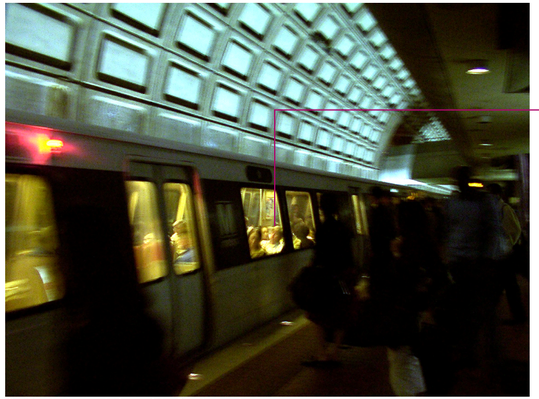


fig 34 – the lower platform of the Rosslyn station

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.

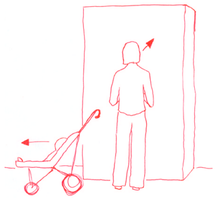
During the first research sessions at Metro stations, I wrote and sketched my observations down in a notebook and verbally recorded them on a handheld tape recorder. Prior to obtaining permission to photograph riders inside the Metro stations, these notes proved to be a good method for quickly recording 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.

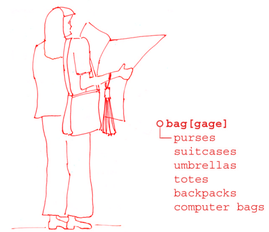
Observational research findings are printed below in the order of collection. For the complete observational research text please see appendix B.

- 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?
- Exitfare 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 1-3 pieces of baggage, which the current system's components do not accommodate.
- Could universal graphics be used to educated 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 analyzation.

General Observations





clockwise from top left:
fig 35 – woman with an injured hand inserting money into a "Farecards" machine
fig 36 – sketch depicting compromised attention issues for users with children
fig 37 – sketch of a woman waiting in the station
fig 38 – woman leaning on handrail while she waits for an arriving passenger
fig 39 – woman with a stroller using the farecards machine

Interviews With Users and Employees

clockwise from top left:
fig 40 – man with stroller purchasing a farecard
fig 41 – man using the system map to wayfind
fig 42 – woman purchasing a farecard

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 AFCS issues and brought up points I had not 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. Full text from the user interviews can be found in appendix C. Due to the lengthiness of some interviews, main points and informational highlights have been summarized rather than transcribed verbatim.

In addition to interviewing the system's users, two WMATA employees were also interviewed to gain insight into how Metro staff view the current entrance system, and how it affects their working lives. Metro staff interviews can be found in appendix D. Both Metro employees interviewed are station managers who work out of a station manager's booth/office and directly interact with the system's riders. When a rider has a problem or question, or needs information or assistance, the station manager is the person they turn to first. The station manager's job however, includes much more than just customer assistance. They are also responsible for rider safety, station security, monitoring train schedules, and keeping abreast of AFCS equipment and elevator maintenance. During the employee interviews it became clear that a well-designed entrance system would not only improve the user's experience, but also the work environment for, and efficiency of, Metrorail's staff.

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 user transaction. Sacrificing scientific precision for a more natural interview feel meant that information shared by the rider could be followed up effectively. This free-form interview style also let interviewees share tangential and previous experiences. As I became more comfortable in the role of "interviewer", I became more pursuant of users who appeared to be having difficulties, and asked more open-ended, less leading questions. This produced better interview results and seemed to put participants at ease.

"Conclusions" drawn from observations and interviews with riders and staff took the form of questions and ideas. These became "clues" that led the way to a design strategy.

- Station manager's role should not be that of AFCS tutor.
- Information needs to be available to users in a variety of modes.
- It should be available where it is needed and used.
- The components of the AFCS should reflect and coordinate with the user process.
- Components need to enhance users' safety and security.
- Components should afford users some degree of privacy.
- Riders need secure places to handle their baggage, money, and belongings.
- Station environments should facilitate the entrance process.
- Comfortable interior conditions include good lighting and comfortable conditions.
- The entrance system learning process must be built in, and elective.

