The Modernization Imperative for Critical Infrastructure Owners & Operators

Using Data-Driven and Technology-Enabled Decision Making to Make Infrastructure More Resilient, Reliable, and Sustainable

Trimble

The need for modernization doesn't just apply to infrastructure systems themselves.

By now, we all know that many vital public infrastructure assets are in dire need of repair or replacement. In its 2021 report card, the American Society of Civil Engineers (ASCE) graded many legacy transportation and water resource systems in the D range. An unsettling number of assets are in fair to poor condition and capacity, meaning they pose a strong risk of failure. The ASCE findings reinforce the imperative to modernize critical systems. However, the systems themselves aren't all that need updating.

We also need to update the way infrastructure is designed, planned, operated & maintained.

Vast volumes and types of data are being generated and collected across the infrastructure lifecycle at this very moment. Too frequently, however, this data is siloed and inaccessible, and its full value isn't being unleashed. The technology exists today to excavate this data so it can be analyzed, aggregated, and shared. Yet, infrastructure owners and operators are notoriously slow to adopt technology. ***This tired storyline needs to change.***

Given the urgency to build and operate the infrastructure that's required to maintain our standard of living, national prosperity, and global competitiveness, owners and operators must be open to exploring how technology can help.

Being unwilling or unable to take advantage of the technology tools available is riskier than ever, contributing to:

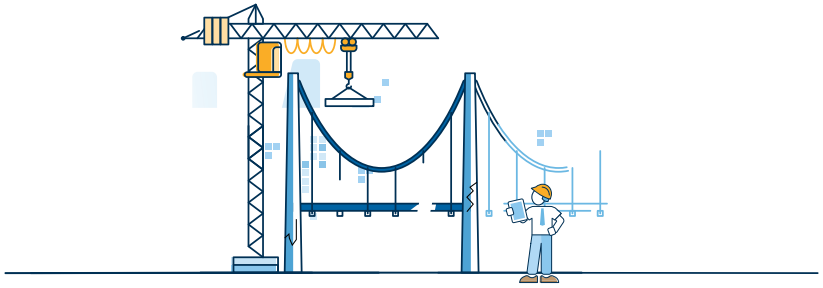
- **Increased vulnerabilities to safety and security threats**
- **Inability to meet growing directives and expectations**
- **Further erosion of public trust and confidence**
- **Deterioration of competitive advantage and economic strength**

It may seem counterintuitive, but by adopting technology at greater scale and at a quicker pace, owners and operators can mitigate these risks while also resolving the longstanding problems that threaten the success of infrastructure projects.

Read on to deepen your understanding of how the right technology tools can lighten the heavy burden owners and operators carry, and get guidance on how to safely navigate digital transformation.

Digital transformation in public infrastructure:
The integration of digital technology that enables data access, analysis, and collaboration across the asset lifecycle to increase efficiency, transparency, reliability, resiliency, sustainability, and public satisfaction.

Nearly 8 out of every 100 bridges are structurally deficient.



Trimble

Is the way you've traditionally worked really working for you?

Infrastructure owners and operators have never had a shortage of challenges to manage. Among them are some persistent problems that never seem to get addressed, like schedule delays and cost overruns. And the bigger the project, it seems, the bigger the price tag.

Meanwhile, new challenges are emerging all of the time. As if rising to the call to rebuild America's aging infrastructure isn't daunting enough, you face increasing pressure to:

- **Deliver the value you promise**
- **Meet sustainability requirements**
- **Be transparent about the allocation of public funds**
- **Ensure social equity in project planning and management**
- **Demonstrate job creation and positive socioeconomic impacts**

To meet these rising expectations, it's worth contemplating how you got here in the first place and questioning some of the long-held assumptions that might be working against you.

Why do we accept that projects will experience delays, overruns, and rework? What if we instead committed to reducing these costly and wasteful issues?

Going over budget and schedule may happen more often than not, but it doesn't have to be the case. The Golden Gate Bridge, which was built in the 1930s, was completed both on time and on budget, despite a host of engineering and environmental challenges.

