



TIES LIVING LAB PROGRAMME

Good data through collaboration (IP9)

October 2022





## INTRODUCTION

Decisions taken today about what infrastructure assets to build, and how and where, may have repercussions that only emerge decades later. That's why access to high-quality data is crucial for all aspects of commissioning and delivering infrastructure construction projects, no matter how simple or complex. But now that so much data is available, how do today's decision-makers know they have thoroughly assessed the options and implications of creating new assets or maintaining existing stock?

A core aim of the TIES Living Lab Programme was to promote the use of high-quality data by demonstrating the power of collaboration, including developing and testing the efficient and effective use of standardised solutions between transport infrastructure stakeholders, and driving cultural change in the transport infrastructure sector.

This information paper explains how the TIES Living Lab data research team, known as the Analytical Consortium, harnessed data from the four modern methods of construction (MMC) demonstrator projects (IP2, IP3, IP4 and IP14) to create a repository of benchmark data and to output standard performance metrics. This work – under the project on Metrics, Benchmarking & Repository, and the project on Artificial Intelligence for Data Mining – analysed data using artificial intelligence (AI), as part of a wider aim to provide strategic insight into how to improve performance in projects.

## BACKGROUND

In September 2021 the Infrastructure and Projects Authority published its *Transforming Infrastructure Performance: Roadmap to 2030* (TIP Roadmap) in response to a large increase in public spending on transport infrastructure. The aims of the TIP Roadmap are aligned with those contained in the UK Government's *Construction Playbook* (2020), and focus on increasing the efficiency of delivering infrastructure projects and using

whole life cost-benefit analysis as part of choosing which projects to fund. The TIP Roadmap also advocates the adoption of long-term, outcome-based collaborative delivery models. In this context, the TIES Living Lab aims to support collaboration between TIES Partners to help drive construction efficiency within the transport sector through benchmarking and the use of MMC.



## CHALLENGES

The current transport infrastructure landscape is characterised by numerous methods of measurement, data requirements, reporting structures and taxonomies. This makes it difficult to compare (benchmark) between organisations and to use data effectively to improve efficiency across the sector. Specific challenges include:

- **Limited quality of data:** The construction sector as a whole has historically been plagued by poor quality data. Anecdotal evidence suggests that almost a third of existing construction project data could be classified as inaccurate, incomplete, wrong or duplicate. In one survey of global construction industry stakeholders, 45% of UK-based respondents estimated that less than half of their organisation's project data was actually usable; another study acknowledged that using poor quality data can often result in poor decision-making, and that can have an impact on the financial performance of an organisation through misleading cost forecasts. Additionally, having to dedicate resources to handle issues related to data quality can impact a company's profitability.
- **Too much data is still not enough:** The amount of data collected in the construction sector in recent years has increased substantially but only a small portion of it is being analysed and translated into (a) information and then (b) intelligence. Engagement activities undertaken as part of the TIES Living Lab Programme highlighted that there are crucial elements where data is either not being collected or is not visible to client organisations because it sits within the supply chain.

- **Lack of collaboration and data sharing:** This can lead organisations to reinvent the wheel by, for instance, developing bespoke or internal data structures that prevent wider data sharing. It also encourages siloed thinking – contributing to industry-wide compartmentalised data, incompatible data structures, and lack of comparability between and within organisations, or in the supply chain.
- **Lack of comparability:** This project uncovered inconsistencies in reporting systems and practices between TIES Partners, between different parts of the same organisation, and between organisations and their supply chains, preventing effective comparison of similar assets between partners. Each TIES Partner has its own data capture structure: capturing data at either task or elemental level makes it difficult to align data for similar assets across TIES Partners. Similarly, data capture and verification processes may change over time, making it very difficult to compare historical and current data.

*The sector needs a consistent set of metrics and project attributes to maximise benefits while minimising data collection efforts.*

## DRIVING CHANGE THROUGH COMMUNITIES OF PRACTICE

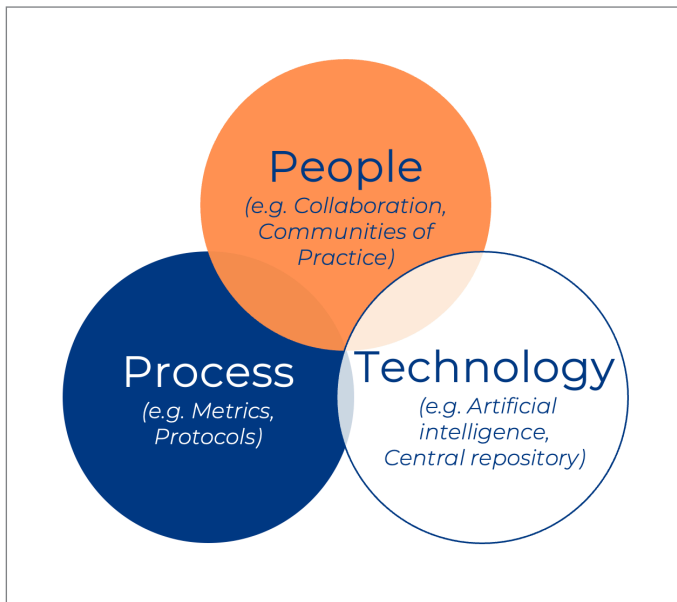
The Data Management Association (DAMA UK) has identified six core factors that can be used to assess data quality:

- **Completeness** – the degree to which records are present
- **Uniqueness** – the degree to which there is no duplication in records



- **Consistency** – the degree to which values in a dataset do not contradict other values representing the same entity
- **Timeliness** – the degree to which the data is an accurate reflection of the collection period
- **Validity** – the degree to which the data is in the range and format expected
- **Accuracy** – the degree to which data matches reality.