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

- Are we asking the AFCS machines to do too much?
- Or are our expectations for the AFCS too low?
- How can the entering process be integrated into one system?
- Is it necessary to have a point of purchase and a point of entry?
- Could these functions be met simultaneously under a different program?
- Can the placement of the points of purchase organize interior station traffic?
- Could sensorial information be used to direct the entry process?
- What kind of technology would improve the system without confusing the user?
- How should the station environment be improved?
- How should system information be organized and conveyed to the user?

clockwise from top left:
fig 43 – station manager's booth/kiosk at Ballston
fig 44 – a rider with his bicycle
fig 45 – riders using the entrance gates

Surveys and Group Work

fig 46 – riders exiting the Ballston station

Learning about the "Say, Make, Do" design research strategies of Sonic Rim (Martin 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 experiences 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 male group 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 males, 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 Metrorail prior to the in-person group session. People acquainted with Metrorail 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 Metrorail system easy to use.
- The majority of participants found the farecards machines easy to use.
- Only half of the participants found the farecards/passes machines 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 to address – the entrance system, information availability, how they would prioritize improvement needs for Metrorail – 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 ideation. 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, was too entrenched in design culture to have anticipated better what would happen. The participants' discussion of their Metro experiences focused on fare rates, and how the technologies behind the two different farecard media options work. I began to wonder if this was a result of those being the two topics most frequently covered by the media. It was difficult to move the conversation around to the physical form of the entrance system, and the interior station environment. When I asked about WMATA's web offerings however, they took the bait and ran with it. Some groups members thought that because the WMATA's website is so helpful that internet stations should be available in the stations. The infrequent rider felt that the farecard machines should be programmed to walk users through the pass purchase process.

Some improvements I think would have helped the disussion group be more successful include: the use of visual aids to help riders visualize and discuss design issues, a physical model with which to interact, design prototypes to jumpstart brainstorming, and another researcher, or team, with whom to work. I cannot stress enough the importance of teams in conducting design research. Having several researchers to work with would have made it possible to have a discussion leader, a visual/physical aid manager, and someone to document the group's activities more thoroughly since, as I learned editing my observational videos, seeing the whole picture illuminates factors that were missed the first time around.

fig 47 – riders lined up to purchase farecards at Ballston

Storybuilding

fig 48 – mapreader with stroller

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 Metro 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.

fig 49

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
bathroom facilities
elevators

fig 50

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

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

Concerns:
personal space
privacy
safety

Special Needs:
personal safety
navigation tools

fig 51

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

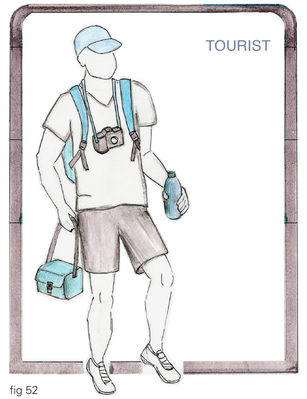


fig 52

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
universal graphics & signage
space for baggage

fig 53

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

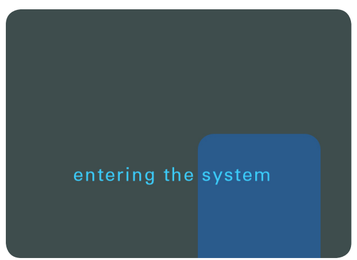
Special Needs:
multi-lingual & universal signage
space for baggage

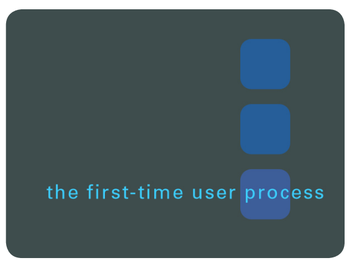
Videography

fig 54 and 55

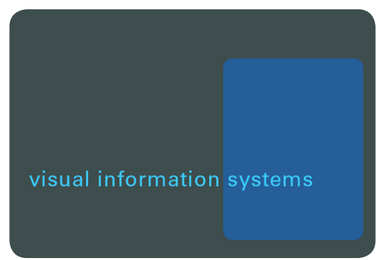
For the next phase of research I wanted to unobtrusively film people using Metro's entrance system. My previous ethnographic techniques were successful in many ways, but they failed to document user difficulties in a truly illustrative way. Creating an observational video let me see "the whole picture" 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.

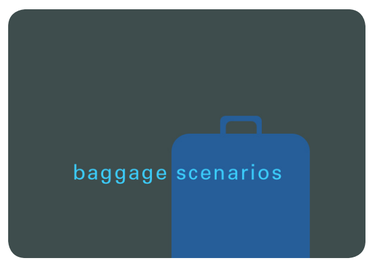
These icons correspond with Quicktime movies created from the digital video footage I shot inside the stations. The video titles refer to the kinds of user/system problems they record, and appear throughout this document where the material they contain is especially relevant, or illustrative of a particular 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 suprised 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.





Entrance System Processes

fig 56 – instructional poster for farecard purchase

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 as 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 Capitol", 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
navigation/wayfinding: the process of physically getting there

Breaking 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: "exiting the system", "orientation/navigation", and "exiting the station".

