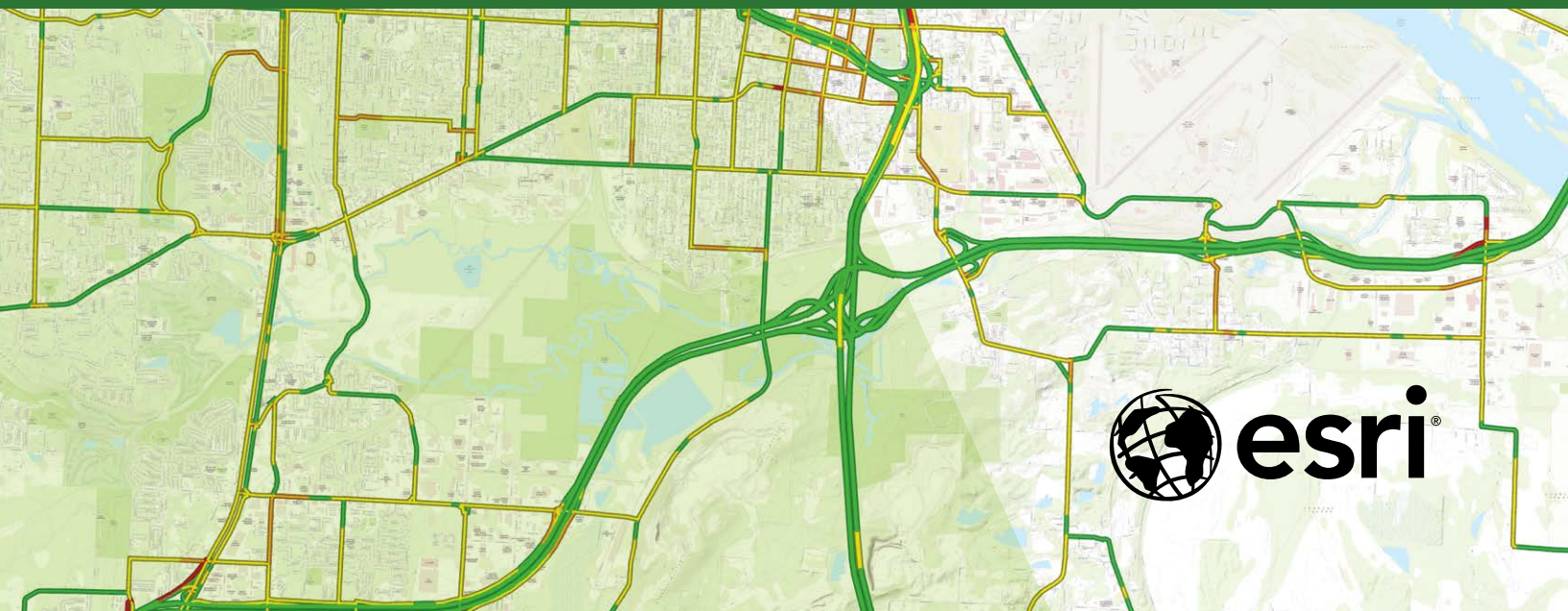
Data-Driven Decisions with Location Intelligence



esri®

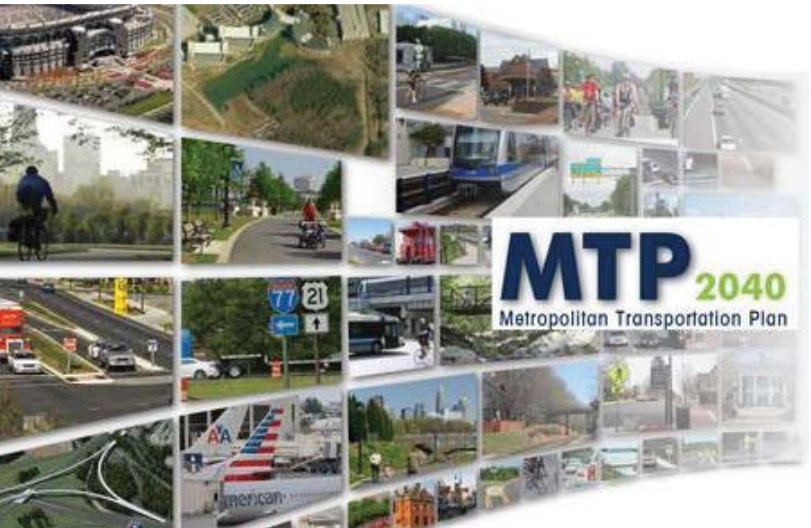
Transforming the Planning Process

There has never been a more challenging time in transportation than today. As the core business of Departments of Transportation (DOTs) shifts from construction to preservation, transportation professionals must increasingly manage complex transportation systems under continually constrained revenues. Limited resources challenge DOTs as they attempt to maintain existing infrastructure while satisfying an ever-increasing set of performance expectations from the public.

