# Smart Travel Concierge System (STCS) Requirements Specification

## Leveraging Innovative Technology to Develop the Smart Travel Concierge System to Facilitate Pre-Trip Planning and Virtualization for Individuals with Cognitive Disabilities

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# Executive Summary

This System Requirements Specification establishes the functional, performance, design, development, and verification requirements for this project. Requirements are detailed for each subsystem that is being developed and/or enhanced based on several cognitively accessible technologies as part of AbleLink Project #2: Leveraging Innovative Technology to Develop the Smart Travel Concierge System (STCS) to Facilitate Pre-Trip Planning and Virtualization for Individuals with Cognitive Disabilities. Specially designed methodologies are required to overcome cognitive limitations experienced by individuals with cognitive disabilities and others with limited ability to use mainstream travel tools to enable these individuals to more independently engage in pre-trip preparation activities. Unique applications and tools are being created by AbleLink Smart Living Technologies to use cloud-based and mobile technology, such as web apps, tablets or smartphones, to deliver these methodologies for enabling individuals to prepare for travel more independently despite existing cognitive limitations or existing difficulty using public transportation systems.

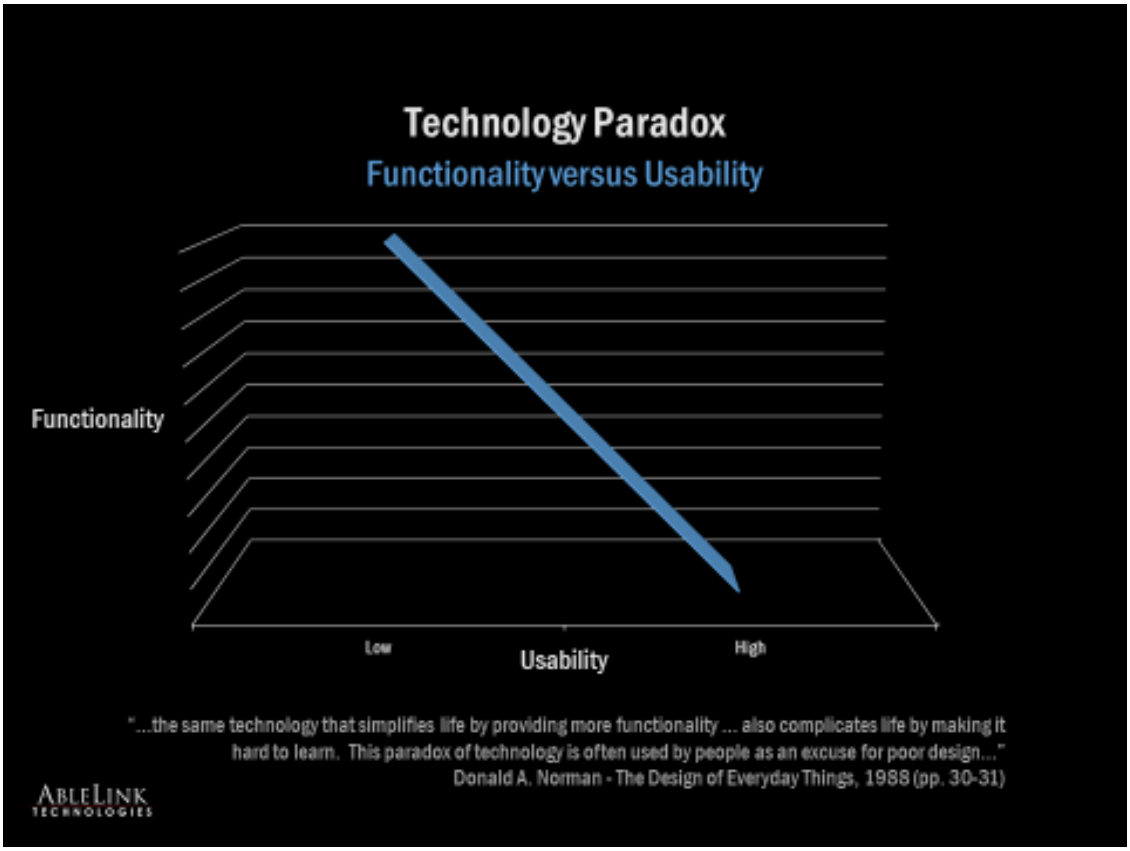
STCS is a suite of technologies that work together to support necessary assessment, training, pre-trip planning and virtualization activities developed to be accessible to individuals with cognitive disabilities to support increased independent use of fixed route public transportation and to reduce the need to use costlier paratransit services. STCS provides an innovative learning curriculum, as well as trip execution technologies for giving individuals who may not be currently using public transportation the opportunity for more transportation options. The expected result is a more normalized lifestyle for individuals with cognitive disabilities, veterans and older adults experiencing age related cognitive decline as a result of being freer to travel when and where they choose.

Phase I of this project 1) defined the interface, functional and technical requirements for each subsystem of the STCS, 2) initiated content development to support each STCS subsystem, 3) completed development of Phase 1 working prototypes of each subsystem, and 4) conducted testing and field evaluation to validate the system concept prior to final development.

## System Design Background

The STCS is being designed to optimize cognitive accessibility. In his timeless book, *The Design of Everyday Things*, Donald Norman introduces the notion of the 'Technology Paradox' (Figure 1). This paradox provides a concise explanation of the growing gap between individuals with cognitive challenges and the mainstream population in realizing the benefits of technology: "…the same technology that simplifies life by providing more functionality…. also complicates life by making it hard to learn. This paradox of technology is often used by people as an excuse for poor design" (Norman, 1988, p. 30-31.) Basically, this notion encompasses the tendency for software developers to create competitive advantages by adding features, or "bells and whistles", that are often marginally related to, or even outside of the primary function of the system being developed. Norman describes at length how this tendency to marginally increase functionality has a proportionate effect of systematically reducing usability. Everyday examples of this paradox can be seen in the evolution of anything from microwave ovens to cell phones. Original microwave ovens may have had one simple dial that was used to set the time for cooking; modern ones include a dizzying array of special function controls that may provide

minimal benefit or shortcuts for cooking; for example, a bag of popcorn or a baked potato—if, that is, the user is able to understand their operation (e.g., one potato or two? How big of a bag of microwave popcorn?) Similarly, the original brick-like cellular phones served the singular purpose of making and receiving phone calls; no picture-taking, no playing Candy Crush, and no option for dozens of apps that clutter screen displays but may never be used. This paradox is pervasive in modern mainstream technology development, and can be seen as well in the design of mainstream transportation support technologies.




*Source: The Design if Everyday Things, December 3, 2018*

**Figure 1: The Technology Paradox**

In response, the AbleLink Smart Living Technologies research team has completed over 80 research and development projects with a goal of *using the power of technology to simplify usability.* This includes implementation of proven methodologies to make software more cognitively accessible, which benefits all types of users (e.g., older adults, veterans, etc.). Examples of these methodologies (researched and developed by AbleLink in numerous projects) which will be employed in the STCS project include:

- A research-based process for determining system requirements that includes key stakeholders early and at critical points in the project leads to a more viable end-product;
- Use of system generated multimedia prompts to guide the user through app navigation;

- Uncluttered interface designs and easily accessible screen elements, such as oversized picture-buttons, maximize the effectiveness of multi-touch screens used for tablets and smart phone devices, as well as supporting physical disabilities;
- Software designed with a linear approach (e.g., provides a straight path of operation as opposed to branching, looping, etc.) for a simplified interface flow;
- Interface designs that incorporate the well-established teaching methodologies of consistency and repetition to promote learning in this population;
- Use of "error minimization" techniques, such as removing buttons from the screen when their appearance is unnecessary, or use of system timers to provide audio prompts after a designated period of time has passed with no user interaction;
- A complete set of configuration options that allow teachers, staff or parents to adapt the software to the unique needs and abilities of each end-user;
- Built in mechanisms to support remote tracking of progress, including GPS and cloud-based supports where applicable;
- Motivational considerations for enjoyable and compelling use of the software where appropriate, such as in system generated verbal or visual reinforcement.

(Davies, Stock, and Wehmeyer, 2004)

As such, the target population for this project includes individuals with intellectual and developmental disabilities, Autism Spectrum Disorder (ASD), traumatic brain injuries, learning disabilities, early stage dementia, older populations in general, and other individuals who may benefit from greater interface simplicity and multimodal presentation. While very different in many aspects, it may be typical in these user populations for people to experience certain interrelated barriers to the use of mainstream technologies that differ from other disability populations such as vision, hearing or mobility/dexterity impaired individuals. Typical users of the STCS will include those individuals who:

- have difficulty navigating complex user interfaces;
- may have literacy challenges that create barriers to accessing primarily text-based interfaces;
- may benefit from additional graphic and auditory presentation of content;
- may benefit from system-generated multimodal cues to support interface navigation, or;
- may not be able to accurately self-report engagement in transportation readiness activities.

In summary, it is well known that certain accommodations for individuals with disabilities can provide benefit for mainstream populations as well; curb cuts designed for people with physical disabilities also benefit mothers with strollers, and automatic door openers improve accessibility for people carrying packages. In the same way, the cognitively accessible design strategies being employed by the STCS provides the potential to improve access for all people, including those who may be less comfortable with technology in general. Cognitively accessible design can simply make things easier for everyone. The STCS will be comprised of four subsystems, each of which will contain cognitive design features. These subsystems will be designed such that they can be used individually or in combination with each other depending on the unique needs of each use case. A brief description of each subsystem is provided below, followed by sample use case narratives to further expand on the concept of how these subsystems might be used individually or in combination with each other.

**Transportation Skills Assessment System**--The first subsystem is a web-based assessment system that allows individuals with cognitive disabilities, older adults and other users to complete self-assessments of public transit experience and skills. Results from completed assessments can inform the second subsystem, described subsequently.

**Transportation Skills Learning Library**—The second subsystem is a web-based general transportation training application that provides self-paced opportunities to address gaps in transportation related skills and knowledge, including those that may have been identified via the assessment subsystem. The content for this general skills training system is being developed via research conducted during the STCS project and will generally not be directly authorable by end users. Ultimately, while these first two subsystems will be highly integrated, users are also able to engage in self-assessment and general training processes independent of each other if required by individual use cases. The intent of these first two subsystems is to provide more general, high-level travel skills assessment and training, while the second two subsystems are being designed to begin addressing more individualized, route-specific supports.

**Pre-Trip Execution System**—The third subsystem involves pre-trip planning, preparation and execution that is specific to a selected travel route. The components of this mobile device-based subsystem include a cognitively accessible personal scheduling system to support the 'when' in keeping a traveler on time with pre-trip preparation activities, and an instructional system to support the 'how' in completing these pre-trip activities. This instructional system uses a step-by-step presentation approach similar to the general transportation skills training system described above, but content will be authored by individual users and/or trainers to provide personalized, route-specific supports and will include an interactive pre-trip checklist format.

**Trip Virtualization System—**Finally, the fourth subsystem is being designed to allow users to experience a travel route virtually without having to leave home. Users will be able to capture video footage of a desired travel route from beginning to end, and then overlay the Global Positioning System (GPS) based prompts from a SMART (Specialized Media for Assisting Route Travel) compliant route (from the related AbleLink #1 ATTRI project) with a video to virtually experience the route. The virtualization system is being designed for use on a desktop platform in order to provide a rich, immersive and realistic virtual experience and to support synchronized video/ mobile app simulation playback on the larger screen format available on desktop or notebook computers.

# Brief Sample Use Cases

**Use Case #1**—Some agencies or individuals may have already invested resources in an alternative or home-grown public transportation training program. In these cases, it is possible that only the Transportation Skills Assessment system is used to help identify which parts of the training program may be needed by an individual, or to measure the effectiveness of engagement in a local training program.

**Use Case #2**—Other agencies that may have a fairly comprehensive public transit training program that includes assessment, training, and travel trainer supports may desire to integrate the virtualization subsystem to fill a gap in the program. Several members of the Project Steering Committee (PSC) have indicated that they already gather video footage of travel routes that could be used in a much richer, more immersive environment such as is being designed in the Trip Virtualization subsystem.

**Use Case #3**—A family may wish to support a member with intellectual disabilities to learn a bus route to another family member's home; the family may use the Assessment subsystem to help determine potential safety issues, the Transportation Skills Learning Library to provide training on identified areas, and the Pre-Trip Checklist to support successful travel.

**Use Case #4**—A public transit service may adopt all aspects of the STCS that could be administered by an existing team of travel trainers who have themselves been trained on use of the STCS. In this case the transit service may provide additional content to the Transportation Skills Learning Library, develop custom Pre-Trip Checklists and build/store downloadable travel routes and/or virtualization scenarios

# Technical Summary of STCS Subsystems

A technical summary is provided in this section for each of the four primary subsystems of the STCS system: ATLAS, Visual Impact, Endeavor and the trip virtualization system.

## ATLAS

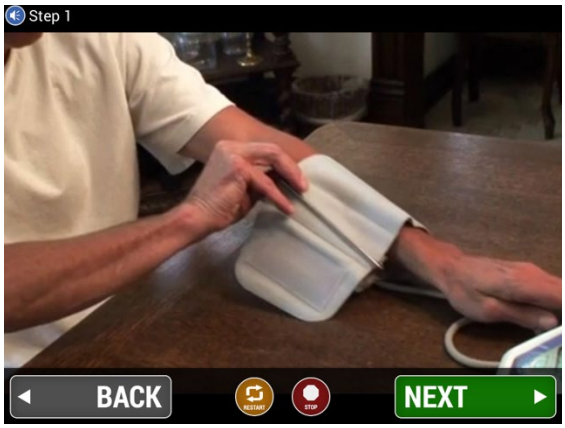
ATLAS (Figure 2) is a cognitively accessible multimedia surveying system from AbleLink Technologies, Inc. that has resulted from a series of research and development projects funded by the Administration for Community Livings National Ins titute on Disability, Independent Living and Rehabilitation Research. ATLAS has been developed specifically to enable individuals with intellectual and other cognitive disabilities to experience greater self-determination and independence in completing knowledge-based assessments or expressing their personal opinions. ATLAS employs principles of universal design in presenting customized survey questions in a multimedia format (using combinations of text, audio, video and pictures) to support independent access for individuals with significant cognitive disabilities, including non-readers. Each question is automatically read aloud, and can also be presented with alternate wording or in a different language. Users can tap on each possible answer in an answer set to hear them read aloud as well. Digital images can be integrated to provide an additional graphical representation of each question or answer option. User's must select an answer before a "Next" button appears to ensure questions are not skipped. Once a survey is complete, results are automatically transferred to a secure web site where they can be viewed or printed survey-by-survey or in aggregate, or downloaded into an organizations existing databases.

*Source: AbleLink, March 1, 2016*

Figure 2: Example of ATLAS Interface

## VISUAL IMPACT

Visual Impact (Figure 3) provides the STCS system with a powerful self-directed learning system (i.e., the 'how' aspect of pre-trip preparation) that incorporates a common language protocol for creation, distribution, playback, and sharing of digital instructional media using visual, textual and/or auditory based cues for providing sequential and non-sequential instructional content. This common language is referred to as the AbleLink Instructional Media Standard (AIMS), a JavaScript Object Notation (JSON) based protocol for describing instructional media that creates a common "language" learning system to facilitate adoption of electronic prompting technologies across different technology platforms. The ways in which instructional media can be used for learning and task completion are virtually limitless. For this project, the Visual Impact approach is being used 1) to provide an independently usable cloud-based learning curriculum for general skills related to community travel, similar to its use in previous projects addressing topics such as diabetes training or voter education, and 2) as a local app to help with preparing for the individual's specific travel activities, such as in completing a personalized pre-trip checklist. For example, upon launching the checklist Visual Impact may announce "Here are the things you need to do before you leave for work. Tap the green Next button on the computer screen to begin." After tapping the Next button, Visual Impact can provide personalized, step-by-step audio, video, text and image-based instructions for completion of the pre-trip preparation activities. Users proceed through sequential or non-sequential multimedia prompts, viewing video modeling segments, and following multimodal instructions to complete each step with the option for automated notifications for task completion to selected family members, trainers or care givers. In this project, the instructional media necessary to learn how to travel safely and successfully in the community is being integrated into the STCS system as a self-directed learning curriculum.

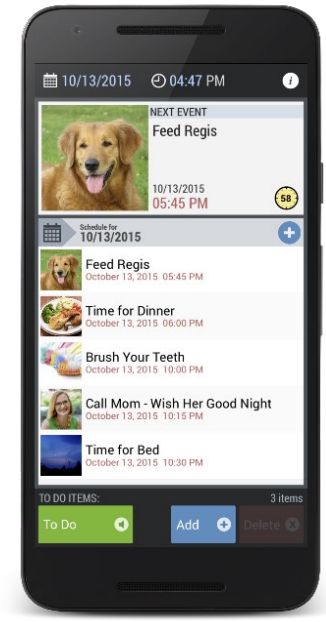



*Source: AbleLink, March 1, 2016*

**Figure 3: Example of Visual Impact**

## ENDEAVOR

Endeavor (Figure 4) functionality is being integrated into the STCS system to support all time-specific user notifications (that is, the 'when' aspect of pre-trip preparation) that will be important for helping individuals complete all necessary activities prior to departure. Time-specific notifications include graphical, text, audible and haptic formats as supported by hardware capabilities. Endeavor is a research-based scheduling system that contains specially-designed features for individuals with cognitive disabilities. Endeavor can also be used in concert with Visual Impact to provide time-sensitive reminders and then automatically launch into the individual's specific pre-trip instructional sequences or checklists. Many individuals with cognitive disabilities – including people with intellectual disabilities, traumatic brain injuries, early onset dementia, and certain learning disabilities – have difficulty remembering when to perform key activities such as catching the bus, taking care of pets, turning off appliances, locking doors, attending appointments, doing chores, performing self-care activities, or any pre-trip task. Endeavor will allow the STCS system to enable individuals to complete pre-travel tasks independently and on time.




*Source: AbleLink, April 22, 2016*

**Figure 4: Example of Endeavor Interface**

## Virtualization Technology

A new system being developed in this project and incorporated into the STCS system provides virtualization scenarios for upcoming travel activity by presenting a multimedia composition using video and a simulation of the mobile wayfinding app to help individuals prepare for specific trips. For example, scenarios can show what to expect for a selected trip, including getting to bus or train stops, landmarks and key points that will be passed during the trip, prompts to stay on the bus when picking up or dropping off other passengers, when the individual will need to notify the driver to stop, where to request help if needed and other pertinent information about the trip or that may be relevant after arriving at their destination. Our development for the virtualization subsystem of the STCS system is being built upon several previous research projects conducted by AbleLink which have used video and animation to support individuals with cognitive disabilities towards the goal of preparing individuals for upcoming travel experiences. The virtualization scenarios are being linked directly to specific SMART compliant routes in the SMART Route Library so that when users select a route to download from the library, the option will be provided to download the associated virtualization scenario for the route as well (if one is available).

# Chapter 1. Needs

There is a total of four interrelated development objectives for this project. Each of these development objectives are being met through research and development activities conducted in Phase 1 and Phase 2 of this project to develop each of these subsystems. The table below provides a high-level summary of the needs that the STCS toolset is being designed to support.

