV) uses one or more electric motors for propulsion. An EV may be powered through a collector system by electricity from off-vehicle sources (e.g., the Brisbane passenger railway system operated by Queensland Rail) or may be self-contained with a battery, solar panels or an electric generator to convert fuel to electricity. For the context of this Strategy, EVs relate to road going vehicles.

EVs have been in existence since the mid-19th century and on the edge of mainstream acceptance since the late 1980s with a cult following, particularly in North America. Interest has boomed in recent years for several reasons including better vehicle batteries and incentives or rebates for 'green' vehicle ownership. In fact, global EV sales have increased substantially over the last six years as outlined in Figure 38.

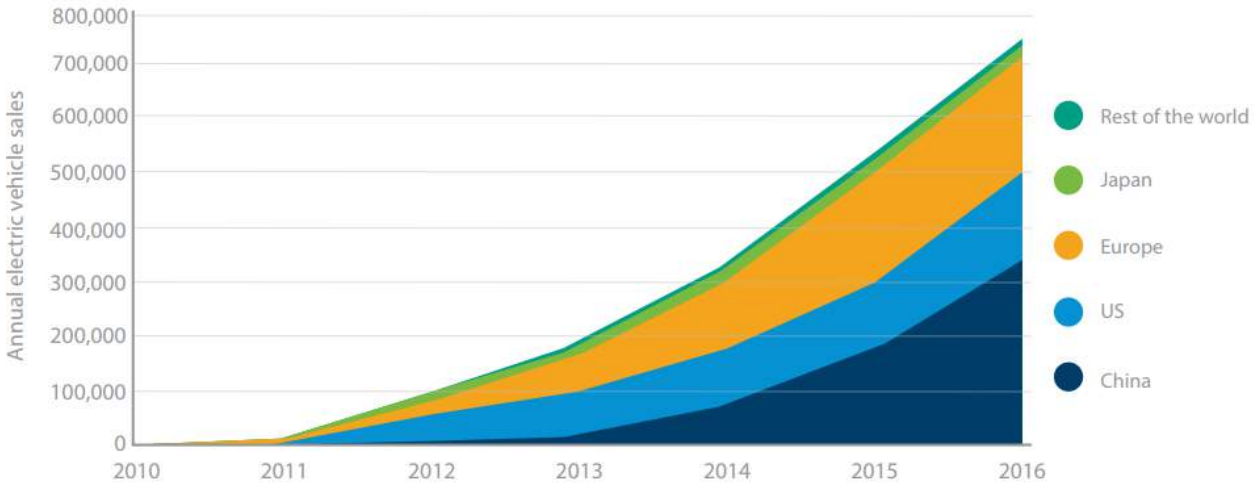


FIGURE 38: Global EV Sales 2010 to 2016

Source: Queensland Electric Vehicle Strategy (2017)

The public acceptance and uptake of EVs will expand over the coming decades and will be a dynamic process as the technology improves and the market conditions continues to develop.

EV Charging Stations

One of the major barriers for the uptake of EVs is the lack of public recharging stations (refer to Figure 39) that can give users (or potential user) 'range anxiety'. The widespread adoption of EVs will require a cultural shift in the way we think about our own mobility needs, how we meet these needs, and in turn, how we recharge EVs.

The Queensland Government is rolling out a network of EV rapid charging stations across Queensland as part of their *Electric Super Highway* initiative – refer to Figure 40.

FIGURE 40: Queensland Electric Super Highway Network

Source: Queensland Government 2017

FIGURE 39: An EV rapid charging station recently installed at Yarrabilba in Logan City

Source: Stantec (2018)

Opportunities exist for Council to support the uptake of EV's through:

- Development of **policies, design standards, signs** and **development incentives**
- Advocacy for EV charging stations to be included at key locations in Ipswich as part of **Phase 2** of the Queensland Government's Electric Super Highway initiative.

'Rideables'

FIGURE 41: Electric scooters are a form of personalised transport referred to as 'rideables'

Source: www.consumeraffairs.com

Other electric personalised devices, referred to as 'rideables', are on the market that can transport individuals without much effort at speeds up to 25km/h. Rideables include Segways, scooters (refer to Figure 41), skateboards, unicycles and wheel- chairs.

As prices reduce and battery technology continues to improve, these types of devices will become more widespread on Ipswich road reserves and public spaces, and will become popular with younger and older residents, people with disabilities and those people who do not have access to a car or driver's licence. Given their compact nature, they provide an opportunity to provide first mile / last mile solutions for public transport journeys as well as being part of a shared mobility scheme in activity centres and large employment zones.

Opportunities exist for Council to support the uptake and safe and effective operation of **'rideables'** as a sustainable and active forms of transport by advocating for a **regulatory framework** to be established and providing **infrastructure** and **promotional initiatives**.

Unmanned Aerial Vehicles

The uptake and use of unmanned aerial vehicles (UAVs - or commonly referred to as 'drones') has entered the mainstream with their technological capabilities increasing and their costs reducing significantly over the last few years.

Council has a drone that it uses to take high quality images of open space and road projects. Other agencies use drones fitted with advance cameras and LiDAR sensors to undertake digital terrain surveys of roads and other public assets in rural and remote areas. However, drone use in urban areas is currently restricted due to air space safety and privacy concerns.

Opportunities exist for Council to build capacity in the use UAVs to more effectively undertake Council business. This includes the following transport related activities:

- Digital surveying for road and bikeway design (refer Figure 42)
- Construction site and safety inspections
- Marketing, promotion and community consultation (including 3D modelling for animated visualisations and promotional videos)
- Aerial photometrics
- Road and traffic condition monitoring (refer to Figure 42)
- Parking and road reserve management and compliance
- Before and after evaluation of road projects
- Advocate for CASA to finalise use and privacy regulations to use UAVs for local government activities in urban areas.

