



fig 65

Research Analysis

After taking so many photographs it was necessary to organize the information they contain. Though I had sorted the photographs into piles based on categories of prominent problems, connecting details in each were missed when they were placed into piles. In order to look more closely for patterns within the organized groupings of photographs, I pinned the photos up and wrote notes around them about problems I saw, large or small. This allowed me to clarify my research observations, and illuminated issues and the links between them. From these results I came up with four categories of prevalent issues: Safety, Information, Design, and Environmental concerns. With colored pencils I went back through my notes and identified the group, or groups, that each point belonged in. Though the 4 main categories were not descriptive enough to use for final evaluation, they were good organizing tools.

Pattern Analysis

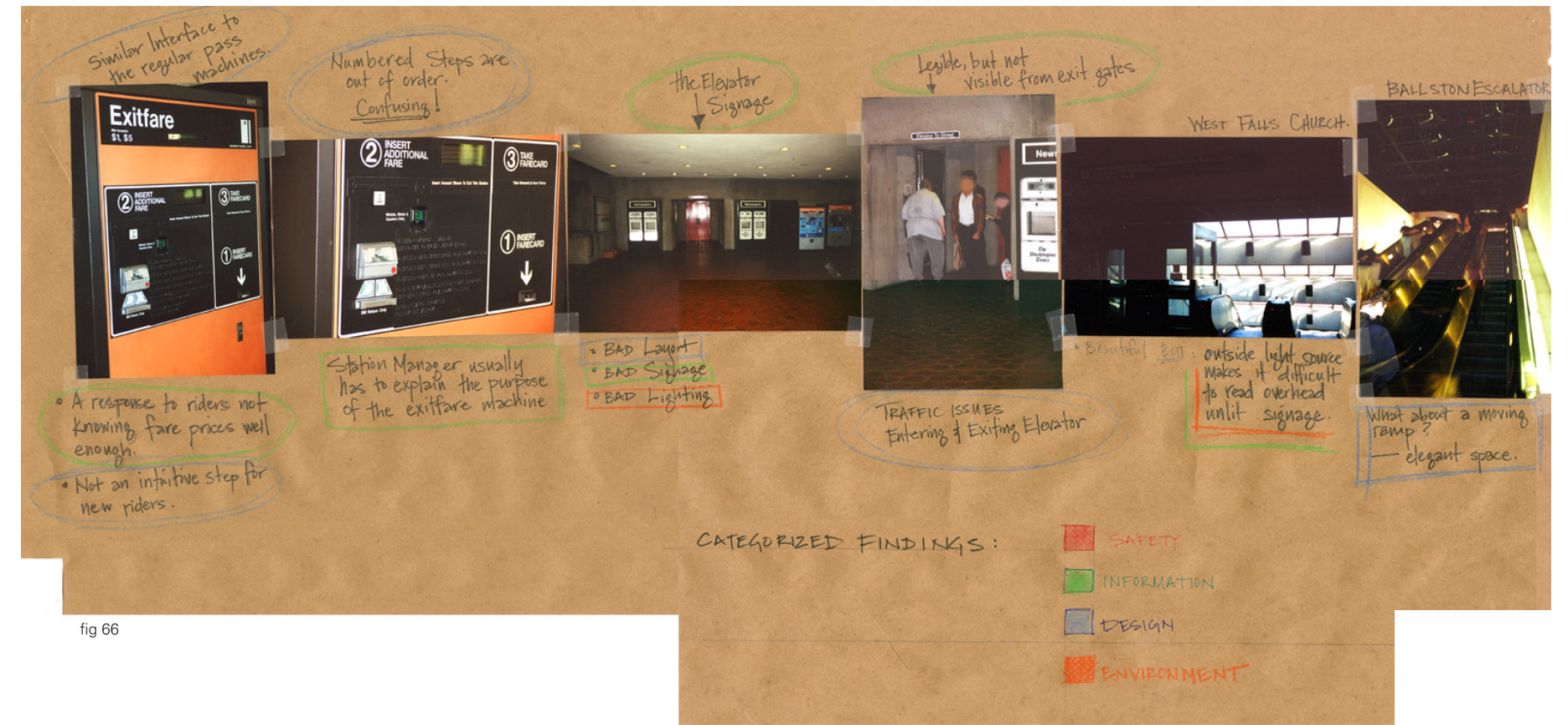


fig 66

Until doing this exercise, the issues that I had identified with Metrorail's entrance system had been laundry-list-like in form, both on paper and in my mind. Most of the images I had collected illustrated one or more issues on this "list." However, some of the photographs documented station environments more than any one user's actions in particular, and they also had valuable information to yield. **Getting at this information was easiest when these images were pulled together and evaluated simultaneously;** looking across the spread patterns popped out. This pin-up exercise was most beneficial though for how it revealed connections between the various "problems" previously noted. For instance, station traffic issues were previously shown to result from several contributing factors, including information system problems, physical access issues, and lighting conditions. Some of the connections corroborate similar findings from the interiors studied.