Taking these factors as a basis for good data, the Analytical Consortium initiated a culture-change strategy to enable a future where good data can be used to inform decision-making around three areas: process, people and technology. Together, these three areas can help drive digitalisation and standardisation of the transport infrastructure sector and improve its performance in delivering projects and maintaining infrastructure assets.



### Process

A key outcome from the TIES Living Lab is a set of metrics (see IP5a) and project attributes across the life cycle of a project from the

pre-design stage to the end-of-life stage. The attributes define the context to which the metrics relate and help to ensure that like is truly compared with like in the benchmarking process. The system has been designed to give TIES Partners maximum benefit from the minimum amount of data collection effort. The performance areas considered by the TIES Living Lab are: cost; schedule; productivity; quality; carbon; circular economy; biodiversity; climate resilience; and social value.

The data capture system developed through this project has been embedded in TIES Living Lab protocols (see IP8), thus ensuring that data is captured at the right level of detail and at the right time, and that data capture is consistent within and across different organisations to allow the derivation of robust benchmarks.

Ultimately this makes it possible to gather whole life performance information that can be used when making infrastructure investment decisions.

### People

Collaboration between stakeholders is a key aspect of driving standardisation and cultural change in the transport infrastructure sector. This means vertically integrated collaboration (i.e. owner – client – main contractor – sub-contractor) must be accompanied by horizontally integrated collaboration (e.g. between contractors working for different clients and, indeed, between clients).

Furthermore, collaboration cannot be a one-off activity; it must be part of “business as usual” to ensure continuous improvement.

To achieve this challenging ambition, the TIES Living Lab and the Cost and Performance Benchmarking Steering Group established seven Communities of Practice (CoPs):



networks of technical experts across transport infrastructure clients tasked with enabling and delivering collaborative benchmarks. The CoPs will implement the legacy of the TIES Living Lab and, in that context, enable infrastructure investment decisions based on whole life benchmarking.

The CoPs are:

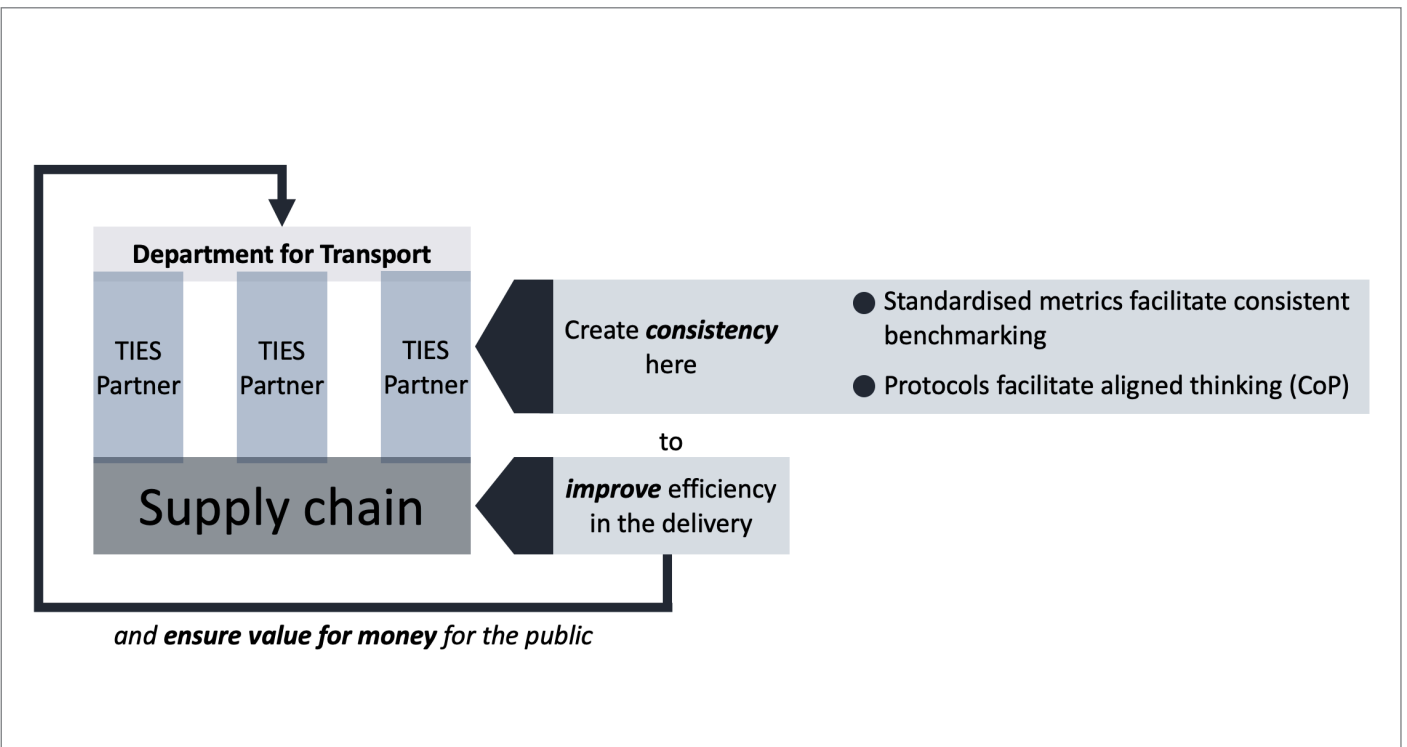
- Cost, schedule, productivity
- Quality
- Carbon
- Materials and waste
- Biodiversity and natural capital
- Climate-resilient performance
- Social value.

