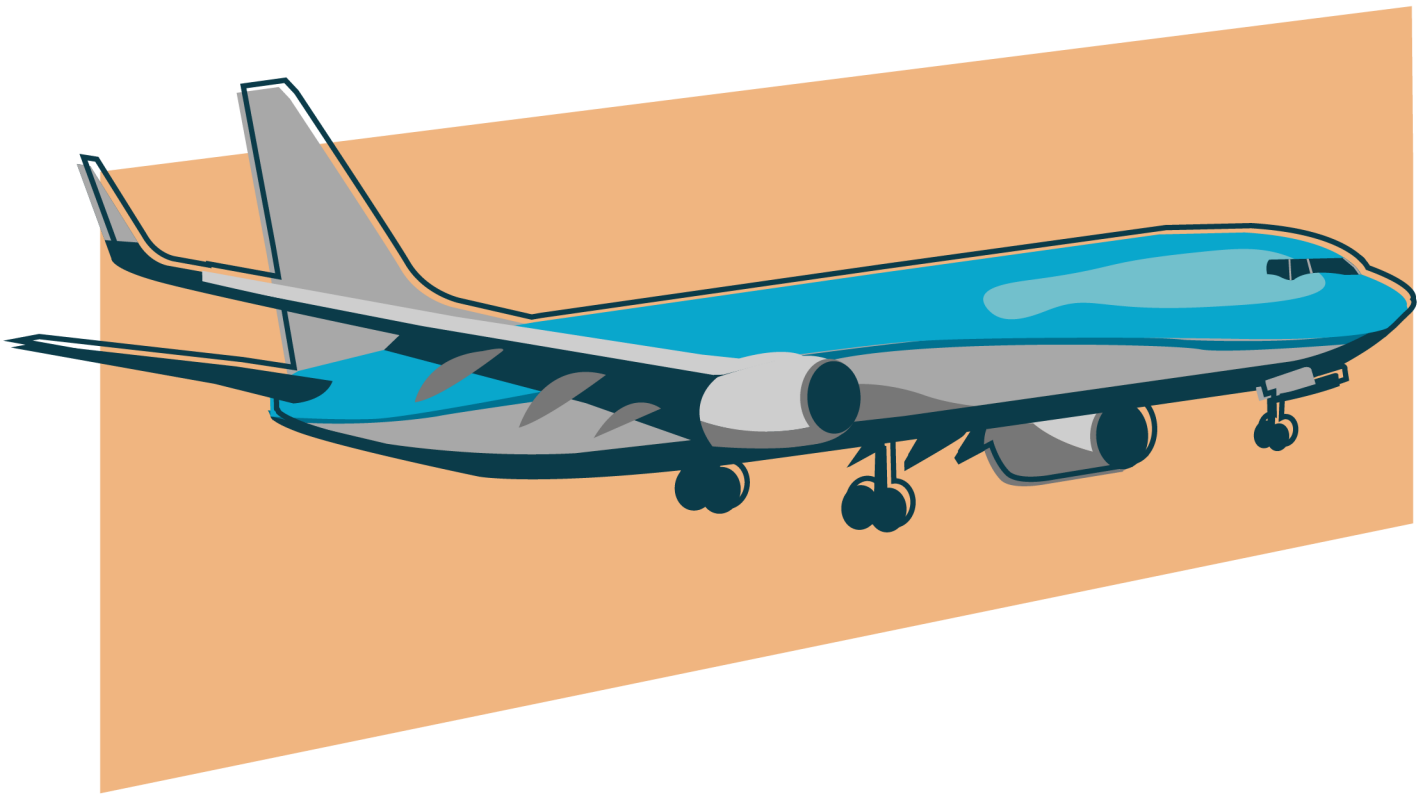
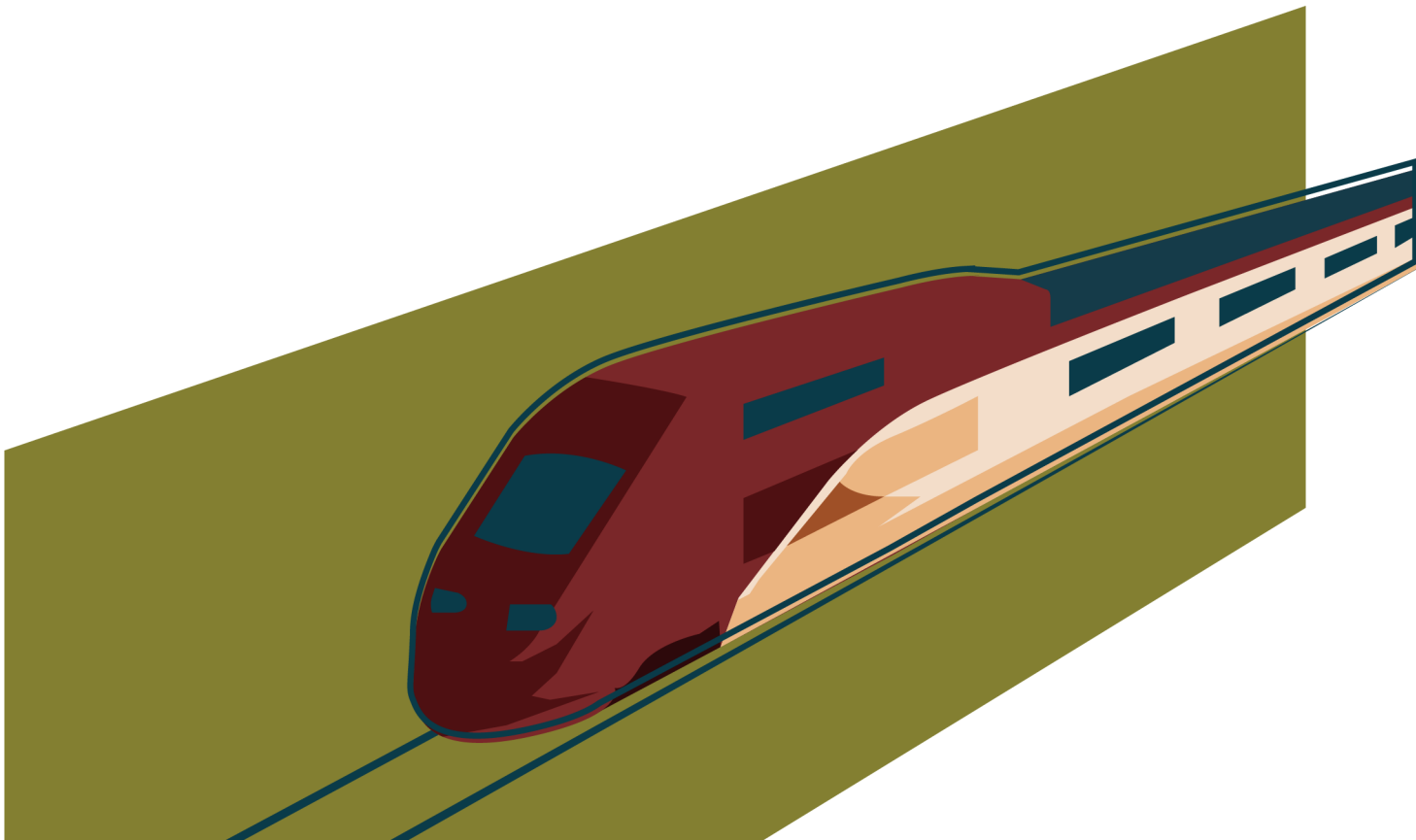


Baggage Solutions for Air-Rail

Fiona Taniguchi



Author

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Master Thesis

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Strategic Product Design
Faculty of Industrial Design Engineering
Delft University of Technology

Graduation Committee

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Acknowledgements

Welcome to my Master thesis! With this report an end has come to the many years of my studies in Delft. Industrial design has shown me its versatility and ingenuity, that will forever spark my interest. This resulted from the many interesting projects that were done during my bachelor Industrial Design Engineering and my master Strategic Product Design. What mostly made my time in Delft special, were the many people that I was able to collaborate with during the many group assignments. Experiencing deadlines, challenges, and successes together, often resulted in close friends, for which I am very thankful for.

I could not have undertaken this journey without my graduation committee, who has helped me start and finish this rigorous project. It was a great pleasure working with you. Bart, even before the start of this project, you were on board and ready to help me. I am very grateful for your willingness to support a student who did not know where to start. And persevering until the end. Sicco, you were the latest addition to the team, and I am very grateful for your support and enthusiasm that you brought to the table. Our meetings gave the motivation to not give up and finalize the project.

Special thanks to Marijn, you have given me support at home by cooking great food and proofreading my work. I am also thankful to my parents who have supported me in many ways during my studies. I fondly look back at the happy moments that we created during the past years, and I will always look forward to having Japanese food for dinner. I am also grateful to Liza and Mirthe, I would not have imagined it possible to make find great friends this late in my studies. You two have made writing my thesis a more enjoyable experience by always being up for drinking an infinite number of coffees, letting me vent about the struggles of the day, and discussing the latest knitting projects.

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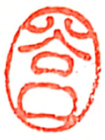
Fiona Taniguchi



Executive Summary

This thesis aims to design baggage solutions for Air-Rail. The result is an implementation roadmap that offers multiple baggage solutions to improve the Air-Rail service between Brussel Zuid train station and Amsterdam Airport Schiphol.

The Dutch government aims to reduce emissions of greenhouse gasses in the aviation industry. This incentive resulted in a collaboration called the 'Actieagenda Trein en Luchtvaart'. The ambition of this collaboration is to strengthen international trains, by making them more attractive alternatives to short-haul flights. Specifically, the route between Amsterdam Airport Schiphol and Brussel Zuid train station. On this route KLM is working together Thalys to offer a service to combine flight tickets and train tickets. This service is called: Air-Rail. The challenges of Air-Rail lie within the transfer that differs from traditional Air-Air, using facilities that are not Air-Rail-specific, and the complex stakeholder network that is involved.

Research is done to understand how the Air-Rail transfer service can be improved to better suit the needs for Air-Rail transfer passengers. This done by experiencing the Air-Rail journey first-hand between Copenhagen and Brussels. As well as, analyzing the results of a research report about the Air-Rail passenger's experiences.

The results of the research conclude that there are three main issues: 1. Pre-travel info, 2. Missing signage, 3. Baggage. From these three issues, it can be concluded that pre-travel info and missing signage require short-term solutions due to being involved with a singular or small number of stakeholders. However, baggage requires a long-term solution based on the complexity of the vast stakeholder network that is involved. Therefore, the main issue to solve is baggage. By creating a focus on a long-term plan, while in the meantime the low-hanging fruit (pre-travel info and signage) is picked to create a fully seamless and complete Air-Rail service.

Subsequently, concepts are generated for baggage. This is done by organizing an Air-Rail stakeholder workshop and interviewing representatives from an Air-Rail rail operator and an Air-Rail airline. The result is a list of generated concepts. From this list a selection is made, to find the best and most fitting baggage concept. This is done by having representatives from an Air-Rail airline and airport, assess by filling in Harris profiles for the concepts. This is done with potential Air-Rail travelers as well, who vary in international train travel experience.

The outcome for the first horizon in 2025, is a temporary door-to-airport baggage delivery service. This service transports Air-Rail baggage by delivery van between Brussels and Amsterdam Airport Schiphol and vice versa. The outcome for the second horizon in 2032, is a permanent concept of designing a new train for Thalys that includes a fourgon. A fourgon is a compartment where Air-Rail baggage can safely and separately be stored on the train. Both solutions create a secure and convenient way of handling baggage during Air-Rail travel between Brussel Zuid and Amsterdam Airport Schiphol.

In the final design of the roadmap, it is elaborated how to implement these concepts. The roadmap specifies what the main product or service is and what is needed to support it. Additionally, the roadmap which steps each Air-Rail stakeholder needs to take to create a successful Air-Rail service.

List of Abbreviations

KLM	Koninklijke Luchtvaart Maatschappij
RSG	Royal Schiphol Group
NS	Nederlandse Spoorwegen
AMS	Amsterdam Airport Schiphol
ZYR	Brussel Zuid/Bruxelles-Midi
ANT	Antwerpen Central Station
LAX	Los Angeles International Airport
CDG	Paris Charles-de-Gaulle Airport
GWP	Global Warming Potential
SNCB	Société Nationale des Chemins de fer Belges
NMBS	Nationale Maatschappij der Belgische Spoorwegen
CPH	Copenhagen Airport
NYC	New York City
BL	Beautiful Lives
TGV	Train à Grande Vitesse
OD	Origin Destination
CPS	Creative Problem Solving
D2D	Door-To-Door
D2A	Door-To-Airport
TS2A	Train Station-To-Airport
BHS	Baggage Handling System
LABIP	Landside Baggage Injection Point
EUR	Euro
UK	United Kingdom

Table of Contents

1. Introduction

1.1 The Air-Rail Context

In the Netherlands, one of the ways the government aims to reduce emissions of greenhouse gasses in the transportation sector is by focusing on the aviation industry. In 2020, a collaboration between the Dutch government, the aviation companies KLM and RSG, and the train companies NS and ProRail, has been set up called the 'Actieagenda Trein en Luchtvaart'. The ambition of this collaboration is to strengthen international trains, making them a more attractive alternative to flights that travel distances up to 700 km (short-haul flights). One of the routes in the agenda that is researched, is between Amsterdam Airport Schiphol (AMS) and Brussels. Currently, on this specific route the airline KLM is working together with the high-speed rail operator Thalys to offer a service to easily combine booking flight tickets and Thalys train tickets between Amsterdam Airport Schiphol (AMS) and Brussel Zuid train station (ZYR). This combined service by KLM and Thalys is called Air-Rail (Figure 1-1).

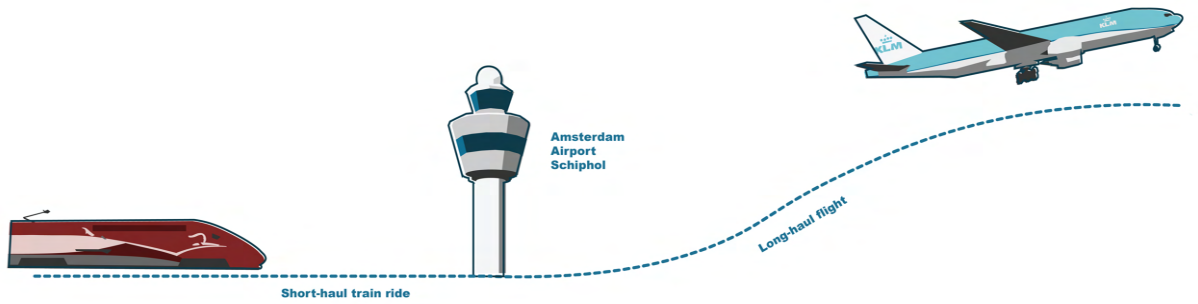


Figure 1-1 The transfer between short-haul train ride and long-haul flight

Air-Rail is meant to encourage passengers to travel by high-speed train to connect with KLM flights. The service connects the hub airport AMS with Antwerp Central (ANT) and ZYR by train instead of by plane. A hub airport serves as a transfer point to aid passengers to their final destination. When KLM and Thalys started offering this service, they set up a pilot to explore and improve the customer experience for the passengers. The pilot was set up as a minimum viable product, meaning it had enough features to attract early-adopter customers and evaluate the concept early in the development cycle. The pilot was scheduled to run between July 2022 and October 2022, seeking to improve the customer experience for the 20 to 25% of passengers (circa. 36.000 consumers yearly pre-COVID) (KLM and Thalys make train travel more appealing to intercontinental and European transfer passengers , 2022) who already chose to replace the short-haul flight (Brussels-Amsterdam) by Thalys train. After this pilot, the results have been deemed successful by KLM and Thalys, that they have agreed to increase the frequency to five trains daily starting in 2023.

The hub layout of AMS is designed to facilitate multiple modes of transportation, such as trains, buses, bicycles, taxis, cars, and airplanes. This is different from other airports where often only two modes of transportation (airplane and bus) are offered. This unique feature

makes AMS a multi-modal hub, its definition is a mobility service infrastructure to switch seamlessly between one mode of transportation (such as the train) and other modes of transportation (airplane) (Redefining Park & Rides for a multimodal mobility future , 2019). Specifically for Air-Rail, the airport has its trains arrive and depart directly below the airport building (Figure 1-2). The Thalys trains that use high-speed rail are scheduled to stop at AMS on the way to Amsterdam Central. This is the very reason why Air-Rail is possible for Thalys and KLM at AMS.

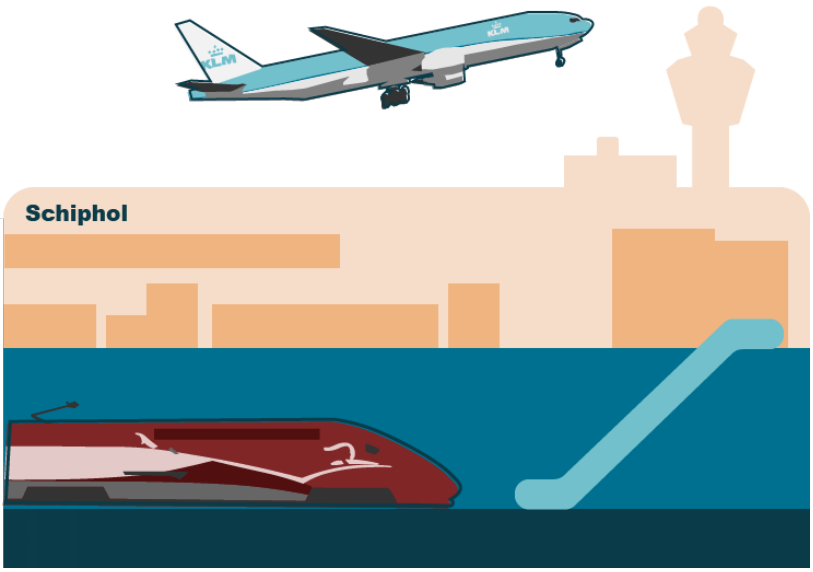


Figure 1-2 Lay-out of AMS with train platforms below the airport.

To be a successful transfer airport, AMS uses the hub-and-spoke model (Figure 1-3) to design their flight lines. The hub-and-spoke model is a distribution network that looks like a bicycle wheel. The hub is the airport (H in Figure 1-3) that sits in the middle and allows each of the spokes (other airports) to move in one direction of delivery and meet at a central location. The way that hub-and-spoke works, is that passengers fly from different airports (A in Figure 1-3) to the 'hub' (H in Figure 1-3) which is AMS, where they transfer to a different plane (D in Figure 1-3) to fly to their end destination. The benefits that Cook & Goodwin (2008) list about using this model are optimizing the connecting service to many destinations, being able to support high daily frequencies to all destinations, and being able to appeal to business travelers that provide for higher business fares.

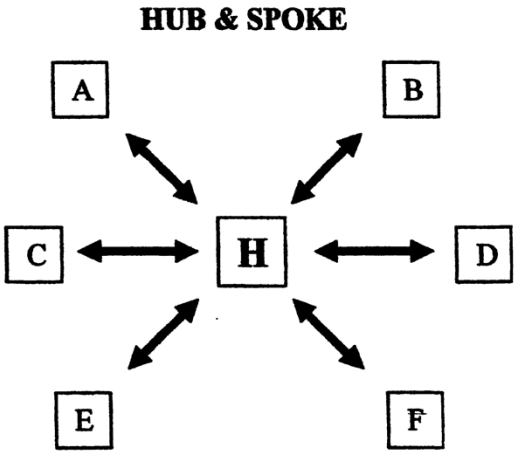


Figure 1-3 Hub-and-spoke, (Cook & Goodwin, 2008)

The differences between the types of transfers, Air-Air, Air-Rail, and Rail-Air; are the different paths and steps the passengers must take during their journeys. As seen in Figure 1-4, passengers that transfer between Air-Air (orange), stay on one side (airside) of the airport. While Air-Rail passengers (green) must pass security or customs into landside to access their mode of transportation.

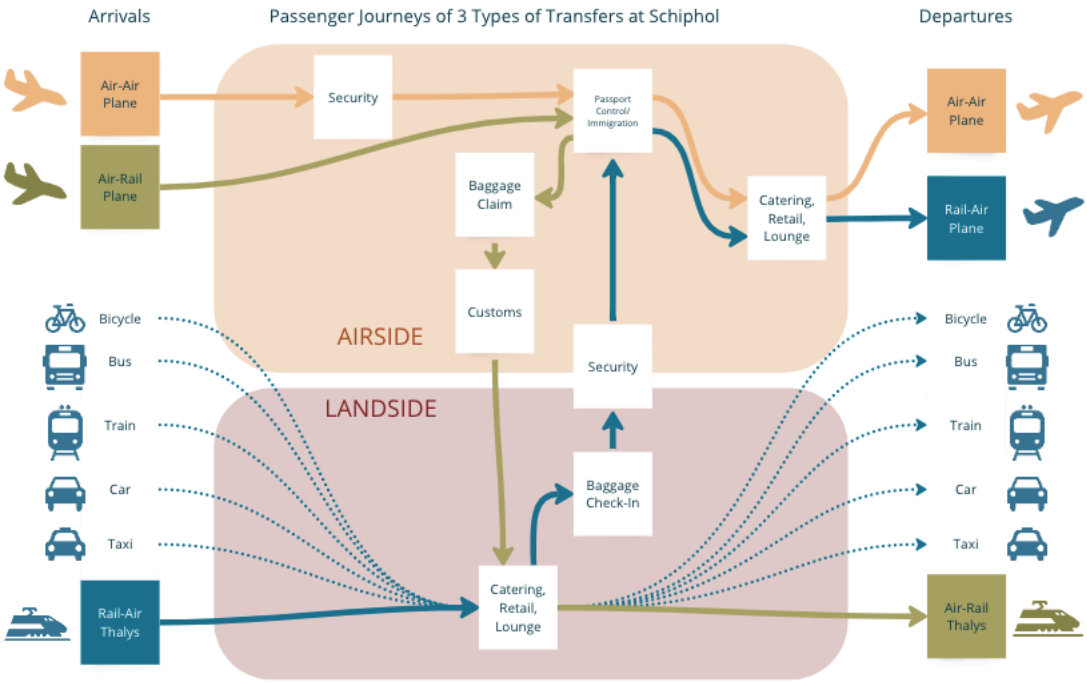


Figure 1-4 Passenger journey of three types of transfers at AMS based on RSG's *(Annual Report 2022, 2023)*

The difficulty of transferring while using the Air-Rail system is caused by having to use existing resources at AMS that are usually designed to cater to the needs of Air-Air passengers, not yet considering different needs for Air-Rail passengers. These existing resources are the terminal hall that is built for Air-Air, the baggage hall underneath the

airport, and the train station situated in AMS. Additionally, both systems contain a complex multi-stakeholder network, including the stakeholders: KLM, RSG, Thalys, NS, ProRail, MvIW; navigating this network, it is difficult to coordinate and operate change because of investment costs and limited available space. These issues lead to passengers not experiencing the seamless journey that they are used to during an Air-Air transfer. As a result, stakeholders are potentially missing out on valuable opportunities.

1.2 Problem definition

In this chapter, the problem definition of the project is explained.

With KLM and Thalys offering a travel service that combines air and rail on one ticket, to eventually replace all four of the short-haul flights between AMS and ZYR, the Air-Rail service must be improved. Research is necessary to determine the quality and improvement of the service during the journey and underlying issues of the Air-Rail service.

1.3 Assignment

This project is performed within the Seamless Personal Mobility Lab. The assignment is:

Design an improvement to the Air-Rail transfer journey for passengers with an implementation roadmap, for the Air-Rail pilot of KLM and Thalys, between Amsterdam and Brussels.

2. Project Approach

The design process in this report follows the principles of the Double Diamond (The Double Diamond). The double diamond is built up out of four different phases, where diverging and converging happens. This helps to go from broad research to important decisions and from many concepts to a final design concept.

In order to create a successful product, IDEO's Desirability, Viability, Feasibility framework (Design Thinking) is used. Desirability stands for how much people want the product. Viability stands for the whether the product is financially sustainable. Feasibility stands for if it is technically possible to create the product. The addition of sustainability is added to the trio, due to the sustainable goals and nature of the subject. In Figure 2-1, this project is located in the middle of the four circles, creating a successful product.

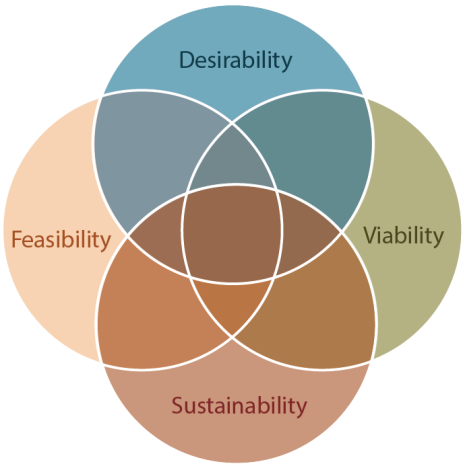


Figure 2-1 IDEO's framework

Process
The goal of this project is to create an improvement to the Air-Rail service. The accompanied roadmap is created to give an overview to al the Air-Rail stakeholders. This is done by first analyzing the current Air-Rail journey, collaborating with Air-Rail stakeholders and diving into the customer experiences during the Air-Rail pilot phase.

Methods
Different kinds of methods were used during the four phases. As an example, in the discover phase, a customer journey map has been designed to analyze issues during the Air-Rail excursion to Copenhagen. In the develop phase, a service blueprint was used to show the new customer journey with the underlying processes for baggage.

Scope
The scope of this project started out broad. During the discover phase, it is important to ensure that the right problem is researched. Therefore, the scope was kept broad, by analyzing the entire journey ZYR – AMS vice versa, looking all issues that came up.

Research question
The research question during the discover phase is:

How can the Air-Rail transfer service be improved to better suit the needs for Air-Rail transfer passengers?

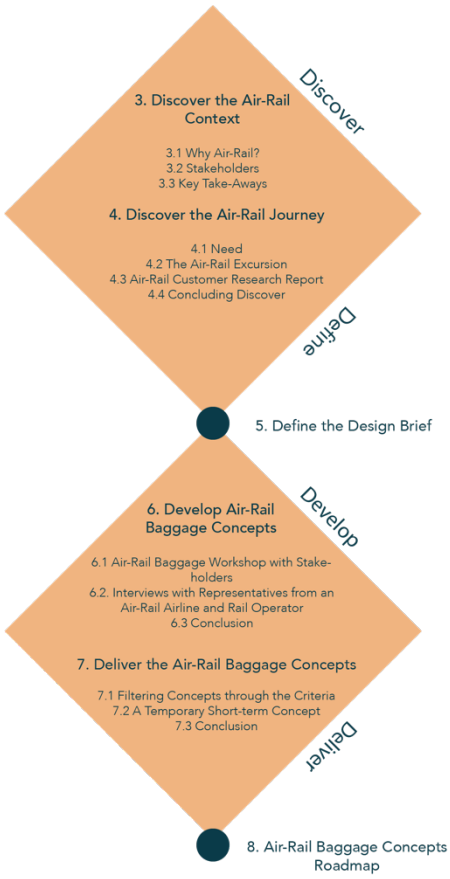


Figure 2-2 Double Diamonds with the included chapter of this project

As seen in Figure 2-2, in the discover phase, the Air-Rail journey was researched deep as possible to find the most interesting and important insights. This was done by experiencing the Air-Rail journey for myself during this phase. The opportunity to research the experiences and opinions of other Air-Rail travelers during the pilot was possible. The insights from this phase come back in the define phase where a design brief is composed. The design brief includes scoping from three issues to one, the new assignment, an approach and final deliverable for the next part of the project. In the develop phase, an Air-Rail baggage workshop and exploratory interview sessions resulted in interesting concepts. In the final deliver phase, a selection was made of the most promising concepts by filtering them through criteria and having Air-Rail stakeholders rate them. And finally, the roadmap that explains the implementation of the concepts is elaborated.

3. Discover the Air-Rail Context

In the discover phase, the first diamond of the double diamond, diverges (Figure *3-1*). The goal is to create a deep understanding of Air-Rail by using different perspectives and resources. In the following two chapters, the Air-Rail context is researched, and an analysis of the current Air-Rail service is done. Before learning more about the research that is done about the current Air-Rail journey, some context is needed to fully understand the Air-Rail challenges. This is provided in this chapter about the Air-Rail context. The chapter consists of the reasoning for why Air-Rail is happening, following with an overview of the involved stakeholders and ending with their involvement in Air-Rail and the complex Air-Rail network.

