Transport Services Strategy and Framework for ITS Roadside Assets on State Highways

September 2025

Version 1

NZ TRANSPORT AGENCY
WAKA KOTAHI

Te Kāwanatanga o Aotearoa
New Zealand Government

1. Scope

The document, "Transport Services Strategy and Framework for ITS Roadside Assets on State Highways", outlines the approach for applying and leveraging Intelligent Transportation Systems (ITS) across the State Highway network in New Zealand. It establishes a clear vision, guiding principles, and a flexible framework to ensure ITS remains relevant and effective in meeting the evolving needs of the transportation landscape.

2. Referenced Documents

The following documents are referenced in this Specification:

2.1. Waka Kotahi New Zealand Transport Agency

Reference	Title
	ITS standards and specifications (S&S)
ITS-STND-RITS-202302	Requirements for Intelligent Transport Systems

3. Quality

Action	Name	Signed	Date
Owner	Kathryn Musgrave		
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4. Definitions

The following definitions apply to this Specification:

Term	Definition
CCTV	Closed-Circuit Television
ConOp	Concept of operations
IoT	Internet of things
ITS	Intelligent Transportation Systems
M	Movement
M&O	Maintenance and operations
NLTF	National Land Transport Fund

NOF	Network Operating Frameworks
NOP	Network Operating Plan
NZTA	NZ Transport Agency
ONF	One Network Framework
P	Place
SCATS	Sydney Coordinated Adaptive Traffic System
SH	State Highway
SVL	Special Vehicle Lane
TOCs	Traffic Operations Centres
VMS	Variable Message Signs
V2X	Vehicle-to-Everything

5. Introduction

5.1. Purpose of the document

The Transport Services Strategy and Framework for Intelligent Transportation Systems (ITS) Roadside Assets sets the approach for the application and leverage of ITS across the State Highway (SH) network by establishing a clear, overarching vision and guiding principles for the planning, design, and implementation of ITS. By providing a flexible framework that accommodates changing government priorities and technological advances, the strategy ensures that ITS remains relevant, adaptable, and effective in meeting the evolving needs of the SH transportation landscape.

In recognition of the continuous development and updating of new technologies to monitor, manage and inform movement across New Zealand, this strategy aims to fill a crucial gap: There is currently no published comprehensive ITS strategy guiding the nationwide development of these systems. ITS initiatives are often executed on a project-by-project basis, lacking a cohesive, big-picture perspective on how individual projects integrate into New Zealand's broader ITS infrastructure.

This strategy is designed to define long-term goals and outline a systematic plan for achieving them. A key component will be the ITS Framework, which delineates the implementation process through a Minimum Standards document to identify the required ITS equipment tailored for various corridor types. Additionally, the strategy will establish performance metrics to evaluate the success of ITS implementations, ensuring that goals are met and providing a basis for continuous improvement.

5.2. What is ITS?

ITS is the amalgamation of sensors and data collection, processing, and communication used to understand and influence the transport system. ITS can improve transportation infrastructure's safety, resilience, and efficiency. ITS can bridge the gap between the data collected on the network and the road user to guide decision-making, improving customer experience and network performance. As transport networks become increasingly complex, the role of ITS expertise in system design, standards, specifications, delivery, and operations will become increasingly important.

Examples of ITS technologies:

- demand or capacity management services through ramp signals, tidal flow systems, e.g. moveable barriers on bridges, managed motorways, capacity management or dynamic lanes, and bus priority schemes
- messaging through traffic signals, adaptive signs, and variable message signs
- detection through loops, radar, cameras, IoT sensors
- communication through mobile data, radar/radio, and wired connections, e.g. Variable Message Signs, Changeable Message Signs, Lane Control Units
- connected vehicles that can communicate with each other, infrastructure, other road users and the internet
- autonomous vehicles that can operate without human interaction
- compliance management through speed cameras, red light cameras, Special Vehicle Lane (SVL) compliance.

ITS expertise plays a vital role in system design by ensuring that appropriate technologies are seamlessly integrated throughout the various phases of projects. Specialists in ITS understand the specific requirements of different technologies, which can be critical elements incorporated into larger projects but can also form the basis of interventions. Incorporating ITS knowledge in the delivery, maintenance, and operations (M&O) phases is also essential; therefore, careful consideration must be given to where these resources are allocated within project teams and the design process and programme.

ITS technology is constantly evolving and changing, and we must be on top of these changes to stay relevant and continue to achieve the outcomes required for New Zealand.

5.3. History of ITS in New Zealand

1930s - Dunedin becomes home to the first traffic signals in New Zealand, establishing a foundation for managing vehicle movements and enhancing road safety.

1930s-1980s - urbanisation progresses and traffic signal systems adopt more advanced technologies.

Mid-1980s - the Sydney Coordinated Adaptive Traffic System (SCATS) connects traffic signals to optimise flow, reduce congestion, and improve urban transport network efficiency.

Late 1990s - Traffic Operations Centres (TOCs) are set up as part of hosting APEC in Auckland, allowing a more coordinated response to incidents and improved overall traffic management.

1997 - the first CCTV cameras are installed on Auckland's southern motorway to monitor traffic management for APEC, with cameras connected to the TOC by radio.

Early 2000s - the All Traffic Management Services (ATMS) programme begins with the growth of traffic counting stations, VMS and CCTV across the Auckland Motorway network.

2004-2008 - fibre is laid in Auckland Motorway corridors allowing development of a 96-core fibre network to support the infrastructure needed for effective ITS operations, with greater security and bandwidth than the previous radio network.