These trends are occurring in the context of a dynamically changing regulatory environment, which requires a greater emphasis on comprehensive information systems to help support better decision-making regarding where and how scarce public resources are allocated. Here are five key factors that are driving these changes:

- **Requirements for Data-Driven Decisions:** The latest transportation authorization acts mandate that the transportation planning process must be driven by decision-making processes that rely on good information systems and defensible analysis.
- **Move to Performance-Based Planning:** Both the Moving Ahead for Progress in the 21st Century Act (MAP-21) and the Fixing America's Surface Transportation (FAST) Act specifically require a performance-based approach to transportation decision-making that supports national performance goals related to safety, mobility, goods movement, preservation, and environmental sustainability.
- **Required Risk-Based Asset Management Plans:** Transportation agencies need to demonstrate that they have implemented a transportation asset management plan (TAMP). These plans must focus on preserving core transportation assets and include a life cycle cost and risk management analysis.
- **Comprehensive Planning Approach:** Interagency barriers need to be overcome to maximize the return on taxpayer investments. Transportation planning agencies need to consider requirements across program areas—not just pavements and bridges but also active transportation and transit—that address all critical deficiencies. Our mobility challenges require smarter planning.
- **Need for Greater Public Transparency:** This final requirement comes less from statute and more from the growing public expectation of greater transparency in the way public dollars are expended. Smart DOTs are taking proactive measures to ensure greater transparency and public engagement.

All these trends significantly impact the way DOTs conduct their planning processes. Collaboration and communication within and among agencies are becoming much more important. This highlights the need for robust and accessible information systems to support increasingly complex management and decision support processes.



Challenges

In the past, DOTs have struggled to access the data required to carry out their planning tasks. Lack of access to relevant data and information has been a constant frustration for many planning professionals. They want the capability to easily access authoritative data sources along with integrated planning tools that visualize and analyze planning scenarios that simplify better decision-making.

Solving this problem requires addressing five separate requirements critical to a comprehensive planning process:

- There must be a way to orchestrate and administer the overall planning process across the organization. Good planning requires inputs from many different groups within the DOT as well as from external agencies. This process requires good administrative workflows that capture and organize information at each stage of the planning life cycle.
- The needs and deficiencies of the various transportation modal networks must be understood. This requires systematic data collection and organization alongside seamless integration with sophisticated models and analytical tools. These cannot be isolated and ad hoc processes but should be primary components of the overall planning workflow.
- Transportation planners need to be able to conduct multiobjective decision analyses (MODA) at the individual project level. This ensures the efficient expenditure of resources and a favorable return on investment (ROI). Good planning hinges on the ability to support several different levels of analysis and granularity. Any planning solution must be capable of this flexibility.
- Senior transportation professionals must balance multiple criteria, priorities, and constraints in the selection of the most strategic portfolio of projects. They need effective cross-asset and cross-modal prioritization models to help achieve this at the district, regional, or central office level.
- Senior managers need a way to effectively monitor performance against established metrics. Doing so supports a process of continuous improvement as part of a DOT's planning and programming processes.

Together, these requirements define the wish list of most planning and asset management directors and senior transportation professionals. Their incorporation helps DOTs meet project planning and prioritization tasks and ensures that only the most strategic planning decisions are made. This is where Esri and geographic information system (GIS) technology can play a significant role in rationalizing the transportation planning process.

The Planning Process Workflow

A System of Engagement: Good planning begins with organizing your information. At Esri, we believe that a GIS can help you establish a system of engagement (SOE) by integrating existing authoritative business systems. This allows you to create a single source of truth that is trusted throughout the organization and united through location.

While this SOE is valuable for everyday business activities, it is especially valuable in helping guide the project planning process. Through GIS, information from transportation models, asset management systems, roadway inventories, and transportation monitoring systems can all be brought together to support the entire planning process. Having all relevant data and information sources easily accessible and centrally located removes a large amount of frustration from the equation.

