BUILD SMARTER WITH GIS

Understand How GIS Can Help Plan and Deliver More Strategic Infrastructure Investments

Lost Ground

The US has been consistently underinvesting in its infrastructure for some time. Recent figures indicate that state and local spending on infrastructure is at a 30-year low. The federal share of infrastructure investment has dropped by half during the past three decades. And as a result, overall total infrastructure spending has fallen from a high of 3 percent of the gross domestic product (GDP) in 1960 to roughly 2.3 percent today.

This compares to countries like China, which spends roughly 8.6 percent of its GDP on infrastructure, India at 5.2 percent, Australia at 4.7 percent, and Canada at 3.5 percent.

The US is now poised to embark on a major infrastructure investment program that will represent one of the largest investments in infrastructure in decades. But before we craft large-scale infrastructure investment programs, we should understand how we can be more effective in the planning, design, and construction of our basic infrastructure.

There are two key areas where we need to do better: we need to improve the cost efficiency in the delivery of our infrastructure because currently, US infrastructure is the most expensive to construct anywhere in the world. And we need to ensure that we are making the most strategic investments to help build the infrastructure of the future and not simply patching up the networks of the past.

Data and Information

Key to becoming more efficient, as well as more strategic in our infrastructure investment decisions, is understanding the importance of information through all stages of the infrastructure life cycle. From better use of data and information in the initial decisions of what infrastructure to build and where to more efficient delivery of our infrastructure projects to the preservation of those assets over time, the role of information is critical to improving our performance.

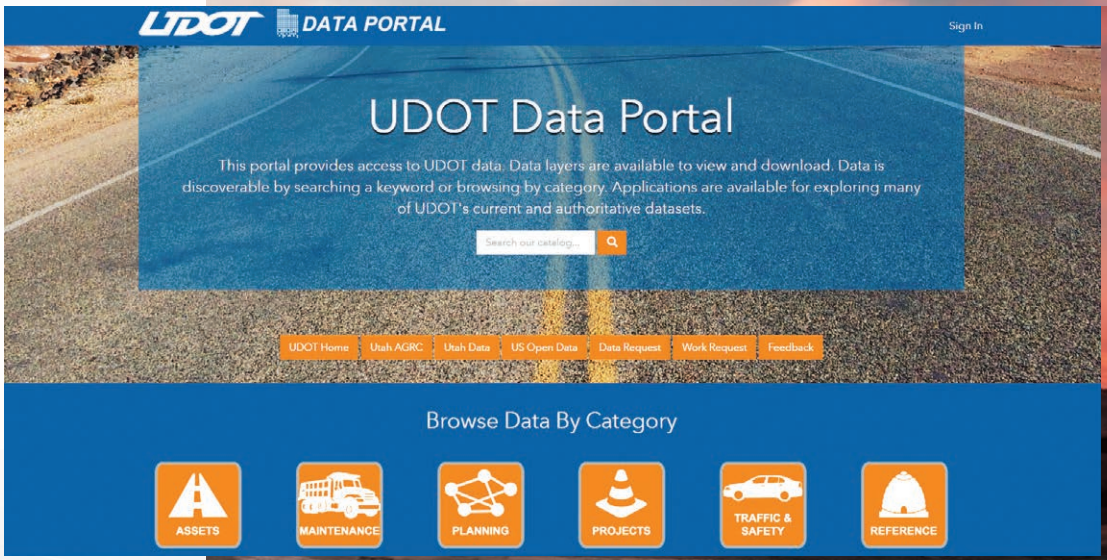
A fundamental part of that data and information is to understand context and location, which is called *location intelligence*. And that is where geographic information system (GIS) technology plays a critical role. GIS helps us organize, integrate, and analyze information in ways that help us discover greater insights, gain efficiencies, and make better-informed decisions.

It is time to start treating that data and information (and spatial information) as the most valuable assets we have to deliver our infrastructure more effectively for the next century.

Organizing Data

We have said that data and information will be key to our future infrastructure. But for many transportation organizations, that data is spread across their agencies, often in different formats, which makes it difficult to take advantage of the information they already have.

