Phase 1 User Needs Identification and Requirements Planning (UNIRP)

Heart of Iowa Regional Transit Agency ITS4US Deployment Project

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COMPLETE TRIP
ITS4US

U.S. Department of Transportation

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Santosh Mishra, Brooke Ramsey, Max Devilliers	N/A

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15. Supplementary Notes

Fred Bowers (FHWA)

16. Abstract

The User Needs Identification and Requirements Plan (UNIRP) outlines the process that the HIRTA team will follow for identifying user needs, developing concept of operations and then subsequently defining system requirements. The document also provides the current schedule for developing needs and requirements. Also, the document describes configuration management process for the user needs and requirements in the event changes/updates are necessary.

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Santosh Mishra	15 March 2021	V 1.0	Initial Draft	Brooke Ramsey
Max Devilliers, Santosh Mishra	12 April 2021	V 2.0	Addressed USDOT Comments	Brooke Ramsey
Santosh Mishra	26 April 2021	V3.0	Addressed USDOT Comments	Brooke Ramsey

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1. Introduction

The User Needs Identification and Requirements (UNIRP) document describes the processes to be followed for collecting user needs, developing concept of operations, and defining requirements based on user needs. The document also describes the process for configuration control of user needs and requirements in the event of any changes necessary during the course of the project.

The UNIRP will serve as the resource for identifying all needs early and accurately. Also, it will serve as the foundation for the Systems Engineering Management Plan (SEMP) that will be delivered later in Task 12.

1.1. Project Background

The Heart of Iowa Regional Transit Agency (HIRTA) is one of the 5 awardees for Phase 1 of the Complete Trip – ITS4US contract for its proposed concept *"Health Connector for the Most Vulnerable: An Inclusive Mobility Experience from Beginning to End"* (Health Connector) by the United States Department of Transportation (USDOT).

The Health Connector deployment will provide enhanced access to healthcare options for "all travelers" in Dallas County with a specific focus on underserved communities, including persons with disabilities, low income, rural, older adults, veterans, and persons with limited English proficiency. The referenced underserved populations' mobility needs vary based on the individual. For the proposed deployment, we plan to develop a scalable and replicable solution that enables inclusive access to transportation and healthcare for all underserved populations and their caregivers by resolving access barriers with use of advanced technologies.

The project will deliver a unified application to provide a true origin to destination wayfinding, transportation, and healthcare experience for all people. In addition to addressing mobility needs, the proposed deployment will recognize the net impact that access to health services have on patient health care outcomes as well as both the financial and health outcomes from the perspective of the health care community/Dallas County Health Department (DCHD).

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Figure 1 provides a visual overview of the concept.
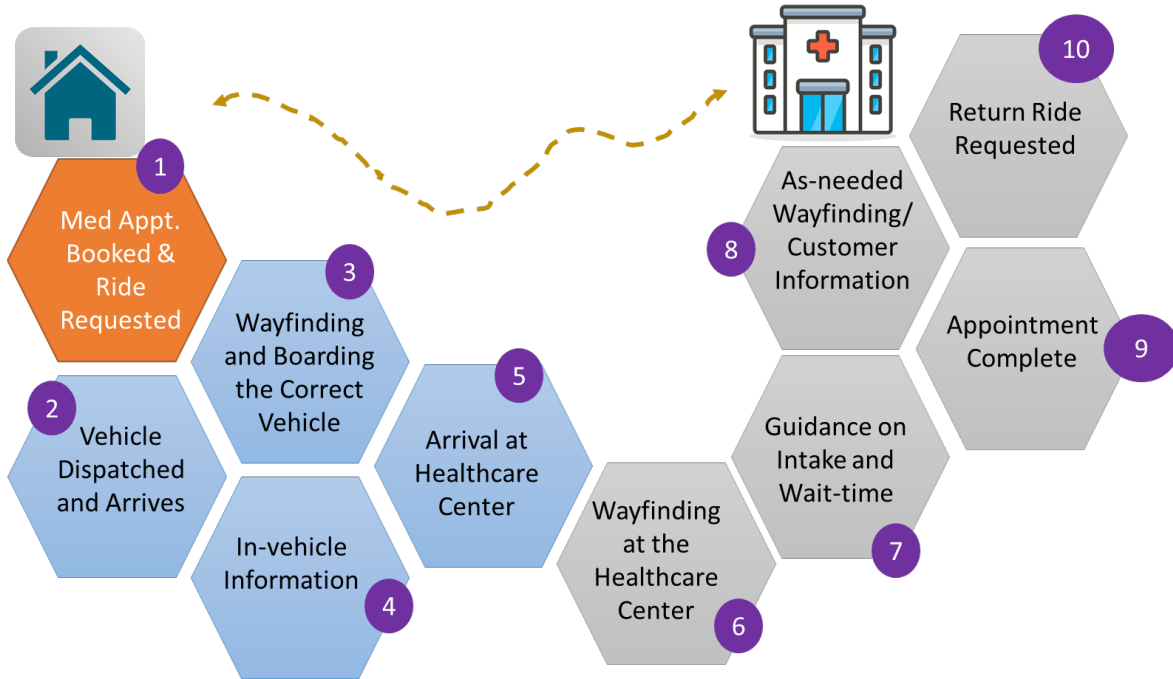
Figure 1. Overview of Health Connector System Concept *(Source: IBI Group, 2020)*

1.2.   Intended Audience

The intended audience for this UNIRP includes HIRTA and its deployment partners, the USDOT and the USDOT representatives. The HIRTA deployment partners include IBI Group, Routematch by Uber, Community Transportation Association of America (CTAA), Dallas County Health Department (DCHD), Capture Management Solutions (CMS), NaviLens, Iowa State University (ISU) and Iowa Department of Transportation (Iowa DOT).

1.3.   User Needs and Requirements Update Process

The HIRTA project team that includes Program Management Lead (PML), System Development Lead (SDL), Concept Development Lead (CDL), Technology Lead (TL), Stakeholder Engagement Lead (SEL) and Healthcare Lead (HL) will be involved in defining, updating and approving the process for stakeholder engagements (see Figure 2 for organizational chart).

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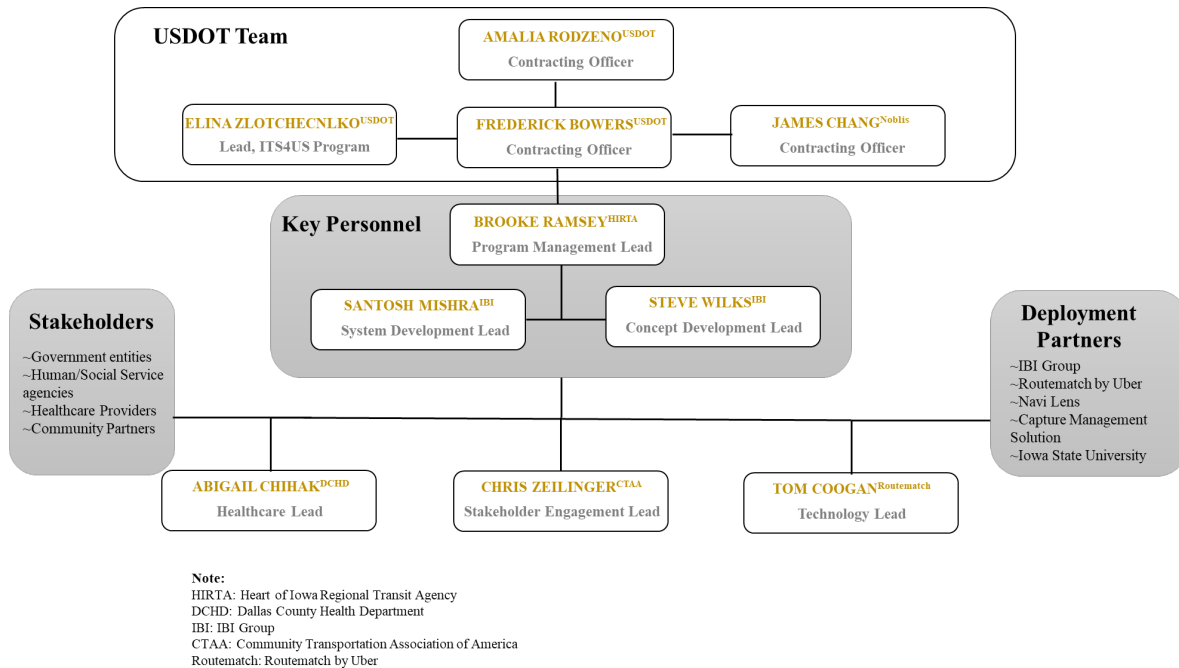
Figure 2. Organizational Chart *(Source: IBI Group, 2021)*