fig 67

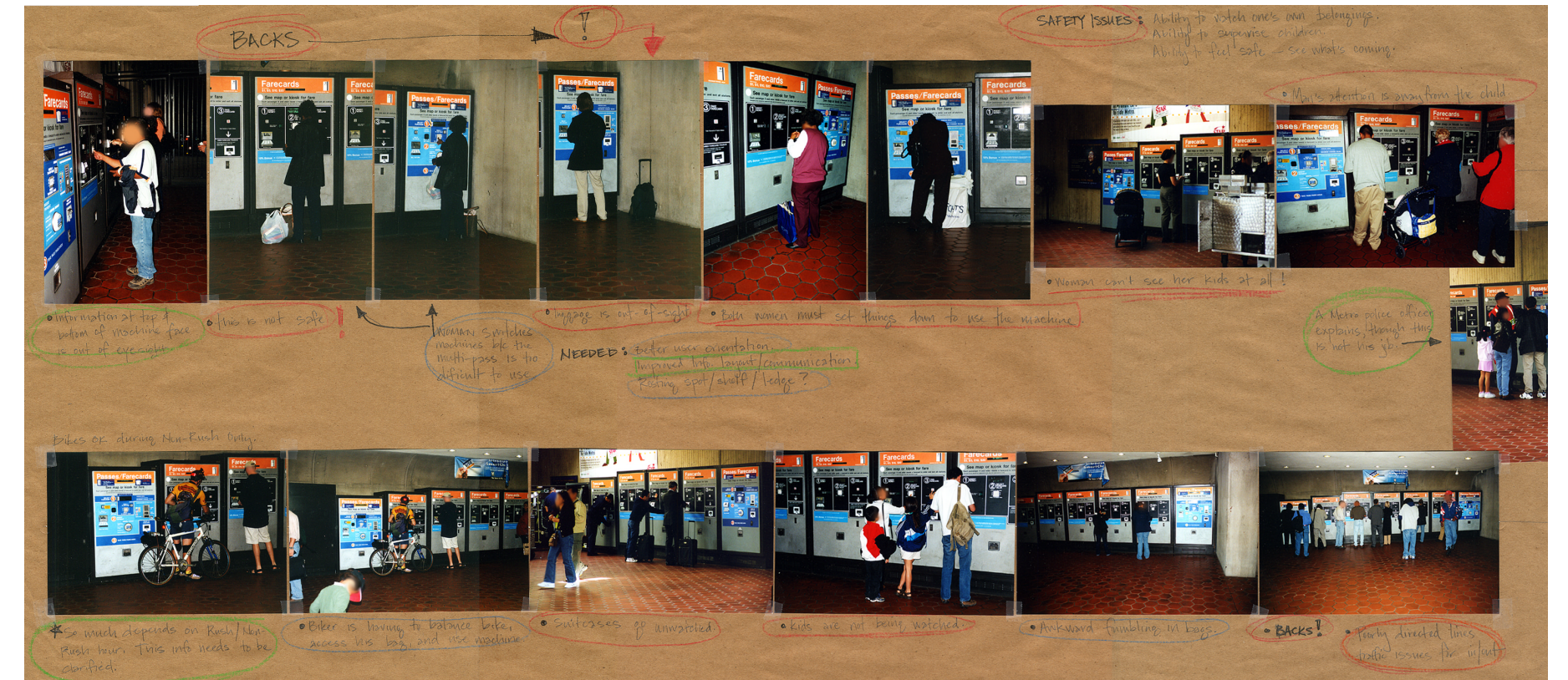


fig 68

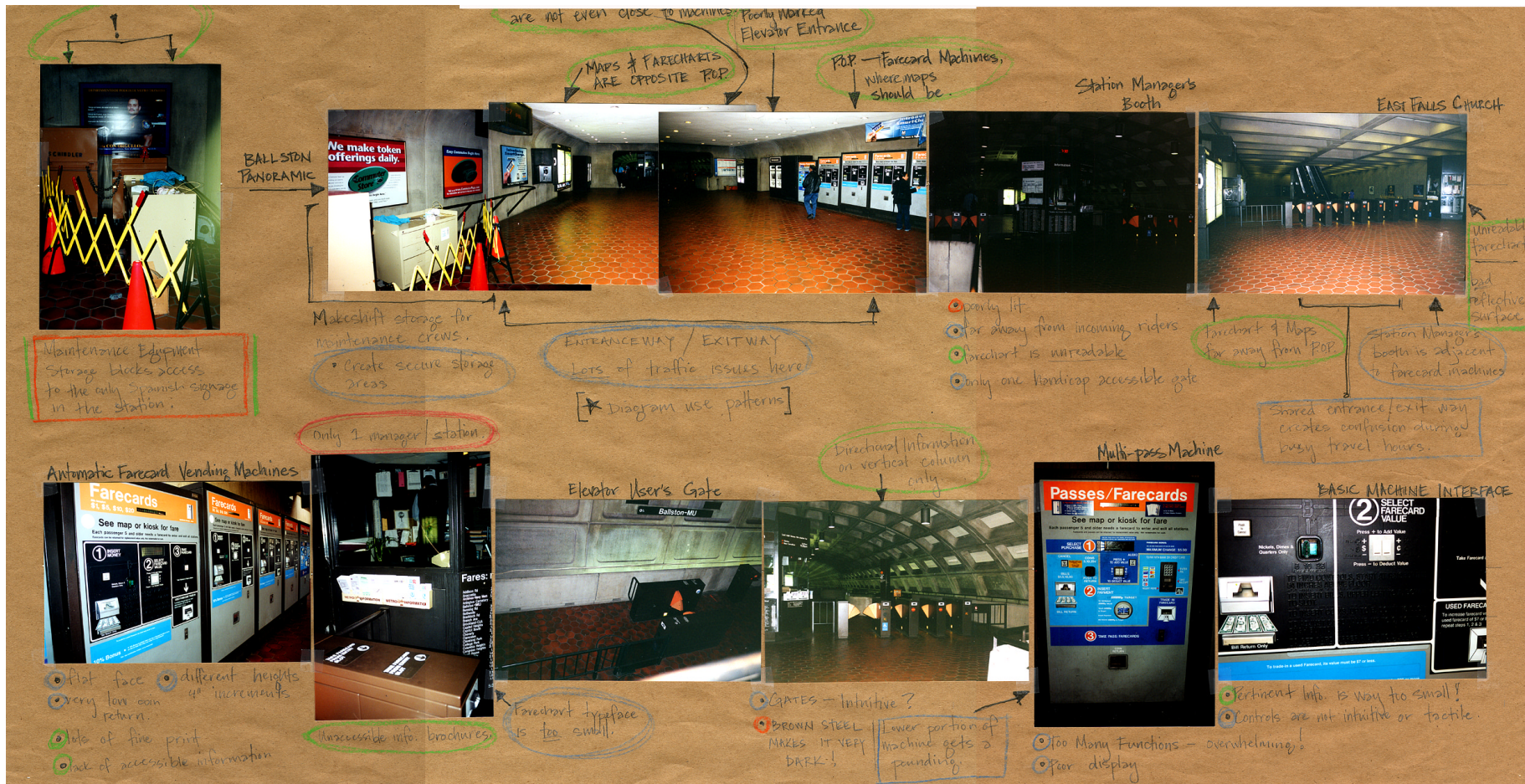


fig 69

Three visually documented patterns that emerged were deemed to be important and of direct concern to riders:

- 1•Riders turn their backs to the rest of the station during most of the entrance process, jeopardizing their safety, and the safety of the belongings and people they may be supervising.
- 2•Riders are without private and secure places to access their wallets and personal bags.
- 3•The machines lack secure places for people to place their personal belongings while purchasing a farecard or pass.

