



ADVANCED
MOBILITY
PARTNERSHIP

Regional mobility data platform concept

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Regional mobility data platform concept: Executive summary

In 2017, when the Denver Regional Council of Governments, Colorado Department of Transportation, Regional Transportation District and the Denver Metro Chamber of Commerce came together to develop the Mobility Choice Blueprint, a new era of technology was beginning to revolutionize the transportation sector. After prioritizing Mobility Choice Blueprint tactical actions in 2020, the partner agencies, known as the Advanced Mobility Partnership, supported initial activities focused on transportation-related data and data sharing, especially around tactical action 4.1 in Mobility Choice Blueprint which encouraged partner agencies to “establish a regional mobility data platform.”

Mobility data helps practitioners understand how regional projects, programs and services relate to shared transportation goals and outcomes around priorities like safety, equity and accessibility. The data also informs and helps Advanced Mobility Partnership partner agencies collaboratively address shared challenges, including how to analyze or understand data and connect data to decision-making processes.

Platform components

The project team developed a concept for a mobility data-sharing platform in the region. The platform concept includes several distinct components and the platform itself has been defined as a set of products

and tools, all of which together meet the various needs of practitioners and stakeholders throughout the region. The four primary platform components encompass different ways to enhance data and data-sharing in the region. The components help people:

- 1) **Discover** information.
- 2) **Share and understand** resources.
- 3) **Collect and analyze** data.
- 4) **Manage and operate** the transportation system.

The diagram that follows on page 5 illustrates the initial tools and resources that would support each of the components, as identified by the project team. For simplicity, relationships among project components aren't illustrated, but the project team anticipates interaction between components.

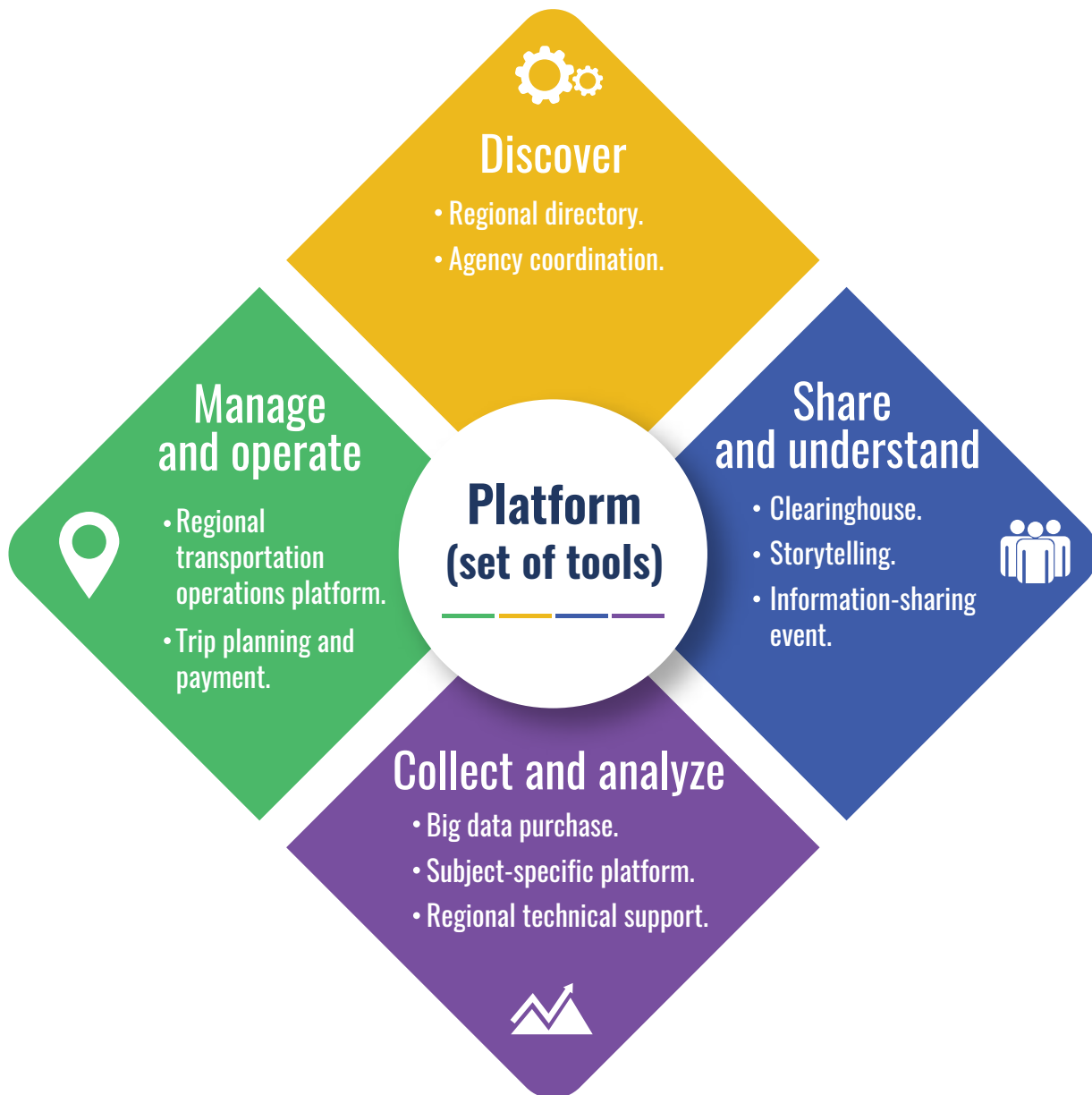
Enabling governance

As project stakeholders continue to develop concept(s) of operations for the four platform components and establish an overarching data governance structure, the project team urges consideration of several enabling elements that will also affect each component's development processes.

Key principles

Development of an overarching, prescriptive regional data governance framework may be challenging for a variety of reasons. Institutional constraints, conflicting legal and regulatory requirements, and other requirements such as agency-specific policies and procedures create a challenging environment in which to develop a single data-governing framework.

However, an agreed-upon set of principles that support partner agency best practices will enable data-sharing and interoperability. Some of these principles may include partnership and coordination, data sharing and stewardship, security and privacy, common standards, adaptability and interoperability.



Regional mobility data platform concept: Introduction

In 2017, when the Denver Regional Council of Governments, Colorado Department of Transportation, Regional Transportation District and the Denver Metro Chamber of Commerce came together to develop the Mobility Choice Blueprint, a new era of technology was beginning to revolutionize the transportation sector. To plan for the future of emerging technology and innovation in the transportation sector, the collaborative group of agencies identified dozens of tactical actions that will help the region prepare for and settle into a new age. After prioritizing the tactical actions in 2020, the partner agencies, known as the Advanced Mobility Partnership, supported initial activities focused on transportation-related data and data-sharing, especially around tactical action 4.1 in Mobility Choice Blueprint which encouraged partner agencies to “establish a regional mobility data platform.” Early in the initial planning process, the project partners defined a “platform” as a set of tools.