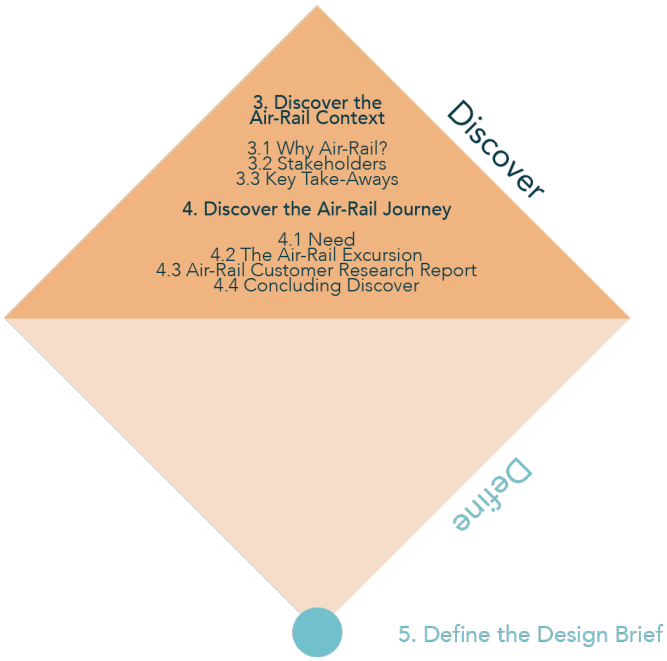


Figure 3-1 Discover of the double diamond

3.1 Why Air-Rail?

The Air-Rail project is heavily motivated by sustainability, with its goals to reduce the amount of carbon emissions when travelling. By improving and investing in the Air-Rail service, airlines will be able to provide a new alternative and more conscious way of travel, with the goal to eliminate short-haul flights between AMS and ZYR completely. With the ultimate goal of expanding this bi-modal service, which is a service that has two modes of transportation to transfer between, to other locations in Europe.

To ensure that KLM is providing a complete Air-Rail service, they have set up five conditions. The Air-Rail service between AMS and ZYR must meet all five conditions for it to be able to fully replace all short-haul flights between Brussels and Amsterdam.

The conditions are (KLM and Thalys make train travel more appealing to intercontinental and European transfer passengers , 2022):

1. International trains must stop at AMS.
2. The departure and arrival of the connecting trains and airplanes must be coordinated.
3. Airline and railway IT systems must be able to communicate with each other (e.g. for check-in, boarding, rebooking passengers in the event of disruption and so on).
4. Railway baggage handling must also be integrated, with trains having secure baggage compartments and with efficient baggage transfer procedures at AMS to ensure speed and convenience.
5. Passengers arriving at AMS by rail must have a separate transit route to the gate.

Passengers prefer to use a single airline for an entire journey, therefore offering many locations of varying sizes is an advantage (Cook & Goodwin, 2008). Additionally, it benefits passengers by utilizing tightly scheduled flights, offering single check-in for the entire journey and more convenient gate placements. And by using one airline, familiarity with their product reduces uncertainty and boosts loyalty (Cook & Goodwin, 2008). Flight frequency can be raised as the network's destinations expand and more passengers travel through the hub. Due to the high frequency, passengers may match flights with desired schedules (Gillen & Morrison, 2005)

According to UIC & McKinsey's report (Guidon & Lorand, 2022), the increasing impact that climate change has resulted in it having big implications for travel. Resulting in a trend for organizations to increase efforts to travel sustainably, thereby often encouraging rail over air. Therefore, rail can position itself as one of the preferred choices of transportation in the future. This would aid solving multiple longstanding challenges that are frequent in passenger transportation: sustainability, speed, and volume. Rail transportation offers notable benefits, such as the transporting substantial passenger volumes, at faster speeds that cars travel, enhanced travel comfort for both leisure and business purposes, and lower carbon emissions per passenger.

To reach the goal for the European Union to be carbon neutral by 2050, CO2 emissions must be reduced. According to Thalys, a passenger traveling by Thalys train between Brussels and Amsterdam produces 1,7 kg CO2eq as seen in Figure 3-2 (Thalys is taking action for a sustainable world). The carbon dioxide equivalent (CO2eq) is a metric measure used to compare emissions of other greenhouse gases (N2O, CH4, and F-gases). These greenhouse gases are in addition to CO2 emissions. The conversion of the other gases is based on their global-warming potential (GWP) by converting levels of other gases to the equivalent quantity of carbon dioxide with the same GWP (Glossary: Carbon dioxide equivalent, sd). With a difference of 42,9 kg CO2eq per passenger compared to the emissions of a short-haul flight between Brussels and Amsterdam, taking a Thalys train is a lot better for the environment.

Some examples of CO_2eq emissions on our network*

	Paris-Brussels	Paris-Amsterdam	Paris-Düsseldorf	Brussels-Amsterdam
	2,2 kg CO_2eq	3,8 kg CO_2eq	9,1 kg CO_2eq	1,7 kg CO_2eq
	70,8 kg CO_2eq	110,1 kg CO_2eq	143,0 kg CO_2eq	44,6 kg CO_2eq
	50,6 kg CO_2eq	82,8 kg CO_2eq	81,4 kg CO_2eq	33,5 kg CO_2eq
	6,1 kg CO_2eq	19,0 kg CO_2eq	15,8 kg CO_2eq	13,9 kg CO_2eq
	7,7 kg CO_2eq	12,5 kg CO_2eq	12,3 kg CO_2eq	5,1 kg CO_2eq

Figure 3-2 Examples of CO2eq emissions on the Thalys network from *(Thalys is taking action for a sustainable world, sd)*

And finally, the potential of Air-Rail is expected to increase based on passenger numbers pre-COVID, Figure 3-3. In 2018 already 25% of the total passengers from Belgium used the Air-Rail. Previously having only 5% in 2010, provides a promising forecast for the potential of Air-Rail (Actieagenda Trein en Luchtvaart, 2020). Not only is this beneficial for KLM, but also for Thalys. They will benefit from the increased number of passengers received from KLM that will not take the short-haul flight between Brussels and Amsterdam. And it will aid in their goal to double their number of passengers to 30 million by 2030.

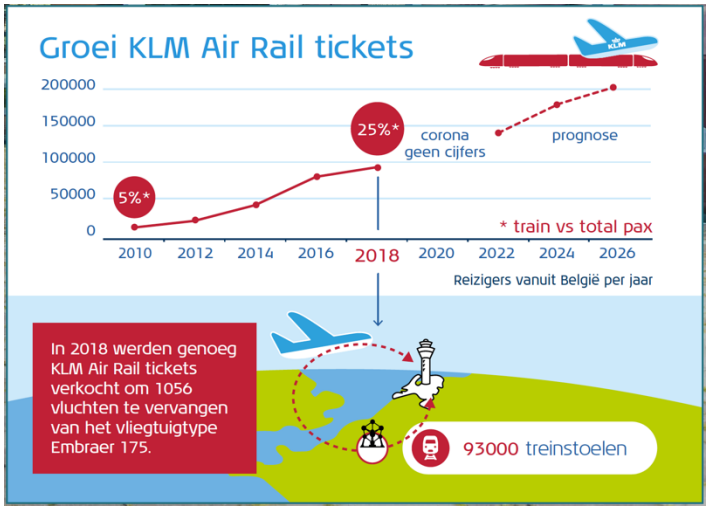


Figure 3-3 Growth KLM AirRail Tickets *(Actieagenda Trein en Luchtvaart, 2020)*

3.2 Stakeholders

This chapter elaborates which stakeholders are involved in the Air-Rail service AMS-ZYR vice versa, for which parts they are responsible and how they create value for each other. In mobility it is common to have to work together with multiple stakeholders. This can lead to difficulties about who is responsible for which part exactly. Having to work together with Belgium and its services, makes it more complicated due to different companies and legislations. Below, information is given about the stakeholders and how they relate to each other.

Figure 3-4 The logos of the Air-Rail stakeholders

Passengers
The passengers using the Air-Rail service are transfer passengers using AMS as a transfer location between air and rail. Their role within the Air-Rail system is using the system.

KLM
The oldest, Dutch airline company. Their role is to transport passengers by air from one destination to the other, with handling baggage as an additional task and working together with Thalys to ensure more use of train services.

RSG
RSG is the owner of numerous airports in the Netherlands such as, Amsterdam Airport Schiphol (AMS), Rotterdam the Hague Airport, Lelystad Airport, and partially Eindhoven Airport. Zooming in on AMS, RSG offers the use of their airport facilities, these include the runways, departure halls, arrival halls, and baggage systems. With Air-Rail, passengers use AMS for the flight facilities, but also Schiphol Plaza where the trains arrive. This area overlaps with the responsibility of NS.

Thalys
Thalys is a French and Belgian high speed train company. They offer use of their high-speed trains to passengers. During an Air-Rail transfer, normal passengers not transferring are also utilizing the Thalys trains for other destinations such as: Amsterdam Central, Rotterdam Central, ANT and Gare du Nord. Thalys and Eurostar have joined forces since October 2023 and continue under the name Eurostar with a new logo and updated look. This means that the combined companies currently offer one train network with easier connections between Belgium, the Netherlands, France, Germany, and the United Kingdom (UK). This change

took place while being involved with the former Thalys during this project. Therefore, for continuity purposes they will be referred to as Thalys in this report.

NS
NS is responsible for buying and maintaining trains that use the Dutch railway system. They must work closely together with ProRail. Because ProRail is responsible for the train tracks and train stations. NS's role is also to receive travelers at their stations and provide facilities at the stations, such as shops and restaurants.

ProRail
ProRail manages and maintains the rail infrastructure of the Dutch rail network. Their relationship with NS is crucial as they both have to work together closely to keep the Dutch railway running smoothly. They are responsible for rail traffic control as well as providing time slots for the Dutch train infrastructure, which Thalys and NS trains use.

Ministry of Infrastructure and Water Management (MvIW)
This ministry is committed to improving the quality of life, access, and mobility in a clean, safe, and sustainable environment. They strive to create an efficient network of roads, railways, waterways and airways, effective water management to protect against flooding, and improved air and water quality. The ministry has offered financial support in 2020 to KLM as a result of the COVID crisis. This support consists of a guarantee for bank loans of up to 2,4 billion euros and a direct loan by the state of up to one billion euros (Kabinet biedt financiële steun aan KLM als gevolg van de coronacrisis, 2020). They play a large role in KLM's shift to more sustainability. Other tasks are to invest in train stations in the Netherlands and are important for possible plans of building new facilities.

SNCB/NMBS
The SNCB transports and operates passengers and trains. Their responsibility is to maintain station and trains and organize and market the rail service in Belgium. The Belgian company is similar to the Dutch NS, where they maintain and operate the trains and train stations.

Involvement of the stakeholders during Air-Rail
In this section it is explained when, where and how the stakeholders are involved with and responsible for the Air-Rail journey between ZYR and AMS.

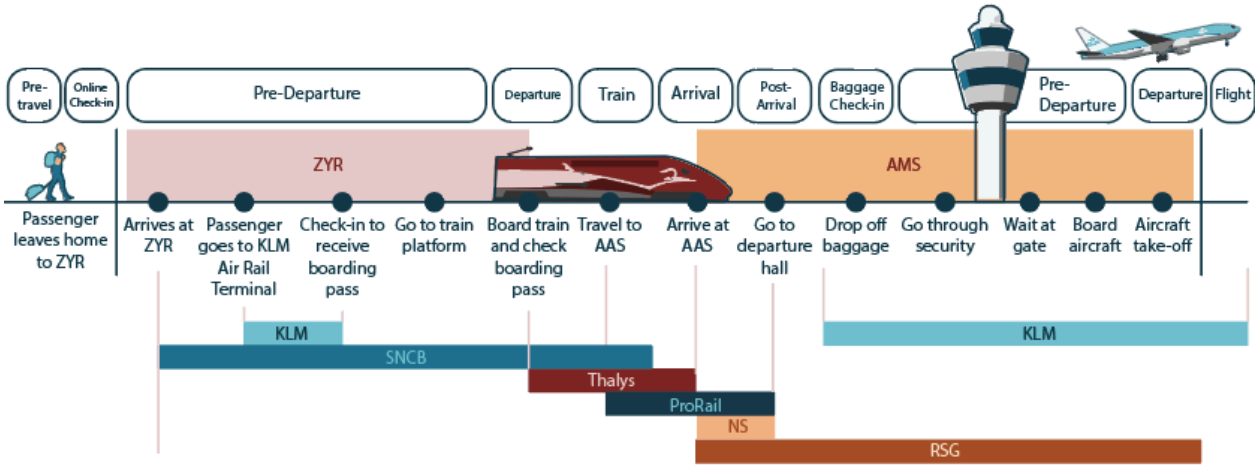


Figure 3-5 Responsible and involved stakeholders during Air-Rail transfer ZYR to AMS

In Figure 3-5, starting from ZYR, SNBC and KLM are directly connected to the passenger. SNCB provides the infrastructure of the station and railways; KLM provides the service desk in the Air-Rail terminal where the passenger checks in and picks up their boarding pass. Further, the passenger boards the Thalys train that uses SNCB's railways in Belgium and ProRail's railways in the Netherlands. ProRail also makes the schedule that Thalys uses for track availability. Arriving at AMS, NS maintains their train station. The passenger encounters KLM throughout their time at AMS at baggage drop off and on the aircraft.

What is remarkable about Figure 3-5, is that the responsibility that KLM has during the rail part of the journey is very limited compared to the other stakeholders. KLM offers a full Air-Rail journey, but hands over the passenger after check-in to Thalys while making use of the facilities provided by SNCB, ProRail, NS and RSG.

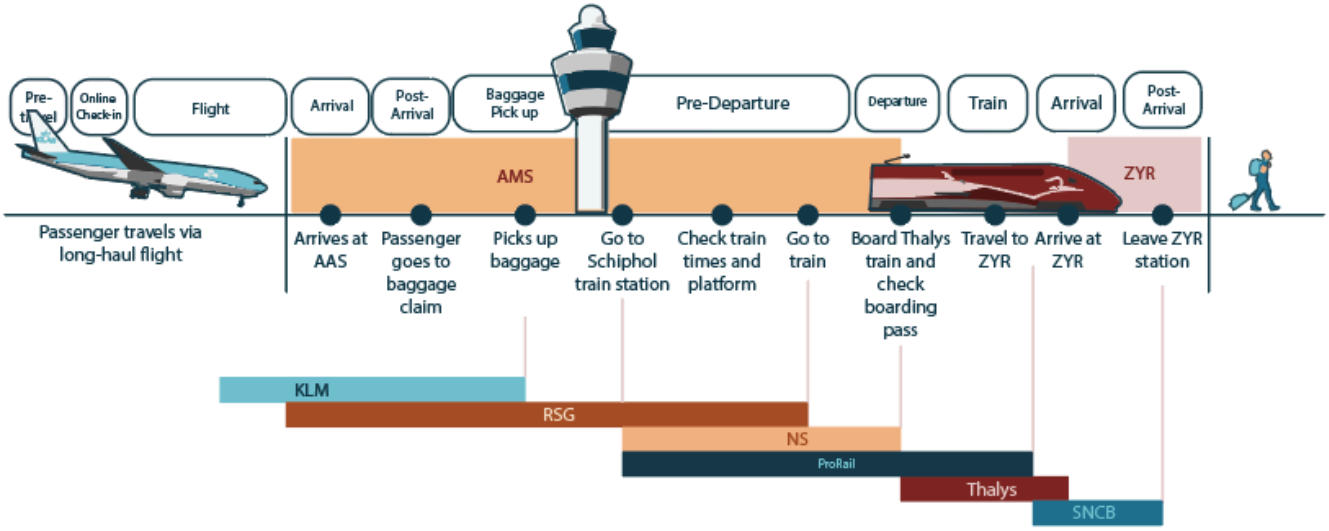


Figure 3-6 Responsible and involved stakeholders during Air-Rail transfer AMS to ZYR

Once the passenger has dropped off their baggage at AMS, KLM is then fully responsible for the passenger and their belongings again. If it occurs that there is a delay of the train, which make it not possible to make the connection to the aircraft, KLM is responsible to acquire a new ticket for the passenger.

In Figure 3-6, the journey starts from AMS with the passenger arriving from a long-haul flight. They arrive on a KLM airplane at AMS. After picking up baggage, the passenger goes to the AMS train station, maintained by ProRail with facilitated shops by NS. Where they will embark Thalys train and use the railway provided by ProRail. Finally, moving into Belgium the railway is operated by SNCB and arriving at ZYR.

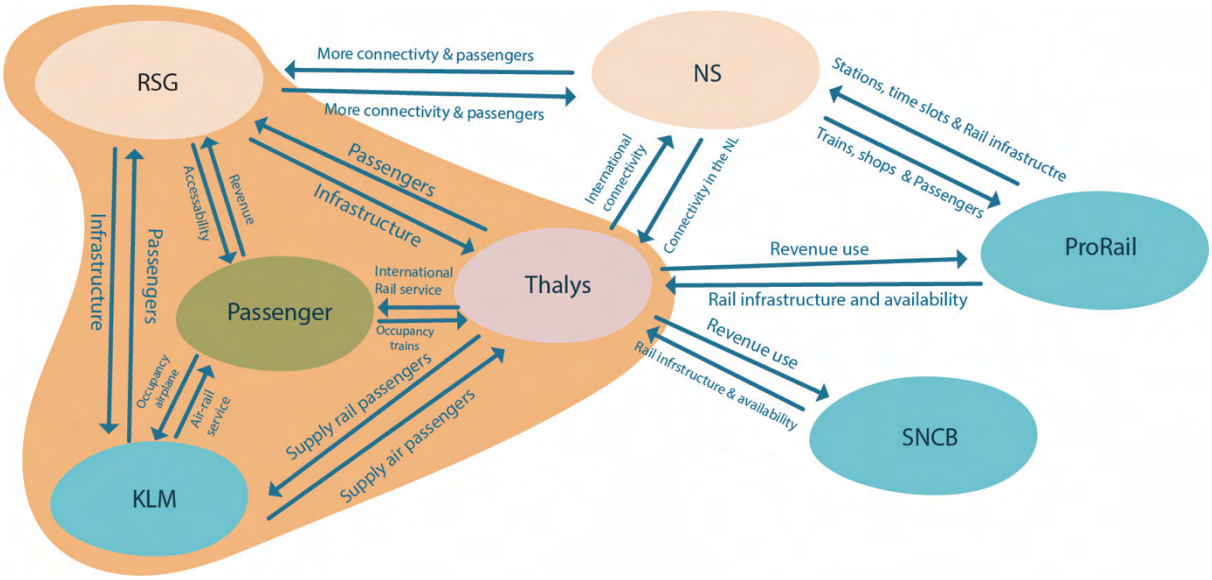


Figure 3-7 Value streams for Air-Rail stakeholders based on

Regarding the value that the different stakeholders create for and offer each other Figure 3-7, a map has been created to visualize the complex relationships these stakeholders have. Hendrikx (Hendrikx, 2021) created a stakeholder map for Air-Rail by segmenting service, infrastructure, and policy. In this project specific companies are defined for this Air-Rail service between ZYR and AMS with fitting companies for airlines, airport, rail operators, infrastructure, and stations. Therefore, it is logical to create a new stakeholder map with the companies that partake in the specific AMS-ZYR Air-Rail service. Creating this map made it clear what the benefits are for each company to participate in this service and what they have to offer.

In figure Figure 3-7, value streams between the stakeholders are visualized in arrows between the companies. Each arrow describes what value is created or offered to the connected company. The orange outline that surrounds RSG, KLM, Thalys and the passenger, highlights the group of primary stakeholders that are most in contact with the passenger. The other stakeholders (NS, ProRail and SNCB) are secondary stakeholders that have a more indirect effect on the passengers.

Looking within the primary group, KLM and Thalys offer each other different types of passengers than they would normally receive. This would be one of the main reasons why this partnership is taking place. KLM and RSG have been working together a long time, with KLM mostly supplying passengers for RSG and RSG offering an easy and connected hub infrastructure for flights at AMS. Thalys has been using AMS's train station for a while, being on the route between Rotterdam Central and Amsterdam Central. By expanding this collaboration Thalys is able to connect more passengers from Belgium to transfer at AMS. With AMS offering an easy and connected infrastructure. In these three cases, the passenger is in the middle and offers revenue and occupancy, while receiving service and accessibility.

In the remainder of the figure, companies are connected by revenue streams, more connectivity or rail infrastructure. An important comment on the stakeholder map, about the missing connections between the passenger, NS, and SNCB. In non-Air-Rail circumstances, these companies have a large amount of interaction with passengers. Having to facilitate stations, personnel, schedules, and trains; they are in direct contact with passengers. Because this project is specifically about the Air-Rail service, these connections were excluded from the stakeholder map to make the map less crowded and easier to read.

3.3 Key Take-Aways

KLM's involvement is missing during large parts of both passenger journeys, when the passenger is traveling by rail. For KLM to be able to offer a complete and seamless Air-Rail journey, they should not ignore their involvement during the passenger's rail journey experience. This is an opportunity where KLM could ensure a completely seamless journey. This is of course beyond the fact that KLM is responsible for booking a replacement flight or replacement train ride if the passenger is not able to make the transfer on time. Another opportunity is for KLM to collaborate more with Thalys. When looking at the value streams between the two companies, rail and air passengers are supplied to KLM and Thalys. The companies gain exposure and trust in not only their Air-Rail service, as well as trust.

4. Discover the Air-Rail Journey

As mentioned before in chapter 3, the discover phase is in the first diamond of the double diamond where it diverges (Figure 4-1). With the goal to create a deep understanding of the Air-Rail journey by using different perspectives and resources. In this chapter the analysis of the current Air-Rail service is done with the goal of finding out if there are positive and negative experiences that occur for Air-Rail. Analyzing the current journey will help to understand its short comings and provides a basis to create an improved new journey for the passengers in the future.

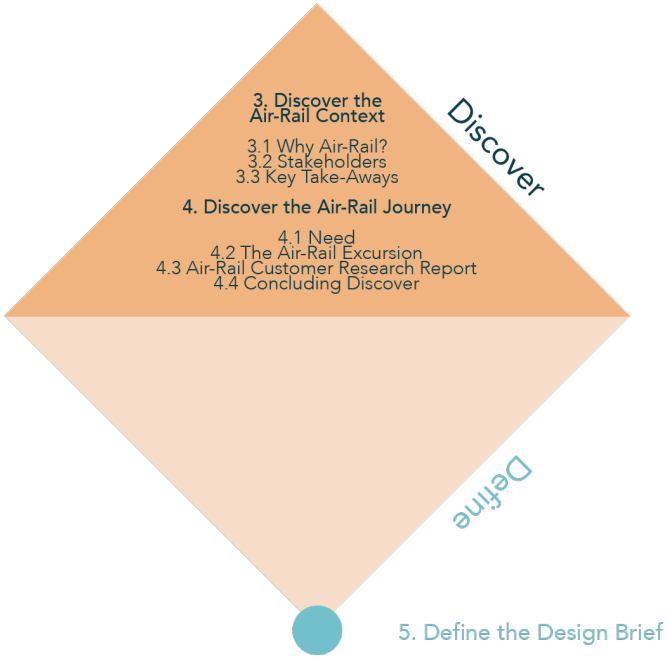


Figure 4-1 Discover of the double diamond

4.1 Need

Two different interventions are conducted to analyze and understand the current Air-Rail journey. First, I experienced the Air-Rail journey myself going to CPH and back. This gave the opportunity to experience possible issues and analyze why and how they are happening. Second, a customer research report by BL that was commissioned by KLM is analyzed. The goal of the report was to research what the experience was of the passengers while traveling using the Air-Rail pilot.

4.2 The Air-Rail Excursion

For the first intervention to analyze the Air-Rail journey, I had the opportunity to experience the journey firsthand. This step was important to help realize which factors during an Air-Rail trip create a pleasant or not so pleasant experience. On top of that, recording when these factors happen and placing them on a timeline of the Air-Rail journey is very important. Reason for this is, it helps understand what the underlying issues could be, and poses possibilities for a quick fix.

4.2.1 Goal

There are two main goals of the Air-Rail excursion: creating an overview of the journey steps and creating an understanding of the issues and positive experiences that happen in these steps. It is necessary to create a complete overview of all the actual the steps of the entire Air-Rail journey because these were not yet available. Therefore, there was no comprehension of the passenger's experiences. The other goal of the excursion is to create an understanding of the issues and positive experiences that happen during the entire Air-Rail trip. These occurrences are analyzed and filled in in the passenger journey steps. Then the occurrences are clustered and categorized by theme.

4.2.2 Gain

The gain of this trip for KLM is to receive a complete and visualized overview of the Air-Rail journey. Additionally, it gives insight and overview into the positive and negative experiences of an Air-Rail traveler. With these positive and negative experiences, KLM has the opportunity to improve their service to increase the satisfaction of their Air-Rail passengers, therefore possibly attracting more Air-Rail passengers in the future.

4.2.3 Sample

The Air-Rail journey from ZYR to CPH was experienced on the 10th of January 2023. I first had to travel by Thalys to ZYR to officially start the journey there. The next day, I travelled back from CPH to Rotterdam, and I got off at the Rotterdam Central instead of ZYR. In my opinion it would not create additional gain in experiencing ZYR again. I brought multiple bags on the trip to try to replicate an as realistic as possible travel setting. I brought one large trolly suitcase, a heavy backpack and a small crossbody bag.

4.2.4 Participants

I was the sole participant in this excursion. Some basic information about my travel experience is given below.

Age: 26
Nationality: Dutch
Languages: Dutch, English, and French
Baggage: one large bag (15 kg), one backpack and one shoulder bag
Experience flying: many flights with KLM (national and international)
Experience with international train: many international train rides with Thalys and other companies

I had some prior knowledge of the Air-Rail transfer before embarking on my excursion; I tried to research the steps of the passenger journey by desk research, which gave insufficient results. And I heard possible short-term and long-term solutions presented by peers and other Air-Rail stakeholders. I also read a customer research report about the passenger experiences during the Air-Rail pilot (in 4.3). All these factors may have caused

bias, by me being aware of what to look out for. But I tried my best to disregard this and go into it the journey with a clean slate trying to follow the instructions and information provided by KLM, AMS and Thalys on the spot.

Figure 4-2 User overview with baggage dimensions in centimeters

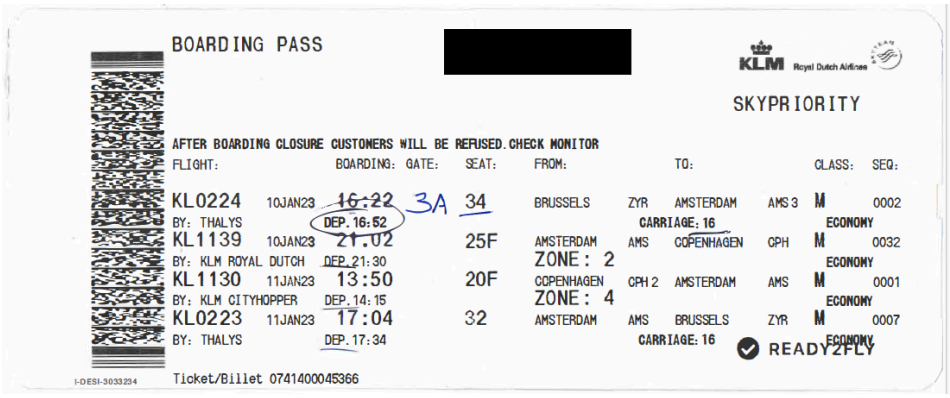
4.2.5 Method

The method for documenting the steps of the Air-Rail trip, issues at numerous locations and times, is based on auto-ethnography. Autoethnography is a form of ethnographic research in which a researcher connects personal experiences to wider cultural, political, and social meanings and understandings (Poulos, 2021). The method for collecting data was by filming and photographing my surroundings and myself as much as possible. Additionally, I recorded voice memos during good and bad experiences, describing what I was feeling, when I was feeling it and possibly why. The data is analyzed by creating passenger journey steps, where the issues and positive experiences are sorted to each step in the journey. Then the data is clustered to show occurring themes. These themes are then named and labeled with the outcome being a user journey map (Gibbons, Journeymapping, 2018).

