Bonneagar Iompair Éireann
Transport Infrastructure Ireland

TII Asset Management Framework

January 2023

Contents

TII's Journey in Asset Management

Protecting Ireland's Investment

TII's Statement of Strategy establishes a commitment to protecting the significant investment that has been made in our national transport system. In line with that commitment, TII established the Asset Management Policy that states,

"Assets will be managed in a sustainable manner through the development, implementation, and maintenance of an asset management approach that is risk-based and data-driven, enabling us to make informed decisions throughout the life of our assets."

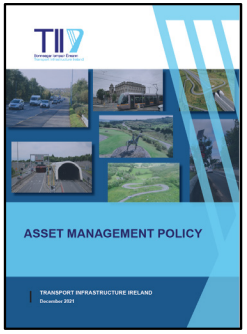
Our policy contains six asset management guiding principles:

- **Policy-driven**
- **Performance-based**
- **Founded on quality information**
- **Reliant on analysis of options and trade-offs**
- **Providing accountability and feedback**
- **Continual improvement**

Our Asset Management Strategy builds on the Policy by introducing our role in delivering safe, efficient, and sustainable transport infrastructure and services that contribute to Ireland's quality of life and economic growth while respecting the environment. The Strategy outlines the range of assets that are managed and their value. It describes the importance of asset management and its link to our strategic objectives and other TII, Department of Transport, and government initiatives. It also introduces the concept of life cycle planning.

The Asset Management Framework builds on the Policy and Strategy by providing the ultimate objectives that will be achieved through asset management. The Strategic Asset Management Plans (SAMPs) will provide more detailed plans on how the objectives will be achieved for light rail, local authority roads, and TII-managed and concession roads.

TII's Asset Management Hierarchy



TII Statement of Strategy — Values, Goals, Objectives

TII Asset Management Policy — Purpose, Vision, Guiding Principles

TII Asset Management Strategy — AM Concepts & Alignment with TII and Government Policies & Strategies

TII Asset Management Framework — Objectives, Data Systems, Governance

Strategic Asset Management Plans (SAMP)

- TII Managed and Concession Roads
- Local Authority Roads
- Light Rail

Develop collaboratively with input from stakeholders
Review of the current state of assets
Gap analysis and improvement plan

Group Level Asset Management Plans (GLAMP)

Pavement	Structures	Tracks	Buildings
Safety Barriers	Signs	ITS	Road Markings

Examples from roads and light rail, Detailed Performance Measures and KPIs

Services We Provide

TII manages and maintains the national road and light rail transport networks through a combination of direct management and concession contracts.

Roads

National Roads -
Centerline Km
500 km PPP
850 km MMaRC
4000 km Local Authority

Tunnels

3 Tunnels
2 x Immersed Tube (0.6km)
1 x Bored (4.5km)

Light Rail

43 km Network
2 Lines
67 Stops
81 Trams

TII Asset Management Objectives

TII set eight strategic objectives founded on its asset management policy.

1 Safety

To ensure transport networks that are secure and safe for all

2 Reliability

To ensure consistent and predictable journeys for the movement of people and goods across all modes

3 Condition

To maintain, preserve, and extend the useful life of our transport assets

4 Maximising Value

To plan, build, operate, and maintain the transport system, through collaboration and appropriately targeted investment choices

5 Customer

To balance the diverse needs of our customers, achieving the best possible outcomes in terms of system quality and effectiveness

6 Sustainability

To promote the sustainability of our transport systems while applying the principles of the circular economy

7 Environment

To provide efficient and effective transport systems with positive environmental benefits

8 Resilience

To proactively assess, plan, and invest in strategies that ensure the resilience of our network

Safety

To ensure transport networks that are safe and secure for all.

TII's safety focus is on the provision of roads, roadsides and light rail infrastructure that enable safer speeds, safer facility uses and safer and healthier modes of travel. The safety of the national road network continues to be improved by TII through the construction of motorways and dual carriageways, which have lower collision rates than the sections of the two-lane national roads they replace. TII also implements safety schemes and skid resistance programmes to mitigate safety issues on existing national roads. From a light rail perspective, TII acts as an asset owner, providing infrastructure and rolling stock that facilitates safe systems of work for passengers and Luas operations and maintenance personnel.

An upturn in active travel modes and specifically in cycling, both for commute and leisure, stresses the need for a greater focus on prioritising the safety of vulnerable road users. This is an important consideration for investment in the national roads and prioritisation of vulnerable road users aligns with the modal hierarchy set out in the National Investment Framework for Transport in Ireland (NIFTI). Ultimately, asset management in relation to safety is focused on reducing death or serious injury for the travelling public as well as for TII staff and operatives, TII subcontractors and everyone who works on the road and light rail networks.

There are many asset groups which are directly related to the safety of the travelling public. These include a wide range of signs and markings for both light rail and roads. Vehicle restraint systems and kerbs are key assets, providing protection both to road users and pedestrians. Asset groups such as bridge parapets and fencing are also central in the management of the interaction between vehicles and the public.

Many other asset groups have safety as a key component of their operations. These include the provision of adequate skid resistance on pavements, provision of footpaths, ramps, and platform areas without trip hazards, and the management of a winter maintenance regime to ensure timely snow and ice removal from roads, footpaths, and light rail platforms.