Mobility data helps practitioners understand how regional projects, programs and services relate to their shared goals and outcomes around priorities like safety, equity and accessibility. This data also informs and helps Advanced Mobility Partnership partner agencies collaboratively address shared challenges, including how to analyze or understand data and connect data to decision-making processes.

In 2020 and 2021, project partners developed:

- A discovery report describing current efforts at partner agencies throughout the region.
- A case study report containing information from around the country about other regional and metropolitan planning organization-level projects around mobility data-sharing.
- A stakeholder survey report, documenting how the project team engaged stakeholders about opportunities and challenges associated with mobility data-sharing in the Denver region.

Following early discovery and stakeholder engagement efforts (https://advancedmobilitypartnership.org/resource_tax_1/general-resources/), partner agencies moved into initial planning work in mid-2021, when they began developing a concept for mobility data-sharing in the region. The phase included a three-part stakeholder workshop series, prioritization of use cases for mobility and transportation-related data in the region (see Part I of this white paper), the development of a mobility data sharing platform concept (see Part II of this white paper) and the identification of several options for next steps (see Part III of this white paper).

Part I: Initial planning

Initial planning

To further refine the mobility data platform concept, the project team wanted to understand use cases for how a potential mobility data platform would be used in the Denver region. To assist with this process, the project team coordinated a three-part stakeholder workshop in October and November of 2021 in partnership with the Harvard Kennedy School of Government. The work from the series informed the development of the mobility data-sharing platform concept outlined in this white paper. To determine what solution(s) might be most appropriate, the project team engaged transportation practitioners and stakeholders in a high-level analysis to identify the kinds of data they need and the things they want to do with the data. The workshops sought to:

- Build on previous stakeholder work.
- Leverage stakeholder knowledge to better understand challenges.
- Identify significant use cases for mobility data and data-sharing in the Denver region.

Audience

While the Advanced Mobility Partnership is a formal partnership among DRCOG, CDOT, RTD and the Denver Metro Chamber (also referred to as AMP partner agencies), several significant AMP stakeholders participated in the development of the mobility data platform concept as well. AMP stakeholders include, but are not limited to, practitioners from local government, the private sector, nonprofit agencies, research organizations and academia. Many of the concept

components include coordination and collaboration with both the AMP partner agencies and AMP stakeholders.

After extensive stakeholder engagement, the project team identified the various audiences that partners wish to consider during the concept and platform development:

- Practitioners.
- Operators.
- Businesses.
- Decision-makers.
- Researchers.
- The traveling public.

While specific use cases were not identified from the public perspective (most were practitioner-, operator- or researcher-focused), several use cases related to potential public concerns (such as travel times across all modes, crash notifications and work zones notifications). The project team considers it important to account for all such perspectives as partner agencies develop specific concepts of operations and refine development of regional mobility data tools and resources.

Use case identification

The series facilitated by the Harvard Kennedy School consisted of three workshops to identify participants' specific use cases and priorities. At the first workshop, facilitators used discussions to identify three broad categories of need: understanding how people move in the region, planning for new modes and improving situational awareness and safety. The project team

focused on specific use case identification within each category at the second workshop and framed the conversation by asking a series of questions: What data do you need? What do you need to do with that data? The conversation was continued during the third workshop, in which participants discussed their priorities for use cases and potential synergies among use cases.

Workshop 1

The project team identified the following objectives for the first workshop:

- 1) Establish a list of transportation data-related challenges experienced by staff and stakeholders of various agencies in the Denver region.
- 2) Explore the challenge areas through an intensive conversation about the core of the challenge, including categorizing its effects, associated costs and the potential effects of its resolution.
- 3) Prepare for future workshops by plotting challenges onto a grid with the dimensions of impact (from low to high) and data intensity (from low to high) to identify the challenges that offer the most potential benefits if addressed or resolved through data-sharing.

Through the project team's engagement with 25 participants, nine challenge areas emerged. The list follows, in order of prioritization for further discussion in the following session based on a simple show-of-hands vote at the end of the session.

Tier 1 priorities

- Understanding how people move throughout the region.
- Having the ability to address new modes of mobility coming online.
- Ensuring safe mobility, in particular in the case of infrastructure quality.
- Pursuing data standardization (this may be a cross-cutting solution for several challenges).

Tier 2 priorities

- Reacting to external forces rather than defining the environment.
- Having access to mobility mode choice and decision-making data at both a macro and micro level.
- Having a routable network for the region.
- Knowing what data exists and how to get it.
- Lack of situational awareness.

Workshop 2

The project team entered the second workshop with the following objectives:

- 1) Develop a list of potential use cases for each of the three prioritized challenge areas from the first workshop.
- 2) Use breakout rooms and encourage participation to maximize the range of potential use cases.
- 3) Identify the utility of use cases to participating individuals and organizations.

There were 25 participants at the second workshop. During three breakout sessions, participants identified roughly 55 unique use cases. At the end of the session, all participants were asked to note in the Zoom chat which use cases from each prioritized challenge was most relevant to them. Below are summaries of these most relevant use cases by prioritized challenge area.

Understand how people move throughout the region:

- Collect and analyze a map of travel speeds versus posted speed limits to identify potential complete streets project locations.
- Collect and analyze ride-hailing and other similar data to identify why consumers choose various mobility services and particularly why public transit is avoided in certain journeys.
- Collect and analyze recent travel patterns for bicyclists and pedestrians to make mobility improvements, identify missing infrastructure, and figure out better routes.
- Identify destination and origins for trips that are less than 3 miles in distance and understand the nature of these trips (going to the grocery store versus visiting a friend) to provide travel options.

Have the ability to address new modes of mobility coming online:

- Collect and analyze car sharing data so partners and stakeholders can:
 - Incentivize, disincentivize or manage various forms of mobility.
 - Adjust micromobility policy effectively.
 - Understand whether microtransit is supplementing or replacing other forms of transit.

- Develop a comprehensive curbside management system so that partners and stakeholders can:
 - Coordinate signage.
 - Dynamically manage different parts of the curb.
 - Ensure true usage of the curb.
- Collect and analyze mobility hub data so partners and stakeholders can:
 - Design them better.
 - Offer better and more services.
 - Make them community-centric.
- Develop data sharing protocols for new entrants into the mobility space so partners and stakeholders can:
 - Assess safety, emissions, or any unforeseen challenges.
 - Ensure consistency and fairness.
 - Understand the value of the “public right of way.”
- Collect and analyze data on mobility/transit deserts so partners and stakeholders can:
 - Improve mobility for those who have been underserved.