1• Interface position issues



fig 70 - man with stroller



fig 71 - woman with stroller



fig 72 - woman with her children

One of the first observations to present itself in the pattern making exercise was that nearly every person photographed has his or her back facing the camera. This stance did not result from their avoidance of the lens, rather it is because they are engaged in orientating, planning and purchasing farecards, and it is taking all of their attention to do so. The design of the AFCS machines is such that any user, seated or standing, of any ability level or walk of life, must frontally face the machine's interface in order to perform the purchase transaction. This means that users are not able to keep an eye on their belongings, including bags, packages, suitcases, and most seriously they cannot supervise their children, whether in or out of strollers. The safety of the users themselves is also at jeopardy while they purchase farecards, since not facing station traffic makes them vulnerable to a number of hazards, including assault or robbery. New design work for the entrance system must address these user hazards and provide secure personal space, both actual and perceptual.

2• Personal space issues



fig 73



fig 74



fig 75



fig 76

3• Baggage issues at the farecard machines



fig 77



fig 78

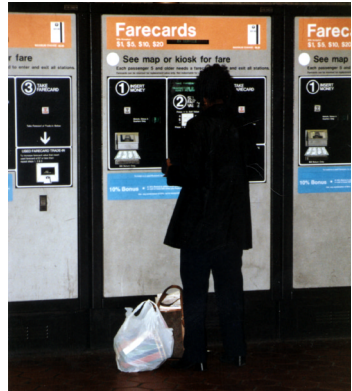
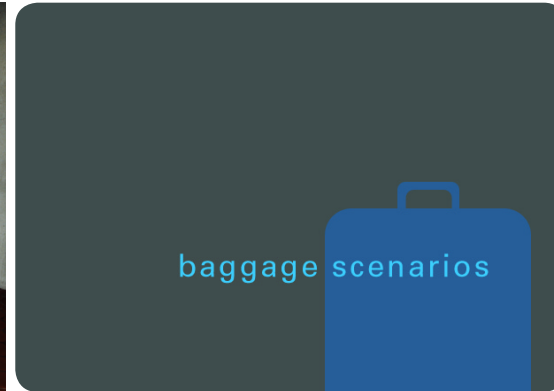


fig 79



fig 80



Most riders have one or two bags with them as they travel. Riders are in need of ways to deal with their bags, packages and luggage more easily while progressing through the entrance process. **Primarily, riders need places where they can securely, even privately access the contents of their bags, as well as a secure way to handle and stow their bags during orientation, planning and purchasing.**

To view a video showing examples of how riders deal with their baggage while entering Metrorail, click on the “baggage scenarios” icon above if you are viewing this document as a PDF or on a CD. If you are reading this document as a printed book and viewing the videos on your computer, select the corresponding title on the CD menu.

The observational videos enabled classification of users by the experiences they had while using the system. For an example of this click on the “senior transit riders” icon at the lower right-hand corner of this page, and view the video of elderly riders progressing through the entrance process. If you are reading this document as a printed book and viewing the videos on your computer, click on the corresponding title on the CD menu. **This experienced-based classification method however, was not pervasive enough because some user types simply weren’t present at the stations during the videography phase of research. For this reason it is important to also consider users according to their varying ability levels, with the implicit understanding that persons with varied abilities will have varied needs.**

Seven distinct ability-based user categories were identified: “Fully-Able,” “Unfamiliar,” “Cognitively Impaired,” “Sight Impaired,” “Hearing Impaired,” “Mobility Impaired,” and “Users With Children.” **These categories were structured around needs, not identities.** This means that many other groups which merit discussion were not given their own categories because ultimately these people fell under the heading of one or more needs-based categories. An example of this is the elderly Metro rider population; members belong to the same overall community, but individually have vastly different physical or cognitive functioning levels. Many people will find they fit into more than one category, which not only makes sense but also has the added benefit of increasing the reader’s awareness of how commonplace limitations of abilities really are.