Once regulatory frameworks are sorted, and UAV technology architectures are standardised, drones will also be used in the future for micro-deliveries (parcels, groceries etc.) and for automated passenger travel ('flying taxis').

FIGURE 42: Drones can be used to undertake digital surveys for municipal infrastructure design.

Source: www.creedla.com

5G MOBILE NETWORK

5G is the term for the next generation of radio systems, mobile communication architecture. Whilst 5G technology is still in the development phase with a global architecture standard currently being prepared, it promises extreme broadband with large gains in speed, lower levels of latency, ultra-low energy consumption and overall smoother and more reliable operation (refer to Figure 43).

5G will support many different cases and business models. For 5G, transport will evolve from a static, linear connection to a programmable mesh that dynamically interconnects all mobile and cloud elements and will be particularly suitable for time sensitive transport technology applications such as CAVs and UAVs, traffic and parking monitoring and CCTV public surveillance.

> "5G will one day open up applications we don't anticipate but will eventual take for granted. While 4G was used to primarily connect people, 5G will also be used to connect a growing number of internet-enabled devices and machines as the internet of things takes off. Think everything from smart phones to autonomous trucks. It's a new industrial revolution. There is almost no industry that won't benefit"
>
> **Mike Wright**
> Telstra Managing Director – Networks (2018)

5G will be the foundation of large-scale internet of things (IoT) deployments that will be the significant driver of smart city projects of the future and revolutionise existing transport technology initiatives and business models. 5G will require the dense deployment of millions of 'small cell' antennas across urban areas on infrastructure such as poles, buildings and bridges connected to a network of macro base antennas. The small cells could be combined with other applications such as micro air quality and weather monitoring systems and traffic counters.

While worldwide commercial launch of 5G is expected in 2020 (once a global standard is ratified), Telstra have recently deployed 5G technology in parts of the Gold Coast to test 5G pre-commercial devices in real world conditions with plans to have more than 200 5G capable sites up and running across Australia in 2019. Optus also have plans to deploy its 5G network in key metropolitan areas in 2019.

Opportunities exist for Council to provide support for the **testing** and **deployment of 5G technology in Ipswich** using public assets and municipal facilities such as street light poles (where appropriate).

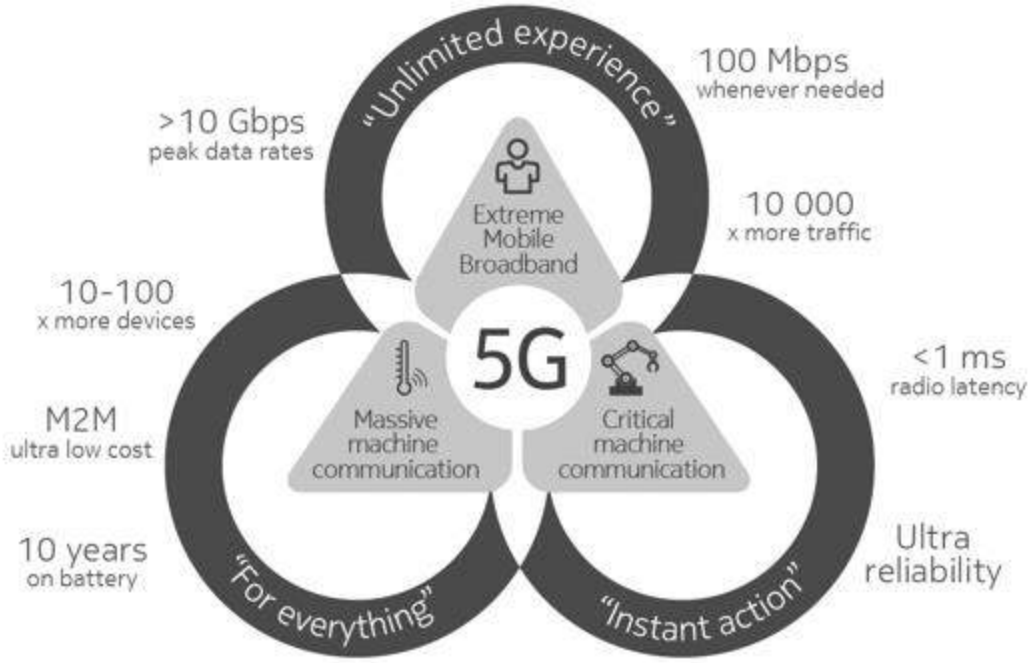


FIGURE 43: Overview of 5G Technology

Source: Nokia (2018)

ACTIONS

The suite of prioritised actions is outlined in Table 18 (over) and include linkages to iGO actions.

ACTION AREAS

The action plan has been developed based around three action areas as outlined in Table 17.

TABLE 17: Actions Areas

ACTION AREA	DESCRIPTION
PROJECTS	These actions will be led and facilitated by Council with supporting partners and include 'on the ground' trials and pilot projects with the view of further investment and deployment if proven practical and feasible.
PROTOCOLS	These actions relate to Council protocols including policies, procedures, systems, standards and specifications.
PARTNERSHIPS	These actions will be led by others but supported by Council either directly and indirectly and includes advocacy, public awareness, promotional and sponsorship activities.

TIMEFRAMES

Each action is given a timeframe that outlines Council's ITS priorities. They are defined as:

- **Signature** (resource focus over the next two years)
- Short (within the next 5 years)
- Medium (6-10 years)
- On-going (already underway and/or will occur across all timeframes)

The timeframes have been established based on need, opportunities and alignment with Advance Ipswich, iGO and the Smart City Program. The actual delivery of each action will be subject to resourcing, the establishment of investment and expertise partnerships and the outcomes of prototype design, testing and evaluation processes. Due to the evolutionary nature of technology, with the continual emergence of new and updated platforms, there are no longer term (10+ years) actions.