Furthermore, once these information sources are organized through the GIS, information products in the form of targeted and easy-to-use applications can be built to assist functional area planners in performing deficiency and needs analyses. The results of these analyses can be organized to give planners wide and easy access to relevant data, as the graphic below from Utah DOT (UDOT) illustrates.

Performance-Based Planning

Current transportation legislation stipulates that states and metropolitan planning organizations (MPOs) must follow a performance-based planning (PBP) approach to plan development and project selection. Such a management approach is designed to inform investment decisions by focusing on projects that help achieve widely shared goals and priorities, improve the project and program delivery process itself, and provide greater transparency and accountability to the public.

The following elements form the core of a PBP process:

Strategic Direction: Where do we want to go? In the transportation planning process, stakeholders articulate a strategic direction that is based on a shared vision of the future. This includes defining the goals, objectives, and performance measures that will help track results.

Planning Analysis: How are we going to get there? Driven by data on performance, along with public involvement and policy considerations, agencies conduct analyses that inform investment and policy priorities. This includes analysis of trends and current deficiencies and the identification of strategies (and alternatives) required to achieve performance goals.

Programming: What will it take? Programming involves selecting specific investments to include in an agency capital plan, a transportation improvement plan (TIP), or a statewide transportation improvement plan (STIP). In a PBP approach, agencies make programming decisions based on whether those decisions support performance targets or contribute to desired trends. This step often includes the development of an investment plan and the prioritization of projects based on their ability to help meet the performance goals outlined.

Implementation and Evaluation: How did we do? A PBP approach is based on the premise that following these processes will lead agencies to their desired goals. To help ensure success, the final steps involve a process of monitoring, evaluation, and reporting. These steps provide feedback that is used in the next planning phase.

Orchestrating the Planning Workflow

This entire planning process depends on having a solid information infrastructure that facilitates effective coordination and communication. This infrastructure brings together the disparate data sources required for monitoring, modeling and analysis, and project prioritization. An effective GIS-based project planning framework can help orchestrate the entire workflow by administering, standardizing, and ensuring consistency throughout the entire process.

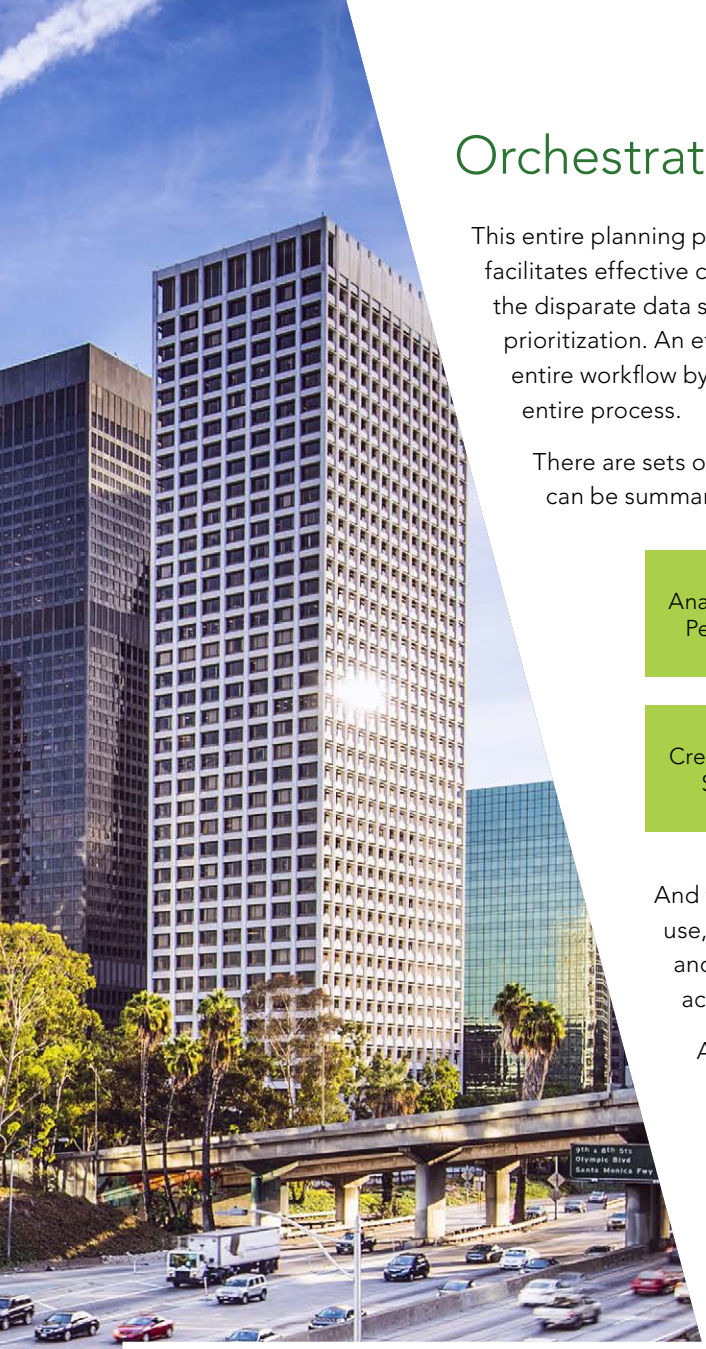
There are sets of repeating activities that most planning processes include, and these can be summarized by the following high-level steps:

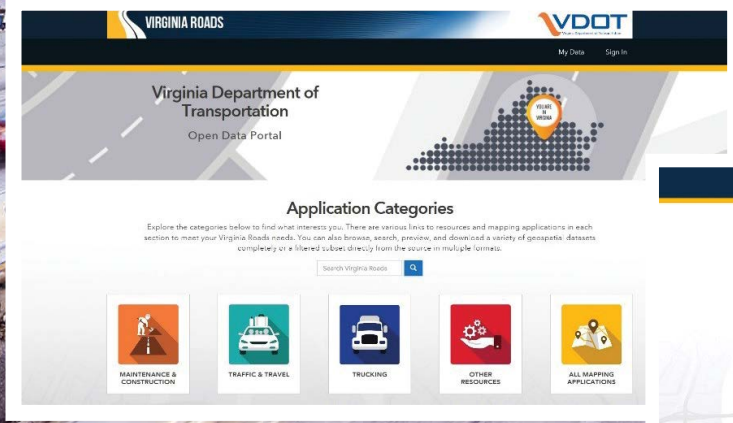
- Analyze Current Performance
- Create and Collect Needs
- Create, Bundle, and Score Projects
- Create Portfolio Scenarios
- Finalize Program of Projects and Plan
- Monitor Performance

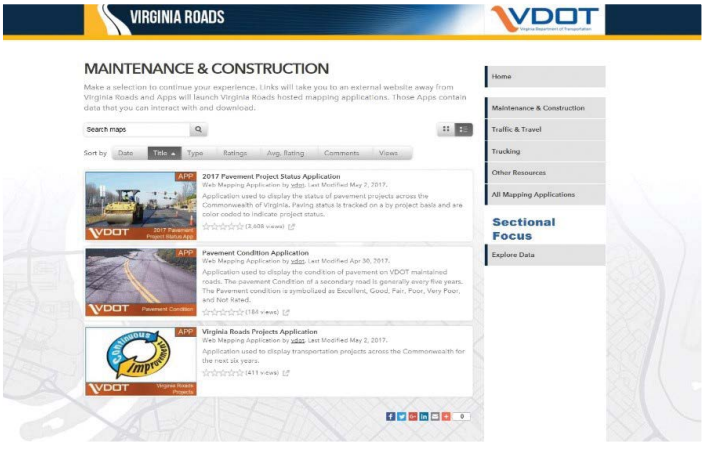
And while no solution can support all the processes that different agencies use, GIS can nevertheless help organize and direct planning activities. Data and analyses from one activity can be seamlessly transferred to the next activity within the agency's unique planning workflow.

As the example below illustrates, various data sources can be organized into a coherent portal with individual applications developed for each of the various functional or modal areas.

These applications can be the result of various modeling scenarios or different analyses of network performance, infrastructural deficiencies, or highway safety, among others. The important point is that these apps no longer represent disparate and ad hoc files that are siloed and often inconsistent.