4.2.6 Planning

Timelines of the entire trip are visualized in Figure 4-4 and Figure 4-8. The planning of the trip was to depart on the 10th of January at 13:58 from Rotterdam Central Station by Thalys train to arrive at ZYR at 15:08 the same day. This would give me a little over an hour to exit the station and re-enter ZYR to officially start the Air-Rail journey to CPH. As seen in Figure 4-3, at 16:22 the train would depart to AMS and arrive by 18:44. But in reality, I was able to catch the train of 15:52 and arrive earlier at AMS. Once at AMS, I have about three hours until my flight to CPH would leave from AMS at 21:30. The next day on the 11th of January, I

would be going back home from CPH, departing by plane at 14:15, and arriving at AMS at 15:37. Then I would take the Thalys train at 17:34 to arrive at Rotterdam Central Station at 18:13.


BOARDING PASS

[redacted]

KLM Royal Dutch Airlines

SKYPRIORITY

AFTER BOARDING CLOSURE CUSTOMERS WILL BE REFUSED. CHECK MONITOR

FLIGHT:		BOARDING:	GATE:	SEAT:	FROM:		TO:		CLASS:	SEQ:
KL0224	10JAN23	~~16:22~~	3A	34	BRUSSELS	ZYR	AMSTERDAM	AMS 3	M	0002
BY: THALYS		DEP. 16:52					CARRIAGE: 16		ECONOMY	
KL1139	10JAN23	~~21:02~~		25F	AMSTERDAM	AMS	COPENHAGEN	CPH	M	0032
BY: KLM ROYAL DUTCH		DEP. 21:30			ZONE: 2				ECONOMY	
KL1130	11JAN23	13:50		20F	COPENHAGEN	CPH 2	AMSTERDAM	AMS	M	0001
BY: KLM CITYHOPPER		DEP. 14:15			ZONE: 4				ECONOMY	
KL0223	11JAN23	17:04		32	AMSTERDAM	AMS	BRUSSELS	ZYR	M	0007
BY: THALYS		DEP. 17:34					CARRIAGE: 16		ECONOMY	

READYZFLY

I-DESI-3033234

Ticket/Billet 0741400045366

Figure 4-3 Boarding pass for Air-Rail journey between ZYR and CPH

4.2.7 Detailed descriptions of the passenger journeys

The detailed descriptions of the Air-Rail trip are split into two parts for the different directions of travel. The first chapter is from ZYR via AMS to CPH and the second chapter is from CPH via AMS to ZYR. An overview of my experiences is noted with the journey steps.

4.2.7.1 Detailed Description of Passenger Journey ZYR – AMS – CPH

Based on the experiences of the journey going from ZYR to CPH, the following passenger journey was made (Figure 4-4). In Figure 4-4, the Air-Rail journey steps are listed horizontally. Moving from left to right, with each block moving upwards when the step moves to a different significant location. Moving to different parts of an airport such as landside and airside, or a different mode of transportation. Comments and quotes are listed with the occurring step. The comments are in pink and the quotes during the trip are in blue. The same has also been done for the trip vice versa in Figure 4-8. For a larger image, see Appendix 11.4.

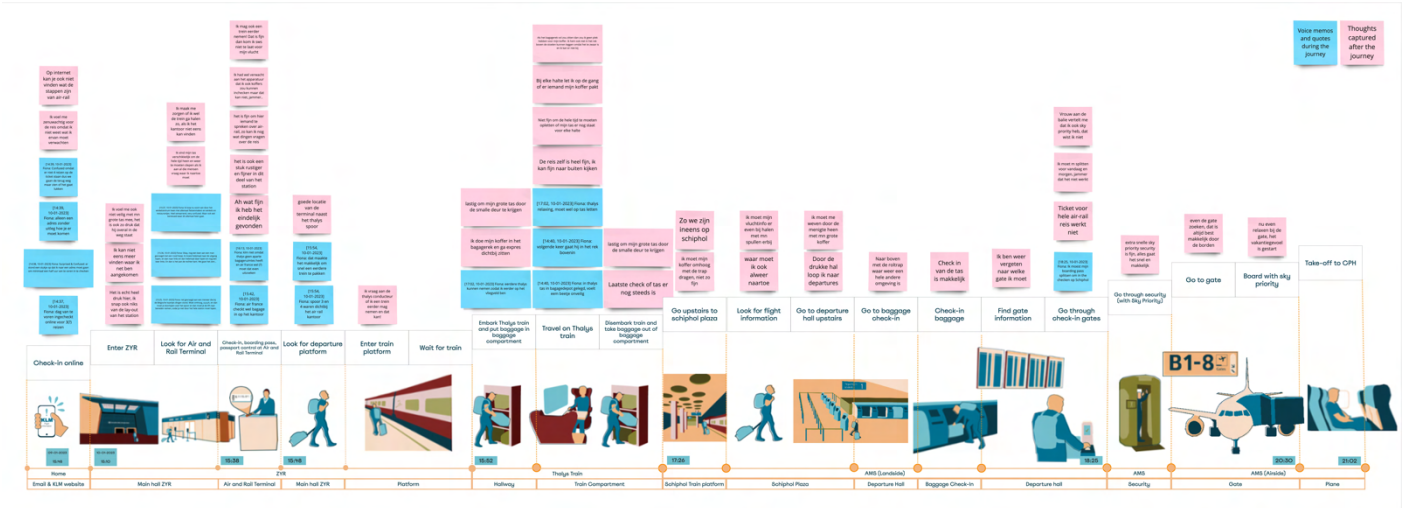


*Figure 4-4 The passenger journey from ZYR to CPH with notes about the experience**

*Notes:
1. I made the connection between Rail and Air at AMS, because there were no delays or disruptions on the Rail leg between ZYR and AMS.

2. There was enough room in the baggage rack on the Thalys from ZYR to AMS to store my bag. The storage space is limited though, so during peak travel times, or as Air-Rail becomes more popular, the space will likely not be sufficient.

I started the journey in Brussels. One day in advance, I received an email with information from KLM about the Air-Rail journey. In this email, a check-in confirmation is provided (Appendix 11.2), which includes the high-speed train part by Thalys and the airplane portion by KLM. In this document it states that the boarding passes are not available online. These boarding passes must be picked up at the 'Air and Rail terminal' that is located at 'Rue de France, 1060 Brussels' at least 30 minutes before departure. This address is located inside ZYR. The next day I departed to Brussels with baggage, to travel to ZYR. This is the 'rail' part of the Air-Rail trip. When I officially arrived at ZYR, I stepped into the main hall of the station, where I had to find the 'Air and Rail terminal' (Figure 4-5).

Figure 4-5 The Air-Rail Terminal at ZYR

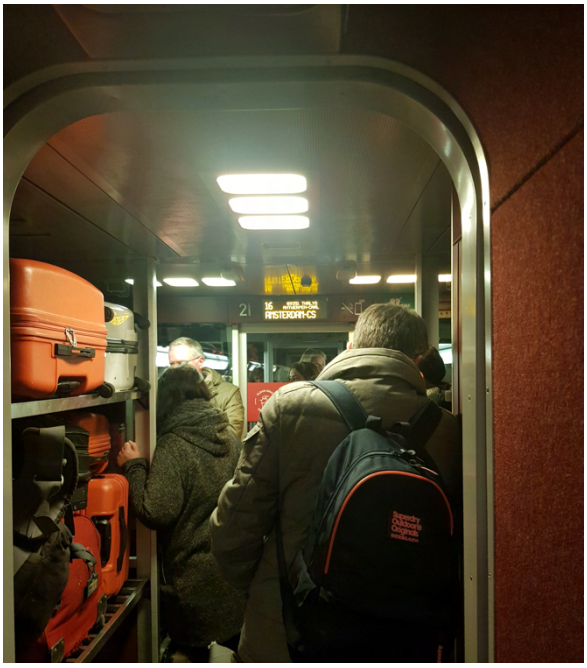
Once I navigated through ZYR and found the 'Air and Rail terminal', I was able to check in with the Air-Rail personnel at least 30 minutes in advance to the Thalys train departing. This Air-Rail terminal is used for KLM as well as Air France, due to Air France also offering an Air and Rail service between ZYR and CDG. This check-in must be done physically at the station, due to KLM having to be able to check if the passenger has boarded the train.

This has to do with 'skiplagging', which is a way for passengers to buy cheaper plane tickets by skipping a specific leg of the flight (de Vries, 2018). As an example: a direct flight from AMS to New York City (NYC) may cost 500 EUR, but if you purchase it as a connecting flight

(e.g., CDG – AMS, AMS – NYC), then it may only cost 350 EUR in total. Passengers may then book the cheaper flight and plan to skip the leg from CDG to AMS. This is called 'skiplagging' and airlines do not accept it. Skipping a leg will result in the airline cancelling all further flights on the same ticket for that passenger. In the case of Air-Rail, the train ride is the first part of the trip, therefore if the passenger does not board the train, their connecting flight and return trip will be cancelled.

At check in I received my boarding pass. Next, I found the platform where the Thalys train departs from. Once the Thalys train has arrived, I found the assigned wagon number and embark the train, hoisting their heavy baggage up the steep steps and squeezing it through the narrow Thalys door. The large bag that I was carrying, is easiest to put in a baggage rack directly next to the train door. This space is open to everyone to leave their baggage and is I found passenger finds my assigned row and seat number and sat down to enjoy the journey to AMS.

Figure 4-6 An impression of the inside of a busy Thalys train



When I arrived at AMS, I took my bag out of the baggage rack (as seen in Figure 4-6), and squeezed it through the narrow door, down the steps and disembarked the train onto the AMS platform, that is situated directly underneath the airport. By taking the escalator or stairs up to the ground floor, I arrived at Schiphol Plaza. This is a busy area with lots of travelers changing to different national and international trains, moving to departure or arrival halls, or outside to buses, taxis, or cars. I had to navigate this busy area with baggage. From this area until security, is considered landside. Taking another escalator up, the I arrived at the departure hall, where people can check in for their flights and drop off their bags for check in (Figure 4-7). I had already been checked in at ZYR when receiving my boarding pass, so I only needed to go to self-service baggage drop off.

Figure 4-7 An impression of the KLM check-in desks in the departure hall at AMS

The self-service baggage drop-off is comprised of machines that automate part of the check-in process. By following the instructions on the screen, I put my bag in the machine, then attached the baggage label to the bag and it is automatically sent to the baggage hall. This way, less personnel is necessary.

After dropping off my check-in bag, I went to security. During this time of Air-Rail, I could make use of a special perk to use sky-priority. Sky-priority has advantages such as, using specially dedicated check-in desks, priority baggage drop-off and pick-up, going through security faster, and having access to the priority boarding lane (SkyPriority service , sd). Priority baggage drop-off and going through security faster are important to Air-Rail passengers especially, in case of delays of the Thalys train might have. These advantages increase the chance of the passenger making their connecting flight.

After going through security and checking the gate number, I headed off through the shopping area on airside. Eventually, arriving at the appropriate gate and using Sky Priority to board the airplane and fly to end destination, CPH.

4.2.7.2 Detailed Description of Passenger Journey CPH – AMS – ZYR

Based on the experiences of the journey going from CPH to ZYR, the following passenger journey was made Figure 4-8. For a larger image see Appendix 11.3.

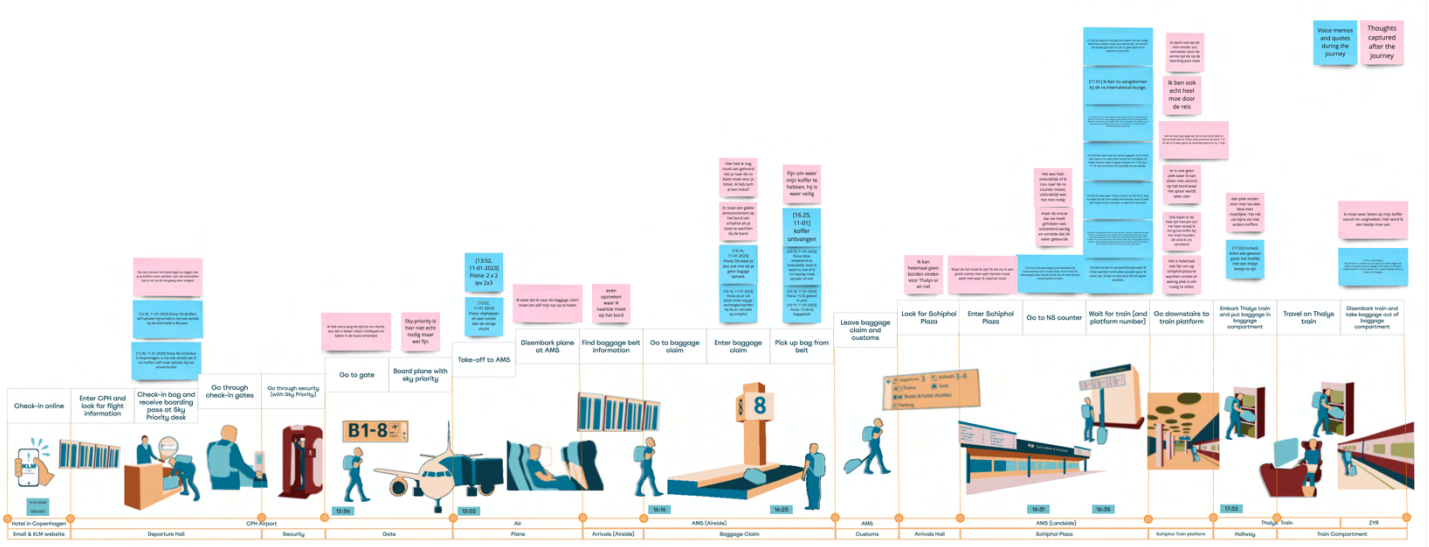


*Figure 4-8 The passenger journey from CPH to ZYR with notes about the experience**

*Notes:

1. I made the connection between Rail and Air at AMS, because there were no delays or disruptions on the Rail leg between ZYR and AMS.

2. There was enough room in the baggage rack on the Thalys from ZYR to AMS to store my bag. The storage space is limited though, so during peak travel times, or as Air-Rail becomes more popular, the space will likely not be sufficient.

The journey started at CPH. I received an email, one day before departure from CPH, with information from KLM about the Air-Rail journey. When I got to the airport, I checked in and dropped off my baggage at the Sky Priority counter. I received two separate boarding passes for the two legs of the trip: plane and train. At the desk the personnel reminded me that I must pick up my bags from the baggage carousel at AMS. Bags will not be labelled

through and automatically sent to the end destination ZYR, an Air-Air transfer where passengers receive their baggage at the end destination airport.

Figure 4-9 An impression of the airplane at CPH

After dropping off my bag I headed up to security. Once through (not Sky Priority) security I went to the gate, where I waited for my plane to arrive. After boarding the plane (Figure 4-9) via Sky Priority lane, I enjoyed the relaxing trip to AMS. After landing at AMS, I headed to the baggage claim area, where I waited for my bag to arrive on the carousel. Above the carousel there were signs with information switching every few minutes. I picked up my bag and went through the 'nothing to declare' or 'goods to declare' door at customs and arrived at the landside part of AMS.

I tried to find my way to the Air-Rail services and follow signs that tell me where to find trains in general. Here I arrived at Schiphol Plaza (Figure 4-10), where different kinds of trains arrive and depart. I had to wait for my assigned train until the platform number is announced on the sign in the hall. So, I waited by sitting on a bench at Schiphol Plaza. Once the platform number was announced, I went downstairs to the platform (Figure 4-10) and waited there for the train. When the Thalys train arrived, I found the correct wagon number and before entering, and showed the conductor my ticket. The conductor lets me in, I hoisted my heavy bag up the steps and maneuvered through the train door and placed the bag in the baggage rack directly next to the door. I went through the train car door to find my corresponding row and seat number. And sat down and enjoyed the ride. Once arrived at Rotterdam I, headed towards the door of the train, there I picked up my bag and left the train by going down the small steps and maneuvering through the narrow door. From then on, I went home.

Figure 4-10 An impression of Schiphol Plaza at AMS

Figure 4-11 An impression of the train platform at AMS

Figure 4-12 An impression of the seating area of the Thalys train

4.2.8 Results of the Air-Rail Journeys

In general, there were negative and positive experiences that happened during both journeys. The results are divided into the general experiences first with the negatives and positives separate. Then the experiences are sorted by type of trip (ZYR – AMS – CPH or CPH – AMS – ZYR) with the negatives and positives separate.

Negative experiences with Air-Rail:

- There is no online check in available when travelling from ZYR. This differs from Air-Air and feels redundant.
- The train station ZYR, is not pleasant and not suitable for large baggage. This is due to large crowds, filthy facilities, homeless people lying around, and renovations at the station.

- The Air-Rail terminal where you must pick up your boarding pass, is hidden in ZYR, with no ways of finding it without help.
- If the first leg of the journey is delayed or disrupted, connection may be missed. I did not experience this myself, but arranging a new ticket may be more complicated, because it is on a different means of transportation.
- Transfers are stressful, with chance of missing connection. The transfer time for ZYR-CPH is comparable to Air-Air, which is rather tight for Air-Rail, with the additional steps of checking in, going through security, and dropping off baggage at the transfer location.
- Thalys baggage storage: feels unsafe to leave baggage close to the door and out of sight. This causes stress and unease, as baggage may be stolen at interim stops.
- Thalys has additional overhead baggage racks, but they are too high & shallow for big, heavy bags or suitcases.
- It is unclear what is included in Air-Rail service and how it differs from regular Air-Air transfers. Check-in information was provided by email, only one day before departure, which showed for the first time that I had to pick up my boarding passes at ZYR 30 minutes before departure. And it was not communicated that Sky Priority is included in the Air-Rail service (for at AMS and at CPH).

Positive experiences Air-Rail:

- Sky Priority is a great perk, especially during peak travel times: skip lines for baggage drop off at AMS, faster through security at AMS, early boarding of airplane at AMS and was also at CPH. This is normally reserved for Business Class passengers, premium Comfort class, Flying Blue Gold and Platinum members etc.
- If connection is missed, then no issue with baggage that may be left behind, because passenger has baggage with them.
- Additionally, if the connection is missed due to delays, KLM and Thalys are responsible for arranging a replacement ticket.
- ZYR – CPH and CPH - ZYR: friendly and helpful personnel to answer questions & provide reassurance, making the journey clearer and more enjoyable.
- Rail: atmosphere on board is quiet, calm, organized. More comfortable than plane.
- Flexibility with hopping on an earlier train if possible.

Negative experiences for ZYR – AMS – CPH

- Pick up boarding pass at ‘Rue de France, Brussel’ : this is in the ZYR railway station. Would be a lot clearer if that info was added about where this is in the station.
- Doing Rail first, is perceived as more complicated, because of having to check in at Air-Rail terminal, instead of online. With online check-in, passengers could arrive at the station closer to departure time of the train.
- Boarding pass is unclear and confusing to use. Smaller font departure time for train under ‘boarding time’. At ZYR passenger has to be at the station to pick up boarding pass 30 mins before departure; boarding of the train is only a few minutes before departure time.
- Air-Rail terminal at ZYR not easy to find.

- ZYR is uncomfortable and confusing: no signs, big & crowded station with mass of people with heavy baggage. Station is dark and grimy with homeless people sleeping inside the building
- Sky Priority is a perk: not explained (see above).
- Passengers are not yet tired from travelling by Air, so waiting for the train is lesser problem.
- Thalys doors are narrow and have steps: passengers have to hoist their baggage up and squeeze through, which is not convenient. Plus, in short boarding time it makes travel extra stressful.
- Baggage rack at Thalys close to the door and out of sight of passenger: passenger cannot keep an eye on their baggage, and it may be stolen.
- Baggage rack has room for limited items of baggage. Too small for peak travel times, and when Air-Rail gets more popular.
- Overhead baggage racks in seating area are too high and shallow to use for heavy, big bags/suitcases.
- Schiphol Plaza = busy. Difficult to navigate through crowds with baggage.
- Combined boarding pass did not work at AMS. I had to go back to the check-in area at AMS to get 2 separate boarding passes.
- At AMS I was constantly searching for information on where to go, especially before I had dropped off my check-in bag. The KLM app that I used, did not give sufficient updates on departure hall number, gate number.

Positive experiences for ZYR - CPH – AMS:

- ZYR helpful staff
- ZYR: location of Air-Rail terminal is pleasant, and close to terminal. So close, that I was able to even take an earlier train.

Negative experiences for CPH – AMS – ZYR:

- Information above baggage carousel at AMS about Air-Rail popped up, that tells travelers to exchange Air-Rail tickets at the Train tickets and Services counter. This is incorrect & confusing.
- AMS Schiphol Plaza is overwhelming, big, open and very busy with lots of people (tourists, commuters, employees)
- Passengers have to wait for their designated Thalys train at Schiphol Plaza. The platform number where the Thalys will arrive, is only displayed a few minutes before arrival of the train. Waiting at Schiphol Plaza is not comfortable.
- AMS Schiphol Plaza: no designated area to sit while waiting for arrival of assigned train. There are benches, but not facing train and platform information.
- Being tired from earlier Air leg makes waiting for the train a little more unpleasant (even more so for passengers transferring from long intercontinental flights with jet lag).
- Also due to tiredness less patience with dealing with baggage: navigating busy Schiphol Plaza, hoisting baggage up Thalys steps and through narrow doors. Plus in short boarding time.
- Thalys doors are narrow and have steps: passengers have to hoist their baggage up and squeeze through, which is not convenient. Plus in short boarding time.

- Baggage rack at Thalys close to the door and out of sight of passenger: passenger cannot keep an eye on their baggage and it may be stolen.
- Baggage rack has room for limited items of baggage. Too small for peak travel times, and when Air-Rail gets more popular.
- Overhead baggage racks in seating area are too high and shallow to use for heavy, big bags/suitcases.
- AMS: no Air-Rail or Thalys signs – had to follow general Trains signs, which was not explained.

Positive experiences for CPH – AMS – ZYR:

- Sky Priority works at CPH too – this is not explained though.

4.2.9 Key Take-aways

The key take aways are the following points. Starting with the general remarks about the positive and the negative experiences that happened during the excursion. There were a lot of negative remarks compared to the positive. At this stage of how Air-Rail is being implemented, it is not a viable option as the entire replacement of short-haul flights between Brussels and Amsterdam. But it does have potential if the issues from the results are resolved. Therefore, the main finding that needs to be solved is listed with the other findings following.

4.2.9.1 Main Finding: Experiencing Air-Rail while accompanied by large baggage is not fun

As the main finding, it was found that being accompanied by a large, bulky, and heavy bag makes the Air-Rail experience even more difficult and unpleasant than without. The train station (ZYR) is not suited for baggage caused by the large number of commuters and dirty facilities. Schiphol Plaza at AMS is also not suited for waiting train travelers with baggage, having to wait in an unsheltered and congested location does not feel comfortable. And lastly, the train is the most unsuitable place for large baggage, due to the limited baggage storage space on the train car, tight spaces to manoeuvre through, narrow doors, and the unsafe baggage storage locations far away near the exits. It is incredible how much accompanied baggage can influence an Air-Rail journey and is necessary to find a fitting solution.

Other findings that are not part of the main findings are listed in the following chapters below.

4.2.9.2 A More Negative than Positive Experience

In general, the amount of provided information was lacking, this was applicable before the day of travel and on the day of travel. By providing Air-Rail travelers with enough information in advance, they can prepare themselves for a new way of travel. Signage was missing at the most important locations ZYR and AMS. And traveling with a suitcase was not pleasant at all due to the train facilities not being designed to fit large baggage.

4.2.9.3 Missing Signage and Provided Information at ZYR

The two different travel directions have their own unique issues. When traveling ZYR – AMS – CPH, the main difficulty is having to go the Air-Rail terminal to receive your boarding passes. Finding the location within the train station is impossible due to no signage and was only doable when asking staff from SNCB for help. Only then was it possible to navigate through the maze that is ZYR and find the Air-Rail terminal. Additionally, it is not explained why going to the terminal is even necessary. Normal online check-in is not possible (this is possible when traveling by Air-Air).

4.2.9.4 Missing Signage and Provided Information at AMS

When traveling CPH – AMS – ZYR, a few difficulties were present. Arriving at AMS and directly out of customs, no specific Air-Rail signage was present. Travelers are expected to follow normal train signs. As well as, incorrect information being displayed at baggage pick-up, about picking up Air-Rail tickets at the NS service desk.

4.3 Air-Rail Customer Research Report

For the next part of discover, the customer research report for Air-Rail was analyzed. The report contains qualitative and quantitative research about the Air-Rail pilot. This was done by a company hired by KLM, called Beautiful Lives (BL). BL stands for insights-based innovations while using principles of design thinking and firmly rooting projects in consumer insights. They researched the experiences of the Air-Rail passenger by having them fill out surveys, conducting in-depth interviews and recording on-sight observations. This report (Weijer & Palmen, 2022) is useful, because it reflects the experience that a large group of Air-Rail passengers have. Which could be different than my personal experience during excursion in 4.2.

4.3.1 Goal

The goal of BL's research is to gain a full and in-depth understanding of the expectations, experiences, triggers, and barriers of the Thalys transfer pilot. This pilot functions as a ground transportation alternative to the short-haul flight gain a full and in-depth understanding of the expectations, experiences, triggers, and barriers of the Thalys transfer pilot as a ground transportation alternative to the short-haul flight ZYR-AMS connection. This is vital input to the planning of the replacement of the other flights on the route of ZYR-AMS.

4.3.2 Gain

By hiring the company to research the Air-Rail pilot, KLM is able to understand the triggers and barriers of the service; the overall experience compared to an Air-Air transfer; the expectations and experiences across the traveler's journey; and improvement areas to optimize the service.

4.3.3 Sample

The Whatsapp assignments ran from the 21st of July until the 3rd of October 2022. The in-depth interviews were conducted in September 2022. And the observations were done on the 20th and 21st of September 2022.

4.3.4 Participants

For the Whatsapp survey, the number of participants that filled out the survey completely is 72. This includes the both journeys of ZYR – AMS and AMS- ZYR. For the in-depth online interviews 17 people participated. The ages of the participants varied, with a mix of business and leisure travelers who went to a variety of destinations.

4.3.5 Methods

Three different methods were used to retrieve the data.

Whatsapp Surveys
This survey ran from the 21st of July until the 3rd of October. Where a link was sent to the participants to fill out the survey. 72 fully completed surveys for ZYR-AMS (n=30) and AMS-ZYR (n=42) combined.

In-depth Online Interviews
The online interviews were done in September 2022, with 17 participators taking place in 45-minute interviews.

Observations
Observations were done for two days, the 20th and 21st of September 2022. Passengers were observed throughout the journey.

4.3.6 Results

The results of the surveys, interviews, and observations are combined. The five most important points are presented in the results.

4.3.6.1 The Air-Rail Journey is far from Seamless

The initial perception of passengers is that the KLM Air-Rail alternative between Amsterdam-Brussels can be a comfortable, sustainable, and time-efficient transfer, but they do not experience the journey as an integrated and seamless trip, causing of stress.

"It was the first time I traveled to Europe by myself. Once I got off the plane, I had no idea what to do or where to go. I was totally lost and by myself."

4.3.6.2 Air-Rail is preferred over Air-Air

Despite the experienced hick-ups, there are more passengers that would prefer the Air-Rail transfer to Air-Air, after completion of the journey.

The majority (62%) of passengers (n=30) who travel ZYR-AMS prefer the train over an airplane, while 26% prefers a plane. For the direction of AMS-ZYR (n=42), the preference is less clear. 44% prefers the train, while 36% prefers a flight. This shift in preference could be due to passengers already having had a (long) journey at this point and are more easily annoyed by the lack of refreshments, having to carry their own baggage or people talking on the phone.

As seen in Figure 4-13, 50% of passengers travelling from Brussels to Amsterdam rate the journey by train as very good or excellent and 10% rates it poorly. When traveling AMS-ZYR, the percentage that has a very good or excellent journey is about the same 47%, but passengers are more likely to rate it poorly: 19% had a poor experience.

