2017

Contributing to the enablement of the right infrastructure to be in the right place at the right time

Improving data quality and interoperability

The Government's long-term vision for infrastructure is that **New Zealand's infrastructure is resilient and coordinated and contributes to a strong economy and high living standards** (The Thirty Year New Zealand National Infrastructure Plan 2015).

Good management (maintenance and renewal) of public sector agency-owned physical assets is beneficial to New Zealand's long-term fiscal position, the performance of the economy and delivering social outcomes.

This document sets out the role that asset metadata standards for vertical infrastructure (residential and light commercial buildings) and 3-waters (potable, storm and waste water) can have to support that vision to become reality and describes a pathway to implementation -

Much of the value of introducing metadata standards will be gained from creating interoperability and readability across different infrastructure classes: vertical infrastructure (residential and light commercial buildings), 3-waters (potable, storm and waste water) **and roads**. Therefore, the technical development of the Standards for the first two classes (residential and light commercial buildings and 3-waters) have been developed alongside the roading standards being developed independently by NZTA

Note: Public Sector agencies - A broad term that refers collectively to central Government and local Government (78 local authorities i.e. 11 regional councils + 67 territorial authorities (Auckland Council & 12 city councils & 54 district councils) controlled organisations (CCO).

Why is metadata important?

Collectively, central Government is responsible for between $116 billion to $250 billion of infrastructure assets, and local government has a further $100 billion of community assets on its balance sheets. Note These figures vary depending on how the assets are valued and when they were valued.

The three-main public-sector agency's asset groups are the 3-Waters, roading and buildings (residential and light commercial), which collectively make up 78% of the total value of publicly owned assets.

Maintaining and improving these assets requires billions of dollars of investment each year. Over the next ten years, approximately $110 billion is forecasted to be spent on infrastructure.
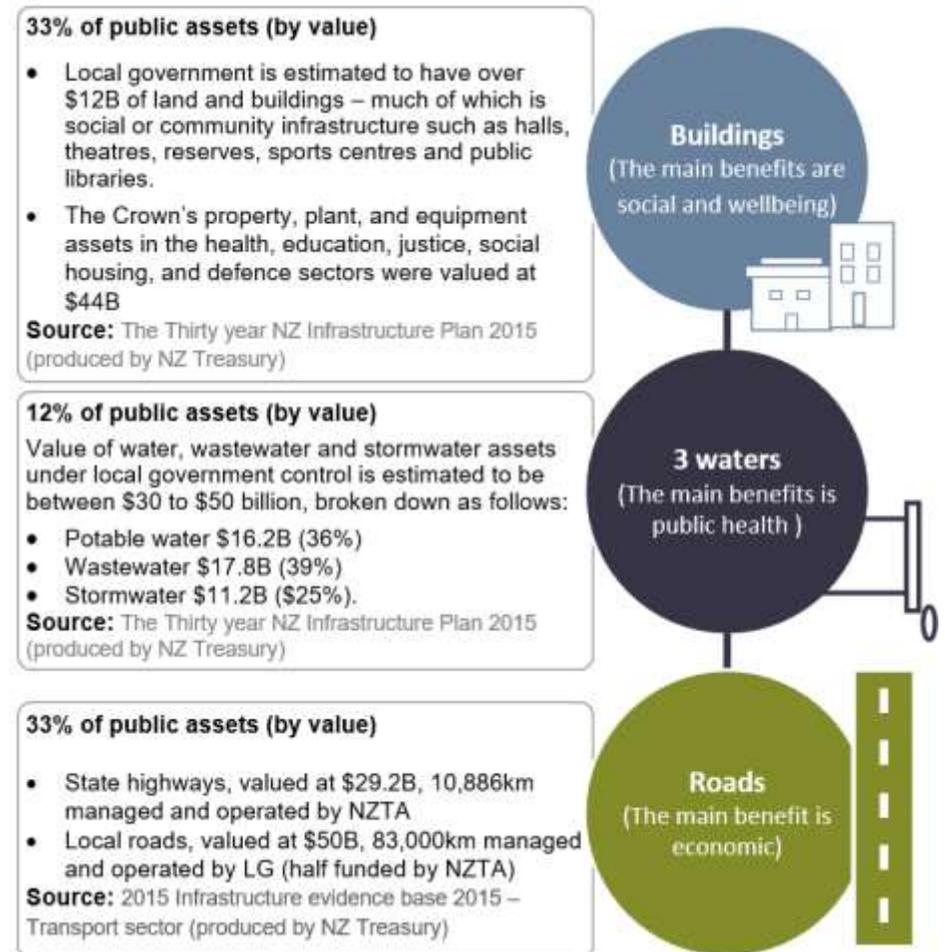
Good evidenced based decision-making about infrastructure assets relies on a foundation of sound information derived from robust data. Good data quality cannot guarantee that good asset management decisions are made, but poor data quality will definitely increase the likelihood of poor decisions and poor outcomes.