TABLE 18: Action Plan

NO.	ACTION	ACTION AREA	TIMING	iGO LINK
ROAD & TRAFFIC MANAGEMENT				
Road Operations				
ITS 1	Establish a road operations data analytics and performance monitoring team that is driven by technology and works in collaboration with TMR to better manage traffic, improve network reliability, enhance the customer experience and inform transport investment decisions. Execution will be over several years as resourcing becomes available and capabilities and partnerships with TMR emerge. The initial rollout will include: (a) Assessment of existing systems, gaps and future needs; (b) Preparation of a *'Concept of Operations';* (c) Development of system protocols (operations, security, privacy, communications and maintenance); (d) Development of a resourcing plan (human, capital, expertise and training); and (e) Establishment of a central road data system / portal.	Project	**Signature**	R1, R5, R7, TDM4
Integrated Corridor Management (ICM)				
ITS 2	Advocate for, and partner with, the Queensland Government to trial an ICM project in Ipswich for the corridor / journey between: (a) Ipswich and Brisbane; (b) Ipswich City Centre and Springfield Town Centre; and (c) Ipswich - Yamanto – Ripley.	Partnership	Short	R1, R2, R5, R7, AT9, LU7
Advanced Traffic Management Systems (ATMS)				
ITS 3	In line with ITS1 (above) identify, design and deploy ATMS technologies on the road network. This may include: (a) Permanent traffic counters on major roads; (b) Travel time / speed measuring system on roads and bikeways (e.g. Bluetooth 'ping' readers); (c) Variable message signs; (d) Traffic cameras; (e) Incident monitoring; (f) Integrated work zone management; and (g) Weather and flood information monitoring.	Project	Short	R5, R7, ATAP 3.5
Smart Road Safety Treatments				
ITS 4	Investigate and implement low cost smart road safety initiatives across Ipswich including: (a) Vehicle actuated dynamic signs (e.g. curve and crest warning signs); (b) Traffic signals pedestrian count down timers at key activities centres; (c) Enhanced speed limit signs; (d) Interactive pedestrian crossings in high activity locations; and (e) Pathway delineation lighting.	Project	Short	R5, R6, R7, AT13

Continued over...

NO.	ACTION	ACTION AREA	TIMING	iGO LINK
Traffic Signal Improvements				
ITS 5	Investigate and implement coordinated traffic signal timing optimisation along major road corridors in line with road function and adjacent land uses.	Project	Short	R5, R7, ATAP 3.5
ITS 6	Install Next Generation SMART traffic signals controllers.	Project	Short	R5, R7
ITS 7	Investigate pedestrian protection technology initiatives at traffic signals to improve pedestrian safety.	Project	Short	R5, R7, AT13, ATAP3.5
ITS 8	Investigate and implement bus priority infrastructure at signalised intersections (e.g. bus lanes, queue jumps) to improve journey time reliability and efficiency.	Project	Short	R5
ITS 9	Investigate and implement alternative connection and communication methods for the effective operation of traffic signals.	Project	Short	R5
Road & Freight Planning				
ITS 10	Consider and incorporate transport technologies into the planning, design, funding and construction of strategic roads and road upgrades including ITS, shared mobility services and EV and AV applications.	Protocol	On-going	R1, R2, F1, F5, AT9, LU7
ITS 11	Consider how AV, EV and shared mobility might influence the design of roads and street in new communities.	Protocol	On-going	R5, LU7, PT3, F1
ITS 12	Support the development and deployment of integrated corridor management techniques, connected and autonomous trucks and innovative fleet management and smart logistics tools.	Protocol	On-going	R5, F1, F5
PARKING				
Smart Parking Solution				
ITS 13	Investigate the feasibility, develop and implement a smart parking solution. Solutions should include allowance for various pricing methods and kerbside allocation, intelligent payment and ticketing systems and more sophisticated compliance, revenue monitoring and customer information systems about parking locations, types and availability. Potential delivery method may involve starting small-scale by testing a range of sensor types across a 'pilot area' and scaling up as performance and benefits are proven. As part of the development and deployment of the smart parking solution: (i) Consider the use of a customer information platform that provides information on parking locations and availability using both mobile device apps, in car navigation tools and on-street dynamic signs; (ii) Provide a platform that allows Council to undertake qualitative surveys to obtain customer feedback and thus make informed decisions on parking management; (iii) Undertake a coordinated public awareness and user education campaign; and (iv) Provide a platform that allows Council to remove time restriction in some areas and allows various pricing methods.	Project	**Signature**	R5, P2, P3, P4, P7, P9, P10, P11, P14, TDM4
Parking Data				
ITS 14	Use the data obtained from the deployment of the Ipswich smart parking solution to inform the preparation of: (a) New and updated **Precinct Parking Plans** for the Ipswich City Centre considering the use of various pricing and kerbside allocation methods; and (b) An updated **Parking Pricing Strategy** considering the use of various innovative pricing, kerbside allocation, parking revenue monitoring and use methods;	Protocol	Ongoing	P5, P6, P7, P13, P14, R5

Continued over...