2006-2013 - New Zealand's transport network sees significant advancements, particularly with the Auckland Motorway Travel Demand Management project. ITS elements include:

- ramp signals to manage merging traffic at motorway entrances
- variable speed limits to optimise traffic flow
- VMS and CCTV systems
- Estimated Journey Time System to improve journey reliability and safety.

2007 - a turning point in the rapid development of ITS, characterised by the nationwide rollout of VMS which enhances communication with drivers about real-time traffic conditions.

2013 - technologies continue to advance. Improved mobile and fibre networks support ITS coverage, alongside key steps in incident detection such as ice detection systems.

2013-2018 - Stage 1 of the Wellington Smart Motorway integrates ITS technologies, followed by Stage 2. Variable speed signs manage congestion during commuter peaks and comprehensive tunnel management systems are developed, among other measures.

The use of cameras proliferates - CCTV is used for surveillance, red-light running detection, and special vehicle lane enforcement to improve road safety and efficient operations.

The Rural VMS Programme complements these initiatives through extending the benefits of modern traffic management solutions to less urbanised areas.

2014 - the Ministry of Transport publishes the Intelligent Transport Systems Technology Action Plan 2014-18 *Transport in the digital age*. The Plan promotes ongoing improvements in traffic management and efficiency through advanced technologies, and leads to innovative ITS trials.

2018 - New Zealand begins exploring groundbreaking technologies by testing autonomous vehicles in the Christchurch Red Zone, and a trial for air taxi systems is held in Canterbury.

2018-2019 - the Ohmio Autonomous Airport Shuttle is trialled in Christchurch, further showcasing NZ's commitment to integrating autonomous technology into its transport system.

Together, these developments reflect New Zealand's commitment to enhancing its transport network through intelligent systems and innovations, paving the way for a safer, more efficient, and future-ready transport environment. By continuously integrating advanced technologies like ramp signals, variable speed limits, VMS, special lane enforcement and tunnel management systems, New Zealand is well-positioned to adapt to evolving transport challenges.

Case Study: the Auckland Network Optimisation Programme

The Auckland Network Optimisation Programme is a smarter approach to improving the operation of Auckland's transport network. By using Intelligent Transport Systems (ITS), the programme focuses on making traffic signals work more efficiently and improving connections across the network, benefiting all road users.

Guided by the Network Operating Plan (NOP), the Traffic Signal Optimisation programme prioritises key movements during peak commuting times to reduce congestion and keep traffic moving smoothly.

The programme has also enabled real-time incident management, resulting in quick responses to disruptions and maintaining better overall network performance, even during heavy traffic.

Another important part of this approach is monitoring how well the network is performing, which helps pinpoint problem areas and measure the success of various ITS interventions. In addition, a range of technology-driven solutions have been introduced to better manage travel demand. These include dynamic lanes, enforcing Special Vehicle Lanes, and warning systems designed to improve safety for cyclists and motorcyclists on urban roads.

Similar strategies could be applied in other cities across New Zealand to achieve better transport outcomes.

6. Strategic Context

6.1. Transport in New Zealand

Transport, particularly the road network, plays a vital role in New Zealanders' daily lives. It serves as the backbone of the economy, enabling people and goods to move across the country's diverse landscapes. However, the transport system faces various challenges that require innovative solutions and strategic planning.

Current issues facing transport in New Zealand include population growth, economic changes, the rising costs of maintaining and upgrading infrastructure, technological advancements, and ongoing road safety concerns. As the population increases, urban areas experience higher traffic volumes, resulting in congestion that puts additional strain on existing transport systems.

To improve the transport system, it is necessary to better connect transport planning with land use development. This can make it easier for rural communities to access services and create more connected towns and cities. ITS can be central to achieving this by making traffic flow more smoothly, providing real-time information, and improving how goods are transported. By embracing technology and new ideas, New Zealand can create a safer, more efficient, and resilient transport network that meets people's changing needs and supports economic growth.

6.2. Arataki 30-year plan

Arataki, first published in 2019, is a vital framework for planning, developing, and investing in New Zealand's land transport system over the next 30 years. By establishing a strong collaborative foundation, Arataki provides direction on how various sectors can work together to deliver a transport system that will keep Aotearoa New Zealand moving.

At the core of Arataki is its alignment with the Transport Outcomes Framework, which sets long-term objectives for the transport sector. This framework supports greater understanding of the system's significant challenges, applying an outcomes-led strategic approach, and promoting a transport system that enhances well-being and creates vibrant communities.

A three-part conceptual framework is applied to achieve the desired long-term outcomes.

1. Understand the challenges - identify the most significant opportunities through:
   - assessing the transport system's current state
   - examining key drivers of change
   - recognising outcome gaps.

2. Focus efforts on initiatives that provide the most significant benefit across multiple outcomes, through:
   - employing a whole-of-system perspective
   - collaborating with partners
   - using evidence-based methods
   - tailoring solutions to address unique regional needs.

3. Clear direction will guide efforts toward the right initiatives, at the correct scale and timing, through:
   - identifying what is necessary for success
   - highlighting priority areas for focus
   - monitoring progress to ensure accountability.

Arataki has significantly influenced the development of this Strategy, through a focus on improving the functionality and safety of roadside infrastructure while ensuring that these assets contribute effectively to the overall system performance. This strategic alignment enables the adoption of advanced technologies and real-time data analytics to improve the management of roadside assets, facilitate safer travel, and enhance traffic flow. Alignment of the ITS strategy with the goals of Arataki will result in a more cohesive and adaptive transport system that responds proactively to evolving challenges.

6.3. Digital Strategy Auahatanga

Digital Strategy Auahatanga aims to enhance NZTA's digital capabilities, including those connected to roadside ITS, to promote a safer, more efficient, and sustainable transport network. The Digital Strategy focuses on three key outcomes relevant to roadside ITS.

