



Northwest Denver MSAA Coordination Project

Developing a Data Exchange Hub

Systems Requirements

prepared for

MSAA Partners:

- **Via Mobility Services**
- **Denver Regional Transportation District**
- **Seniors' Resource Center**
- **City and County of Broomfield**

September 30, 2017

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Draft Report

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Date

September 30, 2017



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1.0 Introduction

Partners in the Northwest Denver Coordination Project are developing a means to electronically exchange trip information among partners with different scheduling systems in order to increase productivity and ultimately provide more rides for more people. The four transportation provider partners operate demand responsive transportation services and have overlapping service areas. They are Via Mobility Services, Denver Regional Transportation District, City and County of Broomfield, and Seniors' Resource Center. Together they are developing a replicable, and scalable hub for exchanging specialized transportation trip information. This project is funded by U.S. Department of Transportation (DOT) Mobility Services for All Americans grant. The resulting software will be written in open-source code and designed to work with application program interfaces or APIs. It will be available to other areas wishing to address the challenge of integrating trips that are scheduled through different scheduling software programs. It will also support the ability for different types of organizations to purchase the type of scheduling software best suited to their organizational needs rather than having to purchase a single system within a region.

The project has been developed through a modified systems engineering design process. The initial coordination project had previously developed processes that worked through first a largely manual process that was then mechanized as much as possible to make it more efficient. In this project, there are two basic activities: (1) expanding it to include more providers and more service areas and (2) developing the software that would enable an already successful concept to be replicated. This project went beyond the planning and design phase and is resulting in the development of software, an activity that requires a myriad of decisions along the way. The stakeholders used the systems engineering concept of defining the stakeholder needs, figuring the options for meeting the needs, and determining which option best met their needs for all decisions along the way.

This System Requirements document describes requirements for the data exchange hub (Hub) that is the basis of exchanging trip information among partners. It contains more information than is typically included in a Systems Requirements document, providing detail that may assist interested parties in replicating the system. As noted above, the basic concept for the system was already in place through manual and semi-automated processes, so some system design activities were covered and are described in this document. The basic project is described more fully in the Concept of Operations document that was prepared as part of this project.

Subsystems

The project elements, or subsystems, are:

1. The Hub, which automatically sends relevant trip information between providers.
2. The application program interfaces (APIs) that enable scheduling software systems to connect to the hub, providing for data flows to and from the Hub. RouteMatch, one of the scheduling systems has opted to use a software adapter (Adapter) that was developed by Ride Connections as part of the RouteMatch Clearinghouse, but all future connections are anticipated to be through APIs.
3. The adaptations to the provider's scheduling software system to enable each to read information coming from the Hub and to send data in a structure that can be read by the Hub.
4. Institutional and non-technical processes and agreements necessary for functionality.

The functional requirements describe the activities that providers can perform using the Hub while the nonfunctional requirements describe the manner in which the system is designed and deployed. These activities and functions are itemized in Sections 3.0 through 5.0 of this document.

Structure and Data Model

This document also describes the overall structure and data model of the Hub. This level of information, describing not just what is required but how it will be accomplished, was needed to develop a viable data exchange. All partners needed a clear understanding of (a) the operational realities faced by providers, (b) the constraints of the scheduling software systems in use, and (c) the choices available in the data exchange hub software. The information on how data are structured is generally contained in appendices to this document.

It is hoped that this project will be replicable and the work eventually adapted and used by others. It is worth noting that while decisions considered the two scheduling software systems that were part of this project (Mobility DR and RouteMatch) it is believed that they are reasonably representative of the other scheduling software commonly used. Some minor adaptation may be needed by software vendors to enable various systems to send data to the Hub and to pull and process data from the Hub, just as some adjustments to operating practices may be needed for participating transportation providers, as part of adapting this system for use elsewhere.

The structure of the Hub is based around API connections, making it relatively easy for other scheduling software systems to connect to the Hub.

Report Structure

The remainder of this document is organized as follows:

- **Section 2.0: Hub Design: Summary of Decisions** - This section describes the basic decisions the stakeholders made about the direction of the project, what it includes and leaves out, and other constraints and limitations;
- **Section 3.0: Functional Requirements of Hub** - This section lists the requirements of the Hub and connecting subsystems, grouped by major functional category;
- **Section 4.0: Functional Requirements of Connections to Hub** - This section describes functional requirements of the connections to the Hub and configuration requirements.;
- **Section 5.0: Requirements of Scheduling Software Adaptations** - This section describes the adaptations needed for scheduling software to be able to send and receive messages through the Hub.
- **Section 6.0: Requirements of Operational/ Nonfunctional Activities** - This section describes the business rules agreed to by providers that are reflected in the configuration of each scheduling system.
- **Section 7.0: Traceability Matrices** - This section covers the project goals and how they are addressed by each functional requirement.

2.2 GOALS AND OBJECTIVES

The needs/goals and objectives for the Hub were developed by the stakeholders and originally described in the Concept of Operations document. For this document the objectives and needs have been refined somewhat to reflect developments over the course of several additional months of meetings and to improve traceability to the requirements. The Systems Requirements are traced back to these identified needs, goals, and objectives in a traceability matrix contained in Section 7.0.

Goal 1 - Coordinate independent paratransit services to improve ridership and productivity and reduce duplication.

- 1.1 Identify those items¹ that can remain independent among partners and those items where consistency is required to enable agencies to exchange trips.

Goal 2 - Identify how to extend the Longmont model to other Call-n-Ride areas and additional transportation providers.

- 2.1 Extend the Longmont coordination model to Louisville, Brighton, Northglenn, Federal Heights, Broomfield, Thornton, Superior, and Interlocken Call-n-Ride (CNR) areas, with Seniors' Resource Center and City and County of Broomfield EasyRide services as additional providers.

Goal 3 - Through technology, provide a high level of automated exchange of data and reduce the amount of manual intervention required.

- 3.1 Develop a means to automate the exchange of trip data so it is feasible to scale the project up to other areas.
- 3.2 Develop a means to import trip data from more than one scheduling system to a data exchange hub for all providers to post and claim trip tickets. This includes the necessary adaptations for each software system.
- 3.4 Develop a means to automatically have data show on a single mobile data terminal (the RouteMatch tablet), so drivers work from a unified manifest.
- 3.5 Address the functional requirements of all stages of the provision of service, including trip data, confirmation and tracking, reporting, and billing.

¹ See Appendix C for a list of agreed-upon definitions, abbreviations, and guidelines

Goal 4 – Work with partner agencies to address institutional and operational barriers so the project can be successfully expanded.

4.1 Work through the operational and back-office issues related to shared trips.

Goal 5 – To develop a system that is scalable, replicable, and cost effective.

5.1 Use open source software.

5.2 Thoroughly document the system so it can be readily understood and adapted by others.

Schedule

The schedule for development of the technology platform that will allow the exchange of trips between partner agencies was defined in the grant application as 18 months or the end of June 2017. At this point the partner agencies expect to have a functional platform that has been tested with at least one Denver RTD Call-n-Ride (CNR) in the Via service area, one CNR in the Broomfield EasyRide service area, and one CNR in the Seniors' Resource Center service area by the end of June 2017. Further work will be needed to address outstanding issues such as payment for trips and the needed memorandums of understanding between partner agencies and to implement the system. Those activities are expected to occur within one year after successful development of the technology platform.

2.3 DECISION-MAKING PROCESS

The project followed along two basic tracks. One was that of developing a technological platform to allow providers to exchange relevant trip information. The other were the agreements needed for the system to function effectively, the processes that needed to be in place, and the items where common definitions needed to be used. These two tracks were worked side-by-side as the software developers needed to understand what the providers needed for the Hub to effectively support their operations and the providers needed to understand the strengths and the limitations of the software options.

While the decision-making process generally followed the systems engineering process, the stakeholders were faced with a variety of decisions along the way. Particularly on the software side, it was very iterative in nature as each decision led to a certain set of choices. Generally, options were identified at decision points and evaluated based on the functional and operating requirements, with an eye towards meeting the primary goals and objectives. Sometimes this led to reassessing the importance of some needs and determining if there were other ways to meet a specific need outside the project. Sometimes the team faced an either-or choice and needed to go down one path or another.

The basic requirements were identified as the system developed in Longmont. In this project, the team was refining them as more automation was added and the project was extended to additional providers. Approximately one year into the process the team took the accumulated list of needs, issues, questions, and decisions and reviewed them in conjunction with the software development to assure that each issue was addressed. The process covered over 20 hours of stakeholder meetings as we worked together to refine the requirements. Some issues still needed to be addressed; some decisions were clarified; some contradictions were sorted out; and some decisions were reassessed in light of more complete knowledge gained as we moved through the project.

This Systems Requirements Document summarizes the results of that review. It will be useful to document the decisions for stakeholders as the system is implemented, in any expansion of the system, and for other areas that may wish to replicate the Hub system.

2.4 PROJECT LIMITATIONS AND CONSTRAINTS

It is important to define those functions that are not part of the Exchange, but are responsibilities the participants retain.

- Providing transportation information and referral to customers.
- Screening for customer eligibility and establishing a customer profile (registration).
- Establishing standards for operations and code of conduct.
- Accommodating a variety of programs and funding sources.
- Facilitating trips beyond the boundaries of the identified Call-n-Ride services areas.

It is noted that Medicaid trips are not a part of this effort (at least as of the date of this document), because the requirements and bureaucratic issues make it too difficult. The exclusion of certain trip types and functions are established in response to the complexities of the task at hand, barriers, and the limited resources. The opportunity to expand into some areas remains open for the future.

Other constraints or limitations include:

- Trips that providers want to include in the hub are both those that cannot be served and those that are difficult to serve.
- Payments for trips between providers will not be addressed for a period of nine months. Some capacity to handle fares will be included in Hub.

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- In addition to coordination of CNR – human service transportation, the project will include Access-A-Ride coordination. The project will not include the other private providers of Access-A-Ride service (such as MV transportation) although perhaps they may be interested at a later point in time.
 - The Hub cannot fix problems of individuals booking on two different providers, as happens regularly, either inadvertently or on purpose.) There are some safeguards built into RM making it less likely that duplicate trips will get into the hub, but if they do there will be another set of eyes on the trips.
 - No subscription trips will be exchanged at this stage, except as converted to individual trips by requestor.
 - The trip exchange will not include same-day trips at this stage.

Definitions

It is also useful to describe the business rules and definitions that have been developed to guide and maintain an orderly operating Trip Exchange Hub and all participating agencies agree to abide by these rules. For clarity, some key definitions are:

- “Requestor” is the requesting agency that did the initial intake and put the trip on the Exchange (and is responsible for funding the trip, when applicable); “Provider” is the agency that accepted the trip and will provide transportation. In some documents the “Requestor” has been referred to as the Owner, and these terms have the same meaning.
- “Booking” is requesting and confirming a customer’s trip (also called reservations); “Scheduling” is placing a trip on a vehicle manifest (provider operations); “Dispatching” is real-time scheduling (such as canceling).
- A trip is considered to be a one-way trip; a round-trip will be booked as two trips.