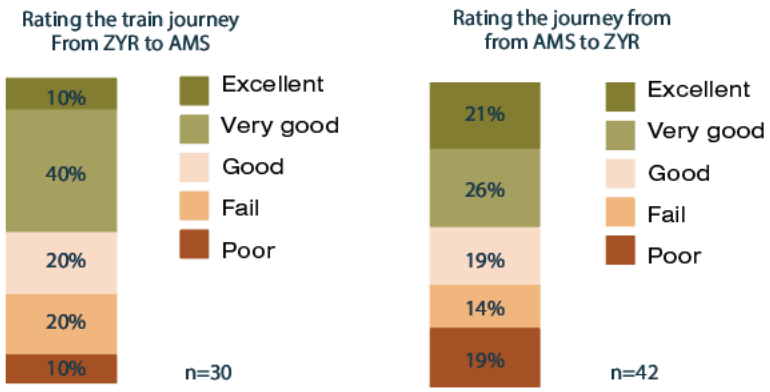


Figure 4-13 Passenger ratings of journeys between AMS and ZYR (ZYR-AMS n=30 & AMS-ZYR n=42)

4.3.6.3 Needs of Passenger are based on Train Travel Experience

There is a key difference between train experienced (previous trips or outbound trip) versus train unexperienced travelers. The experienced passenger is familiar with traveling by train in Europe. Many passengers come from Belgium and are used to taking the train for travel to France of the Netherlands. The passenger compares taking the Thalys (as a short-haul travel option) with taking the TGV to CDG, where it is possible to hand in your check-in baggage at ZYR and receive it at the end destination. The passenger has seen AMS before and knows where to go. The transfer from plane to train is less difficult for them, they know the basic procedural steps. The experienced passenger wants practical, visual, and step-by-step information. The information is about how to handle baggage, Thalys platform number, carriage, and seat number, AMS gate number, and clear departure times.

The unexperienced passenger is less familiar with traveling by train. They do not know how train traveling works in Europe. Usually, they are from different continents and have not yet experienced AMS before, therefore experience more difficulties around AMS (airport and train station) and ZYR. The Air-Rail transfer is extra stressful for this passenger because the airplane and train depart from different locations at AMS. The unexperienced passenger needs guidance throughout the entire journey.

4.3.6.4 The Provided Information is Lacking

The pre-journey information is seen as insufficient and too general. The information that is provided before the passenger starts their Air-Rail travel, is not sufficient to feel fully prepared. Especially for unexperienced passengers, they want to know what to expect during the journey. Instead of the general information given, they want to know.

- What to do prior to the journey and while traveling?
- Where to go, especially concerning the transfer from plane to train or from train to plane?
- How it works with the baggage?
- What to do in case of delay(s) or disturbance(s)?
- Where to go in case of questions or uncertainties?

These questions cause feeling of insecurity prior to the transfer. Some travelers at AMS when transferring from plane to train, did not know that they have to exit the airport, but stay in the building. And finally, information about delay is not up to date in the KLM app.

4.3.6.5 Air-Rail Signage is missing at ZYR

The transfer at AMS is not easy due to no signage specifically for Air-Rail being present. When at Brussels-Midi, the Air France KLM office is very hard to find. The lack of signage at the train station and the backside location of the office makes travelers doubt if they are at the right place.

4.3.6.6 ZYR is not a Pleasant Location

Waiting at Brussels-Midi train station for the Thalys to depart is an unpleasant experience for travelers, especially when they compare it to taking a short-haul flight between Brussels and Amsterdam. Waiting for the Thalys to depart is the beginning of the passenger's Air-Rail journey. Therefore, they would expect the same standards as when taking a short-haul flight from Brussels to Amsterdam. Additionally, the waiting area in front of the Air France KLM office feels shabby and unpleasant as it is not secluded from the train station. Travelers are not aware of the Thalys-lounge outside of the train station. And the facilities at the train station are scarce and toilets have to be paid for with tokens.

4.3.6.7 Transporting Baggage to and from the Train is an Issue

When it comes to baggage, passengers are not fully aware that one must transport their own bag. With baggage not being able to be checked-in and sent to AMS to the end

destination, this is particularly unpleasant for elderly travelers and travelers with special needs.

A significant number of check-in bags were transported by Air-Rail questionnaire participant. In it is visible that for AMS-ZYR (Figure 4-14) 71% traveled with check-in baggage and 29% with hand baggage. For ZYR-AMS, only 32% traveled with check-in baggage and 68% with hand baggage.

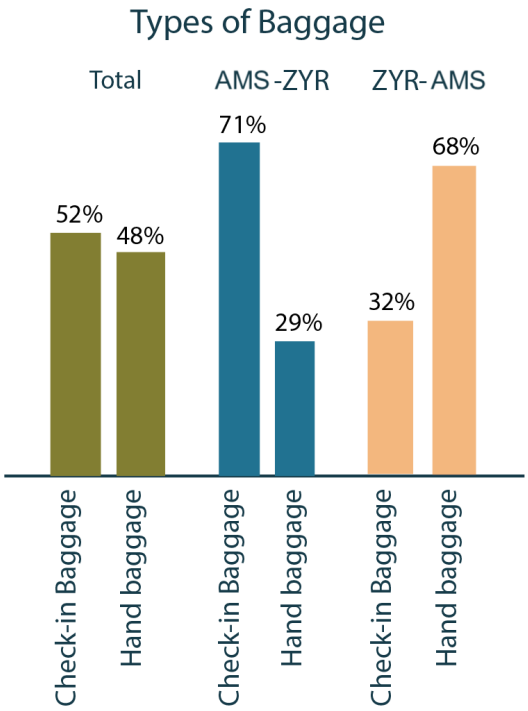


Figure 4-14 Types of baggage brought during Air-Rail (AMS-ZYR n=42 & ZYR-AMS n=24)

4.3.6.8 On the Train, Storing Baggage is an Issue

Passengers are surprised by baggage transportation difficulties at the train station. Passengers are forced to take their baggage on the train with them. Smaller items fit in the overhead baggage compartments on the Thalys which is useful because the items are in sight. Unfortunately, large baggage has to be stored in the unattended baggage racks in the hallways (if there is enough space), which feels uncomfortable and unsafe.

"I would like to be able to check in my bags at Brussels-midi, for delays on the train to be eligible for compensation the same as a flight, gold members to be offered entry to the Thalys lounge."

4.3.6.9 Air-Rail Signage is missing at AMS

The transfer at AMS is not easy due to signage missing that is specifically for Air-Rail. Travelers at AMS when transferring from plane to train, did not know that they had to exit the airport, but stay in the building. As the current transfer signage at AMS focuses on Air-Air transfers. At Schiphol Plaza, passengers cannot find a KLM or Thalys helpdesk. And the

Thalys platforms are difficult to find as well, as by showing platform 5-6, and passengers not knowing which one it is, adding to the confusion.

4.3.6.10 The Waiting Area at Schiphol Plaza is Insufficient

At Schiphol Plaza there is also no Thalys or KLM counter available and no designated area to wait for the train. For passengers who are already tired after the first leg, the Air-Rail transfer at a busy AMS/Schiphol Plaza is confusing (baggage handling, signage, waiting).

4.3.7 Key Take-Aways

The key insights of the Air-Rail customer research report are the following points.

4.3.7.1 Improvement is Necessary

It can be concluded that the Air-Rail service at this time, is far from seamless and improvement is very necessary to create a full replacement for short-haul flights between Amsterdam and Brussels. The service does have the potential to be comfortable, sustainable, and time-efficient transfer, but much improvement is needed.

4.3.7.2 Different Types of Travelers

There are two types of travelers that encounter travel with Air-Rail. These types are based on the experience they have traveling by train. First, the experienced train traveler knows how train travel works, which signs to look for, and where to find the train. They have difficulties with Air-Rail by expecting a different transfer process. Their needs are a practical, visual step-by-step instructions. Second, the unexperienced train traveler has no clue how train travel works. They feel lost and overwhelmed by the train station. Their needs are receiving guidance throughout the entire journey.

4.3.7.3 What should be improved?

Provided Air-Rail Information is lacking
Specific information about Air-Rail that is provided by KLM and Thalys prior to travel, is insufficient and too general. For instance, the baggage handling policy is unclear, where passengers have to go in ZYR, and what the protocol is if a disturbance happens.

Large baggage on the train and at the station is a problem
On the train, small baggage can easily fit in the shallow overhead compartments for safe storage. But for larger baggage, that is normally checked in (with Air-Air), there is no space in the train compartment. Storage for large baggage is available outside of the train compartment near the doors. But the availability is limited and far away from the passenger therefore causing an unsafe feeling. Additionally, passengers who have special needs or who have difficulty carrying baggage are burdened by difficulties at the train station, by having to transport their own baggage to and from the train. The Air-Rail experience differs for travelers due to the amount and size of baggage they have with them.

Facilities are lacking at AMS and ZYR

At both locations, AMS and ZYR, the facilities are lacking. First, the signage at both locations is not catered to Air-Rail travelers specifically. The Air-Rail terminal at ZYR is untraceable and at AMS travelers must know that their Air-Rail train departs from the normal train area. Second, the provided facilities for waiting at AMS and ZYR are not what the Air-Rail travelers expect. The facilities are dirty, exposed and crowded.

4.4 Summary Discover

In this chapter, the most important key insights are recapped from the entire analysis of the Air-Rail journey. A summary of the issues is considered to finally conclude what the most important issue is to contribute to in the next phase in chapter 0.

The discover phase started off with an intervention of the Air-Rail excursion to CPH that I experienced (chapter 4.2). To summarize the conclusions for the Air-Rail excursion, the overall experience was negative with a few positive points. This was caused by three main issues: the provided Air-Rail information was lacking, signage at ZYR and AMS was missing for Air-Rail passengers, and being accompanied by large baggage influenced the travel negatively.

The second intervention was the customer research report, where qualitative and quantitative research was done by a company hired by KLM (4.3). To summarize the conclusions for the report, improvement is necessary for Air-Rail service and is far from seamless. This was mainly caused by three issues: the provided information prior to travel is too general and lacking, facilities including signage are lacking at AMS and ZYR, and large baggage on the train and at the station is a problem. Additionally, the report found that the experience in traveling by train caused passengers to have different needs.

Pre-travel Info, Signage, Baggage
When comparing the excursion to the customer research report, the three main issues are identical. The report has the addition of the two types of train travelers: experienced versus unexperienced. The similarity of the three main issues confirms that my experience during the excursion was similar to that of other travelers.

1. Pre-travel Info
Diving into what the most important issue is of the three to solve. I think that providing more specific Air-Rail information before traveling is easy to resolve short-term. The Air-Rail information should be more elaborate and should contain how Air-Rail differs from Air-Air with which steps to expect during the journey. This is to be executed by KLM due to them being the main provider and contact for booking Air-Rail tickets.

2. Signage
The next issue is signage, for this issue it would be necessary to add Air-Rail focused signs at AMS and ZYR. These signs will guide the Air-Rail traveler, to the Air-Rail terminal at ZYR and its corresponding train platform. And at AMS, the Air-Rail signs will direct the travelers to Schiphol Plaza with it Thalys train platforms. These signs are relatively easy to fix for short-term. This is due to having one Air-Rail stakeholder for each location who is responsible. For AMS this would be RSG, who manages the building where Schiphol Plaza is located. For ZYR, the responsible stakeholder would be SNCB.

3. Baggage
That leaves baggage as the final issue. The impact of being accompanied by a large check-in bag on the train is same as the bag, large. As seen in chapter 4.3.6.7, a fair number of

check-in bags are being transported during Air-Rail. This means that large bags continue to be an issue on the cramped Thalys trains. Solving the issue of having a large baggage on the train and at the station requires a long-term solution. This is based on the complex stakeholder relations that are involved in transferring between different modes of transportation (chapter 3.2). Therefore, baggage is not easily fixed by a short-term solution and requires long-term planning that needs to start now. To involve the many Air-Rail stakeholders in the process. Therefore, the focus of the next sections in this report will be on the topic of baggage. This topic of baggage will be taken to the next chapter, where a design brief is formed as a basis to solve the issue.

5. Define the Design Brief

The findings from the conclusion for the discover phase in chapter 4.4 are formed into a design brief for the second diamond of the double diamond (Figure 5-1). In the define phase, the second half of the first diamond is converging. What is meant by this is that one important finding is chosen to find a solution for. To find a solution a design brief is defined. This is based on the analysis of the Air-Rail system in chapter 4. First the scope of the design is explained going from three issues to one, then the corresponding assignment and design criteria are stated.

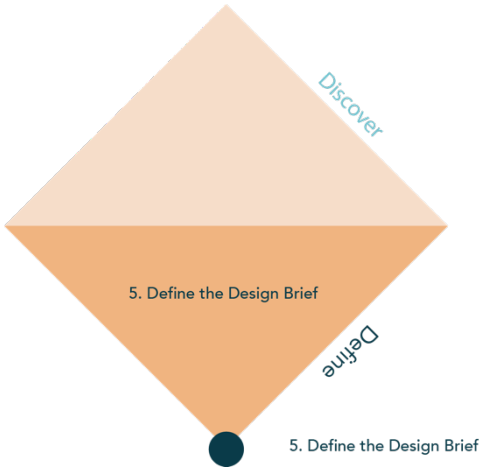


Figure 5-1 Define of the double diamond

5.1 Converging: Choosing One Issue

Based on the urgency and need of climate change that is discussed in chapter 1.1, creating a complete and seamless Air-Rail service is very much necessary to save our planet. However, offering a complete and seamless service can only be reached by fixing the three main issues that passengers experience during the Air-Rail journey (chapter 0). These three main issues are: pre-travel info, signage, and baggage. To be more specific, pre-travel info is lacking special Air-Rail information for its travelers and causing them to not be prepared and being faced with not so pleasant surprises during their Air-Rail journey. Signage for Air-Rail specifically is missing at AMS and ZYR. At ZYR, Air-Rail travelers are not able to find the Air-Rail terminal where they have to pick-up their boarding passes for their entire journey. At AMS, Air-Rail travelers have difficulties finding the special international Air-Rail trains that are hidden with the regional trains. And finally, there is no baggage solution offered for travelers traveling with large check-in baggage. This causes travelers to struggle with finding a secure spot for their baggage on the busy train and at the stations.

Based on the number of stakeholders that are involved in the process and provided information for possible solutions by Air-Rail stakeholders, these three issues can be split into two categories: short-term solvable and long-term solvable. Pre-travel info and signage belong to the short-term solvable category and baggage belongs to the long-term solvable category.

Looking at short-term, the issues are significantly easy to find a solution for due to the limited number of Air-Rail stakeholders that are involved. Pre-travel info would require KLM to provide more specific information about the Air-Rail journey. Signage at ZYR would require SNCB to place signs to follow to the Air-Rail terminal. And for signage at AMS, it would require RSG to place signs to find the Air-Rail trains at Schiphol Plaza. The short-term issues can be seen as low-hanging fruit, that are important to solve but not as complex as the long-term.

However, baggage is part of the long-term solvable category. Check-in baggage is significantly more complex to find a solution for due to the journey that a large bag takes. Baggage is transported through train stations, the train, and the airport. By moving through these locations, multiple stakeholders influence and are involved by baggage. Therefore, a quick solution is not possible and would require multiple Air-Rail stakeholders to come to an agreement about a solution.

Therefore, the main issue to solve is the long-term issue of baggage. By focusing on baggage and creating plans for the long-term future, a valuable and impactful solution can be created that takes into account baggage issues and multiple Air-Rail stakeholders. While this is happening, the low-hanging fruit (pre-travel info and signage) will be picked to create a fully seamless and complete Air-Rail service.

Additionally, this long-term baggage solution is preferably scalable to other similar locations within 700 km of Amsterdam. This is due to the necessity of replacing more short-haul flights by the more sustainable travel option, the train.

One more important factor to take to the design phase, is the amount of experience that the passenger has with traveling by train. The amount of experience (experienced versus unexperienced) matters in what the passengers need during the Air-Rail journey. Mainly, experienced train travelers want concise step-by-step information that is provided before travel. And the unexperienced train travelers need guidance throughout the entire Air-Rail journey.

During the design phase of this project, the focus is to create a long-term Air-Rail baggage solution for experienced and unexperienced train travelers to create a complete and seamless Air-Rail service in the future.

5.2 Assignment

Converged Problem Definition

The passengers who use the current Air-Rail service do not experience a seamless transfer. This is due to lacking pre-travel information and no signage for wayfinding at ZYR and AMS. The final reason for is due to handling baggage on the train. Usually accompanied with a long-haul flight, large baggage is taken with the passenger during their travels. Large baggage does not fit easily on a busy train and having to stow it far away and out of sight of the passenger, the chance of having the baggage stolen is increased. There is no existence yet of an Air-Rail baggage service for between ZYR and AMS.

The design brief is the following:

Design a baggage solution for the Air-Rail journey between AMS & ZYR vice versa and develop a roadmap to implement these solutions with new passenger journeys.

5.3 Design criteria

In chapter 6, different solutions for improving baggage for Air-Rail are generated and checked against the following design criteria. These design criteria originate from research during the discover phase as well as from the Air-Rail stakeholders: KLM, RSG, and Thalys and its users.

The design must:

1. Produce as little as possible greenhouse gas emissions.
2. Provide a consistent Thalys interior for baggage.
3. Provide a secure and on time service for baggage (to and from AMS).
4. Use existing facilities as much as possible.
5. Follow the customs regulations at AMS.
6. Follow the maximum baggage dimensions and weight used by KLM and Thalys, which are 75x53x30 cm and 23 kg.
7. Not cause hinderance for other OD (origin-destination that are not using Air-Rail) Thalys passengers.
8. Provide a solution for both ways of the travel (to and from AMS).
9. Be scalable to other short-haul flight destinations (within 700 km of AMS).
10. Create more room on the train for baggage.
11. Create secure baggage transportation during the trip.
12. Create a pleasant passenger journey for experienced and unexperienced travelers.

The assignment and design criteria are the base for the next phase: develop. The next steps are to start ideation and develop multiple concepts for the baggage issue.

6. Develop Air-Rail Baggage Concepts

In this second diamond, the specified issue that was identified from the first diamond will be solved (Figure 6-1). This is done by generating concepts in the develop phase and finding the best concepts and how to implement them during the deliver phase. This chapter is specifically for the develop phase, where the second diamond diverges. Meaning that we will try to find as many concepts as possible for the Air-Rail baggage issue from the previous chapter. With concept generation being a central part of this phase. Three sessions were conducted to generate concepts for Air-Rail baggage. First an Air-Rail stakeholder workshop was organized, that resulted in generating concepts for Air-Rail baggage concepts. Then two interviews were conducted with representatives from an Air-Rail rail operator and an Air-Rail airline.

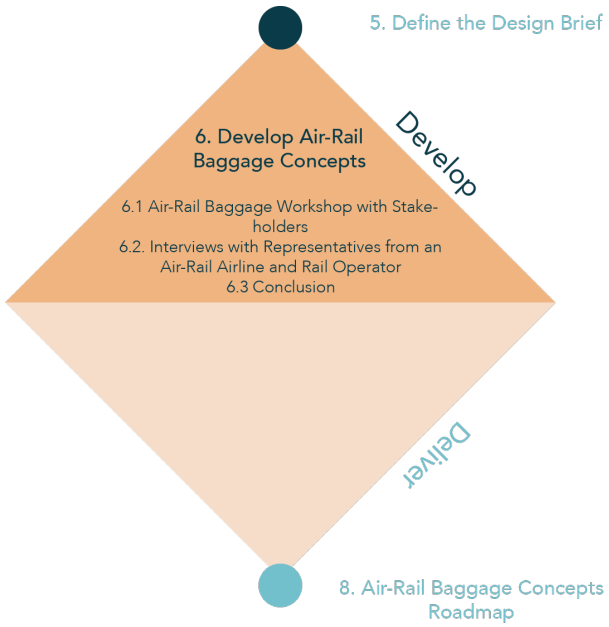


Figure 6-1 Develop of the double diamond

6.1 Air-Rail Baggage Workshop with Stakeholders

In November of 2022, I organized a workshop at the TU Delft where Air-Rail stakeholders participated in solving baggage issues for the Air-Rail service between AMS and ZYR (Figure 6-2). The workshop resulted in baggage concepts for three horizons: 2024, 2030, 2036. These years for these horizons differ from the result roadmap due to opportunities that came forward during the interviews the Air-Rail representatives.

Figure 6-2 Impression of the workshop

6.1.1 Goal

There were two goals for the workshop: create long-term goals with future visions using the knowledge and expertise of the multi-stakeholder group, and to see if there would be significant differences in the goals and visions for different types of travelers based on the amount of experience that results from the chapter 4.4 from the Air-Rail customer report.

6.1.2 Participants

17 people participated in this workshop as seen in Figure 6-3. All the participants were related to Air-Rail for the route between ZYR and AMS or they were generally related to baggage. In Appendix 11.5, the full list of participants is shown.

Figure 6-3 Participants working on templates

6.1.3 Method

The methodology used to set up the workshop and to create long-term goals and future visions originates from the Creative Problem Solving model (CPS) by (Buijs, 1986) (as in (Tassoul, 2009)).

6.1.4 Execution

The workshop started with baggage issues for specific types of travelers. The participants were divided into four different groups, to discuss baggage issues for four types of passengers, the main differences being whether they were experienced or unexperienced travelers and the direction of travel. The participants filled in empathy maps. This was to make to them approach baggage issues from the user's point of view. The full results and materials of the workshop can be found in Appendix 11.5.

The following Table 1 shows the setup of the workshop including the steps, goals, and tasks.

Table 1 Steps, goals, tasks for the Air-Rail Baggage workshop

Step	Goal	Task
	Understand the problem from the perspective of the specific traveler	Fill in Empathy Map
Problem	Think of possible baggage issues to traveler	Fill in Baggage Challenges Canvas
	Find out what their most important issue is to solve	Rank the problems in top 3
	Think of a future vision for 2036 for baggage for traveler	Fill in Creating a future vision statement template
Concepts	Setting user experience goals for the years 2024, 2030 and 2036	Fill in Breaking it down template

6.1.5 Results

As stated above, the goals for the workshop were to create long-term goals with future visions using the knowledge and expertise of the multi-stakeholder group, and to see if there would be significant differences in the goals and visions for four of the different types of travelers.

The future visions that were created were too vague to be useful. The results between the types of travelers were very different and did not have any overlap with each other. Therefore, we can conclude that the experience versus the direction of trip causes to have an entirely different future vision result. The workshop was beneficial in generating concepts for baggage concepts, some of which are useful for this project. The concepts that are specific to Air-Rail are shown in Table 2, where they are numbered and categorized by feasibility (now, short-term, middle-term, long-term).

An additional benefit of the workshop was that the stakeholders used this opportunity to meet in person and build stronger relationships. Working on collaboration for Air-Rail is important due to the complex stakeholder network that Air-Rail requires. Having a close and pleasant collaboration is beneficial for the future of Air-Rail.

Table 2 Concepts from the Air-Rail stakeholder workshop

Concept	Feasibility
Delivery service for baggage	Short-term
Pax can label baggage on train or at the station for drop-off	Short-term
International train stations are like airports – with check-in, bag drop-off, security	Long-term
Train staff puts baggage in the system at AMS	Long-term
Baggage distribution point for airports at train station AMS–ZYR	Long-term
1 terminal for all modalities	Long-term
Automatic baggage with battery (self-moving)	Long-term
Automatic baggage loading and unloading to and from train	Long-term

6.1.6 Key Take-Aways

The most important take-away from the Air-Rail baggage workshop is the list of applicable Air-Rail concepts that was created by the participants for the three horizons (Table 2). Additionally, the collaboration part is just as important as the concepts and should be included in the roadmap.

6.2 Interviews with Representatives from an Air-Rail Airline and Rail Operator

Two interviews with representatives from an Air-Rail airline and Air-Rail rail operator were conducted. This was done to gain more information about Air-Rail from the representative's point of view and to discuss baggage concepts.

6.2.1 Goals

The main goal of both interviews is to discuss possibilities for Air-Rail baggage concepts using the insights of the experts and gain more information. Specifically for the rail operator, the focus was on understanding the rail operator's role and involvement in the service. And for the airline, it was gaining insight about baggage concept possibilities that would influence their business.

6.2.2 Participants

The two participants were interviewed. The first was an Air-Rail expert from an Air-Rail rail operator. The second participant that was interviewed, was part of an Air-Rail airline and had expertise in baggage concepts.

6.2.3 Methods

The method of interviewing was to have the interviewee explain certain points about Air-Rail from their perspective. With the addition of explaining the possibilities about baggage concepts.

6.2.4 Executions

The interview with the railway operator was conducted via Teams on March 13th, 2023. And the interview with the airline was conducted via Teams on May 12th, 2023.

6.2.5 Results

The results from both interviews are stated in this chapter. Each interview's results are divided over different chapters.

6.2.5.1 Results from the Railway Operator

The results contain two critical events that will affect the possibilities for Air-Rail baggage concepts in the future.

Thalys Train renovations to "Ruby"
Thalys has recently started renovating their old trains to include a new interior design called Thalys "Ruby". These trains will contain an increased number of seats by removing a space called the "fourgon". This fourgon is a hallway that is located in the back of the locomotive (Figure 6-4), where about 60 pieces of baggage can be stored. This space is not being utilized now and is only accessible by the train conductors. Therefore, Thalys has made the decision to remove this space and to replace by increasing the number of seats. These train renovations are happening starting in 2023, with about 5 trains every year being renovated. In total there are 25 trains from which 16 will be renovated. This means that the overall Thalys train fleet will include two different types of interiors. To create more room for large baggage in the current interiors, one concept was discussed: installing temporary baggage storage racks over a certain number of seats within the train car.

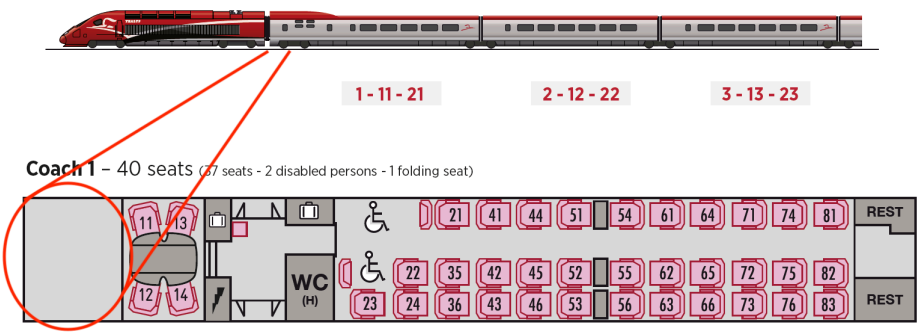


Figure 6-4 The old Thalys train layout, with the 'fourgon' at the front *(THALYS TRAIN LAYOUT PREMIUM - COMFORT)*

New Thalys train fleet in 2032

Thalys has plans to order new trains for 2032. This would mean that around 2030 new trains will be ordered. These new trains create an opportunity for Air-Rail, namely that the new train cars could be designed to become more baggage friendly or include a secure baggage concept on board. A few options for the concepts were discussed: a baggage train car that is attached to the back of the train where Air-Rail baggage could be transported, adding the fourgon back in the design of the train to transport Air-Rail baggage, increasing the comfort for passenger who are handing baggage onboard the train by adding baggage storage racks closer to the passengers. These concepts are listed in Table 3, where they are ranked by feasibility of when it would possible to execute the concepts.

Table 3 Concepts from the Thalys interview

Concept	Feasibility
Fourgon (baggage compartment)	Middle-term
More baggage racks in new interior design in seating area	Middle-term
Replace chairs by baggage racks in seating area	Short-term (temporary)
Separate external baggage car	Long-term

6.2.5.2 Results from the Air-Rail Airline

The baggage concepts that were explored were options that would transport the baggage outside of the train to AMS or ZYR. For instance, by not taking baggage on the train and having it picked up at home and sent to AMS, the baggage would bypass the train entirely. This would create new opportunities that are not limited to the confined space of the train. The options that were discussed are the following concepts with their level of feasibility (Table 4).

The door-to-door (D2D) baggage delivery service would be responsible for sending the Air-Rail passenger's baggage to their travel destination in abroad. As well as sending their baggage to their destination in Brussels. The door-to-airport (D2A) service is providing transportation of baggage between a location in Brussels and the airport AMS and vice versa. Finally, the train station-to-airport (TS2A) service is providing baggage transportation between the train station ZYR and the airport AMS.