NO.	ACTION	ACTION AREA	TIMING	iGO LINK
SHARED MOBILITY				
Mobility Hubs				
ITS 15	Prepare a mobility hub strategy for:	Protocol		LU7, ATAP7.4, R5
	(a) Ipswich City Centre (for deployment as part of its economic and civic revitalisation);		Short	
	(b) Springfield Town Centre (as part of its densification and associated development of a Transport Master Plan and infrastructure charging regime);		Short	
	(c) Ripley Town Centre; and		Medium	
	(d) Other activity centres as they mature including Goodna, Booval, Redbank Plains and Yamanto.		Medium	
ITS 16	Leverage opportunities to stage the implementation of these mobility hub strategies in partnership with developers, business operators and industry.	Partnership	Ongoing	LU7, ATAP7.4, R5
Parking				
ITS 17	Encourage the deployment and uptake of car and ride sharing schemes through the:	Protocol	Medium	LU4, LU&, PT3, P8
	(a) Inclusion of alternative parking codes and development incentives the Ipswich Planning Scheme, particularly for higher and mixed land uses to reduce on-site parking supply; and			
	(b) Provision of dedicated on-street parking spaces in activity centres and in medium and higher density residential areas where appropriate.			
Bicycle Hire Scheme				
ITS 18	Support the deployment of a bicycle hire scheme in:	Partnership	Medium	LU7
	(a) Ipswich City Centre;			
	(b) Springfield Town Centre; and			
	(c) Ripley Town Centre.			
	These could be electric bikes and the first stage of a Mobility Hub Strategy for each activity centre.			
Rideables				
ITS 19	Support the uptake, and safe and effective operation, of 'rideables' as sustainable and active forms of transport by:			AT4
	(a) Advocating for a regulatory framework to be established'	Protocol	Short	
	(b) Providing infrastructure (facilitated through the Mobility Hub Strategy); and	Project	Medium	
	(c) Undertaking promotional initiatives.	Project	Medium	
Special Events				
ITS 20	Consider how on-demand shared mobility options can provide a service capacity "top-up" for special events.	Protocols	Medium	PT20
Planning & Design				
ITS 21	Investigate how and where on-demand and shared mobility services might support and enhance the core PT network including the provision of supporting infrastructure and policy.	Protocol	Short	PT7, PT14, PT15
ITS 22	Support on-demand shared and micro-transit solutions to fill the gap in Ipswich's public transport network.	Protocol	On-going	TDM7, TDM9

Continued over...

NO.	ACTION	ACTION AREA	TIMING	iGO LINK
MOBILITY AS A SERVICE (MaaS)				
ITS 23	Advocate for the Queensland Government to: (a) Lead and promote MaaS; and (b) Explore prospects for new MaaS business partnerships and functional models in Ipswich that will complement their line haul public transport offerings currently operated by Translink and Queensland Rail. *This could include a MaaS product for the RAAF Base Amberley.*	Partnership	Short	R5, TDM3
ITS 24	Advocate for the **City Heart Cabs** Program and other community transport services to be included in the Queensland Government MaaS solution.	Protocol	Short	PT4, PT5
ITS 25	Understand and advocate the opportunity coming with MaaS as tools when travelling to and from schools and other large trip generators.	Protocol	Short	R5, TDM5, TDM6
ELECTRIC VEHICLES				
Electric Super Highway				
ITS 26	Advocate for EV charging stations to be included at key locations in Ipswich as part of Phase 2 of the Queensland Government's Electric Super Highway initiative.	Partnership	Short	R5
Parking and Infrastructure				
ITS 27	Encourage the deployment and uptake of electric vehicles through: (a) Inclusion of alternative parking codes and development incentives in the Ipswich Planning Scheme; and (b) Investigate, plan and provide dedicated on-street and off-street parking spaces and associated infrastructure in activity centres and in medium and higher density residential areas.	Protocol	**Signature**	R5, P8
E-Bikes				
ITS 28	Investigate the concept of purchasing a small fleet of E-bikes for Council staff to use when making small trips to test and showcase their capabilities and benefits.	Project	Medium	R5
CONNECTED & AUTOMATED VEHICLES				
C-ITS Trial				
ITS 29	Actively support the Queensland Government's C-ITS trial in Ipswich.	Partnership	**Signature**	R5
ITS 30	At completion of the C-ITS trial take learnings and potentially roll out infrastructure throughout the city for connected vehicles.	Project	Short	R5
ITS 31	Support ongoing C-ITS testbeds in Ipswich.	Partnership	Ongoing	R5
Autonomous Vehicles				
ITS 32	Support the use of Ipswich's road network as a testbed for Autonomous Vehicle trials.	Partnership	Ongoing	R5

Continued over...

NO.		ACTION	ACTION AREA	TIMING	iGO LINK
Uncertainty Planning					
ITS	33	Undertake **uncertainty planning** activities and scenario testing to prepare for the upcoming revolutionary nature of Connect and Automated Vehicles and thus position Ipswich at the forefront and better position Council's functional responsibilities and service delivery. This includes settings associated transport and land use planning, traffic and parking operations, development assessment, urban design, economic development and jobs, community development and investment prioritisation. *Activities could include:* *(i) Scenario testing;* *(ii) Discussion and research papers;* *(iii) Expert panel 'think tanks';* *(iv) Workshops with industry bodies and 'futurists'; and* *(v) Summits / Symposiums / Enquiry by Design forums.*	Protocol	Medium	R5, LU7
PUBLIC TRANSPORT					
Bus Stop Information					
ITS	34	Partner with the Queensland Government, bus service providers and the private sector to test and deploy digital passenger information solutions (such as wireless and solar powered screens and displays) at key bus stops and in major destinations and places of employment located across the city (e.g. Bell Street, shopping centres, universities and railway stations).	Partnership / Project	Short	PT2
On-demand Bus Services					
ITS	35	Investigate the merits, and advocate for, the introduction of on-demand bus services in: (a) New communities in greenfield areas such as Ripley, Deebing Heights and southern Redbank Plains; and (b) Growing urban fringe areas such as Chuwar, Karalee, Kholo, North Tivoli and Pine Mountain. *Users of such a service could be linked to:* *(i) Activity centres in Ipswich Central and Springfield Central;* *(ii) Public transport hubs at Ipswich Central, Springfield Central, Dinmore, Redbank and Goodna; and* *(iii) Major employment generators such as the RAAF Base Amberley.*	Partnership	Short	TDM8, PT15
ITS	36	Consider the use of an on-demand shared shuttle bus service linking periphery commuter car parks (e.g. Limestone Park) and the Ipswich City Centre core.	Protocol	Short	P12
ITS	37	Investigate how on-demand bus services could provide feeder bus services rather than fixed route/timetable.	Protocol	Short	P14, P15
ITS	38	Consider the role of ICC in 'first/last mile' on demand community transport services, particularly in existing urban fringe and new greenfield communities.	Protocol	Short	PT21
Railway Station Accessibility Design					
ITS	39	Consider CAV, EV and shared mobility services in the accessibility design of all railway station types and functions including: (a) Dinmore, Redbank & Karrabin Railway Stations (key park 'n' ride stations); and (b) Future stations along the Ipswich to Springfield Public Transport Corridor;	Protocol	Short Medium	PT1, PT18, PT19, PT23