Improving asset data quality, through the use of metadata standards, is a critical first step to improving management of those assets.

Metadata is data about data. It is structured information that describes, explains, locates, or otherwise makes it easier to retrieve, use, re-use or manage data resources and knowledge.

Without robust asset data, non-evidence based decisions about asset maintenance and renewals will be made. The quality of these decisions could have adverse impacts on New Zealander's health, their social wellbeing, their living standards, the environment and the economy. Over-investment, or the wrong mix of infrastructure investment, will result in dead weight drag on the economy, stranded investments and lower productivity than could otherwise be achieved.

33% of public assets (by value)

- Local government is estimated to have over $12B of land and buildings – much of which is social or community infrastructure such as halls, theatres, reserves, sports centres and public libraries.
- The Crown's property, plant, and equipment assets in the health, education, justice, social housing, and defence sectors were valued at $44B

Source: The Thirty year NZ Infrastructure Plan 2015 (produced by NZ Treasury)

Buildings
(The main benefits are social and wellbeing)

12% of public assets (by value)

Value of water, wastewater and stormwater assets under local government control is estimated to be between $30 to $50 billion, broken down as follows:

- Potable water $16.2B (36%)
- Wastewater $17.8B (39%)
- Stormwater $11.2B ($25%).

Source: The Thirty year NZ Infrastructure Plan 2015 (produced by NZ Treasury)

3 waters
(The main benefits is public health)

33% of public assets (by value)

- State highways, valued at $29.2B, 10,886km managed and operated by NZTA
- Local roads, valued at $50B, 83,000km managed and operated by LG (half funded by NZTA)

Source: 2015 Infrastructure evidence base 2015 – Transport sector (produced by NZ Treasury)

Roads
(The main benefit is economic)

The benefits of metadata

There are significant issues with the quality of New Zealand's asset data. Metadata allows the quality of that data to be improved.