A central benefit of GIS is the ability to integrate a wide range of information and organize that information in ways that makes it available to anyone who needs to access the data. An ever-growing number of transportation organizations are using GIS to organize their data along with focused information products (maps that analyze data in specific categories) to help their workers access the information they need to make better decisions, whether in the office or in the field.



Understanding Infrastructure

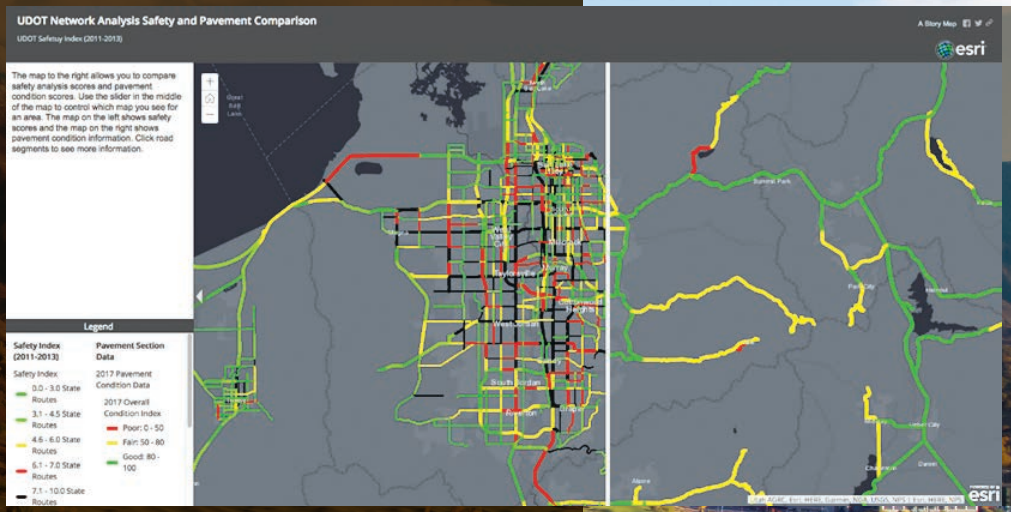
A key starting point for better infrastructure decisions is understanding the location and condition of existing assets. Strategic infrastructure investment is a combination of knowing what assets should be maintained (and at what level), where new investment is needed, and where key safety interventions would result in safer mobility for the public.

Understanding the condition of existing assets, together with calculations of life expectancy, helps agencies be more strategic in the timing of their maintenance and to prioritize those activities given constrained budgets. GIS helps agencies organize, visualize, and analyze asset information to make better-informed decisions to extend the life of those assets.

Understanding Performance and Bottlenecks

Key components of making better investment decisions are understanding the performance of existing networks and determining where there are deficiencies and bottlenecks and thus the need to make new investments.

GIS allows planners to bring together information from a variety of sources—current levels of congestion, road safety, changing mobility patterns, and current freight and multimodal flows—to give transportation agencies a more comprehensive view of their infrastructure and the performance of their networks.

