User Research

fig 34 – The lower platform of the Rosslyn station
Research began with a series of visits to Metrorail stations, where I observed and interviewed the system’s users in order to gather firsthand information about how riders enter the Metrorail system. Conducting this kind of ethnographic research meant that I could learn about the system’s shortcomings as they were experienced by users. This phase of the design research process, where sensitive observations glean terrific insights into users’ lives, was in many ways the most interesting to me. As these insights build upon each other, design criteria and specific design objectives emerge, creating a project “blueprint” from which design strategies and concepts can be developed.

During the first research sessions at Metro stations, I wrote and sketched my observations down in a notebook and verbally recorded them on a handheld tape recorder. Prior to obtaining permission to photograph riders inside the Metro stations, these notes proved to be a good method for quickly recording a situation and some of my thoughts regarding it. These observations often took the form of questions, which have the added advantage of doubling as springboards to design concepts. Later, when I was granted permission to photograph inside the stations, the notes became a narration for the photographs, explaining an image’s context and content.

Observational research findings are printed below in the order of collection. For the complete observational research text please see appendix B.

- Could the interior station space be designed to shape the flow of station traffic?
- People need a space to securely access their bags and rummage through them. This is especially important for riders with limited dexterity or mobility impairments.
- Multi-lingual information and signage is a must.
- Is there a way to create functional waiting space without encouraging loitering?
- People need privacy and space to safely and gracefully handle their baggage.
- Baggage should not “handicap” riders using entry gates that don’t accommodate their possessions. Is there another way to accomplish the entry gates tasks without the actual gates?
- Enforces could be eliminated with a better entrance system.
- Riders purchasing tickets shouldn’t have to turn their backs on their possessions or children. They need a space to do this “work.”
- People typically travel with 3-5 pieces of baggage, which the current system’s components do not accommodate.
- Could universal graphics be used to educate riders about rider etiquette, i.e. how to hold, store, and carry one’s baggage?
- Centralized information stations to consolidate the brochures and signage into a singular location for all-in-one access would help to ease chaotic station traffic and rider confusion.

From this research I concluded that the most important AFCS issues to address were: riders’ safety and privacy needs, baggage transport, information accessibility, and interior station design and entrance system layout. It also became evident while doing this research that the entrance process itself needed further analysis.
On six separate days during 2001 and 2002 I conducted brief, anonymous interviews with randomly selected Metrorail users at several stations. Two members of Metro's staff were also interviewed while they were working as station managers. With permission granted, the interviews were recorded using a handheld tape recorder. In a relatively short period of time my understanding of the experiences had by Metrorail's ridership, and their subsequent concerns, increased exponentially. Prior to speaking with riders I had considered Metrorail to be a good system in need of an equipment update and improved signage, but during the research process this perception changed. The need for universal design coupled with a new information architecture utilizing current technologies was immediately apparent; an accommodating physical structure would also be needed to support such an intelligent system infrastructure.

Talking with Metrorail riders greatly enhanced my understanding of AFC issues and brought up points I had previously considered. Some interviewees had very clear ideas for improving Metrorail's entrance system, while feedback from others more indirectly suggested opportunities for change. The wealth of information generated in the interviews further clarified for me the importance of good user research when formulating design strategies.

Collecting the experiences of riders and staff also provided an education in effective interviewing techniques. Overall, speaking with people was enjoyable and interesting, but not always easy. Interview questions, while not pre-written, were focused on the entering processes of the user, attempting to spontaneously follow the evolving design strategies. The components of the AFCs should reflect and coordinate with the user environment. The entrance system learning process must be built in, and elective. Information needs to be available to users in a variety of modes. Components need to enhance users’ safety and security. Comfortable interior conditions include good lighting and comfortable seating.

The entrance system learning process must be built in, and elective.

Questions are especially helpful because they contain concepts to work toward and are in the ideation phase of design work.