There is also the potential for risks to employees and members of the public due to the nature of TII's road and rail operations. These risks include construction and maintenance operations in close proximity to high-speed traffic and the existence of potentially harmful emissions generated during construction and maintenance. The use of electricity to power our light rail trams, rail lighting and signs, as well as the presence of electricity lines under some road pavements also introduce risks that must be managed. TII considers minimising the risks associated with managing the transport network to be a top priority.

Reliability

To ensure consistent and predictable journeys for the movement of people and goods across all modes.

TII, as an asset management organisation, is required to undertake a series of activities aimed at improving journey time reliability by minimising the risk of unplanned disruption to the operation of the road and light rail networks. Reliability for customers on our road and light rail networks is multi-dimensional. Clearly, reliability in relation to travel time performance is a key attribute, not only in relation to average journey times but also in relation to reducing the variability around these average times. In addition, on-time performance for light rail operations and for road-based public transport on intercity routes will be directly impacted by the asset management processes and systems that are used within TII.

TII's road network is also used to move the vast majority of all commercial road freight in Ireland, and again, the reliability of the road network in delivering consistent and uninterrupted journey travel times is essential in the movement of goods around Ireland and on and off of the island. On the inter-urban network, an objective of the National Planning Framework is to deliver average journey time speeds of 90km/h or better between all of Ireland's cities and regional centres. Enhancing regional and rural accessibility with improved services and reliable journey times is essential to ensuring that economic development and opportunity are distributed across the regions.

Reliability is also critical for our light rail network. This includes:

- Provision of resilient infrastructure and rolling stock.
- Sourcing competent light rail operators and service providers.
- Overseeing good practices in Luas operations and maintenance for all light rail infrastructure and rolling stock.
- Performance of timely renewals.
- Investment in the light rail system to ensure continued safe, reliable operations for all passengers.

From an asset management perspective, reliability is impacted by a number of operational factors and asset groups. The scheduling of maintenance works and the efficient completion of scheduled works to minimise the impact on transport users are key priorities. The development and implementation of winter maintenance standards to ensure consistency and reliability for road users across the entire network are essential. Consistency of signage, road markings, and pavement quality are also essential components in building confidence in the travelling public in the reliability of the networks developed and maintained by TII.

TII works closely with the maintenance teams on light rail, utilising the asset condition records to improve preventative maintenance regimes and ensure the appropriate asset care processes are in place to ensure continued safe operation. Within the light rail industry, TII engages with international light rail bodies to share and learn industry best practice approaches.

Condition

To maintain, preserve, and extend the useful life of our transport assets.

Asset inventory and condition data are the foundation for managing transportation assets. Measurement of the current condition and prediction of the future condition under different funding scenarios has always been a core objective of asset management. Accurate inventory and condition data are needed for supporting asset management processes, such as life cycle planning, projecting funding needs, prioritising projects and monitoring asset performance.

The Federal Highway Administration in the United States has set out that asset managers should operate systems that monitor asset condition and performance to:

- Identify those assets which are under-performing.
- Predict when an asset is expected to fail to deliver the required level of service.
- Ascertain the reasons for performance deficiencies.
- Determine what corrective action is required and when (e.g., preservation, rehabilitation, replacement).

TII operates a wide range of condition assessment surveys to determine current conditions. Due to the diverse nature of the asset groups managed on the light rail and road networks, asset condition is quite specific to the particular asset group. The condition can be a binary measure – a light is working or it is not. The condition can be measured on a continuous scale (e.g., the International Roughness Index for pavement smoothness) or a discrete scale (Structures component rating). The condition may be measured for the full asset (e.g., a road sign) or for sub-components of the asset (e.g., a bridge deck, bridge supports, bridge parapets etc.).

For light rail in particular, TII records many complex measurements, such as multi-facet rail wear, track gauge & cant, rail profile, and rail head surface roughness (corrugation). TII employs cutting edge tools to determine the condition of assets, including regular use of laser surveys for overhead contact wire condition assessment and ultrasonic testing of rail and rolling stock components to find hidden defects.

For complex assets, there may be multiple measures of condition for the same asset. Road pavements have condition measures for structural condition and also for multiple functional conditions, including ride quality and skid resistance. It is very important to seek out measures of condition that are comparable internationally so that direct comparisons can be drawn with condition performance, standards, and targets on other, similar road and light rail networks. When appropriate and relevant condition measures are in place, it is straightforward to define targets and monitor the progression of the condition over time.

Maintenance work is essential to the operation of our light rail system and ensures we deliver a safe, reliable tram service to our customers. Our maintenance employees support our operations and project teams by making sure that every part of our infrastructure – such as signals and power supplies, or assets such as track and platforms – is maintained and in good working order.

Maximising Value

To plan, build, operate, and maintain the transport system through collaboration and appropriately targeted investment choices.

Maximising value has always been a central objective of asset management. Monitoring changes in highway infrastructure value indicates whether asset investments are adequate or if maintenance and renewal costs are being unduly passed on to future users.

A life cycle analysis that considers the asset's condition and the associated agency and user costs over the asset's whole life is a core component of any asset management plan. Traditionally, life cycle analysis has been based on a financial approach where benefits can be monetised, and optimal maintenance and rehabilitation solutions are based on Cost Benefit Analysis (CBA) over the lifecycle of the asset.

Recently, the concept of value in asset management terms is frequently considered as encompassing more than simply financial analysis. Environmental impacts, including carbon content (which can be expressed in financial terms), are frequently included in the analysis framework. In addition, social impacts over the life cycle of the asset, including measures and impacts on accessibility and inclusivity, may be included depending on the particular asset group.