Simplifying and Modernising the Digital Ecosystem:

The development of robust, user-friendly solutions for roadside ITS that prioritise data security and user safety.

Delivery of reusable enterprise platforms for traffic management, smart sensors and surveillance systems will ensure seamless integration with existing infrastructure.

Implementation of modern methods and automation in roadside asset management will leverage machine learning and AI, to optimise traffic flow and support real-time decision-making.

Digitising Roadside Transport Services and Solutions:

The utilisation of smart data and digital technologies to manage roadside assets, including traffic signals, variable message signs, and surveillance cameras.

Automation will be employed for revenue collection (e.g., tolling systems), improving operational excellence through real-time monitoring and enforcement to ensure regulatory compliance and efficient resource use.

Customer Digitisation for Enhanced Roadside Interactions:

The creation of engaging digital channels that enhance user experiences at the roadside, improving safety and operational efficiency.

Real-time communication between road users and roadside systems will provide accessible information on traffic conditions, detours, and travel safety, fostering informed decision-making regarding mode shifts and climate impact.

To achieve these outcomes, it is essential to strengthen foundational digital capabilities for roadside ITS while fostering collaborative partnerships with technology providers and stakeholders. Embracing industry innovations—such as Digital Engineering for asset management, intelligent data analytics for performance monitoring, and AI for operational insights—will be crucial. Accelerating digital transformation is a top priority for both the Government and NZTA, focusing on enhancing transport safety, efficiency, and sustainability. NZTA manages critical systems, including the Driver License and Motor Vehicle Registers, and aims to leverage digital technology to improve service delivery, reduce costs, and boost productivity.

6.4. Transport Operations Centres Future State Proposal

The Transport Operations Centres (TOCs) in New Zealand have not maintained pace with changing customer needs, technology advancements, and network demands. A Future State Proposal has been drafted to outline the specific challenges, identify solutions, and request funding for implementing the solutions.

The challenges outlined by the TOCs include customer experience, TOC resilience, efficiency and effectiveness, network optimisation, and changing technology. These are proposed to be addressed through the following strategic shifts.

- **Fit for Purpose Operating Model:** Implement an operating model that delivers the 4 objectives of Future State, operates Auckland as an integrated network, and enables consolidated and consistent services, processes, digital tools and employment T&C. It will provide clarity of partnering, funding, performance and governance.
- **Travel Information and Advice:** Provide engaging and timely information on the current and expected state of the network to enable customer choice and decision-making. Increase the use of travel information as a lever to optimise the network. Utilise channels that suit customers, ensuring that there is a high level of public trust in the information
- **Partner Framework:** Effectively collaborate with partners to optimise joint responses to network operations, enabled by a foundation of high-quality shared information and a shared framework that clearly defines roles, responsibilities, and agreed outcomes.
- **Strategic Network Optimisation:** Ensure new infrastructure is designed with Operations requirements incorporated. Development of Network Operating Frameworks (NOFs), Network Operations Plans (NOPs) & Concepts of Operations (ConOp) to guide the operation of the network where appropriate. Provide greater input and influence on the initiation of interventions that require capital investment.
- **Tactical Network Optimisation:** Improve the efficiency and reliability of customer journeys by utilising all available tools including data and technology, both within the TOC and on the network. Leverage data and technology to predict, plan, and optimise to deliver an efficient, safe and reliable transport network that benefits all users (e.g. ITS, data analytics, modelling, real time situational awareness, enforcement).

The TOC Strategy identified initiatives to deliver the future state which include investment or use of ITS assets and associated data. Alignment between the different strategies and outcomes allows for more efficiency in delivery, as the initiatives can incorporate the principles and outcomes outlined in this document. This Strategy and Framework for ITS Roadside Assets is aligned with these initiatives including data sharing agreements, operating plans, developing an ITS strategy to set aspiration and standards (this document), network management, real time situational awareness tool, and a One Network source of truth.

7. Vision

7.1. Vision Statement and Objective

Our vision for ITS in New Zealand outlines what we want to achieve as Transport Services. The vision is supported by our objective, core principles, focus areas, and outcomes to guide NZTA on when, where and how to implement ITS on the SH network.

> **Better choices, better journeys through technology driven intelligence.**
>
> To leverage operational technology that enables safer, resilient, and efficient journeys through collection and communication of intelligence across the entire State Highway network, which aids decision making and gives direction and information to customers.

7.2. Core Principles

Core principles will help provide a sound, coherent basis for decision-making. These principles are relevant for ITS across any policy change and enable 'line of sight' to maintain a consistent transport network across all sectors.

Existing infrastructure

The strategic optimisation of the existing network is a fundamental principle guiding the future approach to ITS. Optimisation, in this context, means getting the most out of the existing system to achieve the best possible performance outcomes safely and efficiently. This includes implementing high-benefit, small-scale initiatives that can be executed quickly. These serve to enhance the movement of people and goods while appropriately balancing transport needs with the values of 'place' and creating liveable communities.

The optimisation of the existing system and network acts as a critical enabler for an economically efficient and resilient transport system. It can have a transformative impact on how the network is used now and in the future. By leveraging advanced technologies and data-driven insights, existing network performance can be improved, delaying or avoiding the need for significant investments in new infrastructure.

This principle aligns with the Intervention Hierarchy for National Land Transport Fund (NLTF) investments, which prioritise integrated planning and demand management. Applying this hierarchy reinforces the importance of maximising existing network use before considering new infrastructure needs. Through continuous monitoring and analysis of traffic patterns and user behaviour, ITS empowers decision-makers to identify and make changes that reduce congestion, enhance safety, and improve travel time reliability for all road users. Ultimately, this approach reinforces New Zealand's strategic goals in transport infrastructure development and contributes to communities' economic and social well-being.