**Table 1-1 User Needs the STCS Shall Address**

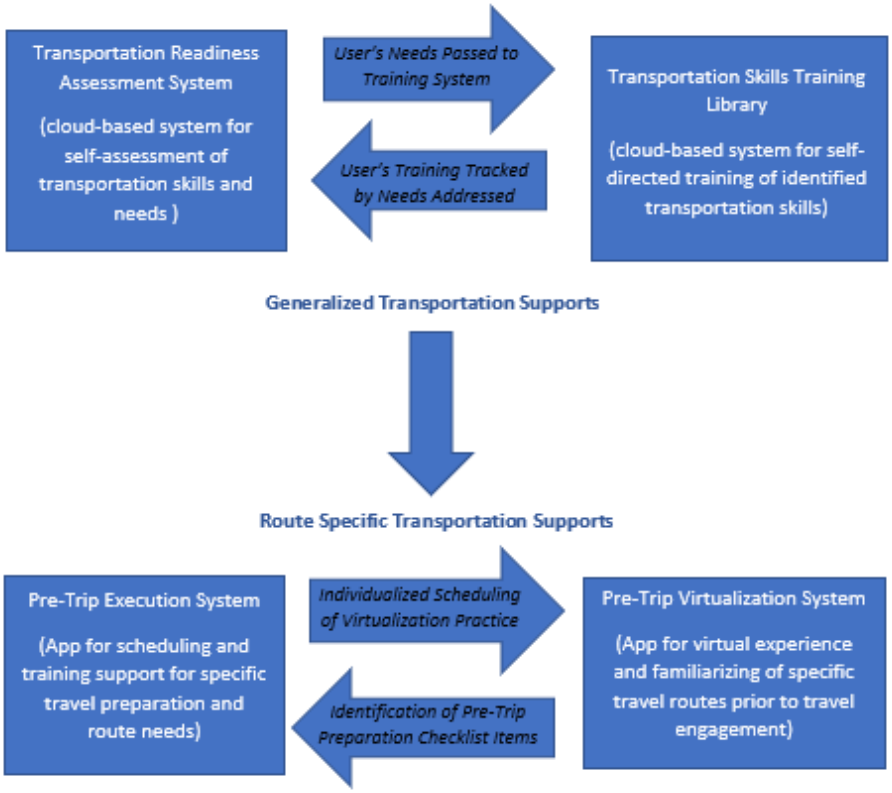
| **STCS Needs Table** |
|---|
| **User Need 1** - Need for visual, auditory, and textual (multimedia) content in systems designed for use by individuals with cognitive disabilities to promote independent usability. |
| **User Need 2** - The need for consistent and repetitive interfaces in systems designed for use by individuals with cognitive disabilities to reduce cognitive load and support independent usability. |
| **User Need 3** - The need for interface design that reduces the opportunity for user error by individuals with cognitive disabilities, such as coding that prevents unintended double clicks while proceeding through a step-by-step instructional sequence. |
| **User Need 4** - The need for system-generated cues to reduce learning curves and promote independent usability by individuals with cognitive disabilities. |
| **User Need 5** – The need to provide route-specific virtualization content to minimize the need for abstract thinking or generalization of learning. |
| **User Need 6** – The need to provide interface customization settings to optimize independent use by individuals with different cognitive skills and needs. |
| **User Need 7** - The need to automatically send notifications to family members or caregivers to inform when training and other pre-trip activities have been completed. |
| **User Need 8** - The need for in-app end user reinforcement to provide compelling and motivating user experiences. |
| **User Need 9** - The need for user access to self-directed multimedia travel training content. |
| **User Need 10** - The need for pre-trip execution tools to support scheduling. |
| **User Need 11** - The need for pre-trip execution tools to support travel preparation. |
| **User Need 12** - The need for tools to support self-assessment of travel readiness. |
| **User Need 13** - The need for tools to support independent use of public transit systems. |
| **User Need 14** - The need for each sub-system to be able to operate independently or in any combination. |

# Chapter 2. System Definition

The overall objective of this project is to develop the STCS, a suite of technologies for assessment of transportation readiness, skills training, pre-trip planning and execution, and trip virtualization activities designed for use by individuals with cognitive and other disabilities, older adults, or others who may benefit from additional supports to promote independence in the use of fixed route public transportation and to reduce the need for use of costlier paratransit services. Assessment, self-pace training, pre-trip planning and trip execution technologies are critical supports necessary for facilitating successful use of the public transportation system by users, including users with cognitive disabilities. The STCS leverages technologies that have enabled individuals with special needs to complete self-directed assessments and perform daily living activities more independently in a wide variety of contexts. In addition, the project provides new technology for virtualization of routes to provide a comprehensive set of transportation readiness assessment and self-directed learning materials, as well as trip execution technologies that address key pre-trip planning topics important for engaging in independent travel. The STCS is being designed for multiple use cases, ranging from stand-alone use of one or more subsystems to a comprehensive process of general assessment and training progressing to specific route training and supports. The STCS provides a powerful companion system to address pre-trip planning and virtualization to complement the companion ATTRI project titled "Leveraging Innovative Technology to Develop the *SMART* Wayfinding Standard to Facilitate Independent Use of Public Transit by Individuals with Cognitive Disabilities." To accomplish the overall project objective, there are four subsystems that are being developed. Figure 5 provides a functional block diagram showing the relationship of the four subsystems presented in Table 2-1.

**TABLE 2-1: STCS Subsystems**

| Subsystem | Subsystem Description |
|---|---|
| 3.7.1 Transportation Skills Assessment System | Cognitively Accessible Web-based Application for Self-Assessment of Basic Public Transportation Skills |
| 3.7.2 Transportation Skills Learning Library | Cognitively Accessible Web-based Application for Self-Directed Multimodal Training on Basic Public Transportation Skills |
| 3.7.3 Pre-Trip Execution System | Integrated App to Support Time-Based and Step-by-Step Instructions on Pre-Trip Preparation Activities |
| 3.7.4 Trip Virtualization System | App to Support Virtual Familiarization with Specific Transportation Routes |




*Source: AbleLink Technologies, Oct. 3, 2018*

**Figure 5: STCS Functional Block Diagram**

### Understanding the Subsystems of the STCS

The first two subsystems—Transportation Readiness Assessment and Transportation Skills Training—include a degree of integration such that they can each be used by themselves or in conjunction with each other. The results of transportation readiness assessments are being mapped to specific training modules to provide a degree of automation in prompting users to engage in training areas identified as deficits by the assessment process. Users are also able to engage in Skills Training independent of the Assessment process in that transportation training modules are also manually selectable to allow users to engage in additional training as desired. These first two subsystems are designed to address general travel skills that are not necessarily specific to a particular route. The second two subsystems then move the focus to specific individualized traveler needs and route training. The pre-trip execution subsystem provides the capability for users to receive time-based prompts to perform key pre-trip preparation activities which may include sequential or non-sequential (e.g., checklist) tasks. Finally, the virtualization subsystem provides the capability to review route-specific virtualization scenarios to support familiarization of key travel elements prior to engagement in route-specific public transportation activities. Internet connectivity is required when downloading virtualization scenarios from the SMART Route Library, but once a virtualization scenario has been downloaded, internet connectivity is not required for playback of the scenarios.

1. **Transportation Readiness Assessment System**.

The Transportation Readiness Assessment subsystem shall provide the capability for self-assessment of key transportation readiness skills by leveraging AbleLink's research-based ATLAS technology. The system shall implement a multimodal presentation of transportation readiness assessment content using variable combinations of text, images, audio and video media presented in a self-paced format. The system shall assess a range of transportation readiness skills, including basic travel skills, safety skills, social skills, street crossing skills, vehicle and route identification skills, and other skills as identified in the project research. The system shall integrate with the Transportation Skills Training Library by targeting specific training content identified during the assessment process. For example, if the assessment process indicates deficiencies in understanding transit signage, it shall provide a cross-reference of assessment content to Learning Library modules to direct the user to subsequent self-paced signage training in the Transportation Skills Learning Library.

2. **Transportation Skills Training Library**.

   The Transportation Skills Training Library subsystem shall present general transportation skills training opportunities. It shall include a hierarchical categorization of training content on a main menu display with categories and content modules identifiable via text, image and auditory descriptions to aid in self-selection of specific training content. Users shall be able to select a desired training content module by clicking or tapping on the representative image in the hierarchical categorization. An introductory audio message shall provide a brief overview of the training content as well as instructions on how to proceed through the content. The multimedia content within each training module shall include combinations of images, video, audio and text-based information presented as needed in a self-paced, step-by-step format. Each step shall automatically display and play the multimedia content when the step is first displayed. Users shall navigate through the content by using single click buttons to move to the next step, repeat the current step, return to the previous step, return to the first step, or abort the training module and return to the main menu display. Selected navigation buttons shall be able to be optionally displayed depending upon the abilities and needs of the end user. Users shall proceed through the training steps in each module until reaching the final step in the respective training module, at which point the navigation button used to move to the next step shall change to a button indicating that the end of the training module has been reached. Visual and auditory confirmation of the end of the training module shall also be provided. Upon reaching the end of a training module, the system shall return the user to the main menu content categorization display. The Transportation Skills Training Library system shall be deployed as an open web-based application with the exception of the content administration component which shall be password protected. In addition, the capability shall be provided to create user accounts that allows repeat users to benefit from additional features as described in the requirements summary.

3. **Pre-Trip Execution System**.

   The pre-trip execution system shall consist of a series of integrated local applications to support pre-trip execution activities. The system shall provide the capability to create multimedia time-based events that notify users of when to perform key pre-trip activities via AbleLink's proprietary Endeavor technology. The system shall also provide the capability to create personalized step-by-step multimedia instructions that shall be used independently by users with cognitive disabilities and other special needs to support sequential task completion via AbleLink's proprietary Visual Impact technology. This instructional subsystem differs from the Transportation Skills Training Library in that it operates as an app on a mobile device and that content is

authorable by end users to provide highly individualized trip-specific information. The system shall also provide the capability to create personalized multimedia pre-trip activity checklists that can be used by travelers with special needs, including users with cognitive disabilities, to independently complete non-sequential pre-trip activities. The system shall provide the capability for the time-based event system to automatically launch pre-trip sequential and non-sequential prompting support tasks or other trip preparation activities at user-designated times.

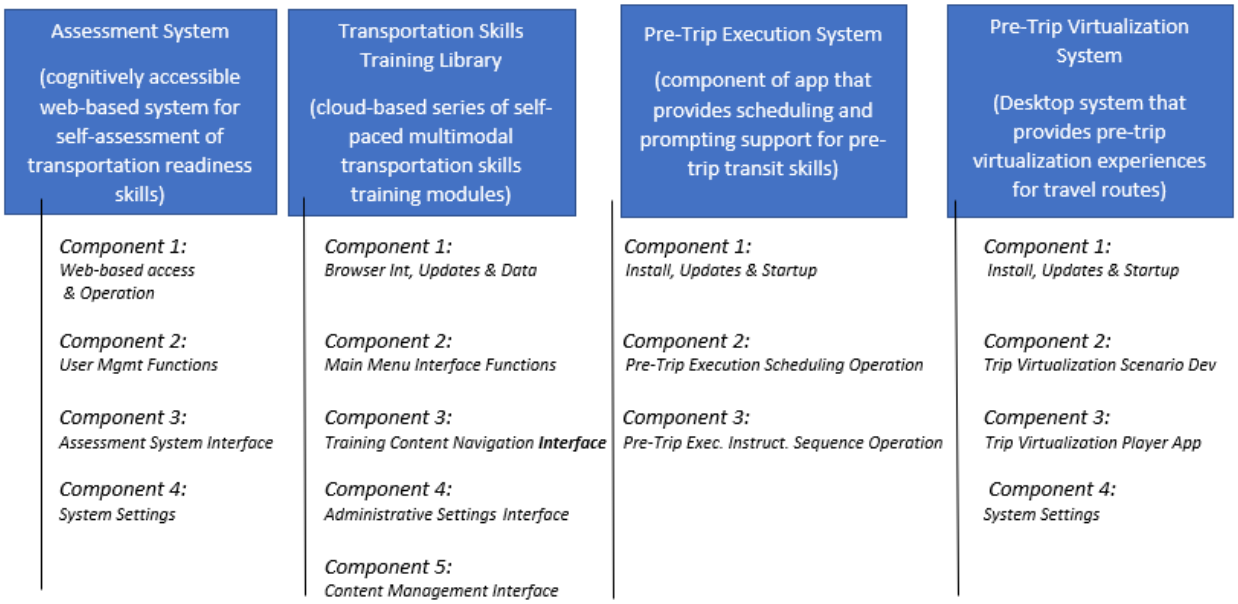
4. **Trip Virtualization System**.

   The Trip Virtualization System shall provide the capability for users to virtually familiarize with specific transportation trips. The system shall provide the capability to associate SMART route instructions, prompts and GPS waypoints with video footage of the route to provide a virtual travel experience. A simulation of the route display as it appears on a mobile device during actual travel shall also be incorporated to provide simulated hands-on with the mobile wayfinding application, such as in learning when to notify the driver of intended stops. The system shall also be able to support virtual familiarization with home-to-stop travel and last stop-to-destination travel. The system shall support the capability for repetition of virtual familiarization as needed for individualized learning opportunities.

# Chapter 3. System Requirements

## 3.1 System Requirements

This section summarizes the requirements associated with each of the four subsystems of the STCS. Each subsystem is broken down into component groups of related requirements. A subsystem components diagram is provided in Figure 6.




*Source: AbleLink Technologies, Oct. 10, 2018*

**Figure 6: STCS Component Diagram**

STCS Component Diagram

### 3.1.1 Operational Assumptions

Travel support for individuals with cognitive disabilities is comprised of multiple facets, including paratransit, specialized travel services provided by agencies serving individuals with cognitive disabilities and natural supports (such as family and friends). Research shows that specially designed wayfinding supports can enable individuals with cognitive disabilities to use public transportation more independently and that agencies serving individuals with cognitive disabilities can reduce both organizational transportation costs and usage of paratransit services (Davies, Stock, Holloway, and Wehmeyer, 2010; Hoetzel & Mullen, 2012). This project extends proven travel support technology to increased numbers of individuals with cognitive and other disabilities through the development of a series of interventions that provide a format

for self-directed, self-paced support of pre-trip activities. As stated previously, Phase 1 of this project 1) defined the interface, functional and technical requirements for each subsystem of the STCS system (assessment of transportation readiness, self-directed skill acquisition learning modules, trip execution support technologies, and travel experience virtualization tools), 2) initiated content development to support each STCS system subsystem, 3) completed development of a working prototype of each component of the subsystems listed above, and 4) conducted user testing and field evaluations to validate the system concept prior to field evaluation and final development. In Phase 2, these technologies are being revised and enhanced based on the results of Phase 1 and will be field tested with two agencies in two different states to evaluate the impact of the assessment, self-directed learning and pre-trip execution technologies developed in this project for improving the transportation readiness of individuals with cognitive disabilities. The project leverages existing technology and builds upon the proven technological approach used in AbleLink's ATLAS, Endeavor and Visual Impact systems that have been previously validated through research and ongoing usage by individuals with disabilities.

### 3.1.2 System Interface Requirements

The subsystems detailed in this specification operate independently, but also may benefit from data connections between selected subsystems. For example, the assessment subsystem has the capability to provide information to the training subsystem to suggest specific training modules based upon assessment results, and the scheduling subsystems able to launch relevant pre-trip execution planning instructions or checklists at designated times.

#### *3.1.2.1 System External Interfaces*

The STCS shall operate independently of external specifications.

#### *3.1.2.2 System Internal Interface*

All internal interfaces are left to the design and requirement specifications for each subsystem.

## 3.2 Performance

The STCS apps will be utilized prior to travel by individuals with cognitive disabilities, including those with intellectual disabilities, ASD, learning disabilities and traumatic brain injuries. In addition, other populations may benefit from the system, including older adults, individuals that have English as a second language, or foreign visitors to the United States. The web-based subsystems shall operate wherever a sufficient internet connection is available to stream text, audio, video and image-based assessment and instructional media. These subsystems are not expected to provide assessment and training functionality when internet connections are not available. The pre-trip execution and virtualization subsystems do not require internet connectivity for operation

### 3.2.1 Physical Characteristics

All outputs of this project are electronic software and textual documents and thus physical characteristics are not applicable to this system.

### 3.2.2 Reliability

Reliability of the web-based applications are being developed and refined throughout the Beta portion of application testing and deployment. AbleLink will develop tests to measure rigorous interaction with the web-based applications and services and determine thresholds of reliability. This will help assess scalability needs as well as refinement of the applications as necessary to reduce bandwidth and stress on the services. End-user Beta testing was conducted during the Year 1 Pilot Study and continues with the Year 2 extended field evaluation. In addition, beta testing is being offered to additional organizations affiliated with and recommended by the project steering committee to extend testing to as broad of an audience as possible, and to help iron out potential issues with the mobile applications, web applications, and services prior to final deployment.

### 3.2.3 Maintainability

Maintainability of the STCS applications which are proprietary to AbleLink will be handled by AbleLink technical staff. AbleLink will continue to refine and improve performance of the subsystems to maintain compatibility with evolving operating systems, both for web-based applications and mobile applications. Maintainability of the web-based applications and services developed in this project will be handled via package management and source control tools such as *npm, git,* and *Mercurial*. Server-level OS patches will be handled via the default mechanism on the platform, such as *apt, yum, dnf,* and *rpm*. Maintainability of the web applications and services will be performed after hours or at predetermined patch windows, which will be communicated to customers of the STCS.

### 3.2.4 Environmental Requirements

Mobile components of the STCS shall operate on off-the-shelf mobile devices designed to withstand typical environmental conditions encountered during normal operation. Because the system targets pre-trip assessment, training, execution and virtualization, outdoor operation is not generally expected but will be supported by the inherent capabilities of mainstream tablet, smart phone and other hardware devices, including conditions in the natural environment (i.e., wind, rain, temperature, noise and environment conditions). These are typical environment conditions experienced when using smartphones or tablet computers and are within the operating tolerances adhered to by mobile technology device developers. There are no additional environmental requirements for devices that will be used to operate STCS apps.

## 3.3 Design and Construction

### 3.3.1 Electromagnetic Radiation

The Assessment System and Transportation Skills Training Library subsystems shall be delivered via a website interface and are not time critical with respect to any specific travel activity. Therefore, loss of internet connectivity (due to EMC/EMI or other cause) during these assessment and training activities will have typical results (e.g., require completing training at another time to complete any training modules that were interrupted). If internet connections are weak or non-existent these portions of the system should not be used until connections are re-established. Usage guidelines for these STCS subsystems will clearly state the need for internet connectivity and encourage development of contingency plans by support personnel for individuals with cognitive disabilities for events which can occur during use, such as

loss of internet connection and other possible events including loss of battery power, loss of device, other hardware or OS malfunction, etc. Internet connectivity is not required for the pre-trip execution subsystems of the STCS system.

### 3.3.2 Workmanship

The STCS apps shall utilize best commercial practices for workmanship. For example, web-based subsystems are expected to support evolving versions of internet protocols, such as HTML-5. Similarly, local apps are expected to support evolving versions of hardware operating systems. In addition, applications are being developed using universal design principles and with standard interface elements to facilitate independent use by individuals with varying abilities. Cognitive design strategies are being applied to all design components, as applicable.

### 3.3.3 Interoperability

The STCS shall be designed to support interoperability among HTML-5 compliant mainstream web browsers identified in the requirements section. In addition, the mobile subsystems of the STCS shall be designed to operate on devices running the Android and iOS operating system to ensure availability of the STCS functionality across a broad range of mobile devices to allow end users to use the applications on their preferred mobile devices.

### 3.3.4 Safety and Security Requirements

The primary issue of safety relates to protection of personal data resulting from use of the web-based Transportation Skills Assessment subsystem. Security shall be incorporated into the cloud-based assessment subsystem to ensure that individual assessment results are not accessible to unauthorized parties.

### 3.3.5 Human Factor Requirements

The primary target user population for this system includes individuals with cognitive disabilities. Therefore, universal design principles shall be applied as appropriate to provide a design that optimizes independent usability by users with cognitive disabilities. For example, literacy skills are often limited for this population, so other modes of communication (e.g., audio, graphics, etc.) shall be used in conjunction with text-based information. Error minimization strategies shall be employed as well to further support error-free operation. An example of an error minimization strategy is to remove buttons from the display when they are not applicable to the current operation rather than simply “greying” out buttons. Individuals with cognitive disabilities often times have difficulty distinguishing a greyed-out button from a button that is not greyed out, leading to unsuccessful attempts to press or activate the greyed-out button.

## 3.4 Documentation

Table 3-2 lists the four documents that will be delivered during Phase 2 of this project.

**TABLE 3-2: Phase 2 Project Documents**

| Required Deliverable Documents | Description of Deliverable | MAC* |
|---|---|---|
| System Requirements Specification – Final | Documents the initial system and interface requirements for each component of the system. | 4 |
| STCS Assessment Content Summary | Details the hierarchical structure and content of the STCS Skills Assessment component | 5 |
| SMART Travel Learning Curriculum | Details the hierarchical structure and content of the STCS SMART Travel Learning Curriculum component | 9 |
| Phase 2 Project Report | Summarizes the project activities conducted during the Phase 2 project | 14 |

* Months after contract

# 3.5 Personnel and Training

Not Applicable.

# 3.6 Subsystem Descriptions

The four subsystems that compose the STCS have been described previously in Table 2-1. The requirements for these subsystems are outlined in the following sections.

# 3.7 Subsystem Requirements

## 3.7.1 STCS Travel Readiness Assessments: Subsystem Requirements

### *3.7.1.1 Definition*

The first subsystem of the STCS is a web-based application that provides a suite of self-directed travel readiness assessments that can be completed by individuals with cognitive disabilities online. The system is referred to as the STCS Assessment system in this section and is based on AbleLink's existing cognitively accessible assessment engine, ATLAS, which shall be used to create and deliver these accessible surveys that individuals can complete in a self-directed manner to communicate their transportation readiness in a variety of content areas including social skills, vehicle identification skills, street-crossing skills, understanding the specifics of riding the bus or train, etc. After the individual's level of readiness is assessed, areas where remedial training is needed (if any) shall be identified for the individual. This information is then useful in identifying specific areas of training needed for the individual, training which shall be available in the second component of the STCS system, the Transportation Skills Training Library, described in 3.7.2, which shall be used to help individuals learn skills necessary for independent travel. After remedial training, the ATLAS system can be used to re-assess skill levels to help

redetermine transportation readiness following the skills training. As indicated above, AbleLink's proprietary ATLAS system is the vehicle used to deliver the assessments and report the results for the STCS Assessment system. This section describes the detailed capabilities of the ATLAS assessment delivery engine as applied in this project.

### *3.7.1.2 Interfaces*

The following subsections define the interfaces and files used by the STCS Assessment system web-based application.

#### *3.7.1.2.1 User Interfaces*

The system shall provide the capability to manage the content and organization of the STCS Assessment system through a password protected web-based interface to the application which allows individuals with administrator privileges to log into the system to make desired changes.

##### 3.7.1.2.1.1 User Input

The STCS Assessment system web-based application shall support the input of user commands through the STCS Assessment system GUI, using a standard keyboard and mouse pointing device.

##### 3.7.1.2.1.2 User Output

The STCS Assessment system web-based application shall support user commands, through the STCS Assessment system GUI, to direct the selection and completion of transportation readiness assessments. User output includes summary reports following completion of selected self-directed assessments.

### *3.7.1.3 STCS Assessment System Requirements*

The STCS Assessment system shall include assessments that will be used to assess the readiness of individuals with cognitive disabilities for independent travel and use of the public transportation system. The goal of the STCS Assessment system is to identify the functional capabilities and current skill level of individuals with cognitive disabilities so that supporting individuals (e.g., travel trainers, agency staff, etc.) can identify areas where the individual may need support, either through training, orientation activities, or potentially through accommodations needed to travel independently. In this project, the initial content of the assessments shall be developed so that it can be delivered via AbleLink's accessible survey system (ATLAS) described earlier. This section describes the technical requirements that are being met with the ATLAS system through existing features or enhancements to the system to support this project.