Understanding Current System Performance

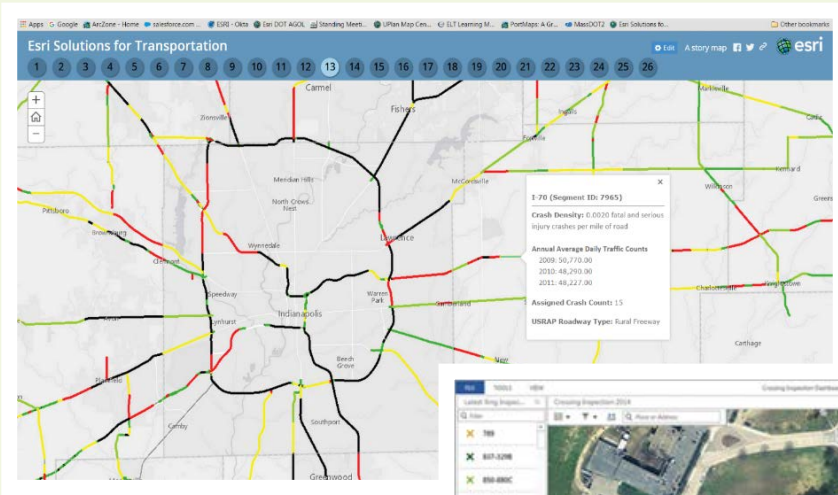
The analytic part of the PBP process begins with a clear understanding of current system performance and deficiencies. Deficiencies are derived from previously defined performance goals, which can be measured and monitored with performance dashboards, network maps, and other data inputs. This helps to understand current system performance and areas where performance is falling short of expectations.

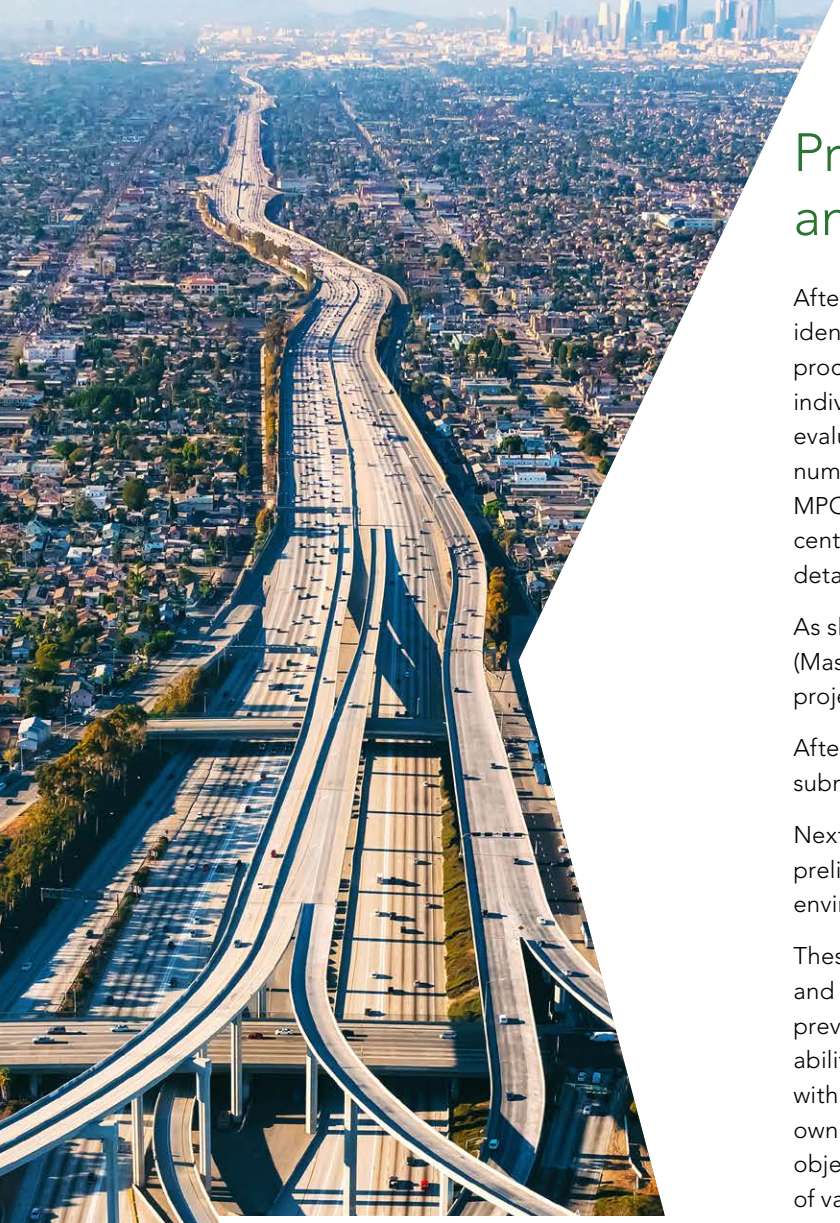
System performance is measured across multiple dimensions and includes asset management, safety, freight, nonmotorized transport, and overall network performance.