Customer focus

The ITS that is researched, designed, and put onto the network should benefit all the customers.

'Customer' can include public road users, traffic operations centres, and transport planners. The types of ITS used and how data is collected and distributed should be relevant to the customer's needs. For example, public road users need to know the location of road closures, available detour routes, and likely delays so they can make informed decisions about route choice before reaching major decision points and adding to congestion. Traffic operations centres need to understand where incidents have occurred and what impact they will have so they can inform road users of the best routes to take. Transport planners need to know where incidents happen most frequently, travel patterns, locations of traffic congestion, route choice, mode type, and the environmental factors that influence road user decision-making.

Innovation

The world of ITS is always developing, including autonomous vehicles, smart motorways, and Vehicle-to-Everything (V2X) infrastructure. Understanding international trends and new technologies can benefit New Zealand and open new markets, such as vehicle technology.

The proactive involvement of ITS specialists in anticipating future needs is crucial as transport networks evolve. Their insights into changing transport patterns, user behaviours, and technological advancements enable efficient, adaptable, and responsive systems to be designed. This forward-thinking approach not only embraces current innovations but also prepares the transport system to leverage future advancements for the benefit of all users.

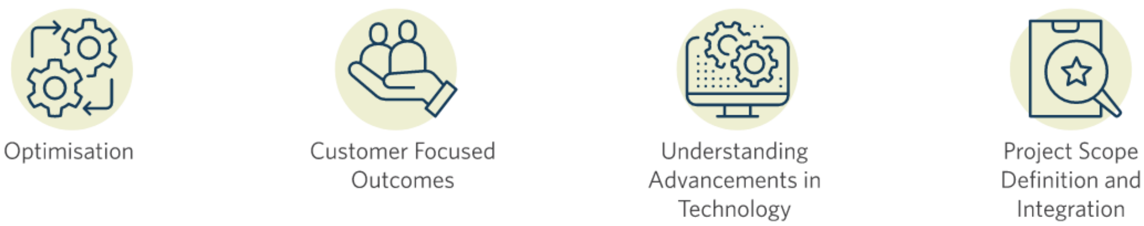
Integration

Given New Zealand's legacy ITS infrastructure, this strategy emphasises the integration of new systems with current assets rather than replacing them entirely. Effective integration is critical to creating a fully connected transport network and should not hinder the adoption of new and innovative technologies. Rapid advances in areas such as predictive analytics, traffic management systems, autonomous vehicles, intelligent traffic signals, and connected infrastructure present challenges and opportunities for efficient operations and user experience. ITS professionals can navigate these advancements to maximise benefits while avoiding risks associated with implementation costs, behaviour changes, or potential obsolescence.

Integration extends beyond newly developed ITS systems, including collaboration with third-party systems and applications. Information about transport network performance and availability can be shared with road users through various channels, including platforms like Google Maps, which can alert people in real-time about changes in the transport network, even in rural areas where traditional Variable Message Signs may not be feasible. Seamless information sharing across different systems promotes a transparent, accessible and efficient transport network.

8. Focus Areas

The following focus areas have been identified to prioritise developing and integrating ITS and enable ITS solutions to effectively contribute to the overarching goals of safety, efficiency, and user satisfaction within New Zealand's transport network.



8.1. Optimisation

The strategic integration of ITS is crucial for optimising the State Highway network (SH network) and improving its overall performance during planned and unplanned events. When the SH network is optimised, it reduces the impact of incidents on customers as events are detected quickly, early and accurate information can be shared, and solutions promptly deployed. This optimisation can be achieved through:

- Automated systems and CCTV monitoring allowing for rapid incident identification, lowering response times, reducing disruptions to traffic flow, and improving safety for all road users.

- Data collected through ITS assisting NZTA to develop operational strategies, plan long-term, and make informed decisions regarding network enhancements and resource allocation.
- Advanced ITS technologies such as adaptive traffic signals, real-time traffic monitoring, enforcement, predictive analytics and variable message signs helping to optimise traffic flow, manage congestion and improve safety.
- Integration of multimodal transport solutions, promoting efficient connections between public transport, cycling, and pedestrian routes.
- Real-time information on traffic conditions improving user engagement and supports sustainable transport practices, such as reducing reliance on single-occupancy vehicles.

Strategic deployment of ITS can transform the SH Network into a responsive and efficient transport system, aligning with New Zealand's commitment to creating sustainable and effective transport solutions for the future. A Concept of Operations (ConOp) is essential for optimising existing systems, articulating the vision and goals for ITS implementation, and ensuring that all stakeholders, including transport planners, road user representatives, and government agencies, are aligned with the operational strategies and intended outcomes.

8.2. Customer Focused Outcomes

The customer is at the centre of ITS and is critical to developing what types of ITS should be used and in what situations. The term ‘customer’ is not confined to road users; it includes transport operations centres, decision-makers, traffic engineers and planners. Each customer group interacts with ITS technology and uses the information differently. Having a complete understanding of how events are detected, the flow of information, and the types of decisions being made helps to inform the types of technology, structure of data, and prioritisation of ITS at different stereotypes of the transport network.

The base needs of each customer group should be determined through a range of consultation methods so that a full understanding of the reasons for different uses and decisions can be gained and reflected in the Concept of Operations.

8.3. Understanding Advancements in Technology

ITS is a rapidly evolving field and as such benefits from significant investments in research and innovation worldwide. As a small economy, New Zealand relies on international collaboration to stay ahead in ITS technology, leveraging global developments for better transport outcomes.