2.5 DECISIONS

Basic Hub Structure

Early in the project the stakeholders were faced with key decisions on the structure of the Hub system. As described in the Concept of Operations document, the basic options were:

Option 1: Develop a purpose-built data exchange hub

Option 2: Use the proposed DRMAC coordination module

Option 3: Enhance and expand the Ride Connection Clearinghouse hub

After evaluation, option 3 was selected. Overall this project did not have the resources to develop a purpose-built hub (option 1) and the DRMAC project was stalled. It was decided that building upon the Ride Connection Clearinghouse hub provided the most value and took advantage of prior work that had been funded through the VTCLI program. Also, adapter software had been developed to enable RouteMatch scheduling software to send and receive data from the Hub, an asset from RouteMatch's perspective.

Software Language

DemandTrans, the project partner responsible for the development of the Hub, discovered that the firm that had done the prior development of the software had disbanded and its staff worked in other places. DemandTrans found that in his area it was difficult to hire a software engineer with adequate skill in the language in which the Clearinghouse program was written, *Ruby on Rails*.

The *Ruby on Rails* program is widely used in the open source software world, and there were good reasons that Ride Connections selected it for the original work. However, DemandTrans found it would be less expensive to recode the software in Java than to build the capacity in-house to modify the program. Recoding in Java also enables DemandTrans to provide support for the Hub once it is completed and installed. Originally it was thought that the firm that developed the Clearinghouse program would be able to provide ongoing support.

Maintaining a program that is open source remained important to the stakeholders, so the rewritten program maintained this characteristic.

Refinements

It was known from the outset that significant improvements would be needed to the Clearinghouse program for it to function as desired by the stakeholders. The functional improvements that will be incorporated in the new version of the Data Exchange Hub software will include the notification capabilities, more refined filtering of data and data views for visibility into the status of transactions that are occurring, and the ability for all transactions to occur in a fully automated mode. The current manual and semi-manual processes will be retained. Enhanced API's will be developed.

The provider agencies want to find a balance between having the minimal amount of information going through the hub and the information that will help the providers do a better job - providing better service to the customer and with less manual work.

Also, the Clearinghouse program had yet to be made operational as one stakeholder had an internal hold on additional IT projects, so the real-life testing that needs to occur in any system had not taken place. Similarly, the Adapter was not tested with live data.

Once the software developers got into the details of the program, they found that while the concepts were similar, the only two parts of the Clearinghouse program that it made sense to use again were the structure of the data table and the Adapter. The rest of the program and visual user interfaces are new code tailored to the needs and requirements of the stakeholder operations.

worked together to determine what was needed to have a system that met the requirements of all provider agencies and fit within the constraints of technology.

- Technology Group (Tech) if they were defined through meetings of this working group.

Comments include information on where the more detailed definitions or lists can be located as well as how the requirement will be verified.

Other abbreviations used:

Hub = data exchange hub

RM = RouteMatch

3.1 DATA EXCHANGE HUB FUNCTIONALITY

The data exchange exists to make it possible for agencies with passenger trip requests that they cannot fulfill themselves to engage with other service providers to obtain the needed transportation. The basic functions of the Hub are to receive, modify, store, and communicate relevant trip data. Additional functions have been identified (such as providing a visual user interface or specifying that the data exchange is automatic) in order to provide the functionality needed for efficient operations. As noted in Chapter 2, the data exchange hub will be written in open source software so it can be modified and replicated by a wide range of users to suit varying circumstances.

Note that there is significant overlap of Hub functions and the Hub – Scheduling Interface functions (Sections 4.0 and 5.0) so verify information in both when working with these tables. The first table describes the basic functions of the data exchange hub.

Table 3.1 Support Trip throughout Life Cycle

ID	Level 1 Requirement	ID	Level 2 Requirement	Source	Comment
3.1	<u>Trip Life Cycle</u> . The data exchange hub shall support the trip from inception to completion, the "trip lifecycle". The lifecycle has the following phases: (1) trip reservation request; (2) trip scheduling; (3) trip cancellation—in cases where this occurs; (4) trip execution; (5) trip reporting.	3.1.1	The data exchange hub shall only pass through that customer information needed to find a suitable service provider and transact trips, such as name, contact info, special assistance, special pickup, aide/attendant, service animal, mobility device.	ConOps	Verified thru testing. See Table 3.3(a) or Appendix A, for details.
		3.1.2	The data exchange hub shall only accept trip requests when required trip information such as date, origin, destination and time, is provided in the specified format.	ConOps	Verified thru testing.
		3.1.3	The data exchange hub shall be structured to provide financial, billing, payment or accounting transactions at a later date but this functionality will not be required immediately.	ConOps	Not completed in current MSAA project.
		3.1.4	The hub and its application program interfaces shall function in almost real time, defined as at least every 5 minutes for notification items and other time-sensitive functions. For non-time-sensitive functions the time windows are defined as: <ul style="list-style-type: none"> • Within two business days for posting of verified trip completion data. • At least every 30-60 minutes for all other functions 	ConOps	Notification detail follows in section 3.3 Notification Message Formats
		3.1.5	The data exchange hub shall allow for filters at the manual reservationist level, the Requester scheduling software level, and at the Hub level as follows. <ul style="list-style-type: none"> • The Hub shall filter for geographic area where the trip will occur via geocoded service areas. • Manual filtering occurs when reservationists identify that a trip is inappropriate for the hub, (e.g., trips provided under fund sources with specific driver or vehicle requirements (NEMT and AAA)). • The scheduling software shall filter or identify trips for Hub through internal settings. Every software scheduling system has such settings which will need to be used to identify trips to send to the Hub. 	ConOps	Verified thru testing.

		3.1.6	<p>The system shall be capable of changing trip status as needed in daily operation. A trip that is modified during its lifecycle is generally treated as a trip that is created and then cancelled, with a new trip replacing the original trip. Modifications that do not result in a new trip being set up are limited to:</p> <ul style="list-style-type: none"> • Clarifying pick up door (as long as location is the same). • Clarifying mobility type (as long as it does not change the need for a lift). <p><i>Note: If a driver shows up and cannot locate passenger the agency's internal procedures shall be followed. The originating agency will be notified by telephone.</i></p>	ConOps	Verified thru testing.
		3.1.7	<p>The data exchange hub shall provide a notes field for drivers regarding client, pick up points, road closures, etc. The notes field is integral to performance of trips.</p>	Meetings	Verified thru testing.

3.2 User Interface

The User Interface is the means through which staff view and access the data exchange hub. It will provide access for administrative functions in addition to the means for reservation staff to post and claim trips, update trips or create reports based on a variety of filters contained in the database.

Many such reports are possible; examples include all trips in a specified status (i.e., trips scheduled to be executed within the next 2 days, trips not yet claimed for scheduling, etc.), trip characteristics such as average distance and average cost, and how many trips are being provided by specific agencies. The User Interface allows any trip that is part of the data exchange to be viewed via the exchange functionality at any point in its lifecycle.

In addition to the requirements listed here, please refer to section 6.0 for additional details on processes, timeframes, agreements, and other details that expand on how the User Interface requirements will be implemented and are necessary for full functionality of the system.

Table 3.2 User Interface

ID	Level 1 Requirement	ID	Level 2 Requirement	Source	Comment
3.2	<u>User Interface</u> . The data exchange hub shall have a limited set of user interfaces so that individuals in participating agencies can determine the "state of the system", including individual trips.	3.2.1	The functions of the User Interface shall be documented in a user manual. The manual shall be provided in Word.	ConOps	Verified thru visual review.
		3.2.2	The User Interface shall establish security roles and permissions, defining user roles, procedures to add users, and procedures to login and download reports	ConOps	Verified thru testing.
		3.2.3	The User Interface shall allow reservation staff, through a series of easily navigable screens and buttons, to readily complete all Hub functions within time frames identified in Table 3.3(a), including: <ul style="list-style-type: none"> • post trips, • claim trips, • poll the status of trips and obtain other reports, • recall unclaimed trips, and • view trip tickets,. 	ConOps	Verified thru testing.
		3.2.4	The interface shall allow for a simple click to accept a trip, at which point it will be automatically processed by the software scheduling system.	ConOps and ensuing meetings	Verified thru testing for each software scheduling system.
		3.2.5	Participating systems shall be able to send and receive reports on services provided on behalf of others and received from others at set intervals (e.g., monthly) and for user-defined intervals.	ConOps	Verified thru testing.
		3.2.6	Data exchange hub shall filter trips and only present to providers those within their service area and operating hours.	ConOps	Verified thru testing.
		3.2.7	Once a trip has been claimed by a Provider it shall no longer be visible thru the visual interface and a notice is sent to the Requestor.	Con Ops	Verified thru testing. For more details see Table 3.3 (a) Notifications
		3.2.8	The Hub shall provide for automatic approval of trips from "white list" providers and an option for providers to confirm acceptance of trips among "grey list" providers	ConOps Meetings	Verified thru testing.

		3.2.9	The Hub interfaces shall be adaptable to mobile-devices.	Meetings	Verified thru testing.
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3.3 Automated Message Exchange

A key characteristic of the project is that data exchange be as automated as possible, reducing the amount of time that schedulers need to spend on each trip request. While requirements for automated message exchange are identified in this section, the reader will find numerous references throughout this document that contribute to the automated functionality, including in sections describing the interfaces between scheduling programs and the Hub, adaptations needed to scheduling programs, and in agency agreements about using consistent terms, definitions, and abbreviations.

Table 3.3 Automated Message Exchange

ID	Level 1 Requirement	ID	Level 2 Requirement	Source	Comment
3.3	<u>Automated Message Exchange</u> . The data exchange hub shall be structured to support automated message traffic that is host system initiated and one-way. That is: the host software systems send messages to the data hub and it responds.	3.3.1	Participating systems will receive email notifications of the following events: <ul style="list-style-type: none"> • Partner creates trip ticket • Partner updates trip ticket • Claimed trip ticket rescinded • Claimed trip re-submitted after update. • Claimed trip ticket expired • New trip claim awaiting approval • New trip claim auto-approved • Trip claim approved • Trip claim declined • Trip claim rescinded • Trip completed • Trip results submitted • Trip ticket comments added/updated 	ConOps	Verified thru testing. See following notification list for details. Table 3.3(a)
		3.3.2	The data exchange hub shall allow for a two-step process for trip completion and transmission of trip data	ConOps	Verified thru testing.
		3.3.3	Notification timing and directions messages are sent shall be as described in Table 3.3(a). Generally, time-sensitive items will use email only on same day up to 2 hours before passenger pick-up. Telephone calls will be used for less than two hours with an email notification also be sent.	ConOps	Verified thru testing. See Table 3.3(a) Message List
		3.3.4	RM and MobilityDR shall poll the Hub at least every 3-5 minutes to identify any changes in data.	ConOps	Verified thru testing.
		3.3.5	Each message type shall be structured so data interchange is automated with no manual intervention.	Conops	Verified thru testing.