Departure Process Chart

1 entering the station
- Descending to the mezzanine by elevator or escalator
- Moving down a tunnel toward the point of purchase
- Acclimating to the interior environment of the station

2 planning
- Determining travel route(s); ascertaining wayfinding information
- Gathering information about fares, pass purchase options, and pricing
- Remembering or storing all pertinent information

3 purchasing
- Locating and approaching farecard machines
- Operating machines: selecting fare prices and options
- Inserting money and completing the transaction

4 boarding the system
- 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

1 exiting the system
- Locating and approaching the ticket gates
- Inserting or swiping pass media to open them
- Using Addfare machine if necessary
- Moving through gates

2 orientation & navigation
- Using signage and maps to orientate
- Planning street travel routes

3 exiting the station
- Moving out of station using tunnels
- Ascending to street level via escalator or elevator
- Acclimating to station's exterior environment

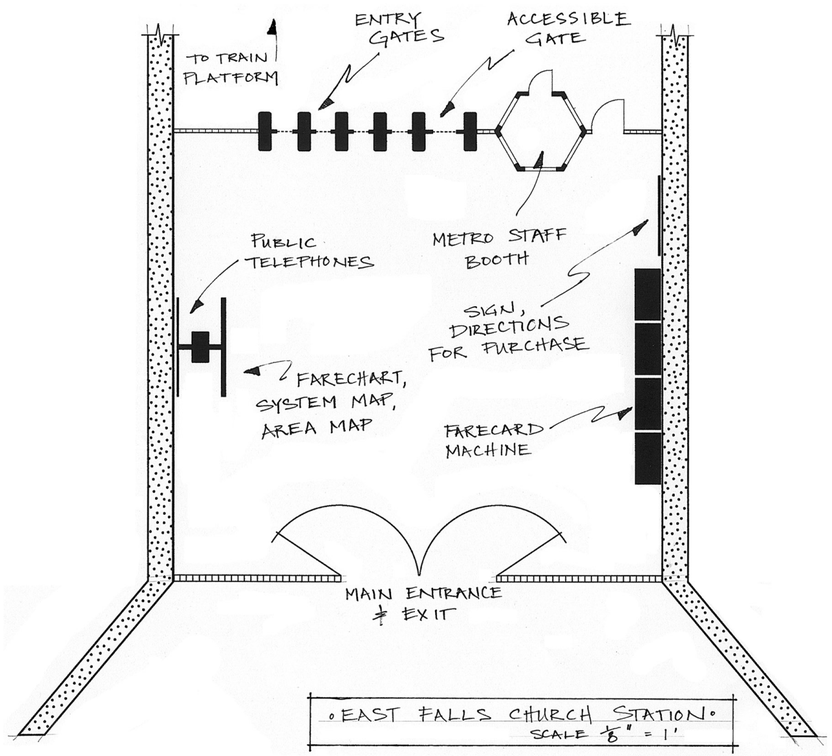


fig 57 – plan of space showing existing objects (not reproduced at scale)

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 this 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, exitfare machines, a poster depicting farecard machine instructions, fare charts, a system map, an area map, 2-4 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.