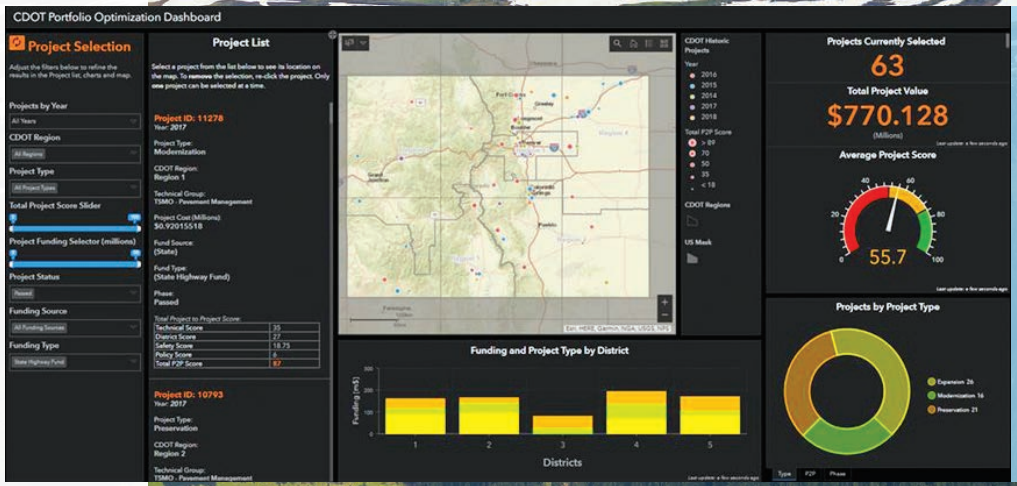


With GIS, agencies can conduct this analysis at any scale or level, including a national-level view of our transportation networks. This process will help us discern where investments would significantly improve the movement of goods and make national supply chains more efficient.

Analysis and Prioritization

Making the most strategic investments almost always involves finding the optimal balance between different values—whether safety concerns, congestion mitigation, or economic development considerations—to achieve the greatest societal benefit. Analysis supported by GIS can help us understand the trade-offs between different investments, ensuring that we target dollars to deliver the greatest impact. As such, GIS is a platform of insight that helps agencies make smarter investments in the future of American infrastructure.

The goal is to ensure that we are working on the right project, at the right time, at the right cost. Whether alone or in combination with other tools and models, GIS can help visualize and analyze a number of competing alternatives to ensure the most strategic decision.



Building Smarter

Between 1960 and 1980, the cost to build one mile of highway tripled, and American infrastructure has long been the most expensive to construct anywhere in the world. While there are many reasons often cited for the high costs of US infrastructure, one that certainly contributes is our inability to effectively leverage information and technology through the full infrastructure life cycle.

A number of years ago, the National Institute of Standards and Technology (NIST) released a study focused on US infrastructure. The publication highlighted the lack of interoperability between software platforms used in the planning, delivery, and management of infrastructure projects (https://bit.ly/31gKB5g). Several key findings are worth repeating here:

- Effective data and information communication can reduce project delivery time by 20–50 percent.
- Poor communication between systems wastes up to 30 percent of project costs.
- Effective data management from the early project stages could save up to 14 percent of operations and maintenance (O&M) costs.

The key takeaway was the inherent inefficiency in the US infrastructure industry, largely driven by the lack of interoperability of platforms and systems used in infrastructure planning. Another way to put that is that we are not very effective at practicing what the Europeans refer to as *whole life cycle information management*.

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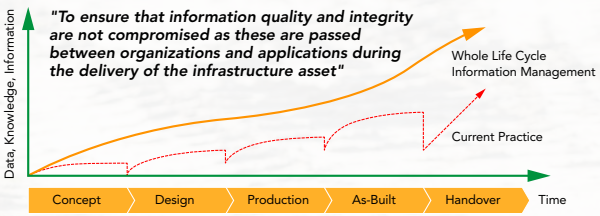
And it is precisely this area where our European and Asian colleagues have focused their attention with considerable results.

The goal of whole life cycle information management is to capture the typical inefficiencies and information loss as we move between the various stages of a project. Because we utilize different software platforms, we often start over with having to re-create data for use in these different platforms. It is the area under the curve in the illustration below that represents the potential efficiency gains if we take our information systems more seriously at the early stages of a project.

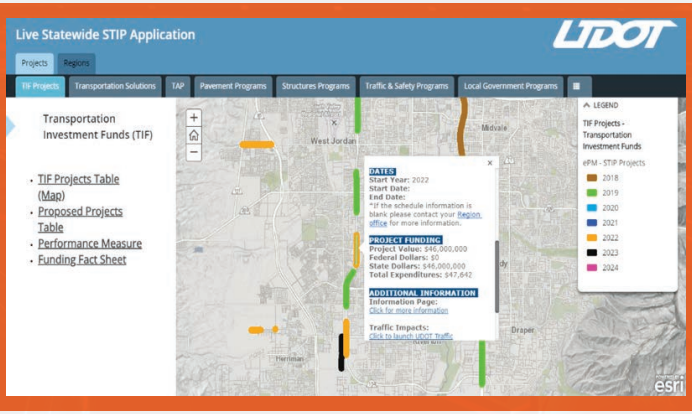
Most European governments have instituted whole information life cycle requirements (building information modeling [BIM] standards) for large publicly funded projects, with the expectation of cost savings in the order of 20 percent for each project. It is time we followed this lead in American infrastructure.



