TriMet 2.0 - Redesigned Experience for Visitors to Portland

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1. INTRODUCTION

Public transportation has become increasingly popular as the preferred choice for most commuters in the United States. Long work hours, longer commute distances and traffic jams leads to longer commute times, further leading to frustration and decreased productivity levels at work and home. Nobody likes sitting in traffic and it's reasonable to assume that if these drivers had a better alternative, they might be willing to hop on board. In theory, that alternative is public transportation – buses, commuter trains, light rail, streetcars and subway systems. At its best, public transportation is as reliable as driving, more efficient, less stressful and cheaper. Most American cities fall well short of that ideal, however. Most – but not all.

With this context in mind and through our work in , User-Centered Innovation, we explored the public transit system in Portland, Oregon to understand how we might develop solutions to improve it. Tasked with an initial focus on improving payment methods, we conducted user research and observations to deeply understand this challenge. As a result of this effort, we learned that for those who are new to Portland - visitors and those moving here who encounter public transit for the first time - there are significant challenges in using public transit, part of which includes payment, but also other challenges, too. Their goals are to take hassle-free, low-cost, and convenient trips via light rail, bus and streetcar to experience Portland at its best - its iconic parks, quirky neighborhoods and scrumptious food. In the following paper, we describe the user-centered innovation process and share our insights, brainstorms and solutions that we suggest will create more emotionally uplifting and useful transit experiences for those new to our awesome city.

2. LITERATURE REVIEW

Here in Portland, Oregon, we are lucky to have a robust public transportation system that is one of the best in the country [1]. Daily commuters, as well as tourists and others, use an interconnected web of bus, light rail and streetcar to travel to/from work, as well as visit popular tourist destinations within the city limits. TriMet provides these services in our region. Founded 45 years ago, from the ashes of the bankrupt Rose City Transit, TriMet has been profoundly influential in shaping the growth and character of the Portland region. Through innovations in policy development, system design and technological advancement, the agency continues to set benchmarks for the transit industry at home and abroad [2].

TriMet, and other transit systems around the country and the world, have started to reap the benefits of more IT-enabled services. For example, many transit systems have buses that are equipped with sensors, that when combined with data processing and other Internet of Things capabilities, can accurately estimate arrival and departure times. [3]. While there were early doubts about whether increasing the use of IT-enabled services would influence ridership, evidence has increasingly demonstrated that such services do have impacts - such as increasing ridership and helping to give the perception of a more modern public transit system [3].

An area where technology-enabled services can demonstrate value is in improving fare collection systems. While these systems still provide the opportunity to purchase tickets with cash - such as at kiosks outside of stops and on transit vehicles themselves - technology improvements have led to an increase in the automation of fare collection, such as paying with prepaid paper cards at turnstiles or through mobile apps or magnetic cards. In Portland, TriMet will soon launch Hop Fastpass, an electronic-fare system where users can tap a card at a Hop station that draws on a prepaid balance. This system is already active in places like Los Angeles and Seattle [4].

Another benefit of increased technology is the ability and increased efficiency of real time data on transit status as well as trip planning. It has been found that advanced public transportation systems have a greater user benefit when compared to demand-responsive transit systems or personal rapid transit systems [1]. Recorded messages over PA systems can have time delays, information errors and require constant input from transit personnel. Even with the increase of smartphones and transportation apps it is still faster to walk by and quickly glance at a kiosk to get real time information rather than open an app and search for the information you need. Daily commuter users in one study used the "On the Go!" system as quickly as "stop and go" sites to get quick information about their commutes [1]. When users have more time during weekends and evenings, the kiosks are used more for information and trip planning. This type of usage doubled on weekends in every site and nearly ten times increase at the Bowling Green station as shown in Table 1 in the Appendix 1. The Bowling Green station has multiple common

tourist locations in the immediate vicinity. This leads us to believe that a significant opportunity exists to serve tourists unfamiliar with local transportation systems seeking common tourist locations.

It is within this context that our project happened. In the following pages, we describe the process we used and solutions we developed to improve the experiences of tourists when trying to pay for public transit fare in Portland, Oregon on the TriMet public transportation system.

3. METHODOLOGY

For our project, we used the double diamond model of problem definition and design. The diamond model allowed us to work across four distinct phases – Discover, Define, Develop and Deliver [5]. The double diamond approach indicates the divergent-convergent approach to problem definition and creating the solution. In all creative processes a number of possible ideas are created ('divergent thinking') before refining and narrowing down to the best idea ('convergent thinking'), and this can be represented by a diamond shape. But the double diamond indicates that this happens twice – once to confirm the problem definition and once to create the solution. One of the greatest mistakes is to omit the left-hand diamond and end up solving the wrong problem. Our goals using this methodology was to land at a clear problem statement and ideate to create the best possible solution. Being a very creative iterative process. the double diamond model helped us develop, test and refine multiple ideas a number of times, with weak ideas dropped in the process.

Discover/Research— insight into the problem (diverging)- The first quarter of the double diamond model covered the initial phase of the project. Our team conducted observations in order to notice new things and gather important insights about the public transport system in Portland [Appendix, 1]. The general problem space began with exploratory fieldwork that included observations and engaging with tourists, students, TriMet employees, Travel Portland, PDX Airport Information Kiosk and frequent TriMet users. We also had the opportunity to gather insights from public transport systems in the UK and Germany Mapping people who are involved and understanding causal influences was the primary focus of the first quarter of the diamond model.

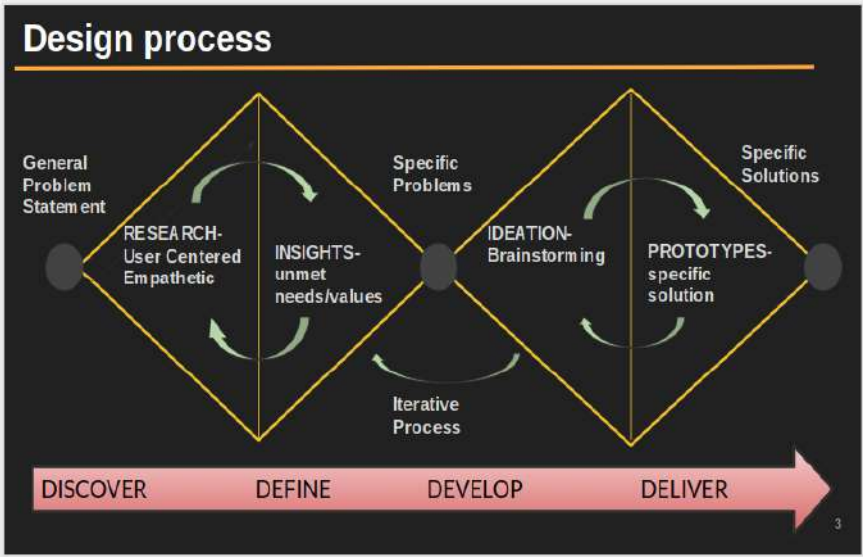


Figure 1. Double Diamond Design Process

Define/Synthesis - defining the focus area (converging) – After extensive sessions of observations and interviewing, the second quarter represents the definition stage, in which designers try to make sense of all the possibilities identified in the discovery phase. Which matters most? Which should we act on first? What is feasible? The goal here was to develop clarity on the specific problem to be solved that appropriately frames the fundamental design challenge. Our approach in this part of the process was to frame each interview in a typical format that highlighted information such as the occupation of the customer, age, frequency of public transport usage, modes of payment and miscellaneous experiences [Appendix 2]. This section also included defining personas and grouping the customer experiences into markets and opportunities spaces, to aid with more specific solution development. With customer insights, needs statements and experience stories, this section allowed us to talk through the positives and negatives of the current transport system, and discuss the potential solutions for each.