Continued over...

NO.	ACTION	ACTION AREA	TIMING	iGO LINK
ACTIVE TRANSPORT				
Data Collection				
ITS 40	Expand pedestrian and cyclist counters and install dynamic user counter display 'panels' on key commuter bikeways to promote their use and active lifestyles as well as a sense of community pride and ownership.	Project	Short	AT9, ATAP 9.1
ITS 41	Leverage public Wi-Fi, Safe City surveillance and future 5G platforms to understand pedestrian movement patterns in the Ipswich City Centre, Springfield Town Centre and other activity centres to plan and design pedestrian priority zones.	Protocol	Short	ATAP 2.1
Bikeway Lighting				
ITS 42	Trial the use of innovative lighting solutions on commuter bikeways including smart lighting and LED pathway lighting to improve delineation.	Protocol	Short	AT9, ATAP 6.5
Public Information				
ITS 43	Consider the development and deployment of a mobile device app and web-based solution to provide information on safe walking and cycle practices. This could be incorporated into the My Ipswich app or put through the Smart City Program's Healthy Living Lab and Digital Studio for development as the early makings of a MaaS product for Ipswich.	Protocol	Short	ATAP 9.1 & 9.2
Planning & Design				
ITS 44	Incorporate ITS applications in the planning and design of strategic commuter bikeways including delineation lighting, signs, route markers, public facing user counters and end of trip facilities.	Protocol	On-going	AT4, AT9, AT15, ATAP7.4
ITS 45	Investigate how cyclists and pedestrians can have priority and 'green by default' at signalised intersections, particularly at cycle track intersections and town centre environments.	Protocol	Short	AT13
ITS 46	Consider technology applications such as gamification, activity tracking tools, 'wearables' and end of trip facilities to promote sustainable travel behaviour.	Protocol	On-going	AT16
ITS 47	Use transport technology solutions as part of the planning, design and delivery of Active Town projects including wayfinding signage, interactive pedestrian crossings, delineation lighting and mobile device apps to enhance the user experience and active travel environment.	Protocol	Medium	ATAP 8.2
COUNCIL OPERATIONS				
5G Mobile Network				
ITS 48	Support appropriate deployment of 5G technology in Ipswich using public assets and municipal facilities such as smart street light poles.	Partnership	Short	R5
Safe City Program				
ITS 49	Explore avenues to potentially expand the capabilities of Council's Safe City Program to monitor road operations, traffic conditions, pedestrian and cycling movements and parking surveillance both in terms of technology capabilities and geographical reach.	Project	Short	R5
Waste Services Fleet				
ITS 50	Investigate the merits of installing sensors on Council's Waste Services fleet to measure and record road asset data and conditions.	Project	Medium	R5

Continued over...

NO.		ACTION	ACTION AREA	TIMING	iGO LINK
Light Vehicle Fleet					
ITS	51	Trial and evaluate EVs as part of Council's light vehicle fleet and if successful look at expanding EVs across the entire fleet. This will include the provision of supplementary infrastructure (workplace charging station) and enhancing Council's operational and maintenance expertise.	Project	Short	R5
Seamless & Contactless Payment					
ITS	52	Explore opportunities to incorporate access to Council related transport services (e.g. payment of parking fees, City Heart Cabs Program, bike hire scheme, shared and fleet vehicles) via: (i) Queensland Government's Go Card system; and (ii) Personal mobile devices	Partnership	Medium	R5
Unmanned Aerial Vehicles (UAVs)					
ITS	53	Build capacity in the to use UAVs (drones) for undertake Council business. This could include the following transport related activities: (a) Digital terrain surveying for road and bikeway design; (b) Construction site and safety inspections; (c) Marketing, promotion and community consultation (including 3D visualisations); (d) Aerial photometrics; (e) Road and traffic condition monitoring; (f) Parking and road reserve management and compliance; and (g) Before and after evaluation of road projects.	Project	Medium	R1, R2, R5, P3, F1 D5
CORPORATE					
Planning & Operational Frameworks					
ITS	54	Incorporate the outcomes of ITS Strategy, and transport technology generally, into the upcoming development of the following Council planning and operational frameworks:	Protocol	Short	
		(a) iGO Resourcing Strategy;			D1
		(b) iGO Risk Management Strategy;			D12
		(c) iGO Performance & Data Strategy;			D1
		(d) Annual 10 Year Transport Infrastructure Investment Plan;			LU7, ATAP7.4
		(e) iGO Way Finding Strategy;			AT5, ATAP6.1
		(f) iGO Road Safety Action Plan;			R10, AT14
		(g) iGO Freight Action Plan;			F1, F6, F14
		(h) iGO Direction Sign & Route Marker Action Plan;			R11, AT5
		(i) iGO Local Area Traffic Management Action Plan; and			R12
		(j) Parking Pricing Strategy.			P6

Continued over...