If there is a change in the process identified in the UNIRP document, we will make updates to the document once the internal project team collectively approves the change. After the internal approval, the PML will submit the changes to the USDOT COR for approval. Only after the COR approves, the UNIRP updates will be considered final.

1.4. Applicable Documents

This document identifies the processes that will be used in the creation of the following documents.

- Concept of Operations (ConOps)
- System Requirements (SyRS)

Further, the document will serve as a foundation for the SEMP document.

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2. User Needs Identification

2.1. Introduction to User Needs

The Health Connector solution was conceived to solve the most pressing issues that act as barriers to providing safe and efficient transportation to customers seeking healthcare. This solution will be fully driven by the user needs and the needs will be identified early on during Phase 1. These needs will serve as the basis for subsequent steps of the systems engineering process that include concept of operations development, requirements definition, design, deployment and testing. It is extremely critical to identify all user and stakeholder needs for the overall success of the project. Users in the context of this project refer to the following:

- Customers seeking HIRTA services for medical appointments.

- Call center and Operations staff at HIRTA responsible for using the system for reservations, scheduling, dispatching and administrative needs.

- Call center and reservations staff at healthcare facilities using the system for coordinating medical and transportation appointments.

The needs development process will focus on the following:

- Needs are uniquely identifiable to ensure that they refer to a unique capability desired for the system.

- Needs must include capability statements that call for major features that are desired in the new system.

- Needs should be technology- or solution-agnostic so subsequent steps of requirements definition and design are not tied to a particular solution.

- Needs statement must identify why a change is needed in the current capability of a system/solution.

- Needs to promote this solution as an identifiable resource to those that will use it.

A sample needs statement for Health Connector may be as the following:

> **1.1.1.1. Boarding the Correct Vehicle upon Arrival.** There is a need for HIRTA **c**ustomers to be able to locate and get step-by-step guidance to the vehicle standing by upon its arrival so customers can embark on the correct vehicle in a safe manner.

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2.2.   User Needs Identification Processes

The user needs and ConOps development process will be led by the CDL with support from the SEL and other leads as necessary. In particular, the CDL will work closely with the SDL to ensure needs statements and other details of the ConOps are in compliance with the systems engineering requirements as outlined by the USDOT.

This section defines the process that will be followed when identifying user needs during Task 2 and an illustration of the process is provided in Figure 3. This figure also illustrates how needs will eventually be used for the concept development and the requirements definition. The key steps that will be followed for Task 2 along with applicable deliverables are described below:

- **Step 1:**

  - Review needs that were developed prior to and during the proposal submission.

  - Review of guiding principles in the Broad Agency Announcements (BAA) document for development of needs.

  - Conduct research of transportation providers, socioeconomic and demographic conditions of customers.

  - Identify frequency/extent of barriers to healthcare trips e.g., which are most prominent or critical in the targeted service area

  Contract Deliverables: Draft User Needs Summary and ConOps Review Panel Roster

- **Step 2**

  - Survey specific population groups to obtain desired information, if necessary.

  - Conduct needs workshops with the stakeholder groups that will participate in ConOps development.

  - Conduct one-on-one interviews with HIRTA operations staff and healthcare providers to understand business processes and needs. Conduct other operational assessments to understand existing business processes and system environments.

  Contract Deliverables: Draft User Needs Summary and ConOps Review Panel Summary

- **Step 3**

  - Revise Draft User Needs Summary and ConOps Review Panel Roster.

  - Define operational and technical concepts

  - Conduct stakeholder workshops to discuss operational scenarios/use cases.

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- ○ Coordinate with other area metropolitan planning organizations (MPOs) or other regional transportation planning organizations (RTPOs) on future transportation investments.

  Contract Deliverables: Final User Needs Summary and ConOps Review Panel Roster, Draft ConOps, ConOps Walkthrough Briefing Deck

- **Step 4**

  - ○ Conduct ConOps walkthrough with stakeholders to gain their feedback on the final needs, technical concepts, anticipated changes to business operations, and operational scenarios.

  - ○ Address USDOT Comments on Draft ConOps

  Contract Deliverables: Final ConOps

Steps 5 and 6 of the process referred to in Figure 3 are further discussed in Section 3.

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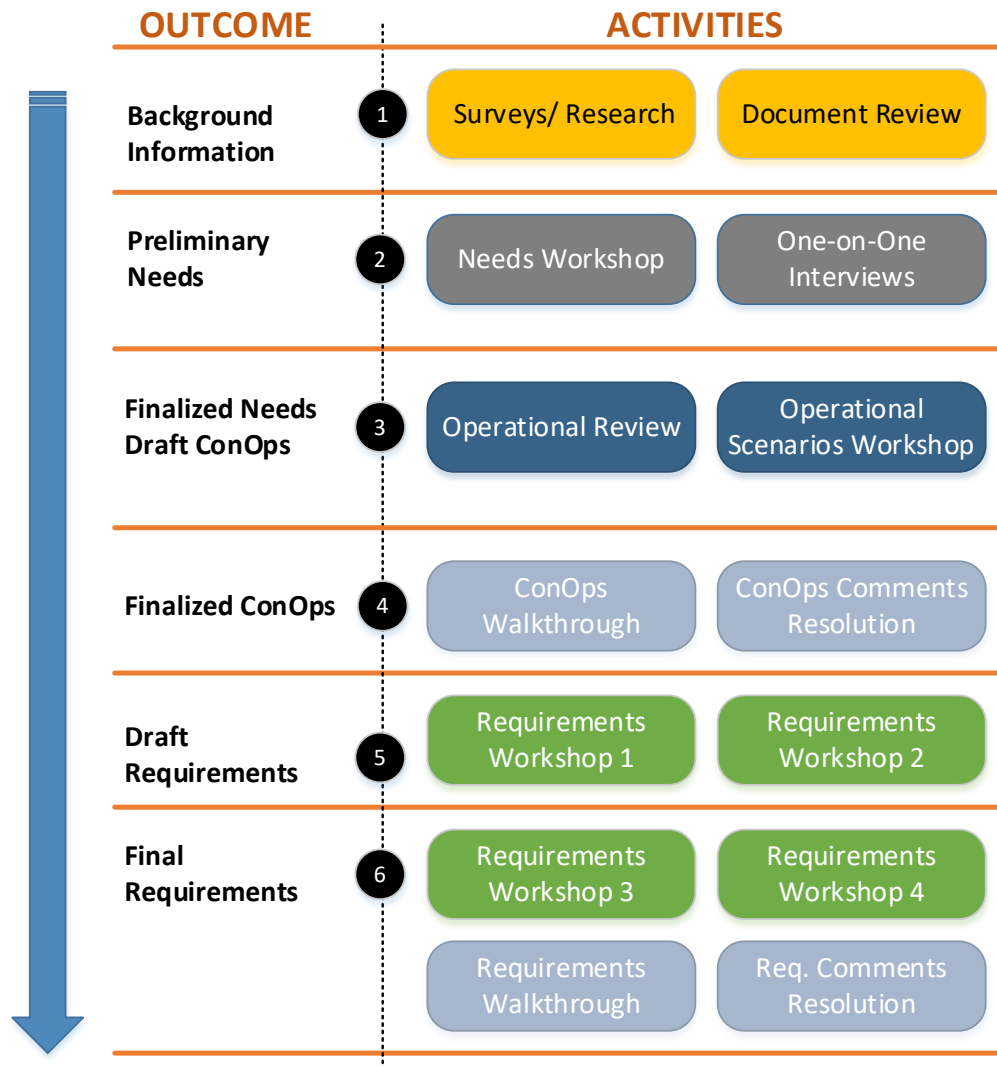
Figure 3. Needs Identification and Requirements Development Process *(Source: IBI Group, 2021)*