As a part of the problem statement definition, we were committed to addressing the emotional component of the frequent public transport users, and using that as a metric for measurement of success of the solution. As we began synthesizing the interviews and observations into a concrete problem statement, we realized the emotional and humanist components for our target users. Additional observations were the extensive use of smartphones, and frequent foreign travelers with language and communication barriers. These observations opened up opportunities for making our solution space more relatable and an importance of the solutions being perceived as hassle free and

intuitive. We developed a balanced scorecard as a medium to measure success, with focus on measuring perceived ease of use and efficiency with the new system.

Brainstorm/Ideation (diverging) and potential solutions (converging) - The second diamond involved ideating, and then developing concepts and solutions for the defined problem statement derived from the first diamond. The ideation began from defining the problem statement from the customer experience and demand tables, our team created from the interview notes [Appendix 3]. This stage involved lots of brainstorming with post-its and drawings to help develop concepts for the solution space. We then developed these concepts into prototypes and solutions, taking into consideration the constraints of limited time and resources, and with a technology that integrated with the current system [Appendix 4].

4. FIELD WORK

A critical part of our project was going out to the field to observe and interview TriMet users.

A. INTERVIEW FORMAT AND QUESTIONS

We utilized components of ethnographic inquiry as an interview methodology for this project. Before we started interviews, we developed a "interview guide" that included a charter/focus for our research. The research objective of our team was to "understand the user experience of public transport users across the city of Portland", their daily activities, feelings, needs, and challenges in order to help build a better hassle free experience. Then we identified the themes for our research in terms of users' experiences, feelings, needs, challenges and economics. Our open-ended interview questionnaire facilitated longer conversations with the interview subjects. The questions we used are as follows:

1. What is your daily commute like?
2. What form(s) of public transportation do you usually use?
3. How often do you travel using public transportation?
4. Where are you usually going when you're using public transit?
5. Are you visiting Portland? If so, what do you think about the transit system? Do you think it's free?
6. How do they feel about the payment process?
7. Are they happy about it? What would make it easier?
8. What are the different types of payment methods?
9. How do you pay for your transit?
10. Do you have a ticket? Yes/No
11. Why? Or why not?
12. What type of ticket do you have? Might I see it? How do you carry your ticket?
13. Are the commuters aware of the different kinds of payment methods that TriMet offers?

We conducted our first round of interviews and observations at bus stops, MAX stops and streetcar stops. With the above questions in hand, and an intent to be conversational and inquisitive, our mission was to gather raw data - notes and sketches - that could then be used to develop need statements and eventually personas.

Our approach included interviewing people from culturally varied backgrounds, students, regular commuters and tourists, in order to draw insights that would guide us to articulate the unmet needs/challenges and difficulties people faced with the current public transport system. Our research was also open to understanding the positives of their experiences in order to develop an empathetic point of view. We also observed the current information kiosks and TriMet ticket purchasing stations. Attached in the Appendix are the pictures of kiosks and ticket purchasing stations at the TriMet stops, inside the max streetcar and at the airport [Appendix 5]. Additional interviews, such as when we visited the Portland International Airport, provided opportunities to dig deeper into specific experiences of visitors to Portland.

During the week of fieldwork and observations, one of our team members was on a business trip to Europe, where he also observed public transit use in Freiburg, Germany and Birmingham, U.K. This gave us an opportunity to develop a different perspective from a place outside of the United States.

B. INTERVIEW INFERENCES

After interviews and observing the routine experiences of public transport commuters from Portland and tourists visiting the city, the next step was to transform the interview data into useful information to aid with problem definition. Our method for this was to write brief keywords from the interviews in a tabular form [Appendix 6]. Our tables included direct observation information - purpose and frequency of use of public transport, preferred mode of payment and commute pattern - as well as inferences we made.

Figure 2. Ticket and Information Kiosk In Europe

Through this approach, we deduced the unmet needs and positive experiences that users were having with TriMet. When looking at the experiences of first-time TriMet users we understood that the system was complicated for them, specifically in terms of understanding the different routes and rail lines across the city. International tourists, especially from non-English speaking countries, found navigating through the city complex due to a lack of clear signage.

An insight from our research in Europe, where a member of our team observed different transportation types, is that at some locations there is an abundance of kiosks and payment methods. This helped diminish feelings of anxiety for tourists, which naturally arise when dealing with transit systems that one is not familiar with. The increased number of systems allowed users to take their time without feeling like they were inconveniencing other users.

5. SYNTHESIS AND PROBLEM STATEMENT

A. SYNTHESIS

After conducting our interviews and observations, the project team synthesized our findings through a fieldwork report and then further refined our thinking through a problem statement presentation. In our problem statement, we attempted to define the critical problem tourists are facing, as well as bring to light their experiences through personas.

Our target users are tourists in Portland who find it challenging to purchase tickets and figure out the best mode of transportation to reach their destination. They want to be able to easily purchase and understand the different payment methods that TriMet offers in order to visit tourist destinations, such as the Oregon Zoo and the Rose Garden. Importantly, from an emotional perspective, they want to have little stress when purchasing fares and when using public transportation while maximizing their enjoyment of the city. They also want to be emotionally and culturally uplifted by visiting tourist destinations.

These infrequent users are in stark contrast to the regular public transit commuters who use TriMet to go to work and back every day. These users often have the annual passes and use smartphones regularly for navigation (many international tourists are not able to use their smartphones). These regular commuters are quite comfortable on TriMet, use it primarily for utilitarian and economic (both money and time) reasons, and consider TriMet an economical way to commute daily. Please see Appendix 7 for our personas.

The key insights from our fieldwork about tourists include:

- Tourists often want to use public transit for three primary reasons:
    - They have a values-based preference for using public transportation, such as because of environmental benefits or because they value public transportation as an intrinsic good.
    - They want to save money by using public transit as compared to Uber or a taxi.
    - They want a more authentic experience of visiting Portland.
- Multiple languages are not available at kiosks
- Visitors to Portland International Airport (PDX) often approach the Visitor Information desk with questions about public transit. Volunteers staffing the desk often use the TriMet Trip Planner website to plan visitors' trips for them, and then print copies of the plans for visitors to use.

- There's a short list of destinations that visitors want to see - such as about a dozen tourist attractions in downtown Portland, hotels, and the Oregon Convention Center.
- The transit system and information are built around regular commuters/users, such as the system maps at kiosks, which are difficult to read for people who are not very familiar with the region.
- Purchasing a ticket is not available on trains.
- Ticket purchasing with credit/debit card is not available on buses.