#### *3.7.1.3.1 Component 1: Web-based Access and Operation*

##### 3.7.1.3.1.1 *Web Browser Requirements*

The STCS Assessment system shall be accessed through an HTML-5 compliant browser via a website login using a unique username and password.

###### 3.7.1.3.1.1.1 Microsoft Edge Support

The STCS Assessment system shall operate on all commonly used mainstream browsers for desktop computers including Microsoft Edge.

#### 3.7.1.3.1.1.2 Google Chrome  Support

The STCS Assessment system shall operate on all commonly used mainstream browsers for desktop computers including Google Chrome.

#### 3.7.1.3.1.1.3 Mozilla Firefox Support

The STCS Assessment system shall operate on all commonly used mainstream browsers for desktop computers including Mozilla Firefox.

#### 3.7.1.3.1.1.4 Apple Mobile Device Browser Support

The STCS Assessment system shall operate on Apple's Mobile Device Browser.

#### 3.7.1.3.1.1.5 Android Mobile Device Browser Support

The STCS Assessment system shall operate on Android Mobile Device Browser.

#### 3.7.1.3.1.2 Offline Operation Not Required

The STCS Assessment system is a web-based application that provides access to a suite of self-directed assessments.  Off-line operation is not required.

#### 3.7.1.3.1.3 Application Update Requirements

Updates to the STCS Assessment system web-based application shall be performed directly on the server containing the application by system administrators.  Therefore, no updates to the STCS Assessment system application will be required by users accessing the system via a web-browser.

*3.7.1.3.2 Component 2: User Management Functions*

The STCS system shall have the capability to manage users of the system by providing the capabilities described in this section.

#### 3.7.1.3.2.1 Creation of New Users

The system shall provide the capability to create new users that can access the system.

#### 3.7.1.3.2.1.1 Creation Date of Users

The system shall provide the capability to automatically record the date the new user was created.

#### 3.7.1.3.2.1.2 User Name

The system shall provide the capability to enter the name for the new user.

#### 3.7.1.3.2.1.3 User Password

The system shall provide the capability to enter a password for the new user.

#### 3.7.1.3.2.1.4 User Access Level

The system shall provide the capability to choose the access level for the user which will identify the features of the system that the user can access

#### 3.7.1.3.2.2 Editing of User Information

The system shall provide the capability to edit user information.

#### 3.7.1.3.2.2.1 Editing Existing Users

The system shall provide the capability to modify all information associated with the user, with the exception of the date the user was created.

#### 3.7.1.3.2.2.2 Canceling Changes to Edits

The system shall provide the capability to cancel changes prior to saving the edited information if the user wishes to abort the edit activity.

#### 3.7.1.3.2.3 User Deletion

The system shall provide the capability to edit user information.

#### 3.7.1.3.2.3.1 Deleting Existing Users

The system shall provide the capability to delete users by those users with appropriate admin privileges.

#### 3.7.1.3.2.3.2 Confirmation of User Deletion

The system shall provide a confirmation dialog that must be acknowledged prior to the user being deleted.

#### 3.7.1.3.2.3.3 Restoring Deleted Users

The system shall provide the capability to restore a deleted user if restoration of the activity is attempted prior to the cache of deleted users being emptied by the user with admin privileges as a maintenance activity (similar to emptying the Recycle Bin in Windows).

#### 3.7.1.3.2.4 Managing Access Levels for Users

The system shall provide the capability to manage access levels for users by providing the following capabilities.

#### 3.7.1.3.2.4.1 Admin Level Access

The system shall provide the capability to allow Admin level access to users which then provide that user with the capability to modify access level for other users of the system.

#### 3.7.1.3.2.4.2 Viewing List of Current Users and Access Levels

The system shall provide the capability for an Admin user to view a list of current users and the current access level of each user.

#### 3.7.1.3.2.4.3 Editing List of Current Users and Access Levels

The system shall provide the capability for an Admin user to edit the list of current users and the current access level of each user.

*3.7.1.3.3 Component 3: Assessment User Interface Functions*

The system shall have the capability for users to access the system via the system's URL.

##### 3.7.1.3.3.1 Access to the Assessments in the STCS Assessment System

#### 3.7.1.3.3.1.1 Open Access to the STCS Assessment System

The system shall have the capability to be accessed by guest users without requiring an account.

#### 3.7.1.3.3.1.2 Access to the STCS Assessment System for User's with Accounts

The main menu interface system shall have the capability to be accessed via a password protected login interface for users with accounts.

##### 3.7.1.3.3.2 User Name Setup Requirements

The system shall provide the capability for a user to choose a user name when creating an account for the first time.

##### 3.7.1.3.3.3 Password Setup Requirements

The system shall provide the capability for a user to choose a password when creating an account for the first time.

##### 3.7.1.3.3.4 Explicit Logout

The system shall provide the capability for a user to specifically log out of the system.

##### 3.7.1.3.3.5 Inactivity Logout

The system shall provide the capability to automatically log a user out of the system after a designated period of inactivity.

##### 3.7.1.3.3.6 Battery of Assessments

The system shall provide the capability for users to browse through and select a desired assessment available in the STCS System.

#### 3.7.1.3.3.6.1 Assessment Start Page Image

The system shall have a start page for a selected assessment which will be used to display an introductory message to the user prior to beginning the assessment.

#### 3.7.1.3.3.6.2 Assessment Start Page Audio Description

The system shall have content modules with a start page that will provide a system-generated audio message that includes a brief description of the assessment provided within the respective module.

#### 3.7.1.3.3.6.3 Assessment Start Page Audio Prompt

The system shall have a system-generated audio message to prompt the user on the next step in navigating the system (e.g., “Select the start button when you are ready to begin.”) which plays following the audio message described in 3.7.1.3.3.6.2.

#### 3.7.1.3.3.6.4 Intro Button Operation

The system shall have a single click start button provided on the intro page for the assessment.

#### 3.7.1.3.3.6.5 Start Button Navigation

The system shall have a start button that allows the user to navigate to the first item in the assessment.

#### 3.7.1.3.3.7 Assessment Content Presentation

The system shall have assessment content provided via a series of assessment item pages.

#### 3.7.1.3.3.7.1 Assessment Item Page Appearance

The system shall have assessment item pages that may include a digital image depicting the item question.

#### 3.7.1.3.3.7.2 Assessment Item Page Audio

The system shall have assessment item pages that include audio descriptions of item questions.

#### 3.7.1.3.3.7.3 Assessment Item Page Text

The system shall have assessment item pages that include a text description of assessment content.

#### 3.7.1.3.3.7.4 Assessment Item Page Forward Navigation

The system shall have assessment item pages that provide a single click forward navigation button with the capability to move to the next item in the assessment.

#### 3.7.1.3.3.7.5 Assessment Item Page Forward Navigation Double Click Denial

The system shall have forward navigation buttons that do not accept a double click.

#### 3.7.1.3.3.7.6 Forward Navigation Button Appearance

The system shall have assessment item pages with a forward navigation button that appears on the display after the audio and/or video portion of the description of assessment content has played.

#### 3.7.1.3.3.7.7 Assessment Item Page Media Replay

The system shall have assessment item pages with a navigation button that provides the capability to replay audio and/or video descriptions of assessment content.

#### 3.7.1.3.3.7.8 Item Page Backward Navigation

The system shall have assessment item pages with a button to navigate to the previous item in an assessment.

#### 3.7.1.3.3.7.9 Assessment Module Survey Complete Notification

The system shall have a Done button on the last item to indicate the assessment module has been completed.

#### 3.7.1.3.3.7.10 Assessment Module Survey Complete Navigation

The system shall return to the main menu when an assessment has been completed.

### 3.7.1.3.3.8 Assessment Results

The system shall provide the capability to report the results of the assessment when the assessment is complete.

#### 3.7.1.3.3.8.1 Viewing Assessment Results

The system shall provide the capability to view the results of the assessment when the assessment is complete.

#### 3.7.1.3.3.8.2 Printing Assessment Results

The system shall provide the capability to print the results of the assessment when the assessment is complete.

#### 3.7.1.3.3.8.3 Storage of Assessment Results

The system shall provide the capability to store the results of the assessment when the assessment is complete in a database located within the STCS system. This capability will only be available when the assessment had been completed by a user that was logged into his or her account, rather than accessing the site as a guest user.

#### 3.7.1.3.3.8.4 Viewing Previous Assessment Results

The system shall provide the capability for users that have logged into the system to view the results of previous assessments the user has completed at a prior time. This capability will only be available when the assessment had been completed by a user that was logged into his or her account, rather than accessing the site as a guest user.

#### 3.7.1.3.3.8.5 Sharing of Results with Transportation Skills Training Library System

The system shall provide the capability for assessment results to be accessed by the Transportation Skills Training Library System to inform the identification of needing areas of training for a specific user that has completed one or more assessments. This capability will only be available when the assessment had been completed by a user that was logged into his or her account, rather than accessing the site as a guest user.

*3.7.1.3.4 Component 4: System Settings*

The following system settings shall be supported within the STCS Assessment system web-based application.

##### 3.7.1.3.4.1 Question Font Size

The system shall provide the capability to set a desired font size for a user so that assessment questions are presented with text of sufficient size to be readable by the user.

##### 3.7.1.3.4.2 Answer Font Size

The system shall provide the capability to set a desired font size for a user so that assessment answers are presented with text of sufficient size to be readable by the user.

##### 3.7.1.3.4.3 Audio Option

The system shall provide the capability to turn on or off audio support for a user as needed when completing an assessment.

##### 3.7.1.3.4.4 Keyboard Navigation

The system shall provide the capability to navigate through a survey from beginning to end and select desired answers to each question using the keyboard as the sole navigation tool if needed to facilitate accessibility.

##### 3.7.1.3.4.5 Touch Screen Navigation

The system shall provide the capability to navigate through a survey from beginning to end and select desired answers to each question using a touch screen as the sole navigation tool if needed to facilitate accessibility.

## 3.7.2 Transportation Skills Training Library: Subsystem Requirements

### *3.7.2.1 Definition*

The Transportation Skills Training Library component shall present general transportation skills training opportunities. It shall include a hierarchical categorization of training content on a main menu display with categories and content modules identifiable via text, image and auditory descriptions to aid in self-selection of specific training content. Users shall be able to select a desired training content module by clicking or tapping on the representative image in the hierarchical categorization. An introductory audio message shall provide a brief overview of the training content as well as instructions on how to proceed through the content. The multimedia content within each training module shall include combinations of images, video, audio and text-based information presented as needed in a self-paced, step-by-step format. Each step shall automatically display and play the multimedia content when the step is first displayed. Users shall be able to navigate through the content by using single click buttons to move to the next step, repeat the current step, return to the previous step, return to the first step, or abort the training module and return to the main menu display. Selected navigation buttons shall be able to be optionally displayed depending upon the abilities and needs of the end user. Users shall proceed through the training steps in each module until reaching the final step in the content, at which point the navigation button that is used to move to the next step changes to a button indicating that the end of the training module has been reached. Auditory confirmation of the end of the training module shall also be provided. Upon reaching the end of a training module, the system shall return the user to the main menu content categorization display. The Transportation Skills Training Library system shall be deployed as an open web-based application with the exception of the content administration component which shall be password protected. In addition, the system shall allow users with accounts to log into the system to benefit from additional data storage and reporting features. The specific requirements for these system capabilities are detailed in this section.

### *3.7.2.2 Interfaces*

The following subsections define the interfaces and files used by the Transportation Skills Training Library component.

#### *3.7.2.2.1 General Interfaces*

##### 3.7.2.2.1.1 User Selection of Training Content

The Transportation Training Skills Library system shall provide a main menu interface of user-selectable training module content.

##### 3.7.2.2.1.2 Training Module Navigation Interface

The system shall provide a training module content navigation interface for users to navigate through the training content in each module.

##### 3.7.2.2.1.3 Admin Settings Management Interface

The system shall provide an administrative settings interface accessible by end user support staff that shall enable customization of the main menu and navigational interfaces to optimize independent access for end users with different needs and abilities.

#### 3.7.2.2.1.4 Admin Content Management Interface

The system shall include a content administration interface to be used by content developers to add, remove or edit training content.

### *3.7.2.2.2 User Interfaces*

#### 3.7.2.2.2.1 User Input

The system shall support the input of user commands through the Transportation Skills Training Library system GUI, using a standard keyboard and mouse pointing device.

#### 3.7.2.2.2.2 User Output

There are no specific user output requirements for the Transportation Skills Training Library.

### *3.7.2.2.3 Main Menu Interface*

The main menu interface shall serve as the web-based landing page and primary URL for end users to begin using the Transportation Training Skills Library system. No login shall be required to promote open access. However, users shall be provided with an opportunity to log into the system to benefit from additional system features. Training content categories shall be depicted by multimedia buttons to aid in identification and navigation to desired content modules. Single clicking or tapping on category buttons shall open sub menu pages containing training content module buttons. Single clicking on training content module buttons shall in turn launch transportation skills training content via the training module content navigation interface. The specific requirements for the main menu interface are described in Section 3.7.2.3.2.

### *3.7.2.2.4 Training Module Content Navigation Interface*

The training module content navigation interface shall provide the capability for end users to navigate through specific transportation skill training content. For example, the system shall be designed to allow users to select a desired training content module by single clicking or tapping on the representative image on the main menu. An introductory audio message shall provide a brief overview of the training content as well as instructions on how to proceed through the content. The multimedia content within each training module shall include combinations of images, video, audio and text-based information presented as needed in a self-paced, step-by-step format. Each step shall automatically display and playback the multimedia content when the step is first displayed. Users shall navigate through the content by using single click buttons to move to the next step, repeat the current step, return to the previous step, return to the first step, or abort the training module and return to the main menu display. Selected navigation buttons shall be able to be optionally displayed depending upon the abilities and needs of the end user. Users shall proceed through the training steps in each module until reaching the final step in the content, at which point the navigation button used to move to the next step shall change to a button indicating that the end of the training module has been reached. Auditory confirmation of the end of the training module shall also be provided. Upon reaching the end of a training module, the system shall return the user to the main menu content categorization display. The specific requirements for the content navigation interface are described in Section 3.7.2.3.3.

*3.7.2.2.5 Administrative Settings Interface*

The administrative settings interface shall include a series of system feature options that determine the configuration of the training module content interface. It shall include toggling various interface elements and functionality between being 'on' (i.e., available for use by end users) or 'off' (i.e., not available to the end user). For example, users with more significant cognitive challenges may be confused by or unable to benefit from a user selectable button to move backwards a step in the step-by-step training content. Administrative settings shall also include the ability to activate or deactivate other training content module interface elements. The requirements for the administrative settings interface are described in Section 3.7.2.3.4.

*3.7.2.2.6 Content Administrator Interface*

The system shall have the capability to add, remove, or edit training content. Access to the content administrator interface shall be provided through a password protected login interface within the Transportation Skills Training Library system component of the STCS. This system capability shall allow individuals with administrator privileges to log into the Library to upload new or edited training content or delete content as needed to maintain the Transportation Skills Training Library. The results of changes to content made through the content administrator interface shall be immediately available for engagement on the system's main menu by any user. The requirements for the administrator interface are described in Section 3.7.2.3.5.

*3.7.2.2.7 Interface with Assessment System Subcomponent*

The system shall provide the capability for user data to be exchanged between the assessment component of the STCS system and the Transportation Skills Training Library component when user accounts have been created and shared between the two systems. This will facilitate managing the training content recommendations and status of completion for users of the system.

**3.7.2.2.7.1 Shared User Accounts**

The system shall provide the capability for user accounts to be shared between the STCS Assessment system and the Transportation Skills Training Library to facilitate interoperability between those components.

**3.7.2.2.7.2 Assessment Results Informing Training Needs**

The system shall provide the capability for the assessment results to inform the identification of training needs and specific training modules for users of the system.

*3.7.2.2.8 Interface with Pre-Trip Execution System Subcomponent*

The Transportation Skills Training Library system shall function independently from the Pre-Trip Execution System Subcomponent.

*3.7.2.2.9 Interface with Trip Virtualization System Subcomponent*

The Transportation Skills Training Library system shall function independently from the Trip Virtualization System Subcomponent.

### *3.7.2.3 Transportation Skills Training Library Requirements*

The Transportation Skills Training Library system shall provide the capability for independent, web-based access to step-by-step multimedia transportation skills training content for users, including users with cognitive disabilities. The system shall provide the capability for a user to log in to enable tracking of specific user engagement in the system. The system shall interact with the assessment system subcomponent to propose specific training sequences based upon individual assessment results.

*3.7.2.3.1 Component 1: Browser Interaction, Application Updates, and Data Integrity*

#### 3.7.2.3.1.1 Installation Requirements

The system shall have no installation requirements as it will not need to be installed to a local computer.

#### 3.7.2.3.1.2 Web Browser Requirements

The system shall operate on all commonly used mainstream browsers (compliant with HTML-5 and higher).

#### 3.7.1.3.1.2.1 Microsoft Edge Support

The system shall operate on all commonly used mainstream browsers for desktop computers including Microsoft Edge.

#### 3.7.1.3.1.2.2 Google Chrome Support

The system shall operate on all commonly used mainstream browsers for desktop computers including Google Chrome.

#### 3.7.1.3.1.2.3 Mozilla Foxfire Support

The system shall operate on all commonly used mainstream browsers for desktop computers including Mozilla Foxfire.

#### 3.7.1.3.1.2.4 Apple Mobile Device Browser Support

The system shall operate on all commonly used mainstream browsers for desktop computers including Apple Mobile Device Browser.

#### 3.7.1.3.1.2.5 Android Mobile Device Browser Support

The system shall operate on all commonly used mainstream browsers for desktop computers including Apple Mobile Device Browser.

#### 3.7.2.3.1.3 Offline Operation Not Required

The system shall be a web-based application that provides access in real-time to self-paced, multimedia step-by-step training modules. Connectivity to the internet will be required for accessing the Transportation Skills Training Library system.

#### 3.7.2.3.1.4 Application Update Requirements

The system shall have updates performed directly on the server containing the application by system administrators. The system shall have no updates required by users accessing the system via a web browser.

#### 3.7.1.3.1.4.1 Data Integrity with Application Updates

Updates to the system shall maintain data compatibility with the previous versions of the system.

#### 3.7.1.3.1.4.2 Data Conversion

The system shall be designed such that new features will not require data conversion of existing content.

*3.7.2.3.2 Component 2: Main Menu Interface Functions*

The system shall have the capability for users to access the system via the system's URL.

#### 3.7.2.3.2.1 Main Menu Interface Access

The main menu interface system shall have the capability to be accessed via a password protected login interface.

#### 3.7.2.3.2.2 User Name Setup Requirements

The system shall provide the capability for a user to choose a user name when logging in for the first time.

#### 3.7.2.3.2.3 Password Setup Requirements

The system shall provide the capability for a user to choose a password when logging in for the first time.

#### 3.7.2.3.2.4 Explicit Logout

The system shall provide the capability for a user to specifically log out of the system.

#### 3.7.2.3.2.5 Inactivity Logout

The system shall provide the capability to automatically log a user out of the system after a designated period of inactivity.

#### 3.7.2.3.2.6 Main Menu Navigation

The system shall provide the capability for users to browse through and select desired training content.

#### 3.7.2.3.2.6.1 Category Button Distinction

The system shall have category buttons in the main menu that are designed to be visually and auditorily distinctly identifiable from content buttons.

#### 3.7.2.3.2.6.2 Category Button Operation

The system shall have category buttons that provide a single click interface.

#### 3.7.2.3.2.6.3 Category Button Navigation

The system shall have category buttons that provide the capability to navigate to a nested subservient page containing content buttons.

#### 3.7.2.3.2.6.4 Content Button Distinction

The system shall have content buttons that are designed to be visually and auditorily distinctly identifiable from category buttons.

#### 3.7.2.3.2.6.5 Content Button Operation

The system shall have content buttons that provide a single click interface.

#### 3.7.2.3.2.6.6 Content Button Navigation

The system shall have content buttons that provide the capability to select and open training content in the training content navigation interface.

*3.7.2.3.3 Component 3: Training Content Navigation Interface Functions*

The system shall have the capability for users to access the system via the system's URL.

##### 3.7.2.3.3.1 Content Modules

The system shall have training content modules that open to a start page.

#### 3.7.2.3.3.1.1 Start Page Image

The system shall have content modules with a start page that will display the same image that is used on the content button.

#### 3.7.2.3.3.1.2 Start Page Audio Description

The system shall have content modules with a start page that will provide a system-generated audio message that includes a brief description of the training content provided within the respective module.

#### 3.7.2.3.3.1.3 Start Page Audio Prompt

The system shall have a system-generated audio message to prompt the user on the next step in navigating the system (e.g., "Select the start button when you are ready to begin.") which plays following the audio message described in 3.7.2.3.3.1.2.

#### 3.7.2.3.3.1.4 Start Button Operation

The system shall have a single click start button provided on the start page.

#### 3.7.2.3.3.1.5 Start Button Navigation

The system shall have a start button that allows the user to navigate to the first step in the training sequence.

#### 3.7.2.3.3.2 Training Content Presentation

The system shall have training content provided via a series of step pages.

#### 3.7.2.3.3.2.1 Step Page Appearance

The system shall have step pages that may include a digital image depicting training content.

#### 3.7.2.3.3.2.2 Step Page Audio

The system shall have step pages that include audio descriptions of training content.

#### 3.7.2.3.3.2.3 Step Page Text

The system shall have step pages that include a text description of training content.

#### 3.7.2.3.3.2.4 Step Page Video

The system shall have step pages that may include video descriptions of training content.

#### 3.7.2.3.3.2.5 Step Page Forward Navigation

The system shall have step pages that provide a single click forward navigation button with the capability to move to the next step in the training sequence.