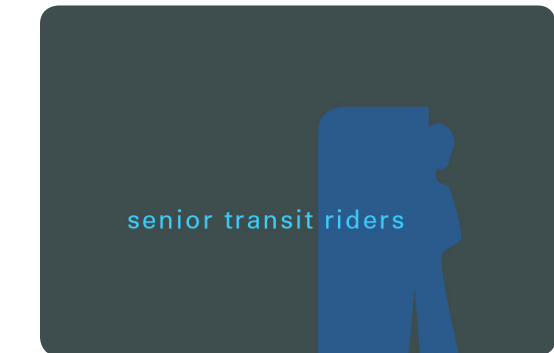
To show how the needs of one ability-based group differ from rest, charts for the departure and arrival activities of each were created. The fully-able user group is used as the control for this exercise, and the additional, and perhaps difficult steps that persons must master in order to complete the entering or exiting processes, are highlighted in magenta on each chart. **This analysis aims to illuminate the spectrum of issues that each user group experiences when entering and exiting Metrorail, and which were not considered in the current entrance system design.**

Demonstrating just how invaluable user research is, I had not considered cognitive impairments among the conditions that could inhibit one’s access of the entrance system prior to meeting interview subject 10. My primary focus until that instance had been on physical and sensorial conditions, which could limit a user’s ability to access the entrance system; thus the inclusion of the “cognitively impaired” grouping. It is also important to acknowledge that this exercise does not cover every possible user need, but it does cover the needs that are most prevalent among Metro’s ridership. Also, some users’ abilities will change over time. For instance, a rider could start out in the “unfamiliar user” category, but after becoming familiar with the system he or she could join the “fully-able” group. Similarly, as riders progress through the system they become more knowledgeable and comfortable with it, so the arrival process is inherently easier than the departure process; this is reflected in the charts as well.

Ability-based User Groupings



fig 81 – rider traffic in Ballston



Fully-Able User Arrival

This chart provides the foundation for the other user-group charts, which are modified to show each group's unique needs in magenta. Fully-able users are Metrorail riders who are either unimpaired, or whose impairments are so minor that they have little or no impact on the rider's ability to use the entrance system. Fully-able users are for whom the current system is primarily designed, so none of the steps in the chart are highlighted because the fully-able user neither needs to adjust to the entrance system, nor change their behavior to use it.

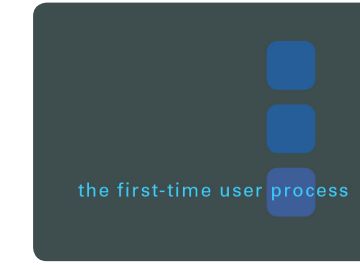
	1 exiting the system	2 orientation & navigation	3 exiting the station
	<ul style="list-style-type: none"> Locating and approaching the ticket gates Inserting or swiping pass media to open them Using Addfare machine if necessary Moving through gates 	<ul style="list-style-type: none"> Using signage and maps to orientate Planning street travel routes 	<ul style="list-style-type: none"> Moving out of station using tunnels Ascending to street level via escalator Acclimating to station's exterior environment

Fully-Able User Departure

	1 entering the station	2 planning	3 purchasing	4 boarding the system
	<ul style="list-style-type: none"> Descending escalator to the station mezzanine Moving down a tunnel toward the point of purchase Acclimating to the interior environment of the station 	<ul style="list-style-type: none"> Determining travel route(s); ascertaining wayfinding information Gathering information about fares, pass purchase options, and pricing Remembering all pertinent information 	<ul style="list-style-type: none"> Locating and approaching farecard machines Operating machines: selecting fare prices and options Inserting money and completing the transaction 	<ul style="list-style-type: none"> Locating entrance gates Inserting or swiping pass media to open them Moving through gates and retrieving pass Descending via escalator to train platform

Unfamiliar Arrival

This category includes first-time and previous riders who lack familiarity with the system. If you are reading this thesis as a PDF or on a CD, and would like to watch "the first-time user process" video, click on the icon above, or select the corresponding title on the videography CD menu. This population has a high concentration of non-English speakers, in part because the Metro system is a main artery for visitors to the Washington, D.C. area, connecting with Reagan National Airport and Amtrak's Union Station, as well as the city's museums and sites. Barriers that these users most often encounter when trying to use the Metro system are related to differences in custom, language, currency, and interface design standards. Making information accessible to a multi-cultural ridership is key to helping the unfamiliar user smoothly experience the Metrorail system.