More recently, the nearly 7-mile-long, cable-stayed Vasco De Gama bridge in Lisbon, Portugal, was also built on time and on budget in the late 1990s.

Do we have a holistic understanding of the condition of our entire asset portfolio? How would having complete and accurate data about assets help us?

As an asset is planned, built, operated, and maintained, a host of data is being collected. Typically, the data from one phase of the lifecycle doesn't transfer to the next phase. Yet, having access to complete and up-to-date asset information can be invaluable.

For example, you can probably understand how the construction data contained in a BIM model can be helpful to operations and maintenance. Having data about what was installed, as well as when and where, helps operators troubleshoot and resolve issues more quickly and effectively.

Now imagine if you had a single evolving multi-dimensional model about an asset that contained all of the layers of information that have been gathered over its lifespan—from BOMs and as-built details, to maintenance records and warranties.

With access to this type of digital twin, you'd have a much more complete understanding of an asset's design, functionality, and current state. You'd have access to the data needed to efficiently maintain its operation, as well as identify ways to improve the construction, operation, and maintenance of future projects.

Are we resigned to continue working in silos? Or can we find ways to share information and collaborate more effectively?

Consider this scenario: The water department of a mid-sized city proactively replaces 80,000 feet of water line each year. Their plans call for replacing water lines and mains in a particular 16-square block section of the city in two years.

Meanwhile, the transportation and infrastructure department, which is responsible for paving, pothole repair, and installing and repairing curb, has plans to make major street improvements in that same neighborhood later this year.

If these two departments aren't collaborating and sharing information, when the water department starts its project, it will end up damaging relatively new pavement that will then need to be repaired or replaced well before planned or budgeted. On the other hand, if they are collaborating and sharing plans, they can coordinate the work to be done more logically and efficiently.

The Real Costs of Critical Infrastructure Projects

Transportation projects

cost 24-40% more

than originally budgeted.

Energy projects

cost 66% more

than originally budgeted.

Source: Mastering the Risky Business of Public-Private Partnerships in Infrastructure, International Monetary Fund, May 10, 2021.

Trimble

Change is rarely easy, but it's necessary

As much as change is uncomfortable, you know that it's not realistic to do things the way you always have and expect improvements to magically occur.

To solve the age-old problems that plague the infrastructure industry, as well as the new ones you face, modernization provides the solutions you need.

4 reasons why modernization is worth prioritizing

1. More Accurate Planning and Budgeting

Access to reliable data provides invaluable insights for stakeholders across the asset lifecycle.

During planning and construction, estimators who have access to past actual vs. budgeted costs can create more precise budgets. By analyzing data on labor, equipment, and materials usage, construction managers can optimize resource allocation, ensuring that resources are utilized effectively, controlling costs and reducing waste.

2. Increased Sustainability

Modern construction methods emphasize eco-friendly materials, energy-efficient designs, and reduced waste. This helps minimize the environmental impact of infrastructure projects, aligning with global efforts to combat climate change. Simple things, like the usage of mobile technologies also improves sustainability by eliminating paper in the field.

Beyond the environmental aspects, access to data increases infrastructure sustainability by making it more responsive to citizen needs. Technologies like real-time monitoring and data analytics can be used to collect data on traffic patterns and make adjustments to improve travel efficiency. This data also enables the use of technologies like adaptive traffic signals and dynamic lane controls to make transportation more responsive to real-time conditions.

3. Better Resilience and Preparedness

Smart grids and digital technologies enable energy providers to monitor the grid in real time. In the event of power outages or grid disturbances, these systems can automatically reroute electricity supply, isolate affected areas, and restore power faster. Using remote monitoring and controls, operators can assess the status of assets, identify issues, and even perform remote diagnostics and repairs, which is especially valuable during emergencies or situations where physical access to the site might be restricted.

IoT devices and sensors can also provide real-time insights into the condition of transportation infrastructure. The data they collect makes it possible to detect issues like structural weakness, traffic congestion, or accidents, and respond quickly to reduce the risk of prolonged disruptions. Technology like predictive modeling can be used to assess the impacts of climate change and weather events, and proactively design systems that can withstand environmental stressors.