Ensure safe mobility through situational awareness:

- Improve crash data and reporting processes to be current, accurate and continuously updated from a centralized source in order to better locate crash sites and understand why crashes happen.
- Develop or purchase a routable network that includes speed data, data segmentation and driving rules in order to establish clear drivesheds.
- Collect and analyze comprehensive and granular commercial trucking data (such as road closures, incidents, runway ramp closures, parking information, hazards, height and width restrictions) in order to get specific data to those who need it the most.

- Share data in real time among municipalities and with private entities in order to improve coordination with neighboring municipalities and better prepare for and mitigate issues.

The project team was able to identify a significant number of use cases for each prioritized challenge area. Many of the use cases had related themes and may have similar solutions, which informed the planning for the third workshop.

Workshop 3

The project team entered the third workshop with the following objectives:

- 1) Categorize the use cases, divided by challenge type, that were the result of the previous workshop's brainstorming exercise into near-, mid- or long-term timeframes based on criteria such as availability and accessibility of the data, impact and level of collaboration required.
- 2) Prioritize the use cases to develop a short list of those most highly desired by stakeholders.
- 3) Gather initial thoughts from stakeholders on the first steps toward implementation of a priority use cases, including thoughts on a potential end product, people with whom to engage, related processes and policies or legislation to consider.

Use case categorization and prioritization

Only 11 people attended the final workshop. In breakout groups, participants categorized the previously brainstormed use cases into three potential timeframes. Following the categorization, participants listed their top one or two priority use cases. Out of 55 total use cases, the top priority use cases identified by participants included:

Challenge area 1: understanding how people move throughout the region:

- As an operator, I want to collect and analyze data on how the volume of vehicles changes, travel times change, and delays travelers experience change over the course of the day to improve quality of life in traffic (near-term).
- As a practitioner, I want to identify destination and origins for trips of less than 3 miles in distance and understand the nature of such trips to better nudge people into switching mobility modes (mid-term).
- As a practitioner, I want to understand changes in transit based on new contexts for households to better understand how to influence the types of trips members of households take (mid- to long-term).
- As a practitioner, I want to collect and analyze ride-hailing and other data to identify why consumers choose various mobility services and why they avoid public transit for certain journeys (long-term).

Challenge area 2: having the ability to address new modes of mobility coming online:

- As a practitioner, I want to identify data-sharing protocols for new entrants into the mobility space to assess safety, emissions and other unforeseen challenges, ensure consistency and fairness, and understand the value of the "public right of way" (near-term),
- As a practitioner, I want to collect and analyze origin and destination data across forms of micro transit to improve efficiency of resource allocation (near-term).
- As a practitioner, I want to collect and analyze data on mobility deserts and transit deserts to improve mobility for underserved communities (near-term).

- As a practitioner, I want to understand how people get to and from transit to allow for better transportation demand management planning and implementation (near-term).
- As a practitioner, I want to understand package delivery patterns to identify opportunities to reduce congestion and improve curb usage (near- to mid-term).
- As a practitioner, I want to develop a system for reserving space for deliveries to reduce emissions and improve air quality (near- to mid-term).

Challenge area 3: ensuring safe mobility and situational awareness:

- As a practitioner, I want to improve crash data so it includes accurate locations to have more consistent results, better calculations and more consistent strategies (near-term).
- As an operator, I want to collect and analyze speed data to improve traffic signals, arrivals on green, coordination data, travel for pedestrians and bicyclists (near-term).
- As a practitioner, I want to develop or purchase a routable (regional) network that tells how travelers can behave through speed data and segmentation to run a driveshed (how far can one drive in X time in light of an emergency response) (mid-term).
- As an operator, I want to collect and analyze travel times across all modes of transport to monitor various modes, understand what is occurring and coordinate responses effectively (mid-term).
- As a practitioner, I want to collect more dynamic crash data to better understand all the factors

(the crash report) and circumstances that lead to crashes; providing more flexibility in analysis (mid-term).

- As an operator, I want to collect real-time operations information like delays to adjust signal timing and bus schedules, and inform travelers in response to such incidents (mid-term).
- As a practitioner, I want to develop a centralized source of crash data to better locate crash sites and have a better view of historical data and trends (mid-term).
- As an operator, I want to share comprehensive connected vehicle data to understand upcoming hazards such as fog or black ice (long-term).

After the workshops

While there was diverse agency and stakeholder attendance at the first two workshops, participation dropped off considerably both by stakeholders and AMP partner agency staff. Due to concerns about the level of participation and engagement from partners, the project team conducted additional stakeholder outreach to better understand use cases for transportation and mobility data in the Denver region. In late 2021, the project team developed a survey using the use cases that had been identified by workshop participants. The purpose of the survey was to reach a broad audience of stakeholders within the region to gauge their interest in the use cases identified at the workshops, prioritize the use cases and solicit additional use cases that may not have been previously captured.