Unfamiliar Departure

	1 entering the station	2 planning	3 purchasing	4 boarding the system
	<ul style="list-style-type: none"> Descending escalator to the station mezzanine Moving down a tunnel toward the point of purchase Acclimating to the interior environment of the station Orientating to the station interior 	<ul style="list-style-type: none"> Locating information points: signage and brochures Locating Metro staff's booth for additional assistance Gathering information about fares, pass purchase options, and pricing Determining travel route(s), cost, and wayfinding information Remembering all pertinent information 	<ul style="list-style-type: none"> Locating and approaching farecard machines Operating machines: selecting fare prices and options Inserting money correct currency Pressing buttons to complete the transaction 	<ul style="list-style-type: none"> Locating entrance gates Inserting or swiping pass media to open them Moving through gates and retrieving pass Locating elevator or escalator to correct train platform Descending elevator or escalator to train platform
	1 exiting the system	2 orientation & navigation	3 exiting the station	
	<ul style="list-style-type: none"> Locating and approaching the exit and ticket gates Inserting or swiping pass media to open them Using Addfare machine if necessary Locating Metro staff's booth for additional assistance Moving through gates 	<ul style="list-style-type: none"> Locating information points: signage and brochures Locating Metro staff's booth for additional assistance Using signage and maps to orientate Planning street travel routes Using signage to locate the station exit 	<ul style="list-style-type: none"> Moving out of station using tunnels Ascending to street level via escalator Acclimating to station's exterior environment 	

Cognitively Impaired Arrival

The reasons that someone might be termed a “cognitively-impaired user” are many and diverse. This chart assumes that the user has the basic spatial, navigation, and communication skills that one would need to enter, ride, and exit the Metro system. **Higher level cognitive tasks like literacy, digit calculation, memory retention, and pattern recognition are of prime concern here.** The presentation of information is a key factor for this group as well. During one of my station visits I was especially fortunate to interview a frequent Metro rider who was extremely open and candid about his learning disability and the negative impact it had on his experiences of the Metrorail system. His courage in sharing his experience with me was fueled by his desire to see better design solutions put into use.

	1 exiting the system	2 orientation & navigation	3 exiting the station
	<ul style="list-style-type: none"> • Locating and approaching the exit and ticket gates • Inserting or swiping pass media to open them • Using Addfare machine if necessary • Locating Metro staff's booth for additional assistance • Moving through gates 	<ul style="list-style-type: none"> • Locating information points: signage and brochures • Locating Metro staff's booth for additional assistance • Using signage and maps to orientate • Planning street travel routes • Using signage to locate the station exit 	<ul style="list-style-type: none"> • Moving out of station using tunnels • Ascending to street level via escalator • Acclimating to station's exterior environment • Orienteating to the streetscape

Cognitively Impaired Departure

	1 entering the station	2 planning	3 purchasing	4 boarding the system
	<ul style="list-style-type: none"> • Descending escalator to the station mezzanine • Moving down a tunnel toward the point of purchase • Acclimating to the interior environment of the station • Orienteating to station interior 	<ul style="list-style-type: none"> • Locating information points: signage and brochures • Locating Metro staff's booth for additional assistance • Gathering information about fares, pass purchase options, and pricing • Determining travel route(s), cost, and wayfinding information • Remembering all pertinent information 	<ul style="list-style-type: none"> • Locating and approaching farecard machines • Operating machines: selecting fare prices and options • Inserting money and completing the transaction • Removing change from coin return dish 	<ul style="list-style-type: none"> • Locating entrance gates • Inserting or swiping pass media to open them • Moving through gates and retrieving pass • Locating the correct escalator or elevator • Descending escalator or elevator to train platform

Visually Impaired Arrival

There are many reasons a person's vision may be poor, from simple focal point deficiencies to more serious problems like macular degeneration or blindness. During my interviews I met a woman in her mid-seventies whose eyes watered in cold weather, making it very difficult for her to see. Because it was very cold that December day and Metro station interiors are not climate controlled, she could barely read the farecharts and the machine's digital visual display. **Dimly lit Metro station interiors can also be hard on eyes since the transition from bright exterior daylight to a dark interior can be a difficult.** For blind users, farecard machines are marked with Braille instructions, but signage and information for sight-impaired persons is non-existent. Textured floor paths and tactile maps are also non-existent. These users must ask the station manager whenever they need information or assistance.