4. More Predictable Management and Maintenance

With access to data-driven insights, operators can respond swiftly to changing conditions and optimize operations based on historical performance and predictive analytics. Modern technologies, such as IoT sensors and data analytics, enable better monitoring and management of infrastructure assets. Early detection allows for proactive maintenance, reducing downtime and minimizing disruptions in critical services.

Technology tools like image analysis also make it possible to evaluate things like current pavement conditions and propose effective maintenance strategies. As more data is collected, machine learning enabled technologies become increasingly effective at predictive analysis across all stages of the asset lifecycle.

Never Underestimate the Power of Data

The problems that plague public projects may seem complex and difficult to solve. However, they all stem from a common root: a lack of data accessibility and sharing.

Traditionally, infrastructure design, construction, operation, and maintenance are treated as separate and distinct processes. When each is operating in isolation from the others, it leads to information silos that make data either inaccessible or difficult to access and share.

When you lack access to reliable information, your ability to anticipate, respond to, and recover from issues and disruptions is severely hamstrung. You can't easily spot trends, predict future needs, or proactively identify brewing issues before they become bigger problems.

Over 40% of the nation's roads and highways are in poor to fair condition.

Trimble

Asset lifecycle management = giving the right people the right data at the right time

Asset lifecycle management may sound like an intimidating concept. But at its core, it's about enabling the collection, analysis, and sharing of data to make well-informed and faster decisions. Giving the right people access to the right data at the right time solves a lot of problems.

Data-driven decision making is vital to realizing the gains needed in infrastructure transparency, visibility, predictability, and sustainability. When teams have the data they need at their fingertips, they can plan for, respond to, and recover from issues more effectively. They can also make better and faster decisions when time is of the essence.

To use data most effectively and to your greatest advantage, you need to be able to collect, centralize, and connect data at every phase of the asset lifecycle. In doing so, you can eliminate the information silos that traditionally exist between different stages of the asset lifecycle and effectively create a single source of truth about the project that's accessible to all stakeholders.

When all stakeholders have access to the same data, they benefit from a shared and holistic understanding of the entire project. Teams are able to collaborate more effectively, and hand-overs are streamlined. At the same time, workflows become increasingly seamless and efficient.

An asset lifecycle approach effectively connects people, processes, and information throughout the entire lifecycle of an asset–– from planning, through construction, to operations and maintenance. Doing so produces a host of benefits, including:

- **Greater confidence in decision making**
- **Earlier problem detection and resolution**
- **Lower total asset costs**
- **More predictability and visibility**
- **Improved productivity and performance**
- **Better risk management and response**
- **Increased sustainability and resilience**

"Connected asset lifecycle management will require changing the way decisions are made, both centrally and on an operational level. Workers will need to be educated on the value of capturing and providing asset data in a way that, traditionally, they have not been required to."

Source: Connected Asset Lifecycle Management, Deloitte

Take the uncertainty out of digital transformation

To experience the advantages of asset lifecycle management, you need to adopt technologies that make data collection, analysis, and collaboration possible. But don't let the concept of digital transformation scare you. Take these steps to get off on solid footing and form a strong foundation on which to build.

Step 1. Assessment and Planning

- Conduct a comprehensive assessment of existing assets, systems, and processes.
- Identify areas that require improvement and prioritize them based on their criticality.
- Develop a clear roadmap and strategy for modernization, outlining goals, objectives, and key performance indicators (KPIs).

Step 2. Stakeholder Engagement

- Involve all relevant stakeholders in the planning process.
- Gather input from these stakeholders to understand their specific needs and challenges.
- Gain early involvement and buy-in to ensure the success of modernization initiatives.

Step 3. Data Collection and Management

- Identify data collection needs, including all relevant data sources.
- Establish data management practices from the get-go, including identifying roles, responsibilities, and requirements for data governance, security, integration, compliance, and backup.