Table 3.3(a) Notification Message Formats

Version: 7-13-2017

<p>1. Partner creates a trip ticket "A new trip ticket from [member name] for [date/time of trip] has been received by the Clearinghouse"</p>	Hub sends to Requestor; this verifies receipt of trip request.	Near real time (less than five minutes)
<p>2. Partner updates a trip ticket "[member name] has updated trip ticket [trip ticket number] for [date/time of trip]"</p>	Requestor sends to Provider	Two-hour cut-off time prior to passenger pick-up.
<p>3. Claimed trip ticket rescinded "Your claimed trip ticket [ticket number] for [date/time of trip] has been rescinded by [member name]"</p>	Requestor sends to Provider	Through hub, the day before; day of requires a phone call. Consider provider procedures for day of changes.
<p>4. A trip your agency previously claimed but which was rescinded is again available. "Trip ticket [original trip ticket number] that you previously claimed but was rescinded by [member name] due to trip logistic changes has been re-submitted as trip ticket [new trip ticket number] and is available exclusively to you to claim again until [date/time of expiration of exclusive claiming period]"</p>	Requestor sends to Provider	Through hub, at least the day before. Any day of changes requires a phone call.
<p>5. Claimed trip ticket expired "Your trip ticket [trip ticket number] submitted on [date/time of ticket submission] for a trip by [passenger name] on [date/time of trip] has expired without being claimed and is no longer active in the Clearinghouse"</p>	Hub to Requester	The default will be 4 PM the business day before the trip. Each agency can decide when messages expire.
<p>6. New trip claim awaiting approval "Trip ticket [trip ticket number] has been claimed by [member name] and requires your approval no later than [expiration date/time of approval period]"</p>	Future. Hub to Requester	
<p>7. New trip claim auto-approved "Trip ticket [trip ticket number] for trip by [passenger name] on [date/time of trip] has been claimed by [member name] and is automatically approved"</p>	Hub to Provider	Automatic upon claim.
<p>8. Trip claim approved "Your claim on trip ticket [trip ticket number] for [date/time of trip] has been approved by [member name]"</p>	Future. Requester to Provider	
<p>9. Trip claim declined "Your claim on trip ticket [trip ticket number] for [date/time of trip] has been declined by [member name]"</p>	Future. Requester to Provider	

10. Trip claim rescinded "Your claim on trip ticket [trip ticket number] for [date/time of trip] has been rescinded by [member name]"	Requester to Provider	Day before.
11. Trip completed Trip [trip ticket number] for [passenger name] on [date/time of trip] has been performed by [member name].	Provider to Requester	Near real time (less than five minutes. For Mobility DR this is actual. For RM this is tentative data as it has not been verified yet.
12. Trip result submitted "The data for completed trip ticket [trip ticket number] for [passenger name] on [date/time of trip] performed by [member name] has been submitted to the Clearinghouse"	Provider to Requester	Within two business days (once data is verified).
13. Trip comment added "A new comment has been added to trip ticket [trip ticket number] for [passenger name] on [date/time of trip]"	Requester to Provider.	As needed, generally when trip is posted. A change in mobility type would result in a new trip.

3.4 Message Sets and Data Elements

In a trip exchange system, the Requesting paratransit software systems may be responsible for no more than the reservation and final reporting for a particular trip, with other functions being handled by another collaborating system. This creates a requirement that both systems be provided with—or at least have access to—all relevant data about the trip, even when the needed data originate in the other system. The following identifies the essential types of messages that must be exchanged by the collaborating host systems, and the key data elements that must be present in those messages.

Table 3.4 Message Sets and Data Elements

ID	Level 1 Requirement	ID	Level 2 Requirement	Source	Comment
3.4	<p><u>Message Sets and Data Elements</u>. The data exchange hub shall support all necessary data exchange among all the host software systems which may be responsible for originating or performing trips, using the following set of messages.</p> <ol style="list-style-type: none"> 1. Trip reservation request 2. Pending trip request 3. Trip scheduling acceptance 4. Trip confirmation 5. Trip cancellation request 6. Provider trip cancellation request 7. Trip completion/execution notice 8. Trip status request <p>The structure of each message and required data elements for each message are detailed in Appendix A and Table 3.3(a)</p>	3.4.1	The <u>trip reservation request</u> message shall be generated by a Requesting software system which is asking a collaborating system to take responsibility for scheduling and execution of a trip reservation request.	ConOps	Verified thru testing
		3.4.2	The message from the Requesting system shall provide all data elements relevant to schedule the trip onto the vehicles that the Providing system controls.	ConOps	Verified thru testing
		3.4.3	The <u>pending trip requests</u> message shall instruct the data hub to provide to the requesting software application a list of all trip reservation requests that remain open, i.e., have not been "claimed" by a service provider, subject to certain qualifying criteria as specified below. If no criteria are provided by the requesting application, all current open requests shall be provided.	ConOps	Verified thru testing
		3.4.5	The requesting system Shall be able to filter the list of pending trip reservation requests returned to it by using one or more of the following criteria: <ul style="list-style-type: none"> • Trip requestor (agency) ID • Host system Trip ID • Date range of trip reservation requests—this could be a single day • Date range of when trip reservation requests were issued • Hub Trip ID 	ConOps	Verified thru testing
		3.4.6	The data returned to the invoking application shall include all data elements specified in the trip reservation request message. There will be as many "records" in the message as there are pending trip requests.	ConOps	Verified thru testing
		3.4.7	The <u>trip scheduling acceptance</u> message shall be sent by an external software application to the data hub, informing the Hub that the trip scheduling request for the specified trip ID has been accepted by a specified transportation provider. This shall change the trip status for the specified trip ID in the data hub's database. Note that with the one-way data communication paradigm, the Requesting system which "owns" the trip shall be	ConOps	Verified thru testing

			responsible for sending a trip status message to the data hub to determine if a trip actually has been scheduled by a provider.		
		3.4.8	The <u>trip confirmation</u> message shall be sent by the trip requestor to the data hub confirming that they agree - or not - to a transportation provider assuming responsibility for delivery of one of their specific trips. If the response is positive, then the provider "owns" the trip from that point forward except in the case of a trip cancellation. If the response is negative, then the status of the requested trip shall be changed back to being available for another provider. Note that with the one-way data communication paradigm, the provider must use the trip status message to determine if a host system has confirmed the provider's "claim" on a trip. Also, note that the hub shall provide for automatic confirmation of trip claims from pre-approved agencies.	ConOps	Verified thru testing
		3.4.6	The <u>trip cancellation request</u> message shall be sent by the trip requestor to the data hub. The hub will send message to the agency that has claimed the trip. The Hub shall specify that the trip identified is no longer to be performed, and any resources associated with performing the trip by the provider can be released. Trip cancellation requests are specific to individual trips; if all trips on a particular day are being cancelled, a message must be sent from the requestor to the data hub for each and every trip for that day. Note that with the one-way data communication paradigm, trip providers must use the trip status message to determine if a host system has cancelled any of the trips that they "own".	ConOps	Verified thru testing
		3.4.7	<u>Provider trip cancellation notices</u> will be used if the trip provider is forced to cancel a trip request that they had previously agreed to serve. For example, if adverse weather conditions limit the amount of service that can be provided on a particular day, then some may need to be cancelled. In such a case, the trip provider can send a message to the data hub, where it will be available for the trip requestor, to inform the latter of the cancellation	ConOps	Verified thru testing. Day of: call Day before: email

			situation. All trip cancellation messages must reference the specific trip ID of the trip being cancelled. Note that with the one-way data communication paradigm, trip requestors must use the trip status message to determine if a provider has cancelled any of the trips that they have previously claimed, or to otherwise determine the status of those trips.		
		3.4.8	<p><u>Trip completion/execution notice.</u> After trips have been executed, the trip provider's scheduling system shall communicate back to the Hub database the information about the actual trip logistics, which shall then enable the trip requestor (originator) to have access to this data. A single message can contain many trip records, each containing required data elements.</p> <p>In near real-time (less than five minutes) a message shall be sent to confirm the trip was completed. Providers will send completed trip data (for RM systems this will be verified data and for Mobility DR systems this will be actual) to the hub within two business days of trip completion.</p> <p><i>Note: This is drop-off time and will not support customer service calls re: "I haven't been picked up yet."</i></p>	ConOps	Verified thru testing
		3.4.9	<p>The <u>trip status request</u> is a message sent by any participating agency to the data hub which requests the status of either a specific trip or a set of trips. The system shall allow one or multiple parameters to be specified to identify trips. The following parameters shall be available:</p> <ul style="list-style-type: none"> • Hub Trip ID • Host System Trip ID • Provider ID—provides all scheduled, cancelled and completed trips for specified provider • Date range—will provide a list of all trips for the specified date range and the status of each • All Future—provides the status of all trips not yet performed (including current day trips) • All Past—provides the status of all trips that have 	ConOps	Verified thru testing

			been performed (including current day trips) <ul style="list-style-type: none">• All—will provide the status of all trips in the system, both past trips and future trips		
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3.5 Database

The database stores information about trips that are sent to the hub for use as trips are claimed (or expire without being claimed) provided, and reported upon. The information will be used by both the Requesting and Providing agencies.

This section lists the basic requirements for the database, agreed upon characteristics, and information on mapping from the two scheduling programs involved in this project. The list of data elements with a detailed description is attached as Appendix B. Information on data mapping follows the Requirements table for this section.

Table 3.5 Database

ID	Level 1 Requirement	ID	Level 2 Requirement	Source	Comment
3.5	<u>Database.</u> The data exchange hub shall include a database that stores the relevant information about all trips that are submitted to the data exchange.	3.5.1	<p>The data exchange hub shall use the data elements in Appendix B. Basic categories of data are listed here. The database shall also provide a Customer Notes field and one or more optional fields for other information.</p> <ul style="list-style-type: none"> • Trip ticket ID (rows 2-7) • Customer address ID and contact (rows 8-29) • Customer characteristics, including customer notes, boarding time, & seats required (rows 30-39) • Pick-up and drop-off addresses (rows 40-69) • Trip information, notes (rows 70-83) • Trip times (rows 84-97) • Various trip characteristics & status (rows 98-124) 	ConOps; refined thru meetings	Verified thru testing. See Appendix B.
		3.5.2	The database shall provide for a custom boarding and alighting field.	ConOps; refined thru meetings	Verified thru testing. See Appendix B.
		3.5.3	<p>The database shall support the following agreements among Providers and any other items reflected in Section 6.0 on non-technical items:</p> <ul style="list-style-type: none"> • The Requester of the trip will be transmitted via the Notes element. • All Providers will offer door-to-door service with CNR drivers asking passengers if they need assistance. • Children under age 8 will not initially be transported via Hub trips. Service quality for this market needs to be assured prior to lowering age limit. • Oxygen and service animal fields are contained in data elements. When needed, car seat notation can go in Notes field or an optional field. • Boarding times in RM are adjustable, and generally set at 2-7 minutes. CNR boarding times are shorter. Providers will work through the practical interface once system is live. • Providers will communicate basic requirements on carry-on items (number, size) and bicycles to riders. This varies between providers, but generally riders can only bring on board what they can carry. 	ConOps; refined thru meetings	Verified thru testing.