2.2.1. Previously Identified User Needs

In 2019, HIRTA started developing a new Business Plan with CTAA, "2021 and Beyond," which was adopted in May 2020. In addition, the Dallas County conducted Community Health Needs Assessment (CHNA) study. These previous studies informed the proposal development process and will serve as the starting point of the Phase 1 needs assessment.

Table 1 lists some of high-level needs identified during proposal development which will be used to develop needs statements. Please note that these are just initial examples and several other topics will also be considered. For example, HIRTA team understands that customers either may not have access to or are not comfortable with solutions available through smart devices and electronic methods. We will design alternate methods (e.g., use of call center, use of digital cash in lieu of electronic payments) to address such issues.

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Table 1. Preliminary Needs by Population Groups

Population Group	Topics
Persons with Disabilities (Mobility/Wheelchair User, Vision, Hearing, Cognitive/Developmental)	(1) Wayfinding services (provided in both audio and visual modes) to the transit vehicle, into the healthcare facility, and to their specific appointment location; (2) Smart device accommodations for visually impaired and deaf/hard of hearing persons; (3) Smart device – user-based settings for ease of use and services preferences;
Older Adults	(1) Smart device - larger screen setting; (2) Smart Device – user-based settings for ease of use and services preferences; (3) Telephone number to call for services; (4) Maintains independence; (5) Solution/service ease of use
Low Income	(1) Contactless Payments: unbanked/underbanked customers; (2) Reliance on HIRTA services: number of personal vehicles per household.
Rural	(1) Access to healthcare appointments; (2) Challenges in coordinating appointment times with availability of transportation; (3) Cost effective transportation solutions; (4) Maintains independence; (5) Solution/service ease of use; (6) Long distance travel may present stamina challenges.
Veterans	(1) Access to veterans hospitals and other veteran support services; (2) Same needs as all above subgroups.
Persons with limited English proficiency	(1) Technology system and services enabling the use of Spanish language; (2) Support to understand all services and technology system developed (e.g., HIRTA travel trainers, DCHD, etc.).

The Health Connector solution will be universally designed to meet the needs of all Dallas County's underserved population, including persons with disabilities, low income, rural, older adults, veterans, and persons with limited English proficiency. As needs vary by the individual, underserved citizens may qualify for one or more these subgroups (i.e., the person may be an older adult, a veteran, a person with a disability and lives in a rural area).

2.2.2. Stakeholder Engagement

HIRTA partners with numerous stakeholder organizations in Dallas County to provide transportation services. In addition, HIRTA partners with many local, state, and federal organizations, such as Iowa DOT, the United States Department of Transportation (USDOT), Federal Transit Administration (FTA), in providing services in the county and region. Figure 4

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provides a list of such stakeholders that will be engaged in the project. The HIRTA team has also identified individuals that will represent these stakeholders.
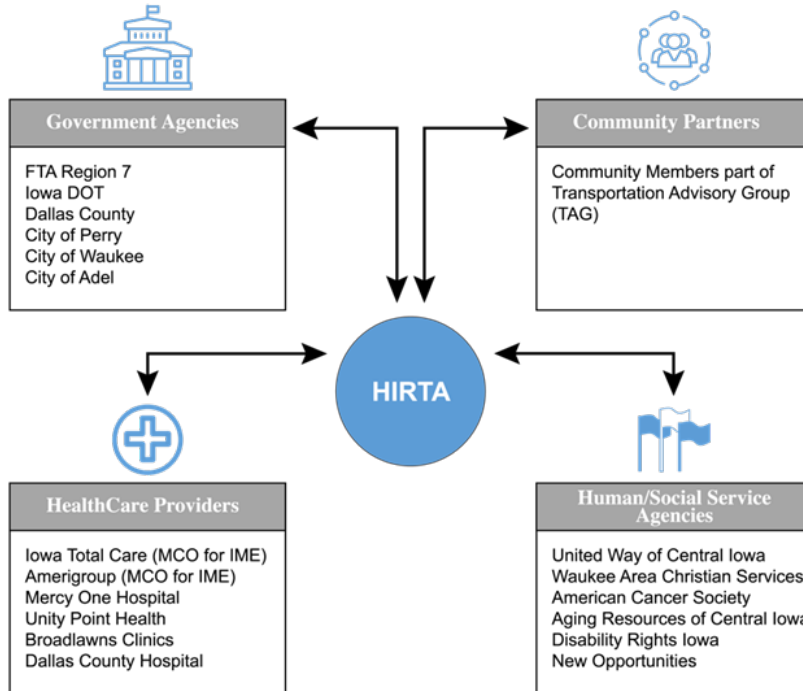
Figure 4. List of Stakeholders *(Source: HIRTA, 2020)*

The HIRTA team will conduct the following stakeholder engagement activities:

Workshops

We have planned stakeholder workshops as part of Task 2 which we will use to engage with stakeholders to understand the issues and gaps in the current system environment and business processes and desires for improvements. We will conduct two (2) workshops as follows:

- Two (2) hour sessions with the two groups, one each from healthcare and non-healthcare-focused stakeholders, for preliminary needs gathering.

- Two (2) hour session with stakeholders for discussion on user scenarios. This workshop will be conducted after one-on-one interviews with select stakeholders are complete (discussed further in the paragraph below).

These workshops will be conducted in form of video conferencing and will be recorded. Further the team will compile detailed notes to inform the needs development activities.

Interviews

One-on-one interviews will be conducted with HIRTA operations staff and healthcare operations staff to understand the current processes and challenges related to medical appointment booking, ride booking, service delivery, customer information, patient intake process and other needs.

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As stated for the workshops, we will compile detailed notes and use those for needs development.

COVID Impact

Given in-person meeting concerns due to COVID-19, the HIRTA Team plans to use appropriate and inclusive digital engagement and collaboration platforms.

For digital engagements, the HIRTA Team is planning to use the following:

1) Miro, a visual collaboration software for detailed discussion with stakeholders during workshops using visual aids.

2) Zoom video conferencing service along with screen sharing, as needed.