Key advancements often arise from car manufacturers, mapping companies, universities, and the private sector. To maximise benefits, New Zealand must develop complementary infrastructure to support emerging technologies such as connected vehicles and improve incident detection through data sharing with companies, especially in remote areas. Integration into an overarching ITS framework is crucial for efficient data processing, timely decision-making and communication with users. However, careful planning is needed as ITS technology evolves quickly, potentially outpacing existing infrastructure.

ITS professionals can play a vital role by aligning their expertise with government goals, ensuring value-for-money investments while improving system functionality and user experience. Collaboration with global experts further enables New Zealand to adopt innovative solutions for a progressive and responsive transport future.

8.4. Project Scope Definition and Integration

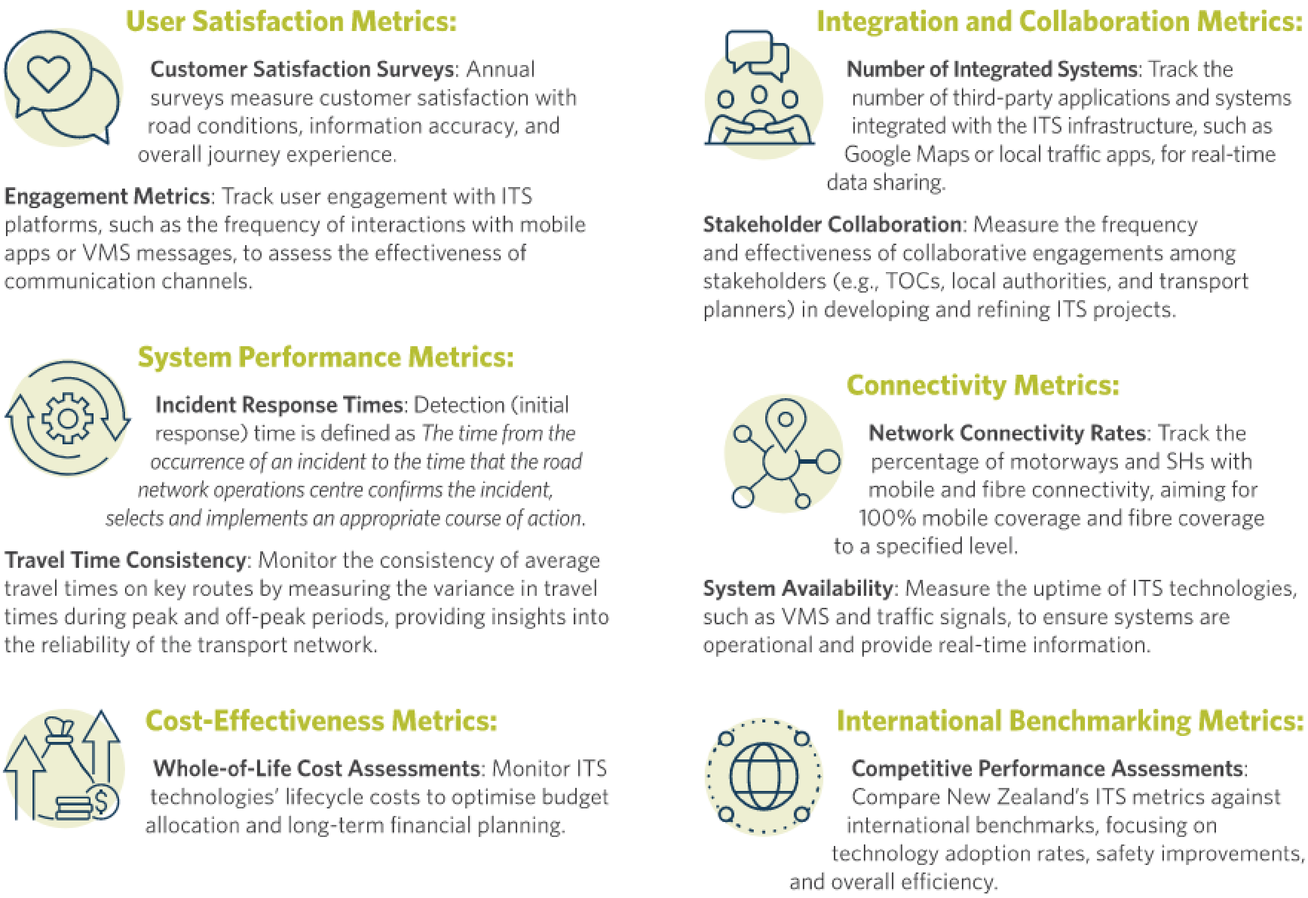
Defining the project scope is a critical component of the system design phase for ITS. Understanding ITS system limitations, expected performance outcomes, and collaboration with digital stakeholders is key to setting clear project objectives, aligning with transport goals, and integrating existing and future systems and regulatory frameworks. This collaborative approach ensures that all stakeholders understand the unique contributions of ITS and helps to define clear expectations for deliverables.

By incorporating input from ITS specialists, the scope can address current needs and future opportunities for relevant traffic management and technology integration. Including a Concept of Operations at the project definition stage can keep the project focused on outcomes and guide technology choice to achieve these. The framework links strategy and minimum requirements, enabling clear:

- scope definition to cover required communications
- road-user information
- demand and corridor management
- incident detection and management
- data collection for optimisation and analysis (as outlined in ITS Core Requirements Guideline and considering strategic direction).

9. Success Metrics

To effectively evaluate the impact of ITS, the following success metrics are proposed, encompassing user satisfaction, system performance, connectivity, integration and collaboration, cost-effectiveness, and international benchmarking.



10. ITS Implementation Framework

Establishing a standardised approach to ITS is key to more consistent, efficient and effective operations across New Zealand's State Highway network. Standardisation aims to optimise project delivery with existing systems and operational processes and achieve better outcomes for road users.

