Executive Summary

Content to be added
# Table of Contents

Executive Summary .................................................................................................................. 1

Background .......................................................................................................................... 3

1. Scope .................................................................................................................................. 4
   1.1 Document Purpose and Scope ...................................................................................... 4
   1.2 Project Purpose and Scope .......................................................................................... 5
   1.3 Procurement ................................................................................................................ 5

2. Referenced Documents ..................................................................................................... 6

3. Vision, Goals, Objectives, and Needs ................................................................................ 7
   3.1 Vision .......................................................................................................................... 7
   3.2 Goals ........................................................................................................................... 7
   3.3 Objectives .................................................................................................................... 8
   3.4 Needs .......................................................................................................................... 12

4. Concepts for the Proposed System .................................................................................. 16
   4.1 Description of the Proposed System ............................................................................ 16
   4.2 System Description ....................................................................................................... 18
   4.3 User Classes and Other Involved Personnel .............................................................. 20
   4.4 Support Environment .................................................................................................. 24

5. Use Cases and Operational Scenarios .............................................................................. 25
   5.1 Use Case: User Interaction, Registration, and Log-in .................................................. 25
   5.2 Use Case: Information Exchange – Near Real Time Operations ................................. 26
   5.3 Use Case: Information Exchange – Planning and Modeling ....................................... 28
   5.4 Use Case: Information Exchange – Research ............................................................... 29
   5.5 Use Case: Information Exchange – Public Access ....................................................... 30
   5.6 Use Case: Data Management: Acquisition, Retention, Delivery ................................. 30
   5.7 Use Case: System Administration ............................................................................... 31

6. Definition of Terms .......................................................................................................... 33
SANDAG Mobility Data Clearinghouse Concept of Operations
(Version 1.0)

Background

For decades, improvements to the transportation network revolved around the extension of physical infrastructure. In efforts to reduce congestion, expansion or addition of new roadways was thought to be the solution. This is not likely the optimal strategy for the future, as transportation financing becomes more constrained, and as such efforts do not directly address the root cause of roadway congestion. Instead, public agencies are shifting their focus by expanding and subsidizing the use of mobility alternatives while leveraging technology to digitally manage right-of-way. Developed by SANDAG, with critical input from Federal, State and Local entities, Transportation System Management and Operations (TSMO) provides the roadmap for implementation of such technologies in the region.

TSMO offers integrated strategies to “improve system performance through multimodal, intermodal, and cross-jurisdictional systems, services, and projects that preserve capacity, enhance public safety and security, enhance seamless connections between modes, and improve reliability” (FHWA, 2017). The strategies are designed to improve safety and reliability by managing traffic congestion and minimizing any unpredictable delays to the transportation system. To implement a successful TSMO program, agencies often need to evaluate the institutional, operational, and technical aspects of its day-to-day processes for planning, programming, designing, constructing, and maintaining projects.

Guided by TSMO, SANDAG has recently embarked on the development of a new regional plan that will serve as the long-term transportation blueprint for the San Diego region. San Diego Forward: The 2021 Regional Plan introduces a bold new vision that uses five key strategies – 5 Big Moves – that complete each other to bring a well-balanced transportation network.

The 5 Big Moves are:

- Complete Corridors: The backbone of a complete transportation system that leverages technology, pricing, and connectivity to repurpose how highways and local roads are used.
- Transit Leap: A complete network of high-capacity, high-speed, and high-frequency transit services that incorporates new transit modes and improves existing services.

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SANDAG Mobility Data Clearinghouse Concept of Operations
(Version 1.0)

- Mobility Hubs: Places of connectivity where a variety of travel options converge to deliver a seamless travel experience.
- Flexible Fleets: On-demand, shared, electric vehicles that connect to transit and travel between Mobility Hubs along the network of Complete Corridors.
- Next OS: An integrated platform that will make all of the strategies work together by connecting travelers, transportation service providers, and infrastructure to orchestrate more efficient movement of people and goods.

This document will describe the Concept of Operations for a system that will utilize the strategies of Flexible Fleets and Next OS by creating a platform to manage the operations of shared mobility devices.

1. **Scope**

1.1 **Document Purpose and Scope**

This Concept of Operations (ConOps) describes the user needs and operational context of a proposed Regional Mobility Data Clearinghouse, hereinafter referred to as the Mobility Data Clearinghouse, or MDC.

The purpose of this ConOps is to communicate a clear understanding of user needs and to describe how the system will operate to fulfill those needs. This preliminary version is considered a living document that will be updated as new user needs are discovered and operational concepts are refined.

The intended audience for this document includes:

1. System developers who will create and support the MDC based on the user needs and system concepts described in this document
2. Local and regional stakeholders to determine whether their needs and desires have been adequately captured
3. Analysts, researchers, and other MDC users requiring access to data for analysis and other allowable purposes.

The major sections of this documents are: (1) a description of the goals, objectives, and user needs for the proposed MDC, (2) the operational concepts that include both the activities of the users and supporting technology, and (3) sample operational scenarios.
1.2 Project Purpose and Scope

The MDC is a new regional system proposed by the San Diego Association of Governments (SANDAG) to support shared mobility trip data ingestion and exchange amongst its member city and county governments (Member Agencies) and other specified users.