2.2.3. Use Case Decomposition

As part of Task 2, the HIRTA team will develop operational scenarios related to every aspect of a door-to-door medical trip. These operational scenarios will help guide the requirements development in Task 6. A few examples of the operational scenarios relevant to the Health Connector solution include immunization visits, preventive care visits, scheduled recurring treatments such as dialysis, prenatal and neonatal care visits, urgent care trips, vehicle breakdown during ride and others. We will develop as many operational scenarios as determined by the needs and describe how Health Connector will help customers in those scenarios end-to-end.

For each of these scenarios, we will consider the entire customer travel chain (e.g., pre-trip, en-route, arrival, check-in, waiting, return trip) so the solution can cater to the Complete Trip needs of customers. The HIRTA team is using *Miro* collaboration software to develop *"customer journey maps"* to identify all touch points for customers with Health Connector system components and users. These will be developed by the 3 key stakeholders who also happen to be users of the system: HIRTA, DCHD and healthcare providers. The stakeholders/users will have an opportunity to comment on these journey maps even after the workshops/meeting events. We will also use these journey maps to identify any sensitive data that may need to be exchanged for completing those touchpoints.

The format of the operational scenario will be as follows:

- Description of the scenario

- Goal to be achieved should be defined to help with performance measurement discussions.

- Technical and non-technical constraints that will be identified during development of customer journey maps (prior to stakeholder workshop) while we identify and further explore the usability and implementation issues for individual system components.

- Technical components involved by identifying all system components.

- Preconditions that need to completed for the scenario.

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- Flows associated with the operational scenario describing various steps necessary to be able to meet the requirements of a particular user scenario.

Once the user scenarios are developed, the team will assess if relevant needs to those scenarios are already captured. If no relevant needs exist, we will define and document those.

The team will also discuss these operational scenarios with stakeholders during the second ConOps workshop as mentioned earlier. During this discussion if we come across any gaps in user needs, we will document those.

2.3.   Concept of Operations Development

Building on the user needs development as discussed in the previous section, we will refine the Health Connector solution to further expand on the following aspects of the concept:

- An integrated healthcare and transportation experience for customers/patients from a single mobile application enabled by interfaces between hospital electronic healthcare record (EHR) such as Epic (used by Unity Point hospital) and Evident (used by Mercy One hospital) systems and Routematch by Uber software currently being used by HIRTA. Customers will also be able to designate a Personal Caregiver to act on their behalf. As an explanation, An EHR is a hospital information management system that allows hospitals to manage patient's electronic medical records, manage appointments, order prescription, manage billing and manage any other necessary medical appointment related and other administrative activities.

    If HIRTA cannot meet the required capacity, the system will allow HIRTA to book a ride using a third party service provider (e.g., taxi or TNC). It is assumed that the third party service providers/contractors will use the same system as HIRTA for reservations, scheduling and dispatching and HIRTA will be identifying terms and conditions accordingly in the vendor contracts. In the event HIRTA allows third party contractors to use their own systems for any of these activities (e.g., taxis, TNCs), they will be required to interface with Health Connector system over an open API or open demand response interface.

- A management system that will provide the Dallas County Healthcare Navigators to assess patients based on their healthcare history and connect them to an appropriate provider. Health Navigators have a critical role as noted on DCHD website, *"Health Navigators connect clients with resources to meet their needs, this may include assistance filling out paperwork, completing phone calls, and learning how to navigate the healthcare system. Navigators meet in-home or a location convenient for the client. The program aims to help clients improve their overall quality of life and advocate for their own health needs."*

    DCHD has indicated that they may be replacing their current system (provider: Healthlead USA) so HIRTA team will be working closely with DCHD (also a stakeholder) to minimize any impact on the Health Connector system design. Based on recent discussions, however, HIRTA team understands that the system used by DCHD is for information and referral management only and no medical appointments are managed within this system. Replacement of the current DCHD system will not impact how Health Connector system will operate. If necessary, the new system will be able to connect with Health Connector or hospital EHR directly over open API. Any user needs associated with how DCHD Health Navigators and other user groups will use the Health Connector system will be fully documented.

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- A wayfinding solution from our partner Navi Lens that will help customers board the right vehicles in a safe manner. Further, after getting dropped off, wayfinding solution will help customers navigate to the right floor and room for the patient appointment. Hospitals that we are partnering with are listed in Figure 4. As part of the needs assessment, we are collecting specific issues related to wayfinding that community partners, hospitals and service providers are aware of through complaints from their customers.

- A comfortable on-board experience when traveling to the healthcare center that keeps customers informed about their trip and may provide customers the ability to find more details about the healthcare facility they are visiting or may provide them an ability to complete pre-appointment paperwork or remote triage activities in coordination with healthcare staff, if possible.

- Electronic payments capability for customers. We will be identifying needs of unbanked and underbanked customers as those related to electronic payments and methods to address those concerns (digital cash or alternate modes of payments).

- Electronic process for billing and reimbursement for HIRTA. HIRTA will bill the funding source and get reimbursed electronically for all trips provided, if such process is supported by funding sources (e.g., Medicaid). Electronic billing/reimbursement requires using HIPAA-compliant electronic data interchange (EDI) message formats and current HIRTA system provider Routematch by Uber already has that interface built for Medicaid.

A key aspect of ConOps development will be definition of operational scenarios as discussed earlier. Apart from operational scenarios, we will also identify the following:

- **Business Impacts**: ConOps will describe any changes to HIRTA business and to those of stakeholders (e.g., DCHD and healthcare partners) in terms of modified policies, standard operating procedures, resource needs, financial impacts and others. We will document these impacts so those can be addressed further when developing plans for Phase 2 under Tasks 7 through 11 and Task 13, and 14.

- **Performance Measures**: Based on stakeholder discussions and identified user needs, we will develop use cases during the ConOps development process. User needs and use cases will help us identify key outcomes of the Health Connector system along with relevant key performance indicators (KPIs) to measure those outcomes. These outcomes and KPIs will also form the basis for Tasks 3 and 5 work and deliverables where performance measurement needs will be discussed further and relevant data needs will be identified accordingly.

2.3.1. Role of ConOps Review Panel

HIRTA team will identify a ConOps Review Panel (CRP) who will be engaged in the workshops and user scenario development. This CRP will be fully engaged throughout the ConOps development process and will be responsible for signing off on the concept once the ConOps walkthrough is complete.

2.3.2. ConOps Development Schedule

The schedule for ConOps development is provided in Table 2.

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Table 2. ConOps Development Schedule