B. PROBLEM STATEMENT

We used the synthesis to develop a particular point of view to understand our challenge of how to improve the public transit and payment experience for tourists. Our problem statement seeks to balance human-centeredness (specific for a certain group of users and sensitive to their needs) with creating space for creativity, and with the need to have a manageable scope [6].

Point-of-view statement

"I am new to Portland, and I want to use public transit to visit attractions without asking for assistance with the routes or payment methods. I am interested in a hassle-free and uplifting experience so my attention can be focused on learning about and immersing myself in Portland and its unique experiences"

How might we improve public transit services and touchpoints so someone new to Portland can have a hassle-free and uplifting transit experience?

6. CONCEPT AND SOLUTION GENERATION

A. SOLUTION SCOPE

We started off with observations and fieldwork to better understand our users. We now had to synthesize the information from our observations and fieldwork to define our solution scope.

Solution Scope:

Description

The implementation of this new service is to improve the public transport experience for tourists and visitors, with language barriers and limited knowledge of the city and its interest points. Our scope is limited to public transit services within the Portland area.

Assumptions and Constraints

- Working within limited resources and time.
- Technology will be integral to our solution, yet the ownership of a smartphone is not required.

Needs

- Our personas help capture the needs of our users, which are critical to our solution

Required Capabilities

- Easy to interpret, 6-year-old user
- Integrates with existing technology systems

We tried to understand the existing system by engaging in role playing at the Portland International Airport, which helped us gain insights and empathy for what the challenges really are.

To begin translating these and other insights into solutions, we decided to have a brainstorming session to begin ideation, while keeping empathy at the core of our design process. Brainstorming allowed for every team member to participate in a non-threatening environment, as illustrated in Appendix 4.

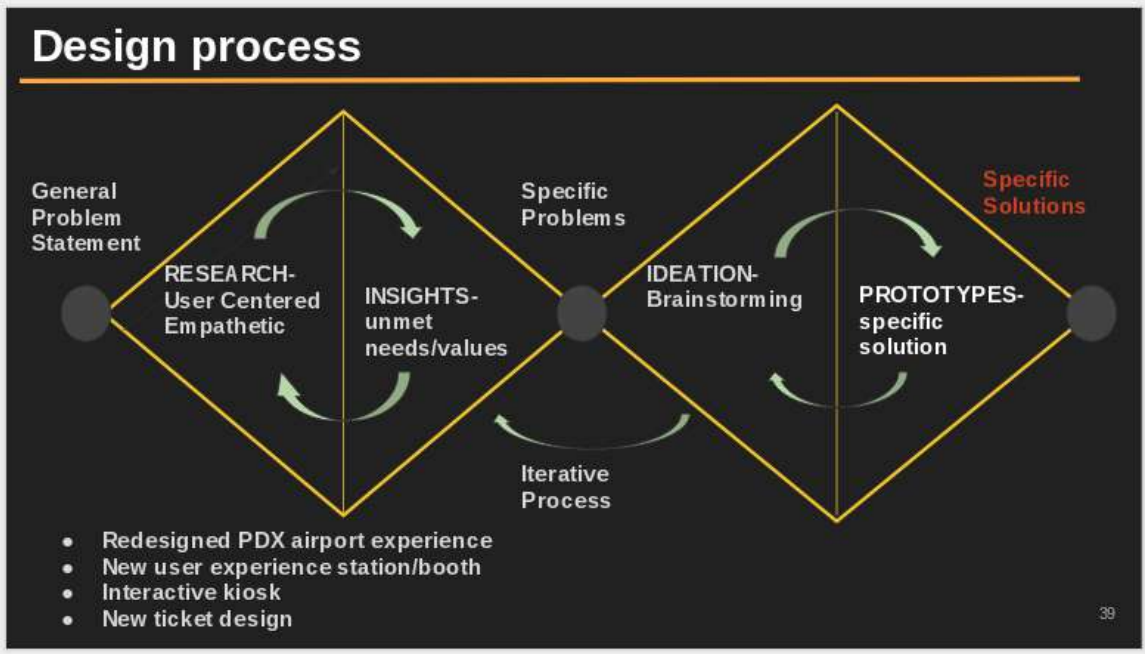


Figure 3. Double Diamond Design Process- Solutions

B. SOLUTION DESIGN

Our brainstorming session led us to identify four solutions:

1. **Redesigning the PDX airport kiosks and signage** Our observation and interviews enabled us to understand the confusion that new TriMet users and tourists experience, especially at the PDX airport. With multiple information stations, kiosks and information flyers, and complex colored MAX line maps, our solution was to redesign and tweak the information kiosk and signs. Our approach is to create a more intuitive experience. This included minor changes like changing "MAX Light Rail" signs to "MAX Light Rail (Train)" to larger changes, such as separate information desk especially for tourists with a welcome board and smart signage that lets visitors know which train is ready for departure. Another goal of this solution set is to reduce the number of paper maps tourists have to carry and minimize the level of assistance required to understand the train arrival and departure schedules. To accomplish this, we developed an interactive kiosk (described below) that would be located at the Information Center, and a welcome-to-Portland booth specifically for tourists near the baggage claim stations at the PDX international airport. Redesigning the PDX airport experience would enable tourists/ new users to better understand the signage leading to reduced perplexity and distress on arrival [Appendix 8].

2. **New user experience station/booth** - This solution is a booth designed specifically for tourists and first time visitors to Portland in order to give them a feel for the MAX and also to make it possible for them to understand routes more easily and quickly. The approach with this solution is to create a specialized information booth, with an interactive kiosk, keeping in mind tourists' unfamiliarity with the city and public transport system. An overarching goal of these booths' is to create a less anxious and more relaxing space for getting acquainted with the transit system. These redesigned booths could have exterior designs that match the local architecture of the city. Thus, designing booths with the local art and structure embedded within its design, our goal is to address the unmet needs of first time users, that are usually different than regular TriMet users [Appendix 9].

3. **Interactive kiosk-** The interactive kiosk is actually a giant version of a google map, with enhanced innovative and interactive platforms. This booth, with a touch screen and interactive map will **allow** the tourist/user to select the language of his/her choice, select a destination which would then guide them toward boarding the right train/bus thus minimizing the need to look at paper maps [Appendix 10]. Mobile technologies such as GPS have advanced to conveniently navigate with the drop of a "you are here" pin. The concept of providing the same location abilities for indoors is usually seen at malls and shopping complexes. Embedding this technology within the interactive kiosk will make the process of visiting a

specific destination to be extremely intuitive. Operating on Wifi technology, the system will allow tourists to search for destinations, other than the station stops. Once the information with the location is selected, the kiosk will highlight the route from the current location, on the kiosk screen, with information regarding train color, travel time, train/bus schedule and travel cost, in the users' own preferred language. To elevate the touristy experience of visitors, the system will also allow the users to customize their trips by generating discount coupons for famous restaurants, cafes and tourist spots in Portland [Appendix 10].

