A Connected Data Environment Primer: What Every Board Needs to Know

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Public health and safety are enshrined in mission statements for many owner-operators, such as transportation agencies, water districts, and energy utilities. The measures of success, according to the leader of one rail and transit agency, are avoiding mention in the local ten o'clock news and not having to call the director of crisis communications. Unfortunately, there are many examples of trial by social media and sentencing in the court of public opinion that illustrate the danger only too well. No wonder owner-operators of long-lived infrastructure assets have developed ways of working and business processes that place maximum value on minimizing risk. Understandably, this mind-set makes boards cautious about implementing change. Then, add their complex IT environments and their chronic struggle for funding. However, they must change.

While human error is blamed for 80 to 90 percent of accidents and catastrophic failures, the root cause is typically a lack of timely access to accurate and complete engineering information about critical assets. The data are usually held in many different systems. These systems range from design systems used in engineering to asset registers in enterprise asset management systems, and even marked-up PDFs, 2D drawings and print-outs, unstructured spreadsheets, and Word documents on hard drives. The reason why accidents happen often boils down to the "Three R's" — not having the right information available to the right person at the right time.

This situation leads to a question for the boards and executives who set the asset management policy and data governance strategy for their agency. What carries more risk – a cautious, steady-as-she-goes, this-is-the-way-we've-always-done-it strategy, or one that is data-driven, data-informed, evidence-based, maximizing the value of the data, and putting information to work whenever and wherever it is needed? In other words, a going digital strategy.

This perspective offers a primer for executives of owner-operators on the concept of a connected data environment. It recommends a game plan for how they can take the first steps on their going digital journey or, if they have already passed the crawl-walk-run stage, how they can accelerate the pace of possible.

Defining a Connected Data Environment

The owner-operators of today use an array of applications and services during the lifecycle of infrastructure assets. Each application or service stores parts of the information in separate, disconnected environments with no consistency in formats or standards. To effectively manage projects and assets, the different applications and services need to access and make best use of data throughout the lifecycle of the asset. A connected data environment can help organizations be more efficient at accessing and utilizing information for construction and project delivery, as well as further along the infrastructure asset lifecycle for operations and maintenance.

A connected data environment is the common source of information used to collect, manage, and share information about the asset. It facilitates collaboration between project team members and owner-operators, and helps them avoid duplication and mistakes by incorporating multiple sources of data into a federated model. A connected data environment can include graphical and non-graphical, structured and unstructured

data, and physical and virtual information from multiple information sources. It can manage spatially-enabled information about assets, networks, and projects stored in files, models, and components. With operational analytics and machine learning algorithms, owner-operators can enable new levels of transparency and visualisation.

Through a connected data environment, organizations can control the status and quality of asset information as it evolves, no matter the source, and support business processes that require multiple data sources across all lifecycle phases. Engineering information produced during the project delivery phase of the asset lifecycle can be used to derive timely and actionable insights, supporting operational decisions that improve asset performance. Likewise, engineering information can be maintained and extended during operations and maintenance and provide the basis for performance-based decisions, including operational, maintenance, refurbishment, and design change assessments. Importantly, with a connected data environment, activities and costs associated with handover of asset information to the owner-operator are avoided, leading to a seamless transition of information and control.

Digital Engineering Models Form an Asset's "Digital DNA"

The heart of a connected data environment is a digital engineering model, comprising of information representing: engineering definitions, requirements and functional components, 2D and 3D models and networks, classification data, change orders, maintenance records, event data, and more. It also increasingly includes continuous survey data from sources like unmanned aerial vehicles (UAVs) and operational data from sensors and other Internet of Things (IoT) devices. The digital engineering model can be repurposed for comprehensive modelling and design, used as a vehicle for collaboration and project delivery, and handed over to operations and maintenance for asset performance and reliability. The digital engineering model is the asset's " digital DNA."

A growing number of standards describe the shared use of information related to projects and assets. Publicly Available Standard (PAS) 1192-2 and PAS 1192-3 define standards and processes for digital information related to project delivery and operations, respectively, including the requirements for common modelling, management, and exchange of digital assets. PAS 1192 also describes the shared use of a common data environment as the trusted source of information used to collect, manage, and disseminate graphical and non-graphical data and documents. These standards were notably implemented on the Crossrail project, Europe's largest infrastructure project, which Bentley played, and continues to play, a pivotal role as a technology partner. Bentley offers a broad portfolio of solutions and services that support a connected data environment as a shared source of information for collecting, managing, and sharing information across the organization and between collaborators and stakeholders in the project ecosystem.

Leverage a Connected Data Environment to Mitigate Risk

Leveraging a connected data environment provides standards, processes, workflows, tools, training, and reports to help minimize risk of time or cost slippage during

design and construction. The key is ensuring that data flows seamlessly between the asset discipline contractors and through the defined lifecycle. It requires agreement on what information is to be advanced (standards and dictionaries), how it is to be advanced (workflows and file formats), when it is to be advanced (schedules) and who is responsible for ensuring delivery and compliance (roles and reports). When these aspects are aligned, owner-operators can fully realize the benefits of asset lifecycle information management.

The intent is to enable owner-operators to incrementally build a digital asset in parallel with the physical infrastructure. This practice will start during the design phase and will be added to continuously. This approach has several advantages, enabling organizations to:

- Identify issues early in the design cycle through collaboration and clash detection
- Improve visibility and measurability of progress earlier in the design process
- Ensure seamless and early handover of "as-built" information for operations and maintenance
- Reduce the total asset cost through access in operations to accurate and approved information

We recommend that owner-operators develop digital engineering models of infrastructure assets that are used in a connected data environment as the single source of truth to accurately design, construct, finance, operate, and maintain their infrastructure assets. A connected data environment will ensure that the right person has the right information at the right time.

Why it matters: A connected data environment enables better transition of engineering information throughout the entire asset lifecycle. In truly digital workflows, data captured or created for one purpose are accessed by applications and algorithms for other purposes, saving time, minimizing rework, and improving data quality over the asset lifecycle. At the end of the day, the availability and quality of engineering information corresponds directly to the amount of risk an organization assumes.