Concept of Operations

Value for Money through Minimum Requirements

Adaptability to Innovation

Roadside Asset Management and Accountability

10.1. Concept of Operations

A Concept of Operations (ConOp) is a core component of standardised design as it facilitates a unified vision among project stakeholders and network operating partners. It clarifies how ITS components delivered as a project should function and integrate within the broader transport system and meet shared objectives.

The ConOp focuses on high-level strategies and guides infrastructure requirements and network management tools. At the same time, specific operational procedures are documented in each network operating partner's Standard Operating Procedures (SOP).

The ConOp approach also acknowledges the diverse roles of stakeholders. It articulates specific operational objectives, performance expectations, and limitations relevant to ITS elements of a project within a corridor and network context. This enhances coordination in operations and management of ITS infrastructure.

The ConOp will be a project deliverable, and its necessity will be agreed with the project sponsor based on the complexity of integration with the wider network.

10.2. Value for Money through Minimum Requirements

The standardisation of ITS delivery is driven by minimum requirements and the principal's expectations that arise from them. Standardisation will be guided by a framework that determines which asset types, such as Variable Message Signs (VMS), are suitable for specific road types. The ConOp will support standardised operational outcomes relevant to various ITS types and provisions, tailored to the physical attributes of the corridor.

Implementing standardised ITS solutions delivers value-for-money benefits by removing the necessity for unique ITS design for each project. This consistency creates clear expectations for stakeholders, resulting in cost savings during the planning and design phases. Each project must consider initial and whole-of-life costs, as well as operational, maintenance, and user benefits derived from the investment.

A standardised approach enables selection of appropriate technologies and methods, ensuring projects are delivered efficiently and with minimal impact on maintenance budget. It encourages best practice planning, design integration and teamwork across SH network projects.

Alignment

The minimum requirements for ITS are aligned with [ITS standards and specifications (S&S)](). These define the criteria for designing, delivering, and integrating ITS equipment and systems within the national transport network. This includes various components such as vehicle detection systems, lane control signals, ramp signals, traffic signals, variable message signs, CCTV cameras, incident detection systems, emergency telephones, and enforcement mechanisms.

The minimum requirements set baseline expectations for ITS implementations linked to ConOp development for a specific project; the ITS Core Requirement Guidelines offer a comprehensive framework of broader objectives. Developing the ConOp enables the identification of inconsistencies with Requirements for Intelligent Transport Systems. It links them to project outcomes and encourages all stakeholders to come to a shared objective during the ConOp development for each project.

The minimum requirements and the ITS Core Requirement Guidelines adopt the ONF categorisation approach to enable comparison and mitigate risks associated with inconsistent applications. This integrated approach ensures that future ITS deployments are coherent, compatible, and efficient across the network.

10.3. Adaptability to Innovation

As the transport sector evolves, the standardised approach remains adaptable to new technologies and innovations. This flexibility allows for the effective incorporation of advancements such as V2X communication, dynamic traffic management systems, and innovative infrastructure solutions.

10.4. Roadside Asset Management and Accountability

Clarity as regards the maintenance and management of roadside ITS assets, emphasising a systems approach and clear lines of responsibility, is critical to ensure efficient network operations and worker safety.

Operations of roadside assets

The Wellington and Auckland Transport Operation Centres (TOCs) form the operational core of New Zealand's ITS framework monitoring and managing the SH network. These centres are responsible for real-time incident response, traffic signal optimisation, and the dissemination of critical travel information, ensuring the safe and efficient movement of people and freight. Their ability to leverage CCTV, data analytics, and collaborative partnerships with emergency services is critical to minimising disruptions and maximising network performance.

To effectively manage the evolving ITS landscape, the TOCs must prioritise adaptability and agility. This includes scaling infrastructure to accommodate new technologies, implementing advanced data analytics for proactive decision-making, and promoting greater integration. Investment in a skilled workforce and proactive planning are also essential to ensure the TOCs can continue to optimise network performance.

Maintenance of roadside assets

Historically, responsibility for roadside assets has been unclear, impacting maintenance efficiency and increasing safety risks. Agreed principles and an operating model need to be developed and embedded to ensure clarity of responsibilities and workflows for managing roadside ITS assets. This should reflect:

Principles:

- **Digital Accountability**: The Digital team is accountable for all ITS technology systems' overall functionality and performance, ensuring they meet business requirements. This includes defining specifications and overseeing end-to-end system performance.
- **Transport Services' Accountability**: Transport Services is accountable for the safe and compliant delivery, maintenance, and renewal of all roadside ITS assets. This includes managing contracts, adhering to health and safety regulations, and coordinating all roadside work.

- **Decision-Making**: Decision-making should be made jointly. Digital retains decision-making authority for changes impacting the technology systems, while Transport Services manages decisions around defining functional requirements of ITS assets, roadside operations, maintenance, and health and safety.
- **Collaborative Approach**: Digital and Transport Services will collaborate using a ’teams of teams’ approach, to encourage seamless integration and shared responsibility. Regular communication and joint problem-solving are key to this approach.

Operating model:

- **Specifications**: Digital defines the technical specifications for roadside ITS equipment based on business requirements.
- **Procurement**: Transport Services manages all procurement processes to maintain and renew roadside ITS assets. Digital is a key stakeholder in these processes, participating in co-design, review panels, and tender evaluations.
- **Maintenance Contracts**: Transport Services manages roadside ITS maintenance contracts, ensuring all work is performed safely and meets quality standards. Regular governance meetings with digital representation will be held to monitor contract performance, address issues, and plan future work.
- **Incident Management**: To handle incidents and ensure timely resolution, a clearly defined escalation process will be implemented. This will involve close collaboration between Digital and Transport Services.
- **Health & Safety**: Transport Services is ultimately responsible for ensuring that all roadside work is conducted safely and in compliance with relevant regulations and industry best practices.