The initial development of the MDC was in response to the growing number of micromobility services like dockless bikeshare, e-scooters, and neighborhood electric vehicles (NEVs) that quickly became popular mobility choices in the San Diego region. In 2018, SANDAG launched a Regional Micromobility Coordination effort to support its Member Agencies as they deployed micromobility programs and to build consensus among cities and other stakeholders (including transit agencies, universities, and military bases) around various topics including data sharing, micromobility parking and passenger loading, education/outreach and equity.

The Regional Micromobility Coordination effort quickly identified data sharing as a key component for effectively regulating micromobility operations while also informing transportation planning and policy decisions. To that end, SANDAG partnered with its Member Agencies to develop data sharing requirements in preparation for the MDC to collect and analyze trip data and other characteristics collected primarily from the operators of shared micromobility vehicle fleets in the San Diego region.

The MDC will ingest micromobility trip data as defined by the Mobility Data Specification (MDS), a data standard created to enable communication between mobility companies and local governments. MDS aims to help cities actively manage private mobility providers operating dockless scooters, bicycles, mopeds, and carshare in the public right-of-way. The data standard is still evolving to include other modes and public infrastructure, but the initial release of the data specification has guided the creation of the MDC ConOps.

1.3 Procurement

Phase one of the MDC will be developed by SANDAG using a combination of in-house expertise (e.g., system developers) and contracted third-party developers. Future improvements or enhancements to the MDC may also require third-party contractors that can maintain the system while fulfilling
data analysis requests from Member Agencies, researchers, and more. A third-party contractor would be selected using a best value procurement process based on responses to a request for proposals (RFP).

2. **Referenced Documents**

The preparation and development of this ConOps has been made in accordance with the following documents providing guidance, standards, and system specifications:


F. Open Mobility Foundation Mobility Data Specification (MDS) [https://github.com/openmobilityfoundation/mobility-data-specification](https://github.com/openmobilityfoundation/mobility-data-specification)

3. **Vision, Goals, Objectives, and Needs**

3.1 **Vision**

The vision for the proposed Mobility Data Clearinghouse (MDC) is to securely collect and store data from emerging and future mobility services, and to provide SANDAG, Member Agencies, researchers, and the public with a regional portal for exchanging and analyzing mobility data. While initial MDC development will be focused on ingesting and analyzing micromobility trip data, the long-term vision for the MDC is to grow the data platform into a larger regional system that incorporates all transportation services and infrastructure in the San Diego region. As part of its Vision for the 2021 Regional Plan, SANDAG has developed the Next Operating System (Next OS) concept, a digital platform that serves as the “brain” of the entire transportation system. Next OS would leverage technology and data to connect and manage different modes of transportation – passenger vehicles, buses, ridesharing vehicles, delivery trucks, autonomous vehicles, dockless bikes and scooters, and more – to improve overall efficiency and accessibility for people and goods to move throughout the region. The MDC would serve as the initial building block in realizing the Next OS.

3.2 **Goals**

As the initial building block of the Next OS, the MDC will need to be tailored around a set of overarching goals. These initial goals will guide the system framework in the context of dockless micromobility services while enabling stakeholders to collaborate in realizing the Vision. The primary goals of the proposed system are:

G1. Boost the ability of Member Agencies and other regional stakeholders to effectively regulate and manage mobility operations

G2. Enhance SANDAG regional travel demand modeling tools to better account for emerging mobility services and their impact on vehicle miles traveled

G3. Inform regional and local transportation planning and policy decisions, including capital infrastructure investments
G4. Positively contribute to academic research efforts examining the benefits and impacts of emerging mobility services

G5. Demonstrate transparency by providing the public with aggregated mobility service data

### 3.3 Objectives

While goals are defined as desired results of a system, objectives are the measurable and precise actions required to achieve the stated goals. The MDC is intended to ensure local stakeholders have access to raw data (both near real-time and historical) and/or corresponding analyses such as geospatial visualizations and tabular reports. The following objectives can be implemented to achieve the above stated goals:

1. Measure utilization by micromobility riders: The system should collect and analyze micromobility trip data characteristics (e.g., trip route, duration, distance, speed) to assess utilization of micromobility services.
2. Monitor micromobility device activity: The system should provide MDC Users with mobility trip information to assess policy adherence to service area, parking, speed, or routing/pathmaking.
3. Monitor micromobility Provider activity: The system should provide MDC Users with micromobility device information to assess Providers’ adherence to vehicle availability, incident/event response, fleet caps, etc.
4. Set, evaluate, and improve mobility policy: The system should provide MDC Users with micromobility trip information to help measure effectiveness of service policies.
5. Monitor micromobility fleet: The system should provide MDC Users with micromobility trip information to help forecast future utilization.
6. Monitor micromobility policy considerations: The system should provide MDC Users with mobility trip information that, along with other planning or mobility data, can provide analyses on mobility services (e.g., equity, mode share, rider safety).
7. Support future planning and policy development: The system should provide Users with mobility trip information that, along with other planning or mobility data, can support other planning and policy efforts, such as street and parking design, traffic safety campaigns, transit/mobility hub design, micromobility pricing, etc.
SANDAG Mobility Data Clearinghouse Concept of Operations (Version 1.0)

8. Maintain security and protect privacy of micromobility data: The system should collect and store micromobility trip data in a manner that complies with SANDAG Micromobility Privacy Impact Assessment recommendations.