WBS	Task Name	Duration	Start Date	End Date
1.B	**Task 2-Concept of Operations (ConOps)**	**104 days**	**Tue 21-03-23**	**Fri 21-08-13**
1.B.1	**Stakeholder Engagement and Needs Development**	**30 days**	**Tue 21-03-23**	**Mon 21-05-03**
1.B.1.a	Revisit HIRTA Business Plan and CHNA Documents	5 days	Tue 21-03-23	Mon 21-03-29
1.B.1.b	Revisit Stakeholder Registry with TAG	5 days	Tue 21-03-23	Mon 21-03-29
1.B.1.c	Identify ConOps Review Panel (CRP) Group	5 days	Tue 21-03-23	Mon 21-03-29
1.B.1.d	Conduct 2-Days Stakeholder Workshop	2 days	Wed 21-03-31	Thu 21-04-01
1.B.1.e	Compile Stakeholder Needs	12 days	Fri 21-04-02	Mon 21-04-19
1.B.1.f	*Submit Draft CRP Roster*	*0 days*	*Mon 21-04-19*	*Mon 21-04-19*
1.B.1.g	*Submit Draft Needs Summary*	*0 days*	*Mon 21-04-19*	*Mon 21-04-19*
1.B.1.h	USDOT Review of Draft Needs Summary and CRP Roster	3 days	Mon 21-04-19	Wed 21-04-21
1.B.1.i	Address USDOT Comments	2 days	Fri 21-04-30	Mon 21-05-03
1.B.1.j	Identify Additional Stakeholders and Needs, If Necessary	2 days	Fri 21-04-30	Mon 21-05-03
1.B.1.k	*Submit Final CRP Roster*	*0 days*	*Mon 21-05-03*	*Mon 21-05-03*
1.B.1.l	*Submit Final Needs Summary*	*0 days*	*Mon 21-05-03*	*Mon 21-05-03*
1.B.2	**ConOps Document Development**	**50 days**	**Mon 21-04-19**	**Mon 21-06-28**
1.B.2.a	**Develop System Concept**	**20 days**	**Mon 21-04-19**	**Fri 21-05-14**
1.B.2.a.i	Customer-facing Trip Concepts	20 days	Mon 21-04-19	Fri 21-05-14
1.B.2.a.ii	Hospital-interface Concepts	20 days	Mon 21-04-19	Fri 21-05-14
1.B.2.a.iii	Transit Management Concepts	20 days	Mon 21-04-19	Fri 21-05-14
1.B.2.a.iv	Wayfinding Concepts	20 days	Mon 21-04-19	Fri 21-05-14
1.B.2.b	Develop Operational Scenarios	20 days	Mon 21-04-19	Fri 21-05-14
1.B.2.c	Determine Business Impacts	20 days	Mon 21-04-19	Fri 21-05-14
1.B.2.d	Determine Performance Measures	20 days	Mon 21-04-19	Fri 21-05-14
1.B.2.e	Prepare Conops Draft Document	25 days	Mon 21-04-19	Fri 21-05-21
1.B.2.f	Prepare ConOps Briefing Deck	25 days	Mon 21-04-19	Fri 21-05-21
1.B.2.g	*Submit Draft ConOps*	*0 days*	*Mon 21-05-24*	*Mon 21-05-24*
1.B.2.h	*Submit ConOps Walkthrough Briefing Deck*	*1 day*	*Mon 21-05-24*	*Mon 21-05-24*
1.B.2.i	USDOT Review of ConOps Submission	6 days	Tue 21-05-25	Tue 21-06-01
1.B.2.j	Address USDOT Comments on ConOps	3 days	Wed 21-06-02	Fri 21-06-04
1.B.2.k	ConOps Walkthrough	1 day	Mon 21-06-07	Mon 21-06-07
1.B.2.k.i	ConOps Walkthourgh Comments	2 days	Tue 21-06-08	Wed 21-06-09
1.B.2.l	*ConOps Comment Resolution Report (Draft)*	*0 days*	*Wed 21-06-09*	*Wed 21-06-09*
1.B.2.m	USDOT Review of Draft Comment Response	3 days	Wed 21-06-09	Fri 21-06-11

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WBS	Task Name	Duration	Start Date	End Date
1.B.2.n	Update ConOps Based on Resolution of Comments	10 days	Mon 21-06-14	Fri 21-06-25
1.B.2.o	*Submit Final ConOps*	*0 days*	*Mon 21-06-28*	*Mon 21-06-28*
1.B.2.p	*Submit Final Comment Resolution Report*	*0 days*	*Mon 21-06-28*	*Mon 21-06-28*
1.B.3	**ConOps Public Webinar**	**25 days**	**Mon 21-06-14**	**Mon 21-07-19**
1.B.3.a	Prepare ConOps Webinar Presentation Materials	15 days	Mon 21-06-14	Fri 21-07-02
1.B.3.b	Coordination on Webinar Scheduling and Promotion	10 days	Mon 21-07-05	Fri 21-07-16

2.3.3. ConOps Walkthrough

One the draft ConOps document is put together, the HIRTA team will organize a meeting with the stakeholders to walkthrough the ConOps and gather any feedback. The following activities will be performed before and after the walkthrough:

- Development of the draft ConOps document, following the outline provided by the USDOT.

- Development of the walkthrough briefing deck. The briefing deck will be developed in Microsoft PowerPoint considering the following:

  o Current situation and justification for change. This session will also include a complete list of user needs.

  o Proposed system concepts.

  o Operational Scenarios.

  o Business Impacts and Analysis of Proposed systems.

  HIRTA team will use our experience in organizing this walkthrough based on similar sessions in the past and will divide up the walkthrough into focused sessions so not all stakeholders have to participate in the full walkthrough over a 3-days period unless absolutely necessary. However, the detailed agenda will be developed after the draft ConOps is put together. We will finalize the briefing deck and the agenda after consulting with the COR.

- ConOps walkthrough with the stakeholder using Zoom video conference and PowerPoint slide deck. Stakeholders will be provided materials in advance to review if necessary.

- Compilation of stakeholder comments and resolution of comments followed by review by the COR.

- Update of ConOps based on comment resolution report and finalization of ConOps.

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3. Requirements Planning

3.1.   Introduction to Requirements Planning

Building on the deployment concepts for system functionalities and performance criteria as established in ConOps (Task 2), and data needs and performance evaluation approach as defined in Task 3 and 5, we will develop functional, performance, interface and data/workflow requirements in a system requirements document. This document will serve as a high-level design guide for the project describing *"what the Health Connector solution will do."*

This effort will be led by the SDL and supported by other project leads.

Key aspects of our requirements development process will be as follows

- **Driven by Stakeholder needs**: requirements must relate back to a unique user need

- **Requirements traceability**: requirements must be traceable to a source user need, operational scenario, or a parent requirement.

- **Attainability**: requirements will be defined such that those can be realistically met at a defined cost. HIRTA team has started these discussions at the ConOps stage when discussing technical concepts to identify any issues with respect to technologies and interfaces involved.

- **Unambiguity**: requirement language will be stipulated such that the desired functionalities and performance criteria are clearly defined

- **Verifiability**: requirements language will be structured to help ensure that each requirement can be demonstrated using a reasonable test procedure

- **Implementation –free**: Requirements must define "what" a system will do and not "how."

- **Allocate-able**: A requirement must be able to be allocated to a particular system component or interface, or organization.

- **Concise**: each requirement should be complete and concise and should refer to a need.

- **Consistent**: a requirement should not duplicate another requirement or introduce any contradiction.

An example requirement statement for a parent/child requirement combination is as follows

> 1.1 The System shall provide a web-based user interface to simultaneously book a medical appointment and a transportation appointment through a single request from a customer.

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1.1.a. Once the trip is successfully booked, the system shall provide the customer with a 6 character confirmation number for future reference.

1.1.b If the booking is unsuccessful, the system shall provide the customer with a configurable message.