For the most part, improving the quality of data for different asset classes will not directly deliver benefits. However, it will remove barriers to, and enable, mature asset management practices (maintenance and renewal) through the creation of information to support evidenced-based decision-making.
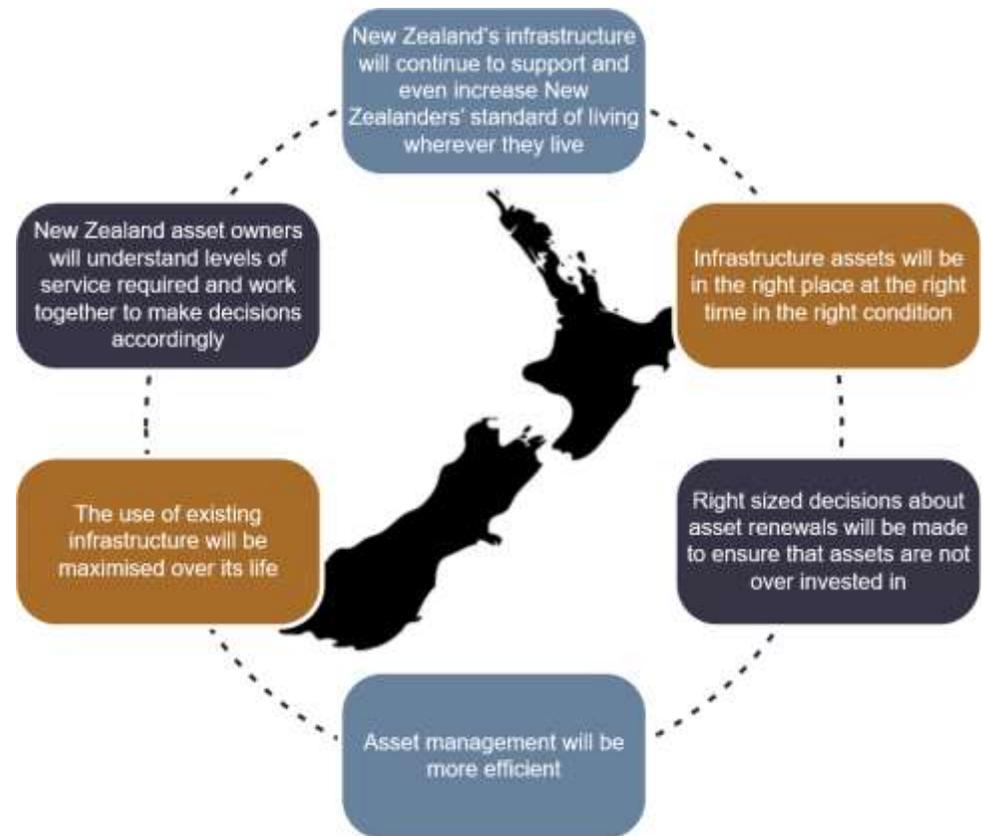
If infrastructure asset owners collectively create and use standardised data then the potential savings over the next 30 years are in the order of billions of dollars. Potential benefits include:

- Decreasing the cost of ownership – for example by enabling preventative maintenance, building assets in a way that makes them more cost effective to maintain.
- Increasing the asset utility by understanding capacity – for example if there is excess capacity it can be used through infill housing and brownfields development. Or if the asset is almost fully utilised, using strategies like demand management, such as water metering, to reduce pressure on the asset. There are potential national savings of $816M to 8.16B over 30 years from understanding residential housing capacity, based on Wellington City Council figures.
- Maximising the value of the asset over its life - e.g. by not replacing it too soon before all economic life has been extracted from it. There are potential savings to the New Zealand infrastructure spend of $5B-$7.5B over 30 years by reducing repair through more effective maintenance.
- Benchmarking, reducing procurement costs and improving insurance costs.

If the investment is made, then there is less likelihood of poor decisions and outcomes that would result in significant dead weight drag on the economy, stranded investments and lower productivity. The biggest benefit to society of improved data to inform better decision-making comes from enabling the

change from an asset driven to a service driven asset management approach because asset managers and decision-makers will be able to see the interconnectedness of their infrastructure. That improved decision making will enable better health, social wellbeing, education and environmental outcomes.

Options for implementing Metadata Standards

Working with technical experts and public-sector agencies, LINZ has developed a set of Metadata Standards (the Standards) for the 3-Waters and buildings (residential and light commercial) infrastructure asset classes. This work has been actively supported by MBIE and Treasury. A complementary set of Standards has been developed for roading by NZTA and local authorities.

Implementing the Standards to improve data and to create robust information is estimated to lead to savings in the order of billions of dollars over the next 30 years and beyond.

Three options for implementing the Standards were considered.

> **Implementation option 1: Publish the Standards and guidance available to asset owners to implement on a voluntary basis (Voluntary Adoption).**

Some organisations will simply adopt the Standards without any assistance from central Government. It is likely that these will be larger asset owners with multiple asset classes and high capability. For voluntary adopters, the benefits for their local networks will be realised. In large urban areas such as Auckland these benefits are likely to be significant.

However, others have different capabilities, capacity and willingness to pick up the Standards, and are unlikely to adopt the Standards. They may not have the required experience and/or resources, or they simply cannot see the benefit.

The full benefits of the Standards will only be realised if a critical mass of asset owners adopt them. The key risk of this option is that there is likely to be a lower pick up rate and lower national benefit realisation.

Therefore, different options have been provided to support a wider range of organisations to adopt the Standards.