For the provision of light rail, TII operates as an intelligent client with significant in-house knowledge in the key disciplines required for the design, operation, and development of the light rail asset portfolio. TII seeks to provide infrastructure which is safe to operate, maintain, and achieve low rates of consumption throughout its operational lifecycle. Best-in-class maintenance, coupled with an understanding of the condition and performance of the assets, is the best way that TII can maximise the value of its asset portfolio. TII also utilises a data-driven approach, informing renewals and upgrades to the existing assets, which further enhances the asset value.

Circular economy principles are also vital in the application of asset management to TII's asset base. One of the major benefits of the application of the principles of the circular economy is value capture, which ensures social, environmental, and economic values are optimised. Value capture and reducing consumption of natural resources will result in cost savings for TII compared to the linear approach. Circularity requires that the whole life value of investments include future operation and maintenance phases in addition to construction. From an asset management viewpoint, preventative maintenance has an important role to play in maximising value as intervening early to treat defects can prevent more costly repairs in the long term. The approach to asset management in TII is aimed at quantifying and demonstrating value for money over the lifecycle of the assets under management.

Customer

To balance the diverse needs of our customers, achieving the best possible outcomes in terms of system quality and effectiveness.

At TII, we aim to provide the optimum level of service to our customers within the funding we are provided. Asset management supports this aim through life cycle analysis of the condition, value for money, sustainability, and other factors. As we move forward, increased use of customer feedback surveys on roads and light rail will enable our asset management decisions to be more focused on customer needs. TII's Light Rail Network Passenger Charter includes the following commitments that are directly impacted by asset management processes:

- Provide you with a safe and comfortable tram journey.

- Provide you with real-time passenger information at stops 99% of the time.
- Provide you with a 99% reliable tram service and publish our performance every 12 weeks.
- Give 1 week's notice to passengers/residents in the event of planned maintenance work.
- Inform and update you in case your tram journey is going to be longer than usual.
- Clean the trams every night and at every stop at least once a day.

The Report on "Value for Money and Policy Review – Current Expenditure on National Road Maintenance", published by the Economic and Financial Evaluation Unit of the Department of Transport, recommends the implementation of a national road user survey to collect data on satisfaction with road infrastructure and maintenance. In road user surveys in other countries, road users are asked to recall the most recent trip they made using the road network and provide details about the journey. The users are asked to rate it separately under the following headings:

1. Last journey: Experiences and satisfaction with journey time – including delays and delay times for commuting and business trips
2. Last journey: Roadworks – including closed lanes, speed restrictions and delays
3. Last Journey: Safety – including weather conditions and other driver's behaviour
4. Last Journey: Satisfaction with upkeep and maintenance – including litter, potholes, poor surfaces and verge maintenance
5. Last Journey: Satisfaction with Information Provision – including legibility and visibility of VMS and static signs

On light rail, TII performed significant work to provide accessible platforms, lifts/escalators/ramps where possible and accessible vehicles with features such as low floor access (100% low floor on the green line fleet, 60% low floor on red line), dedicated spaces for wheelchairs/buggies, induction loops on trams and on ticket machines, audible and visual travel messages onboard and an ongoing commitment to the provision of an accessible light rail system for all users.

Developing and delivering practices and processes to improve TII's engagement with, and understanding of, all of our transport customers will allow adjustment and enhancement of our asset management processes.

Sustainability

To promote the sustainability of our transport systems while applying the principles of the circular economy.

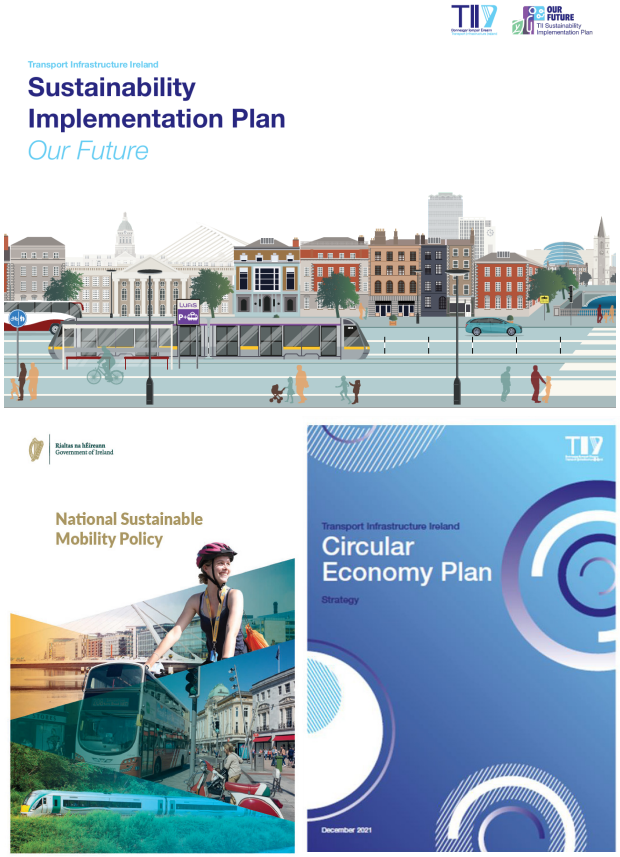
Asset Management is central to the implementation of TII's approach to sustainability. Asset management principles and practices are strongly aligned with sustainability concepts and help to improve the efficiency and effectiveness of service delivery. Sustainability becomes an embedded value in asset management when it is integrated across all aspects of decision-making with a clear commitment to evaluate alternatives with a long-term and life cycle perspective.