		3.5.4	Data shall be retained in the Hub until restrictions are needed due to volume, however this shall always be more than one month.	ConOps; refined thru meetings	Verified thru testing. See Appendix B.
		3.5.5	Data in the Hub shall be accessible by the participating systems through the User Interface, subject to the administrative and security rights of each agency.	ConOps; refined thru meetings	Verified thru testing. See Appendix B.
		3.5.6	The database shall support street addresses, intersections, or common names.	ConOps; refined thru meetings	Verified thru testing. See Appendix B.

Data Mapping

The MSAA project's trip exchange data hub is based on the Ride Connections Clearinghouse, a software application that enables collaborating software systems to exchange data for the purpose of "posting" trip requests for unscheduled customer trips and "claiming" such trip requests in order to provide client rides. There are several data elements in the Clearinghouse data model that will need to be populated in order for it to function satisfactorily. The following tables list these data elements (descriptors) for the major transactional tables in the Clearinghouse. While not all of these data elements are essential for a functioning trip exchange, it may be the case that some of the organizations participating in the coordination system would want to have this data present due to their operational or business practices.

For each of the key data elements, there is an indication whether that data are present in the RouteMatch or MobilityDR (Call-N-Ride) system and can be made available to the Clearinghouse as part of the transactional process. In some cases, the necessary data is part of the system, but is not currently used for transactional purposes, although it could be derived if necessary for the trip exchange data requirements. This is primarily the case with MobilityDR, and is indicated in the entries in the table below.

Table 3.5(a) Clearinghouse Data Elements and Counterparts

Trip Descriptors	RouteMatch	MobilityDR
Customer name	Yes	Some identifier
Customer phone number	Yes	Yes – contact number
Customer address	Yes	Not necessarily

Trip Descriptors	RouteMatch	MobilityDR
Customer date of birth	Yes	No
Customer emergency phone	Yes	Not explicitly
Customer notes	Yes	Not explicitly
Pickup location	Yes	Yes
Drop off location	Yes	Yes
Seats required	Yes	Soft data
Appointment time	Yes	No – only if drop off time
Earliest PU time	Yes – Early Pick Up Window	System parameter based on time window, not trip dependent
Allowed time variance	Yes – Service Window – Modified by Service – if ride time this is managed in settings.	System parameter, not trip dependent
Customer boarding time	Yes – trip dependent or system parameter	Yes, if desired, not mandatory
Customer de-boarding time	Yes - global, customer, trip	Yes, if desired
Mobility type ID*	Yes, database ID – AMB = 1, WC =2, BAR=3 – Agreement on the typology. (Translation) This is a text value.	_____
Customer impairment description	Yes – several options – pick lists, medical needs, service needs, special circumstance (Other types such as Isolation, Minor Transport, Infectious Disease, Psychiatric)	Only if in notes
Number of attendants	Yes – Also Mobility Type	Not explicit field
Number of guests	Yes – also Escorts and identify the mobility options (AMB, WC etc. for both Guests & Attendants)	Not explicit field
Trip purpose (code, description)	Yes	No
Trip notes	Yes	Yes
Originating system customer ID	Yes	Yes
Originating system trip ID	Yes	Yes
Originating system (provider) ID	Yes	Yes
Isolation – Rider rides alone	Yes	No

Trip Descriptors	RouteMatch	MobilityDR
Capacity Needs of the Attendants and Guests - WC vs. AMB - how many seats are required.	Yes	Not broken out between rider and others traveling with them re WC vs. AMB situation

Trip Result Descriptors:	RouteMatch	MobilityDR
Actual PU time	Yes	Yes
Actual drop-off time	Yes	Yes
Base fare	Yes	Yes – actual fare class
Billable mileage	Yes	Derivable
Driver ID (name)	Yes	Derivable
Fare (Collected from the Client)	Yes	Fare class only
Fare type	Yes	Yes
Trip start odometer	Yes	Yes - Derivable (current not being recorded)
Trip end odometer	Yes	Yes
Miles travelled	Yes	Yes
Outcome	Cancelled No Show Completed	Cancelled No Show Completed
Rate (Cost of the trip) - Funding Source	Yes - Cost of Trip, Rider Fare or Co-Pay (funding source, fare)	No
Rate type	Fare Type -	No
Vehicle ID	Yes	Derivable
Vehicle type	Yes	Derivable

Provider Descriptors:	RouteMatch	MobilityDR
Provider name (ID)	Yes	Derivable
Address	Yes	No – could be added
Primary contact of provider (ID)	Yes	No – could be added

3.6 Reliability and Accuracy

All information must be transmitted correctly to enable automatic transfer of data with minimal manual intervention, so accuracy of the system is very important at all stages of the process. However, the accuracy of the Hub is dependent on the accuracy of the endpoint systems. Lack of accuracy is likely to create more problems than reliability issues because if the system is down for a time all parties would revert to manual means of updating trip requests or other functions.

Table 3.6 Reliability and Accuracy

ID	Level 1 Requirement	ID	Level 2 Requirement	Source	Comment
3.6	<u>Reliability and Accuracy.</u> The Hub and its interfaces shall be reliable and convey accurate information.	3.6.1	The Hub shall only accept data streams with correct information or null values.	Meetings	Verified thru testing
		3.6.2	The Hub shall respond with an error message if a message cannot be sent.	Meetings	Verified thru testing
		3.6.3	The Hub shall be operational 24 hours per day, seven days per week.	Meetings	Verify hosting arrangements
		3.6.4	Any scheduled updates or maintenance shall occur outside normal scheduling hours. Notices shall be sent to participating agencies when it is planned to be offline	Discussion	Verify protocols

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The key functionality of the data exchange is to make possible the automated transmission of data among participating organizations, all of whom have software systems that can manage human service paratransit operations.

Application program interfaces (APIs) provide for data flows between the provider scheduling software systems and the Hub. RouteMatch, one of the scheduling systems has opted to use a software adapter (Adapter) that was developed by Ride Connections as part of the Clearinghouse program, as an interim measure but plans to eventually build a restful API to interface directly. The Mobility DR software will use a set of API's and future interfaces for additional providers will be through APIs.

These interfaces must consider the flow of data from the Hub to various scheduling software programs, where each message set must be readable by the scheduling system. They also must consider the flow of data to the Hub: each scheduling software system must be capable of providing information to the Hub in the required message format. In some cases, both the Requestor and Provider agencies use RouteMatch software, so it is important to keep track of the direction of the data flow. Both Provider and Requestor agencies will poll the hub at short, regular intervals (less than five minutes) to either send information or check to see if the status of any trips have changed.

This section contains a list of requirements as well as a file providing basic information on the APIs that will be required for Mobility DR to connect to the Hub. New provider partners may find this list useful as they work to develop API connections. Information on the interim Adapter software is not provided here as it will not be used in future applications.

Table 4.1 Scheduling Software Interface

ID	Level 1 Requirement	ID	Level 2 Requirement	Source	Comment
4.1	The software vendor shall provide a set of Application Programming Interfaces adequate for sending to the Hub the data and messages necessary for all functionalities and for receiving from the Hub all data and messages.	4.1.1	The APIs shall include all items in Table 4.1 for current functionality.	ConOps	See the list of APIs following this table. V = testing
4.2	The software vendor shall provide a mechanism to poll Hub every 3-5 minutes to post updated files and/or receive data.			ConOps	V = testing

Table 4.1(a) API List

(Note: This is an excerpt of the full file.)

Model Name	Request Type	Request URL	Description
User	get	http://localhost:8081/clearinghouse/users	After hitting that API, we can get the data from table for all the users
	getById	<p>FORMAT:</p> <p>http://{ipaddress}:{portno}/clearinghouse/users/{user_id}</p> <p>http://localhost:8081/clearinghouse/users/25</p>	
	Put	<p>FORMAT</p> <p>http://{ipaddress}:{portno}/clearinghouse/users/{user_id}</p> <p>http://localhost:8081/clearinghouse/users/25</p>	When we need to update the data we can use
	post	http://localhost:8081/clearinghouse/users	To add new user
	delete	<p>FORMAT</p> <p>http://{ipaddress}:{portno}/clearinghouse/users/{user_id}</p> <p>http://localhost:8081/clearinghouse/users/30</p>	To deactivate the user
Provider	get	http://localhost:8081/clearinghouse/provider	To get all the providers from database
	getById	<p>FORMAT</p> <p>http://{ipaddress}:{portno}/clearinghouse/provider/{provider id}</p> <p>http://localhost:8081/clearinghouse/provider/2</p>	To get the specific provider information
	Put	<p>FORMAT:</p> <p>http://{ipaddress}:{portno}/clearinghouse/provider/{provider id}</p> <p>http://localhost:8081/clearinghouse/provider/2</p>	To make particular changes in provider details
	post	http://localhost:8081/clearinghouse/provider/	To add new provider
	delete	<p>FORMAT:</p> <p>http://{ipaddress}:{portno}/clearinghouse/provider/{provider id}</p> <p>http://localhost:8081/clearinghouse/provider/2</p>	To de-activate the provider

Model Name	Request Type	Request URL	Description
Provider Partner	get	http://localhost:8081/clearinghouse/providerPartners	To get the all provider partners
	getById	FORMAT http://{ipaddress}:{portno}/clearinghouse/providerPartners/{providerPartner id} http://localhost:8081/clearinghouse/providerPartners/4	To get the specific provider partner request information
	put	FORMAT http://{ipaddress}:{portno}/clearinghouse/providerPartners/{providerPartner id} http://localhost:8081/clearinghouse/providerPartners/4	To modify the provider partner status request
	post	http://localhost:8081/clearinghouse/providerPartners	To add the new request for provider partner
	delete	FORMAT http://{ipaddress}:{portno}/clearinghouse/providerPartners/{providerPartner id} http://localhost:8081/clearinghouse/providerPartners/4	To cancel the request or after request is rejected
Ticket Filters	get	http://localhost:8081/clearinghouse/filters	To get all the filters
	getById	FORMAT http://{ipaddress}:{portno}/clearinghouse/filters/{filter id} http://localhost:8081/clearinghouse/filters/1	To get the specific filter information
	put	FORMAT http://{ipaddress}:{portno}/clearinghouse/filters/{filter id} http://localhost:8081/clearinghouse/filters/1	To make changes in the filters
	post	http://localhost:8081/clearinghouse/filters	Add new filter
	getUserById	FORMAT http://{ipaddress}:{portno}/clearinghouse/filters/user/{userId} http://localhost:8081/clearinghouse/filters/user/28	To get the filters for a particular user

Trip Tickets	get	http://localhost:8081/clearinghouse/tripTickets	To get data of all trip tickets
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Adaptations are required of each provider’s scheduling software system to enable them to read and process information coming from the Hub and to send data in a structure that can be read by the Hub. How the various host software systems manage their interaction with the data exchange is the responsibility of the software vendors that have developed those systems.