Collaboration and Communication

Effective infrastructure planning ultimately requires considerable coordination within a transportation organization, but just as importantly, across a number of other agencies as well. This ensures that all parties can coordinate and collaborate on the development of shared goals, objectives, performance measures, and targets.

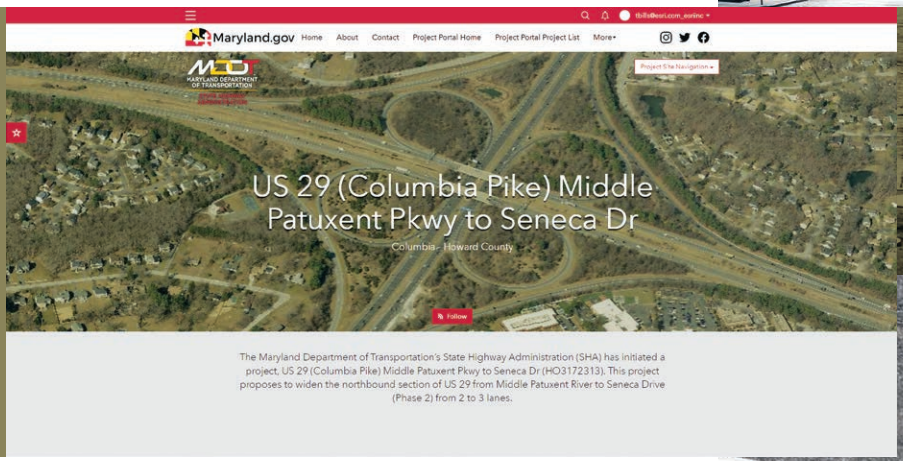
GIS technology provides precisely that framework to facilitate data sharing and collaboration, allowing agencies to share the same information and have the same understanding with respect to project definitions and assumptions. In addition, they can collaborate on analyses, modeling, and other project alternatives and share results, leading to a comprehensive and cohesive planning framework.

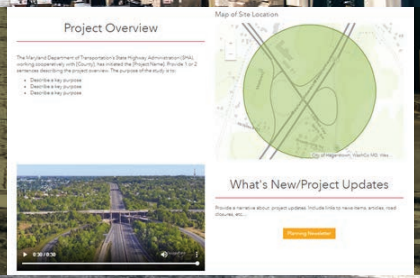


Project Tracking and Public Transparency

Transportation agencies need to carefully track and monitor the progress of their infrastructure projects to ensure on-time and on-budget delivery. GIS can help provide a comprehensive construction management framework, bringing together project management applications, documents, and field construction inspection tools to give project managers the latest information at their fingertips, whether in the office or in the field.

And GIS can help agencies effectively communicate progress in a powerful storytelling framework to keep the public informed throughout the construction process. With GIS, you can be more effective in your public communication and set a high bar for public transparency.





Build Smarter with GIS

GIS provides a platform to help manage data and information through the entire infrastructure life cycle–from planning through delivery and operations. This starts with the ability to integrate information from disparate sources and organize that data to make it widely accessible to anyone who needs access to it from any location.

GIS provides the tools to analyze a wide range of information to discover greater insights, gain efficiencies, and make better-informed decisions.

Learn how you can begin to capture the efficiencies from better management of information throughout the infrastructure life cycle and make better-informed, strategic decisions about the infrastructure needs for the future.

Contact the Esri account team to discuss the best solution for you. Email transportation@esri.com or, to get more resources, visit **go.esri.com/esri-transportation-infrastructure-resources** and submit your contact information for additional information.

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