4. **New ticket design -** This solution would consist of a clear depiction of the map specifically customized for every individual's journey, as generated in the above kiosk. It would specifically indicate the station he/she is supposed to get off at and the timing of when they can expect the next train/bus/street car. This solution will allow tourists and visitors without a smartphone to read their routes in a more pictorial way. The additional coupons would also allow users to check out some of Portland's famous hot spots and also boost the city's economy. The ticket back will specifically highlight the route to be travelled by the customer. Additionally, it would include information such as live events within the city, famous attractions and spots, drawing on information from Travel Portland's events calendar. [Appendix 10].

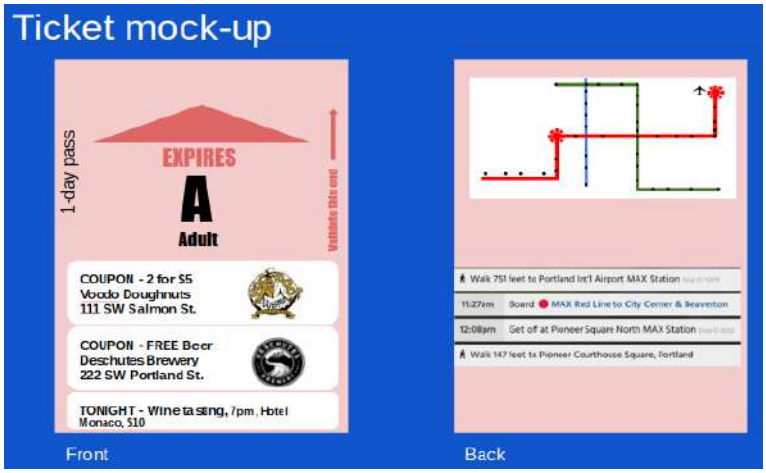
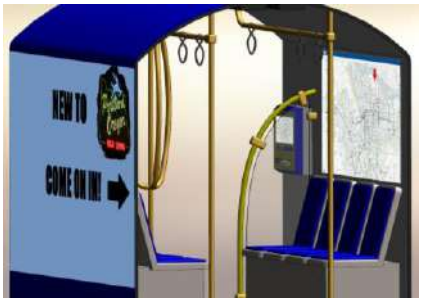


Figure 4. New Ticket Design and Mock-up

7. PROTOTYPE CREATION

The team believed in the "learning by doing" approach for solution generation. It was important for our team to develop a physical prototype to receive feedback from each other and understand our product better. To create a prototype of solution 3, i.e. The Interactive Kiosk, we used a tablet with touch screen technology set in a cardboard model. This helped us consider important factors such as the size of the kiosk and the positioning of the payment options. Navigating around a physical prototype allowed us to experience what it would be like to use the interface.



We also used rapid prototyping to demonstrate the interiors of the new user booth experience. The image on the right shows a virtual representation of solution 2, the New user experience station/booth. The purpose of the second prototype, built with Solidworks, was to speed up prototyping by simulating the interiors of the booth and thus reduce the amount of time to build an actual physical prototype.

Figure 5. New Kiosk Prototype

8. EVALUATION OF SOLUTION - THE BALANCED SCORECARD

After developing our solutions, we used the balanced scorecard approach to evaluate the success of our ideas, based on a set of specific objectives. With the help of the Balanced scorecard, we broke down our overarching goals into measurable objectives, and defined metrics for each the objectives (scale of 0 to 5). Further, we established targets for each of the objectives that would help us achieve the final goal of a hassle-free public transport experience. This allowed us to measure our performance before and after we designed the solutions.

Objectives	Metric	Target	Points	
8 year old users time using the system decreased	Time of use to continue	<5mins	<5 = 5 5-7.5 = 4 7.5-10 = 3 10-12.5 = 2 >12.5 = 1	5
User confidence with using Trimet system increases	Perceived confidence	Users report a 25% increase in perceived confidence	≥25 = 5 25-20 = 4 20-15 = 3 15-10 = 2 <10 = 1	4
Multiple languages available in information system	Number of languages available	5 including english	≥5 = 5 4 = 4 3 = 3 2 = 2 1 = 1	5
Information system does not require use of a smartphone	User does not use smartphone	No use of smartphone to use system	5 or 0	5
System easily located at high traffic areas, on buses, trolleys and trains	What is the size of the system	Less than or equal to one seat	<1 = 5 1 = 4 1.5 = 3 2 = 2 >2 = 1	4
System allows for ticket purchase using cash, credit or debit card	Does the system allow all payment methods	All payment methods	5 or 0	5 28/30

Figure 6. The balanced scorecard with final score evaluation for the new system

A few notes about the table above:

- For the first objective, the age and time of use target was based on a discussion with a TriMet employee and the common times between scheduled train departures.
- User confidence is one of the emotional connections we wanted to produce with our solution.
- Multiple languages were common in kiosks observed in Europe while standard TriMet kiosks currently only have English and Spanish.
- TriMet has users from all socioeconomic levels so the solution had to reach everyone equally regardless of smartphone ownership or if they did or did not have bank cards for payment.
- The size of the system directly relates to the number of systems available in a given space. More kiosks give people extra time and decreases anxiety and stress.

In order to review our combined solutions, we evaluated them (as a whole) against the scorecard. Our total of 28 was slightly less than the perfect score of 30. This provides us with an objective sense of how well our solutions meet user needs [Appendix 11].

9. LESSONS LEARNED

Reflecting on our experiences of directly engaging in user-centered innovation can help us improve when we use this innovation approach in the future. Several things we learned are:

- It's amazing how much information can be gained in just a 5-minute conversation with a user!
- When conducting fieldwork, it was difficult to both listen and sketch at the same time. However, it was helpful to revisit field notes after the interviews to add additional details.
- People were very open to sharing about their experiences, which was energizing.
- By visiting the PDX airport, even for a short amount of time (about an hour), we gained a lot of insights and talked to a host of people - visitors center volunteers, new-to-Portland TriMet users, and a MAX Light rail driver. There is simply no substitute for observations and interviews!
- Thinking about users' emotional experiences was a bit abstract until we started to design with their emotions in mind. Once we did this, our ideas and solutions benefited. For example, the idea of creating a Welcome Center came out of a brainstorm about how to help tourists feel more comfortable when using the MAX Light Rail for the first time.
- The brainstorming to identify solution ideas was fun, as it is energizing to think big.

- We can imagine how difficult it is to take brainstorm ideas and scope/adjust them to be cognizant of viability and feasibility.
- Once we freed ourselves of the expectation of making "really good" prototypes, it was much easier to begin creating them - we shifted to accept that the most important part was getting the idea on paper or slide.

10. CONCLUSION

In closing, we found this project to be incredibly helpful in developing our skills and knowledge with user-centered innovation. We believe our solution ideas and prototypes could provide significant value to TriMet and new visitors to Portland. If one were to think about moving these ideas forward, the next steps would be to make a proposal to TriMet for changes, highlighting the feasibility and viability of these ideas, but also importantly, the improved user experience this would create. Our hope is that TriMet would be incredibly excited to move these ideas forward!

11. REFERENCES

[1] C. Kamga, M. A. Yazıcı, and A. Singhal, "Implementation of interactive transit information kiosks at New York City transit facilities: Analysis of user utilization and lessons learned," *Transp. Res. Part C: Emerg. Technol.*, vol. 35, pp. 218–231, Oct. 2013.