	1 exiting the system	2 orientation & navigation	3 exiting the station
	<ul style="list-style-type: none"> • Locating and approaching the exit and ticket gates • Inserting or swiping pass media to open them • Using Addfare machine if necessary • Locating Metro staff's booth for additional assistance • Moving through gates 	<ul style="list-style-type: none"> • Locating information points: signage and brochures • Locating Metro staff's booth for additional assistance • Using signage and maps to orientate • Planning street travel routes • Using signage to locate the station exit 	<ul style="list-style-type: none"> • Moving out of station using tunnels • Locating elevator or escalator • Ascending to street level • Acclimating to station's exterior environment • Orienteating to the streetscape

Visually Impaired Departure

	1 entering the station	2 planning	3 purchasing	4 boarding the system
	<ul style="list-style-type: none"> • Locating station entrance or elevator entrance • Descending to the station mezzanine • Moving down a tunnel toward the point of purchase • Acclimating to the interior environment of the station • Orienteating to station interior 	<ul style="list-style-type: none"> • Locating information points: signage and brochures • Locating Metro staff's booth for additional assistance • Gathering information about fares, pass purchase options, and pricing • Determining travel route(s), cost, and wayfinding information • Remembering all pertinent information 	<ul style="list-style-type: none"> • Locating and approaching farecard machines • Operating machines: selecting fare prices and options • Inserting money and completing the transaction • Removing change from coin return dish 	<ul style="list-style-type: none"> • Locating entrance gates • Inserting or swiping pass media to open them • Moving through gates and retrieving pass • Locating the correct escalator or elevator • Descending escalator or elevator to train platform

Creating this chart illuminated just how visually-based the majority of user interfaces and signage systems are. Though hearing impairments seem to have a relatively small impact on the user's ability to move through the Metrorail system, first-time or infrequent users could experience difficulties. Some necessary information is posted on the station walls, and printed material is available on various topics, but sorting through brochures is not an efficient way to find specific information. If one of these users needs assistance or information not available in print format, and the only other available resources are the station manager or another Metro rider, they may have a very difficult time communicating with someone who does not know sign language.

Hearing Impaired Departure	1 entering the station	2 planning	3 purchasing	4 boarding the system
	<ul style="list-style-type: none"> Descending escalator to the station mezzanine Moving down a tunnel toward the point of purchase Acclimating to the interior environment of the station Orientating to station interior 	<ul style="list-style-type: none"> Locating information points: signage and brochures Locating Metro staff's booth for additional assistance Gathering information about fares, pass purchase options, and pricing Determining travel route(s), cost, and wayfinding information User cannot hear announcements regarding late trains, elevator outages, system delays etc. Remembering all pertinent information 	<ul style="list-style-type: none"> Locating and approaching farecard machines Operating machines: selecting fare prices and options Inserting money and completing the transaction Removing change from coin return dish (user may not hear the change drop and forget to pick it up) 	<ul style="list-style-type: none"> Locating entrance gates Inserting or swiping pass media to open them Moving through gates and retrieving pass Locating the correct escalator or elevator Descending escalator or elevator to train platform
Hearing Impaired Arrival	1 exiting the system	2 orientation & navigation	3 exiting the station	
	<ul style="list-style-type: none"> Locating and approaching the exit and ticket gates Inserting or swiping pass media to open them Using Addfare machine if necessary Locating Metro staff's booth for additional assistance Moving through gates 	<ul style="list-style-type: none"> Locating information points: signage and brochures Locating Metro staff's booth for additional assistance Using signage and maps to orientate Planning street travel routes User cannot hear announcements regarding late trains, elevator outages, system delays etc. Using signage to locate the station exit 	<ul style="list-style-type: none"> Moving out of station using tunnels Ascending to street level via escalator Acclimating to station's exterior environment Orientating to the streetscape 	