A life cycle analysis has always been central to asset management processes and decision-making and is easily expanded to take account of non-financial parameters that reflect the social and environmental impacts of how we manage our asset base. This is particularly important given the financial scale of the assets being managed on our transport networks, with a gross replacement value in excess of €33 billion.

Our main construction products are aggregates, asphalt, cement, concrete, and steel. We will explore alternatives following the 9R approach in the circular economy, seeking to reuse and repurpose the materials at the highest level in the 9R hierarchy. Through the lifecycle management of our assets, we will develop and implement solutions that reduce carbon emissions during the construction, operations, and decommissioning of assets. Key to this approach will be designing out waste and promoting resource use to protect existing material stocks and the environment.

In addition to focusing on carbon reduction, we will also focus on reducing energy consumption in the production and manufacture of assets used by TII and in the maintenance and rehabilitation of assets on the road and light rail networks.

By necessity, successful asset management requires the development of large databases recording many aspects of our assets. These can include location, asset type, asset condition, age of the asset, makeup of the asset (including materials, sub-components, etc., depending on the asset type), capability and suitability of the asset to be reused or recycled, and many other attributes. This data can be repurposed to support sustainability initiatives around carbon and energy reduction. Sustainable asset management is usually a better way of doing business.



Environment

To provide efficient and effective transport systems with positive environmental benefits.

Transport infrastructure brings about social and economic benefits, such as enhanced mobility, access to markets and social participation. Asset management practices seek to realise these benefits in the most efficient and effective ways possible. However, there may also be negative consequences for the environment and the planet through increased greenhouse gas emissions, consumption of non-renewable energy resources, a range of emissions, pollutants and vehicle noise that adversely impact human and wildlife health and impact on biodiversity. TII's climate adaptation strategy focuses on the prioritisation of low-carbon solutions where possible, reducing the future impacts of climate change.

Many of the same measures that reduce greenhouse gas emissions can also have a beneficial impact on other elements of environmental sustainability. Increased public transport and alternative fuel usage can help to improve air quality and reduce noise pollution, while active travel brings health benefits. It is vitally important that our asset management processes and policies are explicitly aware of the potential negative environmental impacts and are modified to mitigate them as much as possible. Incorporation of the environmental impacts of asset renewal projects such as rail replacement and national road network resurfacing into the overall assessment framework is essential.

It is also possible to have an impact on biodiversity in a positive manner through asset management practices that focus on some land assets, including earthwork features, grass strips, run-off ponds, and other areas. Asset management will actively contribute to TII's striving for no net loss of biodiversity, including restoration, where feasible, of important ecological habitats.

A significant impact on greenhouse gas emissions and sustainable energy can be achieved through a shift from carbon-based fuels to electricity in the vehicle fleet used directly by TII or indirectly through sub-contractors in the delivery of our asset upgrade and maintenance programmes. Similarly, switching lighting components to use LED will directly reduce energy consumption over many years on our road and light rail networks. Assessment of the life-cycle performance of noise-reducing pavements as a possible alternative

surfacing in areas of high population density is also in the overlap between asset management and the environment. TII ensures a best-in-class approach to the management of rail surface roughness (corrugation) and rail wheel management, which returns low noise emissions for the light rail operation. TII continues to work with vendors and the rail industry to reduce emissions where possible.

Resilience

To proactively assess, plan and invest in strategies that ensure the resilience of our networks.

Rising sea levels, more intense storm and rainfall events and increased river and coastal flooding are increasingly likely. Such events have a significant impact on the transport network, with disruption to short sections having potentially large effects. Impacts from a changing climate in Ireland may not be as severe as those predicted in some other European countries, but they are likely to include more frequent flooding, an increased risk of landslides, pavement degradation and potential storm damage.

Building resilience can help minimise these disruptions, ultimately saving on long-term costs and providing societal value. TII will enhance the resilience of national roads, in particular sections of the rural national secondary road network that provide lifeline links to individuals and communities. In asset management, resilience is addressed in two different ways. The first assessment evaluates the effect on the travelling public if a section of the network is unavailable due to some type of failure — e.g., a bridge structure on the road or light rail network is closed, or an accident requires a detour to be put in place. A highly resilient network will have low measurable effects on the travelling public and society more generally. This assessment typically considers three factors:

1. Likelihood of an extreme event: an assessment of the probability, or range of probabilities, of an event such as a flood, earthquake, asset failure, or other risk drivers.

2. Consequences to the asset: an assessment of the damage or loss of function of the asset, conditional on the occurrence of an event.

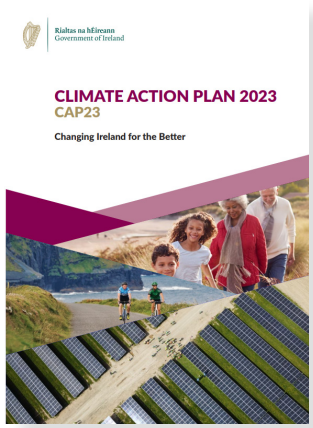
3. Effect on mission, life, property, and the environment: An assessment of the effect on the agency, the public, users, and non-users of the asset damage or loss of function caused by the extreme event.