[2] "History." [Online]. Available: https://trimet.org/history/. [Accessed: 16-Mar-2017].

[3] T. D. Camacho, M. Foth, and A. Rakotonirainy, "Pervasive Technology and Public Transport: Opportunities Beyond Telematics," *IEEE Pervasive Comput.*, vol. 12, no. 1, pp. 18–25, Jan. 2013.

[4] "TriMet to overhaul payment system with Hop Fastpass," *KOIN 6*, 08-Mar-2017. [Online]. Available: http://koin.com/2017/03/08/trimet-to-overhaul-payment-system-with-hop-fastpass/. [Accessed: 09-Mar-2017].

[5] D. Norman, *The Design of Everyday Things: Revised and Expanded Edition*. Basic Books, 2013.

[6] 126Kr, "Define and Frame Your Design Challenge by Creating Your Point Of View and Ask 'How Might We' - 【126Kr】." [Online]. Available: http://126kr.com/article/6xzrc4rejhu. [Accessed: 09-Mar-2017].

APPENDIX

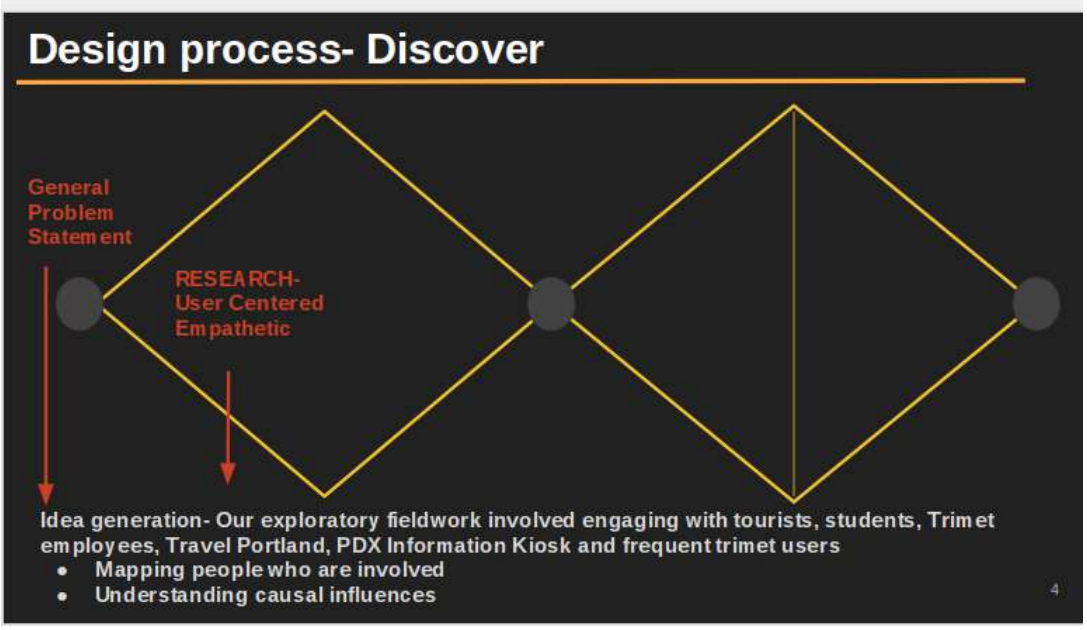
Table 1:

Table 1
Passenger and kiosk utilization[a] (over 5 h).

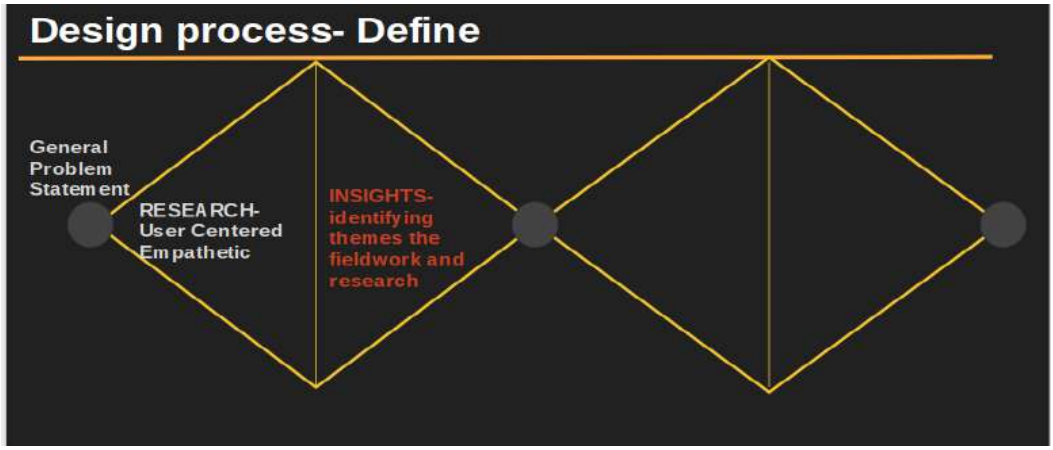
Date–Time		Bowling Green (Manhattan)		Penn Station (Manhattan)		Atlantic Ave (Brooklyn)		Roosevelt Avenue (Queens)	Grand Central (Manhattan)
		December 1st Thursday (1PM–6PM)	*December 10th Saturday (12PM–5PM)*	**December 2nd Friday (1PM–6PM)**	***December 3rd Saturday (12PM–5PM)***	**December 8th Thursday (1PM–6PM)**	***December 10th Saturday (1PM–6PM)***	December 6th Tuesday (1PM–6PM)	**December 9th Friday (1PM–6PM)**
Stop&Go	Actual Count	25	*23*	**236**	***144***	**72**	***37***	33	**211**
	Usage Rate (%)	0.19	*0.65*	**1.33**	***0.87***	**0.31**	***0.22***	0.22	**0.53**
On the Go! Users	Actual Count	4	*39*	**53**	***106***	**55**	***101***	28	**59**
	Usage Rate (%)	0.03	*1.10*	**0.30**	***0.64***	**0.24**	***0.60***	0.17	**0.15**
Total	Actual Count	29	*62*	**289**	***250***	**127**	***138***	61	**270**
	Utilization Rate (%)	0.21	*1.75*	**1.63**	***1.51***	**0.55**	***0.82***	0.37	**0.68**
Total Passenger flow near On the Go!	Actual Count	12,979	*3543*	**17,759**	***16,474***	**23,073**	***16,801***	16,180	**39,562**

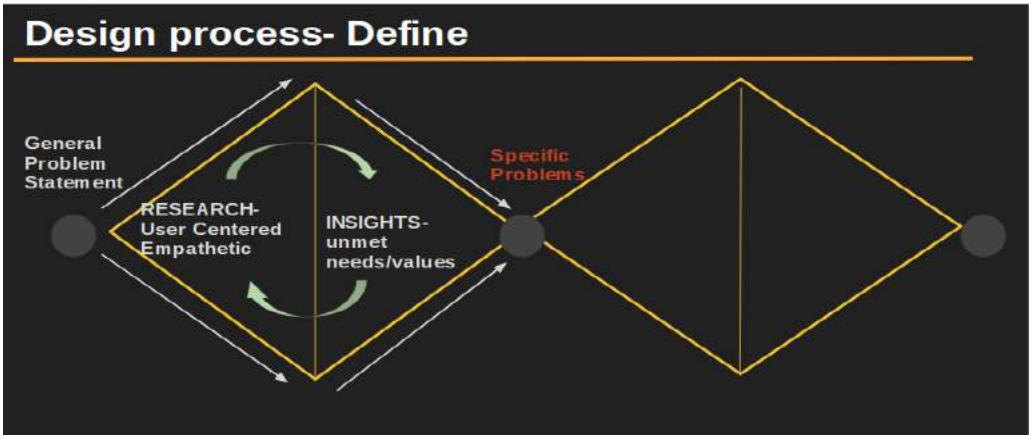
[a] Transportation hubs are shown in **bold**, and the weekend observations are italicized.