<table>
<thead>
<tr>
<th>Goals</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Boost the ability of Member Agencies and other regional stakeholders to effectively regulate mobility operations</td>
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<tr>
<td></td>
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</tr>
<tr>
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</tr>
<tr>
<td></td>
<td>6. Monitor micromobility policy considerations: The system should provide MDC Users with mobility trip information.</td>
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<tr>
<td><strong>3</strong></td>
<td>Inform regional and local transportation planning and policy decisions, including capital infrastructure investments.</td>
</tr>
<tr>
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<td>Monitor micromobility device activity: The system should provide MDC Users with mobility trip information to assess policy adherence to service area, parking, speed, or routing/pathmaking.</td>
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<td>Set, evaluate, and improve mobility policy: The system should provide MDC Users with micromobility trip information to help measure effectiveness of service policies.</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>Monitor micromobility fleet: The system should provide MDC Users with micromobility trip information to help forecast future utilization.</td>
</tr>
<tr>
<td><strong>6</strong></td>
<td>Monitor micromobility policy considerations: The system should provide MDC Users with mobility trip information that, along with other planning or mobility data, can provide analyses on mobility services regarding equity, mode share, greenhouse gas (GHG), traffic safety, etc.</td>
</tr>
<tr>
<td><strong>7</strong></td>
<td>Support future planning and policy development: The system should provide Users with mobility trip information that, along with other planning or mobility data, can support other planning and policy efforts, such as street and parking design, traffic safety campaigns, transit/mobility hub design, micromobility pricing, etc.</td>
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<tr>
<td>4</td>
<td>Positively contribute to academic research efforts examining the benefits and impacts of emerging mobility services</td>
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<tr>
<td>5</td>
<td>Demonstrate transparency by providing the public with aggregated mobility service data</td>
</tr>
<tr>
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</tr>
</tbody>
</table>
### 3.4 Needs

This section outlines the initial set of needs that the proposed system is envisioned to address during its operation. These needs fall into five categories:

- **Capability needs**: These are the functions and features of the proposed new system that will help in consolidating micromobility data into a single regional source.
- **Environment needs**: These needs reflect the environment in which the proposed system will operate in.
- **Operational needs**: These communicate the needs with regards to operational policies, procedures, methods, or work routines of the proposed system.
- **Support needs**: These define the expectations of the system during its operation, maintenance, and administration.

<table>
<thead>
<tr>
<th>Need ID</th>
<th>Need Description</th>
<th>Need Rationale</th>
<th>Corresponding Goal ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDCN1</td>
<td>Collect and Process MDS Data from External Sources</td>
<td>This need is a core need of MDC that supports most of the system functionality. MDS trip data is collected and stored in a relational Database, then processed in a Data Warehouse for analysis and reporting.</td>
<td>G1, G2, G3, G4, G5</td>
</tr>
<tr>
<td>MDCN2</td>
<td>Provide Access to Stored Historical Information</td>
<td>The system will need to allow ad-hoc reporting to create a variety of reports on mobility operations and performance.</td>
<td>G2, G3, G4, G5</td>
</tr>
<tr>
<td>MDCN3</td>
<td>Publish Near Real-Time Information to Agency Regulators</td>
<td>The system will need to disseminate near real-time data from distinct Mobility Providers to their respective agencies for local regulation and enforcement purposes.</td>
<td>G1</td>
</tr>
</tbody>
</table>

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2 MDC ConOps needs subject to further revision based on completion of MDC System Requirements
## SANDAG Mobility Data Clearinghouse Concept of Operations (Version 1.0)

<table>
<thead>
<tr>
<th>MDCN4</th>
<th>Allow for view, query, and download of mobility data or reports.</th>
<th>The system shall allow select users to view, query and download mobility data or reports.</th>
<th>G1, G2, G3, G4, G5</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDCN5</td>
<td>Allow for geospatial analysis of data</td>
<td>The system shall be capable of ingesting both near real-time and historical micromobility trip data and aggregating it in a geospatial format to help users conduct a visual analysis of the data.</td>
<td>G1, G2, G3, G4, G5</td>
</tr>
</tbody>
</table>

### Environment Needs

<table>
<thead>
<tr>
<th>MDCN6</th>
<th>Provide an Internet-based portal for access to data resources.</th>
<th>The MDC shall operate on an Internet-based portal to ensure a streamlined access to data for users and permit the congregation of data sources within a single platform. The Internet portal must be easy to navigate, adhere to all government accessibility standards, and provide a central point for using any of the data sets, Data Environments, and/or real-time data feeds within the system.</th>
<th>G1, G2, G3, G4, G5</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDCN7</td>
<td>Organize and support the use of multi-source data</td>
<td>Member Agencies need to work together to solve institutional issues in collecting multisource and multimode data, which requires Federal, local, and state agencies, as well as research institutions such as universities, to collaborate closely in project synchronization, cost/data sharing, and/or any necessary agreements. The MDC will provide a platform for sharing multi-source and multimodal data.</td>
<td>G1, G2, G3, G4, G5</td>
</tr>
</tbody>
</table>

