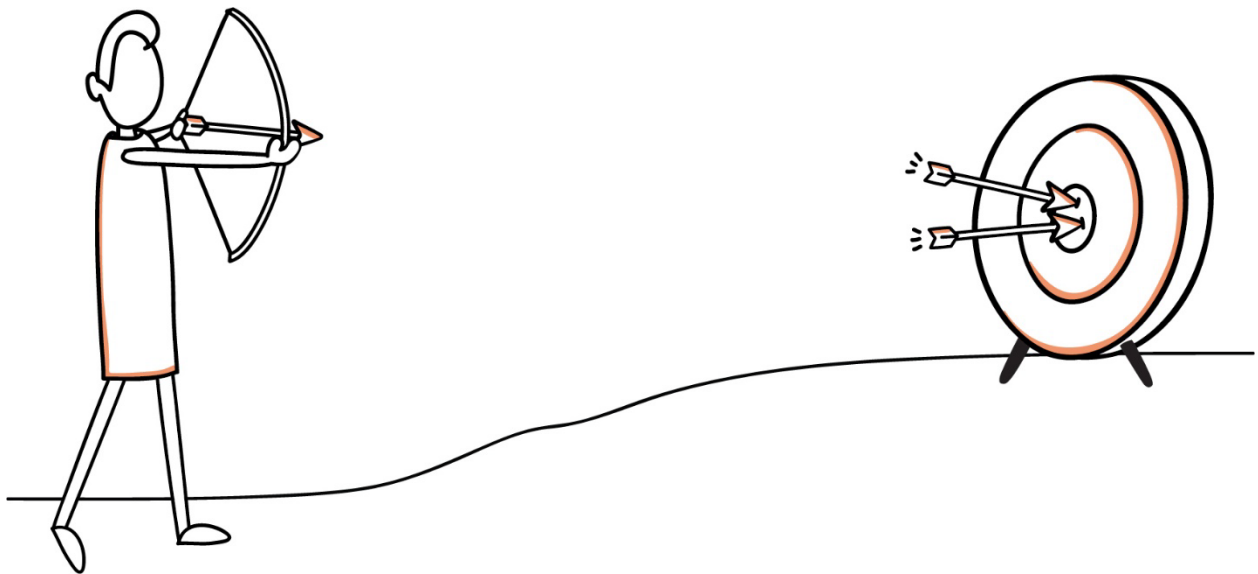# Making Targets Matter
Managing Performance to Enhance Decision Making

Guidebook Addendum

Prepared for

NCHRP Project 02-27

Transportation Research Board of
The National Academies of Sciences, Engineering and Medicine

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February 2023

ACKNOWLEDGMENT OF SPONSORSHIP

DISCLAIMER

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Table of Contents

List of Figures and Tables

Author's Acknowledgement

Abstract

This document is an addendum to the [NCHRP Research Report 993: Managing Performance to Enhance Decision-Making: Making Targets Matter](#), which tries to help transportation agencies breathe new life into performance management by gathering and using feedback. The original guide outlines a framework to help practitioners reconceptualize how feedback fits into existing performance management structures and its importance to seeing progress on meeting targets. It then offers six concrete strategies to help practitioners gather and use feedback more effectively. Real stories of agencies already using these strategies to improve performance close the guide through case studies. This addendum expands on the original strategies with new insights from practitioners and features four new case studies of agencies making strides in gathering and using feedback. Advice on how to engage agency leadership on the importance of supporting a performance-based approach is provided in a companion document.

PART I: PROJECT BACKGROUND

Chapter 1: Project Background

TARGETS THAT MATTER

This research project's original findings were based on the idea that more accurate and more frequent feedback are key to improving performance and seeing progress on your agency's performance targets. In a large and interconnected transportation network, information on conditions and cause-and-effect is dispersed widely. A single entity, such as an agency, cannot know the status or results of everything on their own. They need help.

Transportation agencies can get that help by proactively seeking out information through feedback on needs, the efficacy of actions, and ideas for new solutions from two major sources: the people who participate in the system and the data that reflect reality on the ground.

WHY THIS GUIDE?

Using feedback from people and data is not a new idea; long-range plans require people-driven feedback in the form of public outreach, and "data-driven decisions" is a phrase heard at nearly every transportation agency across the country. So while not suggesting a brand-new silver bullet for performance gaps, this guide has a laser focus on substituting well-worn, but unproductive habits around feedback with fresh strategies better suited for unlocking new knowledge and success.

Escape the "set and forget" trap. Picking targets does not guarantee results. Agencies routinely collect and track a lot of data on the performance of the transportation systems they oversee. Agencies also consistently set numeric performance targets that express organization-wide goals. Tracking performance and setting targets, however, are far from guarantees for meeting goals. They show "you are here," but do not give answers for "how do we get there?" The thoughtful use of carefully collected feedback is a way to bridge this gap.

Tap people and data to deploy the right actions. Even the smartest decision makers cannot know everything about something as complex as the modern transportation system. They need updated information to learn of changing on-the-ground conditions, actions that failed and succeeded, and evolving expectations for the future. They also need insights from other users, planners, and builders of the system to understand the most prevalent priorities, holistic system

needs, and the global approaches available to improve the system. This knowledge is tucked away in data sets and stakeholders' minds throughout the transportation ecosystem; it is up to decision makers to tap into these people and data "sensors" to access it.

Key Guide Audiences

- Performance management staff at MPOs, state DOTs, or transit agencies;

- Senior management personnel tasked with configuring their organizations to make better use of performance information; and

- Practitioners engaged in long-range transportation planning, asset management planning, project programming, or budget development.

GUIDEBOOK OVERVIEW

This guide addendum includes new tactics for the original Making Targets Matter strategies on how to successfully integrate feedback into existing performance frameworks. After this introduction, Chapter 2 introduces the concepts underpinning feedback in systems and serves as a theoretical foundation for the rest of the guide.

Part II describes real-world strategies that practitioners can use to gather better feedback and integrate it into decision making and communications more frequently. These strategies span three chapters:

- Chapter 3: Prepare Sensors
- Chapter 4: Establish Pathways
- Chapter 5: Integrate Feedback

Part III examines how these strategies and tactics are being used in agencies today through four new case studies.

Chapter 2: Feedback Basics

FEEDBACK ELEMENTS

The feedback elements in a mechanical system are easy to see. They are physical objects, there are only one or a handful of each, and each has a clear and defined function within the system. These clear and defined functions make cause and effect easy to discern and understand.

A transportation system has all the same feedback components, but they are far more abstract and harder to conceptualize. Reviewing these elements separately can start to illustrate what each looks like and how to identify them in a transportation context.

Sensors

Sensors in a transportation system are divided into two groups: people and data. The first group includes the people or the organizations with perspectives on what is needed in the transportation system and experiences of on-the-ground conditions. The second group of sensors takes the form of data on performance outcomes, impact of past interventions, contributing factors, or expected future conditions. All this data could be sitting across existing databases and spreadsheets, waiting to be tapped for the information it contains.

Integrating better feedback into decisions requires transportation agencies to establish familiarity and working relationships with people sensors, and an understanding of the landscape of data sensors that are available to an agency. A robust combination of information from across sensor types can help an agency build a more complete picture of the types of actions most likely to achieve performance progress.

Information

Information in the heating system example is simply the temperature. That is the key element about the environment that the simple sensor is designed to register, which can then trigger the system action.

Information in a transportation system can be many, many different things, but the essence of information in this context is anything notable about transportation system conditions, agency interventions, or expected futures. Information can be performance outcomes, overall system functioning, the underlying cause of outcomes, how much other elements contribute to outcomes, effectiveness of actions and decisions, or anything that leads to knowledge and understanding of the system's complexities and cause-and-effect relationships.
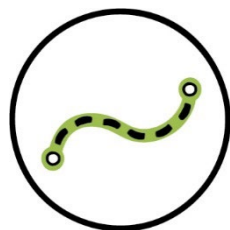
Pathways

In a mechanical system, pathways are the hardwired or wireless connections for information exchange that run between a sensor, a central processing unit, and a mechanical device, such as wiring between thermometer, thermostat, and furnace.

Pathways in a transportation system are more varied and amorphous. They are any opportunity to extract information from sensors to share it with the central unit that will process it: in this case, the agency. This guide focuses on two such opportunity pathways that

regularly occur in transportation agencies: convening people and data, and formal assessment points. Information from stakeholders or system data flows through these pathways into the performance management decision framework.

Action

In a mechanical system, action is the response to information that ensures progress toward closing the gap between actual and desired conditions, such as turning on the furnace to push warm air into a room.

Action in a transportation system is anything an agency does to change conditions and performance, including capital projects, new policies, education and research programs, studies, maintenance, or operational activity. These actions fall under the three broad categories of long-range strategy and planning, medium-range program development, and day-to-day operations.
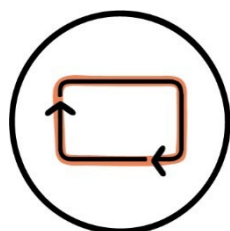
Repetition

In the heating system, the sensor repeatedly checks the temperature and updates the thermostat with this information until action is needed. This process is continuous, with no stop to the cycle of sensing, transmitting information, and acting.

Repetition in a transportation system will often come naturally from the periodicity of core planning and programming activities. Plans will be updated at defined intervals, project programs will be compiled every year, and targets will be revisited each reporting cycle. These points are natural times to integrate information gained from feedback.

In addition to these natural repetition points, agencies can institutionalize new repetition points: times when staff pause, revisit pathways for new feedback, and consider if new knowledge warrants an adjustment.

PART II: STRATEGIES FOR MORE EFFECTIVE AND FREQUENT FEEDBACK

Part I revisited the project's basic premise of how properly functioning feedback systems use information flowing along pathways from sensors to inform actions that close the gap between actual and desired conditions.

Part II outlines six strategies using concrete, actionable advice on how transportation practitioners can improve the feedback elements around them to inform better decisions and support achievement of performance targets. Each section will revisit what the original guide says about that strategy and introduce new tactics from the new round of peer exchanges.

The six strategies fall into the three broad categories discussed in the following chapters:

Chapter 3: Prepare Sensors

Chapter 4: Establish Pathways

Chapter 5: Integrate Feedback

These strategies have been distilled from ideas shared by more than 30 state DOTs, MPOs, and transit agencies. Case studies of these strategies in use at agencies today follow in Part III.
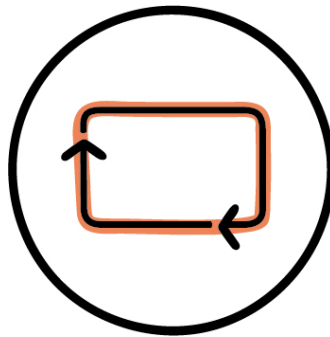
Chapter 3: Prepare Sensors

Transportation agencies are already using information from people and data to make their most important decisions. Public and stakeholder outreach are regular parts of long-range planning; internal working groups to address federal performance measures already exist; and data on performance, project selection, and operational metrics inform dashboards at most agencies.

Preparing your feedback sensors is about getting these elements optimally situated and ready to give useful and targeted information when you tap them for feedback. Two key strategies help prepare your available sensors: (1) building buy-in for the long term, for people sensors; and (2) navigating your data ecosystem, for data sensors.

STRATEGY 1: BUILD BUY-IN FOR THE LONG TERM

From the Original Guide

Defining Buy-In

Building buy-in is shorthand for the process of identifying key partners and fostering long-term relationships with them that spur a sequential process of awareness, acceptance, and support for performance initiatives.

Potential partners might include staff and leaders at local governments, partner transportation agencies, related state or regional agencies, federal agencies, advocacy groups, and at times the business community. Buy-in with partners is not only an external activity; you will also need to build buy-in within your organization from the staff whose work intersects with your performance management activities and executive leadership whose support will be needed for far-reaching changes.