• Are we asking the AFCs machines to do too much?
• Do our expectations for the AFCs too low?
• Can the placement of the points of purchase organize interior station traffic?
• Can these functions be met simultaneously under a different program?
• Is it necessary to have a point of purchase and a point of entry?
• How should system information be organized and conveyed to the user?
• How should the station environment be improved?
• Are we asking the AFCS to do too much?
• How should system information be organized and conveyed to the user?
• Could sensorial information be used to direct the entry process?
• Could these functions be met simultaneously under a different program?
• Is it necessary to have a point of purchase and a point of entry?
• Can the placement of the points of purchase organize interior station traffic?
Learning about the "Say, Make, Do" design research strategies of Sonic Rim (Rim and Schmidt 2001) which actively engage research participants the sharing of their life experiences, prompted an effort to involve users on a deeper level of the design process. A user survey and subsequent group focus session were developed, in order to have a longer conversation with the participants about their personal experience with the system than was possible during an in-station interview. It was also hoped that the group setting would facilitate a creative dialogue about the entrance system, during which the participants would share directly in the design ideation process.

The six participants were Verizon employees and were recruited through a mass E-mail inquiry distributed throughout the company. While it was only by chance that all participants were male, this is certainly not the ideal group mix. However, when a respondent expressed interest in the study I followed up by E-mailing them a survey questionnaire in order to gauge their level of familiarity and experience with Metro prior to the in-person session. People acquainted with Metro on all levels, from none to extensive, were invited to participate. Understanding why people refrained from using the Metro system would be an equally valuable point of view to consider. Though not conducted anonymously, the identities of all research participants were not recorded and will not be disclosed, as is the standard for such research.

Survey findings are summarized in the following list of major points. To read the complete survey text and the respondents' written answers, please see appendix C.

- Convenience and time concerns contribute most to transportation choices.
- The majority of participants found the Metroticket system easy to use.
- The majority of participants found the farecard machines easy to use.
- Only half of the participants found the SmarTrip passes easy to use.
- Only half of the participants found the SmarTrip cards easy to use.
- The system can be complicated for first-time users.
- The SmarTrip media is popular, but the in-station machine is not user-friendly.
- Riders know about and use the WMATA's web-based services.
- MetroRail, Metrobus, and MARC should cooperate better with respect to pass media.

From this exercise I learned that writing a survey that generates good responses and data was much more difficult than I had previously thought. In retrospect, it would have been better if the survey questions had developed a broader picture of the respondents' relationships to Metro.

Conclusions and Reflections
The 6-member discussion group met during lunchtime for one hour in a conference room in Verizon's Rosslyn building. Though I had wanted the group to be a mix of male and female members, only men volunteered to participate. Of the six group members, four were everyday Metrorail riders, one was a frequent rider, and one was an infrequent rider. Prior to the group session I prepared a short list of statements to use as starting points for conversation. These were specific topics I wanted addressed – the entrance system, information availability, how they would prioritize improvement needs for Metro – but I also wanted the participants to feel free to talk about other issues or problems they may have experienced that I may not have considered. I hoped to conduct the discussion in two parts: first, getting general feedback and tapping personal experiences with the system, and second, brainstorming system improvements and design ideas. I used a tape recorder to document the group's discussion but did not photograph the session. I also made a whiteboard available for anyone who wanted to use it, though none of the participants did.

In large part I felt that the discussion group failed because it had not become the generative brainstorming session that I had hoped it would. But perhaps I had been too optimistic, too enthralled in design culture to have anticipated what would happen. The participants' discussion of their Metro experiences focused on fare rates, the system can be complicated for first-time users, the system is user-friendly, and the importance of teams in conducting design research. Having several researchers to conduct the discussion in two parts: first, getting general feedback and tapping personal experiences with the system, and second, brainstorming system improvements and design ideas. I used a tape recorder to document the group's discussion but did not photograph the session. I also made a whiteboard available for anyone who wanted to use it, though none of the participants did.
These user “sketches” were created to develop ideas about user groups and the activities, lifestyles, concerns and needs that each would have when using Metrorail. The characters here represent general passenger types that I encountered during my in-station research. This exercise was intended to be a playful starting point for considering the lifestyles and circumstances of potential Metrorail riders, and was helpful because it got me thinking about the design work ahead. To what audience should an entrance system appeal? How would that audience want it to look like? What does it need to do for each individual user?