### Operational Needs

| MDCN8 | Establish and document governance for the MDC | The system shall operate under governing policies that ensure compliance with local, state, and federal laws in addition to SANDAG | G1, G2, G3, G4, G5 |

13
<table>
<thead>
<tr>
<th>MDCN9</th>
<th>Enforce governance, address user needs, and maintain the system</th>
<th>To help ensure MDC operations success, a single entity must be assigned to monitor and attend to all user needs, enforce data governance, and provide system support. The entity may also be tasked with operating as point of contact for potential MDC Users.</th>
<th>G1, G2, G3, G4, G5</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDCN10</td>
<td>Support quality checking on data from all sources</td>
<td>Quality check and control of the mobility data is required to ensure the accuracy of the datasets which will be used to support decision making. Any errors found in the data shall have the option of that data to be flagged, so users are aware that the specific piece of data may be inaccurate. This gives users and application developers the option of using only processed quality-controlled data or the raw data depending on their needs.</td>
<td>G1, G2, G3, G4, G5</td>
</tr>
<tr>
<td>MDCN11</td>
<td>Monitor and quantify MDC utilization</td>
<td>Performance monitoring of the MDC will provide key metrics on the usage of the system to aid in future improvements, calibrations, and/or other configurations of the system.</td>
<td>G1, G2, G3, G4, G5</td>
</tr>
<tr>
<td><strong>Support Needs</strong></td>
<td></td>
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<tr>
<td>MDCN12</td>
<td>Provide security for the system</td>
<td>The MDC shall be hosted on a secure server using industry standard security measures to</td>
<td>G1, G2, G3, G4, G5</td>
</tr>
<tr>
<td>MDCN13</td>
<td>Support and manage multiple access levels for users</td>
<td>The MDC shall be capable of providing various access to users based on their respective clearance level. The system should ensure that users are only provided access to data appropriate to their user level.</td>
<td>G1, G2, G3, G4, G5</td>
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<tr>
<td>MDCN14</td>
<td>Provide reliable access to system</td>
<td>The system shall be available for access based on inter-agency agreements.</td>
<td>G1, G2, G3, G4, G5</td>
</tr>
<tr>
<td>MDCN15</td>
<td>Restore the system from failure</td>
<td>In the event of a system failure or shutdown, the MDC shall be able to be restored to an earlier version of the system. If the shutdown was caused by a system failure, the back-up version will allow the restoring of the system to an earlier version free of the system error.</td>
<td>G1, G2, G3, G4, G5</td>
</tr>
<tr>
<td>MDCN16</td>
<td>Protect Data</td>
<td>Strong data protection measures need to be put in place to mitigate privacy risks.</td>
<td>G1, G2, G3, G4, G5</td>
</tr>
</tbody>
</table>
4. Concepts for the Proposed System

4.1 Description of the Proposed System

SANDAG currently anticipates that it will host the Mobility Data Clearinghouse (MDC) on a cloud server-based Database System and use a web-based Reporting Solution in conjunction with SANDAG geographic information system (GIS) to access, manage, and share data.

Each Member Agency will contract with one or more Mobility Provider(s), who will in turn give the Provider API key to the Member Agency and/or SANDAG. The MDC will use the Provider API (refer to section 4.2) key to access and ingest MDS trip data. The MDS data will be stored in a cloud-based Database and will be available to the Member Agencies in an aggregated or detailed manner through a cloud-based Reporting Solution. Member Agencies will also be able to access the SANDAG GIS system to display near real-time and historical MDS data for regulatory compliance and transportation planning purposes. The level of access to the MDC data for a Member Agency will be defined by the Data Sharing Agreements. The level of access will be further defined for individuals within a Member Agency based on their role in that agency.

The SANDAG Modeling and Planning teams will have access to historical data through the cloud-based Reporting Solution and the SANDAG GIS system. MDS data may be made available to academic and other researchers in an aggregated or detailed manner. Agreements with researchers will cover level of access to MDC data, as well as security and privacy requirements.

A public-facing data portal will allow the general public to access aggregated data from the cloud-based Reporting Solution and the public facing SANDAG GIS system (refer to Figure 1 below). Future enhancements may include business intelligence tools or analytics modules that can generate customized reports for public consumption.
Figure 1 Conceptual Mobility Data Clearinghouse Framework
4.2 System Description

The MDC is a new regional system that will be administered by SANDAG and primarily serve Member Agencies, SANDAG, and other selected users. The MDC will leverage the MDS to facilitate real-time data exchange among mobility providers of all forms (including micromobility), and municipalities or other regulatory agencies. The MDS is a set of Application Programming Interfaces (APIs) initially developed with a focus on dockless e-scooters, bicycles, mopeds, and carshare. Inspired by projects like General Transit Feed Specification (GTFS) and the General Bikeshare Feed Specification (GBFS), the goals of the MDS are to provide a standardized way for municipalities or other regulatory agencies to ingest, compare, and analyze data from mobility service providers, and to give municipalities the ability to express regulation in machine-readable format.

Originally conceived by the Los Angeles Department of Transportation (LADOT) in 2018, the MDS has quickly grown into the de-facto international standard for micromobility data exchange. In November 2019, the governance of MDS was transferred to an open source software foundation, the Open Mobility Foundation (OMF). OMF is a consortium of international cities and other stakeholders dedicated to developing common data standards, specifications, and best practices in the fields of micro and shared mobility.