Appendix A – ITS Minimum requirements table

Corridor Type	Civil Infrastructure	Operational visibility	Communications	Road User Information	Demand and Corridor Management	Incident Detection and Management	Data collection for optimisation and analysis
Transit corridors	Install ducts and chambers to accommodate communication and power cabling. Allocate space for ITS equipment and maintenance activities. Include additional civil infrastructure, identified through the agreed ConOp to future-proof for any planned ITS enhancements in the corridor.	Ensure full operational visibility of the carriageway, eliminating any blind spots, particularly at ramps and intersections.	Install fibre-optic cables along the corridor to connect all ITS devices to the NZTA network, facilitating secure communication management between each device and NZTA systems. Connect interchange traffic signals and other ITS infrastructure as provided to the fibre backbone network to enhance communication efficiency.	Ability to inform road users in advance of every interchange or inform road users in advance of key decision points. If identified through the ConOp provide ability to inform road users through advance warning information upstream of intersections	Where analysis shows that flow breakdown or congestion is likely to occur, corridor management technology identified through development of the ConOp to be provided.	Equip the corridor with detection systems designed to identify flow breakdowns and enable timely responses to traffic disruptions. Deploy ITS solutions identified in the ConOp to manage unplanned events on the corridor.	Provide the ability to collect data for optimisation and future analysis using appropriate sensor devices
Interregional connectors	Install ducts and chambers to accommodate communication and power cabling. Allocate space for ITS equipment and maintenance activities. Include additional civil infrastructure, identified through the agreed ConOp to future-proof for any planned ITS enhancements in the corridor.	Ensure operational visibility of interchanges and major intersections or likely points of congestion and high-risk areas as identified in the ConOp.	Install fibre-optic cables along the corridor to connect various devices to the NZTA network, facilitating secure communication management between each device and NZTA systems. Connect interchange traffic signals and other ITS infrastructure as provided to the fibre backbone network to enhance communication efficiency.	Ability to inform road users in advance of key decision points as identified in the ConOp. If identified through the ConOp provide ability to inform road users through advance warning information upstream of intersections	Where analysis shows that flow breakdown or congestion is likely to occur, corridor management technology identified through development of the ConOp to be provided. .	Equip the corridor with detection systems designed to identify flow breakdowns and enable timely responses to traffic disruptions. Deploy ITS solutions identified in the ConOp to manage unplanned events on the corridor.	Provide the ability to collect data for optimisation and future analysis using appropriate sensor devices
Urban connectors	Install ducts and chambers to accommodate communication and power cabling. Include additional civil infrastructure, identified through the agreed ConOp to future-proof for any planned ITS enhancements in the corridor.	Ensure operational visibility of any signal installations or adaptive traffic management systems.	Ensure ability to connect devices is provided. This may be with NZTA fibre, commercial fibre or wireless depending on asset density and bandwidth requirements	If identified through the ConOp provide ability to inform road users through advance warning information	Where analysis shows that flow breakdown or congestion is likely to occur, corridor management technology identified through development of the ConOp to be provided.	Equip the corridor with detection systems at key interchanges and high-risk areas as identified by the ConOp. Deploy ITS solutions identified in the ConOp to manage unplanned events on the corridor.	Provide the ability to collect data for optimisation and future analysis using appropriate sensor devices
Main streets	Ensure ability to connect power and communication to devices is provided.	Ensure operational visibility of any signal installations or adaptive traffic management systems.	Ensure ability to connect devices is provided. This may be with NZTA fibre, commercial fibre or wireless depending on asset density and bandwidth requirements	If identified through the ConOp provide ability to inform road users through advance warning information however must be balanced with place function in urban realm.	Provide corridor or location specific control strategies identified through the ConOp and ensure these can be monitored for faults	Deploy ITS solutions identified in the ConOp to manage unplanned events on the corridor.	Provide the ability to collect data for optimisation and future analysis
Activity streets	Ensure ability to connect power and communication to devices is provided	Ensure operational visibility of any signal installations or adaptive traffic management systems	Ensure ability to connect devices is provided. This may be with NZTA fibre, commercial fibre or wireless depending on asset density and bandwidth requirements	If identified through the ConOp provide ability to inform road users through advance warning information however must be balanced with place function in urban realm	Provide corridor or location specific control strategies identified through the ConOp and ensure these can be monitored for faults	Deploy ITS solutions identified in the ConOp to manage unplanned events on the corridor. .	Provide the ability to collect data for optimisation and future analysis
Rural connectors	Adopt corridor approach as identified in ConOp for instance fibre backbone route, particularly if this connects ITS-enabled corridors. Consider commercial fibre or wireless connection in other circumstances.	Operational visibility of major intersections and high-risk areas as identified by the ConOp	Ensure ability to connect devices is provided. This may be with NZTA fibre, commercial fibre or wireless depending on asset density and bandwidth requirements	If identified through the ConOp provide ability to inform road users through advance warning information in advance of key decision points	Provide corridor or location specific control strategies identified through the ConOp and ensure these can be monitored for faults. Examples consideration of speed differential/safety hazard, intersection speed zones.	Deploy ITS solutions identified in the ConOp to manage unplanned events on the corridor. And will be dependent on level of real time visibility	Provide the ability to collect data for optimisation and future analysis