Appendix 1- Double Diamond Design Process- Discover

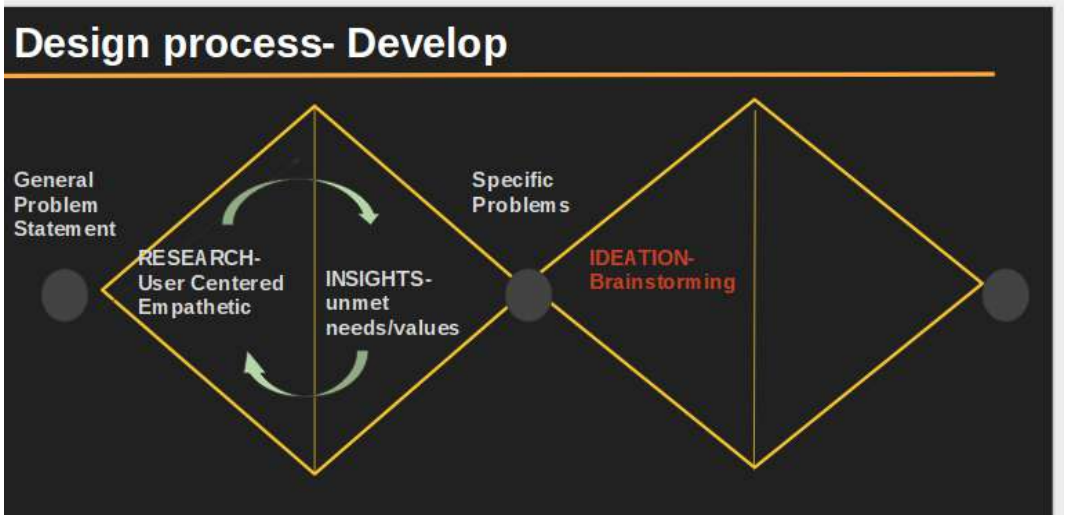


Appendix 2- Double Diamond Design Process- Define

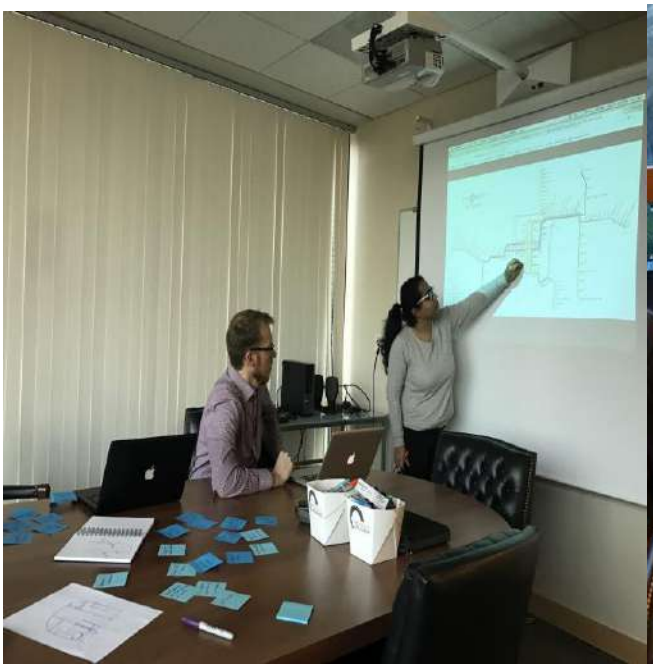


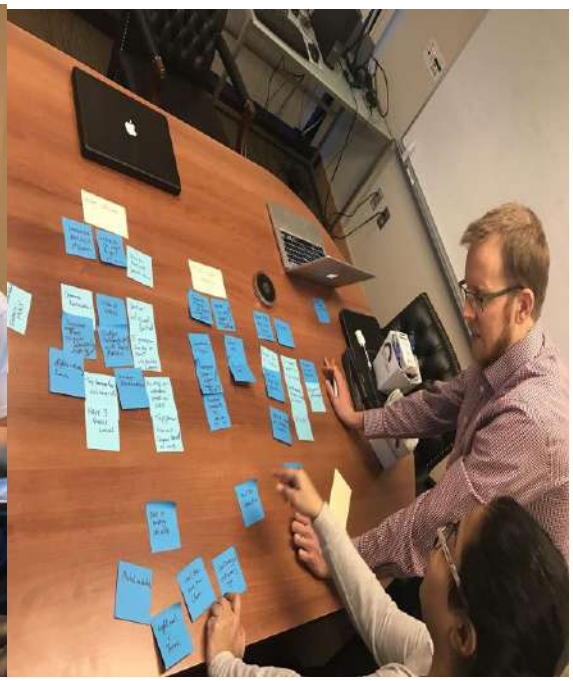


Appendix 3- Double Diamond Design Process- Develop



Appendix 4- Develop/Ideate- Brainstorming sessions.





Appendix 5- TriMet ticket kiosks inside streetcars, TriMet ticket kiosks, TriMet ticket kiosks at the airport,

Appendix 6- Interview Inferences.

Becky

Direct Observation	Inference
Location: Trimet stop, 185th and cornell **Use**: Bus to willow creek **Frequency**: 3 times/week **Tickets**: Has a monthly pass sticker, on her college ID **Experience paying**: Monthly pass is great, coz of its discounts for students. **Other:** currently unemployed **Demographics:** High school student	**She would not rely completely on the app, for the fact, that it at times runs out the credentials, and it's frustrating to re-enter the credit card details back to the app.** She's comfortable with using a smartphone, but prefers the student pass She has very positive experiences with Trimet **Problem- The trimet app is time consuming to install, requiring payment with US credit cards**

Old Asian Couple

Direct Observation	Inference
Location: Max stop outside of Pioneer courthouse. **Use**: As tourists, Bus and Max around the town **Frequency**: NA **Tickets**: 2.5 hour tickets from the kiosks **Experience paying**:They had trouble understanding the methods of paying, Found it frustrating to operate the kiosk. Ended up paying twice for one single ticket. **Demographics:** late 40s/50s	They were very pleased with the frequency and announcements in the bus/max and streetcars. Problems- **1. Too many methods to pay, made it confusing for them.** **2. No real source of information.** **3. Bus/max schedule screens above the kiosks, were extremely helpful** **Opportunities- Pass and information doc should be made available at airports, and max kiosks,** **1. Payments not limited to in US dollars** 6