Providers will continue to use their existing scheduling systems for most scheduling, dispatch, reporting, and back office functions. An important objective for stakeholders is that all trips show up on a single tablet so drivers will be able to work from a single unified manifest. For providers with the RouteMatch scheduling system this will be the RouteMatch tablet. A trip request that comes into the agency and cannot be scheduled and is appropriate for the Hub will be flagged and sent through the Hub to other potential providers. The provider agencies will use their scheduling system to determine if they have the capacity to schedule trip request. If the answer is yes, the trip can be claimed; if it cannot be scheduled, no action is taken on the trip.

The two scheduling systems that are part of this project, Route Match and Mobility DR, are quite different from one another. How each develops the data for message streams and responds to incoming messages to schedule a trip or take other action, will be quite different. Each also uses a different means to communicate with the Hub (Adapter software versus API). This section identifies what they must accomplish, but not how the actions are to be accomplished. RouteMatch has developed an “Interface Control Document” that describes the adaptations to their system will connect to the data exchange hub.

Table 5.1 Scheduling Software Adaptations

ID	Level 1 Requirement	ID	Level 2 Requirement	Source	Comment
5.1	Each software vendor connecting to the Hub shall adapt its software to <u>automatically</u> send/receive eligible trips to/from the Hub (generally trips that are unable to be scheduled with system resources, that occur one or more days in advance, and that are not funded through NEMT or other restricted fund sources) and to update the status of these trips as needed.	5.1.1	Trip information shall automatically be sent to the Hub using the data elements and message formats specified in section 3.1 Data Exchange Hub Functionality and associated documents. All required elements (or null values if appropriate) shall be included in message sets.	ConOps	See the list of APIs following this table. V = testing
		5.1.2	Client, trip, and other information relevant to the scheduling and delivery of the trip sent to the Hub to be available for another provider shall be produced by the scheduling system's database and standard functionalities.	ConOps	V = testing
		5.1.3	The scheduling system shall automatically send updated trip information for trips submitted to the hub, as appropriate, whether claimed or unclaimed.	ConOps	V = testing
		5.1.4	The scheduling system shall have a means to track and report on trips sent to the Hub.	ConOps	V = testing
5.2	The software vendor shall adapt its software to send, receive, read, and act on all messages identified in the message sets in section 3.1.4.	5.2.1	The scheduling software shall produce each message, using the message formats and data elements defined in section 3.1 Data Exchange Hub Functionality.	ConOps	V = testing
		5.2.2	The scheduling software shall be capable of receiving, reading, and automatically acting upon each message, using the message formats and data elements defined in section 3.1 Data Exchange Hub Functionality.	ConOps	V = testing
		5.2.3	The scheduling system shall send completed trip data to the Hub in near real time (within 5 minutes). For Mobility DR, this will be actual data. For RM, tentative data will be sent in near real time and verified data will be sent within two days. <i>Note: This is drop-off time and will not support customer service calls re: "I haven't been picked up yet."</i>	Meetings	V = testing
5.3	The software vendors shall assure that trip data for clients registered in more than one system is not changed when any system with which the passenger is registered uses the Hub to schedule a trip.	5.3.1	Characteristics such as boarding or alighting times, which may change by trip, shall not overwrite the database in the provider agency's scheduling system.	Meetings	V = testing
		5.3.2	All CNR trips shall automatically be scheduled through the RM scheduling systems (or other Provider scheduling systems) and be displayed on a uniform drivers' manifest.	ConOps	V = testing

5.4	The scheduling software shall provide a notes field for drivers regarding client, pick up points, road closures, etc. The notes field is integral to performance of trips.	5.4.1	Either a flag on the driver's manifest or an alert shall be used to notify the driver there is a note that needs to be viewed.	Meetings	V = testing
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The development of the data exchange hub has required collaboration of multiple transportation providers and two scheduling software companies. As a pilot, the collaborating agencies have worked step-by-step to determine what processes, definitions, and agreements are needed to assure the system is compatible with Mobility DR and RouteMatch scheduling systems as well as the business rules, definitions, processes, and institutional practices among four diverse providers.

This section documents both requirements and agreements necessary for a fully functional system. It is expected that as the project proceeds through testing and implementation, some adjustments may be needed. These agreements reflect our best understanding at this time of the institutional agreements and operational practices that will be needed, except in the area of payment for trips (this will be addressed at a later date, after the system is implemented). However, it is likely that time frames for sending messages, some internal agreements, and some protocols may need to be refined.

Table 6.1 Operating Practices

ID	Level 1 Requirement	ID	Level 2 Requirement	Source	Comment
6.1	<p>The system shall provide for the following control of trips:</p> <ul style="list-style-type: none"> • The agency posting the trip (owner) has control over trip until it is claimed by another provider and may change the status of the trip or remove it from the Hub. • Once claimed, the providing agency maintains control of the trip until service is delivered and it is their responsibility to provide the trip. • The agency with control of the trip is responsible for: <ul style="list-style-type: none"> ○ Providing the trip except in unusual circumstances (e.g., snow) ○ Notifying the customer of any changes in status • Notifying the owner of the trip of any changes in status. 			Meetings	Verified by testing of agency procedures
6.2	<p><u>Unscheduled Trips</u> on RouteMatch systems, that meet other qualifications, shall be eligible to be sent to the Hub.</p> <ul style="list-style-type: none"> • Passenger trips offered through the Hub shall remain available until the day before requested travel • Unclaimed trips shall return to the "Unscheduled Trips" status in the scheduling software. 	6.2.1	The system shall allow for a future enhancement of setting variable times for returning unclaimed trips to "Unscheduled Trips" status. For example, 48 hours notice before trip is scheduled might be provided for priority medical trips.	Meetings	6.2 will be verified thru testing; 6.2.1 will not be tested at present.
6.3	<p>Trip scheduling request. The advance period for requesting trip scheduling is one to seven (1 – 7) days; no same day requests. One (1) day in advance is defined as by 5 p.m. the day before.</p>			Meetings	Verified thru testing.
6.4	<p>Trip scheduling acceptance. There is no specified period for acceptance, except that pending requests will be removed automatically from the system after seven days, or after the trip expires (whichever is soonest). Once a provider has accepted a trip, the system will send an email to the requestor, and the trip request (trip exchange) is automatically, mutually confirmed (trip confirmation from requestor is not needed).</p>			Meetings	Verified thru testing.
6.5	<p>The Requestor shall inform the client that their trip has been accepted by the appropriate provider and inform them of the fare required. (A possible future enhancement is for the Hub to send notifications)</p>			Meetings	Verified thru testing.

6.6	<p>Requestor Cancellation. A trip Requestor cancelling a trip request shall abide by the following: <Two (2) hours before pickup – Call provider and send message to hub. The earliest emails can be sent is 7:30 or 8:00 AM, so telephone calls will be used for all same day changes that occur before 9:30 or 10:00 AM. A procedure will be defined to assure that the call reaches a live body (early in the day this may be a dispatcher rather than a scheduler). >Two (2) hours before pick-up – Send message to hub. There are no consequences for cancellations done as above, i.e., no fees paid.</p>			Meetings	Verified thru testing.
6.7	<p>In the rare circumstance that a provider needs to cancel transportation (i.e.; extreme weather), the provider shall be responsible for notifying the client and the Hub that no trip was provided. No subscriptions will be exchanged at this time, except as converted to individual trips by requestor.</p>			Meetings	Verified thru testing.
6.8	<p>The Hub shall not exchange subscription trips at this point. Any such trips shall be converted to one-way trips before being sent through the Hub.</p>			Meetings	
6.9	<p>If there is a change in the trip the Requestor shall notify the client with the following message, "(Provider) will pick you up for your trip and here is their contact information."</p>			Meetings	Verified thru testing

7.0 Workflows

The functional requirements must be traceable to the needs identified by the stakeholders. The needs are described as the goals and objectives identified in Section 2 of this report. Table 7.1 shows each goal or objective identified by the stakeholders and the functions that address that need. Table 7.2 shows each of the functional requirements and lists the need that each function addresses. Note that in these tables the descriptors of the functional requirement may contain less detail than in the individual tables in sections 3.0, 4.0, 5.0, and 6.0. The reader is referred to those tables for additional information.

In Table 7.2 the reader may identify the mismatch that occurred as the ConOps was written at a general level, with descriptions at a planning level, while during the course of the project the team moved through system design activity. As a result, there is a good deal of overlap and clear matches between specific goals/objectives and the functional requirements are hard to find. Many requirements apply to multiple goals. In Table 7.2, we have opted to keep the table at the level of the primary goal rather than identify each specific objective. This improves readability and does not result in a loss of understanding.

This report serves as the Requirements document for both the basic needs and the system design. The next step is to complete an Implementation Plan describing specific agency roles, system performance measures, and testing requirements will be developed.

Table 7.1 Forward Traceability Matrix
(Goals Traced to Functional Requirements)

Goal ID	Goal Description	Forward Traceability Requirements
1.0	Coordinate independent paratransit services to improve ridership and productivity and reduce duplication.	3.1 (trip life cycle), 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.1.7; 3.2 (user interface) 3.2.1, 3.2.2, 3.2.3, 3.2.4, 3.2.5, 3.2.6, 3.2.7;
1.1	Identify those items that can remain independent among partners and those items where consistency is required	6.1 (trip control), 6.2 (unscheduled trips), 6.2.1, 6.3 (trip scheduling request), 6.4 (trip acceptance), 6.5 (client communication), 6.6 (requestor cancellation), 6.7, 6.8, (subscription trips) 6.9 (change in trip)
2.0	Identify how to extend the Longmont model to other CNR areas and additional transportation providers.	3.1. (trip life cycle), 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.1.7; 6.1 (trip control), 6.2 (unscheduled trips), 6.2.1, 6.3 (trip scheduling request), 6.4 (trip acceptance), 6.5 (client communication), 6.6 (requestor cancellation), 6.7, 6.8, (subscription trips) 6.9 (change in trip)