If tended to carefully and authentically, these relationships can blossom into fully   fledged networks of sensors, information, and pathways that bring crucial feedback into efforts to reach the agency's most important aspirational performance targets.
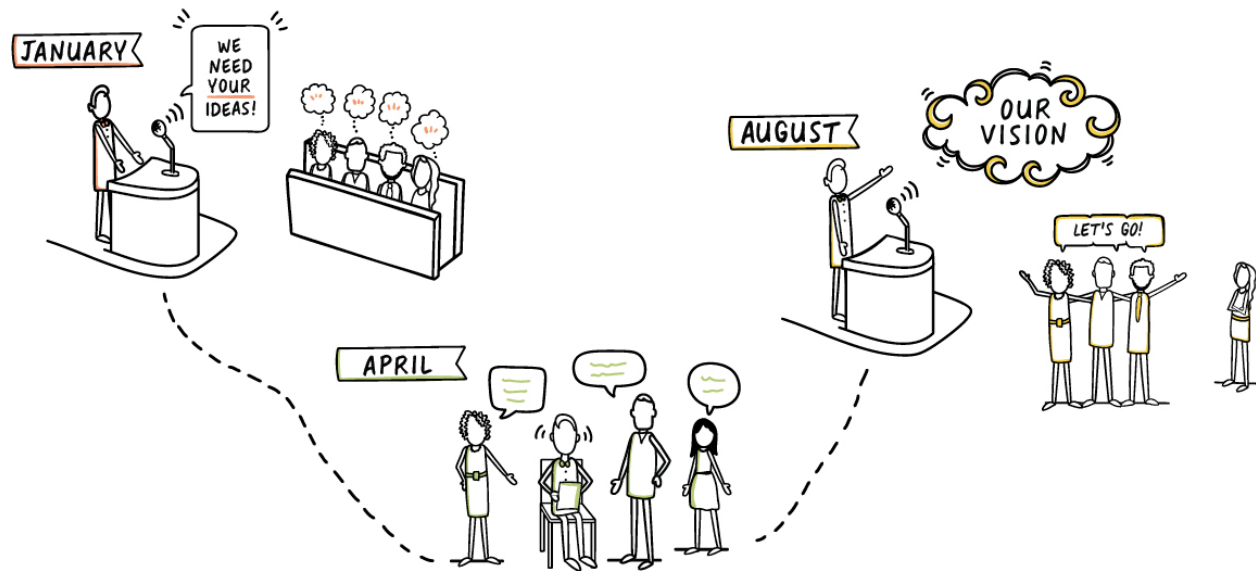
What Building Buy-In Looks Like

Wasatch Front Regional Council (WFRC), UT – The buy-in efforts of Salt Lake City's designated MPO are exemplified by its cultivation of a productive relationship with the mayor of Roy, UT, who serves on WFRC's Regional Growth Committee. Over time and through a process of regular engagement and education, the mayor has transformed into an ally for the transit-oriented design strategies that form part of WFRC's efforts to improve mobility performance in its region.

Iowa DOT Strategic Plan – Iowa DOT has explicitly linked its Strategic Plan to performance management by cultivating employee support for doing things "the performance way." Iowa DOT leadership has actively measured and increased employee engagement with performance initiatives, held leadership forums to hear staff perspectives, and aligned the work their staff does directly with performance measures and outcomes.

Office of Intermodal Performance Investment, VA – The extensive buy-in efforts of the staff at the Office of Intermodal Performance Investment helped persuade Virginia DOT's Commissioners to endorse a significant switch in the state's transportation safety strategies in 2018 to reduce fatalities and serious injuries. A major part of the staff's effort included using data to help tell the story and make the case the Transportation Commission for changes.

Why Buy-In Matters

Buy-in mirrors an interconnected world. Achieving performance targets usually depends on a weblike network of personal and organizational interrelationships. The state DOT, for example, must work with its state's MPOs, who in turn must coordinate with an array of local jurisdictions to gain support for and carry out investments. Transportation solutions often feature multiple modes and transportation needs that involve many stakeholders and advocates. Buy-in helps enable feedback across boundaries.

Buy-in opens doors for new feedback sensors, information, pathways, and actions. Generally, buy-in creates a desirable climate for establishing new sensors, information, and pathways to support feedback on performance management. Imagine, for example, that travel time reliability performance targets fall under your watch. You know incident clearance tactics lead to better reliability, but responsibility for incident management is in the hands of several separate agencies outside your control. When buy-in has been established, you have a route to your counterparts in the emergency responder community, and they understand your aims, which enhances the likelihood of being able to work together.

New Tactics for Building Buy-In

Leverage the relative strengths of partner agencies. MPOs and DOTs have complementary skills and strengths, and each can benefit by leveraging what the other has to offer. For example, MPOs are better situated to listen to community needs and desires, as they are "closer to the ground". DOTs, on the other hand, find synthesizing public input a challenge because they feel they are "putting together anecdotes without data on who or where it's coming from". DOTs can leverage MPOs for this element of connecting performance and investments to community needs. Similar skill sharing can occur on specialized data handling and analytical skills. If one agency has a crack team or analyst already calculating performance for the state or region, there can be great efficiency in having the same individual tweak the analysis for the state or region in addition.

Embrace your role as a connector across the silos in your agency. Performance professionals are increasingly "connectors" in large and complex agencies that have offices that don't always talk internally, let alone coordinate with external partners. Those practitioners who have come to see their mandate as proactively talking with offices across the data ecosystem and up-and-down the performance management process are embarking on some of the most exciting new developments in the performance space, from increasing data maturity in complex and fractured bureaucratic environments to pushing the performance vision through the project design and construction pipeline to ensure on-the-ground impact. In order to see these kinds of transformative developments performance managers can't merely sit in their offices putting out the occasional data request to update a dashboard. As much as possible, be bold in outreach within your agency and err on the side of having extra conversations rather than not enough. Each conversation will bring your colleagues closer to the larger perforamnce improvement vision and prepare them to help where they can.

Let stakeholders into the discussion leading up to decisions. MPOs in particular have expressed a desire to "see how the sausage gets made" on decisions at DOT relating to large investments or target setting, but the same will be true for any key partner or stakeholder. It is difficult to fully sign onto an effort or decision if you are not convinced the decision was made soundly. Stakeholders brought in after decisions are made will likely have questions that were addressed in the discussion leading up to the decision. A key element to succeeding in this will be to reduce your own agency's insecurity around "sensitive" information circulating outside the agency. Talk with leaders or key staff in your agency about which information is truly sensitive and should be kept separate, and which can be shared with trusted partners in the name of developing a truly collaborative solution.

Explore new ways to solicit, document, and integrate community input. Practitioners have noted several challenges around incorporating community input into key decisions. For one, the feedback often heard is "general complaining" without the kind of descriptive information on location or nature of the problem that will help the agency identify and implement a solution. Others have mentioned that anecdotes shouldn't have the same impact as something like a statistically significant survey. Solutions to these issues start with an agency accepting the premise that community input is valid and important to improving performance in the ways that most matter, and then move to trying creative approaches to soliciting input. A few that agencies have tried recently with initial signs of promise include focus groups on performance topics,

engaging with non-profit and civic organizations as representatives of a community, turning to "crowdsourced" dashboards and maps to collect information from many individuals in one place with geography embedded in input, and even paying non-profit groups that represent hard-to-reach communities in their region to provide feedback into their plans and processes.

Understand the context for why your stakeholders might have the perspective they do. The further you expand engagement beyond your central performance office, the more important it will be to understand that the voices that matter to stakeholders vary depending on where they sit in the process. For example, within a DOT the district engineers have an ear toward local officials, while planners are attuned to statewide priorities, like the Governor. In addition, the realities of day-to-day work can be very different in different parts of an agency. Planning outcomes can feel like "fluff" to snowplow operators dealing with the reality of high turnover and not having anyone to keep roads clear. Keeping these things in mind while coordinating is important to understand where sensitivities, concerns, and desires are coming from.

Recognize that staff turnover can create gaps in seamless collaboration and look for ways to bridge these gaps. Maintaining institutional knowledge when key staff leave has always been a challenge, but several practitioners noted that the issue was exacerbated by the Covid-19 pandemic that prompted many people across the country to change jobs amid the changing workplace landscape. This led to difficulty in understanding how past decisions around performance were made and practitioners scrambling to find out more information within their own agencies and at partner agencies. Some have found solutions in including individuals that were previously involved in performance discussion even if their current role is not connected as a way to maintain continuity. Others have recognized that consultants or others outside the agency sometimes have the most continuous view of events, and that bringing these individuals into discussions of past decisions is often essential.

STRATEGY 2: NAVIGATE YOUR DATA ECOSYSTEM

From the Original Guide

Defining Your Data Ecosystem

A *data ecosystem* is defined as a network of actors who directly or indirectly consume, produce, or provide data and other related resources. Like natural ecosystems, data ecosystems can evolve over time, so it's important to understand and stay engaged with your agency's data. A primary challenge to integrating data-driven feedback now is knowing what data is available, how to access it, and how to use it for performance needs. To address this challenge, performance professionals can focus on strengthening access to the agency's data sensors by getting to know the data landscape, starting dialogue with data owners, and linking data to questions on how to improve performance.
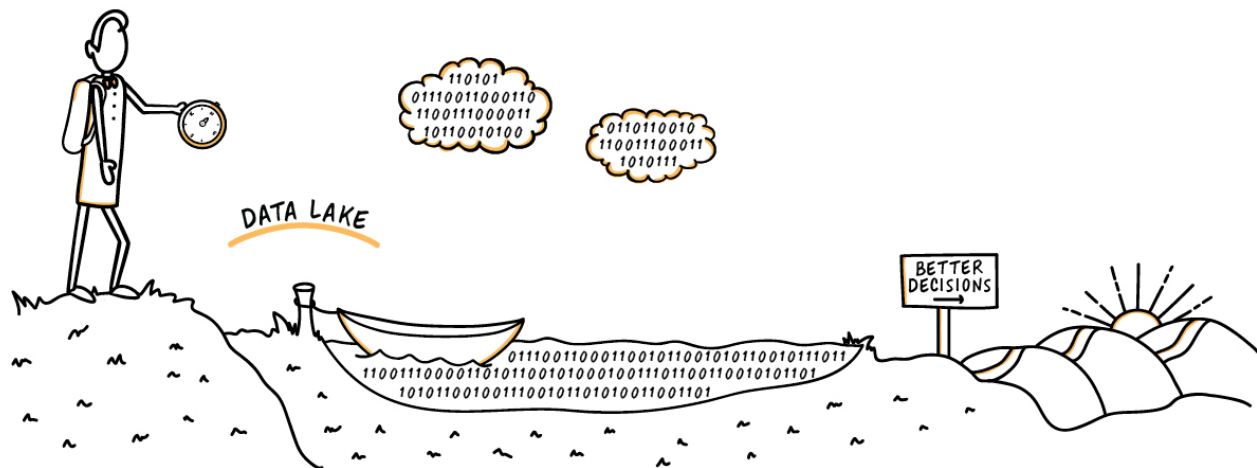
What Navigating Data Looks Like

Nebraska DOT – When the Nebraska DOT (NDOT) decided to identify division- and district-level metrics that could link to statewide measures, the performance office and division leaders discussed which measures they would track. After a sluggish start, the agency's technology office provided a map of data across the agency (Figure 3). This map shows how different sources of data fit together and how NDOT staff can access them. The person leading the performance effort remarked, "This answers 100 questions that I've had. I wish I had this on day one!" Seeing how all the data sources fit together allowed discussions to go more smoothly and helped staff identify the most useful metrics for performance and technical decisions and issues.

Arkansas DOT – Arkansas law enforcement officers were not always filling out all entries in crash reports, leading to incomplete data for the Arkansas DOT's safety analyses. DOT staff contacted law enforcement staff and explained why they needed the full details on the report and how it would help their safety efforts. Once the officers understood its importance, the quality and completeness of the data improved, allowing Arkansas DOT to develop safety interventions with a clearer view of performance needs.

Why Navigating Data Is Important

Accessing the right data from the "data lake" is still a challenge for many agencies and practitioners. Useful data may be inside access-restricted databases, in a spreadsheet on someone's computer, or available only through subscriptions to third-party providers. Many staff may not even know these sources exist or are available to the agency. Barriers to accessing these data sources result in lost opportunities for insights into performance.

For the purposes of performance management, there are three categories of data:

- *Data on actions (cause)* – This category, which includes details on actions such as projects or maintenance work, provides the baseline information needed for analyses on the effectiveness of those actions. Unfortunately, this information is not always documented or widely shared.
- *Outcome data (effect)* – The data in this category is usually performance measure results—items that are tracked on dashboards and constitute traditional monitoring efforts.
- *Explanatory variables (explanation)* – This category includes all other data that might be pulled into an analysis, such as regression, root cause, or more sophisticated before-and-after studies, to understand influences on performance.