Survey details

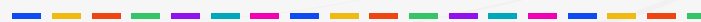
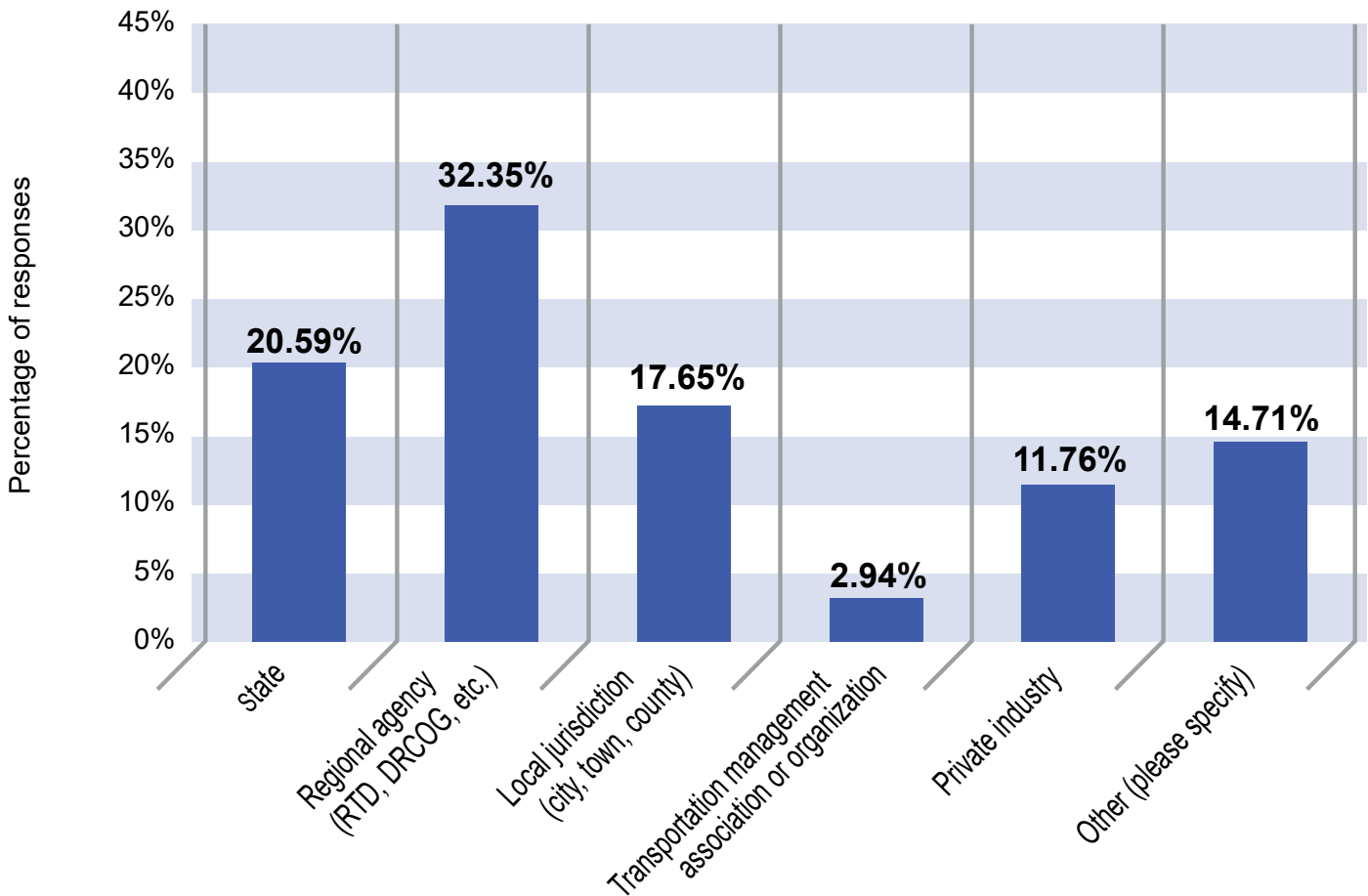
The late 2021 survey received 34 responses. Respondents were asked for information to gauge respondent roles and their experience level with mobility data. Results show respondents represented a range of specialties at a variety of agencies, have a breadth of experience with mobility data (all had at least some experience) and the majority did not participate in the workshops, showing that the survey likely served its purpose of broadening the conversation with stakeholders in the region.

Respondents work for a range of **agencies and organizations** around the Denver region.

“Other” answers included: university, nonprofit, and national lab – Center for Integrated Mobility.

The **primary field of work** among respondents included transportation operations (traffic, incident management, intelligent transportation systems, congestion management), transportation planning (new mobility planning, multimodal planning, transportation demand management, geographic information systems, innovative mobility, integrated mobility systems), data (mobility analytics, traffic data analysis), transit (service planning, scheduling, rail planning, transit-oriented development), design thinking, pilot development, economic development and government partnerships.

What type of agency do you work for?



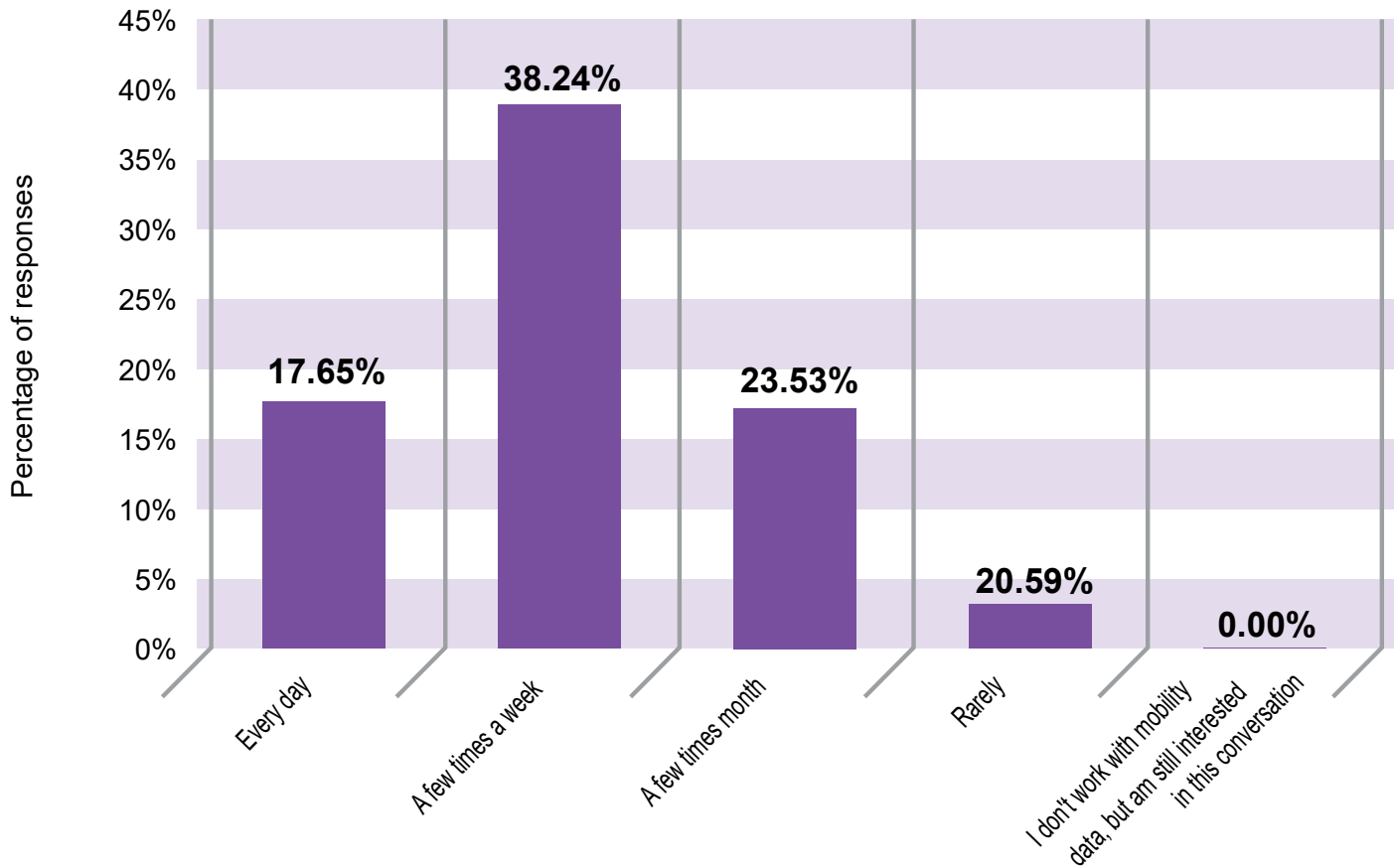
Regarding their **level of engagement** with mobility data in their work, respondents relayed a range of experience levels, although all work with mobility data at least occasionally.