Critical inputs, which assist the planner in understanding current network performance, include the following:

- Outputs from travel demand forecasting models
- Results from highway safety analyses
- Forecasts from asset and maintenance management models
- Trends in current performance measures
- A variety of other information inputs

Each input contributes to an accurate and comprehensive view of current system performance and a thorough analysis of existing deficiencies by functional topic.





Project Definition and Submission

After the analysis of the current system performance and identification of deficiencies, agencies need a formalized process for incorporating asset management needs, bundling individual needs, creating new projects, and submitting and evaluating potential projects. Projects can be defined by any number of different agencies, such as local governments, MPOs, or the DOT itself. Each entity needs access to a centralized process, which allows projects to be defined in some detail before being subjected to initial screening and scoring.

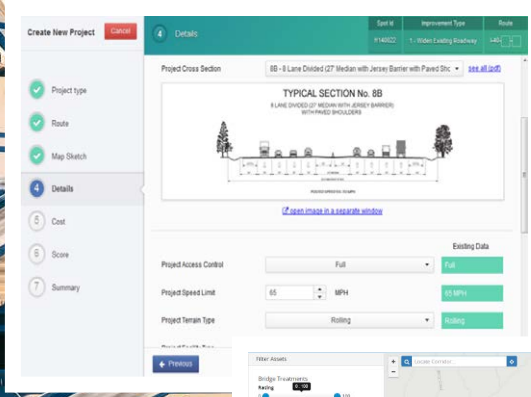
As shown in the example below, the Massachusetts DOT (MassDOT) utilizes a GIS-based application that allows the project submitter to define the project location and boundary.

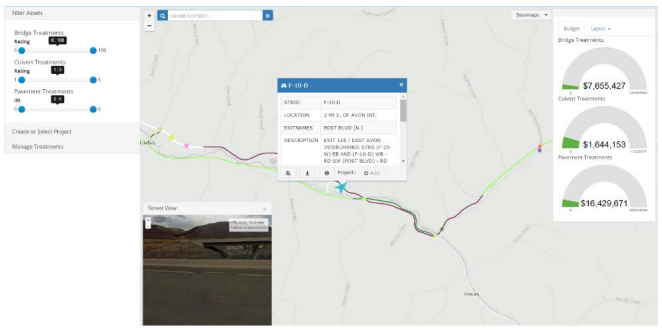
After these parameters have been defined, the project submitter then enters the project details.

Next, the project proposer can see an evaluation and preliminary score for the project, including a preliminary environmental analysis.

These can be maintenance, safety, or new capacity projects, and each is scored differently. The scoring is based on previously agreed on criteria and represents the project's ability to help meet performance goals and its consistency with overall system requirements. Agencies can develop their own MODA scoring criteria based on their specific goals and objectives. Scoring formulas can be based on an infinite number of variables.

Since many highway projects involve multiple elements, there is often an anchor project with many associated satellite projects. Esri's project planning tools allow you to bundle those projects into a larger, more comprehensive project. For example, a highway resurfacing project often also involves culvert repairs and bridge surface treatments, which should be included in the overall cost and scoring evaluation.





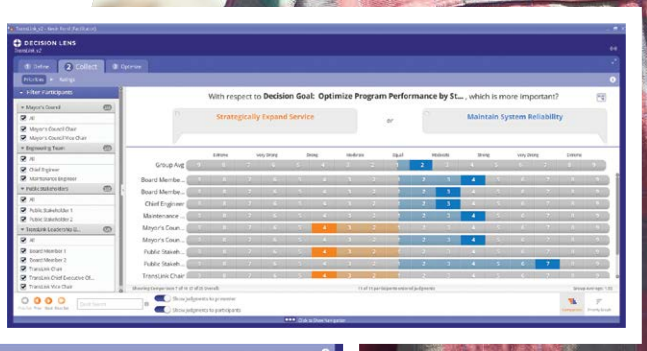
Alternative Portfolios and Optimization Analysis