Visitors from China

Direct Observation	Inference
Location: Street Car stop at PSU Urban Center Building **Use**: Street car only. **Frequency**: Temporary [3 weeks] **Tickets**: pay with cash or card **Experience paying**:It is a different experience. Get confused paying at the kiosk. **Demographics:** mid 50s	They were waiting at the wrong stop .Wanted to go to Waterfront but street car would take them in the opposite direction. Did not speak much English. They have only taken the street car and not the max. Their son is a student at PSU and drives them around otherwise. **Understanding the routes is tough.**

Direct Observation	Inference
Location: Parking Structure 1 information booth **Use**:Max **Frequency**:unknown **Tickets**: unknown **Experience paying**:unknown **Demographics:** early 70s couple	They could have been tourists. Wanted to know if they could purchase their tickets at the information booth where I work. **They clearly did not know where to purchase the max tickets.**

4

Jason		PSU Student	
Direct Observation	**Inference**	**Direct Observation**	**Inference**
Location: On my way to Target: SW Jefferson, Max Station **Use**: max to/from goose hollow to hillsboro **Frequency**: 4 times/week except on Friday **Tickets**: purchases via the app **Experience paying**: finds the app to be convenient **Other:** currently employed **Demographics:** early 30's	**Jason finds the app to be an extremely convenient way to make payment since he never carries cash** **He thinks that the train is too crowded during rush hour and trimet should introduce more number of trains between 4.30- 6.30 PM** Thinks there should be one cop in the trains as sometimes people get into arguments and fights making the journey unpleasant for everyone.	**Location:** Street car stop on PSU campus **Use**: Street car. Max **Frequency**: ~ Street car mostly. Max- very rarely **Tickets**: Does not have to pay on street cars. Has purchased max ticket on his phone app but never used them since they do not check. **Experience paying**:Thinks it is quiet easy to follow instructions at the kiosk and is user friendly from past experience. **Demographics:** mid-20s male	**Thinks public transportation should be made free for students. Cannot afford to pay trimet fares.** Prefers travelling in street cars as much as possible

3

Customer Positives	Customer Negatives
Monthly students passes, are money saving.	Too many modes of payment.
Affordable transportation for the homeless.	Trains are way too crowded during the rush hour
Transportation for international students, tourists without cars	No informational kiosks for the tourists, except on street cars that have maps indicating information on the routes
System is intuitive to use for what type of ticket to buy	

Appendix 7- Personas.

Persona - Tourists

Our target users are tourists in Portland who find it challenging to purchase tickets and figure out the best mode of transportation to reach their destination.

Goals and motivations

- To be able to understand a hassle free way to travel in and around Portland upon arrival at the airport using Trimet
- To be able to purchase the tickets and understand the different payment methods that Trimet offers

Experiences with Trimet

- Does not know where to purchase max tickets
- No direct and easily understandable source of information
- Bus/ Max schedule screens above the kiosks were helpful to a certain extent

Taniya Pal

- Visiting from India
- Speaks fluent English
- 28 years old
- Visiting PSU

Jobs to be done	Desired outcome	Metric of Success	Outcomes to Avoid
Have a hassle-free and fun visit to Portland using public transit	Low-stress and lots of fun	Easy transit use, time-saving, doesn't need to carry multiple maps; emotionally uplifting	Stress

Persona - New Users

Our target users are new users to Portland who find it challenging to navigate through the Trimet routes and maps to reach their destination.

Goals and motivations

- To go to Tom McCall Waterfront near downtown portland
- Visit other tourist destinations

Experiences with Trimet

- No sign to indicate the exact stop that the user is waiting at the right stop.
- Understanding routes is tough
- Maps are confusing

Mr. & Mrs. Chen

- Visiting for a month from China
- Aged 50 - 55 years
- Live on campus with their son
- Do not speak fluent english

Jobs to be done	Desired outcome	Metric of Success	Outcomes to Avoid
Have a hassle-free and fun visit to Portland using public transit	Reach the desired destination on time Low-stress and lots of fun	Easy transit use, time-saving, doesn't need to carry multiple maps; emotionally uplifting	Stress Catch the wrong Max/bus/street car

Persona - **Frequent Trimet Users**

Our target users are not people who use the Trimet system on a daily basis. They use Trimet daily and are quite knowledgeable about how to travel.

Goals and motivations

- Use Trimet to go to work and back everyday
- Users have the annual trimet pass
- Use smartphones regularly for navigation

Experiences with Trimet

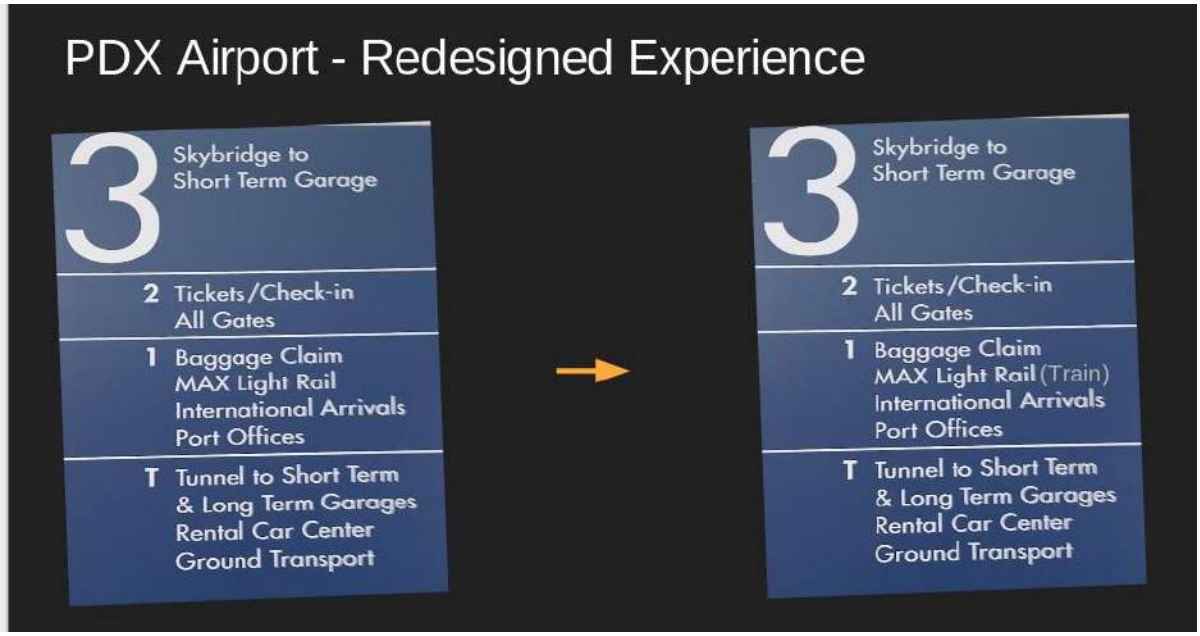
- Finds the Trimet app to be an extremely convenient way to make the payment
- Has a positive experience with Trimet
- Considers Trimet economical and a beneficial service