Table 4 Concepts from the Airline baggage expert

Concept	Feasibility
Door-to-door baggage delivery service (D2D)	Short-term
Door-to-airport baggage delivery service (D2A)	Short-term
Train station-to-airport baggage delivery service (TS2A)	Short-term

6.2.6 Key Take-aways

- Due to renovations, there will be two types of Thalys train interiors, the new 'Ruby' interior and the old interior. The fleet will include both interiors.
- The new 'Ruby' train interior does not include the fourgon anymore, which creates space for more seats.
- A temporary concept to create more space for large baggage is to install baggage storage racks over seats in the train car.
- A new fleet of Thalys trains will be ordered for 2032. KLM could use this opportunity to be involved in designing the train to be more baggage friendly.
- The possible concepts based on the new fleet are:
    - Attaching a baggage car to the back of the train to transport Air-Rail baggage.
    - Adding a fourgon in the new design to transport Air-Rail baggage.
    - Increasing the comfort for passengers who have large bags by adding baggage storage racks closer to the passengers.
    - Temporarily replacing chairs on the train by baggage racks in the seating area.
- Three concepts for a baggage delivery service are applicable as Air-Rail concepts
    - A door-to-door baggage delivery service (D2D)
    - A door-to-airport baggage delivery service (D2A)
    - A Train station-to-airport baggage delivery service (TS2A)

6.3 Conclusion Develop

The results of the workshop and interviews is a list of generated concepts, that are listed in Table 5. These concepts are grouped by estimation of when they would be feasible to

complete (short-term, middle-term, and long-term). For the next step, this list of concepts will be filtered through the criteria from chapter 5.3. Where several concepts will end up as the final concepts for the roadmap.

Table 5 Generated concepts

Concept	Feasibility
Pax can label baggage on train or at the station for drop-off	Short-term
Door-to-door baggage delivery service (D2D)	Short-term
Door-to-airport baggage delivery service (D2A)	Short-term
Train station-to-airport baggage delivery service (TS2A)	Short-term
Replace chairs by baggage racks in seating area	Short-term (temporary)
Fourgon (baggage compartment)	Middle-term
More baggage racks in new interior design in seating area	Middle-term
Train staff puts baggage in the system at AMS	Long-term
International train stations are like airports – with check-in, bag drop-off, security	Long-term
Baggage distribution point for airports at train station AMS–ZYR	Long-term
Automatic baggage loading and unloading to and from train	Long-term
1 terminal for all modalities	Long-term
Automatic baggage with battery (self-moving)	Long-term
Separate external baggage car	Long-term

7. Deliver the Air-Rail Baggage Concepts

In the deliver phase (Figure 7-1), convergence is key. After producing many concepts, a selection is to be made. After this the concepts are elaborated and placed within an implementation plan (roadmap) in chapter 8. This is done by taking the list of generated concepts that resulted from the previous chapter 6.3. The next step is to make a critical selection of the concepts, and this is done by first filtering the concepts through the criteria that are formed in the design brief. The result of filtering through the criteria is three concepts for the short-term future, one concept for the middle-term future, and one concept for the long-term future. Another evaluation is necessary for the short-term future to choose which of the three concepts fits the best. This is done by having an Air-Rail airline stakeholder and an Air-Rail airport stakeholder fill in the selection procedure. Additionally, this is done by an unexperienced and an experienced train train traveler as well. For the long-term horizon, it is decided that it is too vague and far into the future. Therefore, that concept is dropped and will not be proceeded with for the roadmap. The results are concepts for the short-term and middle-term horizons.

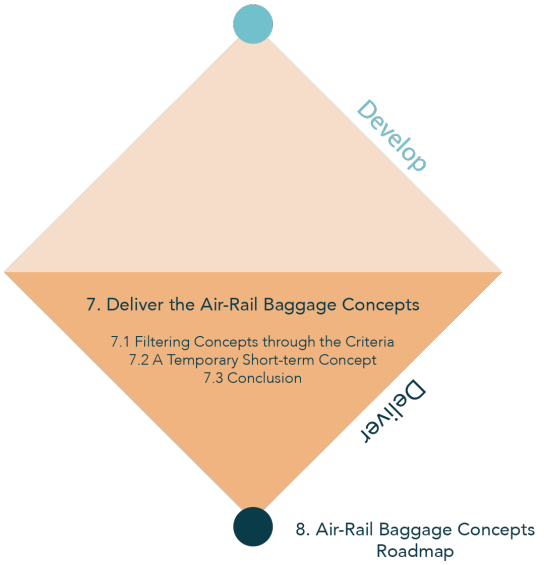


Figure 7-1 Deliver of the double diamond

7.1 Filtering Concepts through the Criteria

The first step of filtering the concepts, is to take the generated concepts from 6.3 and apply the criteria from the design brief to the list to filter out concepts that are not suitable. The criteria are the following:

1. Produce as little as possible greenhouse gas emissions.
2. Provide a consistent Thalys interior for baggage.
3. Provide a secure and on time service for baggage (to and from AMS).
4. Use existing facilities as much as possible.
5. Follow the customs regulations at AMS.
6. Follow the maximum baggage dimensions and weight used by KLM and Thalys, which are 75x53x30 cm and 23 kg.
7. Not cause hinderance for other OD Thalys passengers.
8. Provide a concept for both ways of the travel (to and from AMS).
9. Be scalable to other short-haul flight (within 700 km of AMS) destinations.
10. Create more room on the train for baggage.
11. Create secure baggage transportation during the trip.
12. Create a pleasant passenger journey for experienced and unexperienced travelers.

And the concepts that will be filtered are the following.

Concept	Feasibility
Delivery service for baggage	Short-term
Pax can label baggage on train or at the station for drop-off	Short-term
Door-to-door baggage delivery service (D2D)	Short-term
Door-to-airport baggage delivery service (D2A)	Short-term
Train station-to-airport baggage delivery service (TS2A)	Short-term
Replace chairs by baggage racks in seating area	Short-term
Fourgon (baggage compartment)	Middle-term
More baggage racks in new interior design in seating area	Middle-term
Train staff puts baggage in the system at AMS	Long-term
International train stations are like airports – with check-in, bag drop-off, security	Long-term
Baggage distribution point for airports at train station AMS–ZYR	Long-term
Automatic baggage loading and unloading to and from train	Long-term
1 terminal for all modalities	Long-term
Automatic baggage with battery (self-moving)	Long-term
Separate external baggage car	Long-term

7.1.1 Method

The method that is used to siphon the concepts from the previous chapter by using the criteria, is the Harris profile (Harris Profile). The Harris profile works in the following way. First a list of requirements is defined and set against a four-point matrix for each concept that will be tested. The scale of the matrix is -2, -1, +1, +2. Next the concepts are rated by the requirements. After rating, the concepts are filtered based on how well they have scored with the requirements and a selection is made of the best ones. The scores are calculated by adding the positive points and subtracting the negative points.

7.1.2 Results of the Concepts with the Criteria

Using the Harris profile to filter the concepts through the requirements, results in the following matrices in Figure 7-2.

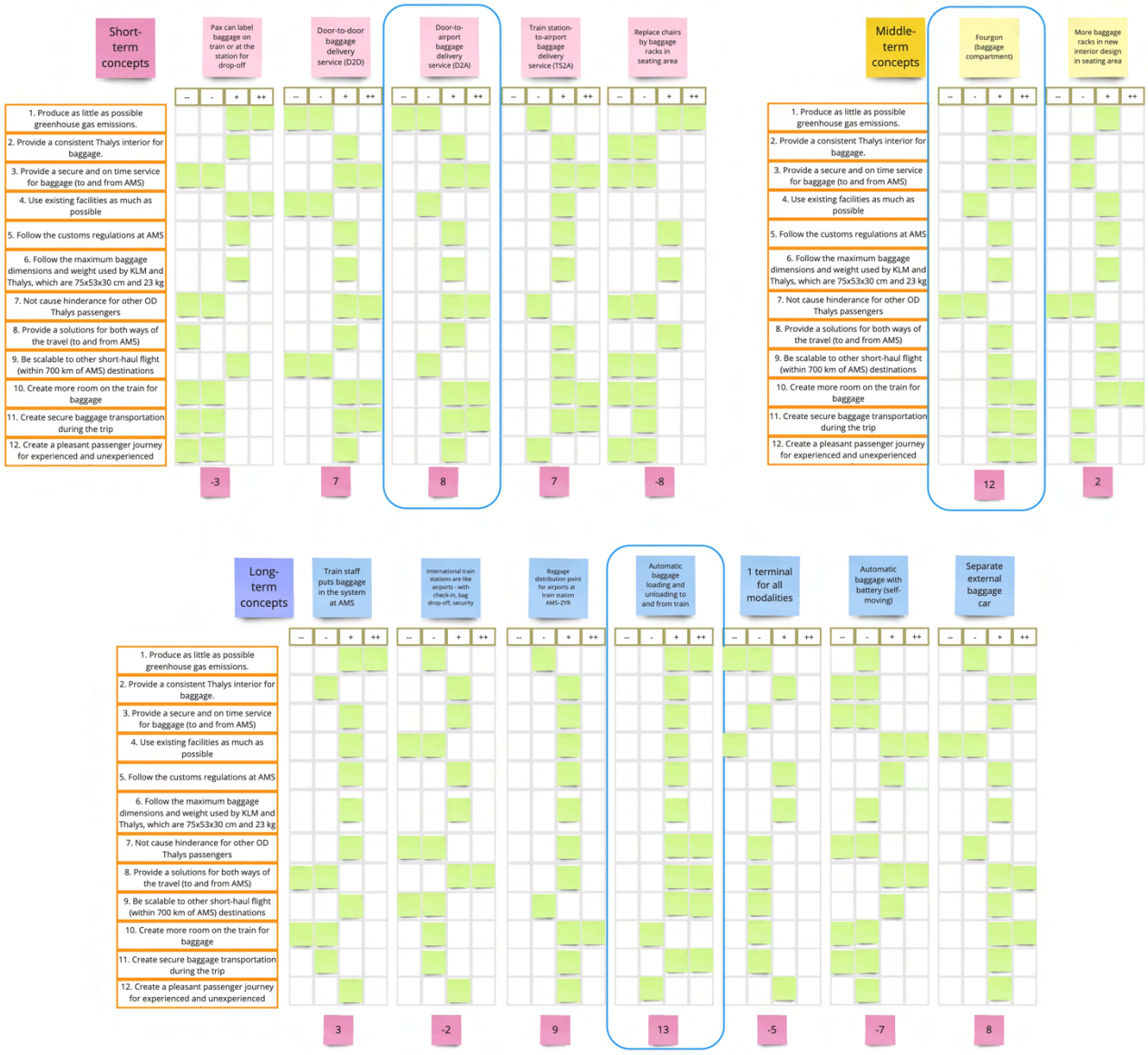


Figure 7-2 Filtering the concepts for short-, middle-, and long-term.

As seen in the figure above, for the short-term future (top left in pink), the door-to-airport baggage delivery service came out as the best concept. For the middle-term future (top right in yellow), the fourgon (baggage compartment) resulted as the best concept. And for the long-term future (bottom in blue), the automatic baggage loading and unloading on and from the train was the best. For a more detailed look at the results, the next chapter will go more in depth into the results for each horizon.

7.1.2.1 Results for Short-term Concepts

Starting with the results for the short-term future that are shown below in Figure 7-3. The concept, D2A baggage delivery service resulted as the best option. The scores of the concepts are located below under the Harris profiles. The winning concept received eight points, while the other similar baggage delivery service concepts receive seven points. Passengers labeling baggage on the train or at the station and replacing chairs by baggage racks in the seating area, received well below the others with -3 and -8 points. These concepts do not provide the Air-Rail user with a more secure and on time service for baggage on the train. The baggage racks create the benefit of more room for storing bags, but not in a particularly safe way. Additionally, bags still have to be carried through the train station and train carriages. Labeling baggage takes away a step at AMS, but still have to be transported by the travelers by train to AMS. Additionally, where they still have to check-in their baggage.

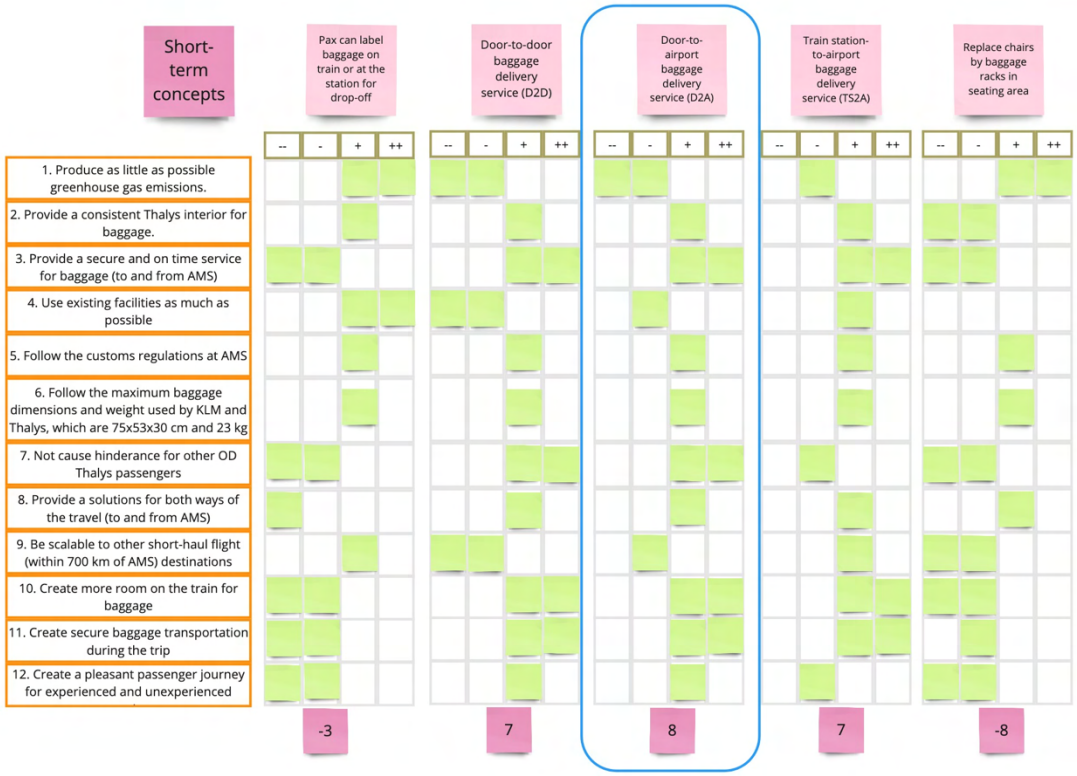


Figure 7-3 Concept results for the short-term future

The three baggage delivery concepts (D2D, D2A, TS2A) are significantly close in results, with the points of seven, eight and seven. With the concepts being similar, the differences between the three are based on the following requirements. Their differences are based on the production of greenhouse gas emissions, having baggage being sent by car outside of the train is not ideal. And the further away a destination is, the more emissions it produces. Using existing resources causes differences as well, the further the delivery car must go, more newer resources and facilities are necessary. And finally, the scalability to other destinations is a reason for different outcomes, due the complexity in logistics of offering many pick-up locations as well as drop-off locations. Limiting the options creates a higher quality and more environmentally sustainable baggage delivery service. As mentioned before, the concepts are very close together and are not the most environmentally conscious. Therefore, the three concepts of D2D, D2A, and TS2A, will be a temporary concept. This temporary concept will create a short-term concept that will quickly create a complete Air-Rail service, until the more permanent middle-term concept is executed. To make this temporary concept as viable and desirable as possible, they will be ranked by Air-Rail representatives and its potential users in chapter 7.2.

7.1.2.2 Results for Middle-term Concepts

Next are the results for the middle-term future, which are shown in Figure 7-4. There are only two options to choose from for this horizon. The first is the fourgon, that is similar to the old layout of the Thalys trains, which is a compartment where baggage can be stored safely and separately from the train travelers. With this compartment an accompanying service is offered where baggage can be checked in at ZYR and AMS, to be directly sent through to the next destination. The other concept is adding more baggage racks in the new interior design of the seating area. This concept creates a more pleasant experience by allowing passengers to store their baggage more conveniently on the train. By adding more storage space for large baggage in the train car, travelers will experience a safer feeling compared to what is offered now. But this concept still includes transporting the baggage by yourself and not being able to bypass check-in. Additionally, having an increased number of bags in the train car, could cause more disturbance to OD train passengers. Both concepts are based on the plans of Thalys renewing their fleet in 2032. Creating the opportunity to add a more baggage friendly design to the trains.

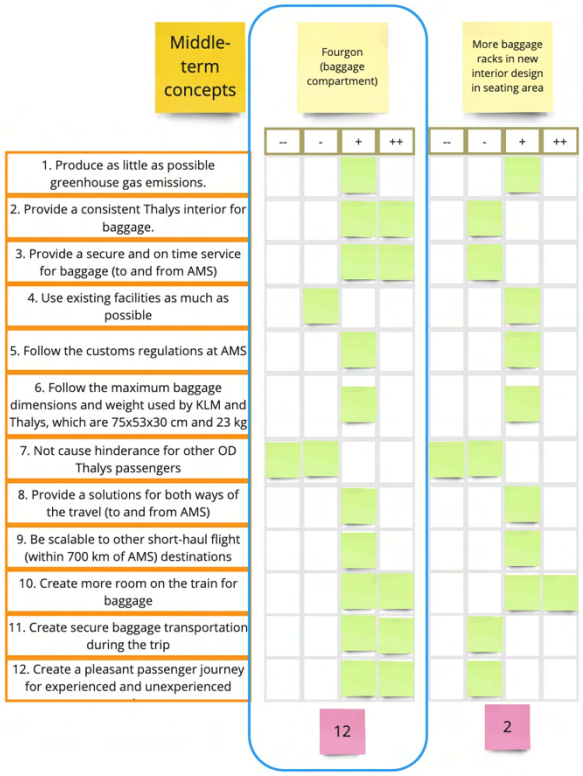


Figure 7-4 Concept results for the middle-term future

The fourgon results as the best concept here, with 12 points versus two. This is due to the fourgon providing a better consistent interior, a secure and on time baggage service and creating a more pleasant passenger journey. In its entirety, the fourgon creates a more seamless experience. This is due to the service being the most comparable to an Air-Air transfer, where the transition of modes of transportation is as seamless as possible. As a result, the fourgon creates a more seamless experience for its users by taking baggage off the passenger's hands before boarding the train. Additionally, once arrived at AMS from ZYR, the passengers are able to bypass check-in and head straight to security.

7.1.2.3 Results for Long-term Concepts

Lastly, are the results for long-term future in Figure 7-5. The concept that resulted as best is the automatic baggage for loading and unloading at the train at AMS. This concept had the best score of 13 points. Other concepts such as baggage distribution point for airports at the train stations and a separate external baggage car, came close in scores with nine and eight points. The remainder of the concepts had low to negative points as their scores. The automatic baggage loading and unloading is the best concept, due to it being a supportive system for the fourgon from the previous horizon. By automatically and accelerating the loading and unloading processes at AMS the occupation time on the train tracks is reduced, which contributes to an overall streamlined and secure Air-Rail experience.

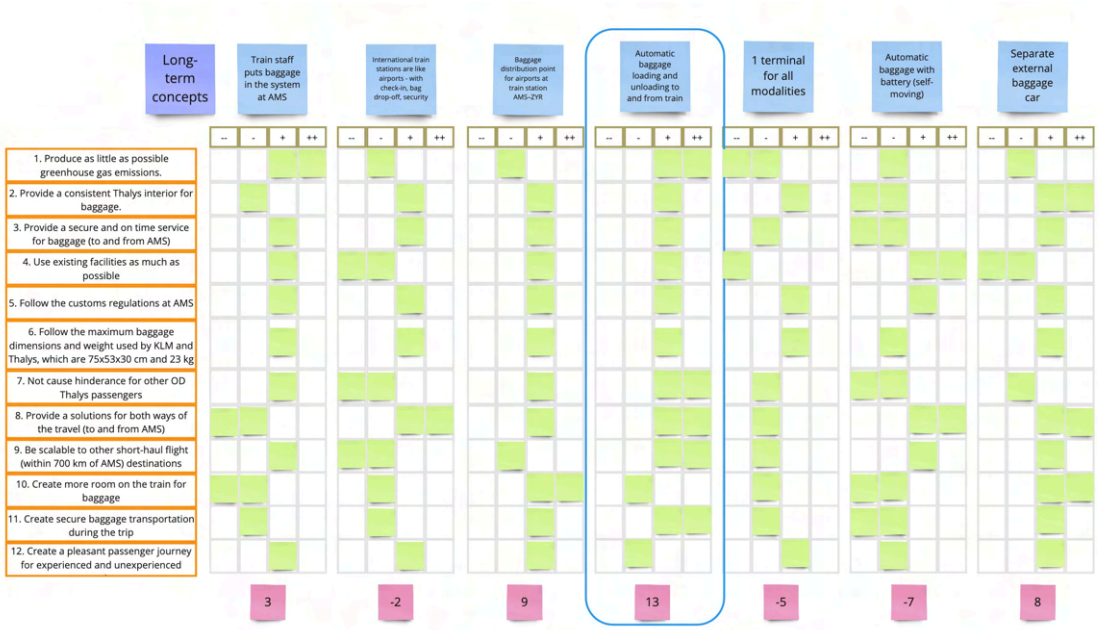


Figure 7-5 Concept results for the long-term future

Because this concept is so far in the future after 2032, the implementation of the concept is too vague to be realized. Therefore, the focus of the concepts goes to the short-term and middle-term. The long-term concept will be mentioned in chapter 9 in the discussion.

7.1.3 Key Take-Aways

The key take-aways from chapter 7.1, are that for the short-term future, the three concepts D2D, D2A, and TS2A needed to be assessed further by other Air-Rail stakeholders. These concepts are very close together in score and will provide a temporary concept due to them emitting additional greenhouse gases. This is done by transporting baggage outside of the train by delivery van. The fourgon train design creates the most seamless baggage experience and will be implemented for the middle-term future (2032). The fourgon train design will be a compartment that was previously removed from the current Thalys train design. In this compartment, baggage can be stored that is checked in at ZYR and AMS. From ZYR, baggage can automatically be sent through at AMS to baggage handling. Travelers can then skip the step of baggage check-in at AMS, and directly head to security. In Table 6, an overview of the concepts is given.

Table 6 Resulted concepts from design criteria

	Concept	Feasibility
1.	Door-to-door baggage delivery	Short-term
2.	Door-to-airport baggage delivery	Short-term
3.	Train station-to-airport baggage delivery	Short-term
4.	Fourgon baggage compartment	Middle-term
5.	Automatic baggage loading and unloading on and from the train	Long-term

Concept 5 for the long-term future is more of a supporting service than a stand-alone concept, therefore it is put aside. The next step is to have Air-Rail stakeholders have a look at the temporary concepts for the short-term future in the next chapter.

7.2 A Temporary Short-term Concept

The next step is to choose which concept will be the temporary concept that will precede the fourgon, as was mentioned in chapter 7.1.2.1. The gap that will need to be bridged from now until 2032. For this period a short-term concept is necessary to quickly offer a complete Air-Rail service that includes a baggage concept. Three concepts that initially went through the design criteria but had similar scores from chapter 7.1, are listed below in Table 7. These concepts failed on the first criterium of producing as little greenhouse gas emissions as possible, by transporting baggage by delivery van between Brussels and Amsterdam. But as a temporary concept these concepts are desirable and create opportunities to quickly create a complete Air-Rail service. Choosing between the three concepts was done by having two Air-Rail stakeholders and two passengers with different levels of experience (unexperienced and experienced) share their opinions on a list of criteria. These criteria are ranked and weighed by Harris profile.

Table 7 Short-term concepts for baggage delivery

	Concept	Feasibility
1.	Door-to-door baggage service (D2D)	Short-term
2.	Door-to-airport baggage service (D2A)	Short-term
3.	Train station-to-airport baggage delivery service (TS2A)	Short-term

Explanations of the three concepts

Figure 7-6 Door-to-door

1. Door-to-door baggage delivery service (D2D)

   A baggage delivery service that handles the passenger's baggage between their starting point (possibly home in Brussels) and end destination and vice versa (Figure 7-6). The baggage travels with the passenger on their flight and is picked-up a day in advance and dropped-off a day later. The duration of receiving baggage in other countries varies. Additionally, when arriving at AMS by plane, passengers must pick up their own baggage, due to European customs laws.

2. Door-to-airport baggage service (D2A)

Figure 7-7 Door-to-airport

A baggage delivery service that handles the passenger's baggage between their starting point and airport (AMS) and vice versa (Figure 7-7). A baggage delivery service that handles the passenger's baggage between their home in Brussels/location in Brussels, and destination airport. The baggage is picked up at the home in Brussels by delivery van and is driven to AMS the next day. At AMS, the bag is put into the BHS and the bag will travel on the same flight as the passenger to the next airport. At that airport, the passenger will take their bag off the baggage belt and go on with the bag to their next location. The other way around, at AMS the passenger picks up their bag from the belt and hands it in at the Air-Rail bag point at AMS. They will receive their bag a day later at home in Brussels.

3. Train station-to-airport baggage delivery service (TS2A)

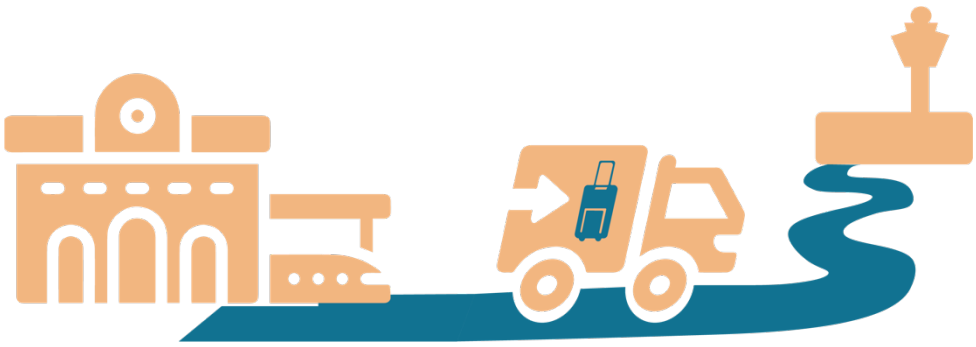


Figure 7-8 Train station-to-airport

A baggage delivery service that handles the passenger's baggage between the train station (ZYR) and the airport (AMS) and vice versa (Figure 7-8). A baggage delivery service that handles the passenger's baggage between a collection point at ZYR, and destination airport. The passenger takes their bag one day in advance to the baggage drop off point at ZYR. After it has been done, they go back home. The baggage is picked up at the baggage point at ZYR by delivery van and is driven to AMS the next day. At AMS, the bag is put into the BHS and the bag will travel on the same flight as the passenger to the next airport. The next day the passenger travels to ZYR and then to AMS, finally arriving at the destination airport. The passenger will take their bag off the baggage belt and go on with the bag to their

next location. The other way around, at AMS the passenger picks up their bag from the belt and hands it in at the Air-Rail bag point at AMS. The bag is sent to ZYR, where the passenger can pick it up the next day.

7.2.1 Goal

The goal of the sessions with the stakeholders and passengers, is to conclude which of the three concepts they would prefer as a temporary concept.

7.2.2 Participants

The participants are two representatives from the Air-Rail stakeholders: an airport and airline. As well as two travelers who differ in travel experience and are aged between 25 and 27 years old. Thalys was also contacted, but unfortunately no response was given.

7.2.3 Method

The method for selecting the concepts for horizon 1 is using the Harris profile. The Harris profile is a method to test concepts based on several criteria with a visual outcome (Harris Profile). The Harris profiles were filled in by the four participants for the three concepts. The selection process happened during online in person meetings.

7.2.4 Execution

Different criteria were used for the Air-Rail representatives and travelers. The criteria that the representative used, are based off the joint interdisciplinary project about Re-thinking Air-Rail Connectivity (2023). These criteria (Table 8) are based on the operational side of the concept (used for KLM and RSG). And the criteria for the travelers are based on their experience and assumptions. Both lists of criteria are ranked, by how important they are perceived for the Air-Rail service, starting from the top. The four participants filled in the profiles in the period of 15/05/23-16/06/23.