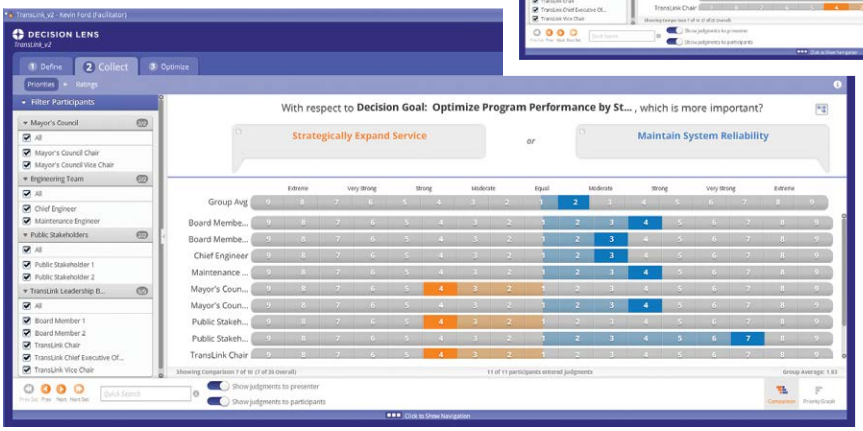
A final step in the process of developing an investment plan and a program of projects involves comparing a set of alternative portfolios to optimize investments across asset classes. For many DOTs, this has been perhaps the most difficult part of the planning process. All too often, the current year's allocation is a factor of the previous year's budget allocation by asset class. However, that is neither a strategic nor a data-driven approach to resource allocation. Under a PBP process, project selection is driven by its ability to help achieve overall goals.

Recently, there has been significant progress in identifying various methodologies to help transportation planners make strategic decisions with respect to project selection and resource allocation. The recent National Cooperative Highway Research Program (NCHRP) Report 806 titled *Guide to Cross-Asset Resource Allocation and the Impact on Transportation System Performance* provides a framework for using an analytic hierarchy process methodology to put an agency's goals at the center of its decision process.

Esri works with several solution providers that deliver a structured approach to cross-asset optimization in the analysis and selection of a portfolio of projects to be included in a final transportation plan. One such solution provider, Decision Lens, built its framework on the work of Thomas Saaty from the Wharton School at the University of Pennsylvania. Esri worked with Decision Lens staff to provide the core inputs for their model using the GIS. This included displaying the resultant project mix in the GIS to facilitate intelligent what-if analyses that would assist planners in determining the most strategic mix of projects and achieving agency goals.

Whether you choose to implement a framework, like the one Decision Lens uses, or an alternative, Esri technology can help decision-makers understand the trade-offs and analyze alternative portfolios of projects.





Collaboration and Communication

Effective performance-based planning ultimately requires considerable coordination not only within but across agencies (DOTs, MPOs, regional transportation planning organizations [RTPOs], and transit 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 a framework to facilitate data sharing and collaboration within or between agencies. The state DOT, MPO, and local governments can all share the same information and have the same understanding with respect to project definitions. In addition, they can collaborate on analyses, modeling, and other project alternatives and share results, leading to a comprehensive and cohesive planning framework.