Goal ID	Goal Description	Forward Traceability Requirements
2.1	Extend the Longmont coordination model to other CNRs in northwest Denver with SRC and Broomfield EasyRide services as additional providers.	6.1(trip control), 6.2 (unscheduled trips), 6.2.1, 6.3 (trip scheduling request), 6.4(trip acceptance, 6.5 (client communication), 6.6 (requestor cancellation, 6.7, 6.8, (subscription trips) 6.9 (change in trip)
3.0	Provide a high level of automated exchange of data and reduce the amount of manual intervention required.	3.1 (trip life cycle), 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.1.7; 3.2 (user interface) 3.2.1, 3.2.2, 3.2.3,3.2.4, 3.2.5, 3.2.6, 3.2.7, 3.2.8,3.2.9; 3.3 (automated message exchange) 3.3.1, 3.3.2, 3.3.3, 3.3.4, 3.3.5; 3.4 (message sets and data elements) 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.4.5, 3.4.6, 3.4.7, 3.4.8, 3.4.9; 3.5 (data base) 3.5.1, 3.5.2, 3.5.3, 3.5.4, 3.5.5; 3.6 (reliability) 3.6.1, 3.6.2, 3.6.3, 3.6.4
3.1	Develop a means to automate the exchange of trip data so it is feasible to scale the project up.	3.1 (trip life cycle), 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.1.7; 3.2 (user interface) 3.2.1, 3.2.2, 3.2.3,3.2.4, 3.2.5, 3.2.6, 3.2.7, 3.2.8,3.2.9; 3.3 (automated message exchange) 3.3.1, 3.3.2, 3.3.3, 3.3.4, 3.3.5; 3.4 (message sets and data elements) 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.4.5, 3.4.6, 3.4.7, 3.4.8, 3.4.9; 3.5 (data base) 3.5.1, 3.5.2, 3.5.3, 3.5.4, 3.5.5; 3.6 (reliability) 3.6.1, 3.6.2, 3.6.3, 3.6.4;
3.2	Develop a means to import trip data from more than one scheduling system to a data exchange hub so providers can post and claim trip tickets. Make the necessary adaptations to scheduling software.	3.1 (trip life cycle), 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.1.7; 3.2 (user interface) 3.2.1, 3.2.2, 3.2.3,3.2.4, 3.2.5, 3.2.6, 3.2.7, 3.2.8,3.2.9; 3.3 (automated message exchange) 3.3.1, 3.3.2, 3.3.3, 3.3.4, 3.3.5; 3.4 (message sets and data elements) 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.4.5, 3.4.6, 3.4.7, 3.4.8, 3.4.9; 3.5 (data base) 3.5.1, 3.5.2, 3.5.3, 3.5.4, 3.5.5; 3.6 (reliability) 3.6.1, 3.6.2, 3.6.3, 3.6.4; 4.1(vendor APIs), 4.1.1, 4.2 (vendor polling),; 5.1 (vendor automation) 5.1.1, 5.1.2, 5.1.3, 5.1.4; 5.2 (messages) 5.2.1, 5.2.2, 5.2.3; 5.3 (client records unchanged); 5.3.1, 5.3.2; 5.4 (notes field) 5.4.1;
3.3	Develop a means to automatically have data show on a single mobile data terminal so drivers work from a unified manifest.	3.1 (trip life cycle), 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.1.7; 3.2 (user interface) 3.2.1, 3.2.2, 3.2.3,3.2.4, 3.2.5, 3.2.6, 3.2.7, 3.2.8,3.2.9; 3.3 (automated message exchange) 3.3.1, 3.3.2, 3.3.3, 3.3.4, 3.3.5; 3.4 (message sets and data elements) 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.4.5, 3.4.6, 3.4.7, 3.4.8, 3.4.9; 3.5 (data base) 3.5.1, 3.5.2, 3.5.3, 3.5.4, 3.5.5; 4.1(vendor APIs), 4.1.1,

		4.2 (vendor polling); 5.1 (vendor automation) 5.1.1, 5.1.2, 5.1.3, 5.1.4; 5.2 (messages) 5.2.1, 5.2.2, 5.2.3; 5.3 (client records unchanged); 5.3.1, 5.3.2; 5.4 (notes field) 5.4.1;
3.4	Address the functional requirements of all stages of the provision of service, including trip data, confirmation and tracking, reporting, and billing.	3.1 (trip life cycle), 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.1.7; 3.2 (user interface) 3.2.1, 3.2.2, 3.2.3,3.2.4, 3.2.5, 3.2.6, 3.2.7, 3.2.8,3.2.9; 3.3 (automated message exchange) 3.3.1, 3.3.2, 3.3.3, 3.3.4, 3.3.5; 3.4 (message sets and data elements) 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.4.5, 3.4.6, 3.4.7, 3.4.8, 3.4.9; 3.5 (data base) 3.5.1, 3.5.2, 3.5.3, 3.5.4, 3.5.5; 3.6 (reliability) 3.6.1, 3.6.2, 3.6.3, 3.6.4; 4.1 (vendor APIs), 4.1.1; 5.1 (vendor automation) 5.1.1, 5.1.2, 5.1.3, 5.1.4; 5.2 (messages) 5.2.1, 5.2.2, 5.2.3; 5.3 (client records unchanged); 5.3.1, 5.3.2; 5.4 (notes field) 5.4.1;
4.0	Work with partner agencies to address institutional and operational barriers	6.1(trip control), 6.2 (unscheduled trips), 6.2.1, 6.3 (trip scheduling request), 6.4(trip acceptance, 6.5 (client communication), 6.6 (requestor cancellation, 6.7, 6.8, (subscription trips) 6.9 (change in trip)
4.1	Work through the operational and back-office issues related to shared trips	3.1.3, 3.1.4; 6.1(trip control), 6.2 (unscheduled trips), 6.2.1, 6.3 (trip scheduling request), 6.4(trip acceptance, 6.5 (client communication), 6.6 (requestor cancellation, 6.7, 6.8, (subscription trips) 6.9 (change in trip)
5.0	To develop a system that is scalable, replicable and cost efficient.	3.1 (trip life cycle), 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.1.7; 3.2 (user interface) 3.2.1, 3.2.2, 3.2.3,3.2.4, 3.2.5, 3.2.6, 3.2.7, 3.2.8,3.2.9;
5.1	Use open source software	3.1 (trip life cycle), 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.1.7;
5.2	Thoroughly document the system so it can be readily understood and adapted by others.	3.2 (user interface) 3.2.1, 3.2.2, 3.2.3,3.2.4, 3.2.5, 3.2.6, 3.2.7, 3.2.8,3.2.9;

Table 7.2 Backward Traceability Matrix*Functional Requirements Traced to Goals*

ID	Functional Requirement	Goal
3.1	Data exchange hub shall support entire trip life cycle.	3, 5
3.1.1	The Hub shall only pass through the information needed to find a suitable service provider and transact trips.	3, 5
3.1.2	The data exchange hub shall only accept trip requests when required trip information such as date, origin, destination and time, is provided in the specified format.	3, 5
3.1.3	The data exchange hub shall be structured to provide financial, billing, payment or accounting transactions at a later date	3, 5
3.1.4	The hub and its interfaces shall function in almost real time, defined as at least every 5 minutes for notification items and other time-sensitive functions. For non-time-sensitive functions the time windows are defined as: <ul style="list-style-type: none"> • Within two business days for posting of verified trip completion data. • At least every 30-60 minutes for all other functions 	3
3.1.5	The data exchange hub shall allow for filters at the manual reservationist level, the Requester scheduling software level, and at the Hub level.	3, 5
3.1.6	The system shall be capable of changing trip status as needed in daily operation.	3, 5
3.1.7	The data exchange hub shall provide a notes field for drivers	3
3.2	The data exchange hub shall have a limited set of user interfaces so that individuals in participating agencies can determine the "state of the system", including individual trips.	3, 4, 5
3.2.1	The functions of the User Interface shall be documented in a user manual. The manual shall be provided in Word.	3, 5
3.2.2	The User Interface shall establish security roles and permissions, defining user roles, procedures to add users, and procedures to login and download reports	3, 4
3.2.3	The User Interface shall allow reservation staff, through a series of easily navigable screens and buttons, to readily complete all Hub functions within time frames identified in Table 3.3(a)	3,4, 5
3.2.4	The interface shall allow for a simple click to accept a trip, at which point it will be automatically processed by the software scheduling system.	3, 5
3.2.5	Participating systems shall be able to send and receive reports on services provided on behalf of others and received from others at set intervals (e.g., monthly) and for user-defined intervals.	3, 5
3.2.6	Data exchange hub shall filter trips and only present to providers those within their service area and operating hours.	3, 5
3.2.7	Once a trip has been claimed by a Provider it shall no longer be visible thru the visual interface and a notice is sent to the Requestor.	3, 5
3.2.8	The Hub shall provide for automatic approval of trips from "white list" providers and an option for providers to confirm acceptance of trips among "grey list" providers	3, 5
3.2.9	The Hub interfaces shall be adaptable to mobile-devices.	3, 5
3.3	Automated Message Exchange. The data exchange hub shall be structured to support message traffic that is host system initiated and one-way	3, 4
3.3.1	Participating systems will receive email notifications of key events.	3, 4

ID	Functional Requirement	Goal
3.3.2	The data exchange hub shall allow for a two-step process for trip completion and transmission of trip data	3, 4
3.3.3	Notification timing and directions messages are sent shall be as described in Table 3.3(a). Generally, time-sensitive items will use email only on same day up to 2 hours before passenger pick-up. Telephone calls will be used for less than two hours with an email notification also be sent.	3, 4
3.3.4	RM and MobilityDR shall poll the Hub at least every 3-5 minutes to identify any changes in data	3, 4
3.3.5	Each message type shall be structured so data interchange is automated with no manual intervention.	3, 4
3.4	The data exchange hub shall support all necessary data exchange among all the host software systems which may be responsible for originating or performing trips, using a set of eight messages.	3, 4
3.4.1	The <u>trip reservation request</u> message shall be generated by a Requesting software system which is asking a collaborating system to take responsibility for scheduling and execution of a trip reservation request.	3, 4
3.4.2	The <u>pending trip requests</u> message shall instruct the data hub to provide to the requesting software application a list of all trip reservation requests that remain open	3, 4
3.4.3	The <u>trip scheduling acceptance</u> message is sent by an external software application to the data hub, and informs it that the trip scheduling request for the specified trip ID has been accepted by a specified transportation provider.	3, 4
3.4.4	The <u>trip confirmation</u> message is sent by the trip requestor to the data hub confirming that they agree – or not.	3, 4
3.4.5	The requesting system Shall be able to filter the list of pending trip reservation requests returned to it by using one or more criteria.	
3.4.6	The <u>trip cancellation request</u> message is sent by the trip requestor to the data hub. The hub will send message to the agency that has claimed the trip.	3, 4
3.4.7	<u>Provider trip cancellation notices</u> will be used if the trip provider is forced to cancel a trip request that they had previously agreed to serve.	3, 4
3.4.8	Trip completion/execution notice. After trips have been executed, the trip provider must communicate back to the hub database the information about the actual trip logistics, which will then enable the trip requestor (originator) to have access to this data.	3, 4
3.4.9	The <u>trip status request</u> is a message sent by any participating agency to the data hub which requests the status of either a specific trip or a set of trips.	3, 4
3.5	The data exchange hub shall include a database that stores the relevant information about all trips that are submitted to the data exchange.	3, 4
3.5.1	The data exchange hub shall use the data elements in Appendix B.	3, 4
3.5.2	The database shall provide for a custom boarding and alighting field.	3, 4
3.5.3	The database shall support agreements among Providers and any other items reflected in the section on non-technical items.	3, 4
3.5.4	Data shall be retained in the Hub until restrictions are needed due to volume. Data shall always be retained for more than one month.	3, 4
3.5.5	Data in the Hub shall be accessible by the participating systems through the User Interface, subject to the administrative and security rights of each agency.	3, 4
	The database shall support street addresses, intersections, or common names.	