Step 4. Pilot Project Identification

- Start small by implementing pilot projects for testing new technologies and processes.
- Involve users early in the implementation process to gain invaluable feedback that will help you refine the technology to better meet user expectations and proactively address usability or training issues.
- Use these smaller scale projects to identify and mitigate potential risks, as well as assess feasibility before a full-scale implementation.

Step 5. Technology Evaluation

- Research solutions that address the priorities and needs you've identified.
- Prioritize solutions that can integrate seamlessly with existing systems as well as support future integrations. Implementation of digital solutions must be undertaken carefully to avoid inadvertently creating silos.
- Don't overlook the importance of cybersecurity. Prioritize systems that employ robust cybersecurity protocols to prevent cyberattacks and ensure the integrity and availability of data.
- Identify a centralized platform that will support the collection, aggregation, and analysis of data from all relevant sources.

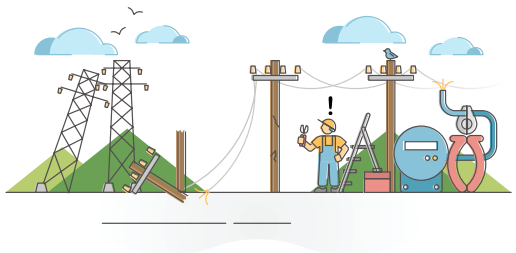
Step 6. Training and Skill Development

- Proactively anticipate the training stakeholders will need to begin using new systems and speed adoption so you realize some quick wins and a rapid return on investment.
- Identify opportunities to cross-train and facilitate collaboration among different stakeholders to prevent silo formation.
- Plan for ongoing education to ensure new users receive proper training, as well as keep everyone's skills and knowledge current.

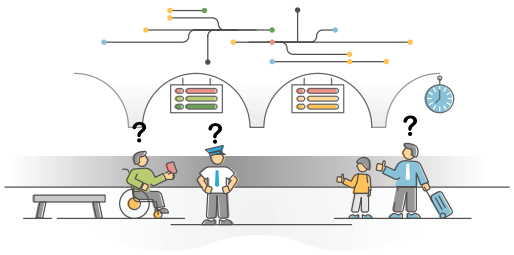
Step 7. Choose Technology Partners Wisely

- Identify technology vendors that specialize in infrastructure modernization and provide solutions that address the complete asset lifecycle, from planning & design, to construction, to operation and maintenance.
- Vet vendors to ensure they support a connected construction approach and provide solutions and integrations to encompass both immediate and future needs.
- Evaluate a vendor's wraparound services, including their support capabilities, training and learning programs, and investment in user communities and conferences, to support quicker adoption and realize the full potential of technology investments.

Vulnerable and aging
distribution systems
account for 92%
of electrical outages.



4 in 10
Americans
don't have access
to public transit.



At least
6 billion gallons
of drinking water
are lost each day.

Trimble

Don’t overlook the importance of change management in Digital Transformation

The success (or failure) of digital transformation efforts can be strongly influenced by effective change management. A thoughtful approach to change management will ensure all stakeholders are prepared, engaged, and aligned with the changes, so your desired outcomes are achieved.

There are a number of change management methods available, including the Prosci AKDAR Model, Kotter’s Change Management Model, and McKinsey’s 7S Model to name a few. Regardless of the method followed, the guiding principles of change management are relatively consistent and encompass these steps:

1. **Acknowledge resistance to change**
2. **Gain top-down support**
3. **Establish clear objectives and desired outcomes**
4. **Involve all stakeholders**
5. **Identify champions**
6. **Communicate frequently**
7. **Invest in training**
8. **Celebrate milestones**
9. **Institutionalize new processes**

When it comes to change management, you don’t need to figure it out alone. As part of your technology evaluation process, be sure to ask potential partners about their support for change management and what resources they can provide to guide your organization through digital transformation.