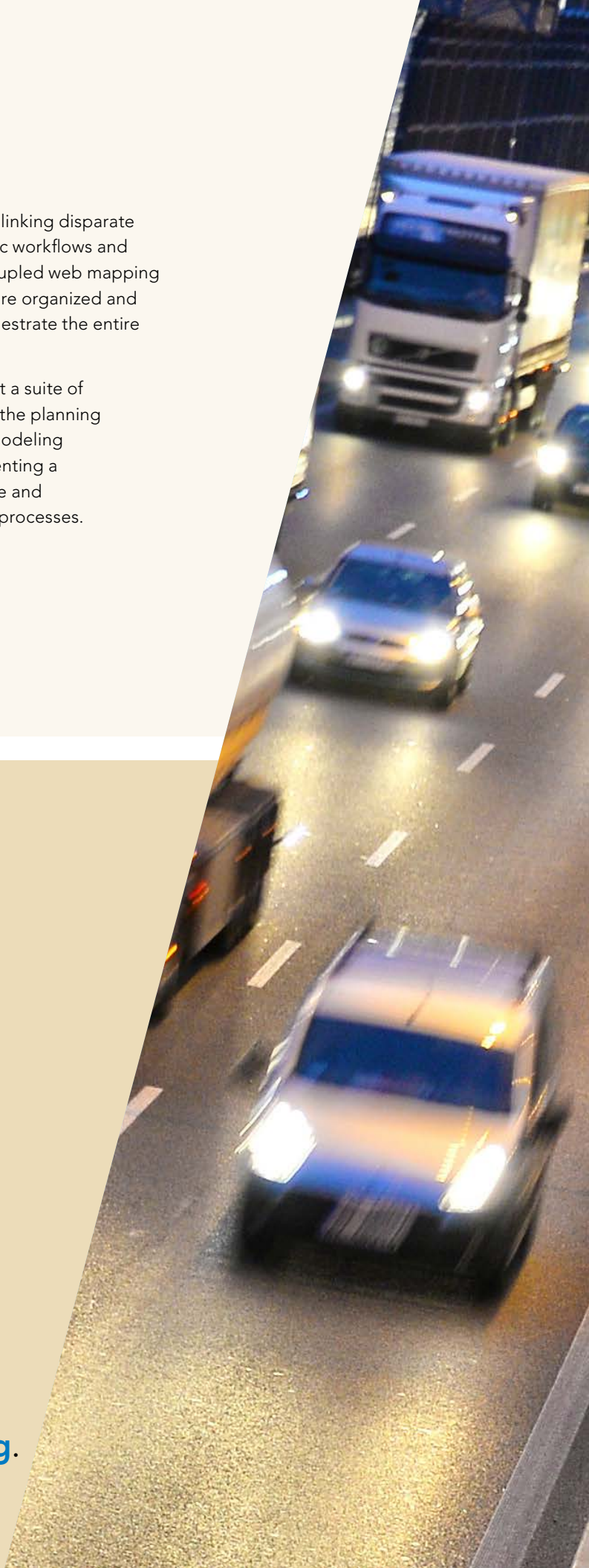
The final step in a PBP process is effectively communicating the plan's components to the public. In the past, comprehensive transportation plans were often presented in written documents that received little attention from the public. These documents were limited by technical jargon and presentation formats that the average reader couldn't understand.

At the same time, a new generation of transportation professionals has discovered the power of Esri® Story Maps templates. These multimedia presentations combine high-quality graphics, maps, text, and videos to present each element of a plan. For example, as shown in the graphic below, the Regional Transportation Alliance of Southeast Pennsylvania recently created and shared an Esri Story Maps app called Imagine Transportation 2.0 that explained its vision to the public.

A Single Platform to Support Better Planning

Leading transportation planning agencies and professionals are linking disparate processes and information systems using GIS technology. Ad hoc workflows and tools are being put aside in favor of simple-to-use, but highly coupled web mapping applications. These applications, along with the planning data, are organized and accessed through a system of engagement that helps them orchestrate the entire planning process workflow.

Esri is the industry leader in GIS capabilities and has already built a suite of solutions designed to help planners rationalize the workflows of the planning process. By organizing planning data, providing a platform for modeling and analysis, comparing alternative project portfolios, and presenting a comprehensible plan to the public, Esri brings greater coherence and effectiveness to your project prioritization and decision-making processes.



Your Next Steps

To take advantage of the benefits of GIS in your DOT, arrange a preliminary evaluation of how Esri's ArcGIS® platform can help your planners achieve their business objectives. When you contact an Esri representative, our transportation experts will help you conduct an official business value assessment to understand where the opportunities to improve your planning process exist. Experienced planners will see how bringing spatial information across your organization can help you meet your current planning challenges. Additionally, Esri's jump-start engagements can help you quickly implement intelligent solutions, so you can start down the path to greater productivity right away.

Today's dynamic transportation environment is moving at a frenetic pace. By reaching out to Esri, we'll make sure your DOT is traveling in the right direction.

For more information, visit **go.esri.com/start-projectplanning**.

esri | THE SCIENCE OF WHERE™

Esri, the global market leader in geographic information system (GIS) software, offers the most powerful mapping and spatial analytics technology available.

Since 1969, Esri has helped customers unlock the full potential of data to improve operational and business results. Today, Esri software is deployed in more than 350,000 organizations including the world's largest cities, most national governments, 75 percent of Fortune 500 companies, and more than 7,000 colleges and universities. Esri engineers the most advanced solutions for digital transformation, the Internet of Things (IoT), and location analytics to inform the most authoritative maps in the world.

Visit us at esri.com.

Contact Esri

380 New York Street
Redlands, California 92373-8100 USA

1 800 447 9778
T 909 793 2853
F 909 793 5953
info@esri.com
esri.com

Offices worldwide
esri.com/locations

Printed in USA

G78649