The second assessment of resilience considers readiness to recover from an extreme event, e.g., damage caused by extreme weather – wind, freeze-thaw cycles, extreme heat, and flooding. Asset management processes need to ensure that supply chains are in place and that there are plans to recover and restore accessibility. For example, there may be a schedule prepared of suitable contractors that have sufficient resources to mobilise with appropriate materials and replacement parts to successfully restore connections to the network.

At the individual asset level, resilience readiness will include backup systems for critical components, availability of materials (e.g., salt for winter maintenance), and backup systems for supporting data systems and processes, among many other relevant topics. In addition, a clear understanding of new threats (for example cyber-security) and the development of strategies to assess and implement appropriate measures to combat the impacts, reduce the impact on the travelling public and establish recovery programmes should extreme events occur.

Asset Management and Climate Adaptation

There are significant areas of overlap with TII's Asset Management Framework, Sustainability Implementation Plan and Climate Adaptation Strategy 2022. The strategic objectives of asset management are strongly aligned with the core guiding principles of sustainability and the strategic objectives of the Climate Adaptation Strategy. Asset Management strategic objectives are also aligned with the aims of Ireland's Climate Action Plan 2023 and will help to deliver on TII's Climate Action Road Map.

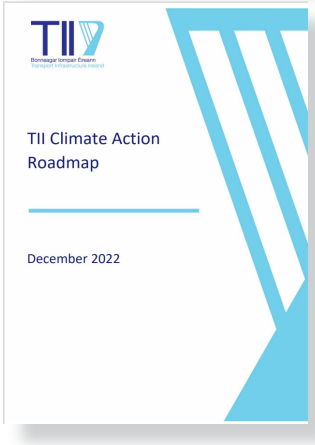


Climate Action Plan 2023

The Climate Action Plan 2023, integral to National Development Plan 2021-2030, outlines how Ireland can accelerate the response to climate crisis, putting climate solutions at the centre of Ireland's social and economic development.

TII Sustainability Implementation Plan (SIP)

In 2021, TII launched its Sustainability Implementation Plan (SIP). The plan sets a clear vision, and establishes a road map for embedding sustainability throughout our organisation and activities by defining six core guiding principles of sustainability.



TII Climate Action Road Map

The Climate Action Road Map 2022 sets out TII's plans to reduce emissions, meet decarbonisation and achieve energy efficiency targets as directed by the government. It demonstrates how TII will attain emission reduction by 2030.

TII Climate Adaptation Strategy 2022

TII developed Climate Adaptation Strategy 2022, underpinned on seven strategic objectives, aligned with the six principles from TII's overarching Sustainability Implementation Plan – Our Future (SIP).

Guiding Principles

2 5 8	Provide effective, efficient and equitable mobility	1
1 2 8	Enable safe and resilient networks and services	2
4 6	Collaborate for a holistic approach	3
3 6	Deliver end-to-end improvements	4
6 7 4	Transition to net zero	5
4	Create total value for society	6

TII Sustainability Implementation Plan (SIP)

Mapping of Asset Management Objectives with Sustainability Principles and Climate Adaptation Objectives.

Strategic Objectives

1	Observe fewer network disruptions during climate-related events	2 8
2	Rapidly recover from any climate-related events	8
3	Have a robust, flexible and equitable organisation that responds effectively during climate events	8
4	Enhance the climate resilience of lifeline roads in order to maintain community accessibility	8
5	Engage with the wider adaptation efforts across Ireland through partnerships and wider research	6 7 8
6	Embed climate adaptation within TII's operations, policies, and procedures in order to ensure a safe and resilient network	6 7 8
7	Adopt a low-carbon approach in TII's designs, standards, and processes when considering climate adaptation, while also considering wider social and environmental benefits	6 8 4

TII Climate Adaptation Strategy 2023

Performance Measures and KPIs

The increasing focus on accountability in transportation asset management is based in large part upon a growing need to demonstrate responsibility. Measuring progress over time against relevant and appropriate performance targets is viewed as evidence that the agency is responsibly using its limited resources to achieve performance that serves the public.

TII is approaching the issue of road and rail network management by recognising that the infrastructure networks are capital assets with measurable asset value. The aim of asset management under this approach is to conserve the asset value of the network. This concept is readily understood by a wide range of decision-makers.

The current asset value of any road or rail network can be estimated with reasonable accuracy at a particular point in time, in the same manner as the balance sheet of a company. Lack of maintenance will result in the deterioration of the network by physical attrition due to the effects of climate and traffic, which implies a continuous decrease in its asset value. Investment in the rehabilitation of currently sub-standard roads and light rail sections or the addition of completely new roads and light rail sections leads to an increase in the asset value of the network.

The long life and large investments in assets necessitate the development of asset management plans that forecast future deterioration, maintenance, and enhancement needs. Monitoring asset value over time is used to demonstrate stewardship of assets. This information provides important input to a case for investing in the maintenance and upkeep of the transport infrastructure networks.

In order to ensure funding can go as far as possible, it is important for an organisation to track the performance of the asset at a network level. Key Performance Indicators (KPI) are commonly used to represent the health of the network, show progress towards goals, and measure the effectiveness of the organisation

in managing its assets and link them back to the asset management objectives of the organisation.