Respondents also shared, related to their expertise with mobility data, the following verbatim responses:

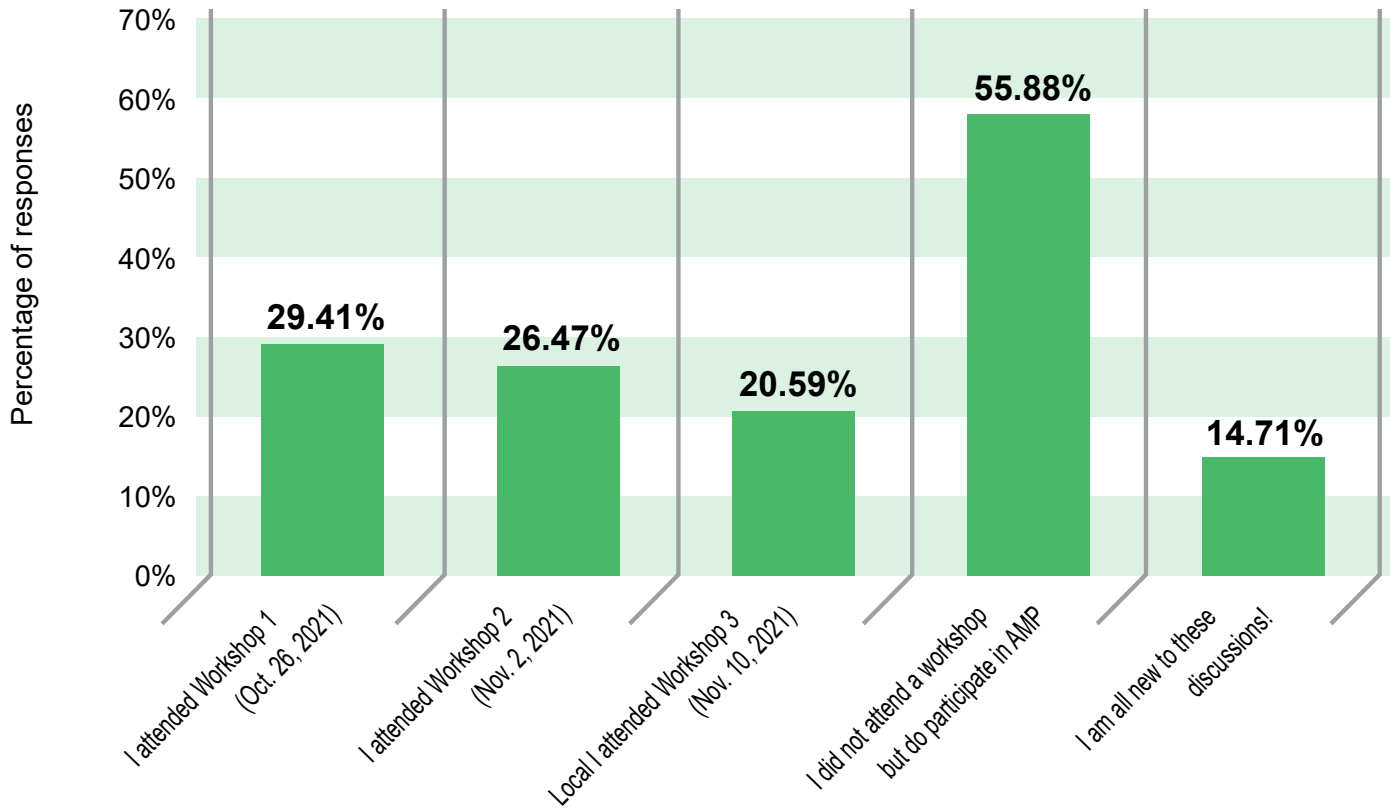
- Consistently get requests to have more integrated fare system for transportation providers in the metro area.

- Large datasets are very expensive.
- Ride report is awesome!
- Some of the data we use is private, some of it public. We collect our own data and use third-party proprietary data.
- I work with a large number of state, councils of government and local agencies regarding the use of and sharing data.

About how often do you work with mobility data?



Please let us know which of the below applies to you. (check all that apply)



Finally, in terms of **participation in previous discussions**, some respondents had participated in the workshops which identified the use cases, but the majority did not.

Question ratings

Various research questions, based on use cases identified at the workshops were presented to

respondents, and the survey asked respondents to rate their interest in finding a solution to the question, and what they believed to be the priority for finding the solution. Results are shown below, ranked by an average of the interest and priority ratings they received, with interest and priority on a scale of 1-5:

Research questions (based on use cases identified)	Interest	Priority	Response rate
What do people consider in choosing a mode? Time, cost, perceived level of safety?	4.04	3.87	71%
Can there be a centralized location where crash data is provided from all sources?	3.95	3.78	56%
How has telework impacted transit and microtransit?	3.91	3.75	62%
Could real-time delay data help our agency spot anomalies, adjust signal timing, and/or adjust transit schedules/routes?	4.00	3.56	53%
Where do travel speeds and posted speeds differ? Can this point to locations for complete streets and traffic calming?	3.62	3.74	71%
How do people access transit? How can transportation demand management (TDM) planning and first/last mile planning support this?	3.90	3.45	62%
Where do infrastructure gaps potentially prevent bicycle and pedestrian travel?	3.63	3.61	71%
How many trips do people make in a day? How many miles by different modes?	3.62	3.57	71%
What are people's origin/destination pairs by mode at a regional level? How would this influence prioritization options along major corridors?	3.67	3.50	71%
Can transportation agencies better coordinate with other agencies (i.e., utilities) to plan for impacts on transportation?	3.67	3.50	53%
Can crash data be provided faster and in a more geographically accurate format (latitude/longitude)?	3.50	3.53	53%
Can neighboring jurisdictions enhance their coordination on signal data to respond to events, weather, incidents, and real time traffic?	3.56	3.33	53%



Research questions (based on use cases identified)	Interest	Priority	Response rate
Can there be a geospatial (i.e., GIS) routable network including speed data, segmentation, and drivesheds?	3.59	3.29	50%
What type of risk and exposure do bicyclists and pedestrians face?	3.39	3.45	68%
How have people changed primary travel modes or modes for specific trips? What led to this change?	3.58	3.22	71%
Is there a consolidated source of real-time information for travelers (i.e., travel time across all modes, notice of crashes, work zones)?	3.58	3.11	56%
Why and how are travelers using mobility hubs? Are there key origin/destination patterns?	3.19	3.40	62%
How could real-time transit occupancy data help to prioritize moving the most people?	3.26	3.21	56%
Can there be a centralized system to automatically update mobility-related data on city websites?	3.41	3.06	50%
Why do people choose transportation network companies (TNCs) instead of other modes? Do TNCs take the place of possible transit trips?	3.29	3.08	71%
What are key destinations for short trips? Does that influence mode choice?	3.09	3.23	68%
Are there opportunities for sharing trucking industry data on closures, incidents, parking, hazards, height/weight restrictions?	3.22	3.06	53%
Could real-time delay data be used to inform travelers of hazards?	3.33	2.94	53%
Can crash data include additional attributes (age, helmet use, etc.)?	3.06	3.06	53%