> **Implementation option 2: Publish the Standards and implement them in two stages:**
>
> 1. **A pilot of the use of the Standards across a number of asset owners**
> 2. **Full "supported" implementation of the Standards with the goal of most asset owners using them within five years.**

This option addresses the key risk of the previous option – the Standards not being adopted by a critical mass of asset owners. Voluntary adoption of the Standards by non-pilot organisations can proceed.

In the pilot a small group of asset owners, and their suppliers, would be would adopt the Standards and use the analytics.

The purpose of pilot would be to:

- **Refine the Standards** themselves as teething issues arise, to make them more industry ready
- Develop and **refine the implementation methodology** and guidance material
- **Determine the likelihood of full adoption of the Standards by all of the relevant asset owners across New Zealand and the reasons for the level of identified uptake**
- **Test the benefits** and value of the Standards and analytics
- **Identify the risks** of implementing the Standards/analytics for Government, asset managers and the other adopters of the Standards
- Confirm the **cost** to successfully fully implement the Standards so Government and other investors can make funding decisions.
- **Identify the interventions** that would be needed to fully implement the uptake of the Standards (from "do nothing" to "regulate")

- **Inform recommendations** to proceed to full implementation, and with whom
- **Test the benefits** of the Standards and analytics

The pilot would happen over a period of 30 months. However, this timing could be adapted:

- If changes are going well and full implementation could be brought forward.
- If large issues arise, the pilot could be stopped early or changes made.

The advantages of this option are that:

- The implementation process risks, issues arising and success/value indicators will be clearer
- A wider range of organisations are more likely to successfully adopt the Standards and therefore realise more fully the benefits
- Voluntary adopters and organisations involved in pilots would have access to more analytic tools than they would under Option 1.

The cost to central Government of this option is roughly $6.6m for the pilot process and up to $30m for full implementation

Implementation option 3: Publish the Standards and regulate to ensure they are used by asset owners immediately.

This option also addresses the risk of scattered implementation, by requiring their uptake by regulation.

Under this option, the use of the Standards would be mandatory and their use could be enforced.

The advantage is that the Standards would be implemented by all asset owners.

The risks are that:

- Additional support (capacity and capability) is likely to be required by many asset owners. Without support many organisations do not have the skills or resources to successfully implement the Standards. The cost to central Government to provide this support cannot be accurately determined without first piloting the adoption of the Standards
- asset owners could view the Standards as a compliance exercise, and therefore do the bare minimum to "comply" in which case the benefits may not be achieved.
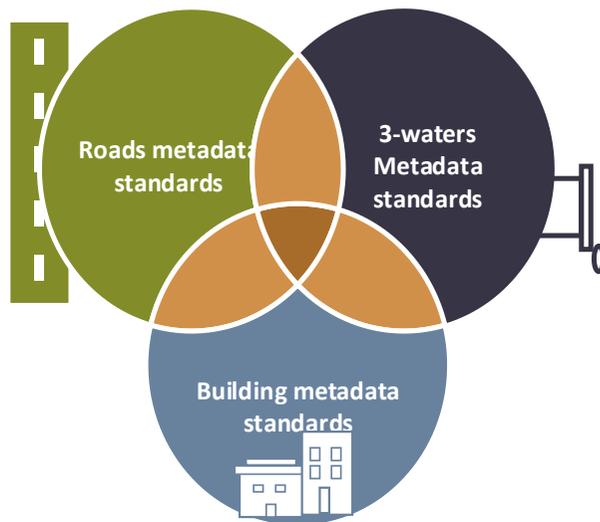
Implementation options Analysis

The options were assessed against five criteria. That analysis showed that **Option 2** was most likely to result in a successful uptake; with asset owners having greater confidence in the Standards and therefore more benefits being realised.

Criteria	Option1	Option 2	Option 3
Successful implementation	Low	High	Medium
Confidence in the Standards	High	High	Medium
Certainty over cost	High	Medium	High
Speed of implementation	High	High	Medium
Benefit realisation	Medium	High	Medium

In October 2016 Ministers indicated Option 2 as their preferred option.