Interior Environment

fig 58 – West Falls Church station entrance

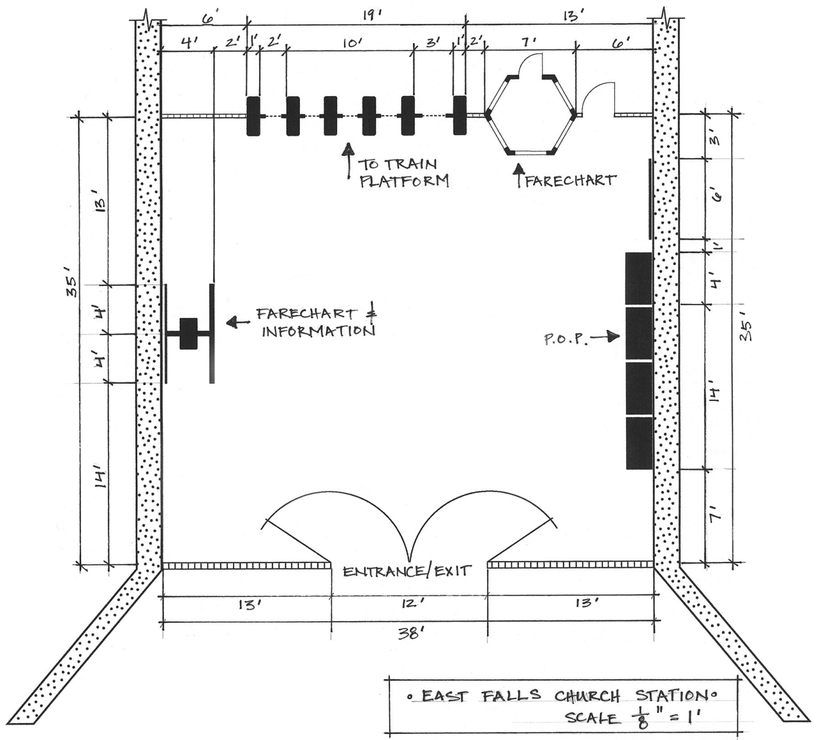


fig 59 – plan of space showing dimensions (not reproduced at scale)

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

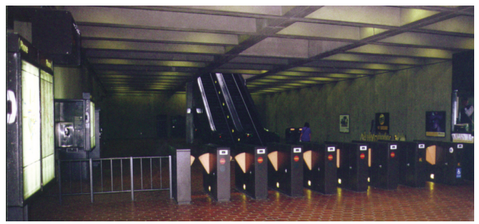


fig 60 – East Falls Church station interior

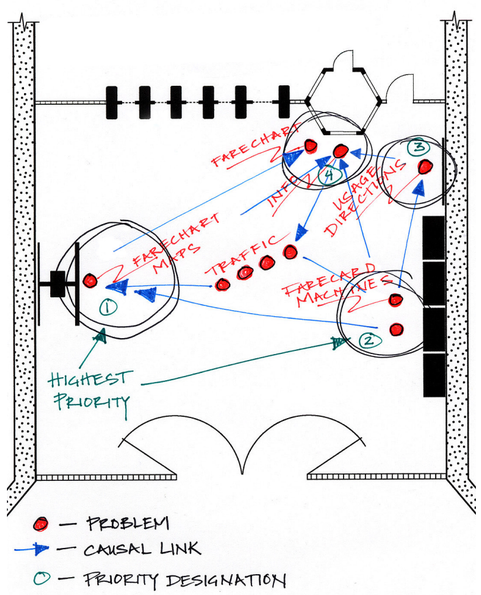


fig 61 – plan of space showing traffic problems and their contributing factors

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, two factors were shown to cause problems experienced at the point of purchase: in-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 for 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 view a video of the traffic problems discussed here taking place inside stations as users experience them, click on the "station traffic flow" icon below if reading this document as a PDF or from 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.

Intended to make visible the levels of activity throughout the station's interior, the use-intensity diagram (fig 63) shows how Metro's riders use the interior space. Understanding where high-activity and low-activity zones occur, and sometimes overlap, helps to explain the previously discussed traffic issues (fig 62). This exercise also makes clear just how inefficiently the interior space of a station is used. Instead of utilizing the natural flow of the entry process to shape the interior space and the placement of the AFCS components, the current interior arrangement concentrates activity in only a few zones, creating crisscrossing pathways between these areas, and ultimately points of collision. Furthermore, regular commuters and smartcard users who don't need to orientate or plan walk directly from the entrance to the entry gates, directly across the path between the AFCS machines and the fare charts.

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 crisscrossed and overlapped. The resulting image in figure 65 correlates 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 concur with the use-intensity diagram, but charts only the paths of entering passengers, whereas the use-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.