3.2.   Requirement Decomposition

The identification of business and technical requirements will build holistically from the ConOps. As shown in Figure 5, the concepts explored and documented in the ConOps will embed a number of functional areas from which the initial functional requirements will be derived. Figure 5 illustrates how we will build from the concept presented in the ConOps to the system requirements as we work through the concepts.
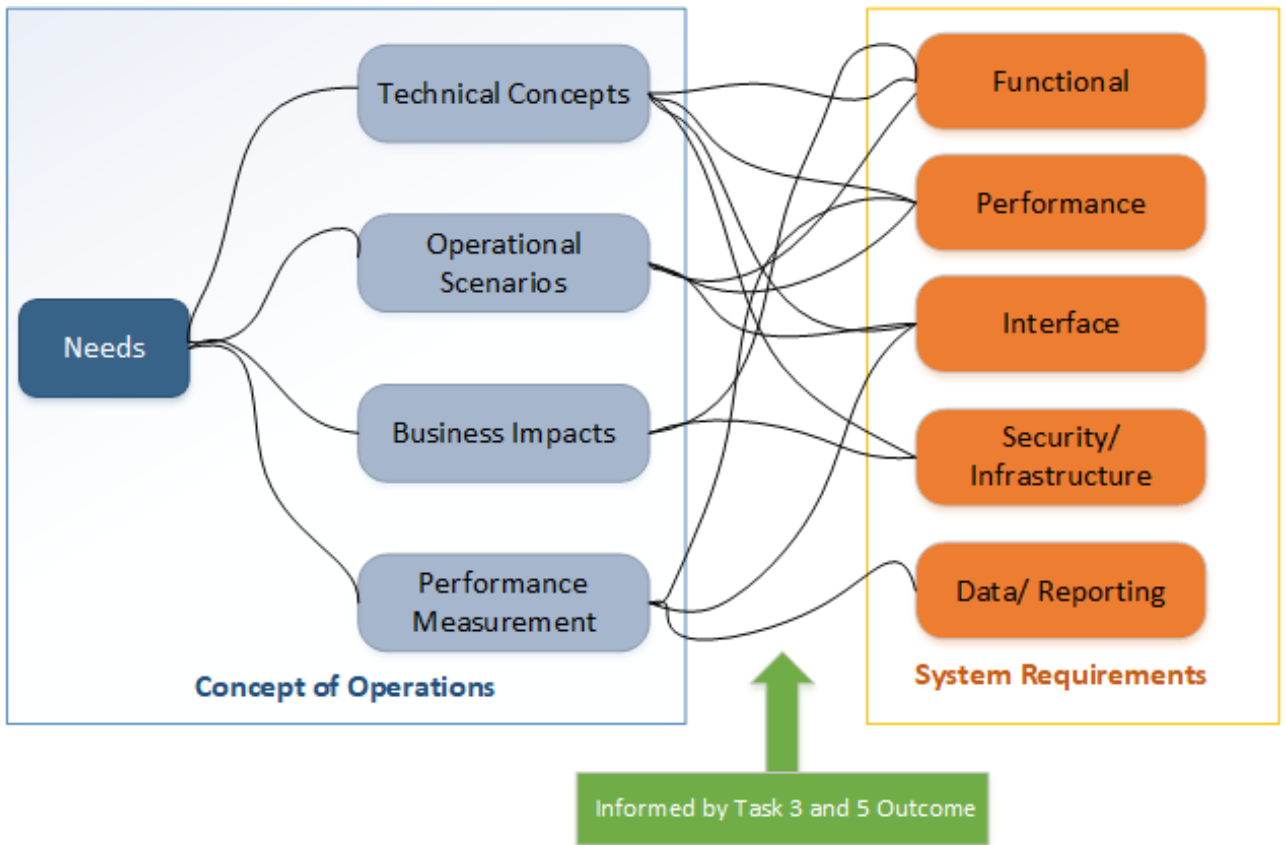
Figure 5. ConOps to Requirements *(Source: IBI Group, 2021)*

The requirements document will focus on the following core aspects: functional definition, usability, performance criteria, interface and integration; and data management and reporting. These requirements will be developed by individual functional categories or modules such as reservation intake module for medical appointments, real-time and batch scheduling, dispatching and real-time service monitoring, electronic manifest management for drivers, real-time

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information and wayfinding for customers and their caregivers, billing/cost-allocation and payments and others.

We will categorize system requirements by hardware, software and data –related components and the requirements development process will take into account the cost, expandability, interfaces with legacy systems in determining feasibility of requirements. These will be documented in the requirements traceability matrix (see section 3.3). For determining feasibility we will rank requirements on a scale of 1-5 for each of the 3 criteria based on HIRTA team's industry experience and research as follows:

- Cost: 1(highly expensive) to 5 (low cost)

- Expandability: 1 (low scalability) to 5 (highly scalable)

- Legacy system interfaces: 1 (complex proprietary interfaces) to 5 (open API/data-based interface)

The most feasible requirements will be those that are low cost, highly scalable and use open API/data-based interfaces. We may also designate requirements as mandatory, desired and optional to show their relative importance.

A brief overview of our approach in developing these is discussed in the following paragraphs:

- **Functional Requirements:** Functional requirements will define what individual components of the Health Connector solution will deliver to meet the identified use cases and operational scenarios in previous tasks. This section will stipulate requirements as they relate to hardware devices on vehicles, software functions used by HIRTA staff, customers and Stakeholders, communication components to facilitate data exchange between vehicles and control center.

  Requirements will include all necessary aspects such as user interaction, data exchange, data processing, visualization, quality control, safety, security and others. A special focus will be on addressing the needs of customers with special needs for customer-facing systems and tools.

- **System Performance Requirements:** Performance will be a very important aspect of requirements given the focus of the proposed solution being on healthcare. Key focus areas of the performance requirements will be on establishing guidelines for response time, maintainability, reliability and availability,

- **Interface Requirements:** Our development partners Routematch by Uber and Navi Lens will provide the critical functionalities of transportation management, customer experience and wayfinding.

  However, a key challenge of this solution will be to identify interfaces with healthcare systems for coordinate transportation and medical appointments and to provide in-vehicle (e.g., orientation, in-take, remote triage) and healthcare center experience (e.g., wait-time and other advisories). It will require an interface with the EHR systems used by hospitals and clinics which vary by hospital. Another interface will be with Navi Lens to provide a seamless wayfinding experience. Other potential interfaces to accomplish any functionalities in-vehicle (safety button, surveillance) or centrally (accounting, billing, payments) will use standard

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interfaces as applicable. Gathering information related to required interfaces is an important aspect of ConOps development exercise and the HIRTA team is using "customer journey map" as a tool (as discussed earlier) to identify any gaps.

- **Data and Performance Management, and Reporting Requirements:** Building on ConOps, Data Management Plan (Task 3) will define various types of data and metadata relevant to the Health Connector solution for the purposes of performance management and reporting, and also for supporting the independent evaluation. The requirements will address needs for data acquisition, processing, storage, management, sharing and reporting.

- **Security/Infrastructure:** There will be a special focus on security and privacy given healthcare data and the requirements will be developed as such. All security and related compute, network, and storage infrastructure requirements will be defined.

3.3.   System Requirements Traceability

The HIRTA team will develop a requirements traceability matrix (RTM) in Microsoft Excel format. The RTM will map each requirement back to a need. Our attempt will be to finalize needs as much as possible by ConOps. If there are any gaps identified during/after requirements, we will follow the change control process identified in Section 4.1.2 to modify documents.

The RTM will become a living document which will be updated until the baseline requirements are developed. Once the baseline requirements have been developed, the HIRTA team will follow the configuration management process (see Section 4) for making changes.

The baseline RTM will subsequently be followed throughout Phase 2 during the design and testing process.

Table 3 shows a format that we will follow for the RTM.

Table 3. Example RTM

User Need ID	User Need	Req ID	Requirement

3.4.   System Requirements Document Development

The following subsections provide an overview and schedule of the system requirements (SysRS) development process. The section describes the following:

- Role of a SysRs Review Panel that will be formed using a key stakeholders and system users.

- Activities to be undertaken for developing the requirements, stakeholder engagement process, review/update process.

- Walkthrough process with stakeholders before the requirements are finalized.