Mobility Impaired Departure	1 entering the station	2 planning	3 purchasing	4 boarding the system
	<ul style="list-style-type: none"> Locating station entrance or elevator entrance Descending escalator to the station mezzanine Moving down a tunnel toward the point of purchase Acclimating to the interior environment of the station Orientating to station interior 	<ul style="list-style-type: none"> Locating information points: signage and brochures Locating Metro staff's booth for additional assistance Gathering information about fares, pass purchase options, and pricing Determining travel route(s), cost, and wayfinding information Remembering all pertinent information 	<ul style="list-style-type: none"> Locating and approaching farecard machines Operating machines: selecting fare prices and options Inserting money and completing the transaction Removing change from coin return dish 	<ul style="list-style-type: none"> Locating entrance gates Inserting or swiping pass media to open them Moving through gates and retrieving pass Locating the correct escalator or elevator Descending escalator or elevator to train platform
Mobility Impaired Arrival	1 exiting the system	2 orientation & navigation	3 exiting the station	
<p>Often mobility-impaired users are thought of as only including people who have difficulty walking or have permanent physical disabilities. However, anyone who has ever broken a toe knows that minor impairments are quite capable of causing major operating difficulties in people's lives. Users with arthritis, for instance, may find a simple money-handling transaction difficult to execute. The wide range of mobility impairments considered in this chart means that some steps are more relevant to certain kinds of impairments than others.</p>	<ul style="list-style-type: none"> Locating and approaching the exit and ticket gates Inserting or swiping pass media to open them Using Addfare machine if necessary Locating Metro staff's booth for additional assistance Moving through gates 	<ul style="list-style-type: none"> Locating information points: signage and brochures Locating Metro staff's booth for additional assistance Using signage and maps to orientate Planning street travel routes Using signage to locate the station exit 	<ul style="list-style-type: none"> Moving out of station using tunnels Ascending to street level via escalator or elevator Acclimating to station's exterior environment Orientating to the streetscape 	

<p>User with Children Departure</p>	<p>1 entering the station</p> <ul style="list-style-type: none"> • Locating station entrance or elevator entrance • Descending escalator to the station mezzanine • Moving down a tunnel toward the point of purchase • Acclimating to the interior environment of the station • Orientating to station interior 	<p>2 planning</p> <ul style="list-style-type: none"> • Locating information points: signage and brochures • Locating Metro staff's booth for additional assistance • Gathering information about fares, pass purchase options, and pricing • Determining travel route(s), cost, and wayfinding information • Remembering all pertinent information 	<p>3 purchasing</p> <ul style="list-style-type: none"> • Locating and approaching farecard machines • Operating machines: selecting fare prices and options • Inserting money and completing the transaction • Removing change from coin return dish 	<p>4 boarding the system</p> <ul style="list-style-type: none"> • Locating entrance gates • Inserting or swiping pass media to open them • Moving through gates and retrieving pass • Locating the correct escalator or elevator • Descending escalator or elevator to train platform
<p>User with Children Arrival</p> <p>In this scenario an adult who is supervising children, such as a parent, teacher, child-care provider, or older sibling, is boarding the Metro system with them. This scenario assumes that the adult is the one who is planning, navigating, and completing the transaction. The adult's cognitive processing skills are compromised when trying to board Metro and safely supervise the children of whom they are in charge. Metro stations are large and busy places with the potential to be dangerous environments for unsupervised children, with risks increasing significantly during the generally hectic and chaotic rush hour. Small children of toddler age and up who are walking on their own have the highest observed risk. Children in strollers and baby carriers can also create problems by inhibiting an adult's movement or by distracting them.</p>	<p>1 exiting the system</p> <ul style="list-style-type: none"> • Locating and approaching the exit and ticket gates • Inserting or swiping pass media to open them • Using Addfare machine if necessary • Locating Metro staff's booth for additional assistance • Moving through gates 	<p>2 orientation & navigation</p> <ul style="list-style-type: none"> • Locating information points: signage and brochures • Locating Metro staff's booth for additional assistance • Using signage and maps to orientate • Planning street travel routes • Using signage to locate the station exit 	<p>3 exiting the station</p> <ul style="list-style-type: none"> • Moving out of station using tunnels • Ascending to street level via escalator or elevator • Acclimating to station's exterior environment • Orientating to the streetscape 	