The time is now to start making data driven decisions

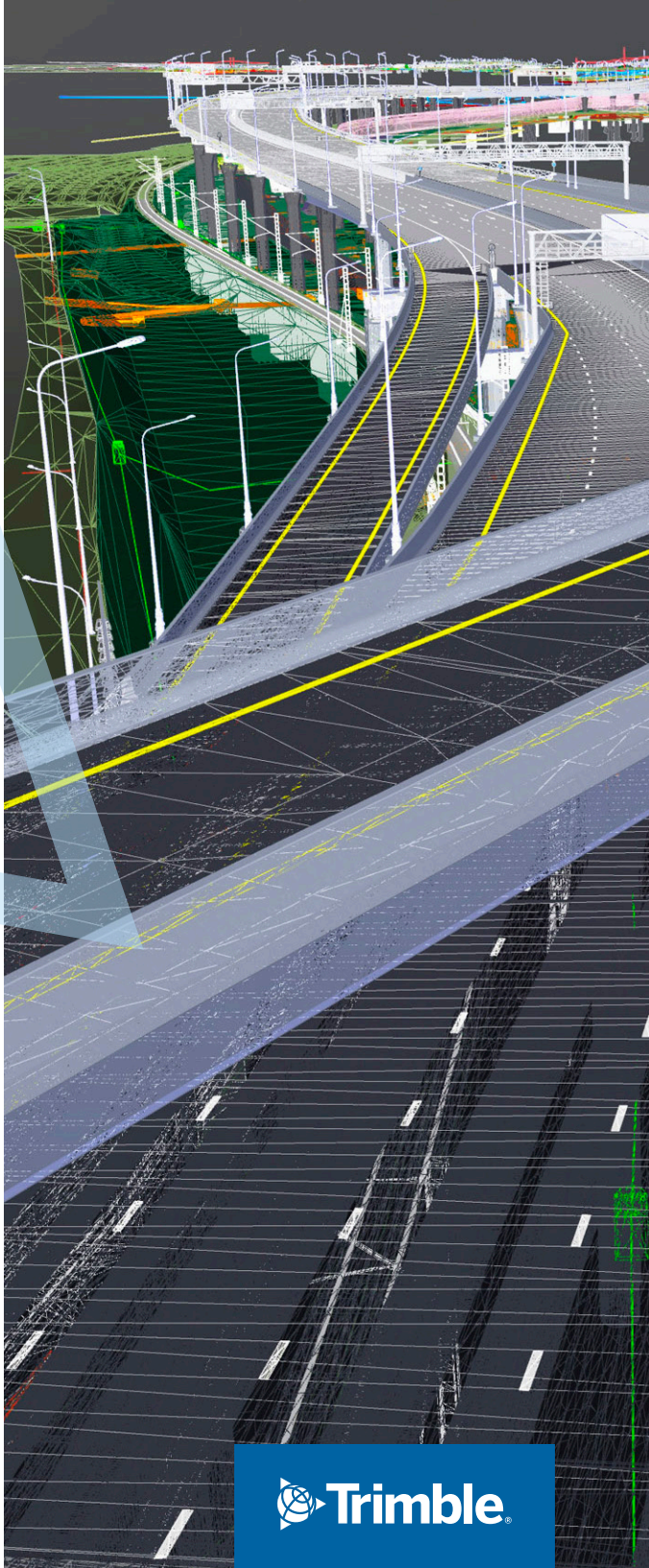
To deliver the critical infrastructure capable of supporting public needs today and for decades to come, owners and operators must be open to technologies that help them more effectively and efficiently plan, design, build, operate, and maintain assets.

"Companies that successfully deploy connected asset lifecycle management could save up to 15 percent of operational expenditure (OPEX) and up to 8 percent of capital expenditure (CAPEX)."

Source: Understanding Connected Asset Lifecycle Management, Deloitte

An integrated technology ecosystem provides the platform for data collection, information sharing, and cross-functional collaboration that's needed to deliver projects that live up to their promises.

By dismantling data silos and unlocking the insights they hold, an integrated technology ecosystem helps owners and operators confidently make decisions today to ensure our vital systems aren't just rebuilt, but reimagined for the future.



Isn’t it time you explored the ways technology can help you transform your projects?

LEARN MORE

Trimble