#### 3.7.2.3.3.2.6 Step Page Forward Navigation Double Click Denial

The system shall have forward navigation buttons that do not accept a double click.

#### 3.7.2.3.3.2.7 Forward Navigation Button Appearance

The system shall have step pages with a forward navigation button that appears on the display after the audio and/or video portion of the description of training content has played.

#### 3.7.2.3.3.2.8 Step Page Media Replay

The system shall have step pages with a navigation button that provides the capability to replay audio or video descriptions of training content.

#### 3.7.2.3.3.2.9 Step Page Backward Navigation

The system shall have step pages with a button to navigate to the previous step in a training sequence.

#### 3.7.2.3.3.2.10 Training Module Restart

The system shall have step pages with a button to restart the training module from the start page.

#### 3.7.2.3.3.2.11 Aborting a Training Module

The system shall have step pages with a button to abort the training module and return to the main menu.

#### 3.7.2.3.3.2.12 Training Module Last Step Notification

The system shall have a done button on the last step to indicate the training module has been completed.

#### 3.7.2.3.3.2.13 Training Module Last Step Navigation

The system shall return to the main menu when a training module has been completed.

*3.7.2.3.4 Component 4: Administrative Settings Interface*

The Transportation Skills Training Library system shall include an administrative settings interface to allow an administrator to adjust features and interface appearance in the training content navigation interface to optimize opportunities for independent operation of the training content navigation interface by users with different needs and disabilities. The system shall provide the capability to activate or deactivate features that may be confusing or unneeded by targeted users (e.g., to turn program navigational audio prompts on or off) or to display or hide screen elements (e.g., the navigational button to abort a training sequence).

##### 3.7.2.3.4.1 Administrative Settings Interface Access

The administrative settings interface system shall be accessed via a password protected login interface.

##### 3.7.2.3.4.2 Password Modification Requirements

The system shall provide the capability for an administrator to change his or her password after logging into the administrative settings interface.

##### 3.7.2.3.4.3 Temporary Password Retrieval

The system shall provide the capability for an administrator to request a one-time use temporary password be sent to him or her in a secure fashion to log into the site if the password not known.

##### 3.7.2.3.4.4 New Administrator Account Creation

The system shall provide the capability for an administrator to create new accounts for additional users of the administrative settings interface with unique usernames and passwords.

#### 3.7.2.3.4.5 Assignment of Administrator Privileges

The system shall provide the capability for an administrator to set/modify the level of access for additional administrator accounts by identifying which system functions are available to the newly created admin user.

#### 3.7.2.3.4.6 Explicit Logout

The system shall provide the capability for an administrator to specifically log out of the system.

#### 3.7.2.3.4.7 Inactivity Logout

The system shall provide the capability to automatically log an administrator out of the system after a designated period of inactivity.

#### 3.7.2.3.4.8 Incorrect Password Lockout

The system shall provide the capability to automatically lockout the user if an incorrect password has been entered on three consecutive attempts. The user will then need to invoke the temporary password retrieval feature (3.7.2.3.4.3) to regain access to the system.

#### 3.7.2.3.4.9 Administrative Settings Interface Appearance

The administrative settings interface system shall include a series of text-based feature descriptions of adjustable elements of the training content navigation interface.

#### 3.7.2.3.4.10 Administrative Settings Interface Operation

The administrative settings interface system shall include the capability to activate or display features and screen elements on the training content navigation interface.

#### 3.7.2.3.4.11 Administrative Settings Interface Controls

The administrative settings interface system shall include administrator-selectable on/off controls to enable activation/deactivation of features or to display or hide screen elements in the training content navigation interface.

#### 3.7.2.3.4.12 Administrative Settings Interface to Save Settings

The administrative settings interface system shall include a button to save adjusted settings while exiting the system.

#### 3.7.2.3.4.13 Administrative Settings Interface to Cancel Settings

The administrative settings interface system shall include a button to cancel adjusted settings while exiting the system.

*3.7.2.3.5 Component 5: Content Management Interface*

The Transportation Skills Training Library system shall include a content management interface to allow an administrator to add or delete multimedia training content sequences. The content management system shall provide the capability to add, delete or edit training content categories.

**3.7.2.3.5.1 Content Management Interface Access**

The content management interface system shall be accessed via a password protected login interface.

**3.7.2.3.5.2 Password Modification Requirements**

The system shall provide the capability for an administrator to change his or her password after logging into the content management interface.

**3.7.2.3.5.3 Temporary Password Retrieval**

The system shall provide the capability for an administrator to request a one-time use temporary password be sent to him or her in a secure fashion to log into the site if the password not known.

**3.7.2.3.5.4 New Administrator Account Creation**

The system shall provide the capability for an administrator to create new accounts for additional users of the content management interface with unique usernames and passwords.

**3.7.2.3.5.5 Assignment of Administrator Privileges**

The system shall provide the capability for an administrator to set/modify the level of access for content management accounts by identifying which system functions are available to the newly created admin user.

**3.7.2.3.5.6 Explicit Logout**

The system shall provide the capability for an administrator to specifically log out of the system.

**3.7.2.3.5.7 Inactivity Logout**

The system shall provide the capability to automatically log an administrator out of the system after a designated period of inactivity.

**3.7.2.3.5.8 Incorrect Password Lockout**

The system shall provide the capability to automatically lockout the user if an incorrect password has been entered on three consecutive attempts. The user will then need to invoke the temporary password retrieval feature (3.7.2.3.5.3) to regain access to the system.

**3.7.2.3.5.9 Adding New Training Content**

The system shall provide the capability for administrators to add new training content.

#### 3.7.2.3.5.10 Deleting Training Content

The system shall provide the capability for administrators to delete existing training content.

#### 3.7.2.3.5.11 Adding Training Content Categories

The system shall provide the capability for administrators to add new training content categories.

#### 3.7.2.3.5.12 Deleting Training Content Categories

The system shall provide the capability for administrators to delete existing training content categories.

#### 3.7.2.3.5.13 Editing Training Content Categories

The system shall provide the capability for administrators to edit training content categories.

## 3.7.3 Pre-Trip Execution: Subsystem Requirements

### *3.7.3.1 Definition*

The pre-trip execution system shall consist of a series of integrated local applications to support pre-trip execution activities. The system shall provide the capability to create multimedia time-based events that notify users of when to perform key pre-trip activities via AbleLink's proprietary Endeavor technology. The system shall provide the capability to create personalized step-by-step multimedia instructions that can be used independently by users with cognitive disabilities and others, to support sequential task completion via AbleLink's proprietary Visual Impact technology. The system shall also provide the capability to create personalized multimedia pre-trip activity checklists that can be used by users, including users with cognitive disabilities, to independently complete non-sequential pre-trip activities. The system shall provide the capability for the time-based event system to automatically launch pre-trip sequential and non-sequential prompting support tasks at user-designated times.

### *3.7.3.2 Pre-Trip Execution System Requirements*

This section describes the detailed system requirements for the Pre-Trip Execution System.

*3.7.3.2.1 Component 1: App Installation, Updates and Startup*

#### 3.7.3.2.1.1 Apple Device Installation

The pre-trip execution system shall be available for as a downloadable app directly from the Apple App store.

#### 3.7.3.2.1.2 Android Device Installation

#### 3.7.2.2.1.2.1 Android Device Installation from Google Play Store

The pre-trip execution system shall be available as a downloadable app directly from the Google Play store.

#### 3.7.2.2.1.2.2 Android Device Installation via .apk File

Android versions of the pre-trip execution system shall be able to be installed directly to the device using an .apk file containing the pre-trip execution system. This feature will allow for installation of the pre-trip execution system by copying the .apk file directly to the device and thus not require connection to an online App store.

##### 3.7.3.2.1.3 Application Update Requirements

#### 3.7.3.2.1.3.1 iOS Version Updates

iOS version updates to the pre-trip execution system shall be made available through the Apple App store.

#### 3.7.3.2.1.3.2 Android Version Updates

*3.7.3.2.1.3.2.1 Android Version Updates via Google Play Store*

Android version updates to the pre-trip execution system shall be made available through the Google Play store.

*3.7.3.2.1.3.2.2 Android Version Updates via .apk File*

Android version updates to the pre-trip execution system shall be made available through .apk files which can be delivered to users electronically.

#### 3.7.3.2.1.3.3 System Startup

*3.7.3.2.1.3.3.1 Direct Startup*

The pre-trip execution system shall be able to be launched from the standard icon from a convenient location on the device.

*3.7.3.2.1.3.3.2 Time-based Startup*

The pre-trip execution system shall be capable of being launched to a specific pre-trip prompting sequence or checklist based on a scheduled event added to the scheduling component of the system. This feature is designed to enable the appropriate pre-trip preparation content to be initiated automatically based on the user's personal schedule.

*3.7.3.2.2 Component 2: Pre-Trip Execution Scheduling System Operation*

The pre-trip execution scheduling system shall display the currently selected day's scheduled events. The system shall display scheduled events using multiple modalities to convey the event to the end user. These event notification modalities may include an image, text name, an audio description and device vibration (for devices equipped with haptic features) when the user selects the event on the display list. If more scheduled events are available than can be displayed, a swipe action method shall be provided to the user to allow access to the additional events that cannot be displayed. The pre-trip execution scheduling system shall include a main display module, a settings module and an event creation and editing module. The specific requirements for each of these capabilities are detailed in this section.

#### 3.7.3.2.2.1 System Controls

The system shall provide controls on the main menu display to access all needed system components, including scheduled events, system settings and the event creation/editor.

#### 3.7.3.2.2.1.1 User Interface

*3.7.3.2.2.1.1.1 Graphical Representation of User Controls*

The system shall present user controls with a graphical icon.

*3.7.3.2.2.1.1.2 Size of Graphical Controls*

The system shall provide graphical controls that are sufficiently large to allow easy operation by a finger touch.

*3.7.3.2.2.1.1.3 Audible Feedback*

The system shall provide audible feedback when a user-controlled icon is selected.

#### 3.7.3.2.2.1.2 Main Menu Interface Controls

*3.7.3.2.2.1.2.1 Volume Control*

The system shall provide a single click volume control to provide the capability for users to cycle through a series of increasing volume levels.

*3.7.3.2.2.1.2.2 Time Control*

The system shall provide a text-based time control that audibly reads aloud the time when selected.

*3.7.3.2.2.1.2.3 Date Control*

The system shall provide a text-based date control that audibly reads aloud the date when selected.

*3.7.3.2.2.1.2.4 Event Preview and Review*

The system shall provide the capability for users to preview a scheduled event.

3.7.3.2.2.1.2.4.1 Multi-modal Event Preview Features

The system shall provide the capability to preview the current day's events using a combination of images, text and audio to facilitate schedule review by end users.

3.7.3.2.2.1.2.4.2 Passed Event Review Features

The system shall optionally provide the capability to review passed day's events using a combination of images, text and audio to facilitate schedule review by end users.

3.7.3.2.2.1.2.4.3 Future Event Preview Features

The system shall optionally provide the capability to preview future day's events using a combination of images, text and audio to facilitate schedule review by end users.

#### 3.7.3.2.2.1.3 Event Creation/Editor Button

The system shall provide the capability to display a button to enter an event creation mode to create or edit events.

*3.7.3.2.2.1.3.1 Preventing Accidental Activation of Event Creation/Editor Mode*

The system shall include one or more features to prevent accidental activation of the event creation mode.

#### 3.7.3.2.2.1.4 Settings Button

The system shall provide the capability to display a button to enter the settings module to allow changes to system settings.

*3.7.3.2.2.1.4.1 Preventing Accidental Entry to System Settings*

The system shall include one or more features to prevent accidental entry to the system settings module to prevent end users from changing system settings when it would be inappropriate for them to do so.

#### 3.7.3.2.2.1.5 Instructional Module Access Button

The system shall provide the capability to display a button to access the instructional module to allow access to multimedia, step-by-step pre-trip execution activities.

#### 3.7.3.2.2.2 Activation of Scheduled Events

The system shall provide the capability for users to acknowledge receipt of scheduled events when they are activated.

#### 3.7.3.2.2.2.1 Automated Launch of Instructional Module

The system shall provide the optional capability for scheduled events to automatically launch related instructional sequences in the instructional module when acknowledged.

#### 3.7.3.2.2.2.2 Automated Launch of SMART Travel Route

The system shall provide the optional capability for scheduled events to automatically launch related SMART Travel Routes when acknowledged.

#### 3.7.3.2.2.3 Scheduled Event System Settings

The system shall display a screen when the system settings button is selected where the user or caregiver can select or modify the system settings. The following system settings will be supported in the pre-trip event scheduling module.

#### 3.7.3.2.2.3.1 Notification Option

The system shall provide the capability to activate or deactivate the option to notify a remote caregiver via email that a scheduled event has been acknowledged by the end user.

#### 3.7.3.2.2.3.2 Calendar Audio Option

The system shall provide the capability to activate or deactivate the option to audibly playback the date when selected on the main menu.

#### 3.7.3.2.2.3.3 Time Audio Option

The system shall provide the capability to activate or deactivate the option to audibly playback the time when selected on the main menu.

#### 3.7.3.2.2.3.4 Settings Button Option

The system shall provide the capability to display or hide the settings button on the main menu.

#### 3.7.3.2.2.3.5 Retrieve Available Instructional Sequences Option

The system shall provide the capability to retrieve all currently available instructional sequences in the instructional sequence module to enable automated launching of instructional sequences upon acknowledgement of scheduled events.

#### 3.7.3.2.2.3.6 Retrieve Available SMART Travel Routes

The system shall provide the capability to retrieve all currently available SMART travel routes on the device to assist with launching the specific route for a specific travel time as an event within the system.

#### 3.7.3.2.2.3.7 Future Preview and Passed Review of Scheduled Events Option

The system shall provide the capability to activate or deactivate the option to preview future day's scheduled events or review passed day's scheduled events.

### 3.7.3.2.2.4 Event Creation/Editor Module

The system shall display a screen when the event creation/editor button is selected where the user or caregiver can create a scheduled event for display on the main menu. The following system settings shall be supported in the pre-trip event creation and editing module.

#### 3.7.3.2.2.4.1 Event Date

The system shall provide the capability to select the date of the scheduled event.

#### 3.7.3.2.2.4.2 Event Time

The system shall provide the capability to select the time of the scheduled event.

#### 3.7.3.2.2.4.3 Event Recurrence

The system shall provide the capability to select recurrence frequencies for the scheduled event.

#### 3.7.3.2.2.4.4 Event Description

The system shall provide the capability to provide a text description of the scheduled event.

#### 3.7.3.2.2.4.5 Event Audio

The system shall provide the capability to record an audio description of the scheduled event.

#### 3.7.3.2.2.4.6 Event Image

The system shall provide the capability to provide a digital image depiction of the scheduled event.

##### *3.7.3.2.2.4.6.1 Selecting an Existing Image*

The system shall provide the capability to navigate to an existing image on the computer, tablet or smart phone.

##### *3.7.3.2.2.4.6.2 Obtaining New Image*

The system shall provide the capability to obtain a new image using the computer, tablet or smart phone's built-in camera.

#### 3.7.3.2.2.4.7 Automated Launching of Instructional Sequences

The system shall provide the capability to launch an existing instructional sequence via the instructional sequence module upon acknowledgement of a scheduled event.

##### *3.7.3.2.2.4.7.1 Display of Available Instructional Sequences*

The system shall provide the capability to display the titles of the instructional sequences that are currently available in the instructional sequence module.

##### *3.7.3.2.2.4.7.2 Selection of Available Instructional Sequences*

The system shall provide the capability to select an existing instructional sequence from the list of titles that will automatically launch upon acknowledgement of the scheduled event.

#### 3.7.3.2.2.4.8 Launching of Trip Virtualization Training Scenario Reminders

The system shall provide the capability to notify the user to launch an existing trip virtualization scenario.

##### *3.7.3.2.2.4.8.1 Display of Available Virtualization Scenarios*

The system shall provide the capability to display the titles of the virtualization scenarios that are currently available in the trip virtualization module.

##### *3.7.3.2.2.4.8.2 Selection of Available Virtualization Scenarios*

The system shall provide the capability to select an existing virtualization scenario from the list of titles that will automatically launch a reminder to practice the virtualization scenario.

#### 3.7.3.2.2.4.9 Automated Launching of SMART Travel Routes

The system shall provide the capability to launch an existing SMART Travel Route and a SMART-compliant mobile app upon acknowledgement of a scheduled event.

*3.7.3.2.2.4.9.1 Display of Available SMART Travel Routes*

The system shall provide the capability to display the titles of the available SMART Travel Routes that are available on the mobile device.

*3.7.3.2.2.4.9.2 Selection of Available SMART Travel Routes*

The system shall provide the capability to select an existing SMART Travel Route from the list of titles that will automatically launch upon acknowledgement of the scheduled event.

*3.7.3.2.3 Component 3: Pre-Trip Execution Instructional Sequence Operation*

The pre-trip execution instructional sequence module shall provide the capability for independent access to step-by-step multimedia pre-trip execution preparation content for users (i.e., tasks), including users with cognitive disabilities. The system shall provide both sequential and non-sequential (e.g., checklist) pre-trip execution preparation task prompting.

##### 3.7.3.2.3.1 Main Menu Interface Functions

The system shall open to a main menu interface that shows the available pre-trip execution instructional sequences.

#### 3.7.3.2.3.1.1 Main Menu Navigation

The system shall provide the capability for users to browse through and select desired training content.

#### 3.7.3.2.3.1.2 Category Button Distinction

The system shall have category buttons in the main menu that are designed to be visually and auditorily distinctly identifiable from content buttons.

#### 3.7.3.2.3.1.3 Category Button Operation

The system shall have category buttons that provide a single click interface.

#### 3.7.3.2.3.1.4 Category Button Navigation

The system shall have category buttons that provide the capability to navigate to a nested subservient category or page containing content buttons.

#### 3.7.3.2.3.1.5 Content Button Distinction

The system shall have content buttons that are designed to be visually and auditorily distinctly identifiable from category buttons.

#### 3.7.3.2.3.1.6 Content Button Operation

The system shall have content buttons that provide a single click interface.

#### 3.7.3.2.3.1.7 Content Button Navigation

The system shall have content buttons that provide the capability to select and open training content in the training content navigation interface.

#### 3.7.3.2.3.2 Pre-Trip Training Content Navigation Interface Functions

The pre-trip execution content interface system shall provide multimodal prompting support for both sequential and non-sequential tasks.

#### 3.7.3.2.3.2.1 Content Modules

The system shall have pre-trip execution content modules that open to a start page.

#### 3.7.3.2.3.2.2 Start Page Image

The system shall have content modules with a start page that will display the same image that is used on the content button.

#### 3.7.3.2.3.2.3 Start Page Audio Description

The system shall have content modules with a start page that may provide a system-generated audio message that includes a brief description of the pre-trip execution content provided within the respective module.

#### 3.7.3.2.3.2.4 Start Page Audio Prompt

The system shall have a system-generated audio message to prompt the user on the next step in navigating the system (e.g., “Select the start button when you are ready to begin.”) which plays following the audio message described in 3.7.2.3.3.1.2.

#### 3.7.3.2.3.2.5 Start Button Operation

The system shall have a single click start button provided on the start page.

#### 3.7.3.2.3.2.6 Start Button Navigation

The system shall have a start button that allows the user to navigate to the first step in the pre-trip execution sequence.

#### 3.7.3.2.3.3 Pre-trip Execution Content Presentation

The system shall have pre-trip execution content provided via a series of step pages.

#### 3.7.3.2.3.3.1 Step Page Appearance

The system shall have the capability to include a digital image depicting pre-trip execution content on the step page.

#### 3.7.3.2.3.3.2 Step Page Audio

The system shall have the capability to include audio descriptions of pre-trip execution content on the step page.

#### 3.7.3.2.3.3.3 Step Page Text

The system shall have the capability to include a text description of pre-trip execution content on the step page.

#### 3.7.3.2.3.3.4 Step Page Video

The system shall the capability to include video descriptions of pre-trip execution content on the step page.

#### 3.7.3.2.3.3.5 Step Page Forward Navigation

The system shall have step pages that provide a single click forward navigation button with the capability to move to the next step in the pre-trip execution content.

#### 3.7.3.2.3.3.6 Step Page Forward Navigation Double Click Denial

The system shall have forward navigation buttons that do not accept a double click.

#### 3.7.3.2.3.3.7 Forward Navigation Button Appearance

The system shall have step pages with a forward navigation button that appears on the display after the audio and/or video portion of the description of pre-trip execution content has played.

#### 3.7.3.2.3.3.8 Step Page Checklist Function

The system shall have the capability in non-sequential pre-trip execution tasks for users to indicate that a step in a non-sequential pre-trip execution step has been completed.

##### *3.7.3.2.3.3.8.1 Tracking Checklist Function Completed Steps*

The system shall provide the capability in non-sequential pre-trip execution tasks to track completed steps in checklist tasks.

##### *3.7.3.2.3.3.8.2 Checklist Function Re-Presentation*

The system shall provide the capability for checklist function pre-trip execution tasks to continue to present steps that have not been marked as completed to prompt the user to complete unfinished steps.

#### 3.7.3.2.3.3.9 Step Page Media Replay

The system shall have step pages with a navigation button that provides the capability to replay audio and/or video descriptions of pre-trip execution content.

#### 3.7.3.2.3.3.10 Step Page Backward Navigation

The system shall have step pages with a button to navigate to the previous step in a pre-trip execution content.

#### 3.7.3.2.3.3.11 Pre-trip Execution Module Restart

The system shall have step pages with a button to restart the pre-trip execution module from the start page.

#### 3.7.3.2.3.3.12 Aborting a Pre-trip Execution Module

The system shall have step pages with a button to abort the pre-trip execution module and return to the main menu.