The performance of the network is measured against multiple objectives. We have defined eight asset management objectives in this framework document. The challenge in our Strategic Asset Management Plans (SAMPs) and Group Level Asset Management Plans (GLAMPS) is to define relevant KPIs and associated target levels that are directly related to each of the eight asset management objectives. Successful definition and implementation of these KPIs and targets, provides the basis for demonstrating best practices in the management of our transport assets.

Asset Management - Answering Key Questions

Asset management data serves as the foundation that allows us to make critical decisions about our transport networks with confidence.

What

> What is the asset?
> What detail do we have on the asset?
  Subcomponents
> What condition is it in?
  Condition surveys

When

> When is it maintained?
  Condition information
  Deterioration Modelling
  Intervention Programme

Where

> Where is it located?
> How is it referenced?
> Geolocated?
  Coordinate referencing system

How

> How is the asset information stored?
  Database, SQL, Excel, ArcGIS
> How much is the Asset worth?
> How is it operated & maintained?
  Maintenance Programs

Who

> Who is in charge of maintaining the asset?
  TII, Contractor, PPP, Local Authority

TII Data and Systems

The performance of an asset management organisation is strongly dependent on the quality and availability of asset data and information, including good inventory and condition information and the costs associated with replacing or renewing infrastructure. The first step in managing assets is to identify and record what you own and manage but knowing how assets perform is fundamental to determining their optimum management strategies. The decisions we make are informed by robust and readily accessible asset data and information. Our asset management systems provide a repository for this data and information to support the enhancement, operation, and maintenance of our assets.

TII has considerable asset management capability developed over many years as well as a number of established asset information systems and datasets that are used to manage the network assets. Notable amongst these are:

- The pavement management system which aims to assess the effects of maintenance activities from both a technical and economic point of view and assist in determining optimum future maintenance strategies.
- The structure management system which has a major focus on a cycle of principal and special inspections with a view to identifying and prioritising maintenance activities.

Initiatives are currently underway to improve knowledge and understanding of other assets such as signs, lines, and roadside infrastructure. Substantial asset inventory data has also been gathered through the three MMaRC contracts, and work is ongoing to have this data fully integrated into an overall asset management structure and approach.
The asset management processes that form part of the management of toll infrastructures such as the Dublin Tunnel and PPP schemes such as the M6 and the M50 will ultimately revert to direct TII management and need to be aligned with the internal TII processes.

Common Asset Registry (CAR)

The level of asset information under the control of TII is vast and diverse in nature with various data repository and asset management systems in existence across the organisation. Asset registers should be the repositories for all data associated with the asset, including inventory, location, and performance. In their basic form, asset registers are databases for each individual asset type. They are used to support maintenance management and the management of defects as part of the asset management system.

TII are developing a Common Asset Register (CAR) for the road assets. The CAR aims to be a comprehensive living tally of assets TII own and manage, providing a common basis for all critical decision making based on current, consistent, and reliable information. The CAR outlines the infrastructure owned or managed by TII, and documents key attributes of each asset type such as the location, age, and current replacement cost.

Among the key challenges in bringing all the data together are consistency of format, accessibility and visibility of asset information. The CAR aims to overcome this challenge by centralising various asset datasets to a common single source, providing a basis to enable live reporting of multiple asset groups on a single platform. A pilot data exchange project using custom APIs is underway which aims to enable automated data exchange from the various data repository systems to reporting platforms in ESRI ArcGIS Online. The project is ongoing since Q1 2021 and will aim to be delivered throughout 2022 and 2023 in stages as the APIs are developed to include other asset groups.

TII Data and Systems-Roads

Asset & Fault Management System (AFMS)

Traffic Signs, Lines and ITS

SCADA - IBM Maximo Tunnels Management

GIS - Collector Apps

Local Authority Lighting and VRS, Routine Maintenance/DMS

dTIMS Pavement Asset Management System

EIRSPAN/dTIMS Bridge Management System

Bridges, Retaining Walls, Gantries, High Masts

Routine Maintenance Management System (RMMS)

MMaRC Assets
Signs, VRS, Lighting, Drainage

TII Data and Systems-Light Rail

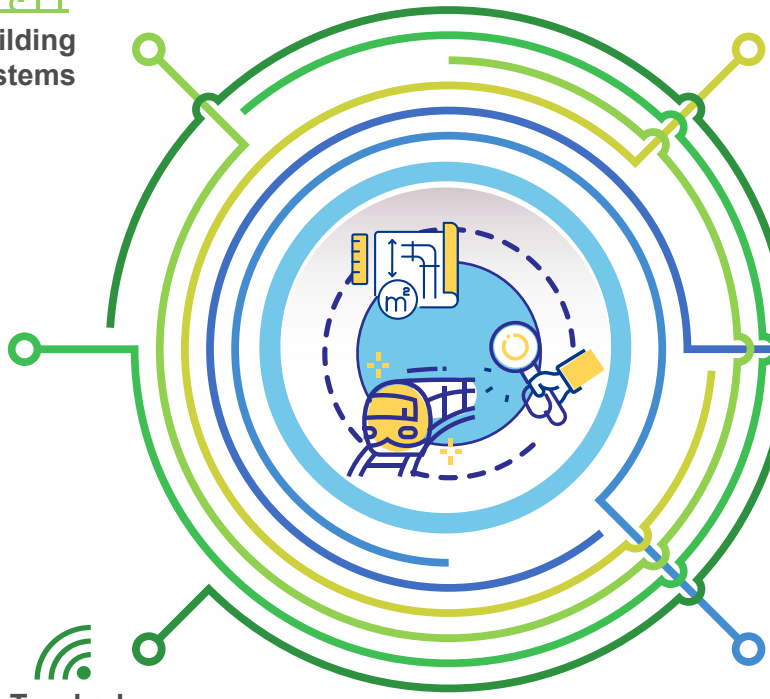


ABB Cylon Building Management Systems

CARL-Source and CARL-Touch Computerised Maintenance Management System (CMMS)