New Tactics for Navigating Data

Make the case that data is an asset, like pavement and bridges. Data is increasingly being recognized as a non-negotiable component of transportation agency functioning. As a result, several agencies have moved toward declaring data a formal asset like pavement and bridges. Having this established status broadcasts to staff across the agency that data access is important, and puts additional weight behind efforts to centralize and make use of data that makes the process easier. Managing data costs money. Having clear executive and agencywide support for it is essential to having more inside the agency recognize the need for it.

Get the IT department on your team. Agencies making progress on data access get support from their IT office to overcome security concerns from data owners, transform data from disparate sources into a standard format, and build the mechanisms by which staff across the agency can access the data directly. Identify which staff in the IT department are the most suitable to have involved in performance-related data access conversations based on their role, support from their manager or leadership, and the individuals' capacity to span both the technical know-how of the IT side with the business need side of why data was originally collected, any sensitivities around the data, and how the data needs to be applied going forward. Leadership support for having access to data will help to allocate IT resources to this kind of data effort over other competing demands. To get this support, see if there are any IT requests in the pipeline that would be solved or made more efficient by the centralized data repository you are seeking to support performance efforts.

Convince data owners of the benefits of centralized data sharing arrangements and propose structures that address concerns. Ownership is great. Stewardship is hard. Practitioners have found that data owners like owning their data but that sharing it out takes additional effort to ensure there are not errors, it doesn't conflict with other data, and that nuances are communicated. Data owners can get very nervous about sharing because of these issues. In order to convince them to become "data stewards" responsible for making data available for purposes beyond just their own, highlight the benefits of fewer one-off requests for the data that must be responded to individually. Propose clear parameters and approval processes for granting access to the data that owners have input on, and separate out access to detailed raw data that is often more sensitive from access to summarized, "curated" data that can be granted to more individuals. Establish standardized operating agreements to govern how data is accessed, which data will be shared, and at what level of detail.

Clearly denote that data is the best available from a single point in time and is subject to updates as better information is obtained. One concern among data owners is that complaints about data quality will start if end users notice that data doesn't match from one source to the next, or if information for a set time period changes after preliminary data is cleaned and updated. Communicating explicitly the point-in-time nature of a data selection and caveating that new updates can shift the numbers will go a long way toward reducing any problems with these realities. Make sure that all data pulls are time stamped and require users to carry this information to their end usage. Be clear with the users of a dashboard or report that in order to share as much information as soon as possible, the numbers are subject to change. One DOT relied on this approach heavily when flooding devastated roads and bridges in the state. Staff put together a dashboard of best-available information on recovery progress, even though they were never completely sure they had the statistics exactly right. They determined that being transparent was more important than perfect information, and the public and legislators greatly appreciated the efforts and updates, even if some of them changed from what was initially reported.

Use self-assessments and surveys to monitor progress in creating seamless data access. Just as with performance improvement, feedback is essential to improving data access within your agency. Regularly checking in with staff who could benefit from more access to more data is one way to gauge whether the ease and scope of access is improving. Using a structured self-assessment for honest reflection can help give you a better sense for where you are in the process and what next steps will be most helpful.

Underscore the importance of data collectors' and owners' work. The frontline staff who collect data are all in the crucial chain of data and information, however these individuals may never be told their importance and how much others rely on the data they are collecting. On top of this, their pay probably doesn't reflect this importance. Ensure that data owners have reason to take pride in their work and produce the highest quality data set possible by recognizing their contribution both to the workers directly and publicly in agency communications. By treating the entire data process with due importance throughout its lifecycle will form a solid foundation of high-quality data assets usable across the agency.

Chapter 4: Establish Pathways

Pathways are the conduits along which information flows. Most agencies already have some elements of these information pathways, so the tactics recommended below are aimed more at improving or clearing out existing pathways rather than fully establishing them. This chapter presents two major pathways agencies can use to improve their flow of information and feedback: (1) convening across boundaries and (2) formalizing the assessments of results.

These pathways are not mutually exclusive, as each can include feedback from both people and data elements. While convening happens primarily with your people sensors as a chance to gather their feedback, it can also be an opportunity to share data and discuss its implications on performance. Similarly, most formal assessments involve an analysis of data, but they can also include expert opinion when data is lacking. Most of the crucial tactics to make assessment an established habit involve bringing people together and convincing them to take needed steps rather than finding new analytical techniques.
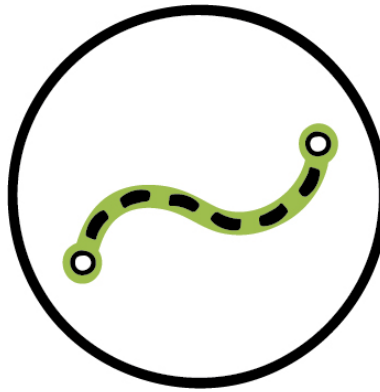
STRATEGY 3: CONVENE ACROSS BOUNDARIES

From the Original Guide

Convening Defined

After building buy-in with people and organizations that can help achieve performance success, convening is the means to get their input and ideas to your agency in a regular, timely manner. *To convene* literally means *to come or bring together for a meeting*. In the context of performance management, convening is a pathway for feedback that can encompass any forum dedicated to interaction, dialogue, and collaboration among broad groupings of people. Convenings are usually meetings and gatherings, but they can also include discussion forums, social media, or other interactive formats.

While people are usually the focus, convening also provides a forum to review data collectively and integrate it into solving problems and improving performance outcomes. Convening provides clear opportunities to tap people sensors for their priorities and insights and to reference data sensors to inform discussions on trends, conditions, and solutions. Convening at transportation agencies comprises two broad categories:

- **Open-ended visioning** focuses on gathering diverse priorities and experiences to inform goals, long-term vision, policy decisions, or other strategic changes.
- **Strategic problem-solving** tackles specific issues or problems that have surfaced. Sharing data and reviewing technical logistics will likely be an important element of these gatherings.
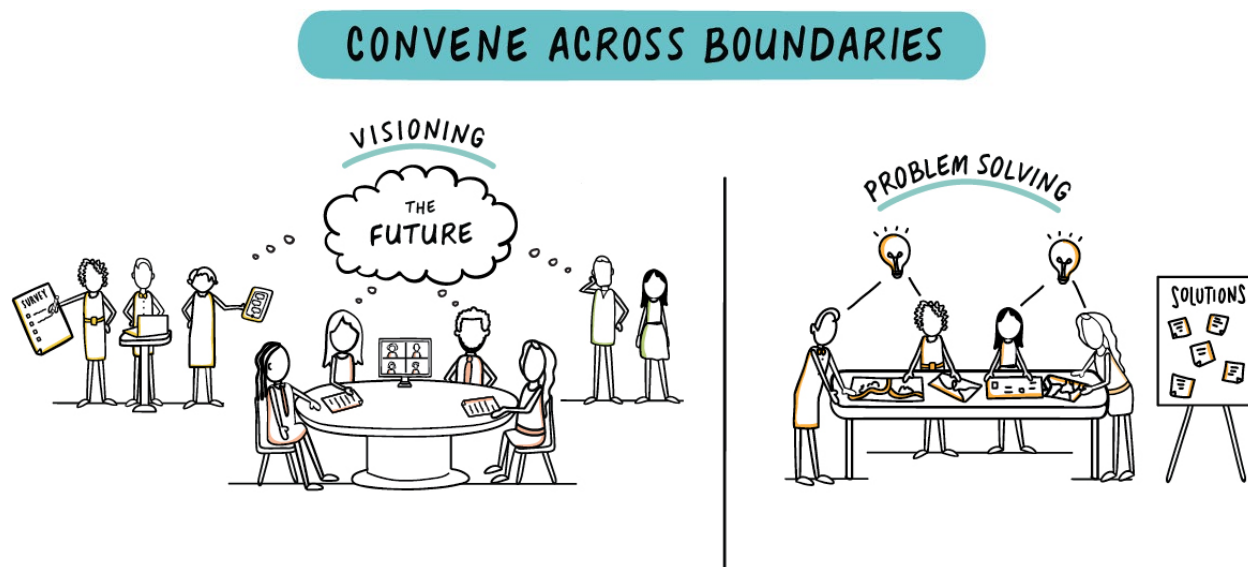
What Convening Looks Like

East-West Gateway MPO, Saint Louis, MO – The East-West Council of Governments describes one of their key roles in transportation as a convener of different agencies and interests. Implementation of federal TPM requirements has spurred the MPO to bring together state and local agencies regularly to share data, coordinate on targets, and discuss performance issues.

Washington Metropolitan Area Transit Authority, Washington, DC – At the "Metro," the in-house performance management team hosts monthly "Stat Meetings" that bring together staff from different divisions to discuss critical performance measures. The Stat Meetings have helped to build buy-in for performance approaches and to solve challenges.

Delaware, Maryland, and Virginia DOTs – These three Washington, DC–area state DOTs joined a quarterly meeting hosted by the region's MPO to discuss safety. These meetings spurred the DOTs to increasingly share information and data. The increased coordination led to a new study, and the conversation is more constructive than before. Passive submittal of data for setting annual performance measures did not lead to as much accountability as in-person meetings have.

Why Convening Matters

Convening is a lever for agencies without direct control of outcomes. MPOs often do not manage capital programs or operate transportation infrastructure, but through serving as a region's convener, they are able to greatly influence the conversation on transportation and the extent to which agencies share information, align to a shared vision, and coordinate decisions and investments.

Convening introduces new voices and perspectives. A frequent performance challenge is staff who are tied to "the way it's always been done." Convening across boundaries brings new voices to the conversation and gradual exposure of participants to new ideas and solutions. You may be missing information from key sensors if you are not regularly convening across boundaries.

Convening is effective. Having time set aside for participants to focus on an issue, where all relevant parties exchange ideas in real time, can foster a deeper discussion of issues or analysis of data, a better understanding of root causes, and identification of more effective solutions.

New Tactics for Convening

Meet participants where they are. Whether you are engaging community members or planning partners, meet them where they are both literally and figuratively. Particularly when engaging hard-to-reach community members, the practice of holding input sessions at existing gatherings is highly effective to have the best chance of hearing the voices of average transportation system users rather than the most vocal activists or special interests. One MPO used summer festivals and other events as the basis for their outreach efforts related to monitoring equity outcomes in transportation investments. Even with planning partners whose input you'd like to gather, allow them to determine the place and method of meeting. It will also make for a more constructive convening to meet them where they are in terms of the topics of most interest and the phrases and language to use. To keep things positive, discuss different ideas by saying "yes, and…" rather than "no" or "yes, but…"

Regularly include new participants. "I'm new with this and just trying to figure it out" can be a great phrase to set the right tone for collaborating. Sometimes a new participant in a meeting is a breath of fresh air, requiring explanations to go back to basics that can better ground the conversation in foundations and asking questions out of genuine curiosity. This led to some meaningful and helpful conversations that would not have happened with people who have done it all before an "just nod along".

Re-imagine convening coming out of the Covid-19 pandemic. The Covid-19 pandemic greatly impacted the way we meet and the landscape of relationships. Re-building relationships may look different going forward, and practitioners may have to make a concerted effort to create trust in a more virtual environment, particularly between agencies. Balance the convenience of virtual meetings with the greater ability to build trust and have meaningful interaction through in-person gatherings.

Leverage natural handoff points to communicate key information. Bandwidth is a pervasive challenge at public agencies and many staff who could have insights or influence on performance issues may not want to add another formal meeting to their calendar. In place of a meeting, look for natural hand-off points between parts of a project or in an initiative implementation process to communicate important details to staff downstream from you or ask questions of those upstream handing off to you. Check in on relevant plans around the effort, context for the discussion behind key decisions, which elements are at risk for needing deviations from the vision, and possible strategies to prevent that from happening.

STRATEGY 4: FORMALIZE ASSESSMENTS OF RESULTS
From the Original Guide

What Are Formal Assessments?

Where will investment lead to the greatest performance gains? Which intervention will prevent the most crashes? Under what conditions will a new pavement application or incident response tactic be most successful? Answering questions to illuminate cause and effect is the heart of performance management. Formal assessments are a pathway to answer these questions and introduce crucial feedback on what works.