#### 3.7.3.2.3.3.13 Pre-trip Execution Module Last Step Notification

The system shall have a done button on the last step to indicate the pre-trip execution module has been completed.

#### 3.7.3.2.3.3.14 Pre-trip Execution Module Last Step Navigation

The system shall return to the main menu when a pre-trip execution module has been completed.

### 3.7.3.2.3.4 Pre-Trip Execution Administrative Settings Interface

The Pre-trip execution system shall include an administrative settings interface to allow an administrator to adjust features and interface appearance in the pre-trip training content navigation interface to optimize opportunities for independent engagement by users with different needs and disabilities. The system shall provide the capability to activate or deactivate features that may be confusing or unneeded by targeted users (e.g., to turn navigational audio prompts on or off) or to display or hide screen elements (e.g., the navigational button to abort a training sequence). The specific requirements for these system capabilities are detailed in this section.

#### 3.7.3.2.3.4.1 Administrative Settings Interface Controls

The system shall provide an administrative settings interface that will allow administrator-selectable on/off controls to enable activation/deactivation of features or to display/hide screen elements in the training content navigation interface.

#### 3.7.3.2.3.4.2 Administrative Settings Interface Notification Control

The system shall provide an administrative settings interface that will allow the capability to activate or deactivate automated remote email notifications of user activity.

#### 3.7.3.2.3.4.3 Administrative Settings Interface Email Notification Text Box

The system shall provide an administrative settings interface that will include a text box to enter an email address to receive automated remote notifications of user activity.

#### 3.7.3.2.3.4.4 Administrative Settings Interface to Save Settings

The system shall provide an administrative settings interface that will include a button to save adjusted settings while exiting the system.

#### 3.7.3.2.3.4.5 Administrative Settings Interface to Cancel Settings

The system shall provide an administrative settings interface that will include a button to cancel adjusted settings while exiting the system.

### 3.7.3.2.3.5 Pre-Trip Execution Content Creation Module

The Pre-trip execution system shall include a content creation interface to provide the capability to create pre-trip multimodal instructional sequences.

#### 3.7.3.2.3.5.1 Pre-Trip Execution Content Module Access

The system shall provide a capability to access the pre-trip execution content module from the main menu interface.

#### 3.7.3.2.3.5.2 Initiating the New Content Creation Process

The system shall provide the capability to access the pre-trip content module creation interface to initiate the new content creation process.

#### 3.7.3.2.3.5.3 New Content Task Name

The system shall have the capability to enter a name for the task.

#### 3.7.3.2.3.5.4 New Content Task Identification Audio Message

The system shall have the capability to record an audio message to assist users with identifying specific instructional sequences displayed on the main menu.

#### 3.7.3.2.3.5.5 New Content Task Image

The system shall have the capability to select an image to assist users with identifying specific instructional sequences displayed on the main menu.

*3.7.3.2.3.5.5.1 Obtaining a New Image*

The system shall have the capability for users to obtain an image via the hardware device’s built in camera.

*3.7.3.2.3.5.5.2 Navigating to an Existing Image*

The system shall have the capability for users to navigate to and select an existing image on the hardware device.

**3.7.3.2.3.5.6 New Content Task Audio**

The system shall have the capability for users to record an audio message that will play following selection of a desired training sequence on the main menu to introduce the task and prompt the user to begin.

**3.7.3.2.3.5.7 Delineation of Sequential or Non-Sequential Task**

The system shall have the capability for users to indicate if the instructional content shall be presented as a sequential (i.e., step-by-step) or non-sequential (i.e., checklist) task.

**3.7.3.2.3.5.8 Adding Step Content to Tasks**

The system shall provide the capability for users to add steps to an instructional task.

*3.7.3.2.3.5.8.1 Entering a Step Name*

The system shall have the capability for users to enter a name for each step in a task.

*3.7.3.2.3.5.8.2 Recording a Step Audio Message*

The system shall have the capability for users to record an instructional audio message for each step in a task.

*3.7.3.2.3.5.8.3 Recording a Step Video Message*

The system shall have the capability for users to optionally record an instructional video clip for each step in a task.

*3.7.3.2.3.5.8.4 Obtaining a Step Image*

The system shall have the capability for users to assign an image for each step in a task.

3.7.3.2.3.5.8.4.1 Obtaining a New Step Image from Camera

The system shall have the capability for users to obtain a new image for each step in a task using the device’s built-in camera.

3.7.3.2.3.5.8.4.2 Obtaining a New Step Image from Disk

The system shall have the capability for users to obtain a new image for each step in a task by navigating to an existing image on the device.

**3.7.3.2.3.5.9 Deleting Steps in a Task**

The system shall provide the capability for users to delete individual steps in a task.

#### 3.7.3.2.3.5.10 Saving and Finishing Newly Created Tasks

The system shall provide the capability for users to save and finish newly created task content and return to the main menu.

*3.7.3.2.3.5.10.1 Displaying Newly Created Tasks*

The system shall return to the main menu after a new task has been saved with the new task displayed and ready for playback on the main menu.

#### 3.7.3.2.3.5.11 Editing Tasks

The system shall have the capability for users to edit task content to include adding steps, deleting steps, or editing step content.

#### 3.7.3.2.3.5.12 Hiding Tasks

The system shall have the capability for users to hide tasks such that they are no longer available to users on the main menu but are still present in the system.

#### 3.7.3.2.3.5.13 Show Tasks

The system shall have the capability for users to show tasks that were previously marked as hidden such that they are again displayed and available to users on the main menu.

#### 3.7.3.2.3.5.14 Delete Tasks

The system shall have the capability for users to completely delete tasks from the system.

*3.7.3.2.3.5.14.1 Confirmation Prior to Task Deletion*

The system shall have the capability for users to have to confirm the deletion of a task prior to the deletion event occurring.

#### 3.7.3.2.3.5.15 Exiting Content Creation Module

The system shall have a button that provides the capability for users to exit the content creation module and return to the main menu.

## 3.7.4 Trip Virtualization: Subsystem Requirements

### *3.7.4.1 Definition*

The trip virtualization module shall provide the capability for users to experience a simulation of a transit trip via an integrated presentation of video, text, image, and audio content. The Trip Virtualization Module shall provide the capability for users to virtually familiarize with specific transportation trips when the system is used in conjunction with SMART-complaint routes. The virtualization viewer shall be a desktop tool, rather than a mobile tool given that simulation of the mobile app will be part of the virtualization experiences. Video playback is more consistent on a desktop player, as opposed to web-based and

video playback rate is very important to ensure the simulated mobile app and video are synchronized. Video playback on the web is often negatively affected by connectivity issues and will not support the synchronized presentation of the virtualization scenario and the mobile app simulation. The system shall support the capability for repetition of virtualization scenarios as needed for individualized learning opportunities.

### *3.7.4.2 Trip Virtualization System Requirements*

This section details the requirements for the Trip Virtualization component of the STCS system. Virtualization experiences for travel activities shall be developed using a desktop virtualization scenario creation tool and then played back as virtualization scenarios that contain a simulation of the mobile wayfinding app that will be using the SMART compliant travel route for individuals to become familiar with the context of a specific trip.

#### *3.7.4.2.1 Component 1: Install, Updates and Startup*

##### 3.7.4.2.1.1 Virtualization Scenario Viewer Distribution Requirements

The Virtualization Scenario Viewer App shall be distributed via electronic delivery of the setup.exe file from a website or email.

##### 3.7.4.2.1.2 Virtualization Scenario Viewer Installation Requirements

The Virtualization Scenario Viewer App shall be able to be installed using a single Windows compliant setup.exe.

##### 3.7.4.2.1.2.1 Startup Requirements

The Virtualization System Desktop Builder App shall be able to be launched from a convenient location on the computer desktop or from the Windows Start Menu.

##### 3.7.4.2.1.2.2 Application Update Requirements

*3.7.4.2.1.2.2.1 Distribution and Installation of Periodic Updates*

Periodic updates to the Virtualization System Desktop Builder App shall be distributed as described in 3.7.4.2.1.1 and installed as described in 3.7.4.2.1.2.

##### 3.7.4.2.1.3 Virtualization System Desktop Builder App Distribution Requirements

The Virtualization System Desktop Builder App shall be distributed via electronic delivery of the setup.exe file from a website or email.

##### 3.7.4.2.1.4 Virtualization System Desktop Builder App Installation Requirements

The Virtualization System Desktop Builder App shall be able to be installed using a single Windows compliant setup.exe.

#### 3.7.4.2.1.5 Startup Requirements

The Virtualization System Desktop Builder App shall be able to be launched from a convenient location on the computer desktop or from the Windows Start Menu.

#### 3.7.4.2.1.6 Application Update Requirements

##### 3.7.4.2.1.6.1 Distribution and Installation of Periodic Updates

Periodic updates to the Virtualization System Desktop Builder App shall be distributed as described in 3.7.4.2.1.3 and installed as described in 3.7.4.2.1.4.

*3.7.4.2.2 Component 2: Trip Virtualization Desktop Scenario Development Tool*

The trip virtualization desktop scenario development tool shall allow caregivers, travel trainers or other transportation support professionals to create new virtualization scenarios used to orient individuals to transportation activities. The specific requirements for each of these capabilities are detailed in this section.

#### 3.7.4.2.2.1 System Controls

The system shall provide controls on the main menu display to access all needed system components, including viewing the local library of virtualization scenarios, accessing system settings and the capability to create/edit new virtualization scenarios.

#### 3.7.4.2.2.2 Library of Existing Virtualization Scenarios

The system shall provide the capability to view the local library of virtualization scenarios that have been created previously to select a scenario to view/edit.

#### 3.7.4.2.2.3 Trip Virtualization Scenario Create/Edit Module

The Trip Virtualization system shall include a create/edit module to provide the capability to create new virtualization scenarios or to edit existing virtualization scenarios.

##### 3.7.4.2.2.3.1 Trip Virtualization Scenario Creation Module Access

The system shall provide a capability to access the content create/edit module from the main menu interface.

##### 3.7.4.2.2.3.2 Initiating the New Virtualization Scenario Creation Process

The system shall provide the capability to initiate the creation of new trip virtualization scenarios to begin the new content creation process.

##### 3.7.4.2.2.3.3 New Virtualization Scenario Name

The system shall have the ability to enter a name for the virtualization scenario.

#### 3.7.4.2.2.3.4 New Virtualization Scenario Identification Audio Message

The system shall have the capability to record an audio message to assist users with identifying specific virtualization scenarios available to them.

#### 3.7.4.2.2.3.5 New Virtualization Scenario Image

The system shall have the capability to select an image to assist users with identifying specific virtualization scenarios available to them.

#### 3.7.4.2.2.3.6 New Virtualization Scenario Audio

The system shall have the capability to record an audio message that will play following selection of a desired virtualization scenario to confirm the user's selection.

#### 3.7.4.2.2.3.7 Adding Videos to Scenarios

The system shall provide the capability to select one or more videos that have been recorded for use in the trip virtualization subsystem.

#### 3.7.4.2.2.3.8 Adding SMART- complaint Routes to Scenarios

The system shall provide the capability for users to incorporate media and other relevant information from a SMART compliant route to provide an enhanced simulation of specific travel routes.

#### 3.7.4.2.2.3.9 Deleting Virtualization Scenario Components

The system shall have the capability for users to delete components added to the virtualization scenario, such as one or more previously added videos or SMART compliant routes.

#### 3.7.4.2.2.3.10 Saving Newly Created Virtualization Scenarios

The system shall provide the capability for users to save newly created virtualization scenarios and return to the main menu.

#### 3.7.4.2.2.3.11 Editing Virtualization Scenarios

The system shall have the capability for users to edit virtualization scenarios to modify the scenario content.

#### 3.7.4.2.2.3.12 Deleting Virtualization Scenarios

The system shall have the capability for users to completely delete virtualization scenarios from the subsystem.

##### *3.7.4.2.2.3.12.1 Confirmation Prior to Virtualization Scenario Deletion*

The system shall have the capability for users to have to confirm the deletion of virtualization scenarios prior the deletion event occurring.

#### 3.7.4.2.2.3.13 Exiting Virtualization Scenario Create/Edit Module

The system shall provide the capability for users to exit the virtualization scenario create/edit module and return to the main menu.

*3.7.4.2.3 Component 3: Trip Virtualization Scenario Viewer App*

The trip virtualization scenario viewer app shall allow individuals with cognitive disabilities and others that may benefit from the trip virtualization experience to select a virtualization scenario to engage in which will simultaneously depict the route in video format along with a synchronized simulation of the mobile device interface which will be used to support independent travel. The specific requirements for each of these capabilities are detailed in this section.

##### 3.7.4.2.3.1 Virtualization Scenario Navigation Interface Functions

The virtualization scenario playback system shall enable users with cognitive disabilities to engage in the trip virtualization experience.

#### 3.7.4.2.3.1.1 Trip Virtualization Scenarios

The system shall display available trip virtualization scenarios that are available to the individual on the playback computer.

#### 3.7.4.2.3.1.2 Virtualization Scenario Start Page Image

The system shall present a selected virtualization scenario with a start page that will display the same image that is used on the scenario selection page.

#### 3.7.4.2.3.1.3 Virtualization Scenario Start Page Audio Description

The system shall provide the capability to play an audio message that includes a brief description of the trip virtualization content provided within the selected scenario.

#### 3.7.4.2.3.1.4 Virtualization Scenario Start Page Audio Prompt

The system shall provide the option to include an audio message to prompt the user to begin the virtualization scenario (e.g., “Select the start button when you are ready to begin.”) which plays following the audio message described in 3.7.4.2.3.1.3.

#### 3.7.4.2.3.1.5 Virtualization Scenario Start Button Operation

The system shall have a single click start button provided on the virtualization scenario start page.

#### 3.7.4.2.3.1.6 Virtualization Scenario Restart

The system shall provide the capability to restart the virtualization scenario.

#### 3.7.4.2.3.1.7 Aborting a Virtualization Scenario

*The system shall provide the capability to abort a virtualization scenario.*

##### 3.7.4.2.3.2 Virtualization Scenario Content Presentation

The system shall support the following content types with the scenario based on the content provided within the associated SMART compliant route.

#### 3.7.4.2.3.2.1 Digital Image Presentation

The system shall have the capability to include digital images depicting virtualization scenario content.

#### 3.7.4.2.3.2.2 Audio Presentation

The system shall have the capability to include audio narration describing virtualization scenario content.

#### 3.7.4.2.3.2.3 Text Presentation

The system shall have the capability to display informational text as part of the virtualization scenario.

#### 3.7.4.2.3.2.4 Video Presentation

The system shall the capability to include video files representing segments of the trip as part of the virtualization scenario.

*3.7.4.2.4 Component 4: System Settings*

The trip virtualization playback app shall provide the capability to support user customization settings to modify the virtualization experience for users.

##### 3.7.4.2.4.1 Text Font Size

The system shall provide the capability to set a desired font size for informational text that will be displayed during a virtualization scenario.

**3.7.4.2.4.2** Audio Option

The system shall provide the capability to turn on or off audio support for a user.

##### 3.7.4.2.4.3 Voice Navigation

The system shall provide the capability to navigate through a virtualization scenario from beginning to end using voice control, if that feature is supported on the mobile device that is being simulated within the virtualization scenario.

##### 3.7.4.2.4.4 Touch Screen Navigation

The system shall provide the capability to navigate through a virtualization scenario from beginning to end using a touch screen.

# 3.8 Performance Requirements

The following subsection defines the general hardware requirements for the host computer which will be used to access the two web-based applications, as well as for mobile devices running local component apps.

## 3.8.1 Host Computer for Accessing Web-based and Local Applications

#### *3.8.1.1 Microprocessor*

The Host Computer's microprocessor shall operate at a minimum clock speed of 1.7 GHz.

#### *3.8.1.2 Random Access Memory (RAM)*

The Host Computer shall contain a minimum 4GB 800 MHz Dual Channel DDR2 SDRAM.

#### *3.8.1.3 Hard Disk*

The Host Computer shall contain a minimum of 10GB free hard disk storage to store any downloaded assessment reports or training content.

#### *3.8.1.4 Network Adapter*

The Host Computer shall contain a minimum 10/100mb per second network adapter.

#### *3.8.1.5 Video Adapter*

The Host Computer shall contain video adapter operating at a minimum of 32-bit color with a minimum horizontal resolution of 1024 pixels, a minimum vertical resolution of 900 pixels, and a total area not less than .9216 million pixels.

#### *3.8.1.6 Standard Keyboard*

The Host Computer shall contain a standard keyboard.

#### *3.8.1.7 Standard Pointing Device*

The Host Computer shall contain a standard pointing device.

#### *3.8.1.8 Operating System*

The Host Computer shall operate with Windows 8 64 bit Professional or Enterprise Operating System or higher.

## 3.8.2 STCS Local Apps

The STCS local component apps shall operate on a tablet or smartphone device (mobile device) with the following characteristics.

#### *3.8.2.1 Display Size*

The mobile device's microprocessor minimum display size shall be 5".

#### *3.8.2.2 Android Operating System*

The Android mobile device shall operate with Android 4.6 or higher.

#### *3.8.2.3 iOS Operating System*

The Apple mobile device shall operate with iOS 6.2 or higher.

#### *3.8.2.4 Notification Services Require Data Connection*

When notification features are needed for the end user, the device used to operate STCS shall require connection to wifi or a data plan to support these system features.

#### *3.8.2.5 Power Loss*

Local content shall be saved on the device so that if power is lost, all content is still available on the device when the device is recharged.

#### *3.8.2.6 Storage*

The mobile device shall support a minimum of 80 MB of storage for scheduling, pre-trip execution and virtualization functions.

# 3.9 Precedence

Not applicable.

# 3.10 Quality Assurance Provisions

Internal testing of the mobile and server applications will be accomplished by the development team and the AbleLink staff. External testing for the mobile applications will be accomplished with a pairing of data gathering within the mobile applications and distribution via the Apple TestFlight beta distribution system for iOS and the Beta Testing program on Google Play for our Android versions.

# 3.11 Software Quality Assurance

## 3.11.1 Requirements Traceability and Verification Matrix

Included in Appendix A.

# 3.12 Notes

Reserved for future use.

# Chapter 4. User Definitions

Please see Table 2-1 for definitions of the STCS subsystems.

| DOCUMENT REVISION HISTORY | | | |
|---|---|---|---|
| **Version Number** | **Approved Date** | **Description of Change(s)** | **Created/ Modified By** |
| **2** | | Requirements revisions, primarily to Trip Virtualization section, reflect ongoing project research and development findings, feedback from the Project Steering Committee and other field practitioners, and broad technology developments. These changes include removal of references to Internet Explorer due to Microsoft's discontinued support of that browser and removal of 360-degree video due to feedback from field practitioners. | Steven E. Stock |
| **2** | | Changes made to Trip Virtualization section have been made to reflect ongoing research and development findings that affect subsystem development. | Steven E. Stock |

# Appendix A. REQUIREMENTS SUMMARY TABLE AND TRACEABILITY TO USER NEEDS

## Key 1

**Table 1. Requirement Summary Table**

| Subsystems | Components |
|---|---|
| A. Transportation Readiness Assessment System | 1. Web-based Access and Operation |
| | 2. User Management Functions |
| | 3. Assessment User Interface Functions |
| | 4. System Settings |
| B. Transportation Skills Training Library | 1. Browser Interaction, Application Updates, and Data Integrity |
| | 2. Main Menu Interface Functions |
| | 3. Training Content Navigation Interface Functions |
| | 4. Administrative Settings Interface |
| | 5. Content Management Interface |
| C. Pre-Trip Execution | 1. Browser Interaction, Application Updates, and Data Integrity |
| | 2. Main Menu Interface Functions |
| | 3. Training Content Navigation Interface Functions |
| | 4. Administrative Settings Interface |
| | 5. Content Management Interface |
| D. Trip Virtualization System | 1. App Installation, Startup and Updates |
| | 2. Trip Virtualization Scenario Development |
| | 3. Trip Virtualization Mobile Player App |
| | 4. System Settings |

# Key 2

**Table 2. Status and Date Summary Table**

| Status | Description |
|---|---|
| 1 | Conceptual |
| 2 | Design |
| 3 | Development |
| 4 | Alpha Test |
| 5 | Beta Test |
| 6 | Release |
| Date | Date status 6 achieved |