Options for technical governance of the Standards

Much of the value of introducing metadata standards will be gained from creating interoperability and readability across different infrastructure classes: vertical infrastructure (residential and light commercial buildings), 3-waters (drinking, storm and waste water) and roads. Therefore, the technical development of the first standards for the first two classes (residential and light commercial buildings; 3-waters) have been developed alongside the roading standards being developed independently by NZTA. The three sets of Standards involve metadata that is unique to their asset class and metadata that is shared with one or all the Standards. This is illustrated in the diagram below where shared parts of the Standards are shaded in orange.

Over time the new Standards will need to be adjusted as technology changes and interoperability and usability improvements are identified. Strong governance is needed to support these changes. To be successful technical governance (with appropriate expertise and standing in their technical communities) needs to fulfil the following functions:

- Make changes to the Standards as required. Standards must continue to be fit for purpose and sufficiently comprehensive without being overly complex. Ongoing technical changes will need to be supported, for example through change requests, consultation, publishing Standards and implementation.

- Maintain and strengthen "overlap" value to ensure that infrastructure decisions can be made across systems rather than within separate assets classes.

The value of maintaining the shared metadata is key to the ongoing success of the Standards and enabling infrastructure to be thought of holistically and not in asset silos., to ensure that infrastructure can be thought of as a system rather than separate assets.

The Thirty-Year Infrastructure Plan 2015 recommended that over time new Standards might be developed for other types of infrastructure such as power and telecommunications.

The table below sets out the functions that are needed to maintain the Standards.

Role	Responsible for
Technical governance	Maintaining the Standards including change management and in particular the overlapping parts of the Standards (in orange)
3-waters, buildings, roads	Each Standard, where they do not overlap with another standard needs to be maintained and updated.

We considered three options for maintaining the Standards during and after implementation.

Under this option, central Government will take no part in maintaining the Standards, so 'industry' will need to provide and implement self-governance.

There is no cost to central Government for this option.

Rather than centrally govern the Standards, there is a risk 'Industry' may adapt them to meet individual needs. Over time the benefits from introducing industry wide, consistent Standards will be eroded and the issues with data, lack of interoperability and poor information will re-emerge.

Governance option 2: One group will maintain all the Standards.

Under this option, one entity would be responsible for maintaining all sections of the Standards.

This option is simple and ensures that the overlap between the Standards is maintained. Other than funding, no central Government involvement would be needed.

Currently no organisations have the technical expertise to maintain all three different, and quite technical Standards – so a recruitment process would need to be undertaken. Initial investigation indicates an ongoing costing of ~$1m pa for this option. It is likely it will have to be funded by central Government.

Governance option 3: Multiple groups will maintain the Standards

Under this option, a technical hierarchy would be implemented to provide specialised governance of the Standards.

One group would maintain overall technical governance, with specific responsibility for the overlapping parts of the Standards.

Specialist entities would then be responsible for specific areas of the Standards. For example:

- WaterNZ or LGNZ could manage the 3-Water Standards
- MBIE or BRANZ could manage the building Standards
- NZTA could manage the roading Standards.

Organisations with the right expertise will maintain the Standards affecting their assets, with a technical governance function to process overlapping areas. There is an added benefit that this option will also bring different classes of asset owners together to work collaboratively on the Standards.

Initial funding indicates this option is likely to cost ~$1.5m per year.

Governance options Analysis

The options were assessed against four criteria.

Criteria	Option1	Option 2	Option 3
Confidence in the expertise of those maintaining the Standards	Low	Medium	High
Maintaining the shared metadata	Low	High	High
Cost effective	High	Medium	Medium
Benefit realisation	Low	Medium	High

That analysis showed that **Governance option 3** was most likely to result in a successful outcome with asset owners having greater confidence in the Standards because of the input of expertise into their maintenance.

Options for central Government ownership

The owner of the Standards will be responsible for oversight (holding the story; evaluation and monitoring), testing the validity and effectiveness of the short-term toolkits and processes being used to release the Standards; motivating uptake and implementation , crystallising and promoting benefits realisation and reporting progress to Ministers as required under the Business Growth Agenda and National Infrastructure Plan action plans.