In developing these profiles the focus was on creating a picture of an individual’s life beyond the role of “Metrorail user.” The point at which the two intersect represents a design opportunity. If Metrorail is to serve more people in more ways than it currently does, the system must be useful to people in more than one facet of their lives. For a tourist without another means of transportation, Metrorail may be primary transportation for their activities, while a parent may only use the system when commuting to/from work. This person’s use could be expanded with consideration of their other activities through new design work.

**Activities:**
- sightseeing
- field trips
- museum visits
- library visits
- shopping

**Artifacts:**
- stroller
- diaper bag
- child’s bag
- purse
- shopping bags
- camera bag

**Concerns:**
- safety
- supervision of children
- compromised attention

**Special Needs:**
- space for baggage

---

**Activities:**
- to/from school
- to/from extracurriculars
- field trips
- hanging out w/friends
- shopping

**Artifacts:**
- backpack / messenger bag
- purse
- cooler
- camera bag

**Concerns:**
- personal space
- privacy

**Special Needs:**
- personal safety
- navigation tools

---

**Activities:**
- entertainment & sports
- visiting friends & family
- dating
- going out to eat
- shopping

**Artifacts:**
- backpack / messenger bag
- purse
- cooler
- camera bag
- shopping bags

**Concerns:**
- privacy
- personal space

**Special Needs:**
- space for baggage

---

**Activities:**
- sightseeing & museum visits
- events on the Mall
- entertainment & sports
- visiting family & friends
- transit to/from airports
- going out to eat
- shopping

**Artifacts:**
- purse / backpack
- luggage & suitcases
- maps & books
- camera bag
- shopping bags

**Concerns:**
- navigation
- language & currency differences
- safety

**Special Needs:**
- multi-lingual signage

---

**Activities:**
- business meetings
- conferences
- transit to/from airports
- going out to eat
- entertainment

**Artifacts:**
- luggage & suitcases
- briefcase / computer bag
- purse

**Concerns:**
- punctuality
- convenience
- language & currency differences
- safety

**Special Needs:**
- multi-lingual signage

---

**Activities:**
- sightseeing
- field trips
- museum visits
- library visits
- shopping

**Artifacts:**
- bag/backpack
- music player
- skateboard / blades
- shopping bags

**Concerns:**
- personal space
- privacy

**Special Needs:**
- space for baggage

---

**Activities:**
- entertainment & sports
- visiting friends & family
- dating
- going out to eat
- shopping

**Artifacts:**
- backpack / messenger bag
- purse
- cooler
- camera bag

**Concerns:**
- privacy
- personal space

**Special Needs:**
- space for baggage
For the next phase of research I wanted to unobtrusively film people using Metro’s entrance system. My previous ethnographic techniques were successful in many ways, but they failed to document user difficulties in a truly illustrative way. Creating an observational video let me see “the whole picture” of a user’s experience, their transaction as well as everything going on simultaneously around them in the station. Paradoxically, looking at the station’s environment through the lens of a video camera actually opened up my view of the situation. I had previously been able to spot specific problems within the entrance system, but video work verified my understandings of how and why these problems developed.

These icons correspond with Quicktime movies created from the digital video footage I shot inside the stations. The video titles refer to the kinds of user/system problems they record, and appear throughout this document where the material they contain is especially relevant, or illustrative of a particular topic. You can watch the videos now, or as you come across them in other sections. If you are reading this document as a PDF or from a CD, simply click on an icon to view. If you are reading this as a printed book, remove the CD from inside the front cover of this book and insert into either a Mac or pc computer with Quicktime to view.