Table 8 Criteria for the Harris profile for Air-rail stakeholders and its travelers

Criteria for the Air-Rail Stakeholders	Criteria for the Air-Rail Travelers
Net carbon emissions	Convenience
Investment costs	Comfort
Desirability for KLM	Desirability
Feasability for KLM	Ease of handing in bags
Reliability of on time baggage arrival	Ease of transfer from train to plane
Reliability of safety of baggage	Safety of baggage
Scalability to other destinations	Overall Improvement of the Air-Rail journey
Dedicated area requirements for KLM	Cost of Service for passenger
Personnel requirements for KLM	
Transportation requirements for KLM	

7.2.5 Results

The results of the Harris profiles in Figure 7-9, are that concept 2 and 3 were the favorites for the Air-Rail representatives. And concept 1 and 2 were the favorites for the travelers. Reasoning for this was given by all four participants.

The airport representative liked concept 1 and 2 because of the use of LABIP (landside baggage injection point). Which will benefit reducing the amount of baggage arriving during peak hours at AMS and more evenly spread out during the day. The preference for concept 2 is due to fewer emissions being produced and the increased scalability to other destinations.

The airline representative had concept 3 as the best because it consumes the least amount of energy. Overall, they were not enthusiastic about the three options due to using more energy by transporting baggage outside of the train.

The unexperienced passenger favored concept 1, because it took away the most tasks and worries before the trip, and they would likely experience a relaxing journey on the day of travel. By having their baggage arrive at their end destination abroad, they would enjoy hands-free travel.

The experienced passenger favored concept 2, because it makes the trip easier and is the most convenient for them. By skipping check-in at AMS, it would be an easier trip to experience. They did not think sending baggage all the way to their end travel destination would be necessary, due to costs.

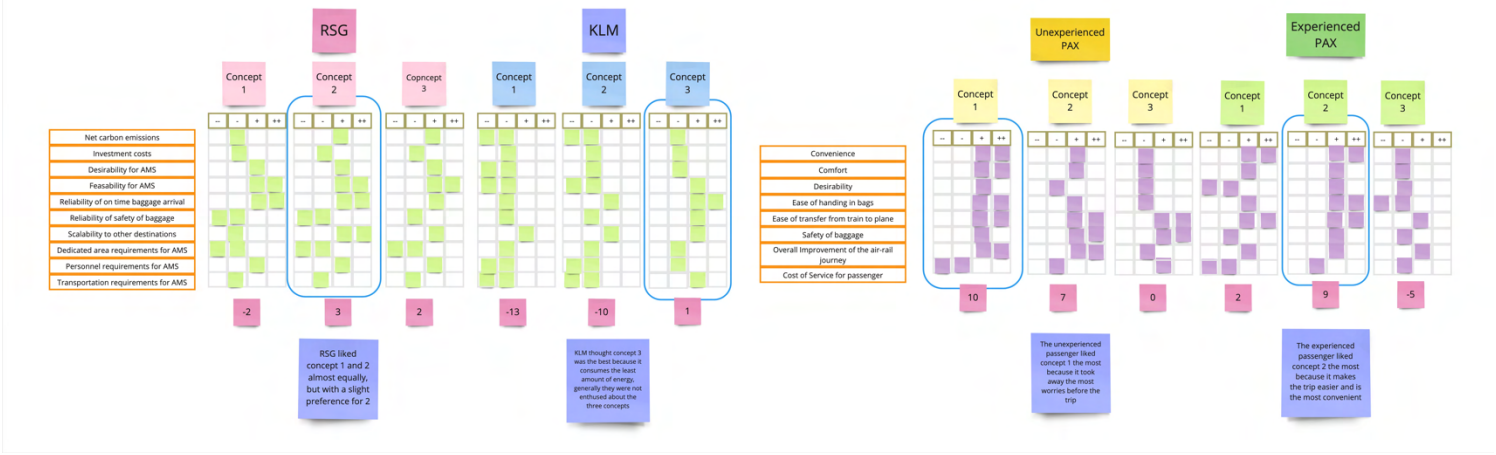


Figure 7-9 Results of the four Harris profiles for a temporary concept

Combining all the results of the Harris profiles, concludes that concept 2, the Door-to-Airport baggage delivery service is the most convenient temporary concept.

7.2.6 Key Take-Aways

The key take-aways from chapter 7.2, are that the door-to-airport baggage delivery service is the best temporary concept. This offers the Air-Rail travelers a short-term concept (2025) that solves the baggage issues temporarily. This concept is the result of the considerations of two Air-Rail representatives and its two types of Air-Rail users.

7.3 Conclusion Deliver

In conclusion, the findings from both chapter 7.1 and 7.2 show the complexity of designing for baggage-related challenges for Air-Rail. The fourgon train design emerges as the optimal middle-term concept, promising a seamless baggage experience by 2032. However, recognizing the need for an immediate, temporary fix, the door-to-airport baggage delivery service is seen as a viable short-term concept, being implemented by 2025.

8. Air-Rail Baggage Concepts Roadmap

This project is about providing a baggage concept for Air-Rail, that is located between Brussels and Amsterdam. The final concept is in the form of a roadmap. The roadmap includes two concepts. The two concepts are focused on the short-term and middle-term future. These two concepts are placed on the roadmap with the accompanying necessary features. In the following paragraphs, the lay-out and the content of the roadmap are explained. Next, the content for horizons one and two are elaborated. After this chapter, the conclusion of the thesis with the discussions follows.

8.1 The roadmap

A roadmap is defined as a visual portrayal of design innovation elements plotted on a timeline (Simonse, 2017). In the roadmap (

Figure 8-1 Roadmap for Air-Rail Baggage Concepts

), a horizontal axis divides the timeline in sections of a specific number of years. On the vertical axis, the value, proposed product or service, necessary technology, roles of the stakeholders, and proposed collaboration between third parties are proposed.

A general explanation of the roadmap starts with the two horizons that are located on the top row of the roadmap. The first horizon is situated in the year 2025. And in this horizon a temporary baggage concept is offered. The second horizon, which is situated in 2032, offers a permanent baggage concept. Why these concepts are temporary and permanent will be explained later in this chapter.

The concept in the second horizon, creates a permanent baggage concept that will improve the Air-Rail transfer process. It starts off with an explanation about the roadmap and how the roadmap is set up. On the top row, two horizons are given, with the first one being situated in 2025 and the second one in 2032.

Purpose
On the first column on the left, we have the purpose that is created for Air-Rail passengers by offering the concepts.

Main Product or Service and Supporting Product or Service
The main product or service is the main concept that has evolved from this project. What the supporting product or service is meant by, are products or services that are necessary to support the main concepts. These supporting concepts aid in creating a complete and smooth service.

Roadmap for Air-Rail Baggage Solutions

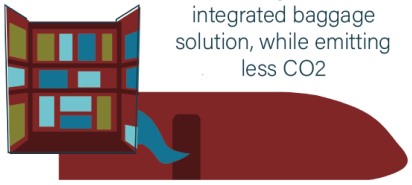
		Now	Offering a temporary baggage solution	Horizon 1: 2025	Creating a permanent baggage solution	Horizon 2: 2032
Purpose			An easier and more relaxing Air-Rail journey without baggage for passengers 		Easy and seamless travel for passengers with an integrated baggage solution, while emitting less CO2 	
The Proposed Product or Service	Main Product or Service		KLM's Air-Rail Bag Service		New Train Design for Baggage	
	Supporting Product or Service		Develop digital Air-Rail boarding pass Create a collaboration platform LABIP completion		Add Antwerp to the baggage delivery service	
	Technology		Develop digital Air-Rail boarding pass		Alstom Siemens Mobility have a history of providing rail technology for Thalys and Eurostar New Thalys trains	
	Collaboration		Creating a shared platform where everyone stays up to date on Air-Rail projects Organize a yearly Air-Rail workshop to discuss issues and improvements		Organize European Air-Rail congress Organize a yearly Air-Rail workshop to discuss issues and improvements	
Air-Rail Stakeholders	KLM		Develop digital Air-Rail boarding pass Pilot digital Air-Rail boarding pass KLM's Air-Rail bag service pilot		Start collaboration with Thalys for an integrated bag solution onboard of train Pilot tests with integrated bag solution on Thalys train	
	RSG		LABIP completion Set up Air-Rail baggage counter		Collaboration with RSG to research best way to transport baggage into BHS	
	Thalys		Connect IT systems with KLM for digital boarding pass		Start collaboration with KLM for an integrated bag solution Update Thalys timetable for longer stop at AMS Pilot tests with integrated bag solution on Thalys train	
	Dutch Government (MvIW)				Dutch Government : Thalys & KLM start negotiations with ProRail & dutch government for longer time at AMS on tracks	
	ProRail					
	Third Party		Luggo: KLM's Air-Rail bag service pilot		SNCB: At Antwerpen Centraal get office for baggage check-in opportunities Alstom or Siemens Mobility have a history of providing rail technology for Thalys and Eurostar SNCB: negotiate a longer time to stop at Brussels and Antwerp	

Figure 8-1 Roadmap for Air-Rail Baggage Concepts

Technology and Collaboration
Moving downward, a section about the technology and collaboration is listed. For technologies, it is listed what kind of technological advancements or investments are needed. For collaboration, it lists what kind of incentives are needed to improve the collaboration between the stakeholders. These two elements of the roadmap are necessary because they create a strong base for the concepts to further build upon.

Air-Rail Stakeholders and Third Parties
At the bottom left of the roadmap the Air-Rail stakeholders are listed, where the specific collaborations and tasks are placed for each horizon. A section for third parties is beneath the Air-Rail stakeholders, to show the tasks that are linked to groups and businesses that are not currently linked to Air-Rail.

Time pacing
The suggested time pacing for the roadmap is based on the urgency of adding a baggage concept to the Air-Rail system. This has to be done as quick as possible, to ensure that Air-Rail passengers receive a complete service. Additionally, the timing of the opportunity to collaborate with Thalys for their new train cars in 2032, is of importance.

8.2 The First Horizon

The concept in the first horizon is to offer a temporary bag delivery service which is a door-to-airport and airport-to-door concept that will run between Brussels and AMS (Figure 8-2). The concept will offer the passengers the opportunity to send baggage between AMS and Brussels, both ways. This is done by transporting baggage by delivery van to and from Brussels. The reasoning for this, is that the passenger will have a more pleasant experience by preventing having to take baggage on the Thalys train with them. During the excursion in chapter 4.2, it was noted that bringing large bags on the train caused unsafe, nervous, and unpleasant feelings. This made the train ride stressful, making Air-Rail a less viable replacement for short-haul European flights. Therefore, as a temporary concept, by transporting the bags outside of the train, the service should create a more pleasant experience for the Air-Rail passenger.

This concept will not be implemented in ANT in the first horizon, due to differing facilities and the different check-in processes (compared to Brussels) for Air-Rail at ANT.

Figure 8-2 Door-to-Airport (D2A) baggage delivery service

The Purpose

The purpose of the baggage service is to offer Air-Rail passengers a way to avoid the stressful rail part of the journey while accompanied by baggage. This is done by having the baggage bypass the train and be transported by delivery van. As seen in the roadmap in

Figure 8-1 Roadmap for Air-Rail Baggage Concepts

, this service creates purpose for Air-Rail passengers by taking away the difficulties of maneuvering baggage through a busy train station and having to keep a constant eye out to prevent baggage from being stolen. The service adds value to the passenger by conveniently checking in baggage at home and being able to directly go to security at the airport. This all results in an easier, more relaxing, and more seamless Air-Rail journey.

For unexperienced passengers this is an enjoyable option because this service helps the passenger by going through fewer steps on the day of travel. Therefore, making the journey easier and less stressful. During the baggage pick-up moment, the unexperienced passenger is greeted by a friendly driver who will take care of their baggage. This also creates an opportunity where the passenger can pose last minute questions about the baggage service and the Air-Rail journey. For experienced passengers, who know what to expect of the Air-Rail journey, the benefit of skipping a step on the travel day. Not having to wait in line at AMS, and going directly to security and the plane, making the journey more comfortable.

Passenger Journey

The baggage delivery service works in different ways based on which way the passenger is travelling. First, the direction of starting in Brussels going to AMS is explained. The way the service works is to be seen in Figure 8-3 and Figure 8-4.

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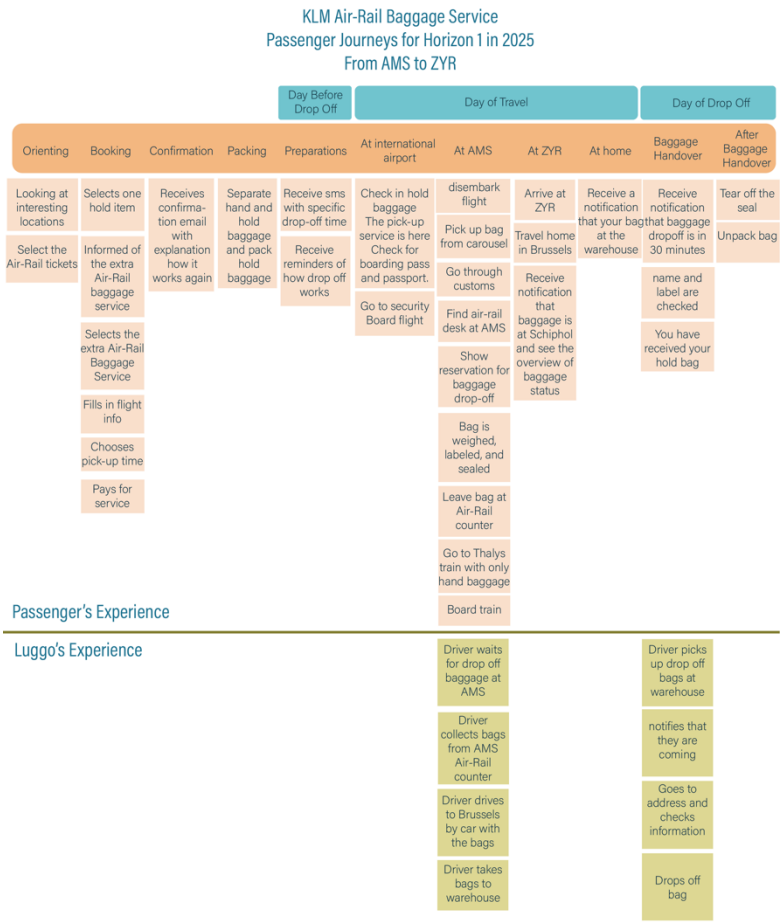

Figure 8-3 Horizon 1 Passenger Journey AMS to ZYR

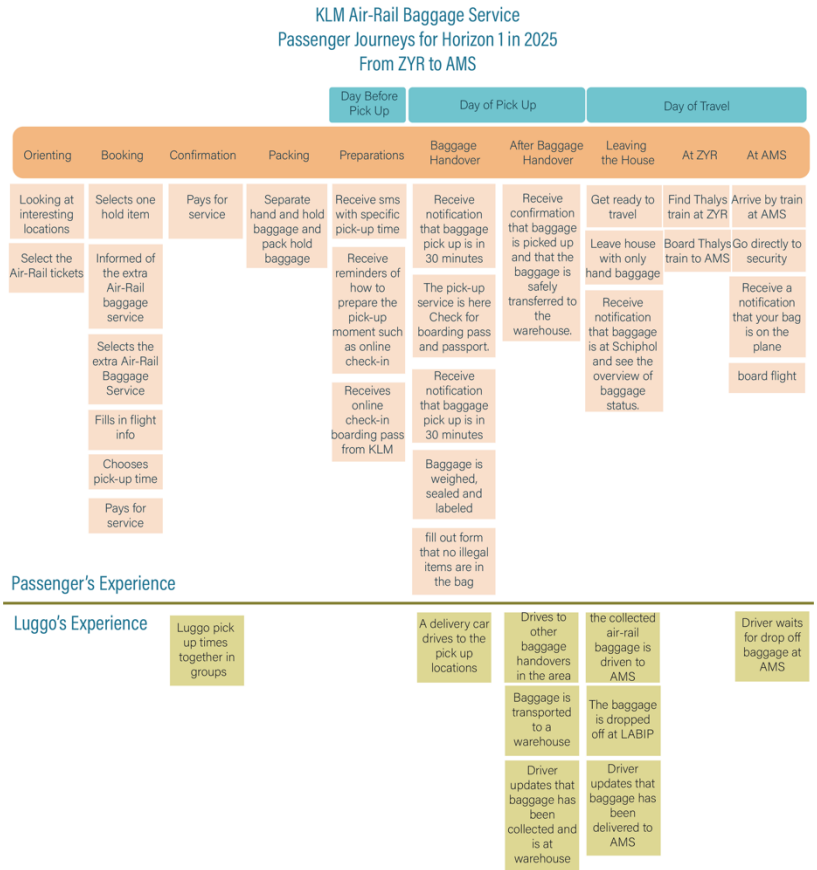

Figure 8-4 Horizon 1 Passenger Journey ZYR to AMS

Products and Services
The main service that is offered is the baggage delivery service in collaboration with Luggo. Luggo is a company that offers checking in baggage at home. By checking in at home, long lines at the airport can be avoided and it creates a more pleasant experience. Currently, pick-up in The Netherlands is offered when flying with KLM, Transavia, and Corendon. This service will be expanded to include Belgium to reach ZYR.

The supporting products and services that will support the baggage delivery service in Belgium are the following: a digital Air-Rail boarding pass, collaboration platform, and LABIP. The digital Air-Rail boarding pass and collaboration platform are discussed in the next paragraphs. LABIP is a project at AMS that is focused on creating more possibility to receive baggage outside of the departure hall at AMS. The letters stand for "landside baggage injection point". LABIP is important for the baggage delivery service, because the service relies on AMS being able to receive larger amounts of baggage outside of their normal facilities. If more people start to use the Air-Rail and with that the baggage service, AMS must be ready to receive more baggage outside of peak hours.

Technology
The digital boarding pass for Air-Rail is a technological supporting product that is necessary to create a complete baggage delivery service. The digital boarding for Air-Rail does not exist yet, this is due to extensive check-in procedure that are not yet available at ZYR or on the train. Air-Rail passengers who use the baggage service, will need to receive their digital boarding passes before arriving at ZYR, to check in their baggage at home. This is a vital part of the service and must be created by KLM and Thalys together.

Collaboration
The supporting collaboration platform is a concept to increase the collaboration for Air-Rail. This is important because of what was seen during the stakeholder workshop, where stakeholders were not aware of plans that would influence Air-Rail. Therefore, a platform should be created all Air-Rail stakeholders are able to update each other easily about the projects that influence Air-Rail. I also recommend planning to meet with these stakeholders in person during a yearly Air-Rail workshop.

Stakeholders and Third Parties
As stated earlier, Luggo is a third party partner in this concept. The reason for choosing to partner up with Luggo, is because of the existing collaboration between KLM and Luggo. In June 2023, the baggage service started off as a pilot for KLM and later was expanded to all KLM flight destinations, except for The United States (due to different baggage rules). For an additional fee, the service includes at-home pick-up in The Netherlands (excluding the Waddeneilanden), baggage check-in, and baggage transportation to AMS.

KLM has the role to develop the digital boarding pass that was mentioned earlier about supporting products and services. Once that is achieved a pilot phase starts for testing and using the boarding pass in combination with the baggage delivery service, which also uses a pilot phase.

RSG has two tasks: work on LABIP and set up an Air-Rail baggage counter at AMS. This Air-Rail baggage counter is necessary for Air-Rail passengers to hand in their baggage to be sent off to Brussels.

Potential Barriers

There are certain barriers that could burden the concept from before and during implementation of the Air-Rail service. First, and most important barrier: emissions. Having a delivery car drive between Brussels and AMS for Air-Rail baggage is something that might not sit well with passengers. The reason that they might have chosen for Air-Rail could be sustainability, therefore they would not want to produce more. An option for improvement would be to invest in electric vehicles, therefore limiting the number of emissions.

The second possible barrier of this concept is the likeliness of the passengers using this service. As was mentioned before, the service is not included in the price of an Air-Rail ticket. The success of the service depends on the pricing and the convenience that is offered. Similar services that offer baggage delivery, such as from anywhere in the Netherlands to AMS, ask around 50 EUR per bag. Moving baggage between two countries (The Netherlands and Belgium), one can expect the price to increase. This could lead to the service becoming too expensive for Air-Rail passengers.

8.3 The Second Horizon

The concept for horizon two in 2032 is an Air-Rail train design for baggage. The concept will be part of the new design of Thalys's train cars that is planned to be executed around 2032. Thalys's plans provide this opportunity to include Air-Rail baggage improvements for inside the train. The main concept is to create more room for stowing baggage by adding the missing baggage hallway that the older Thalys trains have, called the "fourgon". In this baggage hallway, that is located at the front of the train behind the locomotive, a large number of suitcases can be stored (in the old 'fourgon' the capacity allowed a maximum of 60 suitcases). With this new design, Air-Rail offers baggage check-in for your flight at ZYR. Additionally, the new design offers an easier and more secure way to travel by train with large baggage. This concept is for horizon two, due to the timing of Thalys's plan for having new train cars in 2032.

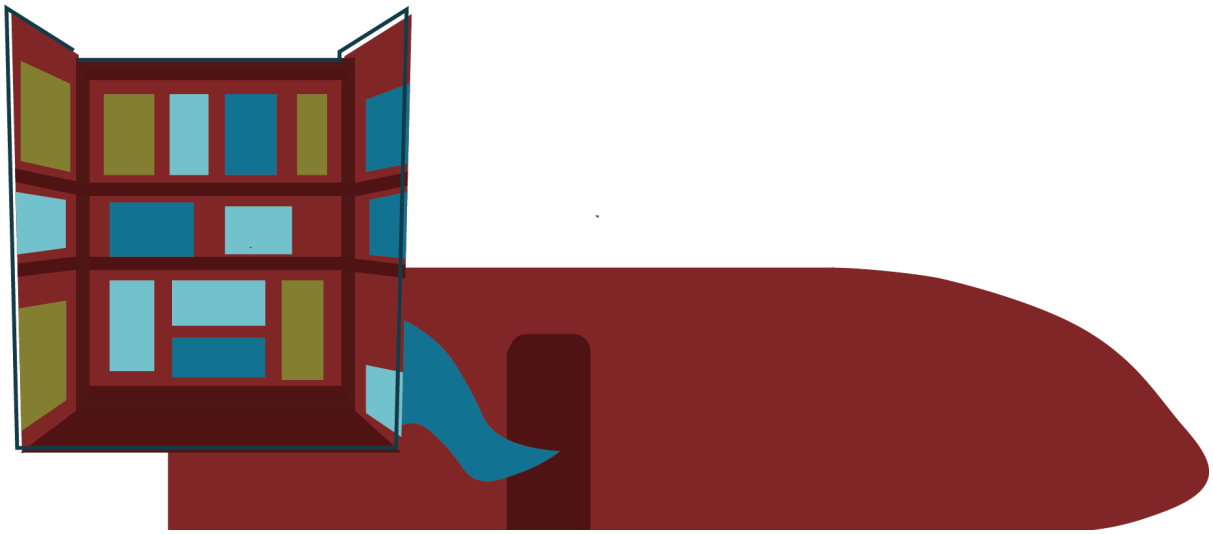

Figure 8-5 Air-Rail train design for baggage

The Purpose

The purpose of this concept is to create a similar baggage experience that flying offers that results in a more seamless experience, where baggage taken off your hands and mind and is securely transported to its next destination. Therefore, making it easier for Air-Rail passengers to navigate the train and creating a more relaxing and seamless Air-Rail journey.

When the passenger arrives at their final airport destination, the baggage is picked up from the baggage carousel. At the transfer airport, passengers often do not have to pick up and check in their baggage, but have it sent through automatically. The service creates value for the passengers by offering an easier, more seamless, and more relaxing way of traveling. That will make Air-Rail the preferred way of traveling.

Passenger Journey

The passenger journey for horizon two is again, split into the two travel directions and the experience of the passenger and the handling of their baggage as seen in Figure 8-6 and Figure 8-7. The passenger journey differs most from the first horizon by still having to travel with baggage to ZYR, where the passenger hands in their bags to be checked in.

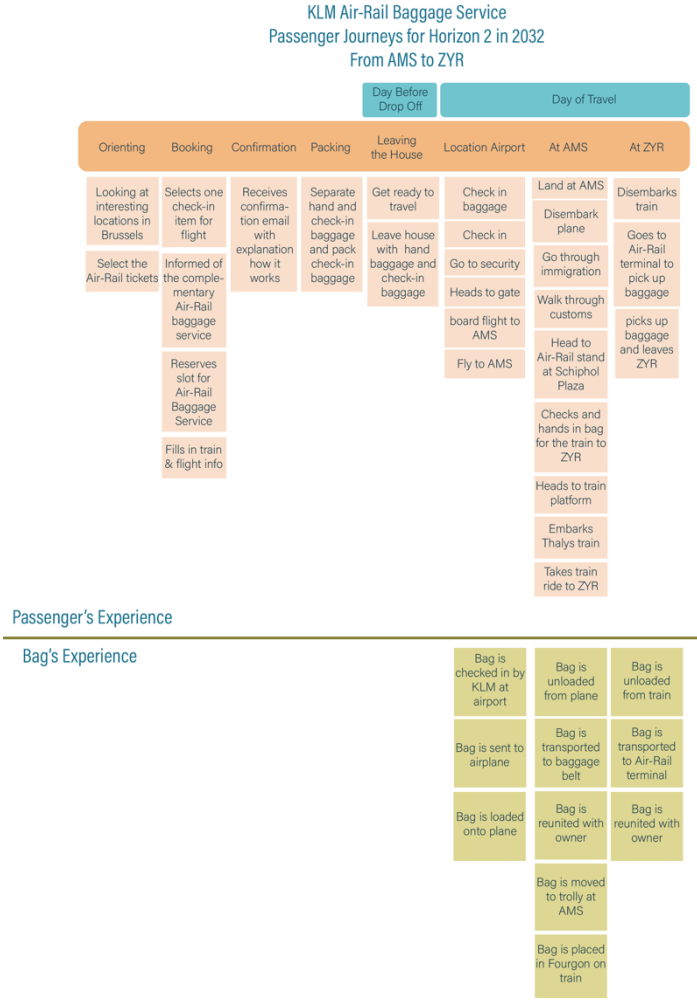

Figure 8-6 Horizon 2 Passenger Journey AMS to ZYR

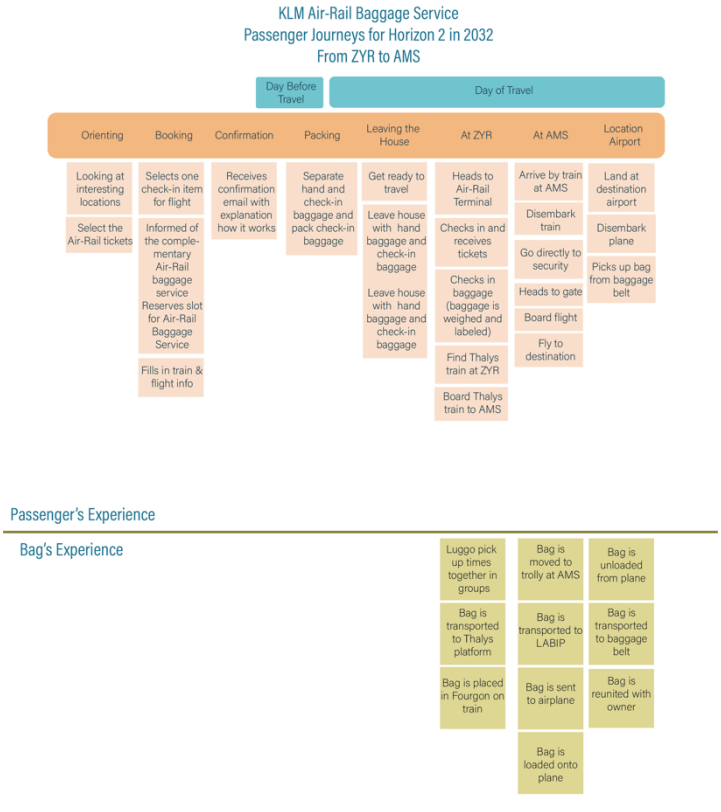

Figure 8-7 Horizon 2 Passenger Journey ZYR to AMS

Products and Services
The main product and service is a newly designed train car that can carry baggage in a separate compartment (fourgon). This compartment will hold a large number of bags that will accompany their owners to Brussels or the airport.