SMARTRAMS Automatic Vehicle Location System

EFARAIL platform (INOSS and SCATEX+) SCADA

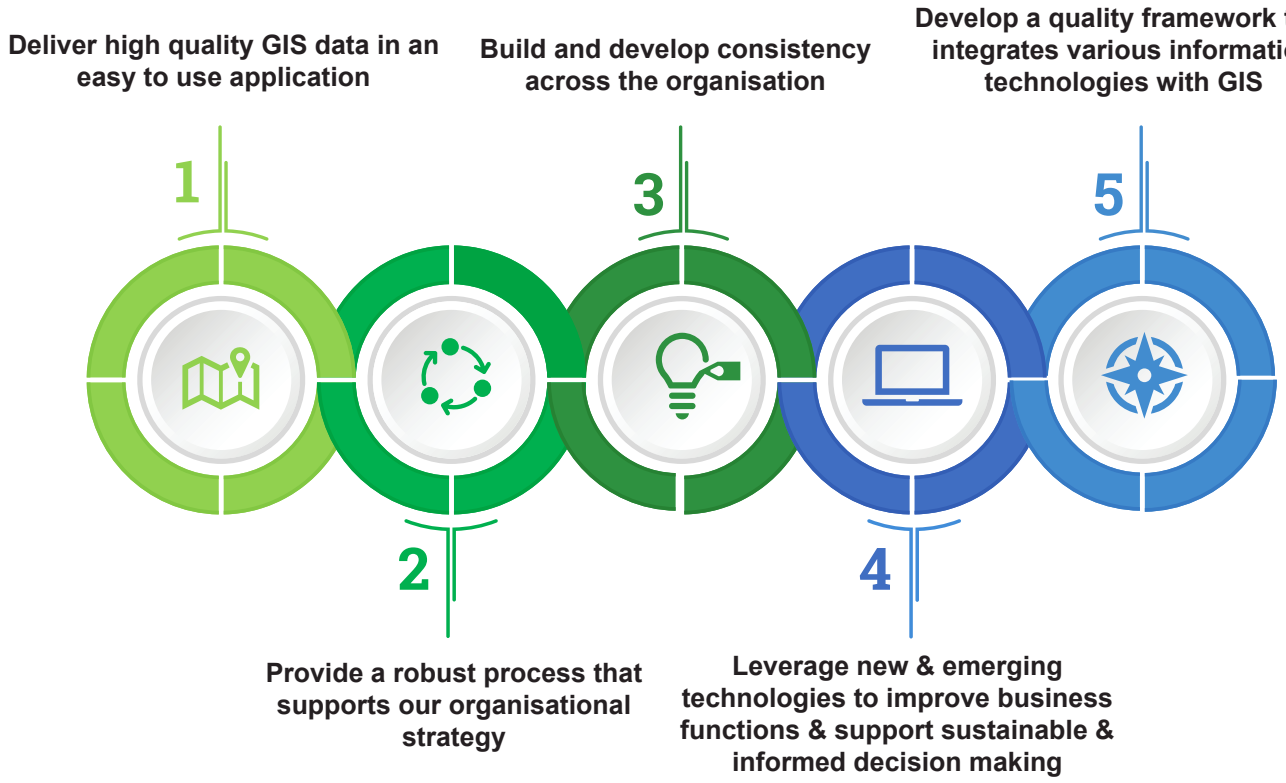
Terrestrial Trunked Radio (TETRA) secure mobile radio