On a Monday morning I shot three DV tapes of material inside the Ballston Common station from 8 to 10 a.m., and the West Falls Church station from 11 a.m. to 1 p.m. These time periods let me capture both the morning rush hour scene and more casual midday traffic. Editing the video illuminated to me that riders experiencing problems with the entrance system spent an average of 5-10 minutes working through the entrance process. I realized that recording user observations by hand distorted my sense of how much time entrance system interactions actually took, which surprised me. I was also surprised by the rate with which I observed riders having difficulties while I was filming inside stations. With only 4 hours of recorded video I was able to create 9 short movie clips.
Research findings established that while the point of pass purchase is a critical part of the entry process, it is only one step among several more complex and cerebral operations that must also be performed in order to enter the WMATA Metrorail system. This process can be especially difficult for the unfamiliar or new rider to execute. To understand what is involved for a rider at each point along the way, the entrance and exit processes were charted. For this exercise entering the system was termed “departure” since the rider would be leaving for a destination; exiting the system was similarly termed “arrival,” since the rider would be arriving at their destination.

Within the cookie cutter mold of transit systems, operators need only to plug their selected variables into a standard formula before they can open their doors to the public. Hence the practice of procuring ticketing systems and other components as pre-fabricated parts. Within the present day transportation paradigm entrance systems need four basic components to operate: a standard fare chart, a standard system map, an AFCS of some sort, and gates for entering and exiting. Combine these elements with a network of transit routes and a ridership will present itself, or so the thinking goes.

In Ronald Dieter’s 1990 book, “The Story of Metro: Transportation and Politics in the Nation’s Capital,” the point is made that a lot of time and thought is put toward structuring a rate system for fares and deciding on what fare collection technologies to use. In contrast, not nearly enough time is spent considering how riders will use the system. Exactly how a rider will procure fare and schedule information, physically progress through the pass purchase transaction, and interact with the AFCS hardware and machine design, did not get discussed during the planning phase.

The process of entering the Metrorail system, more than simply using the AFCS to purchase a farecard or token, actually consists of orientation, planning, and navigation/wayfinding steps. To successfully complete these tasks, riders must use planning, navigation skills before passing through Metrorail’s entrance gates and descending to the train platform.

Basically stated, the three phases of entering that a potential rider must go through are:

**orientation:** adapting to station environment and getting information planning: deciding where to go and how to get there, purchasing fare

Break the departure and arrival processes down further, the departure process encompasses: “entering the station,” “planning,” “purchasing,” and “boarding the system.” When exiting Metrorail riders need different kinds of information and equipment than when they entered. Steps in the arrival process include: “existing the system,” “orientation/navigation,” and “existing the station.”

Entrance System Processes

![Instructional poster for Farecard Purchase](image)

**Top left:** Instructional poster for Farecard purchase

**Arrival Process Chart**

<table>
<thead>
<tr>
<th>1</th>
<th>exiting the station</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>orientation &amp; navigation</td>
</tr>
<tr>
<td>3</td>
<td>exiting the station</td>
</tr>
</tbody>
</table>

**Departure Process Chart**

| 1 | entering the station |
| 2 | planning |
| 3 | purchasing |
| 4 | boarding the system |

**Departure Process Chart**

- Entering the station
- Planning
- Purchasing
- Boarding the system

**Arrival Process Chart**

- Exiting the station
- Orientation & Navigation
- Exiting the station

**Entrance System Processes**

- Acclimating to station’s exterior environment
- Acclimating to station’s interior environment
- Planning street travel routes
- Using signage and maps to orientate
- Using Addfare machine if necessary
- Moving through gates
- Ascending to street level via escalator or elevator
- Using farecard, token, or ticket to travel
- Acclimating to station’s interior environment
- Determining travel route(s); ascertaining wayfinding information
- Gathering information about fares, pass purchase options, and pricing
- Remembering or storing all pertinent information
- Locating and approaching farecard machines
- Operating machines: selecting fare prices and options
- Inserting money and completing the transaction
- Locating entrance gates
- Inserting or swiping pass media to open them
- Moving through gates and retrieving pass
- Descending via escalator or elevator to train platform