Assessment is often used interchangeably with *analysis* and is associated with using data to understand impacts. While data is a core component of assessment and should be used whenever it is available, assessment can also include people-driven feedback through peer learning, expert input, or common-sense reasoning.
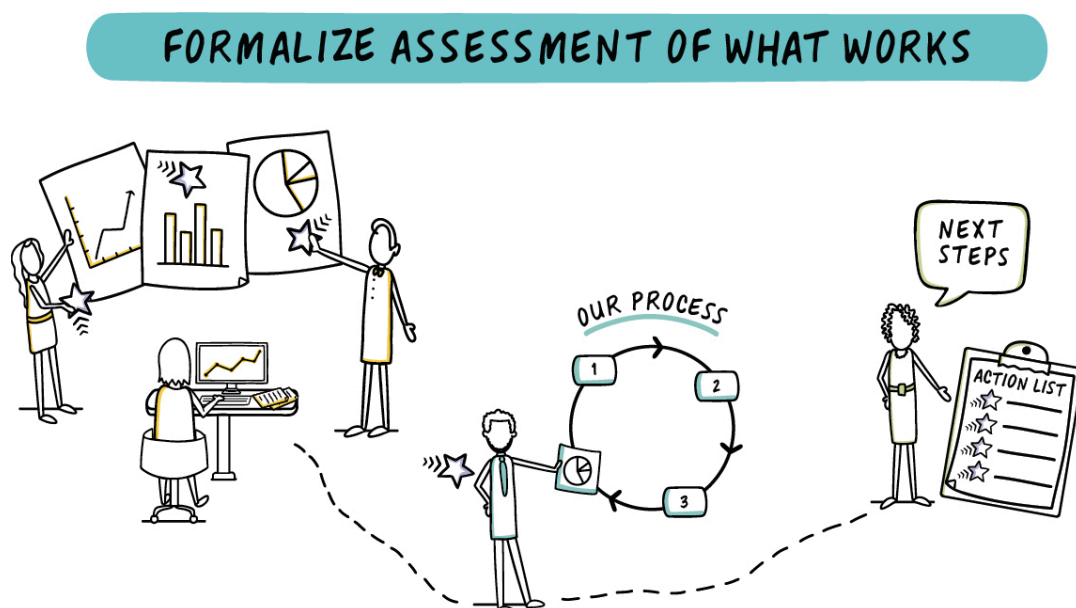
What Formal Assessment Looks Like

Before assessing results, become familiar with different analysis options, the situations they apply to, and what the results of each option can tell you.

Retrospective Analyses – What did we do and what were the outcomes?

Before and after – This common assessment method looks at conditions before a specific intervention and compares them to conditions after the intervention. In its simplest form, all changes in the conditions are attributed to the project or intervention. More sophisticated versions of before-and-after analysis attempt to isolate how much of the change in conditions is attributable to the intervention versus other factors.

Diagnostic Analyses – Why did we get the outcomes we did?

Root cause – Root cause is the fundamental, underlying reason for a problem or result. It helps to avoid treating only symptoms and instead to address the underlying factors behind outcomes.

One of the simplest approaches to root cause analysis is simply asking "Why?" repeatedly until a satisfactory answer is reached.

Predictive Analyses – Where are we headed, and how can we do better?

Trend projections – Using past trends to estimate future performance is a starting point for predictive analysis. At its simplest, historical performance is extrapolated in a straight line into the near future. Other assumptions on external forces, human behavior, or agency action can be introduced for more sophisticated models.

Statistical regression – Regression is a statistical exercise that relies on robust data. Rather than assessing a specific intervention's effectiveness, regression is used to identify the range of variables that influence an outcome, estimate how much each one affects the outcome, and calculate the degree of certainty about that influence.

Other Analyses – Supplemental information

In addition to the core assessments of performance results and expectations listed above, other types of analysis provide more nuanced information about performance.

Cost–benefit analysis – These common assessments gauge the worth of a project by quantifying the costs of an intervention with the benefits, including performance benefits.

Risk assessment – Understanding uncertain factors that could make performance outcomes very different from expected—whether positive or negative—can prepare performance staff to address and communicate unexpected outcomes.

Needs analysis – This type of analysis can answer the very concrete question of, "How much funding do we need to achieve performance targets?" Needs analysis helps set the bar for what it will realistically take to achieve targeted performance. This can help moderate expectations when only a portion of needs are funded.

Equity comparison – An equity analysis can inform whether performance benefits are accruing to some regions or stakeholders more than others. An equity comparison can lead to discussions of whether the agency needs to adjust how it prioritizes projects, or whether some districts or entities need additional help.

Why Formal Assessment Matters

It is impossible to learn what will lead to good performance outcomes without documenting what was done, monitoring outcomes, and analyzing causal factors. A formal process ensures assessments happen, helps to deal with priority and resource shifts, and better safeguards institutional memory.

New Tactics for Formal Assessment

Connect measures to investments wherever possible. Looking at performance measures without any connection to the types, size, or location of investments does little to help understand what produced the results. Connecting results to investments will get people's attention better than results alone and convince them that there is a reason to take performance efforts seriously. Making the connection explicit can also make people nervous, especially individuals who have historically been responsible for making decisions on investments. For this reason, gradually introduce investment analysis into processes and performance discussions. Start with historical analyses of state or regional transportation improvement programs, and see if performance outcomes can be ascribed to each project.

Plan well in advance for project-level assessments. The best time to have gathered data for a project-level evaluation is three years before the project was built. (The second-best time is now.) As agencies are only beginning to undertake post-implementation evaluations of their transportation projects outside of narrowly prescribed circumstances, many face the fact that they do not have the exact data that would most benefit the analysis. Practitioners may want to consider that these kinds of evaluations may become desired in the future and plan now to gather data about system conditions and trends that will be able to inform robust assessments of projects.

Be patient for results. Because the timescale for projects is so long, you may not be able to see the results of the before-and-after study you are undertaking now for another three to five years. Inform stakeholders and leadership of this reality so that hasty conclusions are not drawn before full results are in.

Make plans to hire data scientists now. Agencies who see the future of performance-based decisions across the organization know that they need staff capable of handling data, conducting analyses, and guiding the agency into new innovations like those coming out of machine learning and artificial intelligence. Data scientists are a relatively new position at transportation agencies and as such there are structural challenges around designating their pay scale and figuring out how they fit into a more traditional organizational structure and way of working. Work with leadership and others at your agency to begin addressing these barriers now and begin to build a bench of staff capable of handling the future of data and analysis.

Leverage your partners' data scientists in the meantime. Your partner agencies may already have data-savvy staff, particularly larger MPOs or universities. Make the most of all the skills in your network if your bench of data professionals is still building.

Chapter 5: Integrate Feedback

After improving your agency's people and data sensors, establishing clear pathways, and taking in new feedback, the next challenge is integrating the feedback into agency actions and communication.

This chapter explores two ways to integrate your newly collected feedback: (1) adjusting your actions and (2) developing your performance story.

The first section looks at the menu of adjustment options, or the levers at your agency's disposal to impact performance outcomes, and examines tactics to help decide which adjustments to make and how to implement them smoothly. The second section explores how to communicate your agency's performance vision and the hard work completed to make that vision a reality.
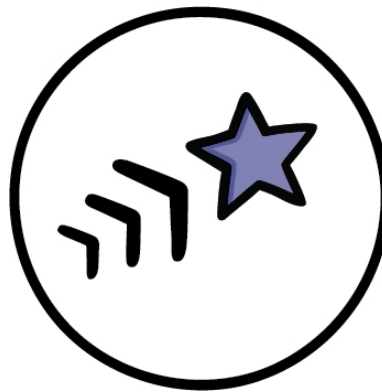
STRATEGY 5: ADJUST YOUR ACTIONS

From the Original Guide

What Are Adjustments?

According to FHWA's *TPM Guidebook* chapter on monitoring and adjustment, adjustment is "the alteration of programming, planning, targets, measures, and goals resulting from analysis of information collected." It is this alteration that leads to improved results, the true goal of performance management.

Programming—the process of selecting which transportation projects to fund and build—gets a lot of attention as agencies' primary tool in improving performance. There is good reason for this emphasis, but new projects take a lot of time and funding to materialize. In addition to this large lever, there are smaller actions that agency staff are engaged in every day that do not require the significant time and monetary investment of new projects. These smaller actions can amount to real impact when rolled up agencywide. Examples of this type of adjustment are given in Table 1.

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New Tactics for Adjusting Actions

Recognize that every handoff from one phase to the next may change the initial vision. Planners can do everything "right" by honestly documenting community needs, talking with stakeholders about how to best meet those needs, and identify top locations and solutions that will address key performance outcomes of interest. Eventually, though, the planners will hand off project concepts to project designers who, for the most part, will not have been involved in the detailed discussions of what performance goals area and which aspects of the project are most important to the community. Keep the discussions going between planners, designers, and project delivery teams to keep projects as close to the original vision while remaining realistic, efficient, and viable.

Be prepared for the reality of how long each intervention will take. There are often large time-lags between action and performance results. Agencies can start to plan for and communicate the realities of how long different changes will take by setting targets at a frequency that reflects project length. Consider using two types of targets for the same measures to better manage expectations around performance: targets for the near-term that reflect anticipated conditions based on projects and interventions already in the pipeline, and longer-term targets that the agency will try to meet with their upcoming decisions and investments.

Connect to a sense of urgency behind why action is needed now. Some agencies have undertaken extensive analysis and research into a new, more performance-based approach to investments, only to have the effort "go nowhere" when it came time to actually implement it. Agencies that continually move forward with new and potentially better approaches have cited an acceptance among leadership and staff that having the right projects is urgently needed, such as because booming growth will snarl out of control if they don't make the smartest decisions. Find an underlying need for getting things "right" that has relevance and urgency for your stakeholders and region.

Don't be afraid to change what didn't work. Performance improvement is an iterative process, and we'll rarely get it right the first time. Plan for there to be a version 2.0 (or 3.0…) of whatever you initially tried as you learn more through its implementation. Making adjustments doesn't mean you were wrong. If you were wrong, it doesn't mean you can't make it right.

STRATEGY 6: TELL YOUR PERFORMANCE STORY
From the Original Guide

What is Your Performance Story?

Being great at your job does not necessarily mean you're great at talking or writing about it. Nonetheless, crafting compelling narratives around work to achieve important targets is a make-or-break element of making targets matter to leaders, peers, and the public. Compelling stories help your message rise above the noise of information-saturated workplaces. Stories help make ideas more concrete, and there is something about a story that is personal and human that facts or data alone cannot attain.

Your performance story is the arrangement of all your agency does to improve performance into a narrative using classic story elements. Employees, partners, leaders, system users, residents, and visitors become your characters; the roads, sidewalks, train cars, buses, and communities are your setting; people's struggle to use the system to get where they need to go represents conflict; and all that your agency does to ease those struggles brings resolution.

Your performance story is a tool that will travel with you throughout your journey to attain targets. It may start off small and ill-defined, but it can evolve and take shape as feedback comes to your agency through the practices outlined in this guide.
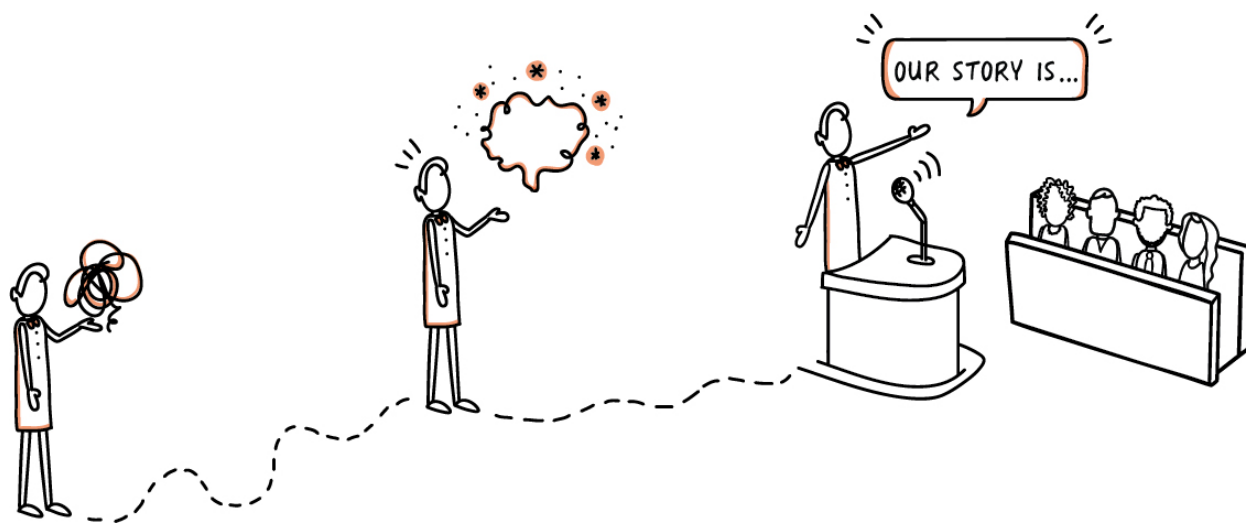
What Performance Stories Look Like

COMPASS, Boise, ID – The Boise MPO changed the way they communicated TIP achievements. Rather than simply reporting total project spending in dollars expended, COMPASS told a story about what that spending achieved in terms of number of crashes reduced, passenger time saved, and pavement condition.