ID	Functional Requirement	Goal
3.6	The Hub and interfaces shall be reliable and convey accurate information.	3, 4
3.6.1	The Hub shall only accept data streams with correct information or null values.	3, 4
3.6.2	The Hub shall respond with an error message if a message cannot be sent.	3, 4
3.6.3	The Hub shall be operational 24 hours per day, seven days per week.	3, 4
3.6.4	Any scheduled updates or maintenance shall occur outside normal scheduling hours. Notices shall be sent to participating agencies when it is planned to be offline	3, 4
4.1	The software vendor shall provide a set of Application Programming Interfaces adequate for sending to the Hub the data and messages necessary for all functionalities and for receiving from the Hub all data and messages.	3, 4
4.1.1	The APIs shall include all items in Table 4.1 for current functionality.	3, 4
4.2	The software vendor shall provide a mechanism to poll Hub every 3-5 minutes to post updated files and/or receive data.	3, 4
5.1	The software vendor shall adapt its software to <u>automatically</u> send/receive eligible trips to/from the Hub	3, 4
5.1.1	Trip information shall automatically be sent to the Hub using the data elements and message formats specified in section 3.1 and associated documents. All required elements (or null values if appropriate) shall be included in message sets.	3, 4
5.1.2	Client, trip, and other information relevant to the scheduling and delivery of the trip sent to the Hub to be available for another provider shall be produced by the scheduling system's database and standard functionalities.	3, 4
5.1.3	The scheduling system shall automatically send updated trip information for trips submitted to the hub, as appropriate, whether claimed or unclaimed.	3, 4
5.1.4	The scheduling system shall have a means to track and report on trips sent to the Hub.	3, 4
5.2	The software vendor shall adapt its software to send, receive, read, and act on all messages identified in the message sets in section 3.1.4.	1, 2, 3
5.2.1	The scheduling software shall produce each message, using the message formats and data elements defined in section 3.1.	3, 4
5.2.2	The scheduling software shall be capable of receiving, reading, and automatically acting upon each message, using the message formats and data elements defined in section 3.1.	3, 4
5.2.3	The scheduling system shall send completed trip data to the Hub in near real time.	3, 4
5.3	The software vendors shall assure that trip data for clients registered in more than one system is not changed when any system with which the passenger is registered uses the Hub to schedule a trip.	1, 2, 3
5.3.1	Characteristics such as boarding or alighting times, which may change by trip, shall not overwrite the database in the provider agency's scheduling system.	3, 4
5.3.2	All CNR trips shall automatically be scheduled through the RM scheduling systems (or other Provider scheduling systems) and be displayed on a uniform drivers' manifest.	3, 4
5.4	The scheduling software shall provide a notes field for drivers regarding client, pick up points, road closures, etc.	3, 4
5.4.1	Either a flag on the driver's manifest or an alert shall be used to notify the driver there is a note that needs to be viewed.	3, 4

ID	Functional Requirement	Goal
6.1	<p>The system shall provide for the following control of trips:</p> <ul style="list-style-type: none"> • The agency posting the trip (owner) has control over trip until it is claimed by another provider and may change the status of the trip or remove it from the Hub. • Once claimed, the providing agency maintains control of the trip until service is delivered and it is their responsibility to provide the trip. • The agency with control of the trip is responsible for: <ul style="list-style-type: none"> ○ Providing the trip except in unusual circumstances (e.g., snow) ○ Notifying the customer of any changes in status • Notifying the owner of the trip of any changes in status. 	1, 4
6.2	<p><u>Unscheduled Trips</u> on RouteMatch systems, that meet other qualifications, are eligible to be sent to the Hub.</p> <ul style="list-style-type: none"> • Passenger trips offered through the Hub shall remain available until the day before requested travel • Unclaimed trips shall return to the "Unscheduled Trips" status in the scheduling software. 	1, 4
6.2.1	For medical trips, notice shall be provided 48 hours before trip is scheduled.	4
6.3	Trip scheduling request. The advance period for requesting trip scheduling is one to seven (1 – 7) days; no same day requests. One (1) day in advance is defined as by 5 p.m. the day before.	4
6.4	Trip scheduling acceptance. There is no specified period for acceptance, except that pending requests will be removed automatically from the system after seven days, or after the trip expires (whichever is soonest). Once a provider has accepted a trip, the system will send an email to the requestor, and the trip request (trip exchange) is automatically, mutually confirmed (trip confirmation from requestor is not needed).	4
6.5	The Requestor shall inform the client that their trip has been accepted by the appropriate provider and inform them of the fare required. (A possible future enhancement is for the Hub to send notifications)	4
6.6	<p>Requestor Cancellation. A trip Requestor cancelling a trip request shall abide by the following:</p> <p><Two (2) hours before pickup – Call provider and send message to hub. The earliest emails can be sent is 7:30 or 8:00 AM, so telephone calls will be used for all same day changes that occur before 9:30 or 10:00 AM. A procedure will be defined to assure that the call reaches a live body (early in the day this may be a dispatcher rather than a scheduler).</p> <p>>Two (2) hours before pick-up – Send message to hub.</p> <p>There are no consequences for cancellations done as above, i.e., no fees paid.</p>	4
6.7	In the rare circumstance that a provider needs to cancel transportation (i.e.; extreme weather), the provider shall be responsible for notifying the client and the Hub that no trip was provided. No subscriptions will be exchanged at this time, except as converted to individual trips by requestor.	4
6.8	The Hub shall not exchange subscription trips at this point. Any such trips shall be converted to one-way trips before being sent through the Hub.	
6.9	If there is a change in the trip the Requestor shall notify the client with the following message, "(Provider) will pick you up for your trip and here is their contact information."	

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- A. Message Detail - follows
- B. Data elements
- C. Client Intake Guidelines, Addressing, and Standard Definitions

Appendix A:

Details on Messages: Functional and Data Requirements

General

The trip reservation request message is generated by a Requesting software system, which is requesting a collaborating system to take responsibility for scheduling and execution of a trip reservation request that the Requesting system cannot accommodate. The message from the requesting system must provide all data elements relevant to the external, collaborating system – referred to as the “scheduling system” – that the latter needs to be able to schedule the trip onto the vehicle resources that it controls. The primary data elements include the following:

- Trip ID (from originating system)
- Passenger identifier (name, etc.)
- Requested pickup or delivery date/time
- Pick-up location (address, geocode)
- Drop-off location (address, geocode)
- Wheelchair indicator
- Other device indicator (walker, etc.)
- Service animal indicator
- Attendant indicator
- Special needs notes
- Time window before – if the passenger can be picked up prior to the requested pickup time, this field will be populated with the value of how many minutes in advance of the requested time it will be feasible to pick-up the passenger.
- Time window after – the time window in the host system for the number of minutes after the requested PU time that the passenger is willing to be picked up, likely to be a system-defined parameter
- Maximum fee – the maximum fee that the originating organization is willing to pay to have this trip delivered. If this value is null, it means that the agency responsible for delivering the trip will use its pre-defined fee formula (e.g., \$5 flag drop, \$1.50 per mile) to generate the fee for the trip.
- Trip confirmation time – if this field is null, there is no requestor-specified time limit on when the trip needs to be scheduled and confirmed, although as a practical matter there will be a default system-specified value such as 1 hour prior to requested pickup time by which a provider must

“claim” the trip. If there is a value in this field it means the trip must be confirmed by the provider organization to the requesting organization prior to the trip confirmation time. After the trip confirmation time is reached, the host system can no longer change anything about the trip.

- Hub trip ID—the hub system will generate a unique identifier for each trip request, which will enable it to be tracked in both the originating system and the scheduling system which has assumed responsibility for the trip—provided by data hub.
- Date/time that the trip-scheduling request is being made—provided by data hub.

There are other data elements that are desirable but not essential to the functionality of the data exchange hub.

Primary Messages

Below is a description of the primary messages.

1. Pending trip requests

The pending trip requests message instructs the data hub to provide to the requesting software application a list of all trip reservation requests that remain open, i.e., have not been “claimed” by a service provider, subject to certain qualifying criteria as specified below. If no criteria are provided by the requesting application, all current open requests are provided. The data returned to the invoking application include all data elements specified in the trip reservation request message. There will be as many “records” in the message as there are pending trip requests.

The requesting system can filter the list of pending trip reservation requests returned to it by using one or more of the following criteria:

- Trip requestor (agency) ID
- Host system Trip ID
- Date range of trip reservation requests—this could be a single day
- Date range of when trip reservation requests were issued
- Hub Trip ID

2. Trip scheduling acceptance

The trip scheduling acceptance message is sent by an external software application to the data hub, and informs it that the trip scheduling request for the specified trip ID has been accepted by a specified transportation provider. This will change the trip status for the specified trip ID in the data hub’s database. Note that with the one-way data communication paradigm, the host system, which “owns” the trip is responsible for sending a trip status message to the data hub to determine if a trip actually has been scheduled by a provider. The data elements contained in the trip scheduling acceptance message are the following:

- Hub Trip ID
- Host system Trip ID
- Trip Provider ID (organization that is providing the transportation)

-
- Trip Provider name
 - Promised pickup date/time
 - Pickup time window (number of minutes after promised pickup time that passenger may have to wait until actual pickup)
 - Trip Provider Vehicle ID—optional, not required initially, provided prior to actual pickup
 - Trip fee—nullable, if value is null the trip fee will be based on fee formula for provider (which can be obtained via user interface in data hub)
 - Trip confirmation flag—set to Null if no confirmation by trip requestor required, initially set to False if trip confirmation required as trip requestor will not have confirmed acceptance of trip by provider yet
 - Notes

3. Trip confirmation

The trip confirmation message is sent by the trip requestor to the data hub confirming that they agree—or not—to a transportation provider assuming responsibility for delivery of one of their specific trips. If the response is positive, then the provider “owns” the trip from that point forward except in the case of a trip cancellation. If the response is negative, then the status of the requested trip is changed back to being available for another provider. Note that with the one-way data communication paradigm, the provider must use the trip status message to determine if a host system has confirmed the provider’s “claim” on a trip. It is possible to configure the trip exchange so that trip confirmations are automatic, that is, there is no requirement that the trip “owner” approve a trip claim. It is also possible to create “trusted” relations among participants in the trip exchange and to restrict automated trip confirmations to such trusted partners, with other trip claims needing to be explicitly confirmed by the organization that “owns” the trip. The following data elements must be present in a trip confirmation message:

- Hub Trip ID
- Host system Trip ID
- Provider ID
- Trip confirmation flag—set to True if trip requestor accepts delivery of trip by provider ID associated with record, set to False if trip requestor does not wish to have trip delivered by provider ID claiming the trip
- Comments—any special messages from the trip requestor to the trip provider which are pertinent to the confirmation or denial of the latter’s trip claim

4. Trip cancellation request

A message sent by the trip requestor to the data hub specifying that the trip identified is no longer to be performed, and any resources associated with performing the trip by the provider can be released.