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3.4.1. Role of SysRS Review Panel

The SysRs Review Panel (SRP), will be identified and will be engaged throughout the entire requirement development process. Along with the stakeholders, we will also include actual system users. The SRP will participate in 4 workshops: 2 before the draft requirements are developed and 2 after the comments on the draft requirements are addressed. The SRP will also be engaged in the walkthrough exercise discussed in Section 3.4.3. The composition of the SRP will be as follows:

- Actual users of the system involved in medical appointment and rides management (e.g., customer care staff, dispatchers, reservationists/schedulers, drivers/supervisors).

- Community partner stakeholders representing customers.

- System Administrators in-charge of system operations, maintenance and security.

- Management and Executive staff at HIRTA and healthcare operations, as necessary.

- Internal and external stakeholders that will benefit from data/reporting capabilities.

3.4.2. SyRS Development Schedule

Table 4 provides the schedule for SyRS development.

Table 4. SysRS Development Schedule

WBS	Task Name	Duration	Start Date	End Date
1.F	**Task 6: Deployment System Requirements (SyRS)**	**70 days**	**Mon 21-07-19**	**Mon 21-10-25**
1.F.1	**Stakeholder Engagement**	**65 days**	**Mon 21-07-19**	**Fri 21-10-15**
1.F.1.a	Identify SyRS Review Panel (SRP)	15 days	Mon 21-07-19	Fri 21-08-06
1.F.1.b	Prepare materials for RW1	15 days	Mon 21-07-19	Fri 21-08-06
1.F.1.c	Conduct Requirements Workshop-1 (RW1)	1 day	Wed 21-08-11	Wed 21-08-11
1.F.1.d	*Submit Draft SRP Roster*	*0 days*	*Mon 21-08-16*	*Mon 21-08-16*
1.F.1.e	USDOT Review of SRP Roster	5 days	Mon 21-08-16	Fri 21-08-20
1.F.1.f	Address USDOT Comments to Update SRP Roster	5 days	Mon 21-08-23	Fri 21-08-27
1.F.1.g	*Submit Final SRP Roster*	*0 days*	*Mon 21-08-30*	*Mon 21-08-30*
1.F.1.h	Prepare materials for RW2	15 days	Thu 21-08-12	Wed 21-09-01
1.F.1.i	Conduct Requirements Workshop-2 (RW2)	1 day	Fri 21-09-03	Fri 21-09-03
1.F.1.j	Prepare materials for RW3	25 days	Mon 21-09-06	Fri 21-10-08
1.F.1.k	Conduct Requirements Workshop-3 (RW3)	1 day	Fri 21-10-08	Fri 21-10-08
1.F.1.l	Prepare materials for RW4	5 days	Mon 21-10-11	Fri 21-10-15
1.F.1.m	Conduct Requirements Workshop-4 (RW4)	1 day	Fri 21-10-15	Fri 21-10-15
1.F.2	**Requirements Development**	**70 days**	**Mon 21-07-19**	**Mon 21-10-25**
1.F.2.a	Develop Functional Requirements	46 days	Mon 21-07-19	Mon 21-09-20
1.F.2.b	Develop Performance Requirements	46 days	Mon 21-07-19	Mon 21-09-20

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WBS	Task Name	Duration	Start Date	End Date
1.F.2.c	Develop Data and Reporting Requirements	46 days	Mon 21-07-19	Mon 21-09-20
1.F.2.d	Develop Interface Requirements	46 days	Mon 21-07-19	Mon 21-09-20
1.F.2.e	Prepare Draft SyRS Document	46 days	Mon 21-07-19	Mon 21-09-20
1.F.2.f	*Submit Draft SyRS Document*	*0 days*	*Mon 21-09-20*	*Mon 21-09-20*
1.F.2.g	USDOT Review of SyRS Document	10 days	Mon 21-09-20	Fri 21-10-01
1.F.2.h	Address USDOT Comments on SyRS Document	15 days	Mon 21-10-04	Fri 21-10-22
1.F.2.i	*Submit Final SyRS Document*	*0 days*	*Mon 21-10-25*	*Mon 21-10-25*
1.F.3	**Requirements Walkthrough**	**70 days**	**Mon 21-07-19**	**Mon 21-10-25**
1.F.3.a	Prepare Walkthrough Workbook	46 days	Mon 21-07-19	Mon 21-09-20
1.F.3.b	*Submit Walkthrough Workbook*	*0 days*	*Mon 21-09-20*	*Mon 21-09-20*
1.F.3.c	Coordinate with USDOT on Logistics	3 days	Mon 21-09-20	Wed 21-09-22
1.F.3.d	Conduct Walkthrough and Collect Comments	2 days	Tue 21-09-28	Wed 21-09-29
1.F.3.e	Prepare Walkthrough Comment Resolution Report	3 days	Wed 21-09-29	Fri 21-10-01
1.F.3.f	*SyRS Walkthrough Comment Resolution Report (Draft)*	*0 days*	*Mon 21-10-04*	*Mon 21-10-04*
1.F.3.g	USDOT Review of Comments Resolution Draft	5 days	Mon 21-10-04	Fri 21-10-08
1.F.3.h	Address USDOT Comments on Resolution Draft	10 days	Mon 21-10-11	Fri 21-10-22
1.F.3.i	*SyRS Walkthrough Comment Resolution Report (Final)*	*0 days*	*Mon 21-10-25*	*Mon 21-10-25*

3.4.3. SyRS Walkthrough

One the draft SysRS document is put together, the HIRTA team will organize a meeting with the stakeholders to walkthrough the ConOps and gather any feedback. The following activities will be performed before and after the walkthrough:

- Development of the draft SysRS document, following the outline provided by the USDOT

- Development of the walkthrough briefing deck. The briefing deck will be developed in Microsoft PowerPoint considering the following:

  o Functional requirements.

  o Performance requirements

  o Interface requirements and information security requirements

  o Data and performance management and reporting requirements

  HIRTA team will use our experience in organizing this walkthrough based on similar sessions in the past and lessons learned from ConOps Walkthrough. We plan to divide up the walkthrough into focused sessions so not all stakeholders have to participate in the full

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walkthrough over a 3-days period unless absolutely necessary. However, the detailed agenda will be developed after the draft requirements are put together. We will finalize the briefing deck and the agenda after consulting with the COR.

- SysRS walkthrough with the stakeholder using Zoom video conference and PowerPoint slide deck. Stakeholders will be provided materials in advance to review if necessary.

- Compilation of stakeholder comments and resolution of comments followed by review by the COR.

- Update of draft SysRS based on comment resolution report and finalization of SysRS

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4. Configuration Management

This section defines the configuration management process for maintaining user needs and requirements before and after those are baselined. Further this section clarifies how the change control of needs and requirements will be done given RTM will be used to track needs and requirements while ConOps and SysRS will include the finalized needs and requirements as well.

4.1. Configuration Management Processes

The following subsections describe how user needs and requirements development process will be managed.

4.1.1. Initial User Needs and Requirements Development

The draft needs will be developed by the HIRTA team members collaboratively in a Microsoft Excel document, shared via Dropbox. The CDL will be in-charge of reviewing and compiling draft needs based on the stakeholder engagement process and internal HIRTA team discussions. The CDL will be supported by the SEL for any stakeholder engagement-related items and by the SDL for any systems-related items.

The needs will be finalized and baselined once the ConOps is accepted by the USDOT COR and after the ConOps Webinar is complete.

Similarly the requirements will be baselined once the SysRS document is accepted by the USDOT COR and the walkthrough is complete.

In the event certain items cannot be finalized before the needs or requirements are baselined, we will flag those items as high risk and develop our mitigation plan with the COR. If the project outcome is not affected, we will develop a plan to finalize the needs while we work on a resolution and any relevant future changes will be made to the baseline version using the process outlined in Section 4.1.2. If the items will have an impact on project outcome (e.g., interface with hospital systems, interface between Routematch by Uber and Navilens, development of data format needed by Navilens), we will work according to the risk mitigation strategy.