Mobility providers collect all Mobility Data delivered via the MDS directly from fleet vehicles and not from individual riders via their personal devices (e.g., smart phones, wearables). All of the specifications in the MDS are APIs which define the types of data to be exchanged (fields) and the predetermined protocols used to exchange them (endpoints). As of the date of this MDC ConOps, the MDS version 1.0.0 includes three interoperable APIs - Provider, Agency, and Policy (refer to Figure 2 below). Later MDS versions will have additional APIs that may be utilized by the MDC in the future, such as Policy, Geography, and Metrics.

- Provider API enables a governmental agency (i.e., a Member Agency or its representative, such as SANDAG) to query (or “pull”) historical Trip Data from a provider (e.g., Lime, Bird) in a form that is useful for most of the use cases identified by SANDAG with respect to the Clearinghouse. Provider API defaults to updating certain Trip Data at a 24-hour latency
SANDAG Mobility Data Clearinghouse Concept of Operations (Version 1.0)

(meaning 24 hours after the relevant events occurred), which gives this Trip Data its “historical” quality.

- Agency API allows governmental agencies to require providers to automatically transmit (or “push”) near real-time Trip Data to agencies within approximately five seconds of each triggering Vehicle Event. (When necessary or helpful, we refer to this subset of Trip Data as “Event Data” herein.) This API is more technically complex to implement but may more readily facilitate some of the enforcement objectives and other advanced use cases that require near-real-time data.

- Policy API enables governmental agencies to specify machine-readable rules (policies) that can be implemented in near-real-time by the providers, such as geofencing to encourage or discourage certain traffic flows.

**Figure 2.** MDS clarifies the data exchange between Municipalities that own/regulated the public right-of-way and Mobility Providers that use the public-right-of-way to provide mobility services to users.
4.3 User Classes and Other Involved Personnel

This section identifies and describes the role of each user of the MDC, including a description of the user and the actions that the user will be able to perform and the user’s responsibilities. Each user accessing MDC will be assigned a specific user class during the registration process.

A user’s role is defined by the level of access and responsibilities the user has within the system. User levels range from an unregistered user, the lowest level, up through an administrator, the highest level. Each level provides access to additional roles, elevated datasets and/or to system functions. These user classes are role-based and an individual may perform multiple roles and thus be a member of multiple user classes.

4.3.1 User Class: Member Agency – Operations/Regulatory

Member Agency representatives will use MDC data to implement, enforce, and monitor the effectiveness of micromobility regulations designed to ensure rider safety, promote equitable access to devices, and achieve other municipal or county-level micromobility program objectives.

Description
Agency Operations users must register with SANDAG through the MDC interface first, to obtain access to system functions. Agency Operations users may have access to Agency’s real-time data feeds but may also have access to additional data sets that require registration for access. The available data fields may be limited to fields deemed as essential for agency operations and/or regulations to ensure an easy-to-use operation for the user.

The registration process will include a request for contact information for authentication purposes, and may also include description of Mobility Provider dataset(s) requested for access, and other specific data fields to access, view, report, etc.

Additional Permissions: To be determined.
4.3.2 User Class: Member Agency - Planning

Member Agency – Planning representatives will use historical MDC to enhance local mobility infrastructure, address long-term changes in local mobility usage trends, and perform other related local planning and traffic engineering responsibilities.

Description
A Member Agency - Planning User must register with SANDAG through the MDC interface. Agency Planning Users have access to Agency’s own historic datasets and possibly other Agency datasets dependent upon the Data Sharing Agreements between Member Agencies. They may have access to additional data sets and resources that require registration for access.

The registration process will include a request for contact information, Mobility Provider dataset(s) to access, and specific data fields to access, view, report, etc.

Additional Permissions: To be determined.

4.3.3 User Class: SANDAG – Modeling

SANDAG – Modeling staff and any contracted, third-party consultants will use disaggregated MDC data to aid the Agency’s efforts in regional transportation modeling and estimating the impact these services have on regional VMT.

Description
A SANDAG - Modeling User must register with SANDAG through the MDC interface. SANDAG - Modeling Users have access to all historic datasets, unless specifically restricted in the Data Sharing Agreement of a contributing Agency and/or the associated Mobility Provider.

The registration process will include a request for contact information and may also include other user information yet to be determined.

Additional Permissions: To be determined.
4.3.4 User Class: SANDAG – Planning

SANDAG – Planning staff and any contracted, third party consultants will use aggregated MDC data to aid the Agency’s efforts in conducting regional long-range transportation planning and near-term development of Flexible Fleet pilots within Mobility Hubs.

**Description**

A SANDAG – Planning User must register with SANDAG through the MDC interface. SANDAG – Planning Users have access to all historic aggregated datasets, unless specifically restricted in the Data Sharing Agreement of a contributing Agency and/or the associated Mobility Provider.

The registration process will include a request for contact information and may also include other user information yet to be determined.

**Additional Permissions:** To be determined.

4.3.5 User Class: SANDAG – Administrator

SANDAG – Administrator staff will maintain and enhance the MDC operations, provide support to users, and perform other administrative functions.

**Description**

SANDAG – Administrator role will be assigned to select qualified SANDAG staff. SANDAG – Administrator users manage user registrations (including the ability to approve, restrict, or delete members), have the ability to change the content and structure of the MDC, and have the authority to perform other administrative functions.

