Designing a Light Rail for the People

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SOUNDTRANSIT

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Introduction

Background

Sound Transit's Link Light Rail, established in 2009, will undergo massive expansion between now and 2041.

Current	Planned
• 32 kilometers	• 187 kilometers
• 22 stations	• 70 stations
• 80k daily riders	• 550k-700k daily riders

Problem

The Link Light Rail expansion will dramatically increase ridership. Because of this, **the light rail needs to adapt** to support existing riders travelling farther and new riders unfamiliar with the system.

Goal

1. Identify what riders value & need adjusted the most.
2. Evaluate and design for current and new riders' values.
3. Recommend light rail changes to better support riders.

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Research

Observations

We observed four light rail stations, taking notes on interactions with each station.

Results
- Riders with baggage, bicycles, or limited mobility struggled with navigating the station most often.

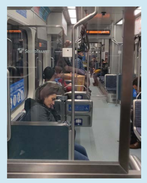

Fig 1. On the light rail at Westlake Station

Surveys

We surveyed 69 light rail riders to identify customer values, needs, and frustrations.

Results
- Riders want less fare enforcement and more frequent trains.
- Speed and convenience were the most important values to riders struggled with navigating the station most often.

Fig 2. A survey summary

Interviews

We interviewed a variety of riders and observed their navigation of the light rail.

Results
- New riders struggled in all of the journey.
- Frequent riders tuned out many on-train voice announcements and signs

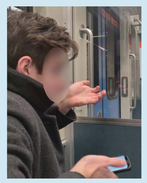

Fig 3. A first-time rider on the light rail

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Airport

Based on observation results and the coming Paine Field Airport station, Nick and Zack explored airport foot traffic.

Evaluation

Steps
1. Model the current SeaTac Station in peak conditions.
2. Create recommendations from testing the model.
3. Design and compare an "improved" station model.

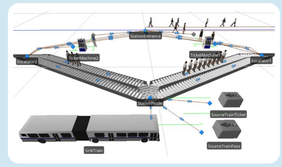

Fig 4. A model of the current SeaTac station

This improved station combines one-way movement to the platform and a moving walkway to and from the station.

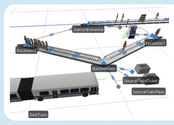

Fig 5. One-way flow to the SeaTac platform

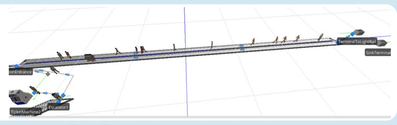

Fig 6. The "people mover" moving walkway model

Findings

Our changes' impact on the average time spent in system:

Throughput Time	Ticket Purchasers	ORCA Tappers
Current Station	6.65 min	5.67 min
One-Way Isolated	6.20 min	5.68 min
People Mover Isolated	4.18 min	3.10 min
Recommended Model	4.11 min	3.22 min

Our analysis could save Sound Transit monvey by more effectively using $50k Ticket Vending Machines.

Recommendations

We recommend making the aforementioned changes, along with changes based on how many ticket vending machines customers require per hour.

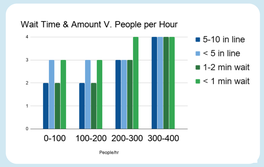

Fig 7. A chart of TVM wait times and amounts compared with people per hour

Seating

Based on survey results and observed interactions on the train, Angela and Itsumi designed for better seating.

Evaluation

Assessment
- Currently, seats can face all four sides of the train.
- The arrangement varies across sections of the train.
- When boarding the train under pressure (ie. rush hour), difficulty finding and picking seats can clog foot traffic.

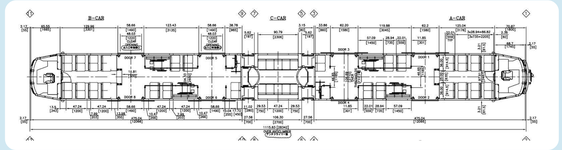

Fig 7: Current specifications of a Link Light Rail train

Testing
- We performed time studies with 50 subjects on the time taken to choose a seat or find a place to stand.
- We surveyed 62 Light Rail riders on their preferences between the existing and recommended arrangement.

Findings

- 72% of riders sat down, taking 7.92 sec. on average
- 28% of riders stood, taking 3.1 sec. on average
- 59.8% of those surveyed thought that seating along the walls would make it easier to find a seat.

Fig 8. (On right) Survey results

Recommendations

Riders can easily familiarize themselves with their surroundings in the new symmetrical layout. Increased aisle space allows riders to move easily through the train, even with luggage. Increased aisle space also allows standing riders room to avoid blocking the doors.

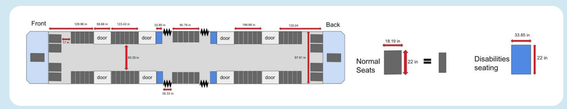

Fig 9. The recommended specifications for a train

Signage

Based on observations, surveys, and interviews, TJ and Tj chose to reimagine the navigational signage on the Link.

Evaluation

Our first tests looked at different UI components. We ran participants through 4 scenarios using a randomized block test, and surveyed what aspects they preferred.

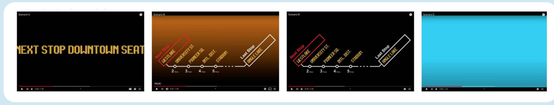

Fig 10: Scenario A. "as-is" scenario

Fig 11: Scenario B. "everything" scenario

Fig 12: Scenario C "digital display" scenario

Fig 13: Scenario D "minimal" scenario

Our second testing iteration featured designs that had been improved upon, and we tested how participants reacted when faced with distractions during the tests.

Fig 14. Our new four scenarios to test

Findings

	Current System	Findings
Screen	Ticker displays current or upcoming station	Riders want to see past and future information
Voice	Announces the next station and train arrival	Voice announcements should be short and clear
Map	There are static maps on the walls of the line	Maps should be simple to support first-time riders
AV	Existing effects are simple dings and lights	These effects can be but need community input

Recommendations

Screens should indicate previous, current, upcoming, and final stations. On-train announcements should have clearer audio and should begin with line and direction. Maps should denote current and upcoming stops with LEDs.

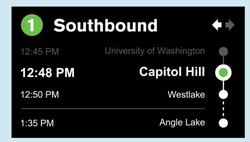

Fig 15. Final design of our recommended navigational user interface.

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Impact

Airport: Sound Transit can calculate the exact number of required ticket vending machines to meet their throughput constraints to save money.

Seating: The cognitive load of travelers is lowered when boarding the train, making transitions smoother, especially during peak travel times.

Signage: Information is communicated clearly, so that first time riders can immediately understand the system, and experienced riders can ride with ease.

Future Considerations

Escalator Maintenance
Many riders indicated accessibility concerns and dissatisfaction with how frequently escalators are broken.

Flow Guidance
Markings on the ground to guide flow and traffic should be implemented. So should more railings on trains.

Auditory Signals
Sound effects can increase the ease of identifying each station which benefits frequent riders.

Acknowledgments

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This project took place on the traditional land of the Coast Salish people. We acknowledge and honor with gratitude the land and the tribes to which it belongs.