This retelling of the TIP provided a complete action-resolution story arc rather than just data. In estimating the impacts of their investments, COMPASS could claim "more wins than losses," which gave them more freedom to talk openly about the losses in a way that did not convey failure.

Nebraska DOT – When staff at NDOT's Lean office need to convince skeptical peers to adopt new habits, they rely on storytelling. For example, they might connect crews' efficiency to drivers' experiences: "When members of the maintenance team spend 20 minutes each day looking for wrenches, that is time when they are not filling potholes that are frustrating drivers and causing unnecessary wear and tear on cars. That is why tool organization is necessary."

Why Performance Stories Matter

People connect to stories. Simple presentations of data, no matter how clearly communicated, lack emotional content that sticks in people's minds. Narrative can both instruct and inspire by teaching us not only why we should act but by moving us to act.

Stories simplify things. The world is complex. Human beings make complexity understandable by fitting the myriad objects and people in the world into story patterns. In public policy, where complexity and ambiguity abound, compelling storytelling is a critical tool to deliver messages that people can understand and remember.

Stories spur feedback. Ultimately, performance stories support buy-in that spurs partners to engage with performance management initiatives and return useful feedback that shapes actions and supports superior performance outcomes.

New Tactics for Performance Stories

Invest in new tools that can blend data and storytelling. From simply feeling like there is too much data to lacking the tools to adequately summarize important findings in the data, agencies are still looking for new and better ways to grapple with data, find the story behind it, and clearly tell it. Explore the options available for this kind of storytelling at your agency. Some have found success in geographic information system (GIS)-based "story maps" that allow for narrative to be interwoven with charts and data-filled maps. Other agencies have developed custom-built portals designed specifically to communicate key information about needs on the system and the potential impact of investments to stakeholders outside their agency. Even internal data management or analysis tools should be adopted with options for communicating important information in mind to share with leadership and decision-makers.

Find a report "no one reads" and make it more meaningful. Government is known for developing an impressive number of reports, many of which are updated and reported out to leaders or legislators every few months or years. Often such reports are treated as rote requirements that best completed by whatever means will check the box most efficiently. Some of these reports, however, represent opportunities to communicate a more compelling story around performance directly to those who most need to hear it. One agency seized on a report with "the same strategies for 15 years" and completely revamped the content to "one people will actually read" and spur a robust conversation around performance-based cross asset allocation.

Tell the story at the scale your audience cares about. Some practitioners have reported trying to collaborate with staff at other agencies, but their partners' eyes glaze over when they put up performance results. Part of the reason behind this may be that people want to see the results and hear the story of *their* region and community, not just statewide results that are harder for local stakeholders to conceptualize and connect with. Several agencies have plans to develop a more localized performance story for their stakeholders grounded in more relevant data.

Talk about carrots more than sticks. Performance reporting can feel like drudgery at times, with staff waiting for the hammer to fall on something that didn't go well. Change the perception of performance by talking about carrots as well as sticks, and celebrating when good things happen or targets are achieved. This will build more positivity around performance efforts and possibly even excitement for the next effort.

Keep simplifying. Simplifying your message was a recommended practice in the original guide, but it bears repeating. Even agencies that reported simplifying their reports and reducing their number of performance measures several years ago are simplifying even further.

PART III: FEEDBACK ON THE GROUND

Chapter 6: Case Studies of Feedback in Action

Each case study in Part III illustrates the principles from Part I and the tactics and strategies presented in Part II with real world examples of how MPOs, state DOTs, and transit agencies have used feedback to improve performance. These examples cover common performance-related activities so other practitioners can recognize similar opportunities in their own agency and take steps to enact them.

Each example follows the same basic structure and answers the following questions:

- What is the main takeaway?
- What makes up the feedback anatomy of sensors, pathways, information, action, and repetition?
- What is the full story?
- How did feedback strategies contribute to success?

The cases studies featured include:

Utah DOT: Gathering Feedback for a Unified Statewide Vision: The Quality-of-Life Framework

East-West Gateway: Gathering Feedback for a New Performance Area: Equity in Transportation Investment

Minnesota DOT: Gathering Feedback via Post-Implementation Project Evaluation: Corridors of Commerce

Virginia DOT: Gathering Data to Better Gather Feedback: The Transportation Data Hub

UTAH DOT – COLLABORATING FOR A STATEWIDE TRANSPORTATION VISION

The Main Takeaway

Utah legislation from 2018 tasked the Utah Department of Transportation (UDOT) with developing a statewide strategic transportation initiative by engaging a broad range of stakeholders from across the state. With little direction on exactly who to include, UDOT staff worked with the Governor's office to identify who would be at the table. The result was more than two dozen organizations spanning industry, government, non-profit organizations. After months of outreach, meetings, and discussions, the group landed on a resounding commitment to implement transportation focused on one core issue: quality of life.

The "Quality of Life Framework" was brought to the public early in 2020, identifying four areas where transportation impacts the community: good health, strong economy, better mobility, and connected communities. With this initiative, Utah had a solid, unified vision for transportation. But the vision came with little in the way of instructions for implementing it.

Because the vision had such broad and thorough support, UDOT leadership quickly signed on to find ways to align current processes with it. The agency decided to start by implementing the framework into its long-range planning efforts via measures for project selection. UDOT planners held their own round of stakeholder meetings to brainstorm metrics that would support each area of the vision for each major category of funding in the plan. The first round of measures is in use now, with the agency revisiting initial decisions to improve and refine them as the organization learns more.

The Feedback Anatomy

Sensors:	Government officials, non-profit staff, industry leaders
Pathway:	A series of focused visioning meetings
Information:	Shared priorities, conditions on the ground
Adjustment:	A new singular statewide transportation vision, new metrics, new initiatives to improve metrics
Repetition:	Repeated meetings and communication, evolving vision and metrics

The Full Story

Mandate for a Statewide Vision

In 2018, the Utah legislature passed S.B. 136 requiring the Utah Department of Transportation (UDOT) to develop statewide strategic initiatives that spanned all modes of transportation, including modes UDOT was not directly responsible for. UDOT reached out to the Governor's office for help identifying the right stakeholders for this big, statewide effort, and together they brought together an impressive 25 organizations that included common transportation stakeholders like MPOs, transit providers, bike advocates, and the trucking industry, along with municipal representatives, business and development groups, universities, and non-profits focused on health and the environment.

The stakeholder group met with the governor's office early on to review the legislative language and better understand their mandate. UDOT led research and hosted a series of visioning meetings and focus groups to clarify meanings, establish priorities, and try to uncover a unifying quality to bring all their interests together. The group reconvened near the end of 2019 to finalize their collective vision: that all transportation in the state of Utah support a better quality of life.

Implementing UVision

The principles that came out of the visioning process was termed the Quality of Life Framework. The framework identified four areas where transportation could have an impact: good health, strong economy, better mobility, and connected communities. These principles became the basis for Utah's transportation vision, or "UVision," that would guide future decisions and investments. But the work of the stakeholder group stopped at this vision, leaving implementation to individual organizations to devise themselves.

UDOT leadership embraced the new vision in part because of the firmly established consensus coming out of the statewide effort. The agency's chosen path to implementing the framework was through a new set of project scoring metrics in its long-range transportation plan, the Utah Unified Transportation Plan, which brings together the statewide rural plan and each MPO's metropolitan transportation plan. The agency set to work with a new round of stakeholder input sessions to develop the performance areas and measures that would be the foundation of the effort.

Stakeholders involved in this process included technical experts inside of UDOT and the state's MPOs and transit agency. The group first identified "criteria areas" of how the four elements of the Quality of Life Framework could reasonably be represented in the transportation system, shown in Figure 1. Within each area, groups of experts and stakeholders would identify metrics suitable to each criteria area.

Good Health	Strong Economy	Better Mobility	Connected Communities
Safety	Accessibility	Travel Time	Connectivity
Public Health	Transport Costs	Throughput	Land Use and Community
Environment	Economic Development	Risk and Resiliency	Integrated Systems

Figure 1 UDOT's criteria areas for each of the four elements of U-Vision's quality of life framework

A key factor of the success of these meetings was having dedicated facilitators who made a concerted effort to create a "yes, and" environment. At this early stage, the focus was on brainstorming the measures individuals most wanted to see without turning down ideas based on data availability. Staff also found that questions such as "How do you want to be measured?" backed people into a place where vague and nebulous answers would protect their own interests. Instead, questions like "How are we going to show our investors, [the public], that they are getting a good return on their investment?" provided opportunities to support success and identify wins for the community. This reframing of responsibility and priorities helped facilitate productive meetings that worked to get at the core of public sector purpose.

Once ideal metrics were identified, the teams worked out the nuts-and-bolts side of data and feasibility. Although some ideas were not feasible and needed to be pared back, others became more realistic as third parties realized they had the data or expertise needed to implement the concept. Some measures ended up using binary yes-no metrics if quantitative metrics were not an option, while for others technical experts weighed in with similar options that could be used instead.

The result of these efforts was a suite of measures that has been used to guide investments from the Transportation and Transit Transportation Investment Funds (TIF/TTIF), two of the major sources of funding in the Unified Plan. Both funds are split into two portions: one on major capital investments (highway capacity, transit hubs, etc.), and one for smaller scale projects (active transportation, first/last mile transit connections, trails, etc.) Each funding category is currently scored separately using their own set of metrics, but UDOT staff kept the structure such that project identification could be combined across categories for a truly "cross asset" approach to investment allocation should that desire arise in the future.

A Simpler 2.0

As UDOT became more experienced with measuring, tracking, analyzing, and communicating these measures, staff started to wonder if there were ways to improve UVision in the long-range plan. One of the biggest feedback points had been, "We like where this is going, but it's way too

complicated." Weights are currently assigned at both the area and criteria level, forcing people to do mental math to understand the true weighting of each metric, which reduces some of the more than a dozen weights to less than 10% of the overall score. There is also an issue in that projects coming from the long-range plan are often sparse on design details, so trying to get data on project impact at the specificity of some of the metrics is harder than the team initially thought it would be.

UDOT decided they needed to revisit these measures with a particular focus on simplifying. The agency held a new round of stakeholder meetings and discussions in 2022 in which they pushed on stakeholders to consider what was <u>really</u> important for each project type in a push to reduce the 15 metrics applied to each project down to fewer than five. Facilitators at these meetings asked participants to answer one simple question: "What makes a good ____ project?" Participants were given only three responses, which forced them to identify what mattered the most to them.

Once the smaller number of measures is finalized, weights will be applied directly to the metrics rather than at multiple levels like the current model does, which confuses stakeholders. While the push is to simplify the measures landscape overall, at the metric level there is a push to shift from simpler binary measures to more quantitative measures of project impact, working closely with technical experts to identify the data and approaches that will allow for this. The new slate of measures is expected to be finalized mid-2023,

Implementing UVision into the Future

Once the metrics are successfully integrated into the entire process for the next long-range plan, UDOT plans to integrate the framework and metrics into other planning documents and processes, such as its transportation asset management plan. In addition, the UDOT team is keeping its eye toward how the vision gets implemented further down the project delivery pipeline. The current process establishes a <u>plan</u> for projects that support a high quality of life, but are the projects being designed with these considerations in mind? Will key elements of the projects that would contribute to quality of life get lost in the construction phase? Project designers and delivery staff are generally not part of the planning discussion, so the next phase of UVision implementation will need to identify ways to communicate the vision to this audience and ensure the continuity of projects that commit to a better quality of life.