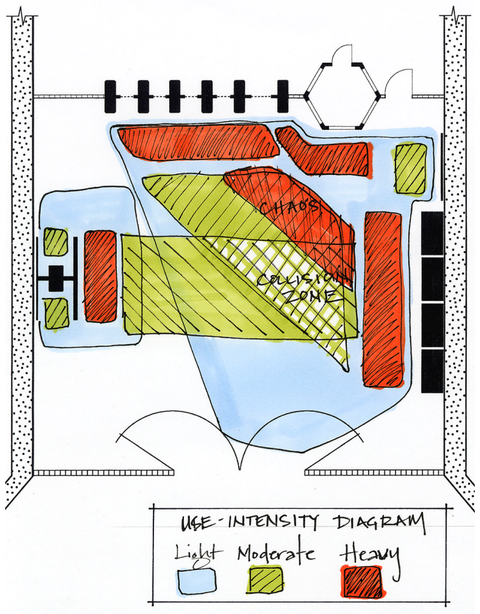


fig 62 – plan of space showing zones of use intensity

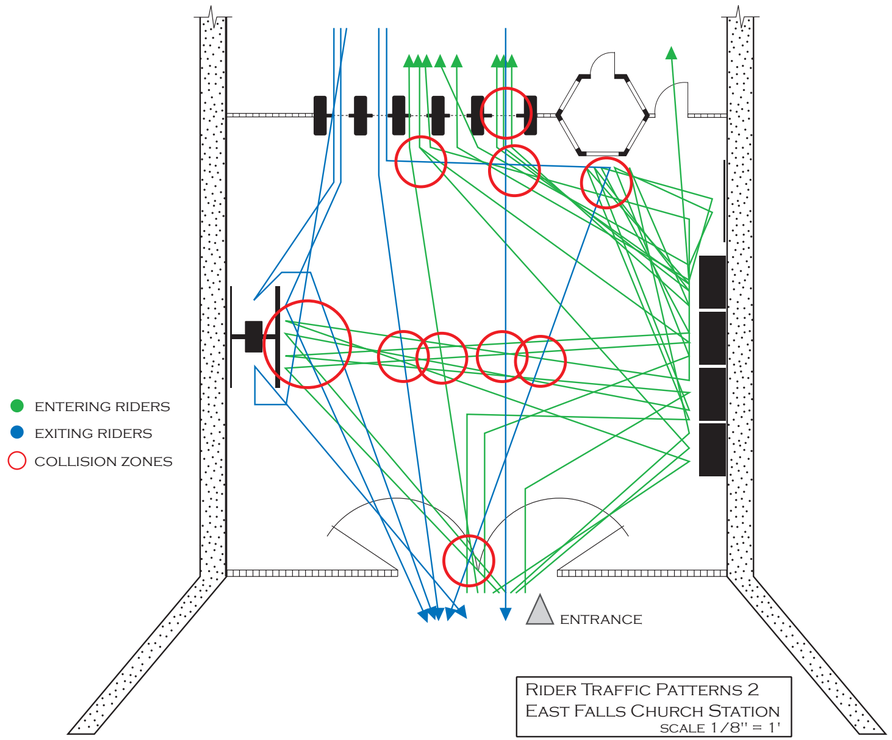


fig 63 – plan of space showing traffic patterns of entering and exiting riders

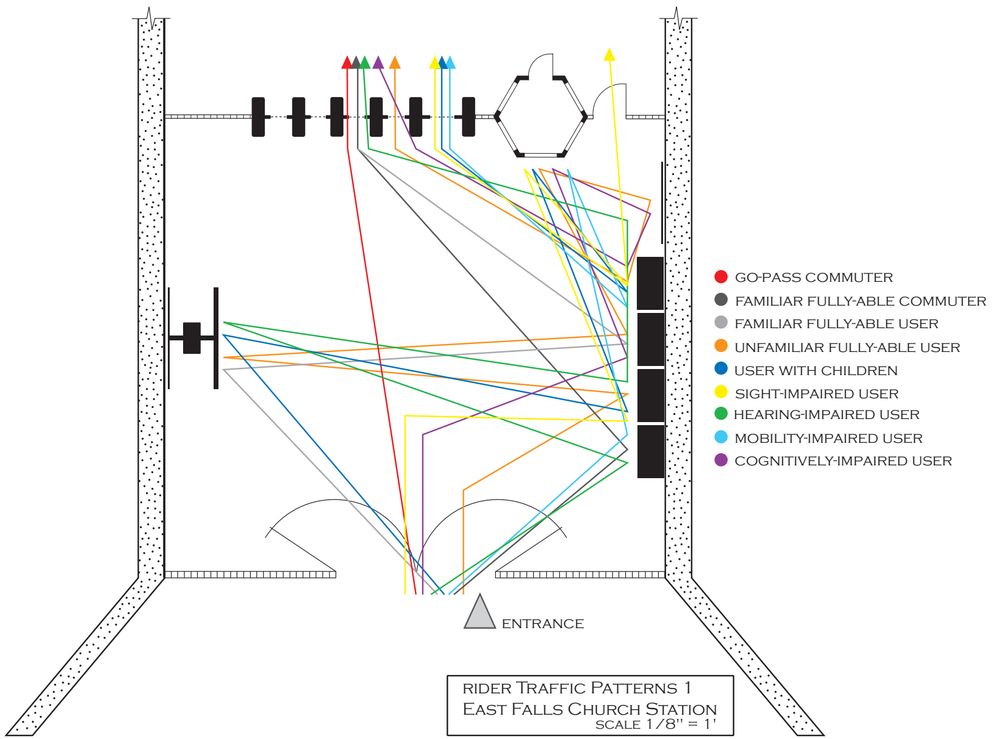


fig 64 – plan of space showing traffic patterns of various user groups entering the station