**Additional roles of the SANDAG - Administrator user class may include:**

- Monitor the sharing of data, metadata, or other information
- Remove unwanted information or messages
- Review new members to ensure the identity of new users [Detailed requirements have not been determined yet. User authentication may include verification of valid agency email and other additional measures.]
- Receive and respond to User questions or comments
SANDAG Mobility Data Clearinghouse Concept of Operations
(Version 1.0)

- Run system backup
- Restore system from backup after a problem occurs
- Add, update, and delete data files
- Test, check, and add new data sets
- Add new data sets
- Add, update, and delete history/context information within the system environment.
- Add, update, and delete MDC documents such as: Terms of Use, FAQ, glossary etc.

4.3.5 User Class: External Partner – Academic Research Institution

Future phases of MDC will allow trusted external partners, such as members of academic research institutions, to access a selected subset of MDC data to perform academic research on topics such micromobility policy effectiveness, utilization, equity, etc.

Description
An Academic Research User must register with SANDAG through the MDC interface. Academic Users have access to explicitly designated historic datasets, unless specifically restricted by the contributing Agency and/or the associated Mobility Provider.

The registration and authentication process of an Academic Research User may include request for contact information; description of Mobility Provider dataset(s) requested for access; and specific data fields to access, view, report, etc.

Additional Permissions: None. (To be determined)

4.3.6 User Class: Unregistered User – Public

An Unregistered User - Public will be able to view publicly accessible information available on the landing page of MDC, such as general information about the Clearinghouse, aggregated data sets and/or pre-determined data visualizations.

Description
Unregistered Users are defined as members of the general public who
visit the public interface to the MDC. Unregistered Users are not registered with the system, and therefore cannot access secure and/or disaggregated data. The public interface will include access to the MDC registration/authentication form to allow qualified members to register with the MDC.

Additional Permissions: To be determined.

4.4 Support Environment

The MDC is expected to be developed and maintained by SANDAG. The datasets and data environments will be created and supported by SANDAG. A third-party contractor may be procured to augment SANDAG staff capacity and/or resources to establish and sustain the MDC.
5. Use Cases and Operational Scenarios

The Use Cases outlined in this section are based on documents developed as part of the Regional Micromobility Coordination effort conducted by SANDAG and participating local agencies. With each Use Case, a corresponding operational scenario is presented to provide an example of possible steps and processes that users may perform during various day-to-day interactions with the system. These examples are not meant to be inclusive, rather they help in illustrating some of the relationships between the different actors and the system. The initial system consists of a database server and supporting subsystem components for data visualization, reporting and transfer to permitted Users.

The Use Cases are divided into four major phases of user-system interactions:

- User interaction, registration, and log-in
- Information exchange
- Information management
- System administration

5.1 Use Case: User Interaction, Registration, and Log-in

Use Case Description

Every user of the MDC will be required to follow a set of user interactions during the process of acquiring access to MDC features and data.

Operational Scenario – User-System Interaction

This scenario addresses interaction between unregistered and registered users and the proposed Mobility Data Clearinghouse (MDC) during normal operations. To access the MDC, a registered account with access permissions is needed. For an unregistered user to gain access to MDC, a registration process must be completed. Upon completion of a sign-up process, an Administrator will review the Unregistered User’s information to verify the user and validate the information provided. User information authentication and registration procedures will be developed for the system to include measures such as email verification, employment verification etc.
Registered Users will input the required log-in information on a landing page, and the system will authenticate the User. If the log-in information provided is correct, the Registered User will get access to the secured information available at their specific user level.

The Registered User is given the ability to access data and view general sections of the system. If the User is a Registered User with Additional Access Permissions, the User is also given access to the specific restricted access data sets and/or Data Environment(s) that they have been granted access to. To prevent unauthorized access to the system, the User may automatically get logged out of MDC following a predetermined time period and may be requested to enter their credentials again to access MDC.

In the event of a lost or forgotten password, the Registered User will have the ability to request a new password following a successful confirmation of account information. To prevent unauthorized access to MDC (for instance by the use of brute force entry), the system will automatically suspend an account after a number of failed log-in attempts. To regain access of a suspended account, the User will be required to follow through a user verification process.

5.2 Use Case: Information Exchange – Near Real Time Operations

Use Case Description

The system will provide near real-time data to registered, authorized Users from Member Agencies.

Operational Scenario - Member Agency Users

This scenario addresses interaction between Users and the system to view data as part of the normal operations.

To access this data, Member Agency Users will first be required to log-in into the proposed System with the appropriate Username and Password.

After a successful login attempt, Member Agency Users will be able to view near-real time data from their respective Mobility Providers in the mapping interface developed for the proposed system. Users will be
able to interact with the mapping interface and will be provided with a set of features to display variations of the available data. The mapping interface will allow Member Agency Users to filter by parameters such as mobility devices parked in restricted areas, or mobility devices idle for an extended period of time.

The queried data is intended to aid Member Agency Users in performing a number of regulatory tasks, such as monitoring service boundary area violations, compliance with deployment and fleet cap rules, Provider responsiveness to improperly parked vehicle complaints, etc. (refer to Figure 3 below).