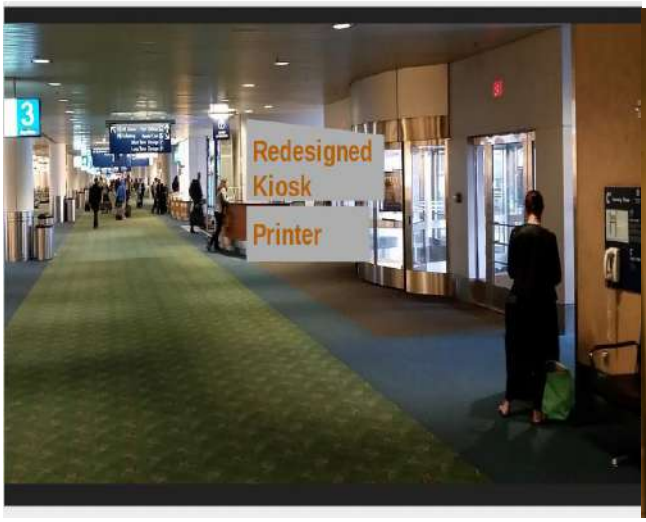
Sally Smith

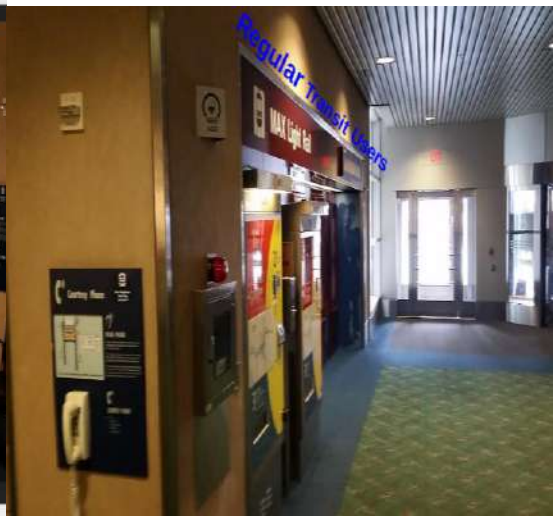
- Is an American
- 35 years old
- Works at a bank in downtown Portland

Jobs to be done	Desired outcome	Metric of Success	Outcomes to Avoid
To catch the Max Blue line from Beaverton Transit Center	To get to work in downtown on time everyday	Have the annual Trimet pass in her wallet at all times	Lose wallet

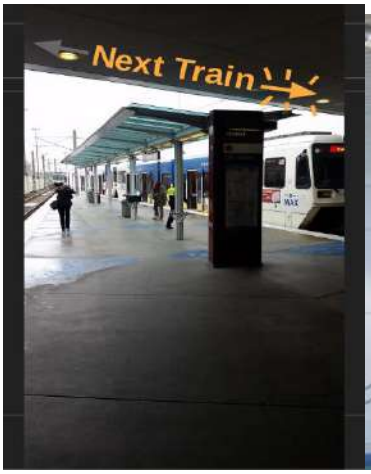
Appendix 8- Solution design- Redesigned PDX airport experience








MAX Light Rail
Train
Bike Assembly Area
Next Train is
City Center
To Trains
MAX


Next Train


Bag Claim 4-10
Intl. Arrivals
Ground Transport
Short Term Garage
Long Term Garage
MAX Light Rail
Restrooms
NEW TO
COME ON IN!


Transit Users New to Portland
- Redesign kiosks (many of them) with trip planners
- Printers
- Redesign electronic signage
- Free Stumptown coffee
- Interactive maps - very large, popular destinations only

Appendix 9- Solution design- Station Design Vs Local Architecture

Appendix 10- Solution design- Interactive Kiosks

Questions to help customize your trip

- How many people are in your group?
- Where do you want to go in Portland?
- How many days will you be here?
- What kinds of things do you like to do?
- Do any of these events sound like fun?

Portland's Voodoo Doughnuts

Calendar feed from Travel Portland

36a

Would you like to customize your trip to receive discounts and learn about events?

Yes No

35

Select your fare

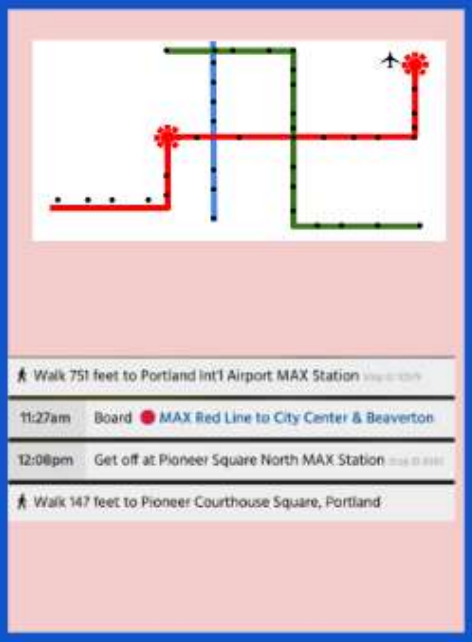
2½ hour ticket	$2.50
1-day pass	$5
7-day pass	$26
14-day	$51
30-day/monthly pass	$100

MAX Light Rail (Train) in downtown Portland

4b

Ticket mock-up

Front



Back

Appendix 11- Success measurement with the Balanced scorecard.

Objectives and Success Criteria

Objectives	Metric	Target	Points
6 year old users time using the system decreased	Time of use to continue	<5mins	<5 = 5 5-7.5 = 4 7.5-10 = 3 10-12.5 = 2 >12.5 = 1
User confidence with using Trimet system increases	Perceived confidence	Users report a 25% increase in perceived confidence	≧25 = 5 25-20 = 4 20-15 = 3 15-10 = 2 <10 = 1
Multiple languages available in information system	Number of languages available	5 including english	≧5 = 5 4 = 4 3 = 3 2 = 2 1 = 1
Information system does not require use of a smartphone	User does not use smartphone	No use of smartphone to use system	5 or 0
System easily located at high traffic areas, on buses, trolleys and trains	What is the size of the system	Less than or equal to one seat	<1 = 5 1 = 4 1.5 = 3 2 = 2 >2 = 1
System allows for ticket purchase using cash, credit or debit card	Does the system allow all payment methods	All payment methods	5 or 0

40

Evaluating our Solutions

Objectives	Metric	Target	Points
6 year old users time using the system decreased	Time of use to continue	<5mins	5
User confidence with using Trimet system increases	Perceived confidence	Users report a 25% increase in perceived confidence	4
Multiple languages available in information system	Number of languages available	5 including english	5
Information system does not require use of a smartphone	User does not use smartphone	No use of smartphone to use system	5
System easily located at high traffic areas, on buses, trolleys and trains	What is the size of the system	Less than or equal to one seat	4
System allows for ticket purchase using cash, credit or debit card	Does the system allow all payment methods	All payment methods	5 = 28/30

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