The current interim owners of the Standards, LINZ and Treasury, do not have responsibility for infrastructure assets, and therefore it is generally accepted they are not the right fit for ongoing ownership. **Upon release of the Standards, in June 2017, LINZ involvement with this initiative will come to an end**.

There are three high level options for ongoing ownership of the Standards:

Ownership option 1: No central Government involvement

Under this option, once the Standards are released, central Government will have no further part role in driving the Standards forward. 'Industry' will have the opportunity to drive the Standards forward without oversight or support from central Government.

With no central agency oversight and drive, there is a risk to fully realising the benefits outlined above. Even if the benefits are initially realised in some areas where uptake happens voluntarily, over time the benefits from introducing industry wide, consistent Standards will potentially be eroded and the issues with data, lack of interoperability and poor information will re-emerge.

Ownership option 2: Interim ownership of the Standards

Under this option, a Government agency or agencies would be assigned 'interim ownership' of the Standards.

This option will ensure there is some central Government learning captured during initial implementation of the Standards, as well as being available to provide guidance around technical governance of the Standards. This approach would allow for temporary responsibility for oversight and reporting, in the formative stages of the settling of the new standards, while benefits and value are being crystallised and the validity and are being tested of the short-term toolkits and processes being used to release the Standards are being tested.

There is not currently no one, logical, central Government organisation to undertake this interim ownership.

Ownership option 3: Identify a new ongoing owner for the Standards

Under this option, a central Government agency or agencies would be appointed to undertake ongoing ownership of the Standards.

This will provide ongoing leadership and central Government support for the Standards, and is the option most likely to ensure that the Standards are being adopted in order to achieve their full benefit.

There is currently no logical central Government agency to undertake this ongoing ownership function. Conversations continue to identify central Government agencies that could undertake this ownership.

Ownership options analysis

The options were assessed against three criteria.

Criteria	Option1	Option 2	Option 3
Industry confidence in Government support of the Standards	Low	Medium	High
Ensuring the Standards are implemented and maintained effectively	Low	High	High
Benefit realisation	Low	Medium	High

That analysis showed that either **Ownership option 2 or 3** are most likely to result in a successful outcome with central Government involvement required to ensure a high level of confidence that the Standards will achieve benefit realisation.

Appendix: Cost of implementation option

The following sets out the cost of the preferred implementation option during pilot and full implementation stages.

Stage 1: Pilot Costs

It is proposed that the cost of Central Government involvement in the piloting of the Standards be borne by appropriation.

This will enable the pilot to be run, implementation tools developed, adopters supported, policy work on implementation levers undertaken, evaluation conducted, work and support done with non-pilot asset owners and work done to prepare for a full implementation.

Pilot participants would be required to fund the substantial cost of implementing the Standards themselves.

The estimated central Government cost for the three-year pilot is $6.6m from 2017/18 to 2019/20. The following table sets out the year by year cost (thousands).

	2017/2018	2018/2019	2019/2020
Contractors	$1,637	$1,637	$1,637
Personnel	$130	$130	$130
Other Staff Expenditure	$30	$25	$25
Travel	$98	$98	$98
Meetings/roadshow	$6	$6	$6
Overhead	$95	$95	$95
Consultants	$0	$0	$70
Contingency	$200	$200	$220
Total	**$2,196**	**$2,189**	**$2,281**

Stage 2: Full Implementation costs

During the pilot period, the true costs of delivery will become clear, a rough order of costs is between $21.6 m to $28.8m from 2019/20 to 2032/34). The full implementation costs have been put into a range because there is a high degree of uncertainty. Those costs will be confirmed over the Pilot stage of the programme.   The following table sets out the year by year cost (thousands).

	Stage 2 (low)	Stage2: (High)
2020/2021	$2,519	$3,351
2021/2022	$2,453	$3,263
2022/2023	$1,572	$2,091
2023/2024	$1,649	$2,193
2024/2025	$1,682	$2,236
2025/2026	$1,668	$2,219
2026/2027	$1,606	$2,135
2027/2028	$1,638	$2,178
2029/2030	$1,670	$2,222
2030/2031	$1,704	$2,266
2031/2032	$1,738	$2,311
2032/2033	$1,773	$2,358
Total	**$21,672**	**$28,823**