![Diagram of SANDAG Mobility Data Clearinghouse Concept of Operations]

*Figure 3 - Conceptual Near Real Time Operations*
5.3 Use Case: Information Exchange – Planning and Modeling

Use Case Description

The system will provide aggregated or deidentified data to registered, authorized Users from Member Agencies.

Operational Scenario - Member Agency Users

This scenario addresses interaction between Users and the system to view and download data or reports as part of the normal operations. The data presented and aggregation precision will be determined by a user’s position and needs.

To access this data, Member Agency Users will first be required to log-in into the proposed System with the appropriate Username and Password.

After a successful login attempt, Member Agency Users will be able to view, query and download historical data from their respective Mobility Providers in the reporting engine and mapping interface developed for the proposed system. Querying functions will allow Member Agency Users to select and filter by Provider, Service Type, Geography, Date Range and Time Range. Reporting functions will allow users to aggregate historical data by various time periods (e.g., hourly, daily, monthly, annually).

The queried historical MDC data will allow the User to measure the proportion of micromobility trips that start or end near transit stations, the usage of arterials and local roads, trip densities and other aggregated statistics.

Operational Scenario - SANDAG Users

SANDAG Users will log-in into the proposed System with the appropriate Username and Password.

SANDAG Users will be able to view, query, and download historical data from all Mobility Providers in the reporting engine and mapping interface developed for the proposed system while adhering to SANDAG Data Governance practices. Querying functions will allow SANDAG Users to select and filter by Provider, Service Type, Date Range, and Time Range. Reporting functions will allow users to
aggregate historical data by various time periods (hourly, daily, annually).

SANDAG – Planning/Modeling staff will use the queried MDC data to aid the Agency’s efforts in regional transportation modeling, long-range planning, and near-term development of Flexible Fleet pilots. Furthermore, SANDAG may use this data to update its regional travel demand model to include all Flexible Fleet options and their characteristics (e.g., mode choice, trip O/D, trip duration, rider access time) into the model. Regional modeling allows SANDAG to learn how the community uses local transportation services and identify opportunities for improving the transportation system (refer to Figure 4 below).

![Figure 4 Conceptual Planning and Modeling](image)

5.4 Use Case: Information Exchange – Research

**Use Case Description**

The System Administrator will manually provide aggregated or deidentified data, as requested, to registered, authorized Users from Academic institutions.
**Operational Scenario - Research Users**

Research Users will enter the public-facing website and request sets of information. Any datasets or graphics deemed appropriate for Research User access will be manually pulled and made available to these users by a System Administrator.

5.5 Use Case: Information Exchange – Public Access

**Use Case Description**

The system will display select aggregated and deidentified data on the public landing site as authorized by the System Administrator.

**Operational Scenario - Unregistered Users/Public**

This scenario addresses interaction between Public Access Users and the system to view and download data or reports as part of the normal operations.

Unregistered and Public Users will enter the public-facing website and will be permitted to view general content and use publicly available portions of the system. Any datasets, graphics, or features deemed appropriate for public access will be available for access by these users. The information may be presented in a geospatial or aggregated report manner.

5.6 Use Case: Data Management: Acquisition, Retention, Delivery

**Use Case Description**

The system will provide MDC data management control to the System Administrator.

**Operational Scenario**

This section addresses interaction between Administrator and the system to acquire, manage, retain, and deliver data as part of normal Operational mode.
Data for the system is determined by Member Agencies notifying the Administrator of new API key(s) available for data transfer into the system. The Administrator will establish data transfer via API pull and configure data for addition into the Database. The Administrator will have the ability to update, delete, configure or otherwise manage the data stored in the Database.

5.7 Use Case: System Administration

Use Case
The system will provide system management and control permissions to the System Administrator.

Operational Scenarios
The following scenarios showcase how the Administrator may interact with the system during normal Operational, Restore and/or Update Modes.

Adding new data to System
After a new Mobility Provider enters into an agreement with a Member Agency, the Member Agency notifies SANDAG of the new data feed and who has access to the data once entered into the MDC. The Member Agency provides the API key to the System Administrator to begin configuring the MDC for the data pull from this Provider into the MDC.

Backing up and restoring System
The Administrator will coordinate with SANDAG IT Services and Infrastructure to perform any/all system administrator tasks including backup of system or subsystems and restoring the system or affected subsystem from a backup.

Receiving authorization request from new Member Agency or Research Institution user
An unregistered user (Public) requests access to the system. Administrator uses established verification protocols to authenticate and register the new user. Administrator will set access permissions to allow access to Member Agency data. The new authenticated user with
the appropriate permissions logs into the system and receives the data that it requests and is authorized to receive.

An unregistered user (Researcher) requests access to the system. Administrator uses established verification protocols to authenticate and register the new user. Administrator will set access permissions to allow access to appropriate Member Agency data. The Administrator sets permissions for Users to access selected datasets, reports, or services. Permissions are based on data sharing agreements executed between Member Agencies, Academic Research Institutions, and Mobility Provider(s), as well as with SANDAG. The Administrator also has the ability to delete a User. Reasons to delete a user may include misuse of data, or the User notifies the Administrator that access is no longer needed to the system.
6. Definition of Terms

**Application Programming Interface (API):** A computing interface which defines interactions between multiple software intermediaries. It defines the kinds of calls or requests that can be made, how to make them, the data formats that should be used, the conventions to follow, etc. It can also provide extension mechanisms so that users can extend existing functionality in various ways and to varying degrees.