Two supporting products and services are the following: adding Antwerp to the baggage delivery service. By first adding ANT to the baggage delivery service of the first horizon, all the stops Belgian Air-Rail stops are included in the service.

Technology
The main technology feature of this horizon is the new train car. Thalys has worked with the manufacturer Alstom (and Eurostar with Siemens Mobility) for their previous trains. These is a good chance that they will choose one of those companies for manufacturing the new trains.

Collaboration
For the collaboration part of the second horizon, working up to 2032, a yearly Air-Rail workshop to discuss issues and improvements is organized for the Air-Rail stakeholders. After this, it is scaled up to create a European Air-Rail congress, that will include Air-Rail stakeholders that are not specific to the Brussels-Amsterdam route.

Stakeholders and Third Parties
Starting with the Air-Rail stakeholders, KLM has the task to initiate the collaboration with Thalys to design the baggage part of the new Thalys trains. KLM will be part of the pilot phase for testing the baggage concept together with Thalys due to Air-Rail being a combination of air (KLM) and rail (Thalys).

Next, RSG has the task to research the best way of transporting the received baggage at AMS into their baggage handling system. Currently, for similar services this is done by having an RSG employee load up a cart with the baggage and manually transporting it to the departure hall, from there the baggage is inserted into the system.

For Thalys, the tasks are the same as for KLM with an additional task of having the Thalys timetable updated. This is necessary when handling more baggage at the AMS stop, to have the train stop for a longer period at AMS for loading and unloading baggage. Once this is done, pilot testing is started to ensure that the service works. This also has to be done for their Belgian locations, ZYR and ANT, for the same reasons as mentioned before. These plans are formed into pilot tests as well.

Dutch Government (MvIW): As mentioned before, Thalys and KLM must negotiate with the Dutch government to have the Thalys train stop for a longer time to unload baggage at AMS. This is possible by having the Dutch government prioritize international train times over Dutch ones. By doing this we will be able to create a complete replacement for short-haul flights between Brussels and Amsterdam.

Finally, the third parties that are included starting off with SNCB, which is the Belgian national railway company. Their task is to facilitate a larger facility to be able to offer the same check-in opportunities that Brussel offers. The current office at ANT, can only distribute Air-Rail tickets. Their other task is to negotiate a longer time to stop at ZYR and ANT to load and unload baggage. And depending on who the manufacturer will be for the new trains; the manufacturers would be a collaborating third party. Examples of these are Alstom or Siemens Mobility.

Potential Barriers
The barriers for this concept are potential delays that could happen during designing and implementing the concept. Another difficult issue is that KLM relies heavily on Thalys for letting them influence the new design of the train. KLM must think of a way to keep their collaboration in a good level and ease themselves into this concept.

And lastly, by adding this baggage hallway, Air-Rail passenger will benefit by having an easy and more sustainable option to take their bags with them on the train. But a possible barrier could be that Thalys would not want this concept, due to them updating their old fleet to take out this space to create more seating. The consideration of whether space is necessary for more passengers or more baggage should be made.

Possible concerns about safety are possible for Air-Rail passengers. Once handing away their bags, passengers could be concerned with people taking stuff out of or adding to their bags.

Passengers may be used to previous service, difficulties adjusting to this one.
Lastly, an important barrier could be that the Air-Rail passengers that are already using the system from the first horizon, are not used to the new system. They would prefer the older over the newer. To work on this issue, it would be best to decide what the future is of the baggage delivery service before making decisions about the new train design.

9. Conclusion and Discussion

This chapter includes the conclusion and the discussion of this project. Additionally, the limitations and recommendations are discussed.

9.1 Conclusion

The overarching research question for this thesis was: "How can the Air-Rail transfer service be improved to better suit the needs for Air-Rail transfer passengers?".

The research question consists of understanding the extent of the offered Air-Rail service from the experience of the user and the context in which the service is being executed. Research about the context was done to learn about the traditional air industry's complex stakeholder network that is made even more complicated by adding train stakeholders to the mix. The entire Air-Rail journey was researched by experiencing the executing an Air-Rail excursion to Copenhagen and back. Additionally, to confirm if the experiences were to that of other Air-Rail travelers, an Air-Rail customer research report was analyzed.

Based on the quantitative and qualitative analyses, the most important insights were that there were multiple larger issues that occurred during the Air-Rail journey. First, large check-in baggage was the main issue during the excursion that influenced the Air-Rail experience. The large accompanying bag did not fit in the cramped train and was not pleasant to bring into the ZYR station.

Next the pre-travel information that KLM provided did not prepare the Air-Rail travelers for their journey. The provided information included too general information that was not specific for Air-Rail. And lastly, signage at ZYR and AMS for Air-Rail was non-existent. Having to find an important building in the train station ZYR was impossible and AMS did not include Air-Rail specific signage to locate the special Air-Rail train.

These three issues are the main insights from the research can be divided into two categories: short-term solvable and long-term solvable. This is done based on the number of stakeholders that are involved with solving the issues. Pre-travel info and signage require one to two stakeholders to be involved to be solvable. Versus baggage, where multiple stakeholders are involved due to baggage accompanying the traveler through most of the Air-Rail journey (at the station, on the train, and at the airport). Therefore, baggage is the most important issue to solve, due to the complexity of the issue that is caused by the intricate stakeholder network and planning that is needed to create an impactful and lasting design.

These insights led to a design brief that was focused on fixing the specific issue of baggage for Air-Rail. Using the design brief, concepts were generated in different ways. By organizing an Air-Rail baggage workshop and interviewing Air-Rail representatives. Multiple concepts resulted from these sessions for three future horizons: short-term, middle-term, and long-term. From an interview an additional result came forward that included insights

about opportunities with Thalys to make use of their timing to upgrade their train fleet in 2032.

The generated concepts were filtered through the design criteria from the design brief and resulted in multiple concepts for the short-term future, one for the middle-term future and one for the long-term future. However, for the short-term future, the concepts were ranked significantly close together and had a great impact of producing more emissions by transporting baggage by car outside of the train. Therefore, they were deemed a temporary concept that additionally needed more assessment by Air-Rail representatives from an airline and airport and its users that varied in train travel experience. Additionally, the long-term concept that resulted from the design criteria, was deemed too vague and too far into the future to create an accurate implementation plan for. Therefore, the long-term concept was dropped. Resulting in the two final concepts being:

Concept for Horizon one: A temporary door-to-airport baggage delivery service that runs between ZYR and AMS for the short-term future of 2025. The baggage delivery service picks up and drops off baggage between Brussels and AMS, having baggage bypass ZYR and the Thalys train. This will create a more pleasant and complete Air-Rail experience for its experienced and unexperienced users.

Concept for Horizon two: An Air-Rail train design that will include a fourgon to store baggage away safely on the train for the middle-term future of 2032, this train design uses the opportunity of Thalys planning to have their new trains in 2032.

To answer the question stated in the beginning, this project aims to improve Air-Rail service to better suit the needs of passengers by offering these concepts that are combined in an implementation roadmap for Air-Rail baggage. This is not without limitations and recommendations; these will be discussed in the following chapter. The roadmap includes the main product or service with supporting products or services, the technology and collaboration between stakeholders that is necessary to achieve the products or services, and the tasks for each involved Air-Rail stakeholder with optional third parties. From this roadmap, a baggage friendly solution is possible for Air-Rail between ZYR and AMS. And with this plan, the world will become a more sustainable place.

9.2 Discussion

In the discussion of the project, important and relevant choices are discussed that influenced the path of the project in answering the question: “How can the Air-Rail transfer service be improved to better suit the needs for Air-Rail transfer passengers?”.

Starting off the discussion, with the choice to design for both ways of travel between ZYR and AMS. This choice was made to offer a complete solution to the baggage issues that were happening during the entire Air-Rial journey. However, by choosing to design for both ways, it made it very difficult to find a solution that would be suitable for both directions. The differences in the directions are significant due to multiple causes. The first one, the travelers who start their journey at ZYR, and travel to AMS to transfer to their flight,

experience the same journey and procedures. Therefore, they are guaranteed to be serviced and provided in the same way. With traveling the other way, from a foreign location via AMS to ZYR, not all travelers experience the same journey and procedures. This makes it difficult to offer a complete service and provide every Air-Rail traveler with the same information. Therefore, the travel direction from ZYR to AMS is easier to design for than the other way. If the choice had been made to focus on the one way of travel, possibly a more in depth solution could have been designed.

Making the short-term concept of a D2A baggage delivery service temporary was a difficult choice. This choice was influenced by the feedback given by the KLM representative. The reasoning was that Air-Rail's existence is to produce fewer emissions and they found it counterintuitive to send baggage by car between Brussels and AMS. If more time would be available, a study could be done to calculate the emissions that are produced to transport the baggage this way. The emissions would be compared to the emissions of a train and a clearer outcome could be concluded. Additionally, the short-term concept is scalable to other locations near AMS as well, once the second horizon is implemented, the service could be expanded to other new locations in Europe.

Working on such a relevant and present-day project was an interesting experience. It kept me on my toes to keep up with the news about the air industry and specifically KLM. It was nice to see changes that I had the possibility of influencing. However, the relevancy made it difficult as well. This was caused by articles being released about improvements or changes that I had not been updated about. As an example, during this project Thalys and Eurostar merged as one company called Eurostar. This made it confusing when writing the report and adapting to the changes that the company made. The merger does come with an advantage, that Air-Rail has the opportunity to expand to the UK. Now that the high speed rail routes of the UK, the Netherlands, Belgium, and France are combined, an even greater connection is possible. And even possibly improve the seamlessness for baggage by using the customs offices that Eurostar uses at train stations.

Lastly, I found that the Air-Rail excursion really opened my eyes. Without this experience, I would not have been able to interpret the experiences of other travelers from the Air-Rail customer research report that well. This was partially due to the then limited amount of information available on the internet about Air-Rail. What to expect of Air-Rail and how it differs from a normal transfer was not available at all (not even on Thalys' and KLM's websites). What I found the most interesting about the Air-Rail excursion was that it was not easy to book the service. On the KLM website, specific train/plane numbers must be used to be able to use the service. I thought it would have been easier to select the service, but alas.

Next, the limitations of the research and design are discussed and ending with recommendations for others who would want to continue this research.

9.3 Limitations and Recommendations

The limitations and recommendations of this project are discussed in this chapter. Starting with the limitations.

9.3.1 Limitations

During the Air-Rail excursion, it was difficult to keep track of all Air-Rail related issues. This includes baggage. Looking back at the experiences, some records of baggage specific issues were not made. This was due to the rush of the train stations, the confined space on the train, and the stressful check-in procedures. By organizing an additional excursion with sole focus on baggage issues, would create an even deeper understanding of Air-Rail baggage.

Another limitation during the project was the timing of the Air-Rail baggage workshop. The workshop was planned to happen during the beginning of the project. This workshop was part of the deal to do the project with KLM and was meant to happen somewhere around October. Looking back, the timing was too early in the process of the project. The goals for the workshop were vague and would have been easier to set, if the timing would have been later. Therefore, the workshop caused a lot of stress and took valuable time away from my project. However, I was able to use the workshop results to generate concepts and it was not for nothing. Next time, I would clearly state what is needed from the workshop and comprise my own group of stakeholders.

While evaluating the short-term concepts, a limitation was that Thalys did not participate in the process. Thalys was contacted before and cooperated with providing information about the future plans. But in June 2023, no answer was given when asked to evaluate concepts. This was maybe influenced by their merger with Eurostar. Therefore, the concepts could have had a different outcome with Thalys' opinion. Additionally, next time another evaluation session would be wanted to evaluate the result of the roadmap with KLM, RSG, and Thalys. By doing this, the viability, desirability, and feasibility would be more accurate.

9.3.2 Recommendations

The recommendations for this project are the following points. Starting off, with recommending a third horizon concept that resulted from the selection in chapter 7. The concept is an automated baggage handling for loading and off-loading baggage for the train. This concept would use machines to load baggage onto the train at AMS, as well as unload baggage from the train at AMS. The benefit of this concept would be to accelerate this process to take up less time on the train tracks at AMS. This concept is set for a non-specific year beyond 2032. Its purpose is automizing the process of loading and unloading baggage between the train and platform at AMS is the following. First, it is to reduce the time that is needed to execute this process. The faster the process goes, the more efficient it is. Second, by automizing the process, the amount of people that are involved in the process can also be reduced, which will probably cut costs. With the main product being a machine that automatically unloads baggage from the Thalys train onto the platform to

AMS's baggage handling system. This machine subsequently loads baggage onto the train again to travel to ZYR and ANT. RSG's task would be to collaborate with the Air-Rail stakeholders to find the best way to connect the baggage on the platform to the baggage handling system. Thalys would have the same task as KLM, to investigate the expansion of locations to the UK and Germany. Another Air-Rail stakeholder, ProRail, who is responsible for maintenance of the train tracks and stations, will have a big role in this. They will have to collaborate with RSG and KLM to automate the baggage unload and load. Finally, the third party that will provide and manufacture the automation machine is one of the following companies. These companies are focused on automizing logistical processes and pushing innovation and located in Europe. Examples of companies are VanderLande, Savoye and TGW Logistics Group

The next recommendation is to investigate providing customs facilities at ZYR train station. The current service requires Air-Rail travelers to pick up their baggage at AMS from the baggage belt, go through customs to exit landside to find their train. If it were possible to provide customs at ZYR, baggage could be directly sent through to Brussels and without pick-up during the transfer at AMS. This would create an even more seamless service that is identical to both travel directions. Additionally, with Eurostar already facilitating travel to the UK, which is outside of Schengen, customs and security facilities already exist at ZYR.

Lastly, the collaboration between the stakeholders was not easy during this project. During the workshop, everyone seemed willing to cooperate and make promises. But these promises are not yet fulfilled. During this project, I felt that the involved Air-Rail companies are mostly forced to cooperate. I had the feeling that the intentions were sometimes vague regarding Air-Rail. It would be more helpful to have the stakeholders work as a collective Air-Rail group to achieve more together. Additionally, more parties should become involved with Air-Rail to create a viable future. For instance, the municipality of Amsterdam is currently working on creating an international train hub at Amsterdam Zuid, which is eight kilometers away from AMS. Plans should be aligned to create the most of our future.

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11. Appendix

11.1 Initial Project Brief

DESIGN FOR our future

TU Delft

IDE Master Graduation

Project team, Procedural checks and personal Project brief

This document contains the agreements made between student and supervisory team about the student's IDE Master Graduation Project. This document can also include the involvement of an external organisation, however, it does not cover any legal employment relationship that the student and the client (might) agree upon. Next to that, this document facilitates the required procedural checks. In this document:

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&SA (Shared Service Center, Education & Student Affairs) reports on the student's registration and study progress.
- IDE's Board of Examiners confirms if the student is allowed to start the Graduation Project.

USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT
Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser.

STUDENT DATA & MASTER PROGRAMME
Save this form according the format "IDE Master Graduation Project Brief_familyname_firstname_studentnumber_dd-mm-yyyy".
Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1 !

family name: Taniguchi
initials: _____ given name: Fiona
student number:
street & no.:
zipcode & city:
country:
phone:
email:

Your master programme (only select the options that apply to you):
IDE master(s): ( ) IPD ( ) DfI (★) SPD
2nd non-IDE master:
individual programme: - - (give date of approval)
honours programme: ( ) Honours Programme Master
specialisation / annotation: ( ) Medisign ( ) Tech. in Sustainable Design ( ) Entrepeneurship

SUPERVISORY TEAM **
Fill in the required data for the supervisory team members. Please check the instructions on the right !

** chair: Suzanne Hiemstra-van Mastrigt dept. / section: DOS
** mentor: Bart Bluemink dept. / section: DOS
2nd mentor: Ronald Verkaaik
organisation: KLM
city: Amstelveen country: The Netherlands

Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v..

Second mentor only applies in case the assignment is hosted by an external organisation.

comments (optional): Suzanne has experience in developing human-centered mobility systems and services to create a seamless travel experience. And Bart is also experience in air travel but more focused on Design Strategy and Service Design.

Ensure a heterogeneous team. In case you wish to include two team members from the same section, please explain why.

APPROVAL PROJECT BRIEF
To be filled in by the chair of the supervisory team.

chair Suzanne Hiemstra-van Mastrigt date - - signature

CHECK STUDY PROGRESS
To be filled in by the SSC E&SA (Shared Service Center, Education & Student Affairs), after approval of the project brief by the Chair.
The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total: _____ EC

Of which, taking the conditional requirements into account, can be part of the exam programme _____ EC

List of electives obtained before the third semester without approval of the BoE

YES all 1st year master courses passed

NO missing 1st year master courses are:

name date - - signature

FORMAL APPROVAL GRADUATION PROJECT
To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked **.
Next, please assess, (dis)approve and sign this Project Brief, by using the criteria below.

- Does the project fit within the (MSc)-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?
- Is the level of the project challenging enough for a MSc IDE graduating student?
- Is the project expected to be doable within 100 working days/20 weeks ?
- Does the composition of the supervisory team comply with the regulations and fit the assignment ?

Content: APPROVED NOT APPROVED

Procedure: APPROVED NOT APPROVED

comments

name date - - signature

Initials & Name Taniguchi Student number

Title of Project Implementing a seamless experience for air-rail transfer passengers

Personal Project Brief - IDE Master Graduation

TU Delft

Implementing a seamless experience for air-rail transfer passengers — project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

start date 13 - 10 - 2022 — 17 - 03 - 2023 end date

INTRODUCTION **

Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...).

To promote sustainable mobility growth, the Ministry of Infrastructure, Schiphol, ProRail, KLM and NS have been aiming to promote the use of international trains for a distance up to 700 km. They announce in 'Actieagenda trein en luchtvaart 2020' that they will take measures to strengthen the international train as an alternative to and in addition to aircraft.

This project is in partial continuation of Rosa Hendrikx's project 'A service design vision for air-rail journeys' from 2021. Her focus was designing for the interaction part of the transfer journey. My focus will mostly be on scaling up the current air-rail pilot and how to implement the air-rail journey.

KLM is working together with Thalys to replace a number of short-haul flights (with a distance less than 700 km) between Brussels and Amsterdam by trains. Since July 17th 2022, they have set up the air-rail pilot to replace 2 flights each day, both ways, between Brussels (BRU) and Amsterdam (AMS). They plan to have the pilot run until the 29th of October.

It works in the following way: passengers book a flight using Amsterdam Schiphol as a transfer hub. If a certain flight and time is selected, automatically the flight BRU-AMS is replaced by a ticket for the Thalys. The passenger receives a normal boarding ticket with the Thalys train added to the journey.

The issue is that these passengers have to transfer between different modes of transportation. From air to rail and vice-versa. Which may cause a less enjoyable and less seamless travel experience. For instance, multiple issues have already come up. First, customers have difficulties with understanding what is included in the service, why this is special and what to expect of it. Second, the inability to check in their baggage at the starting location and not having to handle it until the final destination appears to be a problem. Having to carry and place heavy and large baggage on the train does not add to a more seamless and enjoyable experience.

If the pilot is deemed successful enough, KLM will look into possibilities of expanding of this intermodal product to other destinations within 700 km or replacing airplanes by trains more frequently.

My graduation project will be in collaboration with the following stakeholders: KLM, Thalys, Schiphol, ProRail, NS and Ministry of Infrastructure. With KLM acting as the main contact for questions and updates. This project will contribute to the Seamless Personal Mobility Lab at the TU Delft. In this lab, students and researchers of Industrial Design Engineering work together with transport operators, mobility companies, government and technology developers to get a better understanding of the wants, needs and behavior of travelers.

space available for images / figures on next page

introduction (continued): space for images

TO PLACE YOUR IMAGE IN THIS AREA:
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- CLICK AREA TO PLACE IMAGE / FIGURE

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- IMAGE WILL SCALE TO FIT AUTOMATICALLY
- NATIVE IMAGE RATIO IS 16:10
- IF YOU EXPERIENCE PROBLEMS IN UPLOADING, COVERT IMAGE TO PDF AND TRY AGAIN

image / figure 1:

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image / figure 2:

PROBLEM DEFINITION **

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

My problem definition for this project is, improving the air-rail product to meet the needs of the transfer passenger more.

The challenges that KLM has already encountered, while implementing air rail pilot:
1. The communication between KLM and the passengers about how the air-rail system works and what is specifically included.
2. The difficulties for the transfer passengers when transporting large baggage on a train with having to additionally stand in line at Schiphol to check-in baggage.

This project will start with the focus on improving the journey, then scaling up the pilot and finally implementing the seamless experience. This is done for transfer passengers when switching between the modes of transportation air and rail.

Improving the journey will be based on the route between Amsterdam and Brussels. With 2 kinds of trips, BRU-AMS and AMS-BRU. The scope will be kept very broad in the beginning, allowing assessment of other possible underlying challenges during the journey. While keeping the two challenges that KLM already has encountered in mind. Then I will dive into the most important challenges and focus on how to solve them.

ASSIGNMENT **

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, ... In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

Designing an air-rail transfer journey for passengers (scenario) and implementation strategy (roadmap), using the air-rail pilot in cooperation with KLM and Thalys, between Amsterdam and Brussels, as a case study.

First an improved scenario will be created, with an extensive explanation how it works, how it doesn't work, what it will look like and what benefits it will have. Then a roadmap will be created to explain how to implement this solution.

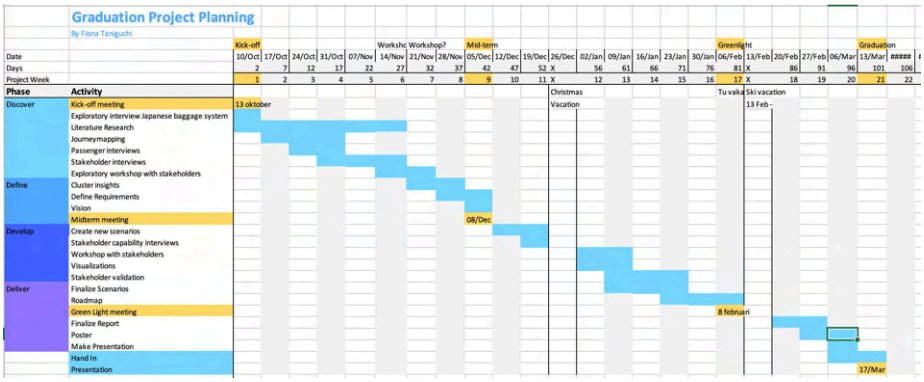
1. New Scenario
A new scenario is designed, based on the solutions that fix the most important challenges during the pilot. And this scenario is scaled up in a way that air-rail is applied more frequently and/or to different destinations. It will at least be including a happy flow and sad flow, and a visualization.

2. Roadmap
The roadmap will act as the implementation plan that is most focused on the first horizon and how to scale up the current product. Important questions that will be asked are:
Which stakeholders should we add to partner list?
Which problems will we be solving exactly?
How will we scale up?
Is scaling up possible?

PLANNING AND APPROACH **

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date 13 - 10 - 2022 17 - 3 - 2023 end date



Important Dates: Kick-off October 13th, Midterm December 8th, Greenlight February 8th (is in the TU vacation) , Graduation March 17th.
The entire trajectory is 100 days, working 5 days a week, and have calculated 2 weeks off for vacation, 1 week for Christmas in December and 1 week in February for skiing.

Working with double diamond method with 4 phases: discover, define, develop, deliver.
Discover: I will explore the journey and gather as much important information as possible.
Define: I will cluster the insights I have found and use the exploratory workshop for underlying wants and needs to create a vision.
Develop: Within the vision I will come up with a new scenario with an explanatory visualization. Hopefully I will be able to do stakeholder capability interviews to define the building blocks for the roadmap. Once, that is done validation interviews with the stakeholders will be held.
Deliver: I will finalize scenarios, the roadmap.

I will start with a broad research phase of the current customer journeys. After finding interesting opportunities, I will narrow it down to a short list. Next, I will generate ideas for new and optimal journeys. In addition to this, in mid to end- November I will be facilitating a creative session together with KLM for all the involved stakeholders. In this session we will be exploring solutions and scenarios that support the needs of the intermodal passengers.

After finding the most optimal solution and journey, I will translate what this means for all the stakeholders by creating a roadmap. The roadmap will explain how to implement this new system, step by step, and what is needed to build it.

MOTIVATION AND PERSONAL AMBITIONS

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge a on specific subject, broadening your competences or experimenting with a specific tool and/or methodology, ... Stick to no more than five ambitions.

1. I want to learn more about and practice leadership and negotiating. With a large group of stakeholders, it could be challenging trying to facilitate everybody's wants and needs. This is my project, so I am the leader, I have to manage the expectations, results and negotiations.

2. I would also like to practice communicating between multiple stakeholders. Because this project is from the Mobility Lab working together with KLM, I want all stakeholders to feel heard and understood.

3. I also want to gain more experience in service design. I have done multiple projects already that resulted in it. Now I would like to test how it is on my own and if this would be a possible future job area for me.

4. And lastly, I want to improve my roadmapping skills. I come across them very often included in big plans. This means that the future will possibly hold many roadmaps. And I would like to become better at making them.

And what I hope to excel at during this project is working with visualizing concepts and visualizing information.

FINAL COMMENTS

In case your project brief needs final comments, please add any information you think is relevant.

11.2 KLM Air-Rail Confirmation

KLM Royal Dutch Airlines

Confirmation

This is not a boarding pass!