Trip cancellation requests are specific to individual trips; if all trips on a day are being cancelled, a message must be sent from the requestor to the data hub for every trip for that day. Note that with the one-way data communication paradigm, trip providers must use the trip status message to determine if a host system has cancelled any of the trips that they “own”. The following data elements must be present in a trip cancellation message:

- Hub Trip ID
- Host system Trip ID
- Cancellation date/time
- Cancellation reason (a list of standard reasons for cancellations will be developed).
- Comments – any special comments about why the cancellation occurred.

5. Provider trip cancellation notice

There may be situations in which the trip provider is forced to cancel a trip request that they had previously agreed to serve. For example, if insufficient vehicles or drivers are available, or adverse weather limits the amount of service that can be provided on a particular day, then fewer trips can be served and some may need to be cancelled. In such a case, the trip provider can send a message to the data hub, where it will be available for the trip requestor, to inform the latter of the cancellation situation. All trip cancellation messages must reference the specific trip ID whose trip with this provider is being cancelled. Note that with the one-way data communication paradigm, trip requestors must use the trip status message to determine if a provider has cancelled any of the trips that they have previously claimed, or to otherwise determine the status of those trips. The following data elements are required in the message:

- Hub Trip ID
- Host System Trip ID
- Provider ID
- Cancellation date/time (the date/time when the provider generated the cancellation)
- Cancellation reason (a list of standard reasons for cancellations will be developed).
- Comments – any special comments about why the cancellation occurred

6. Trip completion/execution message

After trips have been executed, the trip provider must communicate back to the hub database the information about the actual trip logistics, which will then enable the trip requestor (originator) to have access to this data. A single message can contain many trip records, each of which must have the following required data elements:

- Hub Trip ID
- Host System Trip ID

-
- Provider ID
 - Actual Pick-up location (address, geocode)
 - Actual Drop-off location (address, geocode)
 - Actual Pickup Time
 - Actual Drop-off Time
 - On-board distance
 - On-board travel time
 - Total number of passengers
 - Wheelchair flag
 - Other device flag
 - Attendant flag
 - Service animal flag
 - Actual trip cost
 - Notes

7. Trip status request

This is a message sent by any organization participating in the trip exchange to the data hub which requests the status of either a specific trip or a set of trips. The options for identifying trips include the following; one or multiple parameters can be specified in the message. The most restrictive subset will be generated if there are multiple parameters. For example, if both provider ID and a date range are provided in the message request, then the data returned will include only the trips for the specified provider for the days included within the date range. *This message type has not yet been implemented.*

- Hub Trip ID
- Host System Trip ID
- Provider ID – provides all scheduled, cancelled and completed trips for specified provider
- Date range – will provide a list of all trips for the specified date range and the status of each
- All Future – provides the status of all trips not yet performed (including current day trips)
- All Past – provides the status of all trips that have been performed (including current day trips)
- All – will provide the status of all trips in the system, both past trips and future trips

For each trip that is included in the set of trips returned by the data hub, the following data elements are present:

- Hub Trip ID

-
- Host System Trip ID
 - Provider ID (may be null if trip not claimed for scheduling)
 - Current trip status (pending, scheduled, confirmed, cancelled, completed, reported)
 - Passenger identifier (name, etc.)
 - Requested pickup or delivery date/time
 - Pickup or delivery request type
 - Actual pickup date/time (nullable)
 - Actual drop off date/time (nullable)
 - Pick-up location (address, geocode)
 - Drop-off location (address, geocode)
 - Wheelchair indicator
 - Other device (walker, etc.) indicator
 - Service animal indicator
 - Attendant indicator
 - Special needs notes
 - Trip confirmation comments
 - Trip cancellation comments
 - Trip completion notes
 - Trip reservation request date/time
 - Trip scheduling date/time (nullable)
 - Trip confirmation date/time (nullable)
 - Trip cancellation date/time (nullable)
 - Trip cancellation organization ID (requestor ID or provider ID, nullable)
 - Trip cancellation organization role (requestor/provider, nullable)
 - Trip completion date/time (nullable)
 - Trip reported date/time (nullable)



FILE 1.1. New Trip Data File	FILE 1.3 (Trip Claim)	File 1.7 (Trip Complete)
clearinghouse_trip_id	<i>clearinghouse_trip_id</i>	<i>clearinghouse_trip_id</i>
trip_id	<i>trip_id</i>	<i>trip_id</i>
status	proposed_pickup_time	outcome
provider	proposed_fare	actual_pickup_time
customer_id	claim_notes	actual_drop_off_time
customer_first_name	claiming_provider	fare
customer_last_name		fare_type
customer_middle_initial		odometer_start
customer_dob		odometer_end
customer_primary_phone		driver_name
customer_emergency_phone		vehicle_name
customer_home_address_id		
customer_home_address_type		
customer_home_telephone		
customer_home_telephone_extension		
customer_home_common_name		
customer_home_address_1		
customer_home_address_2		
customer_home_city		
customer_home_county		
customer_home_state		
customer_home_zip		
customer_home_latitude		
customer_home_longitude		
customer_home_edge_id		
customer_primary_language		
customer_sex		
customer_race		
customer_internal_id		
customer_notes		
customer_load_time		
customer_unload_time		
customer_seats_required		
customer_mobility_requirement		
customer_assistance_needs		
customer_eligibility		
num_attendants		
num_guests		
attendant_mobility		

guest_mobility
pickup_address_id
pickup_address_type
pickup_telephone
pickup_telephone_extension
pickup_common_name
pickup_address_1
pickup_address_2
pickup_city
pickup_county
pickup_state
pickup_zip
pickup_latitude
pickup_longitude
pickup_home_edge_id
drop_off_address_id
drop_off_address_type
dropoff_telephone
drop_off_telephone_extension
drop_off_common_name
drop_off_address_1
drop_off_address_2
drop_off_city
drop_off_county
drop_off_state
drop_off_zip
drop_off_latitude
drop_off_longitude
drop_off_home_edge_id
requested_pickup_date
requested_pickup_time
requested_drop_off_date
requested_drop_off_time
early_window
late_window
timing_preference
trip_purpose
trip_funding_source
trip_notes
estimated_trip_travel_time
estimated_trip_mileage
trip_type
trip.service.animal

Flag

trip.isolation
Requested Trip Time Outside Core
Hours?
Car Seats

Flag

Numeric

Custom Customer Field 01
Custom Customer Field 02
Custom Customer Field 03
Custom Customer Field 04
Custom Customer Field 05
Custom Trip Field 01
Custom Trip Field 02
Custom Trip Field 03
Custom Trip Field 04
Custom Trip Field 05

Require Both Name &
Field Value

*Cannot support until
an API is used*





I. Client Intake Guidelines

Purpose: To properly enter all data into RouteMatch to produce consistent reporting or gathering of data.

Frequency: As needed

Procedure: The following guidelines are to be followed when entering any information into RouteMatch. Keep in mind not only is this information used for trips but mailings and statistics and DRCOG reporting. All entries must be professional and accurate.

All fields with * on intake form designate demographic data collected by the state and federal government to support the need for continued funding for this program. This data will be de-identified and used in aggregate form to complete statistical information. None of the data is sold to a third party and any personal information will only be used in an effort to better serve the client in providing him/her services.

General: Upper and lower case is be used

No periods

First Name: Proper and accurate with no "quotes", no (xx) using what the customer desires to be addressed as (use your discretion). To be most client friendly please ask the client how they wish to be addressed understanding mailings will use the same. (Example: Mary wants to be called Diamond =Diamond, Edward wants to be called Ed=Ed, George Bob wants be called Bob=Bob, Bobby wants to be called Butch=Butch.

Official Name: When using a nickname or shortened name please use this filed to put in the legal name.

Last Name: Spaces are allowed as per Clients wishes, use hyphens, Use upper/lower as told by client, and apostrophe.

(Example: Van Gordon, Smith-Gordon, O'Brian)

- When searching in RM you will have to search both ways when it comes to spacing. Make sure to do this before creating duplicate record.

Address: Use address abbreviation guide, using address 2 line for apartment # or building # if needed. Please refrain from using the # symbol and just put the numeric or alpha information.

Date of birth: Since our program is specifically for the elderly, particularly for persons age 60 or over, the date of birth needs to be filled in. In the client refuses please enter January 1 and the year which would make them the age they are stating. Then indicate in comments client would not provide DOB.

Language: Is that most understood or spoken even if many apply.

Ethnicity & Hispanic or Latino: please choose from categories in drop down screen for ethnicity and mark yes/no for other. In addition to ethnicity question you must also ask if the client is Hispanic or Latino. These are 2 different questions that need to be asked separately and a separate answer provided.

Elderly: If client is over 75 *[Note: Broomfield checks elderly for everyone over 60 so they can pull reports quickly. Would SRC be willing to change on this?]*

Or

Age 60-74 wheel chair, or needing assistance with 2 daily life functions

(wheelchair, oxygen, cooking, walking as examples)

Disabled: Please use when client is in wheelchair, vision/hearing impaired, physical or mental disability or other qualifying disability

Low income: Under poverty level as stated on intake form

How many people live in household: needed for statistical purpose only, if client refuses for any reason put n/a

What is your monthly household income (from all parties in household including self): needed for statistical purpose only, if client refuses for any reason put n/a

II. Addressing Abbreviations

Purpose: To properly enter all data into RouteMatch to produce consistent reporting or gathering of data.

Frequency: As needed

Procedure: The following guidelines are to be followed when entering any information into RouteMatch.

Upper and lower case is be used

No periods

Abbreviations:

Apt = Apartment

Ave = Avenue

Bldg = Building

Blvd = Boulevard

Ctr = Center

Ct = Court

Dr = Drive

E = East

Hwy = Highway

MHP = Mobile Home Park

N = North

Pkwy = Parkway

S = South

Sp = Space

Ste = Suite

St = Street

Svc = Service

Th = Town Home

Wy = Way

W = West

III. Standard Definitions

Mobility Requirements

Ambulatory
Wheelchair
Knee Walker
Unstable needs assistance
Walker
Ambulatory Lift
Ambulatory
Scooter
Extended Leg W/C
D2D Ambulatory

Service Needs*

Oxygen
Walker
VIP = Visually impaired
HIP = Hearing Impaired
MIP = Memory Impaired
Wheelchair
Electric Wheelchair
Wide Wheelchair
Wheelchair, can transfer
Scooter
D2D = door to door
DTD = door through door
NLA = never leave alone/no leave alone
Crutches
Cane
Service Animal
Driver Alert
IDD = Intellectually or developmentally disabled
SD = Seizure Disorder
Other

*Gate codes and “unstable” will move to notes instead

Trip Purpose*

Medical
Personal
Employment
Adult Day Program
Grocery
HR = Health Related (includes dentist, pharmacy, etc.)
Dialysis
Recreation

*There may be other codes that providers may use but those trips are not likely to be put in the hub (for example, Broomfield meal program code).

Medical Problem ID

MIP = Dementia
VIP = Vision Impaired
HIP = Hearing Impaired
IDD = Intellectually or developmentally disabled
SD = Seizure Disorder
Mental Health
Speech Impaired
Temporary Disability
Neurologic and Degenerative Diseases
Kidney Disease