**Arrival Process Chart**

- Locating and approaching the ticket gates
- Inserting or swiping pass media to open them
- Using Addfare machine if necessary
- Moving through gates
- Using signage and maps to orientate
- Planning street travel routes
- Moving out of station using tunnels
- Ascending to street level via escalator or elevator
- Acclimating to station’s exterior environment

**Departure Process Chart**

- Locating the farecard ticketing machine
- Acclimating to building’s interior environment
- Determining travel route(s); ascertaining wayfinding information
- Gathering information about fares, pass purchase options, and pricing
- Remembering or storing all pertinent information
- Locating and approaching farecard machines
- Operating machines: selecting fare prices and options
- Inserting money and completing the transaction
- Locating entrance gates
- Inserting or swiping pass media to open them
- Moving through gates and retrieving pass
- Descending via escalator or elevator to train platform
AFCS equipment is an important piece of the entrance system, but to a large degree the functionality of the system depends on a station’s interior environment. To understand how the interior environment either contributed or detracted from the AFCS, it was important to establish a sense of how riders use a station’s interior space; how they move through it, and interact with one another in it. After the initial human factors directed visits to Metrorail stations, which concentrated on the farecard machines, it was established that the problems experienced by riders were more systemic in nature. Subsequently, the research focus shifted to observing Metro riders using the whole station, signs, maps, courtesy equipment etc. To document these observations, sketches, photographs, and notes, both written and verbal, were taken. Later, digital video recordings were made. These tools made it possible to analyze station interiors, and gauge the ways that riders use the entrance system.

Most Metrorail station entrances are set up in similar ways, with some elements usually placed near one another, others consistently more remote. Enough station interiors are based on the rectangular floor plan depicted in figure 54, or a close adaptation of it, to merit its use as an example. The station pictured at left is East Falls Church, which is located underneath an overpass of the four lane interstate 66, on the border of Arlington county and the city of Falls Church, both in Virginia. Metrorail trains that serve the station are orange line trains, whose rails run down the middle of interstate 66, in between the east and westbound traffic lanes.

Each Metro station contains the same set of interior elements, and though the placement of these elements does vary from station to station, certain aspects remain constant. Interior elements include a booth for Metro’s employees, farecard machines, escrow machines, a poster depicting farecard machine instructions, fare charts, a system map, an area map, pay phones, and entry gates. The Metro staff booth is always located in line with the entry gates. Farecard machines are located together in a row down one wall of the station. Fare charts are posted on the exterior surface of the phone booth, and the exterior surface of the staff booth, and at some stations a fare chart is placed against the window glass of the booth. Maps are also posted on the exterior surface of the phone booth (as well as inside the train cars). A poster depicting farecard machine instructions is always present but its location varies, sometimes on the same wall as the farecard machines, sometimes on an adjacent or opposite wall to the point of purchase.
In combination, the AFCS components can provide the necessary information to plan and execute a trip, but the placement of these interior elements affects how riders orientate to the station interior and the system and its overall effectiveness. Riders may not know what they are looking for when they enter, or they may look for something different each time. Some riders might start by taking a place in line behind one of the farecard machines, while others may look for a fare chart first, or even approach the station staff’s booth. It is common for a rider to enter and go directly to a farecard machine, only to find out that she needs to look at a fare chart and must give up her place in line to do so. Starting over in the orientation process can be very frustrating to users, and the current AFCS doesn’t provide users with guidance as to where, or how, to begin.