**Table 3. Requirements to User Needs Traceability Table**

| SUB | COMP | Requirement | Needs | Status | Date |
|---|---|---|---|---|---|
| A | 1 | 3.7.1.3.1.1 Web Browser Requirements | 2,12 | 4 | |
| A | 1 | 3.7.1.3.1.1.1 Microsoft Edge Support | 2,12 | 4 | |
| A | 1 | 3.7.1.3.1.1.2 Google Chrome Support | 2,12 | 4 | |
| A | 1 | 3.7.1.3.1.1.3 Mozilla Firefox Support | 2,12 | 4 | |
| A | 1 | 3.7.1.3.1.1.4 Apple Mobile Device Browser Support | 2,12 | 4 | |
| A | 1 | 3.7.1.3.1.1.5 Android Mobile Device Browser Support | 2,12 | 4 | |
| A | 1 | 3.7.1.3.1.2 Offline Operation Not Required | 2,12 | 4 | |
| A | 1 | 3.7.1.3.1.3 Application Update Requirements | 2,12 | 4 | |
| A | 2 | 3.7.1.3.2.1 Creation of New Users | 2,12 | 3 | |
| A | 2 | 3.7.1.3.2.1.1 Creation Date of New Users | 2,12 | 3 | |
| A | 2 | 3.7.1.3.2.1.2 User Name | 1,2,3,4,12 | 3 | |
| A | 2 | 3.7.1.3.2.1.3 User Image | 1,2,3,4,12 | 3 | |
| A | 2 | 3.7.1.3.2.1.4 User Password | 2,3,12 | 3 | |
| A | 2 | 3.7.1.3.2.1.5 User Access Level | 2,12 | 3 | |
| A | 2 | 3.7.1.3.2.2 Editing of User Information | 2,12 | 3 | |

| | | | | | |
|---|---|---|---|---|---|
| A | 2 | 3.7.1.3.2.2.1 Editing Existing Users | 2,12 | 3 | |
| A | 2 | 3.7.1.3.2.2.2 Canceling Changes to Edits | 2,12 | 3 | |
| A | 2 | 3.7.1.3.2.3.1 Deleting Existing Users | 2,12 | 3 | |
| A | 2 | 3.7.1.3.2.3.2 Confirmation of User Deletion | 2,12 | 3 | |
| A | 2 | 3.7.1.3.2.3.3 Restoring Deleted Users | 2,12 | 3 | |
| A | 2 | 3.7.1.3.2.4 Managing Access Levels for Users | 2,12 | 3 | |
| A | 2 | 3.7.1.3.2.4.2 Viewing List of Current Users and Access Levels | 2,12 | 3 | |
| A | 2 | 3.7.1.3.2.4.3 Editing List of Current Users and Access Levels | 2,12 | 3 | |
| A | 3 | 3.7.1.3.3.1.1 Open Access to the STCS Assessment System | 2,3,12,14 | 4 | |
| A | 3 | 3.7.1.3.3.1.2 Access to the STCS Assessment System for User's with Accounts | 2,3,12,14 | 4 | |
| A | 3 | 3.7.1.3.3.2 User Name Setup Requirements | 2,3,12 | 3 | |
| A | 3 | 3.7.1.3.3.3 Password Setup Requirements | 2,3,12 | 3 | |
| A | 3 | 3.7.1.3.3.4 Explicit Logout | 2,3,12 | 4 | |
| A | 3 | 3.7.1.3.3.5 Inactivity Logout | 2,3,12 | 5 | |
| A | 3 | 3.7.1.3.3.6 Battery of Assessments | 2,12 | 5 | |
| A | 3 | 3.7.1.3.3.6.1 Assessment Start Page Image | 1,2,3,4,12 | 5 | |
| A | 3 | 3.7.1.3.3.6.2 Assessment Start Page Audio Description | 1,2,3,4,12 | 5 | |
| A | 3 | 3.7.1.3.3.6.3 Assessment Start Page Audio Prompt | 1,2,3,4,12 | 5 | |
| A | 3 | 3.7.1.3.3.6.4 Intro Button Operation | 1,2,3,4,12 | 5 | |
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| D | 1 | 3.7.4.2.1.4 Virtualization System Desktop Builder App Installation Requirements | 5,14 | 3 | |
| D | 1 | 3.7.4.2.1.5 Startup Requirements | 5,14 | 3 | |
| D | 1 | 3.7.4.2.1.6 Application Update Requirements | 5,14 | 3 | |
| D | 1 | 3.7.4.2.1.6.1 Distribution and Installation of Periodic Updates | 5,14 | 3 | |
| D | 2 | 3.7.4.2.2.1 System Controls | 2,3,4,5,6 | 3 | |
| D | 2 | 3.7.4.2.2.2 Library of Existing Virtualization Scenarios | 2,3,4,5 | 3 | |
| D | 2 | 3.7.4.2.2.3 Trip Virtualization Scenario Create/Edit Module | 1,2,3,4,5 | 4 | |
| D | 2 | 3.7.4.2.2.3.1 Trip Virtualization Scenario Creation Module Access | 3,5 | 4 | |
| D | 2 | 3.7.4.2.2.3.2 Initiating the New Virtualization Scenario Creation Process | 3,5 | 4 | |
| D | 2 | 3.7.4.2.2.3.3 New Virtualization Scenario Name | 1,2,3,4,5 | 4 | |
| D | 2 | 3.7.4.2.2.3.4 New Virtualization Scenario Identification Audio Message | 1,2,3,4,5 | 4 | |
| D | 2 | 3.7.4.2.2.3.5 New Virtualization Scenario Image | 1,2,3,4,5 | 4 | |
| D | 2 | 3.7.4.2.2.3.6 New Virtualization Scenario Audio | 1,2,3,4,5 | 4 | |
| D | 2 | 3.7.4.2.2.3.7 Adding Videos to Scenarios | 1,2,3,4,5 | 4 | |
| D | 2 | 3.7.4.2.2.3.8 Adding SMART- complaint Routes to Scenarios | 2,3,4,5,13,14 | 4 | |
| D | 2 | 3.7.4.2.2.3.9 Deleting Virtualization Scenario Components | 3,5 | 4 | |
| D | 2 | 3.7.4.2.2.3.10 Saving Newly Created Virtualization Scenarios | 2,3,4,5 | 4 | |
| D | 2 | 3.7.4.2.2.3.11 Editing Virtualization Scenarios | 2,3,4,5,13 | 4 | |
| D | 2 | 3.7.4.2.2.3.12 Deleting Virtualization Scenarios | 3,5 | 4 | |
| D | 2 | 3.7.4.2.2.3.12.1 Confirmation Prior to Virtualization Scenario Deletion | 5 | 4 | |
| D | 2 | 3.7.4.2.2.3.13 Exiting Virtualization Scenario Create/Edit Module | 5 | 4 | |
| D | 3 | 3.7.4.2.3.1 Virtualization Scenario Navigation Interface Functions | 1,2,3,4,5,13 | 4 | |
| D | 3 | 3.7.4.2.3.1.1 Trip Virtualization Scenarios | 1,2,3,4,5,13 | 4 | |
| D | 3 | 3.7.4.2.3.1.2 Virtualization Scenario Start Page Image | 1,2,3,4,5,13 | 4 | |

| | | | | | |
|---|---|---|---|---|---|
| D | 3 | 3.7.4.2.3.1.3 Virtualization Scenario Start Page Audio Description | 1,2,3,4,5,13 | 3 | |
| D | 3 | 3.7.4.2.3.1.4 Virtualization Scenario Start Page Audio Prompt | 1,2,3,4,5,13 | 3 | |
| D | 3 | 3.7.4.2.3.1.5 Virtualization Scenario Start Button Operation | 2,3,4,5,13 | 3 | |
| D | 3 | 3.7.4.2.3.1.6 Virtualization Scenario Restart | 2,3,4,5,13 | 3 | |
| D | 3 | 3.7.4.2.3.1.7 Aborting a Virtualization Scenario | 2,3,4,5 | 4 | |
| D | 3 | 3.7.4.2.3.2 Virtualization Scenario Content Presentation | 1,2,3,4,5,13 | 4 | |
| D | 3 | 3.7.4.2.3.2.1 Digital Image Presentations | 1,2,3,4,5,13 | 4 | |
| D | 3 | 3.7.4.2.3.2.2 Audio Presentation | 1,2,3,4,5,13 | 4 | |
| D | 3 | 3.7.4.2.3.2.3 Text Presentation | 1,2,3,4,5,13 | 4 | |
| D | 3 | 3.7.4.2.3.2.4 Video Presentation | 1,2,3,4,5,13 | 4 | |
| D | 4 | 3.7.4.2.4.1 Text Font Size | 2,3,4,5,6,13 | 3 | |
| D | 4 | 3.7.4.2.4.2 Audio Option | 2,3,4,5,6,13 | 3 | |
| D | 4 | 3.7.4.2.4.3 Voice Navigation | 2,3,4,5,13 | 3 | |
| D | 4 | 3.7.4.2.4.4 Touch Screen Navigation | 2,3,4,5,13 | 4 | |

# Appendix B. NEEDS TO REQUIREMENTS TRACEABILITY MATRIX

## KEY

**Table 4. Needs to Requirements Summary Table**

| Subsystems | Components |
|---|---|
| A. Transportation Readiness Assessment System | 1. Web-based Access and Operation |
| | 2. User Management Functions |
| | 3. Assessment User Interface Functions |
| | 4. System Settings |
| B. Transportation Skills Training Library | 1. Browser Interaction, Application Updates, and Data Integrity |
| | 2. Main Menu Interface Functions |
| | 3. Training Content Navigation Interface Functions |
| | 4. Administrative Settings Interface |
| | 5. Content Management Interface |
| C. Pre-Trip Execution | 1. Browser Interaction, Application Updates, and Data Integrity |
| | 2. Main Menu Interface Functions |
| | 3. Training Content Navigation Interface Functions |
| | 4. Administrative Settings Interface |
| | 5. Content Management Interface |
| D. Trip Virtualization System | 1. App Installation, Startup and Updates |
| | 2. Trip Virtualization Scenario Development |
| | 3. Trip Virtualization Mobile Player App |
| | 4. System Settings |

**Cross Reference –Indicates cross-reference to other needs for which the requirement applies.**

**Table 5. Needs to Requirements Traceability Table**

| Need # | SUB | COMP | Requirement | Cross-Reference |
|---|---|---|---|---|
| | | | User Need 1 - Need for visual, auditory, and textual (multimedia) content in systems designed for use by individuals with cognitive disabilities to promote independent usability. | |
| 1 | A | 2 | 3.7.1.3.2.1.2 User Name | 1,2,3,4,12 |
| 1 | A | 2 | 3.7.1.3.2.1.3 User Image | 1,2,3,4,12 |
| 1 | A | 3 | 3.7.1.3.3.6.1 Assessment Start Page Image | 1,2,3,4,12 |
| 1 | A | 3 | 3.7.1.3.3.6.2 Assessment Start Page Audio Description | 1,2,3,4,12 |
| 1 | A | 3 | 3.7.1.3.3.6.3 Assessment Start Page Audio Prompt | 1,2,3,4,12 |
| 1 | A | 3 | 3.7.1.3.3.6.4 Intro Button Operation | 1,2,3,4,12 |
| 1 | A | 3 | 3.7.1.3.3.6.5 Start Button Navigation | 1,2,3,4,12 |
| 1 | A | 3 | 3.7.1.3.3.7 Assessment Content Presentation | 1,2,3,4,12 |
| 1 | A | 3 | 3.7.1.3.3.7.1 Assessment Item Page Appearance | 1,2,3,4,12 |
| 1 | A | 3 | 3.7.1.3.3.7.2 Assessment Item Page Audio | 1,2,3,4,12 |
| 1 | A | 3 | 3.7.1.3.3.7.3 Assessment Item Page Text | 1,2,3,4,12 |
| 1 | A | 3 | 3.7.1.3.3.7.4 Assessment Item Page Video | 1,2,3,4,12 |
| 1 | A | 3 | 3.7.1.3.3.7.5 Assessment Item Page Forward Navigation | 1,2,3,4,12 |
| 1 | A | 3 | 3.7.1.3.3.7.6 Assessment Item Page Forward Navigation Double Click Denial | 1,2,3,4,12 |
| 1 | A | 3 | 3.7.1.3.3.7.7 Forward Navigation Button Appearance | 1,2,3,4,12 |
| 1 | A | 3 | 3.7.1.3.3.7.8 Assessment Item Page Media Replay | 1,2,3,4,12 |
| 1 | A | 3 | 3.7.1.3.3.7.9 Item Page Backward Navigation | 1,2,3,4,12 |
| 1 | A | 3 | 3.7.1.3.3.7.10 Assessment Module Survey Complete Navigation | 1,7,12 |
| 1 | A | 3 | 3.7.1.3.3.8 Assessment Results | 1,2,12 |
| 1 | A | 3 | 3.7.1.3.3.8.1 Viewing Assessment Results | 1,2,12 |
| 1 | A | 3 | 3.7.1.3.3.8.2 Printing Assessment Results | 1,2,12 |
| 1 | B | 2 | 3.7.2.3.2.1 Main Menu Interface Access | 1,2,3,4,9,14 |

| | | | | |
|---|---|---|---|---|
| 1 | B | 2 | 3.7.2.3.2.6 Main Menu Navigation | 1,2,3,4,9 |
| 1 | B | 2 | 3.7.2.3.2.6.1 Category Button Distinction | 1,2,3,4,9 |
| 1 | B | 2 | 3.7.2.3.2.6.4 Content Button Distinction | 1,2,3,4,9 |
| 1 | B | 3 | 3.7.2.3.3.1 Content Modules | 1,2,3,4,9 |
| 1 | B | 3 | 3.7.2.3.3.1.1 Start Page Image | 1,2,3,4,9 |
| 1 | B | 3 | 3.7.2.3.3.1.2 Start Page Audio Description | 1,2,3,4,6,9 |
| 1 | B | 3 | 3.7.2.3.3.1.3 Start Page Audio Prompt | 1,2,3,4,6,9 |
| 1 | B | 3 | 3.7.2.3.3.2 Training Content Presentation | 1,2,3,4,6,9 |
| 1 | B | 3 | 3.7.2.3.3.2.1 Step Page Appearance | 1,2,3,4,9 |
| 1 | B | 3 | 3.7.2.3.3.2.2 Step Page Audio | 1,2,3,4,9 |
| 1 | B | 3 | 3.7.2.3.3.2.3 Step Page Text | 1,2,3,4,9 |
| 1 | B | 3 | 3.7.2.3.3.2.4 Step Page Video | 1,2,3,4,9 |
| 1 | C | 2 | 3.7.3.2.2.1 System Controls | 1,2,3,4,6,10 |
| 1 | C | 2 | 3.7.3.2.2.1.1 User Interface | 1,2,3,4,10 |
| 1 | C | 2 | 3.7.3.2.2.1.1.1 Graphical Representation of User Controls | 1,2,3,4,10 |
| 1 | C | 2 | 3.7.3.2.2.1.2 Main Menu Interface Controls | 1,2,3,4,6,10 |
| 1 | C | 2 | 3.7.3.2.2.1.2.2 Time Control | 1,2,3,4,6,10 |
| 1 | C | 2 | 3.7.3.2.2.1.2.3 Date Control | 1,2,3,4,6,10 |
| 1 | C | 2 | 3.7.3.2.2.1.2.4 Event Preview and Review | 1,2,3,4,6,10 |
| 1 | C | 2 | 3.7.3.2.2.1.2.4.1 Multi-modal Event Preview Features | 1,2,3,4,10 |
| 1 | C | 2 | 3.7.3.2.2.1.2.4.2 Passed Event Review Features | 1,2,3,4,6,10 |
| 1 | C | 2 | 3.7.3.2.2.2 Activation of Scheduled Events | 1,2,3,4,10,14 |
| 1 | C | 2 | 3.7.3.2.2.2.1 Automated Launch of Instructional Module | 1,2,3,4,9,14 |
| 1 | C | 2 | 3.7.3.2.2.2.2 Automated Launch of SMART Travel Route | 1,2,3,4,13,14 |
| 1 | C | 2 | 3.7.3.2.2.3.7 Future Preview and Passed Review of Scheduled Events Option | 1,2,3,6,10 |
| 1 | C | 2 | 3.7.3.2.2.4 Event Creation/Editor Module | 1,2,10 |
| 1 | C | 2 | 3.7.3.2.2.4.1 Event Date | 1,2,10 |

| | | | | |
|---|---|---|---|---|
| 1 | C | 2 | 3.7.3.2.2.4.2 Event Time | 1,2,10 |
| 1 | C | 2 | 3.7.3.2.2.4.3 Event Recurrence | 1,2,10 |
| 1 | C | 2 | 3.7.3.2.2.4.4 Event Description | 1,2,10 |
| 1 | C | 2 | 3.7.3.2.2.4.5 Event Audio | 1,2,10 |
| 1 | C | 2 | 3.7.3.2.2.4.6 Event Image | 1,2,10 |
| 1 | C | 2 | 3.7.3.2.2.4.6.1 Selecting an Existing Image | 1,2,10 |
| 1 | C | 2 | 3.7.3.2.2.4.6.2 Obtaining New Image | 1,2,10 |
| 1 | C | 2 | 3.7.3.2.2.4.7 Automated Launching of Instructional Sequences | 1,2,9,10,14 |
| 1 | C | 2 | 3.7.3.2.2.4.7.1 Display of Available Instructional Sequences | 1,2,9,10,14 |
| 1 | C | 2 | 3.7.3.2.2.4.7.2 Selection of Available Instructional Sequences | 1,2,9,10,14 |
| 1 | C | 2 | 3.7.3.2.2.4.8 Automated Launching of Trip Virtualization Training Scenarios | 1,2,5,10,14 |
| 1 | C | 2 | 3.7.3.2.2.4.8.1 Display of Available Virtualization Scenarios | 1,2,5,10,14 |
| 1 | C | 2 | 3.7.3.2.2.4.8.2 Selection of Available Virtualization Scenarios | 1,2,5,10,14 |
| 1 | C | 2 | 3.7.3.2.2.4.9 Automated Launching of SMART Travel Routes | 1,2,10,13,14 |
| 1 | C | 2 | 3.7.3.2.2.4.9.1 Display of Available SMART Travel Routes | 1,2,10,13,14 |
| 1 | C | 2 | 3.7.3.2.2.4.9.2 Selection of Available SMART Travel Routes | 1,2,10,13,14 |
| 1 | C | 3 | 3.7.3.2.3.1 Main Menu Interface Functions | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.1.1 Main Menu Navigation | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.1.2 Category Button Distinction | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.1.3 Category Button Operation | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.1.4 Category Button Navigation | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.1.5 Content Button Distinction | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.1.6 Content Button Operation | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.1.7 Content Button Navigation | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.2 Pre-Trip Training Content Navigation Interface Functions | 1,2,3,4,6,11 |
| 1 | C | 3 | 3.7.3.2.3.2.1 Content Modules | 1,2,3,4,11 |

| | | | | |
|---|---|---|---|---|
| 1 | C | 3 | 3.7.3.2.3.2.2 Start Page Image | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.2.3 Start Page Audio Description | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.2.4 Start Page Audio Prompt | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.2.5 Start Button Operation | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.2.6 Start Button Navigation | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.3 Pre-trip Execution Content Presentation | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.3.1 Step Page Appearance | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.3.2 Step Page Audio | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.3.3 Step Page Text | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.3.4 Step Page Video | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.3.5 Step Page Forward Navigation | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.3.6 Step Page Forward Navigation Double Click Denial | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.3.7 Forward Navigation Button Appearance | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.3.8 Step Page Checklist Function | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.3.8.1 Tracking Checklist Function Completed Steps | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.3.8.2 Checklist Function Re-Presentation | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.3.9 Step Page Media Replay | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.3.10 Step Page Backward Navigation | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.3.11 Pre-trip Execution Module Restart | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.3.12 Aborting a Pre-trip Execution Module | 1,2,3,4,11 |
| 1 | C | 3 | 3.7.3.2.3.3.13 Pre-trip Execution Module Last Step Notification | 1,2,3,4,8,11 |
| 1 | C | 3 | 3.7.3.2.3.3.14 Pre-trip Execution Module Last Step Navigation | 1,2,3,4,8,11 |
| 1 | C | 3 | 3.7.3.2.3.5.1 Pre-Trip Execution Content Module Access | 1,2,3,11,14 |
| 1 | C | 3 | 3.7.3.2.3.5.2 Initiating the New Content Creation Process | 1,2,3,11 |
| 1 | C | 3 | 3.7.3.2.3.5.3 New Content Task Name | 1,2,3,11 |

| | | | | |
|---|---|---|---|---|
| 1 | C | 3 | 3.7.3.2.3.5.4 New Content Task Identification Audio Message | 1,2,3,11 |
| 1 | C | 3 | 3.7.3.2.3.5.5 New Content Task Image | 1,2,3,11 |
| 1 | C | 3 | 3.7.3.2.3.5.5.1 Obtaining a New Image | 1,2,3,11 |
| 1 | C | 3 | 3.7.3.2.3.5.5.2 Navigating to an Existing Image | 1,2,3,11 |
| 1 | C | 3 | 3.7.3.2.3.5.6 New Content Task Audio | 1,2,3,11 |
| 1 | C | 3 | 3.7.3.2.3.5.7 Delineation of Sequential or Non-Sequential Task | 1,2,3,11 |
| 1 | C | 3 | 3.7.3.2.3.5.8 Adding Step Content to Tasks | 1,2,3,11 |
| 1 | C | 3 | 3.7.3.2.3.5.8.1 Entering a Step Name | 1,2,3,11 |
| 1 | C | 3 | 3.7.3.2.3.5.8.2 Recording a Step Audio Message | 1,2,3,11 |
| 1 | C | 3 | 3.7.3.2.3.5.8.3 Recording a Step Video Message | 1,2,3,11 |
| 1 | C | 3 | 3.7.3.2.3.5.8.4 Obtaining a Step Image | 1,2,3,11 |
| 1 | C | 3 | 3.7.3.2.3.5.11 Editing Tasks | 1,2,3,11 |
| 1 | C | 3 | 3.7.3.2.3.5.8.4.2 Obtaining a New Step Image from Disk | 1,2,3,6,11 |
| 1 | C | 3 | 3.7.3.2.3.5.10.1 Displaying Newly Created Tasks | 1,2,3,11 |
| 1 | D | 2 | 3.7.4.2.2.3 Trip Virtualization Scenario Create/Edit Module | 1,2,3,4,5 |
| 1 | D | 2 | 3.7.4.2.2.3.3 New Virtualization Scenario Name | 1,2,3,4,5 |
| 1 | D | 2 | 3.7.4.2.2.3.4 New Virtualization Scenario Identification Audio Message | 1,2,3,4,5 |
| 1 | D | 2 | 3.7.4.2.2.3.5 New Virtualization Scenario Image | 1,2,3,4,5 |
| 1 | D | 2 | 3.7.4.2.2.3.6 New Virtualization Scenario Audio | 1,2,3,4,5 |
| 1 | D | 2 | 3.7.4.2.2.3.7 Adding Videos to Scenarios | 1,2,3,4,5 |
| 1 | D | 3 | 3.7.4.2.3.1 Virtualization Scenario Navigation Interface Functions | 1,2,3,4,5,13 |
| 1 | D | 3 | 3.7.4.2.3.1.1 Trip Virtualization Scenarios | 1,2,3,4,5,13 |
| 1 | D | 3 | 3.7.4.2.3.1.2 Virtualization Scenario Start Page Image | 1,2,3,4,5,13 |
| 1 | D | 3 | 3.7.4.2.3.1.3 Virtualization Scenario Start Page Audio Description | 1,2,3,4,5,13 |
| 1 | D | 3 | 3.7.4.2.3.1.4 Virtualization Scenario Start Page Audio Prompt | 1,2,3,4,5,13 |