NO.		ACTION	ACTION AREA	TIMING	iGO LINK
ITS	55	Incorporate the outcomes of Strategy, and transport technology generally, into the next update to the following Council planning & operational frameworks: (a) Ipswich City Centre Commuter Parking Master Plan; (b) Ipswich Planning Scheme (particularly shared mobility services); (c) Ipswich Local Government Infrastructure Plan (including a benchmark cost for ITS infrastructure); (d) iGO Active Transport Action Plan; (e) iGO Public Transport Advocacy & Action Plan; and (f) iGO Parking Strategy.	Protocol	Ongoing	 TDM2 LU6, LU7, LU11 LU9 D1, LU7 PT7 P15, TDM2
ITS	56	Research, benchmark and include appropriate monetary amounts for the maintenance (routine and programmed) and rehabilitation of ITS infrastructure in future Council budgets. This includes on-going software licence fees, telemetry, computing and data storage costs.	Protocol	Ongoing	n/a
Governance					
ITS	57	Convene a cross functional and multi-disciplinary **Technical Working Group** to oversee the planning, design and staged implementation of: (a) Road operations technology and team (including the Road Information System / Portal); (b) Ipswich Smart Parking Solution; (c) Car and ride sharing infrastructure and parking specification, standards and design; and (d) EV infrastructure and parking specification, standards and design *The Terms of Reference of the technical working group will be to guide the following activities:* *(i) Project feasibility investigations;* *(ii) Design & specification;* *(iii) Market sounding & procurement;* *(iv) Trials and evaluation; and* *(v) Benefits realisation.*	Protocol	Short	n/a
ITS	58	Investigate and establish an appropriate formal governance structure for the planning, design and deployment of ITS initiatives, trials and activities. This includes both strategic, operational and technical decision-making frameworks to ensure transparency, accountability and collaboration.	Protocol	Short	n/a
Procurement					
ITS	59	Use the Smart City Program's procurement framework where practical for the execution of the ITS Strategy and associated initiatives. This could include: (i) Testing of performance-based specifications (not prescriptive); (ii) Market sounding techniques; (iii) Liaison with industry bodies including briefings, expression of interest and reverse briefs; (iv) Pilot projects and trials; and (v) Evaluation (technical and user effectiveness).	Protocol	Ongoing	n/a

Continued over...

NO.		ACTION	ACTION AREA	TIMING	iGO LINK
Standard Drawings					
ITS	60	Prepare, and regularly update, a suite of standard drawings relating to road based ITS applications using best practice innovation in design and specification. This could include the configuration of EV charging stations and bike scheme docks on verges to ensure a quality pedestrian environment and streetscape.	Protocol	Ongoing	R1, R5, LU6
Urban Planning & Design					
ITS	61	Investigate ITS applications that can assist Council in achieving the **Complete Communities** urban model ("10- minute neighbourhood" & "20-minute city").	Protocol	Short	LU3, TDM1
ITS	62	Consider how services like EV charging, bike share docks etc are designed and implemented in streetscape and urban design to maintain quality pedestrian environments.	Protocol	Short	LU6, PT3, R5
ITS	63	Advocate for TMR to enhance the **Land Use and Public Transport Accessibility Index** (LUPTAI) tool by including shared mobility and on-demand transport options.	Protocol	Medium	LU10
iGO Delivery					
ITS	64	Use the ITS Strategy to help advocate the 'clever new thinking' and 'proper investment' mantras as part of a sustainable transport agenda for Ipswich.	Protocol	Ongoing	D1, R5
ITS	65	Use the ITS Strategy as an advocacy tool to attract investment and funding partnerships.	Partnerships	Ongoing	D4
ITS	66	Use ITS and modern technologies to assist with stakeholder engagement to ensure informed transport decisions can be made.	Protocol	Ongoing	D5
ITS	67	Use the iGO 'brand' as part of the delivery of the ITS Strategy.	Protocol	Ongoing	D6
ITS	68	Capture opportunities to partner with universities, research organisations (e.g. ARRB), the Smart City Program's Healthy Living Lab and Digital Studio and industry bodies (e.g. ITS Australia, Austroads, AITPM, ASCA) to undertake and sponsor research and development of transport technology initiatives. This should focus on an integrated road and travel data platform; road operations centre and smart parking solution in the short term. Other research elements could be the impact of AVs on urban function and form and the development of a MaaS product for Ipswich.	Partnership	Ongoing	D7
ITS	69	As part of the ITS Action 1 (Road Operations), collect real time data on transport system use and performance to assist with the prioritisation and programming of network investments and the development of the annual **10 Year Transport Infrastructure Investment Program.**	Protocol	Ongoing	LU7, D8, ATAP7.4
ITS	70	Include the execution of the ITS Strategy in the production of the **iGO Annual Report Card.**	Protocol	Ongoing	D10
ITS	71	Undertake a minor review and adjustments to the ITS Strategy every two years.	Protocol	Ongoing	D11
ITS	72	Incorporate ITS and transport technology risks in the development of the iGO Risk Management Plan to ensure it integrates with other identified risks and the associated mitigation strategy for the execution of iGO. This should include risk associated with data security and privacy, redundancy in technology, integration and interoperability.	Protocol	Ongoing	D12
ITS	73	Incorporate the outcomes of the ITS Strategy into the next major review of iGO.	Protocol	Short	D15

DELIVERY

The tools that Council will use delivery the Strategy to accomplish strategic results is outlined below. This chapter aligns with the overall iGO delivery framework and Smart City Program model. Figure 44 outlines the tactical steps in bringing a strategic vision to reality:

Step 1: Formulation of this Strategy in alignment with Council's transport and smart city aspirations;

Step 2: Operational and institutional processes to position Council to be ready for effective implementation; and

Step 3: Implementing the recommended actions

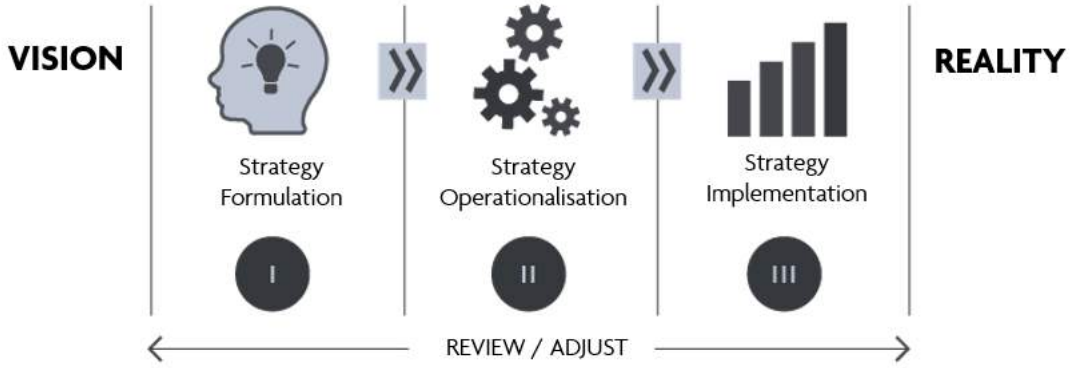


FIGURE 44: Tactical steps in bringing the vision to reality

Source: Stratecon-group.com/en/model

PROCESS

The deployment of ITS initiatives will involve complexities across a range of different systems, processes and platforms. This will make Council investment decisions difficult for both capital and operational funding. As outlined previously, Council is actively seeking partnerships with government, industry and the community to explore, test and deploy the various ITS actions outlined in the Strategy.

Figure 45 outlines the delivery lifecycle that Council will employ internally to guide activities of the ITS program and projects. It shows Council's bottom up approach to ensure that investment decisions and actions are well considered, are made on sound judgement and are transparent, justifiable and accountable.

FIGURE 45: ITS Program & Project Delivery Lifecycle

A program or project must pass through a resourcing 'gate' at the end of each phase before continuing onto the next phase.

The **Exploration** phase is to understand the key foundation elements that will govern a well-designed ITS product. It covers ideas and research into areas such as system requirements, security and management, identification of desired outcomes and potential funding sources, concept design and specification.

If the program or project proceeds to the **Development** phase, activities such as marketing sounding, the formulation of performance measures, prototype design, trials and testbeds.

If the trial proves effective, the ITS program or project will proceed to the **Adoption** phase for wider-scale deployment. This will include procurement and contracts, model design and the facilitation of operational and maintenance protocols.

Both the Exploration and Development phases are iterative and include evaluation along the way. Discoveries may feed back into the previous stages of Exploration and Development as new technology emerges and challenges of the technology are identified.

Throughout the lifecycle, Council will continually address resourcing and capability issues (human and capital), engage with industry stakeholders, work with testing partners and government agencies and track technology trends. This will ensure Council takes an agile approach to technology and change.

PROCUREMENT

Effective procurement is one of the key enablers of this Strategy to ensure Council can engage with innovative opportunities while maintaining its legislative procurement obligations.

Council has adopted the *Smart City Innovative Proposals Policy* to streamline relevant procurement and encourage the market to bring innovative proposals, products and services to Ipswich. Council will also engage with the ITS industry and undertake market sounding activities for various ITS programs and projects before prototype design takes place and formal partnerships are established

As part of its Smart Infrastructure policy agenda, the Queensland Government will soon be establishing an *Infrastructure Innovation Taskforce* whose terms of reference will include examining and making recommendation on the efficiency of procurement processes relating to innovation. For more effective procurement of ITS applications, Council supports a less prescriptive, more outcomes and performance-based process and using trials and pilot projects to test and evaluate initiatives before wider deployment.

RESOURCING

The current reality of a globally constrained fiscal environment presents a significant challenge for government investment to keep pace with growth. However, there are many benefits of transport investment and there is also a high cost (an economic, social, environmental and cultural price) of doing nothing.

The introduction of ITS applications has the potential to assist governments in addressing safety, reliability and resilience issues on their transport system in a cost-effective manner and may even lead to the delay or avoidance of funding major transport infrastructure projects in the future.

As part of the execution of iGO, Council will develop an **iGO Resourcing Plan** that will evaluate the resources (human, operational and capital resources) needed to facilitate the outcomes aspired by iGO and deliver on its recommended actions. The *iGO Resourcing Strategy* will include assessment, benchmarking and recommendations on corporate capacity including organisational structure and personnel, business processes, skills, expertise, people development, affordability, funding and financing.

The role ITS will play in filling the gap between available resources and future needs is critical in this regard. As part of the development of the iGO Resourcing Strategy, a benchmarking exercise will be undertaken that considers the merits of establishing a dedicated and expert transport technology team within Council's transport and traffic program with a focus on transport system data analysis and performance monitoring and the coordination of trials and actions outlined in the Strategy.

RISKS

While ITS applications will provide new opportunities to deliver a safer, more reliable, resilient and sustainable transport system, some of the underlying risks that accompany such digital initiatives are outlined in Table 20. Through an understanding of these risks together with robust operating frameworks and processes, some of these risks can be mitigated and minimised.