How Feedback Strategies Helped

Build Buy-In for the Long Term

Connecting UDOT to over twenty organizations was the first step in this process. As a result of the breadth of the initial visioning effort, UDOT leadership did not hesitate to adopt the vision and look for ways to implement it meaningfully. It gave the effort the broad support that has made consideration of quality of life elements "how we do business" at UDOT.

Despite being responsible for the overall development of the vision and initiatives, the visioning committee has not dictated how partner organizations should measure progress in the framework areas or implement programs to move the needle. This has allowed each agency to

make the vision their own and build new solutions that will have a more lasting effect than if specific actions had been required.

Navigate Your Data Ecosystem

Part of the stakeholder and technical committee meetings involved both identifying "dream data" sources practitioners would want to utilize, and connecting organizational resources that could begin to meet those needs. UDOT staff also worked with data owners during the process, focusing on how those individuals or groups could support the broader organization in showing residents how progress was being made.

Convene Across Boundaries

Even though the framework is focused on transportation's contribution, the groups gathered came from a variety of fields: economic development, local government, legislative policy, and public health. This provided support, data, ideas, and expertise that might not have been present otherwise.

The various stakeholder meetings featured conversations focused on possibilities to bring the UVision to life, not only what they could do easily right now. Having a dedicated facilitator lead each group kept it focused and ensured the team got the input they needed for the effort. Repeatedly bringing together large and small groups of participants further allowed for a wide range of ideas and opinions to be voiced safely and comfortably.

EAST-WEST GATEWAY – A NEW PERFORMANCE AREA: TRANSPORTATION EQUITY

The Main Takeaway

The East-West Gateway Council of Governments (EWG) is the metropolitan planning organization (MPO) for the St. Louis area. Typically, EWG selects a focus area for its long-range transportation plan, the topic of which changes from one plan to the next. For their most recent long-range plan, Connected 2050, the consensus was that the focus should be on a timely topic they had yet to explore: equity. But what began as merely a focus area to the long-range plan grew into a much more robust, stand-alone analysis that went well beyond the plan. The more staff talked, they more they realized that the topic warranted much more thought, care, and attention to do the topic justice.

The agency ended up undertaking the three-phase equity analysis for the St. Louis region. It started with a historical analysis of transportation investments in different parts of the region and the lasting impacts on their respective communities. A review of current conditions and a concerted public outreach component was initiated, hitting community events and summer festivals along with public meetings. A methodical analysis of spending from the transportation improvement program (TIP) completed the analysis to inform the team if there were ongoing disparities in how transportation dollars are distributed.

The Feedback Anatomy

Sensors:	St. Louis region residents; old aerial photos and plans; Census demographics data; historical TIP spending records
Information:	Comparative observations from historical documents; Results and maps from the current conditions analysis of Transportation Equity Populations (TEPs); TIP spending analysis takeaways
Pathway:	Public outreach events; Focus groups with long-term residents; Historical, current conditions, and TIP spending assessments
Action:	Incorporating equity scoring criteria into project TIP project selection process; Adopting a policy requiring regular transportation equity assessments; Upgrading the TIP management system
Repetition:	The team hopes to integrate the transportation equity analysis into the agency's routine planning efforts. When analyses like these are conducted every two years, for example, it becomes easy to see trends and patterns. These outcomes become an asset to the region and its leaders.

Defining the Analysis

In getting the equity analysis started, EWG planning staff worked closely with their board to talk about why an equity analysis was important and to set up definitions and parameters for the study. They began with the critical task of defining "transportation equity." The team struggled to find the right language and spent a lot of time asking people in the region what this term

means, hoping to iterate the definition with the public input. Ultimately, they ended up using FHWA's definition as it hit on most of the important elements they heard.

Determining who should be considered as part of their equity populations also took careful consideration. Staff deliberated over how to assess, "Who was not getting the full equitable access to the transportation system?" The classic approach was to use the federally defined environment justice (EJ) populations or the CDC's social vulnerability index. However, these definitions seemed too broad for EWG's purposes, as they flagged areas that local professionals knew were not transportation-challenged. Ultimately, staff identified a series of historically disadvantaged populations, which they referred to as Transportation Equity Populations (TEPs). These included:

- Persons with Disabilities
- Low-Income
- Seniors
- Minority Groups
- No-Vehicle Households
- People with Limited English Proficiency

EWG then devised three primary components of the full equity analysis:

1. Historical Analysis – Significant investments in the development of the modern highway system that displaced or otherwise impacted communities.
2. Current Context – What are the disparities people face now? This phase included both analysis of current data and a significant outreach component.
3. Transportation Improvement Program (TIP) Analysis – A review of spending by geography from recent history.

Historical Analysis

The historical analysis examined the ways in which transportation investments, notably those for new highways, impacted minority and low-income communities. In this anlaysis, the "where" of the study was a crucial decision. Extensive data on where these major investments displaced residents is not available, with only a sampling of documentation that has survived. There were few examples of even old maps from rural parts of the state, as they weren't even part of the city yet.

Part of selecting locations to study, therefore, was dictated by the availability of data, maps, and aerial photography, as well as how developed the region was at the time. The team also considered geographic spread to ensure that different disadvantaged communities were included and the focus was not solely on urban parts of the region. One important approach for the analysis was overlaying old aerial photographs with current maps of the facilities, as shown for the Mill Creek and Hill neighborhoods in Figure 2. Doing so clearly demonstrated the ways the region was reshaped by these large infrastructures that remain in place today, which could then lead into a discussion about how the area changed.

The team tried as much as possible to tie the story of infrastructure investment to the story of changes in housing, including the phenomenon of "white flight" and the Interstates. This was a

somewhat touchier subject with some of the board members, and points to the sensitivities that have to be navigated for a topic like this. There were a few topics that the analysis touched on or the team was interested in that they did not end up pursuing as part of the analysis due to concerns by board members. In the case of the foundational connection between transportation and housing, however, the team felt it was too important to ignore.
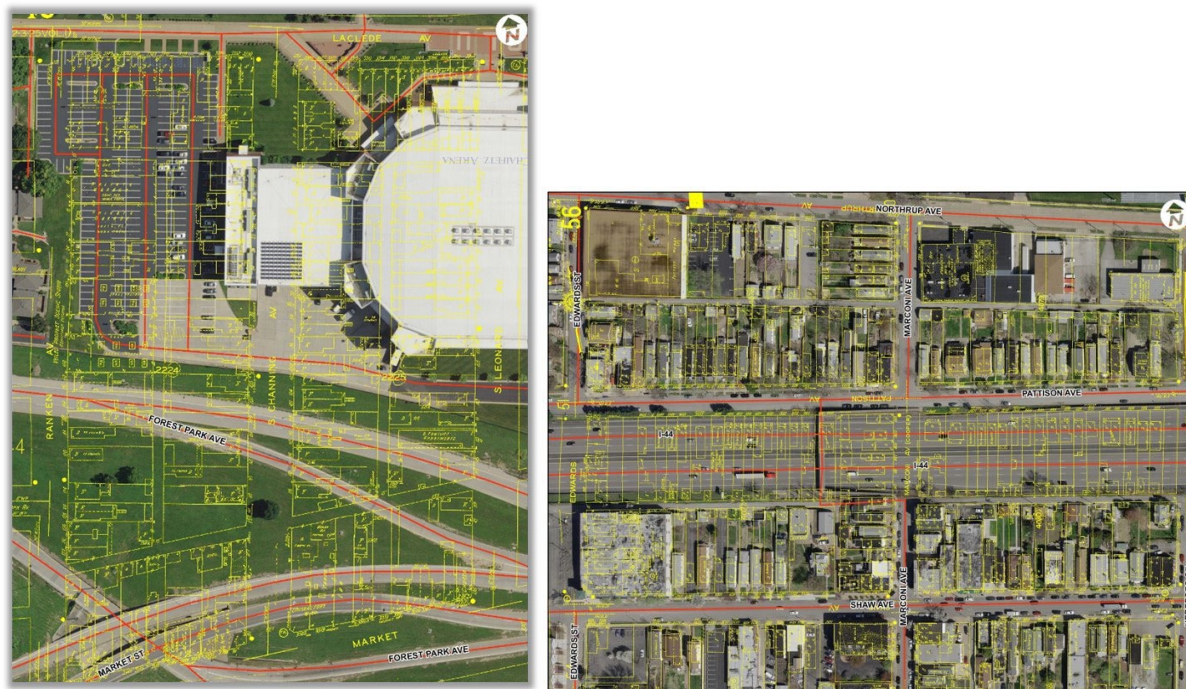

Figure 2 Overlay of home parcels (yellow lines) in the Mill Creek (left) and Hill (right) neighborhoods of St. Louis before a large transportation investment (images). Nearly all homes and businesses in the Mille Creek area were demolished and the residents displaced as a result of the transportation and building development. In the Hill, several blocks of homes and businesses were removed for the current roadway. Source: EWG

Current Context & Outreach

The current conditions analysis involved looking at the equity-related transportation issues the region is facing in the present day. Staff focused on several areas, including safety, emissions, and noise pollution, and access to jobs, health care, green space, and educational facilities. The team also considered infrastructure as a barrier between groups of people. For example, staff could map the lines that divide people by factors like income and life expectancy and they often lined up with a major arterial. They also found that lower income households were clustered along high-volume roadways.

"We spoke with one with former resident of a neighborhood that no longer exists due to the Interstate. That gave a lot of soul to the analysis."

Public engagement was a significant part of the current conditions analysis, as it would tell them what residents themselves think is the state of their transportation today, information that could not be obtained from data. Because EWG wanted to reach as much of the community as possible and most members of the public

don't make it out to dedicated transportation meetings, there was a big effort to do much of the outreach at existing community events as possible. Luckily outreach occurred during the summer, when there were ample opportunities to attend street festivals, parties, and community celebrations across the counties.

In addition, the agency hosted two virtual open houses and met with long-term regional residents, some of whom had lived in neighborhoods that no longer existed because of an interstate. Staff were generally pleased with participation, although virtual engagement could have been stronger, and they acknowledge that the people who participate in public engagement have the time and capacity to do so.

TIP Analysis

Staff refer to the TIP analysis as "the part of the effort that will pay off for years and years." The analysis looked at TIP spending since 2005 and placed the investments in a geographic information system (GIS). This was a more numbers-focused task where staff mapped the investments and assessed them in relation to relevant demographic and economic data. For example, they reviewed where bicycle and pedestrian project spending took place compared to where the no-vehicle households were located to visualize possible investment imbalances, as shown in Figure 3.

The analysis also allowed the agency to see whichh municipalities or counties got the majority of projects, and which got none at all over the 15-year period. There is still internal discussion at EWG as to which findings to publicize, how to best attribute project benefits, and how to portray the "right" mix of investments through the region, but the exercise helped provide a baseline understanding of the recent history of transportation investments in the region.

Perhaps the best lesson of all from the TIP analysis was the agency's realization that they needed a new TIP database going forward that would include more relevant details about each project. Even 15 years ago there was so much information in hard copy and in old spreadsheets. EWG is now seeking consultants to build a new database that will start changing the way they catalogue information with the next TIP cycle.