Appendix B – Interpretation of ONF classifications for ITS

Corridor Type	Place and Movement Ranking	Density of on-street activity	Intensity of use (dwell time)	Function	Adjacent Land Use	Place Function Primary Attributes	Movement Function Primary Attributes	Objectives for ITS
Transit Corridors	P5 M1	Low	Low	Motorways and expressways provide fast and efficient movement of people and goods within urban areas.	Low-density residential or industrial usually separated from the Transit corridor.	Motorways and expressways are usually separated from adjacent land use, so there is no on-street activity.	Mass transit corridors for private motor vehicles, freight, and public transport (also includes heavy rail networks)	ITS on Transit Corridors should facilitate seamlessly integrated and efficient transport networks focused on the safe and reliable movement of people and goods. Through advanced technology and data-driven decision-making, we aim to enhance connectivity, minimise congestion, and improve travel experiences across urban landscapes. By prioritising real-time information, effective communication, and collaborative partnerships, sustainable transport solutions will be provided that adapt to future needs, optimising transit corridors as vital arteries of people's movement and economic growth.
Interregional Connectors	P4/5 M1	Low	Low	Safe, reliable, and efficient long-distance movement of people and goods between and within regions.	Farmland Conservation land Natural areas	Low levels of roadside activity associated with residents going about their daily lives.	Very high/high levels of motor vehicle traffic, including freight.	ITS on Interregional connectors should establish a robust and efficient transportation network that ensures the safe, reliable, and timely movement of people and goods across regions. Interregional Connectors should leverage advanced technology and data-driven insights where applicable to optimise traffic flow by managing unplanned events on these routes.
Urban Connectors	P3/4 M1-3	High to Low	Low	Provides safe, reliable, and efficient movement of people and goods between different parts of urban areas.	Full range of urban land-use – from suburban residential to the CBDs of cities Connector roads in industrial areas	Low levels of pedestrian activity associated with people moving through an area or along the side of the road/street.	High levels of motor vehicle traffic, including freight Often public transport route Often major routes for cyclists Usually on-street parking Formal crossing opportunities for pedestrians across the main carriageway at bus stops, major intersections and mid-block where activities such as schools, shops, parks, and recreational destinations located Urban connectors provide safe, reliable and efficient movement of people and goods between regions and strategic centres and mitigate the impact on adjacent communities.	ITS on Urban Connectors should facilitate safe, reliable, and efficient movement of people and goods across urban areas while minimising impacts on adjacent communities. Urban Connectors are vital in the transport network by providing key routes for multiple modes, including private vehicles, public transport, freight, and cyclists while prioritising efficient traffic flow. The ITS on Urban connectors must account for these various modes, with the ConOp considering future operational requirements to balance the needs of multiple modes to enable safety and optimisation of people throughput, with a focus on ITS to enhance safety, optimising throughput with adaptive control systems and demand management strategies. Data collection and analysis are critical to monitor traffic patterns, evaluate performance, and respond to incidents while integrating different modes of transport to ensure seamless connectivity across public transit, cycling, and walking.
Main Streets	P1/2 M2/3	High	High/Very high	Access to adjacent land use is available for all modes, particularly pedestrians. The location offers an attractive environment that encourages people to spend time there. It accommodates high/medium levels of through movement for all modes.	Office blocks Low-rise apartments Entertainment venues Retail Place function – primary attributes Commercial businesses Community facilities	High pedestrian numbers accessing adjacent land-use On-street amenities (e.g., al fresco dining, street furniture, green spaces, planting, public artworks) People spending time in the area (e.g., visiting businesses, meeting other people, gathering at destinations)	All modes - high pedestrian numbers In cities, often a primary public transport route Often on-street, time-bound parking for motor vehicle drivers to be able to access desired destinations. Regular formal crossing opportunities include high movement across the street/road. Cycle parking facilities	ITS on Main Streets should support the dual objectives of enhancing the pedestrian-friendly environment and ensuring efficient movement for all modes of transport. Given the high pedestrian activity and the need for access to local businesses and community facilities, a well-integrated approach to ITS identified through the ConOp process should focus on safety and managing congestion but also accommodate cyclists and public transport, promoting a holistic approach to urban mobility that aligns with community needs and supports economic vitality.

Corridor Type	Place and Movement Ranking	Density of on-street activity	Intensity of use (dwell time)	Function	Adjacent Land Use	Place Function Primary Attributes	Movement Function Primary Attributes	Objectives for ITS
Activity Streets	P2/3 M2-4	Medium	Medium/High	Access to adjacent land use for all modes. Accommodates medium to high levels of through movement for all modes.	Office blocks Low-rise apartments Retail Entertainment venues Commercial/trades Community facilities Industrial	In CBDs of cities, high pedestrian numbers accessing adjacent land-use Some on-street amenities (e.g., al fresco dining*, street furniture) Some people spending time in the area, particularly in cities (e.g., visiting businesses and gathering at destinations)	All modes - high pedestrian numbers in cities Often public transport routes in cities Often on-street parking or driveway access for motor vehicle drivers to be able to access carparks of desired destinations Formal crossing opportunities to facilitate pedestrian movement across street/road. Limited cycle parking facilities.	ITS on Activity Streets should focus on facilitating safe and efficient access to shops, services, and community facilities for all modes of transportation while managing the competing demands of movement and place.
Rural Connectors	P5 M2/3	Low	Low	Movement of people and goods between different parts of rural areas. Linking rural roads with SH network. Access to adjacent land use.	Farmland Conservation land Natural areas	Low levels of roadside activity associated with residents going about their daily lives.	High-medium levels of motor vehicle traffic, including freight.	ITS on Rural Connectors adopt a network and corridor approach identified through the ConOp. Location-specific control strategies to manage risks may be appropriate to provide timely responses to identified hazards.