| | | | | |
|---|---|---|---|---|
| 1 | D | 3 | 3.7.4.2.3.2 Virtualization Scenario Content Presentation | 1,2,3,4,5,13 |
| 1 | D | 3 | 3.7.4.2.3.2.1 Digital Image Presentations | 1,2,3,4,5,13 |
| 1 | D | 3 | 3.7.4.2.3.2.2 Audio Presentation | 1,2,3,4,5,13 |
| 1 | D | 3 | 3.7.4.2.3.2.3 Text Presentation | 1,2,3,4,5,13 |
| 1 | D | 3 | 3.7.4.2.3.2.4 Video Presentation | 1,2,3,4,5,13 |
| | | | User Need 2 - The need for consistent and repetitive interfaces in systems designed for use by individuals with cognitive disabilities to reduce cognitive load and support independent usability. | |
| 2 | A | 1 | 3.7.1.3.1.1 Web Browser Requirements | 2,12 |
| 2 | A | 1 | 3.7.1.3.1.1.1 Microsoft Edge Support | 2,12 |
| 2 | A | 1 | 3.7.1.3.1.1.2 Google Chrome Support | 2,12 |
| 2 | A | 1 | 3.7.1.3.1.1.3 Mozilla Firefox Support | 2,12 |
| 2 | A | 1 | 3.7.1.3.1.1.4 Apple Mobile Device Browser Support | 2,12 |
| 2 | A | 1 | 3.7.1.3.1.1.5 Android Mobile Device Browser Support | 2,12 |
| 2 | A | 1 | 3.7.1.3.1.2 Offline Operation Not Required | 2,12 |
| 2 | A | 1 | 3.7.1.3.1.3 Application Update Requirements | 2,12 |
| 2 | A | 2 | 3.7.1.3.2.1 Creation of New Users | 2,12 |
| 2 | A | 2 | 3.7.1.3.2.1.1 Creation Date of New Users | 2,12 |
| 2 | A | 2 | 3.7.1.3.2.1.2 User Name | 1,2,3,4,12 |
| 2 | A | 2 | 3.7.1.3.2.1.3 User Image | 1,2,3,4,12 |
| 2 | A | 2 | 3.7.1.3.2.1.4 User Password | 2,3,12 |
| 2 | A | 2 | 3.7.1.3.2.1.5 User Access Level | 2,12 |
| 2 | A | 2 | 3.7.1.3.2.2 Editing of User Information | 2,12 |
| 2 | A | 2 | 3.7.1.3.2.2.1 Editing Existing Users | 2,12 |
| 2 | A | 2 | 3.7.1.3.2.2.2 Canceling Changes to Edits | 2,12 |
| 2 | A | 2 | 3.7.1.3.2.3.1 Deleting Existing Users | 2,12 |
| 2 | A | 2 | 3.7.1.3.2.3.2 Confirmation of User Deletion | 2,12 |
| 2 | A | 2 | 3.7.1.3.2.3.3 Restoring Deleted Users | 2,12 |

| | | | | |
|---|---|---|---|---|
| 2 | A | 2 | 3.7.1.3.2.4 Managing Access Levels for Users | 2,12 |
| 2 | A | 2 | 3.7.1.3.2.4.1 Admin Level Access | 2,12 |
| 2 | A | 2 | 3.7.1.3.2.4.2 Viewing List of Current Users and Access Levels | 2,12 |
| 2 | A | 2 | 3.7.1.3.2.4.3 Editing List of Current Users and Access Levels | 2,12 |
| 2 | A | 3 | 3.7.1.3.3.1.1 Open Access to the STCS Assessment System | 2,3,12,14 |
| 2 | A | 3 | 3.7.1.3.3.1.2 Access to the STCS Assessment System for User's with Accounts | 2,3,12,14 |
| 2 | A | 3 | 3.7.1.3.3.2 User Name Setup Requirements | 2,3,12 |
| 2 | A | 3 | 3.7.1.3.3.3 Password Setup Requirements | 2,3,12 |
| 2 | A | 3 | 3.7.1.3.3.4 Explicit Logout | 2,3,12 |
| 2 | A | 3 | 3.7.1.3.3.5 Inactivity Logout | 2,3,12 |
| 2 | A | 3 | 3.7.1.3.3.6 Battery of Assessments | 2,12 |
| 2 | A | 3 | 3.7.1.3.3.6.1 Assessment Start Page Image | 1,2,3,4,12 |
| 2 | A | 3 | 3.7.1.3.3.6.2 Assessment Start Page Audio Description | 1,2,3,4,12 |
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| 4 | B | 2 | 3.7.2.3.2.6.3 Category Button Navigation | 2,3,4,9 |
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| 4 | C | 2 | 3.7.3.2.2.1.1 User Interface | 1,2,3,4,10 |
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| 4 | C | 2 | 3.7.3.2.2.1.2.4.1 Multi-modal Event Preview Features | 1,2,3,4,10 |
| 4 | C | 2 | 3.7.3.2.2.1.2.4.2 Passed Event Review Features | 1,2,3,4,6,10 |
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| 4 | C | 2 | 3.7.3.2.2.3.5 Retrieve Available Instructional Sequences Option | 3,4,6,9,14 |
| 4 | C | 2 | 3.7.3.2.2.3.6 Retrieve Available SMART Travel Routes | 3,4,6,13,14 |
| 4 | C | 3 | 3.7.3.2.3.1 Main Menu Interface Functions | 1,2,3,4,11 |
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| 4 | C | 3 | 3.7.3.2.3.1.2 Category Button Distinction | 1,2,3,4,11 |
| 4 | C | 3 | 3.7.3.2.3.1.3 Category Button Operation | 1,2,3,4,11 |
| 4 | C | 3 | 3.7.3.2.3.1.4 Category Button Navigation | 1,2,3,4,11 |
| 4 | C | 3 | 3.7.3.2.3.1.5 Content Button Distinction | 1,2,3,4,11 |
| 4 | C | 3 | 3.7.3.2.3.1.6 Content Button Operation | 1,2,3,4,11 |
| 4 | C | 3 | 3.7.3.2.3.1.7 Content Button Navigation | 1,2,3,4,11 |
| 4 | C | 3 | 3.7.3.2.3.2 Pre-Trip Training Content Navigation Interface Functions | 1,2,3,4,6,11 |
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| 4 | C | 3 | 3.7.3.2.3.3.9 Step Page Media Replay | 1,2,3,4,11 |
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| 4 | C | 3 | 3.7.3.2.3.3.12 Aborting a Pre-trip Execution Module | 1,2,3,4,11 |
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| 4 | D | 2 | 3.7.4.2.2.1 System Controls | 2,3,4,5,6 |
| 4 | D | 2 | 3.7.4.2.2.2 Library of Existing Virtualization Scenarios | 2,3,4,5 |
| 4 | D | 2 | 3.7.4.2.2.3 Trip Virtualization Scenario Create/Edit Module | 1,2,3,4,5 |
| 4 | D | 2 | 3.7.4.2.2.3.3 New Virtualization Scenario Name | 1,2,3,4,5 |
| 4 | D | 2 | 3.7.4.2.2.3.4 New Virtualization Scenario Identification Audio Message | 1,2,3,4,5 |
| 4 | D | 2 | 3.7.4.2.2.3.5 New Virtualization Scenario Image | 1,2,3,4,5 |
| 4 | D | 2 | 3.7.4.2.2.3.6 New Virtualization Scenario Audio | 1,2,3,4,5 |
| 4 | D | 2 | 3.7.4.2.2.3.7 Adding Videos to Scenarios | 1,2,3,4,5 |
| 4 | D | 2 | 3.7.4.2.2.3.8 Adding SMART- complaint Routes to Scenarios | 2,3,4,5,13,14 |
| 4 | D | 2 | 3.7.4.2.2.3.10 Saving Newly Created Virtualization Scenarios | 2,3,4,5 |
| 4 | D | 2 | 3.7.4.2.2.3.11 Editing Virtualization Scenarios | 2,3,4,5,13 |
| 4 | D | 3 | 3.7.4.2.3.1 Virtualization Scenario Navigation Interface Functions | 1,2,3,4,5,13 |
| 4 | D | 3 | 3.7.4.2.3.1.1 Trip Virtualization Scenarios | 1,2,3,4,5,13 |
| 4 | D | 3 | 3.7.4.2.3.1.2 Virtualization Scenario Start Page Image | 1,2,3,4,5,13 |
| 4 | D | 3 | 3.7.4.2.3.1.3 Virtualization Scenario Start Page Audio Description | 1,2,3,4,5,13 |
| 4 | D | 3 | 3.7.4.2.3.1.4 Virtualization Scenario Start Page Audio Prompt | 1,2,3,4,5,13 |
| 4 | D | 3 | 3.7.4.2.3.1.5 Virtualization Scenario Start Button Operation | 2,3,4,5,13 |

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| 4 | D | 3 | 3.7.4.2.3.1.6 Virtualization Scenario Restart | 2,3,4,5,13 |
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| 4 | D | 3 | 3.7.4.2.3.2 Virtualization Scenario Content Presentation | 1,2,3,4,5,13 |
| 4 | D | 3 | 3.7.4.2.3.2.1 Digital Image Presentations | 1,2,3,4,5,13 |
| 4 | D | 3 | 3.7.4.2.3.2.2 Audio Presentation | 1,2,3,4,5,13 |
| 4 | D | 3 | 3.7.4.2.3.2.3 Text Presentation | 1,2,3,4,5,13 |
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| 4 | D | 4 | 3.7.4.2.4.1 Text Font Size | 2,3,4,5,6,13 |
| 4 | D | 4 | 3.7.4.2.4.2 Audio Option | 2,3,4,5,6,13 |
| 4 | D | 4 | 3.7.4.2.4.3 Voice Navigation | 2,3,4,5,13 |
| 4 | D | 4 | 3.7.4.2.4.4 Touch Screen Navigation | 2,3,4,5,13 |
| | | | User Need 5 - The need to provide route-specific virtualization content to minimize the need for abstract thinking or generalization of learning. | |
| 5 | C | 2 | 3.7.3.2.2.4.8 Automated Launching of Trip Virtualization Training Scenarios | 1,2,5,10,14 |
| 5 | C | 2 | 3.7.3.2.2.4.8.1 Display of Available Virtualization Scenarios | 1,2,5,10,14 |
| 5 | C | 2 | 3.7.3.2.2.4.8.2 Selection of Available Virtualization Scenarios | 1,2,5,10,14 |
| 5 | D | 1 | 3.7.4.2.1.1 Virtualization Scenario Viewer Distribution Requirements | 5,14 |
| 5 | D | 1 | 3.7.4.2.1.2 Virtualization Scenario Viewer Installation Requirements | 5,14 |
| 5 | D | 1 | 3.7.4.2.1.2.1 Startup Requirements | 5,14 |
| 5 | D | 1 | 3.7.4.2.1.2.2 Application Update Requirements | 2,5,14 |
| 5 | D | 1 | 3.7.4.2.1.2.2.1 Distribution and Installation of Periodic Updates | 2,5,14 |
| 5 | D | 1 | 3.7.4.2.1.3 Virtualization System Desktop Builder App Distribution Requirements | 5,14 |
| 5 | D | 1 | 3.7.4.2.1.4 Virtualization System Desktop Builder App Installation Requirements | 5,14 |
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| 5 | D | 1 | 3.7.4.2.1.6 Application Update Requirements | 5,14 |

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| 5 | D | 1 | 3.7.4.2.1.6.1 Distribution and Installation of Periodic Updates | 5,14 |
| 5 | D | 2 | 3.7.4.2.2.1 System Controls | 2,3,4,5,6 |
| 5 | D | 2 | 3.7.4.2.2.2 Library of Existing Virtualization Scenarios | 2,3,4,5 |
| 5 | D | 2 | 3.7.4.2.2.3 Trip Virtualization Scenario Create/Edit Module | 1,2,3,4,5 |
| 5 | D | 2 | 3.7.4.2.2.3.1 Trip Virtualization Scenario Creation Module Access | 3,5 |
| 5 | D | 2 | 3.7.4.2.2.3.2 Initiating the New Virtualization Scenario Creation Process | 3,5 |
| 5 | D | 2 | 3.7.4.2.2.3.3 New Virtualization Scenario Name | 1,2,3,4,5 |
| 5 | D | 2 | 3.7.4.2.2.3.4 New Virtualization Scenario Identification Audio Message | 1,2,3,4,5 |
| 5 | D | 2 | 3.7.4.2.2.3.5 New Virtualization Scenario Image | 1,2,3,4,5 |
| 5 | D | 2 | 3.7.4.2.2.3.6 New Virtualization Scenario Audio | 1,2,3,4,5 |
| 5 | D | 2 | 3.7.4.2.2.3.7 Adding Videos to Scenarios | 1,2,3,4,5 |
| 5 | D | 2 | 3.7.4.2.2.3.8 Adding SMART- complaint Routes to Scenarios | 2,3,4,5,13,14 |
| 5 | D | 2 | 3.7.4.2.2.3.9 Deleting Virtualization Scenario Components | 3,5 |
| 5 | D | 2 | 3.7.4.2.2.3.10 Saving Newly Created Virtualization Scenarios | 2,3,4,5 |
| 5 | D | 2 | 3.7.4.2.2.3.11 Editing Virtualization Scenarios | 2,3,4,5,13 |
| 5 | D | 2 | 3.7.4.2.2.3.12 Deleting Virtualization Scenarios | 3,5 |
| 5 | D | 2 | 3.7.4.2.2.3.12.1 Confirmation Prior to Virtualization Scenario Deletion | 5 |
| 5 | D | 2 | 3.7.4.2.2.3.13 Exiting Virtualization Scenario Create/Edit Module | 5 |
| 5 | D | 3 | 3.7.4.2.3.1 Virtualization Scenario Navigation Interface Functions | 1,2,3,4,5,13 |
| 5 | D | 3 | 3.7.4.2.3.1.1 Trip Virtualization Scenarios | 1,2,3,4,5,13 |
| 5 | D | 3 | 3.7.4.2.3.1.2 Virtualization Scenario Start Page Image | 1,2,3,4,5,13 |
| 5 | D | 3 | 3.7.4.2.3.1.3 Virtualization Scenario Start Page Audio Description | 1,2,3,4,5,13 |
| 5 | D | 3 | 3.7.4.2.3.1.4 Virtualization Scenario Start Page Audio Prompt | 1,2,3,4,5,13 |
| 5 | D | 3 | 3.7.4.2.3.1.5 Virtualization Scenario Start Button Operation | 2,3,4,5,13 |

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| 5 | D | 3 | 3.7.4.2.3.1.6 Virtualization Scenario Restart | 2,3,4,5,13 |
| 5 | D | 3 | 3.7.4.2.3.1.7 Aborting a Virtualization Scenario | 2,3,4,5 |
| 5 | D | 3 | 3.7.4.2.3.2 Virtualization Scenario Content Presentation | 1,2,3,4,5,13 |
| 5 | D | 3 | 3.7.4.2.3.2.1 Digital Image Presentations | 1,2,3,4,5,13 |
| 5 | D | 3 | 3.7.4.2.3.2.2 Audio Presentation | 1,2,3,4,5,13 |
| 5 | D | 3 | 3.7.4.2.3.2.3 Text Presentation | 1,2,3,4,5,13 |
| 5 | D | 3 | 3.7.4.2.3.2.4 Video Presentation | 1,2,3,4,5,13 |
| 5 | D | 4 | 3.7.4.2.4.1 Text Font Size | 2,3,4,5,6,13 |
| 5 | D | 4 | 3.7.4.2.4.2 Audio Option | 2,3,4,5,6,13 |
| 5 | D | 4 | 3.7.4.2.4.3 Voice Navigation | 2,3,4,5,13 |
| 5 | D | 4 | 3.7.4.2.4.4 Touch Screen Navigation | 2,3,4,5,13 |
| | | | User Need 6 - The need to provide interface customization settings to optimize independent use by individuals with different cognitive skills and needs. | |
| 6 | A | 4 | 3.7.1.3.4.1 Question Font Size | 2,3,6,12 |
| 6 | A | 4 | 3.7.1.3.4.2 Answer Font Size | 4,6 |
| 6 | A | 4 | 3.7.1.3.4.3 Audio Option | 2,3,6,12 |
| 6 | B | 3 | 3.7.2.3.3.1.2 Start Page Audio Description | 1,2,3,4,6,9 |
| 6 | B | 3 | 3.7.2.3.3.1.3 Start Page Audio Prompt | 1,2,3,4,6,9 |
| 6 | B | 3 | 3.7.2.3.3.2 Training Content Presentation | 1,2,3,4,6,9 |
| 6 | B | 3 | 3.7.2.3.3.2.6 Step Page Forward Navigation Double Click Denial | 2,3,4,6,9 |
| 6 | B | 3 | 3.7.2.3.3.2.8 Step Page Media Replay | 2,3,4,6,9 |
| 6 | B | 3 | 3.7.2.3.3.2.9 Step Page Backward Navigation | 2,3,4,6,9 |
| 6 | B | 3 | 3.7.2.3.3.2.10 Training Module Restart | 2,3,4,6,9 |
| 6 | B | 3 | 3.7.2.3.3.2.11 Aborting a Training Module | 2,3,4,6,9 |
| 6 | B | 4 | 3.7.2.3.4.1 Administrative Settings Interface Access | 3,6,14 |
| 6 | B | 4 | 3.7.2.3.4.2 Password Modification Requirements | 3,6,14 |
| 6 | B | 4 | 3.7.2.3.4.3 Temporary Password Retrieval | 3,6,14 |

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| 6 | B | 4 | 3.7.2.3.4.4 New Administrator Account Creation | 3,6,14 |
| 6 | B | 4 | 3.7.2.3.4.5 Assignment of Administrator Privileges | 3,6,14 |
| 6 | B | 4 | 3.7.2.3.4.6 Explicit Logout | 3,6,14 |
| 6 | B | 4 | 3.7.2.3.4.7 Inactivity Logout | 3,6,14 |
| 6 | B | 4 | 3.7.2.3.4.8 Incorrect Password Lockout | 3,6,14 |
| 6 | B | 4 | 3.7.2.3.4.9 Administrative Settings Interface Appearance | 3,6 |
| 6 | B | 4 | 3.7.2.3.4.10 Administrative Settings Interface Operation | 3,6 |
| 6 | B | 4 | 3.7.2.3.4.11 Administrative Settings Interface Controls | 3,6 |
| 6 | B | 4 | 3.7.2.3.4.12 Administrative Settings Interface to Save Settings | 3,6 |
| 6 | B | 4 | 3.7.2.3.4.13 Administrative Settings Interface to Cancel Settings | 3,6 |
| 6 | B | 5 | 3.7.2.3.5.1 Content Management Interface Access | 3,6,14 |
| 6 | B | 5 | 3.7.2.3.5.2 Password Modification Requirements | 3,6,14 |
| 6 | B | 5 | 3.7.2.3.5.3 Temporary Password Retrieval | 3,6,14 |
| 6 | B | 5 | 3.7.2.3.5.4 New Administrator Account Creation | 3,6,14 |
| 6 | B | 5 | 3.7.2.3.5.5 Assignment of Administrator Privileges | 3,6,14 |
| 6 | B | 5 | 3.7.2.3.5.6 Explicit Logout | 3,6,14 |
| 6 | B | 5 | 3.7.2.3.5.7 Inactivity Logout | 3,6,14 |
| 6 | B | 5 | 3.7.2.3.5.8 Incorrect Password Lockout | 3,6,14 |
| 6 | B | 5 | 3.7.2.3.5.9 Adding New Training Content | 4,6,9 |
| 6 | B | 5 | 3.7.2.3.5.10 Deleting Training Content | 4,6,9 |
| 6 | B | 5 | 3.7.2.3.5.11 Adding Training Content Categories | 4,6,9 |
| 6 | B | 5 | 3.7.2.3.5.12 Deleting Training Content Categories | 4,6,9 |
| 6 | B | 5 | 3.7.2.3.5.13 Editing Training Content Categories | 4,6,9 |
| 6 | C | 2 | 3.7.3.2.2.1 System Controls | 1,2,3,4,6,10 |
| 6 | C | 2 | 3.7.3.2.2.1.2 Main Menu Interface Controls | 1,2,3,4,6,10 |
| 6 | C | 2 | 3.7.3.2.2.1.2.2 Time Control | 1,2,3,4,6,10 |
| 6 | C | 2 | 3.7.3.2.2.1.2.3 Date Control | 1,2,3,4,6,10 |