Results

While the final report has yet to be finalized and published, the project has yielded several significant outcomes and recommendations for the MPO:

- **Incorporate new equity scoring criteria into the TIP project selection process.** EWG is still working on consensus about what should be measured and how to quantify tradeoffs.
- **Institutionalize the transportation equity analysis program**. Staff suggested that regular equity analyses could be standardized, perhaps by embedding these activities into a policy. This way when staff leave, the work continues.
- **Include TIP analysis maps in future calls-for-projects**. Asking locals to think about how proposed projects are going to impact historically disadvantaged populations may encourage more funding for projects that will help them.
- **Replace the TIP database**. This outgrowth of the study is almost certain to go forward and will aid any similar studies – on equity or other topics- in the future.
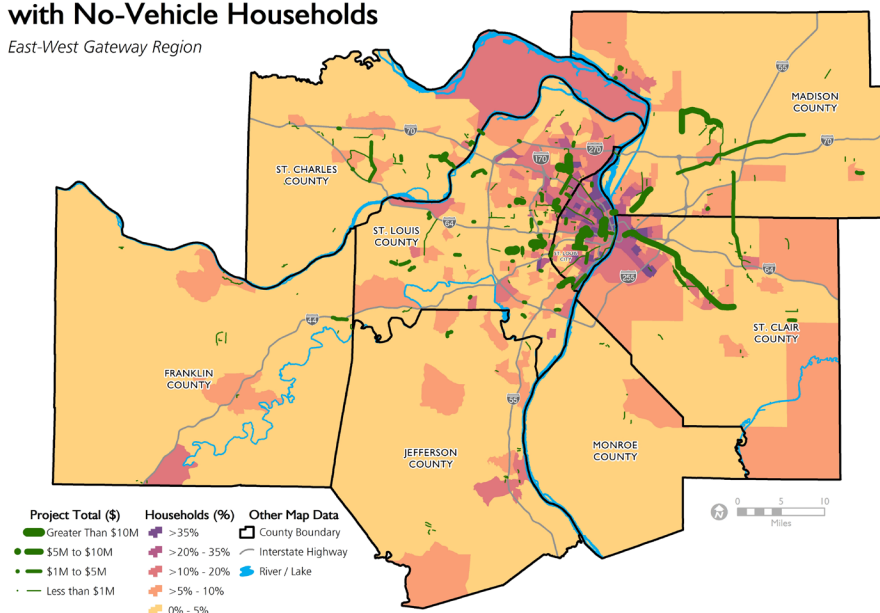
Figure 3 A mapping of bike and pedestrian project spending overlaid on no-vehicle household data. Source: EWG

How Feedback Strategies Helped

Navigate Data

The historical analysis required a lot of reading and reviewing of old comprehensive and land use plans as a unique source of data for the historical analysis. In addition, EWG has a program called Where We Stand that compiles large amounts of high-quality data on how the St. Louis region compares to peers. The team was able to leverage a lot of what was already available through this effort, tailored to this topic. Data includes commute times, where people work, commuter flow across demographics, and socioeconomic data. Investing in this kind of centralized data makes these kinds of initiatives easier and can be an asset for local leaders, who can use it to show that a trend is real in the region.

Build Buy-In

Some stakeholders bristled at the idea of "going back in time" for the historical analysis, arguing that the organization should be more forward-looking. The MPO board was a diverse collection of officials from the whole region, including suburban and rural localities not sure how they wanted to approach an equity analysis. EWG planning staff tried to address this by presenting a plain examination of the facts. The photos were a crucial asset because agency staff could compare old photos and maps and clearly see the way the region was reshaped. This was not debatable because the physical infrastructure was still there in plain sight.

Own Your Performance Narrative

Planning staff tried to own their narrative by keeping the issues broad, rather than focusing on one or two very specific equity considerations, to reduce the potential for political division. They also tried to tie in federal decisions whenever possible by considering any policies that would

have influenced transportation planning (e.g., clean air, clean water, housing, and economic policies).

MNDOT – CORRIDORS OF COMMERCE POST-IMPLEMENTATION PROJECT EVALUATIONS

The Main Takeaway

Minnesota's Corridors of Commerce (CoC) Program was intended to prioritize transportation investments that add capacity to address system bottlenecks and improve and preserve freight movement through the state. State legislation requires MnDOT to assess projects funded through the program biennially across key metrics using before-and-after analysis. This post-implementation evaluation helps to identify those projects with clear on-the-ground benefits that will have the most impact on the program's goals.

The Feedback Anatomy

Sensors: Vehicle probes; traffic counts; crash statistics

Pathway: Biennial evaluation of recently completed CoC projects

Information: Before-and-after changes in travel speeds, reliability, freight movement, and safety outcomes

Adjustment: Insights on the most successful investments guide applicants and MnDOT on the kinds of projects that best meet program goals

Repetition: Evaluations take place every even-numbered year and are reported to the state legislature

The Full Story

The Program

Corridors of Commerce (CoC) is a transportation investment program for Capital Improvement Projects or Freight Improvement Projects through which Minnesota cities, counties, MPOs, regional development organizations, or other government entities can apply for funding. All projects must be on the Interregional Corridor Network of state highways, able to begin construction within three years, and not already listed in the MnDOT statewide transportation improvement program (STIP). "Recommendations", as project proposed by local agencies are referred to, include a description of the proposed improvement and its expected benefits, as well as a construction estimate that has been reviewed by a professional engineer (PE). From these recommendations, MnDOT staff develop full project descriptions, cost estimates, and scoring according to program metrics for each recommended project.

The CoC program is required to report on the "results of an independent evaluation of impacts and effectiveness of the program" every other year. MnDOT staff not involved with regular CoC program operation evaluate projects funded through the program that are "substantially complete and open to traffic."

The Evaluations

The post-implementation evaluations look at both project delivery outcomes, such as cost estimate comparisons, as well as transportation system outcomes, such as improvements to safety or congestion. The analysis team evaluates transportation system outcomes using specific metrics:

- Impacts on Travel Speed – The analysis team uses vehicle speed data from the National Performance Management Research Data Set (NPMRDS) to estimate speed changes on the segments affected by CoC projects. The evaluation is conducted for all traffic, as this data is better quality, but they can also look only at truck movements to explore whether there are differential impacts to trucks compared to general traffic movement.
- Crash Incidence and Severity – MnDOT's Office of Traffic Safety assists the evaluation team with crash analysis. Safety analysis remained fairly limited in the first few years of the evaluations, looking only at total crash rates and fatal and serious injury crashes along project corridors. For the most recent round, the team decided to look further into the fatal crashes that did take place and include qualitative contextual information about the crashes. The hope was that this additional context could provide a better sense for whether the CoC project could be credited with improvements in results.
- Commercial Volumes – The evaluation team works with the Transportation Data Analysis office to get vehicle and truck volume estimates along the corridors of interest to assess whether projects supported growth in commercial activity.

Analytical Challenges

Beyond the ever-present resource constraint of too few staff for extra analyses, there are very real analytical challenges that prevent more agencies from undertaking post-implementation project assessments. The MnDOT CoC evaluation team has dealt with these challenges in each cycle of their evaluations. For some challenges, they have accepted the limitations in interpreting the results, but with each successive evaluation they make progress on addressing others.

Changing Data Collection Methods

A common and recurring issue comes from data collection and format inconsistency from one evaluation cycle to the next. For example, data collection for traffic volumes is in the process of moving from manual, short-duration counts toward more passive methods of collection on high-volume roadways that use radar-based methods. This has resulted in significant differences between the direct "tube" counts from previous years and the new passive methods. In addition, the radar counts classify larger vehicles in a different way, resulting in very different truck volume estimates. Members of the evaluation team agree that that there is not a lot that can be done to prevent this from happening, since changes are often being done to improve methods, gather the data more efficiently, or are the result of a major disruption like the Covid-19 pandemic. Dealing with evolving data collection must be accepted as part of evaluation.

A strategy the team has used to deal with the challenge is to use data reported to FHWA by other states to normalize the data, on the assumption that other states were not going through the same data conversion process at the same time. In future years this should smooth out as more observations are based on wave and radar units.

Infrequent Data

Thankfully, fatal and serious injury crashes are infrequent events on any particular stretch of road, especially in rural areas. But this infrequency means that small variations in occurrences from one year to the next create erratic trends and rates. One recent evaluation for a small project in the CoC program expanded a half-mile section with daily traffic of about 4,000 vehicles to four lanes. If those fatalities or suspected serious injuries went from two in a year up to four,

the fatality rate for that segment spikes significantly. The team has found that having a longer "post" period for evaluation can help address this issue and have standardized having at least three years of post-construction data to get reliable results across all their performance metrics.

Insufficiently Detailed Data

A CoC project to move to a divided roadway on US 14 near Mankato showed very clear and exciting post-implementation safety results: fatal and serious injury crashes fell from about six in a three-year period to just one in the post-implementation three-year evaluation period. This seemed to indicate a clear improvement due to the project. However, as noted in the CoC evaluation report, these results only represent correlation, not causation. Even with this clear before and after difference, the team cannot tell 100% that moving to a divided roadway on this corridor was the primary reason for the performance improvement.

Additional analyses could provide support to the theory of project causation, like looking at the types of crashes that improved. Moving to a divided highway, you would expect to see fewer head-on collisions and road run-off crashes. However, the team was not able to conduct this more detailed analysis because information on the types of crashes was not available in the data set they currently have access to. Getting access to the more detailed data would require working with a separate state agency, which adds a layer of complexity. There are concerns that having another organization step in to "do this work for us" could cause tension among staff who already have other work priorities to manage. The limitation tamps down on how ambitious some of the analyses are.

Isolating Project Impact from External Trends

During the pandemic there was a significant and widespread decrease in congestion and delays across both Minnesota and the country. As a result, it was very hard to disentangle the projects' more modest impacts from the decreases due to Covid.

To deal with this on safety, the team broke out pre-and post-Covid results from the total post-implementation portion of the data. In contrast to its impact on congestion, Covid-19 worsened fatal and serious injury safety outcomes across the country, particularly on rates. For many projects, the "post" results that were before the pandemic looked much better than the results after Covid's effect came through, allowing the team to isolate some project benefits before the larger impacts of the pandemic washed them out.

To try and tease out the impact on truck volumes, statewide change in VMT was applied to the project area to obtain an "expected" change if there had been no project built. This captures the influences of external variables at play other than the project's construction. This expected change is compared to the actual change along the project location corridor. Any improvement in the results beyond what would be expected given exogenous trends can be correlated with the CoC project.

Isolating Project Impact from Other Projects

The above approaches unfortunately do not solve another complicating factor in the analysis: disentangling the impacts from multiple projects built in the same corridor or general area. For example, a CoC project on I-94 near St. Michael and St. Cloud was constructed at the same time as several other improvements along a 40-mile corridor of I-94. How could the team be sure

which impacts were a results of which projects? For now, the team's approach is to discuss the specific improvements and observed changes on the roadway qualitatively to rationalize how each project is likely contributing to observed outcomes, and to qualify other factors that could be influencing results.

Improvements for the Future

When asked directly what improvements to the data, support, and processes would improve the team's ability to conduct efficient and robust post-implementation project analyses, the team had a few ideas.

1. Have local recommendations include as much information in advance as possible. Having a sense for what the expected project benefits are likely to be can help guide the team on metrics and data to focus on for the evaluations. It is also helpful to know when construction is expected to start, when it is likely to be completed.

2. Collect better pre-construction data. MnDOT maintains a GIS program that allows traffic counts to be pulled up for any facility for any part of the year, which is a great resource for the CoC evaluations. But these don't always represent actual counts – they are modeled based on the most recent actual count, which may have taken place two or three years before, and based on traffic on nearby facilities. To obtain better actual traffic counts, the team was recently informed that they can coordinate with data collection staff in the districts to do special-purpose counts for areas where they know projects are going to be constructed. All they need is a few months' notice from when they would like the counts to take place. This will provide a stronger set of pre-construction data that will give greater confidence in the pre- and post-construction comparison.

3. Prepare stronger pre-construction counterfactuals. Developing more involved pre-construction analyses for documented safety needs at proposed project locations can lead to proposed countermeasures expected to best address the safety need. The team could then look up crash modification factors (CMFs) that are associated with that countermeasure and build it into the project's estimated likely impacts. This would provide a counterfactual against which to compare the actual observed impacts to get a better sense for how well the project performed relative to expectations.

Results & Implications for Broader Application

For now, evaluation results are used solely to report on previously funded projects to the Minnesota legislature in accordance with legislatively mandated program requirements. Results of the evaluations are not formally and directly included in new CoC project selection criteria, but they can influence awareness of which projects might be successful. Having the numbers on past projects can help those making funding decisions within the program to select projects that most resemble successful ones in the past. Lessons learned through the quantitative evaluation process can improve methods of forecasting expected benefits on key criteria for recommended projects.

MnDOT does not have explicit plans to apply similar evaluations to broader project selection processes, though post-implementation assessment is a topic of growing interest among practitioners in the transportation industry. When asked to consider what broader use of evaluations like this might entail, the CoC evaluation team acknowledged that there would likely

be organizational and political challenges as well as the analytical challenges noted above. It could be difficult to have to take an honest look at projects that didn't produce anticipated results, especially those that were requested directly by the districts or local officials. Addressing these concerns will be necessary if broader application of project evaluations is to take place.