This random movement of people between equipment and information points as they learn the entrance process and then progress through it, at a variety of speeds, can make the in-station pedestrian traffic chaotic. To better understand how people move around and through a station’s interior, measurements of East Falls Church station and its AFCS components were taken, from which the floor plans shown in figures 55 and 56 were drawn, which respectively show existing objects in the space, and the dimensions of the space. This method of working with floor plans provided a way to visually express the rider traffic problems that had been observed, as well as a way to study how AFCS components placed within the interior environment affected the traffic flow. Simply attributing orientation difficulties to poor interior space design, however, did not address the interactions between the user, components, and the interior space.
specifically enough.

Figure 62 makes visible the correlation between how people use the system and in-station traffic issues they may experience, getting at the roots of observed problems. This diagram was created by marking the locations problems were observed to most frequently occur at with red dots. Next, blue arrows were added to indicate causal links and factors that contributed to a problem. For instance, red dots were shown to cause problems experienced at the point of purchase (+-station traffic interfering with the user’s orientation, and the unavailability of pertinent information at the farecard machine itself. By comparison, problems experienced throughout the station brought riders to the metro staff booth to help, making it a contributor to traffic problems, but not the root of the problem.

Information problems were decided to be of the highest priority, though the interdependence of the entrance system means that when one part is inefficient the entire system become so as well. To plan a trip, to purchase a farecard, to go anywhere, riders must first know where they are going, how much it will cost, and how to use the AFCs (see entering processes p.38). Without accessible information, unfamiliar or infrequent riders often wander from point to point until a member of the Metro staff or another more knowledgeable rider assists them. Having an appropriate level of information accessible to riders at relevant points throughout the entry process would smooth the entering and exiting processes for riders. At the same time it would decrease in-station traffic by eliminating the need for these riders to move from point to point inside the station.

To understand why in-station traffic patterns are so variable, they were plotted on the floor plan according to user group (fig 65), a determining factor for patterns. User groupings were determined based on the ethnographic research findings. It was immediately apparent that people’s paths through the station space crossed and overlapped. The resulting image in figure 65 illustrates the unique actions of each user group during the entrance process with the physical station space in which those actions take place. This user group diagram does coincide with the user-intensity diagram, but charts only the paths of entering passengers, whereas the user-intensity diagram had looked at station traffic overall, including exiting passengers.

During the in-station research work, passengers were observed experiencing difficulties moving through the station space against the incoming or outgoing flow of rider traffic. Passengers had problems while trying to view system maps or fare charts, while moving to and from the elevator, and while moving from the machines to the entry gates. Figure 64 was created to simultaneously view the paths of incoming and outgoing passengers from the various user groups, and see where collisions between the two occur. Points of collision are circled in red, five of which appear across the middle of the floor plan. These were the result of incoming riders searching for information provided by maps or fare charts, crossing the paths of riders exiting from the station. Another point of collision appears at the handicap entry gate. This is because the gate is bi-directional and is used frequently by passengers of all ability levels. Collisions also occurred near the Metro staff booth where exiting users seeking assistance from Metrorail personnel cross paths with entering riders also seeking assistance.
entrance
hearing-impaired user
sight-impaired user
cognitively-impaired user
mobility-impaired user
go-pass commuter
user with children
familiar fully-able commuter
familiar fully-able user
unfamiliar fully-able user
scale 1/8" = 1'
rider Traffic Patterns 1
East Falls Church Station

collision zones
entering riders
exiting riders
scale 1/8" = 1'
Rider Traffic Patterns 2
East Falls Church Station

GO-PASS COMMUTER
FAMILIAR FULLY-ABLE COMMUTER
FAMILIAR FULLY-ABLE USER
UNFAMILIAR FULLY-ABLE USER
USER WITH CHILDREN
SIGHT-IMPAIRED USER
HEARING-IMPAIRED USER
MOBILITY-IMPAIRED USER
COGNITIVELY-IMPAIRED USER

fig 63 – plan of space showing traffic patterns of entering and exiting riders

fig 64 – plan of space showing traffic patterns of various user groups entering the station

user research