4.1.2. Baselined User Needs and Requirements

Figure 6 illustrates the configuration/change control process for requirements that the HIRTA team will follow. Before the needs or requirements are finalized, the HIRTA team members will work collaboratively in a Needs (for needs development) document and RTM (for requirements and traceability to needs). These documents will be updated as new needs or requirements are developed or existing ones are updated based on the stakeholder and USDOT feedback. CDL will be in-charge of maintaining the Needs document and the SDL will be in-charge of maintaining the RTM.

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Once the ConOps is finalized, the needs will be consider final and a baseline version will be created. These baseline needs will become the basis of SysRS and RTM documents. The requirements development process will also incorporate input from outcomes of Tasks 3 and 5 as and when needed before the requirements are finalized. Once the requirements are finalized after the SysRS is final, the RTM will be baselined and will become the primary source of requirements and needs.

After the RTM is baselined, any changes requested to 1) incorporate stakeholder feedback; 2) make adjustments for related documents (e.g., Human Use Summary); 3) technology constraints or other reasons will have to be approved by the change control board (CCB). The CCB will be formed of all leads identified for the project: PML, CDL, SDL, SEL, HL and TL.
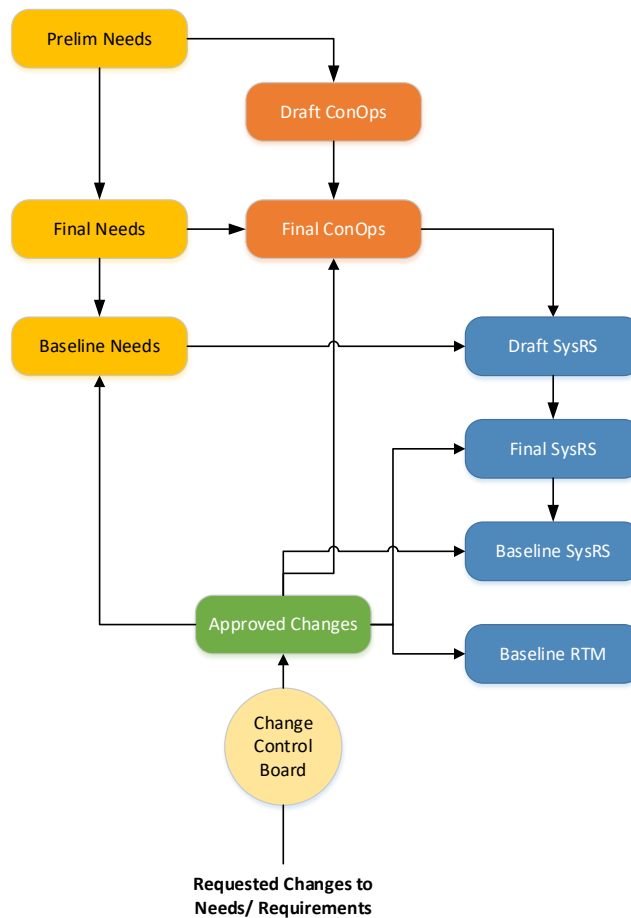
Figure 6. Configuration Management Process *(Source: IBI Group, 2021)*

The CCB will consider at least the following before approving changes:

- Impact on system functionalities

- Impact on system cost

- Impact on system schedule

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- Risks to the project

After it is determined any changes are needed to the needs or requirements, appropriate documents will be updated and will be sent to the COR for approval. The COR comments will be addressed before the changes are considered final.

4.2. Authoritative Source of User Needs and Requirements

For user needs, ConOps will be considered the authoritative source. For requirements, SysRS will be considered the authoritative source. If any changes are necessary, first those will be reflected in the SysRS and the RTM and then further assessment will be conducted to determine additional changes needed to the final ConOps and any other document (e.g., Task 3 and 5 deliverables).

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Appendix A. Acronyms and Glossary

ADA – Americans with Disabilities Act

Refers to the civil rights legislation passed and signed into law in 1990 to prevent discrimination against people with disabilities.

CHNA - Community Health Needs Assessment

Refers to the Community Health Needs Assessment Report developed by Dallas County in 2019.

CO: Contract Officer

The CO will serve as the USDOT point of contact for any concerns related to the contracts.

COR - Contract Office Representative

The Contract Office Representative will serve as the USDOT representative for this project and is responsible for coordination and review of the proposers work.

CTAA – Community Transportation Association of America

One of the project Partners who will lead stakeholder engagement on this project.

DCHD – Dallas County Health Department

One of the project Partners who will lead integration with healthcare services.

DMP – Data Management Plan

The Data Management Plan is Task 3 of Phase 1 and will describe the approach for data collection, processing, storage and utilization.

DOT – Department of Transportation

The government department responsible for transportation. In this report this generally refers to either the State of Iowa's DOT or the United States DOT referred to as Iowa DOT and USDOT, respectively.

EDI – Electronic Data Interchange

In this context, refers to the electronic data interchange (EDI) format messages developed by HIPAA following American National Standards Institute (ANSI) X12 standard for electronic data exchange and are used to communicate with third party healthcare provider systems (e.g., Medicaid).

EHR – Electronic Healthcare Record

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Refers to the healthcare information management system used by hospitals for patients' healthcare-related appointments, transactions and records management.

GTFS – General Transit Feeds Specification

GTFS is a standard to provide static public transportation schedule information. The standard has been expanded to include real-time passenger information (GTFS-realtime), flexible services (GTFS-flex) and accessible routing within stations (GTFS-pathways).

HIPAA – Health Insurance Portability and Accountability Act of 1996

Provides guidelines for data protection of sensitive patient health information.

HIRTA - Heart of Iowa Regional Transit Agency

Rural, regional public transit agency in central Iowa. HIRTA will serve as Proposer/Applicant for the Complete Trip project.

HL7 – Health Level Seven International

A not-for-profit, standards developing organization focused on electronic health information.

ICTDP – Integrated Complete Trip Deployment Plan

The Integrated Complete Trip Deployment Plan is a deliverable of Task 13 under Phase 1.

IPFP - Institution, Partnership and Financial Plan

The Institution, Partnership and Financial Plan is a deliverable of Task 10 under Phase 1.

ISU– Iowa State University

Iowa State University is a public research university with multiple campuses in the State of Iowa and will be engaged as the research and evaluation partner in Phases 2 and 3.

KPI – Key Performance Indicators

Represents primary metrics used to assess the success of a project or operations.

LEP – Limited English Proficiency

Refers to individuals who have a limited ability to read, speak, write, or understand English.

NEMT – Non-emergency Medical Transportation

The provision of transportation to patients for medical appointments, lab visits, and other routine care.

PII – Personal Identifiable Information

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Refers to any data that can distinguish an individual, either alone or when linked with other available data.

RWP – Requirements Working Group

Is subset of identified stakeholders that will guide the requirements development process.

SEMP – System Engineering Management Plan

A System Engineering Management Plan describes how systems engineering process of planning, design, and deployment is applied to a project.

SMP – Safety Management Plan

A Safety Management Plan describes the steps to be taken to ensure the safety of the project stakeholders and beneficiaries.

TAG – Transportation Advisory Group

The TAG is a diverse group of community stakeholders and business representatives interested in the advancement and improvement of public transportation in the HIRTA service area.

TNC – Transportation Network Company

Encompasses a group of companies that provide on-demand Ridehailing services.

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