How Feedback Strategies Helped

Formalize Assessments

While the scope of the assessment is limited, the fact that there is a defined point in time when it is expected to take place means that it actually happens and other staff in the DOT are ready to support it. It is the structure and expectation stemming from the legislative requirement and report deadline that is the impetus for the work. Institutionalizing similar expectations and requirements – even requirements that MnDOT puts on itself – would be essential to a broader application of post-implementation project evaluations. This effort can serve as a model for how such processes would work, data needs, and analytical challenges to overcome.

Know Your Data

The project evaluations in Minnesota showed how important discussions with key staff can be to getting data for the analyses most desired. When the evaluation team's district contact was fully brought into the discussion of the before-and-after analysis, she learned of the shortcomings of the "before" traffic data. Having a full understanding of what the data was needed for, she was able to offer a solution to ask the districts to proactively collect traffic data on road segments where CoC projects were expected for construction in the next few years. This will allow for greater confidence in the results of the evaluations going forward.

"We've been doing these analyses for several years, and it's only now that our data contact told us we can ask the districts to do special-purpose counts for areas where we know projects are going to be constructed."

Getting this buy-in could also potentially help obtain more detailed crash data to allow the team to explore the kinds of crashes that are improving at each project location. This level of detail is currently not in the safety data used by the team, but asking another office to put the time into providing this data requires a level of engagement and buy-in that the team has not developed yet.

Build Buy-In

Getting buy-in on evaluations like this is important for both increasing access to data and analytical options, as shown by the example of the team getting traffic data from districts above, as well as for preparing individuals to accept the results of the evaluations even when they wished the results were different. Post-implementation project evaluations have inherently political elements related to tensions over the projects that perform well. For post-implementation evaluation results to be taken seriously, leaders need to buy into the realities of results, commit to using them, and give staff the resources necessary to do them well.

The Main Takeaway

Virginia's Office of Intermodal Planning and Investment (OIPI) set out to create a centralized data hub as the single source from which offices across the Virginia Department of Transportation (VDOT) could pull data needed for analyses. The idea came out of frustrations and challenges related to gathering the wide range of data needed to set targets for national performance measures. There was a wide range of information participants wanted to consider in the target-setting discussions, but tracking down each piece of supporting information for 17 measures across the agency proved very challenging.

This sparked staff at both agencies to hold a two-day workshop, along with staff from other transportation agencies, for participants to discuss the "ideal state" for data access. The original lofty vision of a statewide Data Trust among multiple agencies stalled when legal concerns surfaced, but a scaled-back version just for VDOT's data moved forward with the same principles envisioned in the workshop.

Today, the Transportation Data Hub is a curated collection of 21 data sets from across VDOT, with nine additional data sets in progress. Any VDOT or OIPI staff can apply for access to the data through a centralized office and uniform application, rather than negotiating individually with data-owning offices. The concerted effort garnered attention from agency leadership, who have since declared data an official agency asset just like roads and bridges, thus cementing the importance of data in agency decisions and operations.

The Feedback Anatomy

Sensors:	Transportation data sets
Pathway:	A centralized agency data hub
Information:	Safety, bicycle facilities, roadway inventory characteristics (number of lanes, land use designations, speed zones, railway crossings), traffic monitoring system raw data, vehicle counts, and reports from the 511 system.
Adjustment:	Better-informed decisions across the agency from an ability to perform "off-book" analyses with existing data
Repetition:	Ongoing data expansion, updates, and access to helpful data

The Full Story

Data Access Before the Transportation Data Hub

Most offices at VDOT collect, structure, and format data with specific use cases in mind. Data owners and the analysts responsible for these pre-determined applications are typically the ones who access data collected by that office, in which case inter-agency coordination is not necessary. However, much of this data has the potential to be valuable for additional analyses in different offices. Because other staff do not have ready access to the data for these secondary or "off-book" analyses, each instance of using the data requires negotiation with the data-owning office

on the logistics of sharing, parameters for and restrictions on use, and how much about the data or analytical results can be shared.

In Virginia, the DOT has a sister agency that supports performance-based transportation decision-making: the Office of Intermodal Planning Investment (OIPI). When target-setting efforts for the 17 national performance measures began in 2018, OIPI staff in charge of this task quickly realized how difficult it could be to gather data across so many topics and offices. For one thing, there could be multiple sources of the same or similar data, with little indication of how or why they differed, or which was the definitive one to use. There were also no uniform formatting guidelines, so these similar data sets often had different fields or were aggregated at different levels. These challenges with accessing data for secondary uses and the lack of a consistent data structure across data assets made it clear that a data centralization effort was necessary.

An Evolving Vision for Data Sharing

To get the ball rolling, OIPI held a 2-day workshop with staff from VDOT, the Virginia Department of Rail and Transportation (DRPT), Department of Motor Vehicles (DMV – Virginia's Highway Safety Office, and the Virginia Transportation Research Council to discuss data issues, envision what an ideal would look like, and develop a plan for how they would get there. In general, there was consensus that something needed to be done to improve data sharing, but determining the best route was more challenging.

The original vision was to participate in a statewide, interagency Commonwealth Data Trust that included other state, federal, and local agencies. VDOT was supportive of the effort to improve data sharing, but had reservations about using the external data trust. As an alternative, VDOT and OIPI developed the idea for an internal version of the Data Trust for sharing within the two agencies. This new arrangement would be a curated data asset that contained certain agreed-upon fields and historical data from select VDOT data sets. They would call it the Transportation Data Hub.

Building Support

Proponents gained top-down support for the Transportation Data Hub by giving multiple presentations on the potential benefits of improving access to data. They were able to convey the magnitude of the need by developing a Data Roadmap that listed all the data sets that were not centralized but should be. The team also had to address concerns around funding sources and how to balance this request with others in the long list of IT projects. This campaign of presentations combined with addressing key concerns garnered sufficient top-down support to pilot the effort.

The approach was tried out on an analysis of three proposed safety projects that were very data intensive and required a lot of the same data sets. The analysis team made a matrix of all the data they wanted to use and identified all the overlap among different data sets. With a clear picture for what a central data set would look like and how having such data access would help in this small, specified case, a key member of leadership championed the effort, saying during one meeting, "We need to do this."

To move forward, the team next had to convince data owners to participate and dedicate time and resources to an effort that would not directly benefit or provide value to them. Data owners did not want to relinquish control of their data completely. There is a general concern that once the data is accessible, people may find errors or quality issues that the data owners were not aware of. There is also a concern that people may analyze their data in ways that they do not anticipate or lead to findings that misconstrue the data.

Crucial to getting their support was building long-term relationships with the data owners that helped to build trust, and reciprocal engagement of helping the data owning offices as much as they could. Communicating the reduction in workload related to data requests was also helpful, as data owners acknowledged that they received a lot of requests for sharing their data and were interested in the Data Hub's potential to reduce the number of requests received.

Discovering Data & Building the Hub

According to one OIPI staffer, talking about the Data Hub in broad terms during the influence campaign "was the easy part." It's when you get into the specifics of particular data sets that things get challenging. Responsibility for this task and overall management of the Data Hub went to an OIPI project manager with years of experience working with VDOT data. This previous experience proved invaluable for coordinating with data owners and making informed data structuring decisions. This combination of coordination skills and data know-how was instrumental to the effort to identify and dig into data sets from across VDOT and wrangle them into the Hub.

The project manager worked with the agency's Performance Management Work Group to hold hour-long data discovery sessions with the individuals closest to each data set of interest, which could be agency staff or third-party contractors, making identifying the right individuals for these meetings a challenge. The sessions were a space for the Work Group to communicate project benefits and address data owners' concerns, while finding out as much as they could about each data set, as many staff had limited or no knowledge of many of them. Data owners gave presentations on the attributes and years available and significant time was left for discussion and questions. Individuals who had used the data in the past were included in these conversations to increase the context for the data's potential uses.

After the sessions, the Hub project manager requested metadata and additional information about each system from the session participants, though the amount of documentation varied significantly. The project manager then drafted a description of the data set and specified the columns and years of data desired. This draft was then shared with the data discovery group for review and edits. These specifications ultimately became the IT requirements for the project.

Rather than compiling all elements from data set included in the Hub, content from each data collection system was selectively curated by the team and data owners. IT set up automated processes to grab the source system tables directly and set up a data lake in its raw format within the Hub. A series of pipelines, or linked processing commands, convert the raw data into a structured, curated form more readily available for the average data analyst. The Hub provides both the curated data set and its underlying raw data, depending on a user's need for detail.

Managing Access

The Transportation Data Hub is available to all VDOT and OIPI staff, though defined access levels and procedures for granting permission put data owners more at ease with the sharing arrangement. One insight that came out of data governance discussions was that not all staff required the same level of detail in the data they were looking to use. This resulted in two levels of access being defined: "Data Scientist," with access to the raw data, and "Analyst" that would only use the curated version of the data. Reducing the number of people with access to the raw data was an important check for many data owners.

A prospective user of data in the Hub must explicitly request access, and all requests are reviewed and approved by multiple entities. There is a central portal, managed by IT, through which users request access to the specific data set of interest. After submitting the request, the user's supervisor reviews it to confirm that it is within the scope of the staff's responsibilities. If approved, the request goes to the data owner directly. If the data owner approves the request, IT acts as the data administrator and grants the user access. This process allows the data owners to be aware of and have some say in who gains access. If a data owner is concerned about how the data will be used, they can request that any analyses based on the data be shared with the owner prior to publication. The data owners also do an annual review of who has access to the data.

Continued Evolution of Data

The Transportation Data Hub has been up and running for several months, and the team is working on strategies to communicate its early benefits. VDOT and OIPI also continue to make technical improvements to the Hub, such as automation tools that are currently under development. VDOT is also developing training materials and planning additional training sessions on how to get access to and use the data.

While the Transportation Data Hub has only been operational for a few months, they have recently had success in developing a cloud computing resource that has helped with analysis. Some staff were experiencing technical difficulties related to processing such large amounts of data on their local machines. VDOT decided to set up the hub as a cloud computing resource, which would allow users to code in the cloud using python or R with Azure DataBricks. OIPI intends to use this functionality to support before-and-after evaluations of completed projects in the coming year.

The Transportation Data Hub was part of the impetus that led agency leaders to declare data an asset in the state, just like pavements and bridges. This was an important development as it gives data weight in planning priorities, helps to provide funding to manage data, and creates the expectation that data is a resource that should benefit all aspects of transportation planning and

programming. The early success of the Transportation Data Hub points to a bright future for data sharing and expanded transportation analyses in Virginia.

How Feedback Strategies Helped

Navigate Your Data Ecosystem

This is a story all about navigating data. But to make this navigation easier for everyone else at the agencies, those leading the effort had to first find out what data was even available. Conversations with staff across offices were crucial for this, as were the data discovery sessions in which proponents of the Hub learned directly from data owners about what was included in each data set, what different attributes meant, characteristics about the data, and how they could be used.

Build Buy-In

OIPI had to build buy-in from both VDOT leadership and data owners to make the Transportation Data Hub a reality. Building buy-in from these groups required different strategies. OIPI gained top-down support for the concept by giving presentations on the potential benefits of improving access to data and the importance of data as an asset. Having a specific application in mind helped. The team demonstrated the usefulness of centralized data through a pilot of three safety projects that all required similar data.

Gaining buy-in from data owners required a different strategy. Most important for this was listening to data owners' concerns and seriously addressing them in the structure and process of the Hub. Important steps included keeping the data sharing internal, having full discussions on the data to ensure everyone understood it, curating data to only what was needed, creating tiered access to limit the dissemination of raw data, and establishing procedures for granting permission on its use.

Convene Across Boundaries

The realization of the need for something like the Hub came out of people meeting to discuss target setting, underscoring the importance of regular meetings to recognize broader needs. The effort kicked off with a multi-agency workshop to establish a vision, which served as a foundation for the work that followed. The data discovery sessions that brought together technical experts and those leading the centralization effort were crucial to getting everyone on the same page and working through important details. Virginia's experience demonstrates the importance of multiple opportunities to discuss and grapple with technical challenges and sensitivities for a large, cooperative effort like centralized data sharing, which should serve as a model for other agencies embarking on a similar journey.