Research questions (based on use cases identified)	Interest	Priority	Response rate
Are there places to improve cross-jurisdictional coordination on dynamic parking for events?	2.91	3.10	62%
How long are microtransit trips and what are the origins and destinations?	3.17	2.83	71%
Could access to connected vehicle data provide alerts for hazards?	3.17	2.78	53%
Where do commercial vehicles load? How do loading policies influence these trends?	3.05	2.79	62%
Is there route and parking data on new and zero-emission delivery options (cargo bikes, delivery bots)?	2.95	2.86	65%
Are there places to improve cross-jurisdictional coordination on dynamic messaging?	2.90	2.79	59%
Could curb usage data enable flexible curbside management, where the curb use is adjusted based on how needs evolve over time of day?	3.05	2.63	59%
Is there data to help in identifying sites for public electric vehicle charging stations?	2.76	2.90	62%
Is there trip replacement or mode shift with carshare? Do carshare users own vehicles?	2.95	2.60	62%
Is there peer-to-peer carshare parking data? Can this help us to understand how people are parking and if charges or incentives are needed?	2.90	2.55	59%
What is the usage on "free floating" carshare? (non-designated parking spots)	2.85	2.53	59%
Would delivery space reservations reduce emissions?	2.70	2.63	59%



Research questions (based on use cases identified)	Interest	Priority	Response rate
Are there places to improve cross-jurisdictional coordination on curbside management?	2.80	2.45	59%
What are the impacts of autonomous vehicle shuttles, particularly in mobility deserts? How do they impact the economy and options for people?	2.33	2.40	62%
Is there data to inform urban air mobility planning (i.e., planning for drones -- potentially including new uses such as delivery or passenger services)?	2.43	2.26	62%

Additional use cases identified by survey respondents:

- Can coordinated roadway conditions data help route emergency vehicles to incident scenes?
- Can coordinated roadway conditions data help plan and facilitate mass evacuations?
- Can connected vehicle data be used to better notify and guide drivers of approaching emergency vehicles?
- Can machine learning techniques be developed to analyze all archived data to determine the cause of crashes?
- Can predictive analytics, using both archived and real-time data, improve transportation operations strategies to be applied on a day-to-day basis?
- How can mobility data be used to inform redesign of roads and public right-of-way to move more people safely?
- Modeling the accessibility of locations based on user behavior data.
- Person-trip analysis on corridors by mode.
- Centralized incident management control and reporting in near real time to both responders, and traveling public. Ability to clear the incident and report.

Survey findings

The project team believes the strong relationship between interest and priority is important and demonstrates that there is, among survey respondents, professional and personal interest and enthusiasm around those areas that are also seen as the highest priority for the region to resolve. Highly rated use cases represent a range of topics and data capabilities, but primarily deal with understanding the system that exists today (such as understanding how people are using the existing system, what leads to changes in modal behavior, identifying locations for improvements). Respondents placed less emphasis on some of the use cases involving new modes, with the exception of how new modes might contribute to a greater understanding of the existing system (such as using connected vehicle technology for greater real-time awareness of hazards). In terms of the types of data respondents identified, solutions might include better (or faster) access to existing data sources, improved data analysis capabilities, better data-sharing among agencies, and improved operations and management capabilities. The project team synthesized from survey responses that big-data solutions may represent an additional important solution.



Part II: Regional mobility data platform concept

Platform components

Following the initial planning work to identify the various types of data required to do specific tasks (use cases), the project team developed an initial concept for a mobility data-sharing platform in the region.

The Advanced Mobility Partnership has defined the platform itself as a set of products and tools, all of which together meet the various needs of practitioners and stakeholders throughout the region. The platform will consist of several unique components. The project team identified the various components and capabilities that make up the platform and which will inform the development of the platform. While the project team and stakeholders developed dozens of use cases, the project team grouped the use cases by thematic area. Each thematic area will catalyze the next stage of platform development. Depending on the preference of the AMP Executive Committee, the project team will develop either:

- 1) A platformwide concept of operations.
- 2) A concept of operations for each platform component.

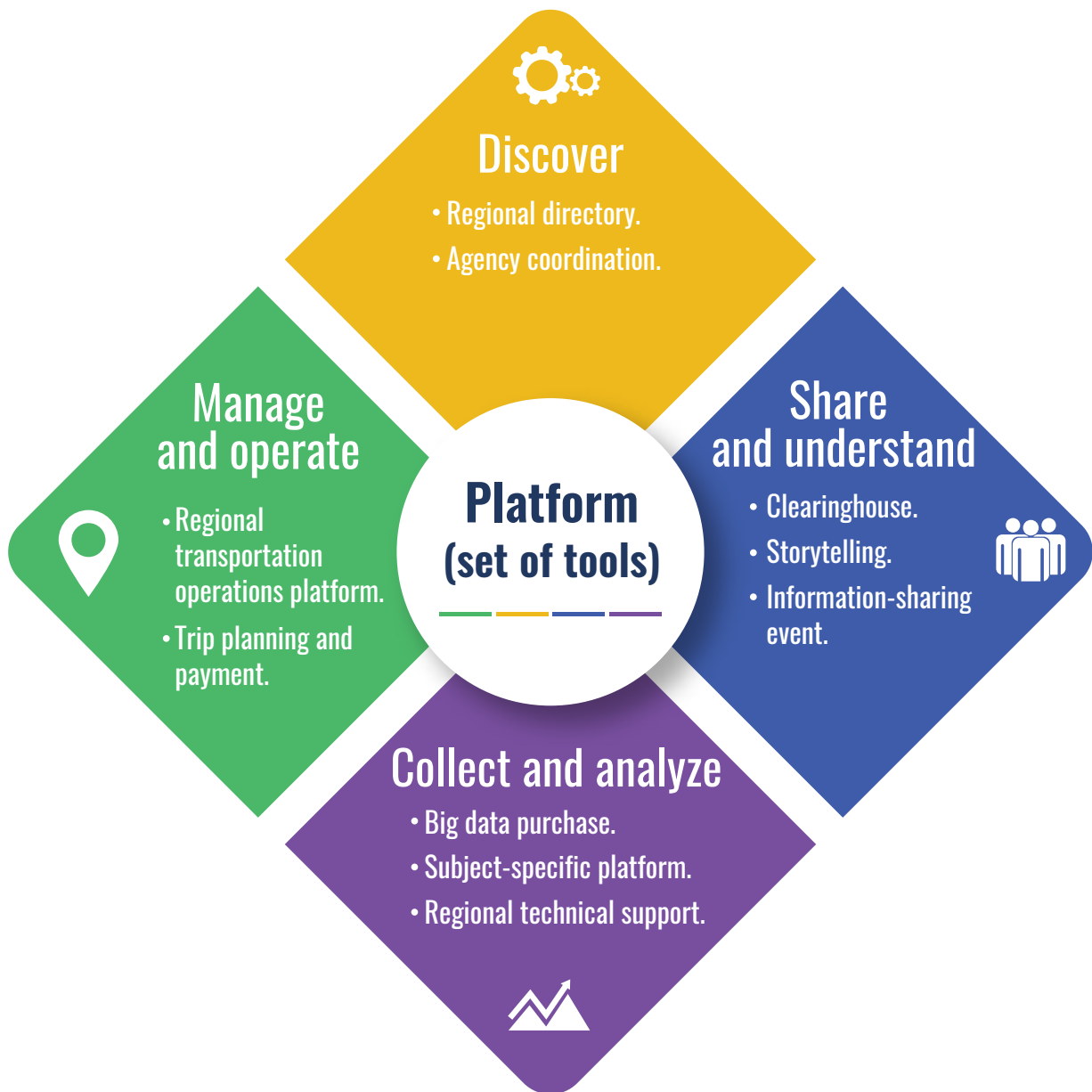
The four primary platform components encompass various ways to enhance data and data-sharing in the region which include helping people:

- Discover information.
- Share and understand resources.
- Collect and analyze data.
- Manage and operate the transportation system.

In the diagram that follows on page 20, the project team has identified initial tools and resources that would support each of the components (highlighted in the narrative component descriptions that follow and, in the diagram, using bullet points). Additionally, the project team considers it important to note that it anticipates interaction between the components. For example, regional traveler information, a tool that helps practitioners manage and operate the transportation system, could also use datasets accessible in a directory (under the “discover” component) and be augmented by big-data analysis (under the “collect and analyze” component). The interactions will vary based on use case and application.

Discover

Throughout the Denver region, many existing resources aid agencies and the general public in finding mobility data. Some of these products are standalone resources developed by one or more AMP partner agencies (for example, RTD Open Spatial Data Portal, COtrip Traveler Information Feeds, or travel time data feeds from several local agencies) and others are the result of AMP partner agency collaboration (for example, the Shared Micromobility Data Collaborative or Household Travel Survey). For existing and future resources, establishing and maintaining a single regional data directory will point users to, and promote discovery of, mobility information. The project team learned that many existing data resources already can or have the potential to meet the needs of stakeholders, but there was a general lack of awareness of or access to the data itself.



Share and understand

Similar to existing data resources themselves, AMP partner agencies and stakeholders have produced a wealth of information through resources such as studies, research, analyses, methodology development and pilot reports. Identified use cases support the need to improve distribution and availability of existing resources, especially when considering replicability and transferability of partner agency and stakeholder work.

The development of, or strategic use of an existing, curated digital repository, will improve sharing of regional mobility information -- a key component of the mobility data platform concept.

Collect and analyze

Tools to collect, analyze and use data are also a major component of the mobility data platform concept. Many use cases identified by stakeholders suggest that having

additional, new and improved information available (either via collection or acquisition) and tools that can be used to conduct analysis and better understand or operationalize existing data would vastly improve the mobility data and data-sharing landscape in the Denver region. Such tools differ depending on the specific use case and could include efforts like group purchases of big data, subject-specific platform subscriptions or tool development, or cross-jurisdictional technical support and coordination. An example of a collect-and-analyze tool is the regional contract with Ride Report, a third-party platform that provides tools to ingest and analyze shared micromobility data in communities throughout the Denver region.

Manage and operate

Mobility Choice Blueprint identified several tactical actions that require enhanced digital infrastructure and improved access to data and information. Each of the priority tactical actions below requires cross-jurisdictional or intermodal coordination:

- Implement transit priority on all major bus corridors.
- Implement smart traffic signal control technology on all major regional arterial corridors.
- Pilot integrated corridor management on ten arterial corridors.
- Coordinate traffic management center systems and operations.

To improve the management and operation of the Denver metro area’s regional transportation systems, the project team identified several real-time, focused use cases that would improve situational awareness, facilitate traveler decision-making and improve safety throughout the region. The data and associated use cases related to managing and operating the regional transportation systems include both real-time and

historic data. The project team recommends that these datasets also be included in some of the tools in the “discover” component and products or research also related to the “share and understand” and “collect and analyze” components.

DRCOG’s Regional Transportation Operations Working Group is developing an operational concept for a regional operations data and information-sharing framework. Its work will identify possible next steps regarding the “manage and operate” component of the regional data platform.

Enabling governance

As project stakeholders continue to develop concept(s) of operations for the four platform components and establish an overarching data governance structure, the project team urges consideration of several enabling elements that will also affect each component’s development processes. Since each AMP partner agency currently has, and will likely continue to develop, its own individual transportation-related data assets, tools and resources, the concept presented here focuses on the shared use cases and tactical actions from Mobility Choice Blueprint.

Should the AMP Executive Committee decide to move forward with the proposed platform concept, additional work must occur to outline overarching regional data governance components and principles along with guidance specific to individual, platform-supportive projects. Examples of guidance may include the process to confirm institutional roles and responsibilities, the priority use cases for regional collaboration, and technical and financial implementation of projects.

Leadership

Depending on the direction provided by the AMP Executive Committee, the project team recommends considering several models for governance. If a multiagency, cross-jurisdictional partnership is preferred to manage the platform or platform components as defined earlier, a distributed governance model is likely most appropriate. The regional mobility data platform concept is defined in Part II to comprise a set of tools. Specific tools or components may be operated or maintained by a single agency, but developed or governed via a multiagency partnership. As such, the project team recommends flexibility in understanding the nature of each tool to determine the appropriate roles of partner agencies and stakeholders.

Since each AMP partner agency has differing levels of regulatory authority, responsibility and ownership or operation of the transportation network, a distributed governance model would allow AMP partner agencies the ability to participate in the development of tools, but then allow individual agencies that operate or maintain the tool(s) the ability to manage and operate the tool as needed and in coordination with agency-specific structures. A shared (distributed) approach to ownership and the operation of platform component(s) allows the flexibility required to put together a cohesive set of tools for the Denver region.

The shared responsibility of AMP partner agencies would be to direct and guide the overall direction, funding, use case development and issue resolution for tools (through the regional Working Group and

Executive Committee), while daily tool management, operations and maintenance would fall to the owner of the tool or product. Additional details will have to be developed following acceptance of the overall mobility data-sharing platform concept.