**Cloud Server:** A Cloud Server stores the database in an online environment instead of a physical on-premises database. Utilizing a Cloud Server improves scalability, performance, and disaster recovery.

**Data Exchange:** As used in this document, *Data Exchange* is a system designed to provide access to a variety of data that is hosted and managed in one or more locations by one or more entities. A Data Exchange encompasses many of the attributes and features described in the definitions below.

**Data Set** A *data set* is a collection of related data, organized into a regular and consistent format. As used in this document, a data set also includes the associated metadata and other documentation about the data.

**Data Environment** A *Data Environment* consists of datasets and/or real-time data feeds. A *Data Environment* is:

- a well-organized collection of data of specific type and quality;
- captured and stored at regular intervals from one or more sources;
- systematically shared in support of one or more applications; and
- designed to promote research and decision making.

A single Data Environment may include data sets that physically reside in one or several different Data Management Systems. Data Environments are a new concept to the surface transportation community, developed for the Mobility Data Capture Program which captures the notion of a the logical collection of data compiled and organized to support research and decision-making regardless of where data elements originate or are stored.

**Data Governance:** A collection of processes, roles, policies, standards, and metrics that ensure the effective and efficient use of information in enabling an organization to achieve its goals. It establishes the processes and responsibilities that ensure the quality and security of the data used across a
business or organization. Data governance defines who can take what action, upon what data, in what situations, using what methods.

**Data Management System**: A physical system that stores data (data sets), and/or real-time data feeds, and/or Data Environments. The MDC physically consists of interconnected Data Management Systems and the Data Portal. Data Management Systems is a more general term than Data Warehouse, and in this document, the term Data Management System is used in reference to component systems of the MDC.

**Data Portal**: A component of the MDC. It provides a common, web-based interface into the various Data Management Systems in MDC. It will also house and provide the user with additional information about the various data sets, Data Environments, and real-time data feeds that the Mobility Clearinghouse can provide.

**Data Warehouse**: A repository of electronically stored data. It houses data that originated from either another application or an external system. In this document, the term Data Warehouse will always refer to existing systems, not to the planned MDC or its component systems. Instead, the more general term Data Management System is used.

**Flexible Fleet**: Shared, on-demand transportation services that provide convenient and personalized travel options. While they build on the popularity of services such as rideshare, bikeshare, and scootershare, fleets can also include neighborhood shuttles and delivery services. These fleets provide services for all types of trips, 24/7, which can reduce the need to own a car. They also provide important connections between high-speed Transit Leap services and key destinations such as work or home, making it easier for commuters to choose transit. Flexible Fleets are primarily accessible through mobile apps and can be operated by public and private agencies or through partnerships.

**General Bikeshare Feed Specification (GBFS)**: The open data standard for bikeshare as developed by public, private sector and non-profit bike share system owners and operators, application developers, and technology vendors.

**General Transit Feed Specification (GTFS)**: Defines a common format for public transportation schedules and associated geographic information. GTFS
"feeds" let public transit agencies publish their transit data and developers write applications that consume that data in an interoperable way.

**Micromobility:** Shared-use fleets of small, fully or partially human-powered vehicles such as bikes, e-bikes and e-scooters. These vehicles are generally rented through a mobile app or kiosk, are picked up and dropped off in the public right-of-way, and are meant for short point-to-point trips.

**Mobility Data Specification (MDS):** The MDS is comprised of a set of APIs and code projects that enable standard communications between cities and users of the public right-of-way (e.g., e-scooter companies or city-run bus services) to improve safety and protect residents.

**Mobility Provider:** A public or private entity that operates a transportation and/or technology service including shared fleets of micromobility devices (e.g., dockless e-scooters and e-bikes).

**Next Operating System (Next OS):** Next OS is the “brain” of the entire transportation system. It is a digital platform that compiles information from sources such as passenger vehicles, buses, ridesharing vehicles, delivery trucks, bikes, and scooters into a centralized data hub. Analysis of this data will improve how transportation is planned, operated, and experienced. Transportation operators will be able to better manage supply and demand by modifying how infrastructure and services are used throughout the day. The result will be a modernized transportation system with roads and transit services that operate smoothly and serve people better.

**Raw Data:** Unprocessed dataset and/or real-time data.

**Real-Time Data Feed:** A mechanism for receiving updated data as it is made available. The data may be updated periodically or the updates may be event-driven. The mechanisms to access a real-time data feed can vary, including information that is subscribed to and pushed out automatically to subscribers or information can be pulled, with the sender transmitting it upon receiving a request from the recipient. The Data Portal is the component of the Research Data Exchange that supports access to real-time data feeds.

**Regional Travel Demand Model:** A simulation of individual and household transportation behaviors and decisions that compose their daily travel itinerary. People travel outside their home for activities such as work, school, shopping, healthcare, and recreation, and the model attempts to predict
whether, where, when, and how this travel occurs. Typical modeling use cases include: regional plans and EIRs, jurisdiction general and community plan updates, corridor studies, climate action plans, SB 743 VMT analysis, and development impact analysis.