TABLE 20: Some Potential Transport Technology Risks

CATEGORY	COMMENT
User Privacy, Data Security and Legislation	As digital systems continue to advance, the user data that they collect becomes ever more personal. The connected nature of such systems also means that, much of this data is often collected, stored and processed through sensors via the internet. Such data helps to drive forward evidence-based policy and analysis while helping to influence improvements in the overall transport system. However, this collection, processing and storing of data also raises concerns around ensuring such systems are secure and user privacy is treated with upmost importance. Council will ensure privacy aspects are clearly understood and appropriate mitigation and management strategies are put in place to protect against data breaches and unauthorised access. The widespread collection of user data through connected infrastructure also brings to light the roles and responsibilities of the governing public service authority. The General Data Protection Regulation (GDPR) and the updated Australian Privacy Act of 1988 are two of the more recognised pieces of legislation that control the collection, storage, processing and reporting of data. Such digital initiatives often bring together many stakeholders across all levels of government, the private sector and from the community. With uncertainty surrounding the way in which such technologies will be regulated, it is important to ensure that public interests are protected, and appropriate safeguards are in put in place. Concurrently, Council will work together with other stakeholders to ensure such legislation is well shaped to protect the Ipswich community against such vulnerabilities. Projects will be based on sound legal frameworks and governance that sets a strong foundation to prevent the misuse of such technology within our transport system.
Reliability and Dependency of Technology	When city transport systems have critical data and infrastructure linked into single, controlling technology driven systems, they are often at risk for breaches and systems failures. It becomes ever more important to ensure that such systems account for this and have appropriate safety and operational mechanisms to provide the required reliability that is needed. This is further underpinned when such systems are inter-connected with other systems, where such inter-dependencies raise the possibility of unforeseen system failures as well as unauthorised security breaches. When considering the design, procurement and implementation of transport technology initiatives, Council will develop a framework that enhances reliability and security of such technology and carefully considers consequences of failure and appropriate redundancy in operations.
Commercial and Procurement	As Council looks to advance transport technology and digital systems on a citywide scale, we will need to work and partner with other public and private sector organisations to deliver such projects. Whilst these partnerships will be mutually beneficial, bringing together considerable collaborative benefits, Council also understands there may be potential commercial and procurement barriers and pitfalls. With the ever-changing technology and digital landscape, there are risks associated with making large capital investments on technologies that might become redundant quickly. Similarly, market led proposals and complicated commercial agreements on such projects may risk Council being locked into proprietary technology or software services, opening the door to exploitive pricing and control imbalances. Whilst Council will look at the merits of establishing an outcome and performance-based procurement framework for smart city projects, an expert, well-informed internal team will help safeguard against some of these risks. Where possible, open source alternatives can help reduce the reliance on proprietary software and services. All projects must be carefully considered on their own merit to understand the value they deliver and how they align with the overall strategic roadmap for Council.

The **iGO Risk Management Strategy** has identified risks associated with its delivery and outline a risk mitigation and monitoring strategy. This includes narrative on transport technologies integrated with other transport risks. Components of the ITS Strategy will be included in the annual review of the risk management strategy.

EVALUATION

Both the Strategy itself and its individual initiatives will be evaluated as part of the overall iGO assessment and reporting processes. The various elements of Councils evaluation, as outlined in Table 21, will be used to gain insights into how the Strategy is tracking. The evaluation will identify areas for change, improvement and provide insight on the performance and derived benefits of each initiative. This assessment will ensure that investment decisions are made using justification and are accountable.

> "However beautiful the strategy, you should occasionally look at the results"
>
> **Sir Winston Churchill**
> British Prime Minister
> (1940-1945 & 1951-1955)

TABLE 21: Evaluation Elements

ELEMENT	COMMENT
Benefits Realisation	There is no value in investment in a transport technology application if it cannot or does not deliver the benefits that were promised. Council will undertake a 'benefit realisation' process at the front and back end of every pilot project to identify the potential benefits (both tactical and technical) and then evaluate their realisation or otherwise. Through this framework Council will: • Map the intended benefits and broader success factors at the front end at both the tactical and technical levels; • Track the benefits during the pilot project including establishing performance baselines; and • Evaluate the benefits at the back end against those mapped at the front end.
Strategy Monitoring	The Strategy's implementation will be monitored as part of the overall iGO process to track progress towards achieving its vision, objectives, mode share targets, policy focus areas and actions. This will involve the production of an **iGO Annual 'Report Card'** that will provide a snapshot of the achievements of delivering iGO over the previous year and the key actions for the next year. Further narrative on Council's monitoring process will be determined as part of the development of the overarching **iGO Performance and Data Strategy**. From here, planning, funding, infrastructure and service delivery priorities will be adjusted where required in response to technology changes and the introduction of new applications as they emerge onto the market.
Strategy Review	Given the current rate of development and introduction of new transport technologies onto the market, minor reviews to the Strategy will be undertaken continuously. Incorporated in the iGO Performance and Data Strategy will be the requirement to undertake a major review of iGO every five years (the next being 2021) to assess progress and the 'value for money' achieved during the previous five-year period. Major reviews will involve an assessment of the identification of the impacts on Ipswich residents travel behaviour and trends relative to monetary investment and progress towards each policy focus, the mode share targets, objectives and vision. The outcomes of this Strategy will be incorporated into the next major review of iGO. A major review of this Strategy will be undertaken every five years. This will provide an opportunity to identify any 'lessons learned', adjust priorities for the next five-year period where required and be responsive to further planning work undertaken by the Queensland Government, new technical documents and legislative changes.
Performance Indicators	iGO's monitoring and review processes will be undertaken with the assistance of performance indicators including such measures as parking availability, public transport patronage, network usage, crash and incident analysis, household travel patterns and network connectivity. As part of the development of the **iGO Performance and Data Strategy**, the required performance indicators, evaluation measures and data types required (including its collection and analysis) will be identified and implemented.

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