Key principles for AMP partner agencies

Development of an overarching, prescriptive regional data governance framework may be challenging for a variety of reasons. Institutional constraints, conflicting legal and regulatory requirements and other requirements create a challenging environment in which to develop a single data-governing framework. However, an agreed-upon set of principles that support partner agency best practices enable data-sharing and interoperability.

Partnership and coordination

The project team suggests that identifying AMP partner agency commitments is necessary before beginning work on any of the platform components. Having a clear understanding of the desired roles and responsibilities of each agency in the regional platform components will allow project partners to begin development of a concept of operations clearly and transparently for each platform component. AMP partner agency commitments might include dedicated staff time or monetary contributions, as well as direct development of project components. Additionally, the project team recommends defining the roles and responsibilities of the AMP Executive Committee as the region transitions from planning to implementation.

Pilots and opportunities to learn

AMP partner agencies have piloted technologies, approaches and tools for many years, and the proposed mobility data platform concept supports the notion that, when appropriate, pilots and their evaluation are essential parts of the project development and technology deployment process.

Data-sharing, stewardship, security and privacy

AMP partner agencies have made subject-specific commitments to data sharing, but as concept(s) of operations are developed for each platform component, the project team considers it essential that clear information about the data needed and data-sharing commitments be made available as part of that process. Identification of appropriate data stewards also needs clarity and is likely dependent on specific product proposals. Additionally, because some information associated with identified use cases may include personally identifiable information or proprietary information, the project team indicates that a concept of operations will have to outline steps that ensure data privacy and security as well.

Common standards

Common data standards should be identified as part of each component's concept of operations and documented in the regional intelligent transportation systems architecture. Where appropriate, the project team recommends that AMP partner agencies defer

to the use of open-source data specifications. During the discovery part of this project, the project team identified the use of open-source data specifications in practice in many parts of the transportation sector and throughout many existing AMP partner agency projects, and recommends that the practice should be carried on into any subsequent projects. Subject matter experts and regional stakeholders should be consulted before identification of standards occurs as part of a project development process to ensure the appropriate standard is being required.

Adaptability

The mobility sector is always evolving. Ongoing coordination and partnership enables AMP partners to adapt to a changing landscape. As new (or improved) specifications are released, new modes and data sources come to the market, or internal agency capacity is changed, the project team recommends that partners and their approach to the overall concept remain flexible and leverage their ability to coordinate and work together, accounting for the inherent variability of the regional stakeholders' resources, capabilities and deployment schedules.



Part III: Options for implementation

The project team responsible for developing a concept for a regional mobility data platform also proposed some options for implementation and next steps. While buy-in for the platform concept as described in Part II might be successful and partner agencies may agree to the concept, the project team thought it best to present several options for next steps depending on agency ability to commit staff or funding to the project.

Initial investment in platform development

If support for the concept is unanimous and AMP partner agencies are ready to commit financial and other resources to the project development, staff recommends beginning with the development of either a:

- 1) Concept of operations for the platform.
- 2) Concept of operations for each platform component.

The next step will inform the requirements-gathering and design for a regional mobility data platform, identify the

specific roles and responsibilities for partner agencies and stakeholders associated with each component, and include the development of a regional data governance approach. During the development of the concept of operations, the project team encourages partners to consider ongoing investments required to operate, maintain, manage and improve any proposed products.

Incremental improvements

Incremental improvements support the various use cases identified during the initial planning phase. In most instances they relate to one or more platform components, but have been singled out to represent potentially smaller, more achievable pieces regional partners could invest in while supporting the overall mobility data platform concept and minimizing risk. These incremental improvements are listed in no particular order and summarized in the table below.

Improvement	Description	Example
Group purchase of big data.	Group purchases and sharing of data that may currently be ad hoc for agencies or projects throughout the region.	The Colorado Department of Transportation’s INRIX big-data contract or the Regional Transportation District’s purchase of LOCUS LBS data.
Subject-specific tools.	Regionally shared tool that meets specific use cases identified among stakeholders that may or may not include cost-sharing agreements.	The Denver Regional Council of Governments’ regional project with CDOT, RTD, local governments and Ride Report (shared micromobility).
Increased coordination and sharing.	Coordination among partners to share existing resources or tools that could serve additional uses for stakeholders across the region.	Existing resources, like posted speed data.
High-priority use cases.	Tool applied to one or more priority use cases.	DRCOG-led crash consortium

Group purchase of big data

While working with stakeholders in the Denver region to identify use cases, the project team noted many use cases could be met if the region had access to big data, like Streetlight or another comparable source. The information could support inquiries, analyses and planning recommendations and without project stakeholders building, developing or maintaining their tool locally. Stakeholders could benefit from work that has already been done by the private sector to make the data easier to access, understand and operationalize.

Example: CDOT's statewide purchase of INRIX data allows various stakeholders (like DRCOG) to share access to big data that supports multiple use cases.

Subject-specific tools

When stakeholders have subject-specific use cases, partners can come together to procure or develop distinct tools to meet the needs of various partners. Ensuring ongoing coordination and partnership by subject area enables AMP partner agencies to procure or develop tools that meet needs tailored to the use cases in question, rather than taking an overarching approach to all use cases identified in the transportation sector. This can often be an effective way to pilot an approach or to meet the needs of a variety of stakeholders with targeted investment. The project team recommends that any AMP-related subject-specific tool development include all AMP partner agencies as part of the project or product development process and solicit AMP Working Group and Executive Committee engagement. Selecting specific subject areas can be led by a champion on an ad hoc basis (as dictated by stakeholder interest and engagement) or as directed by the AMP Executive Committee.

Example: DRCOG's partnership with CDOT, RTD and local governments enabled group access to the Ride Report platform so that agencies can manage and analyze shared micromobility in the Denver region.

Increased coordination and sharing

Improving coordination is specific to finding and sharing platform components. Each AMP partner agency has, and will continue to have, various transportation-related data resources and tools. Stakeholders identified several use cases that could currently be met with existing resources, but the information or method for accessing the information wasn't well-known. AMP partner agencies could, for a minimal investment, use existing staff time and resources to promote increased sharing and coordination of existing transportation-related data resources.

Example: DRCOG's Denver Regional Data Consortium highlights new data and tools for regional GIS and data professionals every quarter. While not specific to transportation and mobility, AMP partner agencies could make a more concerted effort to share and coordinate existing data and resources.

High-priority use cases

Another option which applies to use cases throughout platform components includes prioritizing individual use cases on a case-by-case basis as resources and staff time allow. Such an approach would certainly allow for agencies to take a leadership role on use cases critical to their staff and stakeholders without major investment in the development of an entire platform or platform component.