NAME [redacted]

BOOKING REFERENCE

FREQUENT FLYER NUMBER

TICKET NUMBER

Sec.nr.:KL224:**002**, KL1139:**032**, KL1130:**001**

BRUSSELS	KL 224	**AMSTERDAM**	DATE	BOARDING	DEPARTURE	GATE	SEAT	TRAVEL CLASS
ZYR		AMS	10 JAN 23	16:22	16:52	-	16/34	Economy
OPERATED BY KLM								

AMSTERDAM	KL 1139	**COPENHAGEN**	DATE	BOARDING	DEPARTURE	GATE	SEAT	TRAVEL CLASS
AMS		CPH	10 JAN 23	21:02	21:30	-	25F	Economy
OPERATED BY KLM								

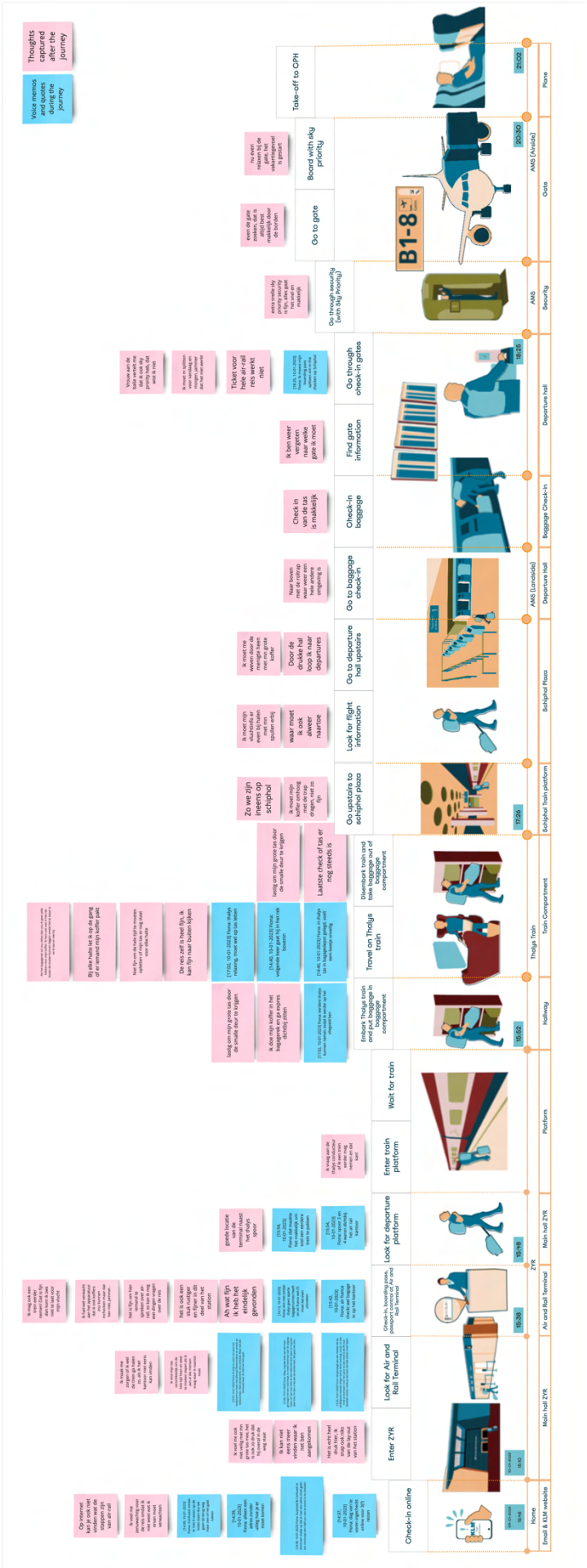
COPENHAGEN	KL 1130	**AMSTERDAM**	DATE	BOARDING	DEPARTURE	TERMINAL / GATE	SEAT	TRAVEL CLASS
CPH		AMS	11 JAN 23	13:50	14:15	2 / -	20F	Economy
OPERATED BY KLM								

Receive your boarding pass

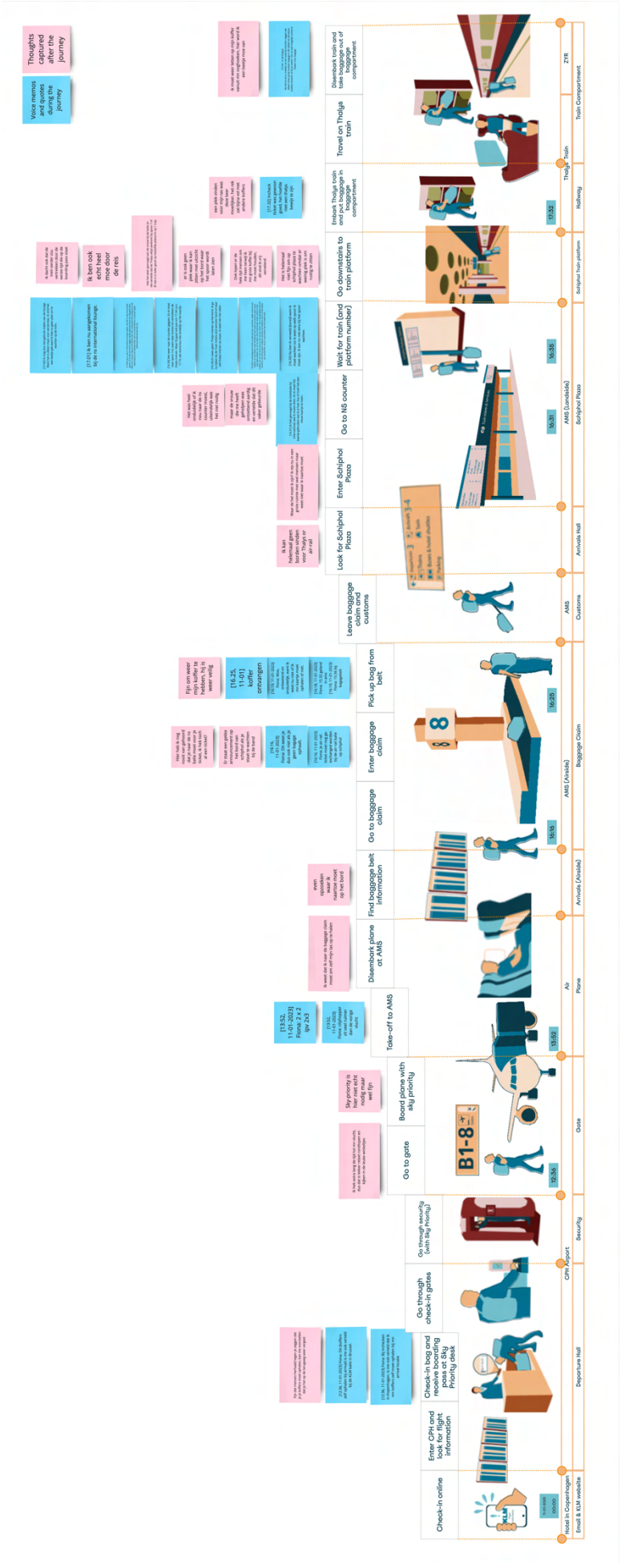
Please note:

To receive your boarding pass, please go to the Air and Rail terminal at least 30 minutes before departure of your train. The Air and Rail terminal is located at Rue de France, 1060 Brussels.

11.3 Passenger Journey ZYR – AMS – CPH



11.4 Passenger Journey CPH – AMS – ZYR



11.5 Intermodal Baggage Workshop with Air-Rail Stakeholders

Goal

There were three goals for the workshop: create long-term goals and future visions using the knowledge and expertise of the multi-stakeholder group; and to see if there would be significant differences in the goals and visions for the four different travelers; and to observe how the stakeholders are currently working together. I wanted to see if they were up to date about each other's companies' future plans and observe any possible underlying issues or promising opportunities to improve collaboration.

Gain

The gain of this session for KLM is to come together with the stakeholders in a neutral environment, where they can discuss the future of Air-Rail together. This could possibly be the beginning of a semi-annual meet up. And if stakeholders had not met each other yet, this would be good opportunity to expand their network and make it easier to contact each other in the future.

Sample

17 people participated in this workshop. All the participants are related to Air-Rail between ZYR and AMS or they are related to baggage.

Participants

In Table 9 below, the participants are listed. The table includes their names, from what organization they are from, function, and in which group they participated. A large group of people from KLM were present because KLM originally offered to host this workshop. My company mentor invited colleagues who are mostly involved with Air-Rail or baggage. RSG only had three people present due to a cancellation. Thalys sent two people all the way from Belgium. One person from NS was present. Two people were there from TUD, they helped with design thinking in their groups. And two people from the Dutch ministry of infrastructure and water management to experience KLM's efforts to become more sustainable. Unfortunately, no one was present from ProRail.

Table 9 The participants of the Intermodal Workshop

		Subject
	Organization	
1.	KLM	Mother with two young children
2.	KLM	Mother with two young children
3.	RSG	Mother with two young children

4.	KLM	Mother with two young children
5.	TUD	Mr. Pensionado
6.	Thalys	Mr. Pensionado
7.	KLM	Mr. Pensionado
8.	Ministerie van Infrastructuur en Waterstaat	Mr. Pensionado
9.	KLM	Solo-Backpacker
10.	RSG/TUD	Solo-Backpacker
11.	NS	Solo-Backpacker
12.	KLM	Solo-Backpacker
13.	KLM	Business Traveler
14.	KLM	Business Traveler
15.	RSG	Business Traveler
16.	Ministerie van Infrastructuur en Waterstaat	Business Traveler
17.	Thalys	Business Traveler

Method

The methodology used to set up the workshop and to create long-term goals and future visions originates from the Creative Problem Solving model (CPS) by (Buijs, 1986)(as in (Tassoul, 2009)). The CPS model (Figure 11-1) includes three steps, within each step diverging and converging is happening. In the first diamond, the goal is to generate a problem statement from a given issue. First diverging happens by asking questions and generating an overview and understanding of the issue. The next stage when converging happens, a problem statement is generated by narrowing down to one important issue. The next step is diverging to generate ideas then converging to select one idea. Finally, for concept the idea is developed by diverging and going back to converging by acceptance and implementation.

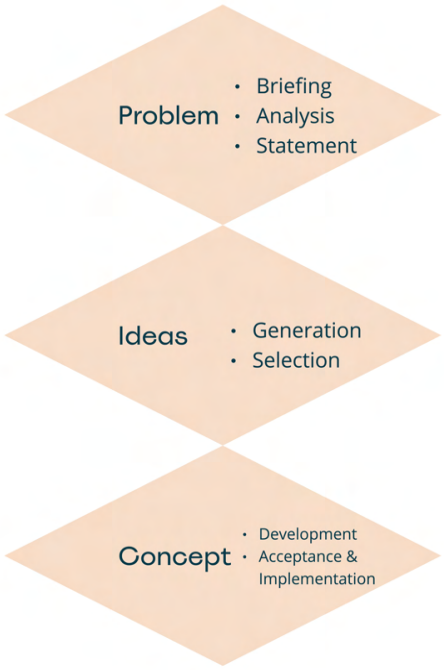


Figure 11-1 The Three diamonds CPS Model (Buijs, 1986) as in *(Tassoul, 2009)*

How I used this CPS model for the workshop is visible in Figure 11-2. I started off with the vague problem of baggage during an intermodal transfer. To be able to test if different types of passengers versus different journeys, would need one overarching solution or different solutions. I had the participants divided into four groups (Figure 11-3) based on being an experienced or unexperienced passenger (for more information about this see 4.3) and which way they were travelling, ZYR- AMS – Singapore or Singapore – AMS- ZYR. Four different personas came out of the combinations. The first being 'Mr. Pensionado', this is a not so experienced traveler, who is traveling from ZYR to see the world. Next is the 'solo backpacker' who is an experienced traveler and is also traveling from ZYR to see the world. Then the unexperienced 'mother with two young children' is traveling from Singapore back home to ZYR. And finally, 'the business traveler' who is very experienced and is also traveling back to ZYR.

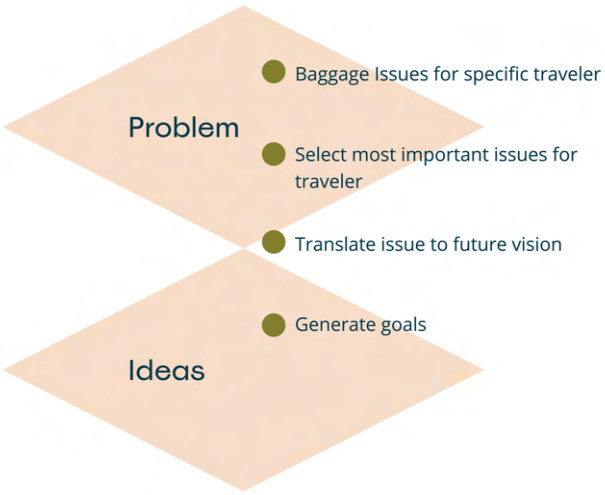


Figure 11-2 How I used the CPS model for the workshop

The steps of the workshop are visible in Table 10 with the corresponding goals and tasks.

	Unexperienced	Experienced
Travel ZYR-AMS-Singapore	Mr. Pensionado	Solo-Backpacker
Travel Singapore-AMS-ZYR	Mother with two young children	Business Traveler

Figure 11-3 Four types of travelers based on experience and journey

Table 10 Steps, goals, tasks for the intermodal workshop

Step	Goal	Task
	Understand the problem from the perspective of the specific traveler	Fill in Empathy Map
Problem	Think of possible baggage issues to traveler	Fill in Baggage Challenges Canvas
	Find out what their most important issue is to solve	Rank the problems in top 3
	Think of a future vision for 2036 for baggage for traveler	Fill in Creating a future vision statement template
Ideas	Setting user experience goals for the years 2024, 2030 and 2036	Fill in Breaking it down template

Empathy Map

One of the methods used to have the participants understand their user, was having them fill in an empathy map. This map was based on (Gray, 2017). The definition of an empathy map is "An empathy map is a collaborative visualization used to articulate what we know about a particular type of user. It externalizes knowledge about users in order to: create a shared understanding of user needs; and aid in decision making." (Gibbons, Empathy

Mapping: The First Step in Design Thinking, 2018). In Figure 11-4 the used empathy map is shown.

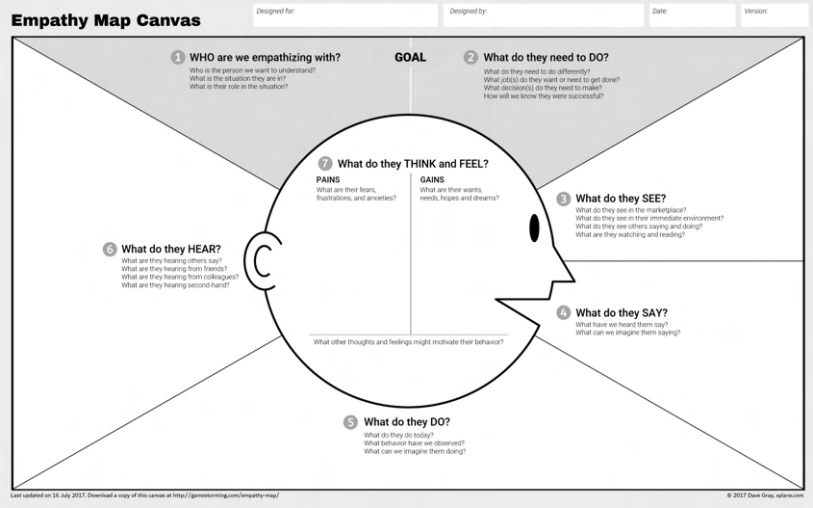


Figure 11-4 The used empathy map for the quadrant personas

Planning

The session was divided into two parts, one in the morning and one in the afternoon with the 20 people attending both parts. In the morning the research group Beautiful Lives (that conducted the research from 4.3) gave a presentation about their research results. They had the participants come up with short-term solutions for issues during the Air-Rail journey. I was not responsible for this part; therefore, I will not discuss the results.

I was responsible for the part in the afternoon, where the participants were going to focus on generating long-term building blocks for my research later. The timetable for the entire day is shown in Figure 11-5.

Draaiboek Template

Onderwerp	Goal	Duur (mi	Duur (hh:mm	Start	Eind
Settle In	Aankomen, spullen pakken, klaarzetten	30	00:30:00	09:00	09:30
Inloop	Chat with each other	30	00:30:00	09:30	10:00
Introductie	Uitleggen wat het programma is	5	00:05:00	10:00	10:05
Air Rail Pilot	Ronald Pilot uitleggen	15	00:15:00	10:05	10:20
BeautifulLives	Quick wins halen uit het qualitatieve onderzoek	100	01:40:00	10:20	12:00
	Aankondigen volgende deel programma + verhuizing	10	00:10:00	12:00	12:10
	Lunch (Catering 12.00-13.00 X-Lab)	60		12:00	13:00
Total time Ochtend		130			
	Intro focus on Baggage	5	00:05:00	13:00	13:05
	Split into 4 groups + explanation ?energizer?	10	00:10:00	13:05	13:15
Empathy Map	Empathize with traveller & step into their shoes	30	00:30:00	13:15	13:45
Baggage Challenges	Challenges for baggage	10	00:10:00	13:45	13:55
Future Vision	Future Vision 2036	30	00:30:00	13:55	14:25
	PAUZE	10	00:10:00	14:25	14:35
	Energizer	5	00:05:00	14:35	14:40
Goals	Set User Experience Goals for 2024, 2030, 2036	20	00:20:00	14:40	15:00
	Define responsibilities + discussion	10	00:10:00	15:00	15:10
	Present to the group final things (ligt eraan of we tij	20	00:20:00	15:10	15:30
	Samenvatting + conclusie ochtend deel	20	00:20:00	15:30	15:50
	Closing	15	00:15:00	15:50	16:05
Total Time Afternoon (minutes)		150			
Time Planned (minutes)		150			

Figure 11-5 Timetable of the intermodal baggage workshop

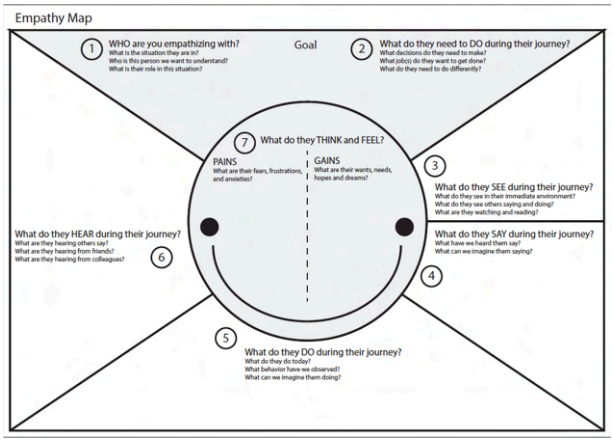


Figure 11-6 Workshop empathy map

The tasks I had set up for the group was to start off with filling in the empathy map, see Figure 11-6. In this empathy map they have to step into the shoes of the passengers. This is done by answering the questions 'who are you empathizing with?' and 'what do they need to do during the journey?'. Then they would switch to focusing on the passenger's senses: see, say, do, hear. Ending the task about what the passenger feels and thinks. These feelings and thoughts then translate to pains and gains, meaning what the passenger fears or dreams about.

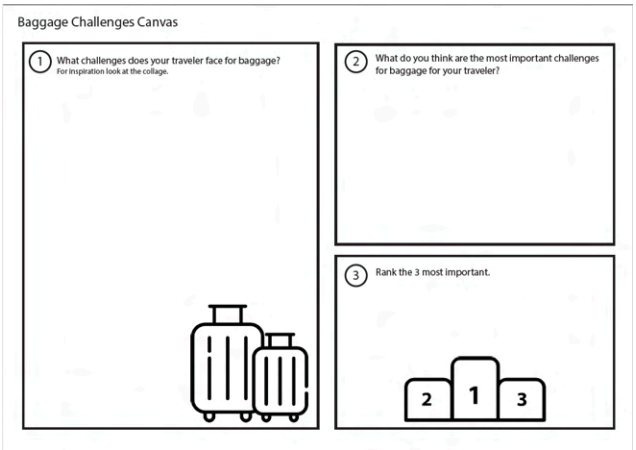


Figure 11-7 Workshop baggage challenge canvas

The next step is to fill in the baggage challenges canvas (Figure 11-7), where the group has to think about the challenges that their passenger faces for baggage. From the imagined issues, the three most important issues are ranked.

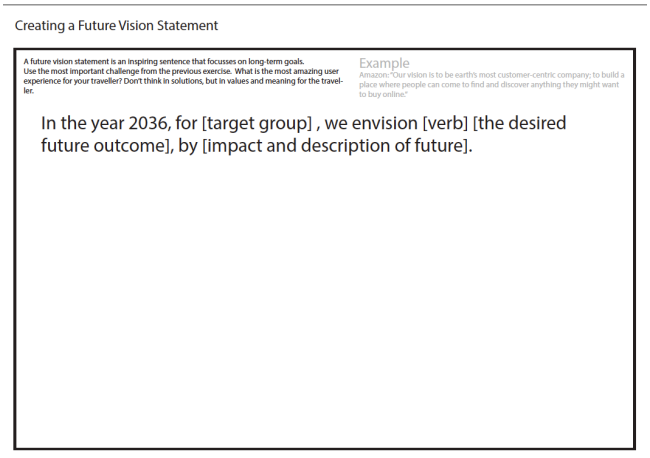


Figure 11-8 Workshop creating a future vision statment

From then on, the participants had to fill in the template for creating a future vision statement (Figure 11-8). A future vision statement is a statement that describes the desired future state of business within a certain timeframe and guides the direction of the business's efforts. The most important issue from the previous canvas is used for the vision statement for the year 2036.I had chosen the year of 2036, because at the time I was not sure for which year to design my own solution. 2036 is far enough away to come up with futuristic ideas and not by limited by current plans, but it is not so far away that the results are unobtainable and unrealistic. Once they had filled in the template, a future visions statement would be the result.

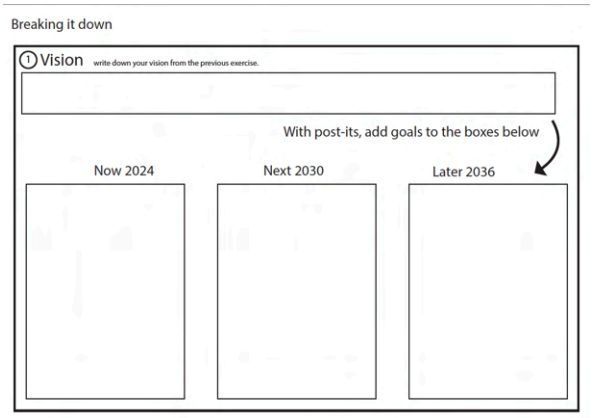


Figure 11-9 Workshop breaking down the future vision into goals

Then the participants had to fill in the next template, where they had to use the previous vision statement and create goals for the years 2024, 2030 and 2036. These goals provide a step-by-step approach to achieve the future vision.

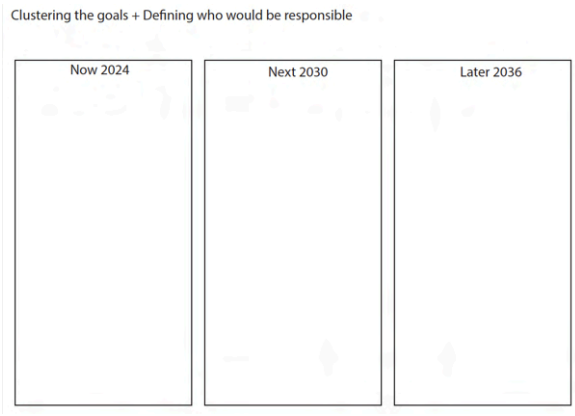


Figure 11-10 Workshop clustering goals and defining responsibility

After this step, the four groups had to cluster their goals and label them with colored tape, to show which stakeholder would be responsible. Finally, the four groups presented their results and elaborated their reasoning.

Results

The results for the future vision statements for each type of passenger are the following.

	Unexperienced	Experienced
Travel ZYR-AMS-Singapore	Mr. Pensionado: In the year 2036, for everyone, we envision care-free experience feeling welcomed, taken care of by providing pro-active, unrequested assistance at all touch points.	Solo-backpacker: In the year 2036, for our experienced travelers, we envision creating a natural seamless intermodal journey, by offering intuitive customer centric services and products.

Travel Singapore-AMS-ZYR	Mother with two young kids: In the year 2036, for all passengers (or only EU passengers) with check-in baggage, we envision the Rail-Air journey being the same as the Air-Air journey, by providing full bag handling from origin to end destination by labeling bags to the end destination.	Business traveler: For business traveler, we envision hassle free travel by organizing a secure baggage transfer.

Figure 11-11 Workshop vision statements for type of passenger

In figure Figure 11-11, the vision statements for each persona, with the accompanying experience and journey are shown. The results of the future visions as to be compared with each other.

The vision statements for the mother and Mr. pensionado, who are both unexperienced travelers, describe the Air-Rail journey as being the same as Air-Air and providing a care-free experience and being taken care of by offering assistance. This is summarized to the service being assisted and easy for unexperienced passengers.

The vision statements for the solo traveler and business traveler, who are both experienced travelers, describe the Air-Rail journey as natural, seamless, intuitive, hassle-free, and secure. This is summarized to easy and secure for experienced passengers.

The vision statements for the journeys starting at ZYR, for solo traveler and mr. pensionado, the vision statements contain natural, seamless, intuitive, care-free, welcomed, proactive and unrequested assistance. This description can be summarized in logical, easy, and assisted.

The vision statements for the journeys ending at ZYR, for the mother and business traveler, they contained full baggage handling, hassle-free and secure. There is no summary necessary for this group.

Figure 11-12 Participants discussing solutions during the morning part.

Figure 11-13 Participants working on templates in the afternoon.

Figure 11-14 Impression of the workshop

The results for the goals that were created to reach the previous vision statements in 2036, the results are the following Figure 11-15.

Figure 11-15 Workshop results goals

All the goals were put together in Figure 11-15, this is done based on the passengers being experienced or unexperienced. Yellow and green are for mr. pensionado and the mother. Blue and pink are for business traveler and solo backpacker.

After the step setting user experience goals, I want the group to come together and reflect on the different goals and future visions that were generated. During this task I also wanted to gain information for later, about if these goals would be implemented, who would be responsible for which part. This was done by putting stickers next to the values, with a different color for each Air-Rail stakeholder.

2024
For 2024 there are two clusters where the two types of experienced passengers had the same goals, and two types of unexperienced passengers had the same goal. This is visualized by the red rectangles on the left. This is the following conclusion for 2024: the experienced traveler sends voluminous baggage upfront to the airport or home, with the service provided by KLM and Schiphol. The unexperienced traveler receives assistance to help with bags on the train platform.

2030
For 2030, the goals from the unexperienced mother and the experienced solo-backpacker are matching (this is shown by the green dots), they both contain baggage delivery that is offered by a third party. The conclusions for 2030 is: the experienced and unexperienced traveler have in common that they use door-to-door baggage delivery service. This service

will be provided by third parties such as Luggo. This service will make the trip easier for the passenger by taking the heavy and bulky bags out of a busy train.

2036
For 2036, something remarkable is the two types of ideas that appear more than once (labeled by the blue dots and red dots). First, a separate terminal exists for air with other modalities (including rail), this creates an easier route for the passengers (blue dot). The other idea is that there are baggage distribution points everywhere or at every station (red dot). From those points baggage is moved between the airport and the train station.

Observations
Other general observations during the workshop were that the participants were enthusiastic about working together in real life with each other. During the workshop they were often talking to each other, whether it was about Air-Rail or other subjects. Additionally, important updates about plans were also revealed during the workshop. For instance, Thalys is planning on purchasing a new train fleet around 2030 due to their merger with Eurostar. This creates opportunities to improve the Air-Rail service onboard of the train.

7.5 Key Take-Aways
The key take-aways of the intermodal workshop were the following points.

1. Work on enhancing a guiding and clear communication with the passenger throughout the Air-Rail journey.
2. Improve the physical aspects of the journey, such as signage, security, information desks and available lounges.
3. Offer a short-term baggage solution, with a long-term option such as a home pick-up option.
4. Different values are present for the two types of passengers. The unexperienced traveler values intuitive, easy, and secure and the experienced traveler values care-free and pro-active and unrequested assistance.
5. Trips going ZYR-AMS and AMS-ZYR differ a lot from each other that they both need to be considered separately.
6. For 2024, a steward on the platform was recommended to help with loading and unloading baggage for unexperienced travelers. For experienced, they would already like an option for sending baggage upfront.
7. In 2030, both door-to-door baggage delivery service seems desirable for the experienced and unexperienced travelers.
8. For 2036 a multimodal gate that is integrated was recommended to make the journey more seamless for both types of passengers.
9. Finally, I recommend continuing organizing events/meet ups/workshops with the large group of stakeholders. This will benefit the collaboration between the organizations and hopefully accelerate the speed at which a better Air-Rail service can be provided.

7.4 Reflection

I thought that the workshop went well, the results were interesting and surprising. I did not expect the outcome to be in this way. This is because I had envisioned that everyone would come up with values and goals for their types of travelers. These values and goals would not by solutions. Instead by providing solutions, the last part of the workshop turned into an idea generation session. This is not bad at all; The participants are all related to the Air-Rail system in any way (or baggage), therefore I consider them experts. And I can use these ideas during the design phase of the project. Additionally, these kinds of moments where a large group of stakeholders get together, it creates a stronger relationship between people. This is a good way to build trust between the companies. Therefore, improving collaboration in the future. I hope in the future that specifically KLM and RSG can work on their relationship, since they rely heavily on each other. The workshop was also good moment for updating each other on current Air-Rail plans and to maybe be able to try and align them. During discussions important information raised, that would be useful for all stakeholders to know. Such as, Thalys is planning to order a new fleet of trains, due to merging with Eurostar. This may be considered by other stakeholders when making plans for Air-Rail. I suggest continuing working on the bond between the stakeholders to further improve a great collaboration in the future. For the participants who had not met each other yet (including me), this event was a nice way to break the ice and start an easier point for future communications. After the workshop I was able to contact a few stakeholders personally for detailed questions.

7.5 Limitations for Air-Rail excursion

There were limitations to this research. It was difficult to fully document the feeling and thoughts while trying to navigate an unfamiliar place. Additionally, taking pictures and videos during the trip was a challenge, being on my own with a large and bulky suitcase and a full backpack made it difficult to access my camera and phone with my hands. The contents of the baggage were also not ideal, during the trip I spent one night in Copenhagen to fly back the next afternoon. Therefore, I only brought limited amount of clothing, making it not as heavy as it would normally be. Next time I would recommend travelling with a companion who not only has never experienced the Air-Rail transfer but as well as know no information about it in advance. And plan this transfer when travelling for multiple days. This would increase the realism of the feelings of tiredness travelling from CPH to AMS to ZYR.