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| 6 | C | 2 | 3.7.3.2.2.1.2.4 Event Preview and Review | 1,2,3,4,6,10 |
| 6 | C | 2 | 3.7.3.2.2.1.2.4.2 Passed Event Review Features | 1,2,3,4,6,10 |
| 6 | C | 2 | 3.7.3.2.2.1.3.1 Preventing Accidental Activation of Event Creation/Editor Mode | 3,6 |
| 6 | C | 2 | 3.7.3.2.2.1.4 Settings Button | 3,6 |
| 6 | C | 2 | 3.7.3.2.2.1.4.1 Preventing Accidental Entry to System Settings | 3,6 |
| 6 | C | 2 | 3.7.3.2.2.3 Scheduled Event System Settings | 2,3,6 |
| 6 | C | 2 | 3.7.3.2.2.3.1 Notification Option | 2,3,6,7 |
| 6 | C | 2 | 3.7.3.2.2.3.2 Calendar Audio Option | 2,3,6 |
| 6 | C | 2 | 3.7.3.2.2.3.3 Time Audio Option | 2,3,6 |
| 6 | C | 2 | 3.7.3.2.2.3.4 Settings Button Option | 2,3,6 |
| 6 | C | 2 | 3.7.3.2.2.3.5 Retrieve Available Instructional Sequences Option | 3,4,6,9,14 |
| 6 | C | 2 | 3.7.3.2.2.3.6 Retrieve Available SMART Travel Routes | 3,4,6,13,14 |
| 6 | C | 2 | 3.7.3.2.2.3.7 Future Preview and Passed Review of Scheduled Events Option | 1,2,3,6,10 |
| 6 | C | 3 | 3.7.3.2.3.2 Pre-Trip Training Content Navigation Interface Functions | 1,2,3,4,6,11 |
| 6 | C | 3 | 3.7.3.2.3.4 Pre-Trip Execution Administrative Settings Interface | 2,3,6,10,11 |
| 6 | C | 3 | 3.7.3.2.3.4.1 Administrative Settings Interface Controls | 2,3,6,10,11 |
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| 12 | A | 3 | 3.7.1.3.3.6.2 Assessment Start Page Audio Description | 1,2,3,4,12 |
| 12 | A | 3 | 3.7.1.3.3.6.3 Assessment Start Page Audio Prompt | 1,2,3,4,12 |
| 12 | A | 3 | 3.7.1.3.3.6.4 Intro Button Operation | 1,2,3,4,12 |
| 12 | A | 3 | 3.7.1.3.3.6.5 Start Button Navigation | 1,2,3,4,12 |
| 12 | A | 3 | 3.7.1.3.3.7 Assessment Content Presentation | 1,2,3,4,12 |
| 12 | A | 3 | 3.7.1.3.3.7.1 Assessment Item Page Appearance | 1,2,3,4,12 |
| 12 | A | 3 | 3.7.1.3.3.7.2 Assessment Item Page Audio | 1,2,3,4,12 |
| 12 | A | 3 | 3.7.1.3.3.7.3 Assessment Item Page Text | 1,2,3,4,12 |
| 12 | A | 3 | 3.7.1.3.3.7.4 Assessment Item Page Video | 1,2,3,4,12 |
| 12 | A | 3 | 3.7.1.3.3.7.5 Assessment Item Page Forward Navigation | 1,2,3,4,12 |
| 12 | A | 3 | 3.7.1.3.3.7.6 Assessment Item Page Forward Navigation Double Click Denial | 1,2,3,4,12 |
| 12 | A | 3 | 3.7.1.3.3.7.7 Forward Navigation Button Appearance | 1,2,3,4,12 |
| 12 | A | 3 | 3.7.1.3.3.7.8 Assessment Item Page Media Replay | 1,2,3,4,12 |
| 12 | A | 3 | 3.7.1.3.3.7.9 Item Page Backward Navigation | 1,2,3,4,12 |
| 12 | A | 3 | 3.7.1.3.3.7.10 Assessment Module Survey Complete Navigation | 1,7,12 |
| 12 | A | 3 | 3.7.1.3.3.8 Assessment Results | 1,2,12 |
| 12 | A | 3 | 3.7.1.3.3.8.1 Viewing Assessment Results | 1,2,12 |
| 12 | A | 3 | 3.7.1.3.3.8.2 Printing Assessment Results | 1,2,12 |

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|---|---|---|---|---|
| 12 | A | 3 | 3.7.1.3.3.8.3 Storage of Assessment Results | 12 |
| 12 | A | 3 | 3.7.1.3.3.8.4 Viewing Previous Assessment Results | 12 |
| 12 | A | 3 | 3.7.1.3.3.8.5 Sharing of Results with Transportation Skills Training Library System | 3,9,12,14 |
| 12 | A | 4 | 3.7.1.3.4.1 Question Font Size | 2,3,6,12 |
| 12 | A | 4 | 3.7.1.3.4.3 Audio Option | 2,3,6,12 |
| 12 | A | 4 | 3.7.1.3.4.4 Keyboard Navigation | 2,3,12 |
| 12 | A | 4 | 3.7.1.3.4.5 Touch Screen Navigation | 2,3,12 |
| | | | User Need 13 - The need for tools to support independent use of public transit systems. | |
| 13 | C | 2 | 3.7.3.2.2.2.2 Automated Launch of SMART Travel Route | 1,2,3,4,13,14 |
| 13 | C | 2 | 3.7.3.2.2.3.6 Retrieve Available SMART Travel Routes | 3,4,6,13,14 |
| 13 | C | 2 | 3.7.3.2.2.4.9 Automated Launching of SMART Travel Routes | 1,2,10,13,14 |
| 13 | C | 2 | 3.7.3.2.2.4.9.1 Display of Available SMART Travel Routes | 1,2,10,13,14 |
| 13 | C | 2 | 3.7.3.2.2.4.9.2 Selection of Available SMART Travel Routes | 1,2,10,13,14 |
| 13 | D | 2 | 3.7.4.2.2.3.8 Adding SMART- complaint Routes to Scenarios | 2,3,4,5,13,14 |
| 13 | D | 2 | 3.7.4.2.2.3.11 Editing Virtualization Scenarios | 2,3,4,5,13 |
| 13 | D | 3 | 3.7.4.2.3.1 Virtualization Scenario Navigation Interface Functions | 1,2,3,4,5,13 |
| 13 | D | 3 | 3.7.4.2.3.1.1 Trip Virtualization Scenarios | 1,2,3,4,5,13 |
| 13 | D | 3 | 3.7.4.2.3.1.2 Virtualization Scenario Start Page Image | 1,2,3,4,5,13 |
| 13 | D | 3 | 3.7.4.2.3.1.3 Virtualization Scenario Start Page Audio Description | 1,2,3,4,5,13 |
| 13 | D | 3 | 3.7.4.2.3.1.4 Virtualization Scenario Start Page Audio Prompt | 1,2,3,4,5,13 |
| 13 | D | 3 | 3.7.4.2.3.1.5 Virtualization Scenario Start Button Operation | 2,3,4,5,13 |
| 13 | D | 3 | 3.7.4.2.3.1.6 Virtualization Scenario Restart | 2,3,4,5,13 |
| 13 | D | 3 | 3.7.4.2.3.2 Virtualization Scenario Content Presentation | 1,2,3,4,5,13 |
| 13 | D | 3 | 3.7.4.2.3.2.1 Digital Image Presentations | 1,2,3,4,5,13 |

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|---|---|---|---|---|
| 13 | D | 3 | 3.7.4.2.3.2.2 Audio Presentation | 1,2,3,4,5,13 |
| 13 | D | 3 | 3.7.4.2.3.2.3 Text Presentation | 1,2,3,4,5,13 |
| 13 | D | 3 | 3.7.4.2.3.2.4 Video Presentation | 1,2,3,4,5,13 |
| 13 | D | 4 | 3.7.4.2.4.1 Text Font Size | 2,3,4,5,6,13 |
| 13 | D | 4 | 3.7.4.2.4.2 Audio Option | 2,3,4,5,6,13 |
| 13 | D | 4 | 3.7.4.2.4.3 Voice Navigation | 2,3,4,5,13 |
| 13 | D | 4 | 3.7.4.2.4.4 Touch Screen Navigation | 2,3,4,5,13 |
| | | | User Need 14 - The need for each sub-system to be able to operate independently or in any combination. | |
| 14 | A | 3 | 3.7.1.3.3.1.1 Open Access to the STCS Assessment System | 2,3,12,14 |
| 14 | A | 3 | 3.7.1.3.3.1.2 Access to the STCS Assessment System for User's with Accounts | 2,3,12,14 |
| 14 | A | 3 | 3.7.1.3.3.8.5 Sharing of Results with Transportation Skills Training Library System | 3,9,12,14 |
| 14 | B | 1 | 3.7.2.3.1.3 Offline Operation Not Required | 2,9,14 |
| 14 | B | 1 | 3.7.2.3.2.1 Main Menu Interface Access | 1,2,3,4,9,14 |
| 14 | B | 2 | 3.7.2.3.2.2 User Name Setup Requirements | 2,3,14 |
| 14 | B | 2 | 3.7.2.3.2.3 Password Setup Requirements | 2,3,14 |
| 14 | B | 2 | 3.7.2.3.2.4 Explicit Logout | 2,3,14 |
| 14 | B | 2 | 3.7.2.3.2.5 Inactivity Logout | 2,3,14 |
| 14 | B | 4 | 3.7.2.3.4.1 Administrative Settings Interface Access | 3,6,14 |
| 14 | B | 4 | 3.7.2.3.4.2 Password Modification Requirements | 3,6,14 |
| 14 | B | 4 | 3.7.2.3.4.3 Temporary Password Retrieval | 3,6,14 |
| 14 | B | 4 | 3.7.2.3.4.4 New Administrator Account Creation | 3,6,14 |
| 14 | B | 4 | 3.7.2.3.4.5 Assignment of Administrator Privileges | 3,6,14 |
| 14 | B | 4 | 3.7.2.3.4.6 Explicit Logout | 3,6,14 |
| 14 | B | 4 | 3.7.2.3.4.7 Inactivity Logout | 3,6,14 |
| 14 | B | 4 | 3.7.2.3.4.8 Incorrect Password Lockout | 3,6,14 |
| 14 | B | 5 | 3.7.2.3.5.1 Content Management Interface Access | 3,6,14 |

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| 14 | B | 5 | 3.7.2.3.5.2 Password Modification Requirements | 3,6,14 |
| 14 | B | 5 | 3.7.2.3.5.3 Temporary Password Retrieval | 3,6,14 |
| 14 | B | 5 | 3.7.2.3.5.4 New Administrator Account Creation | 3,6,14 |
| 14 | B | 5 | 3.7.2.3.5.5 Assignment of Administrator Privileges | 3,6,14 |
| 14 | B | 5 | 3.7.2.3.5.6 Explicit Logout | 3,6,14 |
| 14 | B | 5 | 3.7.2.3.5.7 Inactivity Logout | 3,6,14 |
| 14 | B | 5 | 3.7.2.3.5.8 Incorrect Password Lockout | 3,6,14 |
| 14 | C | 1 | 3.7.3.2.1.1 Apple Device Installation | 2,10,14 |
| 14 | C | 1 | 3.7.3.2.1.2 Android Device Installation | 2,10,14 |
| 14 | C | 1 | 3.7.3.2.1.2.1 Android Device Installation from Google Play Store | 2,10,14 |
| 14 | C | 1 | 3.7.3.2.1.2.2 Android Device Installation via .apk File | 2,10,14 |
| 14 | C | 1 | 3.7.3.2.1.3 Application Update Requirements | 2,10,14 |
| 14 | C | 1 | 3.7.3.2.1.3.1 iOS Version Updates | 2,10,14 |
| 14 | C | 1 | 3.7.3.2.1.3.2 Android Version Updates | 2,10,14 |
| 14 | C | 1 | 3.7.3.2.1.3.2.1 Android Version Updates via Google Play Store | 2,10,14 |
| 14 | C | 1 | 3.7.3.2.1.3.2.2 Android Version Updates via .apk File | 2,10,14 |
| 14 | C | 1 | 3.7.3.2.1.3.3 System Startup | 2,3,10,14 |
| 14 | C | 1 | 3.7.3.2.1.3.3.1 Direct Startup | 2,3,10,14 |
| 14 | C | 1 | 3.7.3.2.1.3.3.2 Time-based Startup | 2,3,10,14 |

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|---|---|---|---|---|
| 14 | C | 2 | 3.7.3.2.2.2 Activation of Scheduled Events | 1,2,3,4,10,14 |
| 14 | C | 2 | 3.7.3.2.2.2.1 Automated Launch of Instructional Module | 1,2,3,4,9,14 |
| 14 | C | 2 | 3.7.3.2.2.2.2 Automated Launch of SMART Travel Route | 1,2,3,4,13,14 |
| 14 | C | 2 | 3.7.3.2.2.3.5 Retrieve Available Instructional Sequences Option | 3,4,6,9,14 |
| 14 | C | 2 | 3.7.3.2.2.3.6 Retrieve Available SMART Travel Routes | 3,4,6,13,14 |
| 14 | C | 2 | 3.7.3.2.2.4.7 Automated Launching of Instructional Sequences | 1,2,9,10,14 |
| 14 | C | 2 | 3.7.3.2.2.4.7.1 Display of Available Instructional Sequences | 1,2,9,10,14 |
| 14 | C | 2 | 3.7.3.2.2.4.7.2 Selection of Available Instructional Sequences | 1,2,9,10,14 |
| 14 | C | 2 | 3.7.3.2.2.4.8 Automated Launching of Trip Virtualization Training Scenarios | 1,2,5,10,14 |
| 14 | C | 2 | 3.7.3.2.2.4.8.1 Display of Available Virtualization Scenarios | 1,2,5,10,14 |
| 14 | C | 2 | 3.7.3.2.2.4.8.2 Selection of Available Virtualization Scenarios | 1,2,5,10,14 |
| 14 | C | 2 | 3.7.3.2.2.4.9 Automated Launching of SMART Travel Routes | 1,2,10,13,14 |
| 14 | C | 2 | 3.7.3.2.2.4.9.1 Display of Available SMART Travel Routes | 1,2,10,13,14 |
| 14 | C | 2 | 3.7.3.2.2.4.9.2 Selection of Available SMART Travel Routes | 1,2,10,13,14 |
| 14 | C | 3 | 3.7.3.2.3.5.1 Pre-Trip Execution Content Module Access | 1,2,3,11,14 |
| 14 | D | 1 | 3.7.4.2.1.1 Virtualization Scenario Viewer Distribution Requirements | 5,14 |
| 14 | D | 1 | 3.7.4.2.1.2 Virtualization Scenario Viewer Installation Requirements | 5,14 |
| 14 | D | 1 | 3.7.4.2.1.2.1 Startup Requirements | 5,14 |
| 14 | D | 1 | 3.7.4.2.1.2.2 Application Update Requirements | 2,5,14 |

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|---|---|---|---|---|
| 14 | D | 1 | 3.7.4.2.1.2.2.1 Distribution and Installation of Periodic Updates | 2,5,14 |
| 14 | D | 1 | 3.7.4.2.1.3 Virtualization System Desktop Builder App Distribution Requirements | 5,14 |
| 14 | D | 1 | 3.7.4.2.1.4 Virtualization System Desktop Builder App Installation Requirements | 5,14 |
| 14 | D | 1 | 3.7.4.2.1.5 Startup Requirements | 5,14 |
| 14 | D | 1 | 3.7.4.2.1.6 Application Update Requirements | 5,14 |
| 14 | D | 1 | 3.7.4.2.1.6.1 Distribution and Installation of Periodic Updates | 5,14 |
| 14 | D | 2 | 3.7.4.2.2.3.8 Adding SMART- complaint Routes to Scenarios | 2,3,4,5,13,14 |

# Appendix C. PERFORMANCE REQUIREMENTS SUMMARY TABLE AND TRACEABILITY TO USER NEEDS

## Key 1

**Table 6. Performance Requirements Summary Table**

| System | Elements |
|---|---|
| P. Performance Requirements | 1. Host Computer |
| | 2. STCS Apps |

## Key 2

**Table 7. Status and Date Summary Table**

| Status | Description |
|---|---|
| 1 | Conceptual |
| 2 | Design |
| 3 | Development |
| 4 | Alpha Test |
| 5 | Beta Test |
| 6 | Release |
| Date | Date status 6 achieved |

**Table 8. Performance Requirements to User Needs Traceability Table**

| SUB | COMP | Requirement | Needs | Status | Date |
|---|---|---|---|---|---|
| P | 1 | 3.8.1.1 Microprocessor | 9, 12,13 | 1 | |
| P | 1 | 3.8.1.2 Random Access Memory (RAM) | 9, 12,13 | 1 | |

| | | | | | |
|---|---|---|---|---|---|
| P | 1 | 3.8.1.3 Hard Disk | 9, 12,13 | 5 | |
| P | 1 | 3.8.1.4 Network Adapter | 9, 12,13 | 5 | |
| P | 1 | 3.8.1.5 Video Adapter | 9, 12,13 | 5 | |
| P | 1 | 3.8.1.6 Standard Keyboard | 9, 12,13 | 5 | |
| P | 1 | 3.8.1.7 Standard Pointing Device | 9, 12,13 | 5 | |
| P | 1 | 3.8.1.8 Operating System | 9, 12,13 | 5 | |
| P | 2 | 3.8.2.1 Display Size | 9, 12,13 | 5 | |
| P | 2 | 3.8.2.2 Android Operating System | 10,11 | 5 | |
| P | 2 | 3.8.2.3 iOS Operating System | 10,11 | 5 | |
| P | 2 | 3.8.2.4 Geo-Location Functions Not Requiring Data Plan | 10,11 | 5 | |
| P | 2 | 3.8.2.5 Notification and Real-time Location Services Require Data Plan | 10,11 | 5 | |
| P | 2 | 3.8.2.6 Power Loss | 10,11 | 5 | |

# Appendix D. NEEDS TO PERFORMANCE REQUIREMENTS TRACEABILITY MATRIX

## Key 1

**Table 9. Performance Requirement Summary Table**

| System | Element |
|---|---|
| P. Performance Requirements | 1. Host Computer |
| | 2. STCS Apps |

**Cross Reference –Indicates cross-reference to other needs for which the performance requirement applies.**

**Table 10. Needs to Requirements Traceability Table**

| Need # | System | Element | Requirement | Cross-Reference |
|---|---|---|---|---|
| | | | User Need 9 - The need for user access to self-directed multimedia travel training content. | |
| 9 | P | 1 | 3.8.1.1 Microprocessor | 9,12,13 |
| 9 | P | 1 | 3.8.1.2 Random Access Memory (RAM) | 9,12,13 |
| 9 | P | 1 | 3.8.1.3 Hard Disk | 9,12,13 |
| 9 | P | 1 | 3.8.1.4 Network Adapter | 9,12,13 |
| 9 | P | 1 | 3.8.1.5 Video Adapter | 9,12,13 |
| 9 | P | 1 | 3.8.1.6 Standard Keyboard | 9,12,13 |
| 9 | P | 1 | 3.8.1.7 Standard Pointing Device | 9,12,13 |
| 9 | P | 1 | 3.8.1.8 Operating System | 9,12,13 |
| 9 | P | 2 | 3.8.2.1 Display Size | 9,12,13 |
| | | | User Need 10 - The need for pre-trip execution tools to support scheduling. | |

| | | | | |
|---|---|---|---|---|
| 10 | P | 2 | 3.8.2.2 Android Operating System | 10,11 |
| 10 | P | 2 | 3.8.2.3 iOS Operating System | 10,11 |
| 10 | P | 2 | 3.8.2.4 Geo-Location Functions Not Requiring Data Plan | 10,11 |
| 10 | P | 2 | 3.8.2.5 Notification and Real-time Location Services Require Data Plan | 10,11 |
| 10 | P | 2 | 3.8.2.6 Power Loss | 10,11 |
| | | | User Need 11 - The need for pre-trip execution tools to support travel preparation. | |
| 11 | P | 2 | 3.8.2.2 Android Operating System | 10,11 |
| 11 | P | 2 | 3.8.2.3 iOS Operating System | 10,11 |
| 11 | P | 2 | 3.8.2.4 Geo-Location Functions Not Requiring Data Plan | 10,11 |
| 11 | P | 2 | 3.8.2.5 Notification and Real-time Location Services Require Data Plan | 10,11 |
| | | | User Need 12 - The need for tools to support self-assessment of travel readiness. | |
| 12 | P | 1 | 3.8.1.1 Microprocessor | 9, 12,13 |
| 12 | P | 1 | 3.8.1.2 Random Access Memory (RAM) | 9, 12,13 |
| 12 | P | 1 | 3.8.1.3 Hard Disk | 9, 12,13 |
| 12 | P | 1 | 3.8.1.4 Network Adapter | 9, 12,13 |
| 12 | P | 1 | 3.8.1.5 Video Adapter | 9, 12,13 |
| 12 | P | 1 | 3.8.1.6 Standard Keyboard | 9, 12,13 |
| 12 | P | 1 | 3.8.1.7 Standard Pointing Device | 9, 12,13 |
| 12 | P | 1 | 3.8.1.8 Operating System | 9, 12,13 |
| 12 | P | 2 | 3.8.2.1 Display Size | 9, 12,13 |
| | | | User Need 13 - The need for tools to support independent use of public transit systems. | |
| 13 | P | 1 | 3.8.1.1 Microprocessor | 9, 12,13 |
| 13 | P | 1 | 3.8.1.2 Random Access Memory (RAM) | 9, 12,13 |
| 13 | P | 1 | 3.8.1.3 Hard Disk | 9, 12,13 |
| 13 | P | 1 | 3.8.1.4 Network Adapter | 9, 12,13 |

| | | | | |
|---|---|---|---|---|
| 13 | P | 1 | 3.8.1.5 Video Adapter | 9, 12,13 |
| 13 | P | 1 | 3.8.1.6 Standard Keyboard | 9, 12,13 |
| 13 | P | 1 | 3.8.1.7 Standard Pointing Device | 9, 12,13 |
| 13 | P | 1 | 3.8.1.8 Operating System | 9, 12,13 |
| 13 | P | 2 | 3.8.2.1 Display Size | 9, 12,13 |

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