### Technology

The TIES Living Lab initiated the development of a central repository to store benchmarking

data and enable the TIES Partners to use it to inform decision-making. The repository was developed and is hosted by the Office for National Statistics (ONS) based on the protocols and data capture framework agreed by TIES Partners, to ensure that whole life performance data can be accepted, stored, accessed, exported and analysed in a standardised way. Ultimately this will enable partners to determine the differences in performance between apparently similar assets and identify where the opportunities for improvement lie.

In addition, the project demonstrated the potential for using AI techniques to analyse historical cost data. This part of the project developed, trained and tested an array of semi-automated AI systems that extract cost data and map it into a standardised schema based on the language used to characterise the data (see IP5b).





## LESSONS LEARNED

Project-specific lessons include:

- Consistent performance measurement can be driven through standardised metrics and aligned thinking through the CoPs.
- It is essential to agree and establish solid protocols that cover the processes for collecting, cleansing, storing in a central repository, analysing and reporting data to derive benchmarks.
- Protocols also need to cover the organisational structure, governance and processes by which the integrity and security of the data and its analysis is assured.

Capturing data with improved quality and quantity using new technologies will mean that organisations and people will have to learn how to:

- Understand the purpose of data collection/ extraction (and the type of intelligence they are aiming to derive)
- Understand the characteristics the data should have
- Discern the difference between “data” and “good data”, since only the latter should be used to improve performance.

In this way, positive change can be driven across the TIES Partners and their supply chains and the wider sector, as well as improving efficiency in the delivery of Government transport initiatives.

## LEAVING A LEGACY

Data standardisation in the industry is in its infancy, but the data collection protocols developed through this project – if they can be substantially implemented – will dramatically simplify analysis in the future, with enormous benefits for the sector with a minimum of cost.

This project has provided the foundations and tools for future collaboration among TIES Partners, and there is scope to extend the lessons learned and tools developed to a wider range of transport infrastructure and other construction stakeholders.

The metrics, the data structure, the protocols and the central repository all enable the collection, storage and processing of good-quality data which, through AI and the Intelligent Infrastructure Control Centre (see IP11), can be used to produce the intelligence for efficient and effective whole life value-based decision-making. And the CoPs, as part of the Cost and Performance Benchmarking Steering Group, are now established and tasked with implementing the benchmarking legacy of the TIES Living Lab and ensuring that infrastructure investment decisions are supported by robust, reliable, consistent and appropriate benchmarks so that better value for money and whole life performance can be achieved.

This work was coordinated by Doug Forbes of Whole Life Consortium Limited and delivered by experts from the TIES Living Lab Analytical Consortium (Accelar, Loop, University of Dundee, University of Leeds, University of West of England (UWE Bristol), and Whole Life Consultants Limited), under the project on Metrics, Benchmarking & Repository, and the project on Artificial Intelligence for Data Mining, overseen by the Cost and Performance Benchmarking Steering Group (Network Rail, National Highways, HS2, East West Rail, Transport for London, Department for Transport and the Infrastructure & Projects Authority).

# Living Lab



## Transport Infrastructure Efficiency Strategy

The TIES Living Lab is a transformative collaboration of 25 partners together with Government, i3P and the Construction Innovation Hub that use data, technology and Modern Methods of Construction within live transport infrastructure projects to deliver significant value-adding benefits across the transport infrastructure sector. The programme is funded via a grant from Innovate UK through the Transforming Construction programme, plus contributions from the Department for Transport, HS2, Transport for London, Network Rail and National Highways.

The four strategic outcomes of the collaboration are to:

1. Improve the way Transport Infrastructure projects are set up to maximise value
2. Achieve better assurance of project and programme value and what assets should cost (benchmarking)
3. Accelerate the wider adoption of MMC
4. Establish the TIES Living Lab as a catalyst for long term cultural change across sectors by making a compelling case for long term HM Treasury funding to scale this facility.

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