Gigabit (GbE) Ethernet network

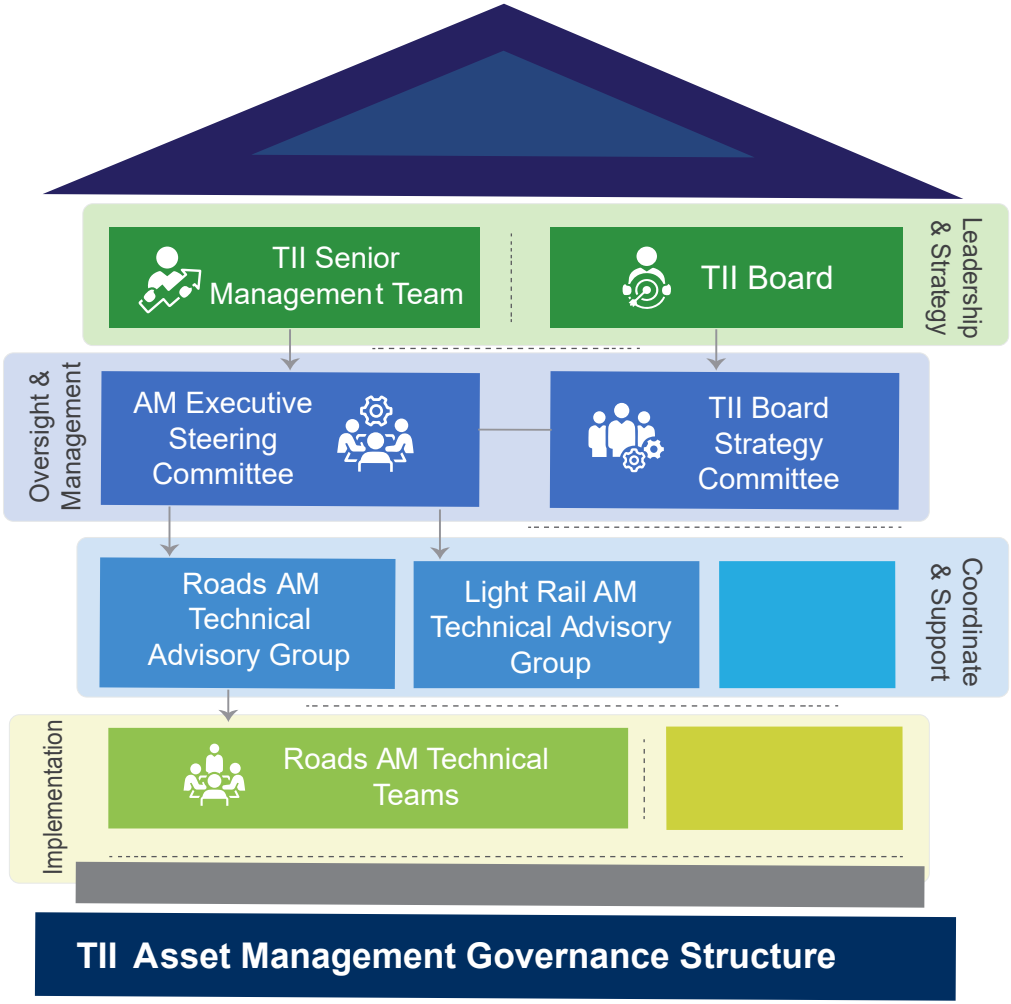
Network Referencing and GIS

TII asset managers and data processes rely on more than one system of network referencing, but best practice suggests that a consistent referencing system yields the best results in asset management. Link and section referencing based on chainage are used for the Pavement Asset Management System (PAMS) and the light rail network. Geospatial co-ordinates are also used within the PAMS to facilitate mapping and reporting for GIS, and many other asset groups use geospatial co-ordinates to locate and report. The use of consistent referencing systems allows for mapping and reporting across many asset groups. For compatibility and ease of data exchange, all asset registers should at least have data referenced to National Grid Co-ordinates using the Irish Transverse Mercator geographical coordinate system.

"To serve as a road map for moving from a limited departmental application of GIS to a full organisational enterprise GIS implementation at TII, TII is supporting the provision of sustainable transport infrastructure and services, delivering a better quality of life, supporting economic growth, and respecting the environment."



TII Asset Management Governance Structure



Past capital investment in national roads and light rail has delivered very valuable state assets. TII is putting in place a structured system of layered governance to ensure consistency of approach while monitoring and reporting on asset management delivery across the organisation. The Asset Management Steering Committee (AMSC) is a sub-group of the Senior Management Team and reports to the Strategy Committee of the Board of TII. The AMSC is responsible for the development, update, and monitoring of asset management enhancements within TII. It is also responsible for ensuring that the purpose, vision and guiding principles outlined in TII's asset management policy are embedded throughout the organisation, ensuring that the day-to-day asset management activities we deliver are aligned to our strategic objectives. The AMSC is also responsible for approving policies, programmes, processes, and performance targets necessary for the implementation of asset management in TII.

Asset management is a team effort, requiring a variety of specialised skills and capabilities. In particular, the asset types, performance measurement and protection/renewal programmes are very different on the light rail network.

TII Asset Management Governance Structure

Separate Asset Management Technical Advisory Groups composed of relatively senior managers are needed for both transport networks.

A major function of the Technical Advisory Groups is to ensure that all parts of the asset management process are functioning together as a unit. The Technical Advisory Groups will also fulfill an asset management data planning and management function with participation from the multiple units that produce and consume data relevant to asset management. The mission of the data planning and management function is to ensure that the right data are collected in an efficient manner to meet the organisation's needs and that the data are managed throughout its life cycle to provide value.

The Technical Advisory Groups support the full implementation of asset management in TII. This includes developing performance measures and targets to be reviewed for approval by the steering committee; identifying and prioritising risks to TII's transport infrastructure; recommending changes to policies, procedures and processes, and ensuring distinct groups and sections within TII work together to maximise the outputs from the resources employed. The Asset Management Technical teams support the implementation and reporting of the activities that deliver effective asset management for TII through programmes carried out by key stakeholders working on behalf of TII. The activities include compiling and analysing data to support the development of performance targets aligned with TII's AM objectives and using asset management systems to perform gap and life cycle analysis that cover a range of funding scenarios. It also includes developing and managing programmes of protection and renewal for the various asset types and reporting on the outcomes of the programmes.

Adequate resources are vital to the successful implementation of an asset management improvement plan. There is likely to be a need for new skills and qualifications within TII to fully implement the asset management plans while ensuring line of sight from the Board and the Senior Management team all the way through to the day-to-day delivery of maintenance, renewal and protection programmes and activities on the ground. These resources include adequate training for agency staff to ensure sufficient skills and understanding to implement asset management throughout the organisation.

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